Lab Manual to the Flora of New Mexico

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Flora of New Mexico

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October 2009

Contents

Introduction

To the Student: This lab manual has been compiled specifically for use in the Flora of New Mexico class. Some of the information within these pages used to be meted out throughout the semester in individual handouts. We felt it was time to update what is currently known about the ever-changing field of plant taxonomy and combine this information in an organized, bound manual.

The lab course has been designed to introduce you to the flora of our region by going on a series of field trips to different geographic/ecological zones within and nearby the Albuquerque area. In addition, you will receive the information and skills to collect scientifically valuable plant specimens, and obtain the basic information and instruction needed to recognize at-a-glance the 40 or so most common plant families that represent ~85% of the plant diversity in the state. Fresh plant material will be provided by the Teaching Assistant so that you have a first-hand opportunity to dissect and study the (often minute) structures of flowers, fruits, and seeds that help define the various families of flowering plants in our region.

New Mexico has a rich diversity of plants, including more than 150 plant families, 1000 genera, and 3610 species. This lab manual presents a total of 75 of the more common families in our state. There are ~43 primary families (bold face in the table of Contents) that you are required to learn. Additionally, ~33 secondary families are included to broaden your knowledge, but due to flowering times, fresh plant material generally is not available. While the primary families are crucial, the information provided in the secondary families will be helpful to learn for your plant collection that will be due towards the end of the semester. We hope you will gain an appreciation for the great diversity of plant life that we have in New Mexico. Happy botanizing!

To the Teaching Assistant: This manual was produced in Adobe InDesign and the file and original documents are located in the UNM Herbarium. Future TA's should work with the Collection Manager in updating this lab manual and making printed copies from the original document/pdf, and avoid making copies of copies, as the quality will suffer.

Acknowledgments

We would like to thank past graduate students/teaching assistants of the Flora of New Mexico lab who taught this course, especially David Bleakly who literally cut and pasted handout materials. In addition, we thank Robert DeWitt Ivey whose drawings of New Mexico plants came from the Flowering Plants of New Mexico, 4th edition. We also acknowledge the UNM Herbarium, a division of the Museum of Southwestern Biology for use of their software and hardware, supplies and staff time.

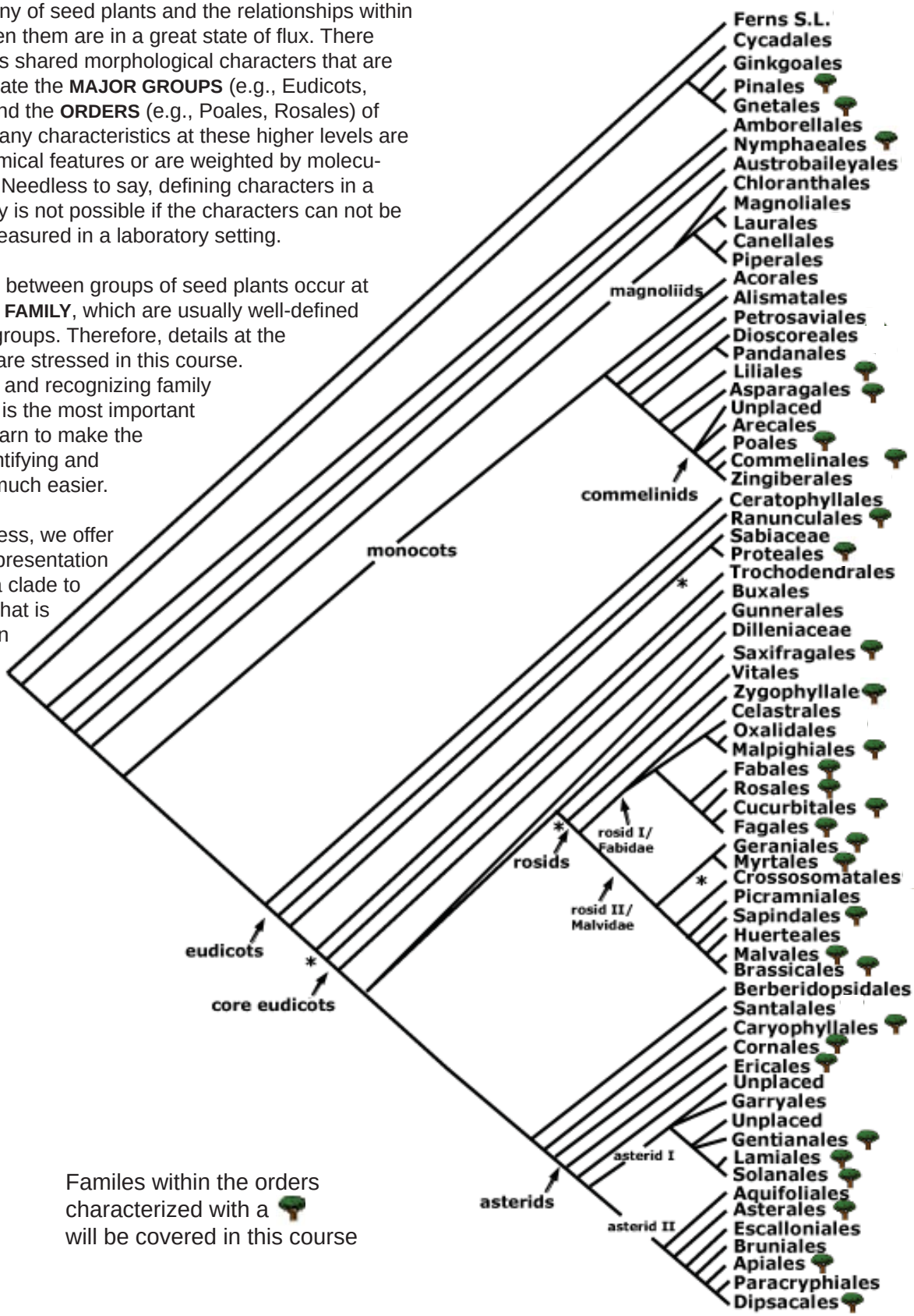
Finally, and most importantly, we express our thanks and dedicate this manual to Tim Lowrey, curator of the UNM Herbarium and long-time Professor who has taught hundreds of students the Flora of New Mexico.

Seed Plant Phylogeny

The phylogeny of seed plants and the relationships within and between them are in a great state of flux. There are few obvious shared morphological characters that are useful to separate the **MAJOR GROUPS** (e.g., Eudicots, Rosids, etc.) and the **ORDERS** (e.g., Poales, Rosales) of seed plants. Many characteristics at these higher levels are obscure anatomical features or are weighted by molecular similarities. Needless to say, defining characters in a meaningful way is not possible if the characters can not be observed or measured in a laboratory setting.

The real clarity between groups of seed plants occur at the level of the **FAMILY**, which are usually well-defined monophyletic groups. Therefore, details at the level of family are stressed in this course. Understanding and recognizing family characteristics is the most important skill you can learn to make the process of identifying and keying plants much easier.

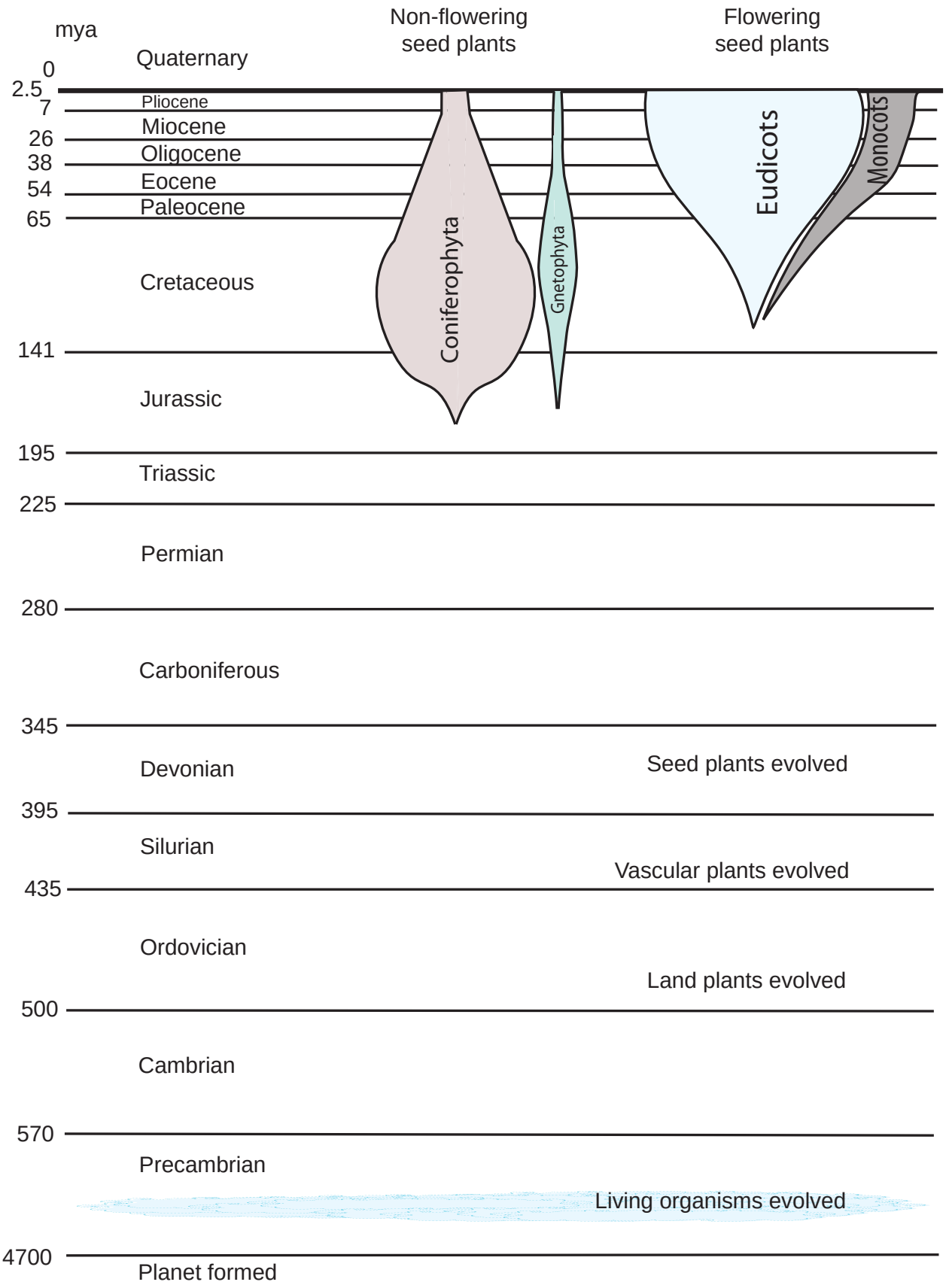
For completeness, we offer this graphic representation in the form of a clade to demonstrate what is currently known about the evolution and phylogeny of seed plants.



Familes within the orders characterized with a
will be covered in this course

Timeline for the Evolution of Seed Plants

for groups covered in this course



Non-flowering Seed Plants

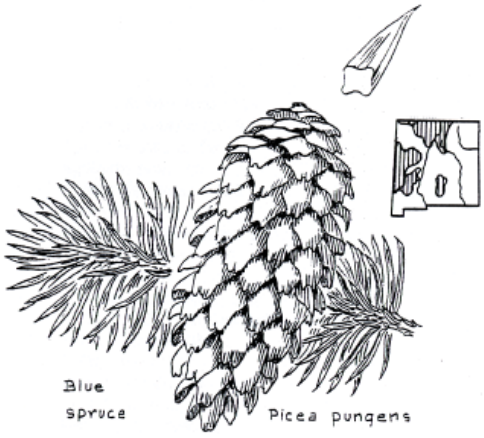
Order Gnetales

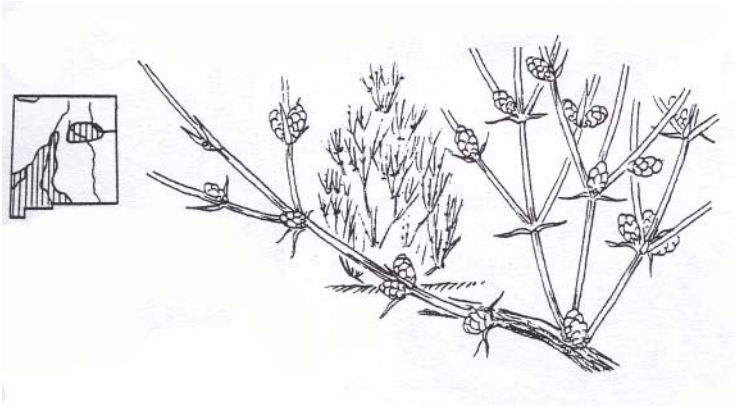
Ephedraceae

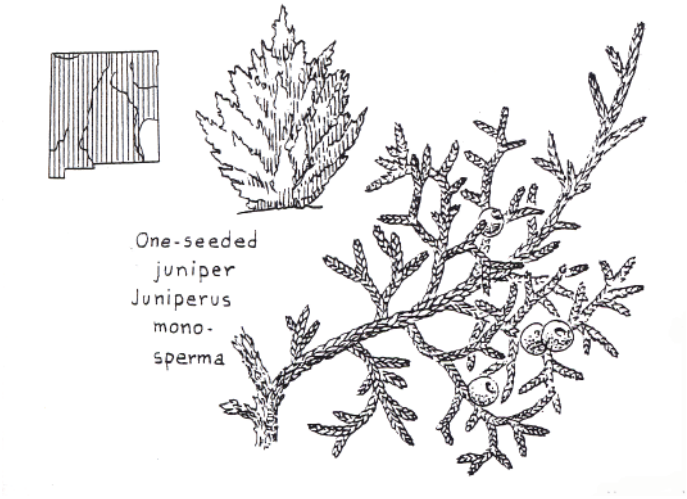
Order (ungrouped) The Conifers

Cupressaceae

Pinaceae







EPHEDRACEAE
(Ephedra family)

Order: Gnetales
Non-flowering seed plants

Habit: shrubs with green photosynthetic stems; much branched, with jointed, green stems; usually dioecious (male and female cones borne on different plants)

Leaves: reduced to small brownish papery scales and separated by very long (2-10 cm) internodes; opposite or whorled

Male cones: with stalked sporophylls surrounded at base by membranous bracts

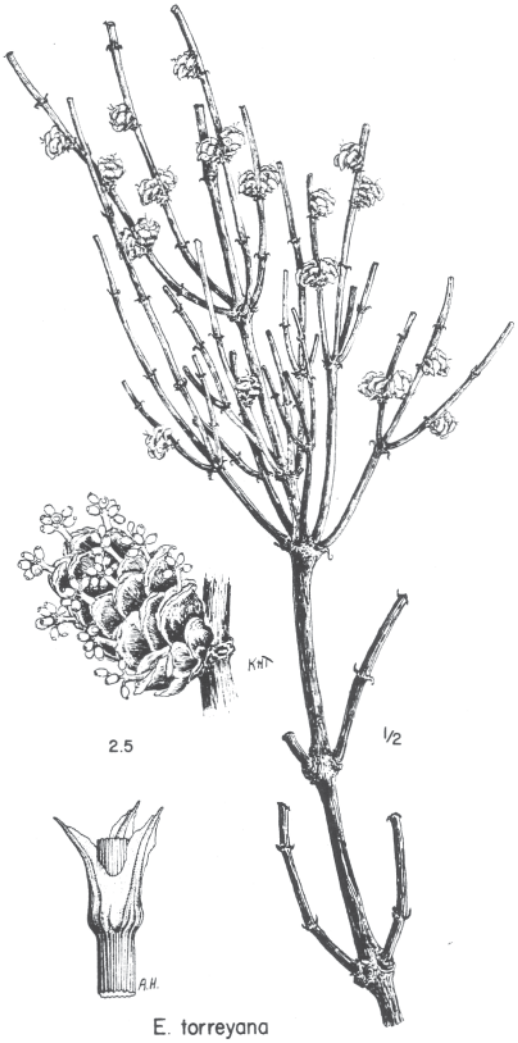
Female cones: with 1-2 ovules surrounded at base by fleshy bracts

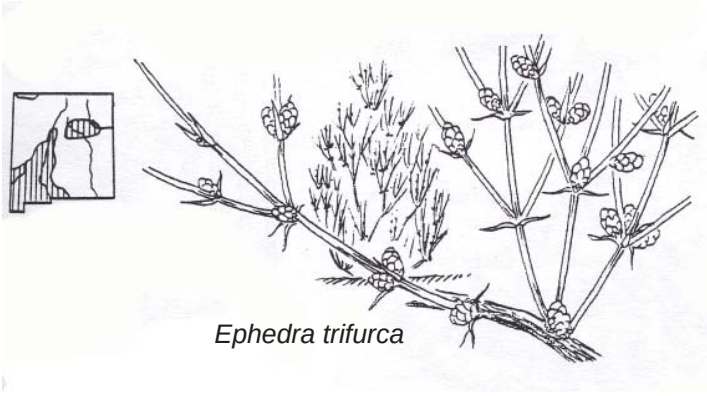
New Mexico:
Ephedra is the only genus in the family

Distribution: genera/species
Worldwide: 1/44
NM: 1/6

Economic uses- medicinal, stimulant (ephedrine)

Ephedra male cone (above) and female cone (left)





Ephedra trifurca

CUPRESSACEAE
(Cypress family)

Conifers (Ungrouped to Order)
Non-flowering seed plants

Habit: evergreen trees and shrubs; stems thick, woody, non-photosynthetic; plants monoecious or dioecious

Leaves: green, photosynthetic, small, scale-like or awl-shaped, persistent

Cones: berry-like when mature; fleshy or mealy, or dry and woody, the scales fused or sometimes spreading at maturity

Male cones: small and inconspicuous

Female cones: with the ovule scales fused, woody, or fleshy at maturity

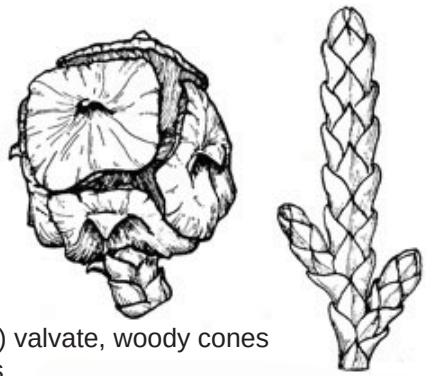
New Mexico genera:
Cupressus- Cypress
Juniperus- Juniper, Cedar

Distribution: genera/species
Worldwide: 27-30/130-140
NM: 2/8

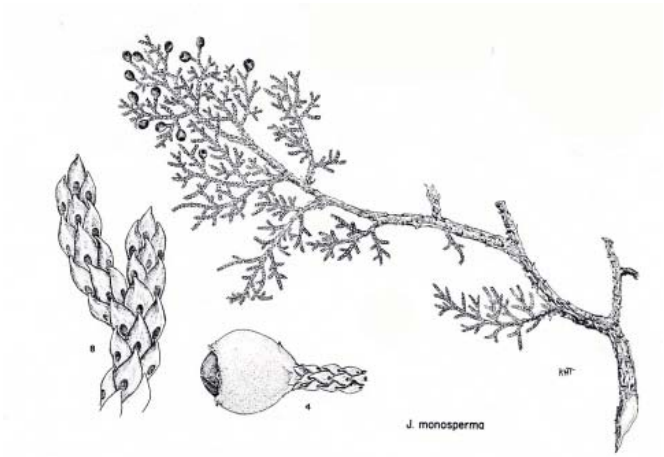
Economic uses- lumber, landscaping

The family includes the largest (Giant Sequoia) and tallest (Coast Redwood) trees in the world.

awl-shaped leaves

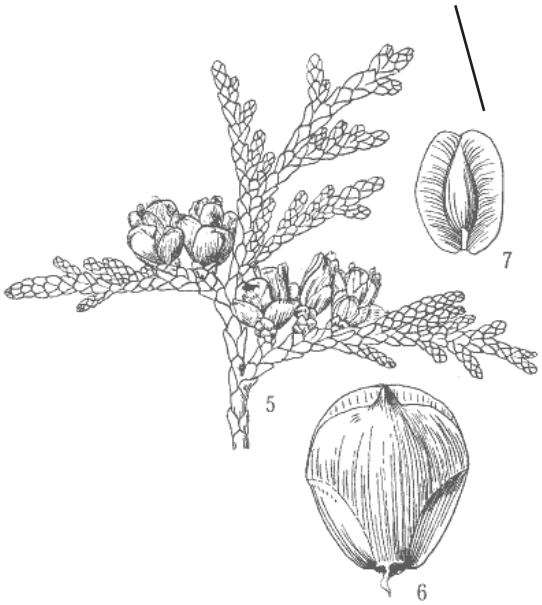


Cupressus (Cypress) valvate, woody cones and scale-like leaves

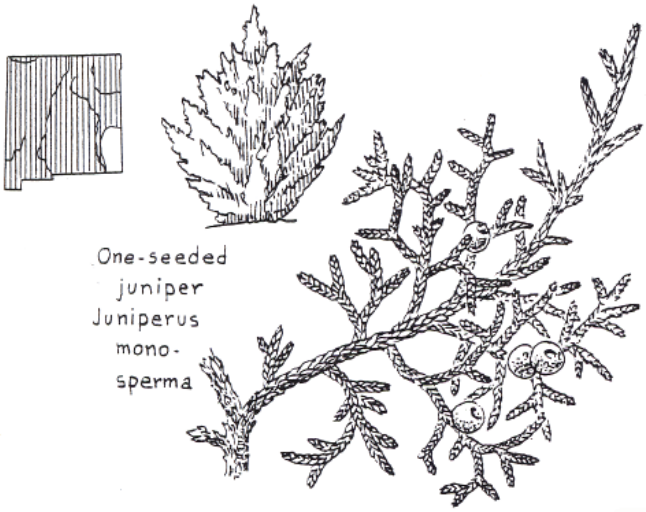


Juniperus detail of leaves and cone anatomy (wingless seeds)

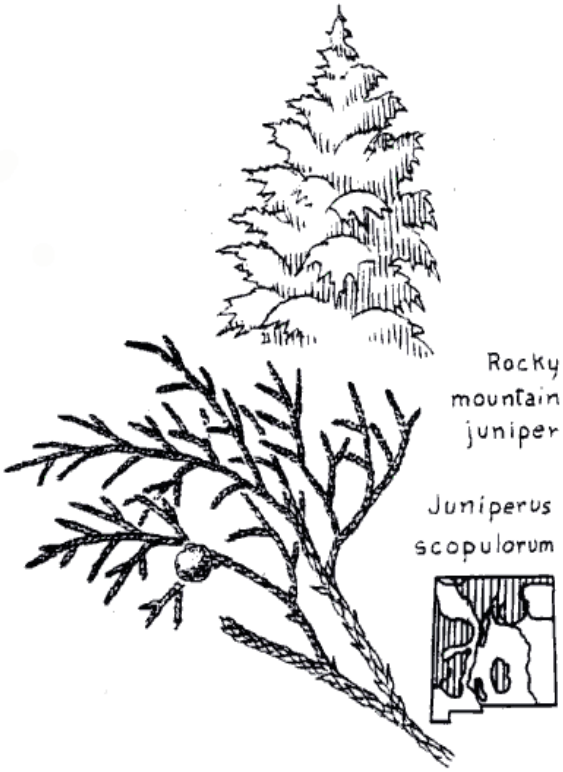
Cupressus cone anatomy (winged seeds)



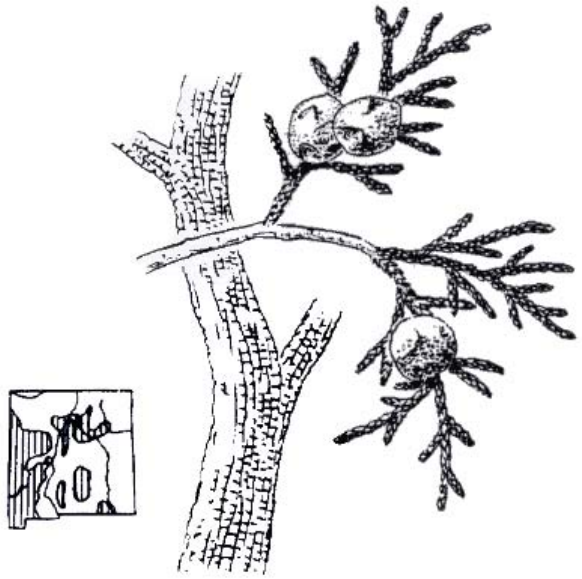
Cupressaceae in New Mexico



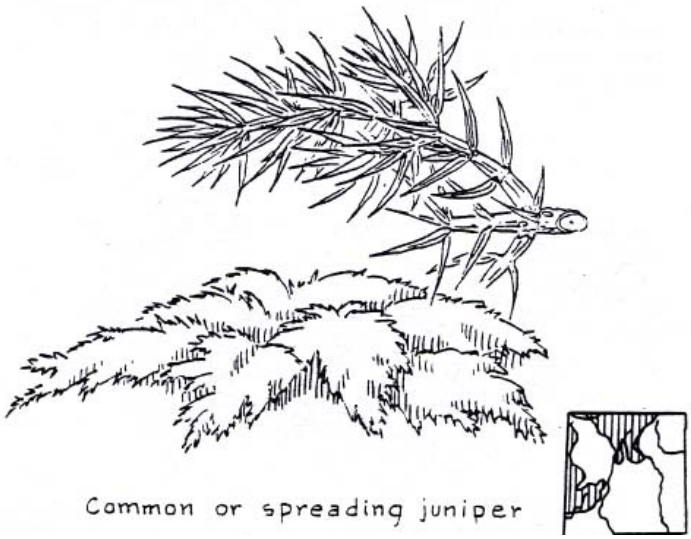
One-seeded juniper
Juniperus mono-sperma



Rocky mountain juniper
Juniperus scopulorum



Alligator juniper
Juniperus deppeana



Common or spreading juniper

Non-flowering Seed Plant Chart
Cupressaceae (Cypress Family)

Juniperus (Juniper)

Taxon	Range	Elevation (ft) (NM range)	Seeds/fruit	Other
Juniperus monosperma (One-seed juniper)	New Mexico, Colorado Plateau	5000-7500	1 (2); cones globose, fleshy, 5-7 mm diameter	branches from base; dioecious
J. osteosperma (Utah juniper)	nw New Mexico, Utah, Great Basin	6000-7500	1 (2); cones ovoid, mealy, 8-18 mm long	tree-like with trunk; may be sprawling; us. monoecious
J. deppeana (Alligator juniper)	s New Mexico to nw Mexico	6500-8000	3-4; cones globose, 8-12 mm diameter	distinctive bark; usually conspicuous glands on leaves
J. scopulorum (Rocky Mountain juniper)	Rocky Mts, New Mexico, w TX, AZ	7000-9000	2 (1); cones globose, 4-6 mm diameter, juicy	branches slender, drooping; dioecious
J. communis var. *depressa* (Dwarf juniper)	Alaska to New Mexico, AZ and CA	8500-11500	1-3; cones globose, 7-9 mm in diameter, fleshy	needle-like leaves; shrubby and montane

PINACEAE
(Pine family)

Conifers (Ungrouped to Order)
Non-flowering seed plants

Habit: trees (in the southwest); thick, woody, non-photosynthetic stems

Leaves: green, photosynthetic- thin, linear, often needle-like, persistent

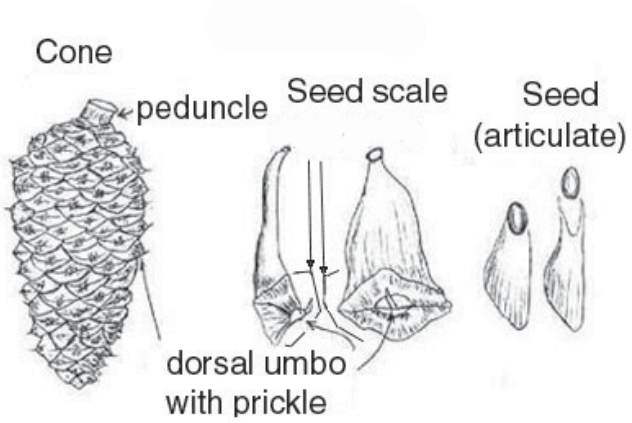
Cones: large (>10 cm), woody, dry, usually persistent; mostly monoecious (male and female cones on the same plant)

Four genera in the southwest:
1. *Pinus* (Pine)- leaves needle-like, in bundles known as fascicles; cones pendulous

2. *Picea* (Spruce)- leaves 4-sided, solitary on small peg-like structures known as sterigmata; cones pendulous

3. *Abies* (Fir)- leaves flat, solitary, sessile; cones upright, the scales deciduous

4. *Pseudotsuga* (Douglas fir)- leaves flat, solitary, petiolate; cones pendulous, with 3-parted bracts



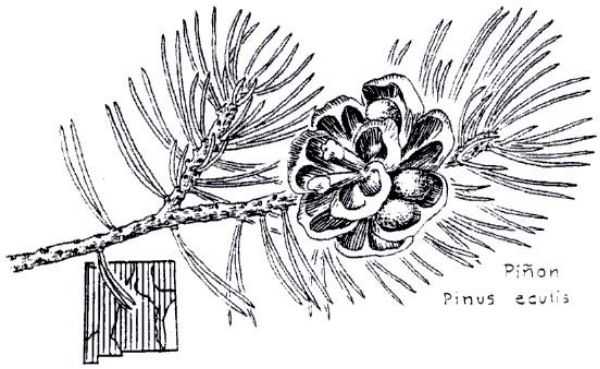
Distribution: genera/species
Worldwide: 11/220-250
NM: 2/14

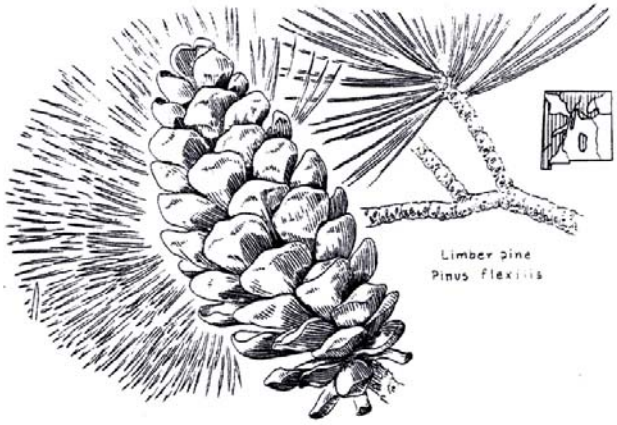
Economic uses- lumber, landscaping

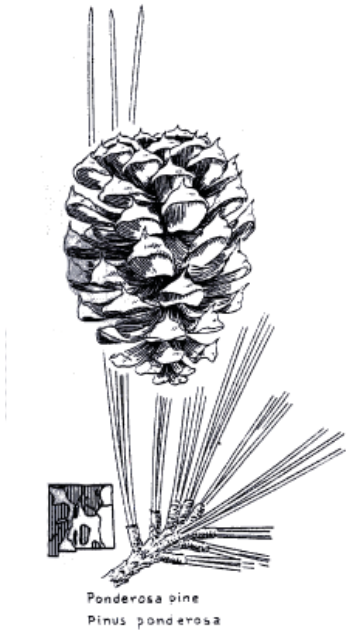
This is largest conifer family in terms of species diversity.

Pinaceae in New Mexico

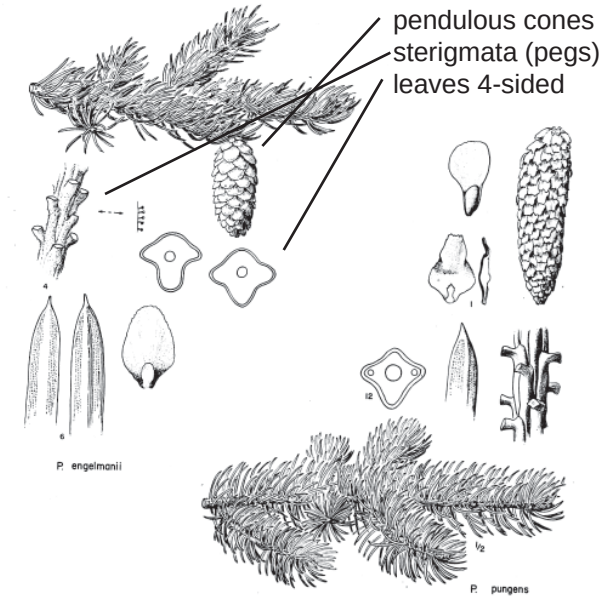
The genus *Pinus* (pine)

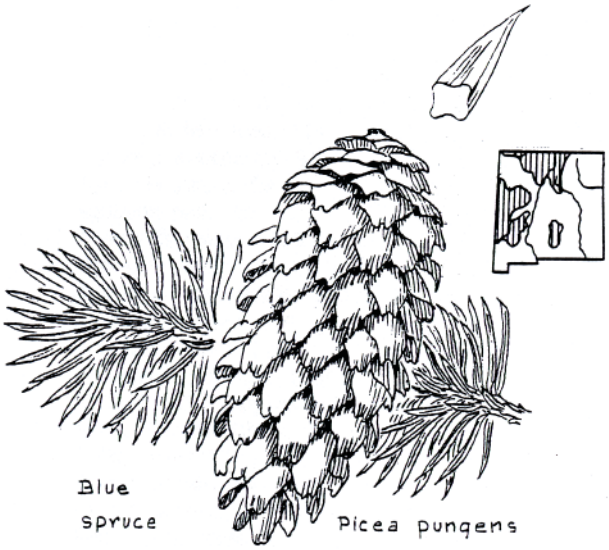






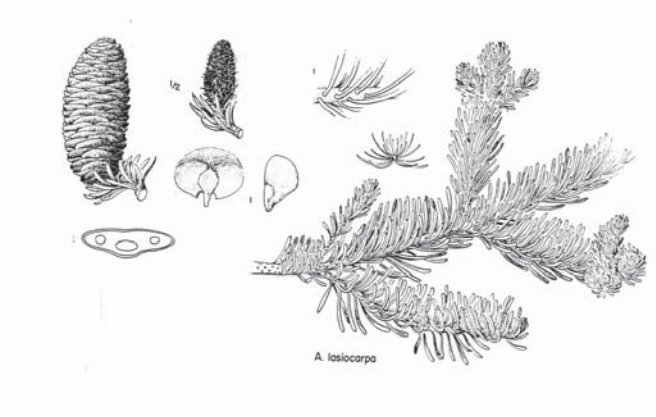
The genus *Picea* (spruce)



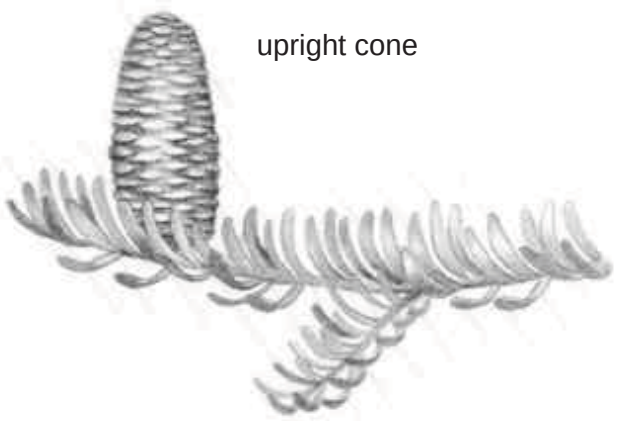


Pinaceae in New Mexico

The genus *Abies* (fir)

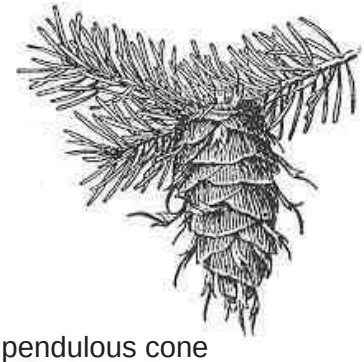


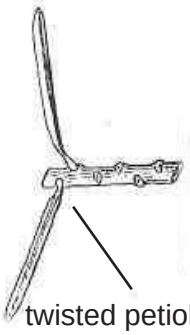
upright cone



Abies concolor- white fir

The genus *Pseudotsuga* (Douglas fir)

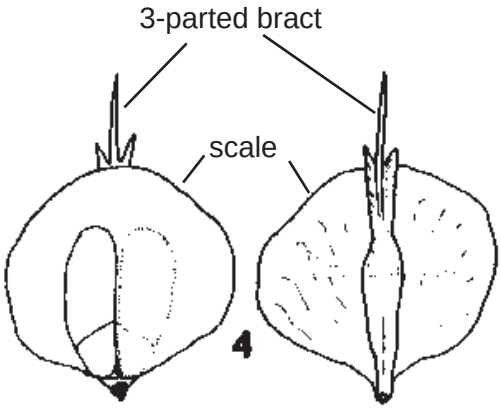




pendulous cone

twisted petiole

Pseudotsuga cone scale with 3-parted bract



Non-flowering Seed Plant Chart
Pinaceae (Pine Family)

Pinus

Taxon	Range	Elevation (ft) (NM range)	# Needles (length)	Cones	Other info
Pinus edulis (Colorado pinyon pine)	New Mexico and the southwest	5000-8000	2 1-2”	1-2.5” no wing	edible seeds
P. leiophylla var. *chihuahuana* (Chihuahua pine)	New Mexico, Arizona, w Mexico	5000-7000	3 2-4”	1.5-2” stalked	2 resin ducts
P. cembroides (Mexican Pinyon pine)	sw New Mexico, se Arizona, n Mexico	5500-8500	3 (1-5) 1-2”	1-2.5”	thick shell
P. engelmannii (Apache pine)	sw New Mexico, w Mexico	6000-8000	3 10” (8-15)	2.5-6”	14-16 resin ducts
P. ponderosa var. *scopulorum* (Ponderosa pine)	New Mexico, w US	7000-9500	3 (2-5) 5-7” (4-11)	2.5-6” winged	common
P. ponderosa var. *arizonica* (Arizona pine)	sw New Mexico, Arizona, Mexico	6000-9000	5 5-7”	2-3.5”	3 resin ducts
P. aristata (Bristlecone pine)	s Rockies (alpine)	10000-12000	5 1-1.5”	3-3.5”	long umbo on scale
P. flexilis (Limber pine)	scattered in New Mexico and the west	7500-12000	5 2-3.5”	3-10” sh stalked	umbo unarmed; flexible branches
P. strobiformis (Southwestern white pine)	s New Mexico, se Arizona, w Mexico	7000-10500	5 1.5-3.5”	3.5-10”	scales reflexed

Soft pines (section **strobus**)
1 vascular bundle
often much resin
softer, coarser grain
dehiscent sheath
needles usually 5 (1-4)
face of cone scale usually unarmed
taxa: *P. flexilis, P. aristata, P. edulis*

Hard pines (section **pinus**)
2 vascular bundles
usually little resin
harder, closer grain
persistent sheath
needles usually 2-3 (occ. 5)
face of cone usually armed
taxa: *P. ponderosa, P. leiophylla*

Picea (spruce) peg-like, woody petioles (sterigmata); 4 sided leaves

Picea engelmannii (Engelmann’s spruce)	New Mexico, Arizona, California, w Canada	8500-12000	softer, no resin ducts	1.5-3.5” persistent	branchlets pubescent
P. pungens (Colorado blue spruce)	New Mexico to Idaho and Arizona	7500-11500	stiffer, 1 resin duct	2.25-4” persistent	branchlets glabrous

Non-flowering Seed Plant Chart
Pinaceae (Pine Family)

Abies (fir) no sterigmata or petioles; leaves flattened; cones dehiscent)

Taxon	**Range**	**Elevation (ft)** (NM range)	**Needles**	**Cones**	**Other info**
Abies arizonica (Cork-bark fir)	Colorado to New Mexico and Arizona	8500-12000	1-1.5” tips notched to rounded	purple, scales longer than wide	branchlets pubescent
A. concolor (White fir)	w North America to n Mexico	7000-9000	2-3” tips rounded to acute	pale green, scales wider than long	branchlets glabrous

Pseudotsuga (Douglas fir) *no sterigmata; petiolate; leaves flattened; cones persistent*

Pseudotsuga menziesii var. *glauca* (Douglas fir)	Alberta to New Mexico and Arizona	6500-10500	soft, grooved on top; petioles twisted	2.5-4” persistent	cones with 3-toothed bracts

Field Trips

Sandia Crest
Las Huertas Canyon
Sevilleta NWR
West Mesa
Rio Grande Bosque

Sandia Crest

We will be visiting Sandia Crest by driving east of Albuquerque on Interstate 40, through Tijeras Canyon, which separates the Sandias from the Manzanillo Range just to the south. From the village of Tijeras we will head north through Cedar Crest, then westward into Cibola National Forest, and up the winding road to Sandia Crest. We will climb approximately 5,100 ft. during the one hour trip, from 5,500 ft. at the UNM campus to more than 10,600 ft. at the crest.

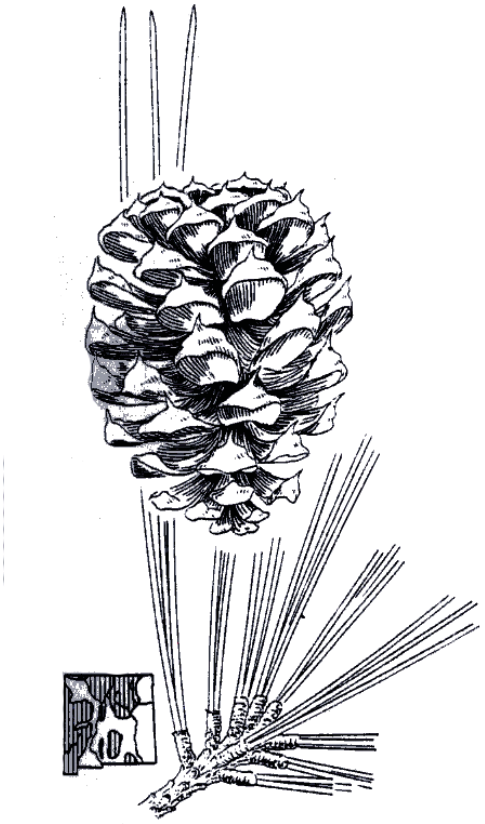
Enroute you will have an opportunity to note some features relating to the flora already discussed, or to be discussed, in class. Although we will concentrate mainly on the Spruce-Fir Forest near the crest, we will actually climb through at least four lower vegetation communitiies on the way up: *desert grassland, pinyon-juniper woodland, ponderosa forest, and mixed conifer forest.* In addition, we will view two other vegetation communities from a distance: *cottonwood riparian community and dry chaparral.*

After we leave the UNM campus, we soon turn eastward on I-40. You will notice that we begin to ascend in elevation as we approach the mountains. We are climbing the western bajada of the Sandias, created by great alluvial fans of sediments eroded off the mountains. In its natural state, the bajada is mostly covered by desert grassland. On this trip, however, we will see little natural vegetation until we get past the eastern limits of the city. We will get a much better look at desert grasslands on later field trips.

As we approach the mouth of Tijeras Canyon, you will see the boulder-covered lower slopes of the Sandia Mountains on the north side of the highway. This rock is chiefly granite, eroded from the massive granitic core of the Sandia range. Growing among the rocks are scattered grayish shrubs. Most of these are Scrub Oak (*Quercus turbinella*), a species typical of areas much further to the south. As we enter the canyon, you will notice that on the south side of the highway the slopes are covered with shrubs that appear darker green. These are one-seed junipers (*Juniperus monosperma*), one of the most common woodland trees in New Mexico. It requires conditions slightly cooler and moister than the oaks and thus, at this elevation, prefer north-facing slopes, which are cooler.

Along the highway as we enter the canyon you will see some large broad-leaved trees growing in the canyon bottom directly to the south. The water here is available near the surface of the ground along Tijeras Creek. We are looking at a cottonwood riparian community, dominated by the Rio Grande cottonwood (*Populus deltoides* ssp. *wislizeni*), a large broad-leaved deciduous tree which has roots that are able to penetrate to a shallow water-table. Such a plant is known as a Phreatophyte. Cottonwoods are also the dominant trees along the banks of the Rio Grande. We will get a close-up look at a cottonwood riparian community when we visit the Rio Grande bosque on a later field trip.

A mile or so into the canyon the oaks disappear from the south-facing slopes and are replaced by the one-seed junipers. These are soon joined by pinyon pine (*Pinus edulis*), the state tree of New Mexico. Pinyons require slightly more moisture and cooler conditions than junipers. Pinyons and junipers, together with oaks in some areas, are the dominant woodland trees in the



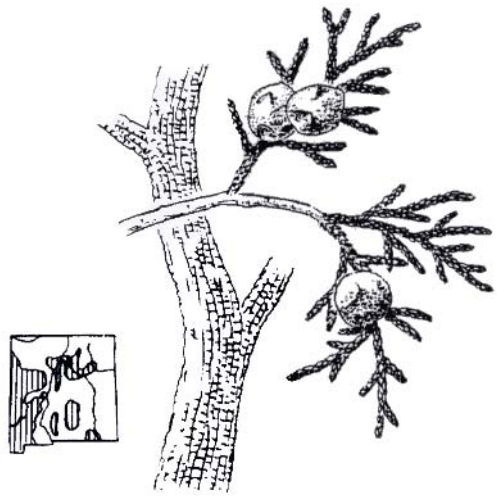
Ponderosa pine
Pinus ponderosa

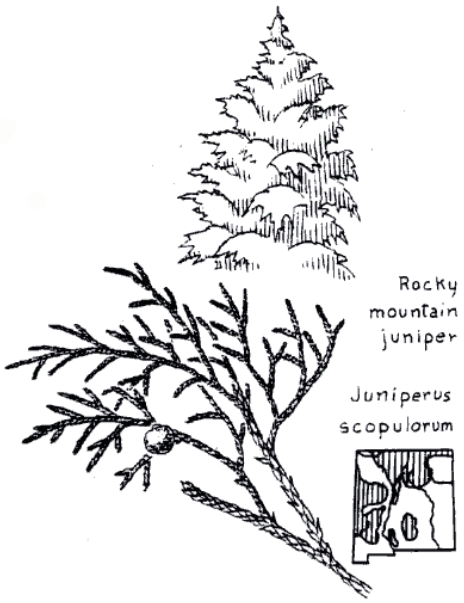
southwest. Vast stretches of New Mexico and Arizona are covered by pinyon-juniper woodland. As with the grassland and riparian communities, we will be visiting a pinyon-juniper woodland close-up on a later field trip.

To the north of the highway, high on top of the mountain, you may spot the first ponderosa pines (*Pinus ponderosa*), tall, massive trees which dominate the lowest of the three forest zones we are about to enter.

As we turn northward at Tijeras, you will be able to look westward at the forested eastern slope of the Sandia Range. Note that the eastern side of the mountain slopes more gently than the steeper west side. The east side of the mountain is surfaced with limestone deposited on the bottom of shallow seas which existed here during the Paleozoic Era. Unlike the drier, sparsely vegetated western slope, the wetter eastern slope is heavily forested. The forest is usually divided into three zones, based on the kinds of trees present:

Ponderosa forest dominated by ponerosa pine. Good stands of this tree may be seen at Doc Long's Campground. Also at Doc Long's are many boxelders (*Acer negundo*), which is actually a species of maple. Unlike most maple species, which have simple leaves with 3 to 5 lobes, boxelders have compound leaves, each leaf divided into 5 to 7 separate leaflets. Another tree found at Doc Long's is alligator juniper (*Juniperus deppeana*). The distinctive, rough, scale-like bark is what gives

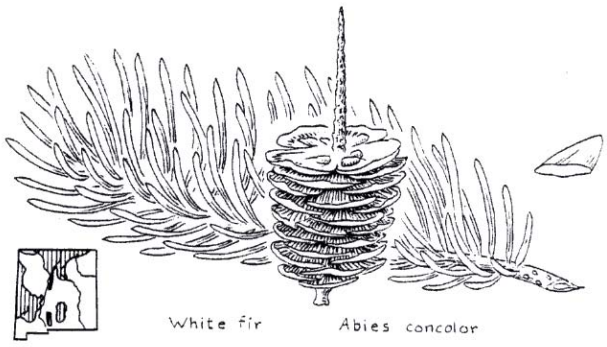




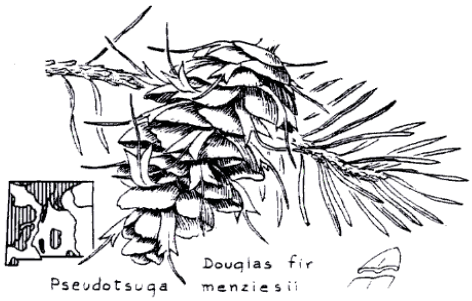
this juniper its common name. Alligator juniper is not abundant in the Sandia Mountains but is much more common farther south and west in New Mexico.

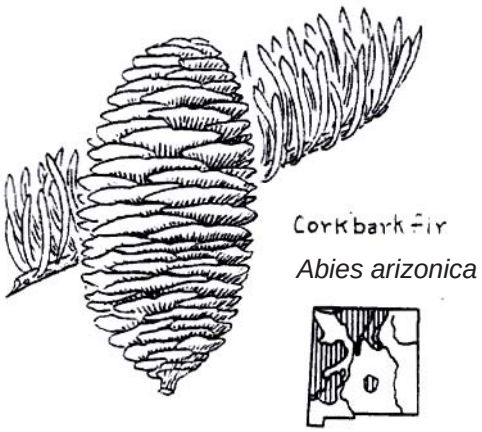
As we enter the ponderosa forest, the pinyons and one-seed junipers gradually disappear. However, another juniper makes its appearance at the lower edge of the ponderosa forest, the Rocky Mountain juniper (*Juniperus scopulorum*). Unlike the shrubby, scrubby-looking one-seed juniper, the Rocky Mountain juniper is definitely tree-like, with a single, straight trunk and slender branches, which may have a languid, drooping appearance from a distance. Its foliage is generally more grey-green in color than other junipers.

Mixed conifer forest, dominated by white fir (*Abies concolor*). This is one of the most common trees between Doc Long's Campground and the spruce-fir forest near the crest. Also common in this zone are Douglas fir (*Pseudotsuga menziesii*), ponderosa pine, Rocky Mountain juniper, aspen (*Populus tremuloides*), and mountain maple (*Acer glabrum*). You will note that the genus name of aspen, *Populus*, is the same as that for the Cottonwood. These two species are, in fact, closely related. The aspen is unique in that its major mode of reproduction is vegetative. That is, it has an extensive underground root system that is capable of copious budding, creating numerous "daughter" trees in ever wider concentric circles surrounding a single "mother" tree in the center of a clump. What may appear to be a grove of several separate trees is, in reality, a single clonal group. All of the trees in the grove are genetically identical.

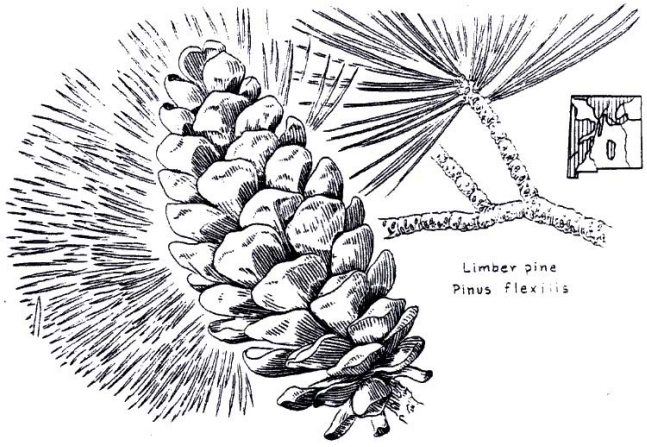


One area of note in the mixed conifer forest occurs at Tree Springs, 8,000 ft. elevation. The white fir forest on the east-facing slope contrasts with the shrubby chaparral community on the hotter west-facing slope. The chaparral is made up of chokecherry (*Prunus virginiana*), mockorange (*Philadelphus microphyllus*), Gambel's oak (*Quercus gambelii*), fendlerbush (*Fendlera rupicola*) and other shrubby species.





Spruce-fir forest, is also known as subalpine forest. The two dominant trees here are Engelmann spruce (*Picea engelmannii)*, and corkbark or subalpine fir (*Abies lasiocarpa*). Douglas fir and aspen continue to be widespread in this zone. The spruce-fir forest will be reached at about 10,000 feet. You may notice the extremely sharp spire shapes of the subalpine fir and the scaly bark of the Engelmann spruce. At the crest, we will park the vehicles and hike to a number of different habitats in and around the subalpine forest. A major stop will be Kiwanis Meadow, a fine example of a montane meadow habitat, which should be in fine flower at this time of year. Along the crest itself, we will see a number of examples of limber pine (*Pinus flexilis*), as well as numerous hardy wildflowers.



After our tour around the crest and meadow, we will board the vehicles and return directly back to Albuquerque and UNM.

Partial Species List of Sandia Crest

NON-FLOWERING SEED PLANTS

CUPRESSACEAE Cypress Family
Juniperus communis var. depressa DWARF JUNIPER
Juniperus scopulorum ROCKY MOUNTAIN JUNIPER

PINACEAE Pine Family
Abies arizonica CORK-BARK FIR
Abies concolor WHITE FIR
Picea engelmannii ENGELMANN'S SPRUCE
Picea pungens BLUE SPRUCE
Pinus flexilis LIMBER PINE
Pinus ponderosa var. scopulorum PONDEROSA PINE
Pseudotsuga menziesii var. glauca DOUGLAS FIR

ANGIOSPERMS

APIACEAE Parsley Family
Aletes acaulis INDIAN-PARSLEY
Cymopterus lemmonii MOUNTAIN-PARSLEY
Ligusticum porteri OSHA
Osmorhiza depauperata LESSER SWEET-CICELY

ASTERACEAE Aster Family
Achillea millefolium var. occidentalis WESTERN YARROW
Ageratina herbacea FRAGRANT SNAKEROOT
Agoseris auranticaca ORANGE-FLOWERED GOAT-CHICORY
Antennaria parvifolia LITTLE-LEAF PUSSYTOES
Artemisia campestris ssp. caudata FILED WORMWOOD
Artemisia dracunculus TARRAGON
Artemisia franserioides RAGWEED SAGEBRUSH
Artemisia ludoviciana ssp. albula NEW MEXICO WORMWOOD
Artemisia ludoviciana ssp. mexicana MEXICAN WORMWOOD
Cirsium pallidum PALE THISTLE
Cirsium undulatum WAVY-LEAF THISTLE
Erigeron eximius SPRUCE-FIR FLEABANE DAISY
Erigeron subtrinervis THREE-NERVE FLEABANE DAISY
Erigeron vetensis BLUETOP FLEABANE DAISY
Gutierrezia sarothrae BROOM SNAKEWEED
Helianthella parryi PARRY'S DWARF SUNFLOWER
Helianthus annuus L. ANNUAL SUNFLOWER
Hymenoxys richardsonii var. floribunda PINQUE
Oreochrysum parryi PARRY'S GOLDENROD
Packera fendleri FENDLER'S GROUNDSEL
Packera neomexicana ssp. neomexicana NEW MEX. GROUNDSEL
Packera sanguisorboides BURNET GROUNDSEL
Senecio bigelovii BIGELOW'S GROUNDSEL
Solidago nana
Solidago simplex var. simplex
Taraxacum laevigatum RED-SEED DANDELION
Taraxacum officinale COMMON DANDELION
Tetraneuris acaulis STEMLESS RUBBERWEED
Townsendia eximia ROCKY MOUNTAIN TOWNSEND-DAISY

BERBERIDACEAE Barberry Family
Berberis fendleri FENDLER'S BARBERRY
Berberis repens CREEPING OREGON-GRAPE

BORAGINACEAE Borage Family
Mertensia franciscana SAN FRANCISCO BLUEBELLS
Mertensia lanceolata PRAIRIE BLUEBELLS

BRASSICACEAE Mustard Family
Draba cuneifolia WEDGELEAF WHITLOW-GRASS
Draba helleriana var. helleriana HELLER'S WHITLOW-GRASS
Draba helleriana var. patens HELLER'S WHITLOW-GRASS
Erysimum capitatum PLAINS WALLFLOWER

CAMPANULACEAE Harebell Family
Campanula rotundifolia HAREBELL

CAPRIFOLIACEAE Honeysuckle Family
Sambucus racemosa var. microbotrys RED ELDER
Symphoricarpos rotundifolius ROUND-LEAF SNOWBERRY

CARYOPHYLLACEAE Pink or Carnation Family
Arenaria fendleri FENDLER'S SANDWORT
Arenaria lanuginosa ssp. saxosa SPREADING SANDWORT
Cerastium fontanum ssp. vulgare COMMON CHICKWEED
Minuartia macrantha ALPINE STICHWORT
Moehringia macrophylla LARGE-LEAF SANDWORT
Paronychia sessiliflora LOW NAILWORT
Pseudostellaria jamesiana STICKY STARWORT
Silene scouleri ssp. pringlei PRINGLE'S CATCHFLY

CHENOPODIACEAE Goosefoot Family
Chenopodium capitatum STRAWBERRY BLITE
Chenopodium fremontii FREMONT'S GOOSEFOOT

CRASSULACEAE Stonecrop Family
Sedum cockerellii COCKERELL'S STONECROP
Sedum integrifolium ROSEWORT

CYPERACEAE Sedge Family
Carex duriuscula SPIKE-RUSH SEDGE
Carex occidentalis NEW MEXICO SEDGE
Carex wootonii WOOTON'S SEDGE

FABACEAE Pea or Bean Family
Lathyrus leucanthus ASPEN SWEATPEA
Robinia neomexicana NEW MEXICO LOCUST
Thermopsis rhombifolia var. montana GOLDEN PEA
Trifolium attenuatum ROCKY MOUNTAIN CLOVER
Vicia americana AMERICAN VETCH

FAGACEAE
Quercus gambelii GAMBEL'S OAK

GENTIANACEAE
Frasera speciosa ELK WEEDT
Gentiana affinis PLEATED GENTIAN
Gentiana bigelovii BIGELOW'S GENTIAN
Gentianella amarella ssp. heterosepala DWARF GENTIAN

GERANIACEAE Geranium Family
Gernaium richardsonii RICHARDSON'S GERANIUM

GROSSULARIACEAE Gooseberry Family
Ribes wolfii WOLF'S CURRENT

HYDRANGEACEAE Hydrangea Family
Jamesia americana CLIFFBUSH
Philadelphus microphyllus ssp. microphyllus

HYDROPHYLLACEAE Waterleaf Family
Hydrophyllum fendleri FENDLER'S WATERLEAF

IRIDACEAE Iris Family
Iris missouriensis ROCKY MOUNTAIN IRIS

LAMIACEAE Mint Family
Agastache pallidiflora ssp. neomexicana GIANT-HYSSOP

LILIACEAE Lily Family
Allium geyeri GEYER'S ONION
Anticlea elegans MOUNTAIN DEATHCAMAS
Calochortus gunnisonii GUNNISON'S MARIPOSA-LILY
Maianthemum racemosum FALSE SOLOMON'S-SEAL
Maianthemum stellatum STARRY FALSE SOLOMON'S-SEAL

MALVACEAE Mallow Family
Illiamna grandifllora WILD HOLLYHOCK
Malva neglecta DWARF CHEESEWEED
Sidalcea candida WHITE CHECKER-MALLOW

NYCTAGINACEAE Four-o'clock Family
Mirabilis nyctaginea HEART-LEAF FOUR-O'CLOCK
Mirabilis oblongifolia MEADOW FOUR-O'CLOCK
Mirabilis oxybaphoides SPREADING FOUR-O'CLOCK

ORCHIDACEAE Orchid Family
Calypso bulbosa var. americana FAIRY-SLIPPER ORCHID
Corallorhiza maculata SPOTTED CORAL-ROOT
Corallorhiza striata var. vreelandii HOODED CORAL-ROO
Goodyera oblongifolia RATTLESNAKE PLANTAIN

OROBANCHACEAE
Castilleja integra FOOTHILLS PAINTBRUSH
Castilleja miniata SHOWY PAINBRUSH
Pedicularis procera GIANT LOUSEWORT

OXALIDACEAE Oxalis Family
Oxalis alpina ALPINE WOOD-SORREL
Oxalis caerulea BLUE WOOD-SORREL

PLANTAGINACEAE Plantain Family
Penstemon inflatus INFLATED PENSTEMON
Penstemon strictus ROCKY MOUNTAIN PENSTEMON
Penstemon whippleanus DUSKY PENSTEMON

POACEAE Grass Family
Blepharoneuron tricholepis PINE DROPSEED
Bromus carinatus MOUNTAIN BROME
Bromus ciliatus FRINGED BROME
Bromus inermis SMOOTH BROME
Bromus porteri PORTER'S BROME
Dactylis glomerata ORCHARDGRASS
Danthonia parryi PARRY'S DANTHONIA
Elymus trachycaulus ssp. subsecundus WHEATGRASS
Elymus trachycaulus ssp. violaceus PURPLE WHEATGRASS
Festuca arizonica ARIZONA FESCUE
Festuca brachyphylla ssp. coloradensis SHORTLEAF FESCUE
Festuca sororia RAVINE FESCUE
Festuca thurberi THURBER'S FESCUE
Horedum jubatum ssp. intermedium FOXTAIL BARLEY
Melica porteri PORTER'S MELICA
Muhlenbergia montana MOUNTAIN MUHLY
Poa arctica ARCTIC BLUEGRASS
Poa fendleriana var. fendleriana FENDLER'S MUTTONGRASS
Poa fendleriana var. longiligula LONGTONGUE MUTTONGRASS
Poa interior INTERIOR BLUEGRASS
Poa occidentalis NEW MEXICO BLUEGRASS
Poa pratensis KENTUKY BLUEGRASS
Poa tracyi TRACY'S BLIEGRASS
Trisetum montanum ROCKY MOUNTAIN TRISETUM

POLEMONIACEAE Phlox Family
Aliciella pinnatifida STICKY GILIA
Collomia linearis NARROW-LEAF MOUNTAIN-TRUMPET

Ipomopsis aggregata ssp. formosissima SKYROCKET
Polemonium brandegei BRANDEGEE'S JACOB'S-LADDER
Polemonium flavum YELLOW JACOB'S-LADDER
Polemonium foliosissimum JACOB'S-LADDER

POLYGONACEAE Buckwheat or Knotweed Family
Rumex crispus CURLY DOCK
Rumex hymenosepalus TANNER'S DOCK

PRIMULACEAE Primrose Family
Androsace septentrionalis PYGMY ROCK-JASMINE
Dodecatheon pulchellum DARK-THROAT SHOOTING-STAR
Primula rusbyi var. ellisiae ELLIS' PRIMROSE

PYROLACEAE Pyrola Family
Orthilia secunda SIDEBELLS
Pyrola chlorantha GREEN-FLOWER WINTERGREEN

RANUNCULACEAE Buttercup Family
Aconitum columbianum MONK'S HOOD
Actaea rubra ssp. arguta RED BANEBERRY
Anemone canadensis WINDFLOWER
Aquilegia elegantula RED COLUMBINE
Clematis bigelovii BIGELOW'S LEATHERFLOWER
Clematis columbiana COLUMBIAN VIRGIN'S-BOWER
Delphinium sapellonis SAPELLO CANYON LARKSPUR
Thalictrum fendleri FENDLER'S MEADOW-RUE

ROSACEAE Rose Family
Amelanchier alnifolia SASKATOON SERVICEBERRY
Amelanchier utahensis UTAH SERVICEBERRY
Fragaria vesca WOODLAND STRAWBERRY
Fragaria virginiana PALE STRAWBERRY
Holodiscus dumosa INLAND OCEANSPRAY
Potentilla concinna PRETTY CINQUEFOIL
Potenilla fruticosa SHRUBBY CINQUEFOIL
Potentilla gracilis var. pulcherrima GRACEFUL CINQUEFOIL
Potentilla pensylvanica PENNSYLVANIA CINQUEFOIL

RUBIACEAE Madder Family
Galium boreale NORTHERN BEDSTRAW
Galium fendleri FENDLER'S BEDSTRAW
Galium mexicanum ssp. asperrimum MEXICAN BEDSTRAW

SALICACEAE Willow Family
Populus tremuloides QUAKING ASPEN

SAXIFRAGACEAE Saxifrage Family
Heuchera pulchella SANDIA ALUMROOT

SCROPHULARIACEAE Figwort Family
Scrophularia montana MOUNTAIN FIGWORT
Verbascum thaspus WOOLY MULLEIN

VALERIANACEAE Valerian Family
Valeriana edulis TOBACCO-ROOT

VIOLACEAE Violet Family
Viola canadensis CANADIAN VIOLET

VISCACEAE Mistletoe Family
Arceuthobium douglasii DWARF-MISTLE-TOE
Arceuthobium vaginatum ssp. cryptopodum MISTLE-TOE

Las Huertas Canyon

Our trip to study a Montane Riparian habitat will take us up Las Huertas Canyon at the north end of the Sandia Range. After leaving the UNM campus we will head north on Interstate 25 to the town of Bernalillo. We will then turn eastward to the village of Placitas, and from there southward on a winding dirt road to the middle of Las Huertas Canyon. Our study sites in the canyon will be at approximately 7,000-7,500 ft., in well protected forested areas. The trip will take approximately one hour.

As we head north on I-25, after we pass the Albuquerque city limits, we will be driving through **desert grassland**, dominated by numerous grass species (Family Poaceae), including various species of grama grasses (*Bouteloua* spp.), dropseeds (*Sporobolus* spp.), and three-awns (*Aristida* spp.). As you look toward the Sandia Mountains, you can see that the grassland continues all the way to the base of the mountains, where **pinyon-juniper woodland** becomes dominant. As you look to the west, you can see the **Rio Grande bosque**, a ribbon of green running through the dry desert grassland. The bosque is a cottonwood riparian community, dominated by the Rio Grande Cottonwood (*Populus deltoides* ssp. *wislizenii*).

Fallugia paradoxa

The broad ancestral flood-plain of the Rio Grande soon becomes visible as we proceed northward. The flood-plain is the wide level area over which the river wandered in former times before it was contained between levees. Originally, much of this flood-plain was patchily covered with bosque and swampy areas, and was a rich wildlife habitat. Small drainage channels or arroyos cross the highway from time to time. Along their banks grow various shrubs which can survive because the soil moisture conditions there are more favorable than in the surrounding dry grassland. Common among them are Apache plume (*Fallugia paradoxa*), desert willow (*Chilopsis linearis*), four-wing saltbush (*Atriplex canescens*), and chamiso (*Chrysothamnus nauseosus*).

Quercus gambelii

Populus angustifolia

From Bernalillo to Placitas, we travel through a woodland of widely scattered junipers (*Juniperus monosperma*), interspersed with grasses and shrubs. The spacing of the junipers is determined by the amount of area it takes to supply water for one tree. The less water there is, the more widely spaced the junipers. But under-ground between the trees, the area is crisscrossed with roots. After Placitas, the woodland becomes much denser and the junipers are joined by pinyons (*Pinus edulis*) and Gambel oak (*Quercus gambelii*).

Soon after the road turns to dirt, we enter Las Huertas Canyon and the surrounding foliage changes dramatically. The road is now running alongside Las Huertas Creek and the increased soil moisture provides support for numerous riparian plants, including a number of broad-leaved deciduous trees. Unlike the vast majority of water courses in the Sandia Mountains, Las Huertas Creek is not ephemeral. It is permanent, running year-round. Its origin is a spring located on a private ranch higher up the mountain.

If a permanent stream were not located in Las Huertas Canyon, the vegetation community would be pinyon-juniper woodland, gradually grading into mixed conifer

forest. Both of these community types are visible on the upland areas on either side of the creek. But hugging the creek itself is a montane riparian woodland, a fairly rare habitat in New Mexico. It is dominated by numerous deciduous species, including boxelder (*Acer negundo*), mountain maple (*Acer glabrum*), New Mexico locust (*Robinia neomexicana*), and narrowleaf cottonwood (*Populus angustifolia*). Narrowleaf cottonwood, closely related to both the Rio Grande cottonwood and aspen, is noteworthy as a North American source of the fragrant resin, Balm-of-Gilead, a waxy effusion from the buds that is used in perfumes.

Acer negundo

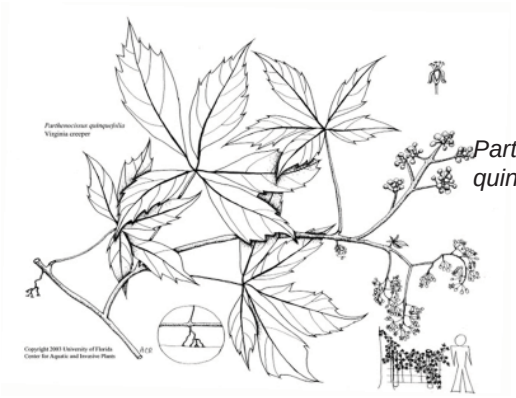
Robinia neomexicana

In addition to the dominant woodland trees, two climbing vines are quite prominant in this riparian community, Virgin's Bower (*Clematis ligusticifolia*) and Virginia Creeper (*Parthenocissus quinquefolia*). Virgin's Bower should be covered with showy, white fuzzy plumes at this time of year. The fuzzy plumes are attached to the fruit and assist in seed dispersal. The leaves of Virginia Creeper should be turning bright scarlet now, anticipating the fall colors of the other deciduous plants in the riparian community.

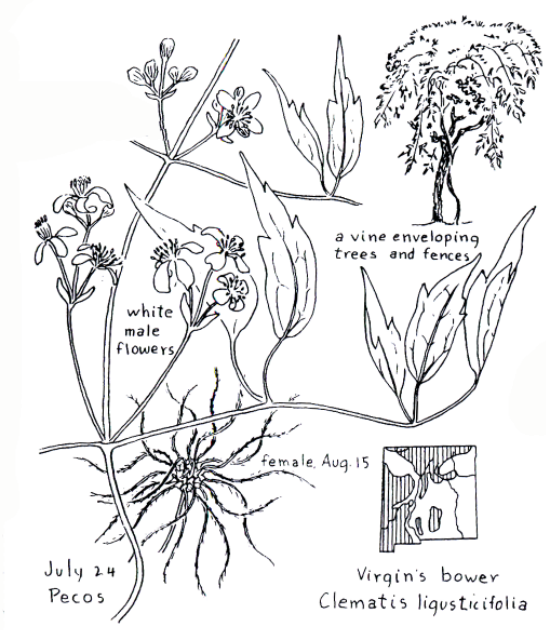
Another broad-leaved plant whose leaves should be turning scarlet is Smooth Sumac (*Rhus glabra*). This is a shrub or small tree which grows in somewhat drier and sunnier areas of the woodland. Its prominant bundle of red berries is used to make "Wild Lemonade" by some people. One final plant is important to mention, **Poison Ivy** (*Rhus radicans*). While this plant grows as a woody vine in other parts of the country, it is strictly herbaceous and not viney at all in New Mexico. Still, it is rather abundant in certain areas of this riparian community. So, be careful when examining herbs with compound leaves, 3-leaflets per leaf.

We will be visiting at least two different habitats within the Montane Riparian Community: 1) the deciduous woodland; and 2) an adjoining open meadow.

Rhus radicans
Poison Ivy



Parthenocissus quinquefolia



Partial Species List of Las Huertas Canyon

ACERACEAE
Acer glabrum Rocky Mtn. Maple
Acer negundo Boxelder

ANACARDIACEAE
Rhus glabra Smooth Sumac
Rhus radicans Poison Ivy
Rhus trilobata Lemonade Berry

ASTERACEAE
Artemisia dracunculus
Artemisia ludoviciana
Brickellia grandiflora
Conyza canadensis
Dyssodia papposa
Ericameria nauseosa
Erigeron divergens
Grindelia nuda var. aphanactis
Gutierrezia sarothrae
Helianthus annuus
Lactuca tatarica
Ratibida tagetes
Rudbeckia laciniata
Solidago wrightii
Viguiera multiflora

BERBERIDACEAE
Berberis fendleri
Mahonia repens

BORAGINACEAE
Lappula occidentalis
Mertensia lanceolata

BRASSICACEAE
Lepidium virginacum var. medium
Thelypodium wrightii

CANNABINACEAE
Humulus lupulus

CAPPARACEAE
Cleome serrulata

CAPRIFOLIACEAE
Symphoricarpos rotundifolius

CHENOPODIACEAE
Chenopodium album
Dysphania graveolens
Salsola tragus

CONVOLVULACEAE
Convolvulus arvensis
Ipomoea cristulata

CUPRESSACEAE
Juniperus monospermum
Juniperus scopulorum

EUPHORBIACEAE
Chamaesyce prostrata
Euphorbia brachycera

FABACEAE
Dalea candida
Melilotus albus
Melilotus officinalis
Robinia neomexicana
Trifolium pratense
Trifolium repens

FAGACEAE
Quercus gambelii
Quercus undulata

GERANIACEAE
Erodium cicutarium
Geranium caespitosum
Geranium richardsonii

GROSSULARIACEAE
Ribes inebrians
Ribes leptanthum

HYDRANGEACEAE
Fendlera rupicola
Jamesia americana
Philadelphus microphyllus

LINACEAE
Linum lewisii

LOASACEAE
Mentzelia albicaulis

MALVACEAE
Malva neglecta
Sphaeralcea angustifolia
Sphaeralcea fendleri

MONOTROPACEAE
Pterospora andromedea

NYCTAGINACEAE
Mirabilis multiflora

ONAGRACEAE
Oenothera caespitosa
Oenothera coronopifolia
Oenothera villosa

OROBANCHACEAE
Castilleja integra
Conopholis mexicana
Cordylanthus wrightii

PINACEAE
Abies concolor
Picea engelmanii
Picea pungens
Pinus ponderosa
Pseudotsuga menziesii

POACEAE
Aristida purpurea
Bothriochloa laguroides
Bouteloua curtipendula
Bouteloua gracilis
Bromus japonicus
Dasychloa pulchella
Elymus canadensis
Glyceria striata
Hordeum jubatum

PLANTAGINACEAE
Penstemon barbatus
Penstemon strictus
Penstemon whippleanus
Plantago major

POLEMONIACEAE
Ipomopsis aggregata
Polemonium foliosissumum

POLYGONACEAE
Eriogonum jamesii
Eriogonum polycladon
Polygonum ramossimum
Rumex crispus

RANUNCULACEAE
Clematis ligusticifolia
Thalictrum fendleri

ROSACEAE
Cercocarpus montanus
Crataegus macrantha
Fallugia paradoxa
Prunus americana
Prunus virginiana
Rosa woodsii

RUTACEAE
Ptelea trifoliata

SALICACEAE
Populus angustifolia
Salix exigua
Salix irrorata

SIMAROUBACEAE
Ailanthus altissima

SOLANACEAE
Physalis hederifolia
Solanum elaeaginifolium

VERBENACEAE
Glandularia bipinnatifida
Verbena bracteata
Verbena macdougalii

VIOLACEAE
Viola sororia var. affinis

VISCACEAE
Phoradendron juniperum

VITACEAE
Parthenocissus quinquefolia
Vitis arizonica

Sevilleta

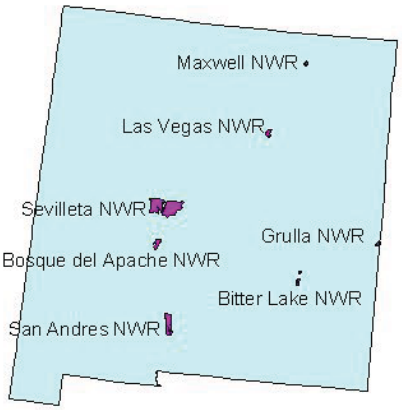
Our trip to study the flora of desert grasslands and the Chihuahuan desert will take us to the Sevilleta National Wildlife Refuge (NWR). The Sevilleta NWR is located ~60 miles south of Albuquerque, on Interstate 25 and should take about an hour. The Sevilleta NWR is approximately 220,000 acres in size, bordered by the Los Piños Mountains to the east of I-25, and by the Sierra Ladrone Mountains to the west. The Rio Grande valley lies in between. The Sevilleta NWR is situated near the junction of several significant floristic zones in New Mexico and the southwest including; the Southern Rocky Mountains/Mogollon Plateau, Short-grass Prairie, Colorado Plateau, and the Chihuahuan Desert. In addition, the Rio Grande riparian zone supports a wide range of mesic species. As a result of the great variety of ecosystems in the region, the biodiversity of the Sevilleta NWR is very rich, supporting more than 1,200 species of plants.

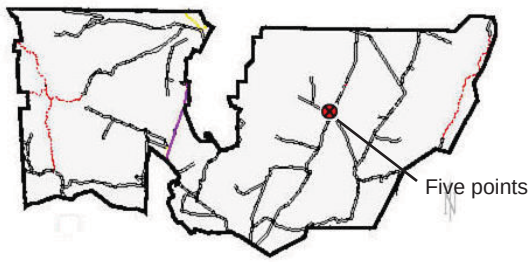
We will be visiting a few of the Sevilleta Long Term Ecological Research (LTER) sites near Black Grama Core, and Creosote Core a short distance from Five Points, which is located in the center of the east side of the Sevilleta NWR at an elevation of approximately 5280 ft. Five Points includes the black grama grassland and the creosote shrublands and is the transition between Desert Grassland and Chihuahuan Desert Scrub habitats. In addition, we will also visit a gypsum outcrop and look at the plants from this soil type. Gypsum is one of the more common minerals in sedimentary environments and soils are generally white and nutrient poor.

Cool vs Warm season grasses- Desert grasslands are dominated by warm season grasses, as contrasted with the cool season grasses which dominate the great grasslands of the American plains. Warm season grasses differ from cool season grasses in a number of significant ways:

Cool Season Grasses

Growth season:	Late spring - early summer
Photosynthesis:	C3
Reproduction:	Largely vegetative
Habit:	Mat-forming sods



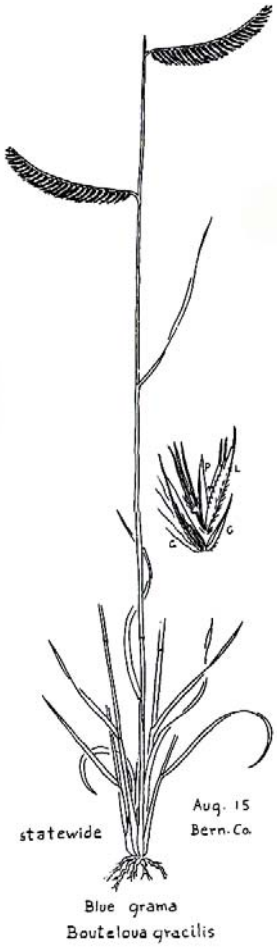


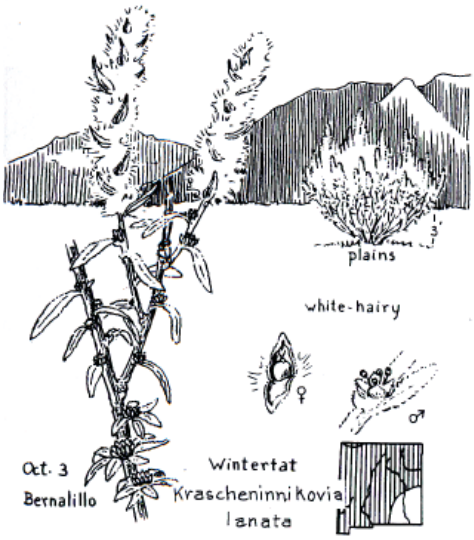
Warm Season Grasses

Growth season:	Mid to late summer
Photosynthesis:	C4
Reproduction:	Mainly from seeds
Habit:	Clumps or bunches

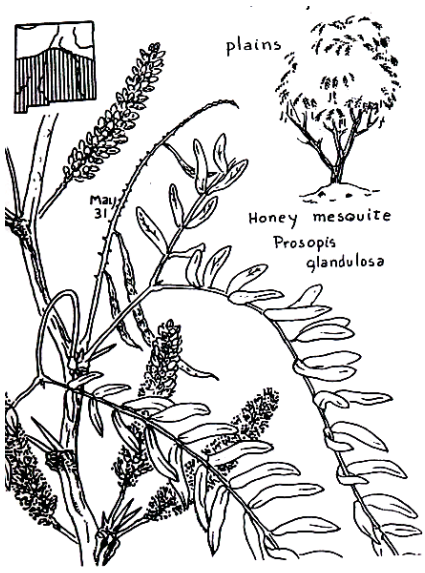
All of the above differences are the result of adaptations made by warm season grasses to cope with the hot, arid conditions found in the desert west.

Muhlenbergia arenicola

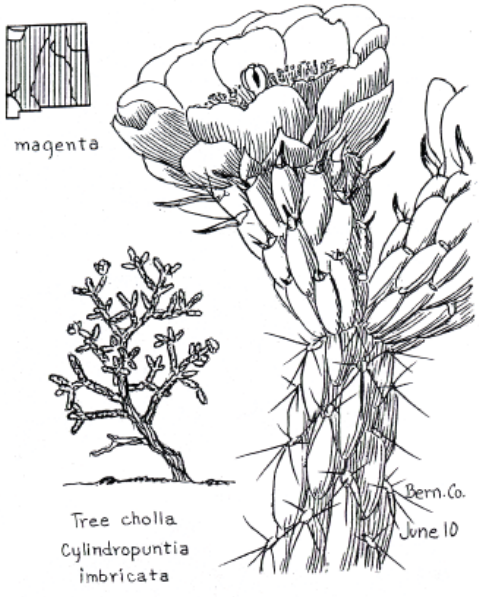


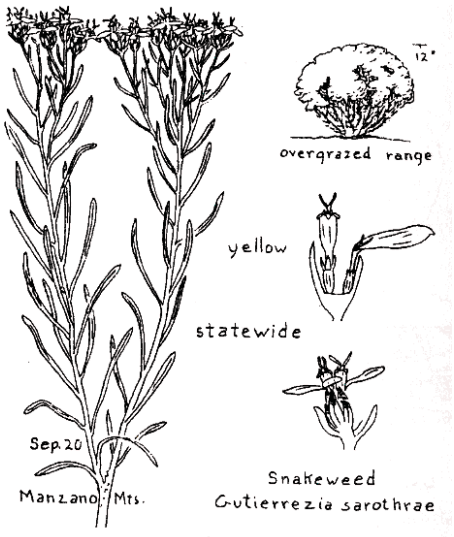


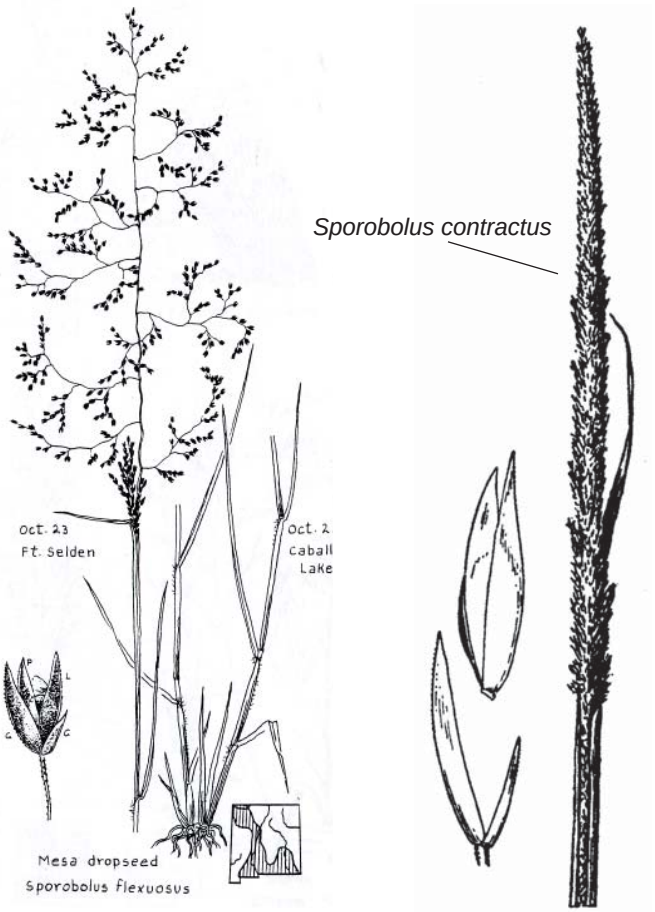
Sporobolus cryptandrus



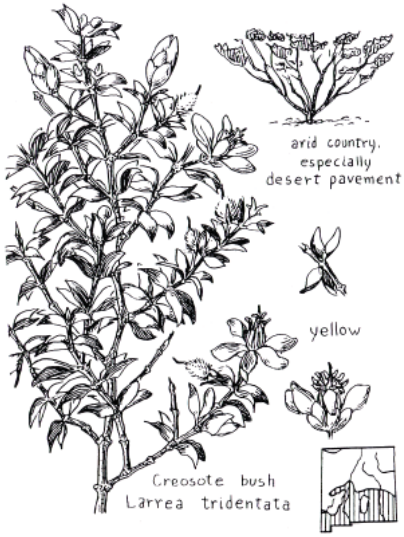
Desert Grassland- The desert grassland near Five Points is dominated by numerous grass species (Poaceae), including black grama (*Bouteloua eriopoda*), blue grama (*Bouteloua gracilis*) dropseed grasses (*Sporobolus contractus, Sporobolus cryptandrus, Sporobolus flexuosus*) and sand muhly (*Muhlenbergia arenicola*). In addition, there are also many shrubs including broom snakeweed (*Gutierrezia sarothrae*), fourwing saltbush (*Atriplex canescens*), Mormon tea (*Ephedra torreyana*), winterfat (*Krascheninnikovia lanata*), tree cholla (*Opuntia imbricata*), club cholla (*Opuntia clavata*), desert pricklypear (*Opuntia phaeacantha*), soapweed yucca (*Yucca glauca*), and the occasional, creosotebush (*Larrea tridentata*).







Chihuahuan Desert- At Creosote Core, a short distance from the desert grasslands site near Five Points, the Chihuahuan Desert scrub community is dominated by creosotebush, broom snakeweed, purple pricklypear (*Opuntia macrocentra*), feather dalea (*Dalea formosa*), and soapweed yucca. In addition, several species of grasses are prevalent, including, black grama, fluffgrass (*Dasyochloa pulchellum*), burrograss (*Scleropogon brevifolia*), bushmuhly (*Muhlenbergia porteri*), and galleta (*Pleuraphis jamesii*).



Partial Species List of the Sevilleta

AGAVACEAE (Century-Plant Family)
Nolina microcarpa
Yucca baccata
Yucca glauca

AMARANTHACEAE (Amaranth Family)
Amaranthus blitoides
Amaranthus hybridus
Amaranthus palmeri
Tidestromia lanuginosa

ANACARDIACEAE (Sumac Family)
Rhus microphylla
Rhus trilobata

APIACEAE (Carrot Family)
Aletes acaulis
Aletes filifolius
Cymopterus acaulis var. fendleri

ASCLEPIADACEAE (Milkweed Family)
Asclepias asperula ssp. asperula
Asclepias latifolia
Asclepias speciosa
Asclepias subverticillata

ASTERACEAE (Aster Family)
Acourtia nana
Artemisia filifolia
Artemisia ludoviciana
Baccharis salicifolia
Berlandiera lyrata
Bidens cernua
Chaetopappa ericoides
Dyssodia papposa
Ericameria nauseosa
Erigeron divergens
Erigeron flagellaris
Gaillardia pinnatifida
Gutierrezia sarothrae
Helianthus petiolaris
Isocoma pluriflora
Machaeranthera tanacetifolia
Melampodium leucanthum
Ratibida tagetes
Thelesperma megapotamicum
Zinnia grandiflora

BIGNONIACEAE
Chilopsis linearis

BORAGINACEAE (Borage Family)
Cryptantha cinerea var. cinerea
Cryptantha crassisepala
Lithospermum multiflorum
Tiquilia canescens
Tiquilia hispidissima

BRASSICACEAE (Mustard Family)
Descurainia obtusa
Descurainia pinnata
Dimorphocarpa wislizeni
Erysimum capitatum
Lepidium montanum
Lesquerella fendleri
Lesquerella gordonii
Schoenocrambe linearifolia

CACTACEAE (Cactus Family)
Echinocereus fendleri
Opuntia clavata
Opuntia erinacea
Opuntia imbricata
Opuntia leptocaulis
Opuntia phaeacantha
Opuntia polyacantha var. juniperina

CAPPARACEAE (Caper Family)
Cleome serrulata
Polanisia dodecandra ssp. trachysperma
Polanisia uniglandulosa

CHENOPODIACEAE
Allenrolfea occidentalis
Atriplex canescens
Chenopodium incanum
Kochia scoparia
Krascheninnikovia lanata
Suaeda suffrutescens

CUCURBITACEAE (Cucumber Family)
Cucurbita foetidissima

CUPRESSACEAE (Cypress Family)
Juniperus monosperma

ELAEAGNACEAE (Oleaster Family)
Elaeagnus angustifolia

EPHEDRACEAE (Mormon-Tea Family)
Ephedra torreyana
Ephedra viridis

EUPHORBIACEAE (Spurge Family)
Chamaesyce albomarginata
Chamaesyce fendleri
Chamaesyce geyeri
Chamaesyce revoluta
Chamaesyce serpyllifolia ssp. serpyllifolia
Chamaesyce serrula
Croton texensis
Reverchonia arenaria
Tragia ramosa

FABACEAE (Pea Family)
Astragalus albulus
Astragalus lentiginosus
Astragalus nuttallianus
Caesalpinia jamesii
Dalea lanata var. terminalis
Dalea scariosa
Glycyrrhiza lepidota
Hoffmannseggia glauca
Melilotus officinalis
Parryella filifolia
Prosopis glandulosa
Psorothamnus scoparius
Senna bauhinioides

FAGACEAE (Oak Family)
Quercus turbinella

FOUQUIERIACEAE (Ocotillo Family)
Fouquieria splendens

HYDROPHYLLACEAE (Waterleaf Family)
Nama hispidum
Phacelia integrifolia

LAMIACEAE (Mint Family)
Hedeoma drummondii
Hedeoma nana
Mentha arvensis

MALVACEAE (Mallow Family)
Malvella leprosa
Sphaeralcea digitata
Sphaeralcea incana
Sphaeralcea wrightii

NYTAGINACEAE (Four-O'Clock Family)
Abronia fragrans
Allionia incarnata
Boerhavia erecta
Boerhavia intermedia
Boerhavia spicata
Mirabilis linearis
Mirabilis multiflora
Tripterocalyx micranthus

OLEACEAE (Olive Family)
Fraxinus velutina
Menodora scabra

ONAGRACEAE (Evening-Primrose Family)
Calylophus hartwegii
Gaura coccinea
Gaura parviflora
Oenothera cespitosa ssp. cespitosa
Oenothera elata ssp. hirsutissima
Oenothera pallida

OROBANCHACEAE (Broom-Rape Family)
Orobanche ludoviciana ssp. multiflora

PINACEAE (Pine Family)
Pinus edulis

PLANTAGINACEAE (Plantain Family)
Plantago major
Plantago patagonica

POACEAE (Grass Family)
Achnatherum hymenoides
Agrostis gigantea
Aristida purpurea
Bothriochloa laguroides ssp. torreyana
Bouteloua aristidoides
Bouteloua barbata
Bouteloua curtipendula
Bouteloua eriopoda

Bouteloua gracilis
Bouteloua hirsuta
Echinochloa crus-pavonis var. macera
Elymus elymoides
Muhlenbergia asperifolia
Poa bigelovii
Poa fendleriana
Sporobolus contractus
Sporobolus cryptandrus
Sporobolus wrightii
Vulpia octoflora var. glauca

POLEMONIACEAE (Phlox Family)
Ipomopsis longiflora
Ipomopsis multiflora

POLYGONACEAE (Buckwheat Family)
Eriogonum annuum
Eriogonum jamesii
Eriogonum leptophyllum

SOLANACEAE (Potato Family)
Lycium pallidum
Solanum elaeagnifolium

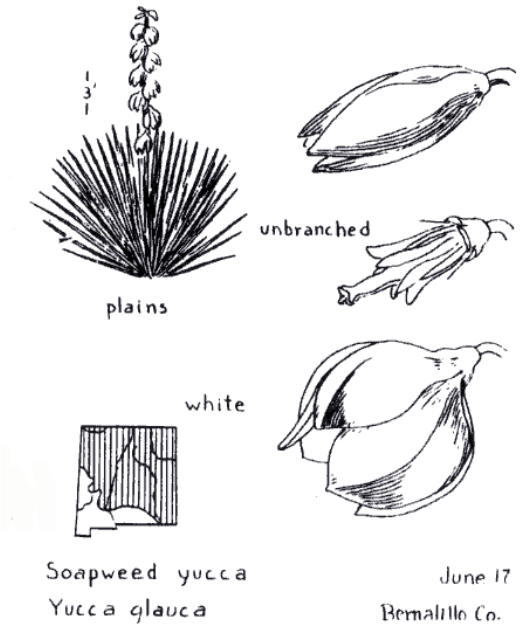
TAMARICACEAE (Tamarisk Family)
Tamarix chinensis

ZYGOPHYLLACEAE (Creosote-Bush Family)
Kallstroemia parviflora
Larrea tridentata
Tribulus terrestris

West Mesa

Our trip to study the flora of a Sandy Grassland habitat will take us to the West Mesa, specifically to the Puerco Breaks, the sandy escarpment that overlooks the floodplain of the Rio Puerco. The Puerco Breaks are located approximately fifteen miles west of the Rio Grande. Our route will take us north on Interstate 25 to Paseo del Norte, west across the Rio Grande to Coors Road, then north to Alameda Boulevard. At Alameda we will go west and follow the road as it curves north and becomes Rio Rancho Boulevard. We will enter the city of Rio Rancho and drive to Southern Boulevard. At Southern we will go west to the city limits, where the road changes from pavement to dirt, then continue west on the dusty, bumpy road to its end at a parking area at the base of the *Puerco Breaks*. The drive should take us about an hour.

The surface soil of the *West Mesa* is sand that has been deposited by the prevailing winds from the west and south. Most of the sandy soil now sitting atop the West Mesa, from Coors Road to the Puerco Breaks, originated in the Rio Puerco valley. The top of the Puerco Breaks is made up of active sand dunes that are still moving eastward as the winds continue to drive them. Dunes such as this are located throughout the southwest, always near a body of water and always to the east and/or north of the water. In a sense, the entire west mesa is still actively moving eastward. Communities such as Rio Rancho and Paradise Hills are literally built upon shifting sands.



Sporobolus cryptandrus

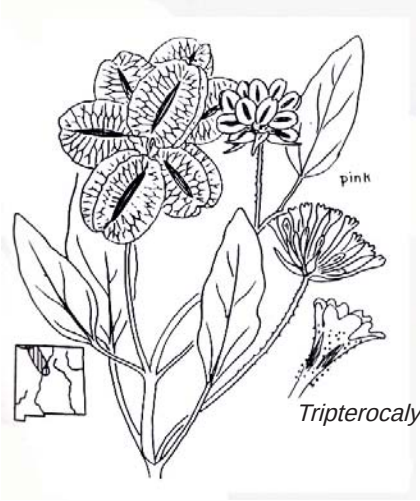
Achnatherum hymenoides

The sand itself is composed mostly of silicates, which provide both good news and bad news for plants. The good news is that silicates are excellent moisture reservoirs. The bad news is that they are poor in nutrients. So, plants that can overcome the nutrient-poor soil are rewarded with a fairly consistent, albeit minimal, supply of water. Whereas the desert grassland of the westen bajada of the Sandia Mountains is dominated by grasses because there is insufficient moisture to sustain most forbs, the sandy grassland of the west mesa is more heterogeneous in its mix of species. Grasses and forbs are generally intermixed throughout the west mesa habitat.

The combination of low nutrients and grass-forb mix make this habitat less than ideal for grazing animals. However, the plants of this habitat are generally great seed producers. So, seed lovers such as rodents and many species of birds find this habitat very attractive. The large rodent population attracts numerous

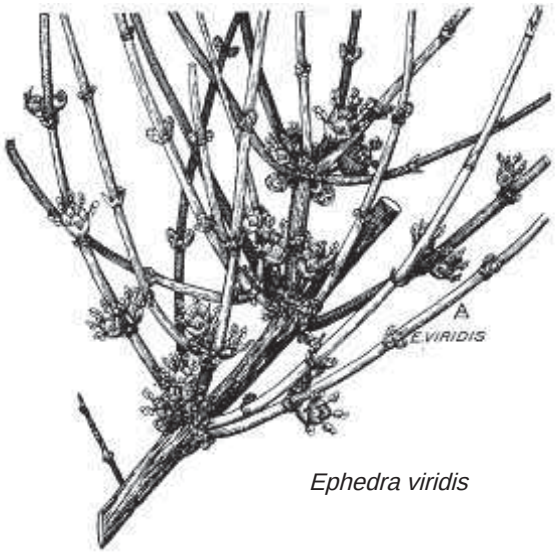
predators, including many species of snakes. The sandy habitat attracts another form of wildlife, as well, the off-road-vehicle enthusiast. So, as we explore the area today, we should be on the lookout for rattlesnakes and for the somewhat more dangerous ORV riders.

As we drive westward beyond Rio Rancho, numerous colorful flowers can be seen from the road. Conspicuous among them are the orange globemallow (*Sphaeralcea* spp.), the yellow snakeweed (*Gutierrezia microcephala*), the purple aster (*Arida parviflora*), and the white evening primrose (*Oenothera* spp.).



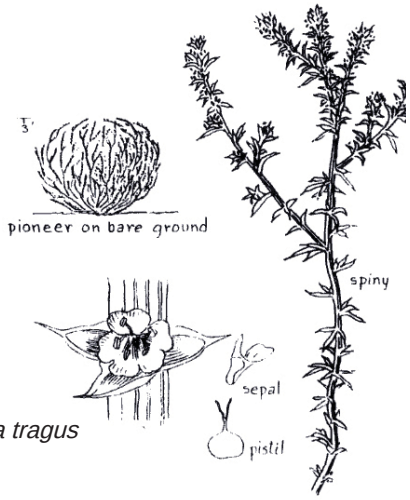
Tripterocalyx sp.

As we approach the Puerco Breaks, some junipers (*Juniperus monosperma*) can be seen, but they remain few and far between. Another gymnosperm that grows on the west mesa is Mormon tea (*Ephedra viridis*), which we should see in abundance. Most species of Ephedra in the southwest produce their cones and seeds in the spring and early summer, so we probably will not see any of them with cones intact.



Ephedra viridis

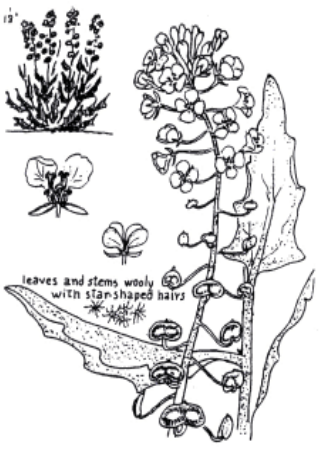
After we park, we will take the short hike up to the top of the escarpment, where we should get an excellent view of the floodplain of the Rio Puerco. One hundred years ago, the river flowed year-round and sustained several small agricultural communities. During the latter part of the 19th century, severe overgrazing caused increased erosion. The Rio Puerco cut a much deeper arroyo than it had previously. This, in turn, caused the water table to drop and the river stopped its year-round flow. The small agricultural communities that depended upon the river were no longer viable and they were ultimately abandoned.



Salsola tragus

All of the plants in the area should be making seeds at this time of year, even though many of them will continue to bloom for another month or so. Among the most abundant seed producers are ragweed (*Ambrosia artemesifolia*), sand sage (*Artemisia filifolia*), spectacle pod (*Dimorphocarpa wislizenii*), and tumbleweed (*Salsola tragus*).

Among the numerous grasses growing on the west mesa, the most noticable today should include Indian rice grass (*Achnatherum hymenoides*), six-weeks grama (*Bouteloua barbata*), sandhill muhly (*Muhlenbergia pungens*), and sand dropseed (*Sporobolus cryptandrus*).



Dimorphocarpa wislizenii

Partial Species List of the West Mesa

ASTERACEAE
Ambrosia artemisifolia
Artemisia dracunculus
Artemisia filifolia
Baccharis wrightii
Baileya multiradiata
Chaetopappa ericoides
Cirsium spp.
Ericameria puchella
Ericameria nauseosa
Gaillardia puchella
Gutierrezia sarothrae
Helianthus annuus
Helianthus petiolaris
Hymenopappus filifolius
Thelesperma megapotamica
Macheranthera canescens
Macheranthera gracilis
Macheranthera pinnatifida
Macheranthera tanacetifolia
Palafoxia sphacelata
Psilostrophe tagetina
Sanvitalia abertii
Senecio longilobus
Thymophylla acerosa
Wyethia scabra
Zinnia grandiflora

BORAGINACEAE
Cryptantha sp.
Heliotropium convolvulaceum

BRASSICACEAE
Dimorphocarpa wislizenii Spectacle Pod

CAPPARACEAE
Cleome serrulata Bee Plant

CACTACEAE
Cylindropuntia imbricata Cholla
Opuntia polyacantha Beaver tail

CHENOPODIACEAE
Atriplex canescens Four winged Saltbush
Chenopodium sp. Lambs Quarters
Kraschennikovia lanata Winter Fat
Salsola tragus Tumbleweed or Russian Thistle

CUPRESSACEAE
Juniperus monosperma One-seed juniper

EPHEDRACEAE
Ephedra torreyi Mormon Tea

EUPHORBIACEAE
Croton texensis

FABACEAE
Astragalus lentiginosus Loco Weed
Dalea formosa Feather dalea
Dalea lanata
Parreyella filifolia
Psorothamnus scoparius

HYDROPHYLLACEAE
Phacelia integrifolia Scorpionweed

LILIACEAE
Yucca glauca

LINACEAE
Linum aristatum Yellow Flax

LOASACEAE
Mentzelia pumila Stick Leaf

MALVACEAE
Sphaeralcea coccinea Globe Mallow

NYCTAGINACEAE
Abronia fragrans
Mirabilis glabra
Tripterocalyx sp.

ONAGRACEAE
Oenothera coronopifolia

PLANTAGINACEAE
Penstemon ambiguus
Plantago patagonica

POACEAE
Achnatherum hymenoides Indian Rice Grass
Aristida purpurea Three Awn
Bouteloua barbata Annual Grama
Bouteloua eriopoda Black Grama
Bouteloua gracilis Blue Grama
Bromus tectorum Cheatgrass
Cenchrus pauciflorus Sand Bur
Chloris verticillata Windmill Grass
Pleuraphis jamesii Galleta Grass
Muhlenbergia porterii Ring Muhly
Muhlenbergia pungens Sand Muhly
Sporobolus contractus
Sporobolus cryptandrus
Sporobolus flexuosus

POLEMONIACEAE
Ipomopsis longiflora

SOLANACEAE
Lycium pallidum Pale Wolfberry
Solanum elaeginifolium Horse Nettle

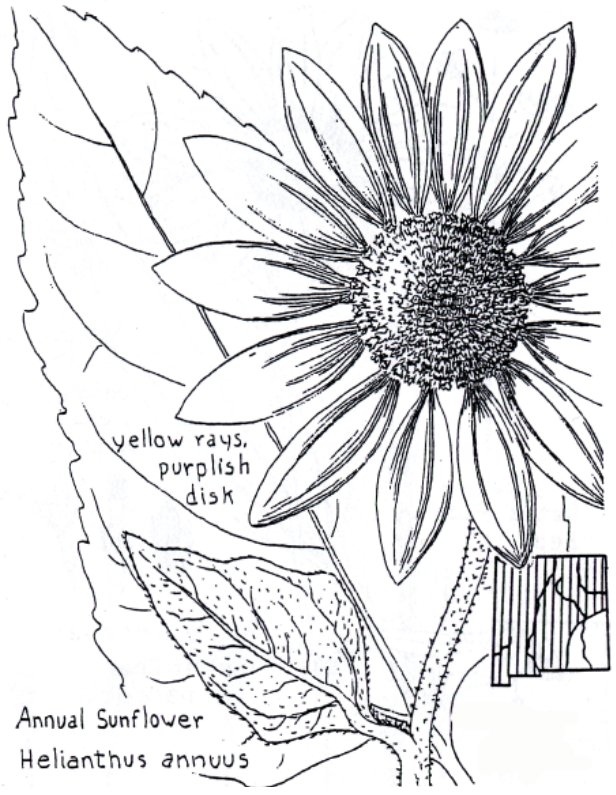
ZYGOPHYLLACEAE
Tribulus terrestris Goat's Head or Puncture Vine

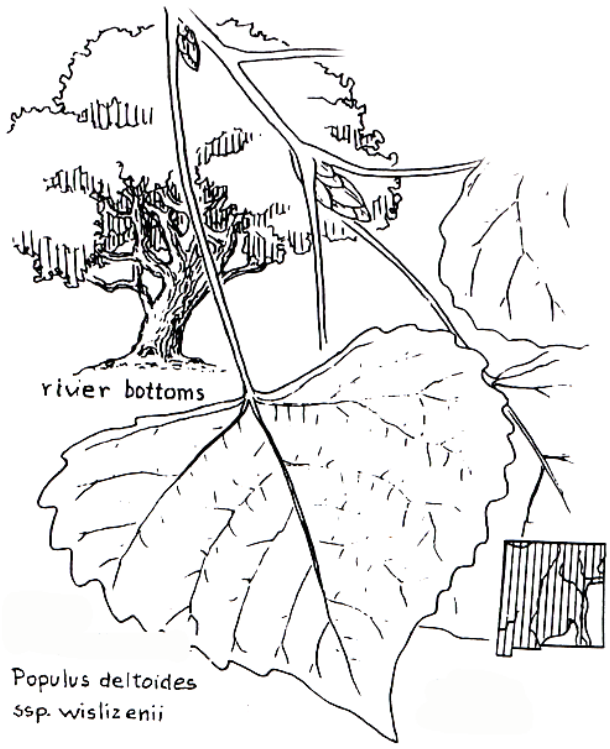
Rio Grande Bosque

Our trip to study the flora of the Rio Grande Bosque will take us to the Rio Rancho Bosque Preserve located off State Highway 528, north of the Village of Corrales along the western floodplain of the Rio Grande. The term "bosque" literally translates from Spanish as "woods". Along the Rio Grande in New Mexico, it has come to mean the cottonwood forest that dominates the floodplain of the river.

From UNM, we will drive north on Interstate 25 to Paseo del Norte, west across the Rio Grande to Coors Road, then north past the Village of Corrales. The drive should take ~45 minutes.

As we drive west on Paseo del Norte, you may note that the landscaping along the highway is predominately native plants, including Rio Grande cottonwood (*Populus deltoides* ssp. *wislizenii*), annual sunflower (*Helianthus annuus*), Apache plume (*Fallugia paradoxa*), and chamiso (*Ericameria nauseosa*). The chamiso should be coming into bright yellow flower at about this time of the year.



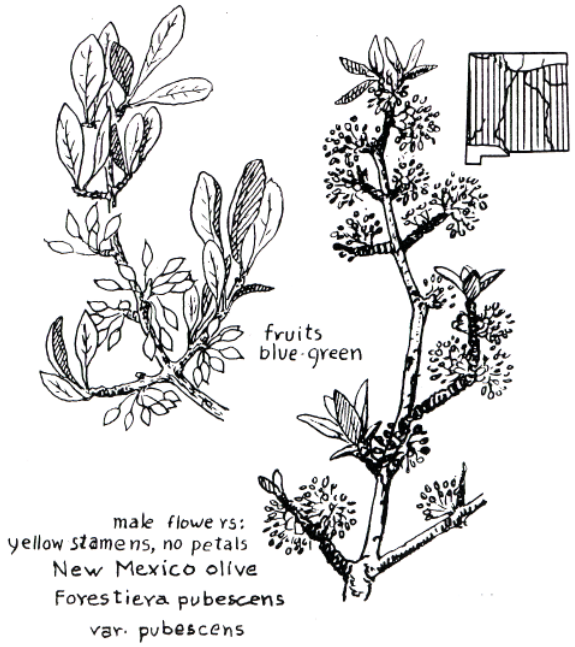


The Rio Grande Bosque is dominated by the Rio Grande cottonwoods. We will see some very large, old specimens of this species on our trip today. Cottonwoods are able to dominate the bosque because of special habitat conditions that exist along the river: the broad floodplain and shallow water table. Cottonwoods are phreatophytes, that is, they grow deep roots which are able to tap into the water table. So, they are able to withstand extended drought conditions without being adversely affected. The seeds of cottonwoods require a soaking before they will germinate. Traditionally, seeds would float down the river during the spring floods and eventually be deposited somewhere along the floodplain when the water receded.

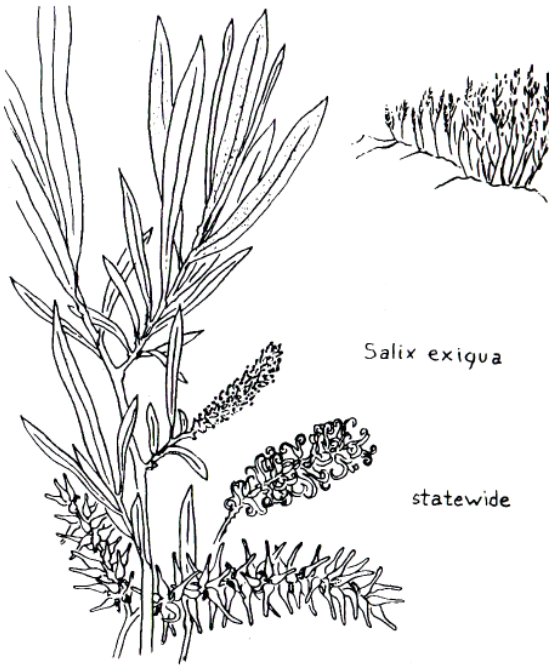
However, the bosque is considerably changed from its natural state before the coming of European immigrants. And the changes have not been beneficial for the cottonwoods. The major changes have to do with flood control. Spring floods are a thing of the past for the Rio Grande, especially since the completion of Cochiti Dam in 1974. Without the annual flooding, the cottonwood seeds are no longer scattered across the floodplain. You will notice that even though the bosque is still dominated by cottonwoods today, most of them are large, mature trees. You will not see many seedlings growing on the forest floor.

Seedlings of other trees which do not require annual flooding are seen in the forest, notably those of the exotic Siberian elm (*Ulmus pumila*), Russian olive (Elaeagnus angustifolia), saltcedar (Tamarix chinensis), and tree-of-heaven (Ailanthus altissima). Ecologists believe that unless measures are taken to remedy the situation, the cottonwoods of the bosque will eventually be replaced by introduced tree species. Increasingly, plantings of cottonwood seedlings have been undertaken in order to maintain its dominant position in the bosque. At Bosque del Apache, another preserve located along the Rio Grande about 100 miles south of Albuquerque, annual spring flooding has been reintroduced as an experiment to see if the cottonwoods will begin germinating again naturally.

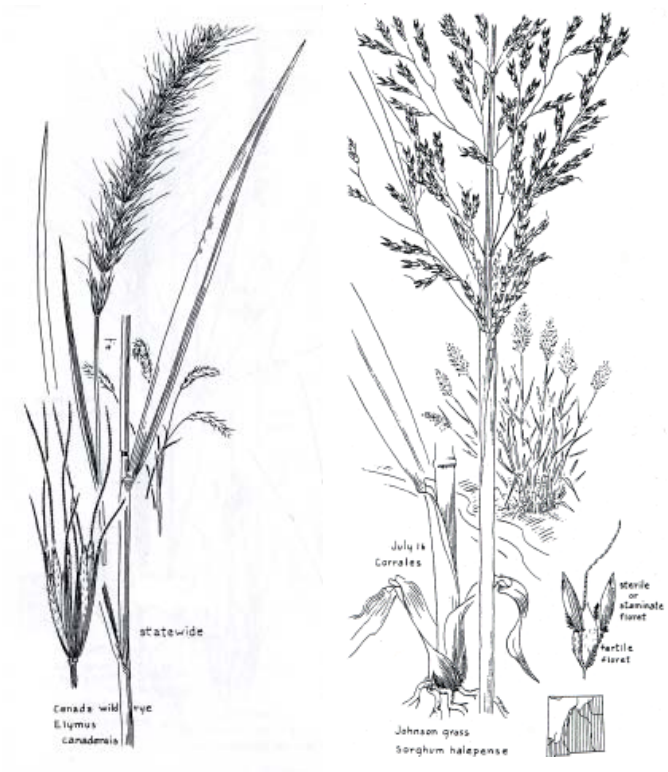
Cottonwoods are dioecious. The male flowers bloom in early Spring. They appear in striking bright red catkins. The female flowers bloom slightly later, in yellowish-green catkins. The female inflorescense grows into a bunch of "grape-like" seed pods (technically, capsules). Each seed has cottony fiber attached to it. At maturity, the capsules burst open and the cottony seeds are released into the air, to be scattered by the winds.

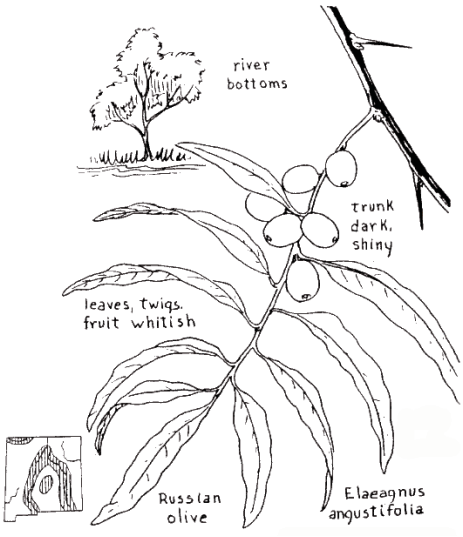


In addition to the cottonwoods, numerous other native woody plants grow in the bosque, including New Mexico olive (*Forestiera pubescens*), silverleaf buffaloberry (*Shepherdia argentea*), coyote willow (*Salix exigua*), and false indigo (*Amorpha fruticosa*). There are also a number of grasses, including Indian rice grass (*Achnatherum hymenoides*), Canadian wildrye (*Elymus canadensis*), and Johnsongrass (*Sorghum halepense*). On the sandbars along the river, a number of other grasses and grass-like plants are found, including sedges (*Cyperus* spp.), rushes (*Juncus* spp.), and cattails (*Typha* spp.).

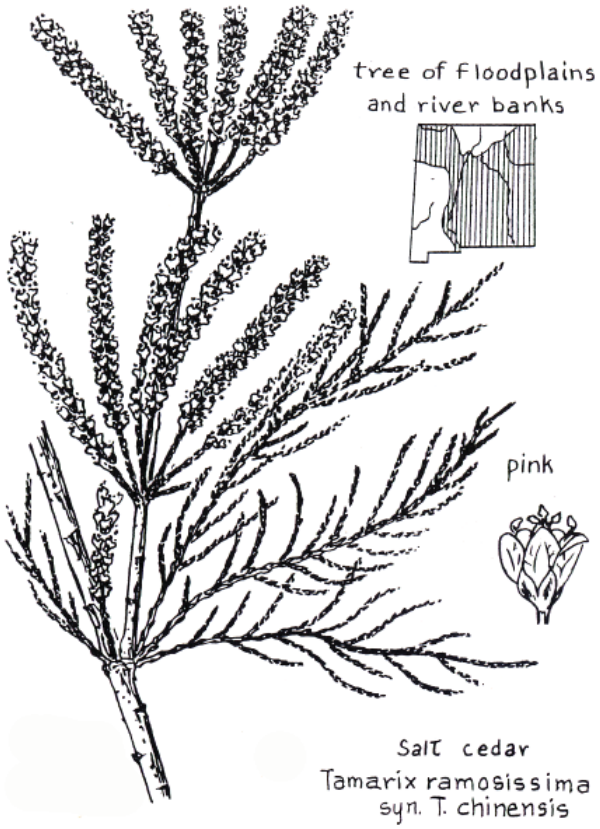


We will be visiting at least two different habitats within the preserve; the **cottonwood forest** which dominates the area, and a nearby **sandbar** along the river.





Ailanthus altissima



Achnatherum hymenoides

Partial Species List of the Rio Grande Bosque

AMARANTHACEAE
Amaranthus hybridus

ANACARDIACEAE
Rhus trilobata

APOCYNACEAE
Apocynum cannabinum

ASCLEPIADACEAE
Asclepias subverticillata

ASTERACEAE
Almutaster pauciflorus
Ambrosia artemisiifolia
Artemisia dracunculus
Artemisia filifolia
Bidens frondosa
Chloracantha spinosa
Conyza canadensis
Flaveria campestris
Grindelia nuda
Helianthus ciliaris
Helianthus annuus
Lactuca serriola
Machaeranthera parviflora
Senecio flaccidus
Sonchus asper
Solidago altissima ssp. *gilvocanescens*
Symphyotrichum ericoides
Symphyotrichum falcatum var. *commutatum*
Thelesperma megapotamicum
Xanthium strumarium

CAPPARACEAE
Cleome serrulata
Polanisia dodecandra

CHENOPODIACEAE
Atriplex canescens
Chenopodium fremontii
Kochia scoparia
Salsola tragus

CONVOLVULACEAE
Convolvulus arvensis
Ipomoea purpurea

CUCURBITACEAE
Cucurbita foetidissima

CYPERACEAE
Bolboschoenus maritimus
Carex emoryi
Carex hystericina
Carex pellita
Cyperus aristatus
Eleocharis palustris
Schoenoplectus acutus (syn=*Scirpus acutus*)
Schoenoplectus americanus (syn= *Scirpus americanus*)
Schoenoplectus pungens

ELAEAGNACEAE
Elaeagnus angustifolia
Shepherdia argentea

EPHEDRACEAE
Ephedra spp.

EQUISETACEAE
Equisetum laevigatum

EUPHORBIACEAE
Croton texensis
Chamaesyce prostrata
Chamaesyce serpyllifolia
Euphorbia davidii

FABACEAE
Amorpha fruticosa
Astragalus lentiginosus
Dalea leporina
Dalea scariosa
Gleditsia triacanthos
Glycyrrhiza lepidota
Medicago sativa
Melilotus albus
Melilotus officinalis
Psorothamnus scoparius
Robinia pseudo-acacia
Sphaerophysa salsula

GERANIACEAE
Eriodium cicutarium

GROSSULARIACEAE
Ribes aureum

HYDROPHYLLACEAE
Nama hispidum
Phacelia integrifolia

JUNCACEAE
Juncus bufonius
Juncus dudleyi
Juncus torreyi

LAMIACEAE
Lycopus americanus
Mentha arvensis

LEMNACEAE
Lemna spp.

LOASACEAE
Mentzelia multiflora

MALVACEAE
Anoda cristata
Sphaeralcea angustifolia

MORACEAE
Morus alba

OLEACEAE
Forestiera pubescens

ONAGRACEAE
Gaura coccinea
Gaura mollis (syn= *G. parviflora*)
Oenothera elata ssp. *hirsutissima*
Oenothera pallida

OROBANCHANCEAE
Orobanche ludoviciana

PLANTAGINACEAE
Mimulus glabratus
Plantago lanceolata
Plantago major
Plantago patagonica
Veronica americana

POACEAE
Achnatherum hymenoides
Aristida purpurea
Bouteloua aristidoides
Bouteloua barbata
Bouteloua curtipendula
Bouteloua gracilis
Bromus japonicus
Bromus tectorum
Cenchrus spinifex
Cenchrus pauciflorus
Chloris virgata
Cynodon dactylon
Distichlis spicata var. *stricta*
Echinochloa crus-galli
Elymus canadensis
Elymus longifolius
Hordeum jubatum
Hordeum murinum ssp. *glaucum*
Muhlenbergia asperifolia
Panicum obtusum
Phragmites australis
Pleuraphis jamesii
Polypogon monspeliensis
Setaria leucopila
Setaria viridis
Sorghastrum nutans
Sorghum halepense
Sporobolus airoides
Sporobolus contractus
Sporobolus cryptandrus
Sporobolus wrightii

POLYGONACEAE
Persicaria lapathifolia (syn=*Polygonum lapathifolium*)
Persicaria maculosa (syn= *Polygonum persicaria*)
Rumex crispus
Rumex hymenosepalus

SALICACEAE
Populus deltoides ssp. *wislizenii*
Salix amygdaloides
Salix exigua
Salix gooddingii

SAURURACEAE
Anemopsis californica

SCROPHULARIACEAE
Verbascum thapsus

SIMAROUBACEAE
Ailanthus altissima

SOLANACEAE
Datura quercifolia
Datura wrightii
Lycium pallidum
Lycium torreyi
Physalis virginiana
Solanum elaeagnifolium
Solanum rostratum

TAMARICACEAE
Tamarix chinensis

TYPHACEAE
Typha domingensis
Typha latifolia

ULMACEAE
Ulmus pumila

VITACEAE
Parthenocissus vitacea

ZYGOPHYLLACEAE
Kallstroemia parviflora
Tribulus terrestris

Flowering Seed Plants - The Monocots

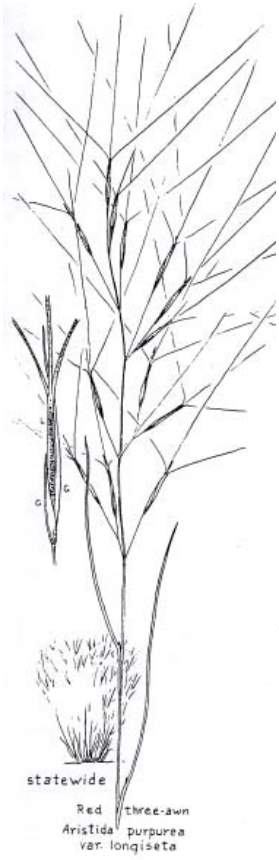
Order Alistmatales
- Lemnaceae

Order Asparagales
- Iridaceae
- Orchidaceae

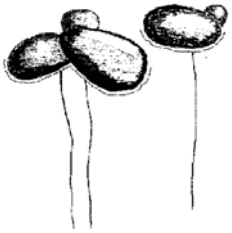
Order Commelinales
- Commelinaceae

Order Liliales
- Liliaceae

Order Poales
- Cyperaceae
- Juncaceae
- Poaceae
- Typhaceae



LEMNACEAE
(Duckweed family)



Order: Alistmatales
Monocots
(sometimes included within the Araceae)

Habit: floating or submerged aquatic herbs, the stems flattened and thallus- or leaf-like, with or without roots; reproduction is mainly vegetative

Leaves: absent

Flowers: unisexual (monoecious), borne in a pouch, lacking a perianth

Androecium: stamens 1-2

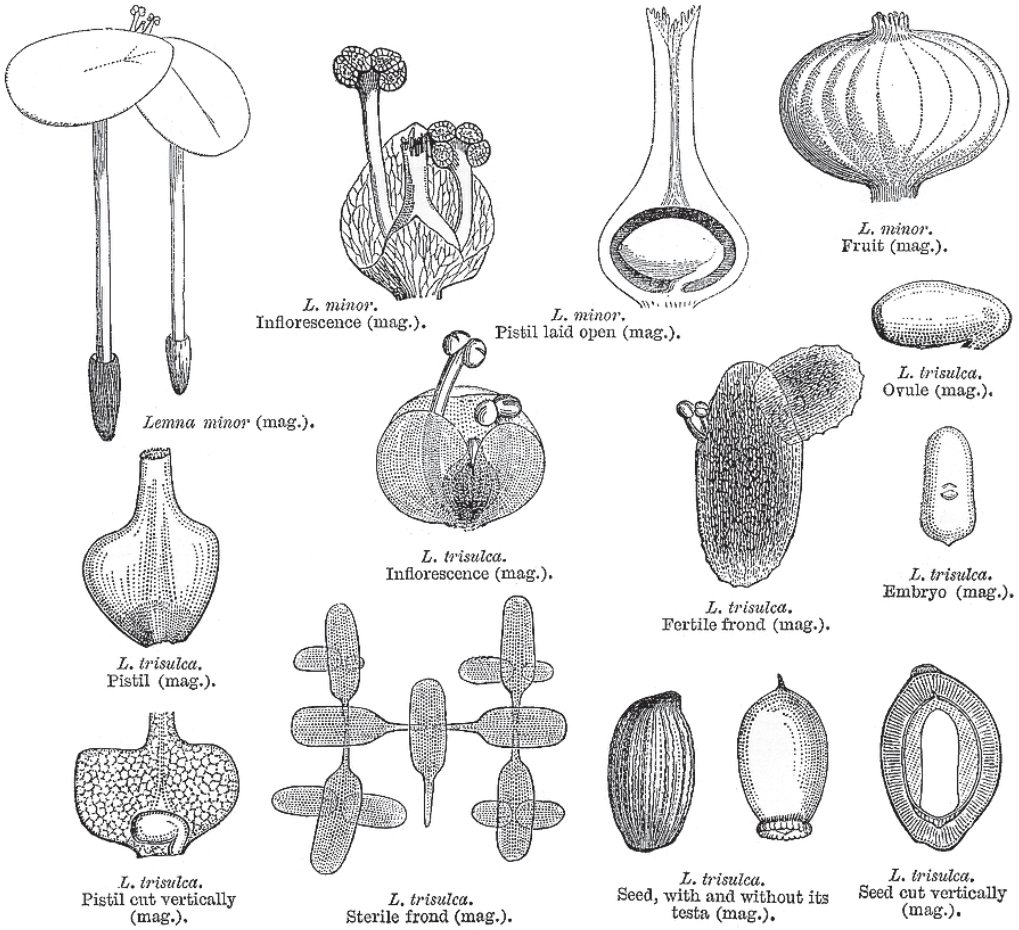
Gynoecium: pistil single, superior, of a single carpel

Fruit: utricle

Distribution: genera/species
Worldwide: 5/30
NM: 2/7

New Mexico genera:
Lemna- duckweed
Spirodela- duckmeat

Economic uses: *Lemna* contains proteins of pharmaceutical interest



IRIDACEAE
(Iris family)

Order: Asparagales
Monocots

Habit: perennial herbs from bulbs, corms, or rhizomes

Leaves: alternate or basal, 2-ranked, often equitant, the base sheathing

Flowers: large and showy, actinomorphic or zygomorphic, perfect; sepals 3, petal-like; petals 3, distinct or connate

Androecium: stamens 3

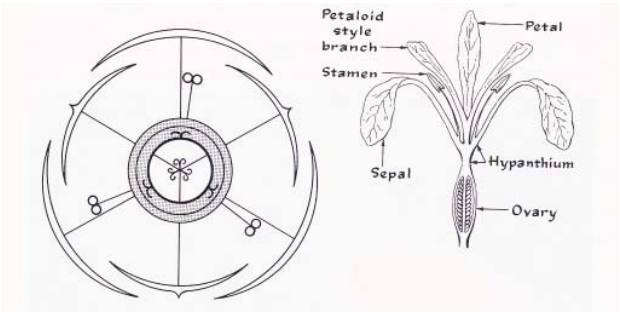
Gynoecium: pistil single, inferior, of 3 united carpels

Fruit: capsule

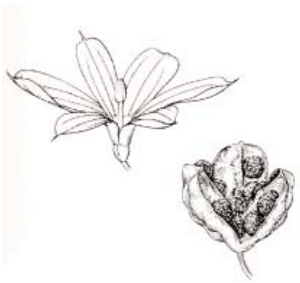
New Mexico genera:
Iris- iris
Sisyrinchium- blue-eyed-grass

Distribution: genera/species
Worldwide: 92/1800
NM: 2/7

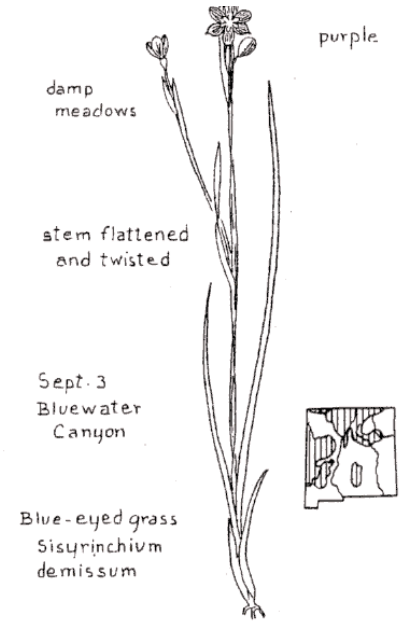
Economic uses: numerous ornamentals, plus orris root (from *Iris* rhizomes) and saffron dye (from *Crocus* stigmas)



Iris floral diagram and flower detail



Sisyrinchium flower and capsule



ORCHIDACEAE
(Orchid family)

Order: Asparagales
Monocots

Habit: perennial herbs; terrestrial, epiphytic, occ. saprophytic; probably all have mycorrhizal fungi

Leaves: alternate (rarely opposite or whorled); often distichous; simple, often fleshy, sheathing; cccasionally reduced to scales

Flowers: bisexual (rarely unisexual, then species mono- or dioecious; usually zygomorphic; bracteate, 3-merous; inflorescence of racemes, spikes, or panicles

Calyx: either green and sepaloid or brightly colored and petaloid

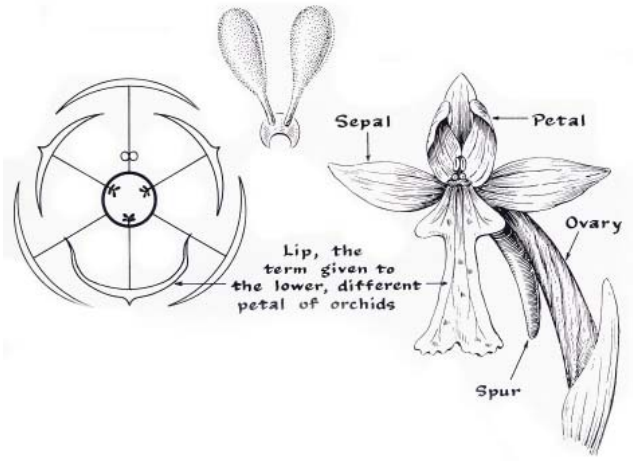
Corolla: upper petal appearing as lower because of twisting pedicel (resupination); lower petal often elaborately modified into lip or **labellum** which may be fairly simple or modified into a sac or spur

Androecium: 1 or 2 stamens; anthers usually appear as cap-like structure on a **column**; pollen usually in waxy or mealy masses (**pollinia**); rarely tetrads (*Goodyera*) or single; tip of pollinium may have sterile structure at end -- **caudicle**

Gynoecium: 3 united carpels; parietal placentation

Distribution: genera/species
Worldwide: 725-800/25,000
US: 50-60/?
NM: 10/24

Economic uses: ornamentals, vanilla

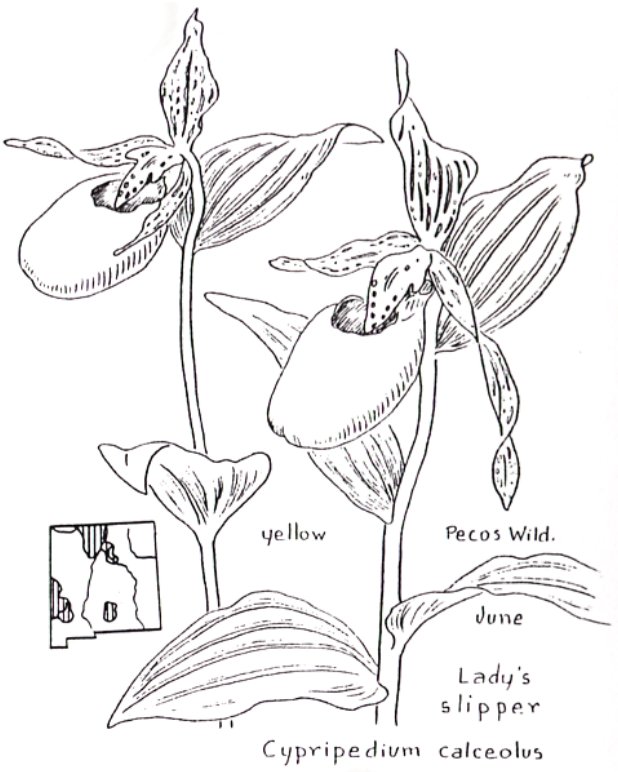


Column or gynandrium: structure formed of stigmas, styles and androecium; stigma often appears as shallow depression on inner side; all 3 stigmas may be fertile, but often the 2 laterals are fertile and the 3rd modified into a small sterile outgrowth (**rostellum**); **viscidium** (a modification of the rostellum), is a sticky disc to which the pollinia attach

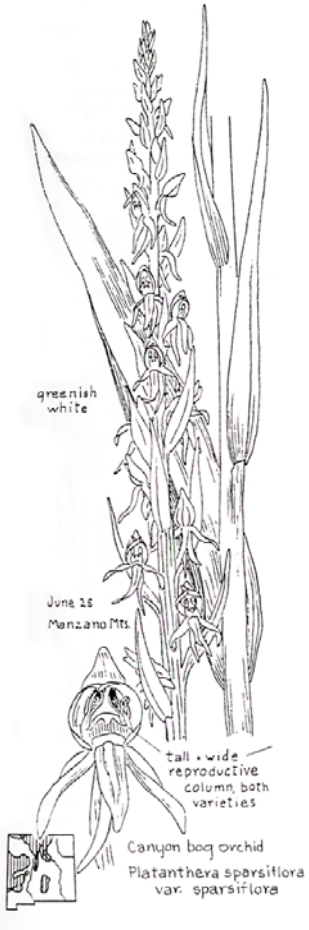
Pollination vectors and mechanisms often very unusual and distinctive; labellum may be modified to resemble the female of the pollinating insect and the male attempts to mate, thus bringing about pollination; many are strongly scented

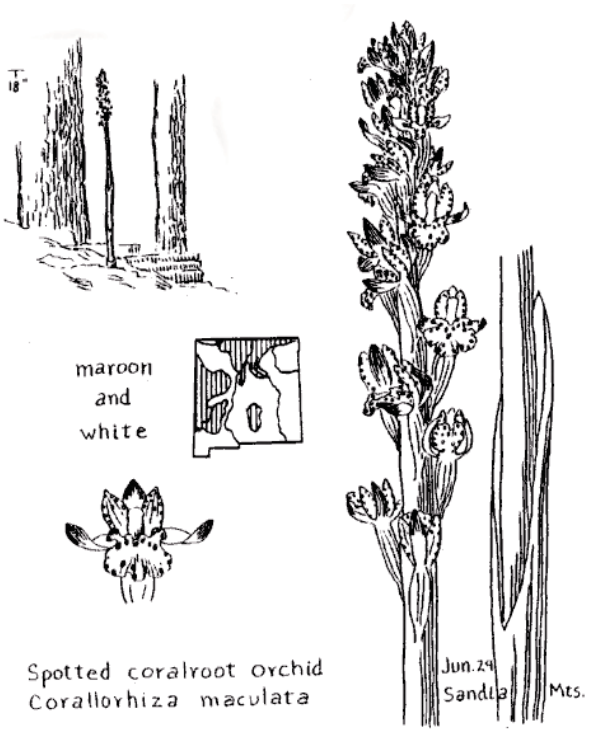
Fruit: capsule; seeds tiny and numerous and need presence of mycorrhizal fungi to germinate

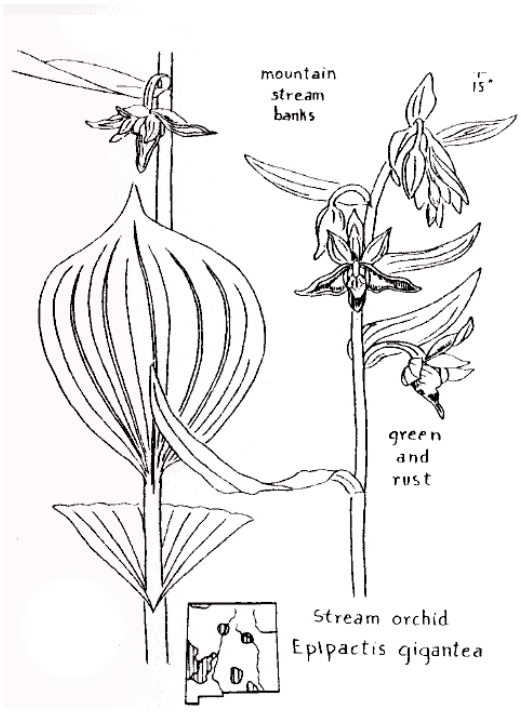
New Mexico genera:
Calypso (Fairy slipper), *Corallorhiza* (Coralroot) [saprophytes], *Cypripedium* (Lady's slipper), *Epipactis* (Helleborine), *Goodyera* (Rattlesnake plantain), *Spiranthes* (Ladies tresses)



Platanthera floral parts







COMMELINACEAE
(Spiderwort family)

Order: Commelinales
Monocots (Commelinids)

Habit: perennial herbs, commonly semi-succulent with swollen nodes

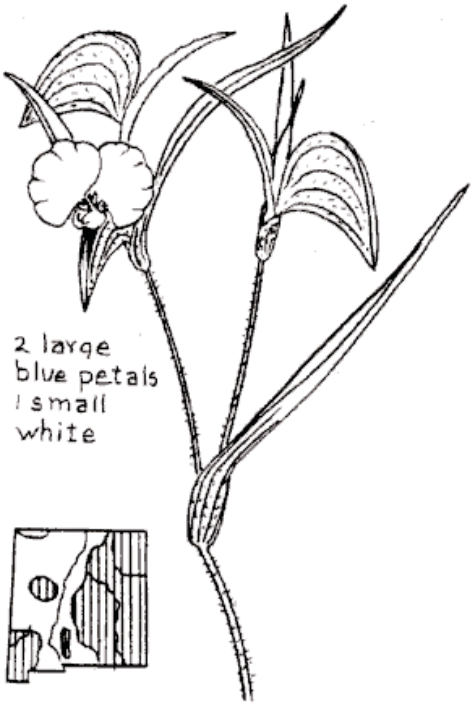
Leaves: alternate, simple, entire, sheathing at the base

Flowers: actinomorphic or zygomorphic, perfect, usually borne in a spathe; sepals 3, green; petals 3, distinct, usually blue, violet, or white

Androecium: stamens 6

Gynoecium: pistil single, superior, of 3 united carpels, the style single

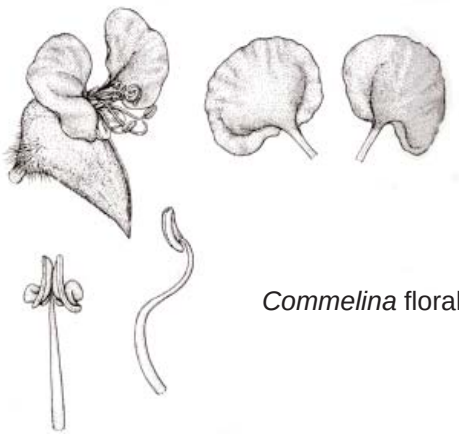
Fruit: capsule



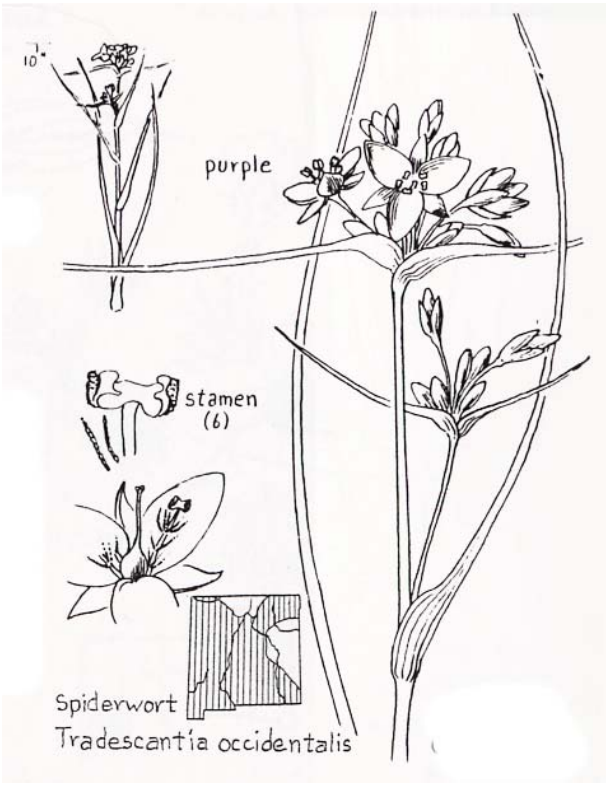
New Mexico genera:
Commelina- dayflower
Tradescantia- spiderwort

Distribution: genera/species
Worldwide: 38/500
NM: 2/5

Economic uses: garden ornamentals and houseplants



Commelina floral parts



LILIACEAE
(Lily family)

Order: Liliales
Monocots
(Includes Agavaceae, Alliaceae, Amaryllidaceae, Calochortaceae, Smilacaceae, and Yuccaceae, all of which are sometimes considered separate families)

Habit: mostly perennial herbs from bulbs, rhizomes, or corms

Leaves: alternate, simple, linear (broader in some families), few and basal in Amaryllidoideae; fleshy and fibrous in Agavoideae

Flowers: bisexual (occasionally unisexual, then species usually Dioecious); actinomorphic, usually showy; inflorescence various racemose arrangements; perianth petaloid and 3+3; ***corona*** may be present

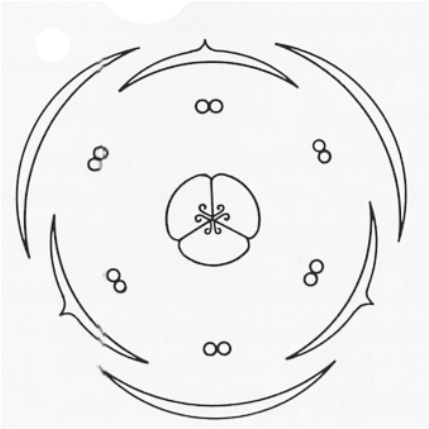
Androecium: 6 stamens

Gynoecium: 3 united carpels; 3 locules; axile placentation; ovary superior, half-inferior, or inferior

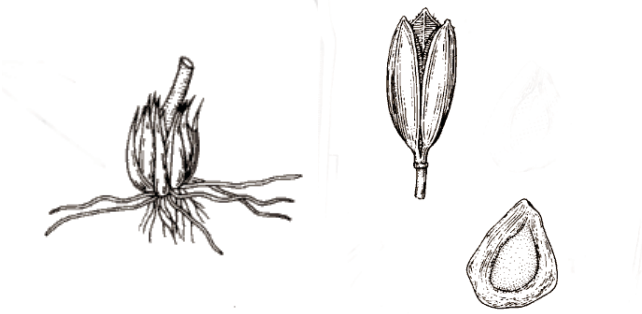
Fruit: capsule or berry

Distribution: genera/species
Worldwide: 300-400
US: 75
NM: 24/58

Economic uses: many ornamentals, some food plants, some medicinals



Lilium floral diagram, longitudinal section of flower, and pistil and stamen detail



Lilium bulb, capsule and seed

Subfamily	Genus
Melanthioideae	*Zigadenus* (death camas); *Veratrum*
Asphodeloideae	*Aloe*
Lilioideae	*Calochortus* (mariposa or Sego lily); *Lilium* (lily); *Fritillaria* (fritillary); *Tulipa*
Asparagoideae	*Smilacina* (false Solomon"s seal); *Asparagus; Convallaria* (lily of the valley)
Allioideae	*Allium* (onion); *Dichelostemma* (wild hyacinth)
Amarylloidideae	*Amaryllis; Narcissus* (narcissus, daffodil)
Agavoideae	*Agave* (century plant), sisal; *Yucca; Nolina* (bear grass); *Dasylirion* (Sotol)

CYPERACEAE
(Sedge family)

Order: Poales
Monocots

Habit: perennial herbs; often with rhizomes; stems usually 3-sided and solid; grows in wet or damp sites

Leaves: basal and cauline; usually 3-ranked; base sheathing, closed

Flowers: bisexual (some monoecious, *Carex*); tiny; inflorescence in some ways similar to a grass inflorescence/flower, but uses different terminology; spikes or spikelets arranged distichously or spirally in paniculate, spicate, or umbellate inflorescences; unit of inflorescence = **spike** or **spikelet;** may be subtended by involucel bracts

Perianth: if present, reduced to hairs, scales, or bristles; pistillate flowers (usually in *Carex*); may be surrounded by a sac-like structure called the **perigynium**

Androecium: [1], 3 [6] stamens

Gynoecium: superior, 2 or 3 united carpels uni-ovuled, unilocular

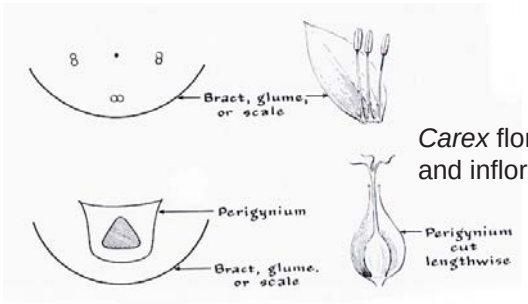
Fruit: achene

New Mexico genera:
Cyperus (flat sedge)
Papyrus (Papyrus)
Scirpus (Bulrush)
Eleocharis (Spike rush)

Distribution: genera/species
Worldwide: 90-115/3600-4000
US: 24/?
NM: 11/95

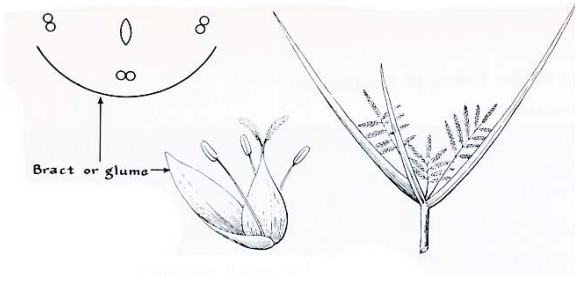
Economic uses: Fibers and “paper”, some food plants (*Eleocharis tuberosa* is the water chestnut), medicinals, and ornamentals

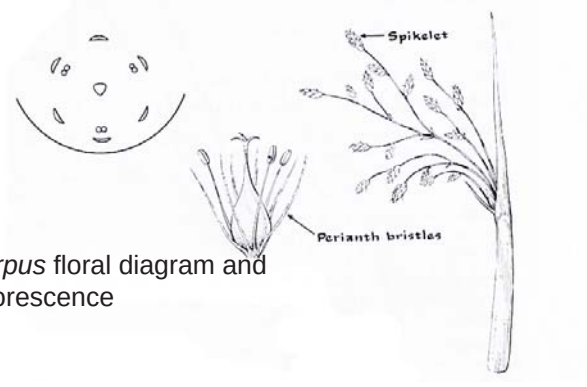
Adaptations for wind pollination:
large anthers with long filaments; prominent stigmas with long styles; both anthers and stigmas often protrude beyond the subtending scale, giving the spikelet a scraggly, hairy appearance



Carex floral diagram and inflorescence

Cyperus floral diagram and inflorescence



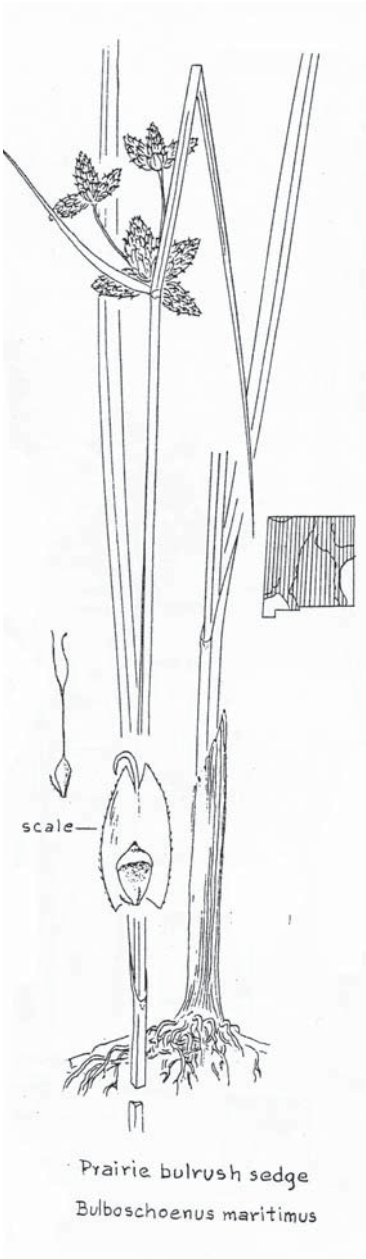


Scirpus floral diagram and inflorescence

Cyperaceae in New Mexico

Cyperus showing subtending bract

Cyperus node showing closed leaf sheath



JUNCACEAE
(Rush family)

Order: Poales
Monocots

Habit: annual or perennial herbs; usually grows from culm or rhizome; stems terete and solid; grows in wet or damp sites

Leaves: mostly basal, sheathing, usually open; sometimes reduced to sheaths

Flowers: bisexual (rarely dioecious); actinomorphic; small and greenish; inflorescence of heads, panicles, or corymbs

Perianth: 3+3 sepaloid tepals

Androecium: 6, often 3+3; or 3

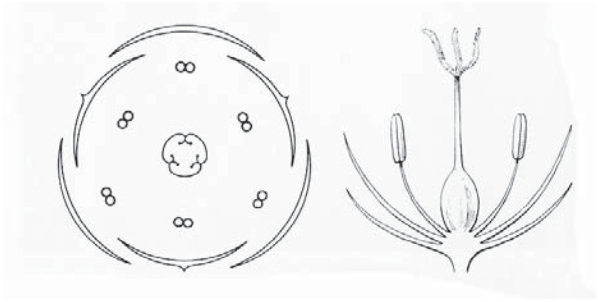
Gynoecium: superior, 3 fused carpels: parietal placentation, unilocular

Fruit: loculicidal capsule

New Mexico genera:
Juncus (Rush)
Luzula (Wood rush)

Distribution: genera/species
Worldwide: 9/400
US: 2/?
NM: 2/24

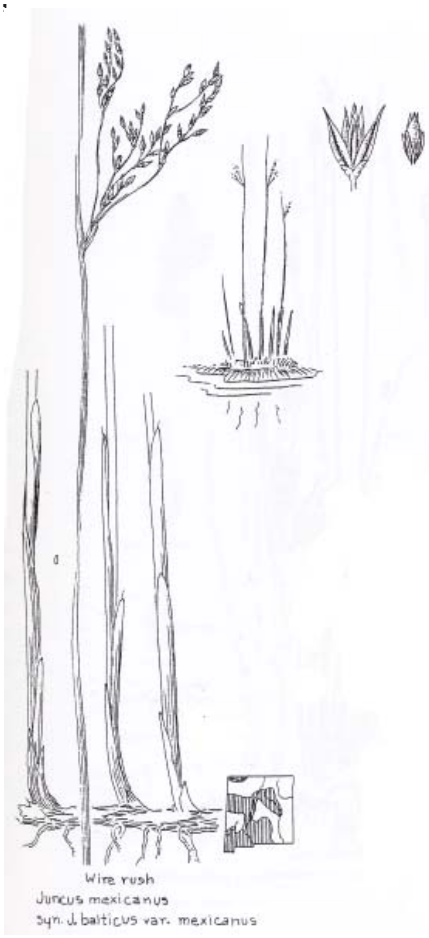
Economic uses: fibers

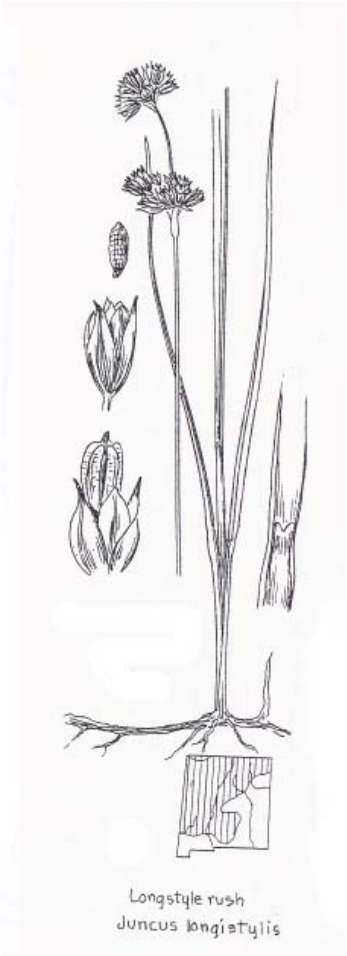


Juncus floral detail

Juncus loculicidal capsule with persistent perianth

cross section of ovary





POACEAE
(Grass family)

Order: Poales
Monocots

Habit: annual or perennial herbs; occasionally woody or rarely treelike in warm areas; roots fibrous, rhizomes frequent; cell walls, particularly the epidermis, highly silicified; stems (**culms**) usually terete and internodes hollow; perennial plants may form innovations (sterile shoots) in addition to culms tillering; (branching) may occur at ground level to form a rosette or tussock

Leaves: alternate, simple, 2-ranked; leaves in 3 parts: **lamina** (blade), **sheath**, and **ligule**

sheath open, with edges meeting or overlapping slightly, may cover the entire internode

a **ligule** is a membrane or series of hairs at the junction of the lamina and sheath

there may be a pair of **auricles** at the base of the lamina

Flowers: bisexual or unisexual (species are monoecious or dioecious); small, wind-pollinated; flowers in **spikelets** (the unit of the inflorescence), these arranged into spikes or panicles

spikelets borne on a pedicel; composed of 1-many **florets** (flowers and subunits of the spikelet)

rachilla is the continuation of the pedicel in the spikelet; pairs of bracts (**glumes**) are found throughout the spikelet; the lowest pair are sterile and called the **first and second glumes**.

The individual florets are subtended by 1st the **lemma** and then the **palea**. The lemma is inserted on the rachilla, the palea is inserted on the pedicel of an individual floret.

Bracts usually have **nerves** (strands of vascular tissue) visible.

Glumes and lemmas may bear **awns** (stiff, hair-like processes) usually on their tips, but occasionally elsewhere.

Spikelets, in cross-section, may be *terete*, or flattened **laterally** or **dorsally** (see illustration)

Spikelets **disarticulate** (break apart) at specific points, either **above** and between the florets (so that **the glumes** remain on the pedicel) or **below the glumes** (so that the entire spikelet falls from the pedicel)

Floret: no well-developed perianth and may be reduced to 2-3 small lodicules (which may not be present but act to force the palea and lemma apart to facilitate pollination)

Androecium: [2] 3 [6] stamens with relatively large anthers

Gynoecium: superior, 3 united carpels, only one is functional and therefore unilocular and one-seeded; usually 2 feathery stigmas visible

Summary: *spikelet*= 2 glumes + 1 or more florets
floret= lemma & palea + enclosed sexual parts

Fruit: **caryopsis** (= grain)

Classification of New Mexico Grasses (according to Kelly Allred, NMSU)

Arundinoideae Subfamily
- Aristideae Tribe
  - *Aristida*
- Arundineae Tribe
  - *Arundo, Cortaderia, Phragmites*
- Danthonieae Tribe
  - *Danthonia, Schismus*

Bambusoideae Subfamily
- Bambuseae Tribe
  - **Phyllostachys**
- Oryzeae Tribe
  - *Leersia*

Chloridoideae Subfamily
- Aeluropodeae Tribe
  - *Distichlis*
- Cynodonteae (Chlorideae) Tribe
  - *Bouteloua, Buchloe, Chloris, Cynodon, Hilaria, Pleuraphis, Schedonnardus, Spar - tina, Tragus, Zoysia*
- Eragrostideae (Eragrosteae) Tribe
  - *Blepharoneuron, Calamovilfa, Dactyloctenium, Dasyochloa, Eleusine, Eragrostis, Erioneuron, Leptochloa, Lycurus, Muhlenbergia, Munroa, Redfieldia, Scleropogon, Sporobolus, Tridens, Triplasis*
- Pappophoreae Tribe
  - *Cottea, Enneapogon, Pappophorum*

Panicoideae Subfamily
- Andropogoneae Tribe
  - *Andropogon, Bothriochloa, Coix, Elionurus, Hackelochloa, Heteropogon, Imperata, Miscanthus, Saccharum, Schizachyrium, Sorghastrum, Sorghum, Trachypogon, Tripsacum, Zea*
- Paniceae Tribe
  - *Brachiaria, Cenchrus, Dichanthelium, Digitaria, Echinochloa, Eriochloa, Panicum, Paspalum, Pennisetum, Rhynchelytrum, Setaria, Stenotaphrum, Urochloa*

Pooideae Subfamily
- Aveneae Tribe
  - *Agrostis, Alopecurus, Anthoxanthum, Apera, Arrhenatherum, Avena, Beckmannia, Calamagrostis, Cinna, Deschampsia, Helictotrichon, Hierochloe, Holcus, Koeleria, Phalaris, Phleum, Polypogon, Spenopholis, Trisetum*
- Meliceae Tribe
  - *Glyceria, Melica, Schizachne*
- Poeae (Festuceae) Tribe
  - *Bromus, Catabrosa, Dactylis, Festuca, Lolium, Poa, Puccinellia, Sclerochloa, Torreyochloa, Vulpia*
- Stipeae Tribe
  - *Oryzopsis, Piptochaetium, Stipa, Ach natherum, Hesperostipa*
- Triticeae (Hordeae) Tribe
  - *Aegilops, Agropyron, Elymus, Eremopyrum, Hordeum, Leymus, Psathyrostachys, Secale, Triticum*

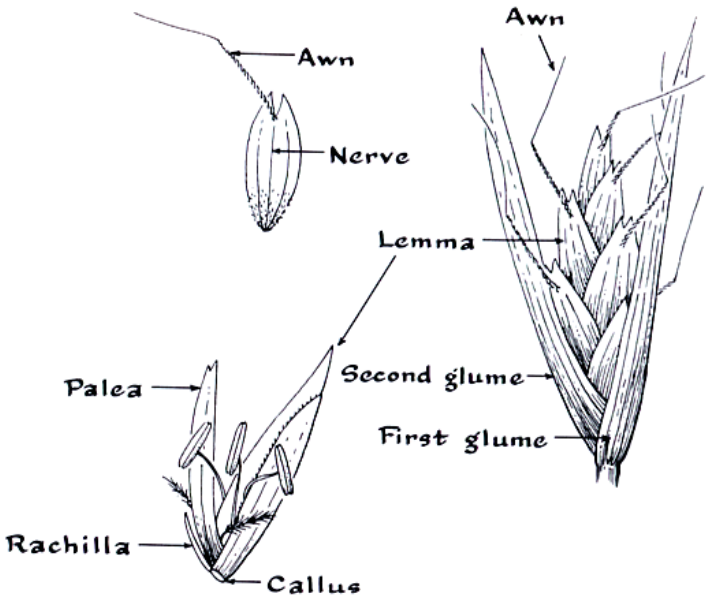
Distribution: genera/species
Worldwide: 600-650/9000-10,000
US: 180/1000
NM: 90/386

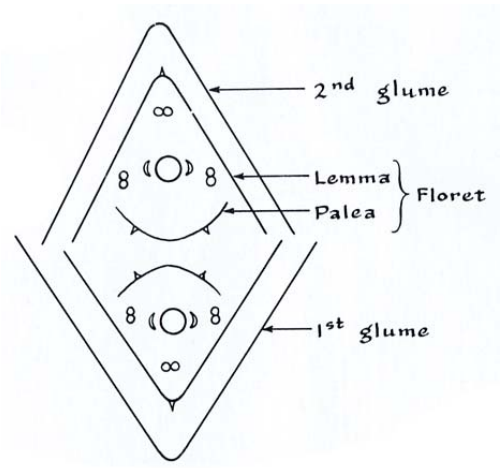
Economic uses: food plant (this family is most important to humans)
Ornamentals
Weeds

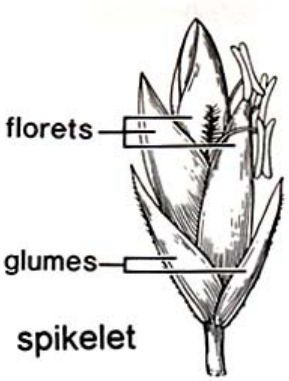
A good reference for grasses, sedges, and rushes is:

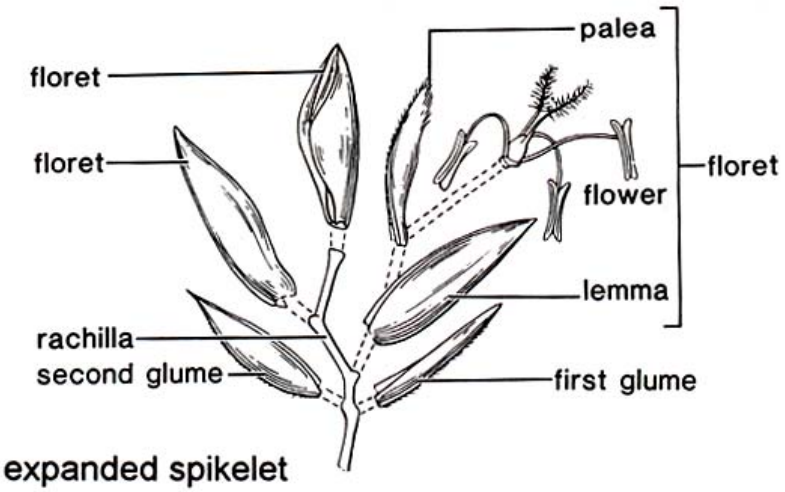
H.D. Harrington. 1987. How to Identify Grasses and Grasslike Plants. Swallow Press, Ohio University Press, Athens, Ohio.

Spikelet details









TYPHACEAE
(Cattail family)

Order: Poales
Monocots

Habit: tall, perennial herbs from rhizomes, forming dense colonies in marshy soil

Leaves: alternate and basal, simple, entire, long and linear, sheathing at the base

Flowers: many small, unisexual (monoecious), the female borne below the male on a dense spadix; perianth of many bristles or scales

Androecium: stamens 2-5

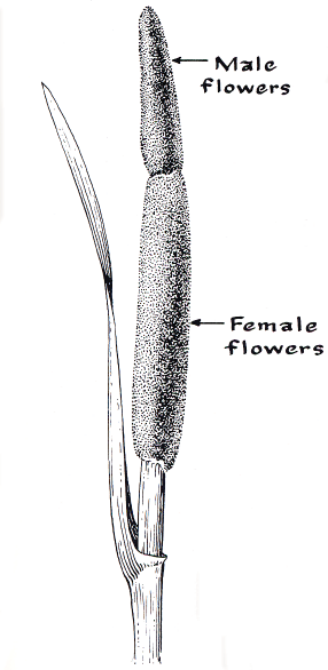
Gynoecium: pistil single, superior, of a single carpel, the style single

Fruit: an achene or follicle, small, and wind-dispersed

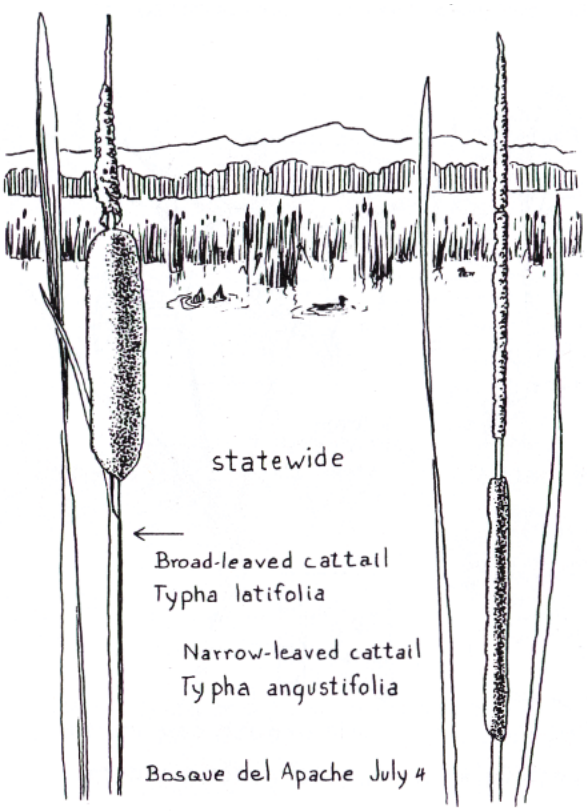
New Mexico genus:
Typha- cattail

Distribution: genera/species
Worldwide: 1/10
NM: 1/3

Economic uses: leaves used in weaving chair bottoms and mats



Pistillate flower



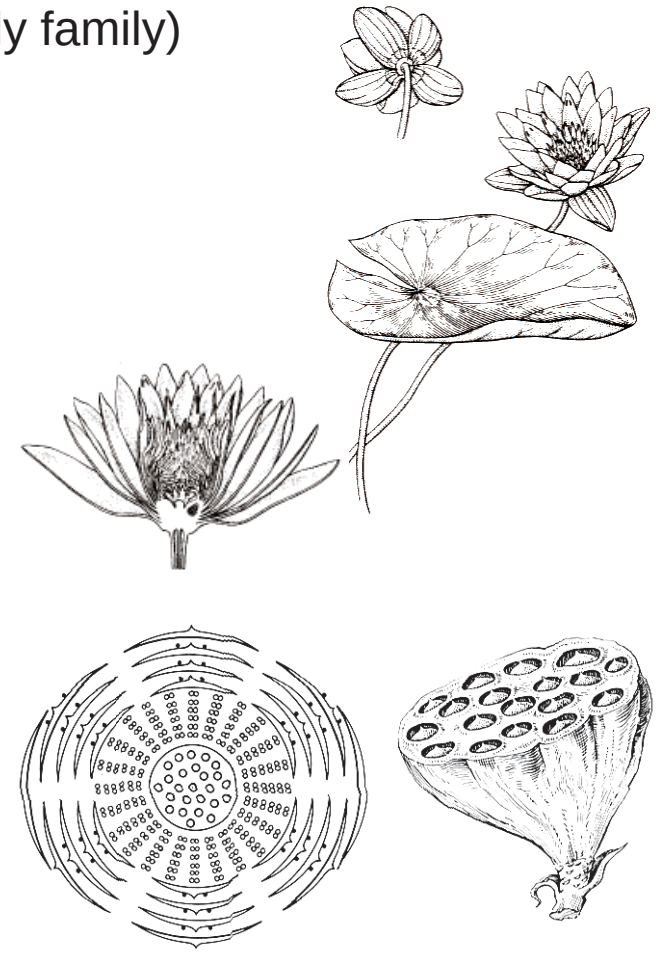
Staminate flower

Flowering Seed Plants - The Eudicots

Early-Diverging Eudicots

- Order (ungrouped)
  - Nymphaeaceae
- Order Proteales
  - Platanaceae
- Order Ranunculales
  - Berberidaceae
  - Papaveraceae
  - Ranunculaceae

NYMPHAEACEAE
(Water Lily family)



Order (ungrouped)
Eudicots: Early-diverging

Habit: perennial aquatic herbs, rhizomatous; large leaves submerged, floating, or emersed

Leaves: mostly alternate, simple; entire to dissected; stipules present or absent

Flowers: actinomorphic, bisexual; solitary and showy; long-pedicellate; perianth composed of sepals and petals indefinite in number and in 2 or more series; calyx and corolla poorly differentiated

Androecium: 3-many laminar to filamentous stamens; commonly numerous petaloid or reduced staminodes

Gynoecium: apocarpous or more often syncarpous; 2-many carpels, free or united; ovary superior to inferior; parietal placentation

Fruit: nut-like or berry-like, or an irregularly dehiscent fleshy capsule

New Mexico genera:
Nuphar- pond-lily
Nymphaea- water-lily (non-native)

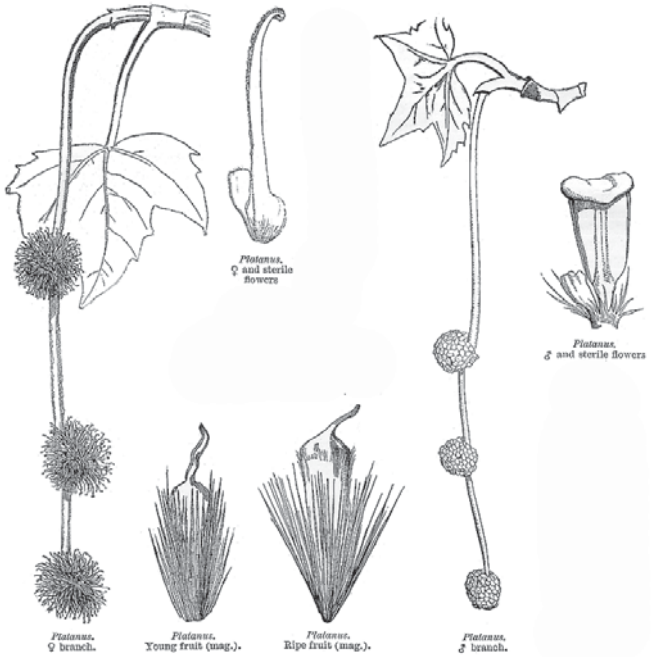
Distribution: genera/species
Worldwide: 8/70
US: 3-4/33-36
NM: 2/3

Economic uses: many ornamentals, including *Nelumbo* (Lotus lily) and *Victoria* (Giant Water Lily of the Amazon)

Note: Scattered vascular bundles
Frequent presence of latex

PLATANACEAE
(Plane-tree family)

Order: Proteales
Eudicots: Early-diverging
(some classification systems group the Plantanaceae within the Proteaceae)



Habit: large trees

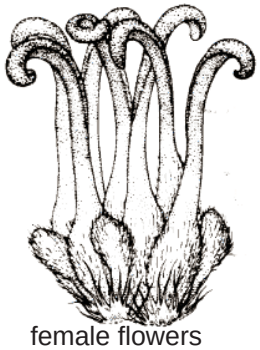
Leaves: deciduous, medium-large; alternate; petiolate (petiole base enclosing the axillary bud); blade variously lobed to dentate; stipulate (around the stem), ochreate, scaly and cauducous

Flowers: aggregated in inflorescences (heads); globose; inflorescences either all male or all female

Androecium: 3-4 stamens; 1 whorled

Gynoecium: superior; apocarpous

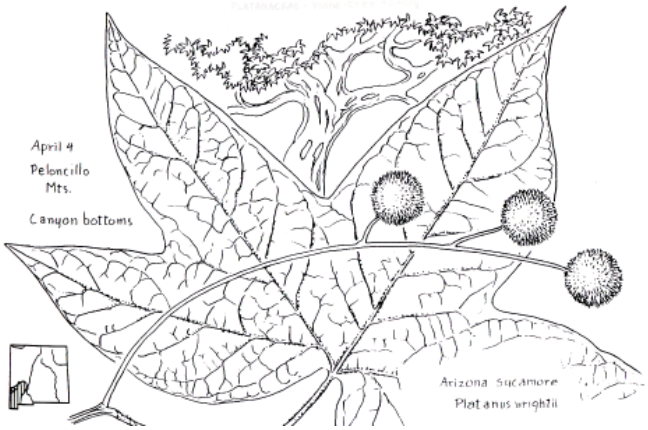
Fruit: non-fleshy; an aggregate; fruiting carpel indehiscent; achene with pappose hairs from the base


female flowers


male flowers

New Mexico genus:
Platanus- Sycamore

Distribution: genera/species
Worldwide: 1/10
US: 1/5
NM: 1/1



Economic uses: Landscape tree
Native to temperate and subtropical regions of the Northern Hemisphere, the family consists of only a single living genus *Platanus*. The hybrid London plane tree is widely planted.

BERBERIDACEAE
(Barberry family)

Order: Ranunculales
Eudicots: Early-diverging

Habit: shrubs, perennial herbs, often spiny; (x-section of wood is yellow in color)

Leaves: alternate; simple or compound; persistent or deciduous; usually exstipulate; often spiny

Flowers: actinomorphic; usually bisexual; perianth often tepals (often yellow); calyx 4-6 or 3+3; corolla 4-6 or 3+3 (occasionally lacking)

Androecium: stamens usually 6; biserate; opening by flap-like valves

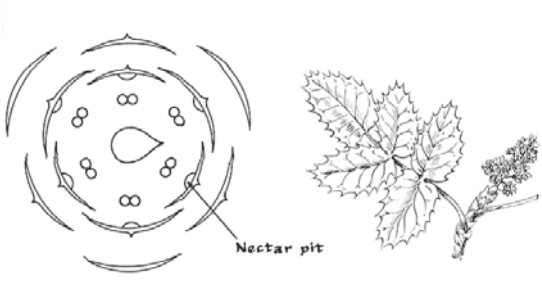
Gynoecium: appears single, but derived from 2-3

Fruit: usually a berry

New Mexico genus:
Berberis- Barberry (formerly *Mahonia*)

Distribution: genera/species
Worldwide: 9-15/570-590
US: 5
NM:1/7

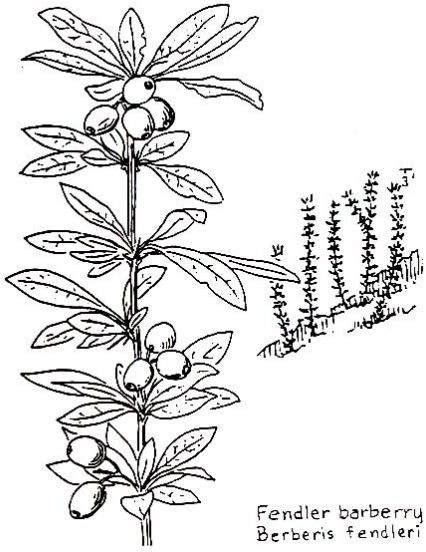
Economic uses: some medicinals and ornamentals (*Nandina*- Heavenly bamboo, *Podophyllum*- Mayapple); some fruits are edible



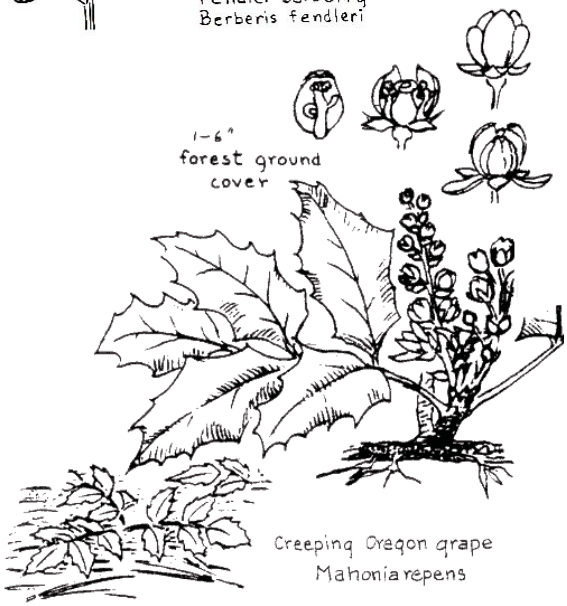
Berberis, floral diagram.

Mahonia (*Berberis*), flowering branch.

Red barberry, algerita
Mahonia haematocarpa



Fendler barberry
Berberis fendleri



Creeping Oregon grape
Mahonia repens

PAPAVERACEAE
(Poppy family)

Order: Ranunculales
Eudicots: Early-diverging

Habit: annual/perennial herbs, and a few shrubs; sap often milky or colored

Leaves: alternate; variously divided, some entire; exstipulate

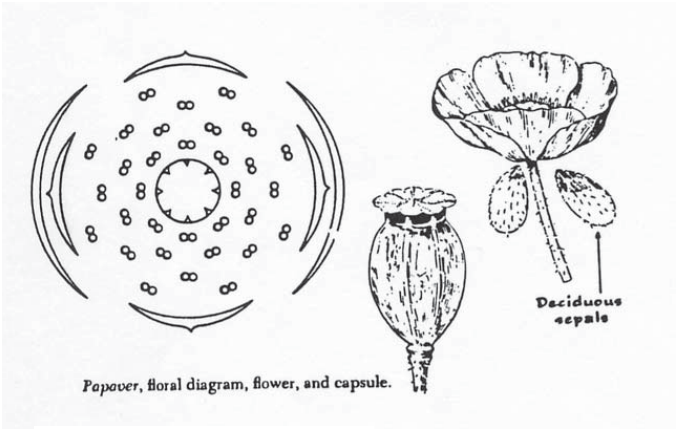
Flowers: actinomorphic; bisexual; usually large and showy; calyx usually caducous; corolla usually 2x the number of the calyx; corolla in 2 whorls (biseriate); 4-6 or 8-12 (2+2, 3+3)

Androecium: usually numerous

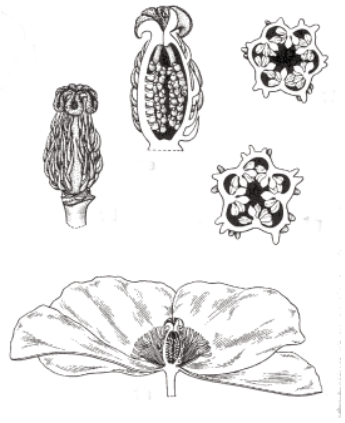
Gynoecium: 2-numerous; usually unilocular or several locules; from intrusive placentae

Fruit: capsule with valves or pores

Common genera:
Papaver- Poppy
Eschscholzia- California poppy
Argemone- Pricklypoppy

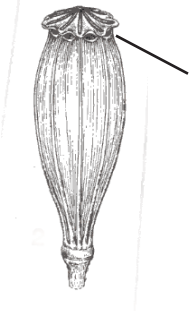


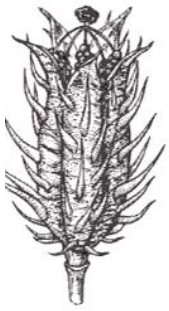
Papaver, floral diagram, flower, and capsule.

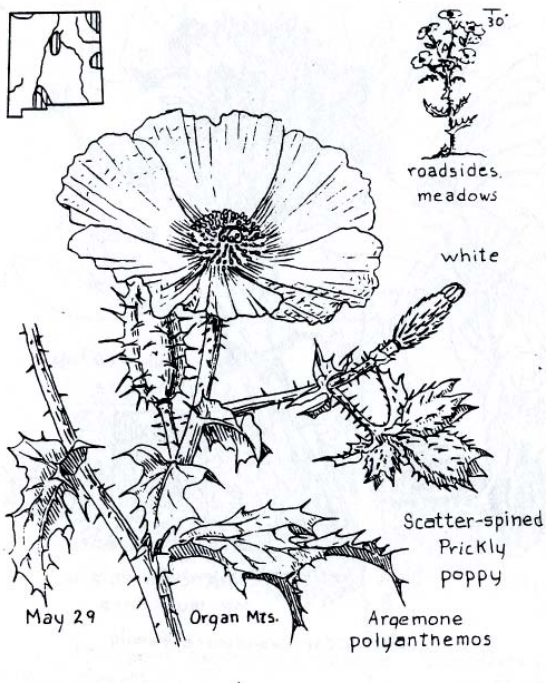


Distribution: genera/species
Worldwide: 23-26/200-210
US: 13/?
NM: 3/9

Economic uses: many ornamentals; some medicinals; *(Papaver somniferum* is the opium poppy)

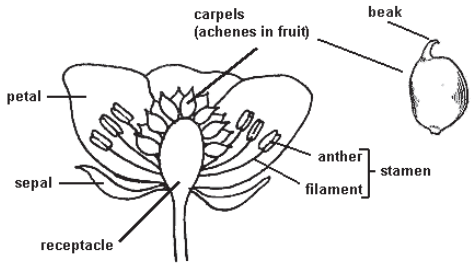

capsule with pores





RANUNCULACEAE
(Buttercup family)

SECTION OF A BUTTERCUP FLOWER



Order: Ranunculales
Eudicots: Early-diverging

Habit: annual/perennial herbs or vines

Leaves: palmately veined or compound; exstipulate; usually sheathing; alternate or basal

Flowers: actinomorphic, occ. zygomorphic; usually bisexual (occ. unisexual); floral series on long receptacle; perianth often petaloid calyx and corolla may be hard to distinguish corolla often spurred, or lacking

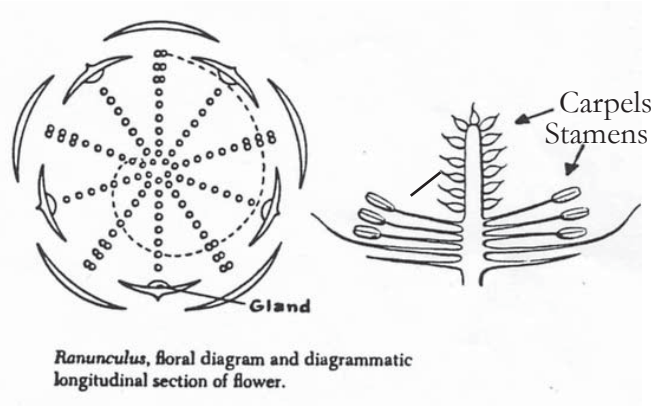
Androecium: numerous, spirally inserted

Gynoecium: apocarpous, usually numerous

Fruit: follicle, berry; achene

Distribution: genera/species
Worldwide: 35-70/1750-2000
US: 21/?
NM: 12/70

Economic uses: many ornamentals, some medicinals, many poisonous



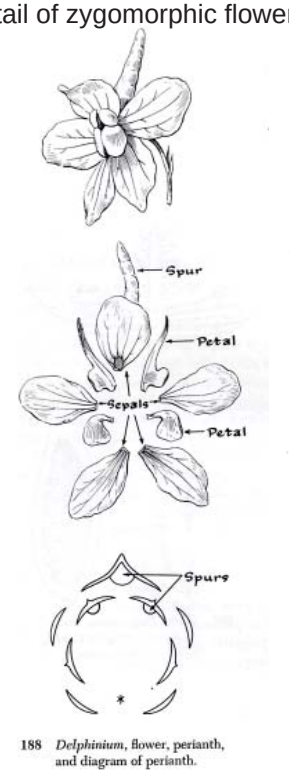
Ranunculus, floral diagram and diagrammatic longitudinal section of flower.

Helleboroideae (Fruit not an achene)
Caltha (Marsh marigold)
Aquilegia (Columbine)
Delphinium (Larkspur)
Aconitum (Monk's hood)

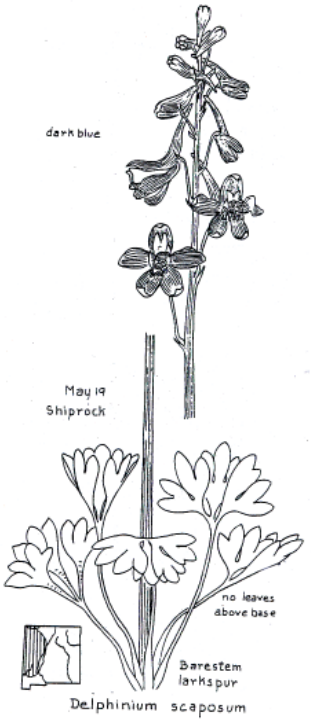
Ranunculoideae (Fruit an achene)
Ranunculus (Buttercup)
Thalictrum (Meadow Rue) flws unisex
Anemone (Wind or Pasque flower)
Clematis (Virgin's bower)

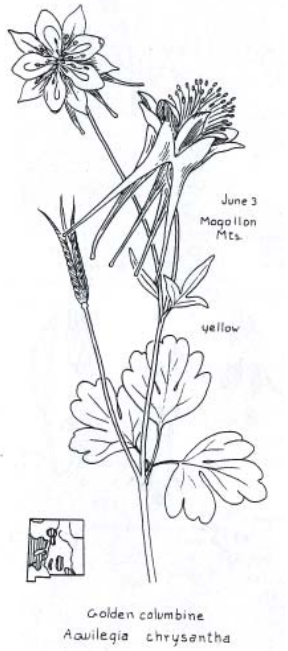
Ranunculaceae in New Mexico

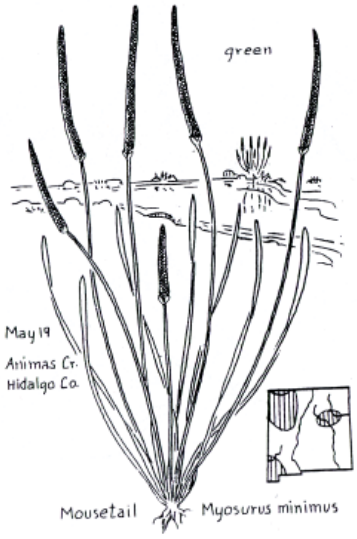
Detail of zygomorphic flower



188 *Delphinium*, flower, perianth, and diagram of perianth.



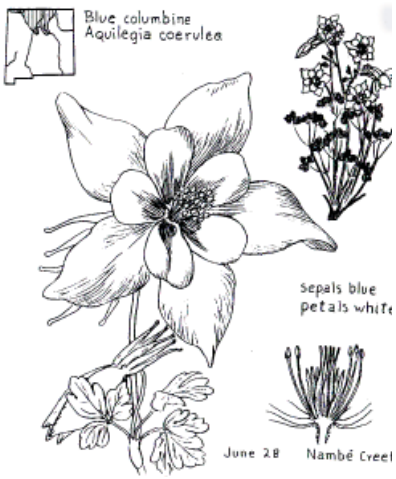


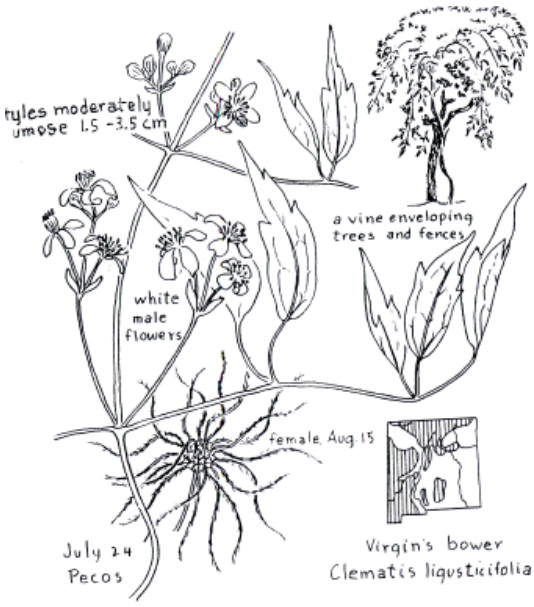


Detail of unisexual flowers

longitudinal section of staminate (male) flower

longitudinal section of carpellate (female) flower





Flowering Seed Plants - The Eudicots

Core Eudicots

Saxifragales
- Crassulaceae
- Saxifragaceae

Rosids

Order Zygophyllales
- Zygophyllaceae

Rosid I

Order Cucurbitales
- Cucurbitaceae

Order Fabales
- Fabaceae

Order Fagales
- Betulaceae
- Fagaceae
- Juglandaceae

Order Malpighiales
- Euphorbiaceae
- Linaceae
- Salicaceae
- Violaceae

Order Rosales
- Elaeagnaceae
- Rosaceae
- Ulmaceae

Rosid II

Order Brassicales
- Brassicaceae
- Capparaceae

Order Geraniales
- Geraniaceae

Order Malvales
- Malvaceae

Order Myrtales
- Onagraceae

Order Sapindales
- Anacardiaceae
- Rutaceae
- Sapindaceae

Caryophyllales
- Amaranthaceae
- Cactaceae
- Caryophyllaceae
- Chenopodiaceae
- Nyctaginaceae
- Polygonaceae
- Portulacaceae
- Tamaricaceae

Santalales
- Santalaceae
- Viscaceae

Asterids

Order Cornales
- Cornaceae
- Fouquieriaceae
- Loasaceae

Order Ericales
- Ericaceae
- Polemoniaceae
- Primulaceae

Asterid I
- Boraginaceae (unplaced)

Order Gentianales
- Apocynaceae
- Asclepiadaceae
- Gentianaceae

Order Lamiales
- Lamiaceae
- Oleaceae
- Orobanchaceae
- Plantaginaceae
- Scrophulariaceae
- Verbenaceae

Order Solanales
- Convolvulaceae
- Solanaceae

Asterid II

Order Apiales
- Apiaceae

Order Asterales
- Asteraceae
- Campanulaceae

Order Dipsacales
- Caprifoliaceae

CRASSULACEAE
(Stonecrop family)

Order: Saxifragales
Core eudicots

Habit: mostly succulent herbs; Crassulacean acid metabolism (CAM); vegetative reproduction common from rhizomes, offsets, and bulbils

Leaves: alternate or opposite; simple, entire; fleshy; exstipulate

Flowers: usually perfect and regular; cymes; corolla may be separate or connate

Androecium: equal to the corolla or 2x corolla

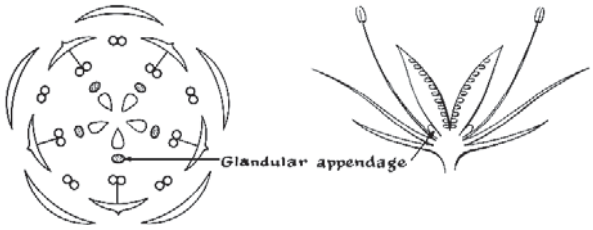
Gynoecium: superior, free or basally connate (4 or 5); each carpel subtended by nectiferous gland or scale; unilocular, parietal placentation

Fruit: follicle

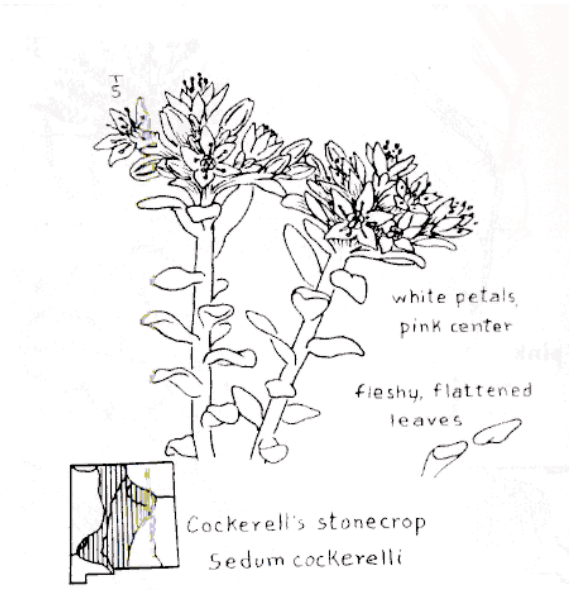
New Mexico genera:
Sedum- Stonecrop
Graptopetalum- leather-petal

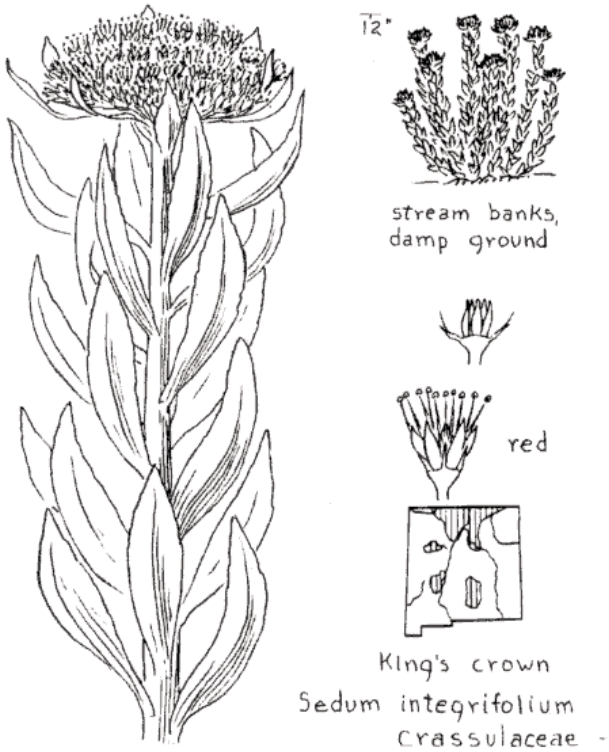
Distribution: genera/species
Worldwide: 33-35/1500
North America: 9/?
NM: 2/8

Economic uses: Many ornamentals including: *Crassula, Sempervirum, Aeonium, Echeveria, Kalanchoe* (plantlets from leaf margins)



Sedum, floral diagram and longitudinal section of flower.





SAXIFRAGACEAE
(Saxifrage family)

Order: Saxifragales
Core eudicots

Habit: herbs

Leaves: alternate, opposite, or fascicles; simple, often palmately veined or lobed; exstipulate or stipules modified into spines

Flowers: actinomorphic, 4-5 merous; bisexual usually perigynous or epigynous; (with hypanthium); calyx usually 4-5; corolla usually 4-5, usually free lobes

Androecium: usually 5 (in one series) or 10; (biseriate), often 2x calyx

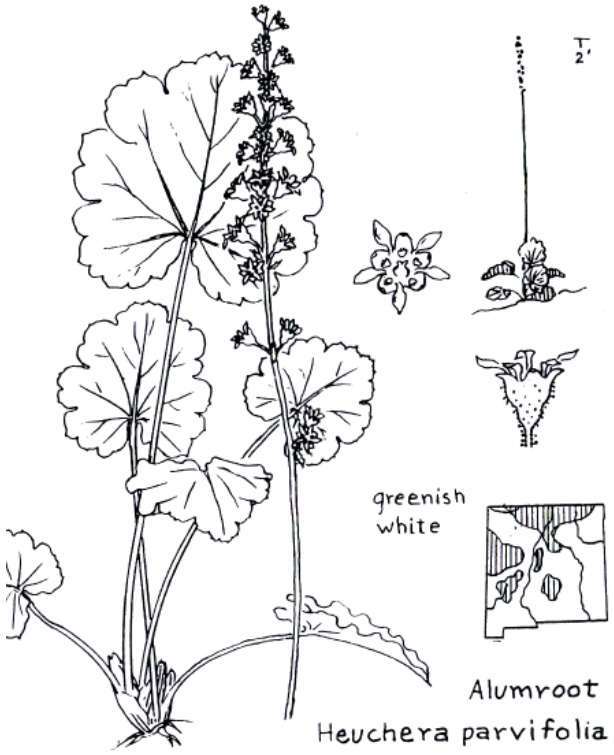
Gynoecium: superior; syncarpous, united at least at the base; typically with 2 carpels; styles usually same number as carpels

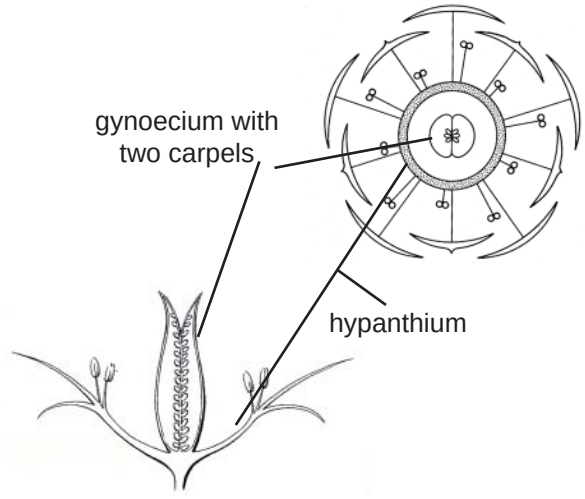
Fruit: usually a capsule

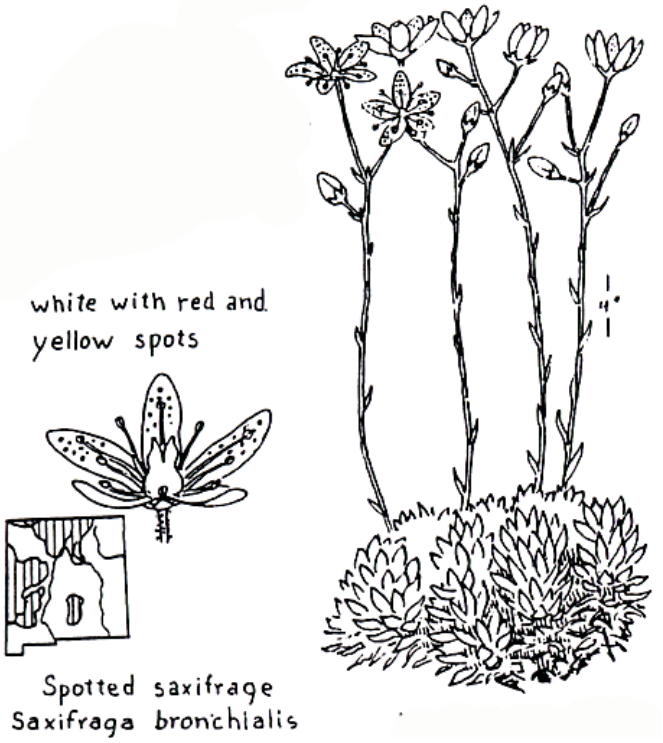
Common genera:
Saxifraga (350) Saxifrage
Heuchera (50) Alumroot; coral bells

Distribution: genera/species
Worldwide: 80/1250
US: 25/?
NM: 5/25

Economic uses: many ornamentals







ZYGOPHYLLACEAE
(Creosote bush family)

Order: Zygophyllales
Rosids

Habit: herbs, shrubs or trees, the nodes often jointed

Leaves: fleshy or leathery, opposite or alternate, simple to pinnately compound; stipules present

Flowers: actinomorphic, perfect, showy; sepals 4-5; petals 4-5, distinct

Androecium: stamens usually 10, opposite the petals

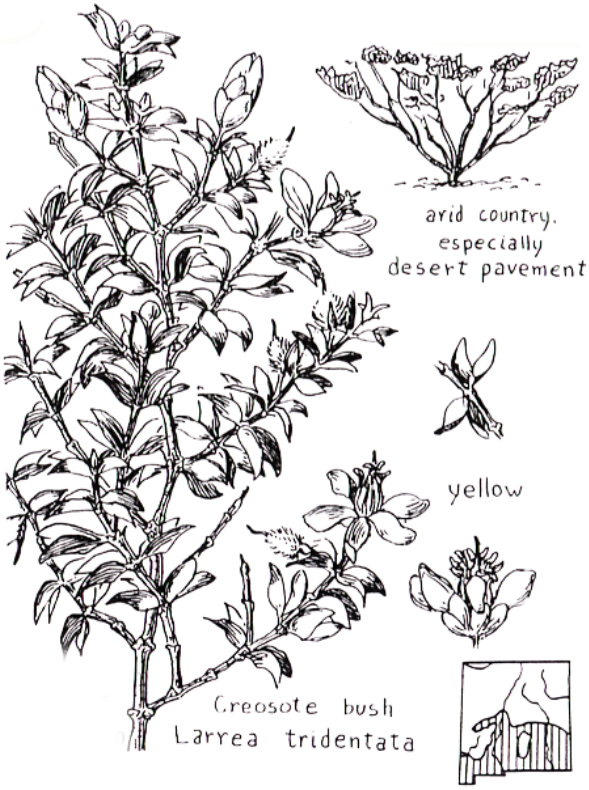
Gynoecium: pistil single, superior, of 5 united carpels, the style single

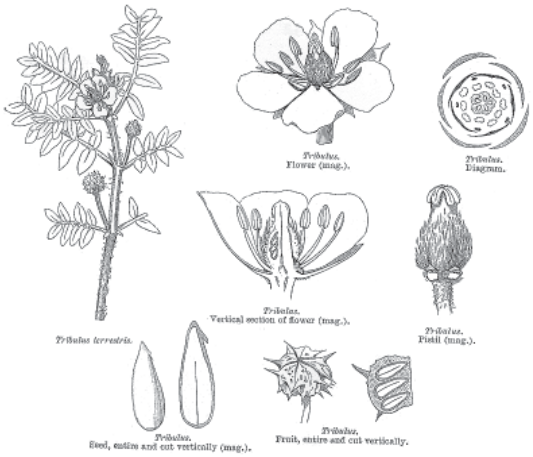
Fruit: berry, drupe, capsule, or schizocarp

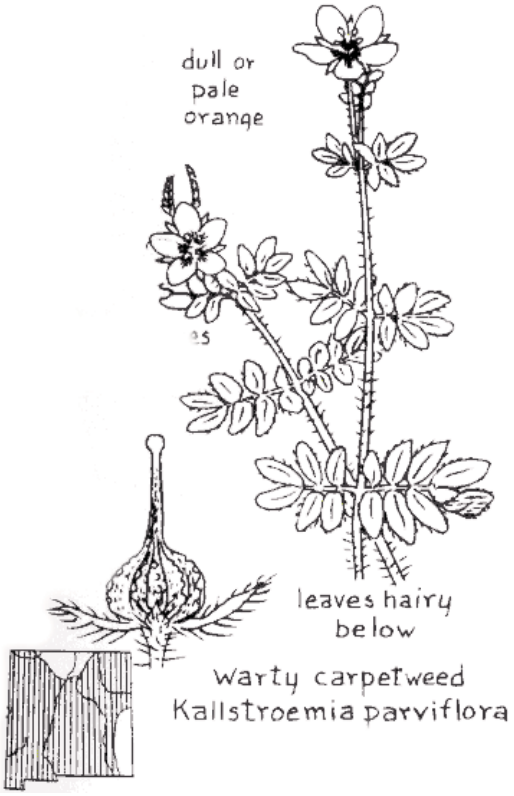
Common genera:
Kallstroemia- caltrop
Larrea- creosote bush
Tribulus- puncture vine

Distribution: genera/species
Worldwide: 30/235
NM: 5/8

Economic uses: ornamentals, wood







CUCURBITACEAE
(Gourd family)

Order: Cucurbitales
Rosid I

Habit: perennial or annual herbs; climbing or trailing; often scabrid; usually with one coiled tendril per node (branched or unbranched)

Leaves: alternate, simple, exstipulate; usually palmately veined and/or lobed

Flowers: unisexual (plants monoecious or dioecious); actinomorphic; usually large, usually axillary; corolla of 5 at least partially fused, often yellow or white petals

Androecium: 5 stamens; usually highly modified due to twisting, cohesion, etc.

Gynoecium: inferior, of 3 united carpels; unilocular, parietal placentation

Fruit: pepo (modified berry)

Common genera:
Cucurbita- Pumpkin, gourd, squash
Sycyos- Bur cucumber
Echinocystis- Wild or Mock cucumber

Distribution: genera/species
Worldwide: 100-120/760-850
US: 14
NM: 8/11

Economic uses: many food plants- *Marah* (Bigroot cucumber), *Citrullus* (Watermelon), *Luffa* (Vegetable sponge), *Sechium edule* (Chayote), *Cucumis* (Muskmelon, Cucumber)
Ornamentals

FABACEAE
(Pea family)

Order: Fabales
Rosid I

Habit: trees, shrubs, vines; occasionally spiny; usually with root nodules containing nitrogen-fixing bacteria

Leaves: alternate; usually pinnately compound; stipulate (some spiny)

Flowers: bisexual, zygomorphic or actinomorphic; not solitary; calyx connate

Androecium: usually 10, occasionally more or less; free, mona- or diadelphous

Gynoecium: unicarpellate, unilocular; placentation marginal

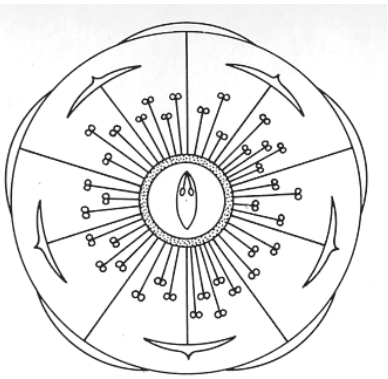
Fruit: legume or loment; variable in appearance

Distribution: genera/species
Worldwide: 500-700/17,000 (3rd largest family)
US: ?
NM: 42/283

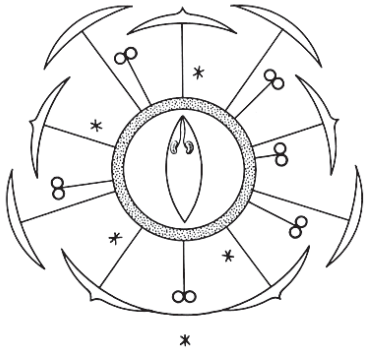
Economic uses: many food plants, forage crops; timber, dye, etc.

Three subfamilies
Mimosoideae
Caesalpinioideae
Papilionoideae

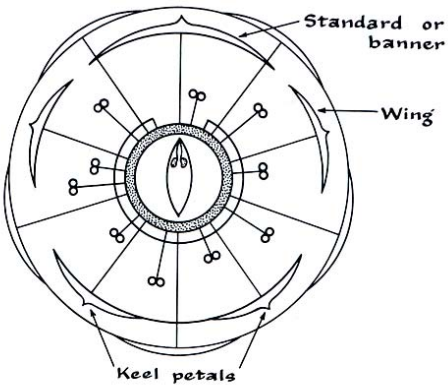
Mimosoid floral diagram



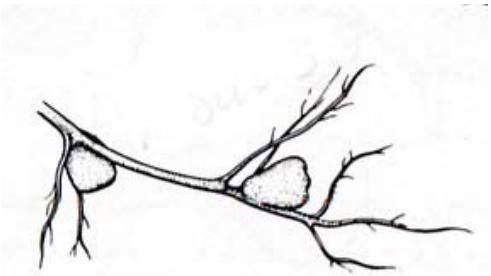
Caesalpiniod floral diagram



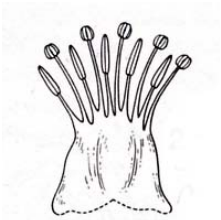
Papilionoid floral diagram



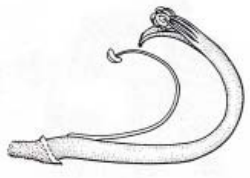
loments and legumes



Root nodules

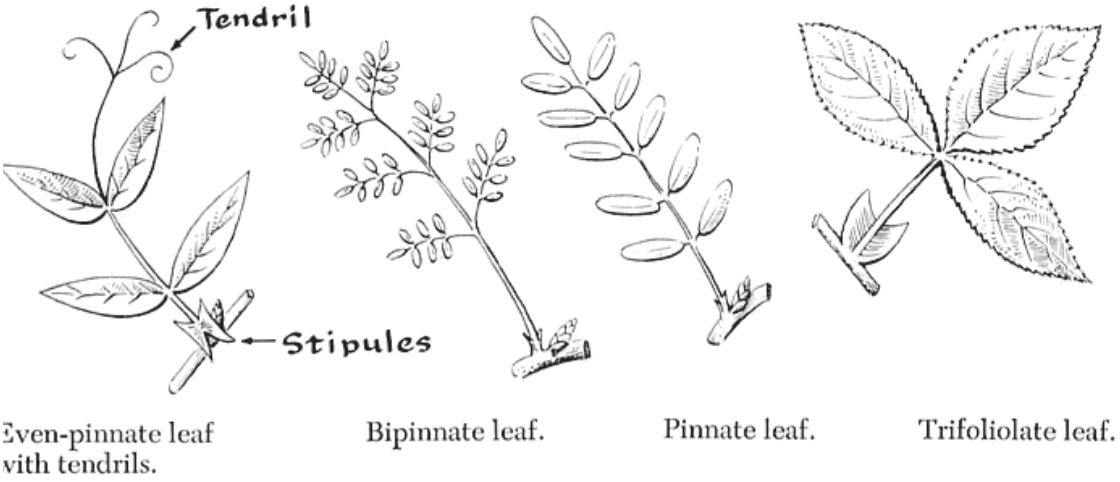


monadelphous stamens



diadelphous stamens

leaf arrangements

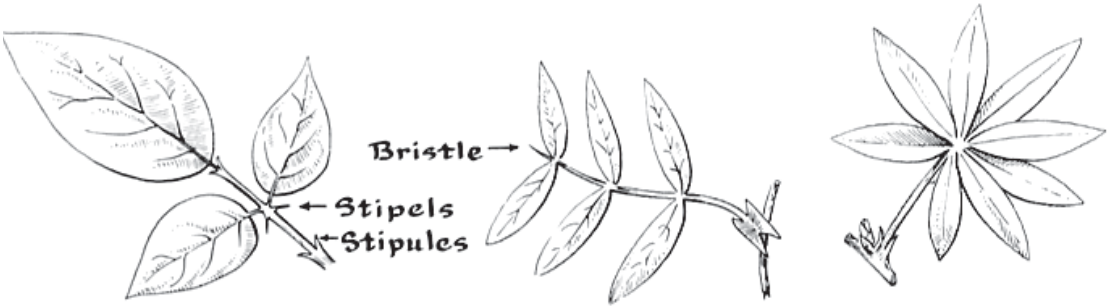


Even-pinnate leaf with tendrils.

Bipinnate leaf.

Pinnate leaf.

Trifoliolate leaf.



Leaf with stipels.

Even-pinnate leaf with a bristle.

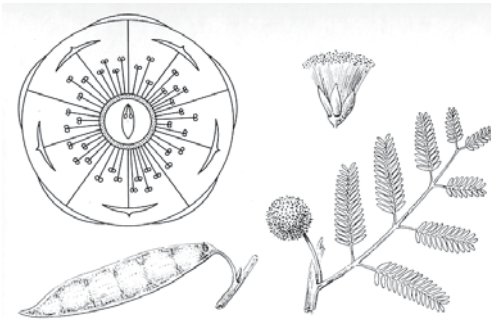
Digitate leaf.

Subfamily characters

Character	**Mimosoideae**	**Caesalpinioideae**	**Papilionoideae**
Habit	trees, shrubs	trees, shrubs	herbs, shrubs, trees
Leaves	often bipinnate	pinnate (simple)	pinnate, palmate (simple)
Flowers	heads, many small	often large & showy	distinctive
Symmetry	actinomorphic	+/- zygomorphic	zygomorphic
Petals	valvate	banner inside wings	banner outside wings
Stamens	[4] 10-many	10 [many]	10, often 9 + 1

Mimosoideae

$K^5\ C^5\ A\ [4]\ 10\text{-many}\ \underline{G}^1$

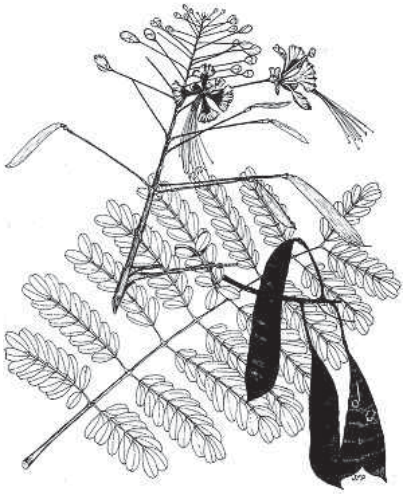


238 *Acacia*, floral diagram, portion of plant, flower, enlarged, and fruit.

Genera in the Mimosoideae
Acacia
Albizia
Calliandra
Desmanthus
Mimosa
Prosopis

Caesalpinioideae

$K^{(5)}\ Cz^5\ A^{10}\ \underline{G}^1$

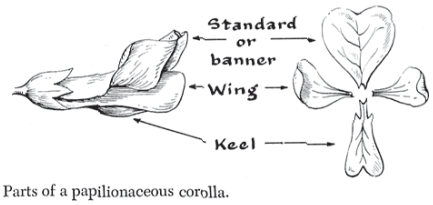


Caesalpinia

Genera in the Caesalpinioideae
Caesalpinia
Cassia
Gleditsia
Hoffmannseggia
Pomaria
Senna

Papilionoideae

$K\ ^{(5)}\ Cz^{1+2+2}\ \overset{\frown}{A}^{9+1[10]}\ \underline{G}^1$



Parts of a papilionaceous corolla.

Types of keel petals.

Genera in the Papilionoideae

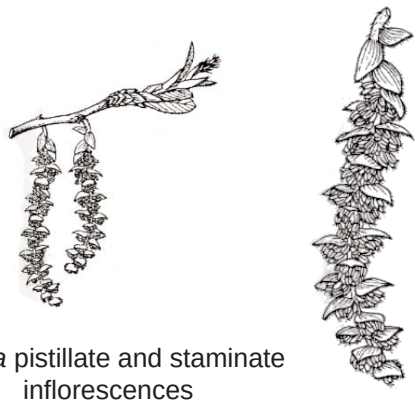
Alhagi
Amorpha
Astragalus
Dalea
Desmodium
Indigofera
Lathyrus
Medicago
Melilotus
Oxytropis
Parryella
Pediomelum
Phaseolus
Pisum (pea)
Psoralea
Psoralidium
Psorothamnus
Robinia
Sesbania
Sophora
Swainsona
Thermopsis
Trifolium
Vicia
Wisteria

BETULACEAE
(Birch family)

Order: Fagales
Rosid I

Habit: trees and shrubs

Leaves: deciduous; alternate; simple; stipulate (often these deciduous); pinnately veined; serrate margins



Betula pistillate and staminate inflorescences

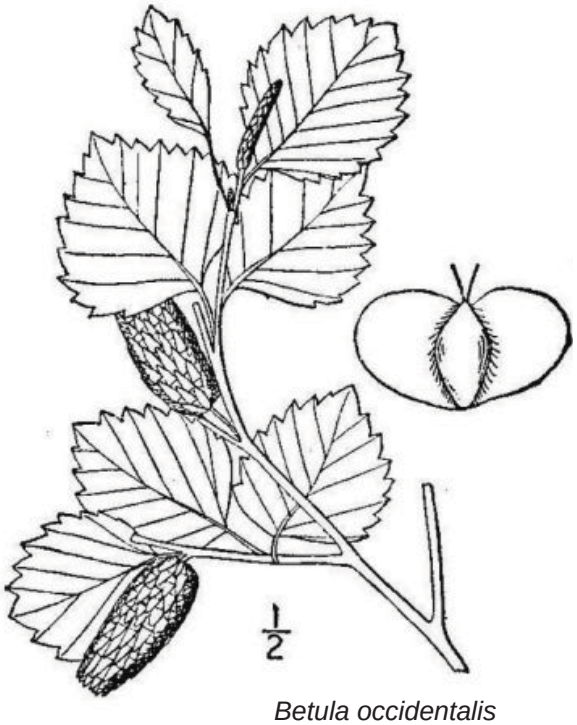
Flowers: unisexual, plants monoecious, flowers associated with bracts and in complex cymes; staminate in catkins; pistillate in catkin-like spike (strobilus)

Androecium: 2-20

Gynoecium: inferior or “naked” (can’t determine ovary position)

Fruit: nut or samara

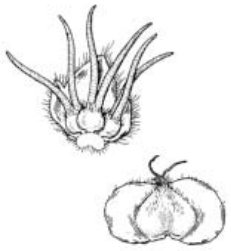
New Mexico genera:
Betula- Birch; pistillate infl. in catkin
Alnus- Alder; pistillate infl. in woody “cone”
Ostrya- Hop hornbeam, ironwood



Betula occidentalis

Distribution: genera/species
Worldwide: 6/110-150
US: 5/25
NM: 3/4

Economic uses: lumber and edible fruit, *Corylus*- Hazelnut (or filberts)



Betula flower and fruit

Alnus oblongifolia

FAGACEAE
(Beech/oak family)

Order: Fagales
Rosid I

Habit: trees and shrubs; deciduous or evergreen

Leaves: alternate, simple; pinnately veined variously lobed or entire; stipules deciduous

Flowers: unisexual, plants monoecious
staminate: usually catkin-like
pistillate: in involucre; 3 locules, 1 seeded by abortion

Fruit: nut, free or fused
cupule (fused bracts) acorns in *Quercus*

Buds: clustered at tips of twigs

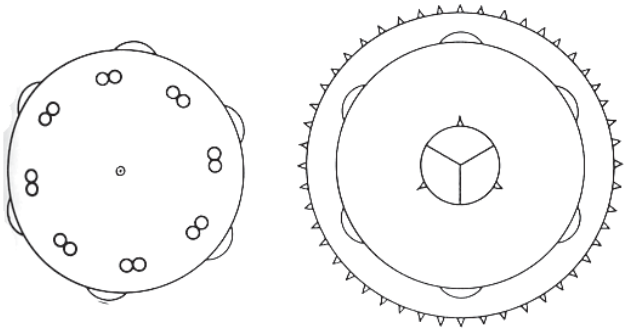
New Mexican genus:
Quercus- Oak

Subgenus *erythrobalanus* are the black and red oaks; fruits mature at the end of the second seaon (produced on previous year's branchlets)

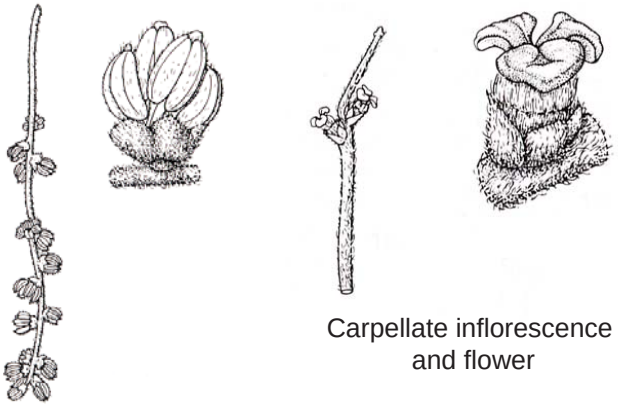
Subgenus *leucobalanus* are the white oaks; fruits mature in one season (produced on current year's branchlets)

Distribution: genera/species
Worldwide: 7-9/600-1050
US: 5/90
NM: 1/13

Economic uses: Lumber
Ornamentals- *Fagus* (Beech)
Cork (*Quercus suber*)
Edible fruit- *Castanea* (Chestnut)
Tanning- *Lithocarpus* (Tanoak)



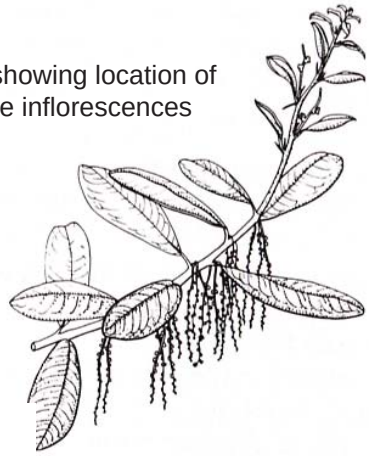
Floral diagrams male (left) and female (right)



Carpellate inflorescence and flower

Staminate inflorescence and flower

Quercus branch showing location of male and female inflorescences



Quercus fruit

JUGLANDACEAE
(Walnut family)

Order: Fagales
Rosid I

Habit: trees with prominent pubescent buds

Leaves: alternate, odd-pinnately compound with resinous aromatic glands; stipules absent

Flowers: (appearing before leaves); unisexual (monoecious), wind-pollinated, the male flowers hanging in **catkins**; perianth of 4 parts or absent; petals none

Androecium: stamens 3-many

Gynoecium: pistil inferior, of 2 unite carpels

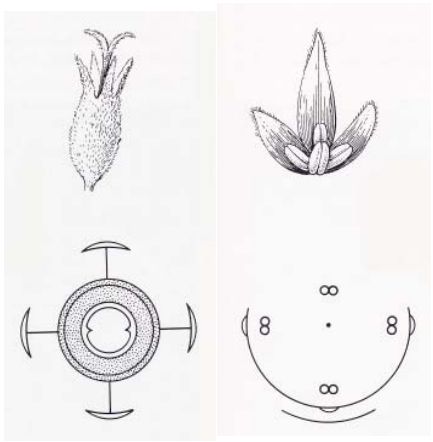
Fruit: nut

New Mexico genera:
Juglans- walnut

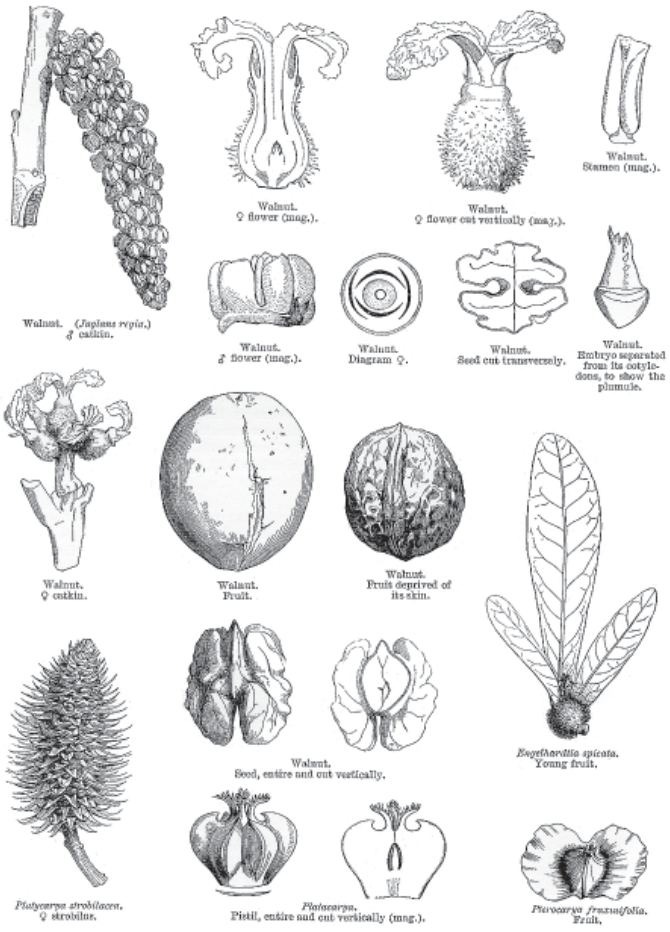
Distribution: genera/species
Worldwide: 8/50
NM: 2/12

Economic uses: sources of edible nuts (walnut, pecan), and many valuable timber species (walnuts, hickory)

Juglans



Carya (hickory) female flower and floral diagram (left) and male flower and floral diagram (right) and branch showing male catkins



Juglandaceae details

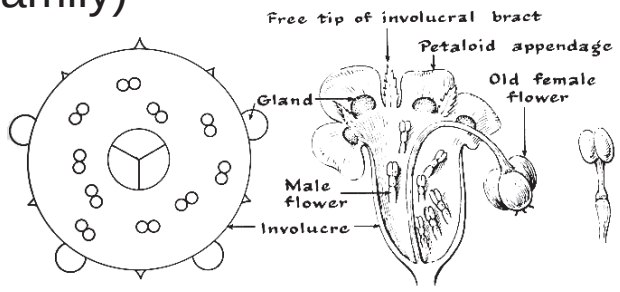
EUPHORBIACEAE
(Spurge family)

Order: Malpighiales
Rosid I

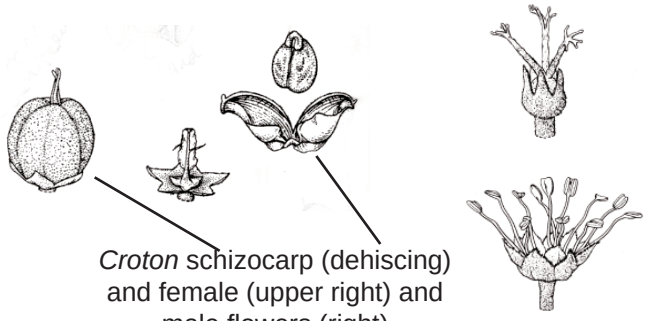
Habit: herbs, (shrubs & trees elsewhere); many xerophytic (and cactoid forms, with paired spines elsewhere); most with milky, poisonous latex

Leaves: alternate (some opposite or whorled); usually stipulate, but may be modified into glands, hairs or spines

Flowers: unisexual (usually monoecious); actinomorphic; pistil usually inconspicuous or absent; female flowers may have staminodia; gynoecium superior, usually 3; male flowers may have pistillodia



Euphorbia floral diagram and longitudinal flower section



Croton schizocarp (dehiscing) and female (upper right) and male flowers (right)

Two types of flowers

Euphorbia type: borne in complex, highly reduced cyme; (**cyathium**) the whole structure resembling a single flower; cuplike part of cyanthium called **involucre;** involucre usually contains several male and one female flower; staminate flower reduced to a single stamen; female flower reduced to tricarpellate, trilocular gynoecium; both types of flowers are pedicellate; each locule contains one *carunculate*, usually mottled seed; sometimes subtended by showy bracts
male: $K^0\,C^0\,A^1\,G^0$
female: $K^0\,C^0\,A^0\,\underline{G}^{(3)}$

Non-Euphorbia type
pistil 5 merous, when present; K, C, or K & C may be lacking; male flowers with variable number of stamens; female tricarpellate, with 1, rarely 2, carunculate seeds
male: $K^{0\text{ or }5}\,C^0\,A^{1-\infty}\,G^0$
female: $K^{0\text{ or }5}\,C^{0\text{ or }5}\,A^0\,\underline{G}^{(3)}$

Fruit: schizocarp

Common genera:
Euphorbia- Spurge
Croton- Croton
Ditaxis- Silverbush
Phyllanthus- Leaf-flower
Tragia- Noseburn

Distribution: genera/species
Worldwide: 290-320/7500-8000
US: 25
NM: 10/88

Economic uses: Latex or oil plants, *Aleurites* (tung and other oils), *Hevea brasiliensis* (Para rubber)
Food, medicinals, dyes, fish and arrow poisons, *Ricinis communis* (Castor bean; seeds lethal)
Ornamentals & Food- *Euphorbia pulcherrima* (Poinsettia), *Manihot esculenta* (Cassava, manioc, tapioca)
Sebastiana pringlei contain larvae of the moth *Carpocapsa saltitans* which compose "Jumping Beans"

LINACEAE
(Flax family)

Order: Malpighiales
Rosid I

Habit: herbs (in NM)

Leaves: alternate or opposite, simple, entire; stipules small, sometimes gland-like

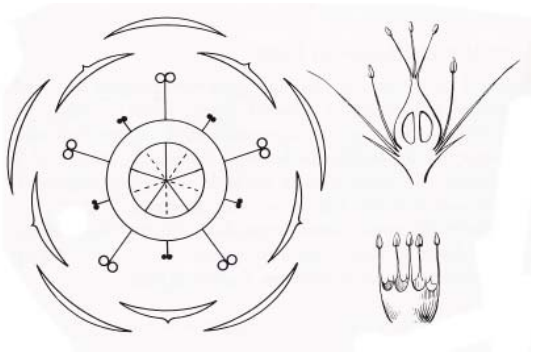
Flowers: actinomorphic, bisexual; sepals 5; petals 5

Androecium: stamens 5

Gynoecium: pistil single, superior, of 3-5 united carpels, with 1-5 styles

Fruit: capsule

New Mexico genus:
Linum- flax

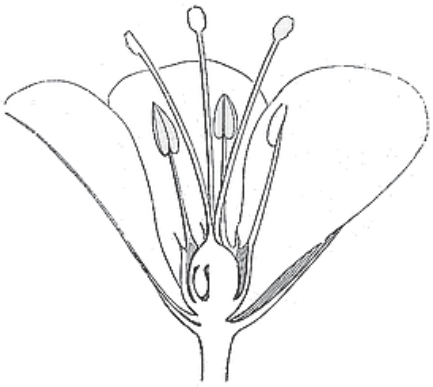


Linum floral diagram and longitudinal flower section and stamen detail

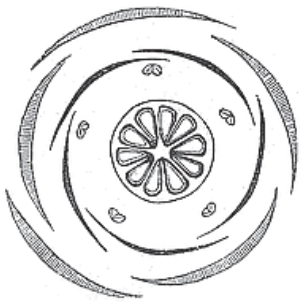
Distribution: genera/species
Worldwide: 14/250
NM: 1/14

Economic uses: Common flax (*Linum usitatissimum*) fiber is used to produce linen, and the seeds to produce linseed oil

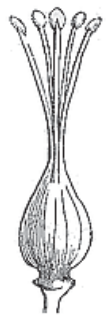
Flax.
(*Linum usitatissimum.*)



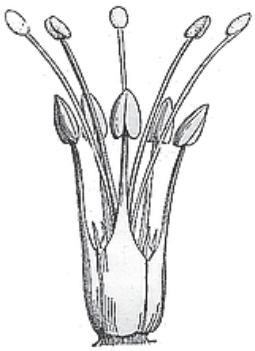
Flax.
Vertical section of flower (mag.).



Flax.
Diagram.

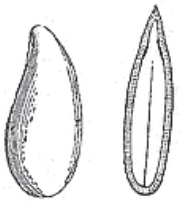


Flax.
Pistil (mag.).



Flax.
Androecium and pistil (mag.).

Flax.
Transverse section of ovary (mag.).



Flax.
Exalbuminous seed, entire and cut vertically (mag.).

Flax.
Fruit (mag.).

SALICACEAE
(Willow family)

Order: Malpighiales
Rosid I

Habit: trees and shrubs

Leaves: simple, alternate; stipulate (may be caducous)

Flowers: unisexual, (dioecious); in catkins (often appearing before leaves); catkins subtended by fringed or hairy bracts; calyx possibly reduced to cup-like disk, or to 1-2 glands; no distinct, countable parts; corolla absent

Androecium: 2–many

Gynoecium: unilocular; parietal placentation; 2 carpels

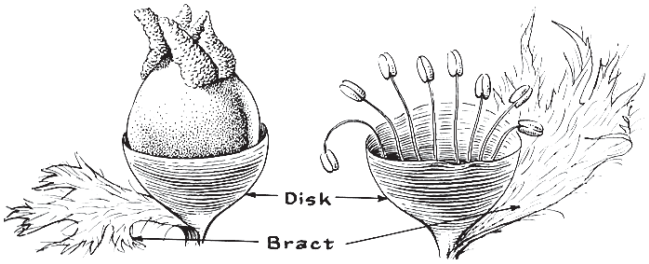
Fruit: capsule; seeds comose; short-lived

Common genera:
Salix- Willows (buds with single rounded bud scale)
Populus- Poplar (several pointed sticky scales; petioles often flatted)

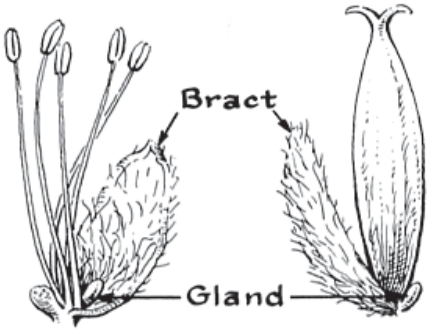
Distribution: genera/species
Worldwide: 2/350-500+
US: 2
NM: 2/33

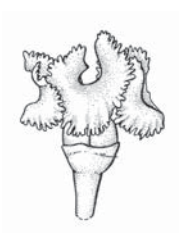
Economic uses: timber, pulp, medicinals, ornamentals

Salix floral diagrams
female (left), male (right)

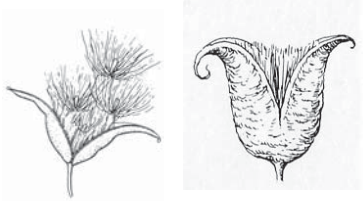


Female and male flowers

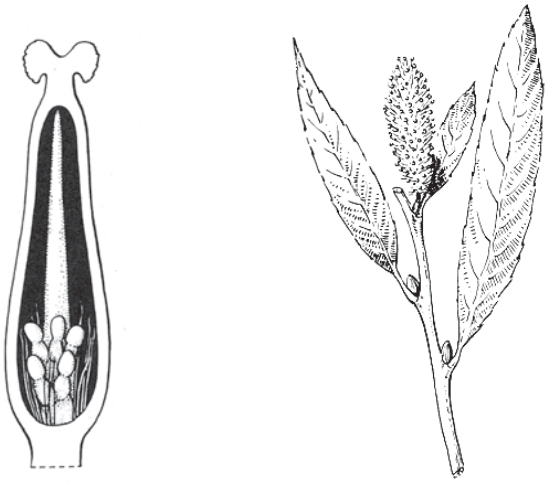




Populus carpellate flower



Salix capsule dehiscing (left) and capsule (right)



Salix longitudinal section of pistil (left), and catkin (right)

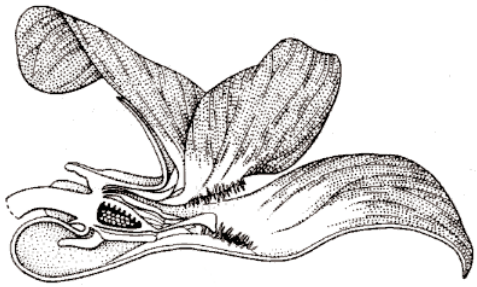
VIOLACEAE
(Violet family)

Order: Malpighiales
Rosid I

Habit: perennial herbs

Leaves: alternate; usually simple, entire or lobed or dissected; prominently stipulate

Flowers: bisexual; zygomorphic (or actinomorphic); may be cleistogamous; corolla with unequal petals, the lowest often enlarged and spurred



Viola longitudinal section of flower

Androecium: abaxial stamen often spurred

Gynoecium: superior ovary; three united carpels; unilocular, parietal placentation

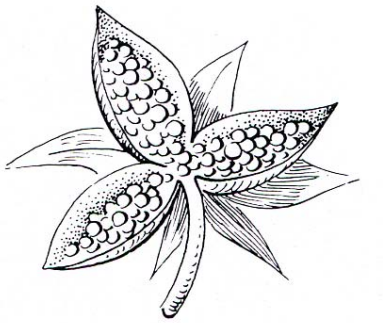
Fruit: explosive loculicidal capsule

New Mexico genera:
Viola- Violet, Pansy
Hybanthus- Green violet

Distribution: genera/species
Worldwide: 21/900
NM: 2/11

Economic uses: ornamentals

Viola canadensis



Viola capsule split open showing seeds

ELAEAGNACEAE
(Oleaster family)

Order: Rosales
Rosid I

Habit: shrubs or trees, covered with scales or branched hairs, often thorny

Leaves: alternate or opposite, simple, entire; stipules absent

Flowers: actinomorphic, perfect or unisexual (monoecious); sepals 2 or 4, petal-like; petals none

Androecium: stamens 4 or 8, filaments short

Gynoecium: pistil superior, simple of 1 carpel

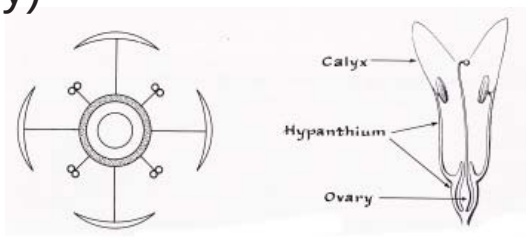
Fruit: drupe-like achene, surrounded by the persistent base of the calyx tube

New Mexico genera:
Shepherdia- buffalo-berry
Elaeagnus- oleaster

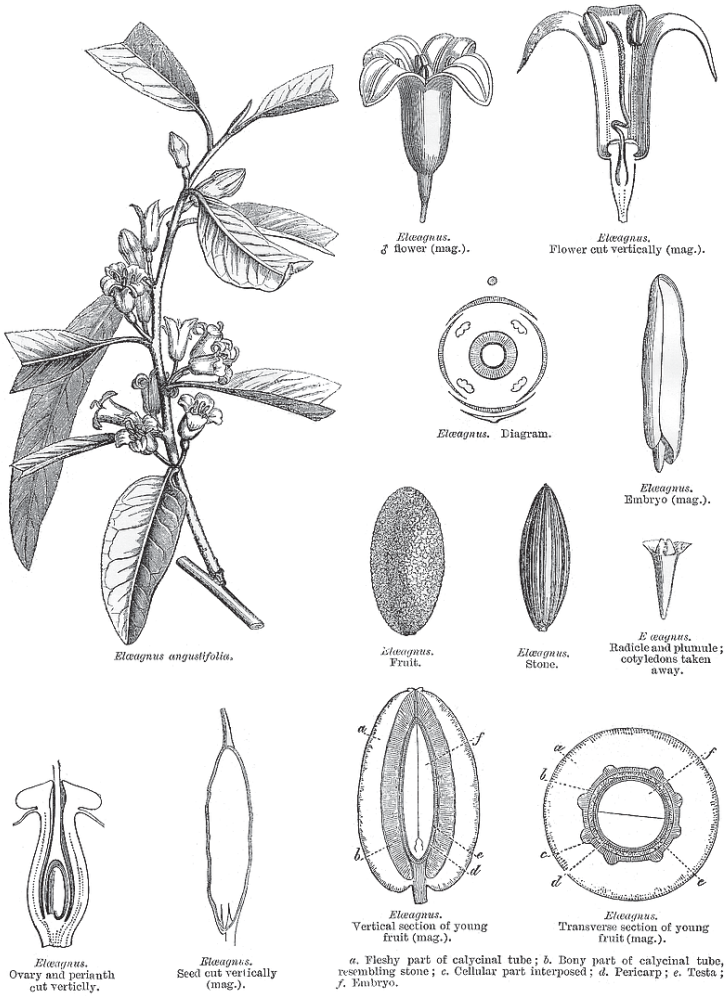
Distribution: genera/species
Worldwide: 3/50
NM: 2/3

Economic uses: The Elaeagnaceae often harbor nitrogen-fixing actinomycetes in their roots, making them useful for soil reclamation.

Elaeagnus scale from leaf



Elaeagnus floral diagram and longitudinal section of floral details



ROSACEAE
(Rose family)

Order: Rosales
Rosid I

Habit: trees, shrubs and herbs

Leaves: alternate, simple or compound usually stipulate (except Spiraeoideae)

Flowers: usually bisexual; usually actinomorphic, usually 5-merous; usually perigynous (i.e., with **hypanthium**); calyx usually connate; corolla arises from rim of hypanthium

Androecium: usually numerous (occasionally 5, 10)

Gynoecium: uni-, apo, or syncarpous; ovary superior or inferior

Fruit: achene, aggregate, drupe, pome, or follicle depending on carpel number and ovary position; some accessory fruits (e.g., strawberry, rose hips)

Distribution: genera/species
Worldwide: 100-120/3000-3400
US: 50
NM: 22/91

Economic uses: many food plants
Ornamentals
Timber

Subfamily Rosoideae
Rosa- Rose
Rubus- Raspberry
Cercocarpus- Mt. Mahogany
Purshia- Antelope bush
Fallugia- Apache plume
Geum- Avens
Potentilla- Cinquefoil
Fragaria- Strawberry

Subfamily Spiraeoideae
Holodiscus- Rock spirea
Physocarpus- Ninebark

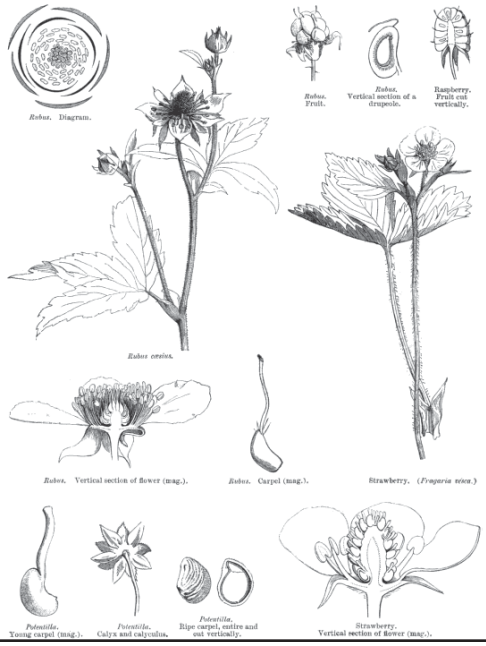
Subfamily Prunoideae
Prunus- Plum, cherry

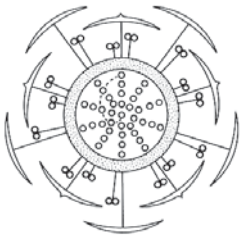
Subfamily Pomoideae
Pyrus- Pear
Malus- Apple

Subfamily	Stipules	Carpel #	Ovary Positon	Fruit
Rosoideae	+	many	superior-perigynous	drupe; achene; hip
Spiraeoideae	-	2-5[1-12]	superior-perigynous	follicle; capsule
Prunoideae	+	1	superior-perigynous	drupe
Pomoideae	+	2-5	inferior-epigynous	pome

Subfamily Rosoideae

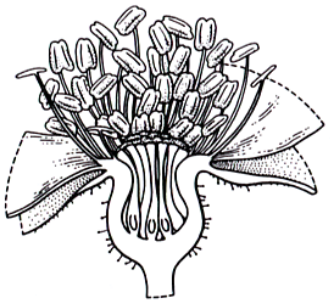
<u>G</u> many perigynous; stipulate; drupe, achene, hip

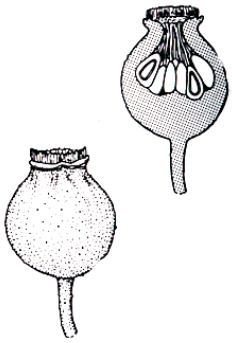




Potentilla hypanthium and floral diagram

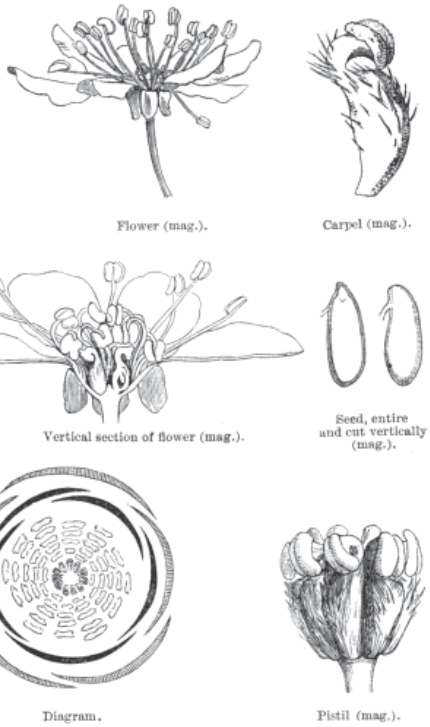
Rosa longitudinal section and fruit (rose hips)





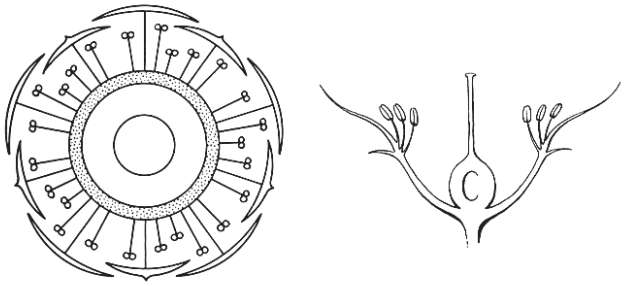
Subfamily Spiraeoideae

<u>G</u>$^{2-5}$ perigynous; exstipulate

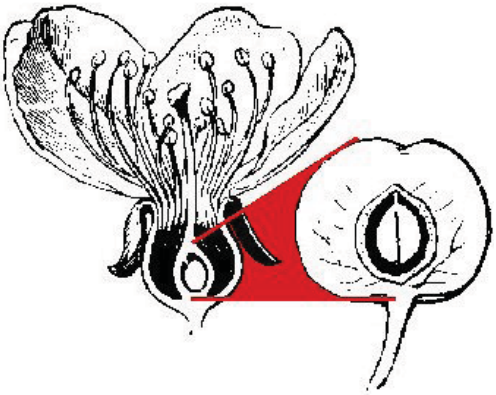


Subfamily Prunoideae

G[1] perigynous; stipulate; drupe



Prunus floral diagram and long section (above)
Prunus flower and fruit (below)



Prunus serotina

Peach. (*Persica vulgaris.*)

Peach. Diagram.

Peach.
Ripe fruit, open, showing the stone.

Peach.
Open stone (mag.).

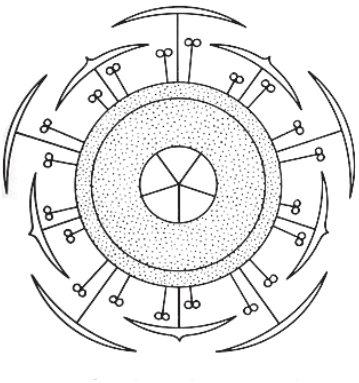
Peach.
Vertical section of flower (mag.).

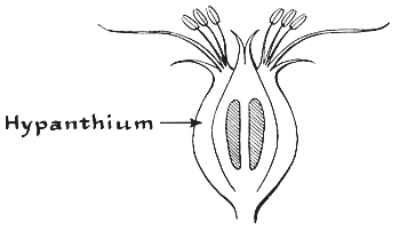
Peach.
Transverse section of ovary

Cerasus Mahaleb.

Subfamily Pomoideae

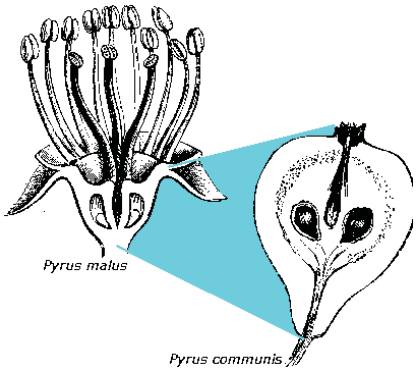
$\overline{G}^{2-5}$ inferior, epigynous; stipulate; pome

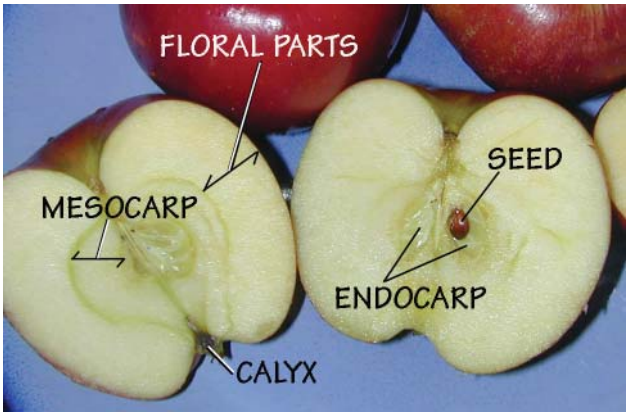


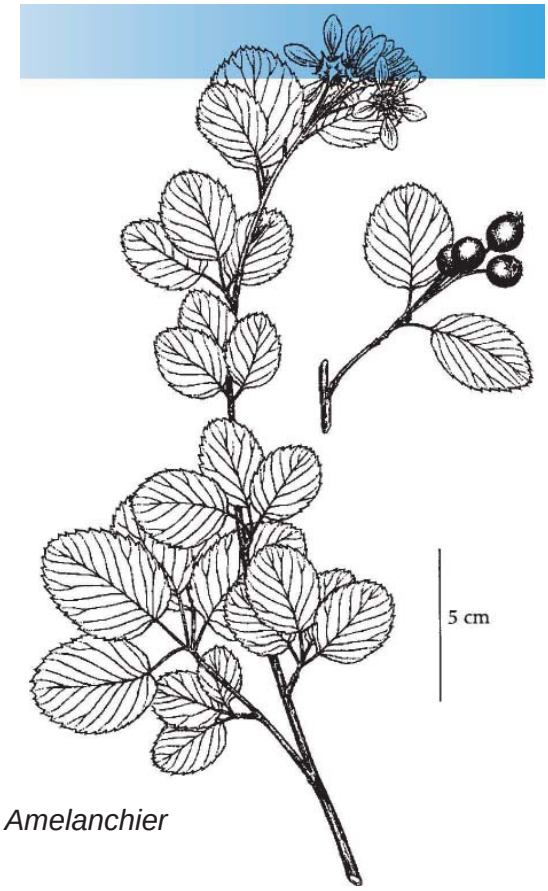


Malus flora diagram and long section of flower (above).

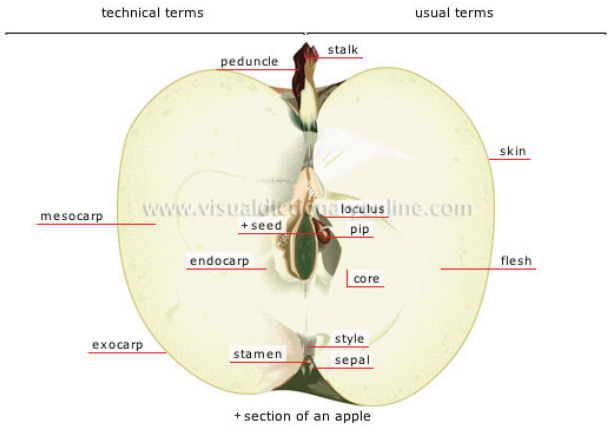
The fleshy, edible portion is derived from the hypanthium and/or receptacle tissue and not from the ovary itself.







Amelanchier



+ section of an apple

ULMACEAE
(Elm family)

Order: Rosales
Rosid I

4-8 0 4-8 2
CA CO A G

Habit: trees and shrubs

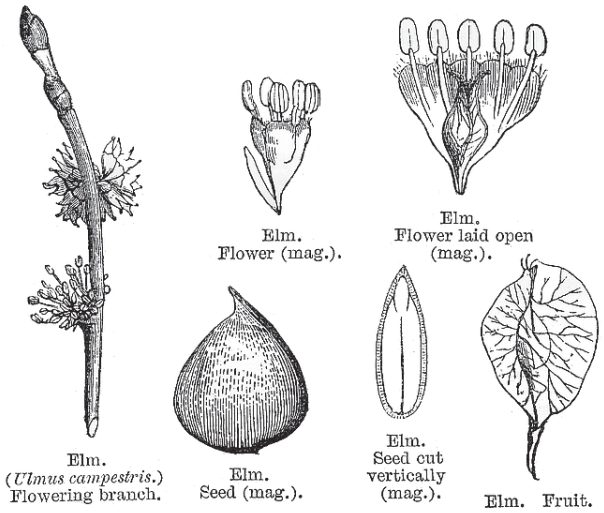
Leaves: simple; alternate; usually with oblique leaf bases; stipules paired

Flowers: unisexual or bisexual (*Ulmus*); calyx may be fused; corolla absent

Androecium: opposite the calyx or 2x calyx

Gynoecium: superior and unilocular

Fruit: samara (*Ulmus*), or drupe (*Celtis*)



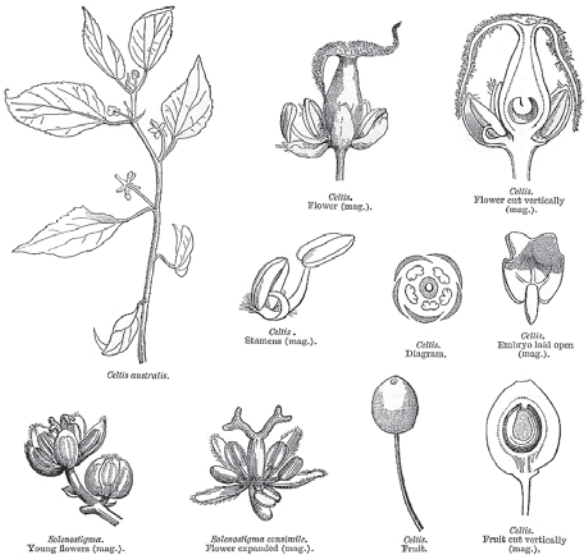
New Mexico genera:
Ulmus- Elm (lumber)
Celtis- Hackberry (some fruits edible, yellow dye, charcoal)

Ulmus pumila
Siberian elm

Distribution: genera/species
Worldwide: 15-16/140-200
NM: 2/3

Economic uses: timber, (from *Ulmus*) especially for furniture

Celtis reticulata
hackberry



BRASSICACEAE
(Mustard family)

Order: Brassicales
Rosid II

Habit: annual or perennial herbs; often with acrid, watery juice

Leaves: alternate, simple to pinnately dissected; exstipulate

Flowers: bisexual, actinomorphic; usually in bractless racemes; perianth 4-merous; cross-shaped

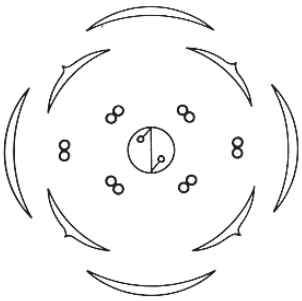
Androecium: with 6 **tetradynamous** stamens; 4 long and 2 short (4+2)

Gynoecium: with 2 united carpels and 2 locules

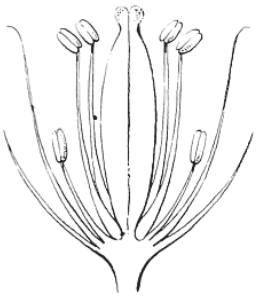
Fruit: **silique**, length is >3x width (think sleek); **silicle**, short and broad; both fruit types are dehiscent; the nature of the mature fruit is “crucial” to the identification of genera and species in this family

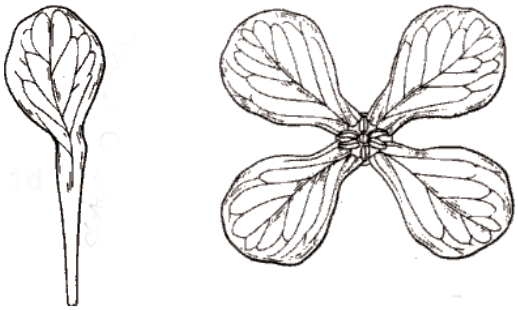
Distribution: genera/species
Worldwide: 375-390/3000-3200
US: 55
NM: 28/124

Economic uses: food *Brassica* (mustard, cabbage, kale, cauliflower, rutabaga, kohlrabi are all derived from *Brassica oleracea; Armoracia rusticana* (Horseradish)*; Raphanus sativus* (Radish)
Many ornamentals- *Nasturtium*
Many weeds



Brassica floral diagram and longitudinal flower





Raphanus “clawed” petal and cross-shaped corolla

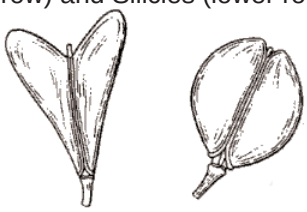
tetradynamous (4+2) stamens

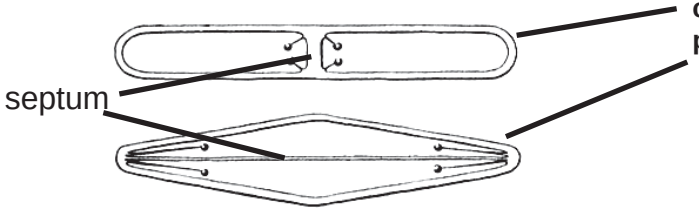
Brassicaceae

Common genera:
Arabis- Rock cress
Capsella- Shepherd's purse
Descurainia- Tansy mustard
Dithyrea- Spectacle pod
Draba- Whitlow grass
Erysimum- Wall flower
Lepidium- Peppergrass
Lesquerella- Bladder pod
Physaria- Bladder pod, twinpod
Rorippa- Cress
Sisymbrium- Tumble mustard
Stanleya- Prince's plume
Streptanthus- Twist flower
Thelypodium- Thelypody
Thlaspi- Pennycress

Silique= greater than 3x longer than wide

Siliques (upper row) and Silicles (lower row)





Two types of flattening of fruits, one flattened contrary to the septum, the other flattened parallel to the septum

CAPPARACEAE
(Caper family)

Order: Brassicales
Rosid II

Habit: herbs, some shrubs

Leaves: alternate; simple or palmately compound; stipules lacking, reduced, or spiny

Flowers: usually bisexual; usually zygomorphic; often in bracteate racemes; receptacle often prolonged into gynophore/ androgynophore (also called a **stipe**)

Androecium: 4 or 6-many; usually exserted

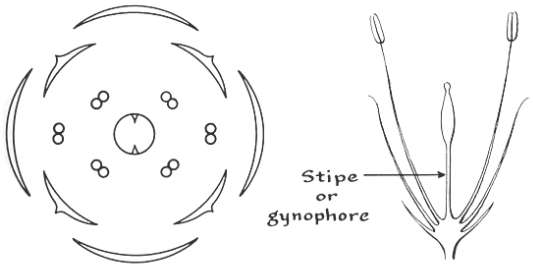
Gynoecium: superior, 2 united carpels; unilocular, parietal placentation

Fruit: capsule (occasionally a berry)

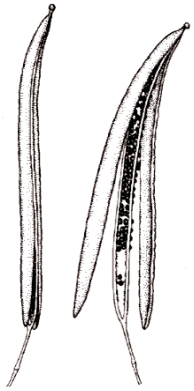
Common genera:
Cleome- Bee plant
Polanisia- Clammyweed
Wislizenia- Jackass clover
Cleomella- Stinkweed

Distribution: genera/species
Worldwide: 45/670-800
US: 8-9
NM: 4/7

Economic uses: some food plants- *Capparis spinosa* (flower buds are Capers)
Ornamentals



Cleome floral diagram and longitudinal flower



capsule

Note the 4 petals all on one side (not radially arranged), and the very long and exserted stamens

GERANIACEAE
(Geranium family)

Order: Geraniales
Rosid II

Habit: herbs (subshrubs elsewhere); usually with aromatic oils on hair glands

Leaves: alternate or opposite; dissected or compound; stipulate

Flowers: bisexual, actinomorphic or slightly zygomorphic; 5-merous; calyx 5 free or partially connate sepals; corolla 5 free, often alternate with nectar glands

Androecium: 5, 10, or 15; occasionally connate at the base

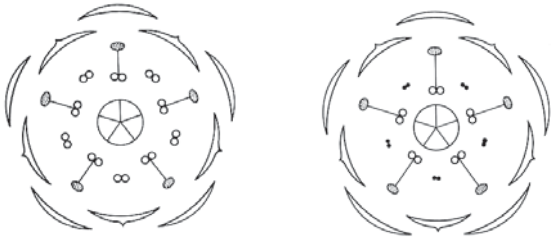
Gynoecium: superior; with elongating, persistent beak or column; inflorescence a cyme or umbel

Fruit: schizocarp, the mericarps splitting away from and rolling up the beak or column

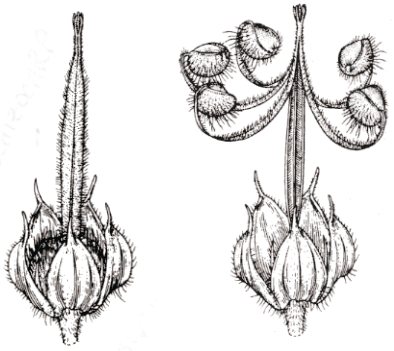
New Mexico genera:
Geranium- Crane's bill (leaves palmate)
Erodium- Stork's bill (leaves pinnate)

Distribution: genera/species
Worldwide: 11-14/73-781
US: 2/
NM: 2/10

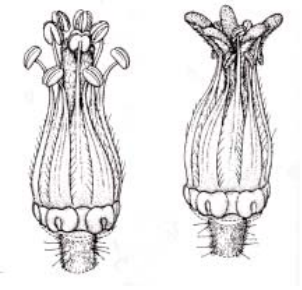
Economic uses:
Ornamentals- *Pelargonium* (cultivated Geranium)
Medicinals
Oils



Geranium (left) and *Erodium* (right)



Schizocarp before dehiscing (left) and after dehiscing (right)



Protandrous floral progression showing male then female structures

Geranium floral longitudinal section (left) and flower (right)

MALVACEAE
(Mallow family)

Order: Malvales
Rosids II

Habit: herbs, some shrubs; often with stellate hairs

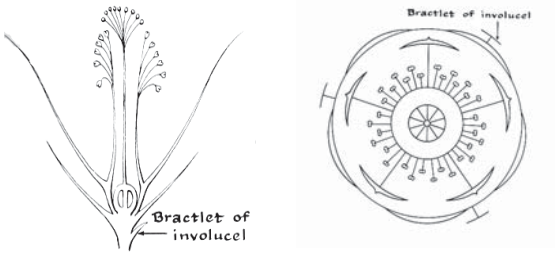
Leaves: alternate, simple; usually palmately veined and/or lobed; stipulate

Flowers: usually bisexual; actinomorphic, often showy; solitary and axillary or cymes; flowers sometimes subtended by epicalyx = coherent bracts; calyx of 3-5 united sepals; corolla of 5 petals

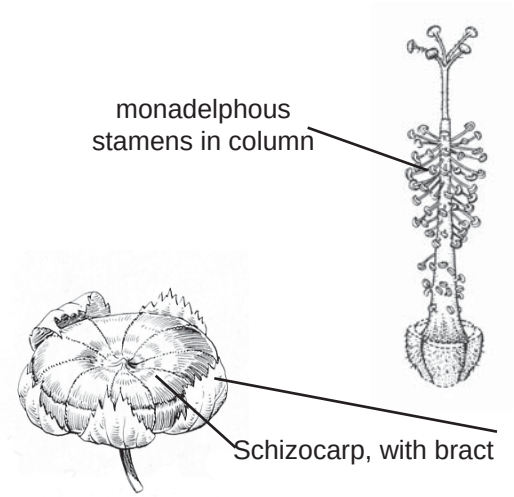
Androecium: many, forms a tube = **monadelphous stamens**

Gynoecium: superior, 5-8 united carpels

Fruit: loculicidal capsule = **schizocarp**



Malva long section and floral diagram

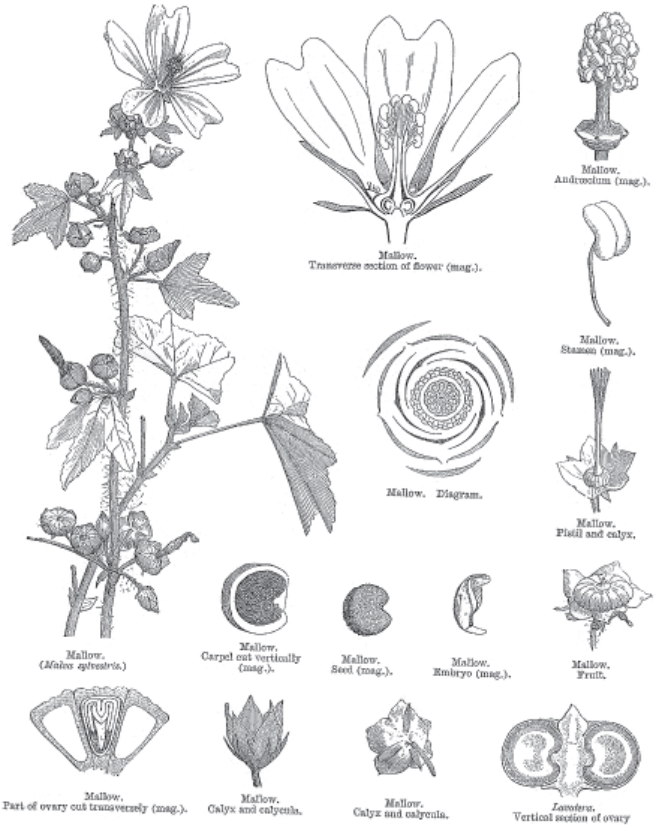


New Mexico genera:
Tribe Malveae (fruit a schizocarp)
Abutilon- Indian mallow
Sphaeralcea- Globemallow
Malva- Mallow, cheeseweed
Sida- Alkalai mallow
Sidalcea- Checkered mallow

Tribe Hibisceae (fruit a capsule)
Hibiscus, Gossypium

Distribution: genera/species
Worldwide: 85-116/1500
US: 27
NM: 10/53

Economic uses: Fibers- *Gossypium hirsutum* (upland cotton of the south)
Food plants- *Hibiscus esculentus* (Okra)
Ornamentals- *Hibiscus, Althaea* (Hollyhock, Marshmallow)



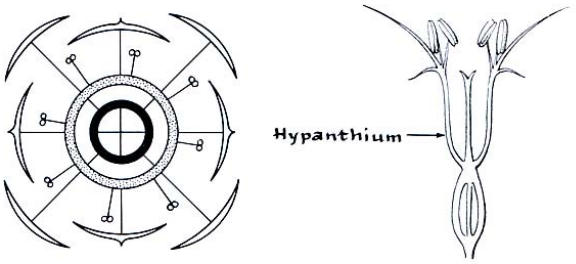
ONAGRACEAE
(Evening-primrose family)

Order: Myrtales
Rosid II

Habit: mostly herbs

Leaves: alternate or opposite, simple; usually exstipulate

Flowers: bisexual, actinomorphic; often 4-merous; epigynous with **hypanthium;** calyx separate, inserted on hypanthium; corolla often clawed

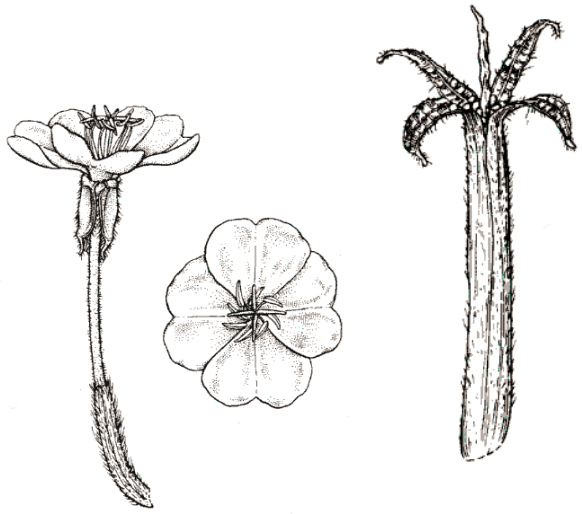


Oenothera floral diagram and longitudinal section of flower

Androecium: same number as corolla, or 2x the corolla

Gynoecium: inferior; often with 4 prominent stigma lobes

Fruit: often a loculicidal capsule, nutlet

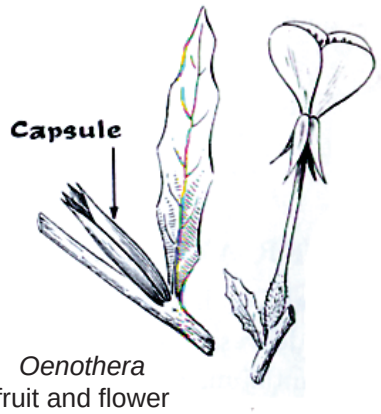


Oenothera flower and capsule

New Mexico genera:
Calylophus- Sundrops
Epilobium- Fireweed
Gaura- Bee-blossom
Ludwigia- Primrose-willow
Oenothera- Evening-primrose
Camissonia- Suncup

Distribution: genera/species
Worldwide: 20-24/650
US: 12/
NM: 6/70

Economic uses: ornamentals, e.g., *Fuchsia*



Oenothera fruit and flower

ANACARDIACEAE
(Sumac family)

Order: Sapindales
Rosid II

Habit: shrubs (and trees elsewhere); often with resinous bark

Leaves: alternate, usually pinnately compound, exstipulate

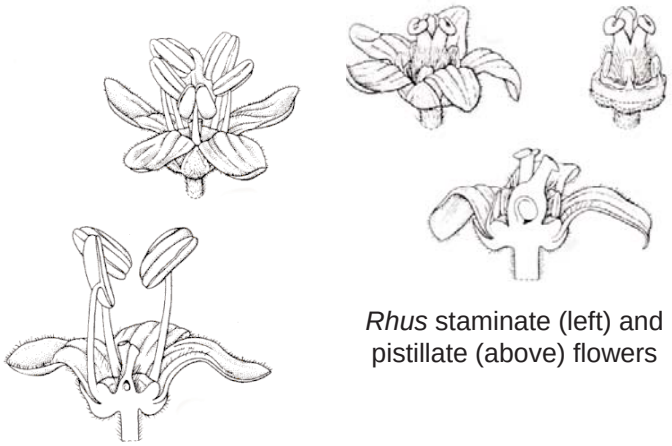
Flowers: bisexual or unisexual (then species polygamous); actinomorphic, small; usually 5-merous; panicles; calyx basally connate

Androecium: associated with staminal disc

Gynoecium: superior; 3 united carpels, unilocular by abortion

Fruit: drupe

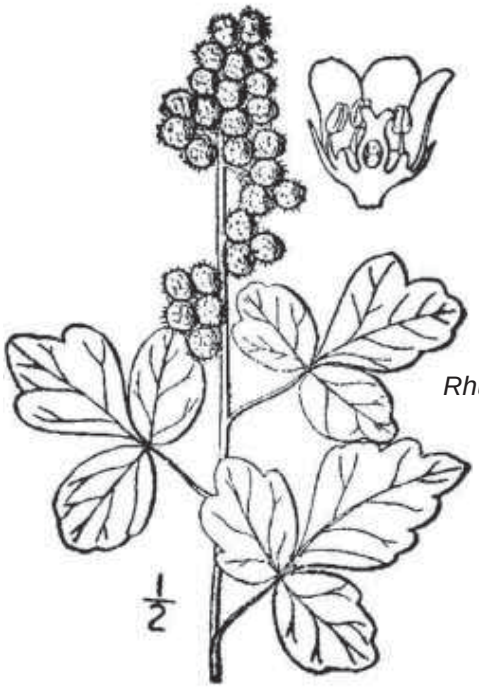
New Mexico genera:
Rhus- sumac
Toxicodendron- poison ivy



Rhus staminate (left) and pistillate (above) flowers

Distribution: genera/species
Worldwide: 73-79/600-850
US: 7/?
NM: 2/6

Economic uses: food plants, ornamentals, resins (tanning, lacquer), timber
Anacardium occidentale (Cashew nut, resins); *Mangifer- M. indica* (Mango); *Pistacia vera* (pistachio nut)



Rhus trilobata

Rhus stem cross section

RUTACEAE
(Citrus family)

Order: Sapindales
Rosid II

Habit: shrubs or small trees; aromatic

Leaves: alternate, simple, trifoliate, or pinnately compound, usually with resin glands; exstipulate

Flowers: greenish-yellow, actinomorphic, perfect; sepals 4-5; petals 4-5, distinct or connate at the base

Androecium: stamens 4-10

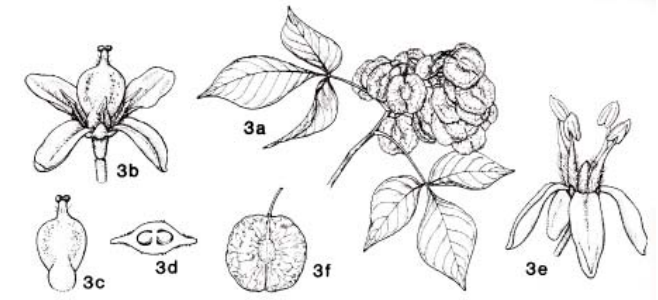
Gynoecium: superior; pistil single, of 2-5 united carpels, the style single

Fruit: berry, drupe, or schizocarp

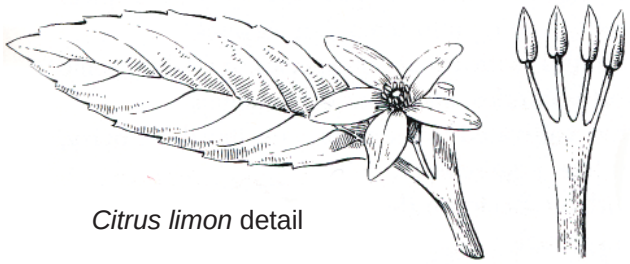
New Mexico genera:
Thamnosma- rue
Choisya- Mexican-orange
Ptelea- hoptree

Distribution: genera/species
Worldwide: 150/900
NM: 3/3

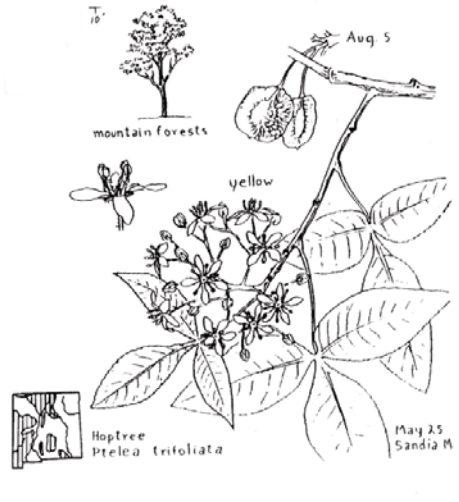
Economic uses: *Citrus*, which includes the orange (*C. sinensis*), lemon (*C.* × *limon*), grapefruit (*C. paradisi*), and lime (various, mostly *C. aurantifolia*, the key lime)



Ptelea details of floral and fruit structures



Citrus limon detail



SAPINDACEAE
(Soapberry family)

Order: Sapindales
Rosid II
note: the family has recently been expanded to include the Aceraceae and the Hippocastanaceae

Habit: shrubs or trees

Leaves: alternate or opposite, pinnately compound or trifoliate; stipules present or absent

Flowers: small, actinomorphic or zygomorphic, usually unisexual; sepals 4-5; petals 4-5, distinct

Androecium: stamens 4 or 8, filaments usually pubescent or papillose

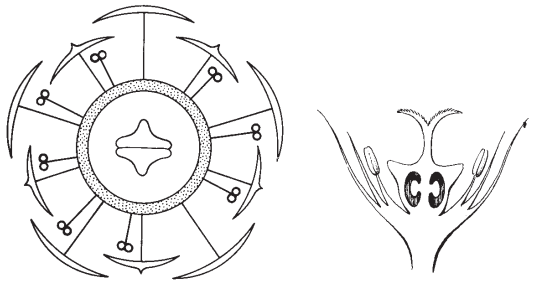
Gynoecium: pistil & style single, superior, simple of 2-3 united carpels, stigmas 2-3

Fruit: fleshy or dry, a berry, capsule, or schizocarp (samara)

New Mexico genera:
Sapindus- soapberry
Acer- maple
Ungnadia- buckeye

Distribution: genera/species
Worldwide: 140-150/1400-2000
NM: 3/5

Economic uses: tropical fruit, soapberries, maple syrup; wood from maple and buckeye; ornamentals; saponins used commercially in cosmetics and detergents



Acer floral diagram and long section of flower

Fig. 307. Acer negundo var. californicum Sarg. Fruit, × ⅓. Leaf, × ⅛.

Acer fruit (samara) and leaf

AMARANTHACEAE
(Amaranth family)

Order: Caryophyllales
Core eudicots

Habit: annual or perennial herbs and shrubs; often with **reddish** lower stems (contains **betalains**)

Leaves: alternate or opposite; simple, usually entire; exstipulate

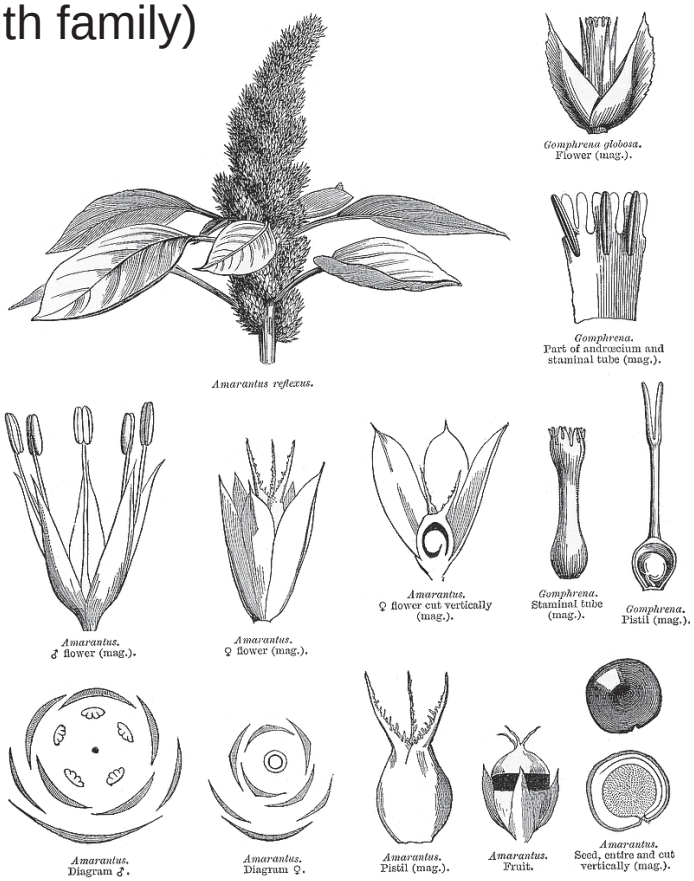
Flowers: usually small and green; often with scarious, bristly bracts; calyx usually small and dry; corolla absent

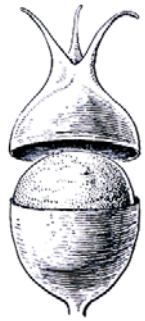
Androecium: opposite the sepals; monadelphous

Gynoecium: unilocular; usually one-ovuled

Fruit: pyxis or utricle; embryo curved

pyxis: a capsule dehiscing by means of a lid
utricle: indehiscent; one-seeded, bladder-like fruit



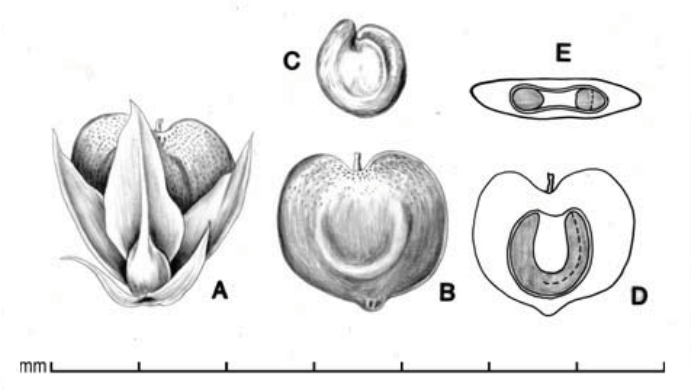


Amaranthus fruit, pyxis

Common genera:
Acanthochiton- Greenstripe
Amaranthus- Pigweed
Gomphrena- Globe-amaranth
Iresine- bloodleaf
Tidestromia- honeysweet

Distribution: genera/species
Worldwide: 60-71/800-900
US: 12
NM: 10/27

Economic uses: some ornamentals, *Celosia*- Cock's comb; some edibles; many weeds
Note: Betalains occur in the Caryophyllales



A, Utricle with perianth; B, utricle; C, seed; D, longitudinal section of fruit showing embryo; E, transverse section of fruit showing embryo

CACTACEAE
(Cactus family)

Order: Caryophyllales
Core eudicots

Habit: perennial succulent shrubs, or herbs; more or less spiny, with clusters of spines in hairy, spiralled areoles; principal photo-sythesizing function transferred to stems

Leaves: when present and identifiable as such, deciduous (often caducous); when present, alternate, spiral, simple

Flowers: bisexual; flowers solitary, or aggregated in 'inflorescences'; cymose; flowers often showy; perianth sequentially intergrading from sepals to petals, or petaline; 20–100

Androecium: exclusively of fertile stamens; stamens 15–100

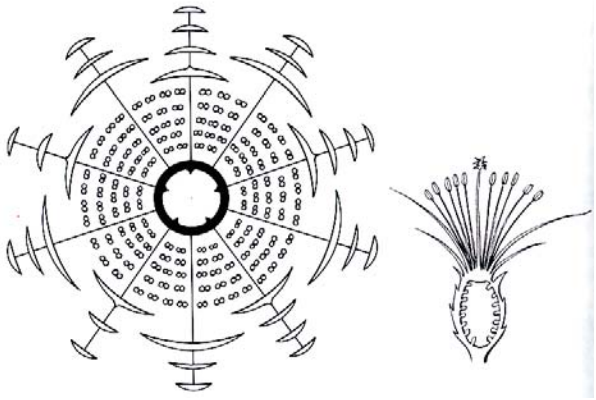
Gynoecium: inferior; 3–100 carpelled; ovary 1 locular; epigynous disk present (within the hypanthium)

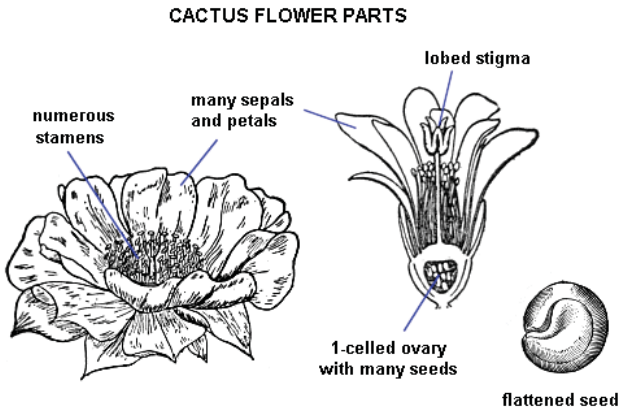
Fruit: fleshy (usually), or non-fleshy; indehiscent (usually), or dehiscent (rarely); a capsule (rarely), or a berry (usually)

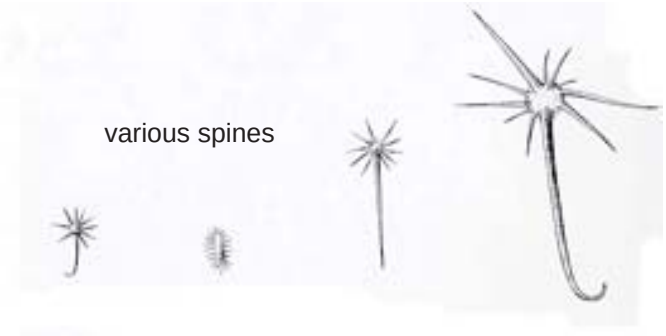
New Mexico genera:
Coryphantha- beehive-cactus
Cylindropuntia- cholla
Echinocereus- hedgehog-cactus
Opuntia- prickly-pear

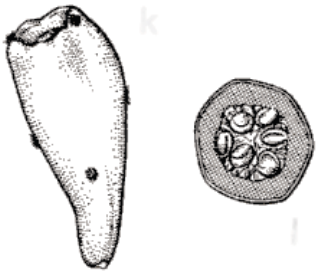
Distribution: genera/species
Worldwide: 90/2000
North America:
NM: 14/58

Economic uses: some edible fruits (prickly pear)









Prickly pear fruit and in x-section

CARYOPHYLLACEAE
(Pink family)

Order: Caryophyllales
Core eudicots

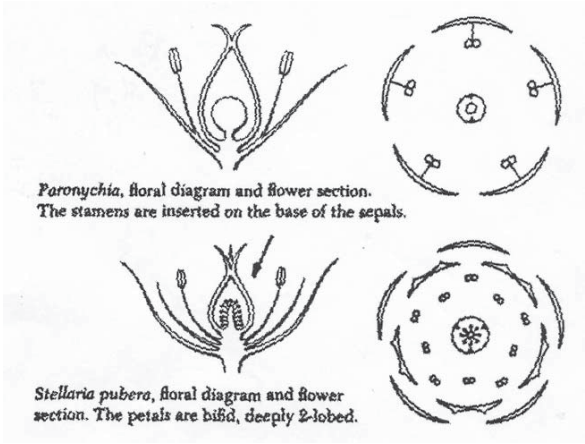
Habit: annual or perennial herbs; often with swollen nodes

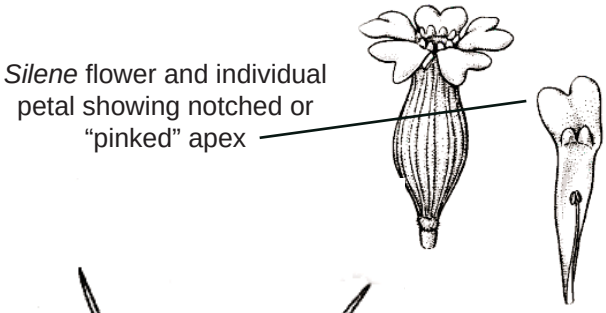
Leaves: usually opposite; simple, entire; often lanceolate; usually exstipulate

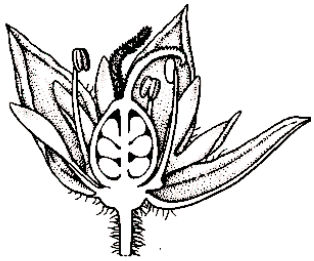
Flowers: actinomorphic; usually bisexual, perfect; solitary or cymes; petals often notched or cleft

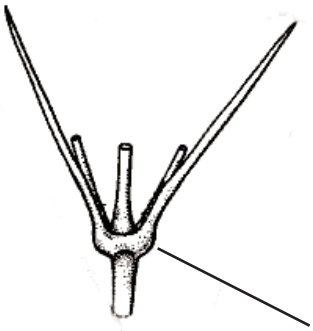
Gynoecium: unilocular; usually free-central placentation

Fruit: capsule, often denticidal





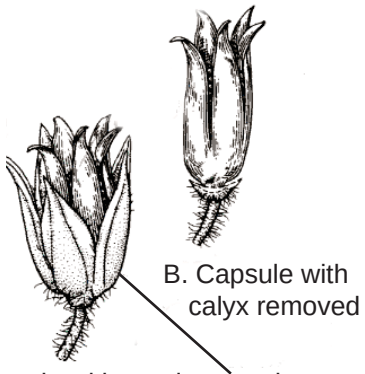




Common genera:
Arenaria- Sandwort
Stellaria- Chickweed
Cerastium- Mouse-ear chickweed
Silene- Campion, Catch-fly
Dianthus- Dianthus

Distribution: genera/species
Worldwide: 88-89/2000-2070
US: 20
NM: 12/51

Economic uses: many ornamentals including *Caryophyllus* (Carnation)
Note: this family contains **Anthocyanins**



CHENOPODIACEAE
(Goosefoot family)

Order: Caryophyllales
Core eudicots

Habit: annual or perennial herbs and shrubs; often xerophytic and halophytic; occasionally stems jointed, fleshy, leafless

Leaves: alternate (opposite in *Salicornia*); simple, exstipulate; sometimes fleshy or reduced to scales

Flowers: usually bisexual, some unisexual; actinomorphic; reduced and green (mealy); often bracteate (not scarious); corolla absent

Androecium: opposite to the sepals

Gynoecium: unilocular, one-ovuled

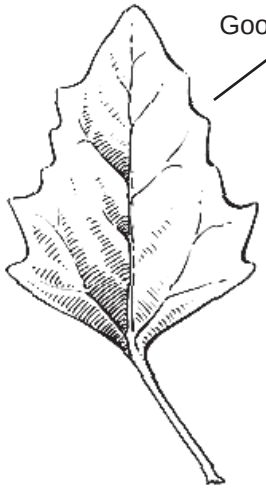
Fruit: indehiscent nutlet; embryo coiled

Common genera:
Chenopodium- Goosefoot, lamb's quarters
Atriplex- Saltbush
Kochia- Summer cypress
Salsola- Russian thistle

Distribution: genera/species
Worldwide: 102-120/1300-1500
US: 14
NM: 13/66

Economic uses: many edibles including;
Spinacia oleracea- Spinach
Beta vulgaris- Beet and chard
Chenopodium quinoa- Quinoa
Many weeds

Goosefoot vs. Goose feet



Long section of flower

Chenopodium viride.

Chenopodium. Flower (mag.).

Chenopodium. Fruit (mag.)

Chenopodium. Seed cut (mag.).

Beta. Seed (mag.).

Beta vulgaris. Flower (mag.).

Beta. Diagram.

Beta vulgaris. Fruits (mag.).

Beta vulgaris. Flower cut vertically (mag.).

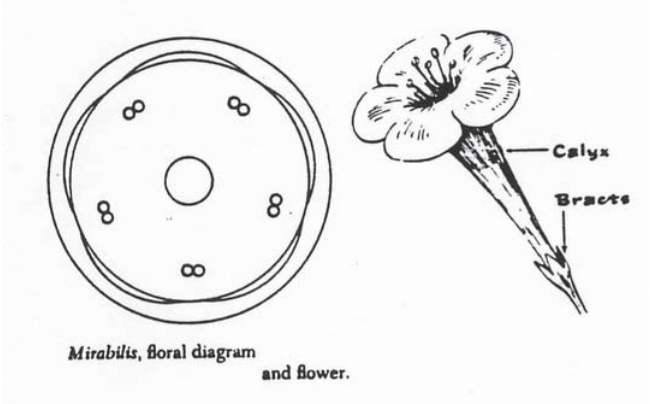
NYCTAGINACEAE
(Four o'clock family)

Order: Caryophyllales
Core eudicots

Habit: herbs (tropical trees and shrubs)

Leaves: opposite, often one leaf larger than opposing leaf; simple, entire; exstipulate

Flowers: actinomorphic; usually bisexual; often in cymes; inflorescence often subtended by large and sometimes brightly colored bracts (mimics the calyx); calyx tubular, petaloid (mimics corolla); corolla absent

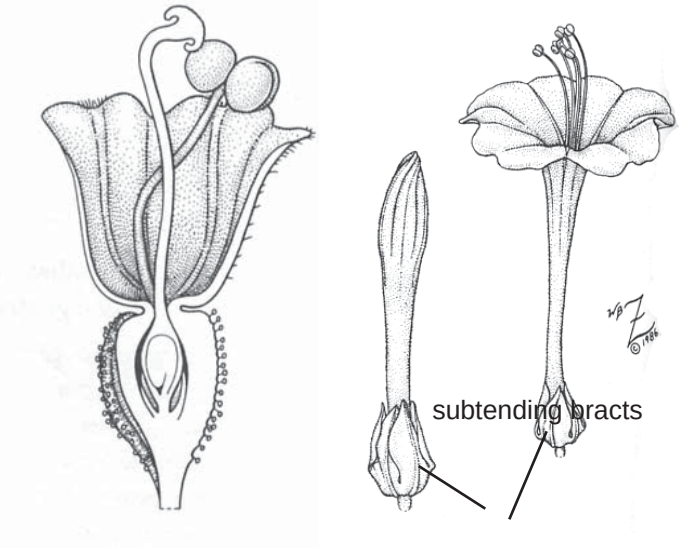


Mirabilis, floral diagram and flower.

Androecium: usually same nuber as calyx

Gynoecium: unicarpellate, unilocular

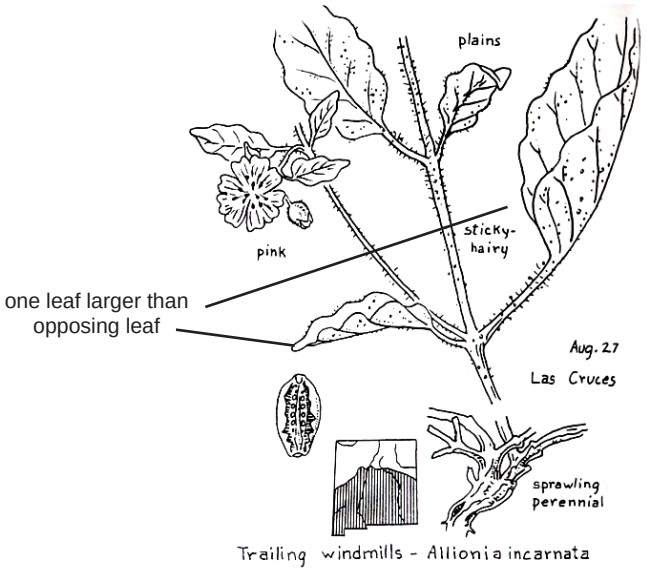
Fruit: achene or nut; often enclosed by persistent calyx (anthocarp)



Common genera:
Mirabilis- Four o'clock
Abronia- Sand verbena
Oxzybaphus- Umbrella wort
Tripterocalyx- Sandpuffs

Distribution: genera/species
Worldwide: 20-34/160-350
US: 15
NM: 10/41

Economic uses: some ornamentals including *Bougainvillea*
Some medicinal or edible



POLYGONACEAE
(Buckwheat family)

Order: Caryophyllales
Core eudicots

Habit: mostly herbs; stems with swollen nodes

Leaves: usually alternate; simple, entire; often with stipules forming sheath around node =**ochrea** (though not in *Eriogonum* spp.)

Flowers: usually bisexual; usually, small, numerous in racemes; spike-like panicles, or heads; actinomorphic; calyx petaloid; corolla absent

Androecium: often biseriate

Gynoecium: unilocular, one-ovuled

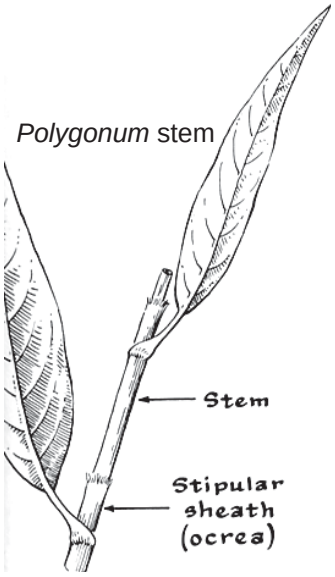
Fruit: lenticular or 3-sided achene; embryo curved

Flowers cyclic:
Eriogonum- False buckwheat
Rumex- Dock

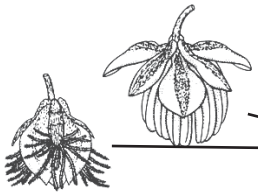
Flowers acyclic:
Polygonum- Knotweed
Persicaria- Smartweed

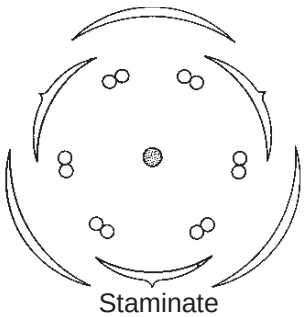
Distribution: genera/species
Worldwide: 40-50/800-1150
US: 15
NM: 6/80

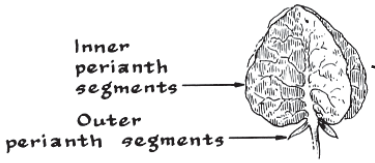
Economic uses: some edibles- *Rheum rhaponticum*- Rhubarb; *Fagopyrum esculentum* is the edible Buckwheat
ornamentals; contains **anthocyanins**



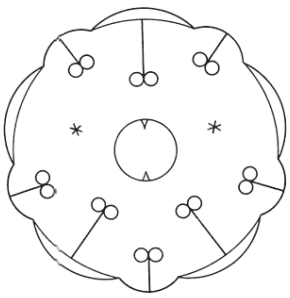
Flowers Cyclic
Calyx 3+3
Corolla 0
Androecium 3-9







Flowers Acyclic
Calyx 5
Corolla 0
Androecium 5-8



PORTULACACEAE
(Purslane family)

Order: Caryophyllales
Core eudicots

Habit: Annual or perennial herbs; often succulent

Leaves: alternate or opposite; often fleshy; usually with scarious or hairy stipules

Flowers: Bisexual, actinomorphic; calyx may actually be bracts; corolla may be sepals

Androecium: A= number of petals, or x2, or many; often epipetalous and opposite petals

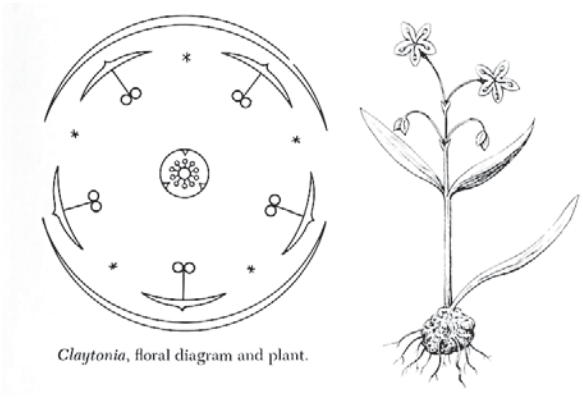
Gynoecium: Superior, 2-8 united carpels but (2-) 3 (-5) stigma lobes and styles; Unilocular; basal or free-central placentation

Fruit: Usually capsule; often pyxis -- circumsissile capsule or loculicidal capsule

New Mexico genera:
Portulaca oleracea- purslane, is edible weed
Lewisia- bitter root
Montia- Miner's lettuce
Claytonia- Spring beauty
Talinum- Talinum

Distribution: genera/species
Worldwide: 19-21/400-580
NM: 6/21

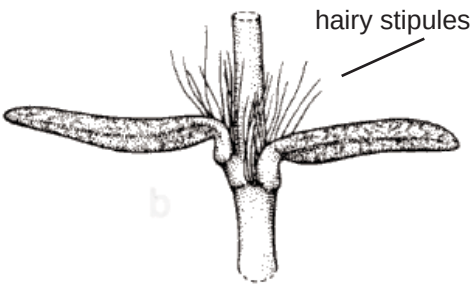
Economic uses: ornamentals, edibles



Claytonia, floral diagram and plant.

longitudinal section of flower

Portulaca, circumscissile capsule (pyxis)



TAMARICACEAE
(Tamarisk family)

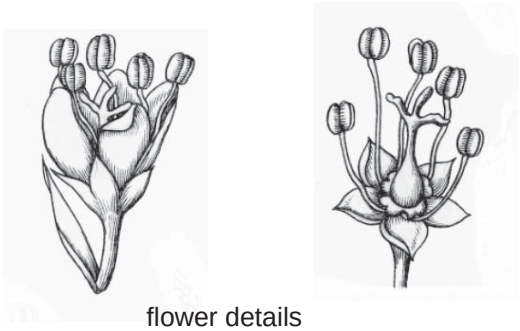
Order: Caryophyllales
Core eudicots

Tamarix floral diagram

Habit: small trees or shrubs; mostly xerophytic (or halophytic)

Leaves: small, evergreen and scalelike; alternate; often with salt glands; exstipulate

Flowers: bisexual or dioecious; Perianth with distinct calyx and corolla; 8, or 10, or 12



flower details

Androecium: 4–6, or 8–12 (often twice as many as the petals)

Gynoecium: (2–)3–4(–5) carpelled

Fruit: a non-fleshy, dehiscent capsule; loculicidal; seeds conspicuously hairy

New Mexico:
Tamarix- Saltcedar, tamarisk

Distribution: genera/species
Worldwide: 4/120
NM: 1/3

Branch detail showing leaves

Fig. 104. Saltcedar (*Tamarix pentandra*). Branch showing tiny leaves and spikes of flowers. a. Flower. b. Seed with tuft of hair.

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SANTALACEAE
(Sandalwood family)

Order: Santalales
Core eudicots

Habit: tropical and temperate herbs, shrubs, and trees; semi-parasites

Leaves: simple, entire; spirally arranged, occasionally opposite; often reduced, scale-like leaves or none; branches often flattened, imitates true leaves

Flowers: actinomorphic; bisexual, monoecious, or dioecious; small and inconspicuous; calyx 4-5, united at base; corolla lacking

Androecium: number of stamens = number of calyx lobes

Gynoecium: inferior, unilocular

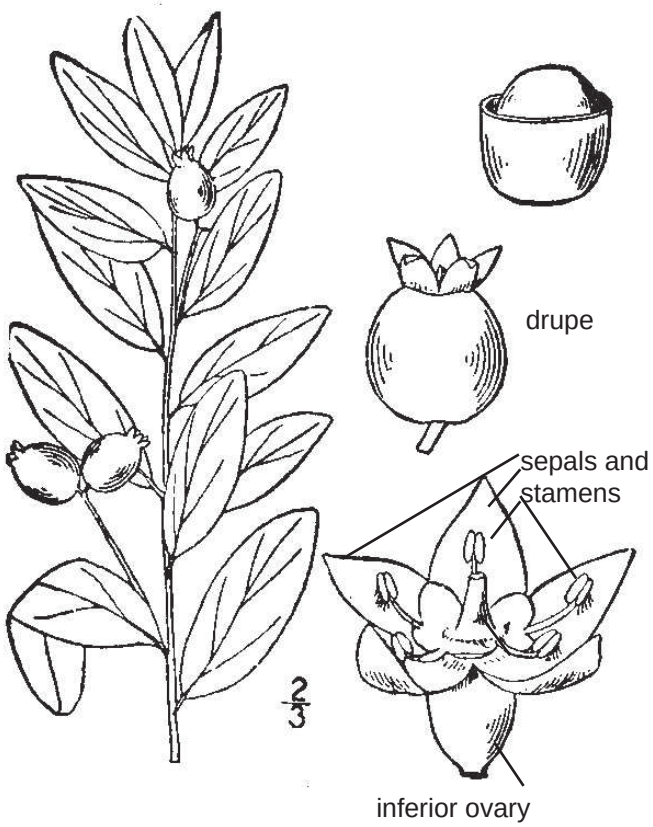
Fruit: nut or drupe, usually non-sticky

One genus in New Mexico:
Comandra- Bastard toad-flax

Distribution: genera/species
Worldwide: 35/400
NM: 1/1

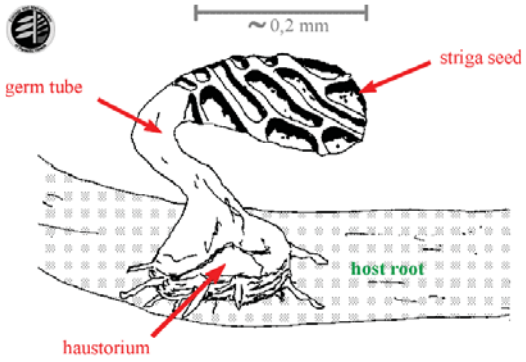
Economic uses: economically important *Santalum album* (Sandalwood tree), the fragrant timber is used for incense, and Sandalwood oil is used for soaps, perfumes and massage oils

Comandra



VISCACEAE
(Mistletoe family)

Order: Santalales
Core eudicots
(Viscaceae recently placed in the Santalaceae)



Attachment

Habit: chlorophyllous but partially parasitic; rootless (but with haustoria); photosynthesizing function often transferred to stems

Leaves: well developed or much reduced; opposite, simple; entire, exstipulate

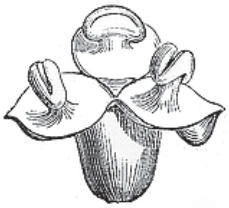
Flowers: solitary to aggregated in inflorescences; bracateate; minute to small, regular; calyx 2-4; corolla lacking

Androecium: 2-4, in one whorl

Gynoecium: 3-4 carpelled; unilocular, inferior; styles 1

Fruit: berry (with viscous tissue)


AMERICAN MISTLETOE


Arceuthobium ♂ flower


Arceuthobium ♀ inflorescence

New Mexico genera:
Arceuthobium- Dwarf mistletoe
Phoradendron- Mistletoe

Distribution: genera/species
Worldwide: 7/450
NM: 2/12

Economic uses: *Viscum album* and *Phoradendron flavescens* are the Yuletide mistletoes
Temperate to tropical distribution
Tree parasites


Phoradendron

CORNACEAE
(Dogwood family)

Order: Cornales
Asterids

Habit: trees and shrubs; non-laticiferous and without colored juice

Leaves: usually opposite and entire; herbaceous or leathery, usually petiolate; simple and **pinnately veined**; exstipulate; unicellular hairs branched

Flowers: bracteate; small to medium-sized; regular; 4–5 merous

Androecium: of fertile stamens; stamens 4, or 5; isomerous with the perianth; oppositisepalous; alternating with the corolla members

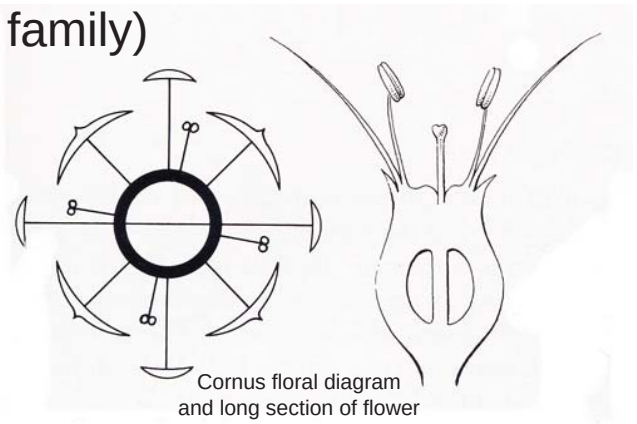
Gynoecium: 2(–4) carpelled; the pistil 1–4 celled; inferior; epigynous disk present

Fruit: fleshy to non-fleshy; indehiscent; a drupe (usually), or a berry (less often)

One genus in New Mexico:
Cornus- dogwood

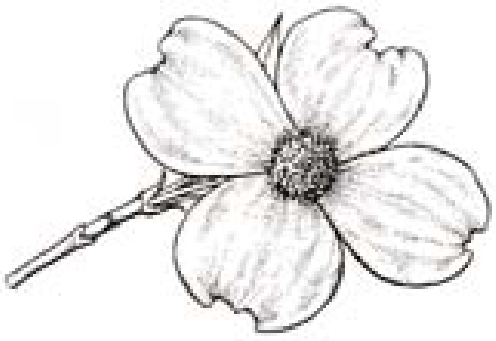
Distribution: genera/species
Worldwide: 1-6/60
NM: 1/2

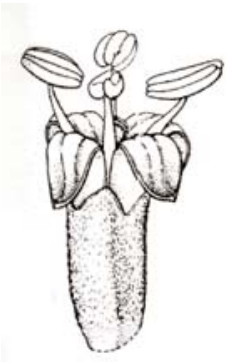
Economic uses: some edible berries



Cornus floral diagram
and long section of flower

pinnately veined leaves





FOUQUIERIACEAE
(Ocotillo family)

Order: Cornales
Asterids

Habit: small trees or shrubs (cactoid); principal photosynthesizing function transferred to stems

Leaves: deciduous, often ephemeral; small, alternate; fleshy; petiolate; simple; lamina entire; pinnately veined; exstipulate

Flowers: bisexual; terminal or axillary; showy, regular to slightly irregular; perianth with distincet calyx (5) and corolla (5)

Androecium: 10-15, alternating with and opposite the corolla; stamens exserted

Gynoecium: superior; 3 carpelled; one locular; 3 styles

Fruit: non-fleshy, dehiscent capsule; seeds winged

One genus in New Mexico:
Fouquieria- Ocotillo

Distribution: genera/species
Worldwide: 2/11
NM: 1/1

Economic uses: ornamentals; Ocotillo is used for fencing, house walls, and ramada roofs by native Americans and ranchers. The buried stems often root, creating a living fence.

Ocotillo fence

LOASACEAE
(Loasa family)

Order: Cornales
Asterids

Habit: perennial or biennial herbs covered with coarse silicified (and/or calcified) hairs sometimes glandular or stinging

Leaves: simple; often lobed; alternate or opposite; exstipulate

Flowers: bisexual; actinomorphic; solitary or in cymes; calyx 5, persistent and reflexed in fruit; corolla 5

Androecium: 5-numerous, often in several series, and appearing like petals (*Mentzelia*)

Gynoecium: inferior; unilocular; parietal placentation

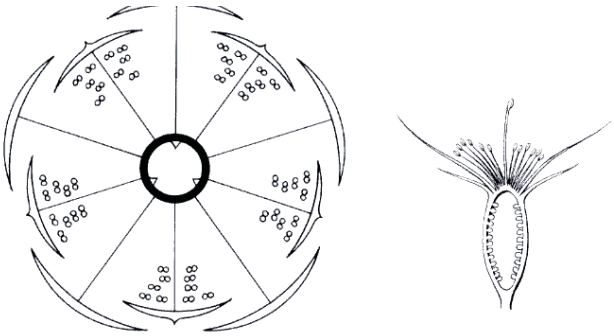
Fruit: capsule

New Mexico genera:
Mentzelia- Stickleaf, blazing star
Cevallia- Cevallia

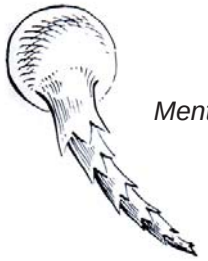
Distribution: genera/species
Worldwide: 15/260
US: ?
NM: 2/18

Economic uses: some ornamentals

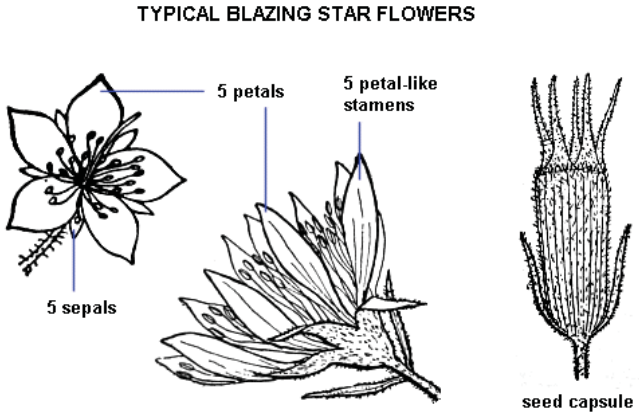
Note: Also called the “Stickleaf” family because the hairs on the foliage cause them to stick to clothing, fur, etc.



Mentzelia floral diagram and longitudinal section of flower



Mentzelia hair



ERICACEAE
(Heath family)

Order: Ericales
Asterids
(including Pyrolaceae and Monotropaceae)

Habit: shrubs or subshrubs; almost all require acidic soils

Leaves: usually alternate, simple; often leathery and evergreen; exstipulate

Flowers: bisexual, actinomorphic, solitary or bracteate racemes; calyx often urceolate or campanulate

Androecium: usually 2x the corolla and biseriate; often tailed; occasionally inserted on a disk; anthers terminally poricidal

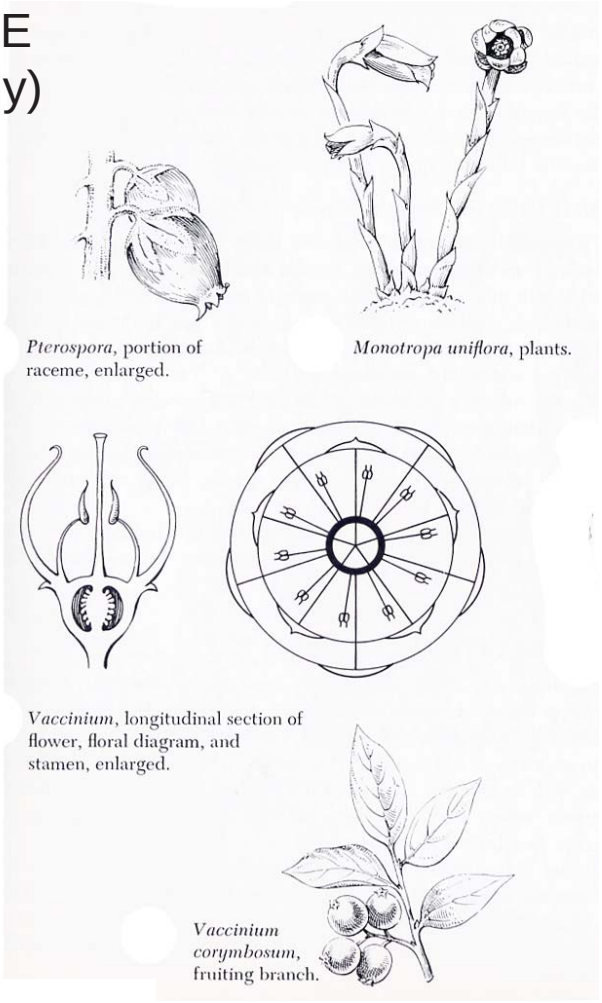
Gynoecium: superior or inferior; many locules; axile placentation

Fruit: capsule, drupe, berry

New Mexico genera:
Arbutus- Madrone
Arctostaphylos- Manzanita, bearberry
Gaultheria- Wintergreen
Vaccinium- Blue-, Huckle-, and Cranberry

Distribution: genera/species
Worldwide: 50-103/1300-3350
NM: 5/8

Economic uses: food plants, many ornamentals including *Rhododendron* (Rhododendrons and Azaleas) and *Erica* (Heath)

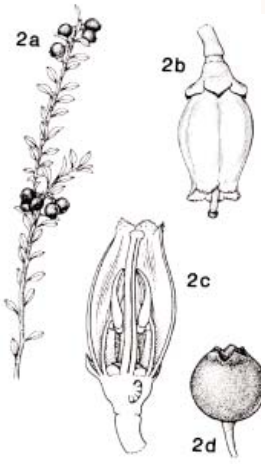


Pterospora, portion of raceme, enlarged.

Monotropa uniflora, plants.

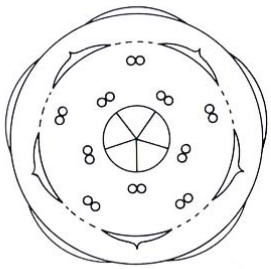
Vaccinium, longitudinal section of flower, floral diagram, and stamen, enlarged.

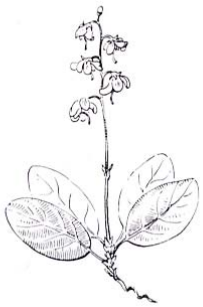
Vaccinium corymbosum, fruiting branch.



Vaccinium details

Arctostaphylos, longitudinal section of flower, enlarged.





Pyrola, floral diagram and plant.

POLEMONIACEAE
(Phlox family)

Order: Ericales
Asterids

Habit: perennial or annual herbs, (lianas, trees and shrubs)

Leaves: alternate or opposite; simple to divided to pinnately compound; exstipulate

Flowers: bisexual; actinomorphic (rarely zygomorphic); often showy; 5-merous (except the gynoecium); inflorescence usually cymose or solitary; calyx fused, lobes occasionally unequal; corolla rotate to salverform

Androecium: epipetalous and alternate; occasionally arising at different levels

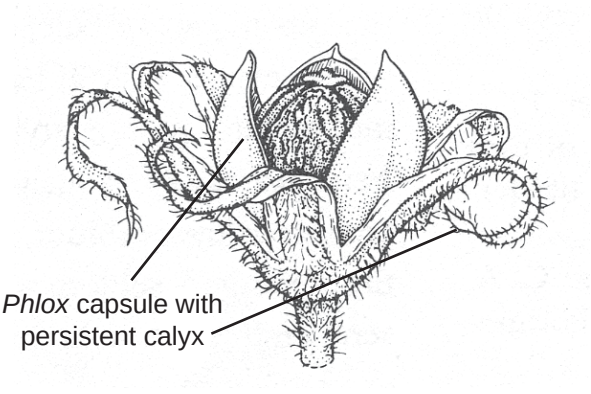
Gynoecium: long, slender style; divided stigma, often 3-cleft; as many locules as carpels; axile placentation

Fruit: loculicidal capsule

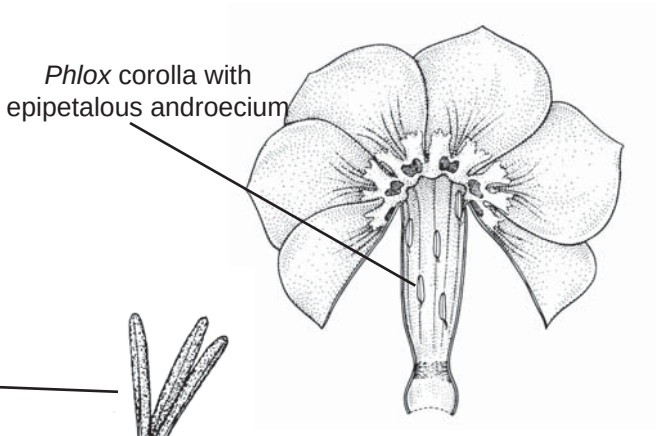
New Mexico genera:
Gilia-Gilia
Ipomopsis- Ipomopsis
Aliciella- Gilia
Phlox-Phlox
Polemonium- Jacob's-ladder
Linanthus- Linanthus
Collomia- Trumpet

Distribution: genera/species
Worldwide: 18-20/275-320
US: 12
NM: 10/56

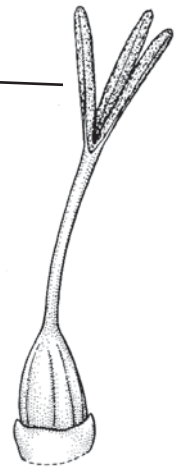
Economic uses: many ornamentals



Phlox capsule with persistent calyx

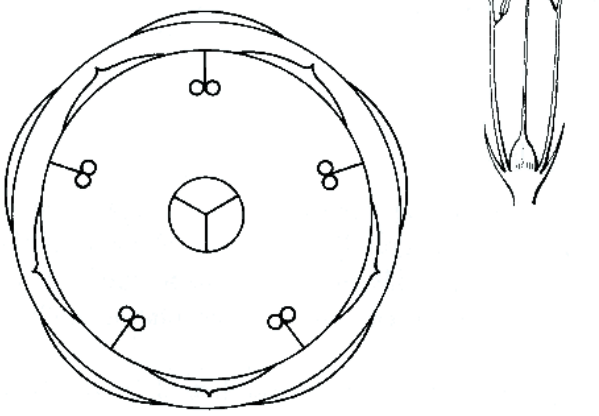


Phlox corolla with epipetalous androecium



Phlox pistil with 3-lobed style

Phlox floral diagram and longitudinal section of flower



PRIMULACEAE
(Primrose family)

Order: Ericales
Asterids

Habit: perennial or annual herbs

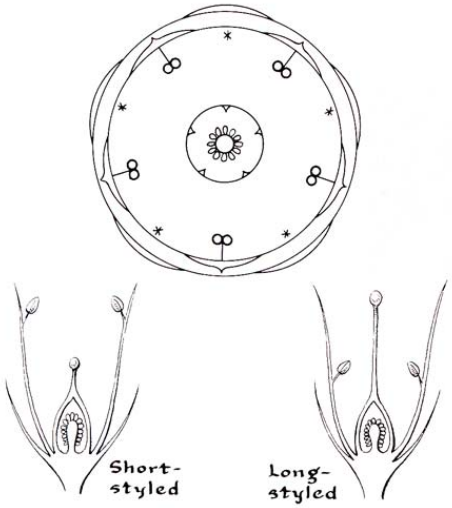
Leaves: opposite, whorled, or basal; simple, exstipulate

Flowers: bisexual, actinomorphic; flowers 5-merous

Androecium: equal in number to the calyx, opposite and often epipetalous

Gynoecium: superior, 5 united carpels; unilocular; free-central placentation

Fruit: capsule or pyxis



Primula floral diagram and long section of flowers

New Mexico genera:
Androsace- Rock Jasmine
Dodecatheon- Shooting star
Lysimachia- Loosestrife
Primula- Primrose
Cyclamen- (non-native ornamental)

Distribution: genera/species
Worldwide: 22-28/800
NM: 7/20

Economic uses: ornamentals

Primula flower, floral diagram and capsule (pyxis)

BORAGINACEAE
(Borage family)

Order: (ungrouped)
Asterid I

Habit: herbs (shrubs, trees, climbers); often with scabrous, hispid, unicellular hairs

Leaves: simple, entire; alternate, exstipulate

Flowers: bisexual, actinomorphic; 5-merous (except gynoecium), often blue; often in coiled cymes; calyx usually fused (may be basally connate); corolla salverform, funnelform, or campanulate

Androecium: epipetalous; alternate with the corolla; often with nectiferous disc at base

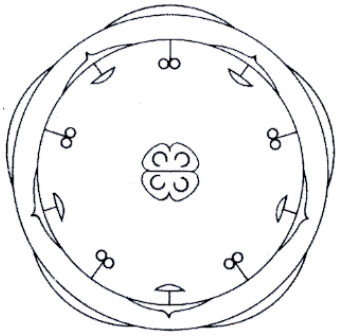
Gynoecium: superior; 4-loculed by false septum, 4-lobed; each locule one-seeded; axile placentation; style arising from base of ovary (gynobasic)

Fruit: 4 nutlets or achenes (few by abortion)

New Mexico genera:
Cryptantha- Hiddenflower
Hackelia- Stickseed
Heliotropium- Heliotrope
Lithospermum- Stoneseed
Mertensia- Bluebells

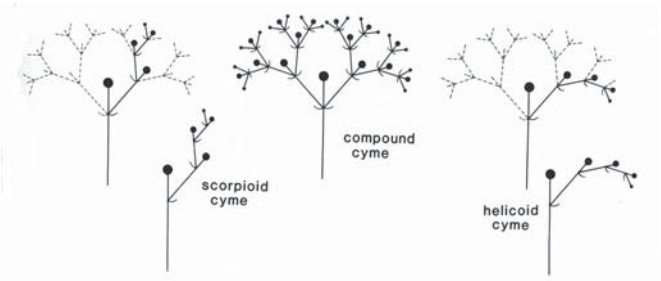
Distribution: genera/species
Worldwide: 100-154/2000-2500
US: 22
NM: 14/52

Economic uses:
some ornamentals
dyes
medicinals

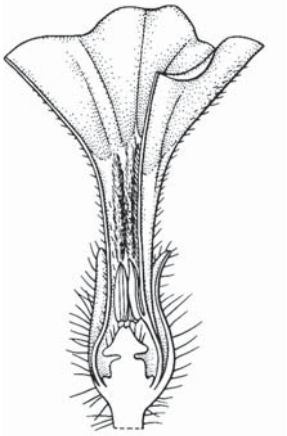


Myostis floral diagram

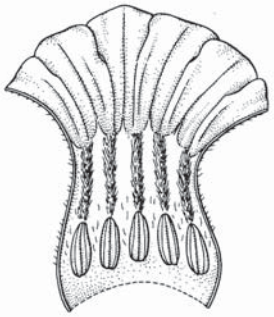
Inflorescence types in the Boraginaceae



Heliotropium pistil and nectiferous discs



Heliotropium longitudinal section of flower



Heliotropium expanded corolla with epipetalous androecium

Heliotropium nutlets with persistent calyx

HYDROPHYLLACEAE
(Waterleaf family)

Order: (ungrouped)
Asterid I

Habit: annual or perennial herbs (shrubs); often bristly, glandular, or scabrid

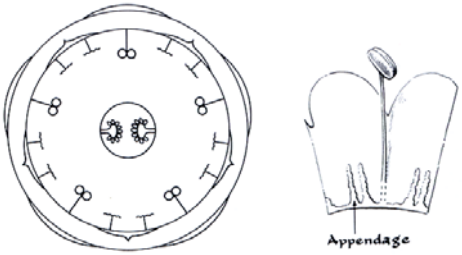
Leaves: alternate or opposite, often basal; entire to pinnately lobed, exstipulate

Flowers: bisexual, actinomorphic; 5-merous (except G); inflorescence cymose, usually coiled (helicoid); calyx 5, fused corolla 5, rotate, campanulate, or funnelform

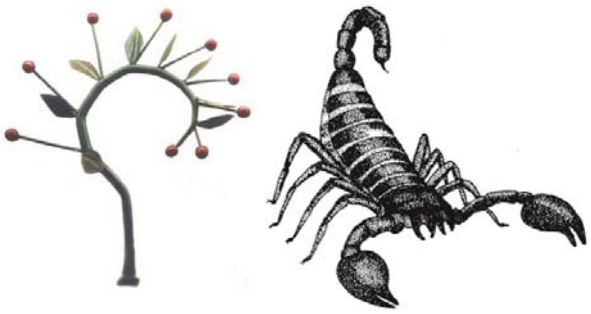
Androecium: 5, epipetalous; alternate with the corolla; usually exserted; often with a pair of scales or appendages on either side

Gynoecium: 2, superior, usually unlobed; numerous ovules; if unilocular, then parietal placentation; if bilocular, then axile placentation; style arising from base of ovary (gynobasic)

Fruit: loculicidal capsule



Phacelia floral diagram; and portion of corolla showing stamens with paired appendages



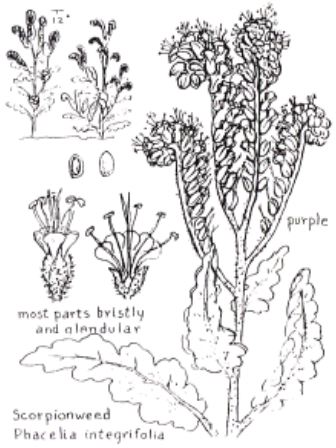
Scorpionweed (*Phacelia*) is named for the inflorescence's resemblance to the coiling tail of a scorpion (helicoid cyme)

Phacelia pistil and 2-lobed style

Common genera:
Hydrophyllum- Waterleaf
Phacelia- Scorpionweed
Nama- Fiddleleaf, or nama

Distribution: genera/species
Worldwide: 20-22/275
US: 16
NM: 5/31

Economic uses: some ornamentals



APOCYNACEAE
(Dogbane family)

Order: Gentianales
Asterid I

Habit: shrubs and herbs (trees elsewhere), usually with milky sap

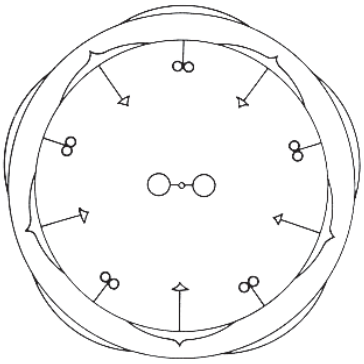
Leaves: usually opposite; simple, entire, usually exstipulate

Flowers: bisexual; usually actinomorphic; may be large, showy, and fragrant; usually in cymes or racemes; 5-merous (except the gynoecium)

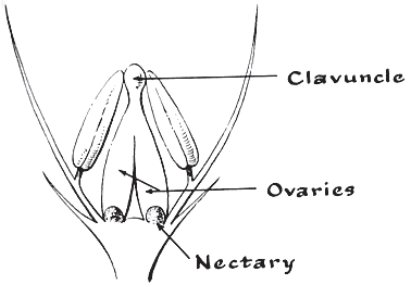
Androecium: 5 stamens; epipetalous and alternate with the corolla

Gynoecium: 2 carpels, free or united by thickened styles; clavuncle is fused, thickened stigma; each carpel with marginal placentation

Fruit: a pair of follicles (or berries, capsules); seeds often comose



Floral diagram of *Apocynum*



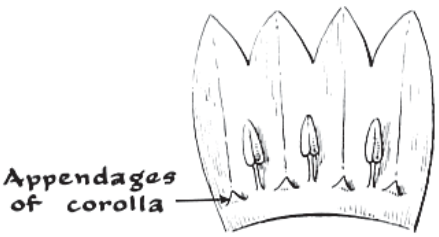
Longitudinal section of *Apocynum*

Fruit, a pair of follicles

Common genera:
Amsonia- Bluestar
Apocynum- Dogbane

Distribution: genera/species
Worldwide: 200-215/2000-2100
US: 11
NM: 4/16

Economic uses: Ornamentals- *Plumeria* (Frangipani), *Carissa* (Natal plum), *Vinca* (Periwinkle), *Nerium* (Oleander), *Catharanthus* (Madagascar periwinkle), *Rauvolfa* (Snakeroot); many medicinals, some edible fruits;
Some latex (rubber); Timber



ASCLEPIADACEAE
(Milkweed family)

Order: Gentianales
Euasterids I

Habit: perennial herbs, some erect or twining shrubs (trees and succulents elsewhere); milky sap

Leaves: opposite or whorled; simple, entire, exstipulate

Flowers: bisexual, actinomorphic; inflorescence usually cymose and umbelliform; 5-merous (except the gynoecium); calyx +/- connate at base; corolla 5, united; calyx and/or corolla often reflexed

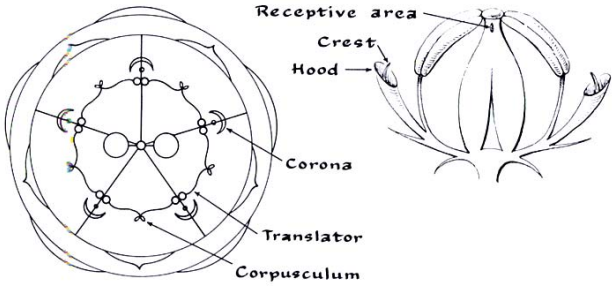
corona often present, an outgrowth from the receptacle, with variable structure, composed of 5 units [5x (hood and crest)]: **hood**, the basic unit of the corona; **horn or crest or beak** may be associated with the hood; points toward center

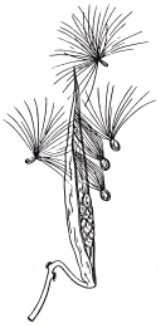
Androecium: is unique, found within the corona and not evident as a whorl; epipetalous; anthers (5), adherent to the stigma; adjacent anthers joined by **translators** (or connectives) to a **corpusculum** (or **gland**) found between each half anther; the mass of pollen from a half-anther is called a **pollinium**.

pollinia + translators + corpusculum = **pollinarium**
The 5 stamens are adnate to the gynoecium to form a single structure, known as a **gynostegium**; pollination is distinctive because of the **gynostegia** and **pollinia**

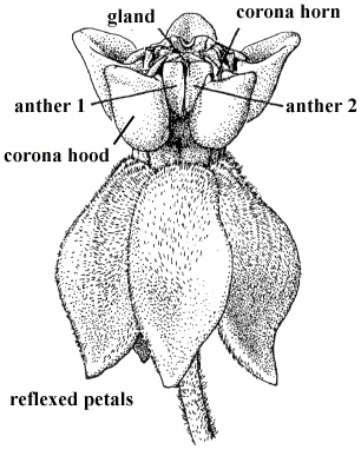
Gynoecium: united at upper style and stigma
2 carpels, placentation marginal

Fruit: a pair of follicles, seeds often comose





Asclepias fruit



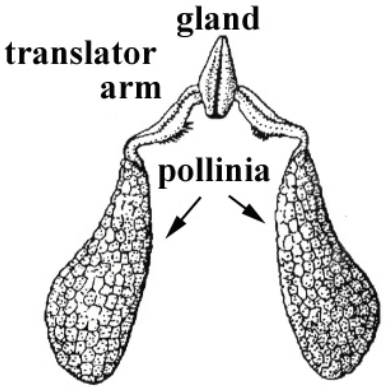
Asclepias flower

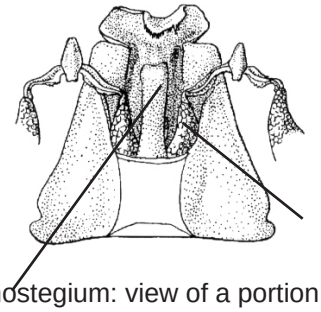
New Mexico genera:
Asclepias- Milkweed
Cynanchum- Climbing milkweed
Matelea- Milkvine
Sarcostemma- Milkvine

Distribution: genera/species
Worldwide: 250-350/2000-2850
US: 5
NM: 4/32

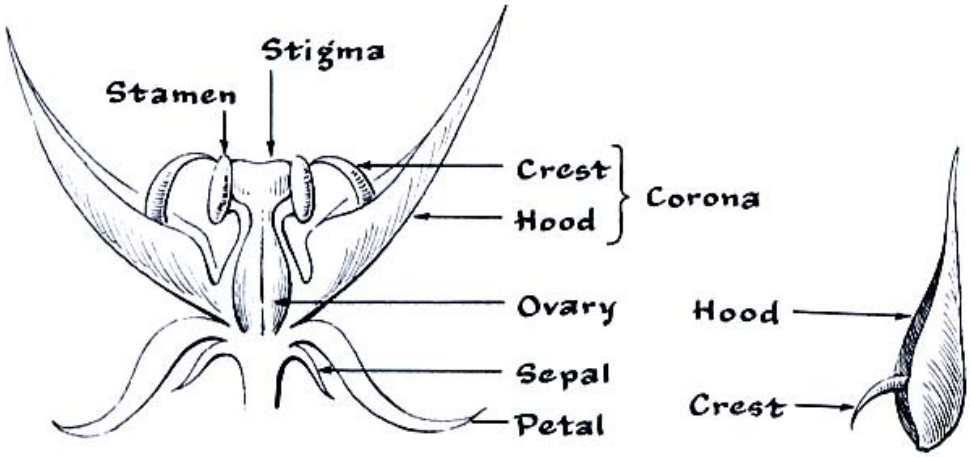
Economic uses: Ornamentals- *Hoya* (Wax plant), *Stapelia* (Carrion flower); medicinals; some latex (rubber); some fibers from seeds

Asclepiadaceae





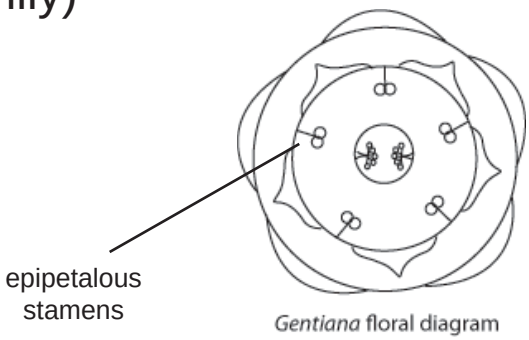
Gynostegium: view of a portion of the gynoecium with parts of the stamens



Longitudinal section of *Asclepias* flower

GENTIANACEAE
(Gentian family)

Order: Gentianales
Asterid I

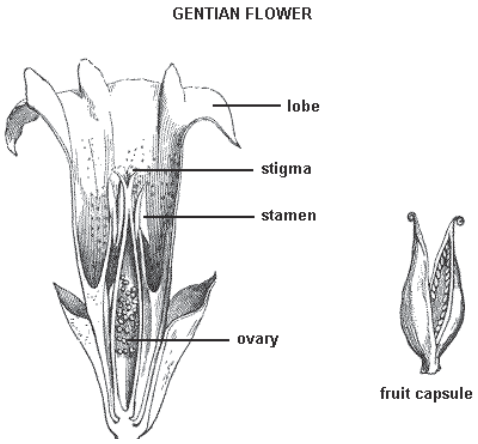


Gentiana floral diagram

Habit: annual or perennial herbs

Leaves: opposite, entire, often sessile, and exstipulate

Flowers: bisexual, actinomorphic, often showy; 4- or 5- merous; solitary or in cymes; calyx fused; corolla united: campanulate, funnelform, or occasionally salverform



Androecium: equals the number of the corolla and alternate; epipetalous

Gynoecium: superior, 2 united carpels, parietal placentation, unilocular; glandular disc at base

Fruit: septicidal capsule

New Mexico genera:
Centaurium- Centaury
Eustoma- Prairie gentian
Gentiana- Gentian
Swertia (and *Frasera*)- elkweed, green gentian

Distribution: genera/species
Worldwide: 70-74/1100-1200
US: 13
NM: 6/25

Economic uses: ornamentals, medicinals

LAMIACEAE
(Mint family)

Order: Lamiales
Asterid I

Habit: aromatic herbs (shrubs, trees elsewhere); stems usually 4-sided

Leaves: opposite and decussate,occasionally whorled; simple, exstipulate; often hairy with epidermal glands secreting volatile oils

Flowers: bisexual (occ. gynodioecious); usually bracteolate; inflorescence in whorls of compact axillary cymes (verticillasters) or paired; axillary cymes congested into fake whorls at nodes; calyx united, sometimes bilabiate; corolla zygomorphic, often bilabiate; 2 fused upper petals and 3 fused lower petals

Androecium: 2 or 4 stamens:
if 4 , then usually didynamous (2+2)
if 2, then usually 2 staminodes
epipetalous, alternate to the corolla; nectar disc often present

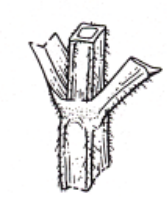
Gynoecium: 2 united carpels, 4-lobed; 2 locules often appearing 4-loculed because of false septa; one style arising from among lobes of ovary (gynobasic)

Fruit: usually 4 nutlets

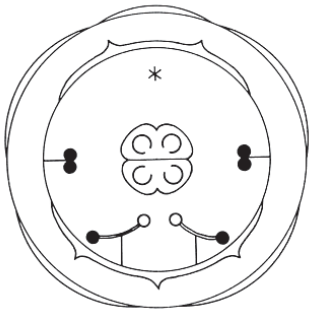
New Mexico genera:
Agastache- Giant-hyssop
Monarda- Beebalm
Mentha- Mint
Hedeoma- False pennyroyal
Salvia- Sage

Distribution: genera/species
Worldwide: 180-220/3500-5600
US: 50
NM: 20/60

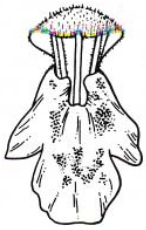
Economic uses: ornamentals, culinary and food plants, essential oils for perfumes, etc.

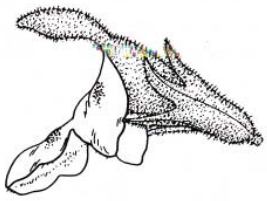


square stems

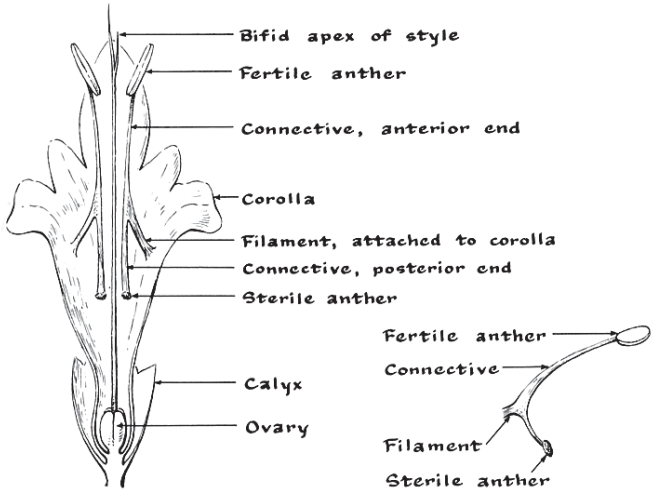


Salvia floral diagram





bilabiate flowers



Salvia long section detail

Schizocarp with 4 nutlets

OLEACEAE
(Olive family)

Order: Lamiales
Asterid I

Habit: trees and shrubs

Leaves: usually deciduous; usually opposite; petiolate; exstipulate; complex hairs present; usually peltate

Flowers: usually bisexual; solitary, or aggregated in ‘inflorescences’; often fragrant; regular; usually 2–6 merous; perianth with distinct calyx and corolla; usually 4- merous

Androecium: 2 (usually) of fertile stamens; oppositisepalous

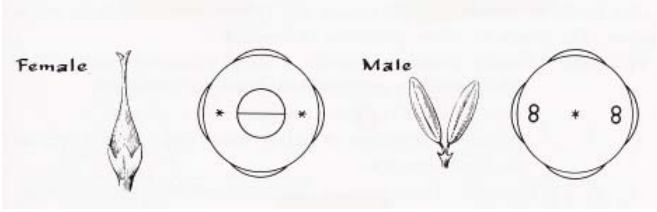
Gynoecium: 2 carpelled; superior; styles 1; apical; stigmas 2 lobed; placentation axile

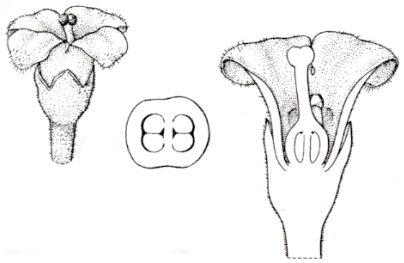
Fruit: various including schizocarps, capsules, berries, or drupes; 1–4 seeded

New Mexico genera:
Forestiera- desert olive
Fraxinus- ash
Menodora- menodora

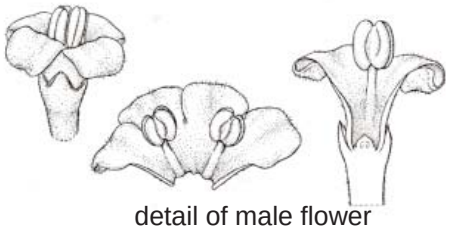
Distribution: genera/species
Worldwide: 25/900
NM: 5/13

Economic uses: edible fruit and edible and medicinal ‘olive oil’ from *Olea europaea*, cultivated trees and shrubs, timber trees (*Jasminum, Osmanthus, Forsythia, Syringa, Ligustrum, Fraxinus,* etc.)





detail of female flower



detail of male flower

drupes of *Forestiera*

OROBANCHACEAE
(Broomrape family)

Order: Lamiales
Asterid I
holoparasitic species are completely parasitic, lack chlorophyll, and may be yellowish, brownish, purplish, or white, i.e. lacking any green color; the hemiparasitic species (transferred from Scrophulariaceae) are capable of photosynthesis, and may be facultative or obligate parasites

Habit: **holoparasitic** or **hemiparasitic** herbs growing on the roots of their host by means of ***haustoria***

Leaves: alternate or opposite, simple, sometimes reduced to scales (holoparasitic); stipules absent

Flowers: bisexual, zygomorphic; sepals 2-5; petals 5, connate, bilabiate

Androecium: stamens 4, epipetalous, sometimes with a 5th staminode

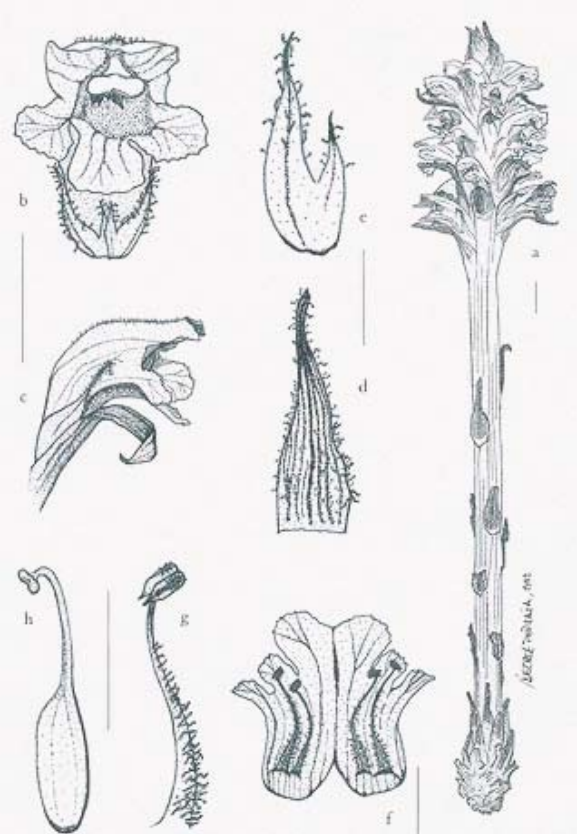
Gynoecium: pistil is one-celled; ovary superior, of 2 united carpels, the style single

Fruit: capsule

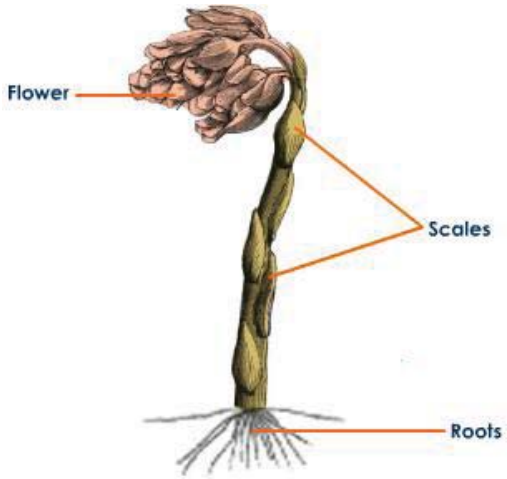
New Mexico genera:
Castilleja- Indian Paintbrush (hemiparasitic)
Conopholis- (holoparasitic)
Cordylanthus- Bird's-beak(hemiparasitic)
Orobanche- Broomrape (holoparasitic)
Orthocarpus- Owl's Clover (hemiparasitic)
Pedicularis- Lousewort (hemiparasitic)

Distribution: genera/species
Worldwide: 90/2000
NM: 9/46

Orobanche details



Conopholis



PLANTAGINACEAE
(Plantain family)

Order: Lamiales
Asterid I
(recently much of the former Scrophulariaceae has been added to the Plantaginaceae)

Habit: herbs, shrubs and rooted aquatics (not parasitic)

Leaves: leaves alternate or opposite, simple, entire to variously toothed; pinnate to parallel-veined; stipules absent;

Flowers: bisexual, often bilateral, to almost symmetric; sepals 4-5 or absent; petals 5 but may appear as 4 (due to fusion of 2 upper lobes), connate, the corolla often bilobed

Androecium: stamens 4, sometimes 2, a 5th staminode often present

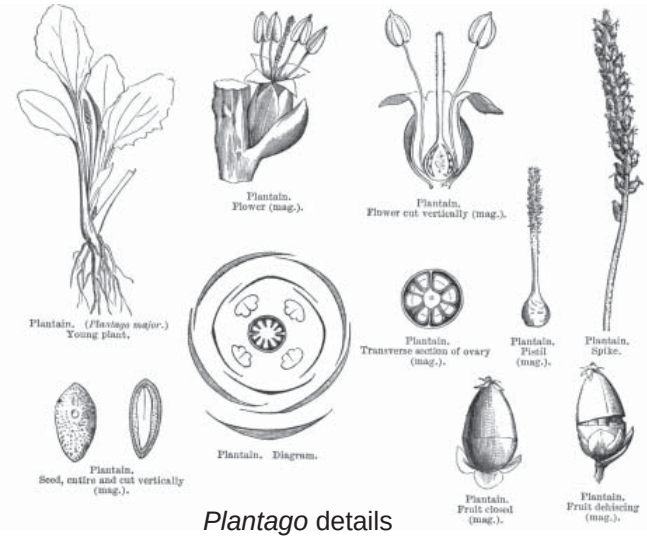
Gynoecium: pistil single, superior, of 2 united carpels; the stigma usually bilobed

Fruit: capsule

Common genera:
Callitriche- water-starwort
Mimulus- monkey-flower
Penstemon- beardtongue
Plantago- plantain
Veronica- speedwell

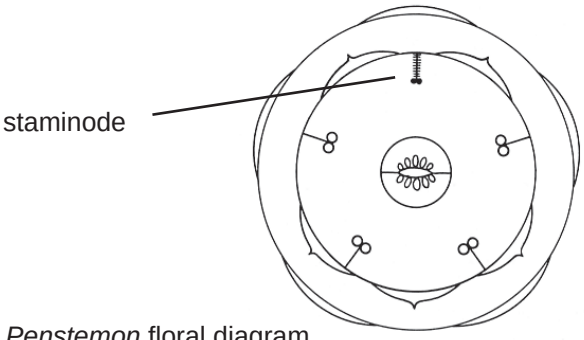
Distribution: genera/species
Worldwide: 90/1700
NM: 17/93

Economic uses: ornamentals, medicinals, psyllium husk fiber (*Plantago ovata*)



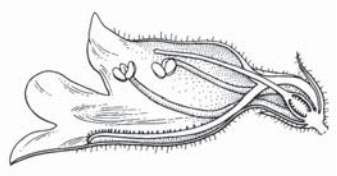
Plantago details

Penstemon details



Penstemon floral diagram

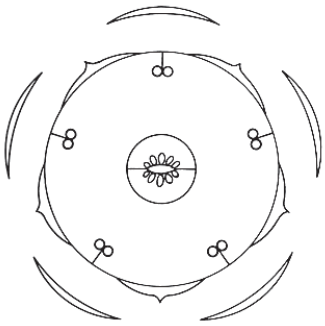
longitudinal flower section and capsule

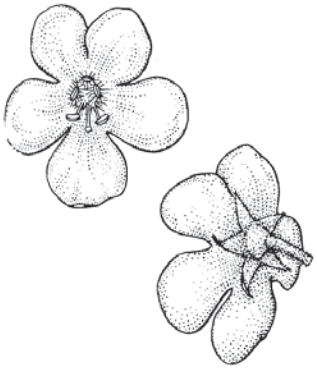


SCROPHULARIACEAE
(Figwort family)

Order: Lamiales
Asterid I
(formerly a large polyphyletic group, recent molecular studies have transferred many genera to the Plantaginaceae and the Orobanchaceae)

Verbascum floral diagram





Verbascum flowers

Habit: perennial herbs or small shrubs (not parasitic)

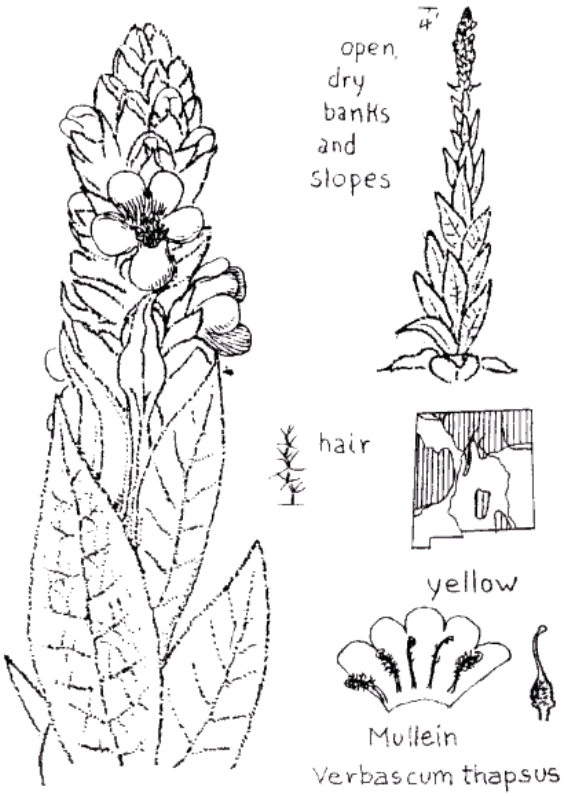
Leaves: alternate or opposite, simple, entire to toothed; stipules absent

Flowers: bisexual, usually zygomorphic (some almost actinomorphic); sepals 3-5; petals 4-5, connate, the corolla often bilabiate

Androecium: stamens 4-5

Gynoecium: pistil single, superior, of 2 united carpels, style single, with a two-lobed stigma

Fruit: capsule or schizocarp with two achenes



Common genera:
Leucophyllum- Texas sage
Scrophularia- Figwort
Verbascum- Mullein

Distribution: genera/species
Worldwide: 65/1700
NM: 3/8

Economic uses: ornamentals, medicinal

VERBENACEAE
(Vervain family)

Order: Lamiales
Asterid I

Habit: herbs, shrubs (trees in the tropics); stems often 4-sided

Leaves: opposite or whorled; simple, exstipulate

Flowers: bisexual, usually zygomorphic; usually bracteolate; inflorescence often in cymes; heads, racemes; calyx lobes 5, may be irregular; corolla often bilabiate or salverform, slender; of 5 united petals

Androecium: didynamous (2+2)

Gynoecium: single, terminal style; locules = 1x or 2x the number of carpels; axile placentation

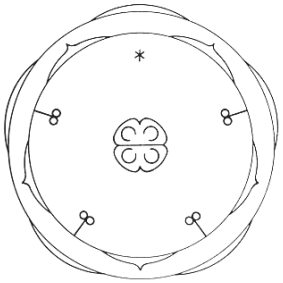
Fruit: drupe (with 2 or 4 stones), four one-seeded separating nutlets, or 2- or 4-valved capsule

New Mexico genera:
Aloysia- beebush
Glandularia- vervain
Phyla- frogfruit
Verbena- verbena

Distribution: genera/species
Worldwide: 75-91/1900-3000
US: 14
NM: 9/29

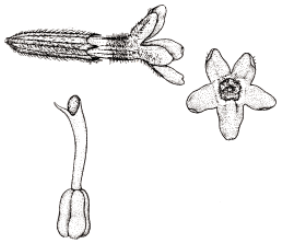
Economic uses: ornamentals - *Lantana*
Food, tea plants- *Aloysia* (Lemon verbena)
Medicinals
Weeds
Timber-*Tectona grandis* (teak)

Verbena fruit

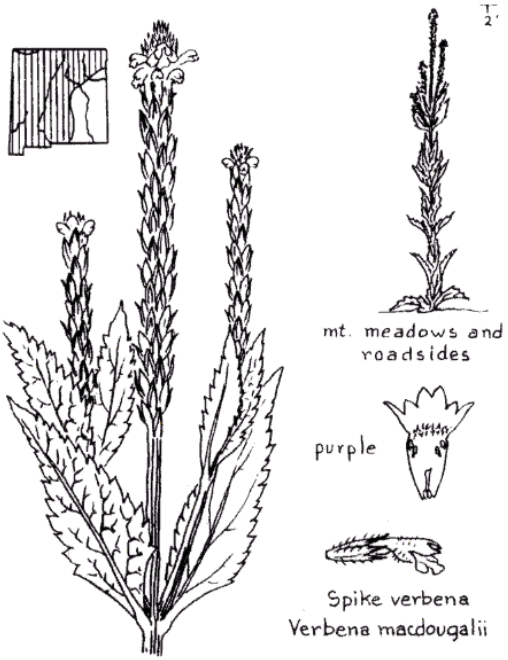


Verbena floral diagram

Verbena pistil and longitudinal section of flower



Verbena flower and pistil



CONVOLVULACEAE
(Morning glory family)

Order: Solanales
Asterid I

Habit: annual or perennial herbs, shrubs (trees in the tropics); often twining or climbing (always twining to the right); often with milky latex

Leaves: alternate, simple; entire to lobed; often hastate; exstipulate

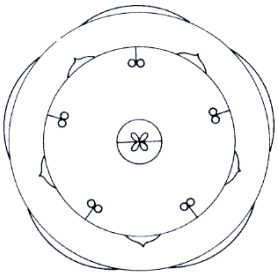
Flowers: bisexual; actinomorphic, usually 5-merous; often showy; solitary or in terminal or axillary dichasia; sepals of the calyx are usually distinct; corolla is strongly sympetalous, plaited, and often rotate or trumpet shaped with inconspicuous lobes

Androecium: epipetalous; alternate with the corolla; filaments often unequal in length

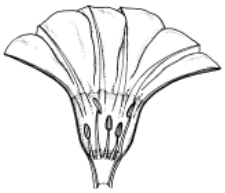
Gynoecium: consists of a single compound pistil of 2 or rarely up to 5 carpels; usually an unbranched or 2-cleft style; superior ovary of 2 or sometimes up to 5; locules, each with 1 or 2 axile ovules; a prominent annular nectary disk is usually present around the base of the ovary

Fruit: usually a loculicidal capsule

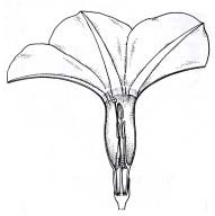
Ipomoea capsule



Convolvulus floral diagram



Ipomoea flower with epipetalous stamens



Ipomoea flower long section

Common genera:
Convolvulus- bindweed
Evolvulus- dwarf morning glory
Ipomoea- morning glory

Distribution: genera/species
Worldwide: 50-58/1400-1800
US: 10
NM: 6/40

Economic uses: ornamentals; food plants, *Ipomoea batatus* (Sweet potato); medicinals and hallucinogens

SOLANACEAE
(Potato family)

Order: Solanales
Asterid I

Habit: herbs, shrubs (lianas & trees elsewhere); often spiny or thorny

Leaves: alternate, usually simple; exstipulate

Flowers: bisexual, actinomorphic (some slightly zygomorphic); usually 5-merous (except the gynoecium); inflorescence usually cymose or solitary; calyx persistent, occ. enlarging in fruit; corolla rotate to tubular

Androecium: epipetalous; stamens often adherent, surrounding the style

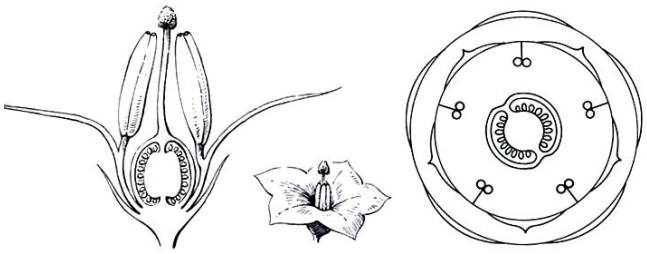
Gynoecium: 2 carpels and locules; axile placentation

Fruit: berry or septicidal capsule

New Mexico genera:
Datura- Jimson weed
Lycium- Wolfberry
Nicotiana- Tobacco
Physalis- Ground cherry
Solanum- Nightshade

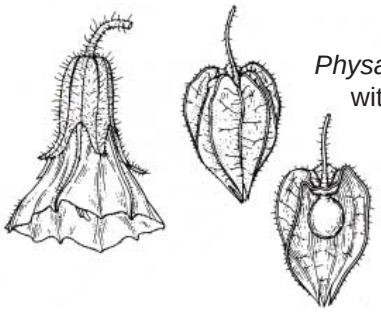
Distribution: genera/species
Worldwide: 85-90/2300-2600
US: 13
NM: 10/47

Economic uses:
Ornamentals
Food plants- *Capsicum* (Peppers, chilis), *Solanum tuberosa* (Irish potato), *Lycopersicon esculentum* (Tomato)
Medicinals
Tobacco and poisons (including insecticides)

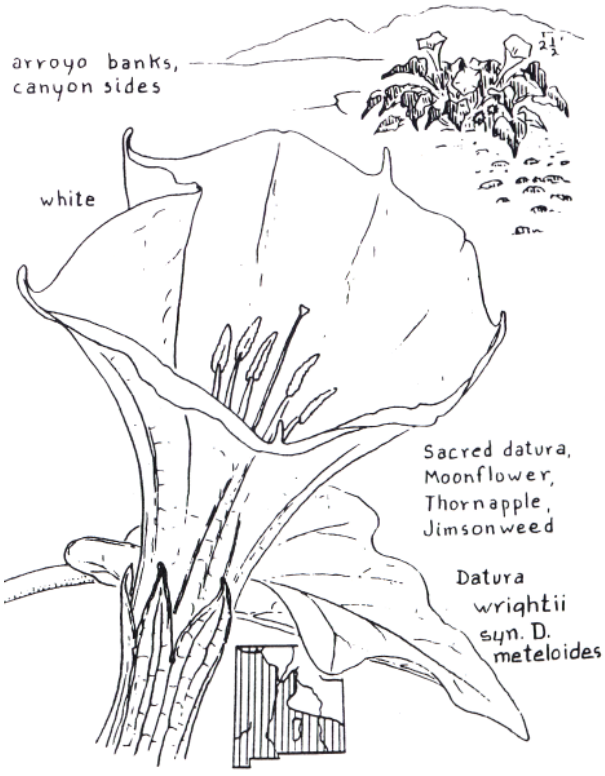


Solanum long section and floral diagram

Solanum fruit



Physalis flower and fruit with inflated calyx



APIACEAE
(Celery family)

Order: Apiales
Asterid II

Habit: biennial or perennial herbs; often aromatic; stems usually stout, furrowed with hollow internodes

Leaves: alternate; usually compound or dissected; sheathing leaf bases

Flowers: bisexual, actinomorphic, small 5-merous, epigynous; calyx of 5 separate sepals; corolla of 5 separate petals (often yellow or white)

Androecium: 5 stamens

Gynoecium: inferior, of 2 united carpels, 2 locules; above the ovary is a stylopodium, the fleshy fused bases of the two styles; inflorescence usually compound umbel

Fruit: schizocarp

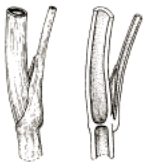
Much of the taxonomy in this family depends on the details of the fruit. The 2 mericarps that form the schizocarp meet at a **commisure**.

The outer wall of the mericarps have
5 primary ridges:
2 lateral ridges at the edge of commisure
1 central dorsal ridge
2 intermediate ridges between the other 2

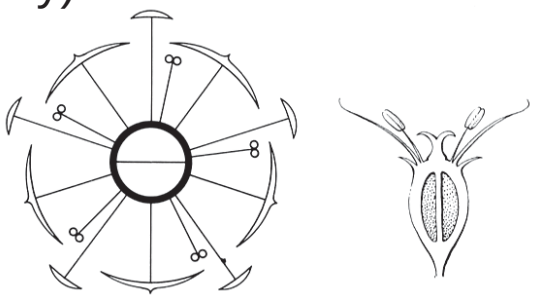
4 secondary ridges may occur among the 5 primary ridges

In the valleys between the ridges oil passages (vittae) may also occur

Cicuta schizocarp



sheathing leaf base and hollow internode



Apiaceae floral diagram and longitudinal flower section

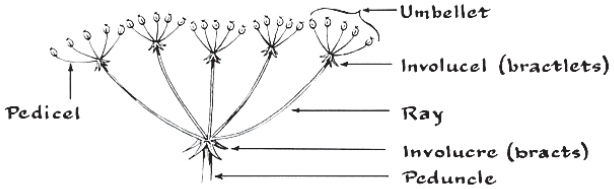


diagram of an umbel

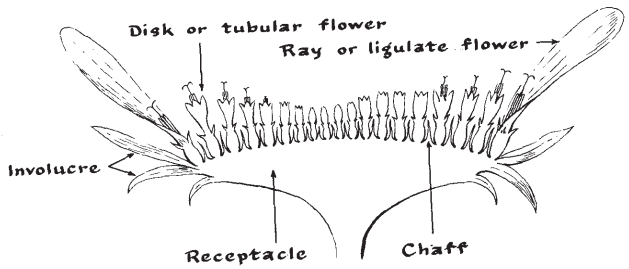
Common genera:
Aletes- Indian-parsley
Angelica- Angelica
Cicuta- Water-hemlock
Conium- Poison hemlock
Cymopterus- Spring-parsley
Ligusticum- Wild-lovage
Lomatium- Desert parsley
Osmorhiza- Sweet-cicely

Distribution: genera/species
Worldwide: 300-418/3000-3100
US: 75-100/300
NM: 29/48

Economic uses: Many medicinals, some poisonous, some ornamentals
Food, flavoring plants- *Coriandrum sativum* (seed is Coriander, foliage is Cilantro), *Apium graveolens* (Celery), *Foeniculum vulgare* (Fennel), *Pastinaca sativa* (Parsnip), *Petroselinum crispus* (Parsley), *Carum* (Caraway), *Anethum graveolens* (Dill), *Pimpinella anisum* (Anise), *Daucus carota* (Carrot)

ASTERACEAE
(Aster family)

Order: Asterales
Asterid II



Habit: mostly herbs, some shrubs; sap watery or milky

Leaves: usually alternate; often with basal rosettes; simple or compound, exstipulate

Flowers: distinctive inflorescence: ***capitulum*** (head) composed of many tiny flowers (florets); florets inserted on a common receptacle (disc); head surrounded by involucre of bracts (***phyllaries***); phyllaries in one to several series or imbricate; individual florets may be subtended by modified bracts (chaff), in the form of scales, bristles, etc.

Florets: bisexual or unisexual (species mono- or dioecious); always epigynous (ovary inferior); calyx highly modified into pappus, in the form of bristles, awns, or scales; corolla 5 merous and sympetalous

Androecium: 5 stamens, united by anthers to form a tube around the style

Gynoecium: bicarpellate, unilocular, ovary inferior

Fruit: cypsela, small, dry, one-seeded, similar to an achene, except that cypsela is derived from 2 carpels (one embryo aborts)

Distribution: genera/species
Worldwide: 1300/25,000-30,000
US: 200+
NM: 137/602

Economic uses:
Many ornamentals
Some food/oil plants
Timber, medicinals, weeds

Florets of 2 basic types:
1) Tubular or disc floret (actinomorphic)
2) Ligulate or ray floret (zygomorphic)

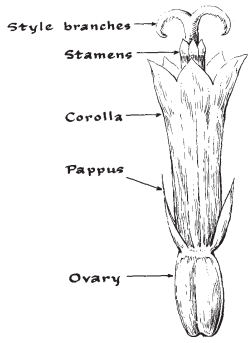
The 2 floret types are found on heads in three basic arrangements:
1) Discoid head: all bisexual disc florets
2) Ligulate head: all bisexual ray florets
3) Radiate head: disc florets in center (bisexual or male) and ray florets at periphery (neuter or female)

Representative genera in New Mexico:
Discoid:
Cirsium- Thistle
Xanthium- Cocklebur
Ambrosia- Ragweed
Artemisia- Sagebrush
Chrysothamnus- Chamiso

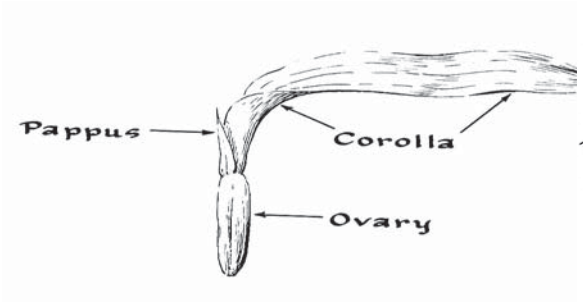
Ligulate:
Tragopogon- Goatsbeard
Cichorium- Chicory
Lactuca- Wild lettuce
Taraxacum- Dandelion
Sonchus- Sow's thistle

Radiate:
Helianthus- Sunflower
Erigeron- Fleabane
Gutierrezia- Snakeweed
Gaillardia- Blanket flower
Ratibida- Coneflower
Solidago- Goldenrod

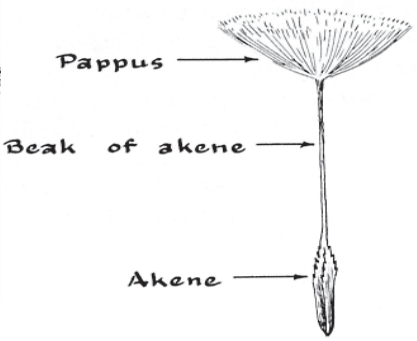
Asteraceae in New Mexico



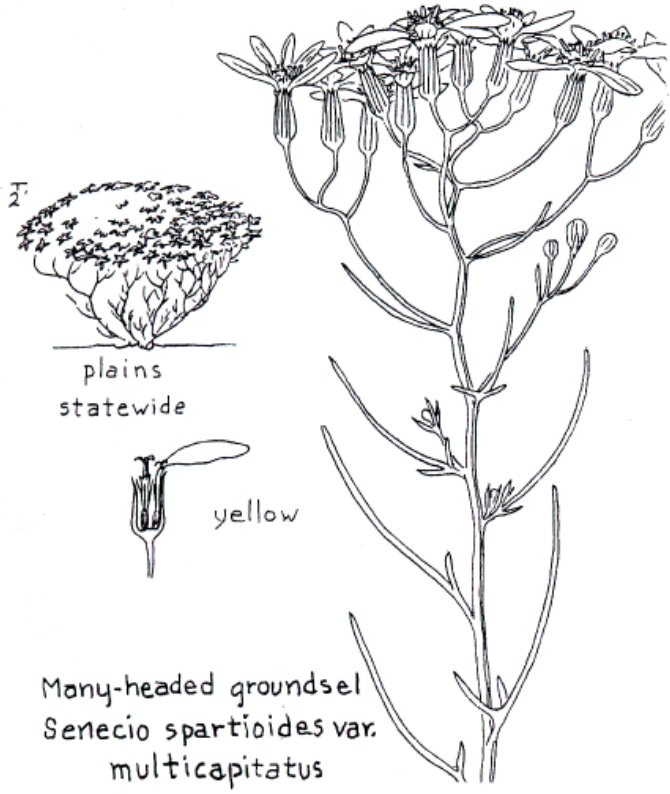
Disc floret



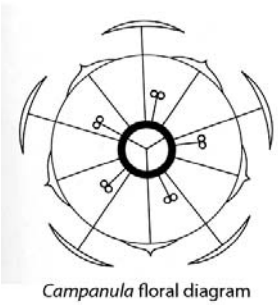
Ray floret



fruit an achene



CAMPANULACEAE
(Bluebell family)



Campanula floral diagram

Order: Asterales
Asterid II

Habit: herbs (shrubs, trees elsewhere); occasionally with milky latex

Leaves: alternate, simple, exstipulate

Flowers: bisexual, actinomorphic or zygomorphic; 5-merous; often showy and blue; inflorescence various; calyx ((3-) 5 (-10)); corolla 5 united petals

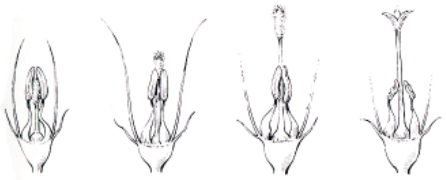
Androecium: may be free or fused (either filaments or anthers)

Gynoecium: inferior ((2-) 3 (-5)); locules equal to the number of carpels; numerous ovules; placentation axile

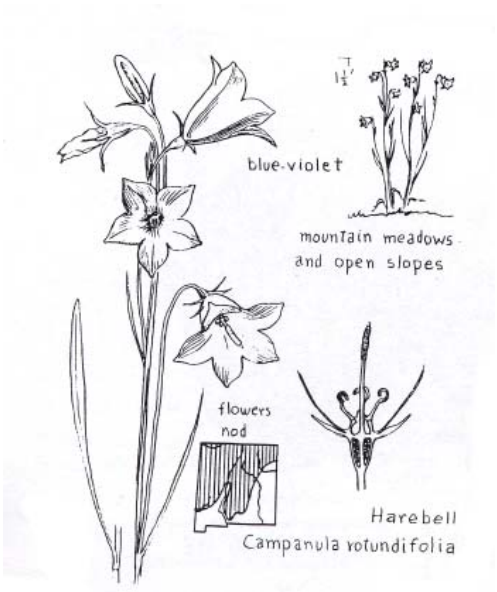
Fruit: capsule; rarely a berry

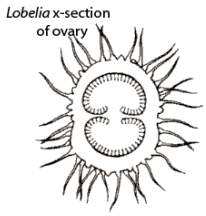
New Mexico genera:
Campanula- Harebell, bluebell
Lobelia- Cardinal flower

Campanula



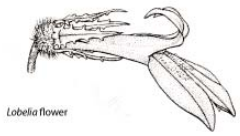
Successive stages of style elongation

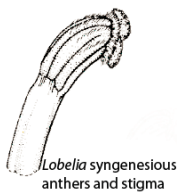


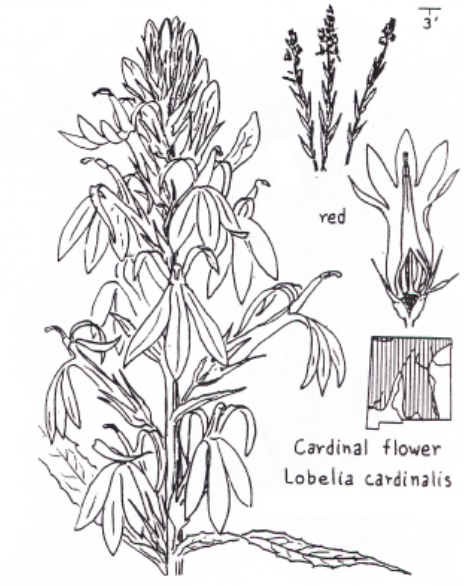


Distribution: genera/species
Worldwide: 70-87/2000
NM: 3/9

Economic uses: Ornamentals







CAPRIFOLIACEAE
(Honeysuckle family)

Order: Dipsacales
Asterid II

Habit: shrubs, trees and vines

Leaves: opposite (usually), or whorled; herbaceous (occasionally leathery); petiolate; often connate; simple; often stipulate

Flowers: often cymose in axillary pairs; inflorescences terminal, or axillary; flowers usually bracteolate; often fragrant; zygomorphic; 4–5 merous; perianth with distinct calyx and corolla, 8–10; calyx (2–)4, or 5; corolla 4, or 5; campanulate, or funnel-shaped, or tubular

Androecium: (2–)4, or 5 stamens, epipetalous; opposite the sepals

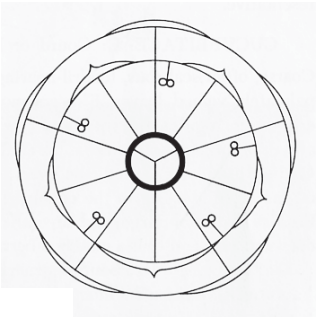
Gynoecium: 2–5–8 carpelled; inferior; styles 1; stigmas 1, 1–5 lobed

Fruit: a capsule, or achene-like, or a berry

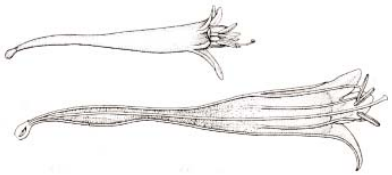
New Mexico genera:
Dipsacus- Teasel
Lonicera- Honeysuckle
Symphoricarpos- Snowberry
Valeriana- Valerian

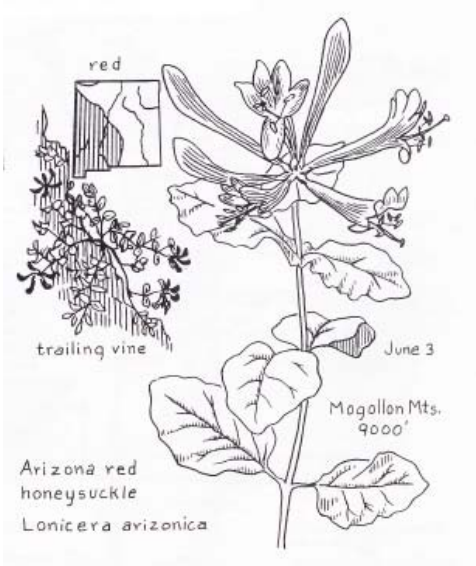
Distribution: genera/species
Worldwide: 12/330
NM: 5/19

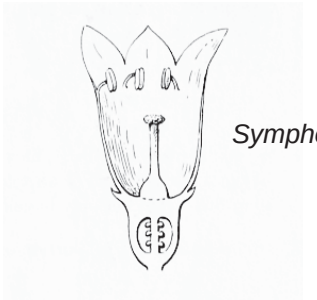
Economic uses: Ornamental shrubs and vines



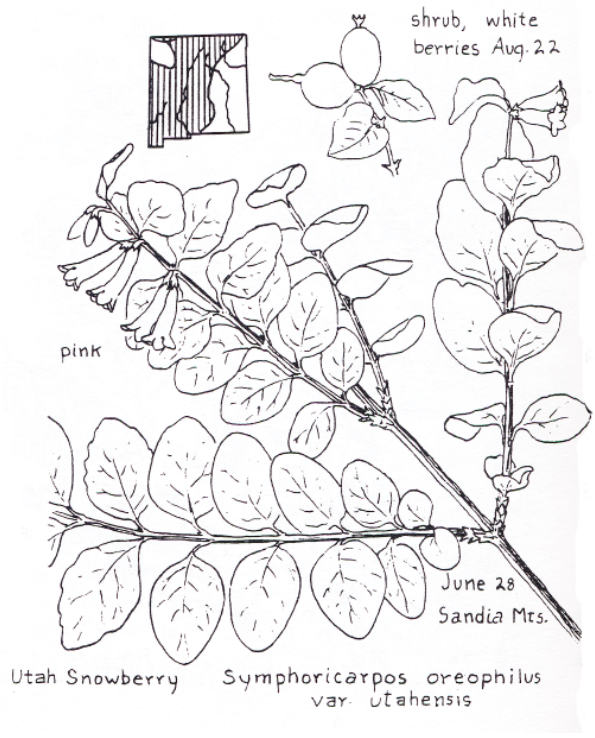
Lonicera floral diagram and long section of flower





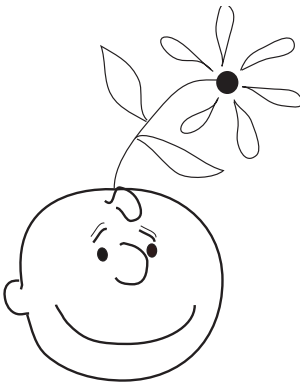


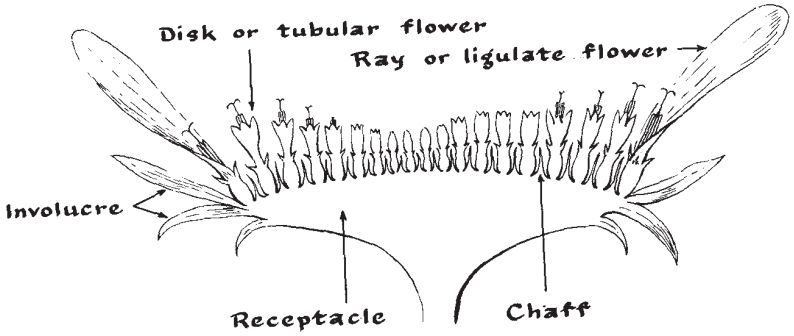
Symphoricarpos flower detail



Appendices

Collecting Plant Specimens
Illustrated Glossary
Bibliography





COLLECTING PLANT SPECIMENS

Robert Sivinski, Botanist, New Mexico Forestry Division
excerpted from a handout for training botanical volunteers

Properly collected and prepared specimens can remain useful for centuries and will add to a growing body of scientific data on plant diversity, variation, distribution and ecology. Interesting or otherwise unusual plants you collect will be permanently archived at the UNM Herbarium, so take special care and read this material carefully.

Plant Press

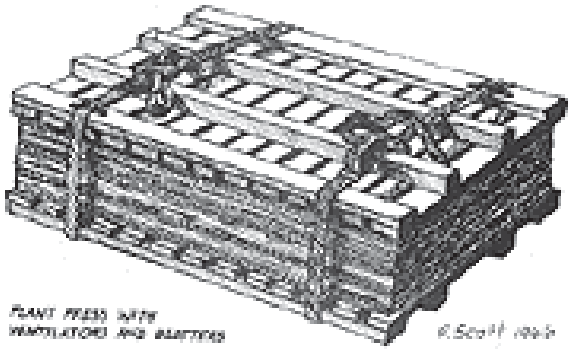
Plants should be pressed immediately after collection. You can do this in a drying press, or temporarily in a field press and later transferring them to a drying press.

A basic plant press consists of two 12" by 18" endboards of plywood or masonite, plus two adjustable straps or ropes. If you are handy in the wood shop, a more traditional press can be made with hardwood strips and rivets.

Plant presses may be purchased from the Herbarium Supply Company www.herbariumsupply.com.

The endboards are placed on the outside of a stack of cardboard ventilators, and the straps are tied around the outside. The straps need to be long enough to surround the expanding stack (as plants are added) and strong enough to allow you to tighten the press down very hard. Ideally, there are two pieces of blotter paper between the cardboards, but one (or even no) blotter will do.

A temporary field press can be made of two thin pieces of masonite (or heavy cardboard) as endboards for a few cardboard ventilators and much newspaper held together by straps, rope, or bungee cords. This light-weight press can be carried into the field to press specimens that will be later transferred to a heavy drying press.



Collecting tools and supplies

*Field press, or plastic bags
*Trowels, knives, and/or pruners,
*Thorn proof gloves
*GPS unit
*Field book
*Plant press

Pressing and drying procedures

1. Collect enough plant material to fill an herbarium sheet. Almost all specimens must have flowers, fruits, or both to be accurately identified. Only a few tree and shrub species with obvious leaf characteristics can be vouchered without flowers or fruits.

2. Unwanted parts, dead leaves, extra leaves, etc., should be trimmed off before pressing. All parts should be free of dirt before they are put into the press.

3. Place a single piece of newspaper between the blotters and write the specimen collection number on the margin. (11" x 14" weekly newspapers are best)

4. Plant parts should be arranged in the newspaper so there is as little overlap as possible; stems should

be bent sharply and neatly to fit in the paper. Plants should not be layered or massed together within the pressing papers.

5. Close the press and pull the straps very tight. Kneeling on the press while the straps are being tightened helps to compress and flatten the specimens within.

6. Most specimens will dry within a week or two. Some woody or more succulent plants may require a month of drying in the press. If blotters are not used, or the plant material is thick with moist tissue, drying can be hastened by removing specimens from the press (while in their papers) every two days and letting them (and the open press) dry in a warm place for two or more hours before placing them back in the press. Failure to do this may cause the specimen to become blackened and moldy.

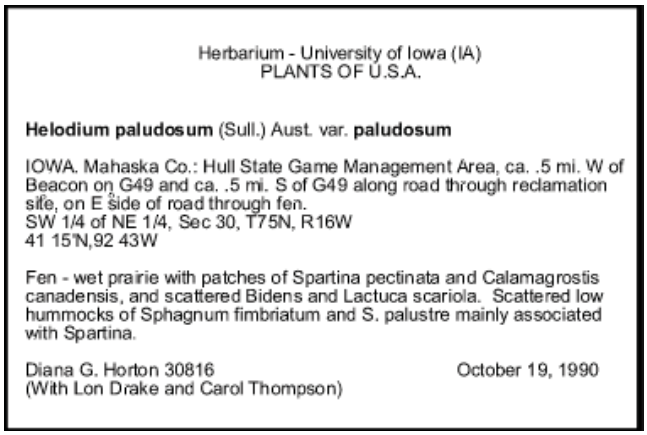
7. If a plant press becomes moist from rain or frequent use, it must be disassembled and completely dried before being used again to press plants.

8. The dried specimens are brittle, fragile, and loose within their drying papers. They can be transported to the herbarium in a rigid cardboard box, or by bundling several at a time between two cardboard pieces tied with string.

Label Data

Even the most beautifully preserved plant specimen is useless without complete and accurate label data. At a minimum, collection data must include:
•Collection location – state, county, both a narrative description and a point location (Lat-Long or UTM), and elevation.
•Habitat – substrate and plant community.
•Collection date
•Collector name(s)
•Collection number
•Plant characteristics not obvious from dried specimen.

Example specimen label


Herbarium - University of Iowa (IA)
PLANTS OF U.S.A.

Helodium paludosum (Sull.) Aust. var. **paludosum**

IOWA. Mahaska Co.: Hull State Game Management Area, ca. .5 mi. W of Beacon on G49 and ca. .5 mi. S of G49 along road through reclamation site, on E side of road through fen.
SW 1/4 of NE 1/4, Sec 30, T75N, R16W
41 15'N,92 43W

Fen - wet prairie with patches of Spartina pectinata and Calamagrostis canadensis, and scattered Bidens and Lactuca scariola. Scattered low hummocks of Sphagnum fimbriatum and S. palustre mainly associated with Spartina.

Diana G. Horton 30816 October 19, 1990
(With Lon Drake and Carol Thompson)

LOCATION – Collection locality information should be enough to place a point on a map, or for a future botanist to return to the same location. Always include the state, county, and a narrative description that is detailed enough to get there with a map. If your are collecting in a mountain range, drainage, National Forest, State Park, etc., include the names of these places in the narrative so that future database searches can reveal their floras.

Narrative Location
Poor: About 9 miles north of Roswell
Better: Hwy 285, 8.7 miles north of intersection with Hwy 70 at Roswell
Best: Salt Creek arroyo on west side of Hwy 285, 8.7 miles north of intersection with Hwy 70 at Roswell

Point locality coordinates allow your collections to be accurately mapped in a floristic atlas and will also help future researchers return to the places of your collections. A point location is either Latitude-Longitude or UTM coordinates. Either one can be obtained in the field with a hand-held GPS unit. If you don't have a GPS, mark the point of your collection on a map. Whether you use a GPS unit or topographic map, be sure to write down the map datum you used. The NAD83/WGS84 map datum is preferable to NAD27 map datum, but either way – write it down! (Note: You do NOT need a GPS reading or coordinates for every plant you collect – just for each new collecting location.)

Elevation not only helps locate the collection point, but also provides important data on the ecological amplitude of the plant species you collect. Elevation can be recorded in either feet or meters and is obtained from your GPS unit or a topographic map.

The maps you take to the field should be detailed enough to accurately describe your collection locations. USGS 7.5 Minute Quadrangle maps are very detailed and easy to use, but have the limitation of not covering a large enough area. The most convenient field maps are the BLM edition 1:100,000 scale, 30 x 60 Minute Quadrangle showing topographic contours and surface ownership. The surface ownership feature is very helpful in avoiding lands where trespass is not allowed without permission. These maps fold-up like a road map and sell for about $8.00 each. The entire state is covered by 64 of these maps, but you need only purchase the ones where you will be collecting plants. The least expensive alternative is to purchase a New Mexico Road Atlas, which covers the whole state, also has the land ownership feature, but is not topographically contoured and names fewer geographic features.

HABITAT – Habitat descriptions provide important ecological data for the species. Try to identify the physical substrate and plant community. This can be simple like "rock outcrop in conifer forest" or more complete such as "coarse, sandy soil in cracks of granitic outcrop with *Pinus ponderosa*, *Pseudotsuga menziesii* and *Quercus gambelii*". Naturally, the more complete description is better, but only include the information you are certain of. If you can't tell granite from rhyolite or *Pinus ponderosa* from *Pinus flexilis*, then use the simple description and don't risk conveying inaccurate information.

Substrate is often significant in determining the plant community. If there is a lot of exposed parent rock try to determine if it is igneous (granite, volcanic, etc.) or sedimentary (limestone, sandstone, shale, gypsum). Soil information is also useful, so describe it if obviously sandy, clayey, silty, or alkaline. Other details about the landscape can also be recorded, such as N-facing slope, swale, cliff face, arroyo bottom, etc. Host plants of parasitic plants should be noted and even included with the specimen (if possible).

Try to convey an image of the plant community with common descriptive terms, such as arid grassland, desert scrub, mountain meadow, conifer forest, riparian woodland, etc. If you can, include the Latin names of a few dominant species in the tree, shrub and herbaceous cover.

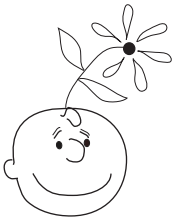
DESCRIPTION OF PLANT – Describe features of the plant that will, or may, not be evident when the specimen is dried and mounted. Flower color often changes when dried, so make a note of the fresh flower color when collected. Specimens from trees, shrubs, and large herbaceous species do not include the whole plant, so note the height and growth form. An indication of abundance (locally common, occasional, rare, or number of plants seen) can also be useful to future researchers.

COLLECTOR & COLLECTION NUMBER – The person who records the specimen in a field journal and assigns it a collection number must be the collector name on the specimen label. The names of field associates who are present when the collection is made can also be included on the label as collectors, but this is optional. If multiple names are included as collectors, the first name must be the person who assigned the collection number and made the journal entry.

The collection number is unique to a specific collector and collection, and cannot be used more than once. This number refers the specimen to a single entry in the collector's field journal. Duplicate specimens can be collected

under the same number, if they are collected by same person at the same location on the same day, but would get different numbers if anything differs on the specimen labels. For instance, I can send three specimens of *Physaria newberryi* to three different herbaria and number them all 2647 because I collected them at the same place at the same time. If they were only flowering specimens and I went back a month later to

collect the same species in fruit, the later collection would get a different collection number. If I went to a different location and collected the same species on the same day, it too would get a different collection number.



What to Collect and What Not to Collect

New Mexico university herbarium collections document the regional flora. The flora consists of all native and naturalized plant species. All naturally occurring native plant species should be collected and vouchered as labeled herbarium specimens. DO collect non-native plants, but only those that are self-sustaining and feral. DO NOT collect native or non-native plants that have been purposely planted and maintained in landscaping, agricultural fields, or reclamation areas.

DO NOT collect plants that are federally listed as threatened or endangered. These plants are protected by the Endangered Species Act and can only collected under permit from the U.S. Fish & Wildlife Service. Plant taxa that are listed as endangered by the State of New Mexico (but not by the Feds) should be collected to voucher their population distributions and abundance. Permits to make herbarium specimens of state endangered plants may be obtained from the NM Forestry Division (call Bob Sivinski, 476-3347). Several other rare plants are listed as 'sensitive' by various federal agencies and may, or may not, be collected within some federal jurisdictions. Agency status of sensitive, threatened and endangered plants can be found on the NM Rare Plants web site at: nmrareplants.unm.edu.

Where to Collect and Where Not to Collect

Collecting a specimen that duplicates an existing herbarium specimen from the same, or approximately the same, location is usually not useful. There are several areas in the state where few, if any, plants have been collected. These areas should be the focus of future general collection efforts.

Bureau of Land Management (BLM) land is the only jurisdiction in New Mexico where a field botanist can freely travel and collect herbarium specimens (except T&E plants). All other lands in NM require permission or collection permits from the landowners or management agencies. National Parks and Monuments and military reservations are especially difficult places to gain permission to collect. National Forest permits are not difficult to obtain, but most National Forests in NM are relatively well collected and are not a priority. Permission to access and collect on private and tribal lands must be obtained by the collector.

Illustrated Glossary

Bracts

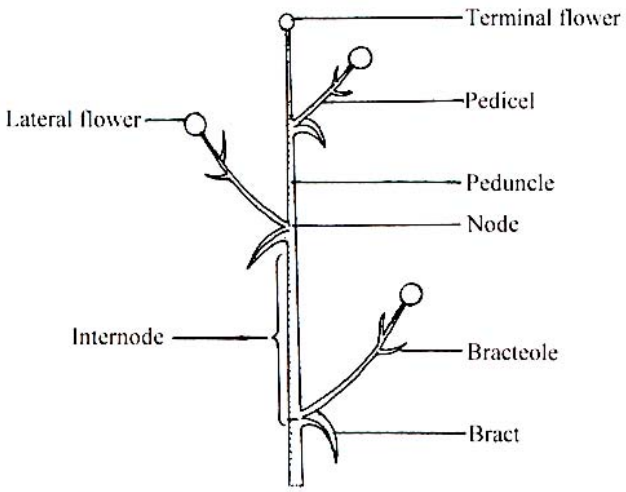
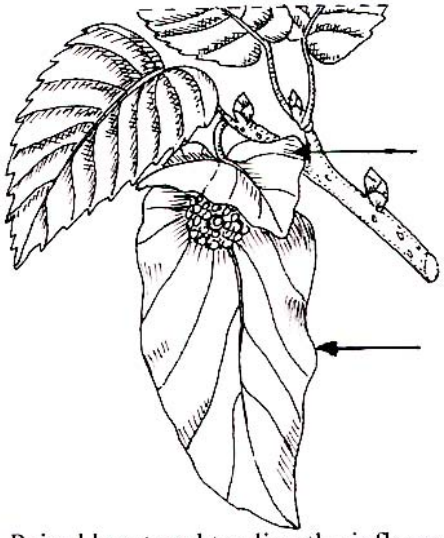
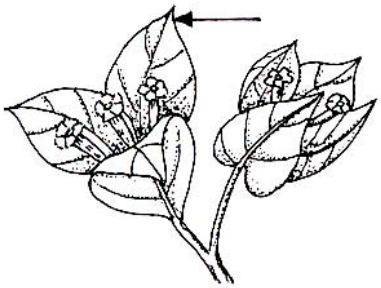


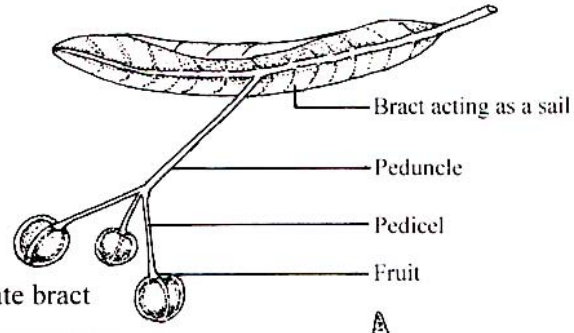
Diagram of a racemose inflorescence indicating the position of bracts and bracteoles



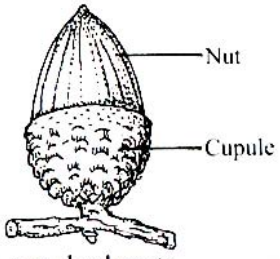
Paired bracts subtending the inflorescence



Petaloid bracts subtending the flowers

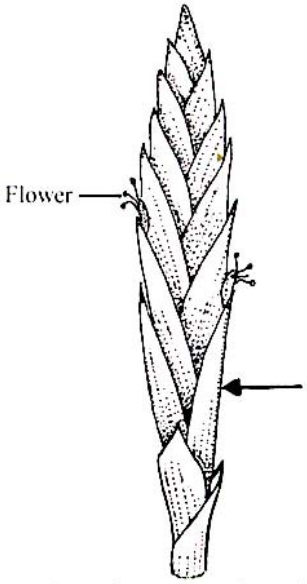


Adnate bract



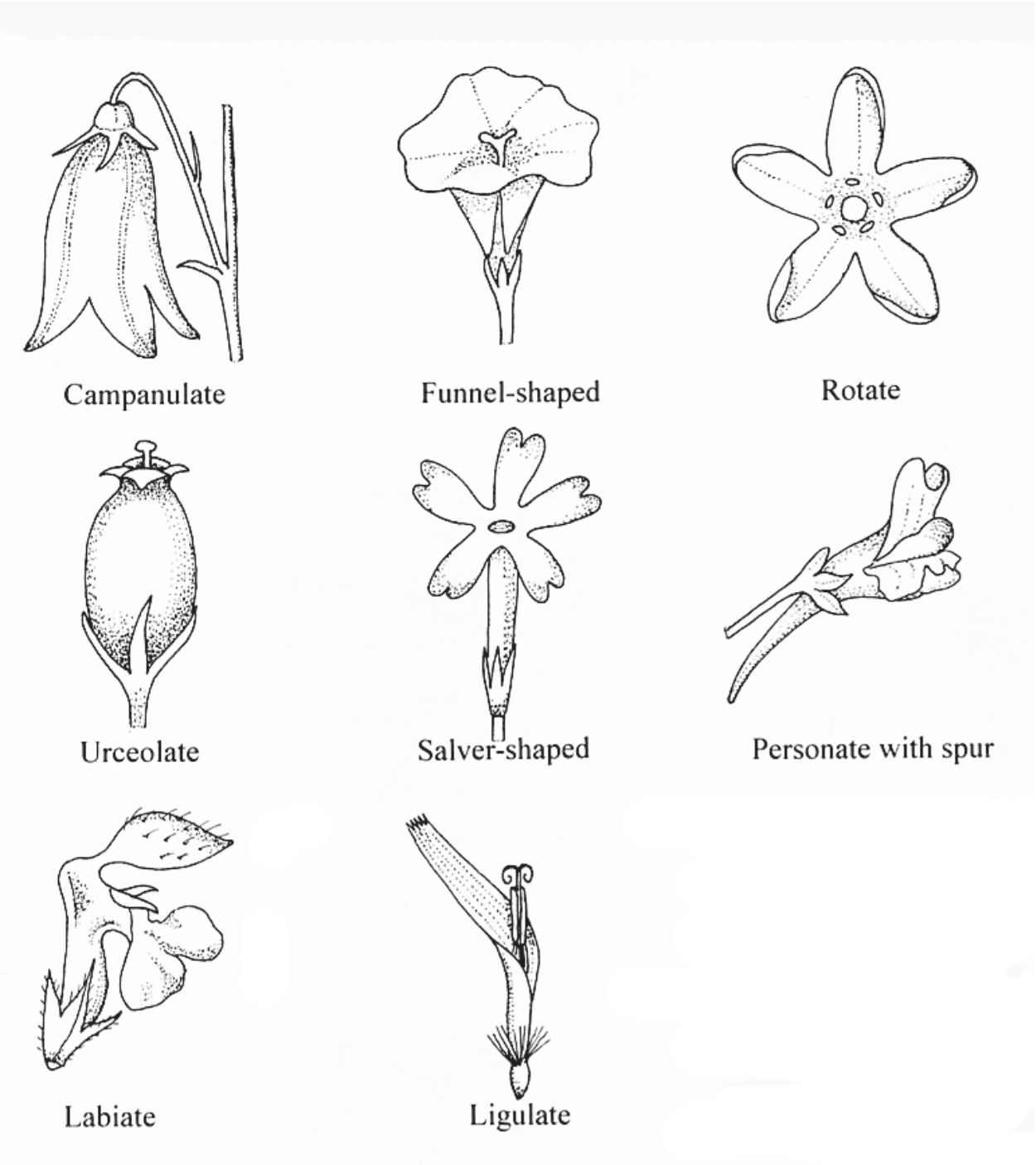
Fused cupular bracts

Involucral bracts

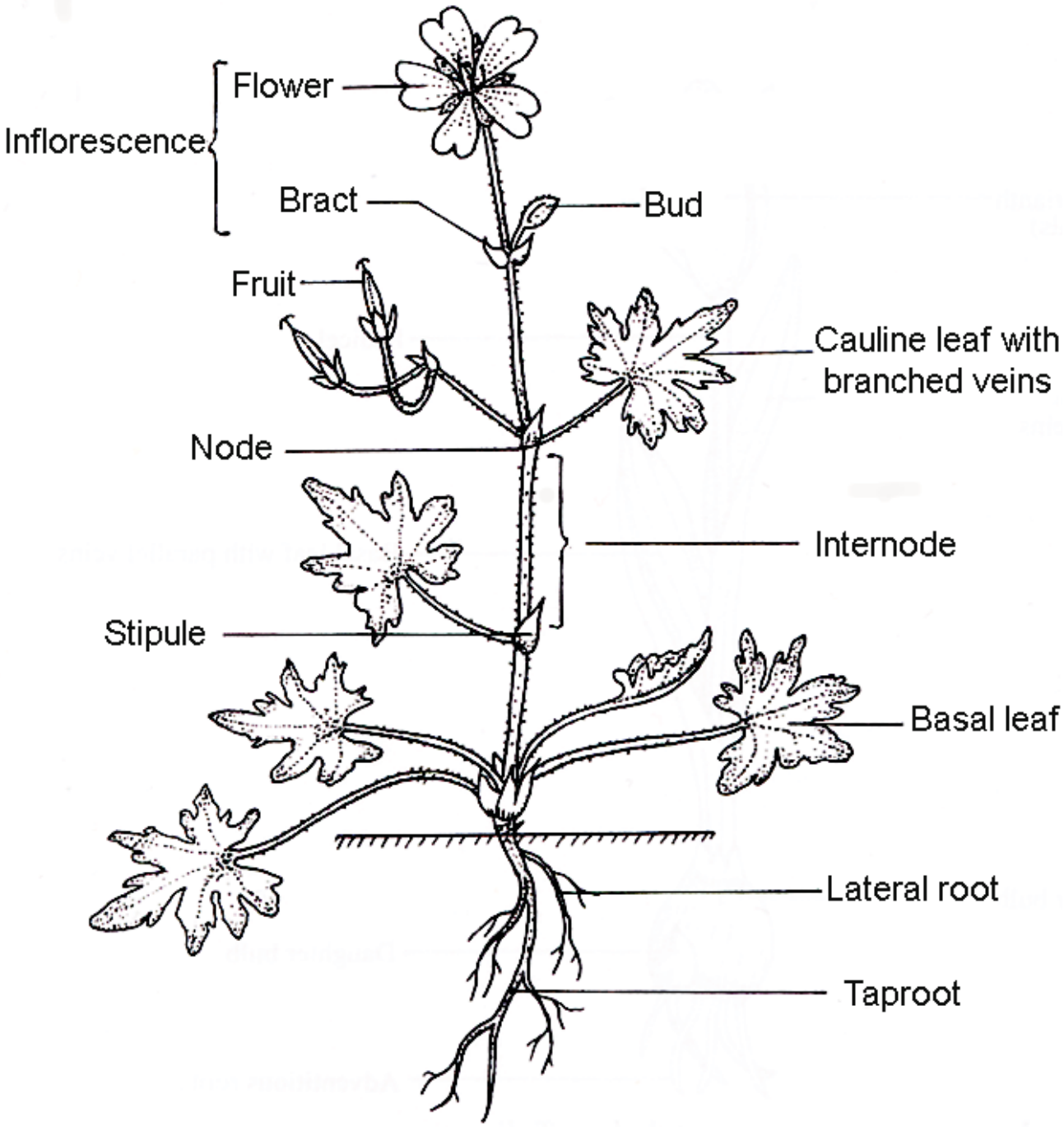


Imbricate bracts on the spicate inflorescence

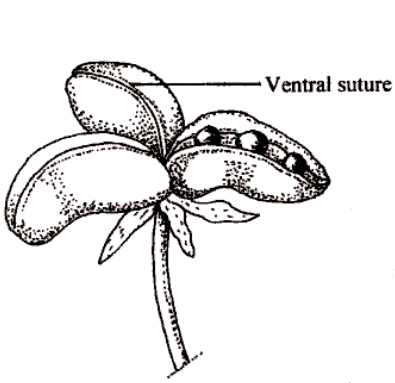
Corolla shapes



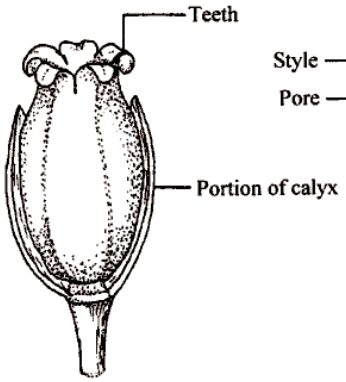
Eudicot morphology



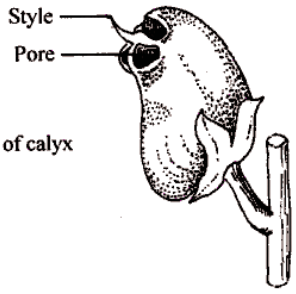
Fruit types



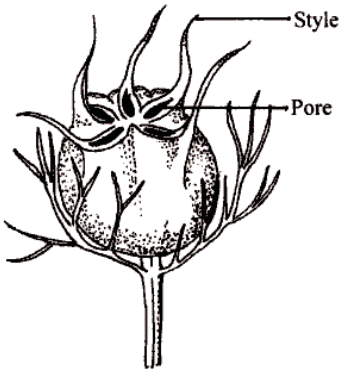
Follicle



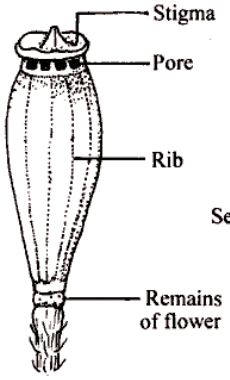
Capsule with apical teeth



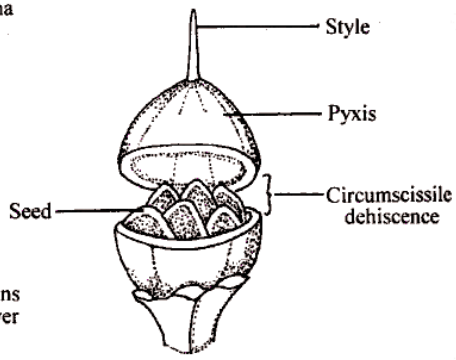
Poricidal capsule



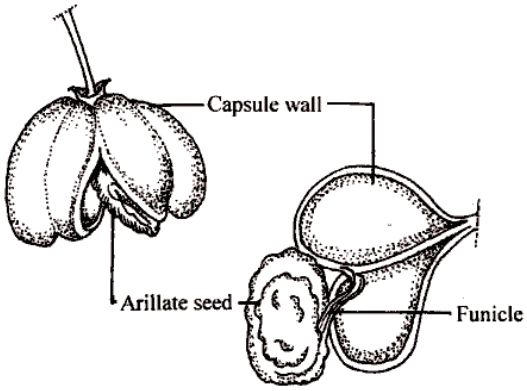
Poricidal capsule



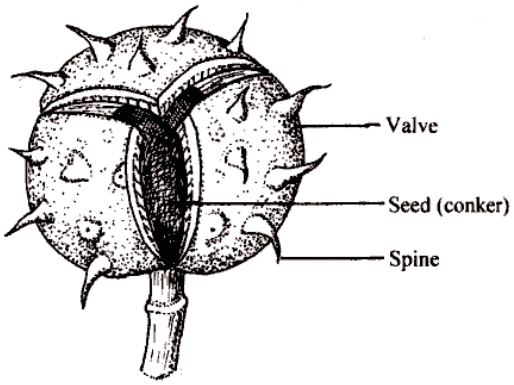
Poricidal capsule with sessile stigma



Capsule with circumscissile dehiscence

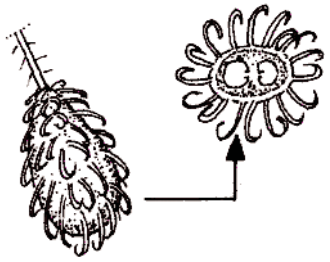


4-lobed capsule dehiscing longitudinally, whole and in section

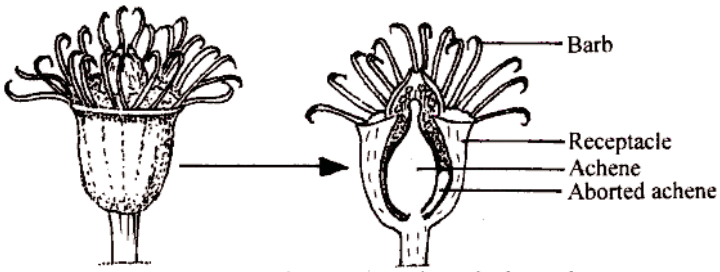


Valvate capsule

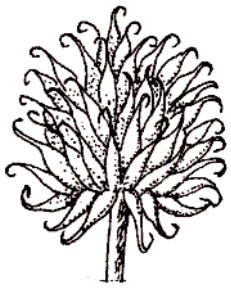
Fruit types



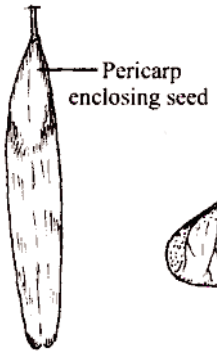
Hooked pericarp, whole and in section



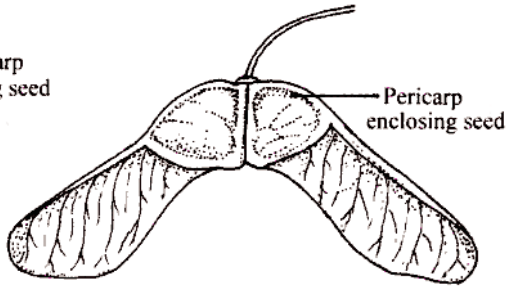
Barbs developed on the receptacle, whole and in section



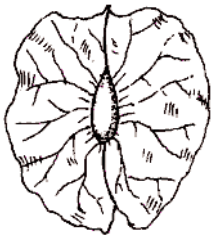
Involucre of hooked bracts surrounding infructescence



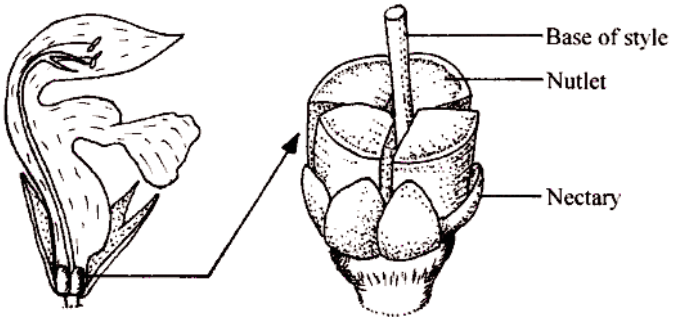
Samara



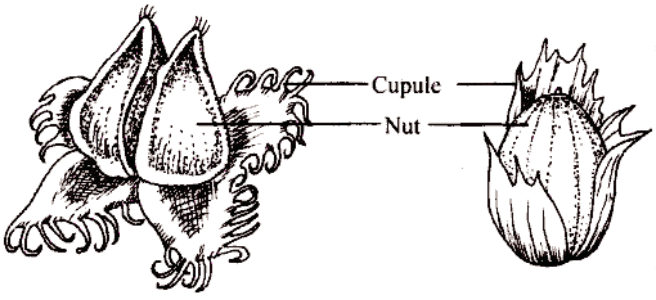
Double samara



Winged pericarp

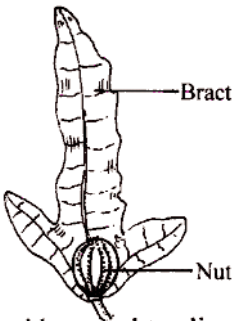


Nutlets



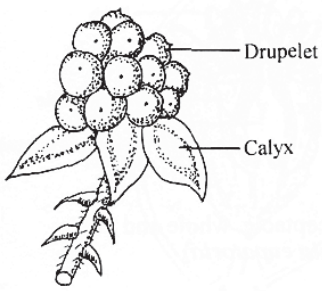
Triangular nuts

Nut

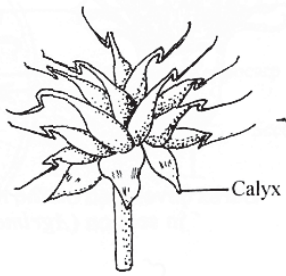


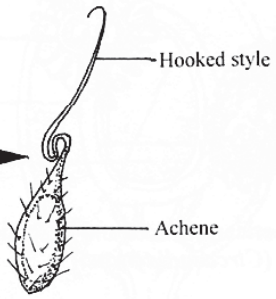
Winged bract subtending nut

Fruit types

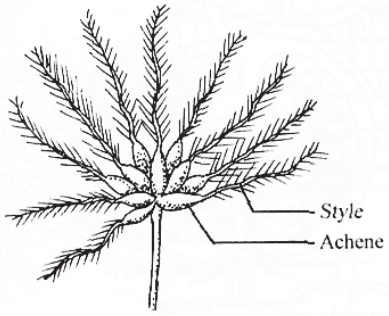


Aggregate of drupelets

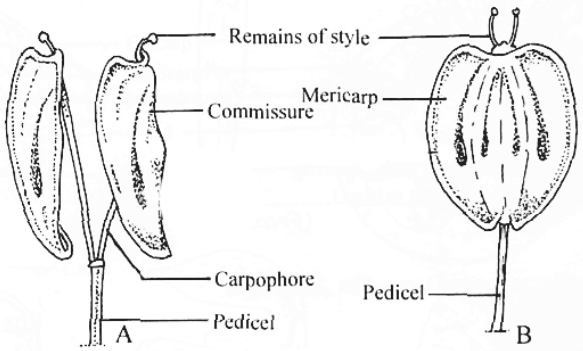




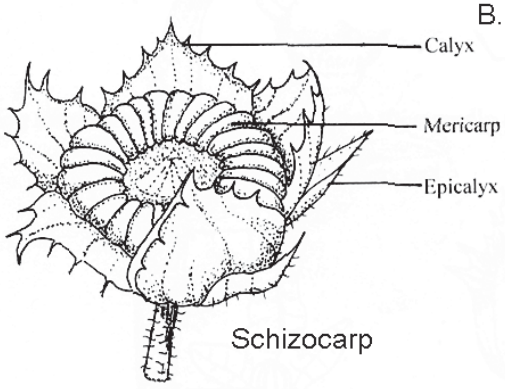
Aggregate of hooked achenes



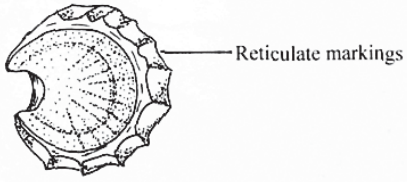
Aggregate of feathered achenes



A. The 2 mericarps (one twisted) pendent on the divided carpophore.
B. The whole schizocarp before dehiscence

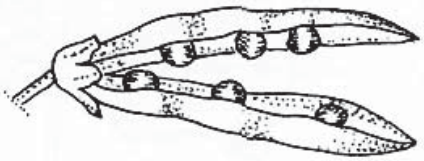


Schizocarp



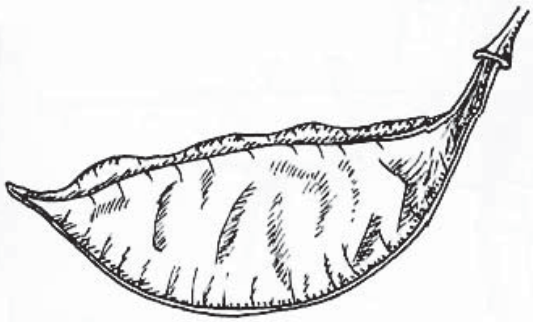
Mericarp = a wedge-shaped nutlet

Fruit types- legumes



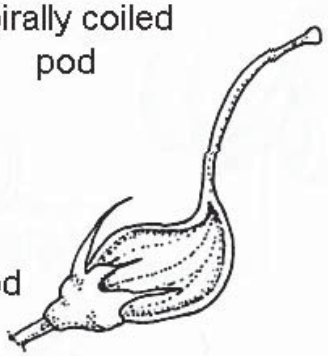
Legume

Lomentum



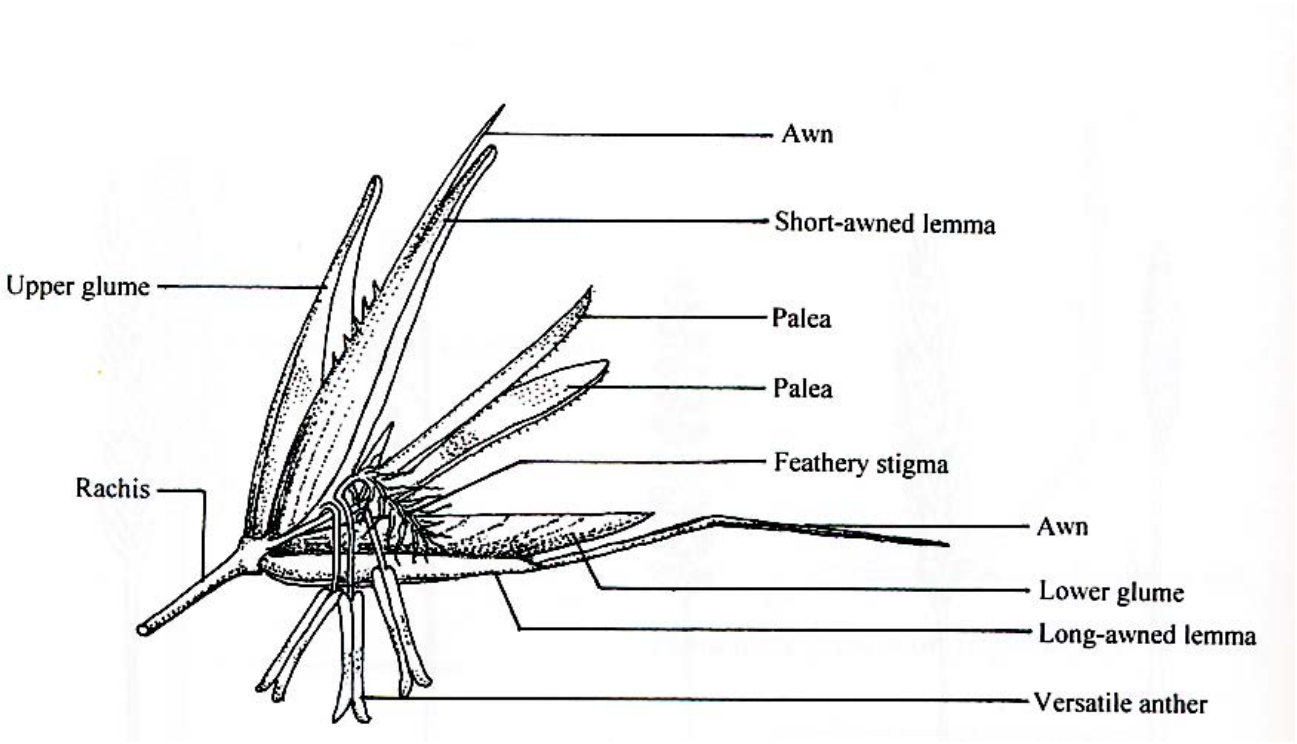
Inflated many-seeded pod with papery walls

Spirally coiled pod

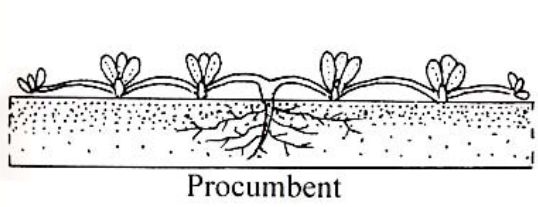


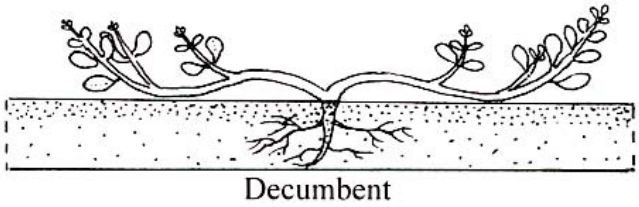
1- or 2-seeded pod with beak

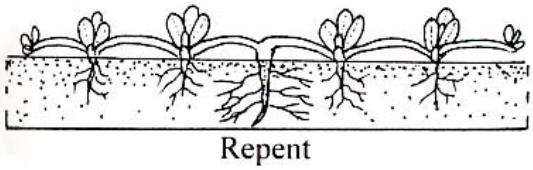
Grass morphology

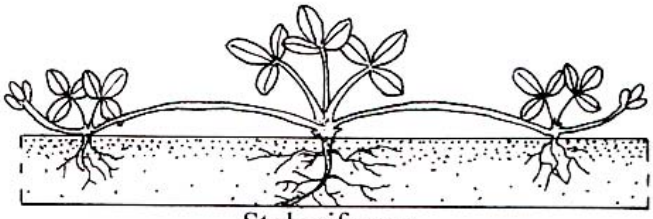


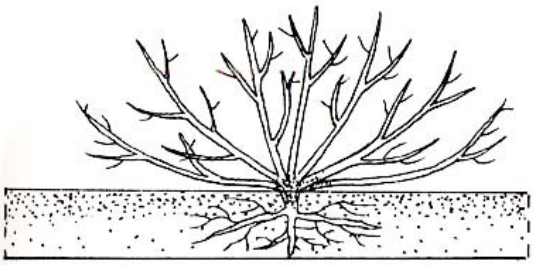
Growth forms

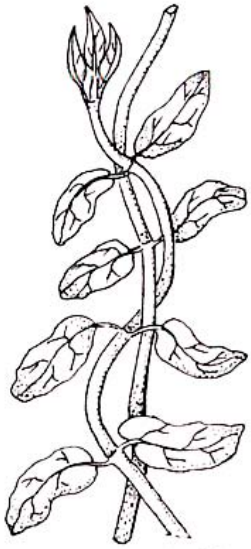

Procumbent


Decumbent

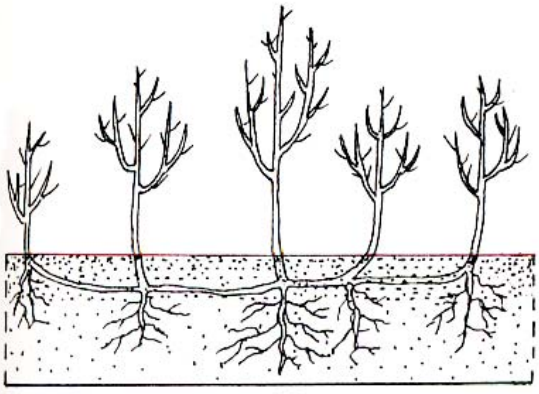

Repent

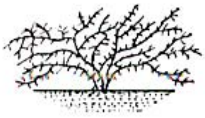

Stoloniferous

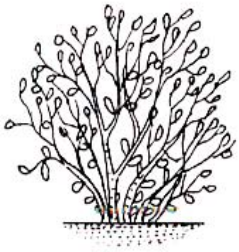

Ascending

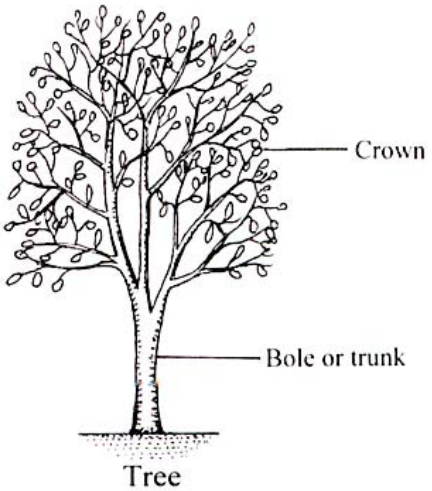

Clockwise climbing shoot


Counter-clockwise climbing shoot


Soboliferous

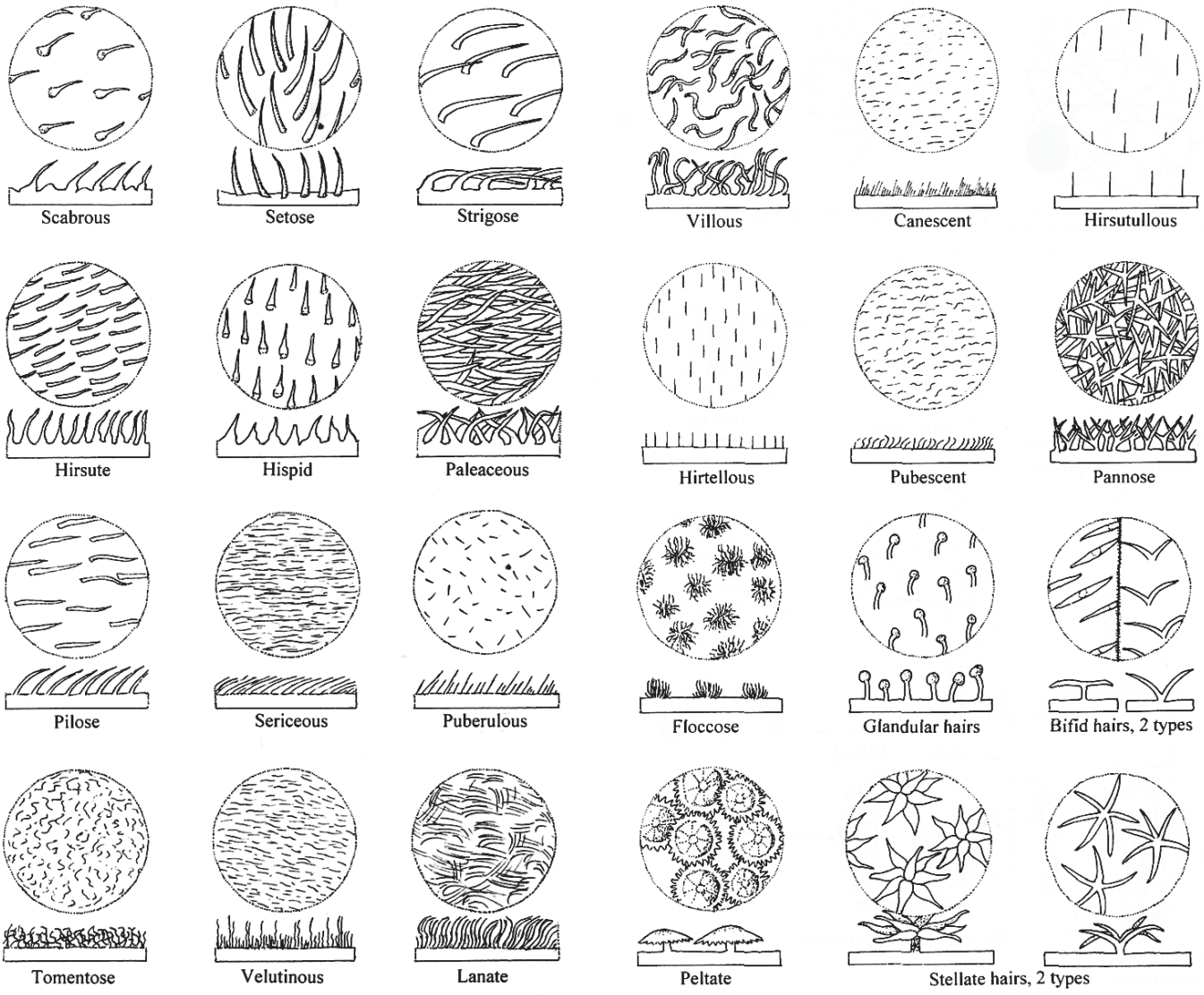

Subshrub


Shrub

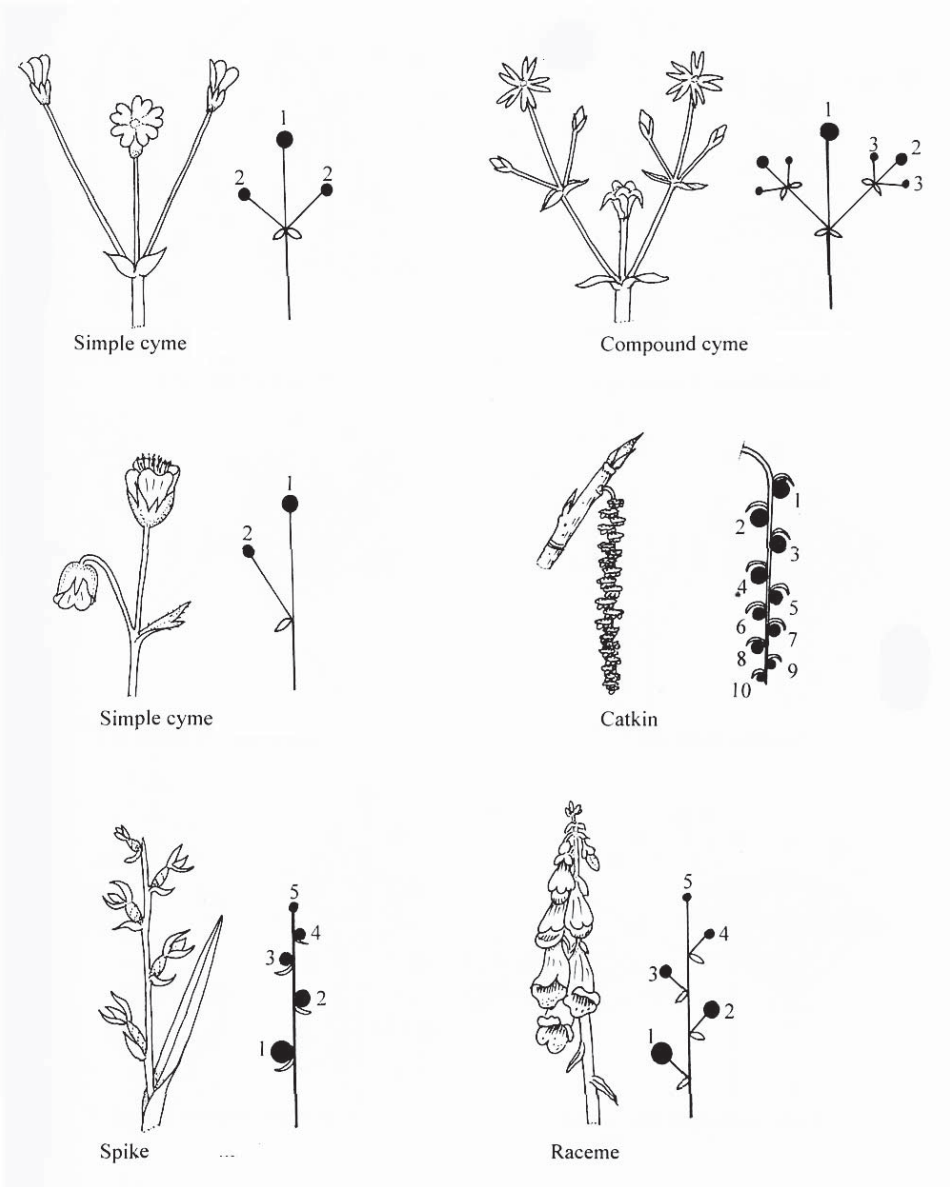


Tree

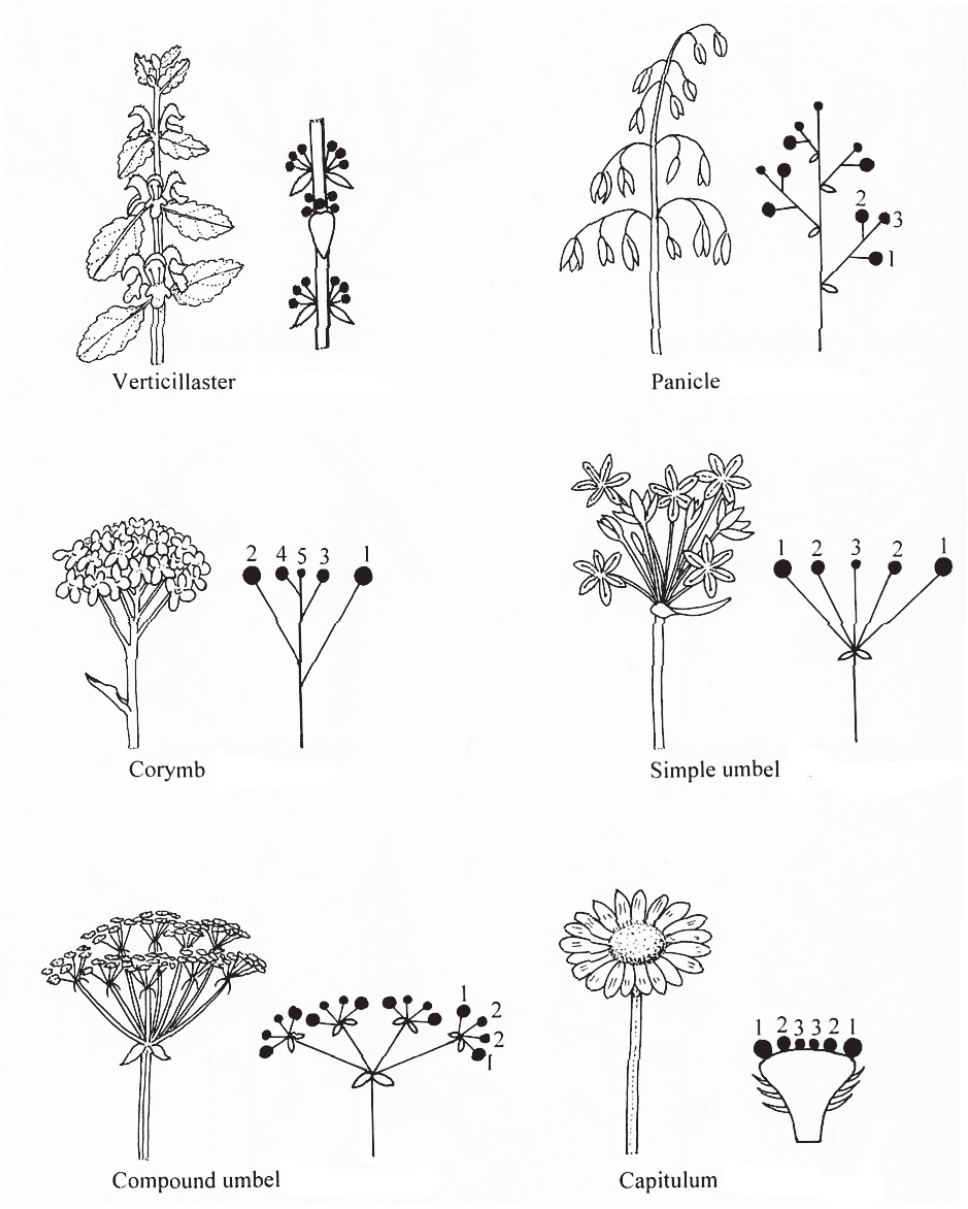
Hairs


Scabrous
Setose
Strigose
Villous
Canescent
Hirsutullous
Hirsute
Hispid
Paleaceous
Hirtellous
Pubescent
Pannose
Pilose
Sericeous
Puberulous
Floccose
Glandular hairs
Bifid hairs, 2 types
Tomentose
Velutinous
Lanate
Peltate
Stellate hairs, 2 types

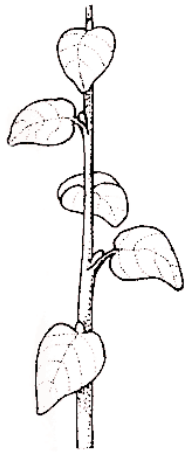
Inflorescences



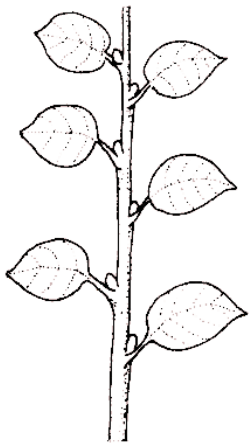
Inflorescences



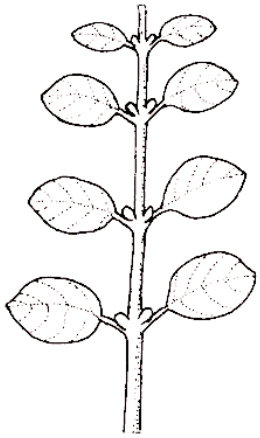
Leaf arrangements, stipules and petioles



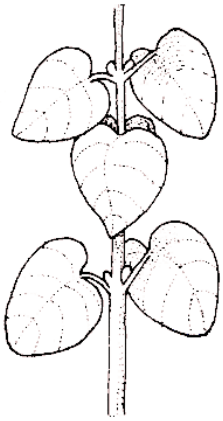
Alternate



Alternate, distichous



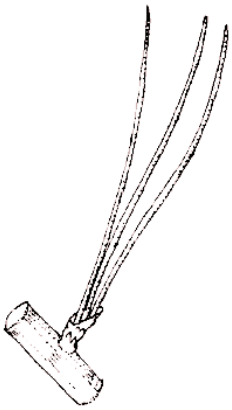
Opposite



Opposite, decussate

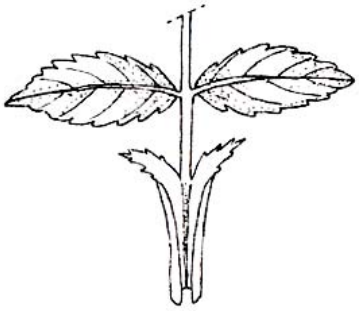
Whorled

Clustered

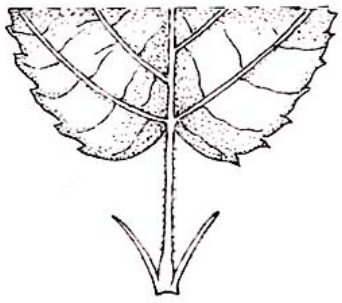


Fascicled

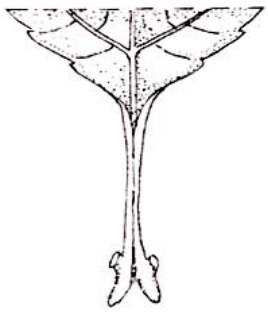
Imbricate



Adnate leafy stipules

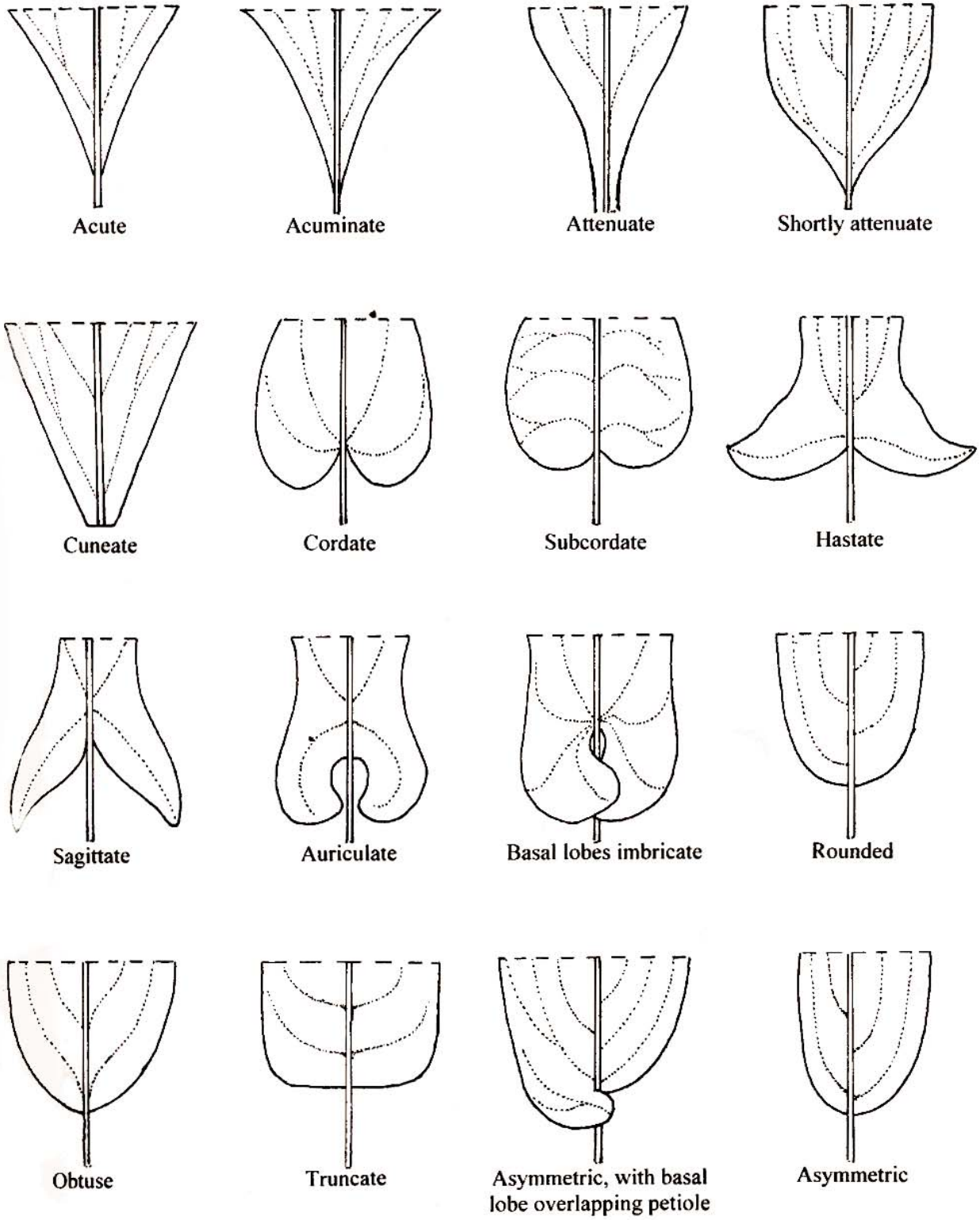


Filiform stipules

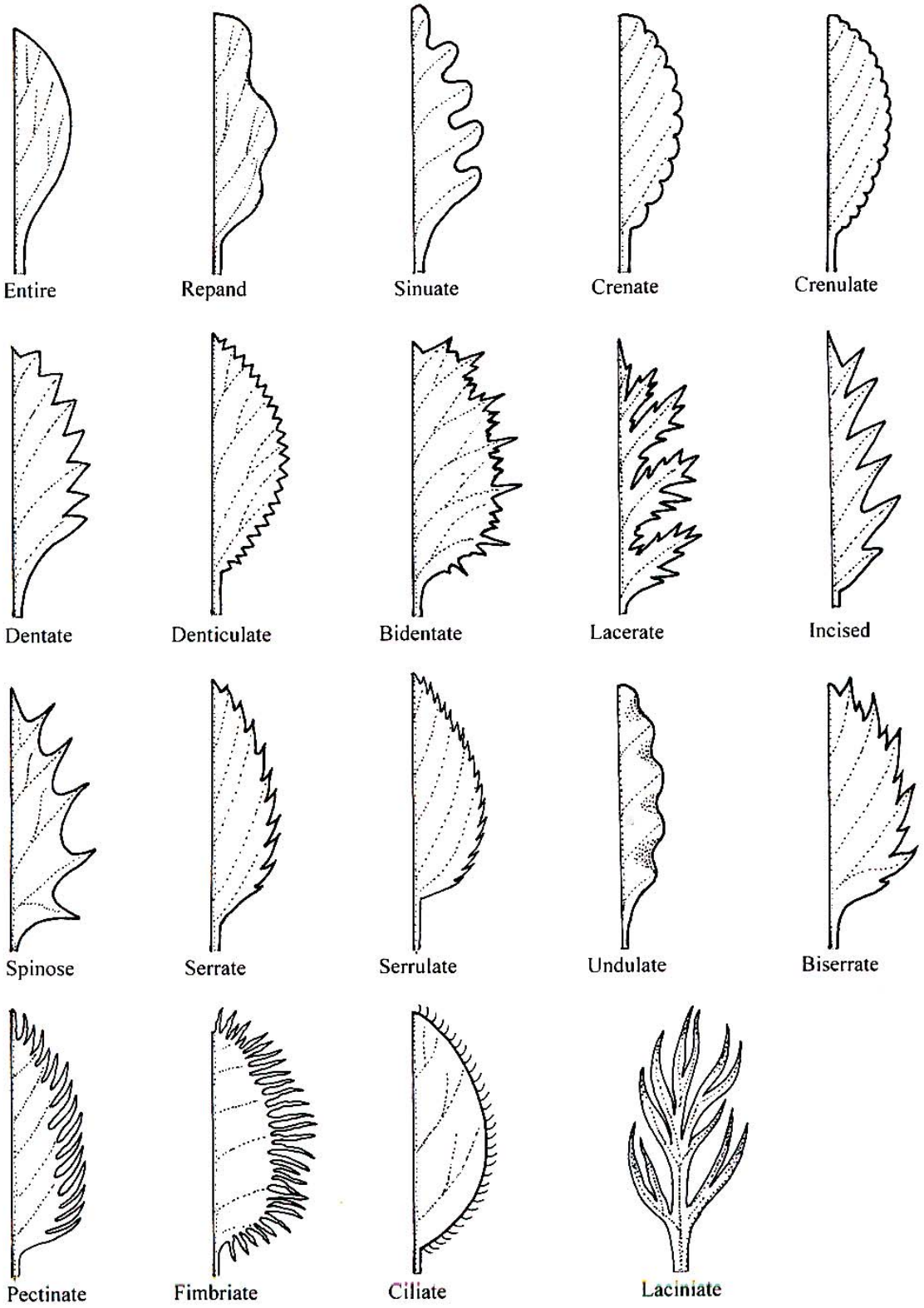


Petiole with glands

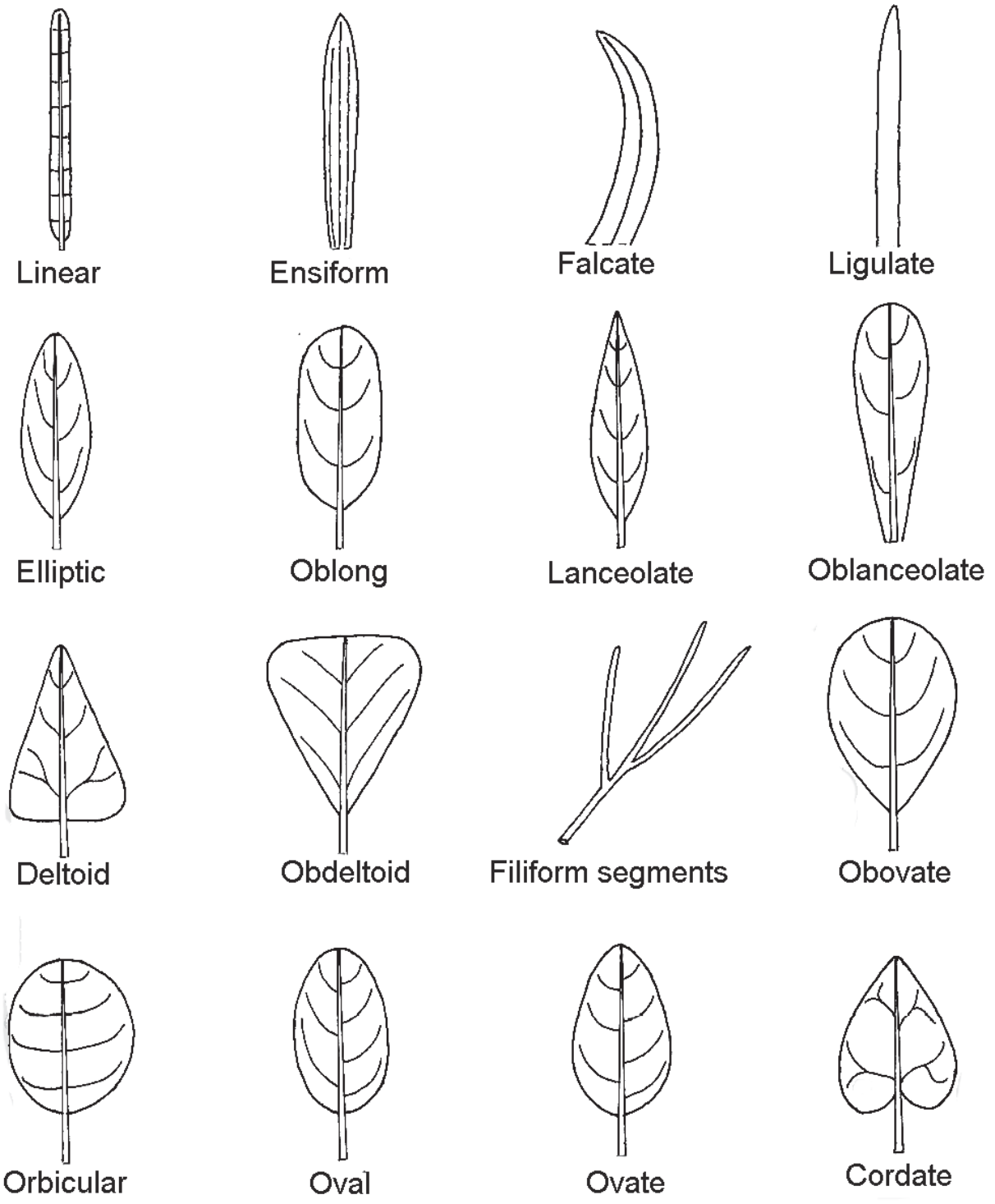
Leaf bases


Acute
Acuminate
Attenuate
Shortly attenuate
Cuneate
Cordate
Subcordate
Hastate
Sagittate
Auriculate
Basal lobes imbricate
Rounded
Obtuse
Truncate
Asymmetric, with basal lobe overlapping petiole
Asymmetric

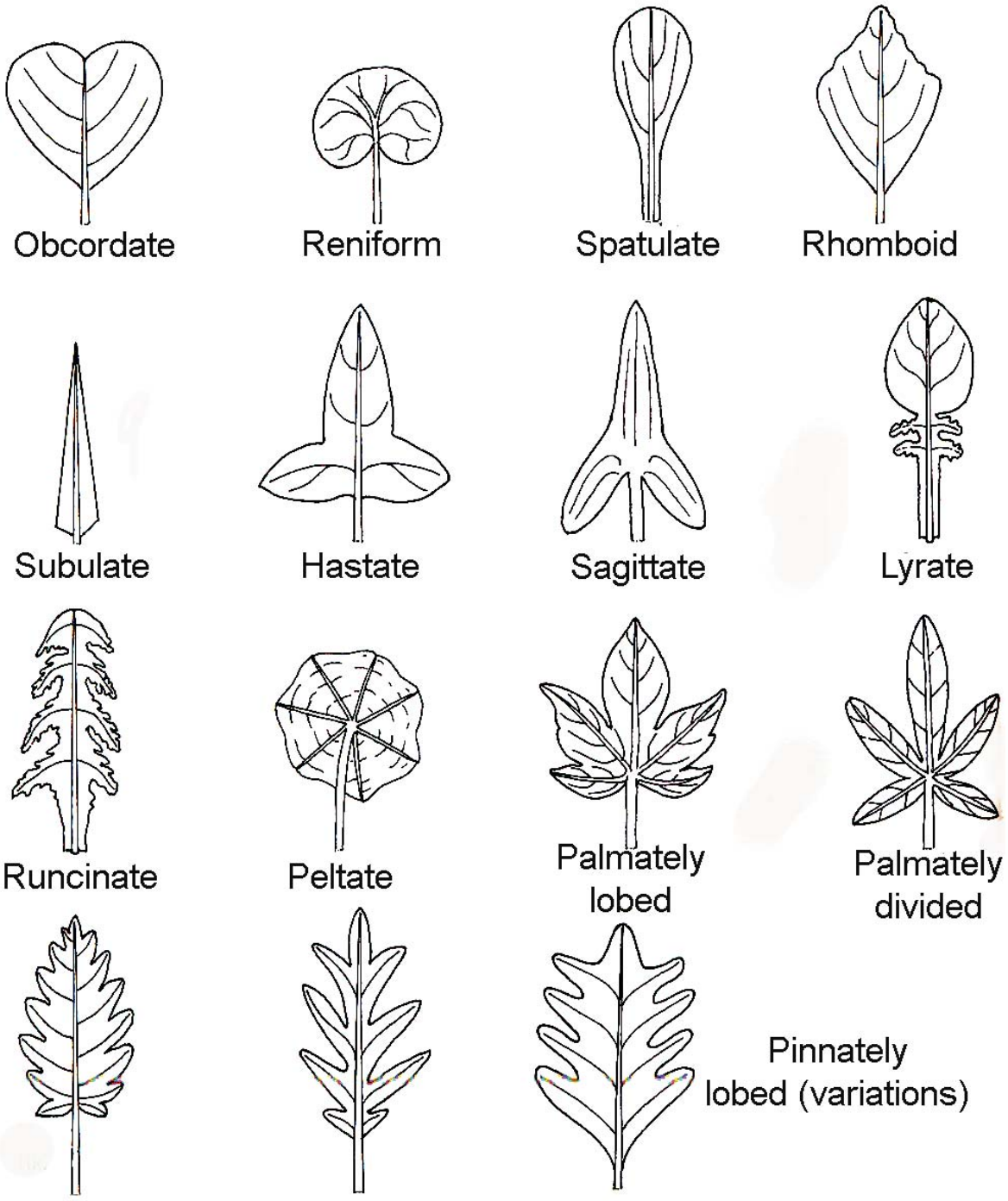
Leaf margins



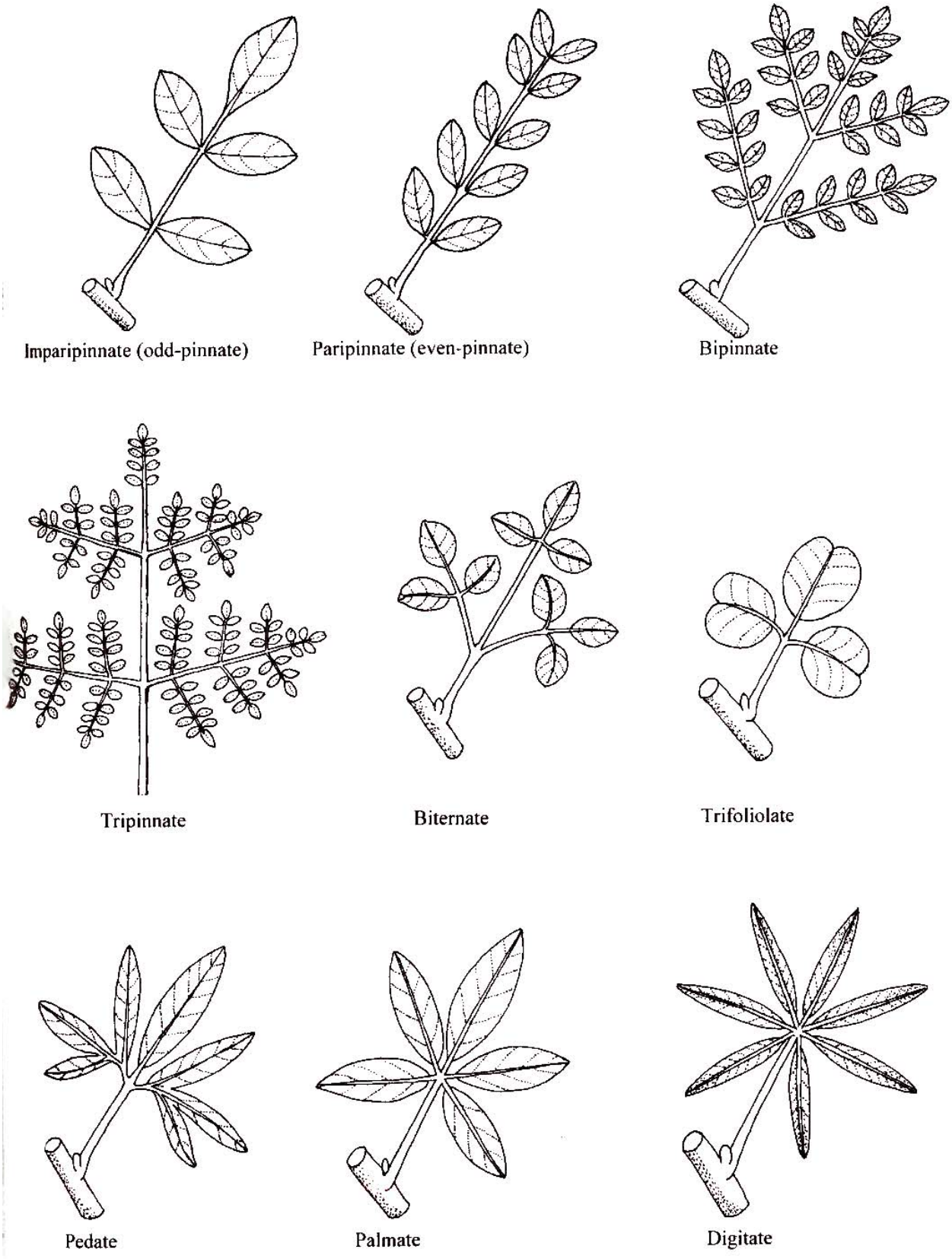
Leaf shapes


Linear
Ensiform
Falcate
Ligulate
Elliptic
Oblong
Lanceolate
Oblanceolate
Deltoid
Obdeltoid
Filiform segments
Obovate
Orbicular
Oval
Ovate
Cordate

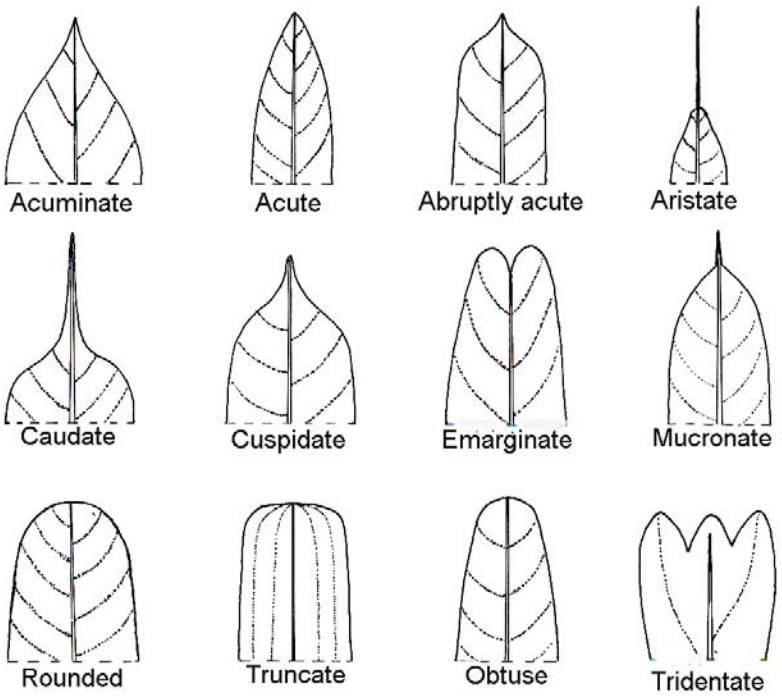
Leaf shapes


Obcordate
Reniform
Spatulate
Rhomboid
Subulate
Hastate
Sagittate
Lyrate
Runcinate
Peltate
Palmately lobed
Palmately divided
Pinnately lobed (variations)

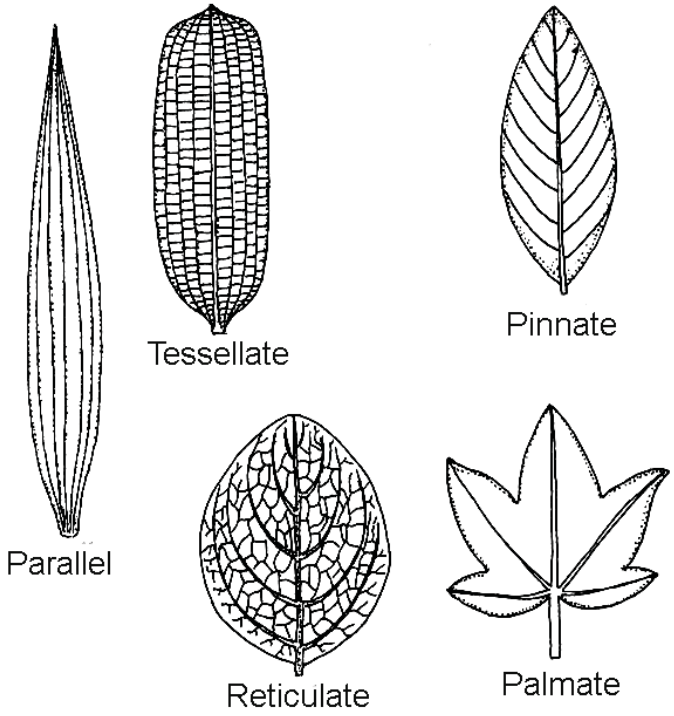
Leaf shapes


Imparipinnate (odd-pinnate)
Paripinnate (even-pinnate)
Bipinnate
Tripinnate
Biternate
Trifoliolate
Pedate
Palmate
Digitate

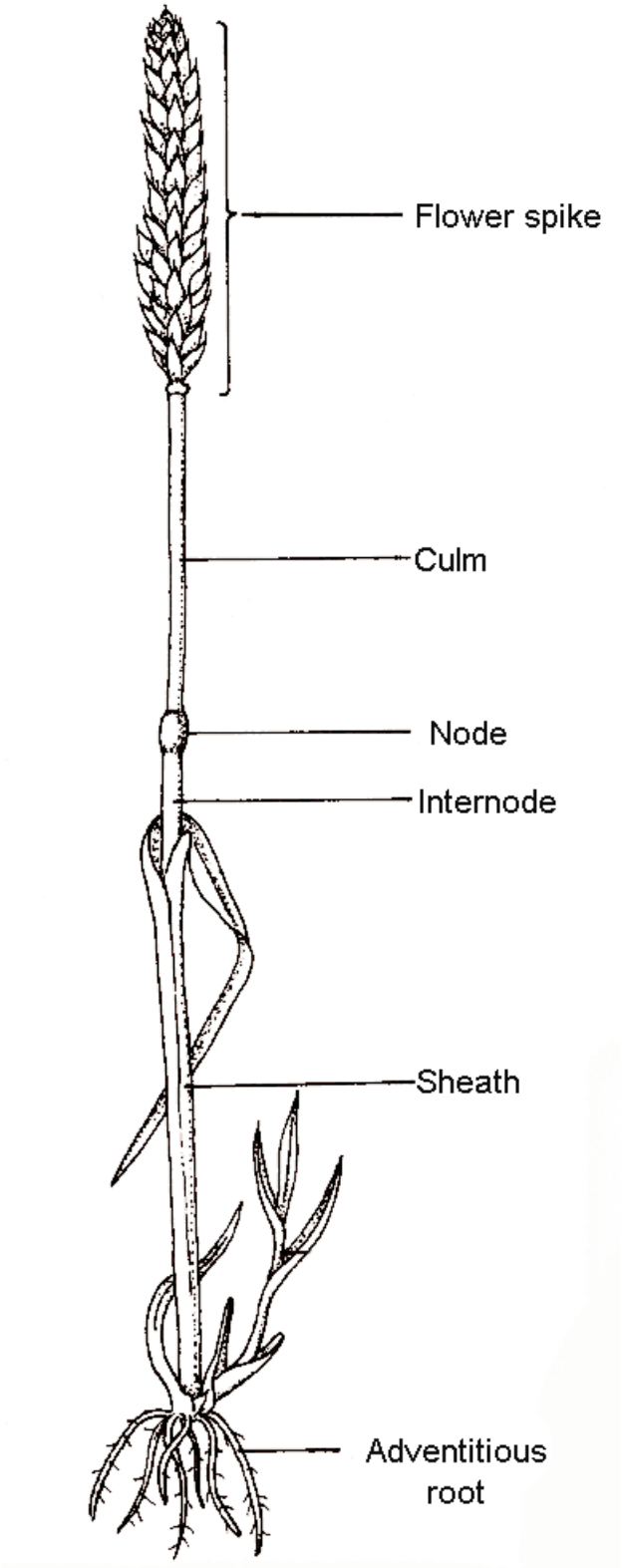
Leaf tips



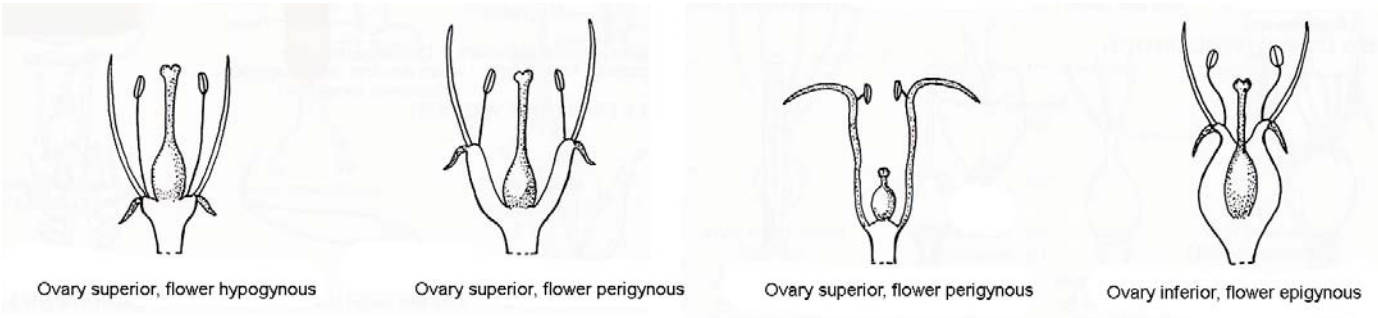
Leaf venation



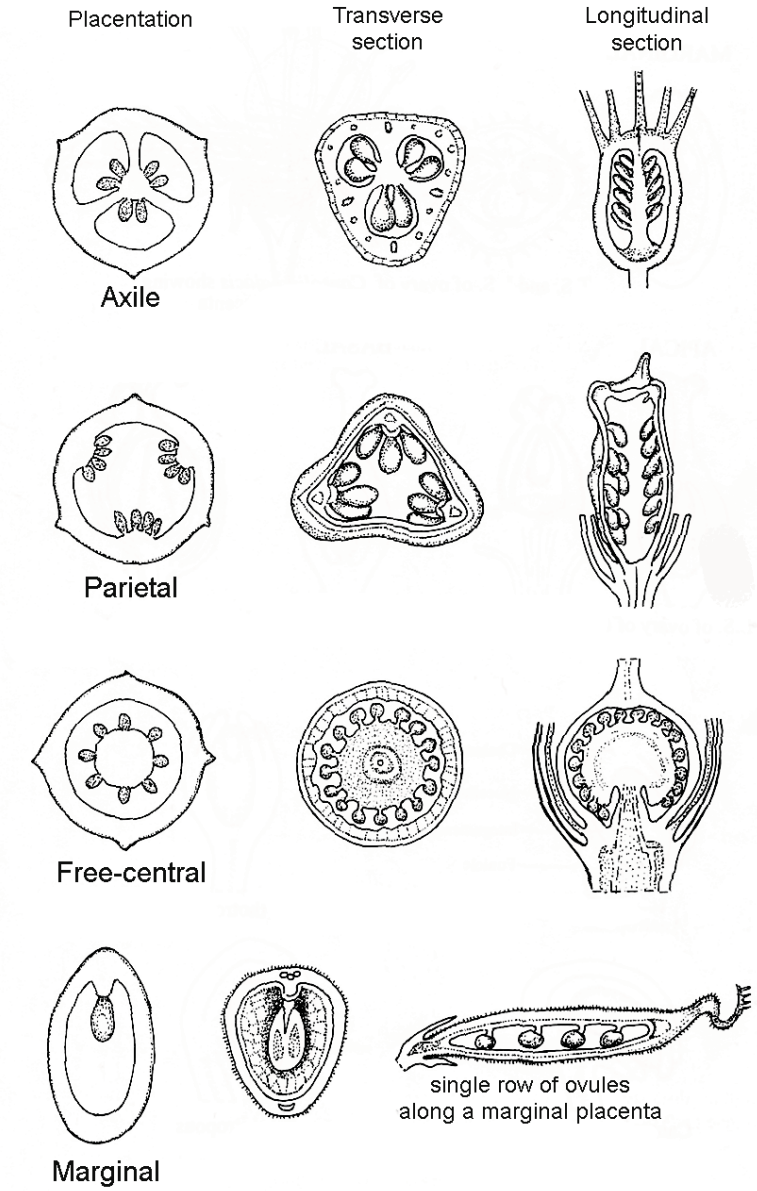
Monocot morphology



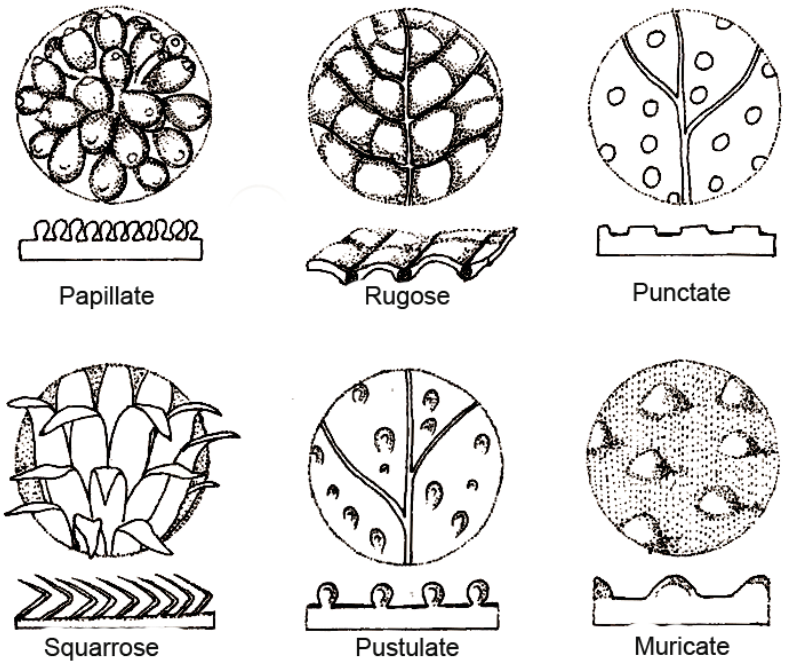
Ovary positions



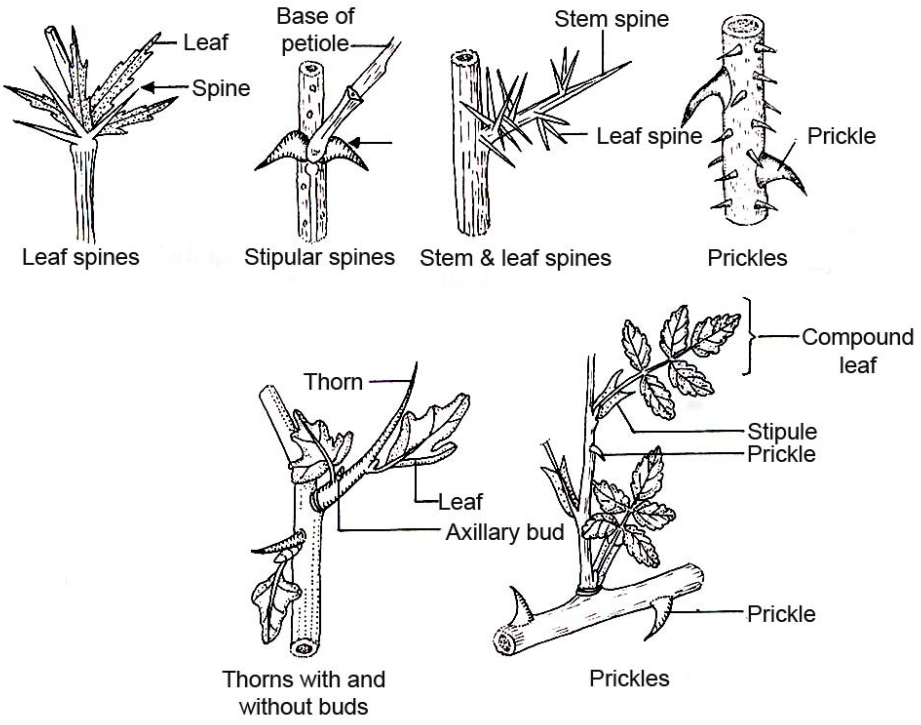
Placentation



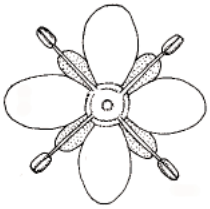
Scales and glands

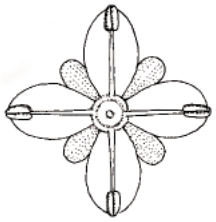


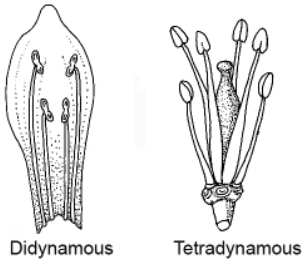
Spines, thorns and prickles

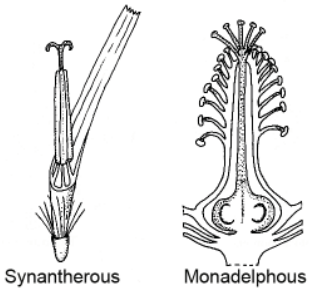


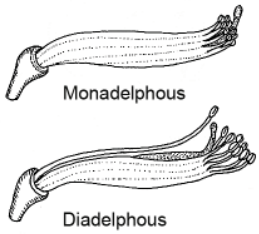
Stamen arrangement



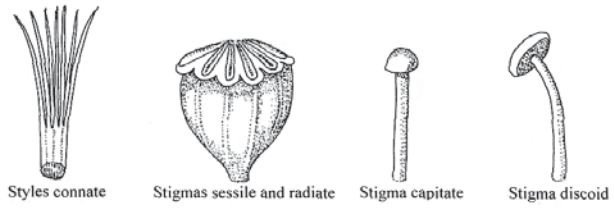


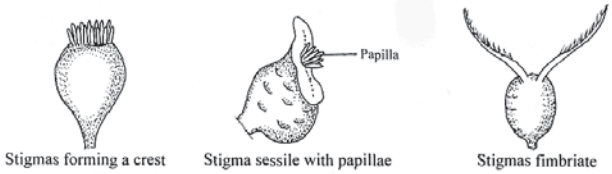






Styles and stigmas





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