KEYS TO THE VASCULAR PLANTS OF NORTH CENTRAL TEXAS

INCLUDING GENERAL KEY TO ALL FAMILIES[1] ON PP. 126

KEY TO MAJOR VASCULAR PLANT GROUPS

1. Plants without seeds or flowers, reproducing by microscopic spores borne in sporangia (= spore cases), these either (usually) on the surface of leaves or leaf-like structures (Polypodiophyta—Ferns) OR at the base of quill-like leaves (*Isoetes*) OR in small usually more or less cone-like structures (*Equisetum*, *Lycopodium*, and *Selaginella*); plants fern-like, moss-like, with quill-like leaves, or leaves reduced and stems green and hollow ____ **Lycopodiophyta, Equisetophyta, and Polypodiophyta**
(Pteridophytes = Ferns & Similar Plants)
—see Key on pp. 110 OR Group K on pp. 154

1. Plants reproducing by seeds, these developing either from flowers or on the surface of thin or thick, sometimes woody cone scales; plants usually not with growth forms as above (Spermatophytes = Seed Plants).
   2. Plants without flowers, the seeds on the surface of thick or thin, sometimes woody cone scales (cone scales fleshy in *Juniperus* with berry-like cones or thin, becoming fleshy in *Ephedra*); leaves needle-like (*Pinus* and *Taxodium*) OR very small, scale-like, and closely appressed to the stem (*Juniperus*) OR reduced to non-leaf-like scales in whorls at the joints of the stem (*Ephedra*) _____ **Pinophyta and Gnetophyta**
   (Gymnosperms ("naked seeds"))
   —see Key on pp. 113 OR General Key to all Families on pp. 126
   2. Plants with flowers, the seeds developing inside a closed carpel, the base of which (= ovary) becomes the fruit; leaves usually broader than needles or scales, rarely needle-like or scale-like—Magnoliophyta (Angiosperms ("vessel seeds") = Flowering Plants).
      3. Plants with 2 or more of the following characters: leaves parallel-veined; cotyledon (= seed leaf) 1; floral parts in 3s or 6s; mostly herbaceous plants with vascular bundles of stem usually scattered throughout the pith; cambium usually absent _____ **Monocotyledonae**
      (Monocots)
      —see Key on pp. 121 OR Key to Keys on pp. 110
      3. Plants with 2 or more of the following characters: leaves net-veined; cotyledons 2; floral parts usually not in 3s or 6s (usually in 2s, 4s, or 5s); herbaceous and woody plants with vascular bundles of stem in a ring around the pith; cambium usually present except in some annuals _____ **Dicotyledonae**
      (Dicots)
      —see Key to Keys on pp. 110

[1]The *General Key to All Families* was modified from *Key and Descriptions for the Vascular Plant Families of Oklahoma* contributed by Oklahoma Flora Editorial Committee (Tyrl et al. 1994).

KEY TO KEYS

1. Plants aquatic (either free-floating on or in water OR entirely submersed OR rooted in bottom and floating OR basal part in water and upper part emergent) _____ **Key to Aquatic Plants on pp. 113 OR Group G on pp. 141**

1. Plants terrestrial.
   2. Plants ferns OR fern-like plants OR gymnosperms.
      3. Plants ferns OR fern-like plants __ **Key to Ferns and Similar Plants on pp. 110 OR Group K on pp. 154**
      3. Plants gymnosperms __ **Key to Gymnosperms on pp. 113 or General Key to all families on pp. 126**
   2. Plants angiosperms (= flowering plants).
      4. Plants woody vines _____ **Key to Woody Vines on pp. 119 OR Group A on pp. 127**
      4. Plants not woody vines.
         5. Plants monocots _____ **Key to Monocots on pp. 121 OR General Key to all Families on pp. 126**
         5. Plants dicots _____ **General Key to all Families on pp. 126**

Key to Ferns and Similar Plants (Pteridophytes)

1. Plants small floating aquatics _____ (*Azolla*) **Azollaceae**

1. Plants not small floating aquatics, either terrestrial (rooted in soil or mud) OR aquatic (rooted on bottom) OR growing on rocks or tree trunks.
   2. Stems conspicuously jointed, green and hollow, the segments separating easily at the joints (= nodes), unbranched or branched at the nodes; leaves reduced to small essentially non-photosynthetic (non-green) scales in whorls at the nodes; sporangia (= spore cases) in terminal strobili (= cone-like structures) on stems without green leaves _____ (*Equisetum*) **Equisetaceae**
   2. Stems not jointed, not green and hollow; leaves usually green; sporangia either on the surface of leaves or leaf-like structures OR in terminal strobili on leafy stems OR in short-stalked sporocarps at leaf bases.
      3. Leaves simple, linear, grass-like or thread-like, the blades not expanded; spore-bearing structures embedded in leaf bases or on very short stalks (1–2 mm long) at leaf bases; plants often rooted in mud or in temporary pools.
         4. Leaves tightly clustered together (plants superficially resembling a green onion), arising from a corm-like rootstock, quill-like (larger at base); sporangia embedded in the leaf bases, borne one per leaf _____ (*Isoetes*) **Isoetaceae**
         4. Leaves scattered along a creeping rhizome, separate, not clustered; sporangia in stalked (stalks 1–2 mm long), globose, hairy sporocarps (= nut-like or hard bean- or pea-like sporangia-bearing cases) arising at the base of the leaves, numerous per sporocarp _____ (*Pilularia*) **Marsileaceae**
      3. Leaves compound or simple, with expanded blades OR leaves needle-like or scale-like, neither grass-like nor thread-like; spore-bearing structures neither embedded in leaf bases nor on very short stalks (1–2 mm long) at leaf bases; plants rooted in various substrates including mud or soil or on rocks or tree trunks.
         5. Leaf blades deeply 4-parted (resembling a 4-leaf clover) on petioles usually much longer than the blades; sporangia in sporocarps borne near the base of the plant __ (*Marsilea*) **Marsileaceae**
         5. Leaf blades variously compound or simple but not 4-parted; petioles usually much shorter than leaf blades to absent; sporangia not in sporocarps near the base of the plant.
            6. Leaves 8 mm or less long; plants with numerous, small, usually overlapping or divergent, scale-like or needle-like leaves with a single unbranched vein (this type of leaf is

a microphyll); stems well-exposed above the ground surface, covered with the numerous small leaves; sporangia in the axils of the microphylls, these often aggregated into cone-like strobili.

7. Sporangia in cylindrical strobili at the tips of elongate, distinctly erect, leafy, fertile stems; leaves 4–8 mm long; plants homosporous (= with 1 spore type of a single size) _____ (*Lycopodiella*) **Lycopodiaceae**

7. Sporangia in ± 4-angled strobili at the tips of leafy stems; fertile stems ascending or spreading, not distinctly erect; leaves 1–3 mm long; plants heterosporous (= with 2 spore types which are of different sizes) _____ (*Selaginella*) **Selaginellaceae**

6. Leaves usually much more than 10 mm long; plants with relatively few large leaves with numerous branched veins (this type of leaf is a megaphyll); stems underground rhizomes or short crowns or caudices, not well-exposed above the ground surface and relatively inconspicuous; sporangia in clusters (= sori) on the surface of the leaf blades (the blades can sometimes be considerably modified).

8. Plants with 1(–2) leaves per stem; leaves with 2 distinct parts, the sterile portion either entire or ternately (= in 3 parts) to pinnately compound to dissected, the fertile portion being an elongate stalk with a spike-like or panicle-like sporangia-bearing terminal part _____ **Ophioglossaceae**

8. Plants usually with numerous leaves per stem; leaves not as described above.

9. Lowermost 2 pinnae (= primary divisions of a leaf, here one on each side of the leaf) of the fertile leaf greatly elongated and bearing the sporangia near their tips _____ (*Anemia*) **Anemiaceae**

9. Lowermost 2 pinnae of the fertile leaf neither greatly elongated nor bearing the sporangia near their tips.

10. Sori linear-oblong, in one row on each side of, immediately adjacent to, and parallel with the costae (= midveins of the pinnae) or costules (= midveins of the pinnules), chain-like in arrangement _____ (*Woodwardia*) **Blechnaceae**

10. Sori various, but arrangement not chain-like in one row on each side of, immediately adjacent to, and parallel with the costae or costules.

11. Fertile and sterile leaves either completely different OR fertile portion of fertile leaves essentially without any blade tissue (leaves extremely dimorphic).

12. Fertile leaves completely different from sterile leaves, essentially without photosynthetic tissue, solely sporangia-bearing, glabrous; sterile leaves 1-pinnatifid (= deeply divided but not completely pinnate), the rachis (= central axis of a fern frond/leaf) with a conspicuous flange or wing of photosynthetic tissue _____ (*Onoclea*) **Dryopteridaceae**

12. Fertile leaves either with numerous ± normal photosynthetic pinnae OR fertile leaves with conspicuous pubescence; sterile leaves pinnate (= pinnae narrowed to petiole-like attachment to rachis, the rachis without a flange or wing of photosynthetic tissue except possibly at very tip of blade) _____ (*Osmunda*) **Osmundaceae**

11. Fertile and sterile leaves or portions of leaves similar or somewhat modified, the fertile portion never so different as to be without blade tissue (leaves not extremely dimorphic).

13. Sori marginal or submarginal (= located at or near the edges of the leaves) with leaf margins recurved over the sori, protecting them and forming a false indusium (= thin scale-like outgrowth covering the clusters of sporangia) (except not recurved in *Astrolepis* which has stellate or coarsely ciliate scales on the adaxial leaf surfaces).

14. Plants stout, to 1 m or more tall; leaf blades triangular in shape or nearly so, with 3 main divisions (each division usually bipinnate); petioles grooved, greenish or ± straw-colored; stems and petiole bases with slender hairs but without scales ___ (*Pteridium*) **Dennstaedtiaceae**
14. Plants slender, usually 0.1–0.5 m tall; leaf blades neither triangular nor with 3 main divisions; petioles rounded, often dark brown or black; stems and petiole bases generally with scales _____ **Pteridaceae**

13. Leaf margins never recurved to form a false indusium; sori variously located on the abaxial (= beneath) leaf surfaces, often near veins, occasionally near the margins of the leaves; adaxial leaf surfaces without stellate or coarsely ciliate scales.
15. Sori elongate along the veins; leaf blades 1-pinnate _____ (*Asplenium*) **Aspleniaceae**
15. Sori round or variously shaped, not elongate (in our species, except elongate in *Athyrium* with leaf blades 2-pinnate-pinnatifid); leaf blades in our species 1-pinnatifid, 1-pinnate, or more than 1-pinnate.
16. Leaf blades in our species only 1-pinnate or 1-pinnatifid (pinnae not further subdivided into pinnules).
17. Leaf blades only pinnatifid (in our species), divided nearly but not all the way to the rachis (= midrib); pinnae essentially as wide at base as towards their tips; margins of pinnae (in our species) without any teeth or basal auricles _____ (*Pleopeltis*) **Polypodiaceae**
17. Leaf blades pinnate, divided all the way to the rachis; pinnae narrowed basally to a very narrow petiole-like attachment to the rachis; pinnae with small teeth on the margins, sometimes with basal auricles _____ **Dryopteridaceae** (in part)
16. Leaf blades more than 1-pinnate, the pinnae themselves either pinnate or pinnatifid.
18. Ultimate leaf segments variously incised, serrate, dentate, crennate, or lobulate, not entire; sori round or elongate; indusia elongate or splitting into spreading lobes _____ **Dryopteridaceae** (in part)
18. Ultimate leaf segments entire; sori round; indusia round to kidney-shaped _____ (*Thelypteris*) **Thelypteridaceae**

Key to Gymnosperms

1. Shrubs 0.25–1 m tall OR plants with clambering vine-like habit; leaves inconspicuous, the main photosynthetic structures being the green to gray-green or yellow-green stems; stems ± jointed; seed-producing cones 6–12 mm long, the scales thin, the inner scales becoming fleshy and red; longest internodes 1–8 cm long; plants neither resinous nor fragrant (Gnetophyta) _____ **Ephedraceae**
1. Trees or shrubs much more than 1 m tall; leaves conspicuous (though often small) and serving as the primary photosynthetic structures; stems not jointed; seed-producing cones either large (15 mm or more long) and woody or small (to 10 mm long), berry-like, and blue to bluish black, bluish purple, reddish, or copper-colored; longest internodes usually 0–1 cm long; plants usually resinous and fragrant (Pinophyta).
   2. Adult foliage leaves needle-like, not flattened, 50–450 mm long, in fascicles of 2–5 surrounded at the base by a membranous sheath; seed-producing cones 40 mm or more long (often much longer) _____ **Pinaceae**
   2. Adult foliage leaves scale-like OR flat and linear, ca. 15 mm or less long, not in fascicles; seed-producing cones 5–25(–40) mm long _____ **Cupressaceae**

Key to Aquatic Plants

1. Entire plants (single unit or small chain-like cluster) small, usually less than 2 cm long, lacking leaves or stems OR with minute leaves 1 mm or less in diam.; plants floating-free on the surface or just beneath.
   2. Plants with numerous very small leaves; minute branching stems present _____ (*Azolla*) **Azollaceae**
   2. Plants of 1–several joints or thalli, not differentiated into leaves or stems _____ **Lemnaceae**
1. Entire plants more than 2 cm long; leaves and/or stems present; plants free-floating or bottom-rooted.
   3. Plants reproducing by spores produced in basal sporangia or sporocarps, without flowers, fruits, or seeds; leaves either linear and grass-like or narrowly filiform (= thread-like) OR with 4 leaflets (resembling a 4-leaf clover) (Ferns and Similar Plants).
      4. Leaves simple, linear, grass-like or thread-like, the blades not expanded.
         5. Leaves tightly clustered together (plants superficially resembling a green onion), arising from a corm-like rootstock, quill-like (larger at base); sporangia embedded in the leaf bases, borne one per leaf _____ (*Isoetes*) **Isoetaceae**
         5. Leaves scattered along a creeping rhizome, separate, not clustered; sporangia in stalked (stalks 1–2 mm long) globose, hairy sporocarps arising at the base of the leaves, numerous per sporocarp _____ (*Pilularia*) **Marsileaceae**
      4. Leaf blades expanded, deeply 4-parted (resembling a 4-leaf clover), on petioles usually much longer than the blades _____ (*Marsilea*) **Marsileaceae**
   3. Plants reproducing by flowers, fruits, and seeds; leaves various (Flowering Plants).
      6. Leaves (or stems if plants leafless) all attached at base of the plant.
         7. Plants with leaves (possibly leaf-like branches) or branches either thread-like or divided into thread-like segments, with numerous, small, bladder-like traps for capturing small organisms; corollas bilaterally symmetrical, spurred, yellow _____ (*Utricularia*) **Lentibulariaceae**
         7. Plants with linear to lanceolate, elliptic, ovate, or orbicular leaves OR plants leafless with unbranched, cylindrical or thread-like, green stems, without bladder-like traps; corollas not as above.
            8. Leaves modified into hollow, tubular, trumpet-shaped pitchers _____ (*Sarracenia*) **Sarraceniaceae**
            8. Leaves not modified into pitchers.
               9. Leaf blades linear to lanceolate, entire OR plants leafless with unbranched, cylindrical or thread-like, green stems about as thick as wide (these sometimes flattened).

10. Plants completely submersed aquatics; male flowers numerous, tiny, breaking from a spathe and free-floating at maturity; female flowers solitary in pedunculate spathes at the water surface at flowering time _____ (*Vallisneria*) **Hydrocharitaceae**

10. Plants partly emergent; flowers borne above the water surface.

11. Plants without obvious leaves (only bladeless sheaths present), with unbranched, cylindrical or thread-like, green stems about as thick as wide (these sometimes flattened); perianths absent or of inconspicuous bristles or small scales _____ **Cyperaceae**

11. Plants with obvious leaves (rarely reduced to bracts); perianths conspicuous, white or yellow OR inconspicuous, but with conspicuous whitish hairs.

12. Leaves without distinct petioles; flowers in a single, small (up to 30 mm long), dense head or spike terminating an elongate naked scape, the head or spike either cone-like with numerous, overlapping, brownish, thin, ± woody bracts (subtending yellow flowers) OR head whitish or grayish due to numerous hairs on the subtending involucral bracts and flower parts.

13. Inflorescences cone-like, with spirally imbricated, brownish, thin, ± woody bracts; flowering inflorescences usually with a single yellow flower exposed _____ (*Xyris*) **Xyridaceae**

13. Inflorescences small whitish or grayish heads, not cone-like, lacking brownish woody bracts; flowering inflorescences without yellow flowers _____ (*Eriocaulon*) **Eriocaulaceae**

12. Leaves with distinct spongy petioles; flowers in whorls on an elongate inflorescence _____ **Alismataceae**

9. Leaf blades elliptic to ovate to orbicular, entire, shallowly toothed, or lobed.

14. Plants free-floating, with abundant and conspicuous roots in water.

15. Leaves distinctly petiolate, the petioles swollen, ca. as long as the blade or longer, the blades glabrous; perianth 4–6 cm long, bluish lavender, the upper segment with a yellow spot, very showy _____ (*Eichhornia*) **Pontederiaceae**

15. Leaves sessile, velvety-hairy; perianth absent _____ (*Pistia*) **Araceae**

14. Plants rooted in bottom (broken off stem sections can sometimes be found free-floating but these without abundant conspicuous roots).

16. Leaf blades with wide, rounded teeth or shallow lobes; largest leaf blades 8 cm or less broad, often nearly orbicular _____ **Apiaceae**

16. Leaf blades entire or nearly so (but basal notch often present); largest leaf blades 5–90 cm or more long or broad, variously shaped.

17. Plants emergent, 1–2 m tall; flowers 1 cm long or less, purplish; inflorescence a panicle with zigzag branches and a striking white-powdery appearance _____ (*Thalia*) **Marantaceae**

17. Plants without the above combination.

18. Inflorescence a fleshy spike (= spadix) with a yellow or creamy white leafy bract (= spathe) subtending or enclosing it; flowers very small, numerous and crowded on the spike, individually inconspicuous; perianth absent or minute _____ **Araceae**

18. Inflorescence not a fleshy spike; individual flowers large and conspicuous, individually easily seen even at a glance; perianth obvious.

19. Petals 3 (or apparently 6 due to 3 colored, petal-like sepals in some species); leaf blades not lying flat on water surface, variously shaped (elliptic, ovate, often sagittate), but never peltate

and usually without a single, more or less parallel-sided, basal notch (except in *Pontederia*), usually longer than wide.

20. Perianth with a well-developed tube, white to purplish blue, with one petal having a pair of light yellow dots at base OR blue with yellow markings; pistils solitary per flower, made up of a single carpel or of several carpels fused together; fruits various, 1–many-seeded; stamens 3 or 6 _____ **Pontederiaceae**

20. Perianth without a tube, white or rarely pink; pistils numerous per flower, free from each other or nearly so, each pistil developing into a 1-seeded indehiscent fruit (achene); stamens 6–numerous _____ **Alismataceae**

19. Petals numerous; leaf blades often lying flat on water surface (under dry conditions sometimes above the water), either peltate OR with a single more or less parallel-sided basal notch (never sagittate), usually nearly as wide as long.

21. Leaf blades peltate, not notched; pistils (and later fruits) sunken into the greatly enlarged, inverted-conical receptacle; fruiting stalks held well above the water surface; fruits nutlike _____ (*Nelumbo*) **Nelumbonaeaceae**

21. Leaf blades not peltate, the petiole attached at base of deep notch in blade; pistils not sunken into the receptacle; fruits maturing underwater; fruits fleshy _____ **Nymphaeaceae**

6. Leaves not all attached at base of plant, rather borne along the stems.

22. Leaves pinnately divided.

23. Leaf divisions broad, flat, blunt; fruits many-seeded, 2-valved, dehiscent, linear capsules; stamens 6 per flower (2 short, 4 long) _____ (*Rorippa*) **Brassicaceae**

23. Leaf divisions linear or thread-like, pointed; fruits indehiscent, either nutlets OR 4–lobed and eventually splitting into 4 nutlets; stamens 3, 4, or 8 per flower _____ **Haloragaceae**

22. Leaves not pinnately divided.

24. Leaves all opposite or whorled.

25. Leaves in distinct whorls of 3–8, giving the stem a "bottle brush" appearance; plants completely submersed; flowers (male and/or female) borne to the water surface on a thread-like stalk 3–6 cm long; perianths 3–10 mm long, white or translucent, visible with the naked eye _____ **Hydrocharitaceae**

25. Leaves opposite, or if whorled, the stem not appearing like a "bottle brush"; plants completely submersed OR partly floating OR partly emergent; flowers and perianths various.

26. Leaves deeply palmately divided or dichotomously forked, the ultimate segments linear or thread-like.

27. Leaves usually opposite (rarely whorled); perianth usually whitish (rarely purplish or yellowish), 4–12 mm long; small (blades ca. 1–3 cm long), alternate, peltate, entire, floating leaves usually present in addition to deeply palmately divided leaves _____ (*Cabomba*) **Cabombaceae**

27. Leaves whorled; perianth absent; floating leaves absent (algae in the Characeae with whorled "branches" can superficially resemble *Ceratophyllum*; however, *Ceratophyllum* can be recognized by the dichotomously forked leaves) _____ (*Ceratophyllum*) **Ceratophyllaceae**

26. Leaves entire or with small teeth to undulate-dentate or coarsely so, neither palmately divided nor dichotomously forked.

28. Leaves (2–)3–60 mm wide, linear to lanceolate to spatulate to suborbicular.
    29. Inflorescences silvery whitish pedunculate heads lacking corollas (silvery whitish color due to numerous tepals and bracts) _____ (*Alternanthera*) **Amaranthaceae**
    29. Inflorescences various, but not silvery whitish pedunculate heads with numerous bracts and tepals; corollas present OR absent.
        30. Corollas white to cream, violet, lavender, pale blue, pink, rose-purple, or red-purple, sometimes with darker markings, sometimes quickly deciduous.
            31. Corollas sympetalous, slightly to strongly bilaterally symmetrical, usually 2-lipped, 6–28 mm long; calyces 5-merous; flowers axillary OR in pedunculate heads or spikes.
                32. Flowers in pedunculate heads or spikes; seeds 2–4 per fruit _____ (*Justicia*) **Acanthaceae**
                32. Flowers axillary; seeds 12 or more per fruit _____ **Scrophulariaceae**
            31. Corollas of separate petals, radially symmetrical, 2.5 mm or less long; calyces 4-merous; flowers axillary _____ **Lythraceae**
        30. Corollas yellow OR absent.
            33. Corollas slightly to strongly bilaterally symmetrical, often 2-lipped, with a definite tube _____ **Scrophulariaceae**
            33. Corollas if present radially symmetrical, without a definite tube, either of separate petals OR rotate with petals united only at base.
                34. Flowers in umbels; petals united at base; leaves suborbicular; ovaries superior _____ (*Nymphoides*) **Menyanthaceae**
                34. Flowers solitary in the leaf axils; petals separate or absent; leaves lanceolate to spatulate to suborbicular; ovaries inferior _____ (*Ludwigia*) **Onagraceae**
28. Leaves 3 mm or less wide, variously shaped, often linear.
    35. Leaves obviously toothed to the naked eye _____ (*Najas*) **Hydrocharitaceae**
    35. Leaves not obviously toothed to the naked eye.
        36. Leaf blades linear or thread-like, mostly < than 1 mm wide; a rosette of floating leaves never present.
            37. Leaf blades usually very minutely denticulate (under a scope); fruits not stipitate, without a beak _ (*Najas*) **Hydrocharitaceae**
            37. Leaf blades entire; fruits short stipitate (= stalked), also with a beak to 1.5 mm long _____ (*Zannichellia*) **Zannichelliaceae**
        36. Leaf blades linear to obovate, at least the uppermost usually 1–3 mm wide; a rosette of floating leaves sometimes present.
            38. Stipules present; flowers perfect; fruits subglobose cap sules; leaves not forming rosettes at the stem tips _____ (*Elatine*) **Elatinaceae**
            38. Stipules absent; flowers imperfect, the plants monoecious; fruits somewhat flattened laterally, often slightly heart-shaped and appearing to have 2 lobes, eventually splitting into 4 achene-like mericarps; leaves sometimes forming rosettes at the stem tips _____ (*Callitriche*) **Callitrichaceae**

24. Leaves alternate, at least on lower part of stem.

39. Leaf blades peltate, floating (submersed dissected leaves can also be present) _____ **Cabombaceae**

39. Leaf blades not peltate, either floating OR not floating.

40. Leaves of 2 kinds, the emersed leaves toothed, the submersed leaves deeply pinnatifid or pectinate _____ (*Proserpinaca*) **Haloragaceae**

40. Leaves of 1 or 2 kinds, but none either deeply pinnatifid or pectinate.

41. Leaves palmately compound or palmately divided (segments not thread-like) _____ (*Ranunculus*) **Ranunculaceae**

41. Leaves entire or finely toothed OR leaves (possibly leaf-like branches) irregularly or palmately divided into thread-like segments.

42. Leaves (possibly leaf-like branches) or branches irregularly or palmately divided into linear, thread-like segments; plants with numerous, small, bladder-like traps for capturing small aquatic organisms _____ (*Utricularia*) **Lentibulariaceae**

42. Leaves entire or finely toothed; plants without bladder-like traps.

43. Perianth parts greenish, unequal, one of them differentiated into a lip divided into three narrow lobes and extended at base into a spur 9–14 mm long _____ (*Habenaria*) **Orchidaceae**

43. Perianth parts equal, white, green, or yellow OR absent OR reduced to bristles or scales, none differentiated into a lip; spur absent.

44. Plants large (1–3 m tall) emergents with linear leaves and an extremely dense, large (12–40 cm long), cylindrical, brownish spike with thousands of very tiny flowers _____ (Typha) **Typhaceae**

44. Plants not as above.

45. Leaves ovate, cordate basally; inflorescences spike-like, 10–20(–30) cm long, 10–15 mm in diam., erect, the tip often drooping, of numerous (to 300 per inflorescence), crowded, whitish flowers _____ (*Saururus*) **Saururaceae**

45. Leaves usually much narrower than ovate, not cordate basally; inflorescences not as above.

46. Leaves differentiated into a basal tubular sheath surrounding the stem and a terminal, usually elongate, linear, parallel-sided blade; petioles not present.

47. Perianth present, of 6 small scaly segments; fruits 3–many-seeded; flowers not subtended by chaffy, scale-like bracts _____ **Juncaceae**

47. Perianth absent or reduced to bristles or rarely of 3 small scales; fruits 1-seeded; each flower usually subtended by 1–2 chaffy, scale-like bracts.

48. Leaves usually 2-ranked with sheath split down one side; stems with hollow internodes, round, typically jointed (nodes obvious); flowers usually each subtended by 2 bracts (lemma and palea), additional bracts (glumes, sterile lemmas) also sometimes present _____ **Poaceae**

48. Leaves usually 3-ranked with sheath closed; stems with solid internodes, rounded or often triangular, typically not jointed; flowers usually each subtended by 1 bract _____ **Cyperaceae**

46. Leaves not differentiated into a basal sheath and a terminal blade (but may have sheathing stipules); petioles usually present and clearly differentiated from blades.
    49. Leaves either all submersed or some submersed and some floating; perianth absent OR pale yellow with an elongated filiform tube; leaf blades usually parallel-veined or with concentrically curved veins about equally prominent from base to tip.
        50. Flowers in pedunculate, often dense spikes; perianth absent; leaves all submersed or some floating _____ **Potamogetonaceae**
        50. Flowers solitary; perianth present, pale yellow with an elongated filiform tube; leaves all submersed _____ (*Heteranthera*) **Pontederiaceae**
    49. Leaves often borne on stems emergent from the water; colorful perianth often present; leaf blades 1-veined OR with branched or irregular veins.
        51. Plants armed with 1–2 spines per node; corollas blue (rarely white), showy, 11–17 mm long _____ (*Hydrolea*) **Hydrophyllaceae**
        51. Plants unarmed; corollas if present usually much smaller, never blue.
            52. Corollas sympetalous; ovaries inferior; stamens inserted near middle of corolla tube _____ (*Sphenoclea*) **Sphenocleaceae**
            52. Corollas (or perianth) of separate parts; ovaries superior OR inferior; stamens not attached to perianth.
                53. Sheathing stipules (= ocrea) present at base of petiole; fruit a 2- or 3-sided, 1-seeded nutlet; perianth usually white to pink; ovaries superior _____ (*Polygonum*) **Polygonaceae**
                53. Sheathing stipules absent at base of petiole; fruit a many-seeded capsule; perianth yellow or absent; ovaries inferior _____ (*Ludwigia*) **Onagraceae**

Key to Woody Vines

MODIFIED FROM
WOODY VINES OF THE SOUTHEASTERN STATES
DUNCAN (1967)

1. Leaves compound (in *Cissus* some leaves, but not all, only deeply 3-parted).
   2. Leaves opposite.
      3. Plants climbing by aerial roots; corollas tubular, red-orange; stamens 4; each flower producing a single capsule _____ **Campsis**
      3. Plants climbing by twisting leaf stalks; corollas absent, but the 4(–6) sepals petal-like and separate, white to lavender to blue-purple or red; stamens numerous; each flower producing numerous achenes (these often with long plumose beaks) _____ **Clematis**
   2. Leaves alternate.
      4. Plants armed, the stems with prickles; pistils 12 or more per flower; fruits aggregates of druplets or achenes.
         5. Hypanthium globose to urn-shaped, with a constricted opening, the achenes concealed inside (the hypanthium is termed a hip, is smooth in outline and typically red or reddish orange) _____ **Rosa**
         5. Hypanthium flat or hemispheric, the ovules and drupelets conspicuously exposed (the cluster of druplets is commonly termed a blackberry or dewberry and is lumpy in outline and red to dark purple or black) _____ **Rubus**
      4. Plants unarmed, the stems without prickles; pistils 1 per flower; fruits drupaceous, legumes, or berries.
         6. Plants climbing by aerial roots; leaves with 3 (or rarely 5) leaflets, pinnate; fruits drupaceous _____ **Toxicodendron**
         6. Plants climbing by twining or by tendrils (the tendrils are sometimes similar to roots; they sometimes have adhesive discs at their tips); leaves with 3–many leaflets, palmate or pinnate; fruits legumes or 1–4-seeded berries.
            7. Stems twining, the plants without tendrils; fruits legumes.
               8. Leaflets 3, the largest 10 cm or more long _____ **Pueraria**
               8. Leaflets 7–19, the largest less than 10 cm long _____ **Wisteria**
            7. Stems not twining, the plants with tendrils (the tendrils sometimes have adhesive discs at their tips); fruits 1–4-seeded berries.
               9. Leaves 2-pinnately or (partially 3-pinnately) compound, the leaflets many _____ **Ampelopsis**
               9. Leaves once palmately compound (or apparently so), the leaflets 3–7.
                  10. Leaves with 3 leaflets, conspicuously fleshy; inflorescences resembling compound umbels; flowers 4-merous; leaflets and petioles falling apart when pressed and dried _____ **Cissus**
                  10. Leaves with (3–)5–7 leaflets, usually not fleshy; inflorescences paniculate, racemose, or cymose; flowers 5-merous; leaflets and petioles usually not falling apart when pressed and dried _____ **Parthenocissus**
1. Leaves simple (some deeply lobed).
   11. Leaves opposite or rarely whorled.
      12. Sap milky; leaf blades often (but not always) cordate basally; corollas with a corona.
         13. Plants woody nearly throughout; leaf blades acute to broadly rounded basally; corollas brown-purple; introduced species _____ **Periploca**
         13. Plants woody only in lower half; leaf blades cordate (in nc TX species) basally; corollas white to cream or greenish white; native species _____ **Cynanchum**
      12. Sap not milky (except in *Trachelospermum*); leaf blades not cordate basally; corollas without a corona.

14. Corollas often bilaterally symmetrical (sometimes nearly radially symmetrical); uppermost leaves united around stem OR not so; fruits fleshy berries _____ **Lonicera**

14. Corollas radially symmetrical; uppermost leaves not united around stem; fruits dry and dehiscent at maturity.

15. Leaves evergreen, leathery; corollas conspicuously yellow, with tube > 15 mm long; fruits 2-celled capsules, flattened contrary to the partition; seeds without hairy tufts at ends _____ **Gelsemium**

15. Leaves evergreen or deciduous, leathery OR not so; corollas creamy white to pale yellow, with tube 10 mm or less long; fruits of twin follicles; seeds with hairy tufts at ends _____ **Trachelospermum**

11. Leaves alternate.

16. Pith lacking, the stems solid except sometimes for scattered pores, with scattered vascular strands; tendrils arising in pairs from the petioles of leaves; plants often armed, with prickles often present on stems _____ **Smilax**

16. Pith present or stems rarely hollow; tendrils absent or if present not arising from the petioles of leaves; plants unarmed, prickles absent.

17. Plants climbing by tendrils or aerial roots.

18. Plants climbing by aerial roots; leaves evergreen; inflorescences umbels (solitary or racemosely arranged) OR flowers hidden from view inside a hollow receptacle; introduced species.

19. Leaf blades usually 3–5 lobed; sap not milky; flowers and fruits (small 3–5-seeded berries) in solitary or racemosely arranged umbels _____ **Hedera**

19. Leaf blades unlobed; sap milky; flowers and fruits hidden from view inside a hollow receptacle _____ **Ficus**

18. Plants climbing by tendrils; leaves deciduous; inflorescences various, but flowers neither in umbels nor hidden inside a hollow receptacle; mostly native species.

20. Leaf blades entire, ovate, not lobed; petioles dilated at base and extending into a minutely pubescent ring (stipular) surrounding the stem; tendrils limited to the ends of the branches; stems grooved _____ **Brunnichia**

20. Leaf blades toothed or lobed, or if unlobed or entire the stems not grooved (sometimes with soft corky ridges); petioles not as above; tendrils opposite leaves and thus apparently lateral to stems although basically terminal.

21. Petioles bearing two stalked glands between the middle of the petiole and the blade; stems, except youngest, with tight almost white corky longitudinal strips or sometimes covered with the cork; flowers and fruits one per pedicel, solitary to two in leaf axils _____ **Passiflora**

21. Petioles with glands absent; stems lacking the whitish cork, the older stems sometimes with rough brownish bark or the brownish bark sometimes shredding; flowers and fruits several to many in clusters attached opposite leaves.

22. Tendrils with slender, pointed, curling tips; native species.

23. Inflorescences cymes, wider than long, dichotomously forking; leaf blades truncate to cordate at base; plants essentially glabrous; year-old stems having white continuous pith; petals spreading at flowering time and later dropping singly; mature fruits a turquoise blue, not edible; bark of stems tight _____ **Ampelopsis**

23. Inflorescences panicles, longer than wide, not dichotomously forking; leaf blades cordate at base; plants densely pubescent to nearly glabrate; year-old stems having brown pith with cross

partitions at the nodes, except in *V. rotundifolia*; petals separating only at their bases and falling as a unit; mature fruits black or purple, edible although sometimes sour or bitter; bark of stems of most species loosening into elongated flakes or shreds _____ **Vitis**

22. Tendrils with small, disk-like tips; introduced ornamentals _____ **Parthenocissus**

17. Plants climbing by twining.
    24. Leaf blades palmately veined.
        25. Petioles attached inside the edge of the leaf blade on the underside (occasionally on some leaves by as little as 1 mm) _____ **Menispermum**
        25. Petioles joining the edge of the leaf blade at blade base.
            26. Leaf blades not lobed, cordate to broadly ovate; fruits capsules; calyces curved, pipe-like in shape _____ **Aristolochia**
            26. Leaf blades usually slightly to deeply lobed; fruits drupes; calyces not curved.
                27. Lower surface of leaf blades glabrous beneath except for sparse hairs on the larger veins; drupes black, 15–25 mm long and flattened only on one side; leaf blades deeply 3–5-lobed, the middle lobe narrower at the base than in the middle, the tips of lobes sharply pointed but not mucronate; at least seven veins arising from blade base, the lowermost ones often obscure; bud area neither vertically elongate nor hairy _____ **Calycocarpum**
                27. Lower surface of leaf blades silky pubescent; drupes red, 5–8 mm long and flattened on both sides; leaf blades usually only slightly lobed (but variable, ranging from unlobed to 3–5-lobed), the tips of the blades mucronate; not more than 5 (rarely 7) veins arising from the blade base, the lowermost ones often obscure; bud area vertically elongate and densely hairy _____ **Cocculus**
    24. Leaf blades pinnately veined.
        28. Pinnate veins of leaf blades nearly straight, evenly spaced, and parallel; margins of leaf blades entire or obscurely crenate _____ **Berchemia**
        28. Pinnate veins of leaf blades neither straight, evenly spaced, nor parallel; margins of leaf blades with distinct and rather uniformly distributed serrations _____ **Celastrus**

Key to Families of Monocots

1. Leaf blades palmately divided, fan-like, up to 1 m or more wide; plants palm-like (Palmae) _____ **Arecaceae**
1. Leaf blades simple or pinnatifid, usually much narrower; plants not palm-like.
    2. Plants epiphytic (growing on branches of other plants, without roots in the ground) _____ (*Tillandsia*) **Bromeliaceae**
    2. Plants terrestrial or aquatic.
        3. Plants small (of 1–several fronds or thalli each ca. 1 cm or less long), floating aquatics, without definite stems or leaves _____ **Lemnaceae**
        3. Plants not as above, usually much larger, terrestrial OR aquatic and rooted in substrate OR floating; stems or leaves distinguishable.
            4. Stems woody.
                5. Leaves many, clustered close together, either all basal or in a crown, long and sword-

like (usually 0.2 m to > 0.5 m long); inflorescences large terminal racemes or panicles with conspicuous flowers _____ **Agavaceae**

5. Leaves conspicuously scattered all along the elongate stem, not long and sword-like (0.25 m or less long); inflorescences not as above; flowers inconspicuous.
   6. Plants climbing or trailing vines with prickles and/or tendrils; fruits black or blue-black berries; leaf sheaths absent _____ (*Smilax*) **Smilacaceae**
   6. Plants erect, without prickles or tendrils; fruits caryopses; leaf sheaths present _____ **Poaceae**

4. Stems herbaceous (not woody).
   7. Plants aquatics growing completely submersed; leaves opposite or whorled.
      8. Leaves opposite (some can occasionally appear whorled where branches arise); flowers sessile or subsessile, borne underwater; perianth absent or minute, clearish or greenish, virtually indistinguishable without a lens.
         9. Leaves obviously toothed to the naked eye _____ (Najas) **Hydrocharitaceae**
         9. Leaves not obviously toothed to the naked eye.
            10. Leaf blades usually very minutely denticulate (under a scope), sheathing basally; fruits not curved, not short stipitate, without a beak; flowers with a single carpel; sheathing stipules not present _____ (*Najas*) **Hydrocharitaceae**
            10. Leaf blades entire, not sheathing basally; fruits curved, short stipitate (= stalked), also with a beak to 1.5 mm long; flowers with 2–8 separate carpels; sheathing stipules present _____ (*Zannichellia*) **Zannichelliaceae**
      8. Leaves in distinct whorls of 3–8; flowers (staminate and/or pistillate) borne to the water surface on a thread-like stalk 3–6 cm long; perianth (staminate and/or pistillate) 3–10 mm long, white or translucent, visible with the naked eye _____ **Hydrocharitaceae**
   7. Plants terrestrial or aquatic; if leaves completely submersed then alternate or basal.
      11. Plants free-floating aquatics with leaves in rosettes.
         12. Leaves distinctly petiolate, the petioles swollen, ca. as long as the blades, or longer, the blades glabrous; perianth 4–6 cm long, bluish lavender, the upper segment with a yellow spot, very showy _____ (*Eichhornia*) **Pontederiaceae**
         12. Leaves sessile, velvety-hairy; perianth absent _____ (*Pistia*) **Araceae**
      11. Plants not free-floating, either terrestrial or aquatic, but rooted in substrate; leaves variously arranged.
         13. Plants completely submersed rooted aquatics with elongate, linear, basal leaves; flowers at the water surface, the inflorescences never extending above the water _____ (*Vallisneria*) **Hydrocharitaceae**
         13. Plants either terrestrial or aquatic, with leaves various; if aquatic then flowers held above the water surface.
            14. Plants without obvious leaves (only bladeless sheaths present), with unbranched, cylindrical or thread-like, green stems about as thick as wide (these sometimes flattened); perianth absent or of inconspicuous bristles or small scales _____ **Cyperaceae**
            14. Plants usually with obvious leaves (rarely reduced to bracts); perianth various, ranging from conspicuous to absent.
               15. Flowers in a single, small (up to 30 mm long), dense head or spike terminating an elongate naked scape, the head or spike either cone-like with numerous, overlapping, brownish, thin, ± woody bracts (subtending yellow flowers) OR head whitish or grayish due to numerous hairs on the subtending involucral bracts and flower parts.
                  16. Inflorescence cone-like, with spirally imbricated, brownish, thin, ± woody bracts, usually with a single yellow flower exposed per inflorescence _____ (*Xyris*) **Xyridaceae**

16. Inflorescence a small whitish or grayish head, not cone-like, lacking brownish woody bracts, without yellow flowers _ (*Eriocaulon*) **Eriocaulaceae**

15. Flowers not in a single, small, dense head or spike terminating an elongate naked scape; head or spike neither cone-like with numerous overlapping brownish bracts nor whitish nor grayish due to numerous hairs on the bracts and flower parts.
    17. Flowers and fruits in the axils of imbricate (= overlapping) or distichous (= 2-ranked) scales, concealed by the scales at least when young; fruits 1-seeded; perianth absent or represented by bristles or small scales (GRASSES and SEDGES).
        18. Stems typically round or flat in cross-section but never triangular, typically jointed (nodes obvious), with hollow internodes; leaves usually 2-ranked, with sheaths normally split lengthwise on the side opposite the blade; each flower usually subtended by 2 scales _____ **Poaceae**
        18. Stems round or often triangular, typically not jointed, with solid internodes; leaves usually 3-ranked, with sheaths continuous around the stem or splitting only in age or leaves reduced to sheaths only; each flower usually subtended by 1 scale _____ **Cyperaceae**
    17. Flowers and fruits not in the axils of imbricate or distichous scales, not concealed by scales, or if so, fruits more than 1-seeded; perianth absent or present, sometimes petal-like or with conspicuous petals.
        19. Inflorescence a fleshy spike (= spadix) of numerous, small, imperfect flowers, the inflorescence enclosed in a specially modified bract (= spathe) or diverging at an angle from the side of a spathe-like structure.
            20. Plants with elongate, linear, sword-like, parallel-veined leaves; spadix diverging from the side of, but not enclosed in, an elongate linear spathe-like structure _____ (*Acorus*) **Acoraceae**
            20. Plants without elongate, linear, sword-like, parallel-veined leaves; spadix enclosed in a spathe _____ **Araceae**
        19. Inflorescence not a fleshy spike; flowers usually perfect; inflorescence neither enclosed in a spathe nor diverging at an angle from the side of a spathe-like structure.
            21. Plants large (1–3 m tall) emergents with an extremely dense, large (12–40 cm long), brownish spike with thousands of very tiny flowers _____ (*Typha*) **Typhaceae**
            21. Plants not as above.
                22. Corollas absent; plants aquatic with submersed or floating leaves; fruits drupe-like, 1-seeded _____ *(Potamogeton*) **Potamogetonaceae**
                22. Corollas present; plants terrestrial or aquatic; fruits capsules, berries, or achenes (if achenes, these usually winged).
                    23. Plants climbing vines.
                        24. Plants with tendrils; leaves alternate; flowers in pedunculate or sessile axillary umbels; ovary superior; fruits berries _____ (*Smilax*) **Smilacaceae**
                        24. Plants without tendrils, climbing by twining;

leaves (at least of lower nodes) opposite or whorled; flowers in paniculate or spike-like inflorescences; ovary inferior; fruits capsules _____ (*Dioscorea*) **Dioscoreaceae**

23. Plants not climbing vines.
    25. Plants 1–2 m tall; flowers 1 cm long or less, purplish; inflorescence a panicle with zig-zag branches and a striking white-powdery appearance _____ (*Thalia*) **Marantaceae**
    25. Plants without the above combination.
        26. Ovary inferior.
            27. Plants very small, 5–20 cm tall; stems delicately thread-like; leaves scale-like (5 mm or less long); flowers small (to 5 mm long), greenish white or cream, sometimes tinged with blue _____ (*Burmannia*) **Burmanniaceae**
            27. Plants usually > 20 cm tall; stems not thread-like; leaves not scale-like (except in saprophytic species); flowers small OR often large, variously colored.
                28. Stamens 6; flowers radially symmetrical _____ **Liliaceae**
                28. Stamens 3 or less; flowers radially symmetrical or bilaterally symmetrical.
                    29. Flowers radially symmetrical; stamens 3 per flower; filaments present, separate or united; column absent; leaves equitant (= 2-ranked with closely overlapping bases) _____ **Iridaceae**
                    29. Flowers bilaterally symmetrical; stamens 1 or 2 per flower; filaments absent; male and female parts united into a column; leaves not equitant ____ **Orchidaceae**
        26. Ovary superior.
            30. Pistils numerous per flower, free from each other or nearly so, each pistil developing into a 1-seeded indehiscent fruit (achene) _____ **Alismataceae**
            30. Pistils 1 per flower, made up of a single carpel or of several carpels fused together; fruits various but often a many-seeded capsule.
                31. Perianth (sepals and petals) of 6 small, dry, bract-like segments, persistent; plants rush-like _____ **Juncaceae**

31. Perianth not bract-like, at least some of the segments usually petaloid, at least the corolla usually not persistent; plants not rush-like.
    32. Plants with large woody bases or a thick, fibrous-rooted crown; inflorescence a large many-flowered raceme or panicle _____ **Agavaceae**
    32. Plants neither woody-based nor with a thick, fibrous-rooted crown; inflorescences various.
        33. Perianth united in lower part forming a slender tube; flowers solitary; plants aquatic or growing in wet areas _____ **Pontederiaceae**
        33. Perianth of distinct segments; flowers solitary or otherwise; plants of various habitats, often terrestrial.
            34. Perianth segments dissimilar, of more than one type (some petaloid, some sepaloid); leaf bases usually sheathing; flowers in 1- or 2-bracted leaf-like spathes _ **Commelinaceae**
            34. Perianth segments all similar (all petaloid); leaf bases usually not sheathing; flowers not in leaf-like spathes _____ **Liliaceae**

General Key to All Families[2]

Modified from
Key and Descriptions for the Vascular Plant Families of Oklahoma
contributed by Oklahoma Flora Editorial Committee (Tyrl et al. 1994).

KEY TO GROUPS

1. Plants trees or shrubs or woody vines or woody aerial hemiparasites (growing on trees or shrubs—mistletoes).
   2.Plants woody vines or woody aerial hemiparasites _____ **Group A**
   2. Plants trees or shrubs.
      3. Stems succulent, bearing spines in clusters; flowers showy; ovaries inferior; perianth parts 25 or more; stamens 25 or more _____ **Cactaceae**
      3. Stems not succulent, not bearing spines in clusters; flowers showy or not showy; ovaries superior or inferior; perianth parts of various numbers; stamens of various numbers.
         4. Plants producing flowers or cones before leaves _____ **Group B**
         4. Plants producing flowers or cones simultaneously with leaves OR producing flowers or cones after leaves are formed.
            5. Leaves opposite or whorled or fascicled or in rosettes _____ **Group C**
            5. Leaves alternate.
               6. Leaves compound _____ **Group D**
               6. Leaves simple.
                  7. Leaf margins entire _____ **Group E**
                  7. Leaf margins lobed or toothed _____ **Group F**
1. Plants herbs, some woody at the base.
   8. Plants aquatic (plants floating or submersed in or emergent from water) _____ **Group G**
   8. Plants terrestrial OR growing on other plants (epiphytes and hemiparasites).
      9. Plants vines or epiphytes or aerial hemiparasites (mistletoes) _____ **Group H**
      9. Plants neither vines nor epiphytes nor aerial hemiparasites.
         10. Plants parasitic or saprophytic; chlorophyll absent _____ **Group I**
         10. Plants autophytic; chlorophyll present.
            11. Stems bearing spines and/or glochids in areoles, succulent; foliage leaves absent; ovaries inferior; perianth parts 25 or more; stamens 25 or more _____ **Cactaceae**
            11. Stems not bearing spines or glochids in areoles, succulent or not succulent; foliage leaves present or absent; ovaries superior or inferior; perianth parts of various numbers; stamens of various numbers.
               12. Plants acaulescent, the aerial stems not apparent and leaves not cauline.
                  13. Plants producing flowers and seeds; spores produced in anthers or ovaries ____ **Group J**
                  13. Plants not producing flowers and seeds; spores produced in sori or sporocarps or in aggregations of sporangia at ends of elongated stalks _____ **Group K**

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[2]While numerous couplets have been added to cover plants which occur in North Central Texas but not in Oklahoma, no couplets have been deleted from the Oklahoma family key. Therefore, some families/taxa occurring in Oklahoma are included that do not occur in North Central Texas. This was done so that the family key would be of maximum benefit to Oklahoma users as well as those in Texas. Such families are indicated in the *General Key to All Families* by a note in brackets, e.g., [Family in OK, not in nc TX]. In a number of instances, it is possible to key to the correct family even if a particular, easily confused dicotomy is misinterpreted. For such cases, explanatory notes are given in brackets in the key.

12. Plants caulescent, the aerial stems apparent and leaves cauline.
    14. Plants not producing flowers or seeds; spores produced in strobili or sori on abaxial surfaces of leaves or in aggregations of sporangia at ends of elongated stalks _____ **Group K**
    14. Plants producing flowers and seeds; spores produced in anthers or ovaries.
        15. Perianth parts absent _____ **Group L**
        15. Perianth parts present.
            16. Perianth parts in 1 series or parts all similar.
                17. Perianth parts 3 or in multiples of 3 _____ **Group M**
                17. Perianth parts 1 or 2 or 4 or 5 or in multiples of 4 or 5 or many ____ **Group N**
            16. Perianth parts in 2 series.
                18. Petals 3 or in multiples of 3 _____ **Group O**
                18. Petals 1 or 2 or 4 or 5 or in multiples of 4 or 5 or many.
                    19. Corollas bilaterally symmetrical.
                        20. Petals free _____ **Group P**
                        20. Petals fused at least at the base.
                            21. Ovaries inferior, wholly or partially _____ **Group Q**
                            21. Ovaries superior _____ **Group R**
                    19. Corollas radially symmetrical or asymmetrical.
                        22. Petals free.
                            23. Ovaries inferior, wholly or partially _____ **Group S**
                            23. Ovaries superior.
                                24. Pistils or fruits 1 per flower _____ **Group T**
                                24. Pistils or fruits 2 or more per flower _____ **Group U**
                        22. Petals fused at least at the base.
                            25. Ovaries inferior, wholly or partially _____ **Group V**
                            25. Ovaries superior _____ **Group W**

GROUP A

Plants woody vines OR woody aerial hemiparasites.

1. Plants aerial hemiparasites (mistletoes). _____ **Viscaceae**
1. Plants autophytic vines.
   2. Leaves opposite or whorled.
      3. Plants climbing by tendrils or aerial rootlets or prehensile petioles.
         4. Plants climbing by prehensile petioles; flowers radially symmetrical; corollas absent, but the sepals petal-like and separate; fruits achenes _____ **Ranunculaceae**
         4. Plants climbing by aerial rootlets or tendrils from leaf rachises (may be absent on scrambling-bushy forms); flowers bilaterally symmetrical; corollas 5-merous, of fused petals; fruits capsules _____ **Bignoniaceae**
      3. Plants climbing by twining stems.
         5. Leaf margins crenate or serrate _____ **Bignoniaceae**
         5. Leaf margins entire.
            6. Corollas yellow to orange, cream, or white, with a dark purple center; petioles conspicuously winged; stamens 4 [Stems actually herbaceous] _____ (*Thunbergia*—Acanthaceae) **Group H**
            6. Corollas variously colored but not light with a dark center; petioles not winged; stamens 5.
               7. Sap milky; leaf blades often (but not always) cordate basally; corollas with a corona _____ **Asclepiadaceae**

7. Sap not milky (except in *Trachelospermum*); leaf blades not cordate basally; corollas without a corona.
   8. Corollas bilaterally symmetrical (sometimes nearly radially symmetrical); uppermost leaves united around stem OR not so; fruits fleshy berries _____ **Caprifoliaceae**
   8. Corollas radially symmetrical; uppermost leaves not united around stem; fruits dry and dehiscent at maturity.
      9. Leaves evergreen, leathery; corollas conspicuously yellow, with tube > 15 mm long; fruits 2-celled capsules, flattened contrary to the partition; seeds without hairy tufts at ends _____ **Loganiaceae**
      9. Leaves evergreen or deciduous, leathery OR not so; corollas creamy white to pale yellow, with tube 10 mm or less long; fruits of twin follicles; seeds with hairy tufts at ends _____ **Apocynaceae**

2. Leaves alternate.
   10. Plants climbing by tendrils or aerial rootlets.
      11. Venation parallel-convergent; tendrils paired; inflorescences umbels; pith absent ____ **Smilacaceae**
      11. Venation palmate or pinnate or pinnipalmate; tendrils solitary or absent; inflorescences various, including racemes, panicles, cymes, umbels, or flowers hidden from view inside a hollow receptacle; pith present.
         12. Leaves compound.
            13. Inflorescences cymes; pistils 2-carpellate; fruits berries, dark blue to black _____ **Vitaceae**
            13. Inflorescences panicles; pistils 3-carpellate; fruits drupes, white (*Toxicodendron*—poison ivy) _____ **Anacardiaceae**
         12. Leaves simple.
            14. Leaves evergreen, thickish; inflorescences umbels (solitary or racemosely arranged) OR flowers hidden from view inside a hollow receptacle; introduced species spreading from cultivation, not expected in native habitats.
               15. Leaves usually 3–5-lobed; sap not milky; flowers and fruits (small 3–5-seeded berries) in solitary or racemosely arranged umbels _____ **Araliaceae**
               15. Leaves unlobed; sap milky; flowers and fruits hidden from view inside a hollow receptacle _____ **Moraceae**
            14. Leaves deciduous, not noticeably thickened; inflorescences racemes, panicles, or cymes; widespread native species.
               16. Leaves ovate or oblong-ovate, the margins entire; inflorescences racemose panicles; flowers perfect; calyces deeply 5-parted; corollas absent; fruits achenes, subtended by persistent sepals _____ **Polygonaceae**
               16. Leaves cordate or rotund to broadly ovate, the margins toothed; inflorescences cymes; flowers functionally imperfect; calyces slightly to shallowly 4-lobed; corollas present, may be caducous; fruits berries _____ **Vitaceae**
   10. Plants climbing by twining stems.
      17. Stipules absent; axillary buds 3, 2 may be obscured by leaf scars.
         18. Stems and leaves glabrous or puberulent; leaf scars U-shaped; flowers imperfect, the plants dioecious; perianths radially symmetrical; fruits drupes _____ **Menispermaceae**
         18. Stems and leaves tomentose; leaf scars elliptic; flowers perfect; perianths bilaterally symmetrical; fruits capsules _____ **Aristolochiaceae**
      17. Stipules or stipular scars present; axillary buds 1.
         19. Leaves compound.
            20. Stems bearing prickles; pistils 12 or more per flower; fruits aggregates of drupelets or achenes _____ **Rosaceae**
            20. Stems not bearing prickles; pistils 1 per flower; fruits berries or legumes.

21. Leaves 1–3 times compound; flowers radially symmetrical; corollas greenish, 1–3 mm long; fruits berries 10–15 mm in diam, not conspicuously hairy _____ **Vitaceae**
21. Leaves once compound; flowers bilaterally symmetrical; corollas purplish or lilac or blue, 15–27 mm long; fruits legumes, much > 15 mm long, conspicuously hairy _____ (Papilionoideae) **Fabaceae**

19. Leaves simple.
22. Inflorescences cymes; fruits berries; vascular bundle scars 12; pith dividing into thin plates at periphery _____ **Vitaceae**
22. Inflorescences panicles; fruits drupes or capsules; vascular bundle scars 1; pith continuous.
23. Axillary buds subglobose, the exposed scales 6; fruits capsules, orange; seeds covered by bright red arils _____ **Celastraceae**
23. Axillary buds triangular and elongated, the exposed scales 1–3; fruits drupes, bluish-black; seeds not covered by bright red arils _____ **Rhamnaceae**

GROUP B

Plants trees or shrubs; flowers or cones appearing before leaves.

1. Plants producing cones, not producing flowers; trunks often with buttresses; plants producing knees (= erect woody projections from the roots) when in standing water _____ **Cupressaceae**
1. Plants not producing cones, producing flowers; trunks without buttresses; plants without knees.
2. Leaf scars opposite.
3. Corollas yellow, showy, 20–30 mm across; stamens 2 _____ **Oleaceae**
3. Corollas absent or small (but conspicuous white bracts present in one species); petals if present 5.5 mm or less long, creamy white to yellowish green, greenish, or red; stamens 2–12.
4. Bracts 20–50 mm long, white; ovaries inferior _____ **Cornaceae**
4. Bracts 5 mm or less long or absent, purple or green or yellow; ovaries superior.
5. Staminate flowers with 2 or 4 stamens; styles of pistillate flowers 1; immature ovaries not winged; vascular bundle scars 1 or numerous _____ **Oleaceae**
5. Staminate flowers with 5–12 stamens; styles of pistillate flowers 2; immature ovaries 2-winged; vascular bundle scars 3 _____ **Aceraceae**

2. Leaf scars alternate.
6. Inflorescences catkins.
7. Plants dioecious; ovaries superior; axillary bud scales 1 _____ **Salicaceae**
7. Plants monoecious; ovaries inferior; axillary bud scales 2–numerous.
8. Terminal buds present; pith 5-starred in cross-section _____ **Fagaceae**
8. Terminal buds absent; pith 3-sided to round in cross-section _____ **Betulaceae**

6. Inflorescences of various types, but not catkins.
9. Perianth parts in 1 series.
10. Inflorescences solitary flowers or clusters of 2–3 flowers; pistils subtended by spiny or muricateor involucral cupules; ovaries inferior; terminal buds present _____ **Fagaceae**
10. Inflorescences umbels or fascicles or dense clusters of flowers; pistils not subtended by spiny or muricate or involucral cupules; ovaries superior; terminal buds absent.
11. Inflorescences umbel-like clusters; stamen number greater than number of perianth parts; branchlets aromatic when fresh _____ **Lauraceae**
11. Inflorescences spherical clusters or fascicles or cymes or racemes; stamen number equal to number of perianth parts; branchlets not aromatic.
12. Sap viscous, white; thorns present; flowers imperfect _____ **Moraceae**

12. Sap thin, colorless; thorns absent; flowers perfect or both perfect and imperfect intermixed _____ **Ulmaceae**

9. Perianth parts in 2 series.
13. Corollas bilaterally symmetrical _____ (Caesalpinioideae) **Fabaceae**
13. Corollas radially symmetrical.
14. Flowers 3- or 4-merous; fruits berries or drupes or capsules.
15. Flowers 3-merous, solitary; petals dull purple; fruits large berries to 12 cm long _____ **Annonaceae**
15. Flowers 4-merous, solitary OR in axillary clusters; petals yellow to reddish yellow, yellowish green, pink, or purplish pink; fruits capsules or drupes.
16. Petals 0.5–1.3 mm long, yellowish green; fruits drupes _____ **Rhamnaceae**
16. Petals much > 1.3 mm long, yellow to reddish yellow, pink, or purplish pink; fruits capsules.
17. Leaves simple; petals linear, yellow to reddish yellow; stamens 4 _____ **Hamamelidaceae**
17. Leaves compound; petals obovate, pink to purplish pink; stamens 7–10 _____ **Sapindaceae**
14. Flowers 5-merous; fruits pomes or drupes or legumes or capsules.
18. Petals pink to purplish pink, obovate, with a pilose claw; stamens 7–10, unequal, conspicuously exserted beyond perianth; fruit a 3-lobed, somewhat woody capsule _____ **Sapindaceae**
18. Petals variously colored, not obovate with a pilose claw; stamens variable in number, exserted or included within perianth; fruit a legume, pome, or drupe.
19. Petals fused; stamens conspicuously exserted beyond perianth, radiating; fruits legumes _____ (Mimosoideae) **Fabaceae**
19. Petals free; stamens included within perianth, not radiating; fruits pomes or drupes.
20. Petals white or pink, 10–25 mm long _____ **Rosaceae**
20. Petals yellow-green, 1–2 mm long _____ **Anacardiaceae**

GROUP C

Plants trees or shrubs; leaves opposite or whorled or fascicled or in rosettes.

1. Leaves fascicled or borne in rosettes at ends of stems.
2. Leaves borne in rosettes at end of stems, the venation parallel.
3. Leaves flabellate (= fan-shaped), longitudinally pleated toward base, 100–150 cm wide; perianth parts 3–10 mm long; fruits drupes, spherical, 8–13 mm in diam. _____ **Arecaceae**
3. Leaves lanceolate or ensiform, 0.5–2.5 cm wide, not pleated; perianth parts 30–50 mm long; fruits capsules, oblong, 25–40 mm in diam. _____ **Agavaceae**
2. Leaves fascicled, the venation pinnate or palmate or not apparent.
4. Leaves even pinnately compound with 8–16 leaflets _____ **Zygophyllaceae**
4. Leaves simple.
5. Leaves needle-like; cut surfaces of stems or leaves exuding sticky resin; flowers absent; cones present, woody _____ **Pinaceae**
5. Leaves terete or flat, spatulate or ovate or cordate-orbicular; cut surfaces of stems or leaves without resin; flowers present; cones absent.
6. Leaves terete, spatulate to ovate, the margins entire, the venation pinnate; petals fused; ovaries superior, with locules 2; berries subtended by persisent calyces _____ **Solanaceae**
6. Leaves flat, cordate-orbicular, the margins serrate or crenate, the venation palmate; petals free; ovaries inferior, with locules 1; berries crowned by shriveled hypanthia _____ **Grossulariaceae**

1. Leaves opposite or whorled.
   7. Leaves scale- or awl-like or reduced to membranous sheaths fused at bases and surrounding stems; flowers absent; cones present.
      8. Trees or shrubs more than 3 m tall; leaves imbricate, scale- or awl-like; ovulate cones globose, fleshy, blue to bluish black, bluish purple, reddish, or copper-colored _____ **Cupressaceae**
      8. Shrubs less than 1 m tall OR plant with clambering, vine-like habit; leaves not imbricate, reduced to membranous sheaths fused at bases and surrounding stems; ovulate cones elliptic, the scales thin, stramineous, the inner becoming fleshy and red _____ **Ephedraceae**
   7. Leaves elongated, terete or flattened, neither scale- nor awl-like nor reduced to sheaths; flowers present; cones absent.
      9. Leaves terete, fleshy, 0.1–0.2 cm wide, 1–2 cm long; plants 20–40 cm tall; [*Pseudoclappia* in OK and w TX, not in nc TX] _____ (*Pseudoclappia*) **Asteraceae**
      9. Leaves flat, not fleshy, more than 1 cm wide, more than 2 cm long; plants more than 40 cm tall.
         10. Leaves compound.
            11. Leaflets 3.
               12. Shrubs 5 m or less tall; twigs with longitudinal stripes; pistils 3-carpellate; fruits capsules, inflated; [Family in OK, not in nc TX] _____ **Staphyleaceae**
               12. Trees to 20 m tall; twigs without stripes; pistils 2-carpellate; fruits samaras _____ **Aceraceae**
            11. Leaflets 5–16.
               13. Leaves pinnately compound.
                  14. Leaves evergreen, even pinnately compound, the leaflets 15 mm or less long; fruits flattened, heart-shaped capsules with an apiculate apex _____ **Zygophyllaceae**
                  14. Leaves deciduous, odd pinnately compound, the leaflets usually much > 15 mm long; fruits drupes OR samaras without an apiculate apex.
                     15. Twigs thick but weak, the pith 1/2–3/4 of twigs in cross-section; ovaries inferior; fruits drupes (berry-like) _____ **Caprifoliaceae**
                     15. Twigs slender and strong, the pith < 1/4 of twigs in cross-section; ovaries superior; fruits samaras.
                        16. Axillary buds solitary; leaflet margins coarsely toothed; stamens 3–12; samaras 2-seeded _____ **Aceraceae**
                        16. Axillary buds superposed, the lower small; leaflet margins entire or shallowly toothed; stamens 2; samaras 1-seeded _____ **Oleaceae**
               13. Leaves palmately compound.
                  17. Leaflets sometimes peppery aromatic, lanceolate to elliptic, entire to conspicuously toothed to deeply palmately divided; petals fused; fruits drupes, 3 mm in diam. _____ **Verbenaceae**
                  17. Leaflets without odor, oblanceolate to obovate, toothed; petals free; fruits capsules, 1- or 3-seeded, 30–50 mm in diam. _____ **Hippocastanaceae**
         10. Leaves simple (but blades may be dissected).
            18. Leaf margins palmatifid, the lobes 3–5-parted 1/2–2/3 to midribs; fruits samaras ____ **Aceraceae**
            18. Leaf margins dentate or serrate or entire; fruits capsules or berries or drupes or schizocarps or multiple syncarps of achenes covered by fleshy calyces.
               19. Petals absent.
                  20. Sap viscous, white; fruits multiple syncarps of achenes covered by fleshy calyces _____ **Moraceae**
                  20. Sap thin, colorless; fruits drupes; calyces absent or minute, not fleshy.
                     21. Flowers in pendulous, catkin-like, fascicled racemes; leaves evergreen; lower surface of leaf blades densely pubescent; ovaries inferior _____ **Garryaceae**

21. Flowers in lateral fascicles or axillary glomerules; leaves deciduous; lower surface of leaf blades glabrous or pubescent; ovaries superior _____ **Oleaceae**

19. Petals present.
    22. Petals free.
        23. Leaves with minute translucent dots when held-up to light; flowers bright yellow; stamens in 3 bundles _____ **Clusiaceae**
        23. Leaves without translucent dots; flowers of various colors, may be pale yellowish white; stamens in whorls.
            24. Leaves conspicuously pinnately veined, the veins strikingly parallel and when viewed on lower leaf surface with an alternating pattern of light and dark areas; fruits small, globose, black drupes ____ **Rhamnaceae**
            24. Leaves without either strikingly parallel veins or an alternating pattern of light and dark areas; fruits capsules OR small red or white drupes.
                25. Leaf margins evenly, finely serrate; ovaries superior; seeds with bright red arils _____ **Celastraceae**
                25. Leaf margins irregularly serrate or entire; ovaries inferior; seeds without arils.
                    26. Axillary buds with scales; leaf margins toothed; fruits capsules _____ **Hydrangeaceae**
                    26. Axillary buds without scales; leaf margins entire; fruits drupes _____ **Cornaceae**
    22. Petals fused.
        27. Corollas radially symmetrical.
            28. Stipules or stipular scars present; inflorescences heads; fruits dry, schizocarps, separating into 2 one-seeded segments _____ **Rubiaceae**
            28. Stipules absent; inflorescences cymes or panicles; fruits fleshy, drupes or berries, not separating into 2 one-seeded segments.
                29. Stamens 5; ovaries inferior _____ **Caprifoliaceae**
                29. Stamens 2 or 4; ovaries superior.
                    30. Branchlets and leaves stellate-scurfy; inflorescences cymes, axillary, forming verticels; stamens 4 _____ **Verbenaceae**
                    30. Branchlets and leaves glabrous or variously indumented, but not stellate-scurfy; inflorescences panicles, terminal, not forming verticels; stamens 2 _____ **Oleaceae**
        27. Corollas bilaterally symmetrical.
            31. Ovaries inferior _____ **Caprifoliaceae**
            31. Ovaries superior.
                32. Corollas reddish, 25–40 mm long.
                    33. Stems not square; calyces ca. 5 mm long; corollas 3–4 cm long; fruits 2-seeded capsules; leaves not gland-dotted _____ (*Anisacanthus*) **Acanthaceae**
                    33. Stems square; calyces 10–15 mm long; corollas 2.5–3 cm long; fruits of 4 one-seeded nutlets; leaves gland-dotted (use lens) _____ (*Salvia*) **Lamiaceae**
                32. Corollas not as above, either not reddish OR if reddish then much smaller (4–7 mm long).
                    34. Plants much-branched shrubs; leaf blades 3–27 mm long _____ (*Aloysia*) **Verbenaceae**

34. Plants shrubs or trees; leaf blades much greater than 27 mm long.
    35. Branchlets and abaxial leaf surfaces densely stellate-scurfy; inflorescences spikes or cymes, axillary, many-flowered; flowers small, 4–7 mm long; fruits drupes _____ **Verbenaceae**
    35. Branchlets and abaxial leaf surfaces not stellate-scurfy; inflorescences panicles, terminal; flowers large, 20–70 mm long; fruits capsules _____ **Bignoniaceae**

GROUP D

Plants trees or shrubs; leaves alternate, compound.

1. Leaves simple, linear, borne on deciduous branchlets [falsely appearing pinnately compound]; flowers absent; seeds borne in fleshy cones; trunks often with buttresses; plants producing knees (= erect woody projections from the roots) when in standing water _____ (Cupressaceae) **Group E**
1. Leaves compound, of various shapes, deciduous at petioles, not borne on deciduous branchlets; flowers present; seeds borne in fruits; trunks without buttresses; plants without knees.
    2. Leaves 2–3-compound.
        3. Leaves 2–3-compound, evergreen; fruits red berries 6–9 mm in diam.; flowers 3-merous; stamens 6 _____ **Berberidaceae**
        3. Leaves 2-compound, deciduous; fruits legumes, not red; flowers 5-merous; stamens 5–many.
            4. Inflorescences dense heads or spikes; stamen filaments 2–4 times longer than sepals and petals; flowers small and individually inconspicuous, the corollas so small as to be ± inevident; corollas radially symmetrical; stamens 5–many _____ (Mimosoideae) **Fabaceae**
            4. Inflorescences racemes or panicles; stamen filaments as long as or shorter than sepals and petals (except longer in *Caesalpinia*); flowers whether small or large usually individually conspicuous, the corollas usually easily seen; corollas weakly bilaterally symmetrical; stamens 10 or less _____ (Caesalpinioideae) **Fabaceae**
    2. Leaves 1-compound or both 1- and 2-compound.
        5. Fruits nuts, enclosed in involucral husks; flowers imperfect, the plants monoecious; staminate flowers borne in elongated catkins; pistillate flowers solitary or borne in clusters of 2–3 _____ **Juglandaceae**
        5. Fruits of various types but not nuts enclosed in involucral husks; flowers perfect; inflorescences of various types, but not catkins.
            6. Inflorescences racemes or globose spikes; fruits legumes or red berries.
                7. Petals 6, equal; stamens 6; fruits red berries 8–10 mm in diam.; leaves trifoliate, the leaflets with spiny lobe-like teeth _____ **Berberidaceae**
                7. Petals 5, unequal; stamens 5–10; fruits legumes; leaves not as above.
                    8. Flowers strongly bilaterally symmetrical; corollas papilionaceous, the upper (= adaxial) petal enclosing other petals in bud _____ (Papilionoideae) **Fabaceae**
                    8. Flowers weakly bilaterally symmetrical; corollas not papilionaceous, the upper (= adaxial) petal enclosed by other petals in bud _____ (Caesalpinioideae) **Fabaceae**
            6. Inflorescences corymbs or panicles or fascicles or solitary flowers; fruits achenes or drupes or drupelets or follicles or berries or samara-like schizocarps or capsules or hesperidia.
                9. Pistils 2 or more per flower; fruits achenes or druplets or follicles.
                    10. Stipules absent; abaxial surfaces of leaves glandular punctate; fruits follicles _____ **Rutaceae**
                    10. Stipules present; abaxial surfaces of leaves not glandular punctate; fruits achenes or druplets _____ **Rosaceae**

9. Pistils 1 per flower; fruits drupes or berries or samaras or samara-like schizocarps or capsules or hesperidia.
   11. Leaves 2- or 3-compound.
      12. Plants shrubs, unarmed; stipules or stipular scars present _____ **Vitaceae**
      12. Plants trees, unarmed OR armed; stipules absent.
         13. Stems and leaves armed with stout prickles; petals 1.5–2 mm long; ovaries inferior; fruits 5-seeded, black, 4–6 mm in diam.; trees sparingly branched _____ **Araliaceae**
         13. Stems and leaves not armed with prickles; petals 9–11 mm long; ovaries superior; fruits 1-seeded, yellow, 12–15 mm in diam.; trees many branched _____ **Meliaceae**
   11. Leaves 1-compound.
      14. Leaflets 3.
         15. Leaflets not gland-dotted; ovaries 1-locular; fruits drupes, red or reddish brown or white to yellowish gray (poisonous species with white to yellowish gray fruits), 5–8 mm in diam. _____ **Anacardiaceae**
         15. Leaflets gland-dotted; ovaries 2–5-locular; fruits samaras OR hesperidia, yellow-brown, ca. 20–50 mm in diam. _____ **Rutaceae**
      14. Leaflets 4–25.
         16. Leaflets gland-dotted or bearing 1–5 dark green glands near bases on lower surfaces; fruits follicles or samara-like schizocarps or samaras.
            17. Branchlets armed with stout prickles; fruits follicles, 5–6 mm long; pith white, occupying less than 1/2 of stem in cross-section; vascular bundle scars 3 _____ **Rutaceae**
            17. Branchlets not armed with prickles; fruits schizocarps, splitting into samaras, 30–50 mm long; pith brown, occupying about 3/4 of stem in cross-section; vascular bundle scars 9 _____ **Simaroubaceae**
         16. Leaflets neither gland-dotted nor bearing 1–5 dark green glands near bases on lower surfaces; fruits drupes or capsules.
            18. Flowers pink to purplish pink; fruits 3-lobed, somewhat woody, stipitate capsules _____ **Sapindaceae**
            18. Flowers white to yellowish or greenish; fruits drupes.
               19. Drupes red or reddish brown, opaque at maturity, 5–8 mm in diam.; sap viscous, white or brown; plants typically thicket-forming shrubs _____ **Anacardiaceae**
               19. Drupes amber or yellow, translucent at maturity, 10–13 mm in diam.; sap thin, colorless; plants typically trees, occasionally forming thickets _____ **Sapindaceae**

GROUP E

Plants trees or shrubs; leaves alternate, simple, the margins entire.

1. Venation parallel.
   2. Stems jointed; branches fascicled at nodes; internodes hollow; leaves with sheaths; flowers borne in spikelets _____ (*Arundinaria*) **Poaceae**
   2. Stems not jointed; branches absent; internodes solid; leaves without sheaths; flowers borne in panicles.
      3. Leaves flabellate (= fan-shaped), longitudinally pleated toward base, 100–150 cm wide; perianth parts 3–10 mm long; fruits drupes, spherical, 8–13 mm in diam. [Leaves large, divided into segments, but the segments mostly entire] _____ **Arecaceae**

3. Leaves lanceolate or ensiform, not pleated, 0.5–8 cm wide; perianth parts 30 mm or more long; fruits capsules, oblong, 25 mm or more in diam. _____ **Agavaceae**

1. Venation pinnate or palmate or not apparent.
4. Plants subshrubs or shrubs, less than 2 m tall.
5. Flowers imperfect, the plants monoecious or dioecious.
6. Inflorescences heads or catkins.
7. Inflorescences heads; pappus present, of capillary bristles; fruits achenes _____ **Asteraceae**
7. Inflorescences catkins; pappus absent; fruits drupes or capsules.
8. Leaves evergreen, resin-dots present, fragrant; fruits drupes, white, waxy; seeds not comose _____ **Myricaceae**
8. Leaves deciduous, resin-dots absent, not fragrant; fruits capsules; seeds comose _____ **Salicaceae**
6. Inflorescences racemes or cymes or solitary flowers in leaf axils.
9. Stipules present, 1–2 mm long (sometimes falling early); pistils 3-lobed, 3-locular, with 3 or more ovules; fruits capsules _____ **Euphorbiaceae**
9. Stipules absent; pistils not lobed, 1-locular, with 1 ovule; fruits utricles or drupes.
10. Leaf surfaces scurfy or farinaceous; fruits utricles; bark not spicy aromatic; plants of saline or alkaline sites _____ **Chenopodiaceae**
10. Leaf surfaces neither scurfy nor farinaceous; fruits drupes; bark spicy aromatic; plants of moist sites _____ **Lauraceae**
5. Flowers perfect.
11. Leaves less than 3 mm long, imbricate; branchlets deciduous _____ **Tamaricaceae**
11. Leaves more than 5 mm long, not imbricate; branchlets not deciduous.
12. Inflorescences heads, 100–300 per plant, in paniculate arrangement; anthers fused in ring around style _____ **Asteraceae**
12. Inflorescences of various types, but not heads; anthers not fused in ring around style.
13. Leaves and stems with silvery peltate scales.
14. Plants usually spiny; fruits drupe-like; flowers usually 1–3 in the leaf axils; stamens 4 _____ **Elaeagnaceae**
14. Plants not spiny; fruits capsules; flowers in terminal 6–14-flowered racemes; stamens (11–)14–18(–21) _____ **Euphorbiaceae**
13. Leaves and stems without silvery peltate scales.
15. Flowers 5–6 mm across, yellow-green, appearing glomerate on short, twig-like, condensed spur shoots (some leaves also crowded with flowers on spur shoots) _____ **Rhamnaceae**
15. Flowers variously colored, not arranged as above.
16. Plants armed (branches ending in stout thorns); petals absent _____ **Rhamnaceae**
16. Plants unarmed OR if armed, not from the ends of branches; petals present or absent.
17. Leaves broadly obovate or broadly elliptic; leaf scars annular, nearly encircling bud; fruits drupes, red; [Family in OK, not in TX] _____ **Thymeliaceae**
17. Leaves of various shapes, but neither broadly obovate nor elliptic; leaf scars not annular; fruits berries or capsules or achenes or follicles, of various colors.
18. Petals fused; fruits berries or capsules.
19. Branchlets armed; axillary buds multiple; anthers opening along longitudinal sutures; pistils 2-carpellate _____ **Solanaceae**
19. Branchlets not armed; axillary buds solitary; anthers opening by apical pores; pistils 5-carpellate _____ **Ericaceae**

18. Petals free or absent; fruits achenes or follicles.
    20. Stipules present as ocrea; perianth parts in 1 series; fruits achenes _____ **Polygonaceae**
    20. Stipules absent; perianth parts in 2 series; fruits follicles; [Family in OK and w TX, not in nc TX] _____ **Crossosomataceae**

4. Plants large shrubs or trees, more than 2 m tall.
    21. Trunks typically with buttresses; plants producing knees (= erect woody projections from the roots) when in standing water; branchlets deciduous and bearing linear leaves; flowers absent; seeds borne in fleshy cones _____ **Cupressaceae**
    21. Trunks without buttresses; plants without knees; branchlets not deciduous and bearing linear leaves; flowers present; seeds borne in fruits.
        22. Plants armed and/or with spur branches.
            23. Sap viscous, white; flowers imperfect, the plants dioecious; fruits multiple syncarps of achenes covered by fleshy calyces, 10–15 cm in diam., globose, yellow-green ____ **Moraceae**
            23. Sap thin; colorless; flowers perfect; fruits berries or achenes or drupe-like or pomes, less than 5 cm in diam., of various colors and textures.
                24. Fruits small red pomes 6–8 mm in diam.; inflorescences small corymbs; stamens 20 _____ **Rosaceae**
                24. Fruits berries, drupe-like, or achenes, not red; inflorescences various; stamens 4, 5, 12, or more.
                    25. Perianth parts in 2 series; stamens 5; fruits berries, black, drupe-like, 1-seeded _____ **Sapotaceae**
                    25. Perianth parts in 1 series; stamens 4 or 12 or more; fruits achenes, plumose or enclosed by fleshy perianths.
                        26. Stems and leaves with silvery peltate scales; spines present; spur branches absent; stamens 4; achenes enclosed by fleshy perianths ___ **Elaeagnaceae**
                        26. Stems and leaves without silvery peltate scales; spines absent; spur branches present; stamens 12 or more; achenes with plumose tails _____ **Rosaceae**
        22. Plants not armed; spur branches absent.
            27. Leaves less than 3 mm long, imbricate; branchlets deciduous _____ **Tamaricaceae**
            27. Leaves more than 10 mm long, not imbricate; branchlets not deciduous.
                28. Flowers solitary.
                    29. Flowers small, 0.2–0.3 cm in diam., imperfect; stamens 5–12, arrangement whorled; pistils 1 per flower; fruits drupes.
                        30. Flowers imperfect; bark becoming warty; leaf blades 3-veined at base; ovaries superior _____ **Ulmaceae**
                        30. Flowers perfect; bark not becoming warty; leaf blades 1-veined at base; ovaries inferior _____ **Nyssaceae**
                    29. Flowers large, 3–25 cm in diam.; perfect; stamens 13 or more, arrangement spiraled; pistils 3 or more per flower; fruits follicles or berries.
                        31. Flowers yellow or white, 10–25 cm in diam.; leaves coriaceous; stipules present, but caducous; fruits follicles; [Family in OK and se and e TX, not in nc TX] _____ **Magnoliaceae**
                        31. Flowers dull purple, 3–4 cm in diam.; leaves not coriaceous; stipules absent; fruits berries _____ **Annonaceae**
                28. Flowers borne in clusters.
                    32. Stems and leaves with silvery peltate scales _____ **Elaeagnaceae**
                    32. Stems and leaves without silvery peltate scales.
                        33. Leaves evergreen.

34. Flowers in panicles; corollas conspicuous, white, ca. 7 mm long; fruits red to yellowish red, berries _____ **Ericaceae**

34. Flowers solitary, in clusters of 2–3, or in catkins; corollas absent; fruits white drupes or brown or green nuts subtended by an involucral cupule (acorn).

35. Terminal buds absent; leaves with resin-dots, fragrant; pistillate flowers in catkins; fruits drupes, white _____ **Myricaceae**

35. Terminal buds multiple; leaves without resin-dots, not fragrant; pistillate flowers solitary or in clusters of 2–3; fruits nuts subtended by an involucral cupule (acorn), brown or green _____ **Fagaceae**

33. Leaves deciduous.

36. Flowers imperfect, the plants monoecious or dioecious.

37. Inflorescences catkins.

38. Terminal buds multiple; pith 5-starred in cross-section; plants monoecious; fruits nuts, solitary or in clusters of 2–3, subtended by an involucral cupule (acorn) _____ **Fagaceae**

38. Terminal buds absent; pith terete in cross-section; plants dioecious; fruits capsules or multiple syncarps of achenes covered by fleshy calyces.

39. Leaves ovate or lanceolate; sap viscous, white; fruits multiple syncarps of achenes covered by fleshy calyces; seeds not comose _____ **Moraceae**

39. Leaves obovate or oblanceolate; sap thin, colorless; fruits capsules; seeds comose _____ **Salicaceae**

37. Inflorescences of various types, but not catkins.

40. Terminal buds multiple; pith 5-starred in cross-section; plants monoecious; fruits nuts, solitary or in clusters of 2–3, subtended by an involucral cupule (acorn) _____ **Fagaceae**

40. Terminal buds solitary or absent; pith terete in cross-section; plants dioecious, monoecious, or polygamo-monoecious; fruits berries or drupes or capsules.

41. Fruits capsules; plants with milky sap _____ **Euphorbiaceae**

41. Fruits berries or drupes; plants without milky sap.

42. Leaf blades 3-veined at base; bark becoming warty; branchlets slender, the growth zigzagged _____ **Ulmaceae**

42. Leaf blades 1-veined at base; bark not becoming warty; branchlets stout, the growth not zigzagged.

43. Leaf scars with 1 vascular bundle scar; petals fused; fruits berries, 2–5 cm in diam., yellowish orange or black _____ **Ebenaceae**

43. Leaf scars with 3 vascular bundle scars; petals absent or free; fruits drupes, 0.5–1 cm in diam., red or blue-black.

44. Accessory buds present; young twigs aromatic; perianth parts yellow or yellow-white; ovaries superior _____ **Lauraceae**

44. Accessory buds absent; young twigs not aromatic; perianth parts greenish; ovaries inferior _____ **Nyssaceae**

36. Flowers perfect.
    45. Flowers bilaterally symmetrical.
        46. Stamens 36–42; petals separate, conspicuously slender clawed with orbicular-cordate blades, large and conspicuous, to 20 mm long, white to pink or purple _____ **Lythraceae**
        46. Stamens 2–10; petals not as above (not slender clawed, sometimes small and inconspicuous, sometimes fused, sometimes yellow).
            47. Corollas papilionaceous; petals free; stamens 10; pistils 1-carpellate; fruits legumes, flattened; seeds not winged _____ (Caesalpinioideae) **Fabaceae**
            47. Corollas campanulate or funnelform; petals fused; stamens 2 or 4 or 5; pistils 2-carpellate; fruits capsules; seeds winged _____ **Bignoniaceae**
    45. Flowers radially symmetrical.
        48. Leaf blades 3-veined at base; bark typically becoming warty; branchlets slender, the growth zigzagged _____ **Ulmaceae**
        48. Leaf blades 1-veined at base; bark not becoming warty; branchlets stout, the growth not zigzagged.
            49. Leaf scars with 1 vascular bundle scar; flowers borne in dense, sessile clusters along sides of branches; petals fused; [Family in OK and se and e TX, not in nc TX] ___ **Symplocaceae**
            49. Leaf scars with 3 vascular bundle scars; flowers borne in peduncled cymes or panicles; petals free or absent.
                50. Branchlets aromatic; wood yellow; inflorescences panicles, terminal; petals persistent; ovaries superior _____ **Anacardiaceae**
                50. Branchlets not aromatic; wood white; inflorescences cymes, axillary; petals caducous; ovaries inferior _____ **Nyssaceae**

GROUP F

Plants trees or shrubs; leaves alternate, simple, the margins lobed or toothed.

1. Venation palmate.
    2. Leaf blades peltate [*Ricinus*, a large herb, can appear ± like a small tree] _____ **Euphorbiaceae**
    2. Leaf blades not peltate.
        3. Flowers perfect; petals present; fruits berries or capsules or follicles or nut-like or drupe-like.
            4. Leaves flabellate (= fan-shaped), longitudinally pleated toward base, 100–150 cm wide; plants palm-like _____ **Arecaceae**
            4. Leaves neither flabellate nor pleated, much < than 100 cm wide; plants not palm-like.
                5. Stipules absent; stamens 5; ovaries inferior _____ **Grossulariaceae**
                5. Stipules present; stamens 10–50; ovaries superior.
                    6. Filaments fused, forming a tube around the style _____ **Malvaceae**
                    6. Filaments separate.
                        7. Plants trees; peduncles arising from midribs of strap-shaped bracts; pistils 1; fruits nut-like or drupe-like _____ **Tiliaceae**
                        7. Plants shrubs; peduncles not arising from midribs of strap-shaped bracts; pistils 2 or 3; fruits follicles _____ **Rosaceae**
        3. Flowers imperfect; petals absent; fruits syncarps composed of numerous achenes or cap-

sules OR fruits hidden from view inside a fleshy receptacle OR fruits capsules, the carpels separating into 5 stalked follicle-like structures.

8. Leaves noticeably thick, obtuse apically; flowers and fruits hidden from view inside a fleshy hollow receptacle; terminal vegetative bud surrounded by a pair of stipules _____ **Moraceae**

8. Leaves not noticeably thick, acute to acuminate apically (rarely subobtuse); flowers and fruits not hidden inside a receptacle; terminal bud scaly, not surrounded by a pair of stipules.

9. Flowers in panicles; leaves 3–5 lobed, the lobes entire; fruits capsules, the carpels separating into 5 stalked follicle-like structures which spread open and become leaf-like and bear seeds on their margins _____ **Sterculiaceae**

9. Flowers in heads or catkins or catkin-like structures; leaves either unlobed or lobed, but if lobed then the lobes with teeth; fruits syncarps, composed of numerous capsules or achenes (these sometimes covered by fleshy perianths and the whole structure berry-like).

10. Sap viscous, white; plants dioecious; staminate catkins pendulous; fruits covered by fleshy calyces _____ **Moraceae**

10. Sap thin, colorless; plants monoecious; staminate catkins erect or ascending; fruits not covered by fleshy calyces.

11. Bark light, gray-green, exfoliating in strips; axillary buds enclosed by petioles; older branches not winged; fruits syncarps of achenes, not spiny _____ **Platanaceae**

11. Bark dark, brown, not exfoliating in strips; axillary buds not enclosed by petioles; older branches winged; fruits syncarps of capsules, spiny _____ **Hamamelidaceae**

1. Venation pinnate.

12. Flowers imperfect.

13. Plants dioecious or polygamo-dioecious.

14. Inflorescences of various types, but not catkins.

15. Perianth parts in 1 series _____ **Moraceae**

15. Perianth parts in 2 series (counting pappus in Asteraceae).

16. Inflorescences heads; pappus present, of capillary bristles; fruits achenes _____ **Asteraceae**

16. Inflorescences of various types, but not heads; pappus absent; fruits drupes or berry-like.

17. Bark spicy-aromatic; inflorescences racemes or umbels _____ **Lauraceae**

17. Bark not spicy-aromatic; inflorescences cymes or fascicles or solitary flowers.

18. Stipules absent; ovaries inferior; locules 1; fruits 1-seeded _____ **Nyssaceae**

18. Stipules or stipular scars present; ovaries superior; locules 2–8; fruits 2–5-seeded.

19. Petals clawed, cucullate; stamens opposite the petals; drupes black _____ **Rhamnaceae**

19. Petals neither clawed nor cucullate; stamens alternate with the petals; drupes red to orange _____ **Aquifoliaceae**

14. Inflorescences catkins.

20. Perianth parts in 1 series; fruits multiple syncarps of achenes _____ **Moraceae**

20. Perianth parts absent or vestigial; fruits capsules or drupes.

21. Leaves oblanceolate, resin-dots present, aromatic; fruits drupes; seeds not comose _____ **Myricaceae**

21. Leaves linear to deltoid, resin-dots absent, not aromatic; fruits capsules; seeds comose _____ **Salicaceae**

13. Plants monoecious or polygamo-monoecious.

22. Perianth parts in 2 series; staminate flowers (1–)2–3 per leaf axil; ovaries superior; fruits drupes _____ **Rhamnaceae**
22. Perianth parts in 1 series or absent; staminate flowers borne in fascicles at bases of branchlets or in pendulous catkins; ovaries superior or inferior; fruits drupes OR nuts subtended by bracts or cap-like involucral cupule.
    23. Leaf bases oblique; plants polygamo-monoecious; staminate flowers borne in fascicles at bases of branchlets; perfect flowers present, borne in axils of leaves; ovaries superior _____ **Ulmaceae**
    23. Leaf bases not oblique; plants monoecious; staminate flowers borne in pendulous catkins; perfect flowers absent; ovaries inferior.
        24. Pistillate flowers in catkins; nuts individually subtended by woody or foliaceous bracts, but not by cupule _____ **Betulaceae**
        24. Pistillate flowers solitary or in clusters of 2–3, but not in catkins; nuts (individually or in clusters of 3) subtended by a spiny or muricate or cap-like involucral cupule; bracts neither woody nor foliaceous _____ **Fagaceae**

12. Flowers perfect.
    25. Ovaries inferior.
        26. Petals fused at least at base.
            27. Leaf blades 0.1–3.5 cm wide; inflorescences heads; fruits achenes _____ **Asteraceae**
            27. Leaf blades 4–10 cm wide; inflorescences clusters of flowers; fruits capsules _____ **Styracaceae**
        26. Petals free or absent.
            28. Plants shrubs; sepals 4; petals 4, yellow _____ **Hamamelidaceae**
            28. Plants trees; sepals 5; petals 5 or 0, white or greenish white.
                29. Leaf margins entire or with 1 or 2 coarse teeth; stipules absent; stamens 5–12; fruits drupes with thin mesocarp and ridged or winged endocarp _____ **Nyssaceae**
                29. Leaf margins serrate or crenate or irregularly lobed; stipules or stipular scars present; stamens 15 or more; fruits pomes or drupes with thick fleshy mesocarp and smooth non-winged endocarp _____ **Rosaceae**
    25. Ovaries superior.
        30. Perianth parts in 1 series, in 1 or 2 whorls.
            31. Leaf margins pinnately lobed or pinnately toothed; leaf bases oblique; bark not spicy-aromatic; nectaries absent _____ **Ulmaceae**
            31. Leaf margins palmately lobed; leaf bases cuneate; bark spicy-aromatic; nectaries present [sometimes resembling stamens hence flowers falsely appearing perfect] _____ **Lauraceae**
        30. Perianth parts in 2 series.
            32. Petals fused.
                33. Petals fused more than half of their length; anthers opening by apical pores; styles present, long; stigmas not subsessile _____ **Ericaceae**
                33. Petals fused only at base; anthers opening along longitudinal sutures; styles absent or short; stigmas subsessile _____ **Aquifoliaceae**
            32. Petals free.
                34. Stamens 15 or more; fruits pomes or follicles or drupes _____ **Rosaceae**
                34. Stamens 4–6; fruits drupes or capsules.
                    35. Branches terminating in straight spiny tips OR with axillary spines _____ **Rhamnaceae**
                    35. Branches unarmed (but leaves can be spiny in some species).
                        36. Plants ± herbaceous shrubs; petals pink or violet, with yellowish base; fruits capsules _____ **Sterculiaceae**
                        36. Plants shrubs or small trees; petals white, yellowish, greenish, or rarely

pinkish; fruits usually drupes (capsules in 1 species in se and e TX and OK).

37. Petals clawed, cucullate; stamens opposite petals; nectary disks present _____ **Rhamnaceae**

37. Petals not clawed, not cucullate; stamens alternate with petals; nectary disks absent.

38. Inflorescences racemes, terminal; fruits capsules _____ **Grossulariaceae**

38. Inflorescences solitary flowers or cymose clusters, axillary; fruits drupes with 4 or 5 stones [falsely resembling berries] _____ **Aquifoliaceae**

GROUP G

Plants aquatic herbs, floating on or submersed in or emergent from water.

1. Plants free-floating in water column or on surface of water.

2. Plants floating on surface.

3. Leaves 4–15 cm long.

4. Plants with gray-green, velvety-hairy leaves in rosettes and conspicuously feathery roots _____ **Araceae**

4. Plants not as above.

5. Petioles or stems not inflated; abaxial surfaces of blades spongy; flowers imperfect; ovaries inferior; fruits berries _____ **Hydrocharitaceae**

5. Petioles or stems inflated; abaxial surfaces of blades not spongy; flowers perfect; ovaries superior; fruits capsules.

6. Leaves simple; leaf blades suborbicular to broadly elliptic; flowers 4–6 cm long; stamens 3 _____ **Pontederiaceae**

6. Leaves pinnately compound; blades of leaflets filiform; flowers 0.4–0.5 cm long; stamens 5 _____ **Primulaceae**

3. Leaves 1.5 cm or less long or absent.

7. Stems 3–7 cm long, inflated, radiating and forming conspicuous floating whorls at surfaces, bearing finely dissected branches with numerous sac-like bladders; flowers conspicuous, borne on scapes 10–15 cm long above water surface; corollas yellow, bilaterally symmetrical _____ **Lentibulariaceae**

7. Stems less than 0.5 cm long or absent; dissected branches absent; bladders absent; flowers inconspicuous or not produced; scapes absent; corollas absent.

8. Plants thalloid (= consisting of a flat or solid body a few mm or less across, not differentiated into stems and leaves); flowers and fruits present (but minute and inconspicuous); spores produced in anthers and ovaries _____ **Lemnaceae**

8. Plants differentiated into stems and fronds (= leaves); flowers and fruits absent; spores produced in soft, thin-walled sporocarps.

9. Fronds less than 1 mm long, imbricate, dull reddish green, the adaxial surface glabrous _____ **Azollaceae**

9. Fronds 5–15 mm long, not imbricate, bright green, the adaxial surface with short, branched, multicellular hairs; [Salviniaceae sensu stricto in OK, not in TX] _____ **Salviniaceae**

2. Plants floating submersed in water column.

10. Plants thalloid (= consisting of a flat or solid body, not differentiated into stems and leaves); entire plant small, usually < 2 cm long _____ **Lemnaceae**

10. Plants not thalloid, with stems and often leaves; entire plant much larger than 2 cm long.

11. Plants without leafy stems.

12. Branches whorled, not dissected, without sac-like bladders, consisting of 1–5 mac-

roscopic cells; joints of stem consisting of single macroscopic cells; flowers and fruits absent; oogonia and antheridia present [This is a macroscopic non-vascular family of algae occasionally collected in ponds and lakes] _____ **Characeae**

12. Branches alternate, finely dissected with numerous sac-like bladders, consisting of many microscopic cells; joints of stem consisting of many microscopic cells; flowers and fruits present; oogonia and antheridia absent; flowers borne on scapes 10–15 cm above water surface; corollas yellow, bilaterally symmetrical _____ **Lentibulariaceae**

11. Plants with leafy stems.
    13. Leaves whorled.
        14. Leaves simple, elliptic to linear-lanceolate; petals 3 _____ **Hydrocharitaceae**
        14. Leaves compound, linear or filiform; petals 0 or 4.
            15. Leaves dichotomously 1–4-compound; flowers submersed _____ **Ceratophyllaceae**
            15. Leaves pinnately 1-compound; flowers borne at water surface or above _____ **Haloragaceae**
    13. Leaves alternate or opposite.
        16. Leaves alternate.
            17. Stipules present; flowers borne in terminal spikes above water surface; perianth parts present; fruits globose, not beaked, not curved _____ **Potamogetonaceae**
            17. Stipules absent; flowers borne in axils of leaves below water surface; perianths parts absent; fruits flattened, beaked, curved _____ **Zannichelliaceae**
        16. Leaves opposite.
            18. Leaves elliptic to linear-lanceolate, the bases not sheathing stems; flowers borne at water surface or just above; petals 3, white _____ **Hydrocharitaceae**
            18. Leaves filiform, the bases sheathing stems; flowers submersed; petals 0.
                19. Leaf blades usually minutely denticulate under a scope OR obviously toothed to the naked eye; pistils 1 per flower; fruits terete, not beaked, not curved, not stipitate _____ (*Najas*) **Hydrocharitaceae**
                19. Leaf blades entire; pistils 2–8 per flower; fruits flattened, beaked (the beak to 1.5 mm long), curved, short stipitate (= stalked) _____ **Zannichelliaceae**

1. Plants rooted in substrate; stems and leaves submersed in or floating on or emergent from water.
    20. Leaves compound or dissected into filiform or linear segments.
        21. Plants attached to rocks by fleshy disks and forming mats or crusts on them; [Family in OK, not in TX]. _____ **Podostemaceae**
        21. Plants attached to substrate by roots, not forming mats or crusts.
            22. Leaves pinnately compound or pinnately dissected.
                23. Leaflets ovate or oval; terminal leaflets larger than lateral ones, somewhat fleshy _____ **Brassicaceae**
                23. Leaflets or leaf segments linear or filiform; terminal leaflets if present not larger than laterals, not fleshy.
                    24. Stems and peduncles inflated; stamens 5; fruits capsules [*Hottonia*—in OK and se and e TX, not in nc TX] _____ **Primulaceae**
                    24. Stems and peduncles not inflated; stamens 4 or 6 or 8; fruits siliques or silicles or nut-like.
                        25. Leaves all alike, emergent ones dissected _____ **Haloragaceae**
                        25. Leaves of 2 forms, emergent ones not dissected.
                            26. Inflorescences racemes, terminal; petals 4; stamens 6; pistils 2-carpellate; fruits siliques or silicles _____ **Brassicaceae**
                            26. Inflorescences solitary flowers, axillary; petals 0; stamens 3; pistils 3-carpellate; fruits nut-like _____ **Haloragaceae**
            22. Leaves palmately compound or palmately dissected or dichotomously compound.

27. Leaflets 4, obdeltoid or flabellate, the venation dichotomous; flowers absent; spores produced in sori borne in hard sporocarps in axils of leaves _____ **Marsileaceae**
27. Leaflets of various numbers, filiform or linear, the venation comprising a single vein; flowers present; spores produced in anthers and ovaries.
28. Leaves alternate.
29. Leaves dichotomously compound; plants attached to rocks by fleshy disks and forming mats or crusts on them; [Family in OK, not in TX]. _____ **Podostemaceae**
29. Leaves palmately compound or dissected; plants attached to substrate by roots, not forming mats or crusts on rocks _____ **Ranunculaceae**
28. Leaves opposite or whorled.
30. Leaves dichotomously 1–4-compound; flowers submersed, inconspicuous; plants may be embedded in substrate, but without roots ____ **Ceratophyllaceae**
30. Leaves palmately 1-compound; flowers borne at water surface, showy; plants rooted in substrate _____ **Cabombaceae**

20. Leaves simple, not dissected into filiform or linear segments.
31. Plants submersed or floating.
32. Leaves floating on surface.
33. Leaves orbicular, peltate or cordate, arising from rhizomes.
34. Pistils 4 or more per flower, simple.
35. Perianth parts 6–8; plants covered with mucilage _____ **Cabombaceae**
35. Perianth parts 12 or more; plants not covered with mucilage _____ **Nelumbonaceae**
34. Pistils 1 per flower, compound.
36. Perianth less than 1 cm across; ovaries inferior; styles 2; stylopodia present; fruits schizocarps _____ (*Hydrocotyle*) **Apiaceae**
36. Perianth 2 cm or more across; ovaries superior; styles 0 or 1 or 12 or more; stylopodia absent; fruits capsules or berries.
37. Petals 5, fused, valvate in bud, the margins fringed; styles 12 or more; fruits capsules, beaked _____ **Menyanthaceae**
37. Petals 12 or more, free, imbricate in bud, the margins entire; styles 0 or 1; fruits berries, not beaked _____ **Nymphaeaceae**
33. Leaves of various shapes, but neither peltate nor cordate, either cauline or basal, but not arising from rhizomes.
38. Petals 3; stamens 12 or more; pistils 12 or more; venation parallel convergent _____ **Alismataceae**
38. Petals 4 or 5 or 0; stamens 1 or 4 or 8 or 10; pistils 1; venation parallel or pinnate or palmate.
39. Inflorescences whitish pedunculate heads; leaves opposite _____ *(Alteranthera)* **Amaranthaceae**
39. Infloresences not whitish pedunculate heads; leaves opposite OR alternate.
40. Flowers in pedunculate, often dense spikes; stipules present; venation parallel; fruits achenes; corollas absent _____ **Potamogetonaceae**
40. Flowers not in pedunculate spikes; stipules absent; venation pinnate or palmate; fruits capsules OR fruits appearing to have 2 lobes and eventually splitting into 4 achene-like mericarps; corollas present OR absent.
41. Leaves less than 15 mm long; flowers imperfect, the plants monoecious; fruits appearing to have 2 lobes and eventually splitting into 4 achene-like mericarps _____ **Callitrichaceae**

41. Leaves more than 15 mm long; flowers perfect; fruits capsules.
    42. Venation pinnate; corollas radially symmetrical or absent; petals free or absent; ovaries inferior. _____ **Onagraceae**
    42. Venation palmate; corollas bilaterally symmetrical; petals fused; ovaries superior _____ **Scrophulariaceae**

32. Leaves submersed.
    43. Leaves obovate or oblanceolate or ovate or lanceolate or elliptic or linear-lanceolate.
        44. Leaves alternate or in basal rosettes; petioles conspicuous, 5–20 cm long; perianth salverform, the segments united below into a distinct tube _____ **Pontederiaceae**
        44. Leaves whorled or opposite; petioles much shorter than 5 cm long; perianth of separate segments or absent.
            45. Leaves whorled, elliptic or linear-lanceolate _____ **Hydrocharitaceae**
            45. Leaves opposite, obovate or oblanceolate.
                46. Stipules present; flowers perfect; fruits subglobose capsules; leaves not forming rosettes at the stem tips _____ (*Elatine*) **Elatinaceae**
                46. Stipules absent; flowers imperfect, the plants monoecious; fruits somewhat flattened laterally, often slightly heart-shaped and appearing to have 2 lobes, eventually splitting into 4 achene-like mericarps; leaves sometimes forming rosettes at the stem tips __ (*Callitriche*) **Callitrichaceae**
    43. Leaves linear or filiform.
        47. Plants cespitose, attached to rocks by fleshy disks and forming mats or crusts on them; [Family in OK, not in TX] _____ **Podostemaceae**
        47. Plants rhizomatous or with stems rooting at nodes, not attached to rocks by fleshy disks.
            48. Leaves alternate or basal.
                49. Leaves basal; flowers absent OR present.
                    50. Leaves thread-like, terete, 1.6–10.2 cm long; flowers absent; spores produced in sori borne in hard sporocarps in axils of leaves _____ **Marsileaceae**
                    50. Leaves ribbon-like, the flattened blades to 20 mm wide, to 60 cm long; flowers present; spores produced in anthers and ovaries _____ (*Vallisneria*) **Hydrocharitaceae**
                49. Leaves alternate; flowers present.
                    51. Perianth pale yellow, with an elongate tube and a 6-parted limb; stamens 3 _____ **Pontederiaceae**
                    51. Perianth of 4 inconspicuous greenish segments or absent; stamens 2 or 4.
                        52. Flowers borne in 2–5 whorls on peduncles elongated above water surface; perianth parts present; stamens 4 ___ **Potamogetonaceae**
                        52. Flowers borne in 1 whorl on peduncle below water surface; perianth parts absent; stamens 2; [Family in OK and se and s TX, not in nc TX] _____ **Ruppiaceae**
            48. Leaves opposite or appearing whorled.
                53. Leaf bases not sheathing stems; apices of leaf blades obtuse, notched.
                    54. Fruits capsules; perianth parts present _____ **Lythraceae**
                    54. Fruits appearing to have 2 lobes and eventually splitting into 4

achene-like mericarps; perianth parts absent _____ **Callitrichaceae**

53. Leaf bases sheathing stems; apices of leaf blades acute, not notched.
    55. Leaf sheaths conspicuously inflated and elongated, 6–10 mm long; flowers borne on elongated peduncles; [Family in OK and se and s TX, not in nc TX] _____ **Ruppiaceae**
    55. Leaf sheaths neither conspicuously inflated nor elongated, 0.2–4 mm long; flowers borne in axils of leaves.
        56. Leaf blades usually minutely denticulate under a scope OR obviously toothed to the naked eye; pistils 1 per flower; fruits terete, not beaked, not curved, not stipitate __ (*Najas*) **Hydrocharitaceae**
        56. Leaf blades entire; pistils 2–8 per flower; fruits flattened, beaked (the beak to 1.5 mm long), curved, short stipitate (= stalked) _____ **Zannichelliaceae**

31. Plants emergent from water.
    57. Leaves modified into hollow, tubular, trumpet-shaped pitchers; flowers solitary at the end of a long naked scape _____ **Sarraceniaceae**
    57. Leaves not modified into pitchers; flowers variously arranged.
        58. Venation pinnate or palmate.
            59. Plants acaulescent; leaves basal.
                60. Flowers 5-merous; fruits schizocarps _____ (*Hydrocotyle*) **Apiaceae**
                60. Flowers 3-merous; fruits capsules or berries or achenes.
                    61. Corollas bilaterally symmetrical, purple; ovaries inferior; fruits capsules _____ **Marantaceae**
                    61. Corollas radially symmetrical or absent, white; ovaries superior; fruits berries or achenes.
                        62. Inflorescences spadices; spathes present; fruits berries _____ **Araceae**
                        62. Inflorescences racemes, the flowers borne in whorls of 3; spathes absent; fruits achenes _____ **Alismataceae**
            59. Plants caulescent; leaves cauline.
                63. Corollas bilaterally symmetrical.
                    64. Seeds 2–4; anther apices recurved; anthers borne at 45 degree angle to filaments _____ **Acanthaceae**
                    64. Seeds 12 or more; anther apices not recurved; anthers borne vertically or at less than 45 degree angle to filaments _____ **Scrophulariaceae**
                63. Corollas radially symmetrical or absent.
                    65. Ovaries inferior.
                        66. Flowers in terminal spikes; capsules with circumscissile dehiscence; corollas sympetalous _____ **Sphenocleaceae**
                        66. Flowers in axils of upper leaves; capsules without circumscissile dehiscence; corollas of separate petals or absent _____ **Onagraceae**
                    65. Ovaries superior.
                        67. Leaves opposite.
                            68. Flowers in pedunculate heads; petals absent (tepals silvery white) _____ (*Alternanthera*) **Amaranthaceae**
                            68. Flowers borne in all axils of stem leaves; petals present, lavender to pink to purple-red or rose-purple _____ **Lythraceae**
                        67. Leaves alternate.
                            69. Inflorescences spadices; spathes present; larger leaf blades to 90 cm long, sagittate at base _____ **Araceae**

69. Inflorescences not spadices; spathes not present; leaf blades of various sizes, typically much smaller, usually not sagittate at base.
    70. Plants armed with 1–2 spines per node; corollas blue (rarely white), showy, 11–17 mm long _____ **Hydrophyllaceae**
    70. Plants unarmed; corollas if present much smaller, never blue.
        71. Leaves of 2 forms, the submersed ones pinnately compound or pinnately dissected, the emergent ones simple; inflorescences racemes or solitary flowers.
            72. Inflorescences racemes, terminal; petals 4; pistils 2-carpellate; fruits siliques or silicles _____ **Brassicaceae**
            72. Inflorescences solitary flowers, axillary; petals 0; pistils 3-carpellate; fruits nut-like _____ **Haloragaceae**
        71. Leaves all alike; inflorescences spikes or spicate racemes.
            73. Stipules present as ocrea; perianth parts present; pistils 1 per flower; fruits achenes _____ **Polygonaceae**
            73. Stipules absent; perianth parts absent; pistils 3–4 per flower, fused at base; fruits capsules _____ **Saururaceae**

58. Venation parallel or parallel-convergent.
    74. Leaf blades sagittate or cordate or ovate or elliptic, the venation parallel-convergent.
        75. Plants caulescent; leaves cauline; perianth parts absent _____ **Saururaceae**
        75. Plants acaulescent; leaves forming a rosette; perianth parts present.
            76. Pistils 12 or more per flower; perianth parts in 2 series, the parts free; fruits achenes _____ **Alismataceae**
            76. Pistils 1 per flower; perianth parts in 1 series, the parts fused; fruits capsules or utricles _____ **Pontederiaceae**
    74. Leaf blades linear or linear-lanceolate, elongated, the venation parallel.
        77. Leaves minute, less than 1 cm long, arising from filiform subterranean stems (leaves are possibly leaf-like branches); sac-like bladders borne laterally on stems; flowers borne on filiform scapes 10–20 cm long, bilabiate _____ **Lentibulariaceae**
        77. Leaves more than 1 cm long, arising from well-developed aerial or subterranean stems; sac-like bladders absent; flowers not borne on filiform scapes, not bilabiate.
            78. Plants caulescent; leaves cauline.
                79. Perianth parts petaloid or sepaloid.
                    80. Inflorescences racemes; ovaries inferior; perianth parts very unequal, one a lip divided into three narrow lobes and extended at base into a spur 9–14 mm long _____ **Orchidaceae**
                80. Inflorescences spadices or panicles or glomerules or head-like clusters; ovaries superior; perianth parts equal, none differentiated into a lip; spur absent.
                    81. Inflorescences spadices; spadices diverging from the side of elongate, linear, spathe-like scapes; peduncles 3-angled; fruits berries _____ **Acoraceae**
                81. Inflorescences panicles or glomerules or head-like clus-

ters; spathe-like scapes absent; peduncles terete or flattened; fruits capsules _____ **Juncaceae**

79. Perianth parts absent or perianth of bristles or scales.
    82. Stems jointed, the nodes and internodes distinct; each flower subtended by 2–5 bracts; stigmas feathery _____ **Poaceae**
    82. Stems not jointed, the nodes and internodes not distinct; each flower subtended by 1 bract or bracts absent; stigmas barbellate or smooth.
        83. Leaves 3-ranked; margins of leaf sheaths fused to form tubes _____ **Cyperaceae**
        83. Leaves 2-ranked; margins of leaf sheaths overlapping, not fused.
            84. Inflorescences cylindrical; achenes long stipitate, subtended by bristles _____ **Typhaceae**
            84. Inflorescences globose; achenes sessile or subsessile, not subtended by bristles; [Family in OK and se and s TX, not in nc TX] _____ **Sparganiaceae**

78. Plants acaulescent; leaves basal.
    85. Flowers absent; spores produced in sporangia at bases of leaves or in subterranean sporocarps.
        86. Plants cespitose with corms 2–5 lobed; leaves 5–60 cm long, divided into 4 longitudinal cavities, the bases enlarged; sporangia embedded in leaf bases _____ **Isoetaceae**
        86. Plants rhizomatous; leaves 1.6–10.2 cm long, not divided into 4 longitudinal cavities, the bases not enlarged; sporangia borne in subterranean sporocarps _____ **Marsileaceae**
    85. Flowers present; spores produced in anthers or ovaries.
        87. Perianth parts absent or perianth of 6 inconspicuous bristles or 6 scales.
            88. Leaves inconspicuous, reduced to scales or bladeless sheaths at stem bases; plants appearing to consist only of green leafless stems _____ **Cyperaceae**
            88. Leaves conspicuous, with well-developed blades and petioles or sheaths; plants not appearing to consist only of green leafless stems.
                89. Leaves 2-ranked; margins of leaf sheaths overlapping, not fused; inflorescences heads, globose, 6 or more per peduncle, with multiple staminate heads above multiple pistillate heads; [Family in OK and se and s TX, not in nc TX] _____ **Sparganiaceae**
                89. Leaves 3-ranked; margins of leaf sheaths fused; inflorescences of various types, 1–4 per peduncle, multiple staminate heads not borne above multiple pistillate heads _____ **Cyperaceae**
        87. Perianth parts present, petaloid or sepaloid.
            90. Flowers imperfect, the plants monoecious; pistils 12 or more per flower; stamens 12 or more; inflorescences racemes or multiple heads; fruits achenes.
                91. Inflorescences racemes, the flowers borne in whorls

of 3; perianth parts in 2 series; petals white; achenes beakless _____ **Alismataceae**

91. Inflorescences heads, the flowers numerous; perianth parts in 1 series; petals absent; achenes beaked; [Family in OK and se and s TX, not in nc TX] _____ **Sparganiaceae**

90. Flowers perfect; pistils 1 per flower; stamens 3 or 4 or 6; inflorescences solitary spikes or solitary heads; fruits capsules.

92. Perianth parts yellow, glabrous; stamens 3; anthers yellow _____ **Xyridaceae**

92. Perianth parts gray-black, bearing fleshy trichomes at apices; stamens 4 or 6; anthers black _____ **Eriocaulaceae**

GROUP H

Plants herbaceous vines or epiphytes or aerial hemiparasites.

1. Plants entirely parasitic; chlorophyll absent; stems filamentous, typically forming tangled masses on host plants, or embedded entirely in tissues of host plants; leaves absent or reduced to scales.
   2. Stems apparent, filamentous, typically forming tangled masses on host plants, white or yellow or orange; flowers perfect; perianth parts in 2 series; ovaries superior _____ **Cuscutaceae**
   2. Stems not apparent, embedded entirely in tissues of *Dalea* spp., only flowers and subtending bracts visible; flowers imperfect; perianth parts in 1 series; ovaries inferior _____ **Rafflesiaceae**
1. Plants autophytic or hemiparasitic (at least partially autophytic); chlorophyll present; stems neither filamentous nor imbedded in host tissues; leaves present.
   3. Plants epiphytes or hemiparasites, the plants growing on other plants, without roots in the ground; stems arising from bark of woody hosts.
      4. Leaf margins entire; flowers present; spores produced in anthers or ovaries; fruits present.
         5. Plants truly epiphytic, growing on branches of other plants but not penetrating the tissues of the host plant; fruits capsules; leaves very narrow to thread-like, 2 mm or less wide _____ **Bromeliaceae**
         5. Plants hemiparasitic, penetrating the tissues of the host plant; fruits drupes; leaves elliptical-ovate to orbicular, much > 2 mm wide [Stems woody at base, but falsely appearing herbaceous] _____ (Viscaceae) **Group A**
      4. Leaf (frond) margins pinnately lobed; flowers absent; spores produced in sori on abaxial surfaces of fronds; fruits absent _____ **Polypodiaceae**
   3. Plants vines; stems arising from soil and climbing or twining among other plants for support.
      6. Stems climbing by tendrils.
         7. Leaves simple.
            8. Leaf margins entire or finely denticulate; leaf venation pinnate or parallel-convergent.
               9. Venation pinnate; inflorescences racemes (these can be panicled); perianth parts 5; fruits achenes _____ **Polygonaceae**
               9. Venation parallel-convergent; inflorescences umbels; perianth parts 6; fruits berries _ **Smilacaceae**
            8. Leaf margins lobed or serrate; leaf venation palmate.
               10. Flowers with a conspicuous fringed corona attached to hypanthial cup; petals free; styles 3; ovaries superior _____ **Passifloraceae**
               10. Flowers without a fringed corona; petals fused; styles 1; ovaries inferior _____ **Cucurbitaceae**
         7. Leaves compound.
            11. Leaves opposite; perianth parts in 1 series; fruits achenes with plumose tails _____ **Ranunculaceae**

11. Leaves alternate; perianth parts in 2 series; fruits legumes or capsules.
    12. Leaves 1-compound; tendrils borne on leaves, formed from ultimate leaflets; flowers papilionaceous; fruits legumes _____ (Papilionoideae) **Fabaceae**
    12. Leaves 2- or 3-compound; tendrils borne on peduncles of inflorescences; flowers funnelform; fruits capsules, inflated, 3-loculed, with 3 round black seeds _____ **Sapindaceae**

6. Stems climbing by twining; tendrils absent.
    13. Plants not producing flowers and seeds; spores produced in sporangia borne in 2-rowed aggregations at ends of oblong marginal lobes of pinnules; [Family in OK and se and s TX, not in nc TX] _____ **Lygodiaceae**
    13. Plants producing flowers and seeds; spores produced in sporangia borne in anthers or ovaries.
        14. Leaves alternate.
            15. Leaves compound, at least on upper stems; flowers papilionaceous; fruits legumes _____ (Papilionoideae) **Fabaceae**
            15. Leaves simple; flowers of various forms, but not papilionaceous; fruits capsules or achenes or drupes.
                16. Perianth parts in 2 series.
                    17. Corollas bilabiate (= 2-lipped); stamens 4 _____ (*Maurandya*) **Scrophulariaceae**
                    17. Corollas not bilabiate; stamens 5–12.
                        18. Petals 5, fused; corollas salverform; fruits capsules; seeds 1–4, wedge-shaped _____ **Convolvulaceae**
                        18. Petals 3 or 6, free; corollas bowl-shaped; fruits drupes, red at maturity; seeds 1, the stone curved into a closed spiral [Plants woody, but distal portion of stems falsely appearing herbaceous] _____ (Menispermaceae) **Group A**
                16. Perianth parts in 1 series or absent.
                    19. Leaves thin-fleshy; stipules absent; perianth parts 5 _____ **Basellaceae**
                    19. Leaves not fleshy; stipules absent OR present as ocrea sheathing stems; perianth parts 3 or 6.
                        20. Stipules present as ocrea sheathing stems; perianth parts 3; fruits achenes, trigonous, not winged, black at maturity _____ **Polygonaceae**
                        20. Stipules absent; perianth parts 6; fruits capsules; seeds 1 or 2, flat, winged, golden-brown at maturity _____ **Dioscoreaceae**
        14. Leaves opposite or whorled.
            21. Leaves whorled, becoming opposite or alternate above _____ **Dioscoreaceae**
            21. Leaves opposite at all nodes.
                22. Petals absent.
                    23. Leaves simple; plants dioecious; perianth parts sepaloid; inflorescences dissimilar, the pistillate flowers in drooping clustered spikes, the staminate flowers borne in drooping panicles _____ **Cannabaceae**
                    23. Leaves compound; plants dioecious or polygamous; perianth parts petaloid; pistillate and staminate inflorescences similar, panicles _____ **Ranunculaceae**
                22. Petals present.
                    24. Inflorescences heads, in cymose-paniculate arrangement, the individual heads 4-flowered; ovaries inferior; pappus present, of numerous capillary bristles; fruits achenes _____ (*Mikania*) **Asteraceae**
                    24. Inflorescences umbels or cymes or racemes or flowers solitary; ovaries superior; pappus absent; fruits follicles or capsules, with seeds usually 12 or more.

25. Corollas yellow to orange, cream, or white, with a dark purple center; stamens 4; petioles conspicuously winged _____ (*Thunbergia*) **Acanthaceae**
25. Corollas variously colored but not light with a dark purple center; stamens 5; petioles not winged.
    26. Pistils 1 per flower; fruits 2-valved capsules flattened contrary to the septum; corollas showy, yellow, funnelform, 25–35 mm long [Plants woody, but distal portion of stems falsely appearing herbaceous] _____ (*Gelsemium*—Loganiaceae) **Group A**
    26. Pistils 2 per flower, united at stigmas; fruits follicles; corollas not as above.
        27. Coronas present; pollen aggregated in pollinia; anthers fused to stigmas to form gynostegia; follicles 1 at maturity _____ **Asclepiadaceae**
        27. Coronas absent; pollen not aggregated in pollinia; anthers united but not fused to stigmas; follicles 2 at maturity [Plants woody, but distal portion of stems falsely appearing herbaceous] _____ (Apocynaceae) **Group A**

GROUP I

Plants parasitic or saprophytic; chlorophyll absent.

1. Stems filamentous, typically forming tangled masses on host plants OR embedded entirely in tissues of host plants; leaves absent or reduced to scales.
    2. Stems apparent, filamentous, typically forming tangled masses on host plants, white or yellow or orange; flowers perfect; perianth parts in 2 series; ovaries superior _____ **Cuscutaceae**
    2. Stems not apparent, embedded entirely within tissues of *Dalea* spp., only flowers and subtending bracts visible; flowers imperfect; perianth parts in 1 series; ovaries inferior _____ **Rafflesiaceae**
1. Stems neither filamentous nor imbedded in host tissues; leaves present (but can be reduced and bract-like).
    3. Ovaries inferior; perianth parts 3 or in multiples of 3 _____ **Orchidaceae**
    3. Ovaries superior; perianth parts 4 or 5.
        4. Corollas radially symmetrical; leaves cauline; fertile stamens 8 or 10; sepals deciduous _____ (previously Monotropaceae) **Ericaceae**
        4. Corollas bilaterally symmetrical; leaves basal; fertile stamens 4; sepals persistent _____ **Orobanchaceae**

GROUP J

Plants acaulescent herbs; plants producing flowers and seeds.

1. Leaves inconspicuous, reduced to scales or bladeless sheaths at stem bases; plants appearing to consist only of green leafless stems _____ **Cyperaceae**
1. Leaves conspicuous, with well-developed blades, and petioles or sheaths; plants consisting of scapes and leaves.
    2. Leaves modified into hollow, tubular, trumpet-shaped pitchers _____ **Sarraceniaceae**
    2. Leaves not modified into pitchers.
        3. Leaves emerging from ground singly or in 2s or in 3s, neither forming conspicuous rosettes nor tufts; flowers borne on scapes that emerge from ground separately from leaves.
            4. Leaves compound.
                5. Inflorescences spadices; spathes present; flowers imperfect, borne in same inflorescence, the staminate above the pistillate; fruits berries _____ **Araceae**
                5. Inflorescences racemes or cymes or solitary flowers; spathes absent; flowers perfect; fruits capsules or achenes.

6. Leaves 2-compound; inflorescences racemes; corollas bilaterally symmetrical _____ **Fumariaceae**
6. Leaves 1-compound; inflorescences cymes or solitary flowers; corollas radially symmetrical.
7. Pistils 1; leaflets usually obcordate _____ **Oxalidaceae**
7. Pistils 12 or more; leaflets of various shapes, but not obcordate _____ **Ranunculaceae**

4. Leaves simple.
8. Leaf margins entire or weakly undulate.
9. Inflorescences spadices or heads.
10. Leaves with sheaths; inflorescences spadices; spathes present; perianth parts 6 or 0; fruits berries _____ **Araceae**
10. Leaves without sheaths; inflorescences heads; spathes absent; perianth parts 5; fruits achenes _____ **Asteraceae**
9. Inflorescences racemes or spikes or panicles or umbels or solitary flowers.
11. Corollas bilaterally symmetrical; stamens 1 or 2, united with style to form a column _____ **Orchidaceae**
11. Corollas (or corolla-like calyces) radially symmetrical; stamens 6 or 12, free, not united with a style.
12. Perianth parts 3; stamens 12; leaves cordate-reniform _____ **Aristolochiaceae**
12. Perianth parts 6; stamens 6; leaves linear or lanceolate or ovate _____ **Liliaceae**
8. Leaf margins crenate or toothed or lobed or cleft.
13. Flowers bilaterally symmetrical, with one of the 5 petals with a short basal spur; fruits 3-valved, unarmed capsules _____ **Violaceae**
13. Flowers radially symmetrical, without a spurred petal; fruits schizocarps or achenes or follicles or capsules (if capsules either prickly or not 3-valved).
14. Leaf blades orbicular, peltate or nearly so, the margins crenate.
15. Flowers borne in open or spicate umbels; styles 2; ovaries inferior _____ (*Hydrocotyle*) **Apiaceae**
15. Flowers borne in 2s in axils of leaves; styles 5; ovaries superior _____ **Geraniaceae**
14. Leaf blades flabellate (= fan-shaped) or reniform, not peltate, the margins palmately lobed or cleft.
16. Stamens 5 or 10; fruits schizocarps, dehiscing into 5, one-seeded, beaked mericarps _____ **Geraniaceae**
16. Stamens 20 or more; fruits capsules or achenes.
17. Pistils 1; fruits capsules; sap of rhizomes red-orange _____ **Papaveraceae**
17. Pistils 20 or more; fruits achenes; sap of tubers colorless _____ **Ranunculaceae**

3. Leaves forming rosettes or tufts; flowers borne on scapes that emerge from centers of rosettes or tufts.
18. Leaves compound.
19. Leaves 2- or 3-compound; ovaries inferior _____ **Apiaceae**
19. Leaves 1-compound; ovaries superior.
20. Inflorescences umbels; stamens 5; fruits schizocarps, dehiscing into 5, one-seeded, beaked mericarps _____ **Geraniaceae**
20. Inflorescences of various types, but not umbels; stamens 6 or more; fruits achenes or drupes or berries.
21. Leaflets 11–25, 30–45 cm long, the arrangement conspicuously flabellate (= fan-shaped); stamens 6 _____ **Arecaceae**
21. Leaflets 3–7, 3–5 cm long, the arrangement not flabellate; stamens 10 or more.
22. Stipules present; perianth parts in 2 series _____ **Rosaceae**
22. Stipules absent; perianth parts in 1 series _____ **Ranunculaceae**

18. Leaves simple.
    23. Leaves spatulate or clavate, covered with long glandular hairs that exude a clear, glistening, sticky secretion; plants insectivorous _____ **Droseraceae**
    23. Leaves of various shapes and with various indumentation, but not covered with long glandular hairs; plants not insectivorous.
        24. Perianth parts absent; flowers enclosed by spathes or chaffy bracts.
            25. Leaves sagittate; flowers enclosed by spathes; inflorescences spadices _____ **Araceae**
            25. Leaves linear or linear-lanceolate; flowers enclosed by chaffy bracts; inflorescences spikes _____ **Cyperaceae**
        24. Perianth parts present; flowers not enclosed by either spathes or chaffy bracts.
            26. Perianth parts in 2 series.
                27. Perianth parts in 3s.
                    28. Perianth parts (tepals) variously bluish to violet or purple _____ **Iridaceae**
                    28. Perianth parts (petals) yellow to white or pink.
                        29. Petals yellow; inflorescences cone-like, with spirally imbricated, brownish, thin, ± woody bracts _____ **Xyridaceae**
                        29. Petals white or pink; inflorescences not cone-like.
                            30. Flowers borne in fascicles at ends of inflorescence branches; pistils 1 per flower _____ **Polygonaceae**
                            30. Flowers borne in whorls of 3 along a rachis; pistils 25 or more per flower _____ **Alismataceae**
                27. Perianth parts in 4s or 5s.
                    31. Perianth parts in 4s.
                        32. Flowers borne at base of plant; ovaries inferior; stamens 8 _____**Onagraceae**
                        32. Flowers (actually inflorescences) borne at ends of elongated peduncles; ovaries superior; stamens 2 or 4 or 6.
                            33. Inflorescences racemes; stamens 6; petals free, yellow or white, membranous; fruits siliques or silicles _____ **Brassicaceae**
                            33. Inflorescences spikes, dense; stamens 2 or 4; petals fused, chartaceous, hyaline; fruits capsules, circumscissile __ **Plantaginaceae**
                    31. Perianth parts in 5s.
                        34. Inflorescences heads, 1–10 per plant, the arrangement solitary or racemose or spicate; pappus of bristles or scales _____ **Asteraceae**
                        34. Inflorescences panicles or umbels or cymes or solitary flowers, heads not present; pappus not present.
                            35. Inflorescences panicles, large, dichotomously branched, with numerous flowers; sepal apices white; fruits utricles; [Family in OK and se and s TX, not in nc TX] _____ **Plumbaginaceae**
                            35. Inflorescences umbels or cymes or solitary flowers; sepal apices green; fruits capsules or achenes.
                                36. Pistils 12 or more per flower; sepals spurred at base; fruits achenes _____ **Ranunculaceae**
                                36. Pistils 1 per flower; sepals not spurred at base; fruits capsules.
                                    37. Corollas bilaterally symmetrical; petals spurred or gibbous.
                                        38. Sepals fused; petals fused; leaves soft-fleshy, greasy to the touch _____ **Lentibulariaceae**

38. Sepals free; petals free; leaves not soft-fleshy, not greasy to the touch _____ **Violaceae**

37. Corollas radially symmetrical; petals neither spurred nor gibbous.

39. Petals free; stigmas 2–4 _____ **Saxifragaceae**

39. Petals fused; stigmas 1 _____ **Primulaceae**

26. Perianth parts in 1 series or parts all similar.

40. Inflorescences heads or spadices.

41. Inflorescences heads; perianth parts and stamens 5; ovaries inferior _____ **Asteraceae**

41. Inflorescences spadices; perianth parts and stamens 6; ovaries superior _____ **Araceae**

40. Inflorescences of various types, but neither heads nor spadices.

42. Pistils 12 or more per flower.

43. Flowers imperfect, borne in whorls of 3; perianth parts 3 _____ **Alismataceae**

43. Flowers perfect, borne singly; perianth parts 5 or more _____ **Ranunculaceae**

42. Pistils 1 per flower.

44. Ovaries inferior.

45. Corollas bilaterally symmetrical; stamens 1 or 2, united with style to form a column _____ **Orchidaceae**

45. Corollas radially symmetrical; stamens 3 or 6, free, not united with style.

46. Inflorescences spikes, elongated, 25–45 cm long; leaves conspicuously stiff and succulent; leaf apices spine-tipped; leaf margins minutely spinose _____ **Agavaceae**

46. Inflorescences of various types, but not elongated spikes; leaves flexible and non-succulent; leaf apices not spine-tipped; leaf margins entire.

47. Leaves equitant; stamens 3 _____ **Iridaceae**

47. Leaves not equitant; stamens 6 _____ **Liliaceae**

44. Ovaries superior.

48. Venation pinnate; flowers borne in umbellate fascicles, subtended by whorls of foliaceous bracts; stamens 9 _____ **Polygonaceae**

48. Venation parallel; flowers not borne in umbellate fascicles; bracts if present neither foliaceous nor in whorls; stamens 3 or 6.

49. Leaves conspicuously 3-ranked; each flower enclosed by 1 chaffy bract; fruits achenes _____ **Cyperaceae**

49. Leaves without conspicuous ranking; flowers not enclosed by chaffy bracts; fruits capsules or berries.

50. Leaves conspicuously stiff and succulent or not so, arising from woody caudices or thick, fibrous-rooted crowns; leaf apices spine-tipped or not so; inflorescences many-flowered racemes or panicles _____ **Agavaceae**

50. Leaves flexible and non-succulent, arising from

fibrous roots or bulbs or corms or rhizomes; leaf apices not spine-tipped; inflorescences various.

51. Inflorescences solitary spikes or solitary heads.
    52. Perianth parts yellow, glabrous; stamens 3; anthers yellow _____ **Xyridaceae**
    52. Perianth parts gray-black, bearing fleshy trichomes at apices; stamens 4 or 6; anthers black _____ **Eriocaulaceae**
51. Inflorescences panicles or racemes or umbels.
    53. Perianth parts green or brown, scarious, persistent at fruit maturity _____ **Juncaceae**
    53. Perianth parts of various bright colors, moist, withering by fruit maturity _____ **Liliaceae**

GROUP K

Plants acaulescent or caulescent herbs; spores produced in sori or sporocarps or in aggregations of sporangia at ends of elongated stalks.

1. Leaves (microphylls) scale-like, less than 1 cm long, the veins 1, unbranched; aerial stems present; strobili present, terminal.
   2. Stems jointed, fluted, the internodes hollow; leaves (very reduced) whorled and forming sheaths around stems _____ **Equisetaceae**
   2. Stems not jointed, not fluted, the internodes solid; leaves spiraled and imbricate.
      3. Leaves 1–3 mm long; strobili 4-angled; spores of 2 sizes _____ **Selaginellaceae**
      3. Leaves 6–7 mm long; strobili cylindrical; spores of 1 size _____ **Lycopodiaceae**
1. Leaves (megaphylls) not scale-like, more than 1 cm long, the veins 2 or more, branched; aerial stems absent; strobili absent.
   4. Leaves linear or filiform.
      5. Plants bearing both simple and dichotomously compound leaves; sporangia produced in sori on abaxial surfaces of pinnae; pinnae present, the margins bearing 1–3 teeth [*Asplenium* spp. with linear or filiform leaves in OK, not in TX] _____ **Aspleniaceae**
      5. Plants bearing only simple leaves; sporangia produced in cavities at bases of leaves or in subterranean sporocarps; pinnae absent.
         6. Plants cespitose with corms 2–5 lobed; leaves 5–60 cm long, divided into 4 longitudinal cavities, the leaf bases enlarged; sporangia embedded in leaf bases _____ **Isoetaceae**
         6. Plants rhizomatous; leaves 1.6–10.2 cm long, not divided into 4 longitudinal cavities, the leaf bases not enlarged; sporangia borne in subterranean sporocarps _____ **Marsileaceae**
   4. Leaves of various shapes, but neither linear nor filiform.
      7. Plants climbing; leaves twining; sporangia clustered in 2-rowed aggregations at ends of oblong marginal lobes of pinnules; [Family in in OK and se and s TX, not in nc TX] _____ **Lygodiaceae**
      7. Plants not climbing; leaves not twining; sporangia clustered in sori or in aggregations at ends of elongated stalks.
         8. Leaves palmately compound; leaflets 4, obdeltoid or flabellate; spores produced in sori borne in hard sporocarps in axils of leaves _____ **Marsileaceae**
         8. Leaves simple or pinnately compound; leaflets when present usually neither obdeltoid nor flabellate; spores produced in aggregations of sporangia at ends of stalks or in sori on abaxial surfaces of fronds; sporocarps absent.
            9. Spores produced in aggregations of sporangia at ends of elongated stalks.
               10. Fronds (leaves) simple.

11. Fronds ovate or elliptic, the margins entire _____ **Ophioglossaceae**
11. Fronds deltoid, the margins pinnatifid _____ **Dryopteridaceae**

10. Fronds (leaves) compound.
12. Lowermost 2 pinnae (= primary divisions of a leaf, here one on each side of the leaf) of the fertile leaf long-stalked and thus greatly elongated (usually longer than the sterile portion of the leaf), very different from the other pinnae, and bearing sporangia near the apex _____ **Anemiaceae**
12. Lowermost 2 pinnae of the fertile leaf not as above, either fronds of 2 different types—sterile and fertile OR fronds differentiated into basal sterile and apical fertile portions.
13. Fronds of 2 types, the sterile fronds foliaceous, the fertile fronds stalk-like and bearing aggregations of sporangia at ends.
14. Pairs of pinnae 15–25; bases of pinnae with tufts of reddish brown hairs _____ **Osmundaceae**
14. Pairs of pinnae 1–12; bases of pinnae without tufts of reddish brown hairs.
15. Blades of vegetative fronds 17–35 cm long; rhizomes present; roots not fleshy _____ **Dryopteridaceae**
15. Blades of vegetative fronds 3–15 cm long; rhizomes absent; roots fleshy [Fronds of 1 type, but divided near base, hence falsely appearing as 2 types of fronds] _____ **Ophioglossaceae**
13. Fronds of 1 type, differentiated into basal sterile and apical fertile portions, the sterile portions foliaceous, the fertile portions bearing paniculate aggregations of sporangia.
16. Blades of sterile portions of fronds 3–15 cm long; rhizomes absent; roots fleshy; reproductive portion of frond arising from base of vegetative portion; sporangia fused to form 2 rows _____ **Ophioglossaceae**
16. Blades of sterile fronds 20–50 cm long; rhizomes present; roots not fleshy; reproductive portion of fronds arising at apex of vegetative portion; sporangia free _____ **Osmundaceae**

9. Spores produced in sori on abaxial surfaces of fronds.
17. Fronds simple.
18. Frond margins pinnatifid; frond bases truncate or acute, the apices acute, neither rooting nor forming new plants; sori orbicular; indusia absent _____ **Polypodiaceae**
18. Frond margins entire; frond bases cordate, the apices attenuate, rooting and forming new plants; sori elongate; indusia present [*Asplenium rhizophyllum* in OK, not in TX] _____ **Aspleniaceae**
17. Fronds 1- or 2- or 3-compound.
19. Fronds of 2 conspicuously different types, sterile and fertile, 1-compound; veins of fronds partly anastomosing _____ **Blechnaceae**
19. Fronds of 1 type, not differentiated into conspicuously different sterile and fertile, 1- or 2- or 3-compound; veins of fronds free OR partly anastomosing.
20. Sori linear-oblong, end to end in one row on each side of, immediately adjacent to, and parallel with the costules (= midveins of the pinnules), chain-like in arrangement; veins of fronds partly anastomosing (veins anastomosing to form a single row of areoles near midvein) _____ **Blechnaceae**
20. Sori various, but not as above; veins of fronds free.
21. Sori located at margins of pinnae or pinnules, completely or partially covered by revolute margins.

22. Blades broadly triangular; sori covered by both margin of pinnule and hyaline indusium; rhizome scales absent _____ **Dennstaedtiaceae**
22. Blades lanceolate or elliptic or rhomboidal or reniform; sori covered only by margin of pinna or pinnule; indusium absent; rhizome scales present _____ **Pteridaceae**

21. Sori not located at margins of pinnae or pinnules, not covered by revolute margins.
23. Indusia absent or seemingly so.
24. Fronds separated; distal portions of rachises winged; veins reaching margins of pinnules _____ **Thelypteridaceae**
24. Fronds clustered together; distal portions of rachises not winged; veins not reaching margins of pinnules _____ **Aspleniaceae**
23. Indusia present, conspicuous.
25. Indusia orbicular or reniform, attached at sinus or in center or at base _____ **Dryopteridaceae**
25. Indusia linear or oblong, attached along edge.
26. Stipes stramineous, angular or flattened; fronds annual, deciduous; indusia crossing veins _____ **Dryopteridaceae**
26. Stipes black or brown or green, terete, neither angular nor flattened; fronds perennial, evergreen; indusia not crossing veins _____ **Aspleniaceae**

GROUP L

Plants caulescent herbs; perianth parts absent.

1. Venation parallel or a single vein.
2. Flowers borne in cyathia; ovaries 3-lobed, the lobes round; fruits capsular-schizocarps, 3-seeded _____ **Euphorbiaceae**
2. Flowers borne in spikelets or spikes or heads or solitary; ovaries not 3-lobed; fruits achenes or caryopses or achene-like mericarps.
3. Flowers subtended by 1–5 chaffy bracts.
4. Leaves 2-ranked; stems rounded, jointed, the nodes and internodes apparent; each flower subtended by 2–5 bracts; stigmas feathery _____ **Poaceae**
4. Leaves 3-ranked; stems rounded or often triangular, not jointed, the nodes and internodes not apparent; each flower subtended by 1 bract; stigmas barbellate or smooth _____ **Cyperaceae**
3. Flowers not subtended by bracts.
5. Flowers solitary, axillary; fruits appearing to have 2 lobes and eventually splitting into 4 achene-like mericarps; stamens 1 _____ **Callitrichaceae**
5. Flowers many, terminal; fruits achenes, 1 per flower; stamens 3.
6. Inflorescences spikes, dense, elongated, cylindrical; achenes long stipitate, subtended by hairs. _____ **Typhaceae**
6. Inflorescences heads, spherical; achenes sessile or subsessile, not subtended by hairs; [Family in OK and se and e TX, not nc TX] _____ **Sparganiaceae**

1. Venation pinnate or palmate.
7. Leaves opposite.
8. Leaves spatulate or obovate or oblanceolate; stems flaccid; flowers solitary, borne in leaf axils; fruits appearing to have 2 lobes and eventually splitting into 4 achene-like mericarps _____ **Callitrichaceae**

8. Leaves ovate or lanceolate or linear; stems rigid or flexible, but not flaccid; flowers borne in heads or cyathia; fruits achenes or capsular-schizocarps, 1 per flower.
   9. Flowers borne in small heads; heads borne in elongated terminal racemes or in axils of leaves; fruits achenes, enclosed in involucre to form a bur _____ (*Ambrosia*) **Asteraceae**
   9. Flowers borne in cyathia; fruits capsular-schizocarps, 3-lobed _____ **Euphorbiaceae**
7. Leaves alternate.
   10. Inflorescences spadices or heads or spiny burs or cyathia.
      11. Root systems fibrous; leaves with sheaths; inflorescences spadices; spathes present; fruits berries _____ **Araceae**
      11. Root systems with a central taproot; leaves without sheaths; inflorescences heads or spiny burs or cyathia; spathes absent; fruits achenes or capsular-schizocarps.
         12. Inflorescences heads or spiny burs; ovaries not lobed; fruits achenes _____ **Asteraceae**
         12. Inflorescences cyathia; ovaries 3-lobed; fruits capsular-schizocarps _____ **Euphorbiaceae**
   10. Inflorescences solitary flowers or panicles or spikes or racemes or glomerules.
      13. Plants dioecious; flowers subtended by 2 or 3 spine-tipped bracts _____ **Amaranthaceae**
      13. Plants monoecious or bearing only perfect flowers or polygamous; flowers not subtended by 2 or 3 spine-tipped bracts.
         14. Plants rhizomatous or stoloniferous; stipules present, fused to petioles; stamens 6–8; seeds 2 or more; leaf blades truncate or cordate basally _____ **Saururaceae**
         14. Plants from taproots, neither rhizomatous nor stoloniferous; stipules absent; stamens 1–5; seeds 1; leaf blades various basally _____ **Chenopodiaceae**

GROUP M

Plants caulescent herbs; perianth parts in 1 series or parts all similar; perianth parts 3 or in multiples of 3.

1. Venation pinnate or palmate or a single vein.
   2. Leaves [branches] fascicled, needle-like or filiform [Leaves reduced to inconspicuous, dry scales; stems cladophylls, hence foliage falsely appearing to comprise fascicled leaves] _____ (*Asparagus*) **Liliaceae**
   2. Leaves alternate or opposite, of various shapes, but neither needle-like nor filiform.
      3. Leaves opposite.
         4. Leaves peltate, the margins palmately lobed; flowers solitary in leaf axils [Sepals 6, but falling off early, and perianth parts thus falsely appearing in 1 series] _____ (Berberidaceae) **Group O**
         4. Leaves not peltate, the margins serrate; flowers 3–12 in axils of leaves _____ **Urticaceae**
      3. Leaves alternate.
         5. Inflorescences umbels; fruits berries, purple-black; tendrils present _____ **Smilacaceae**
         5. Inflorescences spikes or flowers solitary or in clusters of 1–5; fruits capsules or capsular-schizocarps or achenes or utricles, of various colors; tendrils absent.
            6. Perianths tubular, conspicuously curved or S-shaped, the parts fused _____ **Aristolochiaceae**
            6. Perianths bowl-shaped, neither curved nor S-shaped, the parts free.
               7. Flowers imperfect, the plants monoecious.
                  8. Pistils 3-lobed; styles 3 (may be divided); fruits capsular-schizocarps, 3- or 6-seeded _____ **Euphorbiaceae**
                  8. Pistils not lobed; styles 2; fruits utricles, 1-seeded.
                     9. Staminate flowers ebracteate; pistillate flowers without perianth parts ___ **Chenopodiaceae**
                     9. Staminate flowers bracteate; pistillate flowers with perianth parts _____ **Amaranthaceae**
               7. Flowers perfect.
                  10. Ovaries inferior; seeds 3 _____ **Haloragaceae**
                  10. Ovaries superior; seeds 1 or numerous.
                     11. Stamens 12 or more; fruits capsules; sap viscous, yellow or white _____ **Papaveraceae**

11. Stamens 3 or 5–9; fruits achenes or utricles; sap thin, colorless.
    12. Perianth parts 6; stamens 6–9; fruits achenes, trigonous or lenticular, not winged _____ **Polygonaceae**
    12. Perianth parts 3; stamens 3 or 5; fruits utricles, elliptic to orbicular; winged _____ **Chenopodiaceae**

1. Venation parallel or parallel-convergent.
   13. Ovaries inferior.
      14. Perianth parts bilaterally symmetrical; stamens 1 or 2, fused with style to form a column _____ **Orchidaceae**
      14. Perianth parts radially symmetrical; stamens 3 or 6, free or fused to perianth parts.
         15. Stamens 3.
            16. Leaves more than 2 cm long, equitant; inflorescences racemes or panicles _____ **Iridaceae**
            16. Leaves less than 0.5 cm long, not equitant; inflorescences heads, solitary ____ **Burmanniaceae**
         15. Stamens 6.
            17. Leaves conspicuously stiff, succulent, the apices spine-tipped, the margins minutely spinose or filiferous _____ **Agavaceae**
            17. Leaves flexible, not succulent, the apices not spine-tipped, the margins entire _____ **Liliaceae**
   13. Ovaries superior.
      18. Flowers subtended by 1–5 chaffy bracts.
         19. Fruits capsules; seeds 3–many per fruit _____ **Juncaceae**
         19. Fruits caryopses or achenes; seeds 1 per fruit _____ **Cyperaceae**
            20. Leaves 2-ranked; margins of leaf sheaths overlapping, rarely fused to form tubes; stems rounded, jointed, the nodes and internodes apparent; inflorescences spikelets; each flower subtended by 2–5 bracts; stigmas feathery _____ **Poaceae**
            20. Leaves 3-ranked; margins of leaf sheaths fused to form tubes; stems rounded or often triangular, not jointed, the nodes and internodes not apparent; inflorescences spikes; each flower subtended by 1 bract; stigmas barbellate or smooth _____ **Cyperaceae**
      18. Flowers not subtended by chaffy bracts.
         21. Flowers imperfect, the plants monoecious or dioecious.
            22. Tendrils present; inflorescences umbels, axillary; fruits berries; plants dioecious _____ **Smilacaceae**
            22. Tendrils absent; inflorescences heads, terminal; fruits achenes; plants monoecious, the staminate inflorescences above pistillate; [Family in OK and se and e TX, not in nc TX] _____ **Sparganiaceae**
         21. Flowers perfect.
            23. Perianths bilaterally symmetrical _____ **Pontederiaceae**
            23. Perianths radially symmetrical.
               24. Inflorescences spadices _____ **Araceae**
               24. Inflorescences of various types, but not spadices.
                  25. Perianth parts green or brown or stramineous or black _____ **Juncaceae**
                  25. Perianth parts white or greenish white or other colors, but neither green nor brown nor stramineous nor black.
                     26. Leaves spatulate; basal leaf sheaths present; spathes present; stamens 3 _____ **Pontederiaceae**
                     26. Leaves of various shapes, but not spatulate; basal leaf sheaths absent; spathes absent; stamens 6.
                        27. Leaves conspicuously stiff, succulent, the apices spine-tipped, the margins minutely spinose or filiferous _____ **Agavaceae**
                        27. Leaves flexible, not succulent, the apices not spine-tipped, the margins entire _____ **Liliaceae**

GROUP N

Plants caulescent herbs; perianth parts in 1 series or parts all similar; perianth parts 1 or 2 or 4 or 5 or in multiples of 4 or 5 or many.

1. Inflorescences spikelets or heads with flowers subtended by bracts.
   2. Inflorescences spikelets; leaves with basal sheaths; stamens 3 or 6 or 1; perianth parts 2 _____ **Poaceae**
   2. Inflorescences heads; leaves without basal sheaths; stamens 4 or 5; perianth parts 4 or 5.
      3. Stems and leaves prickly; heads subtended by stiff prickly bracts; perianth parts 4; stamens 4, free _____ **Dipsacaceae**
      3. Stems and leaves not prickly; heads not subtended by stiff prickly bracts; perianth parts 5; stamens 5, either anthers or filaments united.
         4. Ovaries superior; fruits urticles; anthers free; filaments united into a slender tube ____ **Amaranthaceae**
         4. Ovaries inferior; fruits achenes; anthers fused into a ring around style; filaments free _____**Asteraceae**
1. Inflorescences of various types, but neither spikelets nor heads with flowers subtended by bracts.
   5. Perianths bilaterally symmetrical.
      6. Perianths spurred or saccate.
         7. Stamens 12 or more; pistils 3 or 5 per flower, free or fused slightly at base; fruits follicles _____ **Ranunculaceae**
         7. Stamens 3 or 6; pistils 1 per flower; fruits capsules.
            8. Leaves alternate, pinnately dissected; perianth parts 4; stamens 6; ovaries superior [Sepals 2, but falling off early, and perianth parts thus falsely appearing to be in 1 series] _____ (Fumariaceae) **Groups P or R**
            8. Leaves opposite, not pinnately dissected; perianth parts 5; stamens 3; ovaries inferior _____ **Valerianaceae**
      6. Perianths neither spurred nor saccate.
         9. Ovaries inferior; perianth parts petaloid.
            10. Leaves and peduncles viscid-villous to glandular-puberulent [calyces tightly constricted above ovaries which falsely appear inferior] _____ **Chenopodiaceae**
            10. Leaves and peduncles glabrous or variously pubescent but not viscid-villous to glandular-puberulent.
               11. Leaves alternate, compound; perianth parts free; inflorescences umbels; fruits schizocarps _____ **Apiaceae**
               11. Leaves opposite, simple; perianth parts fused; inflorescences cymes; fruits achene-like _____ **Valerianaceae**
         9. Ovaries superior; perianth parts sepaloid.
            12. Plants annual; perianth parts 1; fruits utricles _____ **Chenopodiaceae**
            12. Plants perennial; perianth parts 4 or 5; fruits capsules or achenes.
               13. Leaves ovate, the margins serrate; flowers perfect; fruits capsules _____ **Cistaceae**
               13. Leaves linear or lanceolate, the margins entire; flowers imperfect; fruits achenes _____ **Urticaceae**
   5. Perianths radially symmetrical or asymmetrical.
      14. Leaves opposite or whorled.
         15. Leaves whorled.
            16. Pistils 4 or more per flower; stamens 12 or more; fruits achenes _____ **Ranunculaceae**
            16. Pistils 1 per flower; stamens 3–10; fruits capsules or schizocarps.
               17. Ovaries superior; pistils 3- or 5- carpellate; fruits capsules _____ **Molluginaceae**
               17. Ovaries inferior; pistils 2-carpellate; fruits schizocarps.
                  18. Perianth parts 3 or 4, fused; inflorescences cymes; leaves and foliaceous stipules in numerous whorls _____ **Rubiaceae**
                  18. Perianth parts 5, free; inflorescences umbels; leaves in 1 whorl; stipules absent _____ **Araliaceae**

15. Leaves opposite.
    19. Perianth parts bearing long woolly or silky hairs and hidden by them _____ **Amaranthaceae**
    19. Perianth parts glabrous or variously indumented, but neither bearing long woolly or silky hairs nor hidden by them.
        20. Perianth parts fused.
            21. Ovaries inferior, wholly or partially.
                22. Leaves and peduncles viscid-villous to glandular-puberulent [calyces tightly constricted above ovaries which falsely appear inferior] _____ **Nyctaginaceae**
                22. Leaves and peduncles glabrous or variously pubescent but not viscid-villous to glandular-puberulent.
                    23. Leaves ovate or elliptic; stamens 4 _____ **Onagraceae**
                    23. Leaves obovate or oblanceolate or spatulate; stamens 2 or 3 or 12 or more.
                        24. Inflorescences solitary flowers, axillary; stamens 12 or more; fruits capsules, circumscissile _____ **Aizoaceae**
                        24. Inflorescences cymes, terminal, in dense clusters; stamens 2 or 3; fruits achene-like _____ **Valerianaceae**
            21. Ovaries superior.
                25. Ovaries 3-lobed; flowers borne in cyathia; sap viscous, white _____ **Euphorbiaceae**
                25. Ovaries not 3-lobed; flowers borne in various inflorescences, but not cyathia; sap thin, colorless.
                    26. Stipules present, conspicuous, scarious; fruits utricles _____ **Caryophyllaceae**
                    26. Stipules absent; fruits achenes or capsules.
                        27. Flowers subtended by bracts; hypanthia absent; fruits achenes, 5–10 angled or ribbed (actually anthocarps = indehiscent achenes tightly enclosed in persistent base of perianth tube) _____ **Nyctaginaceae**
                        27. Flowers not subtended by bracts; hypanthia present; fruits capsules.
                            28. Perianth parts 5; capsules circumscissile _____ **Aizoaceae**
                            28. Perianth parts 4; capsules not circumscissile _____ **Lythraceae**
        20. Perianth parts free.
            29. Leaves compound; pistils 4–15 per flower _____ **Ranunculaceae**
            29. Leaves simple; pistils 1 per flower.
                30. Leaves 1 or 2 per stem, palmately lobed; fruits berries [Sepals 6, but falling off early and perianth parts thus falsely appearing to be in 1 series] _____ (Berberidaceae) **Group O**
                30. Leaves more than 2 per stem, not palmately lobed; fruits utricles or capsules or achenes.
                    31. Flowers subtended by bracts; bracts scarious; perianth parts scarious or lanate; fruits utricles _____ **Amaranthaceae**
                    31. Flowers not subtended by bracts; perianth parts petaloid or sepaloid; fruits capsules or achenes.
                        32 Flowers imperfect, the plants monoecious or dioecious; perianth parts 2 or 4; pistils 1-carpellate; fruits achenes _____ **Urticaceae**
                        32. Flowers perfect; perianth parts 5; pistils 2–5 carpellate; fruits capsules.
                            33. Flowers pedicelled in terminal cymes; styles 2–5; locules 1 _____ **Caryophyllaceae**
                            33. Flowers sessile in dense axillary glomerules; styles 1; locules 2–5 _____ **Molluginaceae**

14. Leaves alternate.
    34. Ovaries inferior, wholly or partially.

35. Leaves compound or both compound and simple leaves present; styles 2 _____ **Apiaceae**
35. Leaves simple; styles 1.
    36. Leaves peltate; fruits schizocarps _____ **Apiaceae**
    36. Leaves not peltate; fruits capsules or dry drupes.
        37. Inflorescences panicles, terminal; stamens 5; fruits dry drupes; seeds 1 _____ **Santalaceae**
        37. Inflorescences solitary flowers, axillary; stamens 4; fruits capsules; seeds 12 or more.
            38. Capsules 4-loculed, dehiscent longitudinally or by terminal pore _____ **Onagraceae**
            38. Capsules 1–3 loculed, dehiscent by lateral pore _____ **Campanulaceae**
34. Ovaries superior.
    39. Plants bearing only imperfect flowers.
        40. Leaves palmately compound _____ **Cannabaceae**
        40. Leaves simple.
            41. Pistils 3-loculed; fruits capsular-schizocarps; seeds 3 or more _____ **Euphorbiaceae**
            41. Pistils 1-loculed; fruits achenes or utricles; seeds 1.
                42. Leaf margins serrate or crenate.
                    43. Plants with stinging hairs; inflorescences panicles _____ **Urticaceae**
                    43. Plants without stinging hairs; inflorescences glomerules _____ **Moraceae**
                42. Leaf margins entire or sinuate or irregularly toothed or lobed.
                    44. Flowers subtended by 2 or 3 imbricate, unfused, spine-tipped bracts; stamen filaments fused and forming a short tube; perianth scarious _____ **Amaranthaceae**
                    44. Flowers not subtended by 2 or 3 spine-tipped bracts or if subtended by 2 spine-tipped bracts (in 1 species) these fused for 1/2 or more their length; stamen filaments free, not forming a tube; perianth greenish or absent.
                        45. Perianth parts 5 _____ **Chenopodiaceae**
                        45. Perianth parts 2 or 4.
                            46. Styles 2 or 3; fruits utricles _____ **Chenopodiaceae**
                            46. Styles 1; fruits achenes _____ **Urticaceae**
    39. Plants bearing only perfect flowers or plants bearing both perfect and imperfect flowers.
        47. Leaves compound.
            48. Perianth parts 4; stamens 4; hypanthia present _____ **Rosaceae**
            48. Perianth parts 5 or more; stamens 12 or more; hypanthia absent _____ **Ranunculaceae**
        47. Leaves simple.
            49. Stamens 12 or more.
                50. Pistils 4–7; fruits follicles _____ **Ranunculaceae**
                50. Pistils 1; fruits capsules.
                    51. Inflorescences solitary flowers; sap viscous, yellow or white [Sepals 2 or 3, but falling off early and perianth parts thus falsely appearing to be in 1 series] _____ (Papaveraceae) **Group T**
                    51. Inflorescences cymes; sap thin, colorless [Sepals 2, but falling off early and perianth parts thus falsely appearing to be in 1 series] _____ (Portulacaceae) **Group T**
            49. Stamens 1–10.
                52. Perianth parts 4.
                    53. Leaf margins palmately lobed; stipules present; hypanthia present _____ **Rosaceae**
                    53. Leaf margins pinnately lobed or entire; stipules absent; hypanthia absent.

54. Inflorescences cymes; fruits achenes _____ **Urticaceae**
54. Inflorescences racemes; fruits berries or siliques or silicles.
55. Fruits berries _____ **Phytolaccaceae**
55. Fruits siliques or silicles _____ **Brassicaceae**

52. Perianth parts 5 or more.
56. Plants less than 3 cm in diam. or height [Petals minute and easily overlooked hence perianth parts falsely appearing to be in 1 series] _____ (Saxifragaceae) **Group S**
56. Plants greater than 3 cm in diam. or height.
57. Stipules present as ocrea; fruits achenes _____ **Polygonaceae**
57. Stipules absent; fruits berries or utricles or capsules.
58. Inflorescences racemes or scorpioid cymes.
59. Pistils 1, terete, not horned; fruits berries _____ **Phytolaccaceae**
59. Pistils 5–7, angular, horned, united at bases; fruits follicles _____ **Crassulaceae**
58. Inflorescences solitary flowers or cymes or spikes or glomerules.
60. Perianth parts sepaloid; ovaries superior; fruits utricles _____ **Chenopodiaceae**
60. Perianth parts petaloid; ovaries inferior, wholly or partially; fruits capsules, circumscissile [Sepals 2, but falling off early and perianth parts thus falsely appearing to be in 1 series] _____ (Portulacaceae) **Group T**

GROUP O

Plants caulescent herbs; perianth parts in 2 series; petals 3 or in multiples of 3.

1. Venation pinnate or palmate or a single vein.
2. Petals 6 or 9.
3. Corollas 5–6 mm long, white, sympetalous, 6-lobed _____ **Rubiaceae**
3. Corollas without the above combination.
4. Leaves 1 or 2 per stem; fruits berries _____ **Berberidaceae**
4. Leaves 4 or more per stem; fruits capsules.
5. Petals fused, the sympetalous corollas yellow within and ± red without; plants 25 cm or less tall _____ **Oleaceae**
5. Petals separate, the corollas not as above; plants usually > 25 cm tall.
6. Stems and leaves with prickly bristles; stamens 20–150 or more; sap viscous, yellow or orange-red; hypanthium absent; sepals 2 or 3, falling off early _____ **Papaveraceae**
6. Stems and leaves without prickly bristles; stamens 4–12; sap thin, colorless; hypanthium present; sepals 4–6, persistent _____ **Lythraceae**

2. Petals 3.
7. Ovaries inferior.
8. Petals united into a funnelform corolla 2–4 mm long; stipular bristles present; stamens 4; leaves opposite _____ **Rubiaceae**
8. Petals separate or united; stipules absent or minute; stamen number various; leaves alternate or opposite.
9. Inflorescences spikes; flowers not subtended by an involucre _____ **Onagraceae**
9. Inflorescences heads; flowers subtended by an involucre [Petals 5 but fused and conspicuously 3-lobed hence flowers appearing appearing to have 3 petals] ___ (Asteraceae) **Group Q**

7. Ovaries superior.
10. Sepals 3.

11. Pistils 3 per flower; fruits follicles _____ **Crassulaceae**
11. Pistils 1 per flower; fruits capsules or achenes.
12. Perianths with a spur; fruits capsules [Petals 5, but 4 fused into 2 lateral hence flowers falsely appearing to have 3 petals] _____ (Balsaminaceae) **Group P**
12. Perianths without a spur; fruits achenes [Sepals of 2 sizes, the inner larger and can be mistaken for petals] _____ (Polygonaceae) **Group M**

10. Sepals 5.
13. Corollas radially symmetrical; pistils 3-carpellate; styles 0; stigmas 3; seeds 6 _____ **Cistaceae**
13. Corollas bilaterally symmetrical; pistils 2-carpellate; styles 1; stigmas 1, 2-lobed; seeds 2 _____ **Polygalaceae**

1. Venation parallel or parallel-convergent.
14. Corollas bilaterally symmetrical.
15. Ovaries superior; leaves and stems mucilaginous when crushed _____ **Commelinaceae**
15. Ovaries inferior; leaves and stems not mucilaginous when crushed.
16. Plants terrestrial, less than 1 m tall; stamens united with style to form a column; seeds 12 or more _____ **Orchidaceae**
16. Plants emergent aquatics, more than 1 m tall; stamens not united with style to form a column; seeds 1–3 _____ **Marantaceae**

14. Corollas radially symmetrical.
17. Pistils 12 or more per flower; fruits achenes [Plants acaulescent, but can falsely appear caulescent] _____ (Alismataceae) **Group J**
17. Pistils 1 per flower; fruits capsules.
18. Inflorescences solitary spikes or solitary heads.
19. Perianth parts yellow, glabrous; stamens 3; anthers yellow [Plants acaulescent, but can appear caulescent] _____ (Xyridaceae) **Group J**
19. Perianth parts gray-black, bearing fleshy trichomes at apices; stamens 4 or 6; anthers black _____ **Eriocaulaceae**

18. Inflorescences racemes or cymes or solitary flowers.
20. Leaves equitant; inflorescences racemes; stamens 3 _____ **Iridaceae**
20. Leaves alternate or whorled, not equitant; inflorescences cymes or solitary flowers; stamens 6.
21. Leaves alternate; inflorescences cymes; spathes present; stamen filaments pilose _____ **Commelinaceae**
21. Leaves whorled; inflorescences solitary flowers; spathes absent; stamen filaments glabrous _____ **Liliaceae**

GROUP P

Plants caulescent herbs; perianth parts in 2 series; petals 1 or 2 or 4 or 5; corollas bilaterally symmetrical; petals free.

1. Perianth parts spurred or cucullate.
2. Stamens 12 or more; pistils simple, free or fused slightly at base; fruits follicles _____ **Ranunculaceae**
2. Stamens 5 or 10; pistils compound; fruits capsules or schizocarps.
3. Spurs or hoods formed from sepals.
4. Venation palmate; sepals 5; perianths slightly bilaterally symmetrical _____ **Geraniaceae**
4. Venation pinnate; sepals 3; perianths strongly bilaterally symmetrical _____ **Balsaminaceae**

3. Spurs or hoods formed from petals.
5. Petals 5; sepals 5 _____ **Violaceae**
5. Petals 4; sepals 2 _____ **Fumariaceae**

1. Perianth parts neither spurred nor cucullate.
   6. Sepals 4.
      7. Hypanthia present; ovaries inferior _____ **Onagraceae**
      7. Hypanthia absent; ovaries superior.
         8. Leaves simple; stamens in 2 whorls _____ **Brassicaceae**
         8. Leaves palmately compound; stamens in 1 whorl.
            9. Stipules absent or minute; petals 4; stamens exserted beyond perianth; fruits capsules _____ **Capparaceae**
            9. Stipules present, large; petals 5; stamens included within perianth; fruits legumes _____ (Papilionoideae) **Fabaceae**
   6. Sepals 5.
      10. Ovaries inferior; fruits schizocarps _____ **Apiaceae**
      10. Ovaries superior; fruits capsules or achenes or legumes.
         11. Leaves simple.
            12. Stipules present; stamens 10; fruits legumes, inflated _____ (Papilionoideae) **Fabaceae**
            12. Stipules absent; stamens 4 or 6 or 8; fruits achenes or capsules.
               13. Stems trailing or prostrate; inflorescences solitary flowers; stamens 4 or 5; fruits indehiscent, 1-seeded, lanate-tomentose, spiny [Petals appearing free, but slightly fused at base] _____ (Krameriaceae) **Group R**
               13. Stems erect or ascending; inflorescences racemes or spikes; stamens 6 or 8; fruits capsules, usually 2-seeded, glabrous, not spiny [Inner sepals petaloid and can be mistaken for petals] _____ (Polygalaceae) **Group O**
         11. Leaves compound.
            14. Petals 1 _____ (*Amorpha*) **Fabaceae**
            14. Petals 5.
               15. Flowers strongly bilaterally symmetrical; corollas papilionaceous; upper (adaxial) petal enclosing other petals in bud _____ (Papilionoideae) **Fabaceae**
               15. Flowers weakly bilaterally symmetrical; corollas not papilionaceous; upper (adaxial) petal enclosed by other petals in bud.
                  16. Inflorescences spikes; bracts present; fruits 1- or 2-seeded __ (Papilionoideae) **Fabaceae**
                  16. Inflorescences racemes or panicles or umbels; bracts absent; fruits 5- or more-seeded _____ (Caesalpinioideae) **Fabaceae**

GROUP Q

Plants caulescent herbs; perianth parts in 2 series; petals 4 or 5; corollas bilaterally symmetrical; petals fused at least at the base; ovaries wholly or partially inferior.

1. Inflorescences heads.
   2. Stamens 4; anthers free; styles not branched _____ **Dipsacaceae**
   2. Stamens 5; anthers fused into a ring around style; styles 2-branched _____ **Asteraceae**
1. Inflorescences solitary flowers or cymes or thyrses or racemes.
   3. Leaves alternate _____ **Campanulaceae**
   3. Leaves opposite or whorled or appearing whorled due to the presence of stipules.
      4. Corolla lobes 4 _____ **Rubiaceae**
      4. Corolla lobes 5.
         5. Petals yellow or orange to red; stamens 5; fruits berries, 3-seeded _____ **Caprifoliaceae**
         5. Petals white to bluish white; stamens 3; fruits achene-like, 1-seeded _____ **Valerianaceae**

GROUP R

Plants caulescent herbs; perianth parts in 2 series; petals 2 or 4 or 5; corollas bilaterally symmetrical; petals fused at least at the base; ovaries superior.

1. Plants with slender leafless stems bearing finely dissected branches with numerous sac-like bladders; plants free-floating aquatics, but often stranded in wet areas; corollas yellow _____ **Lentibulariaceae**
1. Plants with stems and foliage leaves; sac-like bladders absent; plants terrestrial; corollas variously colored.
   2. Lower cauline leaves alternate.
      3. Leaves compound.
         4. Petals 5; perianth without spurs; fruits legumes (sometimes reduced to 1-seeded and indeshiscent) [Keel petals distally fused and basally free] _____ (Papilionoideae) **Fabaceae**
         4. Petals 2 or 4; perianth spurred; fruits capsules or follicles.
            5. Stamens 6; fruits capsules _____ **Fumariaceae**
            5. Stamens 10–15; fruits follicles _____ **Ranunculaceae**
      3. Leaves simple.
         6. Sepals of 2 forms, stamens 5, 6, or 8.
            7. Perianth with a spur; stamens 5; flowers solitary or in few-flowered cymes _____ **Balsaminaceae**
            7. Perianth without a spur; stamens 6 or 8; flowers in spike-like or head-like racemes ___ **Polygalaceae**
         6. Sepals of 1 form, all alike; stamens 4 or 5.
            8. Petals clawed; fruits indehiscent, 1-seeded, lanate-tomentose _____ **Krameriaceae**
            8. Petals not clawed; fruits capsules or berries, glabrous or variously indumented, but not lanate-tomentose.
               9. Inflorescences spikes or racemes; fruits capsules _____ **Scrophulariaceae**
               9. Inflorescences cymes; fruits berries _____ **Solanaceae**
   2. Lower cauline leaves opposite or whorled.
      10. Fruits nutlets or achenes (each with a single seed).
         11. Fruits achenes, 1 per flower; flowers paired, oriented at right angles to rachises at anthesis; pedicels conspicuously reflexed and flowers appressed against rachises in fruit _____ **Phrymaceae**
         11. Fruits nutlets, 2–4 per flower; flowers solitary or paired or whorled, but not oriented at right angles to rachises at anthesis; pedicels not reflexed and flowers not appressed against rachises in fruit.
            12. Corollas bilabiate or unilabiate; stigmas distinctly bifid; styles gynobasic _____ **Lamiaceae**
            12. Corollas salverform; stigmas not bifid; styles apical. _____ **Verbenaceae**
      10. Fruits capsules, 1 per flower (seed number various).
         13. Plants with fetid odor; surfaces clammy with glandular hairs; fruits with incurved beak that splits at maturity to form 2 horns _____ **Pedaliaceae**
         13. Plants without fetid odor; surfaces not clammy, with or without hairs; fruits not developing 2 horns.
            14. Stamens 2.
               15. Corollas conspicuously bilaterally symmetrical, bilabiate _____ **Acanthaceae**
               15. Corollas inconspicuously bilaterally symmetrical, only 1 lobe slightly larger or smaller, not bilabiate _____ **Scrophulariaceae**
            14. Stamens 4 or 5.
               16. Petals 4, scarious; capsules circumscissile _____ **Plantaginaceae**
               16. Petals 5, not scarious; capsules septicidal or loculicidal.
                  17. Seeds 2–4; anther apices recurved; anthers borne at 45 degree angle to filaments _____ **Acanthaceae**
                  17. Seeds 12 or more; anther apices not recurved; anthers borne vertically or at less than 45 degree angle to filaments _____ **Scrophulariaceae**

GROUP S

Plants caulescent herbs; perianth parts in 2 series; petals 4 or 5 or in multiples of 4 or 5 or many; corollas radially symmetrical or asymmetrical; petals free; ovaries wholly or partially inferior.

1. Stamens 5.
   2. Plants less than 3 cm in diam. or height; inflorescences solitary flowers; seeds 12 or more per fruit. _____ **Saxifragaceae**
   2. Plants greater than 3 cm in diam. or height; inflorescences heads or umbels; seeds 1 or 2 per fruit.
      3. Petals plumose on adaxial surfaces, erect, linear; leaves bearing stinging hairs, sessile or subsessile; inflorescences heads; fruits achenes; sepals obvious _____ **Loasaceae**
      3. Petals not plumose, spreading, not linear; leaves indumented or glabrous, but without stinging hairs, petiolate; inflorescences umbels; fruits schizocarps or drupes; sepals inconspicuous, may be minute.
         4. Leaves whorled, palmately compound; fruits berry-like drupes _____ **Araliaceae**
         4. Leaves alternate, pinnately compound or simple; fruits schizocarps _____ **Apiaceae**
1. Stamens 8 or more.
   5. Sepals 2; styles 3–9; capsules circumscissile; placentation free-central; ovaries partially inferior, the distal 1/2 free from sepals and petals _____ **Portulacaceae**
   5. Sepals 3 or 4 or 5; styles 1; capsules loculicidal or poricidal; placentation axile or parietal; ovaries wholly inferior, the distal portion not free from sepals and petals.
      6. Petals 5 or apparently more with outer stamens sometimes petaloid; stamens 10 or more.
         7. Stamens 15–60; capsules 1-locular, poricidal; herbage with glochidiate, variously ornamented hairs, rough to the touch _____ **Loasaceae**
         7. Stamens 10; capsules 5-locular, loculicidal; herbage indumented or glabrous, but not rough to the touch _____ **Onagraceae**
      6. Petals 4; stamens 8.
         8. Leaves with 3 primary veins; hypanthia urceolate; anthers opening by terminal pores; inflorescences cymes or solitary flowers _____ **Melastomataceae**
         8. Leaves with 1 primary vein; hypanthia tubular; anthers opening by longitudinal slits; inflorescences panicles or spikes or flowers borne in leaf axils _____ **Onagraceae**

GROUP T

Plants caulescent herbs; perianth parts in 2 series; petals 2 or 4 or 5 or more; corollas radially symmetrical or asymmetrical; petals free; ovaries superior; pistils 1 per flower.

1. Petals 2, gray-black, bearing fleshy trichomes at apices _____ **Eriocaulaceae**
1. Petals 4 or 5 or more, of various colors, but not gray-black, not bearing fleshy trichomes.
   2. Flowers imperfect, the plants monoecious _____ **Euphorbiaceae**
   2. Flowers perfect.
      3. Sepals 2.
         4. Leaves fleshy, entire; sap thin, colorless; placentation basal or free-central _____ **Portulacaceae**
         4. Leaves not fleshy, variously toothed or divided; sap viscous, white or yellow or orange-red; placentation parietal _____ **Papaveraceae**
      3. Sepals 3 or more
         5. Petals 4.
            6. Sepals and petals inserted on a hypanthium.
               7. Anthers basifixed, curved; venation parallel-convergent, the veins 3, conspicuous [Ovaries falsely appearing superior because of their separation from hypanthia at maturity] _____ **Melastomataceae**

7. Anthers dorsifixed, straight; venation pinnate or a single vein _____ **Lythraceae**

6. Sepals and petals inserted on receptacle.
   8. Leaves simple, entire or toothed or lobed or pinnatifid, but not compound.
      9. Open flowers 7–10 cm in diam.; sepals with prickles; fruits with prickles; sap viscous, yellow or orange-red _____ **Papaveraceae**
      9. Open flowers 0.3–5 cm in diam.; sepals without prickles; fruits without prickles; sap thin, colorless.
         10. Stamens 12 or more _____ **Clusiaceae**
         10. Stamens 2–10.
            11. Leaves strongly gland-dotted and aromatic with a citrus-like odor; fruits 2-lobed capsules 3–7 mm long, the upward pointing lobes resembling the inflated legs of a dutchman's breeches _____ (*Thamnosma*) **Rutaceae**
            11. Leaves neither gland-dotted nor aromatic; fruits various, but not as above.
               12. Stamens equal in length; pistils 4-carpellate; fruits capsules; placentation free-central _____ **Caryophyllaceae**
               12. Stamens didynamous or tetradynamous; pistils 2-carpellate; fruits siliques or silicles; placentation parietal. _____ **Brassicaceae**
   8. Leaves compound.
      13. Leaves palmately compound.
         14. Stamens tetradynamous; ovaries 2-locular; fruits siliques _____ **Brassicaceae**
         14. Stamens equal in length; ovaries 1-locular; fruits capsules _____ **Capparaceae**
      13. Leaves pinnately compound.
         15. Leaves 1-pinnately compound; stamens 2 or 4 or 6; fruits siliques or silicles _____ **Brassicaceae**
         15. Leaves 2- or 3-pinnately compound; stamens 5 or 10; fruits berries or legumes.
            16. Leaflets ovate or lanceolate; inflorescences racemes; fruits berries __ **Ranunculaceae**
            16. Leaflets linear or oblong; inflorescences heads; fruits legumes _____ (Mimosoideae) **Fabaceae**

5. Petals 5 or more.
   17. Stamens 12 or more.
      18. Filaments fused, forming a tube surrounding styles; stigmas peltate _____ **Malvaceae**
      18. Filaments free or fused only at base, not forming a tube surrounding styles; stigmas not peltate.
         19. Leaves 2- or 3-pinnately compound; fruits legumes or berries.
            20. Leaflets ovate or lanceolate; inflorescences racemes; fruits berries _ **Ranunculaceae**
            20. Leaflets linear or oblong; inflorescences heads; fruits legumes _____ (Mimosoideae) **Fabaceae**
         19. Leaves simple; fruits capsules.
            21. Leaf margins conspicuously spinose; sap viscous, yellow or orange-red; sepals 3; capsules spiny _____ **Papaveraceae**
            21. Leaf margins not spinose; sap thin, colorless; sepals 4 or 5; capsules not spiny.
               22. Sepals in 2 whorls, the outer whorl of 2 smaller than inner whorl of 3; styles 1 _____ **Cistaceae**
               22. Sepals in 1 whorl, all the same size; styles 2 _____ **Clusiaceae**
   17. Stamens 1–11.
      23. Stamens 1–5.
         24. Leaves compound.
            25. Inflorescences cymes; styles 5; fruits schizocarps _____ **Geraniaceae**

25. Inflorescences spikes; styles 1; fruits legumes (can be 1-seeded and indehiscent) _____ (Papilionoideae) **Fabaceae**

24. Leaves simple.
    26. Leaves palmately lobed or crenate; pistils 2-carpellate _____ **Saxifragaceae**
    26. Leaves entire or toothed or pinnately lobed, not crenate; pistils 3- or 4- or 5-carpellate.
        27. Styles 3–5.
            28. Leaves alternate; fruits 5-winged, bladdery capsules; petals pink or violet, with yellowish base; flowers axillary, solitary or in small cymes _____ **Sterculiaceae**
            28. Leaves opposite or alternate; fruits unwinged capsules; petals pink, white, blue, yellow, yellow-orange, or red; flowers variously arranged.
                29. Upper cauline leaves opposite; petals pink or white __ **Caryophyllaceae**
                29. Upper cauline leaves alternate; petals blue or yellow or yellow-orange or red _____ **Linaceae**
        27. Styles 1.
            30. Leaves lobed; inflorescences cymes; pistils 5-carpellate; fruits schizocarps _____ **Geraniaceae**
            30. Leaves entire or toothed; inflorescences solitary flowers; pistils 3- or 4-carpellate; fruits capsules _____ **Saxifragaceae**

23. Stamens 6–11.
    31. Leaves compound.
        32. Leaves opposite.
            33. Leaves pinnately compound; petals yellow _____ **Zygophyllaceae**
            33. Leaves palmately compound; petals pink or purple or white _____ **Geraniaceae**
        32. Leaves alternate.
            34. Leaves palmately compound; styles 5; fruits capsules _____ **Oxalidaceae**
            34. Leaves pinnately compound; styles 1; fruits legumes (can be 1-seeded and indehiscent.
                35. Leaves 1-pinnately compound _____ (Papilionoideae) **Fabaceae**
                35. Leaves 2-pinnately compound _____ (Mimosoideae) **Fabaceae**
    31. Leaves simple.
        36. Leaves alternate.
            37. Petals and stamens arising from a hypanthium; stipules absent _ **Saxifragaceae**
            37. Petals and stamens arising from receptacle; stipules present.
                38. Stamens free; fruits beaked _____ **Geraniaceae**
                38. Stamens fused, forming a tube surrounding styles; fruits usually not beaked _____ **Malvaceae**
        36. Leaves opposite.
            39. Leaf margins palmately lobed or palmately parted; fruits schizocarps _____ **Geraniaceae**
            39. Leaves margins entire or toothed; fruits capsules.
                40. Styles 1; sepals in 2 whorls, the outer whorl of 2 smaller than inner whorl of 3 _____ **Cistaceae**
                40. Styles 2–5; sepals in 1 whorl.
                    41. Stamens 9, in 3 fascicles _____ **Clusiaceae**
                    41. Stamens 5–10, separate, not in fascicles.
                        42. Placentation free-central _____ **Caryophyllaceae**
                        42. Placentation axile _____ **Elatinaceae**

GROUP U

Plants caulescent herbs; perianth parts in 2 series; petals 4 or 5 or in multiples of 4 or 5 or many; corollas radially symmetrical or asymmetrical; petals free; ovaries superior; pistils 2 or more per flower.

1. Leaves opposite or whorled _____ **Crassulaceae**
1. Leaves alternate or basal.
   2. Hypanthia absent; perianth and stamens inserted on receptacle.
      3. Leaves succulent, terete; stamens 8 or 10 _____ **Crassulaceae**
      3. Leaves neither succulent nor terete; stamens 12 or more.
         4. Filaments free, not forming a tube around styles; stamens spiraled; ovaries free throughout development _____ **Ranunculaceae**
         4. Filaments fused, forming a tube around styles; stamens whorled; ovaries fused until the fruits mature, then separating [hence falsely appearing polycarpous] _____ (Malvaceae) **Group T**
   2. Hypanthia present as a disk or cup or tube; perianth and stamens inserted on hypanthium.
      5. Pistils 5 or more per flower _____ **Rosaceae**
      5. Pistils 2 or 3 per flower.
         6. Leaves compound; stipules present _____ **Rosaceae**
         6. Leaves simple; stipules absent _____ **Saxifragaceae**

GROUP V

Plants caulescent herbs; perianth parts in 2 series; petals 2 or 4 or 5; corollas radially symmetrical or asymmetrical; petals fused at least at the base; ovaries wholly or partially inferior.

1. Stems trailing or prostrate.
   2. Tendrils present; leaves alternate; flowers imperfect; fruits pepos _____ **Cucurbitaceae**
   2. Tendrils absent; leaves opposite or whorled; flowers perfect; fruits drupes or schizocarps _____ **Rubiaceae**
1. Stems erect or ascending.
   3. Flowers with hypanthium-tube elongated beyond ovary [thus falsely giving the appearance of fused petals] _____ (Onagraceae) **Group S**
   3. Flowers without an elongated hypanthium-tube.
      4. Anthers connivent or fused.
         5. Inflorescences racemes or cymes or mixed; fruits capsules; sepals present, not modified into a pappus _____ **Campanulaceae**
         5. Inflorescences heads; fruits achenes; sepals absent or modified into a pappus _____ **Asteraceae**
      4. Anthers free.
         6. Ovaries partially inferior, the distal 1/3–1/2 free from sepals and petals.
            7. Petals 5; ovaries 5-carpellate, 1-locular; placentation free-central _____ **Primulaceae**
            7. Petals 4; ovaries 2-carpellate, 2-locular; placentation axile _____ **Rubiaceae**
         6. Ovaries wholly inferior, the distal portion not free from sepals and petals.
            8. Leaves alternate.
               9. Corollas 5–10 mm long; rachises of inflorescences visible; stamens attached at middle of corolla tubes; capsules circumscissile _____ **Sphenocleaceae**
               9. Corollas 2.3–2.7 mm long; rachises of inflorescences not visible; stamens attached at bases of corolla tubes; capsules poricidal or loculicidal _____ **Campanulaceae**
            8. Leaves opposite or whorled.
               10. Flowers numerous, borne in dense flat-topped inflorescences; branches conspicuously dichotomous; locules 3, 2 small and empty, 1 large and containing 1 seed _____ **Valerianaceae**

10. Flowers solitary or borne in few-flowered inflorescences that are not flat-topped or in terminal heads; branches not conspicuously dichotomous; locules 1 or 2 or 3 or 5.
    11. Sepals 8–10 mm long; corollas gibbous; stipules absent _____ **Caprifoliaceae**
    11. Sepals 0.5–5 mm long; corollas not gibbous; stipules present (sometimes leaf-like and the leaves thus appearing whorled) _____ **Rubiaceae**

GROUP W

Plants caulescent herbs; perianth parts in 2 series; petals 2 or 4 or 5; corollas radially symmetrical or asymmetrical; petals fused at least at the base; ovaries superior.

1. Pistils or fruits 2 or 4 or 5 per flower.
   2. Fruits follicles or capsules, multi-seeded.
      3. Plants succulent; petals fused only at base and not forming a tube and limb; fruits 5 per flower _____ **Crassulaceae**
      3. Plants not succulent; petals fused forming a tube and limb; fruits 2 or 4 per flower.
         4. Plants prostrate or decumbent; sap thin; colorless; stigmas not massive; fruits capsules; seeds 2–4; leaves alternate [two ovary lobes united only at base by gynobasic style, and thus falsely appearing separate] _____ *(Dichondra)* **Convolvulaceae**
         4. Plants usually erect or ascending; sap typically viscous; white; stigmas massive; fruits follicles; seeds 12 or more; leaves opposite or alternate.
            5. Coronas present; stigmas fused to anther and/or corolla tissues; pollinia present; styles 2 _____ **Asclepiadaceae**
            5. Coronas absent; sigmas not fused to anther and/or corolla tissues; pollinia absent; styles 1 _____ **Apocynaceae**
   2. Fruits nutlets, each 1-seeded.
      6. Stamens 5; leaves alternate _____ **Boraginaceae**
      6. Stamens 2 or 4; leaves opposite or whorled.
         7. Styles gynobasic; stigmas 2; nutlet scars basal _____ **Lamiaceae**
         7. Styles apical; stigmas 1; nutlet scars covering the entire inner surface _____ **Verbenaceae**
1. Pistils or fruits 1 per flower.
   8. Pistils with 2 separate ovaries, 1 or 2 styles, but only 1 stigma due to fusion; stigmas massive; fruits follicles.
      9. Coronas present; stigmas fused to anther and/or corolla tissues; pollinia present; styles 2 _____ **Asclepiadaceae**
      9. Coronas absent; stigmas not fused to anther and/or corolla tissues; pollinia absent; styles 1 _____ **Apocynaceae**
   8. Pistils with only 1 ovary, 1 or more styles, and 1 or more stigmas; stigmas not massive; fruits capsules or nutlets or anthocarps or legumes or schizocarps or berries.
      10. Fruits nutlets OR anthocarps (= indehiscent achene and persistent base of perianth tube), 1–4 per flower.
          11. Perianths 35–170 mm long [Petals absent, sepals petaloid, and involucre resembling calyx, hence perianths falsely appearing to be in 2 series] _____ (Nyctaginaceae) **Group N**
          11. Perianths 1.2–35 mm long.
              12. Stems usually with at least lower nodes swollen; the two leaves at a node often unequal; ovaries apparently inferior (tightly enclosed by base of perianth); fruits anthocarps, 1 per flower [Petals absent, sepals petaloid, and involucre resembling calyx, hence perianths falsely appearing to be in 2 series] _____ (Nyctaginaceae) **Group N**
              12. Stems usually without nodes swollen; the two leaves at a node usually equal; ovaries superior; fruits nutlets, 1–4 per flower.

13. Stamens 5; leaves alternate _____ **Boraginaceae**
13. Stamens 2 or 4; leaves opposite or whorled.
    14. Styles gynobasic; stigmas 2; nutlet scars basal _____ **Lamiaceae**
    14. Styles apical; stigmas 1; nutlet scars covering the entire inner surface _____ **Verbenaceae**

10. Fruits capsules or berries or schizocarps or legumes.
    15. Leaves opposite or whorled.
        16. Stamens opposite the corolla lobes; pistils 5-carpellate; placentation free-central _____ **Primulaceae**
        16. Stamens alternate with the corolla lobes; pistils 2- or 3- carpellate; placentation parietal or axile.
            17. Pistils 3-carpellate; stigmas 3 _____ **Polemoniaceae**
            17. Pistils 2-carpellate; stigmas 1 or 2.
                18. Inflorescences scorpioid cymes _____ **Hydrophyllaceae**
                18. Inflorescences of various types, but not scorpioid cymes.
                    19. Stamen number less than corolla lobe number.
                        20. Corollas variously colored but not yellow inside and not red outside; capsules not circumscissile; plants of various sizes _____ **Acanthaceae**
                        20. Corollas yellow inside and ± red outside; capsules circumscissile; plants 25 cm or less tall _____ (*Menodora*) **Oleaceae**
                    19. Stamen number same as corolla lobe number.
                        21. Corollas white OR white suffused or lined with pink OR light blue.
                            22. Leaf margins pinnatifid _____ **Hydrophyllaceae**
                            22. Leaf margins entire or serrate.
                                23. Leaf bases connected around the stem by united short stipules or a stipular ridge; corrolla throats indumented OR glabrous; locules 2; placentation axile.
                                    24. Leaves lanceolate or broader, usually 10 mm or more wide; flowers 5-merous _____ **Loganiaceae**
                                    24. Leaves narrowly linear, usually 2 mm or less wide; flowers 4-merous _____ **Buddlejaceae**
                                23. Leaf bases without a trace of stipules; corolla throats glabrous; locules 1; placentation parietal _____ **Gentianaceae**
                        21. Corollas of various colors, but not white or light blue.
                            25. Corollas red and yellow; placentation axile _____ **Loganiaceae**
                            25. Corollas green or blue-purple or pink; placentation parietal _____ **Gentianaceae**
    15. Leaves alternate and/or basal.
        26. Corolla lobes 2, gray-black, bearing fleshy trichomes at apices; anthers black _____ **Eriocaulaceae**
        26. Corolla lobes 4 or 5, of various colors, but not gray-black, not bearing fleshy trichomes; anthers of various colors, but not black.
            27. Pistils 5-many carpellate.
                28. Stamen filaments fused, forming a tube surrounding styles.
                    29. Stamens 5–10 [Petals coherent, and thus falsely appearing fused] _____ (Oxalidaceae) **Group T**
                    29. Stamens 12–many [Petals fused basally to staminal tube, and thus falsely appearing fused] _____ (Malvaceae) **Group T**
                28. Stamen filaments free from each other.

30. Seeds 1; styles 3 or 5; petals fused only at base; [Family in OK and s TX, not in nc TX] _____ **Plumbaginaceae**
30. Seeds 5 or more; styles 1; petals fused more than 1/2 length _____ **Primulaceae**

27. Pistils 1–3-carpellate.
31. Petals 4; fruits circumscissile or septicidal capsules.
32. Inflorescences panicles or racemes, terminal; capsules septicidal _____ **Gentianaceae**
32. Inflorescences terminal spikes or solitary flowers borne in axils of leaves; capsules circumscissile.
33. Inflorescences spikes, terminal; petals scarious, colorless or tan _____ **Plantaginaceae**
33. Inflorescences solitary flowers, axillary; petals not scarious, pink [5-carpellate but falsely appearing 1-carpellate] _____ **Primulaceae**
31. Petals 5; fruits berries or loculicidal capsules or legumes.
34. Stamens 5–12 or more; filaments exserted beyond perianth; inflorescences heads; leaves 2-compound; fruits legumes __ (Mimosoideae) **Fabaceae**
34. Stamens 5 or fewer; filaments not prominently exserted beyond perianth; inflorescences of various types, but not heads; leaves simple, but may be deeply dissected; fruits capsules or berries.
35. Ovaries 3-locular; stigmas 3 _____ **Polemoniaceae**
35. Ovaries 1- or 2- or 4-locular; stigmas 1 or 2.
36. Stamens opposite the corolla lobes; placentation free-central. _____ **Primulaceae**
36. Stamens alternate with the corolla lobes; placentation parietal or axile.
37. Inflorescences helicoid cymes _____ **Hydrophyllaceae**
37. Inflorescences of various types, but not helicoid cymes.
38. Leaves pinnatifid.
39. Petals longer than sepals; fruits berries; seeds 12 or more; placentation axile _____ **Solanaceae**
39. Petals equal to or shorter than sepals; fruits capsules; seeds 4; placentation parietal _____ **Hydrophyllaceae**
38. Leaves entire or variously lobed, but not pinnatifid.
40. Sepals fused.
41. Styles 2; seeds 1–4 _____ **Convolvulaceae**
41. Styles 1; seeds 12 or more _____ **Solanaceae**
40. Sepals free.
42. Corollas 5–9 cm long; styles not divided; seeds 1–4 _____ **Convolvulaceae**
42. Corollas 0.5–2 cm long; styles divided; seeds 12 or more _____ **Hydrophyllaceae**

Ferns and Similar Plants (Pteridophytes)

Seedless vascular plants (reproducing by spores) formerly lumped together as the Division Pteridophyta, the ferns and similar plants are currently segregated into three separate divisions (Lycopodiophyta, Equisetophyta, and Polypodiophyta) to reflect the great diversity between these ancient plant groups; the group Pteridophyta is thus no longer formally recognized. Together the three divisions have nearly 10,000 species (Wagner & Smith 1993). For a Key to Ferns and Similar Plants see page 110 or Key K on page 154.

REFERENCE: Wagner & Smith 1993.

DIVISION **Lycopodiophyta**
CLUBMOSSES, SPIKE-MOSSES, AND QUILLWORTS

A group of 1,200–1,250 species in 12–17 genera arranged in 3 families (Flora of North America Editorial Committee 1993). Extinct members of this ancient division (e.g., Lepidodendrales—scale trees to 30 m tall) were dominants of the Carboniferous forests that formed present-day coal deposits; it is one of the oldest plant groups, dating to the Lower Devonian period (408–360 million years ago) (Benson 1979; Bell & Woodcock 1983; Jones & Luchsinger 1986; Raven et al. 1986). The Lycopodiophyta are characterized by microphylls (= leaves with a single vein). There are three extant families, Isoetaceae, Lycopodiaceae, and Selaginellaceae, all with representatives in nc TX. The group is sometimes referred to as the Microphyllophyta (Woodland 1997).

REFERENCES: Benson 1979; Bell & Woodcock 1983; Jones & Luchsinger 1986; Raven et al. 1986; Bold et al. 1987; DiMichele & Skog 1992; Wagner & Smith 1993; Woodland 1997.

Lycopodiaceae CLUBMOSS FAMILY

A diverse ancient family with a long fossil history; it is cosmopolitan and contains 10–15 genera and ca. 350–400+ species of terrestrial or epiphytic, evergreen, coarsely moss-like, vascular plants with scale- or needle-like leaves containing a single vein; ligules (= minute, tongue-like, basal protuberance on a leaf) are absent and spores are all of one type. Many species were previously treated in the large genus *Lycopodium*, which is now usually divided into a number of segregate genera; some of these segregates are known to hybridize. Certain species were in the past gathered for making Christmas wreaths; in some areas (e.g., Appalachian Mts.) this resulted in populations being greatly reduced; the very flammable, dust-like, dry spores of some were formerly used in fireworks, for stage-lighting, and in photography as flash powder (Jones & Luchsinger 1986).

FAMILY RECOGNITION IN THE FIELD: evergreen, superficially somewhat moss-like herbs with stems covered by numerous, small, linear-lanceolate to lanceolate, *1-veined leaves*; stems lying flat on the ground with upright shoots terminating in *cylindrical, spore-producing cones*

REFERENCES: Correll 1949, 1956, 1966a; Wagner & Beitel 1992, 1993.

Lycopodiella BOG CLUBMOSS

Lycopodiella, distinguished by its prostrate stems, has often been treated in a more broadly defined *Lycopodium* As treated here, *Lycopodiella* is a genus of 8–10 species of the n temperate region and tropical America; a number of the species readily hybridize. (Name derived from the genus *Lycopodium* (Greek: *lykos*, wolf, and *pous* or *podium*, foot; in reference to the resemblance of the branch tips to a wolf's paw), plus the Latin diminutive, *-ella*)

Lycopodiella appressa (Chapm.) Cranfill, (appressed or lying close), CHAPMAN CLUBMOSS, SOUTHERN CLUBMOSS, APPRESSED BOG CLUBMOSS. Plant perennial; horizontal stems flat on ground; upright, usually unbranched leafy shoots (serving as peduncles) scattered along stems; leaves numerous, small, linear-lanceolate to lanceolate, 6–7 mm long, incurved, appressed, 1-nerved; strobili solitary, terminating peduncles, slender, 0–2 mm thicker than the supporting shoot, ca. 25–70 mm long, 3–4 mm wide; sporophylls (= spore-bearing leaves) incurved, appressed, similar to other leaves; sporangia subglobose, solitary at base of sporophylls. Depressions and moist areas; Henderson Co. (Correll 1956), also Carr (1994) listed an unidentified *Lycopodium* (probably *L. appressa*) for Lamar Co.; se and e TX w to e margin of nc TX. Sporulating Jun-Oct. [*Lycopodium appressum* (Chapm.) F.E. Lloyd & Underw.]

Lycopodiella prostrata (R.M. Harper) Cranfill [*Lycopodium prostratum* R.M. Harper], (prostrate), CREEPING CLUBMOSS, PROSTRATE BOG CLUBMOSS, distinguished from *L. appressa* by having its sporophylls ± spreading and the stroboli stout (12–20 mm wide), 3–6 mm wider than the supporting shoot, is known from one TX site just s of nc TX in Travis Co. (Correll 1956).

SELAGINELLACEAE SPIKE-MOSS FAMILY

A cosmopolitan, but primarily tropical and subtropical family currently treated as a single genus with > 700 species of usually terrestrial or epiphytic, superficially moss-like vascular plants bearing spores differentiated into microspores and megaspores; leaves usually have a single vein and ligules (= minute, tongue-like basal protuberance on a leaf; the function is uncertain) are present. This family is apparently only distantly related to the Lycopodiaceae and Isoetaceae. FAMILY RECOGNITION IN THE FIELD: superficially somewhat moss-like, small herbs with numerous, scale-like, *1-veined leaves*; stems terminating in ± *4-angled, spore-producing cones*
REFERENCES: Correll 1956, 1966a; Valdespino 1993.

SELAGINELLA SPIKE-MOSS

Ours small terrestrial or lithophytic (= growing on rocks) plants; stems leafy; vegetative leaves small, with ligule on adaxial side near base, all alike or of 2 kinds; sporophylls (= fertile leaves) modified, in strobili (= cones) at branch tips; sporangia solitary in axils of sporophylls, of 2 kinds (plants heterosporous).

Selaginella is the only extant genus in the family; it has an extremely long history in the fossil record; it is currently most diverse in the tropics. Some are well known as "resurrection" plants, capable of reviving after long periods of dessication. (From *Selago*, an ancient name for *Lycopodium*, a genus resembling *Selaginella*, and the Latin diminutive suffix, *-ella*)
REFERENCES: Clausen 1946; Tryon 1955.

1. Plants of moist habitats, delicately thin-herbaceous; stem leaves not overlapping or only slightly so, in 4 ranks, 2 lateral and spreading, 2 smaller and appressed-ascending along the adaxial (= above) surface of the stem; abaxial (= beneath) surface of the stem easily visible; plants annual ——— **S. apoda**

1. Plants of xerophytic habitats, rather rigid; stem leaves crowded, conspicuously overlapping, appressed to stem, not in 4 distinct ranks; abaxial surface of the stem not visible (concealed by leaves completely surrounding the stem); plants perennial.
   2. Vegetative part of plant erect to ascending; leaves not curving upward, the leaf-covered stems therefore appearing radially symmetrical ——— **S. arenicola**
   2. Vegetative part of plant ± completely prostrate; leaves curving upward making the adaxial and abaxial views of the leaf-covered stems distinctly different ——— **S. peruviana**

Selaginella apoda (L.) Spring, (footless), MEADOW SPIKE-MOSS, BASKET SELAGINELLA. Plant pros-

trate-creeping or ascending, often forming mats; leaves of 2 distinct kinds; lateral leaves ovate to ovate-elliptic, asymmetrical, ca. 1.35–2.25 mm long, 0.75–1.35 mm wide; appressed-ascending leaves smaller, to ca. 1.2(–1.6) mm long; strobili solitary or paired, obscurely quadrangular (= 4-sided)-flattened, 0.5–2 cm long; 2–4 mm in diam.; sporophylls apically acute to acuminate. Moist areas, low fields and woods; Burnet Co., also Ellis (Correll 1956), and Lamar (Carr 1994) cos.; mainly e TX and in several localities in se TX and Edwards Plateau. Sporulating May–Dec.

Selaginella arenicola Underw. subsp. **riddellii** (Van Eselt.) R.M. Tryon, (sp.: growing in sandy places; subsp.: for J.L. Riddell, 1807–1865, botanist), RIDDELL'S SELAGINELLA, RIDDELL'S SPIKE-MOSS. Vegetative part of plant erect to ascending, forming clumps, to ca. 12 cm tall, usually smaller; leaves narrowly triangular-lanceolate to linear-lanceolate, ca. 1.2–3 mm long, 0.4–0.5 mm wide, marginally ciliate, apically with whitish bristle; stroboli solitary, sometimes with apical vegetative growth, quadrangular, ascending, (0.5–)1–3(–3.5) cm long and ca. 1.2 mm in diam.; sporophylls often with a bristle. Rocky areas, sandy or gravelly soils; Bell Co., also Burnet Co. (Correll 1956); e 1/3 of TX w to e Edwards Plateau. Sporulating throughout the year. [*S. riddellii* Van Eselt.]

Selaginella peruviana (J. Milde) Hieronymus, (of Peru, the species ranging to South America), PERUVIAN SPIKE-MOSS. Vegetative part of plant ± completely prostrate, forming loose mats; main stems to ca. 12 cm long; leaves linear-lanceolate to falcate, 1.6–4 mm long, 0.4–0.5 mm wide, marginally ciliate, apically with whitish bristle 0.3–0.8 mm long; strobili solitary, quadrangular, ascending, 0.5–2 cm long, 1–1.5 mm in diam.; sporophylls usually bristle-tipped. On rocks or ground; Comanche Co. (Stanford 1971), also Burnet Co. (Correll 1956); sw part of nc TX through Edwards Plateau to Trans-Pecos. Sporulating Jun–Oct. [*S. sheldonii* Maxon]

ISOETACEAE QUILLWORT FAMILY

A monogeneric, nearly cosmopolitan family of ca. 150 species of superficially grass- or sedge-like plants ranging from perennial evergreen aquatics to ephemeral terrestrials; they are superficially unlike other Lycopodiophyta, but as in other members of the division, the leaves have a single vein; ligules are present as in the Selaginellaceae; spores are differentiated into microspores and megaspores. The long linear leaves have a resemblance to the quills of feathers formerly used as writing implements.

FAMILY RECOGNITION IN THE FIELD: the single nc TX species is a tufted, wet area plant with superficially grass-like or sedge-like leaves and a corm-like rootstock giving it a green onion-like appearance; *sporangia are in the leaf bases*

REFERENCES: Pfeiffer 1922; Correll 1949, 1956, 1966a; Taylor et al. 1993.

ISOETES QUILLWORT

Interspecific hybrids are frequently seen; the spores are reported to be dispersed in the excreta of earthworms; species are often difficult to identify, sometimes requiring microscopic examination of spores. (Greek: *isos*, equal, and *etos*, year, referring to the evergreen habit of some species)

REFERENCES: Taylor et al. 1975; Boom 1982; Taylor & Hickey 1992.

Isoetes melanopoda J. Gay & Durieu ex Durieu, (black-footed), BLACK-FOOTED QUILLWORT. Plant tufted, with leaves tightly clustered together and superficially resembling a green onion, usually terrestrial or becoming so; rootstock corm-like, globose, 2-lobed; leaves superficially grass-like or sedge-like, to 40 cm long, blackish towards very base; sporangia solitary, embedded in basal cavity of leaf with ligule inserted above, often partly covered by a velum (= thin flap of tissue); spores of 2 types (plant heterosporous), the megaspores whitish, usually with prominent ridges. Seasonally saturated soils, temporary pools, shallow pools; Dallas Co., also Burnet and Tarrant cos. (Correll 1956); se and e TX w to nc TX and Edwards Plateau. Sporulating Mar–Oct.

DIVISION **EQUISETOPHYTA**
HORSETAILS

This a very ancient group consisting of a single extant family; fossil forms date to the Devonian period (408–360 million years ago) and the division reached its maximum diversity and abundance in the Paleozoic era; they were components of the Carboniferous swamp forests that formed present-day coal deposits; some reached the proportions of trees (to 18 m tall) and were probably competitors of the tree Lycopodiophyta. The largest living species is the tropical *Equisetum giganteum* L., which may exceed 5 m in height (Bell & Woodcock 1983; Raven et al. 1986; Bold et al. 1987). The division is sometimes referred to as the Arthrophyta (Woodland 1997) or the Sphenophyta (Raven et al. 1986). The Equisetophyta are characterized by microphylls (= leaves with a single vein). Some species have numerous small branches and bear a slight resemblance to a horse's tail.

REFERENCES: Bell & Woodcock 1983; Raven et al. 1986; Bold et al. 1987; Wagner & Smith 1993; Woodland 1997.

EQUISETACEAE HORSETAIL FAMILY

The family is represented only by the distinctive genus *Equisetum* which is also the only extant genus in the division; it has a long fossil history. *Equisetum* is nearly cosmopolitan and contains ca. 15 species.

FAMILY RECOGNITION IN THE FIELD: plant body consisting primarily of *hollow, jointed, green* stems; leaves inconspicuous, scale-like, in whorls at the very distinct nodes; sporangia in *small, terminal cones*.

REFERENCES: Correll 1949, 1956, 1966a; Hauke 1993.

EQUISETUM HORSETAIL, SCOURING-RUSH

Plants perennial, rhizomatous; stems hollow in center, jointed with very distinct nodes, ridged, green and photosynthetic; leaves small, inconspicuous, whorled, scale-like, fused into sheaths but with tips free and tooth-like; sporangia on the undersurface of pelate sporophylls arranged in discrete terminal stroboli (= cones); spores of 1 kind (plant homosporous).

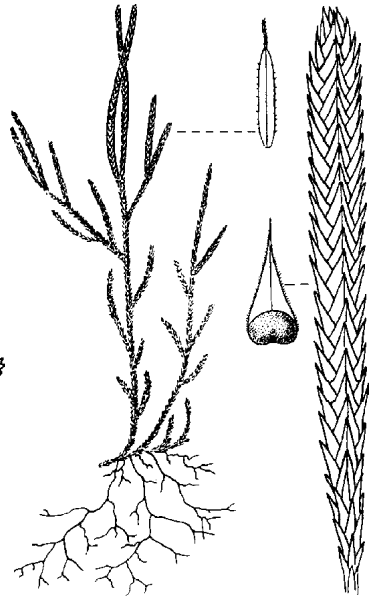
The coarse stems contain silica and were used by early settlers to scour pots and pans (Woodland 1997); ☠ some species contain alkaloids or other toxins such as thiaminase, an enzyme that destroys thiamine and causes Vitamin B_1 deficiency; they can be poisonous to livestock when included in hay (Kingsbury 1964; Burlage 1968; Fuller & McClintock 1986); hybridization between species is frequent. (Latin: *equis*, horse, and *seta*, bristle, referring to the coarse black roots of *E. fluviatile* L.)

1. Sheaths (= fused leaves) dark girdled at most nodes of stem (in addition to thin dark line at sheath apex where teeth are shed), ashy-gray to brownish above girdle; aerial stems usually persisting more than one year; cone apex pointed; teeth of sheaths promptly shed or persistent ——— **E. hyemale**

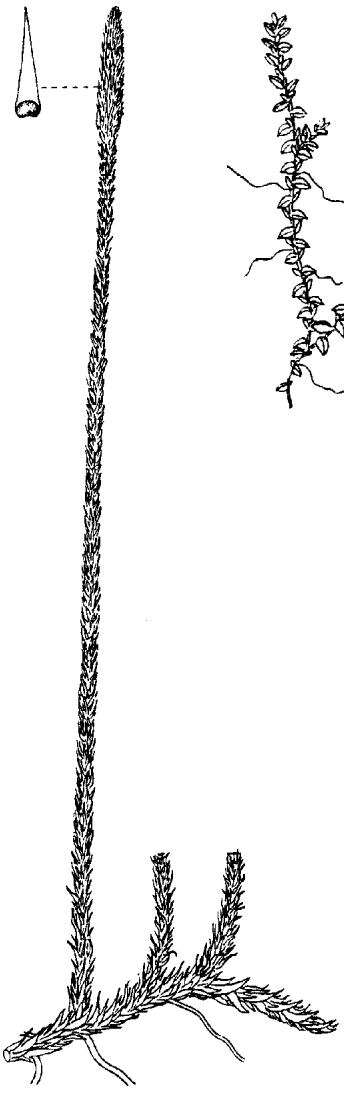
1. Most sheaths green (but with a thin dark line at sheath apex where teeth are shed), only some near stem base dark girdled; aerial stems lasting less than a year, occasionally overwintering; cone apex rounded to pointed; teeth of sheaths promptly shed ——— **E. laevigatum**

Equisetum hyemale L. subsp. **affine** (Engelm.) Calder & R.L. Taylor, (sp.: of winter; subsp.: related), TALL SCOURING-RUSH, AMERICAN SCOURING-RUSH, COMMON SCOURING-RUSH, GREAT SCOURING-RUSH, CAÑUELA. Stems 18–220 cm tall; leaves 14–50 per node (number evident as teeth of sheaths). Parker and Tarrant cos., also Erath and Grayson (Correll 1956); throughout TX. Sporu-

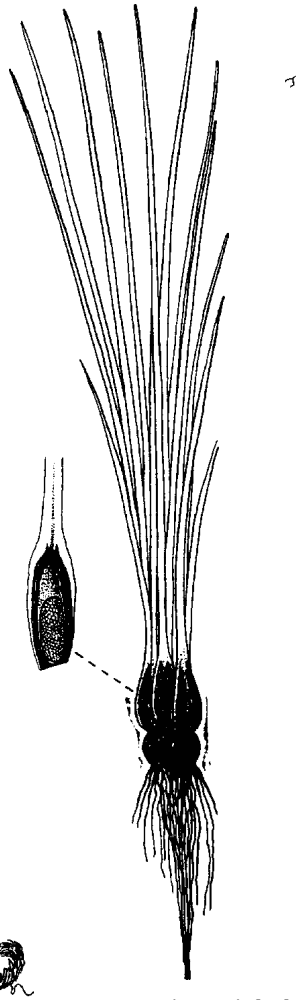
Selaginella apoda [LUN]



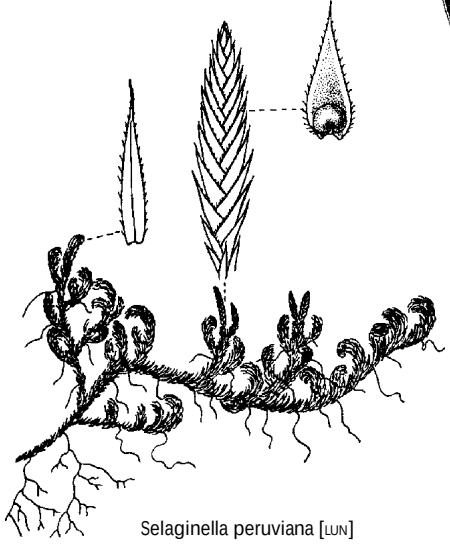
Selaginella arenicola subsp. riddellii [LUN]



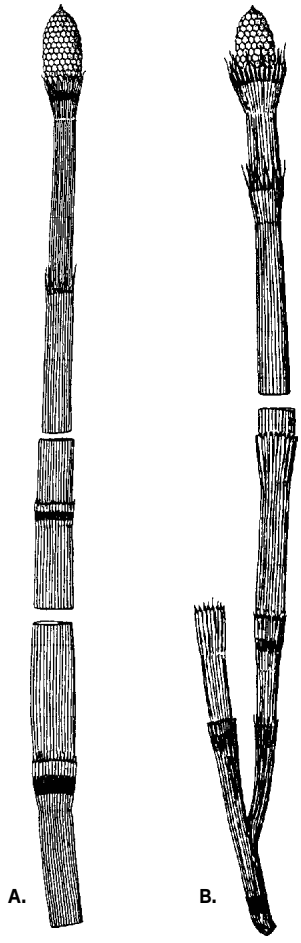
Lycopodiella appressa [LUN]



Isoetes melanopoda [LUN]



Selaginella peruviana [LUN]



A. Equisetum hyemale subsp. affine [LUN]

B. Equisetum laevigatum [LUN]

lating Mar–late fall. [*E. hyemale* L. var. *affine* (Engelm.) A.A. Eaton, *E. prealtum* Raf.] Poisonous (Burlage 1968). 9

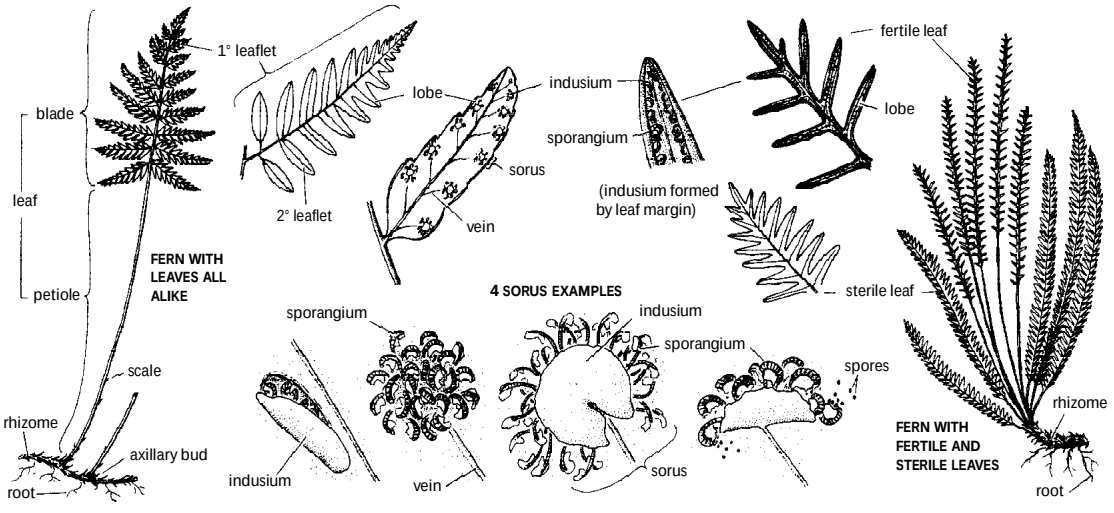
Equisetum laevigatum A. Braun, (smooth), SMOOTH HORSETAIL, SMOOTH SCOURING-RUSH, BRAUN'S SCOURING-RUSH, KANSAS HORSETAIL, KANSAS SCOURING-RUSH, SUMMER SCOURING-RUSH, COLA DE CABALLO, CAÑUELA. Stems 20–150 cm tall; leaves 10–32 per node. Dallas and Somervell cos., also Erath Co. (Correll 1956); throughout much of TX. Sporulating May–Jul. [*E. kansanum* J.F. Schaffn.] These two species are often very difficult to distinguish in nc TX and seem to intergrade. According to Hauke (1993), we are within the range of *E.* ×*ferrissii* Clute, a hybrid between *E. hyemale* and *E. laevigatum*. Hauke (1993) distinguished *E.* ×*ferrissii* from the two parental species (with greenish spherical spores) by its white misshapen spores. Poisonous (Burlage 1968). ☠

DIVISION **POLYPODIOPHYTA**
FERNS

A group of 8,550 species in 223 genera arranged in 33 families (Mabberley 1997). The fossil record of ferns dates to the Carboniferous period (360–286 million years ago) and related groups occurred back to the Devonian period. The leaves are megaphylls (with branched veins) which apparently are derived from modified branch systems; spores are of one or two types. Modern species range from tree ferns (to 24 m tall) to free-floating aquatics, but are mostly rhizomatous perennial herbs. The group is sometimes referred to as the Filicophyta or the Pterophyta (Bell & Woodcock 1983; Raven et al. 1986). For a Key to Ferns and Similar Plants see page 110 or Key K on page 154.

REFERENCES: Bush 1903; Reverchon 1903; Small 1938; Correll 1949, 1956, 1966a; Thieret 1980; Tryon & Tryon 1982; Taylor 1984; Lellinger 1985; Bell & Woodcock 1983; Raven et al. 1986; Bold et al. 1987; Flora of North America Editorial Committee 1993; Wagner & Smith 1993.

GENERAL CHARACTERISTICS OF THE FERNS [JEP]



ANEMIACEAE ANEMIA FAMILY

A family of 2 genera and ca. 119 species widespread in the tropics and subtropics. It is sometimes lumped with the Schizaeaceae.
FAMILY RECOGNITION IN THE FIELD: the single local species has 1-pinnate leaves with 2 conspicuously different types of pinnae: 4–6 pairs of sterile pinnae and below these a pair of *very long stalked*, bipinnate, fertile pinnae.
REFERENCES: Mickel 1981, 1993.

ANEMIA

A genus of 117 species of tropical and subtropical regions of the world, especially Brazil and Mexico. *Anemia* is sometimes placed in the Schizaeaceae (Kartesz 1994); however, we are following Mickel (1993) in placing it in the Anemiaceae. (Greek: *aneimon*, without clothing, referring to the absence of blade protection for the sporangia)
REFERENCES: Correll 1956, 1966a.

Anemia mexicana Klotzsch, (Mexican), MEXICAN FERN. This species, found primarily on limestone outcrops on the Edwards Plateau (n to Travis Co. just to the s of nc TX), is also disjunct to Austin Co. to the se of nc TX. It is a small fern (to ca. 50 cm tall) with leaves 1-pinnate, with 4–6 pairs of sterile pinnae and with the lowermost pair of pinnae fertile, very long stalked, bipinnate, highly modified, to 30 cm long, and usually exceeding the sterile portion of the leaf in length. It is included here to alert collectors because reasonable habitat exists in the s portion of nc TX.

ASPLENIACEAE SPLEENWORT FAMILY

A cosmopolitan monogeneric family of ca. 700 species; all species are currently treated as members of a diverse genus *Asplenium*.
FAMILY RECOGNITION IN THE FIELD: leaves 1-pinnate, all alike or the fertile slightly smaller; *sori elongate* along the veins; indusia attached along one side of the sori.
REFERENCE: Wagner et al. 1993.

ASPLENIUM SPLEENWORT

Ours terrestrial (in soil) or on rocks; stems (rhizomes) short-creeping to erect; leaves clustered, 1-pinnate, mostly evergeen; sori elongate along veins; indusia attached along the edge of the sori.

The genus is well known for its intraspecific hybridization and complex polyploid series with numerous allopolyploids; ploidy levels range from diploid to hexaploid; three-fifths of the species are thought to be of hybrid, allopolyploid origin; a number of species are cultivated as ornamentals (e.g., *A. nidus* L.—BIRD'S-NEST FERN). (Greek: *splen*, spleen; thought by Dioscorides to be useful for treating spleen diseases)
REFERENCES: Wagner 1954; Correll 1956, 1966a.

1. Pinnae (leaflets) usually alternate, with their basal auricles overlapping the rachis, their margins subentire to deeply serrate or incised; plants terrestrial or growing on rocks; leaves slightly dimorphic, the fertile erect, the sterile smaller and spreading ____ **A. platyneuron**
1. Pinnae opposite, usually not overlapping the rachis, their margins subentire to crenulate; plants usually growing on rocks; leaves monomorphic, all fertile, erect or ascending ____ **A. resiliens**

Asplenium platyneuron (L.) Britton, Sterns, & Poggenb., (broad-nerved), EBONY SPLEENWORT. Leaves to 50 cm tall; leaf blades linear-lanceolate to narrowly elliptic-lanceolate in outline; petiole and rachis usually reddish brown to dark brown (rarely nearly black), shining. Sandy, moist,

wooded banks and slopes, or on rocks; Cooke Co. (Correll 1956), Fannin, Grayson, Tarrant, and Parker cos., also Palo Pinto Co. (R. O'Kennon pers. obs.); se and e TX w to West Cross Timbers. Sporulating Apr–Dec.

Asplenium resiliens Kunze, (recoiling), LITTLE EBONY SPLEENWORT, BLACK-STEM SPLEENWORT. Leaves to ca. 35 cm tall, the blades linear-oblong to linear-lanceolate, usually more coriaceous than in *A. platyneuron*; petiole and rachis black, shining. Usually growing on rocks; Bell, Burnet, Grayson, and Palo Pinto cos.; also Brown and Erath cos. (Correll 1956) and Coryell Co. (Fort Hood—Sanchez 1997); widely scattered in TX. Sporulating Apr–Nov.

AZOLLACEAE
AZOLLA, MOSQUITO FERN, OR WATER FERN FAMILY

A cosmopolitan family of a single genus and only ca. 7 species of floating aquatics (sometimes stranded on mud); it is often included in the Salviniaceae, but according to Lumpkin (1993), the relationship is not close.
FAMILY RECOGNITION IN THE FIELD: tiny, liverwort-like, free-floating or mat-forming plants that sometimes form conspicuous velvet-like, green to red mats on the surface of quiet waters.
REFERENCE: Lumpkin 1993.

AZOLLA WATER FERN, MOSQUITO FERN

The upper leaf lobes (out of the water) of *Azolla* are hollow and inhabited by a symbiotic nitrogen-fixing cyanobacterium (= blue-green bacterium), *Anabaena azollae* Strasb. Because of the resulting nitrogen content, *Azolla* species have been widely used agriculturally as a fertilizer. (Greek: *azo*, to dry, and *ollyo*, to kill, alluding to death from drought)
REFERENCES: Svenson 1944, Correll 1956, 1966a.

Azolla caroliniana Willd., (of Carolina), MOSQUITO FERN, WATER FERN. Plant small, free-floating or mat-forming, superficially resembling some liverworts; stems prostrate, to ca. 1 cm long; leaves minute, deeply bilobed, imbricate, deep green to reddish (under stress); infrequently fertile; sporocarps of two kinds, in the leaf axils, the megasporocarps with 1 megasporangium producing 1 megaspore, the microsporocarps with numerous microsporangia containing numerous microspores. Still water of ponds, lakes, or slow-moving streams or stranded on mud; Grayson, Fannin, Lamar, and Tarrant cos., also Dallas Co. (Reverchon 1903; J. Stanford, pers. comm.); sporadically but widely distributed in TX. Where found, this species is often abundant and huge numbers of individuals can at certain times of the summer turn the surface of ponds a striking red color. Sporulating summer–fall.

BLECHNACEAE CHAIN FERN OR DEER FERN FAMILY

A family of ca. 10 genera and ca. 250 species; it is mostly tropical and s temperate except for the n temperate *Woodwardia*. Family name from *Blechnum*, DEER FERN, a mostly tropical, especially s hemisphere genus of ca. 220 species. (Greek: *blechnon*, classical name for ferns in general)
FAMILY RECOGNITION IN THE FIELD: sori *discrete, linear-oblong*, in a *chain-like row* along each side of the midvein of a pinna or pinnule; indusia attached by their outer margin, opening towards midvein.
REFERENCE: Cranfill 1993a.

WOODWARDIA CHAIN FERN

Terrestrial; stems (rhizomes) in ours long-creeping with leaves scattered along the stems; leaves monomorphic or dimorphic, deciduous, the blades 1-pinnatifid or 1-pinnate; sori discrete,

linear-oblong, in a single chain-like row along each side of the midvein; indusia attached by their outer margin, opening on side next to midvein, often obscured by dehisced (= opened) sporangia.

A genus of 14 species of North America, Central America, Mediterranean Europe, and e Asia. (Named for Thomas Jenkinson Woodward, 1745–1820, English botanist)
REFERENCES: Correll 1956, 1966a.

1. Leaves conspicuously dimorphic (pinnae of fertile leaves contracted, linear); sterile blades 1-pinnatifid, with a wing of blade tissue several mm wide along much (at least upper half) of the rachis; pinnae (subdivisions of leaves) themselves not pinnatifid, sometimes sinuate, the margins serrulate ____ **W. areolata**
1. Leaves monomorphic or nearly so; blades 1-pinnate, with no leaf tissue along the rachis; pinnae deeply pinnatifid with entire margins ____ **W. virginica**

Woodwardia areolata (L.) T. Moore, (pitted), CHAIN FERN, NARROW-LEAF CHAIN FERN. Sterile leaves few, 40–58 cm long; pinnae in 7–12 alternate pairs, 1–2.5 cm wide, the veins anastomosing into 2 or more rows of areoles between midvein (= costa) and margin; sori nearly completely covering surface of blade. Low, wet, usually sandy areas; Fannin Co. in Red River drainage; se and e TX w to ne part of nc TX. Sporulating Mar–Nov. This species has sometimes been segregated into the genus *Lorinseria* [as *L. areolata* (L.) C. Presl]. The sterile leaves resemble those of *Onoclea* (subopposite pinnae with entire margins) except *W. areolata* usually has alternate pinnae with minutely serrulate margins.

Woodwardia virginica (L.) Small, (of Virginia), VIRGINIA CHAIN FERN. Leaves numerous, 50–100 cm long; pinnae in 12–23 pairs, the middle pinnae 1–3.5 cm wide, the veins anastomosing to form a single row of areoles near midvein; sori covering only a small part of the blade surface. Low areas; Milam Co. (Correll 1956) on e edge of nc TX; mainly se and e TX. Sporulating Apr–Dec.

DENNSTAEDTIACEAE BRACKEN FAMILY

As currently recognized, the Dennstaedtiaceae is a cosmopolitan, but mostly tropical family of ca. 20 genera and ca. 400 species; it has been variously circumscribed to include as few as 8 genera or in other cases nearly half the genera of higher ferns. Family name from *Dennstaedia*, a cosmopolitan but mostly tropical genus of ca. 70 species. (Named for August Wilhelm Dennstaedt, 1776–1826, German botanist and physician)
FAMILY RECOGNITION IN THE FIELD: the single nc TX species is a terrestrial plant with large leaves with 3 main divisions, each of these being 2-pinnate-pinnatifid; sori linear, *along margins* of the ultimate leaf segments with the leaf *margins recurved* over sori to form a false indusium.
REFERENCE: Cranfill 1993b.

PTERIDIUM BRACKEN FERN

A monotypic, cosmopolitan genus sometimes placed in the Pteridaceae. (Greek: *pteridon*, a small fern, from *pteron*, feather or wing, due to the shape of the leaves)
REFERENCES: Correll 1956, 1966a; Tryon 1941; Page 1976.

Pteridium aquilinum (L.) Kuhn var. **pseudocaudatum** (Clute) A. Heller, (sp.: eagle-like; var.: false-tailed), WESTERN BRACKEN FERN, PASTURE BRAKE, BRACKEN FERN. Terrestrial; stems (rhizomes) deeply underground, long-creeping; leaves monomorphic, deciduous, scattered along the stems, to 1 m or more tall; leaf blades glabrous or nearly so, broadly triangular to triangular-lanceolate in outline, usually of 3 main divisions, each division 2-pinnate-pinnatifid, the pinnae rigidly herbaceous to subcoriaceous; sori marginal, linear, continuous, covered by a false indusium formed by the recurved margin of the ultimate leaf segments and an obscure inner, delicate,

true indusium. Open woods, pastures, thickets, often in sandy soils; Grayson Co. (S. Crosthwaite, pers. comm.) in Red River drainage, also Henderson, Milam, and Red River cos. on the e margin of nc TX; mainly e TX. Sporulating Jun–Nov. This variable species, with numerous infraspecific taxa, is virtually worldwide in distribution, is the most widely distributed fern, and is considered by some to be the most widespread of all vascular plants (with the exception of a few annual weeds) (Page 1976). Its tenacity is shown by regeneration through several meters of volcanic ash on Mt. St. Helens in Washington within 1–2 years of the volcanic eruption (Woodland 1997). In some areas (e.g., British Isles) BRACKEN FERN is a problematic weed and the cause of "bracken poisoning," a potentially fatal condition in livestock. Toxins include a cyanide-producing glycoside (prunasin); an enzyme, thiaminase, which can cause fatal thiamine (Vitamin B_1) deficiency in livestock; and at least two carcinogens. Human consumption of the fiddleheads has been suggested as a cause of stomach cancer in some parts of the world. It is also known to be allelopathic, with toxins leaching from the tissues adversely affecting surrounding plants (Mabberley 1987; Turner & Szczawinski 1991). ☠

DRYOPTERIDACEAE WOOD FERN FAMILY

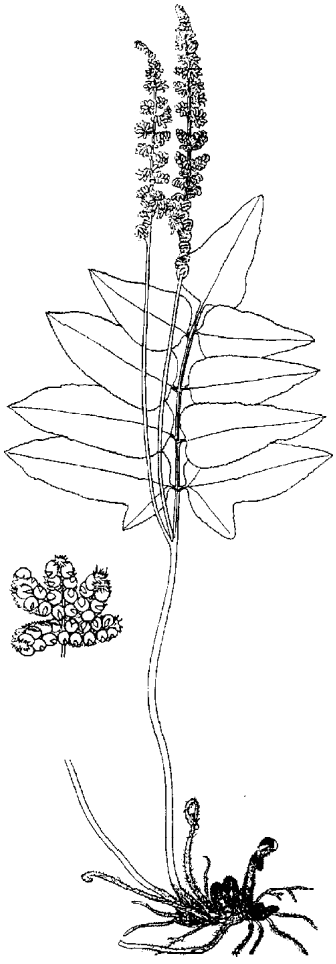
Ours usually terrestrial or on rocks or epiphytic; leaves monomorphic or dimorphic; leaf blades 1-pinnatifid to 1–more-pinnate or pinnate-pinnatifid; sori on abaxial leaf surfaces, on veins or vein tips, usually not marginal, or in berry-like or bead-like structures on fertile leaves conspicuously different from sterile (*Onoclea*).

The family as broadly described here follows Smith (1993b) and includes genera (*Athyrium, Nephrolepis, Onoclea, Woodsia*) at times segregated into other families; it is cosmopolitan and has ca. 60 genera and ca. 3,000 species. The family has sometimes been treated as the Aspidiaceae (an illegitimate name). Family name from *Dryopteris*, WOOD FERN or SHIELD FERN, a mostly temperate (especially Asian) genus of ca. 250 species. (Greek: *drys*, oak or tree, and *pteris*, fern; several species are associated with oak woodlands)

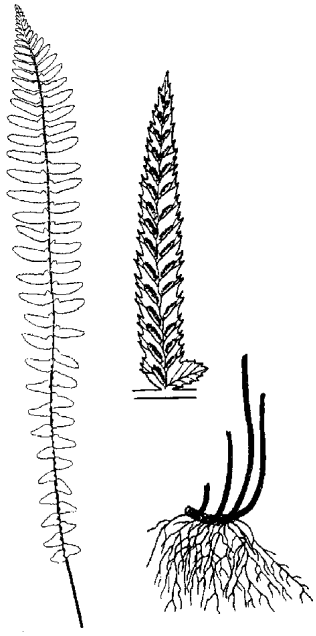
FAMILY RECOGNITION IN THE FIELD: sori in most species on veins or vein tips (usually not marginal), or in *Onoclea* in berry-like or bead-like structures on fertile leaves conspicuously different from the sterile leaves.

REFERENCES: Correll 1956, 1966a; Smith 1993b.

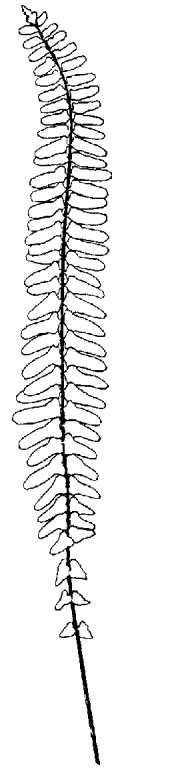
1. Fertile and sterile leaves completely different (leaves extremely dimorphic); fertile leaves without typical blade tissue; sterile leaf 1-pinnatifid (deeply divided but not completely pinnate); rachis with a conspicuous flange of photosynthetic tissue ____ **Onoclea**
1. Fertile and sterile leaves or portions of leaves similar, the fertile portion never so different as to be without blade tissue; leaves at least completely 1-pinnate, often more divided; rachis without a flange of photosynthetic tissue.
   2. Leaf blades only 1-pinnate, the pinnae themselves not further divided, neither pinnate nor pinnatifed (but basal auricles sometimes present).
      3. Sori only on the uppermost somewhat reduced fertile pinnae; indusia orbicular, not at all kidney-shaped; pinnae with bristly teeth on the margins ____ **Polystichum**
      3. Sori not restricted to the uppermost pinnae, the fertile pinnae not reduced; indusia orbicular-kidney-shaped; pinnae without bristly teeth on the margins (but small non-bristly teeth can be present) ____ **Nephrolepis**
   2. Leaf blades more than 1-pinnate, the pinnae themselves further divided, either pinnate or pinnatifid.
      4. Sori elongate; indusia attached to blade along one side of sorus only; basal pinnules often with small auricles; plants to 120 cm tall ____ **Athyrium**
      4. Sori round or nearly so; indusia of lobes or flaps attached at several spots around the sorus; basal pinnules without auricles; plants 60 cm or less tall (often only ca. 30) ____ **Woodsia**



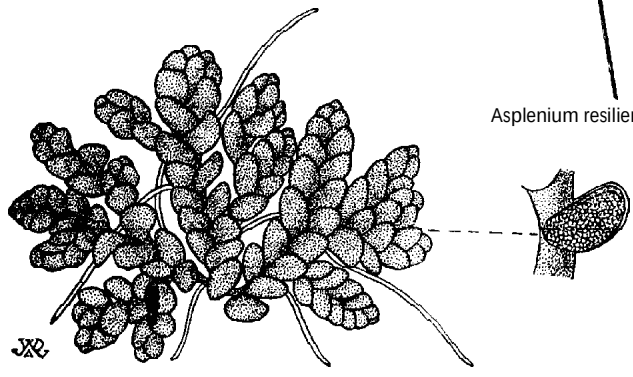
Anemia mexicana [LUN]



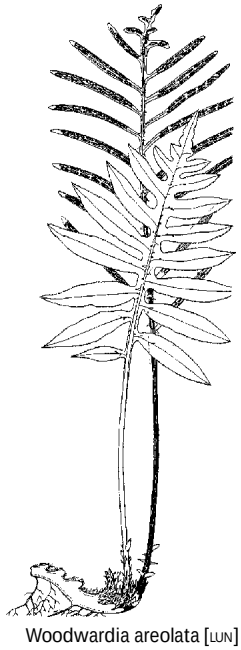
Asplenium platyneuron [LUN]



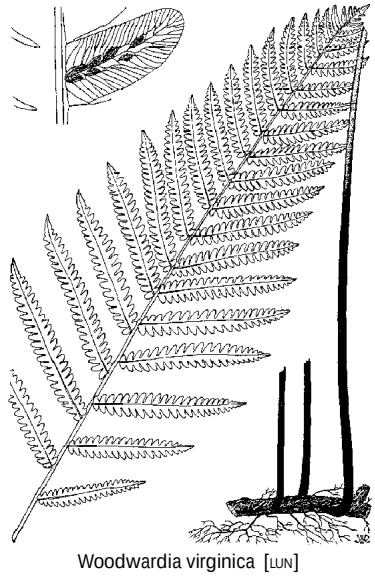
Asplenium resiliens [LUN]



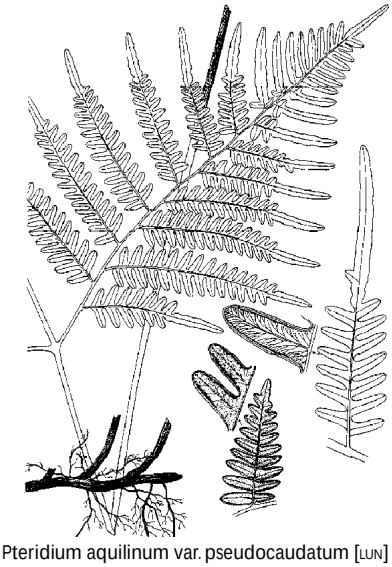
Azolla caroliniana [LUN]



Woodwardia areolata [LUN]



Woodwardia virginica [LUN]



Pteridium aquilinum var. pseudocaudatum [LUN]

ATHYRIUM LADY FERN

A cosmopolitan genus of ca. 180 species. (Greek: *athyros*, doorless; the sporangia only tardily push back the outer edge of the indusium)
REFERENCE: Kato 1993.

Athyrium filix-femina (L.) Roth subsp. **asplenioides** (Michx.) Hultén, (sp.: lady fern; subsp.: resembling *Asplenium*—spleenwort), SOUTHERN LADY FERN, LOWLAND LADY FERN. Stems (rhizomes) short-creeping; leaves monomorphic, deciduous, clustered, to 120 cm tall, 2-pinnate-pinnatifid (rarely sub-3-pinnate), the pinnae usually short stalked; sori elongate, straight to hooked or curved, somewhat resembling those of *Asplenium*, in a single row on each side of the midrib, ca. midway between midrib and margin of ultimate leaf segment; indusia membranous, opening facing midrib. Moist woods, thickets, swamps, stream banks; Williamson Co. (Correll 1956); mainly e TX nw to Red River Co. Sporulating May–Nov. [*A. asplenioides* (Michx.) A.A. Eaton] This species is sometimes cultivated as an ornamental.

NEPHROLEPIS BOSTON FERN

A genus of 25–30 species widespread in tropical areas. *Nephrolepis* is sometimes placed in the Davalliaceae or Nephrolepidaceae. (Greek: *nephros*, kidney, and *lepis*, scale, in reference to the shape of the indusium)
REFERENCE: Nauman 1993.

Nephrolepis exaltata (L.) Schott, (very tall), SWORD FERN, WILD BOSTON FERN. Stems (rhizomes) short, ± erect, with wiry, widely creeping stolons; leaves monomorphic, evergreen, clustered, 1-pinnate, 0.4–1.5(–2) m or more long, the blades linear-lanceolate; sori roundish, somewhat closer to margin than to midvein of pinnae, the indusia ± orbicular-reniform. Escaped, persisting and spreading in yard in Highland Park, Dallas (R. O'Kennon, pers. obs.); apparently naturalized in several sites in e TX and the Edwards Plateau; native to Florida, the West Indies, and scattered Pacific Islands; terrestrial or most often epiphytic in its native habitat. This is a commonly cultivated and commercially important fern with many cultivars including cv. 'Bostoniensis' (BOSTON FERN) and the locally developed DALLAS JEWEL FERN,™ commonly known as the DALLAS FERN.

ONOCLEA SENSITIVE FERN

A monotypic genus of n temperate areas; sometimes cultivated as an ornamental. (Greek: *onos*, vessel, and *cleisto*, closed, in reference to the sori, which are enclosed by the revolute fertile leaf margins)
REFERENCE: Johnson 1993b.

Onoclea sensibilis L., (sensitive), SENSITIVE FERN. Stems (rhizomes) creeping; leaves conspicuously dimorphic, of 2 very different types, scattered along the rhizome, erect, glabrous; sterile leaves to ca. 1(–1.3) m tall, thin herbaceous, deciduous, broadly triangular to ovate in outline, deeply pinnatifid with the pinnae few, the pinnae subopposite (especially the lowermost), undulate to irregularly deeply lobed, with margins entire, the rachis winged; fertile leaves persistent over winter, 2-pinnate, the blades greatly reduced, the ultimate segments rolled into globular, berry-like or bead-like structures concealing the sori, the whole fertile leaf superficially resembling a narrow panicle of small round fruits. Swamps, low woods, and wet areas; Milam Co., also Burnet Co. (Correll 1956) on the s edge of nc TX; mainly se and e TX , the Edwards Plateau, and in the Rio Grande Plains. Sporulating Apr–Dec. The common name is in reference to the sensitivity of the leaves to even a light frost (Johnson 1993b). The sterile leaves superficially resemble those of *Woodwardia areolata*. Reported to be poisonous; horses are said to become unsteady and collapse upon ingesting the plant (Burlage 1968; Turner & Szczawinski 1991).

POLYSTICHUM CHRISTMAS FERN, SWORD FERN, HOLLY FERN

A cosmopolitan genus of ca. 180 species. (Greek: *poly*, many, and *stichos*, row, presumably in reference to the rows of sori on each pinna)
REFERENCE: Wagner 1993.

Polystichum acrostichoides (Michx.) Schott, (resembling *Acrostichum*—another genus of ferns), CHRISTMAS FERN, DAGGER FERN. Stems (rhizomes) erect; leaves essentially evergreen, clustered, to 70 cm long, the blades elliptic-lanceolate to lanceolate in outline, 1-pinnate; pinnae mostly alternate, auricled basally, the margins bristle-toothed; petioles densely scaly; leaf blades partially dimorphic, the proximal pinnae (those near blade base) sterile, the distal pinnae (those near blade tip) of some blades fertile and conspicuously contracted (but blade tissue still evident); sori round, crowded in 2–4 rows, medial, often confluent at maturity; indusia peltate, entire, persistent. Rich wooded slopes, moist areas; included based on citation of vegetational area 4 (Fig. 2) by Hatch et al. (1990); it has been collected a few miles e of the e margin of nc TX in w Red River Co.; mainly e TX. Sporulating May–Nov.

WOODSIA CLIFF FERN

A genus of ca. 30 species found mainly in n temperate regions and at high elevations in the tropics. (Named for Joseph Woods, 1776–1864, English botanist)
REFERENCES: Windham 1987a, 1993d.

Woodsia obtusa (Spreng.) Torr., (obtuse, blunt), COMMON WOODSIA, BLUNT-LOBED WOODSIA, LARGE WOODSIA. Stems (rhizomes) short; leaves monomorphic, semi-evergreen, clustered, erect-ascending, to 40(–60) cm tall, often smaller, the blades elliptic-lanceolate to broadly lanceolate, 2-pinnate or 2-pinnate-pinnatifid; sori round, between midrib and lateral margins of ultimate leaf segments; indusia rather large, at first enclosing the sporangia and later splitting into several spreading, irregular lobes. Rocky areas, outcrops, well-drained often sandy areas; Lamar (Carr 1994) and Kaufman cos. w to Montague and Palo Pinto cos.; mainly e, nc, and c TX. Two subspecies of *W. obtusa* differing in chromosome number, are recognized by Windham (1993d) as occurring in nc TX and separated and described by him as follows. We, however, have been unable to clearly and consistently separate the specimens from nc TX into the 2 subspecies. Windham (1993d) further indicated that the 2 subspecies hybridize in the area of sympatry and form sterile triploids with malformed spores.

1. Spores averaging 42–47 µm; proximal pinnules of lower pinnae usually shallowly lobed or merely dentate; blades coarsely cut and evidently 2-pinnate; stems compact to short-creeping, individual branches usually 5–10 mm diam. ____ subsp. **obtusa**
1. Spores averaging 35–42 µm; proximal pinnules of lower pinnae usually deeply lobed or pinnatifid; blades finely cut, 2-pinnate-pinnatifid; stems short- to long-creeping, individual branches 3–5 mm diam. ____ subsp. **occidentalis**

subsp. **obtusa**. Cliffs and rocky slopes, also terrestrial. $2n = 152$. E U.S. w to e 1/3 of TX.

subsp. **occidentalis** Windham, (western). Cliffs and rocky slopes, also terrestrial. $2n = 76$. C U.S. including nc TX to c TX.

MARSILEACEAE
WATER-CLOVER OR PEPPERWORT FAMILY

Plants aquatic or of very wet habitats; stems (rhizomes) long-creeping; leaves scattered along the stems long-petioled, palmately divided into 4 pinnae or filiform and lacking expanded blades; sori contained in sporocarps (= hard bean- or pea-like structures which are apparently highly

modified pinnae) on stalks from near base of petiole; sporangia of 2 kinds within the same sorus, the megasporangia with 1 megaspore, the microsporangia with numerous microspores.

A nearly cosmopolitan family of 3 genera and ca. 50 species.
FAMILY RECOGNITION IN THE FIELD: plants of wet areas with leaves resembling a *4-leaf clover* (in 1 species apparently rare in nc TX the leaves are thread-like and ± resemble those of a grass); sori in hard, *bean- or pea-like structures* (= sporocarps) near the base of the petioles.
REFERENCES: Correll 1956, 1966a; Johnson 1993a.

1. Leaf blades palmately divided into 4 narrowly to broadly cuneate (= wedge-shaped) pinnae (resembling a 4-leaf clover) ____ **Marsilea**
1. Leaves filiform, very narrow, inconspicuously grass-like in appearance, without expanded blades ____ **Pilularia**

MARSILEA WATER-CLOVER, PEPPERWORT

Small plants, aquatic or of wet habitats, often forming dense colonies; leaves long petiolate with blades palmately divided into 4 pinnae; sporocarps on stalks, the tip of stalk often protruding as a bump or tooth (proximal tooth), a second tooth (distal tooth) sometimes present on sporocarps beyond the attachment point of the stalk.

A nearly cosmopolitan genus of 45 species. The leaves have a superficial resemblance to those of CLOVER; young plants can have unlobed leaves like *Pilularia* . (Named for Count Luigi Marsigli, 1656–1730, Italian mycologist at Bologna)
REFERENCES: Gupta 1957; Thieret 1977b; Johnson 1986, 1988.

1. Pinnae 9–35 mm long, 8–39 mm wide; sporocarps densely villous with long spreading hairs; distal tooth of sporocarps absent or to 0.5 mm long, blunt; sporocarp stalks usually branched, several sporocarps per stalk ____ **M. macropoda**
1. Pinnae 4–19 mm long, 4–16 mm wide; sporocarps pubescent with appressed hairs, often glabrate; distal tooth of sporocarps 0.4–1.2 mm long, acute; sporocarp stalks unbranched, 1 sporocarp per stalk ____ **M. vestita**

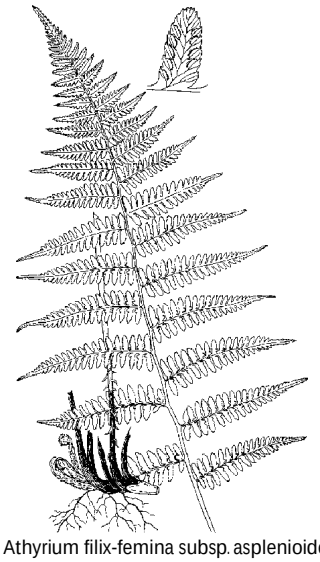
Marsilea macropoda Engelm. ex A. Braun, (large-footed), LARGE-FOOT PEPPERWORT, WATER-CLOVER. Petioles 5–39 cm long. Typically in mud, also shallow water; Brown Co., also Travis Co. (Blackland Prairie (Correll 1956)) just s of nc TX; mainly c to s TX. Sporocarps produced nearly year round. An attractive plant that is cultivated as an ornamental.

Marsilea vestita Hook. & Grev., (covered). Petioles 2–20 mm long. Ponds, wet depressions, along streams and rivers. Sporocarps produced Mar–Oct.

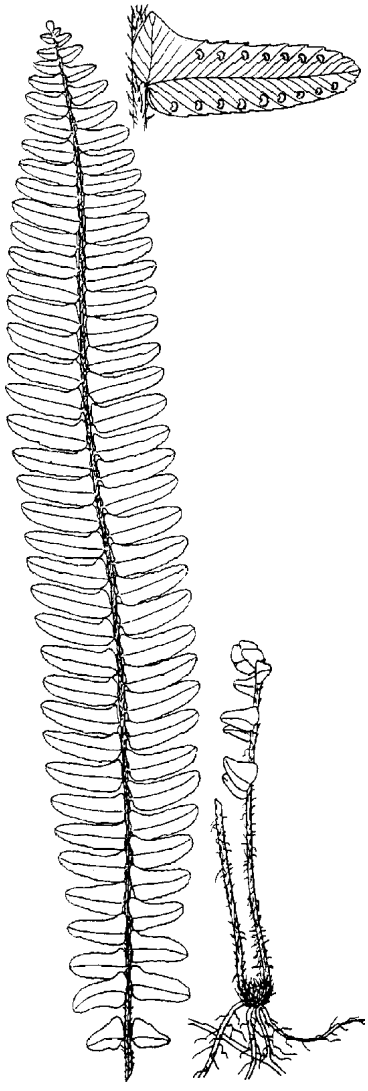
1. Pinnae narrow in appearance, 3–7.5 times as long as wide, narrowly and obliquely cuneate (= wedge-shaped), irregularly toothed or crenulate at apex ____ subsp. **tenuifolia**
1. Pinnae broad in appearance, usually 1–2 times as long as wide, fan-shaped or broadly cuneate, with entire or undulate-crenulate apex ____ subsp. **vestita**

subsp. **tenuifolia** (Engelm. ex A. Braun) D.M. Johnson, (slender-leaved), NARROW-LEAF PEPPERWORT. This rare taxon has been variously treated as a separate species (Correll & Johnston 1970), as a subspecies of *M. vestita* (Johnson 1986; Kartesz 1994), or lumped with *M. vestita* (Johnson 1993a; Jones et al. 1997). Because it can usually be easily distinguished in the field (see key above), we are treating it as a subspecies of *M. vestita*. Included based on citation by Hatch et al. (1990) for vegetational area 5 (Fig. 2); "Burnet (or Llano)" and Travis cos. (Correll 1956) at the s margin of nc TX; mainly on the Edwards Plateau. [*M. tenuifolia* Engelm. ex A. Braun]

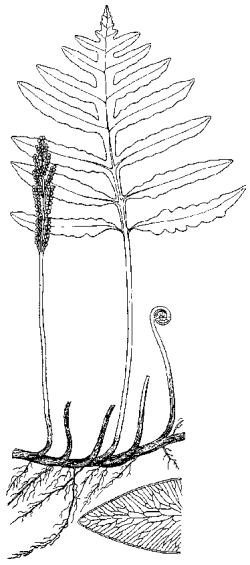
subsp. **vestita**, HOOKED PEPPERWORT, WATER-CLOVER, HAIRY PEPPERWORT. Coryell (Fort Hood—



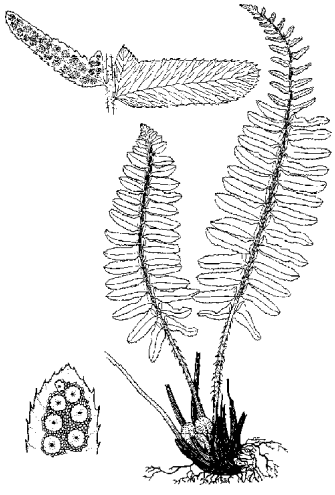
Athyrium filix-femina subsp. asplenioides [LUN]



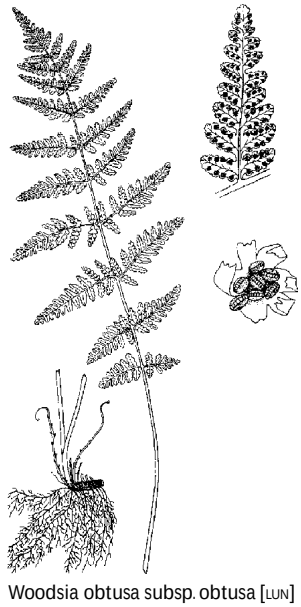
Nephrolepis exaltata [LUN]



Onoclea sensibilis [LUN]

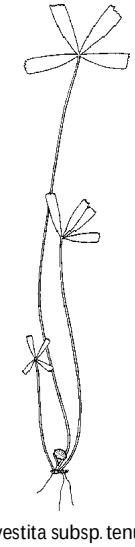


Polystichum acrostichoides [LUN]



Woodsia obtusa subsp. obtusa [LUN]

Marsilea macropoda [LUN]



Marsilea vestita subsp. tenuifolia [LUN]

Marsilea vestita subsp. vestita [LUN]

Pilularia americana [LUN]

Sanchez 1997), Dallas, Ellis, Tarrant, and Williamson (Correll 1956) cos.; Blackland Prairie s and w to w TX. [*M. mucronata* A. Braun]

PILULARIA PILLWORT

A genus of 6 species of North America, South America, Europe, Pacific Islands, Australia, and New Zealand; sometimes placed in its own family. (Latin: *pilula*, a little ball, in reference to the spheric sporocarps)
REFERENCES: LaMotte 1940; Hill 1980a; Dennis & Webb 1981.

Pilularia americana A. Braun, (of America), AMERICAN PILLWORT, WATER-PEPPER. Small inconspicuous aquatic, underwater or infrequently persisting on bare mud; leaves filiform, 1.6–10.2 cm long, lacking expanded blades; sporocarps produced just below ground surface, globose, 2–6(–10) mm long, 2–3 mm in diam. Temporary pools, ponds, reservoir margins. According to the range map in Johnson (1993a), *P. americana* occurs widely in nc TX and it is included here on that basis; the only known nearby collection we have seen is from Burnet Co. (Granite Mt., just s of nc TX). The species is so inconspicuous that it is rarely recognized or collected.

OPHIOGLOSSACEAE ADDER'S-TONGUE FAMILY

Ours terrestrial; stems (± subterranean) simple, unbranched, upright; leaves 1 or less commonly 2 per stem, with common stalk divided into a blade portion (= trophophore) and a fertile sporangia-bearing portion (= sporophore); blade portion simple, divided, or compound; fertile portion (lacking blade-like tissue) typically consisting of a long stalk with a terminal, branched or unbranched, sporangia-bearing area; sporangia large, spherical, thick-walled, borne in 2 rows on the branches or on the unbranched sporangia-bearing area.

A nearly cosmopolitan family of 5 genera and ca. 70–80 species thought by some to be only distantly related to other ferns; they are apparently relicts of an ancient lineage (Bell & Woodcock 1983). The family is made up of 2 clearly defined subfamilies, Botrychioideae and Ophioglossoideae, sometimes recognized as distinct families. The following treatment draws heavily on Wagner and Wagner (1993).
FAMILY RECOGNITION IN THE FIELD: often small plants with only 1 or sometimes 2 leaves; leaves with a blade portion (simple to compound) and an erect, spike-like, fertile portion consisting of an elongate stalk and a terminal, fertile, sporangia-bearing area.
REFERENCES: Clausen 1938; Correll 1956, 1966a; Thomas 1972; Wagner & Wagner 1993.

1. Leaf blades ternately-pinnately compound, divided, or lobed, the margins usually denticulate to serrate or lacerate; veins of leaf blades dichotomous (= equally 2-forked) and free; sporangia in pinnately branched, panicle-like arrangement ____ **Botrychium**
1. Leaf blades simple, the margins entire; veins of leaf blades reticulate (= in a net-like pattern); sporangia in unbranched, linear, spike-like arrangement ____ **Ophioglossum**

BOTRYCHIUM GRAPE FERN, MOONWORT

Blade portion of leaf compound, divided or lobed, ovate to triangular or broadly triangular in outline; fertile portion of leaf consisting of an elongate stalk terminated by a 1–2-pinnate, panicle-like sporangia-bearing region.

A nearly cosmopolitan genus of 50–60 species with greatest diversity at high latitudes and high elevations; most species are quite variable vegetatively. (Latin: *botry*, bunch (of grapes), and *-oides*, like, in reference to the sporangial clusters)
REFERENCE: Holmes et al. 1996.

1. Plants small, to only ca. 12 cm tall; blade portion of leaf prostrate on ground, small, only 3–8 cm long, short-stalked (petiole-like stalk 1.5–3 cm long); ultimate leaf segments fan-shaped, their tips broadly rounded; leaves commonly 2 per plant ——— **B. lunarioides**
1. Plants usually larger, 8–75 cm tall; blade portion of leaf raised above the ground, not prostrate, usually larger, 4–30 cm long, either sessile (petiole-like stalk absent) or long-stalked (petiole-like stalk 3–20 cm long); ultimate leaf segments not fan-shaped, their tips usually pointed; leaves usually 1 per plant.
   2. Blade portion of leaf appearing to have a long petiole (blade portion well-separated from origin of fertile stalk); blade coarsely divided, the relatively few large ultimate segments with finely denticulate margins; leaves present in winter ——— **B. biternatum**
   2. Blade portion of leaf sessile (fertile stalk originating at very base of blade portion); blade finely divided, the numerous small ultimate segments with coarsely serrate to lacerate (= irregularly cut) margins; leaves absent in winter ——— **B. virginianum**

Botrychium biternatum (Savigny) Underw., (twice-ternate), SOUTHERN GRAPE FERN, SPARSE-LOBED GRAPE FERN. Plant ca. 10–35 cm tall; roots usually 10 or less, blackish; leaves present over winter, rarely bronze in winter if exposed; new leaves appearing in late spring to early summer; sterile blade portion green to dark green, long-stalked (stalk 3–20 cm long), herbaceous, to 18 cm long and 28 cm wide, usually smaller, 2–3-pinnate; pinnules elongate, obliquely lanceolate to narrowly lanceolate, the margins nearly parallel, finely denticulate, the apices short-acuminate. The leaves are much less finely divided than in *B. virginianum*, the 2 species immediately distinguishable in the field, herbarium or illustrations. Low woods; included based on map in Wagner and Wagner (1993) and citation of *B. dissectum* Spreng. for vegetational area 4 (Fig. 2) by Hatch et al. (1990); we have seen no nc TX specimens. Sporulating Apr–Dec. While *B. biternatum* is cited only for vegetational area 1 (Fig. 2) by Hatch et al. (1990), all TX material seen by W.H. Wagner, Jr. (pers. comm.) going under the name of *B. dissectum* is actually *B. biternatum* (with the possible exception of material from very close to the LA border). The map in Wagner and Wagner (1993) clearly shows *B. biternatum* in e TX while *B. dissectum* occurs in the se U.S. w to approximately the LA-TX border. The vegetational area 4 (Fig. 2) citation for *B. dissectum* by Hatch et al. (1990) is therefore assumed to be *B. biternatum*. While sometimes resembling *B. biternatum*, according to W.H. Wagner Jr. (pers. comm.) and Wagner and Wagner (1993), *B. dissectum* has leaves that are more dissected and the pinnules trowel-shaped or linear, apically more pointed, and with the margins more lacerate. [*B. tenuifolium* Underw., *B. dissectum* Spreng. var. *tenuifolium* (Underw.) Farw.]

Botrychium lunarioides (Michx.) Sw., (resembling *Botrychium lunaria*), WINTER GRAPE FERN, PROSTRATE GRAPE FERN. Roots 20–30, yellow to brown; leaves appearing in late fall, overwintering and then dying in early spring; sterile blade portion usually pale green, short-stalked, fleshy, to 12 cm wide, 2–3-pinnate-pinnatifid; ultimate leaf segments fan-shaped, with midrib absent, denticulate, rounded at apex. Open grassy areas; Falls, Hunt, Hopkins, Kaufman, Milam, and Navarro cos. on e edge of Blackland Prairie (Holmes et al. 1996); mainly e TX. According to Wagner and Wagner (1993), a "peculiarity of this species is the tendency for the sporophores to remain curled in late fall and early winter and to become erect in February." This taxon was only recently reported from the Blackland prairie (Holmes et al. 1996).

Botrychium virginianum (L.) Sw., (of Virginia), RATTLESNAKE FERN, VIRGINIA GRAPE FERN, COMMON GRAPE FERN. Plant erect, 8–75 cm tall; roots 15 or fewer, yellow to brown; leaves seasonal, appearing in early spring and dying in summer; sterile blade portion pale green, sessile, thin, herbaceous, 4–30 cm long and wide, 3–5-pinnate-pinnatifid; ultimate leaf segments linear, with midrib present, serrate to lacerate, pointed at apex. Moist, rich woods and thickets; Grayson, Lamar, and Tarrant cos.; also Bell, Burnet, and Dallas cos. (Correll 1956); mainly e TX w to nc TX, also Edwards Plateau. Sporulating Mar–Sep.

OPHIOGLOSSUM ADDER'S-TONGUE

Plant small, ours to ca. 25 cm tall; blade portion of leaf simple; fertile portion of leaf consisting of an elongate stalk terminated by an unbranched, linear, spike-like, sporangia-bearing region.

A nearly cosmopolitan, but mainly tropical and subtropical genus of 25–30 species. *Ophioglossum* species have the highest chromosome numbers known for vascular plants, with numbers as high as $2n = 1{,}200+$ being reported. (Greek: *ophis*, snake, and *glossa*, tongue, in reference to the tip of the sporangia-bearing structure)

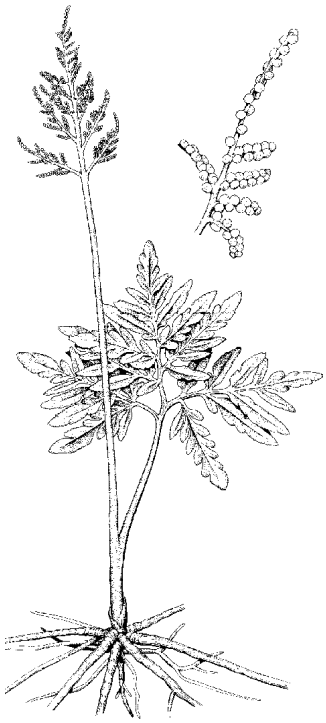
1. Stems (± subterranean and sometimes called rootstocks) globose-bulbous, 3–12 mm diam.; leaves emerging from cavity in top of stem, the blade portion usually near ground surface, appearing spreading or nearly flat on ground, usually roughly triangular to orbicular-ovate or cordate, to only 35 mm long; sporangial clusters < 1 cm long; common stalk (to where blade and fertile stalk separate) usually < 3 cm long ——— **O. crotalophoroides**
1. Stems cylindric upright, to ca. 4 mm diam.; leaves developing at top of stem, the blade portion well above ground, erect to spreading, usually ovate to lanceolate, to 120 mm long; sporangial clusters 2–4 cm long; common stalk to 10 cm long.
   2. Blade portion of leaf with distinct and prominent apiculate tip, commonly ± folded when alive; principal veins of blade forming large primary areoles (= vein enclosed areas) in which are included numerous veinlets forming secondary areoles ——— **O. engelmannii**
   2. Blade portion of leaf without apiculate tip, usually rounded to acute at apex, commonly plane when alive; principal veins of blade forming areoles but these including only free veinlets ——— **O. vulgatum**

Ophioglossum crotalophoroides Walter, (from Greek: *krotalon*, a rattle, and *-oides*, like or resembling, due to the resemblance of the sporongial clusters to rattles or castanets), BULBOUS ADDER'S-TONGUE. Plant usually to only 15 cm tall; blade portion of leaf to 35 mm long and 25 mm wide, usually smaller; fertile stalk 1–5 times as long as blade portion; sporangia 4–8(–12) on each side of fertile stalk. Usually in moist sand; Fannin, Hopkins, Hunt, Lamar, Limestone, and Red River cos.; se and e TX w to n part of nc TX, also e Edwards Plateau. Sporulating Mar–May.

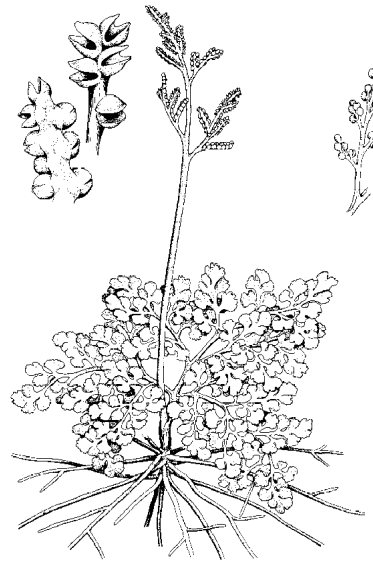
Ophioglossum engelmannii Prantl, (for George Engelmann, 1809–1884, German-born American botanist), ENGELMANN'S ADDER'S-TONGUE, LIMESTONE ADDER'S-TONGUE. Plant to 25 cm tall; blade portion of leaf to 100 mm long and 45 mm wide, commonly folded when alive, when dried uniformly green without pale central band; fertile stalk 1.3–2.5 times as long as blade portion; sporangia 20–40 on each side of fertile stalk. Usually in thin black soils on limestone, wooded rocky slopes; Dallas, Denton, Grayson, Kaufman, Limestone, Montague, and Tarrant cos.; also Bell, Brown, and McLennan cos. (Correll 1956); se and e TX w to West Cross Timbers, also Edwards Plateau and Deaf Smith Co. in the Panhandle (Floyd Waller collection—J. Stanford, pers. comm.). Sporulating Dec–Jun.

Ophioglossum vulgatum L., (common), ADDER'S-TONGUE, SOUTHERN ADDER'S-TONGUE. Similar to *O. engelmannii*; leaves 1 per stem; blade portion of leaf to 120 mm long and 50 mm wide, dark green, somewhat shiny, rounded at apex; fertile stalk 2–4 times as long as blade portion; sporangia 10–35 on each side of fertile stalk. Moist woods, meadows, swamps, usually in sandy soils; Fannin and Lamar cos. in Red River drainage, also Denton Co. (Clausen in Correll 1956); mainly se and e TX w to n part of nc TX. Sporulating Mar–Jun. [*O. pycnostichum* (Fernald) A. Löve & D. Löve, *O. vulgatum* var. *pycnostichum* Fernald]

According to W.H. Wagner Jr. (pers. comm.), two other species, *O. nudicaule* L., (naked stem), and *O. petiolatum* Hook., (with a petiole or leaf stalk), occur just to the east and may yet be found in nc TX. Both are found in disturbed places, commonly in cemeteries and mowed areas around motels. In the key above, *O. nudicaule* would key to *O. engelmannii*; *O. nudicaule* can be

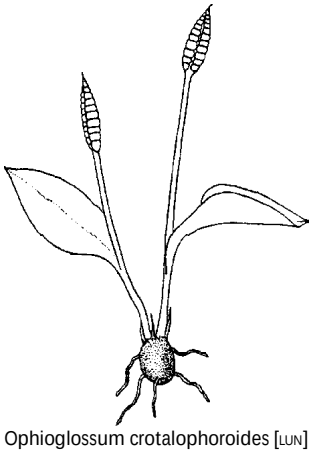


Botrychium biternatum [TAY]

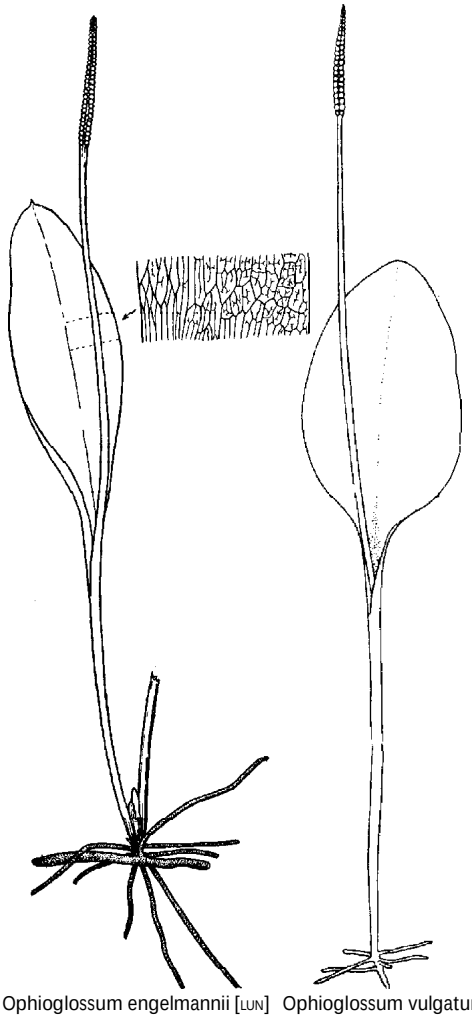


Botrychium lunarioides [TAY]

Botrychium virginianum [TAY]

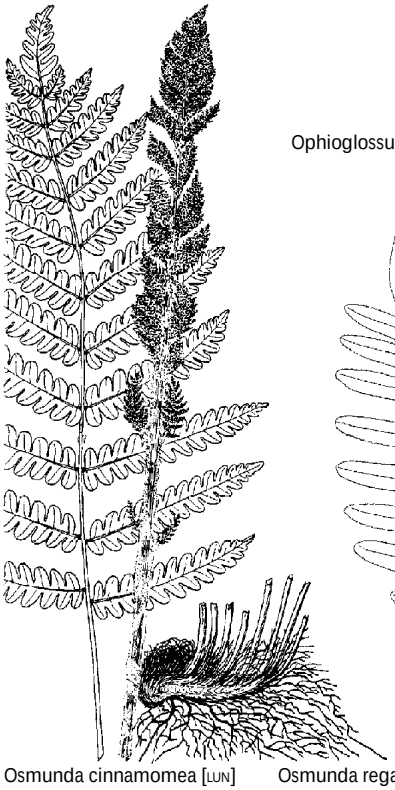


Ophioglossum crotalophoroides [LUN]

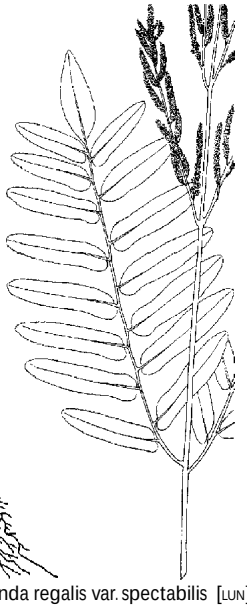


Ophioglossum engelmannii [LUN]

Ophioglossum vulgatum [LUN]



Osmunda cinnamomea [LUN]



Osmunda regalis var. spectabilis [LUN]

distinguished by the following: blade portion of leaf to only 45 mm long and 17 mm wide, plane when alive, when dried commonly with a pale central band; fertile stalk 2–6 times as long as blade portion. In the key above, *O. petiolatum* would key to *O. vulgatum Ophioglossum petiolatum* can be distinguished by: leaves (= blade portion and fertile portion combined) commonly 2–3 per stem; blade portion of leaf acute at apex, to 60 mm long and 30 mm wide, gray-green, dull.

OSMUNDACEAE CINNAMON FERN FAMILY

A nearly cosmopolitan family with 3 genera and up to ca. 36 species; some are cultivated as ornamentals.

FAMILY RECOGNITION IN THE FIELD: leaves usually large, wholly or partly *dimorphic* (fertile leaves or pinnae conspicuously different from sterile); sporangia not in discrete sori.

REFERENCES: Correll 1956, 1966a; Hewitson 1962; Whetstone & Atkinson 1993.

OSMUNDA

Terrestrial; leaves erect to spreading, in a large crown from a stout woody creeping to erect stem (rhizome), wholly or partly dimorphic; sori absent; sporangia clustered; indusia absent.

A nearly cosmopolitan genus of 10 species. (Saxon: *Osmunder*, name for Thor, god of war)

1. Fertile leaves completely different in appearance from sterile leaves; ultimate leaf segments of sterile leaves not narrowed at base, the area of attachment as broad as segment ____ **O. cinnamomea**
1. Fertile leaves similar in appearance to sterile leaves except with greatly reduced sporangia-bearing pinnae at tip; ultimate leaf segments greatly narrowed at very base, attached at one stalk-like point only ____ **O. regalis**

Osmunda cinnamomea L., (cinnamon-brown), CINNAMON FERN, BUCKHORN FERN, BUCKHORN BRAKE, FLOWERING FERN. Sterile leaves 1-pinnate-pinnatifid, ca. 0.3–1.5 m long, the ultimate segments with margins entire and apically usually mucronate; pinnae with a persistent tuft of tomentum at base; fertile leaves with no expanded pinnae, densely tomentose, much narrower and shorter than sterile leaves; sporangia cinnamon-colored. Wet areas; Lamar Co. in Red River drainage, also Milam Co. (Correll 1956); mainly se and e TX. Sporulating Mar–Jul or later.

Osmunda regalis L. var. **spectabilis** (Willd.) A. Gray, (sp.: royal; var. spectacular), ROYAL FERN, FLOWERING FERN. Leaves 2-pinnate; sterile leaves ca. 0.75–1 m long; pinnules lanceolate, the margins subentire to remotely dentate, apically acute to rounded; pinnae without a persistent tuft of tomentum at base, essentially glabrous; sporangia brown at maturity. Wet areas; Lamar Co. (Carr 1994) in Red River drainage; se and e TX w to ne corner of nc TX and Travis Co. (Correll 1956) just s of nc TX. Sporulating Mar–Jul.

POLYPODIACEAE POLYPODY FAMILY

A cosmopolitan family today treated as composed of ca. 40 genera and ca. 500 species. As previously circumscribed the Polypodiaceae encompassed ca. 7,000 species or nearly two-thirds of the living ferns. Family name from *Polypodium*, POLYPODY, a cosmopolitan genus of ca. 100 species; the genus is currently more narrowly defined than previously. (Greek: *poly*, many, and *pous* or *podium*, foot, referring to the branched rhizomes)

FAMILY RECOGNITION IN THE FIELD: the single nc TX species is typically epiphytic or found growing on rocks; the *discrete round sori* (without indusia) are found in single rows on each side of the midrib of the lobes of the *deeply pinnatifid* leaves.

REFERENCES: Correll 1956, 1966a; Smith 1993c.

PLEOPELTIS SHIELD-SORUS FERN

A widespread, but primarily neotropical genus of ca. 50 species of mostly epiphytic ferns; some of the species now treated in *Pleopeltis* were formerly included in *Polypodium*. (Greek: *pleos*, many, and *pelte*, shield, in reference to the peltate scales covering immature sori)
REFERENCE: Andrews & Windham 1993.

Pleopeltis polypodioides (L.) E.B. Andrews & Windham subsp. **michauxiana** (Weath.) E.B. Andrews & Windham, (sp: resembling *Polypodium*; subsp.: for André Michaux, 1746–1803, French botanist and explorer of North America), RESURRECTION FERN, GRAY POLYPODY. Usually epiphytic or sometimes growing on rocks; rhizomes slender, widely creeping, densely scaly; leaves monomorphic, evergreen, widely spaced; leaf blades oblong to triangular-oblong in outline, deeply pinnatifid, to 15 cm long and 5 cm wide, thick, opaque, hygroscopic, involute upon drying, glabrous above except for a few scales along midrib, densely covered with peltate scales below, the margins mostly entire; sori in single rows on each side of the midrib of the lobes near the margins, round, discrete, forming conspicuous bumps on the undersurface of leaves; indusia absent. Usually growing on various species of trees, especially oaks, sometimes on rocks, usually in shady damp situations; Dallas, Grayson, and Fannin cos., also Parker Co. (Correll 1956); se and e TX w to nc TX and Edwards Plateau. Previously lumped into the genus *Polypodium* [as *P. polypodioides* (L). Watt var. *michauxianum* Weath.].

PTERIDACEAE MAIDENHAIR FERN OR BRAKE FAMILY

Ours mostly on rocks, sometimes terrestrial; leaves monomorphic (rarely somewhat dimorphic); leaf blades 1–4(–5) pinnate; sporangia abaxial on the blades, marginal or submarginal; margins of ultimate segments recurved in ours to form false indusia (except in *Astrolepis*).

The taxa included here in the Pteridaceae have been variously treated at the family level. We follow Windham's (1993a) treatment and recognize 5 genera in nc TX; the newer name Adiantaceae has sometimes been applied to the family. The Pteridaceae is a cosmopolitan family of ca. 40 genera and ca. 1,000 species. Family name from *Pteris*, BRAKE FERN, a cosmopolitan, but generally warm and tropical area genus of ca. 300 species. (Greek: *pteris*, fern, from *pteron*, feather or wing, due to the closely spaced pinnae which give the leaves somewhat of a resemblance to feathers)
FAMILY RECOGNITION IN THE FIELD: plants typically growing *on rocks*; *sporangia at or near margins* of the ultimate leaf segments with the leaf *margins usually recurved* over sporangia to form false indusia (except in *Astrolepis*).
REFERENCES: Correll 1956, 1966a; Windham 1993a.

1. Only the apical margin of the ultimate leaf segments recurved; sporangia borne directly on recurved apical margins of ultimate leaf segments; veins of ultimate leaf segments prominent, dichotomously branched (= equally 2-forked), essentially parallel distally (= near their tips) ——— **Adiantum**
1. Apical and lateral margins of ultimate leaf segments usually recurved over sporangia (except margins not recurved in *Astrolepis*); sporangia borne on abaxial (= beneath) leaf surface (and covered by the recurved margins); veins of ultimate leaf segments obscure or, if prominent, pinnately branched and more divergent distally.
   2. Leaf blades 1-pinnate to 1-pinnate-pinnatifid throughout; abaxial leaf surfaces densely covered with coarsely ciliate or stellate scales; adaxial leaf surfaces with coarsely ciliate or stellate scales; margins of ultimate leaf segments not recurved to form false indusia ——— **Astrolepis**
   2. Leaf blades 2–5 pinnate at least at base; abaxial leaf surfaces scaly, pubescent or glabrous; adaxial leaf surfaces without coarsely ciliate or stellate scales; margins of ultimate leaf segments recurved to form false indusia.

3. Leaf blades glabrous abaxially or nearly so; stem scales strongly bicolored (dark central stripe and much lighter margins), or if uniformly colored, then largest ultimate leaf segments more than 4 mm wide ____ **Pellaea**
3. Leaf blades usually tomentose abaxially (except sparsely pubescent to nearly glabrous in *Cheilanthes alabamensis*) OR covered with conspicuous whitish powdery material; stem scales uniformly colored or weakly bicolored; ultimate leaf segments < 4 mm wide.
   4. Leaf blades with conspicuous whitish powdery material and without pubescence abaxially ____ **Argyrochosma**
   4. Leaf blades lacking conspicuous whitish powdery material, usually tomentose abaxially (except sparsely pubescent to nearly glabrous in *C. alabamensis*) ____ **Cheilanthes**

ADIANTUM MAIDENHAIR FERN

A genus of 150–200 species, nearly worldwide in distribution except at higher latitudes (> 60°); sometimes placed in the Adiantaceae. Some are used medicinally and a number are cultivated as ornamentals for their delicate, beautiful foliage. The position of the sporangia is definitive for identification. (Greek: *adiantos*, unwetted, for the glabrous leaves, which shed raindrops)
REFERENCES: Fernald 1950b; Paris 1993.

Adiantum capillus-veneris L., (Venus' hair), VENUS'-HAIR FERN, SOUTHERN MAIDENHAIR, CULANTRILLO. Terrestrial or on rocks; stems (rhizomes) short-creeping; leaves ± monomorphic, weakly deciduous, closely spaced, numerous, lax-arching or pendulous, 15–75 cm tall; leaf blades 2-(–more) pinnate, membranous to thin-herbaceous, bright green, the ultimate segments usually wedge or fan-shaped to irregularly rhombic (4-sided, diamond-shaped), ca. as long as broad, stalked; apical leaf margins recurved to form false indusia; sporangia submarginal, borne on the abaxial (= beneath) surface of the false indusia. Continuously moist calcareous areas, particularly limestone bluffs, rocks and ledges along streams. Bell, Brown, Burnet, Cooke, Somervell, and Tarrant cos.; also Dallas, Kaufman, McLennan (Correll 1956), and Johnson (R. O'Kennon, pers. obs.) cos.; scattered nearly throughout TX, common in some areas such as the Edwards Plateau. Sporulating May–Jan. The species has long been used medicinally for conditions of the skin, scalp, and internal organs (Cheatham & Johnston 1995).

ARGYROCHOSMA

A New World genus of ca. 20 species traditionally recognized in either *Notholaena* or *Pellaea*. (Greek: *argyros*, silver, and *chosma*, powder, referring to whitish farina (= mealy powder) covering the abaxial surface of leaf blades in most species)
REFERENCES: Tryon 1956; Windham 1987b, 1993b.

Argyrochosma dealbata (Pursh) Windham, (white-washed), POWDERY CLOAK FERN, FALSE CLOAK FERN. Usually on rocks; stems (rhizomes) short, ascending; plants small; leaves to only ca. 15 cm long, monomorphic, evergreen, clustered; leaf blades 3–4(–5)-pinnate, less distally, adaxial (= above) surface bluish green, glabrous, abaxial (= beneath) surface with very conspicuous whitish powdery material; pinnae and most pinnules distinctly stalked; sporangia on the abaxial surface of the blades, submarginal, protected by the recurved margins of the ultimate segments. Crevices of limestone and other calcareous rocks; Burnet, Coleman, Hood, Johnson, Parker, and Palo Pinto cos.; also Bell, Bosque, Ellis, Erath, Stephens (Correll 1956), and Brown (Carr 1995; HPC) cos.; nc TX, Edwards Plateau, and Trans-Pecos. While previously placed in a variety of genera, Windham (1987b) segregated *A. dealbata* and related species into the genus *Argyrochosma* [*Cheilanthes dealbata* Pursh, *Notholaena dealbata* (Pursh) Kunze, *Pellaea dealbata* (Pursh) Prantl]

Argyrochosma microphylla (Mett. ex Kuhn) Windham, (small-leaved), mainly occurring in w

Texas and the Edwards Plateau, is disjunct to the e of nc TX in Brazos Co. (Correll 1956). It is easily distinguished from *A. dealbata* by the lack of whitish powdery material on the abaxial leaf surfaces.

ASTROLEPIS STAR-SCALED CLOAK FERN

Usually on rocks; stems (rhizomes) compact to short-creeping; leaves monomorphic, evergreen, clustered, 1-pinnate to 1-pinnate-pinnatifid, the abaxial (= beneath) leaf surfaces with ciliate scales and usually underlying layer of stellate scales concealing the surface, the adaxial surfaces sparsely to densely covered with stellate or coarsely ciliate scales to glabrescent with age; sporangia marginal or nearly so, forming a ± continuous band; false indusium absent.

A New World genus of ca. 8 species. The taxa treated here as *Astrolepis* have been previously lumped into various genera including *Notholaena* or *Cheilanthes*. Benham and Windham (1992) indicated these and several related species are a monophyletic group worthy of recognition as the genus *Astrolepis*. (Greek: *astro*, star, and *lepis*, scale, in reference to the star-like scales on the adaxial surfaces of the leaf blades)

REFERENCES: Tryon 1956; Benham & Windham 1992, 1993.

1. Adaxial leaf surfaces (= above) densely scaly, particularly near margins, the scales usually persistent; largest pinnae entire or slightly lobed; body of adaxial scales 5–7 cells wide ____ **A. integerrima**
1. Adaxial leaf surfaces only sparsely scaly to glabrescent, most scales deciduous with age; largest pinnae often conspicously lobed; body of adaxial scales 1–2 cells wide ____ **A. sinuata**

Astrolepis integerrima (Hook.) D.M. Benham & Windham, (very entire). Leaves 8–45 cm long; largest pinnae usually 7–15 mm long, symmetrically 6–14 lobed. Rocky slopes, outcrops, or cliffs, usually limestone or other calcareous substrates; Burnet and Palo Pinto cos. (Correll 1956), also Brown Co. (Carr 1995); w and sw parts of nc TX s and w to w TX. Sporulating summer–fall. [*Cheilanthes integerrima* (Hook.) Mickel, *Notholaena integerrima* (Hook.) Hevly, *Notholaena sinuata* (Lag. ex Sw.) Kaulf. var. *integerrima* Hook.]

Astrolepis sinuata (Lag. ex Sw.) D.M. Benham & Windham, (wavy-margined), BULB LIP FERN, WAVY CLOAK FERN, LONG CLOAK FERN. Leaves 11–130 cm long; longest pinnae 7–35 mm long, entire or asymmetrically and shallowly lobed. Rocky slopes, outcrops, or cliffs, calcareous or other substrates; Coleman Co. (Correll 1956); mainly c to w TX.; Hatch et al. (1990) also cited vegetational area 4 (Fig. 2), probably based on a record from Anderson Co. (Correll 1956) near the boundary of the Blackland Prairie and Post Oak Savannah vegetation areas. Sporulating Mar–Nov. [*Acrostichum sinuatum* Lag. ex Sw., *Cheilanthes sinuata* (Lag. ex Sw.) Domin, *Notholaena sinuata* (Lag. ex Sw.) Kaulf.] Burlage (1968) reported this species as toxic to livestock.

CHEILANTHES LIP FERN

Xeric-adapted, usually growing on rocks; stems (rhizomes) compact to long-creeping; leaves monomorphic, evergreen, clustered or scattered along the rhizomes; leaf blades 2–more-pinnate-pinnatifid, usually conspicuously tomentose beneath; petioles dark brown to black; sporangia marginal on the abaxial (= beneath) leaf surfaces; margins of ultimate leaf segments recurved to form false indusia; veins of ultimate segments free or rarely anastomosing, obscure.

A genus of ca. 150 species found primarily in the New World with a few in Europe, Asia, Africa, Pacific Islands, and Australia. According to Windham and Rabe (1993), *Cheilanthes* is the largest and most diverse genus of xeric-adapted ferns. Even after the removal of segregates including *Argyrochosma* and *Astrolepis*, it is still a heterogeneous and possibly polyphyletic genus. (Greek: *cheilos*, margin, and *anthus*, flower, referring to the marginal sporangia)

REFERENCES: Mickel 1979; Windham & Rabe 1993.

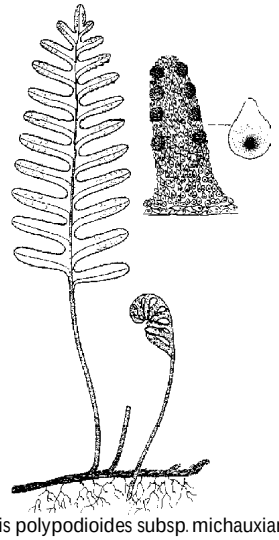
1. Midrib of leaf segments (= pinnae) and/or rachis with scales (hairs can also be present) beneath (= abaxially).
   2. Ultimate leaf segments scabrous (= rough to the touch) on adaxial (= above) surface, covered with stiff hairs ____ **C. horridula**
   2. Ultimate leaf segments smooth to the touch, lacking stiff hairs.
      3. Scales linear, inconspicuous, only slightly wider than hairs, the largest 0.1–0.4 mm wide ____ **C. tomentosa**
      3. Scales linear to lanceolate to ovate, conspicuous, obviously much wider than hairs, the largest 0.4–1.0 mm wide.
         4. Scales ovate to lanceolate, long ciliate, the cilia sometimes forming an entangled mass; rhizome slender, widely creeping, with leaves scattered along the rhizome ____ **C. lindheimeri**
         4. Scales linear to lanceolate, not ciliate, rarely with 1–2 cilia at base; rhizome stout, short, with leaves in a dense clump ____ **C. eatonii**
1. Midrib of leaf segments and rachis lacking scales beneath or with extremely narrow inconspicuous hair-like scales (but can be strikingly pubescent to glabrous).
   5. Leaves essentially glabrous to sparsely pubescent beneath; ultimate leaf segments narrowly elliptic to elongate-deltate, not at all sub-orbicular to bead-like ____ **C. alabamensis**
   5. Leaves densely pubescent beneath; ultimate leaf segments sub-orbicular to bead-like OR not so.
      6. Ultimate leaf segments scabrous (= rough to the touch) on adaxial (= above) surface, covered with stiff hairs ____ **C. horridula**
      6. Ultimate leaf segments smooth to the touch, lacking stiff hairs.
         7. Stipe and rachis not densely tomentose, instead very sparsely to densely hispidulose, the hairs noticeably jointed (under strong lens or dissecting scope).
            8. Leaf blades 3-pinnate near base, the fertile ultimate segments nearly round, bead-like ____ **C. feei**
            8. Leaf blades 2-pinnate-pinnatifid near base, the fertile ultimate segments elongate, not bead-like ____ **C. lanosa**
         7. Stipe and rachis densely tomentose, particularly when young, the hairs not noticeably jointed ____ **C. tomentosa**

Cheilanthes alabamensis (Buckley) Kunze, (of Alabama), ALABAMA LIP FERN, SMOOTH LIP FERN. Leaves clustered, 6–50 cm long; leaf blades lanceolate to oblong, 1–7 cm wide, the largest ultimate segments 3–7 mm long; this is the most glabrous of our *Cheilanthes* species. Limestone hillsides, crevices of limestone ledges and cliffs; Coryell, Palo Pinto, and Tarrant cos.; also Bell, Brown, Hamilton (HPC), Somervell, Williamson (Correll 1956), and Parker (B. Carr, pers. comm.) cos.; widely distributed across TX. Sporulating nearly throughout the year, especially Mar–Nov. *Cheilanthes aemula* Maxon, known se of nc TX in Austin Co. (Correll 1956), differs from the similiar *C. alabamensis* in having broadly triangular to ovate leaf blades 5–15 cm wide.

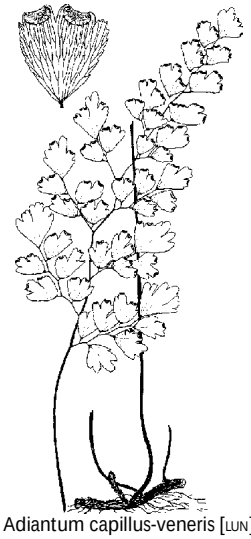
Cheilanthes eatonii Baker, (for its discoverer, A.A. Eaton, 1865–1908), EATON'S LIP FERN. Leaves clustered, 6–35 cm long; leaf blades 1.5–5 cm wide, the ultimate segments oval to round, bead-like, the largest 1–3 mm long; scales conspicuous. Rocky slopes and ledges; Brown Co. (Correll 1956; HPC); mainly Edwards Plateau and Trans-Pecos. Sporulating Mar–Nov. [*C. castanea* Maxon]

Cheilanthes feei T. Moore, (for A.L.A. Fée, 1789–1874, French botanist), SLENDER LIP FERN, WOOLLY LIP FERN, FEE'S LIP FERN. Leaves clustered, 4–20 cm long; leaf blades 1–3 cm wide, the ultimate segments 1–3 mm long; similar to *C. tomentosa*but with jointed hairs and without tomentum on the stipe and rachis. Limestone or calcareous, dry rocky slopes and crevices; Hamilton and Palo Pinto cos. (Correll 1956); w part of nc TX s and w to w TX. Sporulating Mar–Nov.

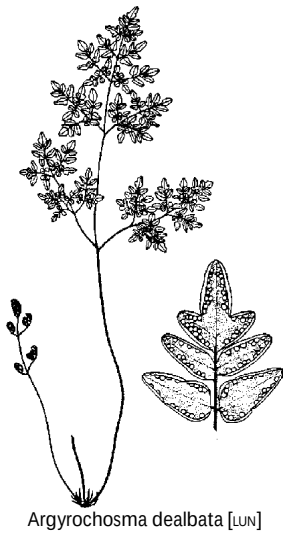
Cheilanthes horridula Maxon, (prickly), ROUGH LIP FERN. Leaves clustered, 5–30 cm long; leaf



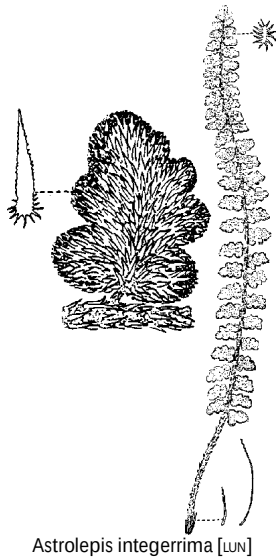
Pleopeltis polypodioides subsp. michauxiana [LUN]



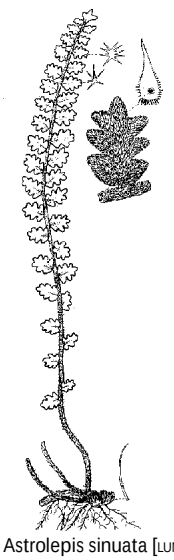
Adiantum capillus-veneris [LUN]



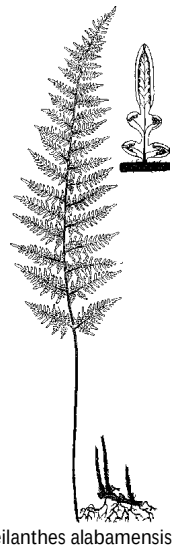
Argyrochosma dealbata [LUN]



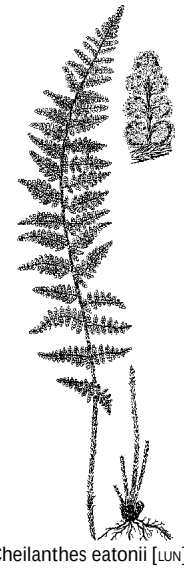
Astrolepis integerrima [LUN]



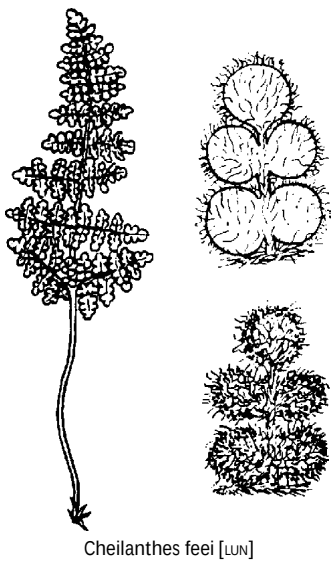
Astrolepis sinuata [LUN]



Cheilanthes alabamensis [LUN]



Cheilanthes eatonii [LUN]



Cheilanthes feei [LUN]

Cheilanthes horridula [LUN]

blades 1–4 cm wide, the ultimate segments narrowly elliptic to elongate-deltate, not bead-like, the largest 3–5 mm long; the distinctive stiff hairs giving the leaf surfaces their scabrous nature are often inflated basally. Rock crevices; Brown, Burnet (HPC), Coleman, and Palo Pinto (Correll 1956) cos.; mainly w 2/3 of TX. Sporulating mainly May–Nov.

Cheilanthes lanosa (Michx.) D.C. Eaton, (woolly), HAIRY LIP FERN, WOOLLY LIP FERN. Leaves clustered, 7–50 cm long; leaf blades 1.5–5 cm wide, the ultimate segments oblong to lanceolate, not bead-like, the largest 3–5 mm long; similar in some respects to *C. tomentosa* but with hispidulous jointed hairs instead of tomentum on the stipe and rachis. Dry rocky slopes and sandstone ledges; known in TX only in McLennan Co. (Correll 1956: *Wherry s.n.*, BAYLU). Sporulating Apr–Oct. Jack Stanford (pers. comm.), who studied the Wherry collection, questioned whether it is actually *C. lanosa*.

Cheilanthes lindheimeri Hook., (for F.J. Lindheimer, 1801–1879, German-born Texas collector), LINDHEIMER'S LIP FERN, FAIRY-SWORDS. The slender creeping rhizomes distinguish this species from other nc TX *Cheilanthes*; scales conspicuous; leaves scattered along the rhizomes, 7–30 cm long; leaf blades 2–5 cm wide, the ultimate segments round to slightly oblong, bead-like, the largest 0.7–1 mm long. Rocky slopes and ledges; Palo Pinto Co. (Correll 1956), also Brown (Carr 1995) and Parker (B. Carr, pers. comm.) cos.; mainly Edwards Plateau and Trans-Pecos. Sporulating Mar–Nov. Jack Stanford (pers. comm.) indicated that this species is found primarily on granite.

Cheilanthes tomentosa Link, (tomentose, densely woolly), WOOLLY LIP FERN. Leaves clustered, 8–45 cm long; leaf blades 1.5–8 cm wide, the ultimate segments oval (rarely oblong), bead-like, the largest 1–2 mm long; scales inconspicuous. Rocky slopes and ledges; Grayson, Denton, Palo Pinto, and Parker cos., also Brown, Comanche (HPC), Milam, and Young (Correll 1956) cos.; widely distributed in TX. Sporulating mainly May–Oct.

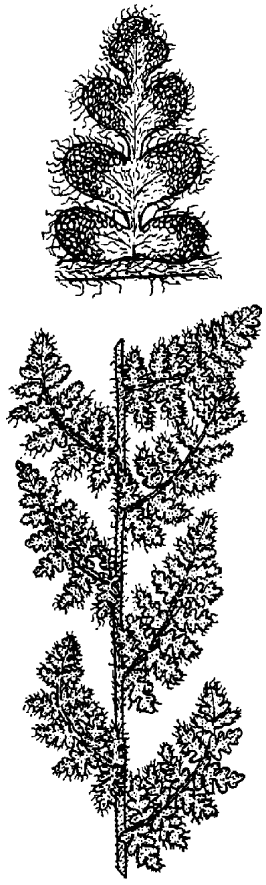
PELLAEA CLIFF-BRAKE

Xeric-adapted, usually on rocks; stems (rhizomes) compact to creeping; leaves monomorphic or somewhat dimorphic, evergreen, clustered to scattered, 1–3 pinnate, in ours glabrous or nearly so, thick-herbaceous to coriaceous; sporangia near margins of leaf segments on the abaxial (= beneath) leaf surfaces; margins of ultimate leaf segments recurved to form false indusia.

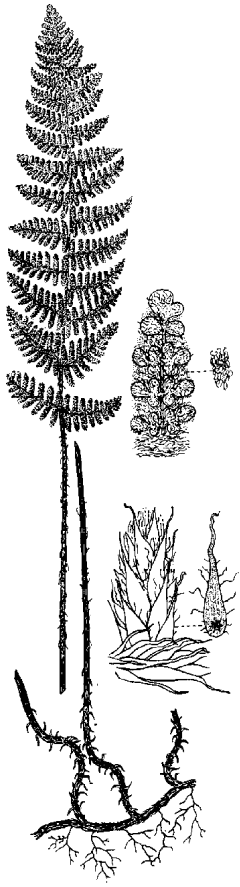
A genus of ca. 40 species distributed mainly in the New World with a few in Asia, Africa, the Pacific Islands, and Australia. The genus has often been circumscribed more broadly, but as such is probably polyphyletic. Some species previously placed in *Pellaea* are now recognized in *Argyrochosma*. (Greek: *pellos*, dark, possibly referring to bluish gray leaves)
REFERENCES: Tryon 1957; Knobloch & Britton 1963; Windham 1993c.

1. Petiole and rachis straw-colored or tan, not shiny, usually glabrous; rachis uniformly zigzag throughout ____ **P. ovata**
1. Petiole and rachis reddish purple to dark brown or blackish, shiny, glabrous or pubescent adaxially (= above) with curly hairs; rachis not uniformly zigzag, at most slightly flexuous.
   2. Pinnules mucronate (= with a small tip); some scales of the stem (look near attachment of petioles) bicolored with a dark, blackish, linear central region and a lighter brown margin; rachis usually glabrous ____ **P. wrightiana**
   2. Pinnules not mucronate; stem scales uniformly reddish brown or tan; rachis pubescent adaxially ____ **P. atropurpurea**

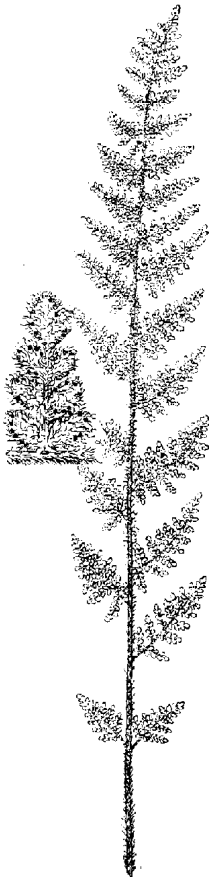
Pellaea atropurpurea (L.) Link, (dark purple), PURPLE CLIFF-BRAKE, CLIFF-BRAKE, BLUE FERN. Plants to 45 cm tall; leaf blades 1-pinnate or 2-pinnate below, 10–30 cm long, 5–20 cm wide. Rocky slopes and woods, cliffs, usually limestone or calcareous rocks; Bell, Burnet, Coleman,



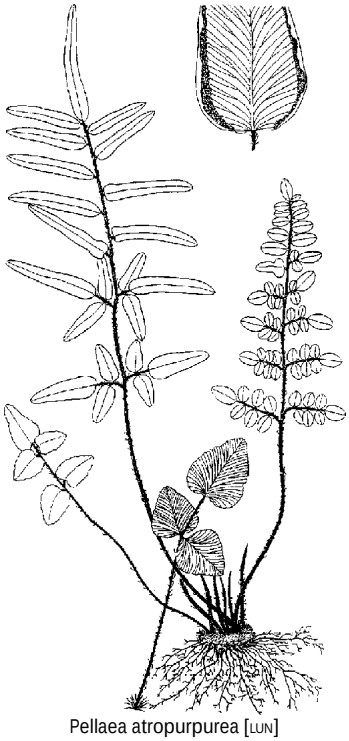
Cheilanthes lanosa [LUN]



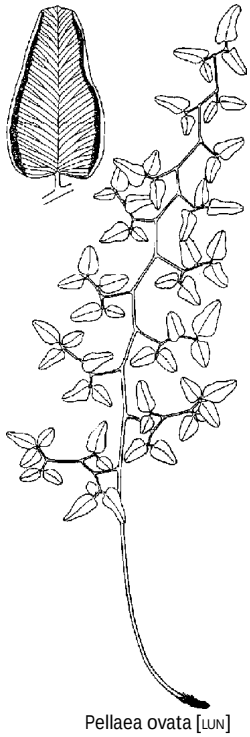
Cheilanthes lindheimeri [LUN]



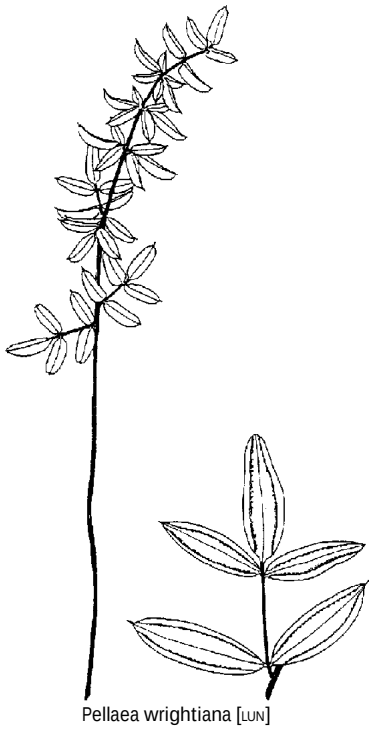
Cheilanthes tomentosa [LUN]



Pellaea atropurpurea [LUN]



Pellaea ovata [LUN]



Pellaea wrightiana [LUN]

Cooke, Denton, Grayson, Hood, Jack, Johnson, Palo Pinto, Tarrant, and Young cos.; also Dallas (Reverchon 1903), Hamilton (HPC), McLennan, and Williamson (Correll 1956) cos.; nearly throughout TX. Sporulating Mar–Nov.

Pellaea ovata (Desv.) Weath., (ovate). Plants usually large, to 1 m or more tall; leaf blades 2–3-pinnate, 15–70 cm long, 5–25 cm wide. Rocky slopes and ledges, including limestone; Burnet Co.; also Brown (J. Stanford, pers. comm.) and Palo Pinto (Correll 1956) cos.; mainly s TX to Edwards Plateau and Trans-Pecos. Sporulating Mar–Nov.

Pellaea wrightiana Hook., (for Charles Wright, 1811–1885, Texas collector), WRIGHT'S CLIFF-BRAKE. Plants 15–30(–50) cm tall; leaf blades 1-pinnate-pinnatifid to 2-pinnate below, usually 8–25 cm long, 1–5 cm wide. Burnet Co.; also Comanche (HPC) and Palo Pinto (Correll 1956) cos.; mainly w 1/2 of TX. Sporulating Mar–Nov. [*P. ternifolia* (Cav.) Link var. *wrightiana* (Hook.) A.F. Tryon]

THELYPTERIDACEAE MARSH FERN FAMILY

A mostly tropical family of ca. 900 species; depending on circumscription, the number of genera can vary from 1 to ca. 30. Many have been historically associated with the Dryopteridaceae, but are not closely related to that family.

FAMILY RECOGNITION IN THE FIELD: leaves all alike, 1-pinnate-pinnatifid with the ultimate segments entire; sori round, located medially to submarginally on the leaf segments; indusia round to kidney-shaped.

REFERENCE: Smith 1993a.

THELYPTERIS FEMALE FERN

Terrestrial; stems (rhizomes) horizontal, short- or long-creeping; leaves monomorphic, spaced (0.5–)1–4 cm apart along the stems; leaf blades 1-pinnate-pinnatifid; ultimate leaf segments entire; petioles about equal to blade in length, straw-colored; sori round, in medial to submarginal position on the leaf segments on the abaxial (= beneath) surfaces; indusia round to kidney-shaped.

A nearly cosmopolitan genus of ca. 875 species; often subdivided into segregates. (Greek: *thelys*, female, and *pteris*, fern)

REFERENCE: Smith 1971.

1. Leaf blades with midveins of pinnae on adaxial (= upper) surface with conspicuous (use lens) hairs usually longer than width of the veins; scales absent on abaxial surfaces of rachises and costae of mature leaves; sori medial to supramedial; n part of nc TX ____ **T. kunthii**
1. Leaf blades with midveins of pinnae on adaxial (= upper) surface glabrous or with a few minute hairs; a few scales often persistent on abaxial surfaces of rachises and costae of mature leaves; sori supramedial to submarginal (sori typically closer to leaf margins than in *T. kunthii*); s part of nc TX ____ **T. ovata**

Thelypteris kunthii (Desv.) C.V. Morton, (for Karl Sigismund Kunth, 1788–1850, German botanist), WIDESPREAD MAIDEN FERN, SOUTHERN SHIELD FERN. Stems short- to long-creeping; leaves up to 2(–3) cm apart along the stems, (15–)50–160 cm long; leaf blades relatively large (pinnae (2–)8–15(–20) cm long), the pinnae cut 3/5–4/5 of width; abaxial (= lower) surface with indument of short hairs on costae, veins, and blade tissue; petioles (5–)20–80 cm long. Moist areas, seeps at base of bluffs; Parker Co. (*Jeff Quayle, s.n.* 1997, BRIT), also a Dallas Co. specimen of *Dryopteris normalis* cited by Correll (1956) is probably this species; mainly e TX. [*Dryopteris normalis* C. Chr., *T. normalis* (C. Chr.) Moxley]

Thelypteris ovata R.P. St. John var. **lindheimeri** (C. Chr.) A.R. Sm., (sp.: ovate; var.: for F.J. Lindheimer, 1801–1879, German-born Texas collector), LINDHEIMER'S MAIDEN FERN. Stems

usually long-creeping; leaves (0.5–)1–4 cm apart along the stems, (30–)55–135(–165) cm long, erect or ascending; leaf blades relatively large (pinnae (5–)10–15(–25) cm long), the basal pinnae usually only slightly shorter than ones just above, the pinnae cut ca. 3/4–4/5 of their width; abaxial (= lower) surface pubescent, the hairs on the abaxial midveins of the pinnae shorter than the width of the midvein; petioles 15–80 cm long; indusia orbicular-reniform, persistent. Low, moist areas, wet bluffs and ledges, including limestone; Bell and Burnet cos., also a Williamson Co. specimen cited by Correll (1956) as *Dryopteris normalis* is probably *T. ovata* var. *lindheimeri*, also a recent Tarrant Co. collection (*Jeff Quayle, s.n.*1997, BRIT) from a ditch in the Fort Worth Nature Center may be an escape from cultivation; nc TX w to Edwards Plateau and Trans-Pecos. Sporulating May–Nov. [*Dryopteris normalis* C. Chr. var. *lindheimeri* C. Chr.] This species has often been confused and lumped (Correll 1956, 1966a, Correll & Johnston 1970, Hatch et al. 1990) with *Thelypteris kunthii* (either as *T. kunthii* or under the name *Dryopteris normalis*); while strikingly similar in overall aspect, the two can be readily distinguished by the characters in the key.

GYMNOSPERMS

The term gymnosperm (literally naked seed), referring to those plants with ovules, and subsequently seeds, borne on the surface of an open scale, is not recognized here as a formal taxonomic category (it was formerly treated as the Gymnospermae). The evolution of the seed in the various gymnosperm groups probably occurred independently from non-seed ancestors. The group would thus be polyphyletic and not worthy of formal recognition. The four living gymnosperm groups (surviving remnants of ancient and much more diverse lineages; currently totaling 840 species in 86 genera arranged in 17 families worldwide) are therefore treated as separate divisions (Cycadophyta, Ginkgophyta, Gnetophyta, and Pinophyta); only two of these are native to nc TX.

REFERENCES: Hardin 1971; Eckenwalder 1993.

DIVISION PINOPHYTA
CONIFERS

This is the gymnosperm division with the largest number of living representatives (70 genera and 598 species arranged in 8 families—Mabberley 1997); the seeds are typically borne in cones (thus the common name from *conium*, cone, and *-fera*, bearing). The fossil history of the group extends to late in the Carboniferous period (360–286 million years ago). Vast forests of Pinophyta (PINE, SPRUCE, FIR, DOUGLAS-FIR, CEDAR, etc.) are present across the northern part of the world between areas of tundra and deciduous forest; they dominate the biome known as taiga. These mostly evergreen species have xerophytically adapted, desiccation resistant foliage that allows them to maintain their photosynthetic surface through the long winter and make immediate and maximal use of the short growing season available in the taiga. Having evergreen leaves that last for several years also means that the high nutrient demand associated with making a new set of leaves each spring is not required—this is considered a significant advantage on the generally nutrient-poor soils of the taiga (Pielou 1988). The result is that this is one of the few gymnosperm groups that has maintained dominance over flowering plants across vast areas. The small family Taxaceae (YEWS) is important because the bark of *Taxus brevifolia* Nutt. (PACIFIC YEW, CALIFORNIA YEW) is the source of the terpenoid taxol, a promising anti-cancer drug used in the treatment of ovarian and other types of cancer; as a result, PACIFIC YEW populations in some areas have been greatly reduced. While not important as a direct source of taxol, the leaves of the European and Mediterranean *Taxus baccata* L. (EUROPEAN YEW, ENGLISH YEW) contain a compound that is now being used in taxol synthesis. It is interesting to

note that like many medically valuable plants "discovered" by modern medicine, the genus has a long history of medicinal use; e.g., early Europeans used it in treating hydrophobia and heart ailments and Native Americans used it against such conditions as rheumatism, bronchitis, fever, scurvy, and skin cancer. ☠ Also like many medicinal plants, YEWS are poisonous; the species have long been used variously as arrow poisons, to kill fish, and in murder and suicide, and are known to be fatally poisonous to animals and humans. Death from YEW can be sudden with animals sometimes being found close to the plant with foliage still in their mouths (Kingsbury 1964; Hartzell 1991, 1995; USDA Forest Service 1993; Cragg et al. 1995; Suffness & Wall 1995). The Pinophyta is sometimes referred to as the Coniferophyta (Raven et al. 1986).
REFERENCES: Hardin 1971; Bell & Woodcock 1983; Raven et al. 1986; Bold et al. 1987; Eckenwalder 1993; Woodland 1997.

CUPRESSACEAE CYPRESS OR REDWOOD FAMILY

Evergreen or deciduous trees or shrubs; monoecious or in *Juniperus* usually dioecious; leaves alternate and spirally arranged, sometimes appearing 2-ranked due to twisting, sometimes dimorphic, often with an abaxial resin gland; pollen cones usually solitary, terminal; pollen not winged; seed cones with scales fleshy or woody.

This family has often been divided between Cupressaceae (in the strict sense), for those genera having opposite or whorled leaves (including *Juniperus*), and Taxodiaceae, or REDWOOD FAMILY, for those genera having leaves mostly alternate. We follow Eckenwalder (1976), Hart and Price (1990), and Watson and Eckenwalder (1993) in treating them as a single family. Recent molecular evidence (Brunsfeld et al. 1994) shows Cupressaceae (in the strict sense) derived from within Taxodiaceae, supporting the single family treatment. The family is widespread in temperate areas and has ca. 25–30 genera and ca. 110–130 species; it includes many interesting or important genera including *Metasequoia*, *Sequoia*, *Sequoiadendron* (GIANT REDWOOD), and *Thuja* (ARBORVITAE). *Metasequoia glyptostroboides* Hu & W.C. Cheng (DAWN REDWOOD), known from only one remote area of China, was discovered in 1945; it has an extensive fossil record—it was the most abundant conifer in w and arctic North America from the late Cretaceous to the Miocene—and is thus often referred to as a living fossil. *Sequoia sempervirens* (D. Don) Endl. (COAST REDWOOD), of the Pacific coast of the U.S., is the world's tallest tree, reaching heights of over 117 m (Raven et al. 1986); it has been greatly overexploited and is now restricted to a few reserves. Family name from *Cupressus*, CYPRESS, a genus of 10–26 species of warm north temperate areas. (Latin name for the Italian cypress, *C. sempervirens* L.)
FAMILY RECOGNITION IN THE FIELD: EITHER evergreen trees or shrubs of dry habitats with opposite or whorled, *scale-like* leaves and *small, berry-like* cones OR trees of wet habitats with alternate, linear to linear-lanceolate, *flat and feathery, deciduous* leaves, nearly *globose, plum-sized* cones, and often with "*knees*" (erect woody projections) from the roots.
REFERENCES: Dallimore & Jackson 1931; Correll 1966b; Eckenwalder 1976; Price & Lowenstein 1989; Hart & Price 1990; Watson & Eckenwalder 1993; Brunsfeld et al. 1994.

1. Leaves (adult) scale-like, closely appressed to stem, to 2.5 mm long, opposite or whorled, evergreen; cones globose to ovoid, to ca. 10 mm long, berry-like; plants typically of dry habitats ——— **Juniperus**
1. Leaves linear to linear-lanceolate, conspicuously flat and feathery, not appressed, 10–15 mm long, alternate, deciduous; cones usually nearly globose, 15–25(–40) mm in diam., woody; plants of wet habitats ——— **Taxodium**

JUNIPERUS JUNIPER

Dioecious (pollen cones and seed cones on separate trees) or rarely monoecious (pollen cones and seed cones on same tree), evergreen, aromatic, resinous trees or shrubs; bark (in our

species) reddish brown to brown or ashy gray, with long, thin, shreddy scales; adult leaves usually scale-like, opposite or in whorls; juvenile leaves needle-like; staminate cones small, cylindric; mature ovulate cones fleshy, berry-like, variously colored, often glaucous, globose to ovoid, to ca. 10 mm long; seeds (in our species) 1–several, wingless.

A genus of ca. 60 species, primarily n hemisphere in distribution with 1 species in e Africa. The decay resistent wood of *Juniperus* species is often used for fence posts; the cones are an important food for birds; also, gin is flavored by the cones of *Juniperus communis* L., of n North America. Numerous cultivars are used in landscaping, particularly those with unusual habits or foliage. The wind borne pollen is one of the most serious allergens in nc TX. JUNIPERS are problematic near apple trees and native hawthorns (*Crataegus* species) since they serve as an alternate host for cedar apple rusts (*Gymnosporangium* spp.). (Latin: *juniperus*, name for JUNIPER)
REFERENCES: Hall 1952; Adams 1972, 1975, 1986, 1993; Flake et al. 1978.

1. Mature ovulate cones (seed cones) reddish or copper-colored; leaf gland often with white crystalline exudate; hilum (= attachment scar) covering seed ca. 1/2 its length ——— **J. pinchotii**
1. Mature ovulate cones blue to bluish black or bluish purple; leaf gland without exudate; hilum covering seed ca. 1/3 or less it length.
   2. Plant usually with one main trunk from base; abaxial (= on side away from twig) leaf glands usually elliptic to elongate, usually not conspicuously raised (10X lens); leaf margins entire, smooth (under a dissecting scope) ——— **J. virginiana**
   2. Plant usually with several trunks from near base; abaxial leaf glands usually roundish in outline, often conspicously raised (10X lens); leaf margins irregularly very minutely cellular-serrulate or cellular-denticulate, not smooth (under a dissecting scope) ——— **J. ashei**

Juniperus ashei J. Buchholz, (for its discoverer, William Willard Ashe, 1872–1932), MOUNTAIN-CEDAR, ROCK-CEDAR, POST-CEDAR, MEXICAN JUNIPER, ASHE'S JUNIPER. Large shrub or small tree to ca. 6 m tall, usually with several trunks from near base; does not resprout after cutting or burning; bark ashy-gray to brown; ovulate cones mostly 7–8.5 mm long when mature, dark blue, glaucous, sweet, resinous; seeds 1(–3), covered by hilum for 1/3 their length. Rocky soils; often forming thickets or "cedar brakes"; Dallas and Cooke cos. s and w; nc TX and Edwards Plateau s and w to w TX. Due to fire supression, this species currently covers much more area than previously (Hall 1952); this has significant negative impacts on other native plants and is problematic for ranchers. *Juniperus ashei* is sometimes distinguished with difficulty from *J. virginiana*; in addition to the characters in the key, *J. ashei* usually has stiffer twigs and more odoriferous herbage; hybridization and introgression are known where the 2 occur together (Correll 1966b, Hall 1952). Hall (1952) noted that *J. ashei* can also hybridize with *J. pinchotii*.

Juniperus pinchotii Sudw., (for botanist Giffard Pinchot, 1865–1946), RED-BERRY JUNIPER, PINCHOT'S JUNIPER. Large shrub or shrub-like small tree to ca. 6 m tall, usually with several trunks from near base; resprouts after cutting or burning; bark ashy-gray to brown; ovulate cones 6–10 mm long, usually not glaucous or only slightly so, sweet, not resinous; seeds 1–2, covered by hilum for ca. 1/2 their length. Gravelly or rocky soils, commonly limestone or gypsum; Montague and Johnson cos., also Little (1971) mapped numerous other counties in the West Cross Timbers and Lampasas Cut Plain; w part of nc TX s and w to w TX. According to Correll (1966b), the branchlets of *J. pinchotii* tend to be more slender and erect than the usually stiffish, recurved branchlets of *J. ashei*.

Juniperus virginiana L., (of Virginia), EASTERN RED-CEDAR, RED-CEDAR, VIRGINIA RED-CEDAR, RED SAVIN, PENCIL-CEDAR, RED JUNIPER. Medium to large tree to 30 m tall, typically much smaller, usually with one main trunk; does not resprout after cutting or burning; bark reddish brown; ovulate cones 5–8 mm long, blue to bluish black or bluish purple, glaucous, resinous; seeds 1–2(–3), the hilum small, inconspicuous. Dry sandy and rocky soils, old fields, fencerows, forest

margins; se and e TX w to West Cross Timbers and Edwards Plateau; Little (1971) mapped the species as far west as Wichita Co. in the Rolling Plains. This is a problematic invader of native prairies under conditions of fire suppression. The aromatic, moth-repelling heartwood is used for cedar chests and closets. RED-CEDAR symbolized the tree of life for a number of Native American tribes and was burned in sweat lodges and in purification rituals (Kindscher 1992).

TAXODIUM BALD CYPRESS

A genus of a single species (sometimes divided into 3) ranging from the United States through Mexico to Guatemala; this is one of only 11 tree genera endemic to e North America (and adjacent tropical areas); (only three of these, *Asimina*, *Maclura*, and *Taxodium*, occur in nc TX) (Little 1983). It is frequently segregated with related taxa into the Taxodiaceae. (*Taxus*, generic name of yew, and Greek *-oides*, like)
REFERENCE: Watson 1985.

Taxodium distichum (L.) Rich. var. **distichum**, (in two ranks), BALD CYPRESS, SOUTHERN CYPRESS. Monoecious (pollen cones and seed cones on the same tree), deciduous trees to 50 m tall with a swollen, often buttressed base; in frequently flooded areas often with "knees" (erect woody projections) from the roots; slender leafy twigs deciduous with the leaves in fall; leaves 2-ranked, feathery, linear, flat, 1–1.5 cm long; staminate (pollen) cones ca. 2 mm in diam., in drooping panicles 10–12 cm long; ovulate (seed) cones usually nearly globose, to ca. 25 mm in diam., the scales somewhat peltate. Swamps and along water courses. Pollen shed in spring; seeds in fall. While BALD CYPRESS does not occur naturally in nc TX (native to Edwards Plateau and e TX as far w as Upshur and Red River cos.), it is now extensively planted and does well even in upland situations; trees planted in a swamp in Fannin Co. appear almost native and a volunteer seedling has been found (Talbot property). It is included because given the frequency of cultivation and the often excellent cone production, more extensive reproduction from seeds along water courses is a strong possibility. BALD CYPRESS is an important timber tree known for its decay-resistant wood, even when in contact with soil; the heartwood is so durable that it has been referred to as "the wood eternal" (Hart & Price 1990).

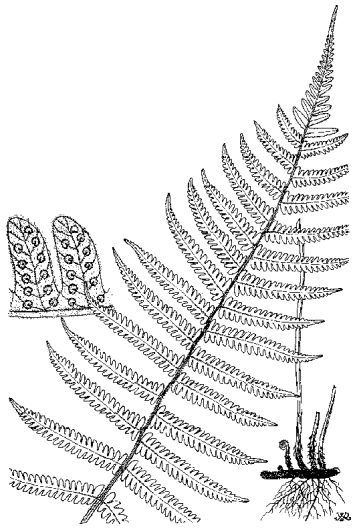
Taxodium distichum var. *mexicanum* Gordon, (of Mexico), [*T. mucronatum* Ten.], the related MEXICAN OR MONTEZUMA BALD CYPRESS, is famous for the "Tule Tree" of Oaxaca, one of the world's largest trees (Hall et al. 1990; Dorado et al. 1996); this ± evergreen variety extends as far n as s TX.

PINACEAE PINE FAMILY

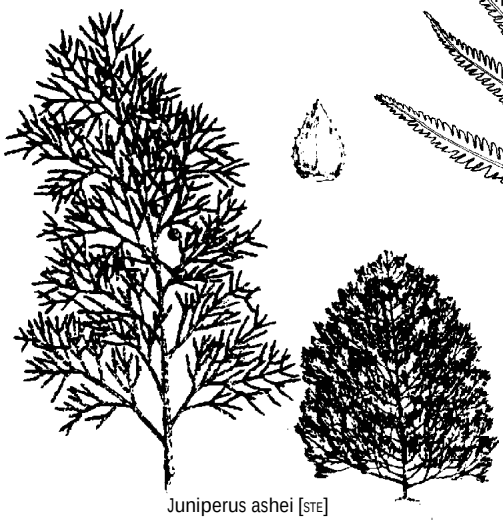
A primarily n hemisphere family of 10 genera and ca. 200 species; it is of great economic importance as a source of softwood timber, pulpwood, naval stores (e.g., turpentine), Christmas trees, and ornamentals. Other important genera include *Abies* (FIRS), *Picea* (SPRUCE), *Pseudotsuga*, and *Tsuga* (HEMLOCK). *Pseudotsuga menziesii* (Mirbel) Franco (DOUGLAS FIR), of w North America, with trunks 3–4 m in diam. and over 90 m tall, is one of the most important lumber trees in the world (Lipscomb 1993; Woodland 1997); it is frequently sold as a Christmas tree in nc TX and can be recognzied by the pointed buds; an individual 133 m tall was reported to have been felled in British Columbia in 1895 (Mabberley 1987).
FAMILY RECOGNITION IN THE FIELD: trees with long, *needle-like leaves in bundles* of 2 or 3 (our species) and large woody *pine cones*; tissues resinous and aromatic.
REFERENCES: Dallimore & Jackson 1931; Correll 1966b; Little 1971; Price 1989; Thieret 1993.

PINUS PINE

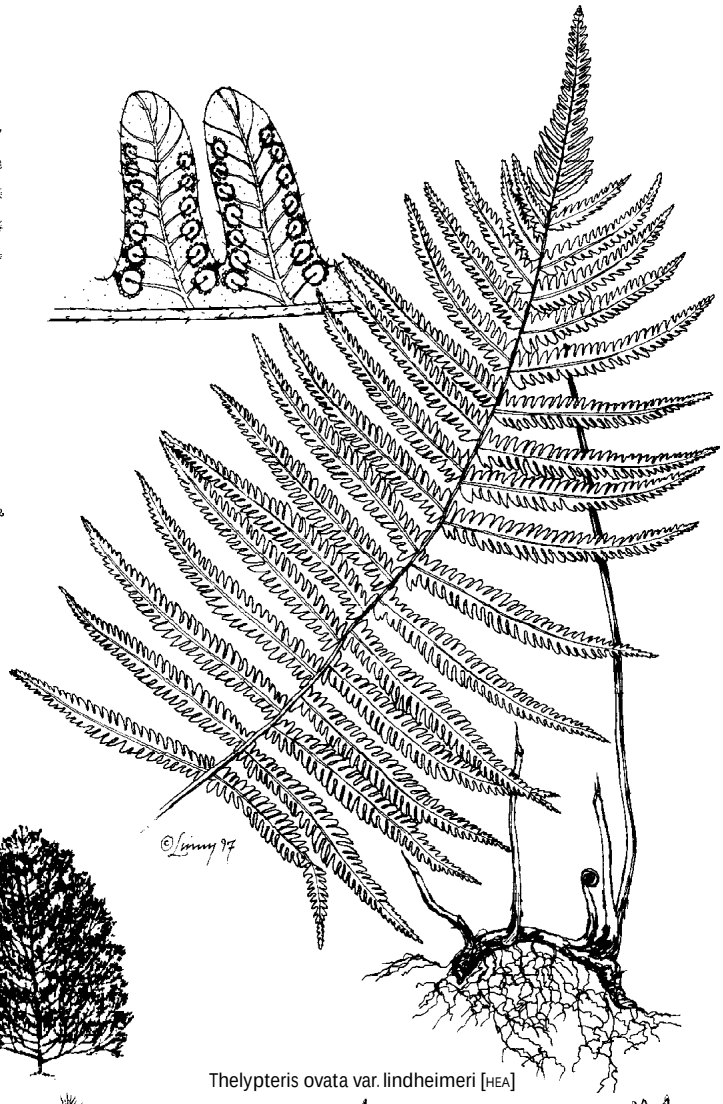
Monoecious (pollen cones and seed cones on the same tree), evergreen, resinous, aromatic trees to 30 m or more tall; leaves of 2 kinds; scale-like leaves subtending minute branchlets; each



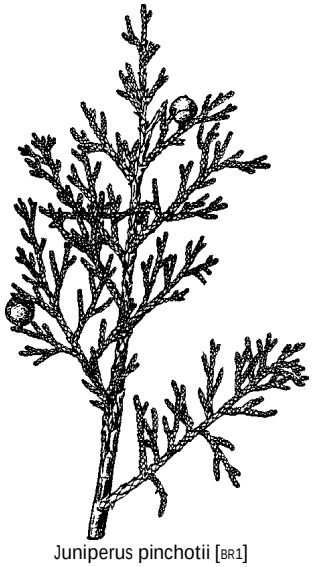
Thelypteris kunthii [LUN]



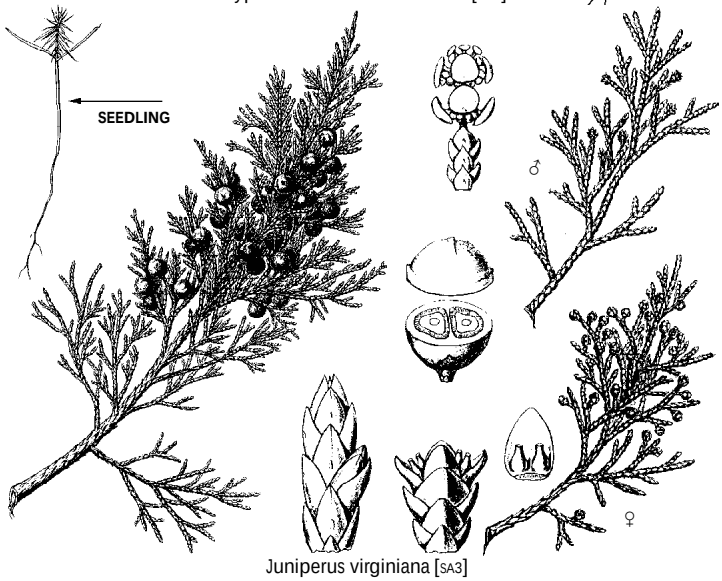
Juniperus ashei [STE]



Thelypteris ovata var. lindheimeri [HEA]



Juniperus pinchotii [BR1]



Juniperus virginiana [SA3]

branchlet bearing a fascicle of 2–3 (in our species) elongate, needle-like foliage leaves (= needles) surrounded at the base by a membranous sheath; staminate (pollen) cones small, in clusters at the base of the current years growth; pollen winged; ovulate (seed) cones becoming large and woody; each scale of seed cones with a thickened, exposed, apical portion (= apophysis) terminated by a protuberance (= umbo); seeds winged (in our species).

A genus of ca. 100 species widely distributed in the n temperate zone and in mountainous areas of the n tropics; many are cultivated for timber, pulp, and resinous products; others are used for their edible seeds (pignons, pignolia or pine nuts) or as ornamentals. According to Millar (1993), "*Pinus* contains more species than any other group of conifers ..." *Pinus longaeva* D.K. Bailey (BRISTLE-CONE PINE of far w North America) is among the oldest living trees, with individuals approaching 5,000 years old; this species has been important in the development of dendrochronology (= tree-ring dating); when dead specimens (which can last thousands of years before decaying) are used, a tree ring record of 8,200 years is available. The genus is economically important and widely cultivated in e TX as a source of wood products. PINES are native as far w as Lamar Co. (Fannin Co.[?] (Correll & Johnston 1970)) in the extreme ne part of nc TX where they occur on sandy, more acidic alluvium associated with the Red River. However, the calcium-rich, basic soils of much of nc TX are not well-suited for pines. The following treatment relies heavily on Kral (1993). (Latin: *pinus*, name for pine)
REFERENCES: Kral 1993; Millar 1993.

1. Needles (20–)25–45 cm long, 3 per bundle; terminal buds silvery white, 3–4 cm long; bundle sheaths of new needles on young twigs 25 mm or more long; seeds with body ca. 10 mm long and wing 30–40 mm long ____ **P. palustris**
1. Needles 5–23(–29) cm long, 2–3 per bundle; terminal buds brownish, 0.5–2 cm long; bundle sheaths of new needles on young twigs 20 mm or less long; seeds with body 5–7 mm long and wing 12–20 mm long.
   2. Needles (5–)7–11(–12) cm long, usually 2(–3) per bundle; bundle sheaths 5–10(–15) mm long; terminal buds 0.5–0.7(–1) cm long; mature seed cones 4–7 cm long; pollen cones 15–20 mm long at time of pollen release; bark with evident resin pockets ____ **P. echinata**
   2. Needles 12–23(–29) cm long, 2–3 per bundle; bundle sheaths (10–)12–20 mm long; terminal buds 1–2 cm long; mature seed cones 6–18(–20) cm long; pollen cones 20–40 mm long at time of pollen release; bark without resin pockets.
      3. Needles almost always 3 per bundle (very rarely 2), yellowish green to grayish green, not glossy; seed cones sessile or nearly so, mostly dull yellow-brown; surface of the exposed, thickened, apical portion of each seed cone scale (= apophysis) dull; pollen cones yellow to yellow-brown; terminal buds 1–1.2(–2) cm long ____ **P. taeda**
      3. Needles 2–3 per bundle, at least some 2, usually dark green, glossy; seed cones short-stalked, light chocolate brown; surface of exposed, thickened, apical portion of each seed cone scale lustrous as if varnished; pollen cones purplish; terminal buds 1.5–2 cm long ____ **P. elliottii**

Pinus echinata Mill., (spiny), SHORTLEAF PINE, SHORTLEAF YELLOW PINE, LONGTAG PINE. Bark on older stems red-brown and separated into irregular, flat, scaly plates, with evident resin pockets; twigs greenish brown to red-brown, red-brown to gray with age, slender (ca. 5 mm or less thick); terminal buds 0.5–0.7(–1) cm long; pollen cones 15–20 mm long at time of pollen release, yellow- to pale purple-green; seed cones 4–6(–7) cm long, red-brown, aging gray, the scales with an elongate to short, stout, sharp prickle. Uplands, dry forests; native to e TX as far w as Henderson (Correll 1966b), Red River (Little 1971), and possibly Lamar (Simpson 1988) cos.; spreading from cultivation in Fannin Co. in Red River drainage.

Pinus elliottii Engelm., (for Stephen Elliott, 1771–1831, American botanist), SLASH PINE, PITCH PINE, YELLOW SLASH PINE. Bark on older stems orange- to purple-brown, broken up into rather

large flat flakes, without resin pockets; twigs orange-brown, darker brown with age, relatively slender (to 10 mm thick); terminal buds 1.5–2 cm long; pollen cones 30–40 mm long at time of pollen release, purplish; seed cones (7–)9–18(–20) cm long, light chocolate brown, the scales with a short stout prickle. Cultivated and used in reforestation; spreading from cultivation on sandy soils in Hood Co. in West Cross Timbers, also spreading on sandy soils in Denton and Tarrant cos. (R. O'Kennon, pers. obs.); mainly se and e TX; native as far w as Louisiana.

Pinus palustris Mill., (of marshes), LONGLEAF PINE, LONGLEAF YELLOW PINE. Bark on older stems orange-brown, of thin papery scales, usually plated on large trees, without resin pockets; twigs orange-brown, darker with age, stout (to 20 mm thick); pollen cones 30–80 mm long at time of pollen release, purplish; seed cones 15–25 cm long, dull brown, the scales with a short reflexed prickle. Sandy soils; se and e TX; cultivated and used in reforestation. Included because it could possibly be found persisting or escaping in the extreme ne part of nc TX.

Pinus taeda L., (ancient name for resinous pines), LOBLOLLY PINE, OLD-FIELD PINE. Bark on older stems dark red-brown and divided into irregular scaly blocks, without resin pockets; twigs orangish to yellow-brown, darker brown with age, relatively slender (to 10 mm thick); terminal buds 1–1.2(–2) cm long; pollen cones 20–40 mm long at time of pollen release, yellow to yellow-brown; seed cones 6–12 cm long, mostly dull yellow-brown, the scales with a stout-based, sharp prickle. Lowlands to dry uplands; native to e TX as far w as Lamar Co. in Red River drainage (Little 1971) and common there; cultivated and escapes further w on sandy soils in Fannin (Lake Fannin) and Grayson (Buckner Preserve and Preston Peninsula) cos.

DIVISION **GNETOPHYTA**
JOINT-FIRS AND RELATIVES

A small group of 3 distinctive families: Ephedraceae, Gnetaceae (1 genus, 28 species), and Welwitschiaceae (monotypic). The division is unusual among the gymnosperms in having double fertilization and xylem with vessels. Recent molecular studies link the three families (i.e., suggest the Gnetophyta is monophyletic) and indicate the Gnetophyta is the sister group of the flowering plants (more closely related to the flowering plants than to any other living gymnosperm group) (Hambry & Zimmer 1992; Chase et al. 1993; Qui et al. 1993; Doyle et al. 1994; Price 1996). Extensive information on the evolution, relationships, and morphology of the Gnetophyta can be found in Friedman (1996).

REFERENCES: Arber & Parkin 1908; Bell & Woodcock 1983; Bold et al. 1987; Doyle 1996; Friedman 1996; Price 1996.

EPHEDRACEAE MORMON-TEA OR JOINT-FIR FAMILY

A monogeneric family of ca. 60 xeric adapted species found mainly in the n hemisphere and South America.

FAMILY RECOGNITION IN THE FIELD: Plants shrubby with *jointed photosynthetic* stems and leaves *reduced to minute scales*; seeds borne in *small cones* at the nodes.

REFERENCES: Correll 1966b; Stevenson 1993.

EPHEDRA MORMON-TEA, JOINT-FIR, MEXICAN-TEA

Erect to vine-like shrubs, dioecious (pollen- and seed-producing cones on separate plants); bark gray; branches jointed, alternate to whorled; twigs green to gray-green or yellow-green, photosynthetic; leaves opposite, scale-like, minute, 1–3 mm long, connate 2/3–7/8 their length, mostly not photosynthetic; cones in ours 1–2 per node on the young branches; pollen-produc-

ing (= staminate) cones compound, of 5–12 pairs of membranous bracts, the proximal bracts empty, the distal bracts each subtending a small cone composed of 2 basally fused bracteoles and a stalk-like sporangiophore; sporangiophores 3–5 mm long, exserted to 1/2 their length, bearing 4–6 pollen-producing microsporangia; microsporangia sessile or on stalks to 2 mm long; seed-producing (= ovulate) cones compound, of 3–6 pairs of bracts; inner bracts becoming fleshy and red, the cones thus fruit-like; seeds 1–2 per compound cone.

A number of species have been used medicinally. Ephedrine, an alkaloid commonly used as an antihistamine and in the treatment of asthma and sinusitis, is derived from Asian species; it has been used in China for 5,000 years. The common name MORMON-TEA comes from the use of various sw U.S. species as a beverage by early Mormon settlers (Woodland 1997). (Greek: *ep-*, upon, and *h dra*, seat or sitting upon a place; from the ancient name used by Pliny for *Equisetum*; the stems resemble the jointed stems of *Equisetum*, the segments of which appear to sit one upon the other)

REFERENCES: Cutler 1939; Steeves & Barghoorn 1959.

1. Plant erect to spreading, to ca. 1 m tall; seed-producing cones with 1 (rarely 2) seeds, sessile or nearly so; microsporangia sessile or on stalks < 1 mm long ____ **E. antisyphilitica**
1. Plant with clambering vine-like habit, to ca. 7 m long; seed-producing cones 2-seeded, on short to long peduncles; microsporangia on stalks 1–2 mm long ____ **E. pedunculata**

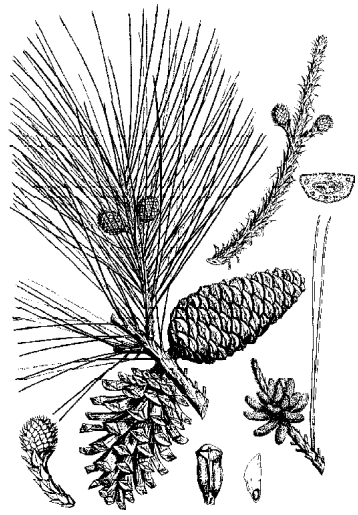
Ephedra antisyphilitica Berland. ex C.A. Mey., (against syphilis), JOINT-FIR, CLAPWEED, POPOTE, TEPOPOTE, CAÑATILLA. Plant erect to spreading, to ca. 1 m tall; branches, stiff, to ca. 4 mm thick; internodes ca. 2–5 cm long; pollen-producing (= staminate) cones lance-ellipsoid, 5–8 mm long, of 5–8 pairs of bracts; seed-producing (= ovulate) cones ellipsoid, 6–12 mm long, of 4–6 pairs of bracts; seeds 6–9 mm long, 2–4 mm wide. Gravelly or rocky soils; Archer, Brown, Callahan, Palo Pinto, Shackelford, and Young cos.; West Cross Timbers s and w across w 2/3 of TX. With cones late winter–early spring. According to Correll (1966b), this taxon can be distinguished from all other TX *Ephedra* species by the very narrow, pale orange-yellow or tannish band that encircles the stem at the very base of the connate leaves.

Ephedra pedunculata Engelm. ex S. Watson, (stalked), VINE JOINT-FIR, COMIDA DE VÍBORA, CLAPWEED. Plant trailing or clambering, to 7 m long; branches lax, to ca. 3 mm thick; internodes 1–8 cm long; pollen-producing cones lanceoloid, 4–8 mm long, of 6–12 pairs of bracts; seed-producing cones ovoid, 6–10 mm long, of 3–6 pairs of bracts; seeds 4–10 mm long, 2–4 mm wide. Dry, sandy to rocky areas; Brown Co. near w margin of nc TX (Cutler 1939; Vines 1960); w margin of nc TX w to w Edwards Plateau and s to s TX. With cones midwinter–early spring.

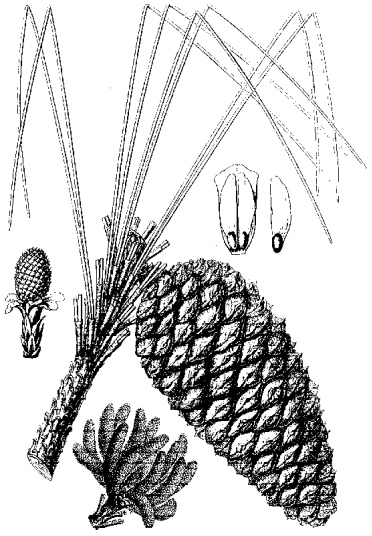
DIVISION **MAGNOLIOPHYTA**
ANGIOSPERMS OR FLOWERING PLANTS

Worldwide, the Magnoliophyta is composed of ca. 249,500 species in 13,185 genera arranged into 405 families (Mabberley 1997); 149 of these families occur in nc Texas. Depending on a variety of factors, including taxonomic philosophy (lumping versus splitting), the number of flowering plant families recognized ranges from 387 to 685; these rather different numbers mainly reflect differences in the rank at which groups are recognized (e.g., family versus subfamily) rather than differing views of evolutionary relationships (Cronquist 1988; Reveal 1993a, 1993b). The Magnoliophyta is the dominant and most diverse group of plants on a worldwide basis; it is also the primary group upon which human civilization relies. The angiosperms are seed plants with flowers, seeds developing inside closed carpels, and double fertilization, a process by which cells in addition to the egg unite during fertilization to form a triploid endosperm (Mabberley 1997). Recent, large scale molecular analyses have indicated that the an-

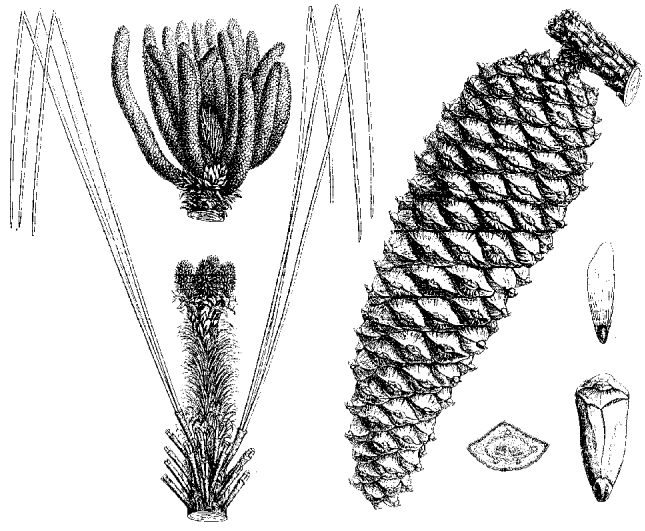
Taxodium distichum var. distichum [BT3, LUN]



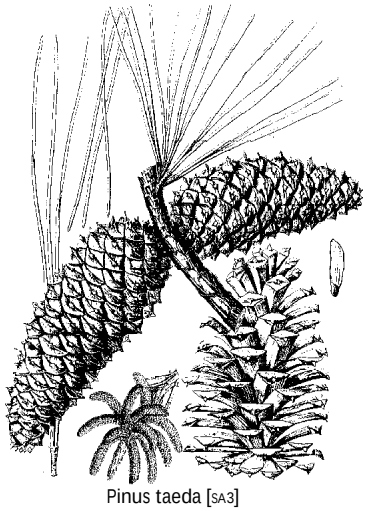
Pinus echinata [SA3]



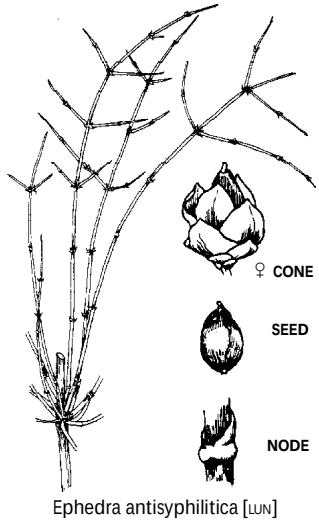
Pinus elliottii [SA3]



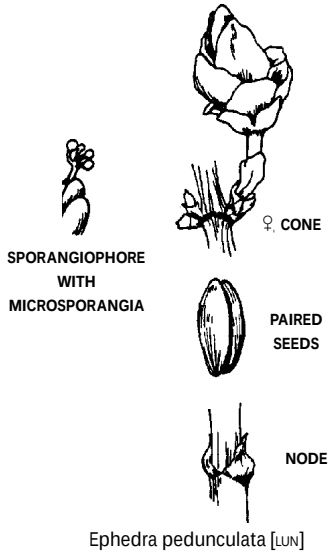
Pinus palustris [SA3]



Pinus taeda [SA3]



Ephedra antisyphilitica [LUN]



Ephedra pedunculata [LUN]