Biol 474, Laboratory

Family characteristics for plant families

The following pages provide basic familiy characteristics for most of the families covered in the lab. These pages have been compiled from a combination of sources. Some are from pages developed by Carolyn Parker for the plant systematics course. Others have been compiled from:

Judd, W.S. Campbell, C.S., Kellogg, E.A., and Stevens, P.F. 1999. *Plant Systematics: A Phylogenetic Approach.* Sunderland, MA, Sinauer Associates, Inc.

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Apiaceae Lindley
(= Umbelliferae A.L.de Jussieu)
(Carrot Family)

Herbs to lianas, shrubs, or trees, aromatic; *stems often hollow in internodal region; with secretory canals containing ethereal oils and resins, triterpenoid saponins, coumarins, falcrinone polyacetylenes, monoterpenes, and sesquiterpenes;* with umbelliferose (a trisaccharide) as carbohydrate storage product. Hairs various, sometimes with prickles. *Leaves alternate, pinnately or palmately compound to simple, then often deeply dissected or lobed,* entire to serrate, with pinnate to palmate venation; petioles ± sheathing; stipules present to absent. Inflorescences determinate, modified and forming simple umbels, these arranged in umbels, racemes, spikes, or panicles, sometimes condensed into a head, often subtended by an involucre of bracts, terminal. Flowers usually bisexual but sometimes unisexual (plants then monoecious to dioecious), usually radial, small. *Sepals usually 5, distinct,* very reduced. *Petals usually* 5, *occasionally more, distinct,* but developing from a ring primordium, sometimes clearly connate, *often inflexed,* imbricate to valvate. *Stamens 5,* but occasionally numerous; filaments distinct; pollen grains usually tricolporate. *Carpels usually 2-5,* occasionally numerous, *connate;* ovary inferior, usually with axile placentation; styles ± swollen at base to form a nectar-secreting structure (stylopodium) atop ovary; stigmas usually 2-5, tiny, capitate to truncate, or elongate. Ovules 1 in each locule, with 1 integument and a thin-walled to less commonly thick-walled megasporangium. *Fruit a drupe with* 2-5 *pits, or* a schizocarp, *the* 2 *dry segments (mericarps) often attached to an entire to deeply forked central stalk (carpophore); globular to elongated oil canals (vittae) often present in schizocarpic fruits;* fruit surface smooth or ribbed, sometimes covered with hairs, scales, or bristles, sometimes flattened or winged; endosperm with petroselenic acid (Figures 8.123, 8.124).

Floral formula: *, 5, (5), 5, (2–5); drupe, schizocarp

Distribution: Nearly cosmopolitan, diverse from tropical to temperate regions.

Genera/species: 460/4250. **Major genera:** *Schefflera* (600 spp.), *Eryngium* (230), *Polyscias* (200), *Ferula* (150), *Peucedanum* (150), *Pimpinella* (150), *Bupleurum* (100), *Oreopanax* (90), *Hydrocotyle* (80), *Lomatium* (60), *Heracleum* (60), *Angelica* (50), *Sanicula* (40), *Chaerophyllum* (40), and *Aralia* (30). Some of the numerous genera occurring in the continental United States and/or Canada are *Angelica, Apium, Aralia, Carum, Centella, Chaerophyllum, Cicuta, Conioselinum, Daucus, Eryngium, Hedera, Heradeum, Hydrocotyle, Ligusticum, Lomatium, Osmorhiza, Oxypolis, Panax, Pastinaca, Ptilimnium, Sanicula, Sium, Spermolepis, Thaspium, Torilis,* and Zizia.

Economic plants and products: Apiaceae contain many food and spice plants: *Anethum* (dill), *Apium* (celery), *Carum* (caraway), *Coriandrum* (coriander), *Cyuminum* (cumin), *Daucus* (carrot), *Foeniculum* (fennel), *Pastinaca* (parsnip), *Petroselinum* (parsley), and *Pimpinella* (anise). However, many are extremely poisonous, such as *Conium* (hemlock, which Socrates is said to have used for suicide) and *Cicuta* (water hemlock). *Panax quinquefolia* and *P. ginseng* (ginseng) and various species of *Aralia* (wild sarsaparilla) are important medicinally. A few genera contain useful ornamentals, including *Hedera* (English ivy), and *Schefflera* (umbrella tree).

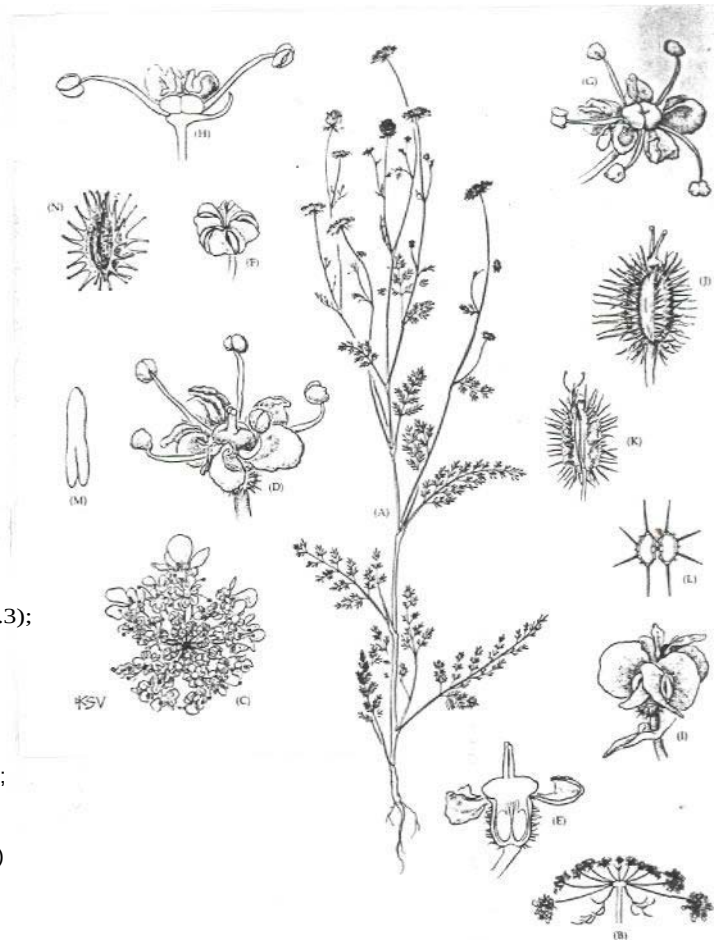


Figure 8.124 Apiaceae (Umbelliferae), subfamily Apioideae. (A-M) *Daucus carota*: (A) flowering plant (x 0.3); (B) inflorescence in longitudinal section, a compound umbel (x 0.5); (C) an umbellate unit from inflorescence (x 6); (D) bisexual flower, note stylopodium, swollen region at base of style (x 18); (E) bisexual flower after fall of stamens, in longitudinal section, note ovules (x 18); (F) bud, staminate flower (x 7); (G) staminate flower, note stylopodium in center (x 18); (H) staminate flower in longitudinal section (x 18); (I) sterile central flower (x 11); (J) schizocarp (x 11); (K) dried schizocarp showing central carpophore (x 11); (L) fruit (schtzocarp) in cross-section (x 11); (M) embryo (greatly magnified). (N) *D. pusillus:* schizocarp (x 11). (From Wood 1974, *A student's atlas of flowering plants,* p. 78.)

ASTERACEAE (=Compositae) Sunflower/Aster Family
Order Asterales

Second largest family of dicots, cosmopolitan. Mostly herbaceous, a few shrubs. Includes some food crops (safflower, artichoke, lettuce, sunflowers), ornamentals (Marigolds, Daisys), and medicinal plants (wormwood, arnica). Many such as dandelion are 'weeds'.

Leaves usually alternate, simple or compound, and exstipulate. Basal rosettes are common. The small reduced flowers (florets) are arranged in a composite head that is diagnostic for the family and acts as a single functional blossom. The head is subtended by imbricated bracts or phyliaries, collectively called the involucre. Composite heads may be solitary or arranged in corymbs, cymes, panicles or racemes on the plant.

Florets may be perfect, imperfect, or sterile. Ovary is inferior; stamens 5. Disk florets are tubular and actinomorphic. Ray florets are zygomorphic, consisting of a short tube and one long ray or ligule, and often lack stamens. The sepals on both floret types are reduced to pappus, bristles, or lacking entirely. Depending on the group, heads may have all ray florets *(Taraxacum),* all disk florets *(Antennaria)* or both, typically with disk florets to the inside, surrounded by ray florets *(Aster).* Fruit is an achene.

New terms: ligule, ray, involucre, disk, tubular, phyliaries, pappus, capitulum

Solidago, Aster, Erigeron, Antennaria, Achillea, Chrysanthemum, Artemisia, Petasites, Senecio, Arnica, Taraxacum, Saussurea, Crepis, and more!

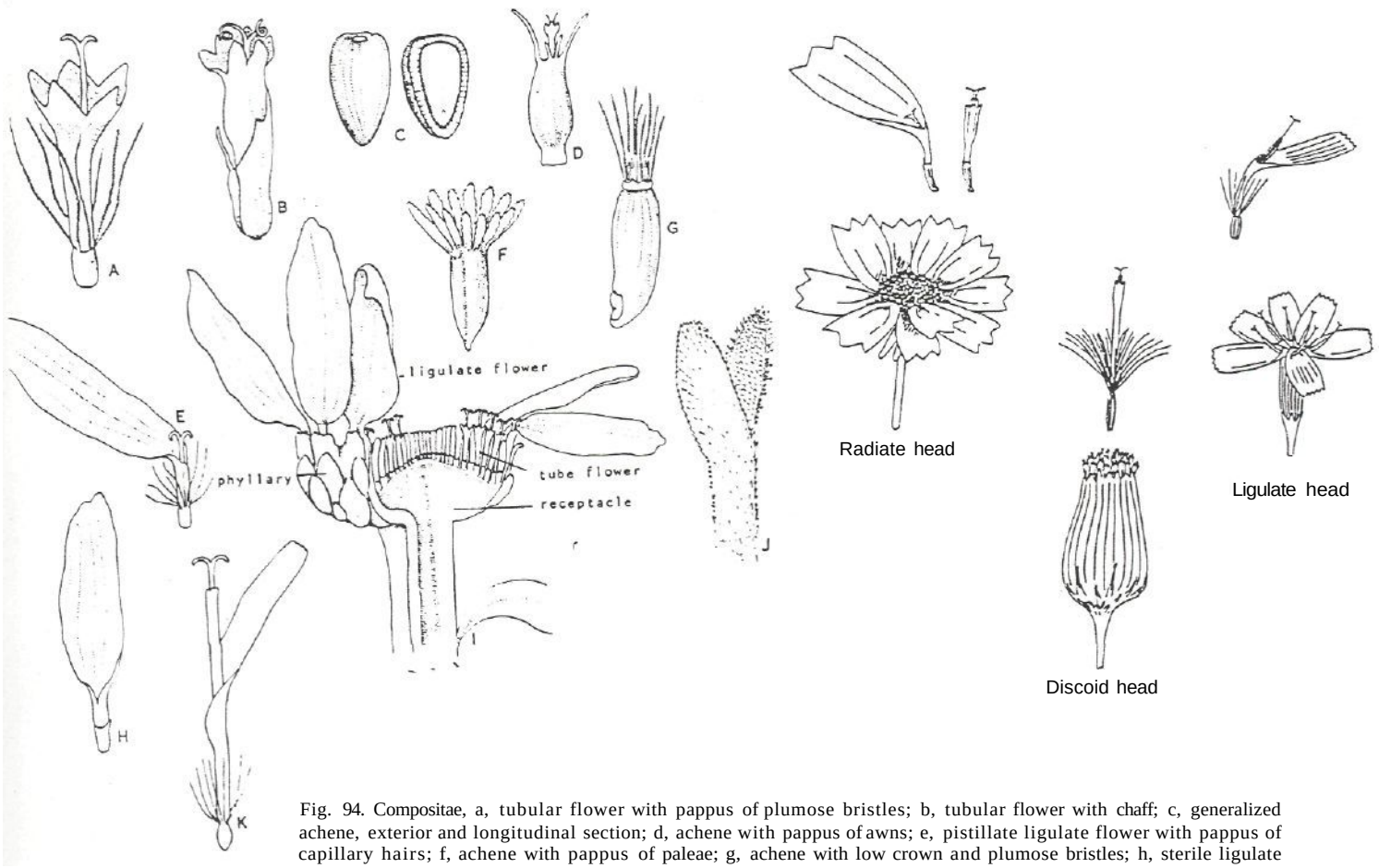


Fig. 94. Compositae, a, tubular flower with pappus of plumose bristles; b, tubular flower with chaff; c, generalized achene, exterior and longitudinal section; d, achene with pappus of awns; e, pistillate ligulate flower with pappus of capillary hairs; f, achene with pappus of paleae; g, achene with low crown and plumose bristles; h, sterile ligulate flower; i, generalized inflorescence; j, style, Anthemideae; k, perfect ligulate flower with pappus of capillary hairs; 1,

BETULACEAE **Birch Family**
Order Fagales

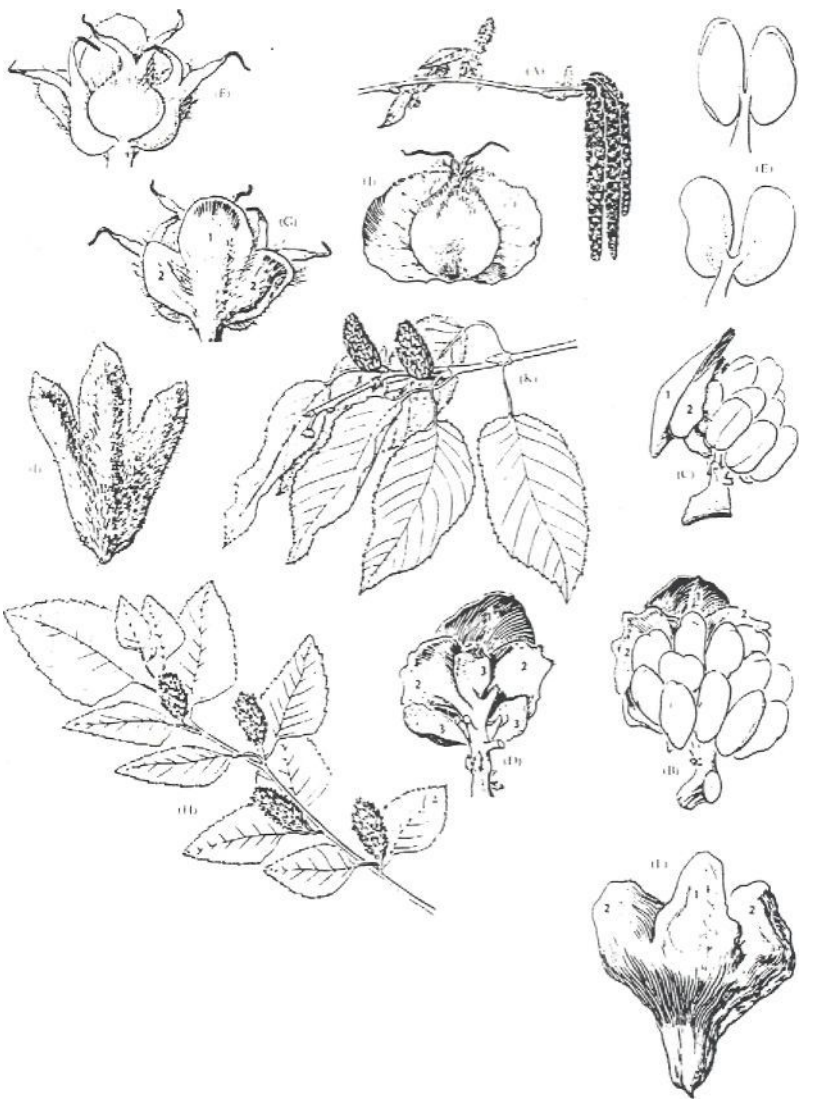
Trees and shrubs with a primarly northern hemisphere distribution. Form a significant element in boreal and temporate forests; often in the early successional stages after fire or other disturbance.

Simple, serrated, stipulate leaves are alternately arranged and often oval or ovate in outline. Reduced, unisexual flowers are arranged in pistillate and staminate catkins which are found on the same plant (all species are monoecious), and often clustered together. There are no nectaries and pollen is dispersed by wind. Flowering is often precocious. Individual flowers may consist of a few small tepals or bracteoles, or a single subtending bract or scale, and either 2 fused inferior carpels or 1-4 stamens. Infructescence in *Alnus* is a small, woody cone-like structure. Fruit is tiny samaras or nutlets which may persist on the 'cone' into winter.

Both *Alnus* and *Betula* are well-defended chemically against herbivory. Alder is an important N-fixer in early successional stages. Frequent hybridization in birch often confounds determination efforts.

New terms: samara, bracteoie, infructescence, 'amentiferae'

Betula (birch), *Alnus* (alder)



Brassicaceae Burnett

(= Cruciferae A. L de Jussieu)

(Crucifer, Mustard, or Caper Family)

Trees, shrubs, or herbs; producing glucosinolates (mustard oil glucosides) and with myrosin cells; often cyanogenic. Hairs diverse, simple to branched, stellate, or peltate. Leaves usually alternate, sometimes in basal rosettes, simple, often pinnately dissected or lobed, or palmately or pinnately compound, entire to serrate, with palmate or pinnate venation; stipules present or absent. *Inflorescences indeterminate,* occasionally reduced to a solitary flower, terminal or axillary. *Flowers* usually bisexual, radial or bilateral, often lacking subtending bracts; receptacle prolonged, forming an elongate or shortened gynophore (or androgynophore). *Sepals 4, distinct. Petals 4, distinct, often forming a cross,* often with an elongate claw and abruptly spreading limb, imbricate or convolute. *Stamens* (2-) 6, or numerous, all ± the same length or the 2 outer shorter than the 4 inner (tetradynamous); filaments elongate to rather short, distinct, or connate in pairs; pollen grains usually tricolporate or tricolpate. Carpels usually 2, connate; ovary superior, with parietal placentation, frequently with the placentas forming a thick rim (replum) around the fruit and often connected by a false septum (a thin partition lacking vascular tissue) that divides the ovary into 2 chambers; stigma capitate, sometimes bilobed. Ovules 1 to numerous on each placenta, anatropous to campylotropous. Nectar disk or gland usually present. Fruit a berry or capsule, frequently with 2 valves breaking away from a replum and often additionally with a persistent septum (the fruit then a silique), these short to elongate, globose to flattened; seeds with or without broad to narrow invagination, occasionally arillate; *embryo curved or folded;* endosperm scanty or absent (Figure 8.92).

Floral formula: * or X, , 4, 4, (2–) 6–∞ , (2); berry, capsule, silique-like capsule, silique

Distribution and ecology: Cosmopolitan, most diverse in the Mediterranean region, southwestern and central Asia, and western North America. Many species occur in early successional communities.

Genera/species: 419/4130. *Major genera: Capparis* (350 spp.), *Draba* (350), *Cleome* (200), *Erysimum* (180), *Cardamine* (170), *Lepidium* (170), *Arabis* (170), *Alyssum* (150), *Sisymbrium* (90), *Lesquerella* (90), *Heliophila* (70), *Thlaspi* (70), *Rorippa* (70), and *Hesperis* (60). Numerous genera occur in the continental United States and/or Canada; in addition to most of the above, noteworthy genera include *Barbarea, Brassica, Cakile, Caulanthus, Capsella, Cochlearia, Descurainia, Dimorphocarpa, Leavenworthia, Physaria, Platyspermum, Polanisia, Schoenocrambe, Stanleya, Streptanthus,* and *Warea.*

Economic plants and products: The family contains many important food plants, including both edible species, such as *Capparis spinosa* (capers), *Raphanus sativus* (radish), *Brassica oleracea* (cabbage, kale, broccoli, cauliflower, Brussels sprouts, kohlrabi), and *B. rapa* (Chinese cabbage, turnip), and sources of condiments, such as *Brassica juncea* (Chinese mustard), *B. nigra* (black mustard), *Sinapis alba* (white mustard), and *Armoracia rusticana.* (horseradish). Table mustard is prepared from a mixture of the seeds of white mustard and either black mustard or Chinese mustard. Vegetable oil is extracted from the seeds of several species of *Brassica,* especially *B. napus* (canola, rapeseed oil). The family contains many ornamentals, such as *Cleome* (spider flower), *Hesperis* (rocket, dame's violet), *Erysimum* (wallflower), *Iberis* (candytuft), *Lunaria* (honesty, money plant), *Lobularia* (sweet alyssum), *Aurinia* (golden alyssum), and *Arabis* (rock cress). Weedy taxa are also common, e.g., *Capsella* (shepherd's purse), *Descurainia* (tansy mustard), *Lepidium* (peppergrass), and *Sisymbrium* (hedge mustard). *Arabidopsis thaliana* (thale or mouse-ear cress), a Eurasian weed, is the most widely used vascular plant in molecular and experimental biology.

Figure 8.92 Brassicaceae (Cruciferae). (A-I) *Capsella bursa-pastoris:* (A) plant with flowers and fruits (x 0.5); (B) flower (x 14.5); (C) flower with sepal and two petals removed to show tetradynamous stamens (x 14.5); (D) floral diagram; (E) silique {x 3.5); (F) replum and septum (x 3.5); (G) seed (x 30); (H) embryo (x 30); (I) diagrammatic cross-section of seed, showing folded cotyledons (x 30), (J) *Coronopus didymus:* silique (x 7). (K) *Lepidium virginicum:* silique (x 7). (L) *L. campestre;* fruit after removal of valve (x 7). (M-N) *Brassica campestris:* (M) siiique (x 2.5); (N) seed (x 7). (O-Q) *Sinapis alba:* (O) silique (x 2.5); (P) embryo (x 7); (Q) diagrammatic cross-section of seed showing folded embryo (x 7). (R) *Diplotaxis muralis:* silique (x 3.5). (S) *Cakile edentula* ssp. *harperi:* fruit, not e transverse joint (x 2). (T) *Calepina irregularis:* silique (x 7). (From Al-Shehbaz 1984, *J. Arnold Arbor. 65:* p. 368.)

Campanulaceae A. L de Jussieu
(Bellflower or Lobelia Family)

Mostly herbs, but sometimes secondarily woody; plants storing carbohydrate as inulin (an oligosaccharide); laticifers present with milky sap; polyacetylenes present, but iridoids absent. Hairs usually simple, unicellular. *Leaves usually alternate, simple,* sometimes lobed, entire to serrate, with pinnate venation; stipules absent. Inflorescences various. *Flowers usually bisexual, radial to bilateral, with hypanthium,* sometimes twisting 180° in development (resupinate). Sepals usually 5, connate. *Petals usually 5, connate, forming a tubular or bell-shaped corolla, or 2-lipped to 1-lipped and then with a variously developed dorsal slit,* the lobes valvate. *Stamens usually 5; filaments distinct to distally connate, usually* attached to disk at apex of ovary; *anthers distinct but pressed together around the style or connate (syngenesious), forming a tube into which the pollen is shed, and the style then growing through this tube, picking up pollen with specialized, often invaginating hairs, or pushing it out, after which the stigmas become receptive (i.e., a plunger pollination mechanism);* pollen grains with 3 to 12 apertures. *Carpels 2-5, connate;* ovary usually inferior (or half-inferior), *with usually axile placentation; style with pollen-collecting hairs near the apex;* number of stigmas equaling number of carpels, globose to cylindrical. Ovules usually numerous, with 1 integument and a thin-walled megasporangium. Nectar disk present above ovary. *Fruit a loculicidal or poricidal capsule or a berry* (Figure 8.126).

Floral formula: * or X, (5), (5), (5), —(2–5)—; capsule, berry

Distribution: Widely distributed in temperate and subtropical regions and in the montane tropics.

Genera/species: 65/2200. *Major genera: Lobelia* (400 spp.), *Campanula* (450), *Centropogon* (200), *Siphocampylus* (225), and *Wahlenbergia* (270). Genera occurring in Canada and/or the continental United States include *Campanula, Downingia, Githopsis, Heterocodon, Howellia, Jasione, Legenere, Lobelia, Nemacladus, Parishella, Porterella, Triodanis,* and *Wahlenbergia.*

Economic plants and products*: Campanula* (bellflower, bluebell), *Lobelia* (cardinal flower, lobelia), and *Codonopsis* (bonnet bellflower) are used horticulturally.

Figure 8.126 Campanulaceae. (A-L) *Lobelia cardinalis:* (A) flowering stem (x 0.75); (B) flower (x 3); (C) flower with corolla removed, filaments monadelphous except at base, stigmas just beginning to expand (x3); (D) anther tube formed by connation (x6); (E) cross-section of anther tube after dehiscence of anthers, style in center (x 9); (F) tip of style with stylar brush and unexpanded stigmas at time of anther dehiscence (x 17.5); (G) expanded stigma, protruding from anther tube following dehiscence of anthers (x 6); (H) expanded stigmas, receptive to pollen (x 18); (I) ovary in cross-section (x 9); (J) ovary in longitudinal section, note half-inferior condition (x 4.5); (K) capsule (x 4.5); (L) seed (x37). (M) *L. siphilitica:* flower (x 4.5). (From Rosatti 1986, *J. Arnold Arbor.* 67: p. 67.)

Caprifoliaceae A. L. de Jussieu
(Honeysuckle Family)

Herbs, shrubs, small trees, or lianas; often with phenolic glycosides, iridoids, and scattered secretory cells. Hairs various. *Leaves opposite, simple,* sometimes pinnately divided or compound, entire to serrate, with pinnate venation; stipules lacking. Inflorescences various. Flowers bisexual and bilateral. Sepals usually 5, connate. *Petals usually 5, connate, often with 2 upper lobes and 3 lower lobes, or a single upper lobe and 4 lower ones,* the lobes imbricate or valvate. *Stamens* (1-) 4 *or 5;* filaments adnate to corolla; pollen large, spiny, usually tricolporate or triporate. *Carpels usually* 2-5, *connate;* ovary inferior, often elongate, with axile placentation, sometimes only 1 locule fertile; style elongate; stigma capitate. Ovules 1 to numerous in each locule, with 1 integument and a thin-walled megasporangium. Nectar produced by closely packed glandular hairs on lower part of corolla tube. Fruit a capsule, berry, drupe, or achene; endosperm present or lacking (Figure 8.125).

Floral formula: X, (5), (5), 4–5, $\overline{(2–5)}$; drupe, berry, capsule, achene

Distribution: Widely distributed, especially in northern temperate regions.

*Genera/species: 36/810. Major genera: Valeriana (*200*), Lonicera (*150*), Scabiosa* (80*),* and *Valerianella* (50*).* Noteworthy genera of the continental United States and/or Canada include *Lonicera, Valeriana, Valerianella, Dipsacus, Linnaea, Symphoricarpos,* and *Dierviella.*

Economic plants and products: Lonicera (honeysuckle*), Abelia, Symphoricarpos* (snowberry*), Weigelia,* and *Kolkwitsia* are used as ornamentals. *Dipsacus* (teasel*)* is a widespread weed.

Figure 8.125 Caprifoliaceae. (A-H) *Lonicera sempervirens:* (A) fruiting branch (x 0.75); (B) flower (x 3); (C) corolla opened lengthwise to show attachment of stamens and distribution of hairs and nectar glands (x 2.3); (D) portion of inflorescence, corollas removed (x 12); (E) ovary in cross-section (x 15); (F) seed (x 9); (G) seed in cross-section, seed coat hatched, endosperm stippled, and embryo unshaded (x 9); (H) embryo (x 18). (I-J) *L. japonica:* (I) flowering branch (x 0.75); (J) flower (x3). (From Ferguson 1966*, J. Arnold Arbor. 47:* p. 55.)

Caryophyllaceae A. L. de Jussieu
(Carnation or Pink Family)

Usually herbs: stems sometimes with concentric rings of xylem and phloem; anthocyanins present; often with triterpenoid saponins. Hairs various. Leaves **opposite,** *simple, entire, often narrow, with pinnate venation, the secondary veins usually obscure and venation appearing ± parallel, the leaf pair often connected by a transverse nodal line, a***nd nodes usually** swollen; stipules lacking or present. *Inflorescences determinate,* sometimes reduced to a single flower, *terminal.* Flowers usually bisexual, radial, sometimes with an androgynophore. *Tepals 4-5, distinct to connate,* imbricate, usually appearing to be sepals. True petals *lacking, but outer whorl of 4-5 stamens very often petal-like, here called "petals", these frequently bilobed and sometimes differentiated into a long, thin, basal portion (claw) and an, expanded apical portion (blade or limb) separated by appendaged joint.* Stamens 4-10; filaments distinct or slightly connate, sometimes adnate to "petals;" pollen grains tricolpate to polyporate. Carpels 2-5, connate; *ovary superior, with free-central* or occasionally basal *placentation*; stigmas minute to linear. Ovules usually numerous, occasionally few or only 1, ± campylotropous. Nectar produced by disk or staminal bases. *Fruit usually a loculicidal capsule, opening by valves or apical teeth,* but sometimes a utricle; embryo usually curved; endosperm ± lacking, replaced by perisperm (Figure 8.44*)*.

Floral formula: *, (4–5), 4–5, (4–10), (2–5), capsule, utricle

Distribution and ecology: Widespread, but **especially** characteristic of temperate and warm temperate regions of the Northern Hemisphere, mostly of open habitats **or** disturbed sites.

Genera/species: 70/2200. *Major genera: Silene* (700 spp.*)*, *Dianthus* (300*)*, *Arenaria* (200*)*, *Gypsophila* (150*)*, *Minuartia (150)*, *Stellaria* (150*)*, *Paronychia* (110*)*, and *Cerastium* (100*)*. Numerous native and introduced genera occur in the continental United States and/or Canada; some of these, in addition to most of the above, include *Agrostemma, Drymaria, Geocarpon, Sagina, Saponaria, Spergulia,* and *Stipulicida.*

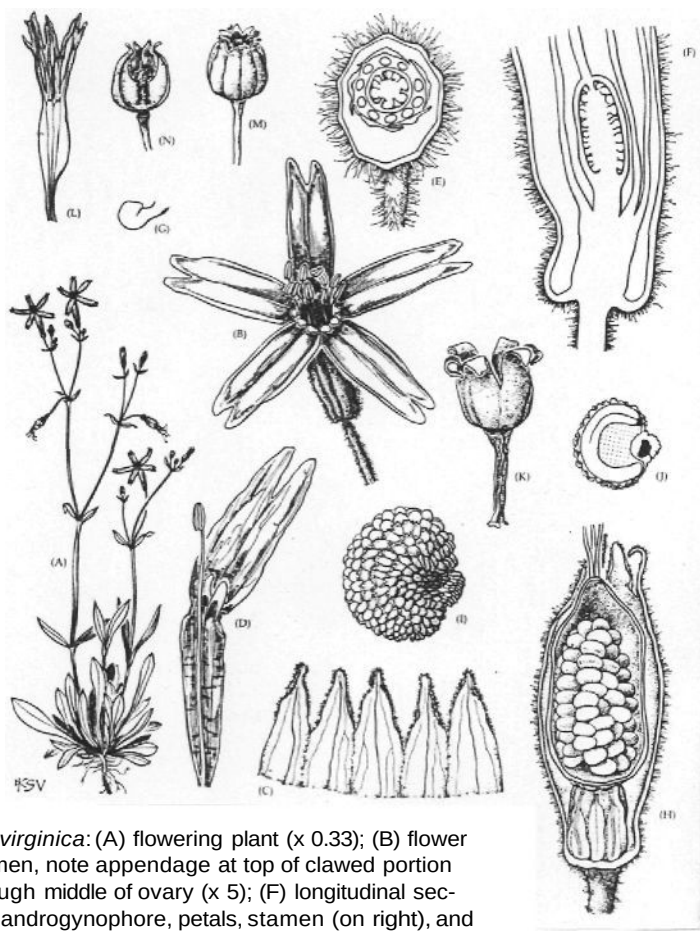


Figure 8.44 Caryophyllaceae. (A-J) *Silene virginica*: (A) flowering plant (x 0.33); (B) flower (x 3); (C) calyx lobes (x 3); (D) petal with stamen, note appendage at top of clawed portion of petal (x 4); (E) cross-section of flower through middle of ovary (x 5); (F) longitudinal section through base of flower, note hairy calyx, androgynophore, petals, stamen (on right), and free-central placenta (x 5); (G) ovule (x 25); (H) nearly mature fruit and calyx in longitudinal section, note seeds on free-central placenta (x 5); (I) seed (x 30); (J) seed in section, note curved embryo and perisperm (stippled) (x 20). (K) *S. caroliniana*: capsule (x 3). (L) *S. ovata*; petal (x 3). (M-N) *S. antirrhina*: (M) capsule, surrounded by dried calyx (x 3); (N) capsule in longitudinal section (x 3). (From Wood 1974, *A student's atlas of flowering plants*, p. 27.)

CORNACEAE (Dogwood Family)
Order Cornales

Mostly trees and shrubs of temperate and subtropical regions. The very untypical herbaceous forms are common in Alaska however. Popular as ornamentals and for woodworking timber.

Leaves simple, lacking stipules, and variously arranged, but commonly opposite or whorled. Inflorescence terminal, often composed of an umbel or corymb of small flowers subtended by showy, petaloid bracts. Perianth 4 or 5-merous; sepals represented by small teeth, fused, or entirely absent, petals small and inconspicuous. Stamens 4 or five. Inferior ovary of 2 or 3 fused carpels. Fruit a cluster of berries or drupes.

Cornus (dwarf dogwood, and American dogwood)

Figure 8.102 Cornaceae. (A-E) *Cornus amomum*: (A) flowering branch (x 0.75); (B) flower (x 9); (C) flower in longitudinal section, with petals and starnens removed (x 9); (D) drupe (x 3); (E) pit in lateral view and from above (x 6). (F-H) *C. florida*: (F) flowering branch (x 0.75); (G) flower (x 6): (H) pit from lateral view and from above (x 6). (I) *C. ?????nifolia*; pit in lateral view and from above (x 6). From Ferguson 1966. J. Arnold Arbor. 47 p. 111)

Crassulaceae A. P. de Candolle
(Stonecrop Family)

Succulent herbs to shrubs; stem often with cortical or medullary vascular bundles; with crassulacean acid **metabolism (CAM);** tannins present; often with alkaloids, sometimes cyanogenic. Hairs simple, but plants more commonly glabrous and glaucous. **Leaves alternate,** opposite, or whorled, sometimes in a basal rosette, simple or rarely pinnately compound, entire to crenate, dentate or serrate, **succulent,** with pinnate venation, but veins often obscure; **stipules** *lacking.* Inflorescences determinate, sometimes reduced to a solitary flower, terminal or axillary. Flowers usually bisexual, radial, lacking a hypanthium. Sepals usually 4 or 5, distinct to connate. Petals usually 4 or 5, distinct to connate (and then forming a ± tubular corolla), imbricate. *Stamens* **4-10;** filaments distinct to slightly connate, free or adnate to corolla; anthers opening by terminal pores; pollen grains tricolporate. *Carpels usually 4 or 5,* distinct to slightly connate at base; ovaries superior, with parietal placentation (or axile at base, if carpels fused); stigmas minute. Each carpel subtended by a scale-like nectar-producing gland. Ovules few to numerous in each carpel. Fruit *an aggregate of follicles,* rarely a capsule (Figure 8.53).

Floral formula: *4–5, 4–5, 4–10, 4–5 ; follicles

Distribution and ecology: Widespread from tropical to boreal regions; plants very often of arid habitats.

Genera/species: 35/1500. ***Major genera:*** *Sedum* (450), *Crassula* (300), *Echeveria* (150), and *Kalanchoe* (125). These, along with *Diamorpha, Dudleya, Graptapetalum, Lenophyllum,* and *Villadia* occur rn the continental urmeu sidits and/or Canada.

Economic plants and products: *Sedum* (stonecrop), *Echeveria, Kalanchoe,* and ***Semperoivum*** (houseleek) are grown as ornamentals because of their distinctive succulent leaves.

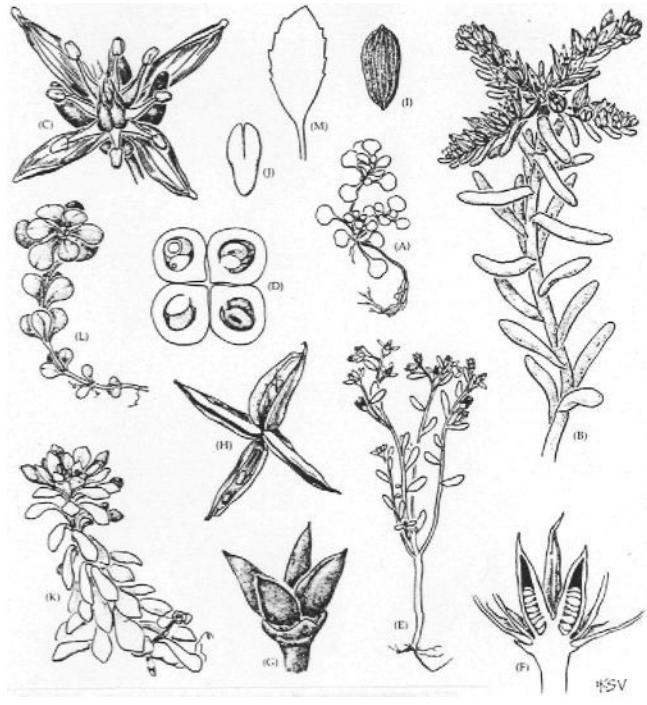


Figure 8.53 Crassulaceae. (A-D) *Sedum pulchellum:* (A) overwintering rosette (x 0.75); (B) flowering shoot (x 1.5); (C) flower (x 8); (D) cross-section through four carpels of gynoecium (x 30). (E-J) *S. pusillum:* (E) habit of mature plant (x 1.5); (F) immature follicles in longitudinal section, note nectaries (solid black) at base of carpels (x 9); (G) immature follicle (x 1.5); (H) mature, dehisced follicles (x 1.5); (I) seed (x 35); (J) embryo (x 35). (K) *S. glaucophyllum:* leafy shoot (x 1.5). (L) S. *ternatum,* leafy shoot (x 0.75). (M) S. *telephioides:* outline of leaf (x 0.75). (From Sponberg 1978, *J. Arnold Arbor. 59:* p.206.)

Cupressaceae Bartlett
(Cypress or Redwood Family)

Trees or shrubs; wood and foliage often aromatic. Bark of trunks often fibrous, shredding in long strings on mature trees or forming blocks. Leaves persistent (deciduous in three genera), simple, alternate and distributed all around the branch or basally twisted to appear 2-ranked, opposite, or whorled, *scale-like, tightly appressed and as short as 1 mm to linear and up to about 3 cm long,* with resin canals, shed with the lateral branches; adult leaves appressed or spreading, sometimes spreading and linear on leading branches and appressed and scale-like on lateral branches; scale-like leaves often dimorphic, the lateral leaves keeled and folded around the branch and the leaves on the top and bottom of the branch flat. Monoecious (dioecious *in juniperus).* Microsporangiate strobili with spirally arranged or opposite microsporophylls; microsporangia 2-10 on the abaxial microsporophyll surface; pollen nonsaccate, without prothallial cells. Cone maturing in 1-3 years; scales peltate or basally attached and flattened, juicy in *Juniperus,* fused to bracts, persistent (deciduous in *Taxodium);* ovules 1-20, on adaxial scale surface, erect (micropyle facing away from the cone axis; in some the ovules may eventually be inverted); archegonia quite variable in number per ovule, clustered. Seeds with 2 (3) short lateral wings (wings absent in some genera); embryo straight, cotyledons 2-15 (Figure 7.15).

Distribution and ecology: This is a cosmopolitan family of warm to cold temperate climates. About three-quarters of the species occur in the Northern Hemisphere. About 16 genera contain only one species, and many of these have narrow distributions. Members of this family grow in diverse habitats, from wetlands to dry soils, and from sea level to high elevations in mountainous regions. The two species of *Taxodium* in the southeastern United States often grow in standing water.

Genera/species: About 29/110-130. *Major genera: Juniperus* (50 spp.), *Callitris* (15), *Cupressus* (13), *Chamaecyparis* (8), *Thuja* (5), *Taxodium* (3), *Sequoia* (1), and *Sequoiadendron* (1).

Economic plants and products: The family produces highly valuable wood. *Cryptomeria, Chamaecyparis, Juniperus, Sequoia, Taxodium, Thuja,* and several other genera are suited for house construction, siding, decking, caskets, shingles, wooden pencils, and many other purposes. Many woods from this family are naturally fragrant and have been used as a natural moth-proofing for closets and chests and in the manufacture of perfumes. *Juniperus* cones are used to flavor gin. *Chamaecyparis, Cupressus, Juniperus, Platycladus, Thuja,* and other genera are grown extensively as ornamentals.

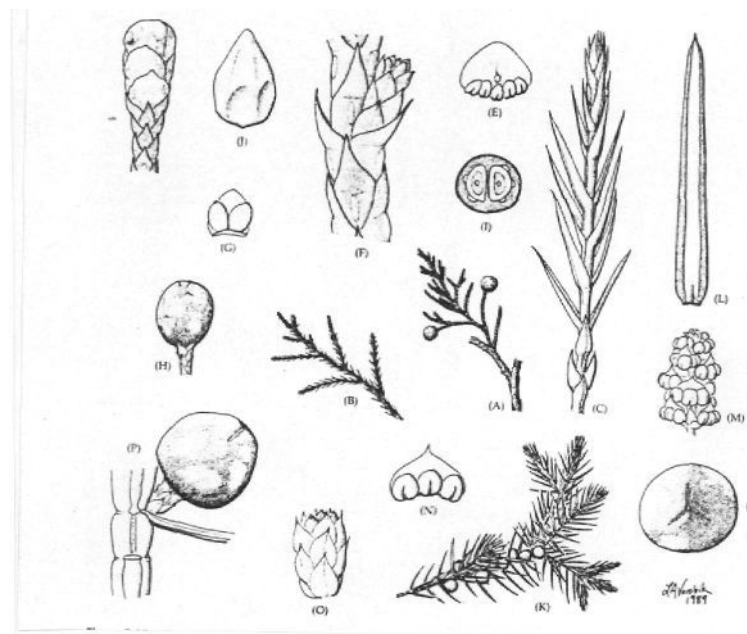


Figure 7.15 Cupressaceae. (A-J) *Juniperus virginiana:* (A) branchlets with only scale leaves, bearing mature ovulate cones (x 0.9); (B) branchlet with scale and needle leaves (x 0.9); (C) detail of branchlet with needle leaves, showing decurrent leaf bases (x 6.2); (D) microsporangiate strobilus before shedding of pollen, subtended by numerous scale leaves (x 6.2); (E) microsporophyll (abaxial view), showing dehisced sporangia (x 12); (F) branchlet with ovulate cone near time of pollination (x 9); (G) cone scale (adaxial view) with 2 erect ovules near time of pollination (x 12); (H) mature ovulate cone with fused cone scales (x 3.7); (I) cross-section of mature cone, only two seeds maturing (note resin vesicles outside seeds) (x 3.7); (J) seed, showing pits and ridges (x 6.2). (K-Q) *J. communis:* (K) branch, showing ternate leaves and axillary ovulate cones (x 0.9); (L) details of abscised portion of leaf in adaxial view, showing broad, white stomatal band (x 6.2); (M) microsporangiate strobilus after shedding of pollen (x 6.2); (N) microsporophyll, abaxial view; (O) axillary shoot with young ovulate cones at apex, showing three ovules near time of pollination (x 12); (P) portion of branchlet with mature ovulate cone; note remnant leaf bases fused to larger stem (x 3.7); (Q) apical views of ovulate cone, showing suture lines between three fused cone scales (x 3.7). (From Hart and Price *1990 J. Arnold Arbor.* 71: pp. 275-322.)

CYPERACEAE Sedge Family

Worldwide distribution, but found especially in cooler, wetter habitats. In our area, they are often the dominant species in wet, marshy sites.

'Grassy' perennials with fibrous roots and/or creeping rhizomes. The stems are often triangu1ar in X-section (sedges have edges) , but otherwise stem and leaves may be very similar to grasses with the exception that sedges do not have ligules and the leaf_sheaths are closed. Flowers are simple, inconspicous, and subtended by a single bract or scale. Flowers, in turn, are arranged in spikelets which display a variety of panicle types. In *Carex,* the primarly genus in our area, the bracts (scales) and the perigynium. the vase-like structure that surrounds the ovary, are important for determination to species.

In your area: *Carex* (Sedges), *Eriophorum* (Cottongrass), *Eleocharis* (Spike Rush), and *Trichophorum.*

New words: perigynium, beak of perignium, perianth bristles, bracts, brachlets. spike, culm, scale.

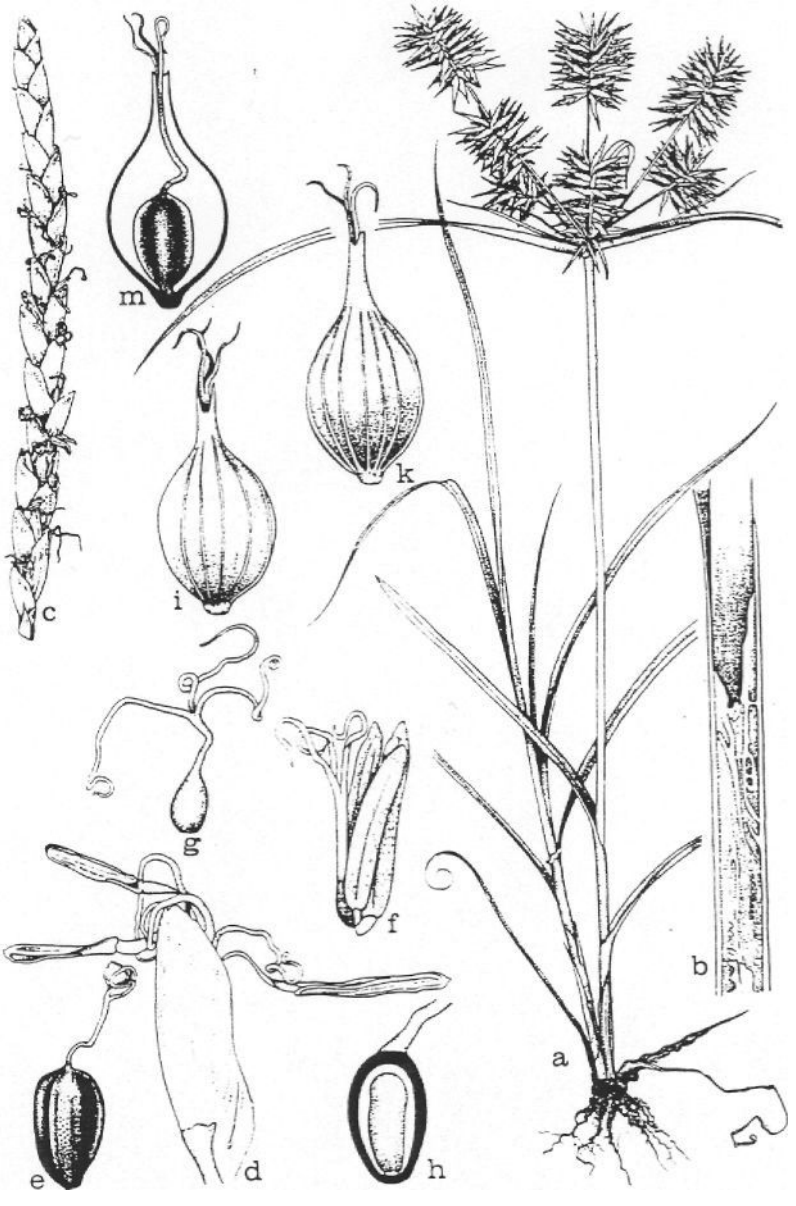


Fig. 9.7 Cyperaceae. a-h, *Cyperus esculenius* L. a. habit, x 1/2; b. portion of stem and leaf-sheath, x 3; c. spikelet. x 4; d. scale and flower, x 16; e. achene, x 12; f. flower, from the side, with the scale removed, x 16; g. pistil, x 16; h. schematic **long-section** of ovary, x 32. i-m. *Carex rostrata* Stokes. i, k. two views of perigymium, x 6; m. schematic long-section of perigynium, with achene enclosed, x 6.

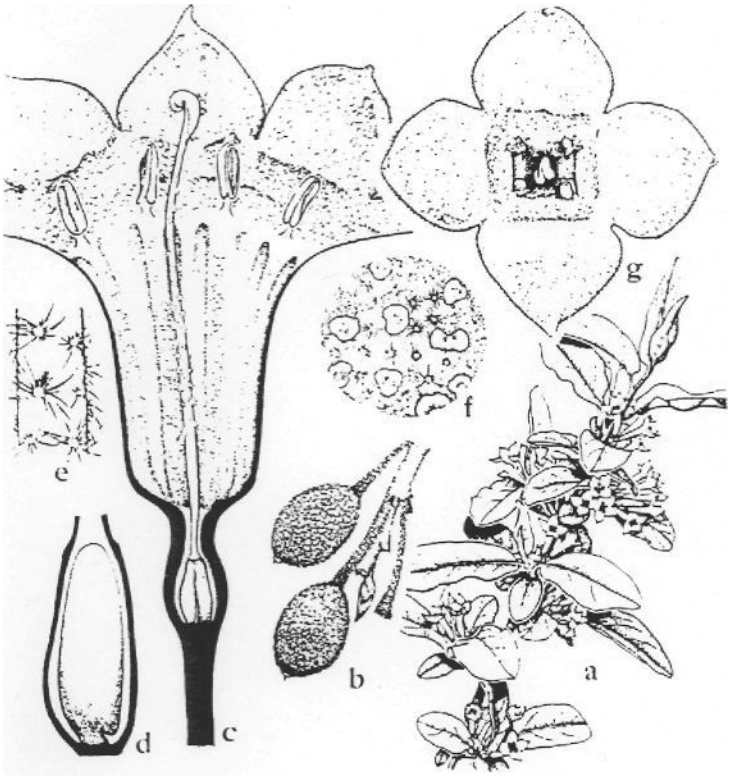
ELAEAGNACEAE (Oleaster Family)

Order Proteales

Shrubs and trees having N-fixing bacteria in their root nodules. Often colonizing recently disturbed sites. Most common in subtropics and temperate regions. The two species in Alaska are common to gravel bars and open dry woodlands.

Plants often covered with scurfy or scaly pubescence. Leaves simple, firm; opposite or alternate along twigs. Small flowers are uni- or bisexual, actinomorphic, and arranged in small axillary racemes or umbels. Petals absent; sepals 2 or 4, fused to form a disc-shaped or tubular calyx. Single carpel is superior, but may appear to be inferior if within the fused calyx. Fruit is an achene, but surrounded by swollen calyx tissue and appearing to be a berry.

Shepherdia (soap berry) with opposite leaves and uni-sexual flowers
Elaeagnus (silver berry) with alternate leaves and perfect flowers



Ericaceae A. L. de Jussieu
(Heath Family)

Trees, shrubs, lianas, sometimes epiphytic, occasionally mycoparasitic herbs lacking chlorophyll, strongly associated with mycorrhizal fungi. Hairs simple, usually multicellular and unicellular, sometimes dendritic, gland-headed, or peltate scales, but not stellate. *Leaves alternate, sometimes opposite or whorled, simple,* entire to serrate, sometimes revolute, with pinnate, ± parallel, or palmate venation, blade reduced in mycoparasites; stipules lacking. Inflorescences various, *flowers usually bisexual,* rarely unisexual (then plants usually dioecious), radial to slightly bilateral, usually ± pendulous. Sepals usually 4 or 5, distinct to slightly connate. Petals *usually 4 or 5 and* connate, often cylindrical to urn-shaped, *with small to large, imbricate to valvate lobes, but sometimes ± bell-shaped or funnel-like,* occasionally distinct (a reversal). Perianth reduced to 2 or 3 sepals and petals, or 3 or 4 tepals in a few genera that are wind-pollinated. *Stamens 8-10,* but reduced to 2 or 3 in wind-pollinated species; filaments free or adnate to corolla, sometimes connate, sometimes with paired projections (spurs) near or at junction with anther; *anthers becoming inverted, 2-* or 1-locular, *usually opening by 2 apical pores,* sometimes with 2 projections (awns) *or with apex narrowed, forming a pair of tubules; pollen grains usually in tetrads,* usually tricolporate, sometimes associated with viscin threads. Carpels 2-10; ovary superior to inferior, usually with axile or deeply intruded parietal placentation; style 1, *hollow, internally fluted;* stigma capitate or slightly lobed. Ovules 1 to numerous per locule, with 1 integument and a thin-walled megasporangium. Nectariferous tissue around base or apex of ovary. *Fruit a septicidal or loculicidal capsule, berry, 1 or several-pitted drupe,* usually erectly held due to movement of pedicel; seed coat thin (Figure 8.105).

Floral formula: * or X, (4–5), (4–5), (4–10), (2–10);
capsule, berry, drupe

Distribution and ecology: Cosmopolitan, but especially common in tropical montane habitats, southern Africa, eastern North America, and eastern Asia; usually light-loving shrubs of acid soils.

Genera/species: 130/2700. *Major genera: Rhododendron* (800 spp.), *Erica* (600), *Vaccinium* (400), *Gaultheria* (150), *Leucopogon* (140), *Cavendishia* (100), and *Arctostaphylos* (50). Noteworthy genera (in addition to most of the above) in the continental United States and/or Canada are *Andromeda, Arbutus, Bejaria, Ceratiola, Chamaedaphne, Chimaphila, Corema, Empetrum, Gaylussacia, Kalmia, Leucothoe, Lyonia, Monotropa, Monotropsis, Oxydendrum, Pieris, Pterospora,* and *Pyrola.*

Economic plants and products: The edible fruits of *Vaccinium* (blueberries, cranberries) are economically important. The family contains many showy ornamentals, including *Arbutus* (madrone), *Calluna* (heather), *Erica* (heath), *Gaultheria* (wintergreen), *Kalmia* (mountain laurel), *Oxydendrum* (sourwood), *Pieris, Rhododendron* (azalea, rhododendron), and *Leucothoe* (fetterbush). *Gaultheria procumbens* is the original source of oil of wintergreen (methyl salicylate).

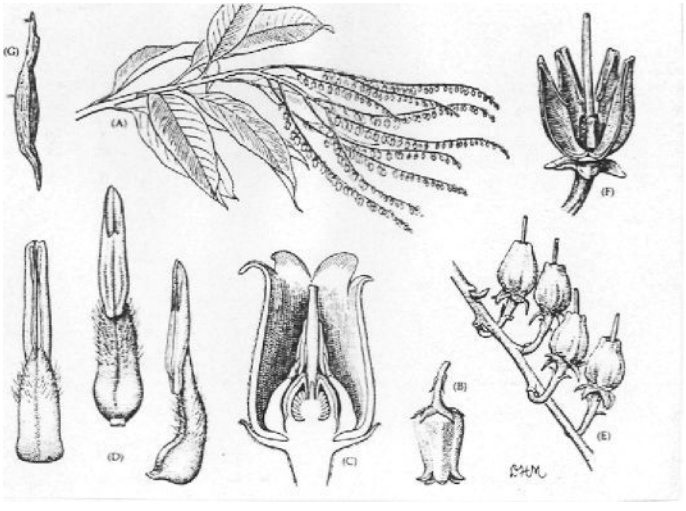


Figure 8.105 Ericaceae. (A-G) *Oxydendrum arboreum:* (A) flowering branch (x 0.4); (B) flower (x 3); (C) flower in longitudinal section (x 9); (D) outer, inner, and lateral views of stamens (x 18); (E) portion of raceme with immature fruits (x 3); (F) opened capsule, one valve removed, note deeply immersed style (x 6); (G) seed (x 15). (From Wood ***1961, J. Arnold Arbor. 42;*** **p. 57.)**

Fabaceae Lindley
(= Leguminosae A.L. de Jussieu)
(Legume or Bean Family)

Herbs, shrubs, trees, or vines/lianas climbing by twining or tendrils; with a high nitrogen metabolism and unusual amino acids, *often with root nodules containing nitrogen-fixing bacteria (Rhizobium);* sometimes with secretory canals or cavities; tannins usually present; often with alkaloids; sometimes cyanogenic; sieve cell plastids with protein crystals and usually also starch grains. Hairs various. *Leaves usually alternate, pinnately (or twice pinnately) compound, to palmately compound, trifoliolate, or unifoliolate; entire* to occasionally serrate, with pinnate venation, occasionally leaflets modified into tendrils; *pulvinus of leaf and individual leaflets well developed, and leaf axis and leaflets usually showing sleep movements; stipules present, inconspicuous to leaflike,* occasionally forming spines. Inflorescences almost always indeterminate, sometimes reduced to a single flower, terminal or axillary. Flowers usually bisexual, radial to bilateral, with a short, usually cup-shaped hypanthium. *Sepals usually 5,* distinct to more commonly connate. *Petals usually 5,* distinct or connate, valvate or imbricate, *all alike, or the uppermost petal differentiated in size, shape, or coloration (i.e., forming a banner or standard), and positioned internally or externally in bud, the 2 lower petals often connate or sticking together and forming a keel, or widely flaring. Stamens* 1 to numerous, but *usually* 10, hidden by the perianth to long-exserted, and sometimes showy; filaments distinct to connate, then commonly monadelphous or diadelphous (with 9 connate and 1, the uppermost, ± distinct); pollen grains tricolporate, tricolpate, or triporate, usually borne in monads, but occasionally in tetrads or polyads. Carpel almost always 1, distinct, usually elongate and with a short gynophore; *ovary superior, with parietal placentation; style 1, arching upward,* sometimes hairy; stigma 1, small. *Ovules 1 to numerous per carpel, borne in 2 raws along an upper placenta, often campylotropous.* Nectar usually produced by inner surface of hypanthium or an intrastaminal disk. Fruit usually a legume, sometimes a samara, loment, follicle, indehiscent pod, achene, drupe, or berry; seeds often with hard coat with hourglass-shaped cells, sometimes arillate, and sometimes with a U-shaped line (pleurogram); embryo usually curved; endosperm often lacking (Figures 8.66-8.68; Table 8.2).

Floral formula: X or *, (5), (5), (10–∞), 1; legume

Distribution and ecology: Nearly cosmopolitan; the third largest family of angiosperms; occurring in a wide range of habitats.

Genera/species: 630/18,000. ***Major genera:*** *Astragalus* (2000 spp.), *Acacia* (1000), *Indigofera* (700), *Crotalaria (600), Mimosa (500), Desmodium* (400), *Tephrosia* (400), *Trifolium (300), Chamaecrista* (260), *Senna* (250), *Inga (250), Bauhinia (250), Adesmia* (230), *Dalbergia* (200), *Lupinus* (200), *Rhynchosin* (200), *Pithecellobium* (170), *Dalea* (150), *Lathyrus* (150), *Calliandra* (150), *Aeschynomene* (150), *Vicia* (140), *Albizia* (130), *Swartzia* (130), *Lonchocarpus* (130) *Caesalpinai* (120), *Lotus* (100), *Millettia* (100), and *Erythrina* (100). Over a hundred genera occur in Canada and/or the continental United States; some of these are listed in Table 8.2.

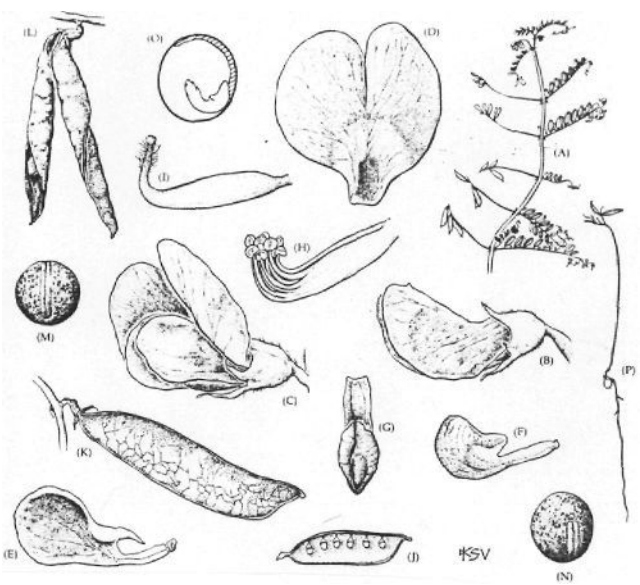


Figure 8.68 Fabaceae, subfamily Faboideae. *Vicia ludoviciana:* (A) tip of vine with flowers and fruits (x 0.3); (B) side view of flower bud (x 5); (C) flower (x 5); (D) banner petal (x 5); (E) inner surface of wing petal (x5); (F) inner surface of keel petal (x5); (G) keel seen from front (x5); (H) androecium with nine stamens fused and one ± free (x7); (I) gynoecium of one carpel (x 7); (J) young fruit, with one valve removed to show ovules (x 1.5); (K) mature legume (x 3); (L) dehisced legume (x 2.5); (M, N) seeds, note hilum half encircling seed (x 6); (O) seed in cross-section, note hilar region (dashed lines), and large embryo, cotyledon, and curved axis (x 8); (P) seedling. (From Wood 1974, *A student's atlas of flowering plants,* p. 60.)

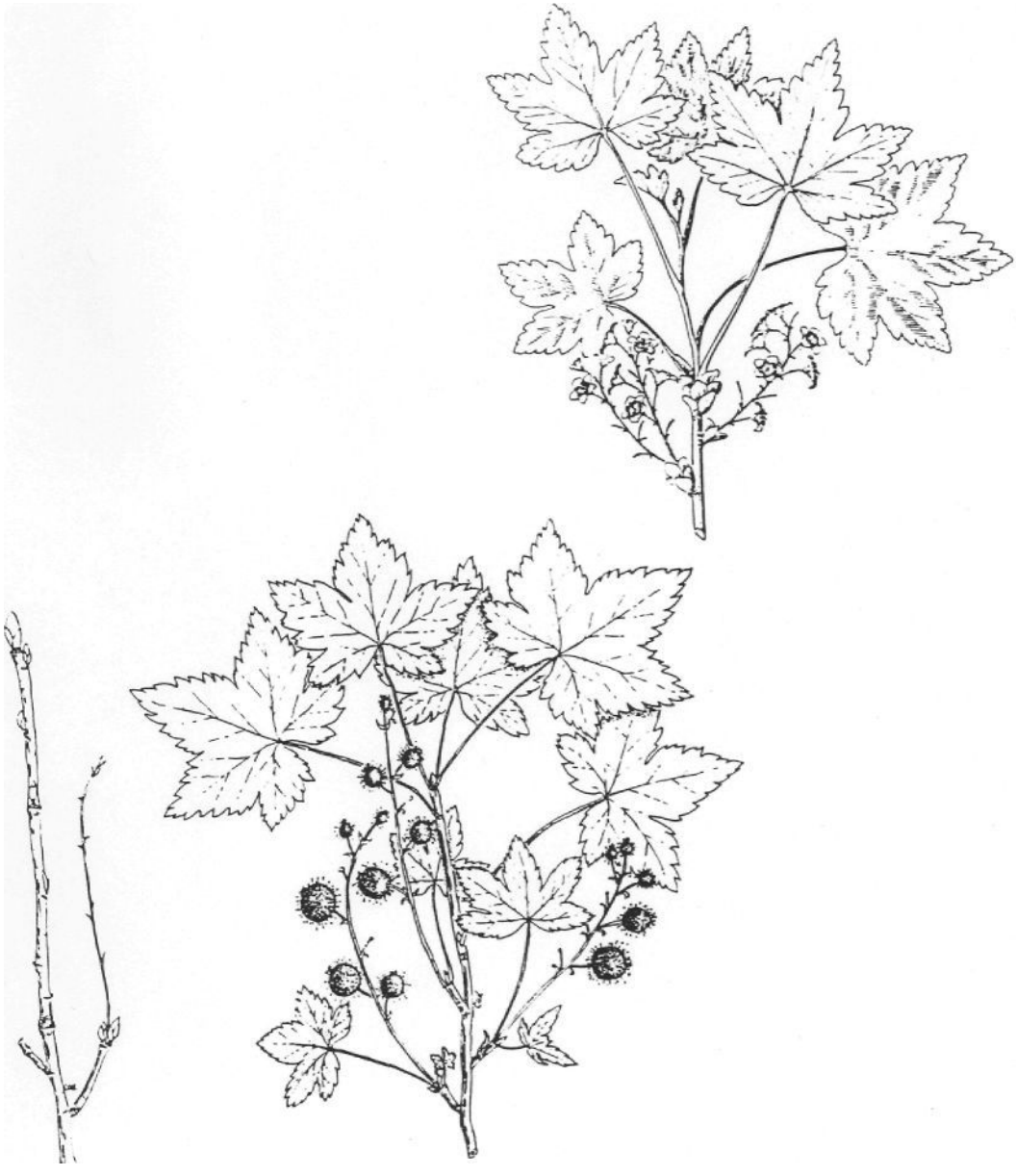
GROSSULARIACEAE (Currant, Gooseberry Family)
Order Rosales

Trees and shrubs with a cosmopolitan distribution, but most common in the northern hemisphere. *Ribes* is the only genus in Alaska and is described here.

Small shrubs with alternate, simple leaves which are often palmately veined and/or lobed. Prickles found on some species. Small actinomorphic 5-merous flowers arranged in axillary racemes. Perianth is usually small and bract-like. Hypanthium is well developed early in flowering stage, the ovary is inferior and develops into a berry. Hypanthium and fruit sometimes covered with resin dots, stalked glands, or hairs.

Some workers consider the genus *Ribes* to be in Saxifragaceae (see Hulten and Welsh), others split Grossulariaceae into several families on a world wide basis. Differs from Saxifragaceae described here in its woody habit, having a well-developed hypanthium, an inferior ovary, and the fruit being a berry.

Ribes (currants)



JUNCACEAE Rush Family

Temperate worldwide, mostly in wet areas. Often found where sedges are common.

Grassy herbs, mostly perennials in our area. Stems are usually round in cross-section, and leaves sometimes only basal, sometimes reduced to sheaths only. Leaf sheaths open. No ligule, but may have auricles at leaf-sheath junction. The small. 3-merous flowers remind one of tiny lily blossums with 3 outer bracts and 3 inner bracts (or 6tepals, or perianth). Flowers are not in true spikes, but may be clustered in some species. Fruit is a dry capsule that resembles a minature lily pod and contains many seeds.

In your area: *Juncus* (rush). *Luzula* (woodrush, sweetgrass).

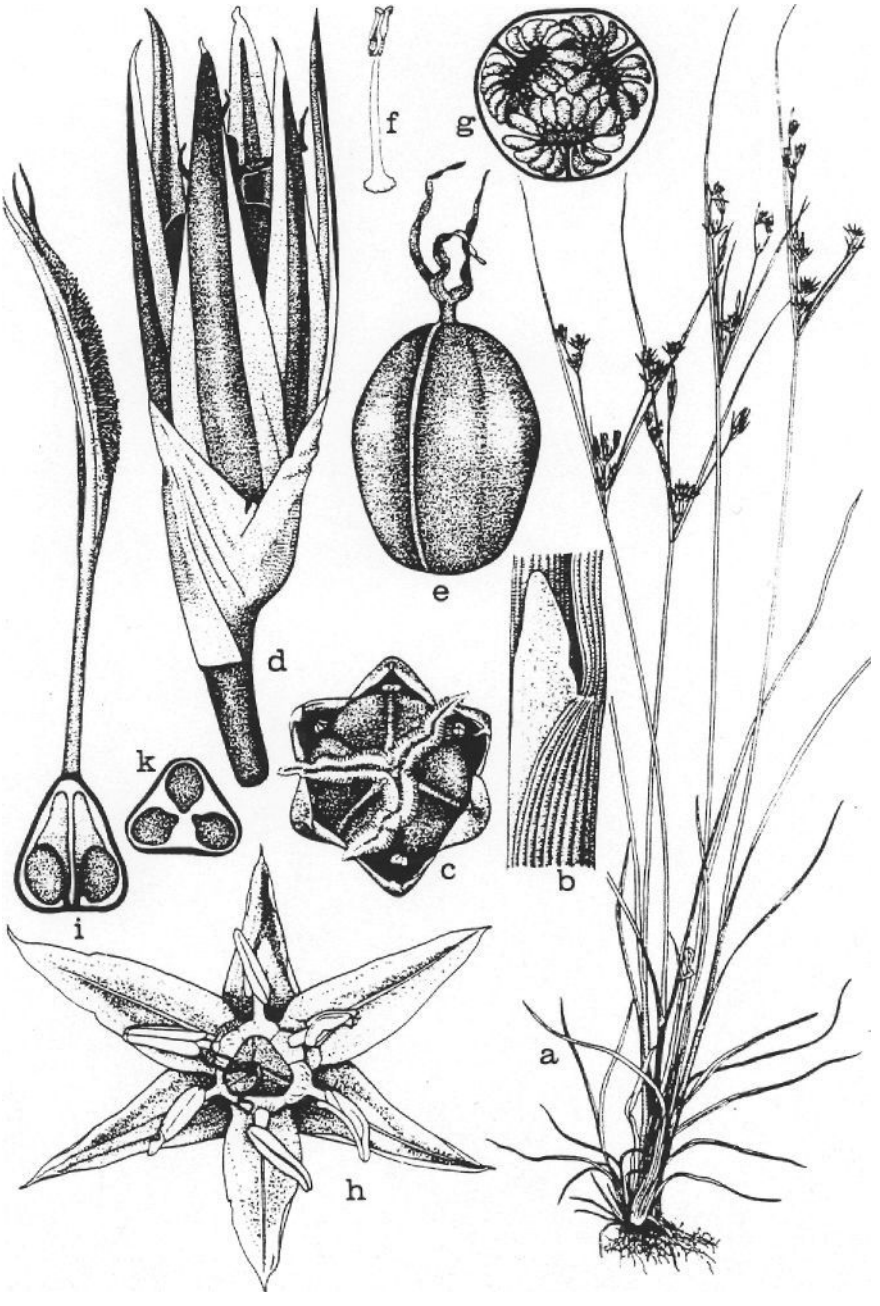


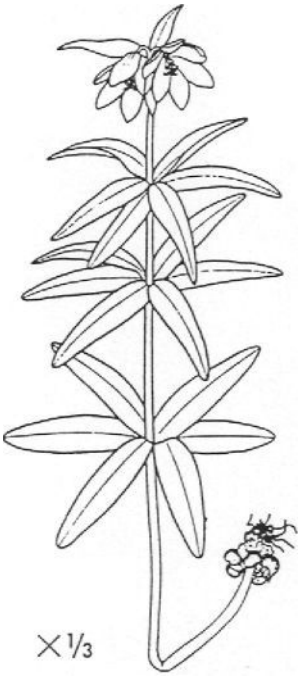
Fig. 9.6 Juncaceae. a-g, *juncus tenuis* Willd. a. habit, x½; b, nodal region, with auricle, x 8; c, flower from above, after anthesis, x 16; d, side view of flower after anthesis. with percent bracteoles and tepals, x 16; e, pistil, x 16; f, stamen, x 16; g, schematic cross-section of ovary, x 16. h-k, *Luzula acuminata* Raf. h. flower, from above, x 8; i, pistil, in partial long-section. x 16;, k, schematic cross-section of ovary, x 16.

LILIACEAE Lily Family

Worldwide distribution. Includes many ornamentals as well as onion, garlic, and chives. A very diverse family which is divided into several different families by some workers.

Herbaceous, 3-merous flowers which are distinctive and known to most. Many have bulbs, corms, or swollen rhizomes. Leaves are simple, often basel, and have parallel venation. Flowers are regular and may be showy, or small and inconspicous, but always have that 'lily' look with 3 sepals (which may be petaloid), 3 petals, and 6 stamens.

In our area: *Tofieldia* (False Asphodel), *Lloydia (Alp Lily), Streptopus* (Twisted Stalk), *Allium* (Wild Onion), *Zygadenus* (Death Camus), and *Veratrum* (Hellebore).



Myricaceae Blume
(Bayberry Family)

Aromatic *trees or shrubs;* triterpenes and sesquiterpenes present; tannins present; roots usually with nodules that contain nitrogen-fixing bacteria. *Peltate scales with a glandular, usually golden-yellow, swollen head,* containing various aromatic oils and/or resins. *Leaves alternate, simple* (deeply lobed in *Comptonia), entire to serrate, with pinnate venation;* stipules absent, or present *(Comptonia).* Inflorescences indeterminate, often spikelike or catkinlike, erect to ± pendulous, axillary, staminate and carpellate flowers usually in separate inflorescences. *flowers unisexual (plants monoecious or dioecious),* radial, inconspicuous, 1 in the axil of each inflorescence bract. *Perianth lacking,* except in *Canacomyrica* where represented by 6 minute tepals at ovary apex, but flowers usually associated with bracts and bracteoles. *Stamens 2-9,* but appearing more numerous due to clustering of several flowers; pollen grains usually triporoporate. *Carpels 2, connate; ovary apparently superior* (due to loss of perianth: *Comptonia), becoming inferior due to intercalary meristematic activity around and/or beneath the gynoecium, forming a cuplike structure,* which raises the bracteoles up as part of the fruit wall *(Gale), or inferior even at the time of pollination, due to early intercalary activity* that forms a thick structure with *(Myrica)* or without *(Canacomyrica)* papillae, with basal placentation; stigmas 2, elongated. Ovule 1 per gynoecium, orthotropous, with 1 integument. Nectaries lacking. *Fruit a drupe, covered either with waxy or fleshy papillae, or an achene,* not associated with conspicuous bracteoles *(Myrica, Canacomyrica),* with 2 bracteoles fused to achene *(Gale),* or simply surrounding fruit *(Comptonia);* endosperm lacking, or nearly so (Figure 8.86).

Floral formula: Staminate: *, -0-, 1-9, 0
Carpellate: *, -0-, 0,@; drupe, achene

Distribution and ecology: Widespread in temperate to tropical regions; often early successional or in wetlands; plants associated with nitrogen-fixing, filamentous bacteria in root nodules.

Genera/species: 4/40. *Major genus: Myrica* (35 spp.).

Economic plants and products: Aromatic wax is extracted from the fruits of several species of *Myrica* (bayberry, wax myrtle, candleberry); a few species have edible fruits. Several species of *Myrica* are used as ornamental shrubs.

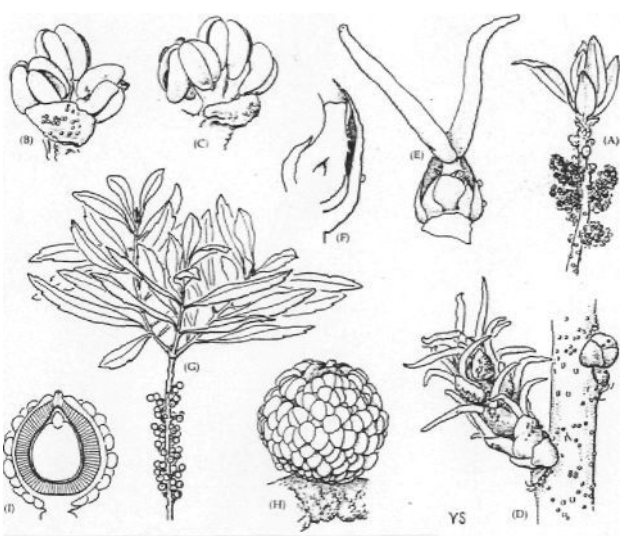


Figure 8.86 Myricaceae. (A-F) *Myrica pensylvanica:* (A) branch with staminate catkins (x 1.5); (B) staminate flower (x 14.5); (C) staminate flower, lateral view (x 14.5); (D) carpellate catkin (x 9); (E) carpellate flower with bracts (x 22); (F) carpellate flower in longitudinal section, showing basal ovule (x 30). (G-I) *M. cerifera:* (G) branch with fruits (x 0.75); (H) drupe (x 12); (I) fruit in longitudinal section, note waxy papillae, endocarp (indicated with numerous radiating lines), and embryo (x 12). (From Elias *1971, J. Arnold Arbor. 52:p.310.*)

Onagraceae A. L. de Jussieu
(Evening Primrose Family)

Herbs to shrubs or occasionally trees; raphides present. Hairs simple. *Leaves* alternate, opposite, or whorled, *simple,* entire to toothed, sometimes lobed, *with pinnate venation;* stipules present to vestigial or lacking. Inflorescences indeterminate, terminal, or axillary and solitary. *Flowers* usually bisexual, radial or bilateral, *usually with well-developed hypanthium that is clearly prolonged above ovary* (except in *Ludwigia). Sepals* (2-) 4 (-7), distinct, valvate. *Petals* (2-) *4* (-7), distinct, sometimes clawed, occasionally lacking, imbricate, convolute, or valvate. *Stamens (4-) 8,* anthers with septa dividing the sporogenous tissue within locules; pollen grains in monads, tetrads, or polyads, usually triporate, occasionally colpate, tricolporate, or biporate, with unique paracrystalline beaded outer exine, and associated with viscin threads. *Carpels usually 4,* connate; ovary inferior, usually with axile placentation; stigma capitate or clavate to 4-lobed or 4-branched. Ovules 1-numerous in each locule; megagametophyte 4-nucleate (i.e., *Oenothera-type).* Nectary usually near or at base of hypanthium. *Fruit a loculicidal capsule,* berry, or sometimes small, indehiscent, and nutlike; seeds sometimes winged or with a tuft of hairs; endosperm lacking (Figure 8.89).

Floral formula:

* or X, 4, 4, 4 or 8, $\underline{\overline{4}}$; capsule, berry, nut

Distribution: Widely distributed and especially diverse in western North America and South America.

Genera/species: *16/650. Major genera: Epilobium* (164 spp.), *Oenothera (120), Fuchsia* (110), *Ludwigia* (80), *Camissonia* (62), and *Clarkia* (45). *chamaenerion* and *Circaea* also occur in North America.

Economic plants and products: *Fuchsia, Oenothera (*evening primrose), and *Clarkia* are ornamentals with showy flowers.

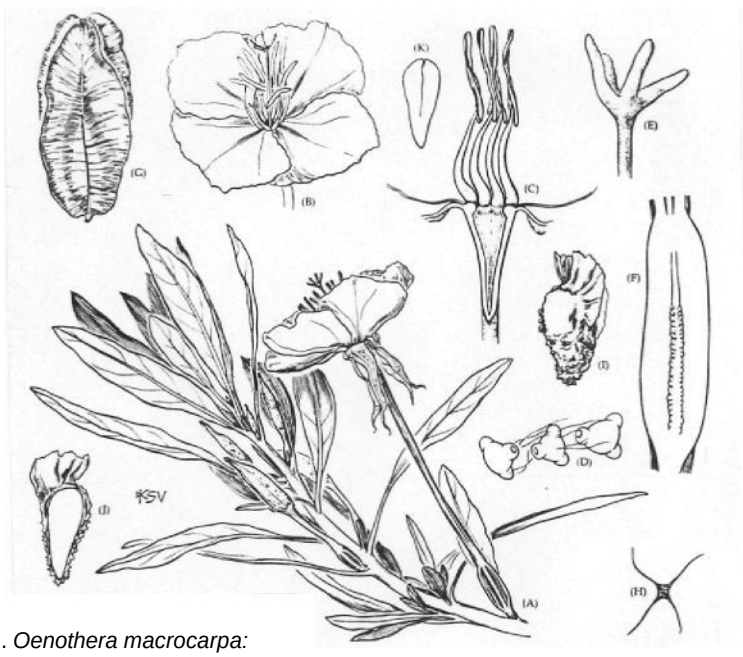


Figure 8.89 Onagraceae. *Oenothera macrocarpa:* (A) part of flowering plant (x 0.5); (B) upper part of flower (x 1);(C) upper part of flower to show insertion of stamens at apex of hypanthium (x 1.5); (D) pollen grains connected by viscin threads (greatly magnified); (E) stigmas (x 30); (F) ovary in longitudinal section, with base of hypanthium and base of style, note ovules (x 3); (G) fruit (x 1); (H) fruit in cross-section (x 1); (I) seed (x 30); (J) seed in longitudinal section, note large embryo (x 30); (K) embryo (x 30). (From Wood 1974, *A student's atlas of flowering plants,* p. 77.)

ORCHIDACEAE Orchid Family

Herbaceous monocots, some are saprophytic. or partially so, and most all are involved in mycorrhizal relationships on which they are dependent.

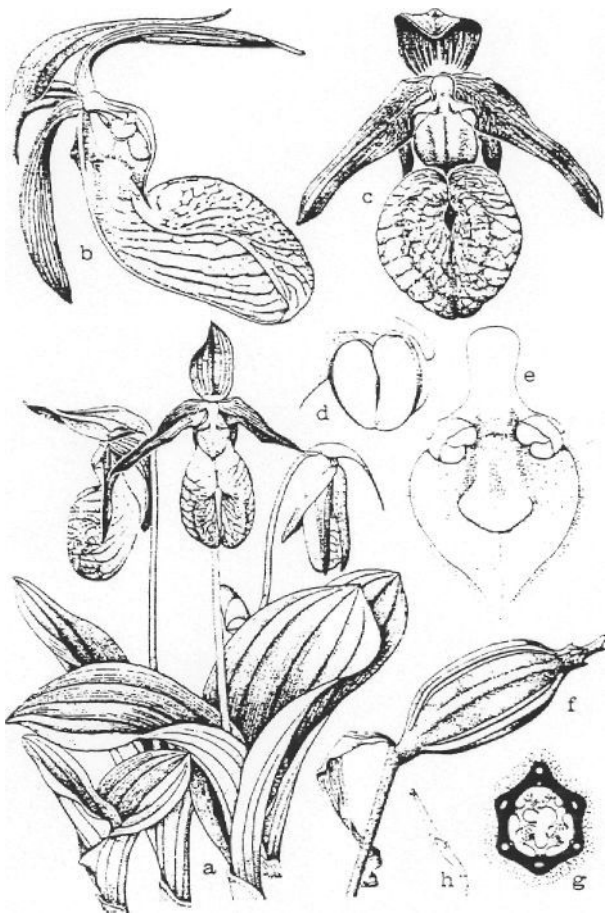
Largest family of flowering plants! over 20,000 species. May be due, in part to the very specialized pollinations relationships they are involved in.

Most abundant in the tropics, becoming less common northward.
Sometimes are epiphytic, such as vanilla. None are native to Hawaii.

Leaves usually simple, sometimes reduced to scales in saprophytic taxa. 3 sepals which may be bract-like or petaloid, 3 petals forming an irregular flower which is really twisted 180 degrees. Lower lip (labellum) sometimes flares out, or is like a pouch. Pollen is packed together into a pollinium, a sticky mass designed to be picked up by insect visitor. Ovary is inferior. Fruits a dry capsule with abundant tiny seeds. Must germinate in a site with the required mycorrhizal partner.

In your area: *Cyperpedium* (Ladies Slipper), *Dactylrhiza* (Key Rower), *Coeloglossum* (Frog Orchid), *Platanthera* (Bog Orchids). *Spiranthes* (Ladies Tresses). *Listera* (Twyblade). *Corallorrhiza* (Coral Root). *Goodyera* (Rattlesnake Plantain), others?

New words: lip, saccate, tuberoids, spur, pollinium, column



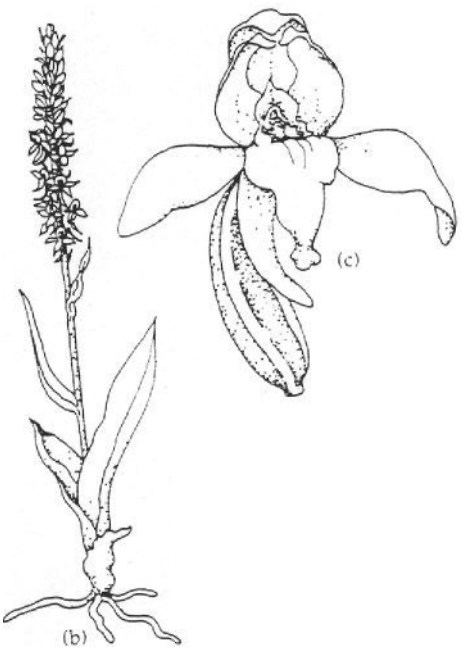


Fig. 11.10 Orchidaceae. *Cyperpedium acaule* Alton. a. habitat x 1; b. flower, with the lip in long-secyion. x 1. c. front view of flower. x 1; d. fertile stamen. x 4. e. column, as seen frombeneath,showing2fertilestamens,stigma,anddilated[?scaminoce?],x2;f.fruit x 1. g. schematic cross-section of ovary, after fertiliation, wtih developing ovules, x 4; h.

NOTE: [illegible] may contain errors that were

Papaveraceae A. L. de Jussieu
(Poppy Family)

Herbs to soft-wooded shrubs; stem with vascular bundles sometimes in several rings; with laticifers present and plants with white, cream, yellow, orange, or red sap, or with specialized elongated secretory cells and sap then mucilaginous, clear; sap with various alkaloids (including the benzyl-isoquinoline type). Hairs simple. *Leaves usually alternate, simple, but often lobed or dissected, entire to more commonly variously toothed, sometimes spinose,* with ± pinnate venation; *stipules lacking.* Inflorescences various. Flowers bisexual, radial (with numerous or only 2 planes of symmetry) to bilateral. *Sepals usually 2 or 3,* usually distinct, imbricate, usually quickly deciduous, large and surrounding bud to small and bractlike. *Petals usually 4 or 6,* sometimes numerous, distinct, imbricate and often crumpled in bud and thus wrinkled when expanded; *often the 2 (or 3) inner differentiated from the 2 (or* 3) *outer,* and sometimes with 1 or 2 of the outer petals with a prominent basal nectar spur or pouch and the 2 inner sticking together at apex, forming a cover over the stigmas. *Stamens numerous, to 6 that are ± connate in 2 groups of 3,* rarely reduced to 4; filaments distinct to connate; pollen grains tricolporate to polyporate. Carpels 2 to numerous, connate; ovary superior, with parietal placentation, the placentas sometimes intruded; stigma(s) distinct to connate, 1 or equaling number of carpels, often discoid and lobed, sometimes capitate. Ovules usually numerous, but sometimes reduced to 1 or 2. Nectaries lacking, or sometimes one or more of the filaments with a basal nectar gland. Fruit a capsule, opening variously, but often by apical pores, valves, or longitudinal slits, *sometimes with a persistent thickened rim (developed from the placenta),* occasionally a nut or lomentlike; seeds sometimes arillate (Figure 8.42).

Floral formula:
* or X, 2–3 , 4–6 (–∞), 4–∞ or ③+③, 2–∞; capsule

Distribution: Widely distributed in mainly temperate regions; especially diverse in the Northern Hemisphere, but also in southern Africa and eastern Australia.

Genera/species: 40/770. ***Major genera:*** *Corydalis* (400 spp.), *Papaver* (100), *Fumaria* (50), and *Argemone* (30). Genera occurring in the continental United States and/or Canada include *Adlumia, Arctomecon, Argemone, Canbya, Ceelidonium, Corydalis, Dendromecon, Dicentra, Eschscholzia, Fumaria, Hesperomecon, Meconella, Papaver, Platystemon, Romneya, Sanguinaria,* and *Stylophorum.* Delimitation of genera is often difficult (see Jork and Kadereit 1995).

Economic plants and products: *Papaver somniferum* (opium poppy) is the source of opium and derivatives such as morphine, heroin, and codeine; the seeds of this species (which do not contain opium) are used as a spice. Many have showy flowers and are cultivated as ornamentals, such as species of *Argemone* (prickly poppy), *Eschscholzia* (California poppy), *Papaver* (poppy), *Macleaya* (plume poppy), *Corydalis* (harlequin), *Sanguinaria* (bloodroot), and *Dicentra* (Dutchman's-breeches, bleeding heart). Most species are highly poisonous.

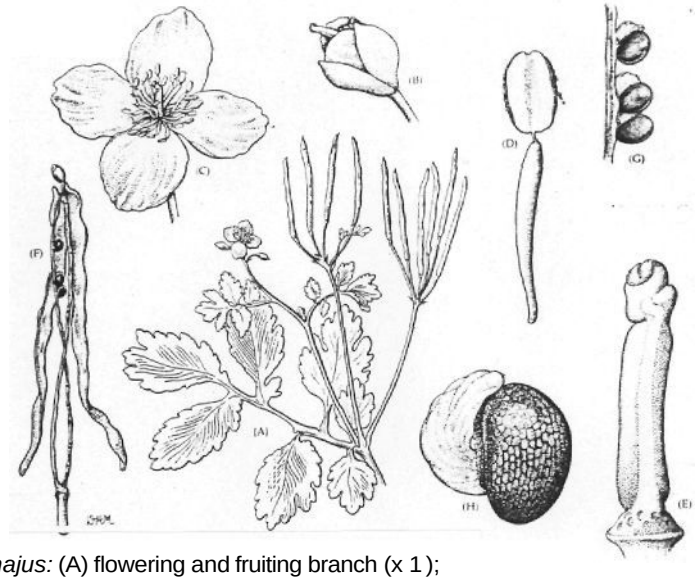


Figure 8.42 Papaveraceae. *Chelidonium majus:* (A) flowering and fruiting branch (x 1); (B) opening flower bud, note two sepals (x 6.5); (C) flower (x 6.5); (D) stamen (x 22); (E) gynoecium (x 22); (F) two-valved capsule, note persistent rim (x 4.5); (G) seeds attached to rim (X 9); (H) arillate seed (x44). (From Ernst *1962, J. Arnold Arbor. 43:p.325.)*

Pinaceae Lindley
(Pine Family)

Trees (occasionally shrubs), often emitting strong fragrances from bark and/or leaves; resin canals present in wood and leaves. Branches whorled or opposite (rarely alternate). Leaves simple, *linear to needlelike* (rarely narrowly ovate), alternate but often appearing 2-ranked by twisting of leaf base to bring most of the leaves into one plane, clustered or fascicled in groups of 2 to 5 in *Pinus,* sessile or short-petioled, on long shoots or tightly clustered on short shoots, persistent (deciduous in *Larix* and *Pseudolarix).* Monoecious. Microsporangiate strobili with spirally arranged, bilaterally symmetrical microsporophylls; microsporangia 2 on the abaxial microsporophyll surface; pollen grains with 2 saccae (saccae absent in *Larix, Pseudotsuga,* and all but two species of *Tsuga)* and 2 prothallial cells. *Cones with spirally arranged, flattened bract-scale complexes;* scales persistent (deciduous in *Abies, Cedrus,* and *Pseudolarix),* bracts free from the scale, longer than the cone scale to much shorter than the cone scale; maturing in 1-2 years; ovules 2, inverted (micropyle directed toward the cone axis), on the adaxial cone scale surface; archegonia few per ovule, not clustered. Seeds with a long, terminal wing derived from tissue of the cone scale (wing reduced or absent in some species of *Pinus);* embryo straight, cotyledons 2-18 (Figure 7.16).

Distribution and ecology: Pinaceae are almost entirely limited to the Northern Hemisphere. Three or four genera grow only in eastern Asia; one *(Cedrus)* is confined to North Africa, the Near East, Cyprus, and the Himalayas; and the remaining six genera (the major genera) all occur widely in the Northern Hemisphere. The family ranges from warm temperate climates to the limit of tree growth above the Arctic Circle, from permanently water-saturated soils to well-drained soils, and from sea level to alpine habitats up to 4800 m above sea level in eastern Tibet. The seeds of pines are primary components of the diets of many species of birds, squirrels, chipmunks, and other rodents. Members of the family provide cover for many wildlife species and are important in watershed protection.

Genera/species: 10/220. *Major genera: Pinus* (100 spp.), *Abies* (40), *Picea* (40), *Larix* (10), *Tsuga* (10), and *Pseudotsuga* (ca. 5).

Economic plants and products: Pinaceae are one of the leading sources of timber in the world. The wood of pines *(Pinus),* Douglas firs *(Pseudotsuga),* spruces *(Picea),* hemlocks *(Tsuga),* larches *(Larix),* and firs *(Abies)* is used extensively for construction, pulp for paper production, fenceposts, telephone poles, furniture, interior trim for houses, musical instruments, woodenware, and numerous other purposes. Pines, spruces, hemlocks, cedars *(Cedrus),* Douglas firs, and firs are used extensively as ornamentals, and hundreds of cultivars have been developed in many of the species of these genera. Pine "nuts," the more or less wingless seeds of pinion pines of southwestern North America, were a staple of native North Americans. These seeds and those of some Old World groups of pines are now a gourmet food. Rosin and turpentine are extracted from various species of pines.

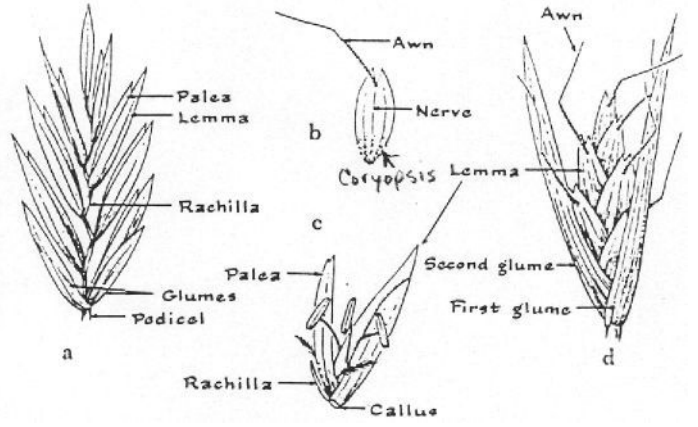
POACEAE (= Gramineae) Grass Family

Worldwide distribution and the most dominant and economically important family of flowering plants. Wheat, rice, corn, oats, sugar cane, bamboo, barley, and millet. This family provides food for the whole world, and shelter and habitat for a large portion of it. Grasses are found in all habitats from the arctic to Antarctica.

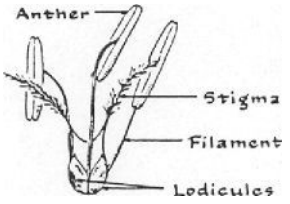
Annual or (in Alaska, mostly) perennial herbs. Fibrous roots and/or rhizomes, round hollow stems with nodes, linear leaves subtended by sheaths which wrap around the stem below the leaf blade. A ligule is found at the leaf-sheath junction. The flowers are reduced to florets which are packaged into spikelets and arranged in a panicle or spike. There is alot of diversity in floret and spikelet morphology and most of grass taxonomy is based on this, asking the student to learn a whole new vocabulary. Identification requires patience, a dissecting scope, and good keys!

Common in our area: *Trisetum* (Oatgrass), *Poa* (Blue Grass), *Calamagrostis* (Bluejoint), *Festuca* (Fescue), *Deschampsia* (Hairgrass), *Agropyron, Arctagrostis,* and several more.

New words: spikelet, glume, lemma, palea, ligule, nodes, awns, culm, callus, and more!

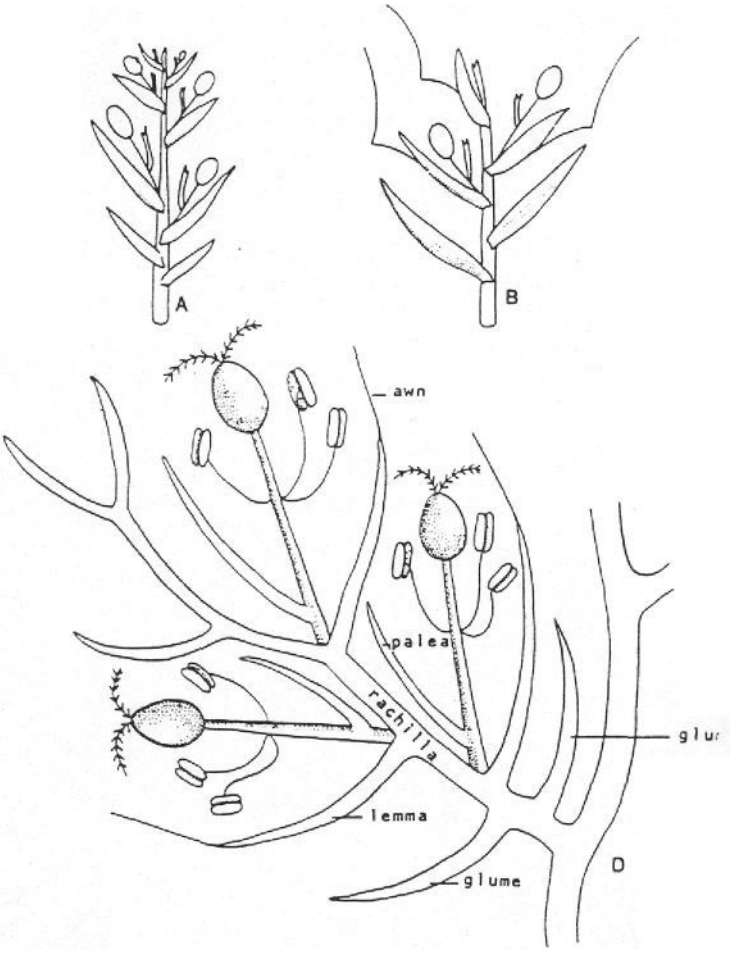


118 (a) Spikelet of bromegrass. (b) Single floret of oat grass. (c) Single floret of a grass at blooming time. *(d)* Spikelet of oat grass.



119 Reproductive parts of a grass floret.

120 Vegetative parts of grasses.



seed coryopsis

Polygonaceae A. L. de Jussieu
(Knotweed Family)

Herbs, shrubs, trees, or vines; nodes often swollen; usually with tannins; often with oxalic acid. Hairs various. *Leaves usually alternate, simple,* usually entire, venation pinnate; stipules present and connate into an often thin sheath (or ocrea) around the stem (lacking in *Eriogonum).* Inflorescences determinate, terminal or axillary. Flowers usually bisexual, sometimes unisexual (and plants then usually dioecious), radial. Perianth of 6 tepals, usually petaloid, sometimes differentiated, with 3 sepals and 3 petals, *or* 5, due to the fusion of 2 tepals, distinct to slightly connate, imbricate, *persistent.* Stamens usually 5-9; filaments distinct to slightly connate; pollen grains usually tricolporate to multiporate. *Carpels usually 2 or 3, connate; ovary superior, with basal placentation;* stigmas punctate, capitate to ± dissected. *Ovule 1,* usually orthotropous. Nectary a disk around base of ovary, or paired glands associated with the filaments. F*ruit an achene or nutlet, and often associated with enlarged (fleshy or dry) perianth parts, these sometimes with various outgrowths;* embryo straight to curved (Figure 8.51*).*

Floral formula: *, (5–6), (6–9), (2–3); achene

Distribution: Widely distributed; especially common in northern temperate regions.

Genera/species: 43/1100. *Major genera: Eriogonum* (240 spp.), *Rumex* (200), *Persicaria* (150), and *Coccoloba* (120). Some genera occurring in the continental United States and/or Canada, in addition to those listed above, are *Antigonon, Chorizanthe, Nemacaulis, Oxytheca, Oxyria, Polygonum, Polygonella,* and *Stenogonum.*

Economic plants and products: Fagopyrum (buckwheat) and *Coccoloba* (sea grape) produce edible fruits. The petioles of *Rheum* (rhubarb) are edible, as are the leaves of some species of *Rumex* (dock, sorrel). A few genera contain ornamental species, including *Antigonon* (coral vine) and *Coccoloba.* Many species of *Rumex, Persicaria* (knotweed), and *Polygonum* (knotweed) are common weeds.

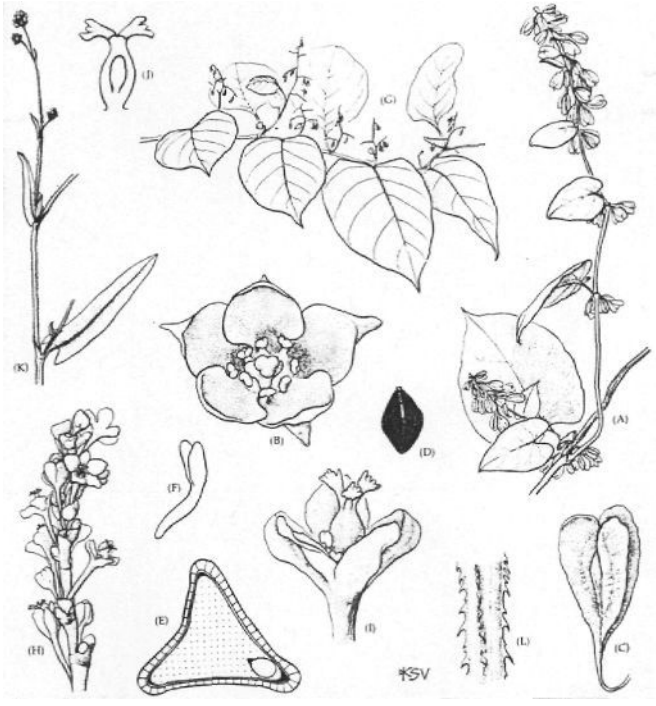


Figure 8.51 Polygonaceae. (A-F) *Polygonum scandens:* (A) fruiting branch (x 1); (B) flower (x 15); (C) accrescent perianth enclosing achene (x 4); (D) achene (x 5); (E) achene in cross-section, note embryo (lower right) and endosperm (stippled) (x 20); (F) embryo (greatly magnified). (G-J) *P. cuspidatum:* (G) branchlet with fruits (x 0.25); (H) tip of inflorescence (x 5); (I) flower (x 15); (J) gynoecium in longitudinal section, with basal, orthotropous ovule (x 15). (K-L) *P. sagittatum:* (K) flowering branch, with an ocrea at each node (x 1); (L) stem with retrose prickles (x 4). (From Wood 1974, *A student's atlas of flowering plants,* p. 22.)

Ranunculaceae A.L. de Jussieu
(Buttercup Family)

Herbs, shrubs, or occasionally vines; stems with vascular bundles often in several concentric rings or ± scattered; usually with alkaloids or ranunculin a lactone glycoside); often with triterpenoid saponins. Hairs usually *simple..Leaves usually alternate, simple, sometimes lobed or dissected, to compound, usually serrate, dentate, or crenate,* with pinnate to occasionally palmate venation; *stipules usually lacking.* Inflorescences determinate, sometimes appearing indeterminate or reduced to a single flower, terminal. Flowers usually bisexual, radial to occasionally bilateral, with short to elongate receptacle. *Perianth parts usually not 3-merous. Tepals 4 to numerous distinct,* and imbricate; *or perianth differentiated into calyx and corolla, then sepals usually 5, distinct, imbricate, and deciduous, and petals usually 5, distinct, imbricate, often with nectar-producing basal portion* or represented only by small nectar glands, probably derived from staminodes. *Stamens numerous;* filaments distinct; *anthers opening by longitudinal slits;* pollen grains tricolpate (or ± modified). *Carpels usually 5 to numerous,* occasionally reduced to 1, *usually distinct;* ovaries superior, with usually parietal placentation; stigmas punctate or extending along one side of the style. Ovules 1 to numerous per carpel. *Fruit usually an aggregate of follicles or achenes,* occasionally a berry (Figure 8.40).

Floral formula:

* or X, -4-∞- or 5, 5, ∞, 1-∞; follicles, achenes, berries

Distribution: Widespread, but especially characteristic of temperate and boreal regions of the Northern Hemisphere.

Genera/species: 47/2000. ***Major genera:*** *Ranunculus* (400 spp.), *Aconitum* (250), *Clematis (250), Delphinium* (250), *Anemone (150),* and *Thalictrum* (100). Some of the numerous genera in the continental United States and/or Canada (in addition to those listed above) are *Actaea, Aquilegia, Caltha, Coptis, Hydrastis, Isopyrum, Myosurus, Trollius,* and *Xanthorhiza.*

Economic plants and products: The family is chiefly important for its numerous ornamental herbs, such as *Anemone* (windflower, including *Hepatica), Aconitum* (monkshood), *Actaea* (baneberry, including *Cimicifuga), Aquilegia* (columbine), *Caltha* (marsh marigold), *Clematis* (virgin's bower). *Delphinium* (larkspur), *Helleborus* (hellebore), *Ranunculus* (buttercup), *Thalictrum* (meadow rue), and *Trollius* (globeflower). A number of genera are highly poisonous.

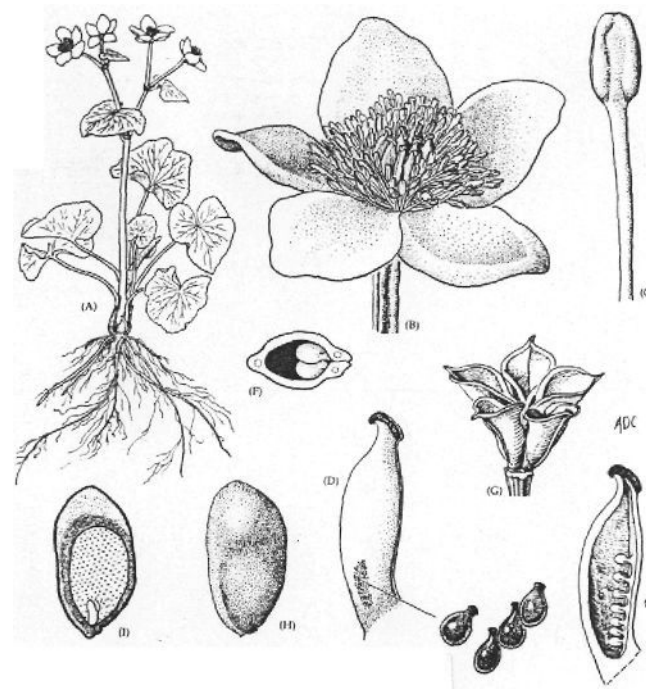


Figure 8.40 Ranunculaceae. *Caltha palustris:* (A) flowering plant (x 0.5); (B) flower (x 3); (C) stamen (x 12); (D) lateral view of carpel, with detail of nectar glands at base (x 10); (E) carpel in longitudinal section (x 10); (F) carpel in cross-section (x 15); (G) follicles from a five-carpellate flower (x 2); (H) seed (x 20); (I) seed in longitudinal section, note spongy seed coat, endosperm (stippled), and minute embryo (x 20). (From Wood 1974, *A student's atlas of flowering plants,* p. 29.)

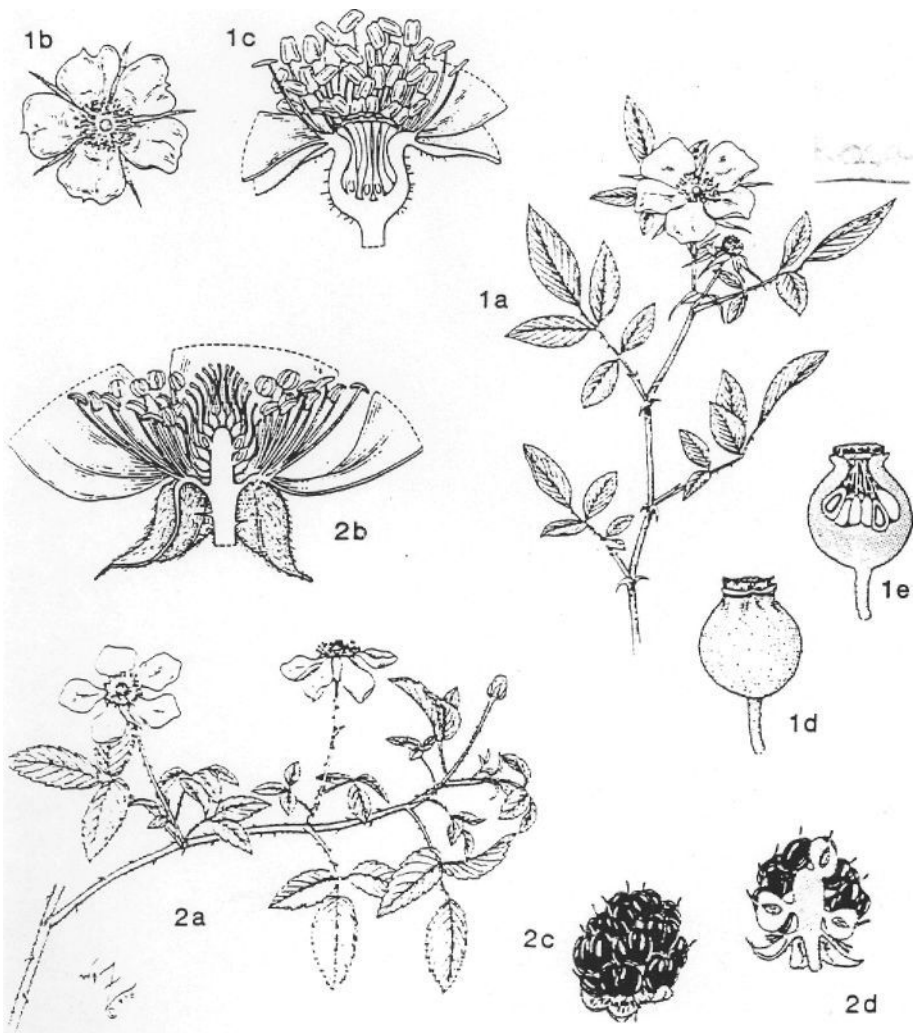
ROSACEAE (Rose Family)
Order Rosales

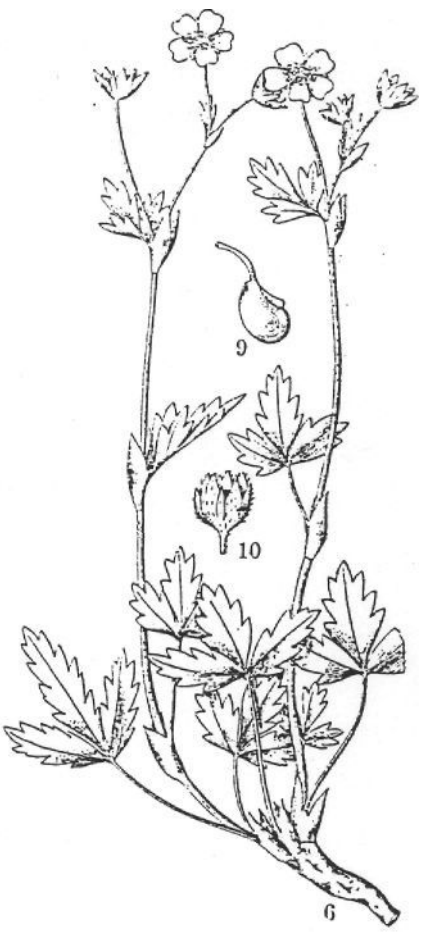
Large worldwide family, centered in northern hemisphere. Very diverse and well represented in Alaska. Includes plants of ecomonic value (apples, almonds, etc.) and ornamentals (roses, burnet).

Trees, shrub, and herbs. Leaves are stipulate, alternate, and quite variable in shape and dissection. Flowers are perfect, actinomorphic, and variously arranged. Perianth usually 5-merous; 5 sepals are fused at their base and often subtended by an epicalyx, the 5 or more petals are distinct and may be clawed. Carpels 1 to many and either superior or inferior. Anthers 5 to numerous. All floral parts are attached to a hypanthium which ranges from a flat disk to an urn-shaped container, depending on species, and/or the stage of fruit development. Fruits are also variable, and include achenes, drupes, pomes, and aggregates. Most species are insect pollinated, having showy flowers with nectar and abundant pollen available. Some taxa are selfing, apomictic, or frequently hybridize...causing much taxonomic grief!

Rubus (cloud berry, salmon berry), *Potentilla* (cinquefoils, silver weeds), *Sibbaldia, Geum, Sanguisorba* (burnet), *Rosa* (wild rose), *Dryas* (mountain avens), *Spiraea, Amelanchier, Sorbus, Luetka, Chamaerhodos, Aruncus, Fragaria,* and a few more.

Terms: drupelet, achene, epicalyx, hypanthium/receptacle, hip.





Rubiaceae A.L.de Jussieu
(Coffee or Madder Family)

Trees, shrubs, lianas, or herbs; lacking internal phloem; usually with iridoids, various alkaloids; raphide crystals common. Hairs various. *Leaves opposite or whorled, usually entire,* with pinnate venation; *stipules present,* interpetiolar *and usually connate,* occasionally leaflike, *with colleters on adaxial surface.* Inflorescences determinate, occasionally reduced to a single flower, terminal or axillary. *Flowers usually bisexual and radial, often heterostylous, frequently aggregated.* Sepals usually 4 or 5, connate, sometimes with colleters on adaxial surface. *Petals usually* 4 *or 5, connate,* forming a usually wheel-shaped to funnel-shaped corolla, adaxial surface often pubescent, the lobes valvate, imbricate, or contorted. *Stamens usually 4 or 5; filaments usually adnate to corolla* and positioned within corolla tube or at its mouth, sometimes basally connate; anthers 2-locular, opening by longitudinal slits; pollen grains usually tricolporate. *Carpels usually 2* (-5), *connate;* ovary inferior, with usually axile placentation; stigma(s) 1 or *2,* linear, capitate, or lobed. Ovules 1 to numerous in each locule, with 1 integument and a thin-walled megasporangium. Nectar disk usually present above ovary. Fruit a loculicidal to septicidal capsule, berry, drupe, schizocarp, or indehiscent pod; seeds sometimes winged; embryo straight to curved; endosperm present or lacking (Figure 8.112).

Floral formula: *, (4–5), (4–5), 4–5, (2–5); capsule, berry, drupe, schizocarp, indehiscent pod

Distribution: Cosmopolitan, but most diverse in tropical and subtropical regions.

Genera/species: 550/9000. ***Major genera:*** *Psychotria (*1500 spp.*), Galium (*400), *Ixora* (400), *Pavetta* (400), *Hedyotis* (400), *Tarenna* (370), *Randia* (250), *Gardenia (250), Palicourea* (250), *Mussaenda* (200), *Borreria (150),* and *Rondeletia* (125). Some of the numerous genera in the continental United States and/or Canada are *Casasia, Catesbaea, Cephalanthus, Chiococca, Diodia, Ernodia, Erithalis, Exostema, Galium, Guettarda, Hamelia, Hedyotis, Mitchella, Morinda, Pentodon, Pinckneya, Psychotria, Randia, Richardia,* and *Spermacoce.*

Economic plants and products: Coffee, a stimulating beverage containing caffeine, is made from the brewed seeds of *Coffea arabica* and *C. robusta.* Quinine, a drug used in treating malaria, comes from the bark of species of *Cinchona,* and ipecac, a drug used to induce vomiting, is derived from *Psychotria. Gardenia, Hamelia, Pentas, Randia, Rondeletia, Serissa, Hedyotis,* and *Ixora* provide ornamentals.

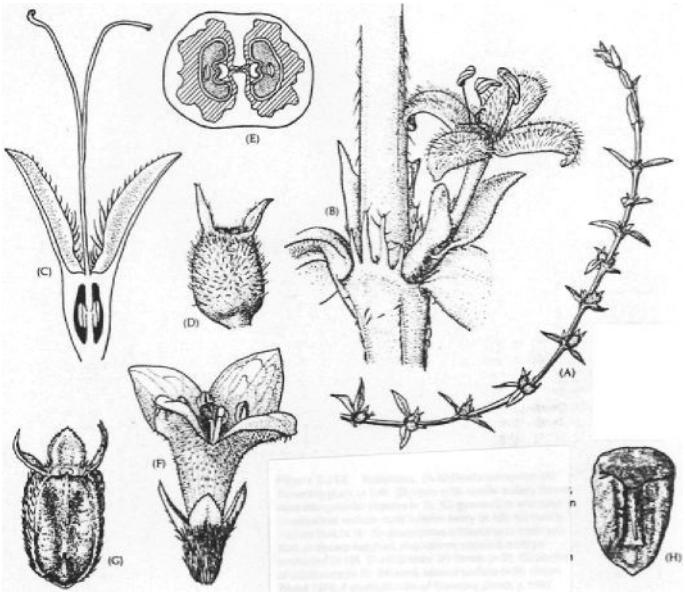


Figure 8.112 Rubiaceae. (A-E) *Diodia tetragona:* (A) flowering plant (x 0.4); (B) node with sessile axillary flower, note interpetiolar stipules (x 5); (C) gynoecium and calyx in longitudinal section, note inferior ovary (x 10); (D) nearly mature fruit (x 5); (E) drupaceous schizocarp in cross-section, endocarp hatched, endosperm stippled, embryo unshaded (x 10). (F-H) *D. teres:* (F) flower (x 5); (G) portion of schizocarp (x 5); (H) seed, adaxial surface (x8). (From Wood 1974, *A student's atlas of flowering plants,* p. 106.)

SALICACEAE Willow Family
Order Salicales

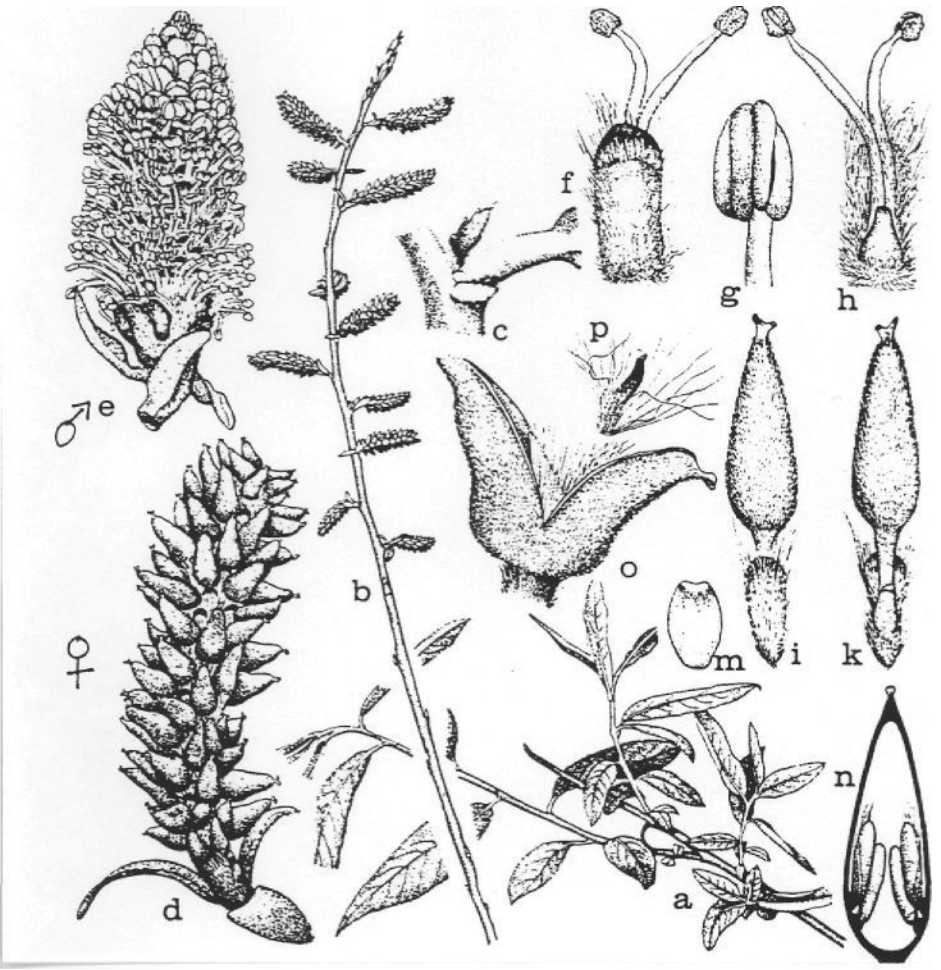
Trees and shrubs, predominantly of north temperate areas. Tree and tall shrub species are significant elements in riparian habitats for both succession after natural disturbance and for wildlife habitat and forage. In alpine and arctic habitats, dwarf shrub species are very common.

Simple, stipulate (bearing stipules) leaves alternately arranged on woody stems. Flowers are minute, unisexual, reduced, and arranged in catkins which often emerge before the leaves (our pussy willows!). Flowers consist of either a superior pistil (1-2 carpels), or of 2 or more stamens, and each reduced flower is subtended by a single, small, ciliate and/or pubescent bract. In *Salix* there are one or two nectary glands at the base of each flower which produce nectar and scent to attract insects, facilitating pollination. *Salix* also has a single bud scale; often diagnostic for winter twig identification. *Populus* has no nectaries, has several bud scales, and the buds often exude balsam, a fragrant, sticky substance that is a harbinger for spring in interior Alaska. Capsules open to release numerous tiny seeds having a tuft of hairs for wind dispersal. All species are dioecious, having staminate and pistillate catkins borne on separate plants.

Uses include lumber, ornamentals, revegetation, and medicinal (balsam and salicylic acid). *Salix* is a taxonomicly difficult group, having both known and suspected hybridization, and displaying extreme morphological variation in response to habitat, disturbance, and browsing. Collecting pistillate calkins and recording plant height greatly facilitates identification later.

New terms: aments, bracts, precocious.

Salix (willows), *Populus* (cottonwood and aspen).



Saxifragaceae A. L. de Jussieu
(Saxifrage Family)

Herbs; vessel elements with simple perforations; often with tannins, sometimes cyanogenic. Hairs often simple. Leaves usually alternate, sometimes in a basal rosette, simple to pinnately or palmately compound, entire to serrate or dentate, with venation pinnate to palmate; stipules lacking or represented by expanded margins of the petiole base. Inflorescences determinate to indeterminate, usually terminal. *Flowers* bisexual to unisexual (plants then monoecious to ± dioecious), radial to bilateral, *with a variously developed hypanthium.* Sepals usually 4 or 5, distinct to connate. *Petals usually 4 or 5, distinct, often clawed,* sometimes variously dissected, imbricate or convolute, sometimes reduced or lacking. Stamens usually 3-10; pollen grains usually tricolpate or tricolporate. *Carpels 2* (-5), ± connate or less commonly distinct; *ovary superior to inferior,* with axile or parietal placentation; stigmas separate, capitate. Ovules usually numerous on each placenta, with 1 or 2 integuments. Nectar disk often present around base of ovary. *Fruit a septicidal capsule or follicle* (Figure 8.52).

Floral formula:
, (4–5), 4–5, 5–10, (2–5); capsule, follicles

Distribution and ecology: Widely distributed in temperate and arctic regions, especially of the Northern Hemisphere, and often in mountainous terrain.

Genera/species: 30/550. ***Major genera:*** *Saxifraga (*325 spp.*), Heuchera (*55*), Chrysosplenium* (55*), Mitella* (20), and *Astilbe (20).* In addition to the above listed genera, noteworthy genera in the colder regions of the continental United States and Canada include *Boykinia, Leptarrhena, Sullivantia, Tellima, Tolmiea,* and *Tiarella.*

Economic plants and products: *Saxifraga, Astilbe,* and a few other genera are cultivated in rock gardens or perennial borders.

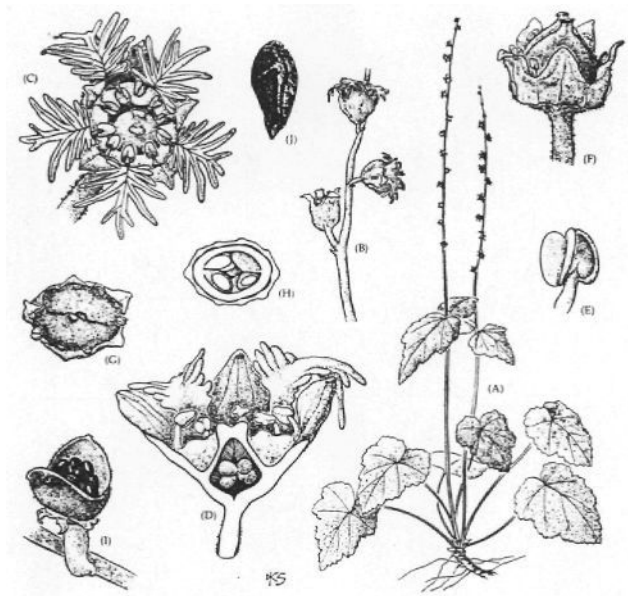


Figure 8.52 Saxifragaceae. *Mitella diphylla:* (A) flowering plant (x 0.75); (B) detail of raceme (x 4); (C) flower (x 15); (D) flower in longitudinal section (x 17); (E) dehisced anther (x 35); (F) immature capsule (x 9); (G) top view of immature capsule (x 9) (H) floral cup and capsule in cross-section (x 9); (I) erect "splash cup" capsule after dehiscence (x9); (J) seed (x 17). (From Sponberg *1972, J.Arnold Arbor.* 53: p. 426.)

Miscellaneous Alaskan (strictly) aquatic plant families

TYPHACEAE Cattails *Typha*

World wide distribution. Tiny reduced unisexual flowers tightly compacted into spikes, the staminate spike narrower and above the pistillate. Emergent in shallow water. Rhizome, and immature spikes and stems are edible. Tiny fruits are wind dispersed.

SPARGANIACEAE Bur Reeds *Sparganium*

Small unisexual flowers clustered into emergent, globose heads. One or more pistillate heads below, 1-2 staminate heads at top, and often deciduous early in season. Linear leaves may be submerged, emergent, and/or floating at surface.

POTAMOGETONACEAE Pondweeds

Potamogeton, Zostera, Ruppia, Zannichellia, Phyllospadix

Reduced tiny perfect flowers are clustered into globose or cylindrical spikes and may be emergent or submerged. Spikes may be axillary or terminal. Leaves linear to broad (considerable variation exists within individuals for some species), and have well-developed basal 'stipular' sheaths. *Potamogeton* is important forage for moose in late summer.

ISOETACEAE Quillworts *Isoetes*

Plant consists of tufts of submerged, stiff, quill-like leaves. Sporangia produced at base of fertile leaves.

CALLITRICHACEAE Water Starwort Family

Callitriche

Small submerged plants, though a terminal tuft of leaves may be emergent. Opposite leaves on single or branching stems. Reduced perfect (stamens lost early) flowers in axils of leaves.

LEMNACEAE Duckweeds *Lemna*

Tiny floating flat clusters of leaves on surface of quiet water. Flowers inconspicuous and usually lacking in our region.

Don't forget! Several of the families we have covered, and a few we haven't, also include a few aquatic species.