

Systematic Botany. Rosidae I

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Outline

Rosanae and Celastranae superorders of Rosidae

Leguminosae, or Fabaceae—legume family

Fagaceae—beech family

Betulaceae—birch family

Elaeagnaceae—Russian olive family

Rosaceae—rose family

Salicaceae—willow family

Euphorbiaceae—spurge family



Rosanae and Celastranae superorders of Rosidae

Leguminosae, or Fabaceae—legume family



General features of Leguminosae

Leguminosae, or Fabaceae—legume family

- ▶ Up to 17,000 species, third largest angiosperm family after Compositae (aster family) and Orchidaceae
- ▶ Widely distributed throughout the world but preferably in tropics
- ▶ Three subfamilies (Caesalpinioideae, Mimosoideae, Papilionoideae) often treated as separate families

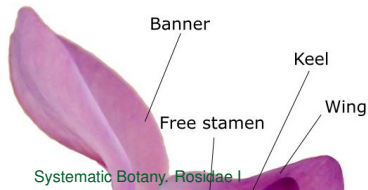
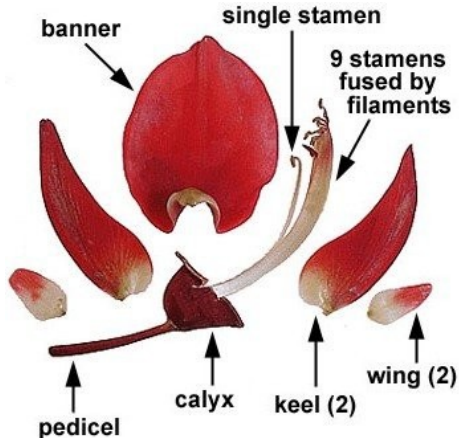


Morphology of Leguminosae

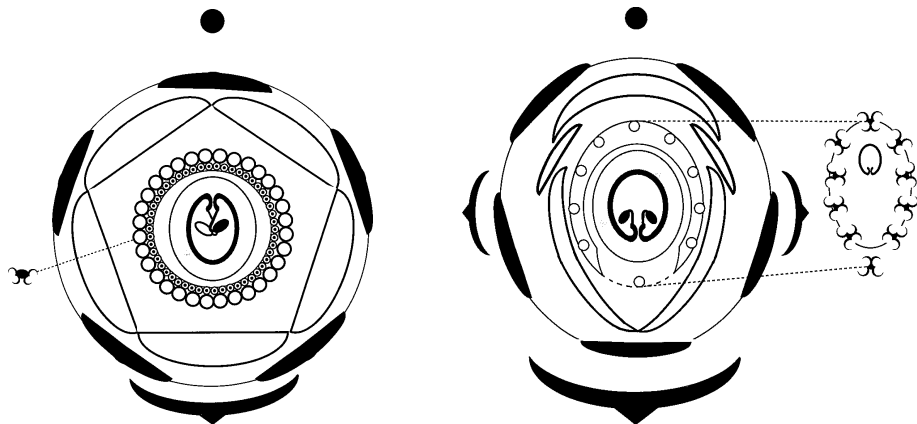
- ▶ Have root nodules with nitrogen-fixing bacteria
- ▶ Leaves alternate, pinnately compound (once or twice), with stipules
- ▶ Sepals 5, united; petals 5, in Papilionoideae they are free, unequal and have special names (banner, keel and wing), in Mimosoideae they fuse and form tube
- ▶ Stamens often 10 with 9 fused and one free stamen; in Mimosoideae, stamens are numerous
- ▶ Single pistil with single carpel
- ▶ Fruit is a legume: dehiscent with one camera
- ▶ Mature seeds without endosperm



Flower of Papilionoideae



Leguminosae flower: Mimosoideae and Papilionoideae



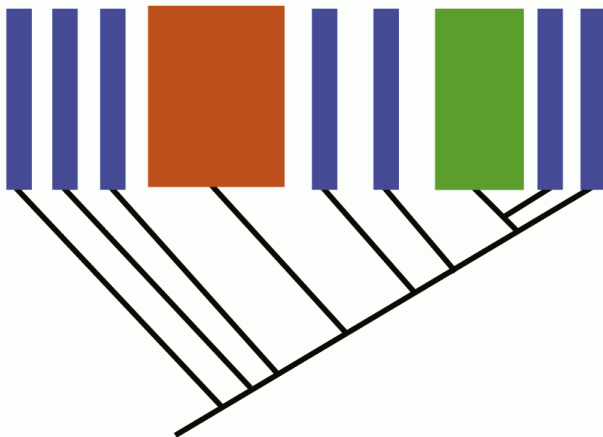
$*K_{(5)}C_{(5)}A_{5-\infty}G_{\underline{1}}$ or $\uparrow K_{(5)}C_{1,2,2}A_{1,[4+5]}G_{\underline{1}}$

The Leguminosae

Caesalpinioideae
(2,250 species)

Papilionoideae
(13,800 species)

Mimosoideae
(3,270 species)



Leguminosae classification

- ▶ Three subfamilies: Caesalpinioideae, Mimosoideae and the biggest is Papilionoideae (Faboideae)
- ▶ Caesalpinioideae:
 - ▶ *Gleditsia*—gleditsia
 - ▶ *Bauhinia*—orchid tree
 - ▶ *Cercis*—redbud
 - ▶ *Delonix*—royal poinciana
- ▶ Mimosoideae:
 - ▶ *Desmanthus*—prairie mimosa
 - ▶ *Prosopis*—mesquite
 - ▶ *Acacia*—acacia
 - ▶ *Mimosa*—sensitive plant, mimosa



Delonix regia in flower



Unusual legume—*Harleyodendron unifoliatum*



Phyllodes of Australian *Acacia glaucoptera*



Desmanthus illinoensis



Mimosa pudica before touch



Mimosa pudica after touch



Representatives of Papilionoideae (Faboideae)

- ▶ Swartzioids (*Swartzia*: highly unusual, but only in tropics)
- ▶ Genistioids
 - ▶ *Lupinus*—lupinus
- ▶ Dalbergioids
 - ▶ *Amorpha*—false indigo
 - ▶ *Petalostemon*, or *Dalea*—prairie-clover
 - ▶ *Arachis*—peanut
 - ▶ *Desmodium*—tick-trefoil
- ▶ Millettoids
 - ▶ *Apios*—ground nut
 - ▶ *Phaseolus*—beans
 - ▶ *Glycine*—soybeans
 - ▶ *Psoralea*—breadroot



Swarzia sp.



Representatives of Papilionoideae (Faboideae) (contd.)

- ▶ Robinioids
 - ▶ *Lotus*—trefoil
 - ▶ *Robinia*—locust
- ▶ IRLC (“inverted repeat-lacking”) group
 - ▶ *Caragana*—Siberian peashrub
 - ▶ *Astragalus*—milkvetch
 - ▶ *Oxytropis*—loco-weed
 - ▶ *Trifolium*—clover
 - ▶ *Vicia*, *Lathyrus*—vetch
 - ▶ *Medicago*—alfalfa
 - ▶ *Melilotus*—sweet clover
 - ▶ *Pisum*—pea



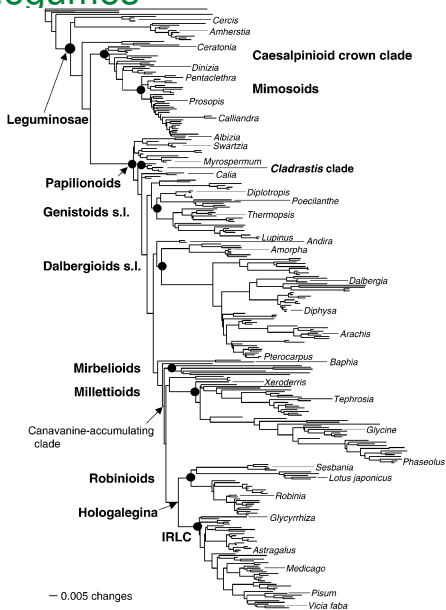
Glycine max, soybean



Arachis hypogaea, peanut



Phylogeny of legumes



Rosanae and Celastranae superorders of Rosidae

Fagaceae—beech family

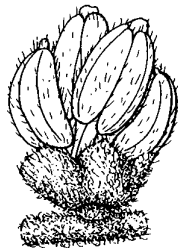


Fagaceae—beech family

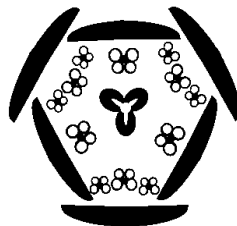
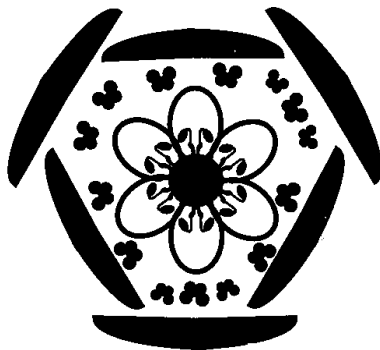
- ▶ \approx 800 species
- ▶ Distributed mostly in broad-leaved forests of North hemisphere
- ▶ Life forms: trees, rarely shrubs with mycorrhizal roots
- ▶ Leaves simple, entire or lobed, alternate, with minute stipules
- ▶ Flowers in catkins, very reduced due to wind pollination, unisexual; carpellate flowers with involucre of multiple fused bracts; perianth scale-like, stamens from 4 to numerous
- ▶ Pistil of 3–6 carpels, ovary inferior, 5 of 6 ovules are aborting
- ▶ Fruit a nut (acorn is a nut + involucre) with one seed with large embryo and no endosperm



Quercus flowers and inflorescences



Fagaceae flowers



$$\begin{aligned} &\text{♀} * P_{6-9} \overline{G_{(6)}} \\ &\text{♂} * P_{6-9} A_{6-12} \end{aligned}$$

Representatives of Fagaceae

Importance: wood producers, sometimes (chestnut) also food plants

- ▶ *Quercus*—oak
- ▶ *Fagus*—beech
- ▶ *Castanea*—chestnut



Rosanae and Celastranae superorders of Rosidae

Betulaceae—birch family

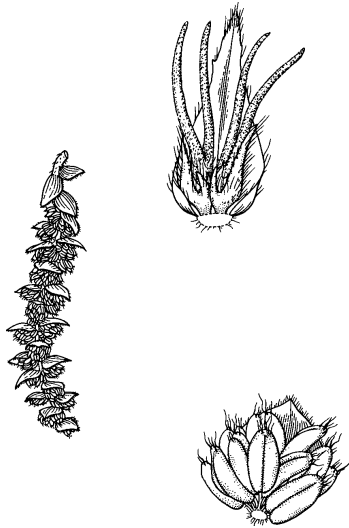


Betulaceae—birch family

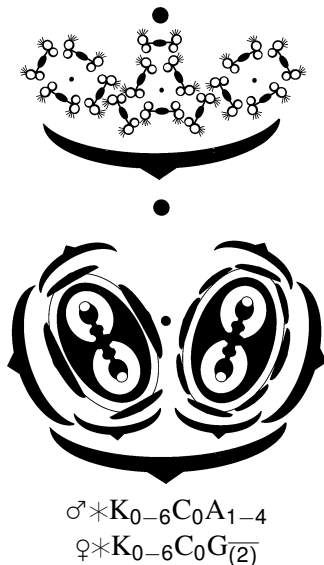
- ▶ \approx 150 species
- ▶ Distributed in Northern hemisphere, frequent from temperate to arctic regions
- ▶ Life forms: trees and shrubs with mycorrhizal roots
- ▶ Leaves alternate, simple, serrate, deciduous, with stipules
- ▶ Flowers in catkins or compact inflorescences, very reduced, unisexual, associated with bracts; perianth minute or absent, stamens 1–4
- ▶ Pistil bicarpellate, ovary inferior, ovules 2, one aborting
- ▶ Fruit a nut or nutlet, with subtended bracts, seeds with large embryo and almost no endosperm



Carpinus flowers and inflorescences



Betulaceae flowers and inflorescences



Representatives of Betulaceae

Importance: ornamental, wood, edible nuts (*Corylus*)

- ▶ *Corylus*—hazelnut (in subfamily Coryloideae: naked male flowers and female flowers with perianth)
- ▶ *Betula*—birch
- ▶ *Alnus*—alder



Cucurbitaceae, melon family

- ▶ \approx 900 species, mostly tropical and subtropical plants
- ▶ Prefer dry regions, important component of different deserts

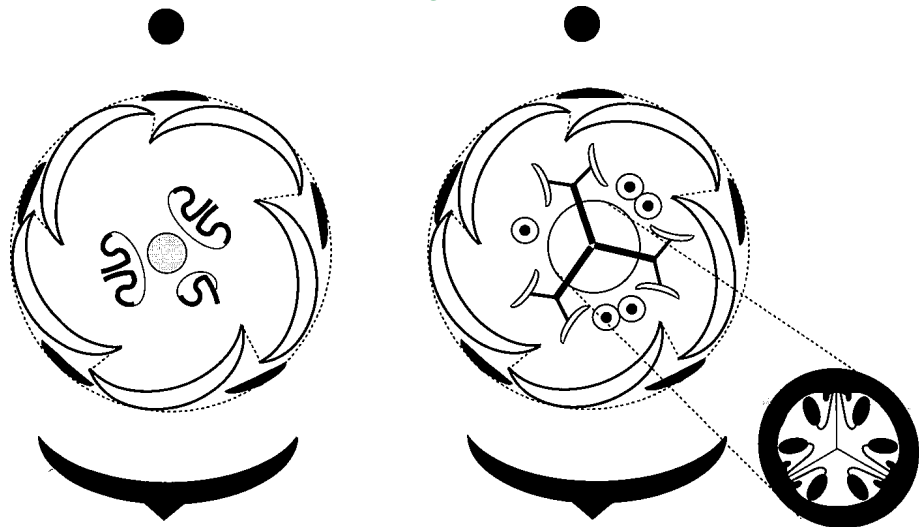


Morphology of Cucurbitaceae

- ▶ Hairy herbs or vines with tendrils (modified shoots)
- ▶ Vascular bundles bicollateral: phloem located on both sides of xylem
- ▶ Leaves alternate, without stipules, sometimes palmately dissected, with actinodromous venation
- ▶ Flowers unisexual, in raceme-like inflorescences
- ▶ Petals fused, form a tube
- ▶ Stamens usually fused
- ▶ Pistil with 3 carpels, ovary inferior (flower epigynous)
- ▶ Fruit is a berry



Cucurbitaceae flower diagram



$*K_{(5)}C_{(5)}A_{(3-5)}; *K_{(5)}C_{(5)}\overline{G_{(3)}}$



Representatives of Cucurbitaceae

- ▶ Many famous crops:
 - ▶ Pumpkin, squash—*Cucurbita*
 - ▶ Melon—*Melo*
 - ▶ Watermelon—*Citrullus*
 - ▶ Cucumber—*Cucumis*
 - ▶ Gourd—*Lagenaria*
- ▶ In North Dakota, invasive wild cucumber (*Echinocystis*) is a common plant now
- ▶ Exploding cucumber—*Ecballium* is a famous example of mechanical seed distribution
- ▶ *Hodgsonia* is one of the most attractive Cucurbitaceae



Wild watermelon, *Citrullus colocynthis*



Wild cucumber, *Echinocystis lobata* (near Minot)



Hodgsonia heteroclita, female plant



Rosanae and Celastranae superorders of Rosidae

Elaeagnaceae—Russian olive family

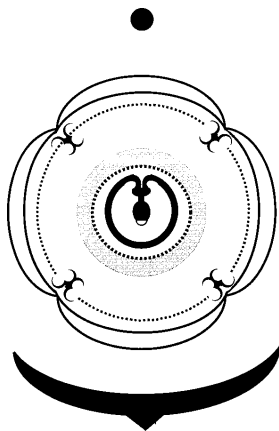


Elaeagnaceae—Russian olive family

- ▶ \approx 50 species
- ▶ Distributed in temperate and subtropical parts of Northern hemisphere
- ▶ Life forms: shrubs or small trees, often thorny, roots nodulated with nitrogen-fixing bacteria
- ▶ Leaves alternate or opposite, simple, entire, without stipules, with specific lepidote trichomes
- ▶ Flowers solitary or in inflorescences, 4-merous, without petals; 4 sepals attached to the hypanthium, stamens also 4.
- ▶ Pistil monomeric, with one basal ovule, ovary superior
- ▶ Fruit consists of dry achene inside of fleshy hypanthium



Elaeagnaceae flower



$$*K_{4-5}C_0A_{4-5}\underline{G_1}$$

Representatives of Elaeagnaceae

Importance: fruits are edible, *Hippophaë* is cultivated as berry plant

- ▶ *Elaeagnus*—Russian olive: we have *E. angustifolia*, Russian olive, and *E. argentea*, silverberry
- ▶ *Shepherdia*—buffaloberry, two species in ND: *Sh. argentea* and *Sh. canadensis*
- ▶ *Hippophaë*—sea-buckthorn



Hippophaë—sea-buckthorn



Rosanae and Celastranae superorders of Rosidae

Rosaceae—rose family



General features of Rosaceae

Rosaceae—rose family

- ▶ $\approx 3,000$ species
- ▶ Nearly cosmopolitan, but more common to temperate and subtropical regions of Northern Hemisphere
- ▶ Forest and meadow plants, do not prefer dry places

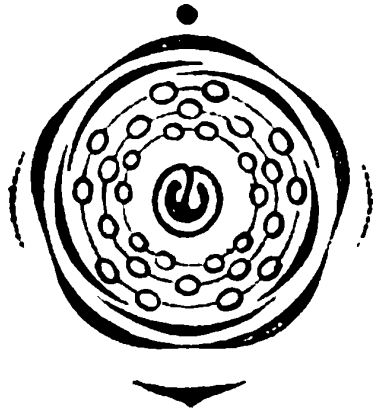
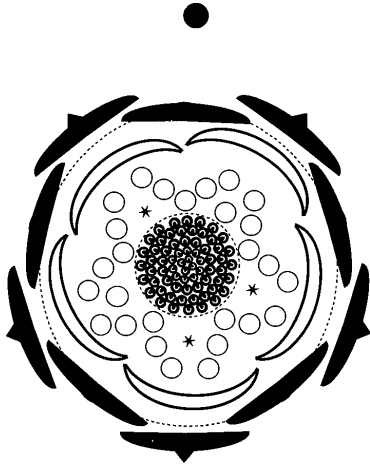


Morphology of Rosaceae

- ▶ Trees, shrubs and herbs
- ▶ Often accumulate cyanogenic compounds (contains $\text{—C} \equiv \text{N}$ group); some Rosaceae have nitrogen-fixing bacteria as symbionts
- ▶ Alternate, simple or dissected leaves with stipules
- ▶ Flowers with hypanthium; in Maloideae hypanthium fuses with pistils and produces inferior ovary
- ▶ Calyx with connected sepals, corolla with distinct petals
- ▶ Stamens numerous, typically in sets of 5 (or 10)
- ▶ Fruits diverse: multiple nuts/drupes in Rosoideae, multiple follicles or single drupes in Spiraeoideae, pomes in Maloideae
- ▶ Mature seeds without endosperm



Rosaceae flower: Rosoideae and Spiraeoideae



*K₅C₅A_{5-10-∞}G_{1-5-∞} ∨ G₍₃₋₅₎ (Maloideae)

Representatives of Rosaceae

Several subfamilies, each with economically important members:

- ▶ **Rosoideae** (multiple one-seeded fruits)
 - ▶ *Rosa*—rose
 - ▶ *Fragaria*—strawberry and close genus *Potentilla*—cinquefoil
 - ▶ *Rubus*—blackberry, raspberry
- ▶ **Spiraeoideae** (fruits—follicles of solitary drupes)
 - ▶ *Prunus*—cherry, peach, apricot, plum
 - ▶ *Spiraea*—meadowsweet, important component of prairies
- ▶ **Maloideae** (now often incuded in Spiraeoideae; have inferior ovary, fruits are pomes)
 - ▶ *Pyrus*—apple, pear
 - ▶ *Crataegus* (hawthorn), *Sorbus* (mountain ash), *Amelanchier* (serviceberry), *Aronia* (chokeberry) and others



Spiraea tomentosa, prairie plant



Aronia × *mitchurinii*



Spontaneous hybrid between American chokeberry and European
Sorbus aria



Potentilla fruticosa, shrubby cinquefoil



Rosanae and Celastranae superorders of Rosidae

Salicaceae—willow family



General features of Salicaceae

- ▶ ≈ 1010 species
- ▶ Distributed across all climatic zones, most genera are in tropics, most species in temperate regions
- ▶ Poplar (*Populus*) and willow (*Salix*) are important component of temperate riparian forests

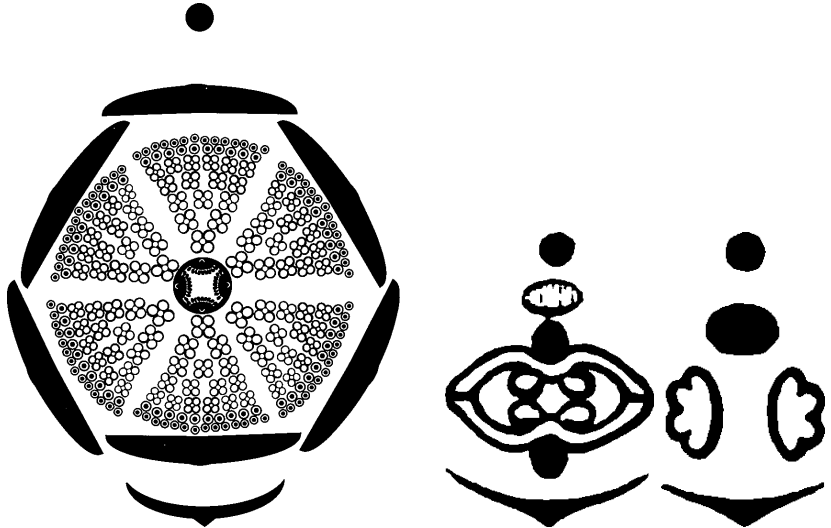


Morphology of Salicaceae

- ▶ Trees, usually with alternate simple leaves with stipules and salicoid teeth
- ▶ In many genera, flowers are more and more reduced—from flowers with numerous stamens and both sepals and petals to apetalous flowers with several stamens
- ▶ Flowers often have disk—flattened nectariferous structure
- ▶ Pistil of two carpels
- ▶ Fruit is a capsule
- ▶ Seeds often with hairs



Salicaceae: *Azara* and *Salix* (female, male)



$$*K_{0-6}C_{0-8}A_{2-\infty}\underline{G_{(2-4)}}$$

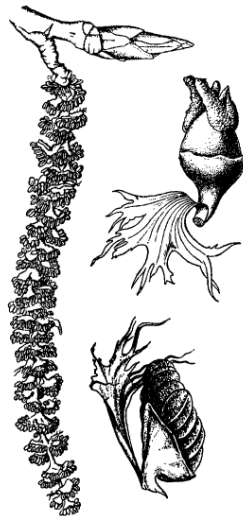
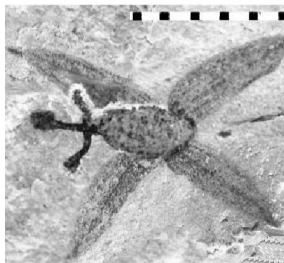
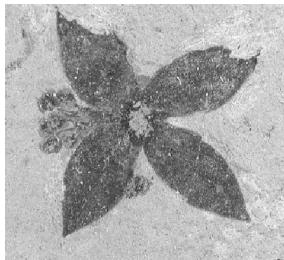


Representatives of Salicaceae

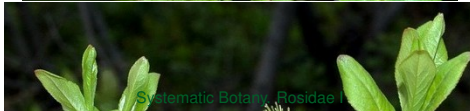
- ▶ Willow (*Salix*), almost 300 species of trees and shrubs, important component of Northern flora
 - ▶ Subgenus *Salix*
 - ▶ *S. amygdaloides*
 - ▶ *S. alba**
 - ▶ *S. babylonica**
 - ▶ *S. fragilis**
 - ▶ *S. lucida*
 - ▶ *S. serissima*
 - ▶ Subgenus *Longifoliae*
 - ▶ *S. exigua*
 - ▶ Subgenus *Chamaetia*
 - ▶ *S. pedicellaris*
 - ▶ Subgenus *Vetrix*
 - ▶ *S. cordata*
 - ▶ *S. eriocephala*
 - ▶ *S. lutea*
 - ▶ *S. discolor*
 - ▶ *S. humilis*
 - ▶ *S. bebbiana*
 - ▶ *S. candida*
- ▶ Poplar, or cottonwood (*Populus*) has ≈ 40 species. Cultivated as a wood source. Aspen (*Populus tremuloides*) is a main component of North Dakota forests.



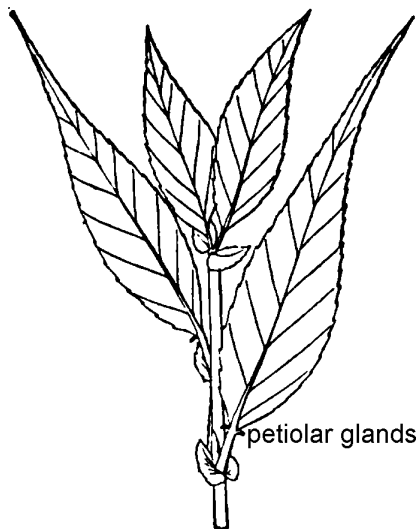
Salicaceae: salicoid teeth; fossil *Pseudosalix* and recent *Populus*



Salix hastata, female and male plants



Salix sp., petiolar glands



Aspen, *Populus tremuloides*



Azara flowers



Rosanae and Celastranae superorders of Rosidae Euphorbiaceae—spurge family

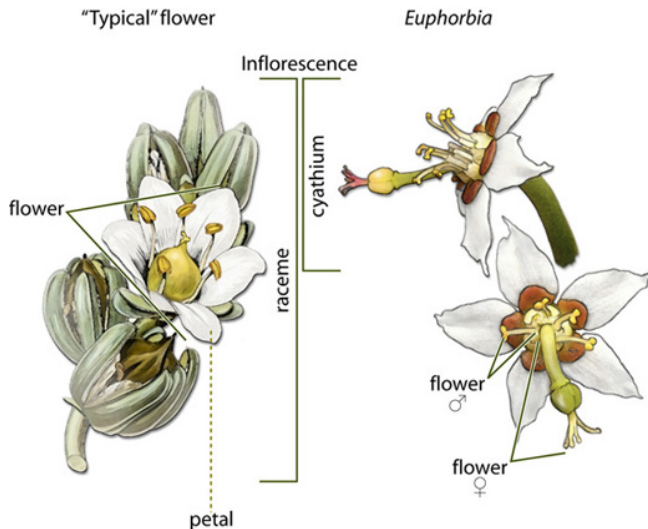


General features of *Chamaesyce*

- ▶ Sometimes, treated as *Euphorbia*
- ▶ Inflorescences are cyathia, small and flower-like



Typical flower vs. cyathium



Other Rosanae/Celastranae

- ▶ Rosales
 - ▶ Urticaceae: *Urtica* (nettle) *etc.*
 - ▶ ... and other smaller families
- ▶ ... and several other orders



For Further Reading



A. Shipunov.

Shipunov, A. Plants of North Dakota. Manual.

2017—onwards.

Mode of access: http://ashipunov.info/shipunov/school/biol_448/nd_manual/nd_manual.pdf



A. Shipunov.

Shipunov, A. Flora of North Dakota: Checklist. Version 2. Ed.: Kartesz, J., and Nishino, M.

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Mode of access: <http://ashipunov.info/shipunov/fnddb2>



Minot State University Herbarium (MSU)



Flora of Great Plains.

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University Press of Kansas, Lawrence, KS.

