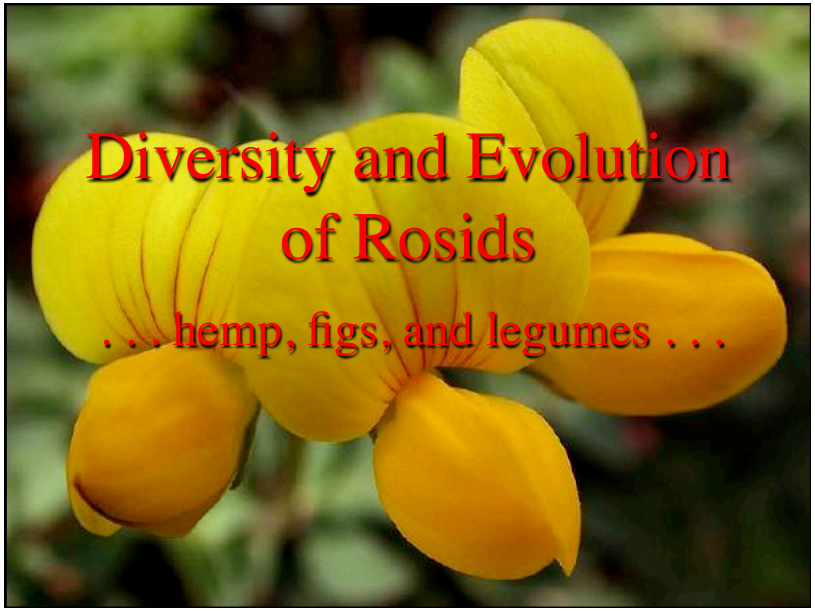
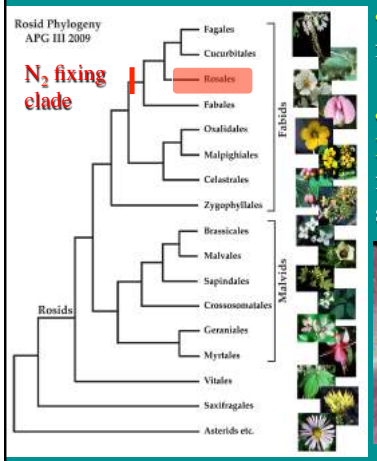



## *Rosales – the rest




- Rosaceae is sister to all other families of the order
- tendencies in rest of the order to loss of petals and shift to unisexual flowers with wind pollination or specialized insect pollination



## Rhamnaceae - buckthorns

52 genera 925 species of trees and shrubs in the tropics and temperate areas

- many of our species are armed with thorns
- leaves are simple and alternate or opposite, often with arcuate venation (arcing along the edge), and serrated edges

*Rhamnus cathartica* - European or common buckthorn [invasive]

## Rhamnaceae - buckthorns

CA 4,5 CO 4,5 A 4,5 G (3)

- flowers 4 or 5 merous (4 merous shown in common buckthorn)
- stamens opposite the petals - unusual in flowering plants!

*Rhamnus cathartica* - European or common buckthorn

# Elaeagnaceae - Russian olive

3 genera 45 species of trees and shrubs largely in north temperate areas

*Elaeagnus angustifolia* - Russian olive

- $N_2$-fixing small trees and shrubs easily recognized by silvery or reddish glandular hairs covering bottom leaves and/or stems

# Elaeagnaceae - Russian olive

3 genera 45 species of trees and shrubs largely in north temperate areas

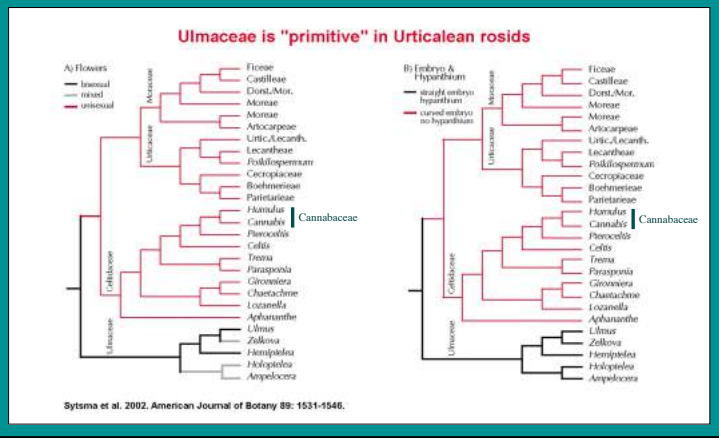
*Elaeagnus angustifolia* - Russian olive

- 4 merous flowers and berry fruits

*Shepherdia* - buffalo berry

# Rosales - Urticalean Families

The remainder of the Rosales show the transition to reduced, unisexual flowers and one-seeded fruits - "Urticales"




# *Ulmaceae - elms

6 genera 35 species of North Temperate trees

- best known for the American elm with its distinctive vase shaped growth form. Dutch Elm disease, caused by the fungus *Ceratostomella umli*, has destroyed most large adults.

*Ulmus americana* - American elm

# *Ulmaceae - elms

*Ulmus americana* - American elm

*Zelkova serrata* - European

• leaves are distichously arranged - 2 ranks in one plane - and pinnately veined; leaf bases are strongly asymmetric

# *Ulmaceae - elms

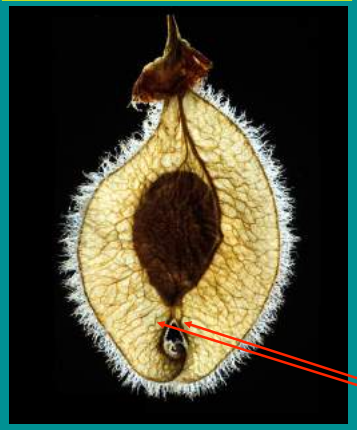
CA 4-8 CO 0 A 4-8 G (2)

• flowers are bisexual but reduced and wind pollinated; they appear before the leaves

*Ulmus americana* - American elm

# *Ulmaceae - elms

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



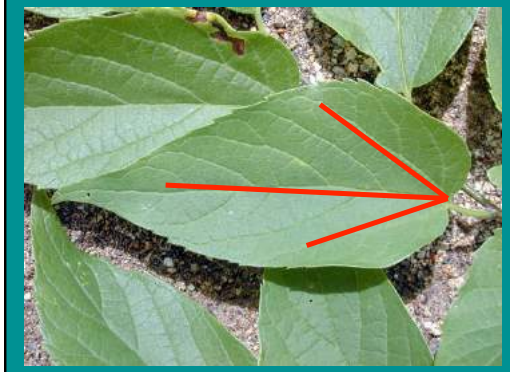
• pistil is made of two fused carpels but only one seed matures; fruit is a samara - a winged achene in this case

*Ulmus americana* - American elm

Note 2 styles on samara

# Cannabaceae - hackberry, hops

• *Celtis* (hackberries ) and relatives are tropical and temperate small trees with unisexual flowers



• leaves are strongly palmi-pinnate - with 3 main veins at base

• this leaf features defines all the other remaining urticalean families

*Celtis occidentalis* - hackberry

# Cannabaceae - hackberry, hops

*Celtis occidentalis* - hackberry

- note distinctive warty bark
- fruit is a one-seeded drupe

# Cannabaceae - hackberry, hops

*Cannabis sativa*
Hemp, marijuana

- *Cannabis* with one species is a coarse herb native to Eurasia
- two subspecies are recognized: one the source of the drug Δ9 tetrahydrocannibol (THC) and the other the source of hemp fiber/oil

hemp rope

manila rope

# Cannabaceae - hackberry, hops

- *Cannabis* is either dioecious or monoecious

*Cannabis sativa*
Hemp, marijuana

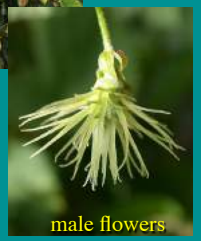
Female inflorescence
Seeds 1-seeded

Male inflorescence

# Cannabaceae - hackberry, hops

- *Humulus* has two viney hop species: one is the source of lupulin used in the brewing industry

*Humulus lupulus*
American hops



male flowers

female flowers

# Urticaceae - nettles

54 genera, 2600 species - largely a tropical family of herbs, shrubs, or treelets

• leaves have palmi -pinnate venation; either alternate or opposite


*Touchardia (Hawaii)*


*Pilea (Wisconsin)*

# Urticaceae - nettles

54 genera, 2600 species - largely a tropical family of herbs, shrubs, or treelets


*Urtica* - stinging nettle


*Urera baccifera*

• some species are a source of irritants found in specialized hair-like cells on stems and leaves

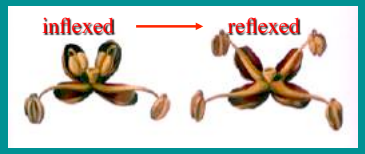
# Urticaceae - nettles

54 genera, 2600 species - largely a tropical family of herbs, shrubs, or treelets


*Urtica* - stinging nettle

• flowers are reduced, unisexual, congested, wind-pollinated, and form one-seeded drupelets

• stamens have a peculiar elastic spring-like mechanism that flings pollen further out from the plant




# Urticaceae - nettles

*Urtica dioica* - stinging nettle
[opposite leaves, stinging]

*Laportea canadensis* - wood nettle
[alternate leaves, stinging]

# Urticaceae - nettles


*Boehmeria cylindrica*
false nettle

*Parietaria pensylvanica*
pellitory

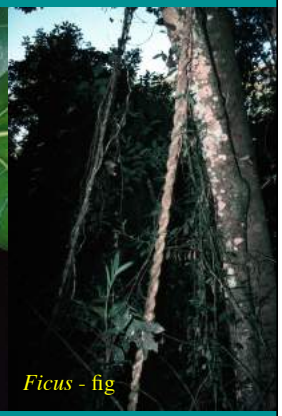
*Pilea pumila*
clearweed

# *Moraceae - mulberry, fig

Large tropical family of 38 genera, 1100 species of trees or vines

*Morus* - mulberry

*Ficus* - fig



*Ficus* - fig

# *Moraceae - mulberry, fig

Large tropical family of 38 genera, 1100 species of trees or vines

*Morus* - mulberry

*Ficus* - fig

- sister family to the nettle family
- latex system well-developed
- leaves are alternate, strongly palmi-pinnately veined

# *Moraceae - mulberry, fig

CA 4 CO 0 A 4 G (2)

- flowers reduced, unisexual, no petals, single seeded ovary

*Morus alba* - white mulberry [left - female ; right - male]

# *Moraceae - mulberry, fig

*Morus rubra* - red mulberry

• single seeded fruits from many flowers coalesce to form one fleshy, multiple fruit [e.g., mulberry, fig, breadfruit]

# *Moraceae - mulberry, fig

*Maclura pomifera* - osage orange

Osage orange is not native but often seen escaped; note the large grapefruit sized multiple fruit

Osage orange multiple fruits rolling down to University Avenue behind Birge Greenhouses

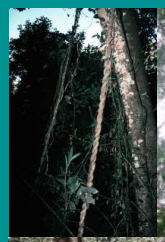
# *Moraceae - mulberry, fig

*Maclura pomifera* - osage orange

Osage orange is not native but often seen escaped; note the large grapefruit sized multiple fruit

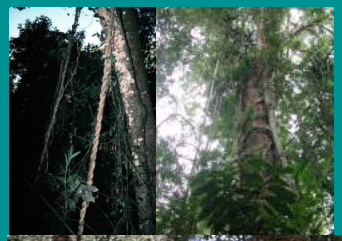
Cross section of multiple fruit showing individual one-seeded fruitlets

# *Moraceae - mulberry, fig



*Ficus* (figs) represent 750 of the 1100 species

# *Moraceae - mulberry, fig

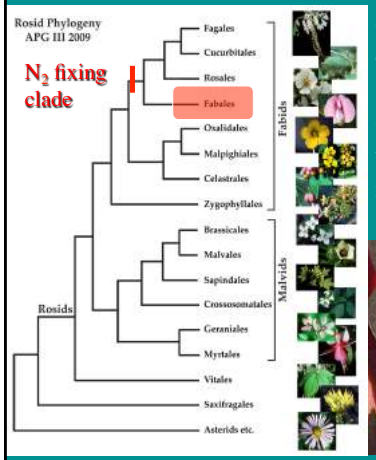




*Ficus* (figs) represent 750 of the 1100 species

• the fig (multiple) fruit or syconium is a "key innovation" for fig species radiation


# Fabales




• Fabales is an order in the Eurosid I or fabid lineage of Rosids ($N_2$ fixing)

• contains 4 families, but Fabaceae - the legumes - comprise the vast majority of the 20,000+ species


Fabaceae


Polygalaceae

# *Fabaceae - legumes

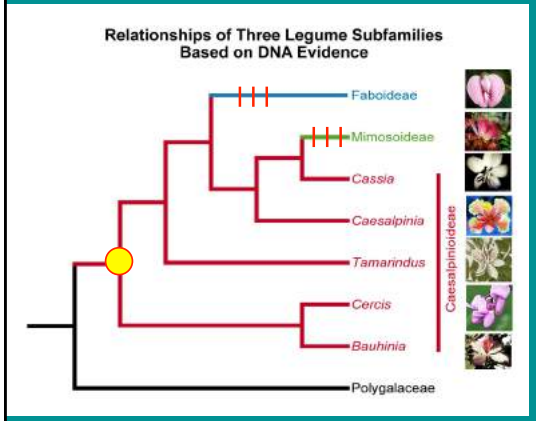
• 730 genera, 19,400 species of herbs, shrubs, and trees that produce specialized follicles - legumes - that open along two lines of dehiscence

• Fabaceae = Leguminosae

• worldwide, $N_2$ (*Rhizobium*) fixers

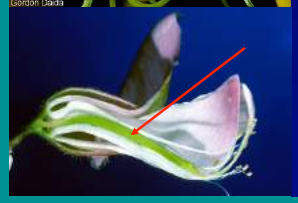
# *Fabaceae - legumes

3 subfamilies previously recognized




- faboid (beans, peas) and mimisoid (acacia, mimosa) legumes are highly modified
- but descended from the common ancestor of caesalpinoids

# *Fabaceae - legumes

Three major characteristics

1. Monocarpic - single superior carpel

# *Fabaceae - legumes

Three major characteristics

2. Legume - follicle but with 2 lines of suture

# *Fabaceae - legumes

Three major characteristics

2. Legume - or modified as one-seeded fruitlets (loments, articles)

# *Fabaceae - legumes


Three major characteristics

3. Alternate, compound leaves - (rarely simple)




# *Caesalpinoid legumes

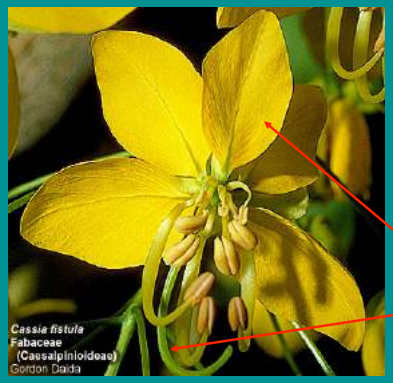
*Bauhinia*

Caesalpinoid legumes form a paraphyletic grade at base of family - the tropical *Bauhinia* is one of the first

*Caesalpinia*

# *Caesalpinoid legumes

CA 5 CO 5 A 10 G 1




- flowers 5 merous with 10 unequal stamens
- topmost petal = banner sits in front of the 2 lateral or wing petals

banner

carpel

# *Caesalpinoid legumes

*Senna marilandica* - southern wild senna

# *Caesalpinoid legumes

*Cercis canadensis* - eastern redbud

# *Caesalpinoid legumes

*Gleditsia triacanthos* - honey locust

*Gymnocladus dioica*
Kentucky coffee tree
[dioecious!]

# *Mimosoid legumes

*Calliandra*

Mimosoid legumes are tropical or subtropical shrubs and trees, often with doubly compound leaves - large genera are taxonomically messy

*Inga*

# *Mimosoid legumes

*Calliandra*

CA (5) CO (5) A (∞) G 1

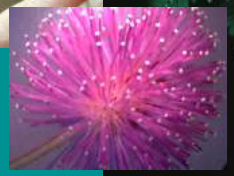
*Albizzia*

- flowers small, but in showy "powder puff" inflorescences
- calyx, corolla, and numerous stamens each show connation

# *Mimosoid legumes

*Mimosa* - 500 species of shrubs and herbs

*Mimosa pudica*
sensitive plant



# *Mimosoid legumes

*Acacia* - giant genus of 1/3 of mimosoid species

- arid species show phyllode leaves = petiole?
- modified stipules for *Azteca* ants
- extrafloral nectaries and Beltian bodies for ants

*Acacia cyclops*

# *Faboid legumes

CA (5) CO 3+(2) A (9)+1 G 1

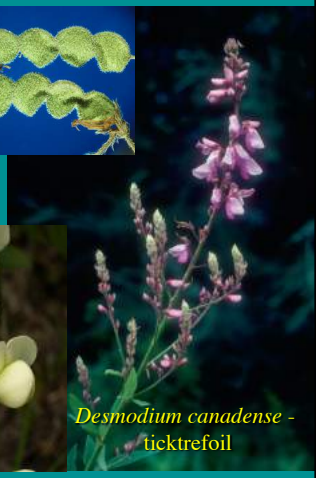
banner petal 2 keel petals 2 wing petals

- calyx often fused
- banner petal behind lateral (wing) petals
- bottom keel petals often fused
- stamens diadelphous = 9 fused + 1 separate

Diadelphous

# *Faboid legumes

*Apios americana* - groundnut



*Baptisia bracteata* - creamy wild indigo

*Desmodium canadense* - ticktrefoil

# *Faboid legumes

*Lathyrus japonicus* - beach pea

*Lupinus perennis* -
lupine, blue bonnet

# *Faboid legumes

*Robinia pseudo-acacia* - black locust

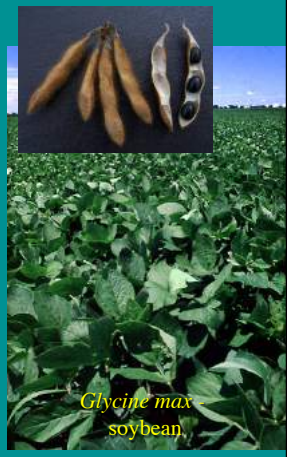
- native to further south, but invasive in Great Lakes region

# *Faboid legumes

- three important legume crops

*Pisum sativum* -
pea

*Phaseolus vulgaris* -
common bean



*Glycine max*
soybean

# *Faboid legumes

- three important "clover" or "alfalfa" species from Eurasia - now naturalized

*Melilotus alba*
White sweet clover

*Trifolium pratense*
red clover

*Medicago sativa*
alfalfa

# *Faboid legumes

*Coronilla varia* - crown vetch

- other Eurasian species brought in for soil stabilization - and now naturalized

*Lotus corniculata* - bird's foot trefoil