

## Cucurbitales

- previously recognized group of 7 families (some N<sub>2</sub> fixers)
- palmate leaves, cucurbitoid teeth, imperfect flowers, parietal placentation

Rosid Phylogeny  
APG III 2009

**N<sub>2</sub> fixing clade**

Cucurbitaceae

Begoniaceae

Datisceae

## Cucurbitaceae - melons

Mainly tropical and subtropical family of 118 genera, 845 species of **herbaceous or woody vines with tendrils** (modified inflorescences)

*Gurania* in Panama

*Cucumis* in Wisconsin

## Cucurbitaceae - melons

- flowers **unisexual** and plants dioecious or monoecious

Male flower

- fusion of perianth (Asterid-like!); stamens are weird, female flower is **epigynous**

Female flower

## Cucurbitaceae - melons



Female flower

Fruit is a berry with leathery rind = \*pepo (pumpkin, melon, pickle, gourd)

## Cucurbitaceae - melons



*Echinocystis lobata*  
wild cucumber



Note the many small male flowers and few female flowers going into fruit and spiny pepo

## Cucurbitaceae - melons

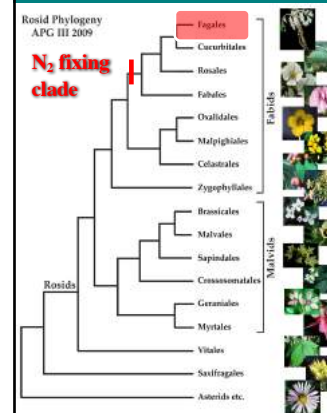


*Sicyos angulata* - bur cucumber



Small "burred" cucumber or pickle-like fruits can be seen on bottom right

## \*Fagales



• core "Amentiferae" of Engler & Prantl and subclass "Hamamelidae" of Cronquist - wind pollinated

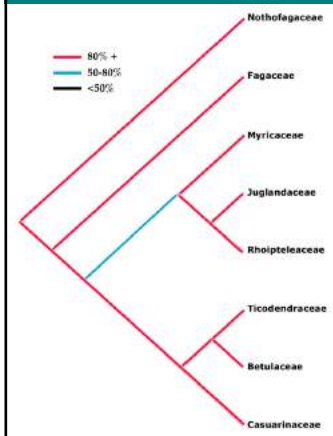
• trees with **unisexual** flowers in **aments/catkins**

• **inferior G** (2-3)

• **nut** - bony 1-seeded



## \*Fagales



**Nothofagaceae** - southern beeches - are sister to all others



## \*Fagaceae - beeches

- North Temperate family of 7 genera, 670 species (1/2 are oaks)
- **simple leaves** and nut enclosed by **subtending bracts**



*Fagus* - beech



*Castanea* - chestnut



*Quercus* - oak

## \*Fagaceae - beeches

- *Fagus* (beech) is characteristic of mesic forests in north temperate deciduous forests
- easy to recognize with **gray bark**
- 2 pistillate flowers (2 nuts) surrounded by **one set of bracts**



*Fagus grandifolia* - American beech



*Fagus sylvatica* - Europe



*Fagus grandifolia* - N. America

## \*Fagaceae - oaks

- *Quercus*, the oaks, have bracts below female flower that coalesce into a woody cup of the **acorn** fruit (nut)
- hybridizing group and taxonomically challenging



## \*Fagaceae - oaks

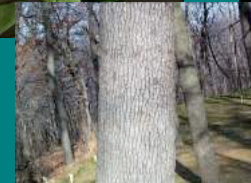


- **White oaks** - rounded leaf lobes, thinner walled xylem of summer wood, fruit matures in 1 yr
- **Red oaks** - bristle tipped leaf lobes, thicker xylem, fruit matures in 2 yrs



## \*Fagaceae - oaks

**White oak** - Alleghenian species typical of more mesic woodlands in Wisconsin



*Quercus alba* - white oak

## \*Fagaceae - oaks

**Bur oak** - Ozarkian element species of xeric oak woodlands and oak savannas



*Quercus macrocarpa* - bur oak

## \*Fagaceae - oaks

**Red oak** - more mesic member of the red oak group; black oak, hill's oak are more xeric tolerant



*Quercus rubra* - red oak

## \*Fagaceae - chestnuts



- *Castanea*, the chestnuts, have 2 female flowers per spiny involucre



## \*Fagaceae - chestnuts



*Castanea dentata* - American chestnut original distribution



American chestnuts Massachusetts in late 1800s prior to 1904 chestnut blight



Japanese chestnut in Connecticut - resistant

## \*Juglandaceae - walnuts

Well known tree family containing walnuts, hickories, and pecans  
10 genera and 50 species are divided into two subfamilies

*Engelhardia*



*Juglans*



## \*Juglandaceae - walnuts




*Juglans cinera*  
Butternut, white walnut

- Leaves **pinnately compound**, alternate
- Leaves often **aromatic** from resinous peltate glands; **allelopathic**



*Carya ovata*  
shagbark hickory

## \*Juglandaceae - walnuts



- Trees are **monoecious**
- **Wind pollinated** features


Female flower

Male inflorescence


*Juglans nigra* - Black walnut

## \*Juglandaceae - walnuts

CA 3-6 CO 0 A 3-∞ G 0




- male flowers apetalous and arranged in pendulous catkins or aments on older stems
- calyx small; each flower bracted




*Juglans regia*  
English walnut

## \*Juglandaceae - walnuts

CA 4 CO 0 A 0 G (2)





- female flowers apetalous and in a small group on this year's new growth
- calyx small, persistent, often fused to **involucral bracts**; 2 stigma feathery





*Juglans nigra*  
Black walnut

## \*Juglandaceae - walnuts

- fruit a **nut** - single ovule fused to ovary wall
- surrounded often by **persistant involucral bracts** which can become fleshy; thus sometimes mistakenly called a "drupe"

*Juglans cinera*  
Butternut, white walnut

*Juglans nigra*  
Black walnut

## \*Juglandaceae - walnuts



- **black walnut**: one of the most prized of all lumber trees for fine furniture



*Juglans nigra* - black walnut

## \*Juglandaceae - hickories



- **shagbark hickory**: common tree of more mesic to xeric forests over much of North America - oak/hickory forests



*Carya ovata* - shagbark hickory

## \*Betulaceae - birches



North Temperate family of 6 genera and 110 species of shrubs to trees - birches and alders



## \*Betulaceae - birches

Female inflorescence



Male inflorescence

- both female and male (drooping) inflorescences are **in aments**/catkins
- flowers possess **no perianth**
- fruit a small nut or 1 seeded samara, subtended by **3-lobed bract**



*Betula papyrifera* - paper birch

## \*Betulaceae - birches



*Betula papyrifera* -  
paper birch



*Betula allegheniensis*  
yellow birch

## \*Betulaceae - birches



*Corylus americana*  
Hazelnut, filbert



*Ostrya virginiana* - eastern  
hop hornbeam, ironwood



*Alnus*, the alders



## Myricaceae - sweet gale



*Myrica gale* - sweet gale

- Small family 3 genera that fix atmospheric nitrogen

- Dioecious shrubs or subshrubs with sweet aromatic smell



*Comptonia peregrina* - sweet fern

## Casuarinaceae



*Casuarina* -  
evergreen with  
equisetoid leaves

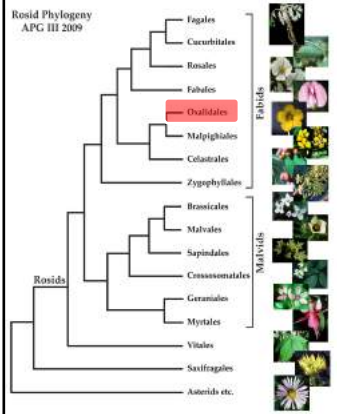


- small family of 100 species - the she oaks of Australia





## Oxalidales



- small, heterogeneous, novel group of 6 families - seed character?



## Oxalidaceae - wood sorrels

6 genera, 770 species in the tropics and temperate areas - 700 belong to *Oxalis* (wood sorrel)



## Oxalidaceae - wood sorrels

6 genera, 770 species in the tropics and temperate areas - 700 belong to *Oxalis* (wood sorrel)



- typically 3-foliolate leaves (the real shamrock)
- leaves are acidic to taste due to oxalic acid in the form of calcium oxalate

## Oxalidaceae - wood sorrels

CA 5 CO 5 A 5+5 G (5)



## Oxalidaceae - wood sorrels

CA 5 CO 5 A 5+5 G (5)

*Oxalis corniculata*



*Oxalis*



- 5 merous flowers
- fruits are 5 locular & winged capsules or berries
- **tristyly** common (3 levels at which 2 sets of anthers and 1 set of styles position)



## Oxalidaceae - wood sorrels

- common native and introduced wood-sorrels

*Oxalis stricta* - tall wood-sorrel



*Oxalis acetosella* - wood-sorrel



*Oxalis violaceae* - violet wood-sorrel



## Oxalidaceae - wood sorrels

- tropical fruit - carambola or star fruit: note 5 carpellate structure

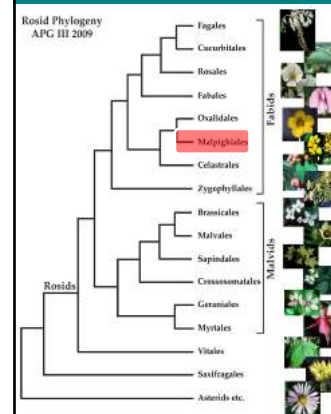


*Averrhoa carambola*



## \*Malpighiales

- large and diverse group of 39 families - many of them contributing importantly to tropical forest diversity



## \*Malpighiales

- “novel” clade – unusual life forms

Rhizophoraceae  
*Rhizophora mangle*  
mangrove

stream aquatic  
Podostemonaceae  
*Podostemon*

Rafflesiaceae  
*Rafflesia* parasite



## \*Malpighiales

- “novel” clade
- leaf margin teeth
- “Parietales” subclade (placentation)
- hosts for *Cymothoe* butterflies



## \*Violaceae - violets

23 genera, 800 species of herbs (temperate) to vines and small trees (tropics). 400-600 of them are violets (*Viola*).



*Viola tricolor* - pansy, jonny-jump-up



*Rinorea* - tropical shrub

## \*Violaceae - violets

*Viola* have either basal leaves or cauline leaves - cordate or palmately lobed or divided.

Stipules are well developed.



## \*Violaceae - violets

CA 5 COZ 5 A 5 G (3)



- Flowers insect pollinated, nectar guides, **zygomorphic**

- Perianth 5 merous

- Lower **petal spurred**, 2 lower stamens have spurs going back into the petal spur

- 3 fused carpels



## \*Violaceae - violets

CA 5 COZ 5 A 5 G (3)



Pistil forms 3 parting capsule in **chasmogamous** flowers (open flowers) from out-crossing



**Cleistogamous**, or closed flowers, form small capsules via self-pollination (note the **parietal placentation** in upper capsule)

## \*Violaceae - violets



*Viola affinis* - sand violet



*V. pedatifida*  
Prairie violet



*V. pedata*  
Bird's-foot violet

## \*Violaceae - violets

*V. sororia* - dooryard violet

Wisconsin state flower! One of many stemless purple violets



*School children on Arbor Day, 1908, voted this violet in as the state flower. It was a very close vote – find one other (of 3) species that lost out.*

## \*Violaceae - violets



*V. pubescens* - downy yellow violet  
a stemmed yellow violet



*V. canadensis* - Canada white violet  
a stemmed white violet

## \*Violaceae - violets

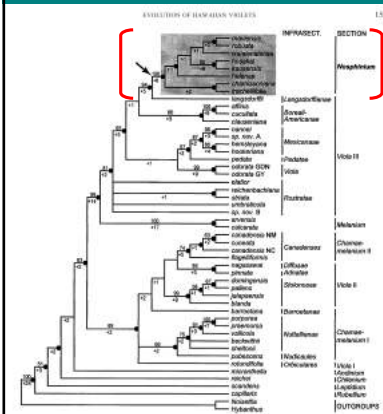


- tropical taxa of other genera and *Viola* are woody
- from where did the 10 species in Hawaii come?



*Viola chamissoniana*  
var. *robusta*  
Violaceae  
© G. D. Carr

## \*Violaceae - violets



- DNA places them **within** a polyploid complex, amph-Beringian tundra species

*V. langsdorffii*



## \*Violaceae - violets



- Beringian source is rare, especially surprising with a group once considered tropical



- bird migration pathway from Beringia to Hawaii is common and potential mechanism of dispersal



## Hypericaceae - St. John's wort

9 genera, 560 species of temperate herbs or small shrubs



- opposite leaved
- leaves are **punctate** - with clearly visible clear to black dots, these sometimes seen on petals as well

## Hypericaceae - St. John's wort

9 genera, 560 species of temperate herbs or small shrubs



"The little holes where of the leaves of Saint Johns wort are full, does resemble all the pores of the skin and therefore it is profitable for all hurts and wounds that can happen thereunto."

Herbalist William Coles (17th century)  
– **Doctrine of Signatures**

**hyperforin** and **hypericin**

## Hypericaceae - St. John's wort

CA 5 CO 5 A ∞ G (3-5) Stamens many, often grouped



*Hypericum perforatum* - Klamath weed [ecologically invasive]  
Note the perforations along edge of yellow petals

## Hypericaceae - St. John's wort

CA 5 CO 5 A ∞ G (3-5) • pistil made up of 3 to 5 fused carpels



*Hypericum pyramidalum*  
great St. John's wort



- placentation either axile (then 3-5 locules) or parietal (as here)

## Hypericaceae - St. John's wort

CA 5 CO 5 A ∞ G (3-5)

- pistil made up of 3 to 5 fused carpels

- placentation either axile (then 3-5 locules) or parietal



*Hypericum pyramidalatum*  
great St. John's wort



- fruit a capsule

## Hypericaceae - St. John's wort

- *Hypericum* common in high elevation regions of tropics



*Hypericum* in Costa Rican paramo

- *Triadenum* restricted to wetlands



*Triadenum virginicum*  
marsh St. John's wort