

# Introduction to Botany. Lecture 38

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December 5, 2011

# Outline

## 1 Questions and answers

## 2 Rosidae, or rosids

- Rosaceae—rose family
- Leguminosae, or Fabaceae—legume family
- Cruciferae, or Brassicaceae—cabbage family

# Outline

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## Previous final question: the answer

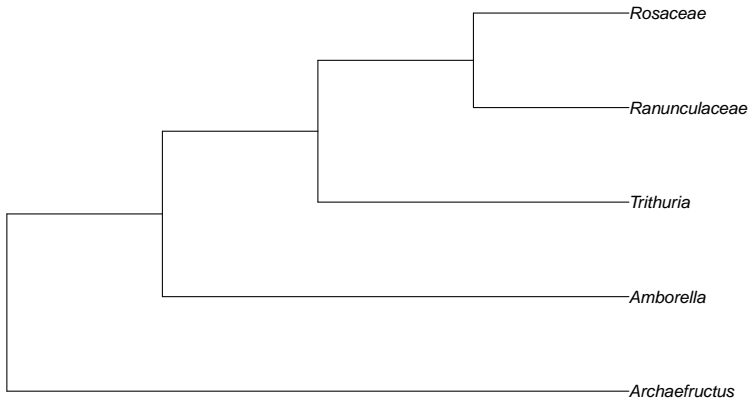
Why magnoliids are most primitive among flowering plants?

## Previous final question: the answer

Why magnoliids are most primitive among flowering plants?

- They still possess many less advanced characters like:  
multiple an unstable number of flower parts, free pistils,  
stylar canal, loosely and strangely arranged organs

# Phylogeny of angiosperms so far



# Plan of family characteristic

- Meta-information: name, position in classification, number of species, distribution
- Ecological preferences
- Morphology and anatomy of stem, leaf and root
- Generative organs from inflorescence to fruit, including flower diagrams and formulae
- Seed
- Representatives and their importance

# Rosidae, or rosids

## Rosaceae—rose family



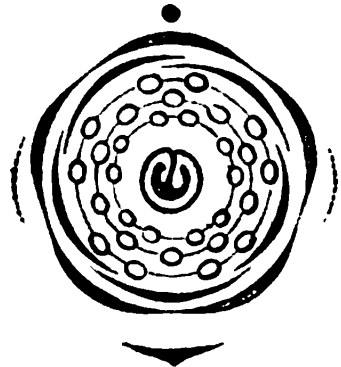
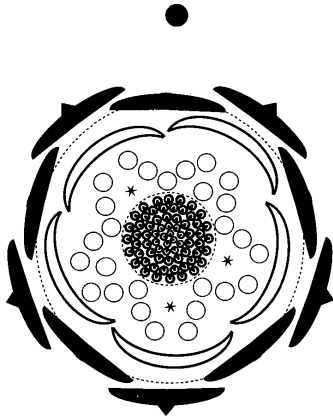
# Rosaceae

- $\approx 3,000$  species
- Nearly cosmopolitan, but more common to temperate and subtropical regions of Northern Hemisphere
- Forest and meadow plants, do not prefer dry places
- Compound or simple leaves with *stipules*
- Subfamilies (formulae simplified):
  - Rosoideae (rose, strawberry, raspberry):  $*K_5C_5A_\infty G_{\infty}$
  - Spiraeoideae (spiraea, cherry, plum):  $*K_5C_5A_\infty G_1$
  - Maloideae (apple, pear, hawthorn):  $*K_5C_5A_\infty G_{(5)}$

# 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



\*K<sub>5</sub>C<sub>5</sub>A<sub>5-10-∞</sub>G<sub>1-5-∞</sub> ∨ G<sub>(3-5)</sub> (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 inculed 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



# Rosidae, or rosids

## Leguminosae, or Fabaceae—legume family



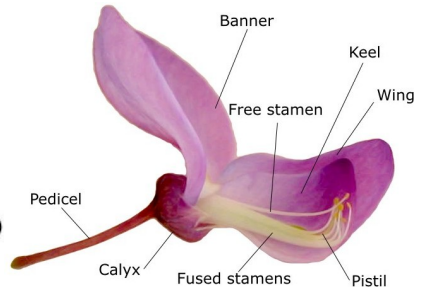
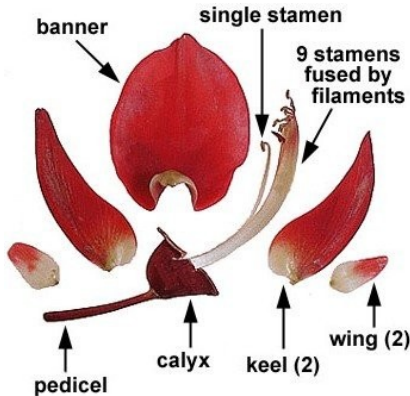
# General features of Leguminosae

- 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

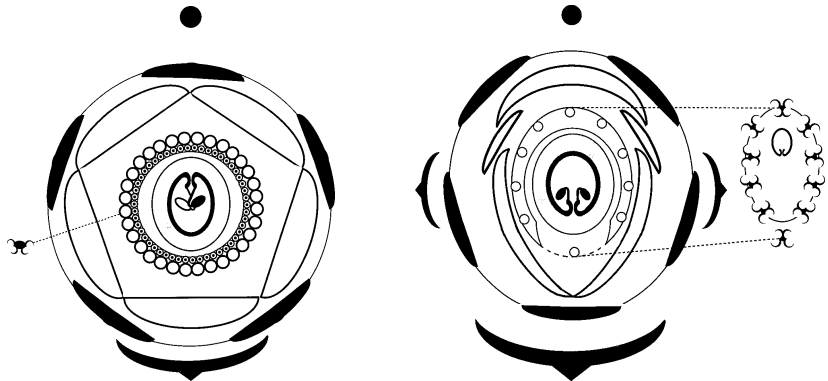
# Morphology of Leguminosae

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

# Representatives of Leguminosae

- **Mimosoideae:** stamens numerous, petals connected
  - *Acacia*—dominant tree of African and Australian savannas, often with phyllodes
  - *Mimosa*—sensitive plant
- **Papilionoideae:** stamens 9+1, petals free; this subfamily contains many extremely important food plants with high protein value
  - *Glycine*—soybean
  - *Arachis*—peanut with self-buried fruits
  - *Phaseolus*—bean
  - *Pisum*—pea

# Phyllodes of Australian *Acacia glaucoptera*



## *Mimosa pudica* before touch



## *Mimosa pudica* after touch





# *Glycine max*, soybean



# *Arachis hypogaea*, peanut



# Rosidae, or rosids

## Cruciferae, or Brassicaceae—cabbage family

# General features of Cruciferae

- $\approx 3,000$  species
- Found mostly in temperate regions, especially in dry climates
- The core part is extremely uniform, both morphologically and ecologically

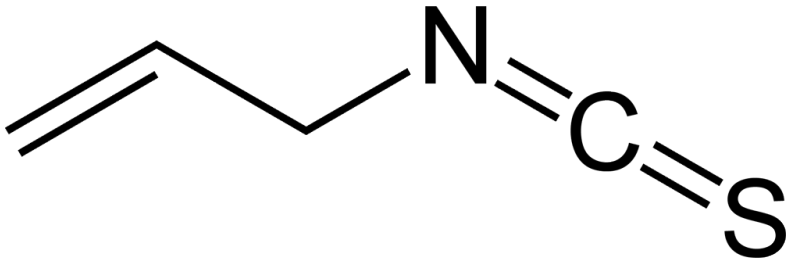
## Morphology of core Cruciferae

- Herbs, often hairy, contain mustard oils (similar to other families of alliance like Caricaceae, papaya family)
- Leaves simple, often dissected, alternate, without stipules
- Flowers dimerous, in racemes
- 4 sepals, 4 petals, ancestrally also 4 stamens but inner stamens split each in two = 6 stamens in total
- Pistil has two carpels
- Fruit is a silique: dehiscent, with two cameras and replum bearing seeds
- Mature seeds with small amount of endosperm

# Mustard oils

- Derivarives of allyl isothiocyanate
- Anti-herbivore chemical, stored in glucosinolate form and released by myrosinase when cells are broken
- Toxic, strong lachrymator, stimulates nasal and eye receptors

# Allyl isothiocyanate



# Summary

- Among three listed families, Rosaceae and Leguminosae are closer relatives (representatives of “nitrogen-fixing alliance”)
- Cruciferae is a representative of “mustard-oil containing families”, the other alliance



## Final question (2 points)

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How to distinguish Rosaceae and Leguminosae?

## For Further Reading



J. E. Bidlack, Sh. H. Jansky.  
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Thomson Brooks/Cole, 2006.  
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