

# Introduction to Botany. Lecture 39

Alexey Shipunov

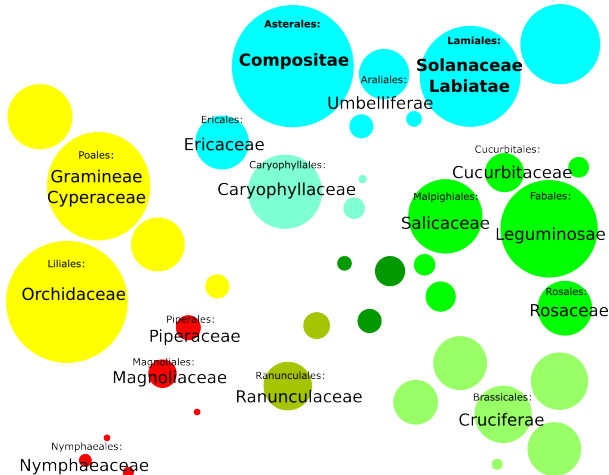
Minot State University

December 10th, 2010

# Outline

- 1 Asteridae, or asterids (Part II)
  - Solanaceae—potato family
  - Labiatae—mint family
  - Compositae, or Asteraceae—aster family

# 18 families of angiosperms



## List of families (Part I)

### ■ Magnoliidae

- 1 Nymphaeaceae—water-lily family
- 2 Magnoliaceae—magnolia family
- 3 Piperaceae—pepper family

### ■ Liliidae

- 1 Orchidaceae—orchid family
- 2 Cyperaceae—sedge family
- 3 Gramineae, or Poaceae—grass family

### ■ Rosidae

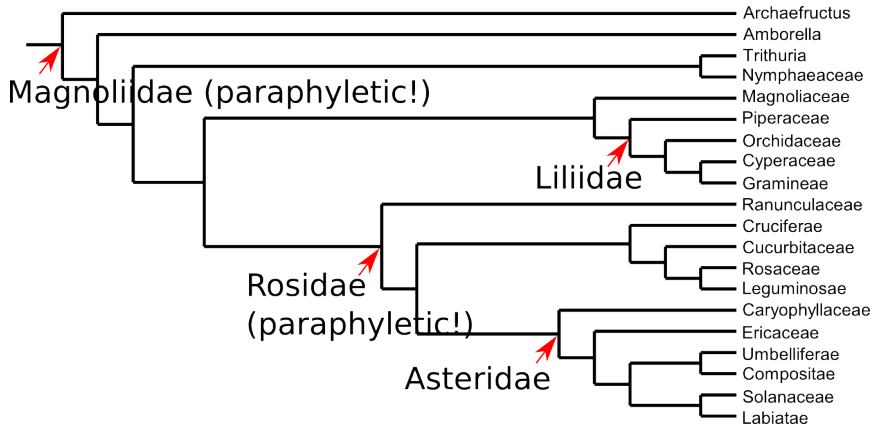
- 1 Ranunculaceae—buttercup family
- 2 Salicaceae—willow family
- 3 Cucurbitaceae—melon family
- 4 Rosaceae—rose family (three subfamilies: Rosoideae, Spiraeoideae and Maloideae)
- 5 Leguminosae, or Fabaceae—legume family (two subfamilies: Mimosoideae and Papilionoideae)
- 6 Cruciferae—cabbage family

## List of families (Part II)

### ■ Asteridae

- 1 Caryophyllaceae—pink family
- 2 Ericaceae—heath family (two subfamilies: Ericoideae and Vaccinioideae)
- 3 Umbelliferae—umbel family
- 4 Solanaceae—potato family
- 5 Labiatae—mint family
- 6 Compositae—aster family (three subfamilies: Carduoideae, Cichorioideae and Asteroideae)

## Phylogeny of 18 angiosperm families\*



\*+ Salicaceae which should be outer to Cruciferae

## General features of Solanaceae

### Solanaceae—potato family

- $\approx 2,300$  species, most of them belong to one genus, *Solanum*
- Cosmopolitan, with center of diversity in South America
- Prefer places with good water supply



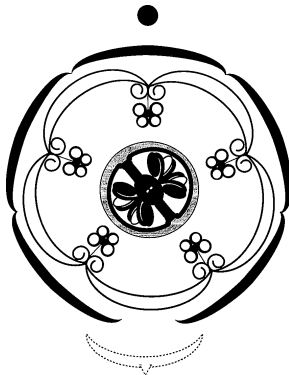
## Morphology of Solanaceae

- Herbs, shrubs, vines, small trees; produce alkaloids, often poisonous
- Stems with bicollaterate vascular bundles
- Leaves alternate, without stipules, with pterodromous venation, simple or compound
- Flowers in cymes, actinomorphic (polysymmetric)
- Petals fused, stamens are attached to corolla
- Pistil has two carpels oriented obliquely to median plane of flower
- Fruit is mostly berry or capsule; seeds with well-developed endosperm





## Solanaceae flower



$$*K_5[C_{(5)}A_5]\underline{G_{(2)}}$$



## Explanations for simplified formulas

- Flower in general: \*—actinomorphic, or polysymmetric, or radial;  
↑—zygomorphic, or monosymmetric, or bilateral
- Sterile zone: P—members of perianth (tepals) OR K—calyx (consists of sepals) AND C—corolla (petals)
- Male zone: A—androecium (consists of stamens)
- Female zone: G—gynoecium (consists of pistils, pistils consist of carpels)
- Brackets () or [] or || mean fusion
- Dash — means variation, “3–5” means 3, 4 or 5
- Plus + means circles,  $C_{5+5}$  means 5 petals in outer circle and 5 petals in inner circle
- Comma “,” means differences within one circle, e.g. in Leguminosae petals  $C_{1,2,2}$  1 is banner, 2 are keel and last 2 are wings
- Multiplication sign  $\times$  means dilatation
- Infinite sign  $\infty$  means number  $> 12$  and non-stable, e.g. apple flower could have 21, 23, 27 or even more stamens, and we use  $A_{\infty}$  for that
- Overline/underline mean inferior/superior ovary, or epiginous/hypogynous flower:  
e.g.,  $\overline{G_{(2)}}$ / $\underline{G_{(2)}}$



## Representatives of Solanaceae

Mostly vegetables and spices

- *Solanum*—include potato (*Solanum tuberosum*), tomato (*Solanum lycopersicum*) and eggplant (*Solanum melongena*)
- *Capsicum*—red (Mexican) pepper
- *Nicotiana*—tobacco
- *Petunia*—important ornamental
- *Atropa*—belladonna, important medicine plant, source of atropin

## *Solanum tuberosum* (potato) fruits



## *Solanum melongena* (eggplant) flowers





## General features of Labiatae

### Labiatae—mint family

- $\approx 3,200$  species
- Cosmopolitan, but better represented in Mediterranean region
- Prefer open spaces

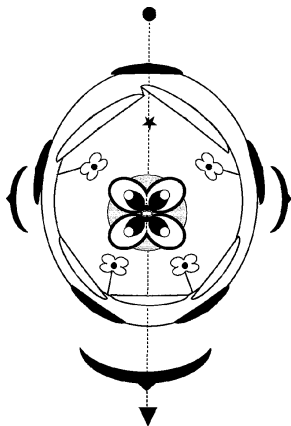


## Morphology of Labiatae

- Aromatic, often hairy, herbs or shrubs; epidermal glands contain ethereal oils; plants also contain iridoid compounds
- Young stems are typically quadrangular; leaves opposite, without stipules, simple, with pterodromous venation
- Flowers in axillary inflorescences, zygomorphic (monosymmetric)
- Calyx tubular, petals also fused, with two upper and one lower petals bigger than others, stamens in two pairs, attached to corolla
- Pistil with two carpels, but each carpel is secondary divided
- Fruit is schizocarp of four half-carpellary nutlets, seeds with little endosperm



# Labiatae flower



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





## Representatives of Labiatae

Spices, ornamentals and medicinal plants

- *Salvia*—sage
- *Lavandula*—lavender
- *Mentha*—mint
- *Thymus*—thyme

## *Mentha spicata* (mint)



## *Thymus* sp. (thyme)





## General features of Compositae

### Compositae, or Asteraceae—aster family

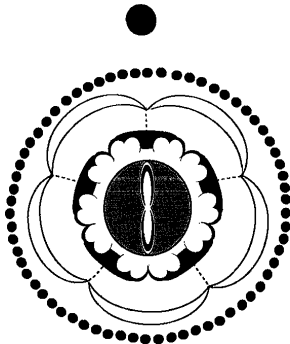
- More than 20,000 species
- Cosmopolitan, but better represented in temperate and subtropical regions
- Prefer open spaces



## Morphology of Compositae

- Herbs, rarely woody plants; store carbohydrates as inulin (not starch), sometimes have resin or laticifers (subfamily Cichorioideae)
- Leaves alternate or opposite, without stipules, with pterodromous venation
- Flowers in involucrate heads which mimic one flower
- Calyx reduced to hairs or bristles (pappus), petals fused in tube or ligula (with 5 or 3 teeth)
- Stamens 5, fused by anthers
- Pistil has 2 carpels, ovary inferior
- Fruit is achene, mature seed has almost no endosperm

## Compositae flower



$*K_{\infty}C_{(5)}A_{(5)}\overline{G_{(2)}}$  (tubular flower) or  $\uparrow K_{\infty}C_{(3 \text{ or } 5)}A_{(5)}\overline{G_{(2)}}$   
(ligulate flower)

## Tubular and ligulate flowers in *Matricaria* sp. (chamomile)





## Representatives of Compositae

Oil plants, vegetables, ornamentals and medicinal plants distributed in 12 (!) subfamilies, most important are three subfamilies:

- **Carduoideae**: mostly tubular flowers
  - *Centaurea*—knapweed
  - *Cynara*—artichoke
  - *Carthamus*—safflower
- **Cichorioideae**: mostly 5-toothed ligulate flowers + laticifers with latex
  - *Taraxacum*—dandelion
  - *Lactuca*—lettuce
- **Asteroideae**: tubular + 3-toothed ligulate flowers
  - *Helianthus*—sunflower (BTW, “canola”, or *Brassica napus* from *Cruciferae* is the second main source of vegetable oil)
  - *Artemisia*—sagebrush
  - *Tagetes*—marigold and lots of other ornamentals



## *Cynara cardunculus* (artichoke)



## *Carthamus tinctorius* (safflower)



## *Tagetes patula* (marigold)





## Summary

BOTANY IS COOL!

## For Further Reading



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.  
*Plant Biology*. 2nd edition.  
Thomson Brooks/Cole, 2006.  
**Chapter 25 + Lecture notes 32–39.**

## Friday test, or Short anonymous voluntary survey

- 1 What do you like most in botany course?
- 2 What do you dislike most in botany course?
- 3 Which lab do you remember most of all?
- 4 Please grade (1—bad, 5—excellent):
  - A Lectures
  - B Labs
  - C Monday tests
  - D Exams
- 5 Are you interesting in doing directed research in botany?