

# Introduction to Botany. Lecture 34

Alexey Shipunov

Minot State University

November 29th, 2010

# Outline

- 1 Monday test
- 2 Basal angiosperms
- 3 Magnoliidae (magnoliids)
  - Nymphaeaceae, water-lily family
  - Magnoliaceae, magnolia family
  - Piperaceae, black pepper family

# Outline

- 1 Monday test
- 2 Basal angiosperms
- 3 Magnoliidae (magnoliids)
  - Nymphaeaceae, water-lily family
  - Magnoliaceae, magnolia family
  - Piperaceae, black pepper family

# Outline

- 1 Monday test
- 2 Basal angiosperms
- 3 Magnoliidae (magnoliids)
  - Nymphaeaceae, water-lily family
  - Magnoliaceae, magnolia family
  - Piperaceae, black pepper family

## Monday test (3 questions, 5 points)

1 What is double fertilization?

## Monday test (3 questions, 5 points)

- 2 Why some scientists argue that first angiosperms were herbaceous? (1 or more reasons)

## Monday test (3 questions, 5 points)

- 3 How phenetic approach differs from cladistic approach?  
(> 1 differences)

# *Archaeofructus*

- Fossil water plant from lower Cretaceous of China
- Very primitive fructifications which are not yet compacted in flower
- Multiple free carpels, paired stamens



# *Archaeofructus* reconstruction



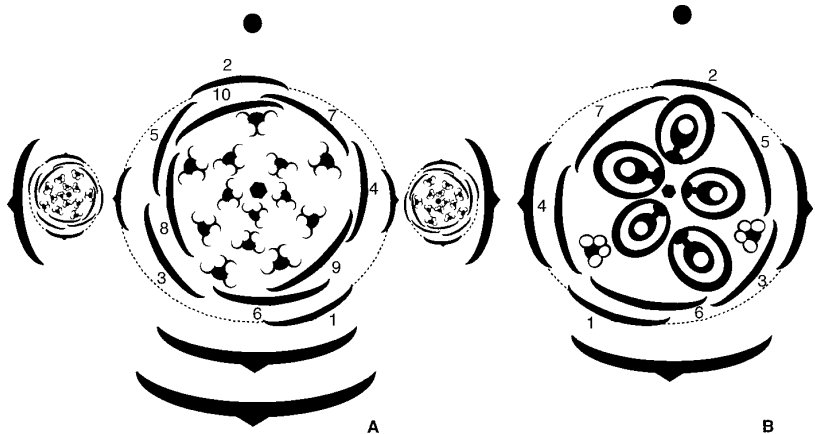
# *Amborella*

- Small forest shrub of New Caledonia (big island in Pacific ocean)
- Have irregular flowers, stylar canal, unusual embryo sac (with three synergids and no antipods)

# *Amborella*, branch with male flowers

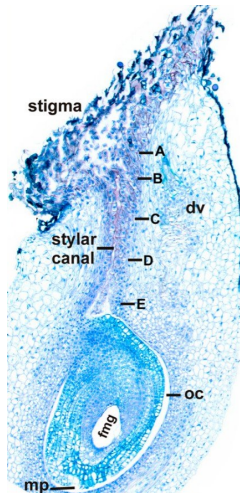


# *Amborella*, diagram and formula



$\partial P_{9-11} A_{12-21}; \partial P_{7-8} St_2 G_{4-6}$   
(where “St” are staminodes, non-functional stamens)

# *Amborella* stylar canal



# *Trithuria*

- Wetland and water plants from south Asia and Australia
- Have unusual structure of fructifications (“non-flowers”) where male organs typically positioned in the center of ?inflorescence/flower

# *Trithuria* general view

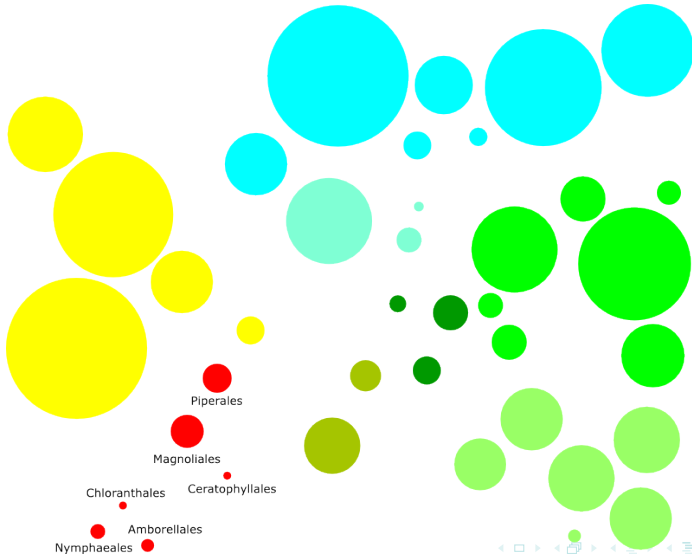


# *Trithuria* fructification





# Overview of magnoliids



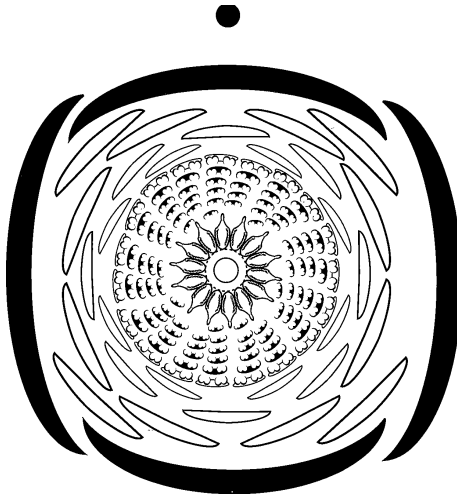
# Nymphaeaceae general features

- 6 genera and  $\approx 100$  species of water plants
- Distributed across all Earth (except Arctic and Antarctic)
- Very old group, first fossils appear in lower Cretaceous

# Nymphaeaceae morphology

- Underground **rhizome** with spirally arranged shield-like (surface) or lanceolate (underwater) leaves with actinodromous or pterodromous venation
- **Flowers** solitary, with double perianth: 4 sepals and multiple petals originated from stamens
- Petals and stamens are **spirally arranged**
- Multiple **carpels united** in pistil which is sometimes half-inferior
- Carpels have styler canal (like *Amborella*)
- **Pollinated** with weevils which attracted by odor, temperature and pollen
- **Fruit indehiscent**, floating

# *Nymphaea* sp., diagram and formula



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

# Nymphaeaceae representatives

- *Nymphaea*, white water-lily
- *Nuphar*, yellow water-lily
- *Victoria*, tropical plant with leaves 2 m in diameter

Monday test  
Basal angiosperms  
Magnoliidae (magnoliids)

Nymphaeaceae, water-lily family  
Magnoliaceae, magnolia family  
Piperaceae, black pepper family

# Nymphaea



Monday test  
Basal angiosperms  
Magnoliidae (magnoliids)

Nymphaeaceae, water-lily family  
Magnoliaceae, magnolia family  
Piperaceae, black pepper family

# *Nuphar*



# Victoria





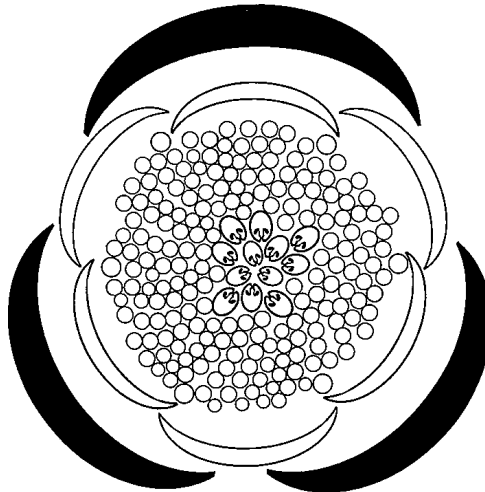
# Magnoliaceae general features

- $\approx 10$  genera and  $\approx 300$  species
- Distributed mostly in East Asia and eastern North America (pacific disjunction)
- Medium-sized forest trees

# Magnoliaceae characters

- **Leaves** alternate, simple, with one stipule each, venation pterodromous
- Flowers solitary, with **enlarged cone-like receptacle**
- **Perianth** double but sepals are similar to petals, trimerous, cyclic (sometimes with additional cycles)
- Stamens often flattened (especially in *Degeneria*)
- **Carpels** free, spirally arranged; one ovule per carpel
- Main pollinators are beetles
- Fruit is a **multiple follicle**, seeds are bird-dispersed

# *Magnolia* sp. flower diagram and formula



$$*K_3C_{3+3}A_\infty\overline{G_\infty}$$

# Magnoliaceae representatives

- *Magnolia*, genus with East Asia / Eastern North America distribution. Asian magnolias are usually deciduous, American are evergreen
- *Liriodendron*, tulip tree, has unusual leaves; again, two species occur in China and on American east coast
- *Degeneria* grows on Fiji islands (Pacific ocean), has primitive stamens and carpels

# Magnolia



# *Liriodendron*



Monday test  
Basal angiosperms  
Magnoliidae (magnoliids)

Nymphaeaceae, water-lily family  
Magnoliaceae, magnolia family  
Piperaceae, black pepper family

# *Degeneria*



# Piperaceae general features

- $\approx 3,000$  species of tropical herbs and vines
- Distributed on all continents



# Piperaceae morphology

- Leaves alternate, with **acrodromous** or pterodromous venation
- **Ataktostele**: vascular bundles are dispersed
- **Simplified flowers** arranged in spikes
- **Perianth** isomorphic (no petals and sepals), usually trimerous; or reduced
- Stamens from 6 to 2 (*Piper*)
- One pistil with **one ovule but three carpels**
- **Wind-pollinated**
- Fruit is an animal-dispersed berry
- In all, many characters are **similar to primitive liliids** (monocots)

# Piperaceae flower diagram and formula



$$*P_{0-3}A_{2 \text{ or } 3 \text{ or } 3+3}G_{(\underline{1-3})}$$

# Piperaceae representatives

- *Peperomia*, cultivated widely as ornamentals
- *Piper*, famous spice

# *Piper nigrum*, black pepper



# Summary

- Fossil *Archaeofructus*, *Amborella* and *Trithuria* are most primitive angiosperms
- Families Nymphaeaceae (Nymphaeales), Magnoliaceae (Magnoliales) and Piperaceae (Piperales) are representatives of magnoliids

# 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.**