

# Introduction to Botany. Lecture 29

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# Outline

- 1 Kingdom Vegetabilia: plants
  - Bryophyta: mosses
  - Pteridophyta: ferns and allies

# Life cycle of mosses

(picture from the board)

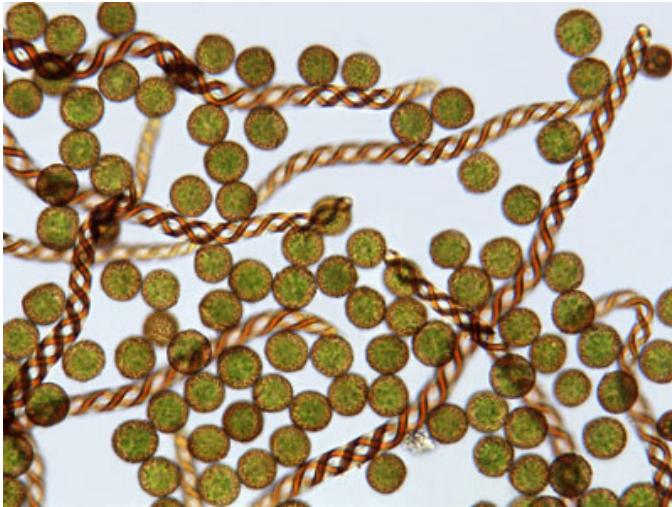
## Three main groups (subphyla)

- **Hepaticae**—liverworts. Three classes, most primitive are Haplomitriopsida. Body has dorsal and ventral parts, sporogon bag-like, without columella, spores with elaters.
- **Bryophytina**—true mosses. Six classes, most important are Sphagnopsida (peat mosses), Polytrichopsida (haircap mosses) and Bryopsida. Body radial, sporogon long, with columella, spores without elaters.
- **Anthocerotophytina**—hornworts. One class. Body flattened, sporogon long, green, with columella and stomata, spores with elaters.

# *Haplomitrium gibbsiae*, primitive liverwort



# Elaters of liverworts (*Lepidozia* sp.)



# *Sphagnum* sp. (Bryophyta, Sphagnopsida) with sporogons



# *Dawsonia superba* (Bryophyta, Polytrichopsida)—the largest moss with vascular system





# *Bryum capillare* (Bryophyta, Bryopsida)



# *Leiosporoceros dussii* (Bryophyta, Anthocerotopsida)—primitive hornwort



# Pteridophyta: ferns and allies

- $\approx 12,000$  species and six classes
- Sporic life cycle with sporophyte predominance
- Gametophyte is often reduced to **prothallium** (small hornwort-like plant), some Pteridophyta have male and female gametophytes
- Have true roots (only whisk ferns, Psilotopsida are exception)
- Homoiohydric plants (same as seed plants)
- Sporophyte always starts development from embryo located on gametophyte
- Have true xylem and phloem, but do not have secondary thickening (exceptions: fossils and extant *Isoëtes* and *Botrychium*)

# Pteridophyta classes

- Subphylum Lycopodiophytina (lycophytes)
  - Class **Lycopodiopsida**
- Subphylum Pteridophytina (monilophytes)
  - Class **Equisetopsida** (horsetails)
  - Class **Psilotopsida** (whisk ferns)
  - Class **Ophioglossopsida** (ophioglossalean ferns)
  - Class **Marattiopsida** (giant, or marattialean ferns)
  - Class **Pteridopsida** (“true” ferns)

# Lycopodiopsida

- Four main genera (*Huperzia*, *Lycopodium*, *Selaginella* and *Isoëtes*) and  $\approx$  1000 species
- Separate, **microphyllous**\* lineage of Pteridophyta (all other groups are **megaphyllous**)
- Sporangia associated with leaves and often form **strobilus**\*. Spermatozoon typically with two flagella (like in mosses). Homosporous genera have achlorophyllous, mycoparasitic underground gametophyte.
- In the past, were dominant trees of Carboniferous tropical swamp forests (lepidodendrids) and their remains became a coal
- Two genera, *Selaginella* (spike moss) and *Isoëtes* (quillwort) are heterosporous.

# Tropical lycophyte, *Huperzia linifolia*



# *Phylloglossum drummondii*, one of smallest lycophytes



# Aquatic lycophyte *Isoëtes* sp.





# Chicago 300 Million Years Ago (lepidodendrids)



# Equisetopsida

- Small group of one genus, *Equisetum* with  $\approx 30$  species
- Leaves are reduced into scales, stems are segmented, photosynthetic. Have specific stele—**artrostele** with specific central, **valecular** and **carinal** canals (similar to stele of some grasses)
- Sporangia associated with specialized leaves—sporangiophores. Spores have attached **elaters**. Gametophyte minute, usually dioecious but plants are homosporous

# Strobili and sporangiophores of *Equisetum arvense*



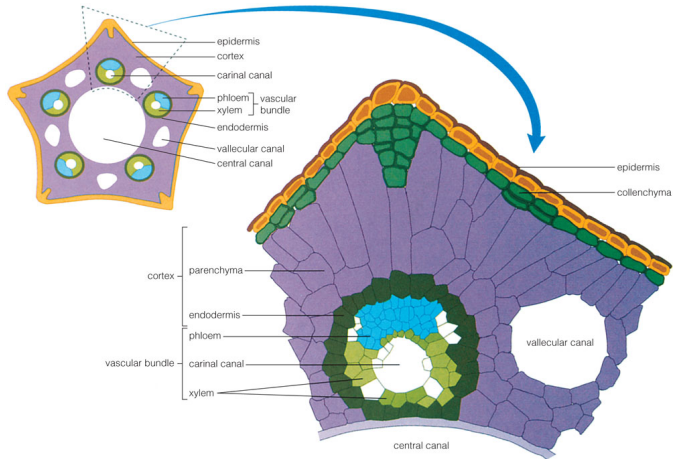
# *Equisetum giganteum*



# *Equisetum* sp. elaters



# Artrosteles



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# Psilotopsida

- Small tropical group of two genera, *Psilotum* and *Tmesipteris* and 7 species
- Have protostele (like lycophytes), underground long-lived gametophytes but multiflagellate spermatozoa (like horsetails and all ferns). Sporangia unite into **synangia**. Leaves may absent (*Psilotum*) and replaced with **enatia**.
- Externally remain fossil rhyniophytes, the oldest extinct Pteridophyta

# Hawaiian *Psilotum complanatum*





# New Zealand *Tmesipteris tannensis* with double synangium



# Ophioglossopsida

- Small group of three genera (*Ophioglossum*, *Botrychium* and *Helminthostachys*) and  $\approx 75$  species
- Always have underground rhizome and aboveground bisected leaves: one half is the leaf blade and other half is **sporangophore**. Gametophytes grow underground
- Some (*Botrychium*, grape fern) have secondary thickening of underground rhizome.
- *Ophioglossum vulgatum*, adder's tongue fern, has  $2n = 1360$ , the largest chromosome number ever.

# *Ophiloglossum vulgatum*, $2n = 1360$ hero



# *Helminthostachys zeylanicum* (Ophioglossopsida)



# Summary

- Bryophyta are only plants with gametophyte predominance.
- Among Bryophyta, Hepaticae is a most primitive group closest to green algae.
- Pteridophyta consist of two lineages (subphyla): microphyllous lycophytes and megaphyllous molinophytes

# For Further Reading



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.  
*Plant Biology*. 2nd edition.  
Thomson Brooks/Cole, 2006.  
**Chapters 22 and 23.**