Introduction to Botany. Lecture 30

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Outline

1. Questions and answers
   - Quiz
2. Kingdom Vegetabilia, land plants
   - Phylum Bryophyta: mosses
   - Phylum Pteridophyta

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Questions and answers

Quiz

Final question (2 points)

What is sporophyte?

- Diplont of Vegetabilia

Kingdom Vegetabilia, land plants

Phylum Bryophyta: mosses

Bryophyta

- $\approx 20,000$ species
- Sporic life cycle with gametophyte predominance*
- Sporophyte reduced to sporogon (sporangium with seta), usually achlorophyllous, parasitic
- No roots, only rhizoid cells (long hairy dead cells capable for apoplastic transport)
- Poikilohydric plants
- Gametophyte starts development from protonema

Life cycle of mosses

Covers: sporogon, biflagellate spermatozoa, the conflict between water cross-fertilization and wind distribution of spores which may be considered as “evolutionary dead end”.

Three main kinds (subphyla) of mosses

- **Hepaticae**—liverworts. Three classes, most primitive are Haplomitriopsida. Body leafy or thalloid, usually 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 (thallus), sporogon long, green, sometimes branched, with columella and stomata, spores with elaters.

Mosses in the “evolutionary dead end”

- They resolved “skyscrapers problem” via gametophyte, not sporophyte
- Gametophyte needs water fertilization, which restricts the size and also requires the dense growing
- Also, root system is absent: this is an additional size restriction
- If sexual organs appear on the bottom of leafy shoot, sporogon (sporophyte) could not distribute spores with a wind
- The only way out is to “start over” from thallus and make sporophyte (which was highly specialized for the spore distribution) a main stage and reduce gametophyte

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

Kingdom Vegetabilia, land plants

Phylum Pteridophyta

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

Before: Chicago 300 Million Years Ago (lepidodendrids)

After: quillwort, aquatic lycophyte *Isoëtes* sp.

Summary

- Three subphyla of mosses differ mostly by their body structure
- Pteridophyta consist of two lineages (subphyla): microphyllous **lycophytes** and megaphyllous **molinophytes**

Final question (3 points)

Final question (3 points)

Why are mosses “evolutionary dead end”?

For Further Reading

A. Shipunov.
Introduction to Botany [Electronic resource].
2016.
Mode of access:
http://ashipunov.info/shipunov/school/biol_154