

Introduction to Botany. Lecture 30

Alexey Shipunov

Minot State University

November 20, 2013



Outline

1 Questions and answers

2 Plant diversity

- Phylum Bryophyta: mosses
- Pteridophyta



Outline

- 1 Questions and answers
- 2 Plant diversity
 - Phylum Bryophyta: mosses
 - Pteridophyta



Previous final question: the answer

What is a sporogon?



Previous final question: the answer

What is a sporogon?

- Moss sporophyte



Plant diversity

Phylum Bryophyta: mosses



Three main groups (subphyla)

- **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 (Bryophytina) in the “evolutionary dead end”

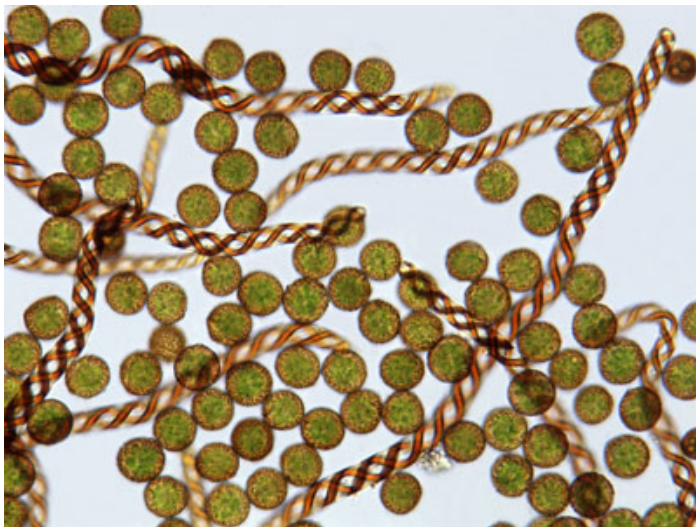
- They resolved “skyscrapers problem” via gametophyte, not sporophyte
- Gametophyte needs water fertilization, which restricts the size and also requires the dense growing
- Also, root system is absent: this is an additional size restriction
- If sexual organs appear on the bottom of leafy shoot, sporogon (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



Plant diversity

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 ≈ 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: aquatic lycophyte *Isoetes* sp.



Equisetopsida

- Small group of one genus, *Equisetum* with ≈ 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*



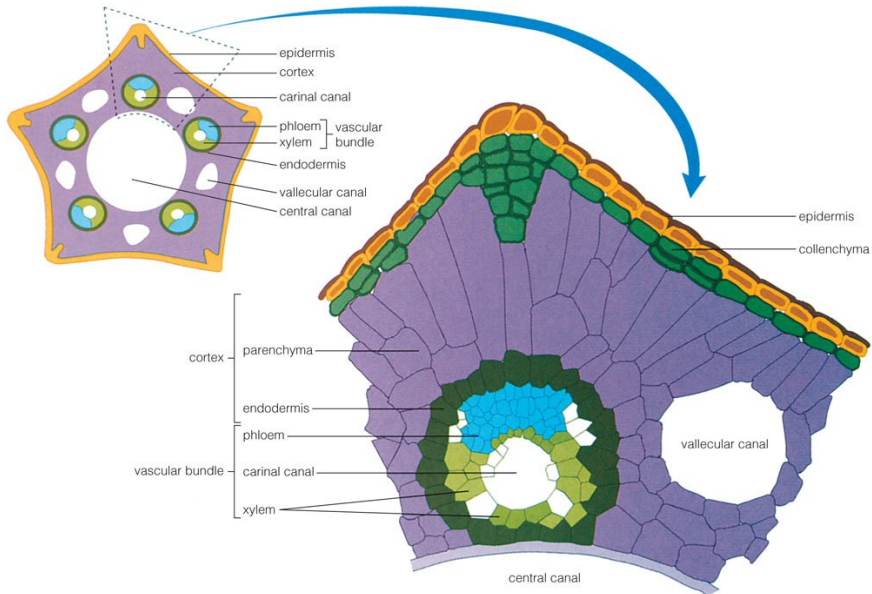
Equisetum giganteum



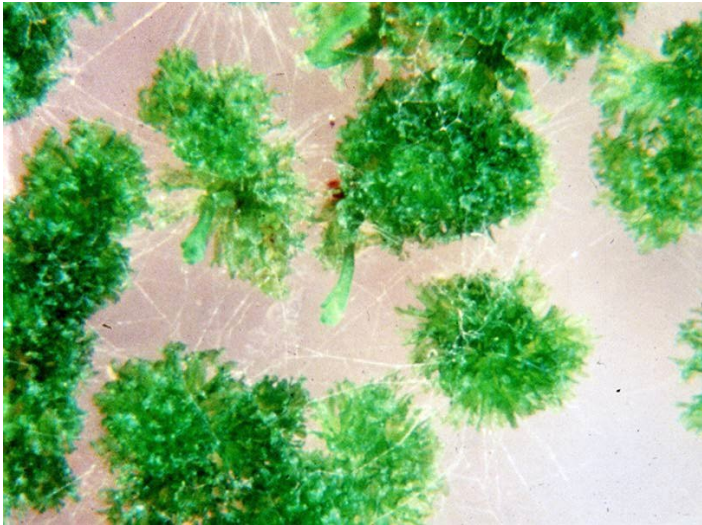
Equisetum sp. elaters



Artrostele



Horsetail gametophytes



Frequently, smaller ones are male whereas bigger are female



Final question (3 points)



Final question (3 points)

Why are ferns more advanced than mosses?



Summary

- **Bryophyta** are only plants₂ with gametophyte predominance.
- Among **Bryophyta**, Hepaticae is a most primitive group closest to green algae.



For Further Reading



A. Shipunov.

Introduction to Botany [Electronic resource].

2010—onwards.

Mode of access:

http://ashipunov.info/shipunov/school/biol_154



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.

Plant Biology. 2nd edition.

Thomson Brooks/Cole, 2006.

Chapters 22, 23.

