

Introduction to Botany. Lecture 29

Alexey Shipunov

Minot State University

November 16, 2015



1 Questions and answers

2 Kingdom Vegetabilia

- Pteridophyta
- Heterospory



1 Questions and answers

2 Kingdom Vegetabilia

- Pteridophyta
- Heterospory



Previous final question: the answer

Why are mosses “evolutionary dead end”?



Previous final question: the answer

Why are mosses “evolutionary dead end”?

- They use gametophyte as main photosynthetic stage but gametophyte needs cross-fertilization and for that, it must be covered with water or dew.
- They cannot place their gametangia on the plant base because their sporophyte must distribute spores with wind, and it is parasitic and cannot grow big enough itself.



Kingdom Vegetabilia

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.



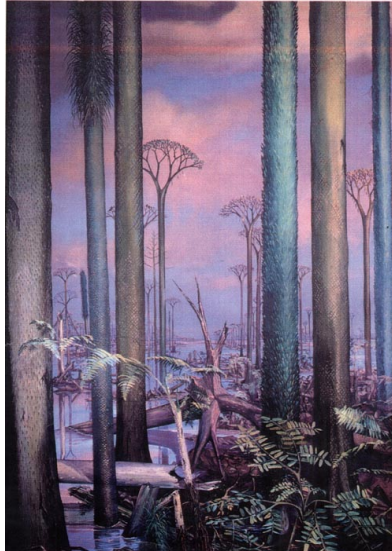
Tropical lycophyte, *Huperzia linifolia*



Phylloglossum drummondii, one of smallest lycophytes



Before: Chicago 300 Million Years Ago (lepidodendrids)



After: quillwort, aquatic lycophyte *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 and peripheral 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*



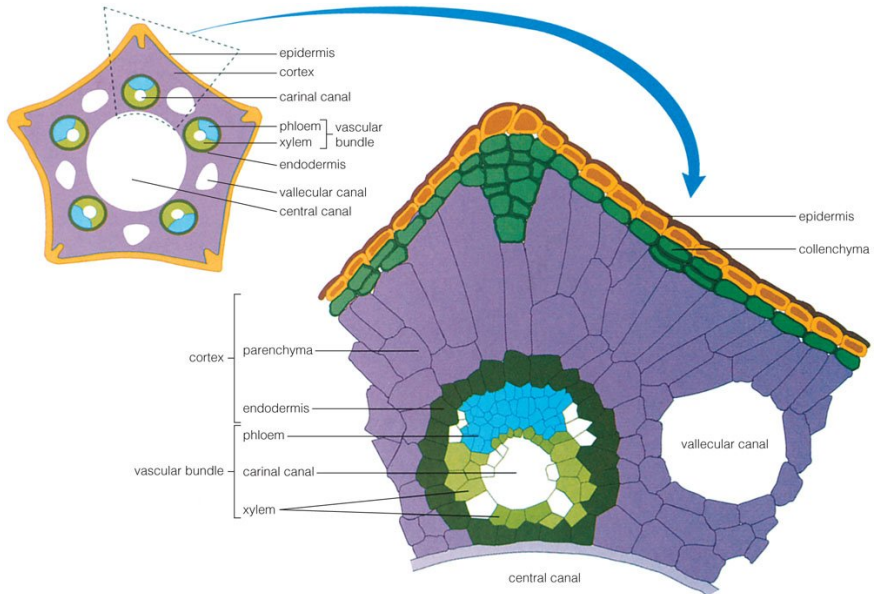
Equisetum giganteum



Equisetum sp. elaters



Artrostele



Horsetail gametophytes

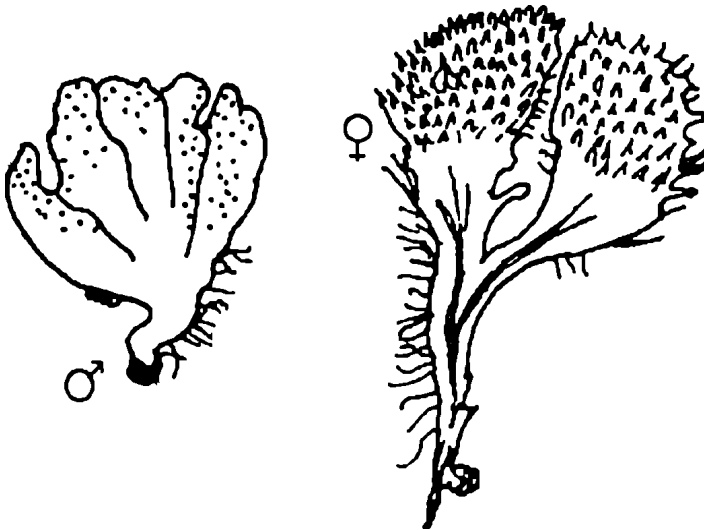


Kingdom Vegetabilia

Heterospory



Horsetails start it: spores same, gametophytes different



Heterosporry

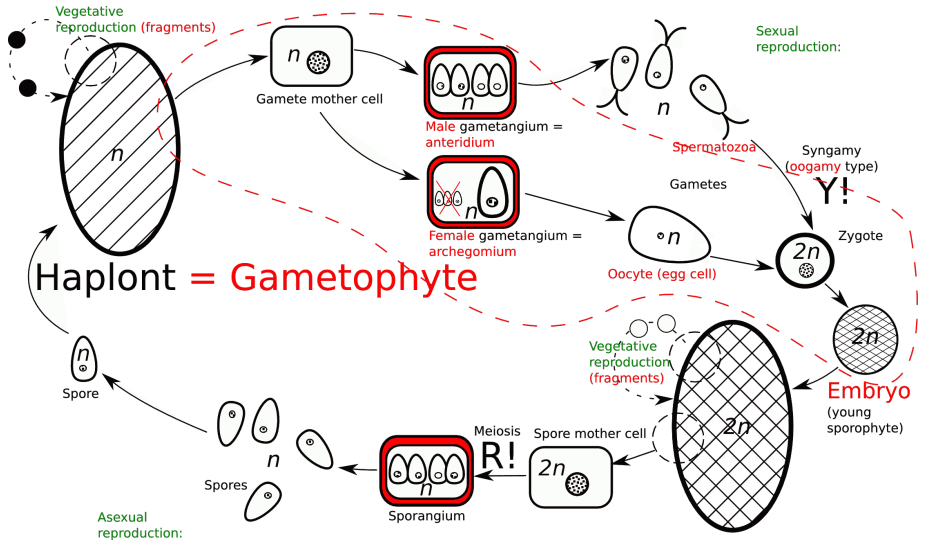
Heterosporous ferns (lycophytes *Selaginella* and *Isoetes*, monilophytes *Salvinia*, *Marsilea*, *Pilularia*, *Regnellidium* and *Azolla*) went one step further and made their spores different too. It will allow the better allocation of resources and will restrict the self-fertilization.

Terms covered:

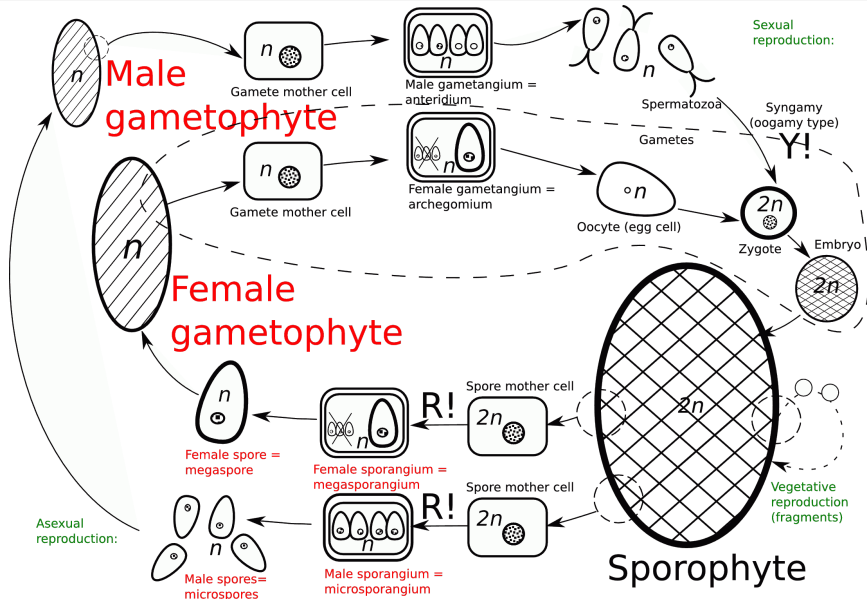
- Male gametophyte, female gametophyte
- Microspores and microsporangium
- Megaspores and megasporangium



Life cycle of land plants



Heterosporic cycle: differences



Summary

- Pteridophyta consist of two lineages (subphyla): microphyllous **lycophytes** and megaphyllous **polinophytes**
- Heterosporous plants have two kinds of spores: female (megaspores) and male (microspores)



For Further Reading



A. Shipunov.

Introduction to Botany [Electronic resource].

2015.

Mode of access:

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

