

Introduction to Botany. Lecture 31

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1 Questions and answers

- Quiz

2 Phylum Pteridophyta

- Classis Equisetopsida, horsetails
- Heterospory
- More “ferny” ferns



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Questions and answers

Quiz



Final question (3 points)

Why are mosses “evolutionary dead end”?

- They made their gametophyte tall and photosynthetic, but this is in contradiction with water fertilization



Pteridophyta classes

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



Phylum Pteridophyta

Classis Equisetopsida, horsetails



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*



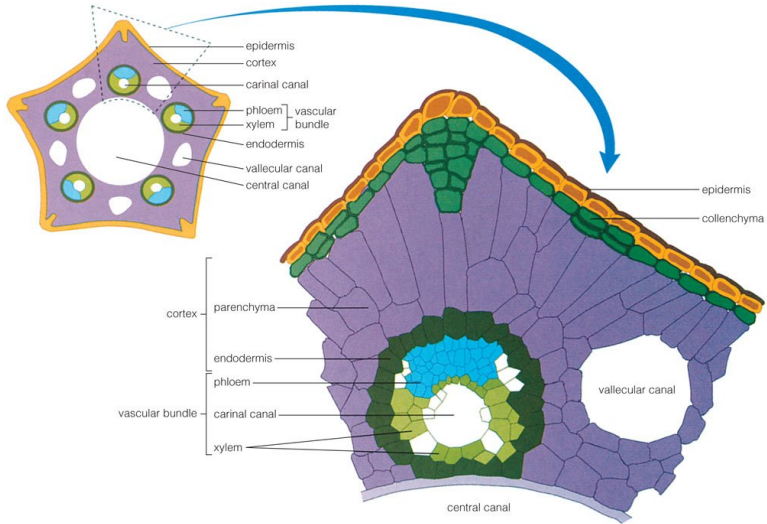
Equisetum giganteum



Equisetum sp. elaters



Artrostele



(please ignore labels)



Horsetail gametophytes



Phylum Pteridophyta

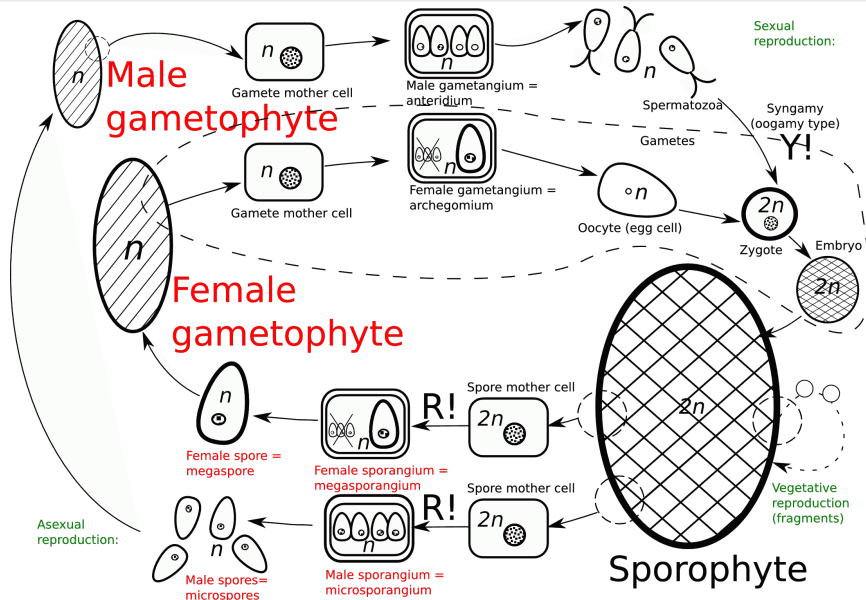
Heterospory



Horsetails start it: spores same, gametophytes different



Heterosporic cycle: differences



Heterosporry

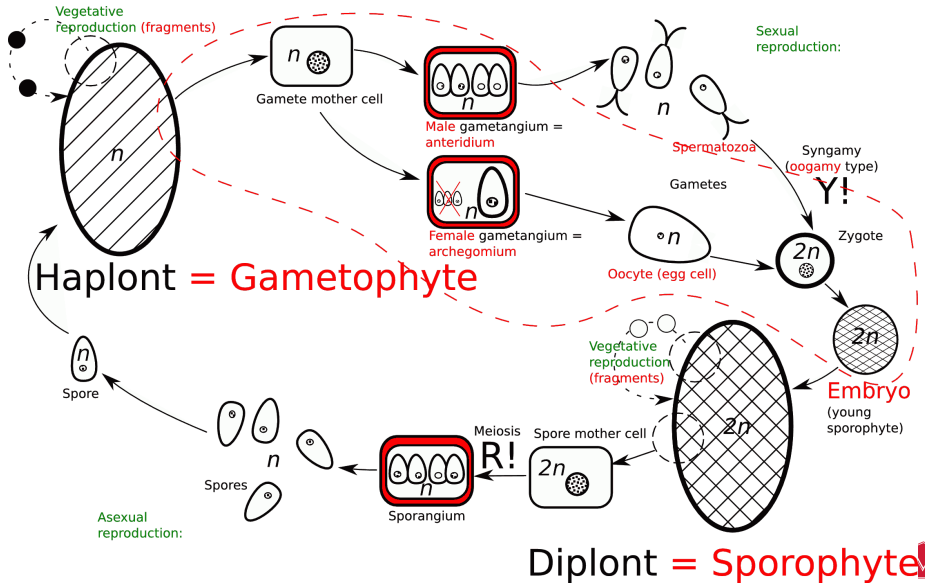
Heterosporous ferns (lycophytes *Selaginella* and *Isoetes*, monilophytes *Salvinia*, *Marsilea*, *Pilularia*, *Regnellidium* and *Azolla*) went one step further and made their spores different too. It will allow the better allocation of resources and will restrict the self-fertilization.

Terms covered:

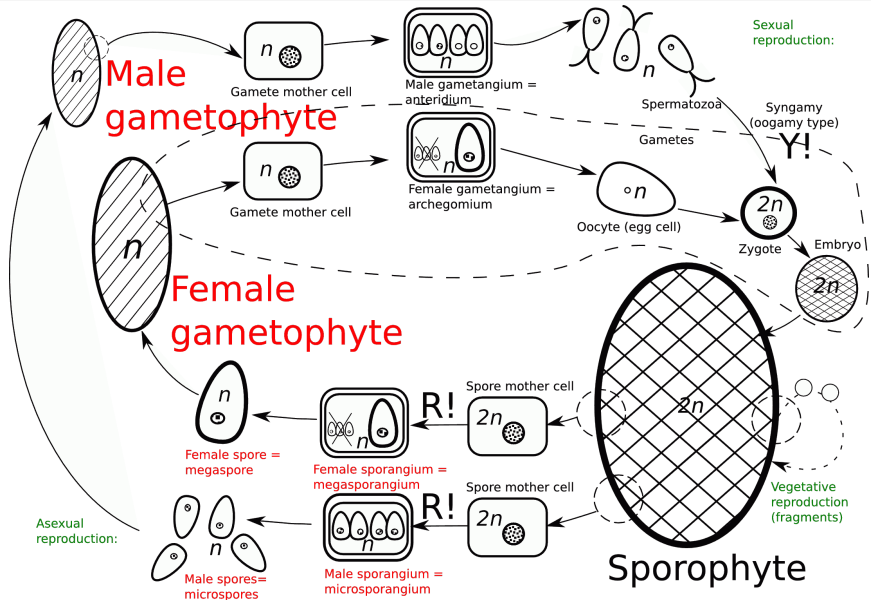
- Male gametophyte, female gametophyte
- Microspores and microsporangium
- Megaspores and megasporangium



Life cycle of land plants



Heterosporic cycle: differences



Phylum Pteridophyta

More “ferny” ferns



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 “higher” 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 (*Ophioglossum*, *Botrychium*, *Mankyua* and *Helminthostachys*) and ≈ 75 species
- Always have underground rhizome and aboveground bisected leaves: one half is the leaf blade and other half is **sporangiophore**. Gametophytes grow underground.
- Some (namely, *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)



Mankyua chejuense (Ophioglossopsida)



Marattiopsida

- Tropical ferns, several genera with ≈ 100 species
- Biggest ferns, one leaf (frond) could be 6 m length, but stems are smaller. Leaves with stipules.
- Sporangia (**eusporangia** like in all other Pteridophyta except “true” ferns) usually unite in **synangia**, gametophytes 1-2 cm in diameter, photosynthetic, terrestrial, usually long-lived.
- In a past, also were dominants of Carboniferous swamp forests.



Angiopteris sp. (Marattiopsida)



Synangia of *Danaea nodosa* (Marattiopsida)

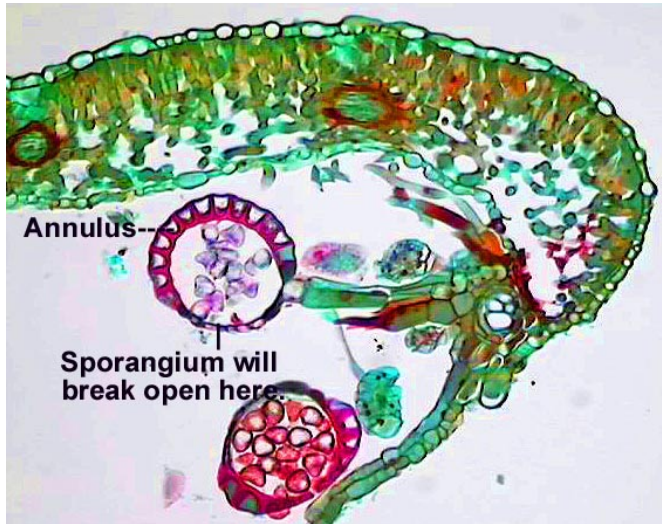


Pteridopsida

- “True” ferns, about 10,000 species.
- Leaves are fronds, with apical growth. Young leaves are coiled in **fiddleheads**.
- Sporangia have one-celled wall (**leptosporangia**) and grouped in **sori** (often covered with indusium)
- Gametophyte minute, grow aboveground. Some genera of ferns are heterosporous.
- Bracken fern, *Pteridium aquilinum*, is the most widespread plant of the world.
- Many ferns have various vegetative reproduction.



Sorus, indusium, leptosporangium and annulus



Heterosporous fern *Marsilea quadrifolia*, the Shamrock. Well, almost...



Young leaves of bracken fern: Korean "gosari"



Summary

- Heterosporous plants have two kinds of spores: female (megaspores) and male (microspores)



Final question (1 point)



Final question (1 point)

Name one heterosporous fern.



For Further Reading



A. Shipunov.

Introduction to Botany [Electronic resource].

2016.

Mode of access:

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

