



Plant features:

- autotrophic photosynthetic organisms that have *colonized land*
- structure interpretable as adaptation to oxygenic photosynthesis *on land*
- +/- certainly evolved from chlorophyte algae; **~ 450 m.y.a.**
- fix sun's energy; massive C-sink; --> high-O₂ atmosphere

07 : 08

2

Plant features:

- enormous range of size:
~ 1mm to ~100m - **5 powers of 10**
- some of the world's longest-lived organisms: *Larrea* clones **>14K y.**
- in adapting to challenges, evolved great **chemosynthetic capacities**
- crucial primary producers

07 : 08

3

How to evolve a terrestrial photoautotroph

BENEFITS of LIFE on LAND

- unimpeded access to **CO₂**
- much higher levels of sunlight through day
[no absorption by medium;
no reflection at surface;
no turbidity]
**MUCH higher rates
of photosynthesis possible**

07 : 08

4

How to evolve a terrestrial photoautotroph

DIFFICULTIES of LIFE on LAND

- air gives no buoyancy for body
 - air provides no nutrients
- air usually rather dry - water loss/access
- air shows much greater temperature range
 - life-cycle becomes problematic

much of modern plant structure represents evolutionary response to these factors

ADAPTATIONS to a LIFE in AIR

- buoyancy** -> woody skeleton; lignin
- nutrients** -> fluid transport [**vascular**] system
- water** -> roots/hairs for access; cuticle and stomata for control of loss; vascular system
[woody roots also provide anchorage]
-> water-independent fertilization
- heat** -> transpirational dissipation
- competition for light** -> leaves; greater height

KINDS of PLANTS

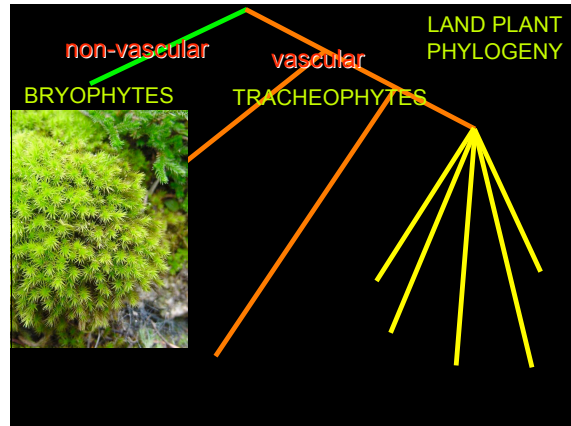
- plant taxonomy is largely based in their **reproductive cycles & structures**
- also associated with **gross anatomy**

"Non-vascular" plants - mosses & liverworts
Bryophytes

"Vascular" plants - everything else:
horsetails, ferns, cone-bearers, flower-bearers
Tracheophytes

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7

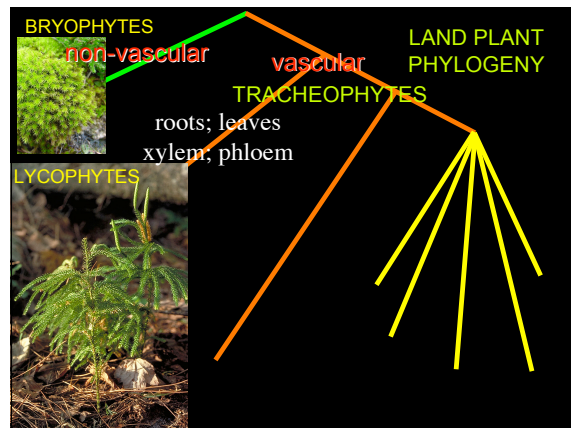


Bryophytes - mosses & liverworts
non-vascular plants ~20,000 spp.

undifferentiated body -
no leaves, vessels, roots, stem

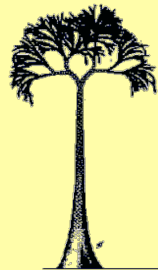


retain many features from earliest plants

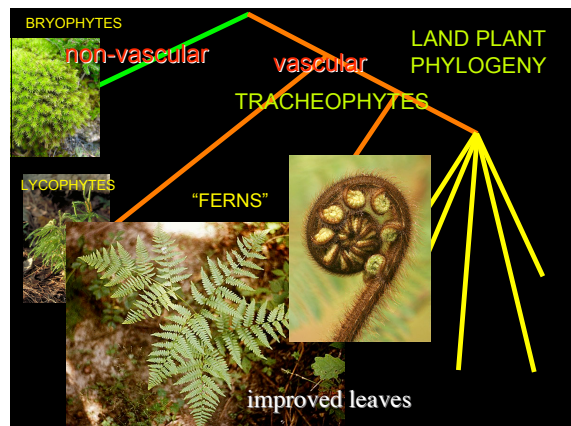


Tracheophytes - vascular plants



Lycophytes - club-mosses
~ 1000 spp.



very diverse in late Paleozoic, including trees

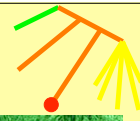



Tracheophytes - vascular plants
Psilophytes - whisk ferns ~3 spp.
 secondarily lack roots & leaves

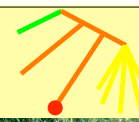

07:08 strongly resemble early land plants 13

Tracheophytes - vascular plants
Sphenophytes - horsetails - 15 spp.

very diverse in late Paleozoic, including trees

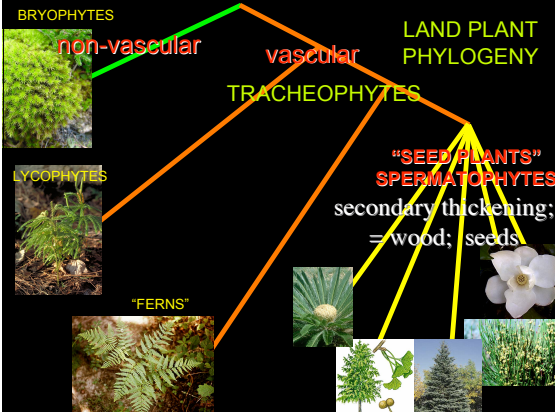
Tracheophytes - vascular plants
Filicinophytes - ferns ~12000 spp.

though seedless, these plants have large leaves;
 produced tree forms in Paleozoic

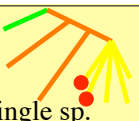
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LAND PLANT PHYLOGENY




BRYOPHYTES
 non-vascular
 vascular
 TRACHEOPHYTES
 "SEED PLANTS"
 SPERMATOPHYTES
 secondary thickening;
 = wood; seeds
 LYCOPHYTES
 "FERNS"

Tracheophytes
 vascular **SEED** plants



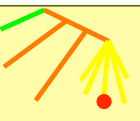
Cycads ~100+ spp. **Ginkgo** - a single sp.




palm-like plants
 in (sub) tropics Chinese relict of
 Mesozoic

17

Tracheophytes
 vascular **SEED** plants



Coniferophyta ~ 550 spp.



mostly needle-leaf
 evergreens

Tracheophytes
 vascular **SEED** plants
Gnetophyta ~ 70 spp.
 diverse form;
 mostly deserts

Tracheophytes - vascular **SEED** plants
Flowering plants - the Angiosperms
 ~250,000 spp. - *perhaps a million*

expanded from Cretaceous; insect relations

flowers, stamens, carpels **ANGIOSPERM PHYLOGENY**

basal dicots
 monocots
 eudicots

NEXT CLASS:
The Plants : part 2

the images used in this presentation derive from these two excellent sites:

<http://www.science.siu.edu/landplants/>

<http://www.dipbot.unict.it/sistematica/xIndex.html>

LAND PLANT PHYLOGENY

BRYOPHYTES
 non-vascular

LYCOPHYTES

TRACHEOPHYTES
 vascular

roots: leaves
 xylem; phloem

improved leaves

"SEED PLANTS" SPERMATOPHYTES
 secondary thickening;
 = wood; seeds

"FERNS"