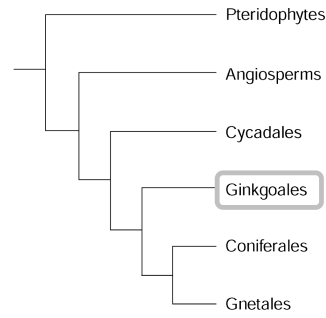


Evolution III

Gymnosperms

March 12, 2008

Ginkgos



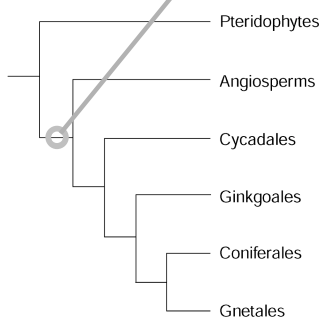
Living fossil

1. Once species rich and widely distributed – today rare and little taxonomic diversity
2. Similar in appearance to fossilized ancestors – often discovered only recently

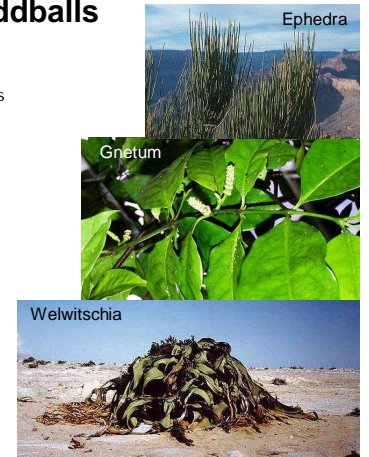
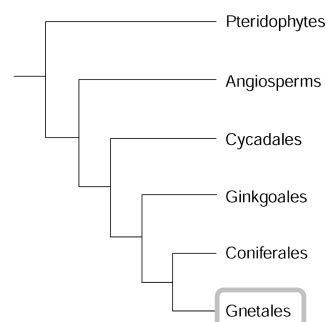


The next evolutionary milestone ...

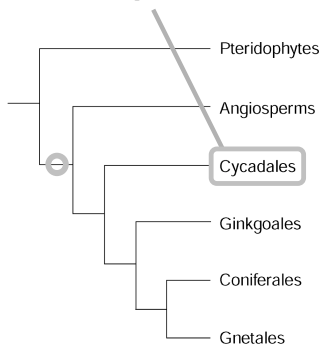
Seed ferns (Pteridosperms)



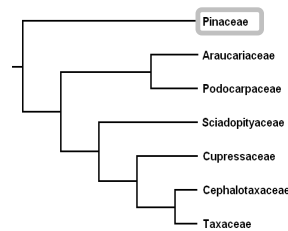
Gnetales: More oddballs



Cycads: similar to Pteridosperms ...



Families within the conifers:



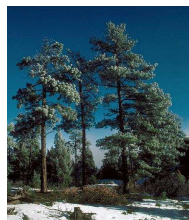
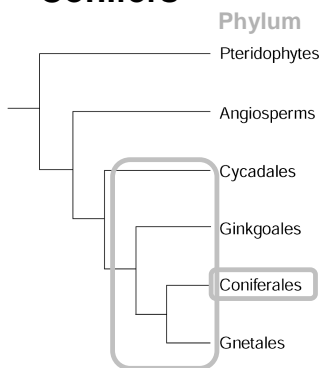
Pines, Spruces, Larches, Fir, Hemlock, Cedars (*Cedrus*)



Cedrus atlantica

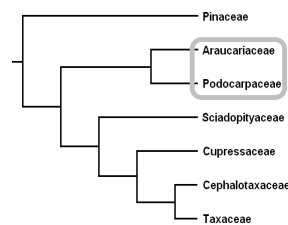
This Lecture: Conifers

Most important and diverse phylum besides Angiosperms



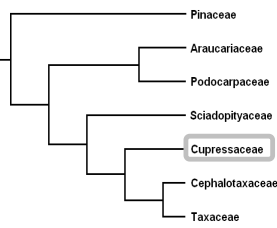
Families within the conifers:

Monkey Puzzle



Podocarps

Families within the conifers:



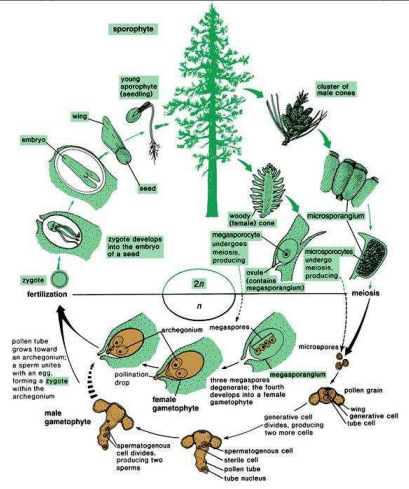
Junipers, Redwoods, Cypress, Arborvitae and other "Cedars"

Another record: 11m dbh Montezuma Cypress

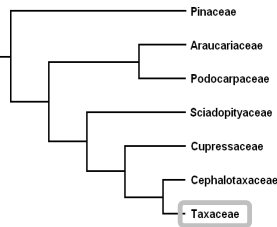


Evolutionary Milestones:

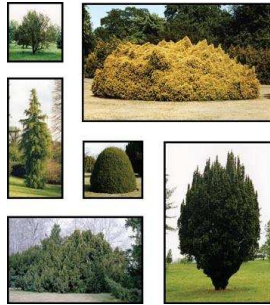
- ♀ Gametophyte stays on sporophyte
- Ferns: gametophyte still free living
- Spores are now responsible for transfer of ♂ gametophyte instead of dispersal.
- No stage of lifecycle vulnerable to harsh environments
- Seed with store of food offers a much better start for a new plant than a spore.



Families within the conifers:



Yews

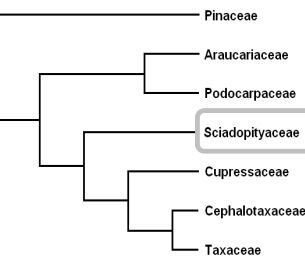


Other Evolutionary Milestones

- Secondary growth & wood
- Leading to the biggest, tallest, toughest, longest living organisms
- Buds (protected embryonic shoots)
- Adaptation to cold climates (protection of apical meristem – quick growth during favorable conditions in spring)



Families within the conifers:



More living fossils

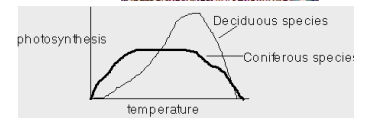
Japanese Umbrella pine (separate genus and family)



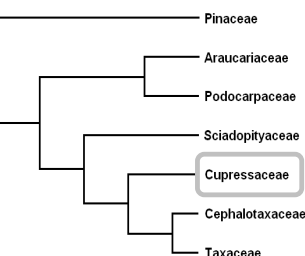
Conifer ecological adaptations

Cold & dry environments

- Leaves:** Xerophytic leaves, evergreen, thick cuticula
 - Water loss & UV protection
 - Suited for incident sunlight (very dark under canopy)
- Wood:** narrow tracheids better suited than wide vessels of angiosperms
 - Less cavitation & less freeze damage through air bubbles
 - Wide sapwood column serves as water reservoir
- Photosynthesis:** optimized for cold temperatures & immediate response
 - Spring, (winter), and fall photosynthesis



Families within the conifers:



More living fossils

Dawn Redwood: only living species of the genus Metasequoia discovered 1941 in China



Review Questions (Reading: Chapter 15)

- What was the appearance of the first seed plants in fossil records and how were they originally called (common or latin name)?
- What is the difference between gymnosperms and conifers? Why are these terms often used interchangeably?
- What are the 3 main conifer families in the northern hemisphere and the 2 main conifer families in the southern family?
- What is a living fossil? Give three gymnosperm examples.
- What is the evolutionary advantage of seeds vs. spores for dispersal?
- Is a pine tree a sporophyte or a gametophyte, 1N or 2N?
- When comparing the life cycle of seed plants to that of ferns, where are the ♂ and ♀ gametophytes and spores in gymnosperms? What is pollen? What is the pollen tube?
- Besides seeds and changes to the lifecycle, what other evolutionary milestones do we see in gymnosperms compared to seedless plants?
- What adaptations allow conifers to dominate cold and dry environments?