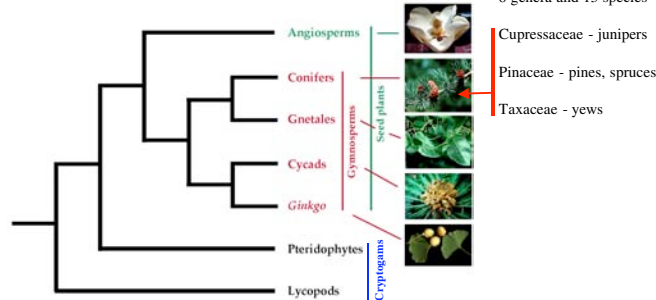


Pinophyta - Gymnosperms

Seed bearing plants without flowers and pistils - "naked seeds"

4 major groups recognized; sometimes as separate phyla

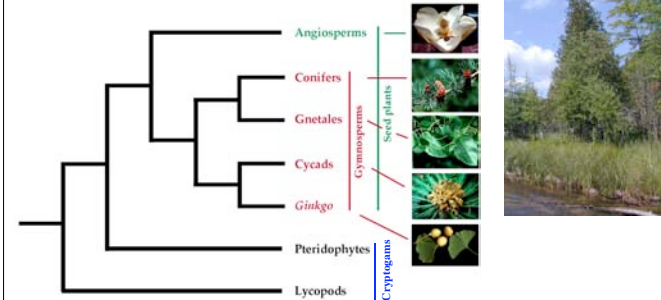
3 families of conifers only in Great Lakes region with 8 genera and 13 species



Pinophyta - Gymnosperms

General characteristics:

- Less diverse than cryptogams: 15 families, 80 genera, 820 species
- Woody: trees, shrubs, lianas, few epiphytes
- Worldwide, but more dominant in colder and arctic regions



Pinophyta - Gymnosperms

General characteristics:

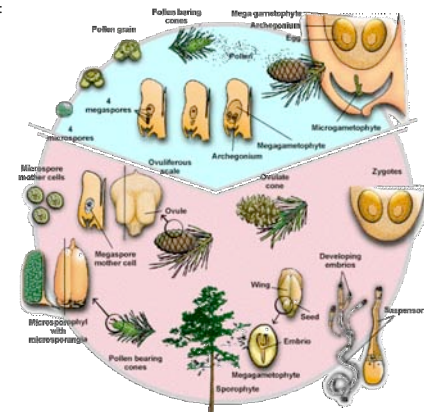
- Less diverse than cryptogams: 15 families, 80 genera, 820 species
- Woody: trees, shrubs, lianas, few epiphytes
- Worldwide, but more dominant in colder and arctic regions
- Include the tallest, most massive, longest living individuals of plants
- Slow to reproduce (vs. flowering plants)
- Needle or scale-like leaves (megaphylls); often evergreen
- Usually no vessel elements in xylem (vs. flowering plants)



Pinophyta - Gymnosperms

General characteristics:

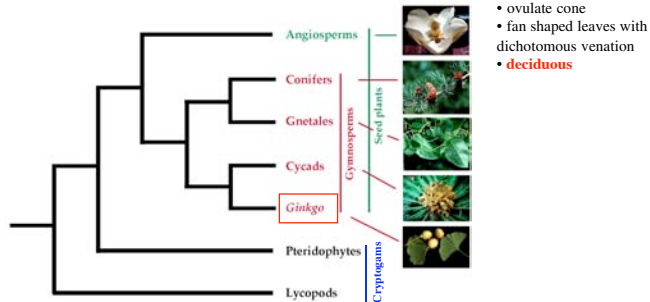
- **Seeds!**
- = mature **ovule**
- "naked seed" in cone
- No water required for sperm movement - **pollen**
- = male gametophyte
- pollinated by wind (mostly)



Pinophyta - Gymnosperms

Ginkgos

- One species in entire group from Asia
- 200 million year old living fossil
- **Diococious** (male and female plants)

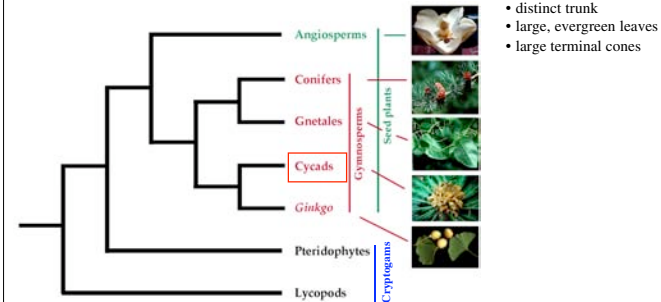


- ovulate cone
- fan shaped leaves with dichotomous venation
- **deciduous**

Pinophyta - Gymnosperms

Cycads

- Palm-like gymnosperms of tropics and subtropics
- 320 million year old lineage (Carboniferous)
- **Diococious** or **monoecious**

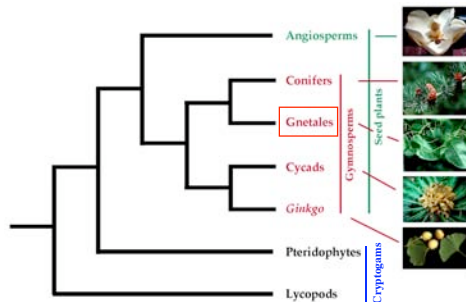


- distinct trunk
- large, evergreen leaves
- large terminal cones

Pinophyta - Gymnosperms

Gnetophytes or Gnetales

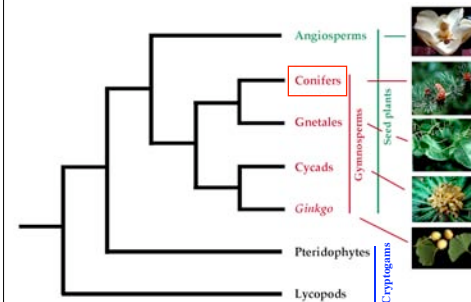
- vessel bearing gymnosperms
- 3 genera (*Gnetum*, *Ephedra*, *Welwitschia*)
- related to angiosperms?



Pinophyta - Gymnosperms

Conifers

- all 3 families and 13 species in Great Lakes region belong to this group
- dominate boreal forests and high elevations
- important lumber trees



Pinophyta - Gymnosperms

Cupressaceae: cypress family

Leaves needle or scale-like
Opposite or whorled, persistent
Important rot resistant trees (redwood, cedar)



Thuja occidentalis
Arbor vitae, White cedar

Leaves opposite in 4 ranks
and heteromorphic

Branches flattened

Small woody cones



Pinophyta - Gymnosperms

Cupressaceae: cypress family

Leaves needle or scale-like
Opposite or whorled, persistent
Important rot resistant trees (redwood, cedar)



Juniperus
Junipers, Red cedar

Leaves closely appressed;
can be scale-like or awl-like

Branches not flattened

Blue "berry" cones



Pinophyta - Gymnosperms

Cupressaceae: cypress family



Juniperus virginiana
Red cedar



Juniperus communis
Common juniper



Juniperus horizontalis
Creeping juniper

Pinophyta - Gymnosperms

Taxaceae: yew family

Leaves needle-like, spreading in one plane - 2 ranked
No cones, single seed in fleshy aril, but seeds naked
1 genus *Taxus*; taxol drug from western *T. brevifolia*



Taxus brevifolia
Western yew

Taxus canadensis
American yew
Ground hemlock

Pinophyta - Gymnosperms

Pinaceae: pine family

6 genera, 200 species of Northern Hemisphere
Foliage leaves needle-like, alternate or fascicled
Many seeds enclosed in fleshy to woody cone, with
conspicuous cone scales



Pinus strobus
White pine



Pinus resinosa
Red pine



Pinus banksiana
Jack pine



Pinophyta - Gymnosperms

Pinaceae: pine family



Abies balsamea
Balsam fir



Larix laricina
Larch, tamarack



Pinophyta - Gymnosperms

Pinaceae: pine family



Picea mariana
Black spruce



Picea glauca
White spruce



Tsuga canadensis
Eastern hemlock