

Systematic Botany. Lecture 12

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Outline

Questions and answers

Conifers

Spermatophyta: seed plants

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Pinaceae—pine family

Cupressaceae—cypress family

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Previous final question: the answer

How to distinguish between Betulaceae and Fagaceae?

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How to distinguish between Betulaceae and Fagaceae?

- ▶ 2 carpels vs. 3–6 carpels
- ▶ Fruits with wings, distributed by animals

Spermatophyta: seed plants

- ▶ ≈ 600 species of non-angiosperms and $\approx 250,000$ species of angiosperms
- ▶ Sporic life cycle with sporophyte predominance and **seed**
- ▶ Gametophyte is reduced to cells inside ovule or inside pollen grain. Minimum number of cells is 3 for male gametophyte (pollen grain) and 4 for female gametophyte (embryo sac of angiosperms). Anteridia are reduced. In angiosperms and Gnetales, archegonia are also reduced.
- ▶ Sporophyte always starts development from embryo located inside nutrition tissue, endosperm₁ (female gametophyte) or endosperm₂ (second embryo)
- ▶ Have axillary buds
- ▶ Homiohydric plants (same as ferns)
- ▶ Have secondary thickening

Spermatophyta classes

- ▶ **Ginkgoopsida**, ginkgo class
- ▶ **Cycadopsida**, cycads
- ▶ **Pinopsida**, conifers
- ▶ **Gnetopsida**, gnetophytes or chlamydosperms
- ▶ **Angiospermae**, or Magnoliopsida, flowering plants

Ginkgoopsida

- ▶ Smallest class, only one species (!), Chinese tree *Ginkgo biloba* which became extinct several thousand years ago but saved as a "church tree".
- ▶ Distinctive triangle-shaped leaves with dichotomous venation
- ▶ Ovules are solitary or paired; microsporangia are in catkin-like structures; has sexual chromosomes (!)
- ▶ Pollen grains produce two mutli-flagellate spermatozoa which swim to large oocyte
- ▶ Seeds are fruit-like (generally edible), become ripe laying on a ground for a long time
- ▶ Almost no phytophagous insects damage *Ginkgo* leaves; the fungal symbiont of *Ginkgo* also belongs to separate class inside basidiomycetes, Bartheletiomycetes.

Ginkgo biloba ovules



Ginkgo biloba male organs



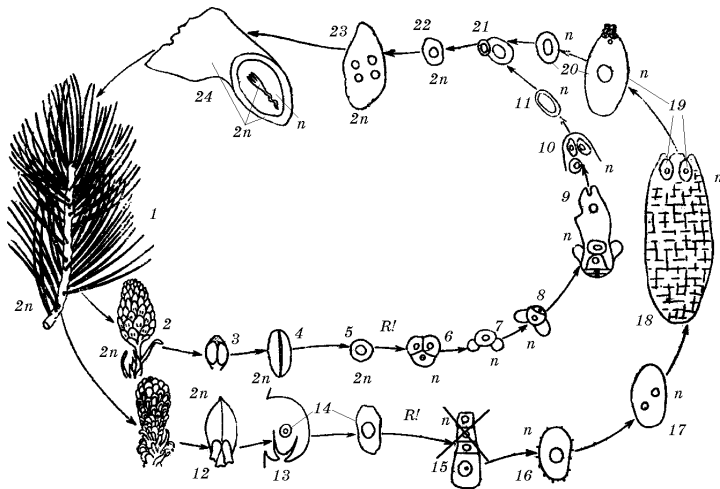
Ginkgo biloba seeds



Pinopsida

- ▶ Three orders, several families and ≈ 600 species
- ▶ Mostly temperate evergreen trees, but some are deciduous (like *Larix*, *Pseudolarix*, and all Cupressaceae subfamily Taxodioideae)
- ▶ Stem with large amount of xylem, relatively small cork and minute pith
- ▶ Ovules are always attached to specialized leaves (seed scales) and together with bract scales they are compacted in cones; microsporangia are attached to microsporophylls and also occur in cones of simpler structure
- ▶ Male gametes without flagella (spermata), consequently, pollen grains grow into **pollen tubes**
- ▶ Female gametophyte is more reduced than in cycads and *Ginkgo*
- ▶ Seeds are wind- and animal-distributed, life cycle shorter

Life cycle of *Pinus*



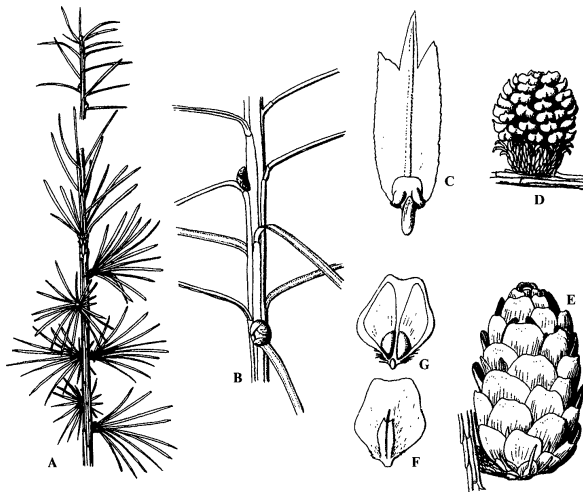
Pinopsida orders and families

- ▶ Pinales
 - ▶ **Pinaceae.**
- ▶ Araucariales—grow mostly in tropics or in South Hemisphere.
 - ▶ Araucariaceae
 - ▶ Podocarpaceae
- ▶ Cupressales
 - ▶ Sciadopityaceae
 - ▶ **Cupressaceae** (incl. Taxodiaceae)
 - ▶ Cephalotaxaceae
 - ▶ **Taxaceae**

Pinaceae

- ▶ \approx 230 species
- ▶ Distributed mostly in Northern Hemisphere, with centers of diversity in East Asia and Mexico
- ▶ Life forms: trees, rarely shrubs. Have resin.
- ▶ Leaves are needle-like, with 2 vascular buds, often in shortened shoots, **brachyblasts**.
- ▶ Have large cones with paired (seed and bract) scales.
- ▶ Pollen saccate, with two “bags”
- ▶ Seeds winged, embryo with 4–11 cotyledons.

Larix (Pinaceae) shoots and cones



Representatives of Pinaceae

Importance: wood and ornamental

- ▶ Subfamily Pinoideae: leaves in brachyblasts
 - ▶ *Pinus*—pine:
 - ▶ Subgenus *Strobus*—soft pines, mostly 5-leaved, e.g. *P. sibirica*, *P. strobus*, *P. bungeana* and 1-leaved *P. monophylla*
 - ▶ Subgenus *Pinus*—hard pines: 3-leaved like *P. ponderosa*, or 2-leaved like *P. sylvestris* or *P. mugo*
 - ▶ *Cedrus*—true cedar
 - ▶ *Larix*—larch
 - ▶ *Pseudolarix*—false larch
- ▶ Subfamily Abietoideae: leaves on normal shoots
 - ▶ *Abies*—fir
 - ▶ *Picea*—spruce
 - ▶ *Pseudotsuga*—Douglas-fir

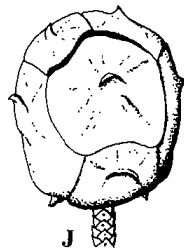
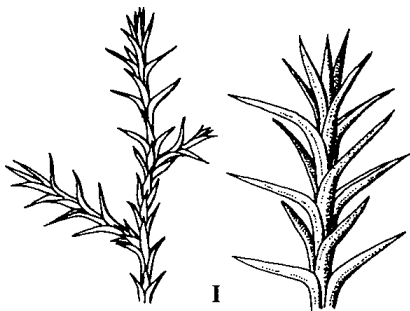
Pseudolarix amabilis (Pinaceae), spring



Cupressaceae—cypress family

- ▶ \approx 130 species
- ▶ Distributed across all Earth
- ▶ Life forms: trees, sometimes shrubs and even creepy shrubs. Part of genera (formerly belong to Taxodiaceae family) are deciduous but with branchlets instead of leaves. No resin ducts (but resin is present).
- ▶ Leaves are dimorphic, needle-like and scale-like, alternate or opposite. Often have juvenile leaves.
- ▶ Cones are small, with fused big (sometimes, in junipers, even fleshy) bract scales and reduced seed scales.
- ▶ Pollen is not saccate, seeds not winged or with asymmetric wings, embryo with 2–5 cotyledons.

Cupressus cones



Representatives of Cupressaceae

Importance: wood, ornamental

- ▶ Subfamily Taxodiodeae
 - ▶ *Sequoia*—coastal red cedar
 - ▶ *Sequoiadendron*—mountain red cedar
 - ▶ *Taxodium*—bald cypress
- ▶ Subfamily Cupressoideae
 - ▶ *Cupressus*—cypress
 - ▶ *Juniperus*—juniper
 - ▶ *Thuja*—red cedar

Sequoia sempervirens (Cupressaceae)



Final question (1 point)

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How Pinaceae differs from Cupressaceae?

For Further Reading



O. A.Stevens.

Handbook of North Dakota plants. 3rd edition.

NDSU, 1963.