

GENERAL BOTANY Lecture 35 - Gymnosperms (Part I)

- I. General characteristics
- A. "Higher" vs. "lower" vascular plants (HVP & LVP)
1. Lower ==> higher: trend towards land plants - woody vascular tissue
 2. Lower ==> higher: trend towards heterospory
 3. Lower ==> higher: less reliance on water for life cycle
 - a) Recall: LVP have free-living gametophytes as part of life cycle and fertilization requires free-swimming sperm; HVP (except cycads and Ginkgo) usually do not require water for life cycle
 4. Advanced reproductive traits of HVP
- B. Evolutionary structures introduced by gymnosperms
1. Pollen grain - immature male gametophyte of seed plants
 2. Ovule - immature seed consisting of the female gametophyte, nucellus (stuff around gametophyte), and integuments (outermost jackets)
 3. Seed - mature ovule consisting of a seed coat, endosperm, and embryo
- C. Gymnosperms in relation to angiosperms
1. In gymnosperms, ovule is exposed to air at pollination; in angiosperms, ovule is covered by carpel wall
- II. Phyla of Gymnosperms ("GYMNOSPERM" is not a formal taxonomic group) - possess vascular tissue and seeds
- A. Cycadophyta (cycads) - look like a cross between a fern and a palm tree
 - B. Ginkgophyta (ginkgo) - have leaves that look like little fans
 - C. Pinophyta (conifers) - typical pine trees
 - D. Gnetophyta (genus Gnetum) - look like dicots - some used for medicinal purposes (contain the alkaloid ephedrine, which is used to treat asthma)
- III. Characteristics of Phylum Pinophyta (cone-bearing plants)
- A. Seeds in cones, trees not palmlike
- B. Includes the most number of species (of gymnosperms) and is the most widespread
- C. Total of nine families, four of which can be found in the Northern Hemisphere
1. Family Pinaceae:
 - a) Genera include: Pinus (pine trees - distinct pine needles), Abies (firs - upright (v), flat "leaves"), Picea (spruces - spread, angular "leaves"), Tsuga (hemlocks - short, 2-ranked "leaves"), Pseudotsuga (Douglas Fir - white lines on margin), Larix (larches - needles are short, linear, and grouped - deciduous [shed in fall])
 2. Family Cupressaceae: junipers and cypresses - cone looks like a berry
 3. Family Taxodiaceae: bald cypress and redwood - big (60 meters) trees
 4. Family Taxaceae: yew - seed is usually called a fruit
- D. Sporophyte of Pinophyta
1. Vascular tissue simple - extremely regular with tracheids (no vessels) and sieve cells (no companion cells) and resin ducts
 2. Two spores - microspores (in staminate cones) and megaspores (in ovulate cones)
- E. Life cycle of Pinophyta
1. Pollination is transfer of pollen from staminate cone to ovulate cone (cone partially open to receive pollen)
 2. Male and female gametophytes develop to maturity in close proximity within the ovule
 3. Egg is formed and ready for fertilization when pollen tube reaches the archegonium - process of formation and development takes about a year
 4. Proembryo is formed which eventually gives rise to an embryo, and finally a seed
 5. The mature embryo consists of several cotyledons, an epicotyl, hypocotyl, and a radicle
 6. Seed is released when the cone opens