

BIOL 1030 – TOPIC 7 LECTURE NOTES

Topic 7: Angiosperms, Flowers and Pollination Syndromes – Phylum Anthophyta (Chs. 30, 38)

- I. **Phylum Anthophyta** – flowering plants (antho – flower)
 - A. also known as **angiosperms** (angeion – vessel or enclosure; sperma – seed)
 - B. ovules enclosed within **carpel** (parent diploid sporophytic tissue) at pollination
 1. the “vessel” is the carpel, which is a modified leaf
 2. carpels, especially their enlarged basal portion (the **ovary**), usually develop into fruit, which is unique to angiosperms
 - C. about 250,000 known living species (dominant photosynthetic organisms on land)
 - D. predominant source of human food
 - E. most widespread and diverse plant phylum
 1. range from microscopic to plants with leaves over 6 m long
 2. flowers show incredible variety from species to species
 3. variety of lifestyles includes **parasites** (ex.: mistletoe, dodder, beechdrops); **mycotrophs** (derive nutrients from fungi; ex.: Indian Pipe, others); **epiphytes** (ex.: some orchids); “carnivorous” (ex. pitcher plants, sundews, Venus flytrap)
 - F. monophyletic group with seeds, refined xylem, double fertilization, and these synapomorphic characteristics:
 1. seed contains endosperm
 2. presence of **flowers** (modified stems and leaves)
 3. **true fruits**
 - G. evolutionary history
 1. monophyletic group
 2. origin about 140 MYA
 - H. phylogeny
 1. historically divided into two classes, dicots and monocots
 - recent genetic analysis has shown that the traditional dicots are a paraphyletic group
 - thus, the old classification scheme is being replaced
 2. no conclusive cladogram has been produced for angiosperms
 - studies are ongoing
 - most modern cladograms have *Amborella* and water lilies as a **sister group** (or groups) to the rest of the angiosperms
 - cladogram below from <http://tolweb.org/tree?group=Angiosperms&contgroup=Spermatopsida>



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- various class-level groupings have been proposed, the overall naming and formal classification within Phylum Anthophyta is still in a state of flux
- nevertheless, by far most of the living angiosperm species are found within two monophyletic groups, **eudicots** and **monocots**

3. **eudicots**

- most have embryos have two **cotyledons** (seed leaves)
- leaves have netlike veins
- flower part typically in multiples of 4 or 5
- groups of vascular tissues in a ring
- pollen grains mostly with 3 or more apertures
- endosperm mostly used up in mature eudicot seeds
- about 175,000 living species; includes nearly all flowering trees and shrubs
- about a sixth are **annuals** (entire growth cycle in one year or less)

4. **monocots**

- embryos have one cotyledon
- leaves have essentially parallel veins
- flower part typically in multiples of 3
- groups of vascular tissues scattered
- pollen grains mostly with one aperture
- endosperm typically present in mature monocot seeds
- about 65,000 living species; no true wood, few annuals

II. Why were (and are) angiosperms successful?

A. 130 MYA two major continental masses

1. **Laurasia** = North America, Europe, Asia
2. **Gondwanaland** = South America, Africa, Australia, Antarctica, India, New Zealand)

B. angiosperms first appeared in Gondwanaland, in what was likely a drier interior region

C. advantages of flowering plants

1. transfer of pollen over great distances promotes outcrossing
2. efficient seed dispersal via fruit
3. endosperm gives seedlings a fast start
4. leaves appropriate for fast growth in hot, dry environment

D. **coevolution** with insects

1. dominant by ~80 MYA, second half of Cretaceous Period
2. all present angiosperm families represented by that time
3. many insect orders appeared or became more abundant at that time

III. Flowers

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- A. modified stems with modified leaves
- B. develop as **primordium** bud at end of stalk called **pedicel**
- C. pedicel widens at tip to form **receptacle**
- D. other flower parts attached to receptacle in four **whorls**; from outside in:
 - 1. **calyx** – **sepals**; usually green, leaf-like, and protect immature flower
 - 2. **corolla** – **petals**; usually colorful, attract pollinators; together with calyx called **perianth**
 - 3. **androecium** – **stamens**; male reproductive structures
 - **filament** + **anther**
 - microspores produced within anther, shed as pollen
 - 4. **gynoecium** – female reproductive structure
 - center location is most protected
 - formed from leaf-like structure with ovules along margin
 - edges fold inwards around ovules, forming **carpels**
 - primitive: many separate carpels
 - advanced: carpels fused (called **pistil**)
 - carpel/pistil segments
 - **ovary** – swollen base with 1 to hundreds of ovules; develops into fruit
 - **stigma** – tip; sticky and/or feathery to catch pollen
 - **style** – usually present; separates stigma from ovary
 - **nectaries** may be present at base of pistil; secrete sugar, amino acids, and other compounds to attract pollinators
- E. know the structures of a flower [Figure 38.2] and their functions

