

Life Cycles and Reproductive Structures (Nabors – Chapter 6)

Plant Reproduction

Ultimate success of plant integration of structure and function is expressed in the production of successful offspring

- Asexual reproduction
 - Occurs through mitosis
 - Results in offspring that are genetically identical to each other & parent
 - Most common in stable environments & environments where sexual reproductive offspring are unlikely to survive
 - Production of adventitious roots from shoots
 - Production of plantlets from leaves
- Sexual reproduction
 - Occurs through meiosis
 - Results in offspring that are combination of traits of two parents
 - Generates genetic variation
 - Most common in changing environments where high degree of genetic variation would promote survival of species

Meiosis and Alternation of Generation

- Meiosis (Fig 6.2)
 - Produces nuclei that have half of the original chromosome number
 - These cells are necessary to keep chromosome numbers constant
 - Meiosis of diploid cell (2 chromosomes) results in four haploid cells (single chromosome)
 - Meiosis I
 - homologous chromosomes separate
 - chromosome number is cut in half
 - Meiosis II
 - sister chromatids separate
 - same process as mitosis

Comparison of mitosis and meiosis (Fig 6.3)

- Alternation of generation (Fig 6.4)
 - Plant sexual life cycles have haploid and diploid multi-cellular forms
 - Multi-cellular diploid (2n) sporophyte
 - Multi-cellular haploid (1n) gametophyte
 - These forms alternate generations

- Meiosis produces haploid spores
- Mitosis produces sperm and egg from structures arising from spores

- Sporophytes are the dominant form in most plants (Fig 6.5)
 - Bryophytes (mosses) – gametophyte dominant
 - Ferns – sporophyte dominant
 - Gymnosperms & angiosperms – sporophyte dominant

Cone and Flower Structure

Seed plants – fertilization first requires pollination

- Gymnosperms (Fig 6.6)
 - Usually male and female gametophytes are on different cones of same plant
 - Cones are reproductive meristems that develop from vegetative meristems
 - Stem becomes central cone axis
 - Pine trees – leaves are modified to become sporophylls in male cones and bracts in female cones
 - In female cones – sporophylls develop from axillary buds

- Angiosperms
 - Most produce flowers that contain both male & female parts
 - Some are monoecious – each plant has male AND female flowers
 - Some are dioecious – each plant has male OR female flowers
 - Flowering is regulated by hormonal signals
 - Apical meristems can give rise to male, female or bisexual flowers

 - All flower parts are modified leaves (sepals, petals, stamens, carpels)

 - Flower structure (Fig 6.7)
 - Male flower (Stamen)
 - Anther – contains pollen
 - Filament – support for anther

 - Female flower (Carpel)
 - Stigma – sticky surface to receive pollen
 - Style – connects stigma to ovary
 - Ovary (Fig 6.11) – contains ovules; site of fertilization to form seed; developing embryo eventually becomes fruit

 - Sepal – protects flower bud before it opens (often green)
 - Petal – colorful modified leaves that attract pollinators

 - Arrangement of flower parts

- Complete flower – sepal, petal, stamen, carpel
- Incomplete flower – lack one of the above

- Perfect flower – stamens AND carpels
- Imperfect flower – stamen OR carpel

- Regular flower – radial symmetry
- Irregular flower – bilateral symmetry

- Natural selection has modified flower structure in order to maximize pollination success and production of viable offspring

Seeds

- Seed function
 - produced to support plant reproduction on land
 - promotes plant survival through seasons (or years) when environment is not appropriate for growth
 - Seed is an embryo surrounded by varying amounts of nutritious tissue (endosperm) and seed coat
 - Endosperm supports early seed growth

- Seed structure
 - Bracts, cone scales, carpels and fruits are formed from modified leaves

 - Gymnosperms
 - Seeds form from ovules on the upper surface of bracts of cones
 - Angiosperms
 - Seeds form from ovules inside carpels of fruits

- Seed germination (Fig 6.12)
 - Seeds are kept dry prior to germination
 - Seed dormancy keeps seeds from germinating before environmental conditions are appropriate for survival
 - Abscisic acid (ABA) prevents germination until environmental conditions are right for germination
 - Seeds receive some treatment – cold, heat, scarification – before germination

 - Water uptake (imbibition) precedes germination
 - Enzymes then digest stored starch to produce energy to support initial growth of the seed
 - Embryonic root and shoot growth proceed, using stored energy, until leaves become photosynthetic and plant becomes self-supporting

Fruit Structure

- Fruit structure
 - consists of mature ovary or ovaries
 - can be fleshy or dry
 - dry fruits
 - dehiscent – split open at maturity
 - indehiscent – remain closed at maturity
 - simple – develop from one carpel
 - aggregate – have more than one carpel in single flower
 - multiple – form from more than one flower
 - types of fruits (Table 6.1)
- Seed and fruit dispersal
 - Wind – gymnosperms (e.g. pine); tumbleweed
 - Water – float long distances (e.g. coconut)
 - Colorful – fruits attract animal dispersers with color or taste; eaten and then dispersed in scat; treated in digestive system
 - Attachment – stick to animals (e.g. cocklebur) using barbs, hooks
 - Ejection – seeds are explosively ejected from pod (e.g. dwarf mistletoe)
 - Humans – international trade routes have greatly dispersed seeds and plants, both intentionally and unintentionally