CHAPTER 6
FRUITS AND SEEDS

Classification of fruits
Fleshy Fruits

Berry: tomatoes, grapes, blue berries
Hesperidium: oranges, lemons, grape fruit, lime.
Pepo: Pumpkin, water, water melon, cucumber.
Drupe: cherries, peaches, plum, mango.
Pomes: apples, pears.

Dry Fruits

Dehiscent
Follicles - milkweed
Legumes- peas, beans
Capsule- cotton, poppy

Indehiscent
Achenes - sunflower
Samaras - maple fruits
Grains or caryopsis - wheat, rice, corn and barley
Nuts- Peanut, cashew and almond

Aggregate Fruits (develops from a flower with many pistils)
Strawberries
Grapes

Multiple Fruits (develops from fused carpels)
Pineapple

A Fruit Structure

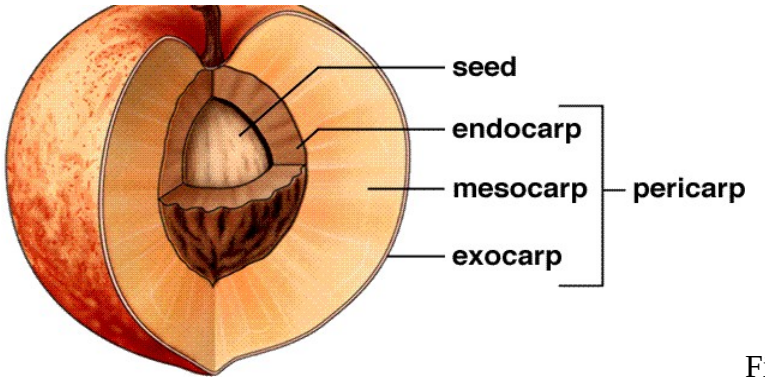

Figure 6.1.: Structure of a fruit.

The wall of the fruit is called a Pericarp that comprises of an exocarp, mesocarp and endocarp as can be seen in figure 6.1.

SEED STRUCTURE

Seeds can be placed in two groups: dicot and monocot seeds. Dicots seeds have two seed leaves known as **cotyledons** that enclose the **embryo**. The monocot seeds have one seed leaf or cotyledon that enclose the embryo. In dicots, the cotyledons are large and fleshy, and the **endosperm** is small or absent. The monocots have large endosperms that serve as food for humans and other animals. The embryo of a dicot has three parts: **epicotyl, hypocotyl and the radicle.** The epicotyl develops into the shoot, and the radicle forms the root. The embryo of the monocot is called **scutellum**, it has all the three parts of a dicot seed, but has a protective sheath covering the epicotyl called **coleoptile** and a similar sheath covering the radicle called **coleorhiza.**

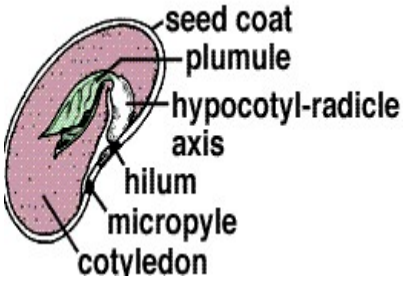

Figure 6.2a. Structure of a dicot seed.

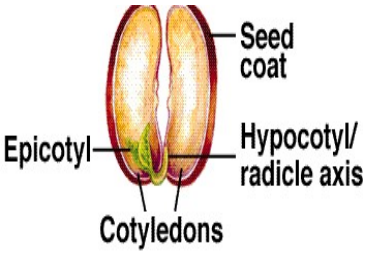

Figure 6.2b. A dicot seed showing the Epicotyl

Figure 6.3. Structure of a monocot seed

GERMINATION

The following factors affect germination of seeds: water, light, environmental conditions, enzymes and plant hormones. During germination, the seeds absorb water and swell; the enzymes start digesting the stored nutrients in the endosperm to provide food for the embryo. As the epicotyl of the embryo develops to produce embryonic leaves, the hypocotyl elongates, and a seedling emerges and starts to use light for photosynthesis.

PLANT HORMONES

Plant hormones are known to help in the germination of seeds and in plant growth in general. Hormones are chemical messengers that the plants need in very small amount to promote growth and development. The hormones can be produced in one part of the plants but have effect on another part. The major plant hormones are **auxins, gibberellins, cytokinins, abscisic acid and ethylene.**

Auxins are produced at the apical meristems of plants. It promotes growth and development. It promotes elongation of seedlings. It promotes apical dominance by inhibiting lateral bud development (preventing branching). Auxins promote adventitious root formation, phototropism and gravitropism. Auxins promote fruit development. Application of auxins to flowers of some plants (tomatoes, cucumber, or grapes) before the pollen is mature can produce parthenocarpy (seedless fruits). Except in pineapples, auxins have no effect on flowering. Auxins can be sprayed on plants to prevent fruit dropping caused by abscission; however high doses of auxins can promote abscission, this phenomenon can be used to induce harvesting of fruits.
Gibberellins are known to stimulate plants' growth, elongation at internodes, it also promotes seed germination, stimulate flowering in biennials, and it is also used to increase size of seedless grapes.
Cytokinins stimulate cell division and differentiation of plant organs. It inhibits senescence (death of plants) in plants. It can be used to keep cut plants (or flowers) fresh.
Abscisic acid promotes dormancy in seeds and buds. It regulates water balance by causing closing of stomata.
Ethylene is a gas produced by ripening fruits, wounded, stressed or senescence plants. High levels of auxins stimulate ethylene production. Ethylene promotes leaf abscission. Ethylene promotes flowering in pineapple. It promotes fruit ripening, stimulating softening of fruits, conversion of starch to sugars, and production of aroma and flavor in fruits.

Key Points

1. A complete plant with both male and female parts is called a sporophyte. This is the diploid phase of the plant (sporophyte), the male part of the plant (anther) produces microspores (pollen grains) and the female part (ovary) produces megaspores (ovules).
2. The ovule (seed) can produce a female gametophyte, while the pollen can produce a male gametophyte. This phase is the haploid phase in the life cycle of the plant.
3. During fertilization, both the male and female gametophyte fuse to produce a zygote or a sporophyte.
4. Transfer of the pollen grains from the anthers to the stigma of the pistil.
5. Pollination can be accomplished by various means: wind, water, animals, humans; and insects.

6. In flowering plants, DOUBLE FERTILIZATION occurs, a process where the pollen deposited on the stigma starts growing a tube carrying two sperm nuclei. One nucleus fertilizes the egg to form an embryo, while the second nucleus joins with a polar nucleus in the ovule to form the endosperm that later nourishes the embryo.
7. Some plants can form fruits without fertilization, a process known as PARTHENOCARPY. Examples of such fruits are bananas and oranges. Some plants can be induced by harmonies to undergo Parthenocarpy, for example production of seedless grapes.

8. Fruits can be classified as fleshy, dry, aggregate or multiple fruits. Fleshy fruits can be subclassified as berry (tomatoes, grapes) hesperidium (oranges), pepo (pumpkin), drupe (mango, plum) and pomes (apples and pears).
9. Dry fruits can be dehiscent (legumes) or indescent (rice; peanut)
10. Aggregate fruits are strawberries and multiple fruits are pineapples.
11. Seeds from dicot plants have two seed leaves known as cotyledons that enclose the embryo, while the seeds of monocot plants have one colydedon. The monocot seeds have large endosperms, examples corn kernel seeds.
12. As the seeds germinate, the dicot embryo has 3 distinct parts: epicotyl, hypocotyl and radicle. The epicotyl forms the shoot, while the radicle froms the root.
13. As the monocot seed germinates, the embryo is called a scutellum with 3 distinct parts, similar to that of the dicot. The scutellum has 3 protective sheaths covering the epicotyl known as coleoptile, while a similar sheath covers the radicle known as coleorhiza.
14. Seed germination requires suitable environmental conditions: water, nutrients and temperature.
15. Plant hormones function in the overall growth and development of plants. They function in the general metabolism in plants including germination. Among them include gibberellin, cytokinin, auxin, abscisic acid and ethylene.
16. Gibberellin promotes stem growth, flowering, size of seeds. Auxin promotes elongation at the apex of plants. Auxin functions in phototropism, gravitropism, parthenocarpy, promotes abscission to induce harvesting. Cytokinins stimulates cell division and inhibits senescence in plants. Abscissic acid promotes dormancy in seeds. Ethylene promotes food ripening.

Study Questions

1. Give at least 2 examples of each of the following groups of fleshy fruits. Berry, Pepo, drupe, and pomes.

2. Give at least 2 examples of each of the following dry dehiscent fruits: follicles, legumes, and capsules.

3. Give at least 2 examples of each of the following dry indehiscent fruits: achemes, samaras, grains, and nuts

4. Give at least 2 examples of aggregate fruits and multiple fruits respectively.

5. Compare and contrast the structure of a monocot and a dicot seed

6. State at least 3 major factors that can affect seed germination.

7. Briefly state the function of each of these hormones: gibberellin, auxin, cytokinin, abscisic acid and ethylene.

8. Mention four factors necessary for seed germination and plant growth.

9. State in what ways, each factor can affect plant growth or seed germination.