

CHAPTER 12

Reproductive Systems in Plants

PERFORMANCE OBJECTIVES

At the end of this chapter, students should be able to:

- draw and label the longitudinal section of a named flower, and identify the functions of the parts of the flower.
- identify the arrangement of different parts of flowers in different plants.
- describe the three major types of flowers.
- describe the five kinds of placentation.

INTRODUCTION

The two main types of reproduction found in flowering plants are sexual reproduction (by the flower) and asexual reproduction (by vegetative organs). The flower is the major reproductive organ of the flowering plants. Male and female gametes are produced in the flowers of same or separate individual plants. Flowers exist in different sizes, shapes, colours, patterns and arrangement. Fertilisation within the flower often leads to the production of seeds

and fruits, which are capable of germinating into new plants. However, some plants like plantain and banana have flowers that develop into fruits, which do not contain seeds and as such are not involved in raising of new plants. Moreover, some fruits develop from unfertilised flowers (ovaries) and are called parthenocarpic fruits.

STRUCTURES AND FUNCTIONS OF THE PARTS OF A FLOWER

A typical dicotyledonous flower is a cluster of modified leaves. These leaves are borne on a reduced stem called flower stalk or pedicel, which ends at an enlarged tip known as the receptacle (thalamus). The modified leaves consist of four floral whorls, namely calyx, corolla, androecium and gynoecium. These are shown in the diagrams in Figures 12.1, 12.2, 12.3, 12.4 and 12.5

FUNCTIONS OF THE PARTS OF A FLOWER

(i) Pedicel: This is the part that attaches the entire flower to the stem or branch. It also called the flower stalk. It could be described as a reduced stem.

(ii) Receptacle: This is the enlarged end of the pedicel to which all the four floral whorls are attached. It also encloses the ovary.

(iii) Calyx: This is made up of a circular, outermost layer of leaf-like structures called the sepals, usually three to five in number and which are fixed to the receptacle. Sepals protect the flower during bud stage. Most of them are greenish and so are photosynthetic. In some flowers like Pride of Barbados, Caesalpinia and Clerodendron, their sepals are brightly coloured and look like petals. Such sepals are called petaloids. Because of their bright colours, petaloids help to attract pollinators.

Sepals may be free or separated from one another and are said to be polysepalous, e.g., Pride of Barbados, Allamanda and Milk bush). They are said to be polysepalous. In some other flowers (e.g., Hibiscus), sepals are fused or joined partly or wholly together to form a cup shape and are said to be gamosepalous. Floral whorls outside the calyx are called the epicalyx. In the Hibiscus flower, there are five narrow green structures making up the epicalyx. Sepals can also be modified into hair-like structures called pappus (e.g., Tridax).

(iv) Corolla: These are brightly coloured modified leaf-like structures called petals. They are borne within the calyx. They are the second floral whorl and are the most prominent part of the flower, which attract pollinators to the flower. They could be separate (e.g., Hibiscus and pride of Barbados) and are called polypetalous, or fused to form a tube (e.g., Allamanda and Milk bush) and are called gamopetalous. Petals are brightly coloured or scented to attract pollinators (insects) that comes to extract sugary fluid called nectar, produced from the flower.

Petals also protect the stamen and the carpels. In few cases, the petals appear greenish and are collectively called perianth (e.g., lilies). Each unit of the perianth is called the tepal. In some flowers, there are additional whorls at the base of the petals called corona (e.g., Spider lily, passion flower, Olender, etc.).

(v) Androecium: This consists of the whorls of group of male reproductive organs of the flower called stamens, which lie inside the corolla. Each stamen is made up of a lobed or swollen head called anther and a long slender stalk called the filament, which bears the anther. Each anther is composed of four pollen sacs, which actually contain the pollen grains (the male gamete). Flowers may have three to numerous stamens, which may be free or united. The filament may be united, whereas the anthers are free. The fused filaments form a staminal tube, as found in the Hibiscus flower. In sunflower, the anthers are fused, whereas the filaments are attached to the petals and are said to be epipetalous.

(vi) Gynoecium: This is the female reproductive organ of flowers. It is the innermost whorl of the floral parts of the flower. It consists of carpels also called the pistil. Usually, a carpel is made up of the following three parts:

- Stigma: This receives the pollen grains during pollination.

- Style: This is the tube that joins the stigma to the ovary.
- Ovary: This contains the ovules, which form fertile seeds after fertilisation.

A pistil, which has only one carpel (e.g., *Crotalaria*), is said to be monocarpous (Figure 12.5). If more than one carpels, it is known as apocarpous (carpels are completely separated from one another, e.g., *Bryophyllum*, as found in Figure 12.5 and rose flower) or syncarpous (carpels are partly or completely fused, e.g., *Hibiscus* as found in Figure 12.5).

TYPES OF OVARIES

Ovaries are classified depending on the position of the ovary in the receptacle. It is common to classify ovaries into the following three types:

(i) Inferior ovary: The ovary is placed below the other floral parts on the receptacle, e.g., *Canna Lily*, *Guava* and *sunflower*, etc. flowers with inferior ovaries are said to be epigynous flowers.

(ii) Half-inferior ovary: The ovary is placed inside a cup-shaped receptacle and other floral parts are attached slightly above it or almost at the same level, e.g., *rose flower*.

(iii) Superior ovary: The ovary is placed above the floral parts on the receptacle, e.g., *Hibiscus* and *Crotalaria*.

ARRANGEMENT OF REPRODUCTIVE ORGANS IN DIFFERENT PLANTS

All the illustrations in Figures 12.1, 12.2 and 12.3 show the arrangement of floral parts in insect-pollinated flowers, e.g., *Hibiscus*, *Pride of Barbados* and *Allamanda*; Figure 12.7 shows the arrangement of the floral buds on a floral branch of *Pride of Barbados*, whereas Figure 12.8 and 12.9 show the arrangement of the floral parts in a wind-pollinated flower, e.g., *Guinea grass*.

GUINEA GRASS (*Panicum Maximum*)

This is found in the tropics. It has wind-pollinated flowers. Its inflorescence (Figure 12.8) is made up of long, slender branches with a pair of flowers at intervals along each branch. Each pair of flowers is enclosed within bracts to form a spikelet about 4 mm long (Figure 12.9).

Within the spikelet, the lower of the two flowers is made up of three yellow stamens. The upper flower has three stamens and an ovary with two feathery purplish-red stigmas. Each flower has two tiny structures, the lodicules, representing the perianth. There are also some surrounding the bracts. The two that are around the upper flower are wrinkled, pale and membranous. Those surrounding the lower flower are green.

Some of the spikelets have protruding stamens, whereas others have stigmas. The flower is protandrous. Hence, the flowers with ripe stigmas are slightly older than those with ripe stamens. The stamens develop within the bracts till they are ready to shed their pollen grains. The bracts then part a bit and the filaments lengthen very rapidly within minutes. Therefore, the anthers protrude and the filaments become very thin threads that shake with the slightest wind or breeze. The anthers burst and release a lot of tiny, light pollen grains that are easily blown about by the wind.

TYPES OF FLOWERS

HYPOGYNOUS FLOWER

In this type of flower, the receptacle forms a conical shape. The ovary emerges at the top of the cone, whereas the whorls are arranged in

concentric rings below the position of the ovary. Such ovary is said to be superior. Example is Hibiscus.

PERIGYNOUS FLOWER

In this type of flower, the receptacle is cup shaped with the ovary situated in the centre of the cup, and the whorls emerging from the edges of the cup. Example is rose. The ovary is said to be half inferior.

EPIGYNOUS FLOWER

The ovary of these flowers fuses with the receptacle, and the whorls emerge from above the ovary. This type of ovary is said to be inferior as in Guava.

KINDS OF PLACENTATION

Inside the ovaries, ovules are attached in various ways to the ridges of fleshy tissues, called the placentae (singular—placenta), by short stalks called funicles. The arrangement of ovules within the ovary is called placentation. Placentations are of various types. They include the following (Figure 12.10):

- (i) Axile: The ovules are attached to the centre, e.g., tomato and Canna lily.
- (ii) Marginal: The ovules are attached along one edge of a monocarpous ovary, e.g., Pride of Barbados, Flamboyant, Cassia and Crotalaria.
- (iii) Parietal: The ovules are arranged along many lines on the ovary wall, e.g., pawpaw.
- (iv) Free-central: The ovules are attached to projections from the base of the ovary, e.g., waterleaf.
- (v) Basal: The ovules are attached to the base of the ovary, e.g., sunflower.

After fertilization, the ovary develops into a fruit, whereas the ovules in most flowers develop into seeds.

SUGGESTED PRACTICALS

ACTIVITY 1

- Collect flowers of Pride of Barbados, Flamboyant, Hibiscus and Allamanda, etc.
- Examine each flower, identify the parts of the flower collected and state the type of ovary.
- Using a sharp razor blade, cut the Hibiscus flower into two equal halves.
- Using a hand lens, observe carefully the half flower on the table, viewing through the longitudinal section.
- Make a large labelled drawing showing the longitudinal section of the Hibiscus flower as observed under the hand lens.
- What type of ovary and placentation does it have? With the information obtained, suggest with reasons the type of pollination that could be found in the flower.

CHAPTER SUMMARY

â- The two major types of reproduction found in flowering plants are sexual reproduction (by the flower) and asexual reproduction (by vegetative organs).

â- The flower is the reproductive organ of the flowering plant modified for producing male and female gametes.

â- Fertilised ovules and ovary develop into seeds and fruits, respectively.

â- The flower consists of four floral whorls attached to the receptacle on the pedicel. These are the calyx, corolla, androecium and gynoecium.

â- Calyx consists of sepals, which protects the flower during bud stage.

â- Corolla consists of petals, which attract pollinators to the flower.

â- Androecium is the male reproductive organ of the flower (stamen), which is made up of the anther (containing pollen grains) and filament.

â- Gynoecium or pistil is the female reproductive organ of the flower (carpel), which consists of the stigma, style and ovary.

â- The three types of ovary are inferior, half-inferior and superior ovaries

â- The three types of flowers based on the position of ovary are pogynous, perigynous and epigynous flowers.

â- Placentation is the arrangement of ovules within the ovary.

â- The five types of placentations are marginal, axile, free-central, basal and parietal placentations.

REVISION QUESTIONS

OBJECTIVE QUESTIONS

Choose the correct options to the following questions.

1. Which of these is not a part of the carpel?
a. Stigma b. Ovary c. Pedicel
2. All are types of ovaries except
a. superior. b. half-superior. c. inferior.
3. Which of the following part of the flower holds the anther? a. Style b. Petals c. Filament
d. Style
d. half-inferior.
- d. Receptacle
4. Which of these statements is false about the structures and functions of parts of a flower?
a. The pedicel connects the stigma to the Ovary.
b. The calyx encloses and protects the other floral parts of the flower during bud stage. c. The stigmas receive pollen grains.
d. The ovules commonly form the seeds.
5. Which of these is not a floral whorl of a flower?
a. Calyx b. Corolla c. Androecium d. Pedicel

ESSAY QUESTIONS

1. Make a large labelled diagram of the longitudinal section of a named insect- pollinated flower.
2. List and explain the three types of flowers of wind-pollinated and insect-pollinated flowers.
3. With the aid of labelled diagrams, describe the three types of ovaries. 4. List any five parts of the flower and state their functions.
5. Explain the five types of placentation.