Students' Learning Outcomes

After completing this chapter, the students will be able to:

- Define pollination.
- Compare self and cross-pollinations in plants.
- List various factors involved in cross-pollination.
- Investigate plants, which are cross-pollinated.
- Differentiate between sexual and asexual reproduction.
- Describe fertilization.
- Describe seed and fruit formation.

A flower's colourful petals attract insects that pollinate the flower. Pollen grains stick to their bodies. Thus, they carry the pollen grains to part of the flower that makes seeds.

All living things reproduce. **Reproduction** is the process by which organisms produce more organisms like themselves. It is a basic characteristic of living things. Flowering plants mostly reproduce through flowers. One major process in the reproduction of flowering plants is pollination. Pollination helps to produce new seeds that grow into new plants.

3.1: Pollination

The transfer of pollen grains from the anther of a flower to the stigma of the carpel is called **pollination**. With the help of this process, the male sex cell (sperm) reaches the female sex cell (egg). Sex cells are also called gametes. Wind, insects, animals and water are the agents for pollination in different plants.

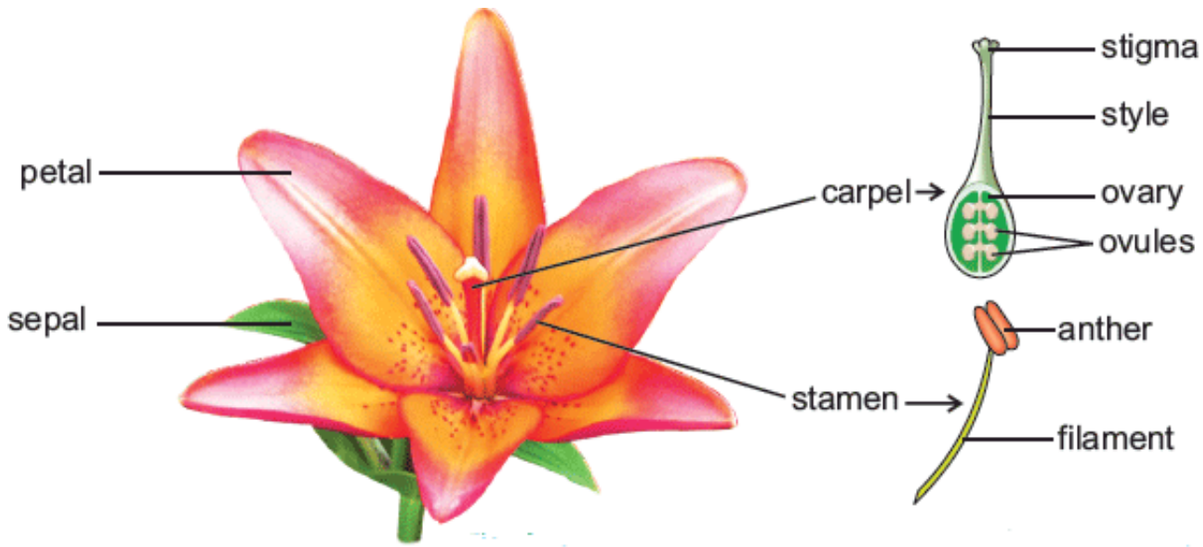

Fig. 3.1: Some parts of a flower help in pollination.

Parts of a Flower

Most flowers have four main parts, i.e. sepals, petals, stamens and carpels. Green **sepals** protect the flower from the Sun and rain in bud form. The coloured **petals** attract insects and other animals for the pollination of the flower. **Stamens** are the male parts of a flower. Each stamen has a filament and an anther. Pollen grains are produced in anthers. **Carpels** are the female parts of a flower. Each carpel has a sticky stigma, a style and an ovary. Ovules are present in the ovary.

3.2: Kinds of Pollination

There are two kinds of pollination, i.e. selfpollination and cross-pollination.
The transfer of pollen grains from the anther to the stigma of the same flower or another flower on the same plant is called **self-pollination** (Fig.3.2). Pea, tomato, rice plants, etc. are self-pollinated.

Fig.3.2: Self-pollination

The transfer of pollen grains from the anther of a flower to the stigma of a flower on another plant of the same kind is called cross-pollination (Fig.3.3).
Poplar, willow, apple, papaya trees, etc. are crosspollinated plants. For cross-pollination, the plants must grow flowers at the same time. Crosspollination usually happens in plants near each other.

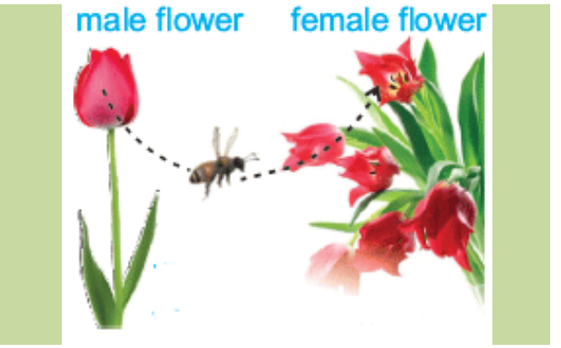

Fig. 3.3: Cross-pollination

Cross- pollination produces stronger plants as compared to the self-pollination.
Some flowers have special features that favour cross-pollination, e.g. coloured petals, long and sticky stigmas, nectar and fragrance.

Extend Your Thinking

What helps the pollen grains to stay on the tip of the style after they land there?

3.3: Agents of Pollination (Pollinators)

The agents that carry pollen grains from the anthers of flowers to the stigmas are called **pollinators**. Wind, water, insects, birds and bats, etc. are a few pollinators.

Pollination by Wind

The wind picks up pollen grains from one flower and blows it onto another (Fig.3.4). Wind-pollinated plants have long stamens and carpels. Most grasses depend upon wind for their pollination.

Fig: 3.4. Wind pollinated flowers produce a large number of pollen grains.

Pollination by Animals

Insects and some other animals can also transfer pollen grains when they move from one flower to the other (Fig.3.5). Bright coloured petals, charming shapes, nectar guides and pleasant smell attract animals towards flowers. Pollen grains have rough and sticky surfaces, due to which they stick to animals' bodies.

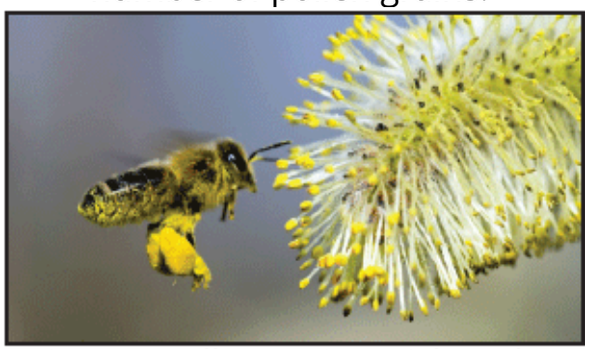

Fig: 3.5. Pollen grains stick to the bodies of bees as they visit flowers for food.

Extend Your Thinking

Grasses do not have bright-coloured flowers. How might this be related to the way these plants are pollinated?

Pollination by Water

Pollination by water is not common but a few plants release their pollen grains into the water. The pollen grains move slowly along the water currents and reach other aquatic plants. Hydrilla, Vallisneria, etc. are water-pollinated plants (Fig.3.6).

Fig: 3.6. Vallisneria is an aquatic plant in which cross-pollination occurs.

Tidbits

- Squirrels pollinate flowers of silk cotton tree.
- Bats pollinate flowers of cactus plants at night.

Activity 3.1

Observing the Pollen Grains

You will need:

- A microscope
- Glass slides
- Cover slips
- Anthers of different flowers

Procedure

1. Under the supervision of your science teacher, place a drop of water on a slide and put the anther of a flower on to it.
2. Put a cover slip on the slide.
3. Study the pollen grains through a microscope.
4. Repeat the procedure for other flowers.
5. Draw diagrams of different pollen grains you see through the microscope.

3.4: Kinds of Reproduction

Plants can reproduce in different ways. Non-flowering plants reproduce by producing spores. Flowering plants produce seeds.

The type of reproduction in which a cell from only one parent develops into offspring is called **asexual reproduction.** Various methods of asexual reproduction are commonly found in plants. We have already studied cutting, grafting and layering in plants in the previous classes.

When two gametes one from each parent combine to form a zygote, the process is called **sexual reproduction**. Flowers are responsible in plants for sexual reproduction. The zygote formed in this process transforms into seed.

Zygote: A male gamete (sperm) and a female gamete (egg) fuse to form a zygote. Later, the zygote develops into the seed and the seed grows into a new plant.

Do You Know?

Potatoes use asexual reproduction. If we look at a potato tuber, we can see little buds, or eyes. Each of these little buds can grow into a new potato plant.

3.5 Fertilization in Plants

The surface of the stigma in a flower is sticky and pollen grains stick to it. Here, a pollen tube grows out from each pollen grain. Two sperms are present in this pollen tube. The tube grows downward through the style and enters the ovary. Pollen tube finally enters an ovule and releases its sperms in it. One of the sperms combines with the egg to form zygote (Fig.3.7). The other sperm combines with another cell to make the store of food.

The process of fusion of sperm with the egg is called fertilization.

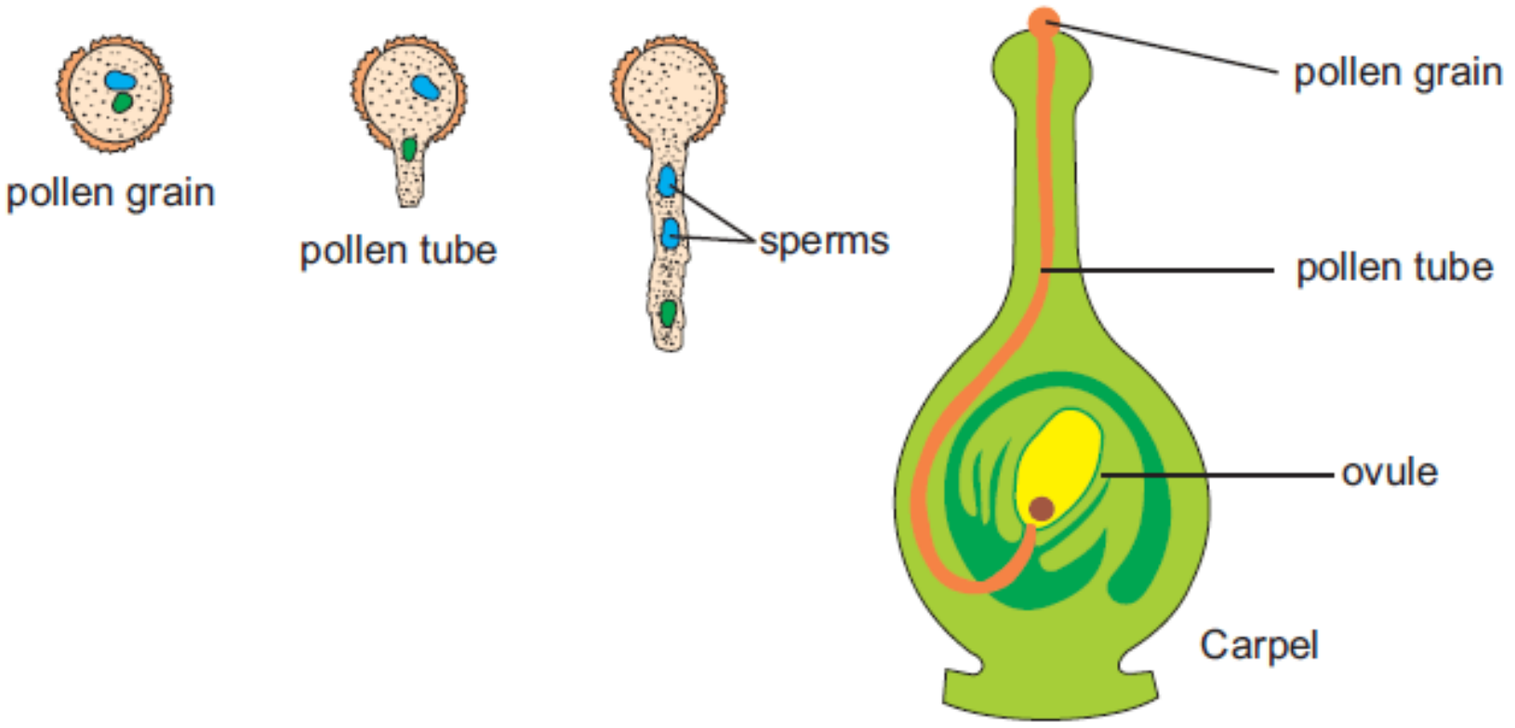

Fig. 3.7: The male gamete (sperm) in the pollen grain combines with the female gamete (egg) in the ovule.

Changes after Fertilization

After fertilization, several changes take place in the flower. The sepals, petals and stamens dry up and fall off. The fertilized egg inside the ovary develops into embryo. Ovules become seeds. The ovary grows large and develops into a fruit. The fruit protects the seed or seeds.

Extend Your Thinking

The papaya plant has male and female parts on separate plants. Why is a lonely papaya tree hard to see with fruit?

Activity 3.2 **Identifying the Parts of a Flower**

Pluck a flower from a garden. Take a pair of forceps and carefully separate the parts of the flower under the supervision of your science teacher. Identify the sepals, petals, stamens and the carpels. Also identify the filament and anther of a stamen, stigma, style and ovary of the carpel. Draw the diagrams of stamen and carpel.

Activity 3.3 **Observing the Formation of Fruit**

Under the supervision of your science teacher, visit an orchard of some fruit producing plants near your school. Observe the flowers developing into fruit. Which part of the flowers are developing into fruit?

3.6: Formation of Seeds and Fruits

Many plants grow and bear fruit to protect their seeds. A seed protects the embryo inside it. In addition, shapes of seeds and fruits help in their dispersal.

Seeds

After fertilization an ovule becomes a seed. The embryo and its store of food are covered by a tough seed coat.

The most important part of a seed is its embryo. Embryo grows into a new plant. The embryo consists of the following parts (Fig.3.9).

Radicle

This part of the embryo develops into the first root of the new plant.

Plumule

This part of the embryo develops into the first shoot (stem) of the new plant.

Cotyledons

This part of the embryo supplies food to the growing young plant.

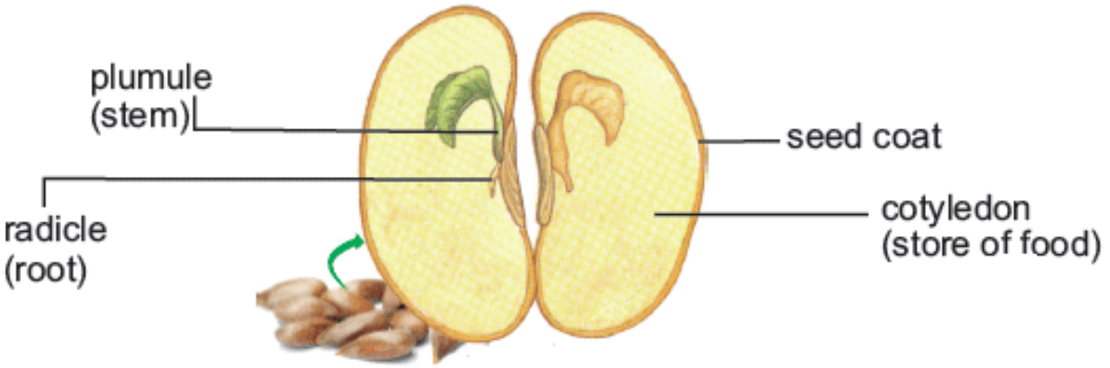

Fig. 3.9: Embryo in the seed is the future plant.

Fig:3.8. Ovary of the flower develops into the fruit.

Activity 3.4

Take some gram seeds and soak them in water for a few hours. They swell up after absorbing water. Now remove the seed coat and examine its parts.

Activity 3.5

You will need:

- Monocot and dicot flowers
- Monocot and dicot seeds
- A sharp knife
- Forceps

Procedure

1. Under the supervision of your science teacher, collect flowers and seeds of some monocot plants and some dicot plants.
2. Take a monocot and dicot flower. Remove and count their sepals. Do the same with the petals.
3. Identify, remove, and observe the stamens and carpels of the flower.

Comparing Flowers and Seeds

4. Take a seed of a monocot plant and dicot plant. Cut the seeds in half and observe the embryos.
5. Locate and observe the cotyledons in the seeds.

Things to Think

(i) What is the function of the outer covering and stored food of a seed?
(ii) What parts are the same in monocot and dicot flowers and seeds?

Fruit

The ripened ovary is called a fruit. The ovary wall forms the fruit wall, called the **pericarp**. Inside the ovary, ovules develop into seeds. The matured fruit may contain single or many seeds.

The pericarp has three layers in most fruits like peaches and mangoes (Fig.3.10). The outer layer is skin, the middle layer is fleshy and the inner layer is tough or hard. Some fruits have hard and dry pericarp, e.g. nuts.

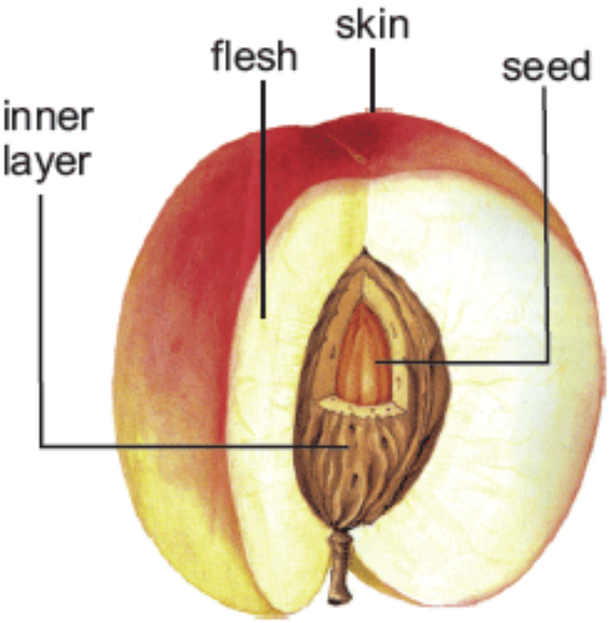

Fig. 3.10: Plants produce fruit to disperse their seeds.

Extend Your Thinking

Which fruits are eaten as vegetables?

Do You Know?

Plants do not produce flowers and fruits for us, but to protect and disperse their seeds.

Science, Technology and Society

Many plants such as snakeroot and ginger have been used as medicines. Most medicines used today are obtained from plants. Scientists are trying to obtain more medicines from plants. Why do you think that different kinds of plants should be protected?

Key Points

- Pollination is the transfer of pollen grains from the stamen to the carpel of a flower.
- There are two kinds of pollination, i.e. self-pollination and cross-pollination.
- Self-pollination is the transfer of pollen grains from anther to the stigma of the same flower or another flower on the same plant.
- Cross-pollination is the transfer of pollen grains from the anther of a flower to the stigma of another flower on another plant of the same kind.
- Coloured petals, long and sticky stigmas, nectar and fragrance are some factors that favour cross-pollination in plants.
- Poplar, willow, apple, papaya, trees, etc. are cross-pollinated.
- Plants reproduce both by asexual reproduction and sexual reproduction.
- Asexual reproduction is the reproduction in which a cell from only one parent develops into offspring.
- In sexual reproduction, two gametes from both parents combine to form a zygote.
- Fertilization is the process of fusion of sperm and egg.
- After fertilization the ovary of a flower changes into fruit while the ovules become seeds.

Questions

1. Complete each of the following sentences by writing the correct term.

i. It protects a seed _____

ii. Male and female sex cells _____

iii. The exchange of pollen grains between two plants of similar type _____ .

iv. Most grasses are pollinated by _____

v. It is present in the ovary of the flower and develops into seed _____

3. Give short answers.

i. Differentiate between asexual and sexual reproduction.

ii. What are the male and female parts of a flower?

iii. Define pollination.

iv. Name a few pollinators.

v. Define a sperm and an egg.

vi. Which part of a seed develops into the first root?

4. Write a detailed note on pollination in plants.

5. Explain fertilization in plants.

6. Describe the structure of a seed.

7. Write a note on fruit.

8. Label the parts of the flower and write the purpose of each part.