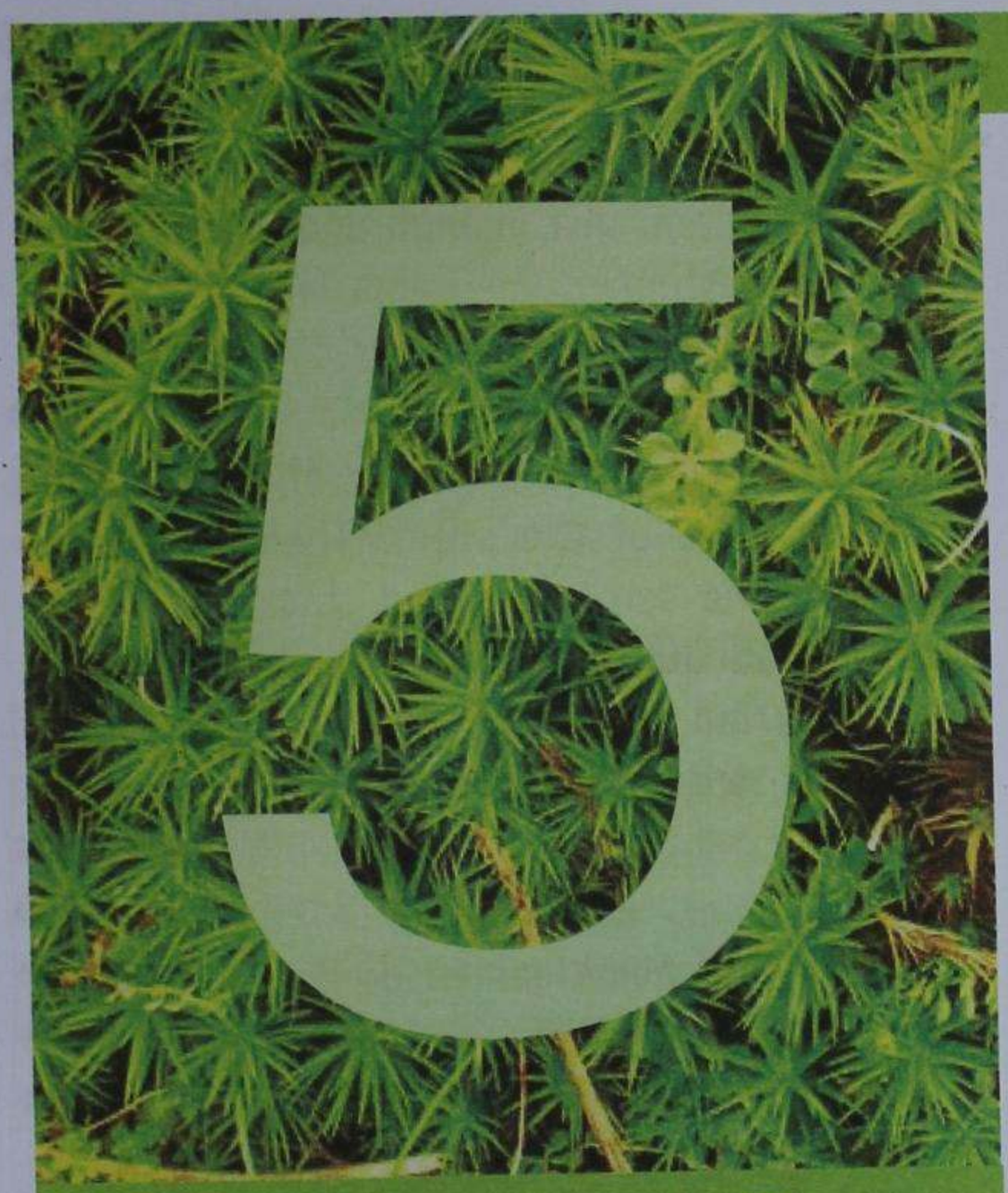


The Structure and Functions of Plant Parts

LEARNING OBJECTIVES

After completing this chapter you will be able to

- identify different parts of a plant.
- list the functions of different parts of a plant.
- identify and compare tap root with fibrous root.
- recognise different types of modified roots, stems and leaves and state their functions.
- identify different parts of a flower and state their functions.
- describe the process of pollination.
- differentiate between self and cross pollination.
- describe the process of fertilization.
- describe the parts and functions of the fruits.
- describe the structure of a seed.
- describe the dispersal of seeds.

We see plants of various types around us. Though these plants differ in many ways, for example, some may be small, some may be big, their leaves may be of different types and size, their flowers may also vary in colours, size and shape, etc. However, the overall structure of these plants is similar. All of them have two parts, one part above the ground, called the **shoot system** and one part below the ground, called the **root system** (Fig. 5.1).

The root system consists of the roots. The shoot system consists of the stem, branches, leaves, flowers and fruits.

THE ROOT SYSTEM

The roots may be of two types, namely, primary root and the secondary root. The **primary root** arises from the base of the stem. The primary root further bears side roots called **secondary roots.** The end parts of the primary or secondary roots have fine hair-like structures, called **root-hairs.** The primary root, the secondary root and the root hair together form the **root system.**

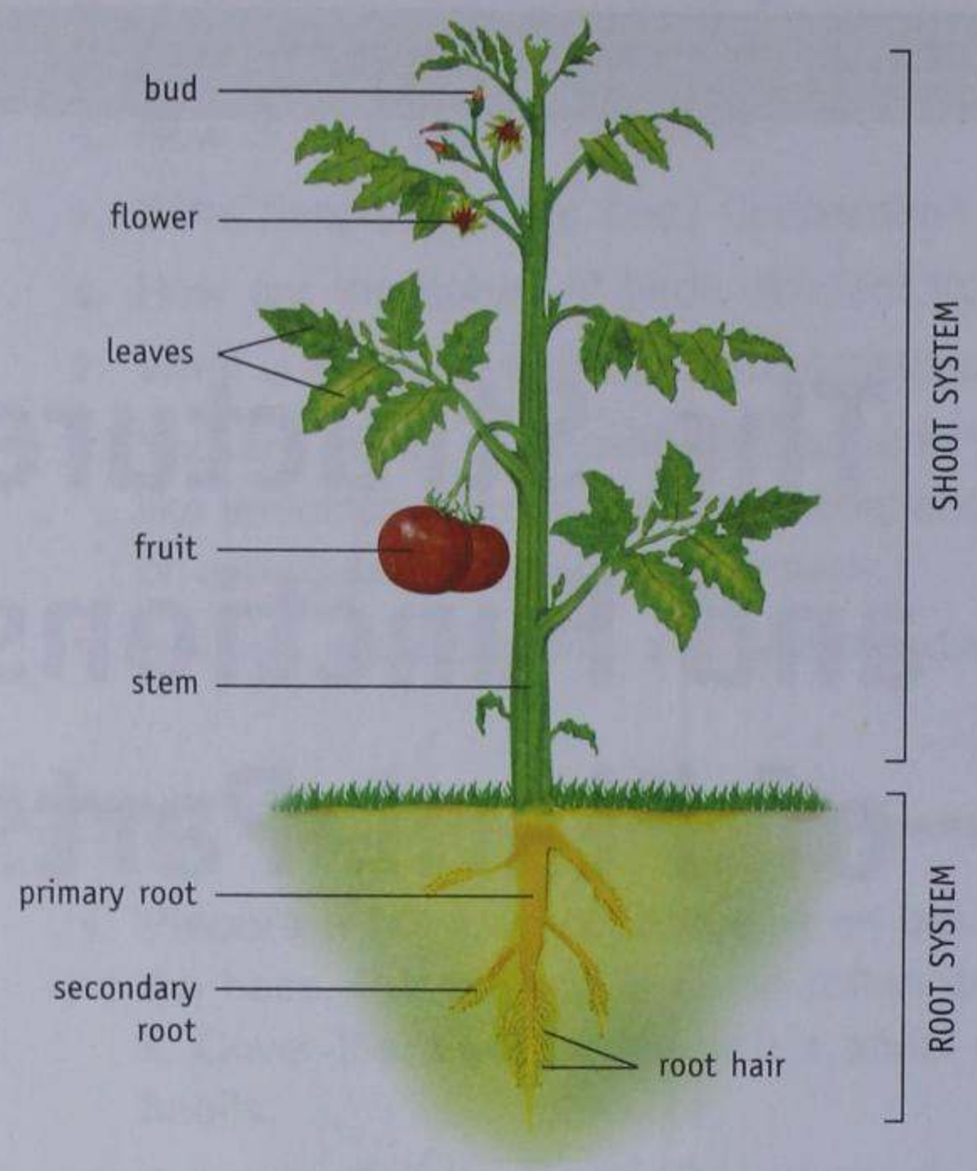


Fig. 5.1 Parts of a tomato plant

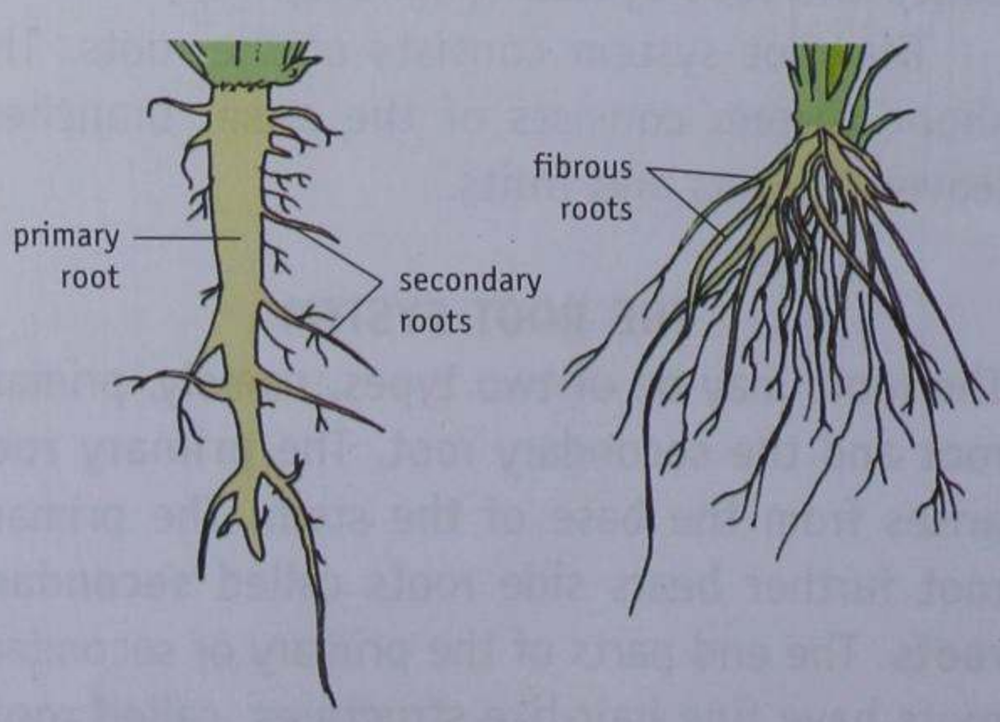
There are two types of root system, based on their structures. These are tap root system and fibrous root system.

Tap root system

Some plants have a main root called a primary root that grows straight down into the soil. The root is broad at its origin, that is, at the base of the stem and thin at the tip. It develops many side roots called secondary roots (Fig. 5.2a). The primary root and the secondary roots together constitute the tap root system. Plants like gram, pea, mango and mustard have a tap root system.

Fibrous root system

Plants like grass have a cluster of roots arising from the base of the stem. These roots are almost of the same size and thickness. These roots spread out in all directions and do not reach very far into the soil (Fig. 5.2b). Maize wheat and rice have a fibrous root system.



a. Tap root system **b.** Fibrous root system

Fig. 5.2 Types of root system

ACTIVITY 1

Go to your home garden or field and pull out a small *Hibiscus* plant. Remove the soil with water and observe its root system. You will observe a primary root, the secondary roots and the further branching roots. On careful examination you will find many hair-like outgrowths on the roots. These are the root hair.

ACTIVITY 2

Go to your home garden or field and pull out grass from the soil. Remove the soil with the help of water. What do you observe? You will observe a cluster of roots arising from the base of the stem. These are fibrous roots. Compare these roots with the tap root of the *Hibiscus* plant.

Did you know?

In some plants, roots grow from the base of the stem. They can grow out of other parts of stem or from the leaves also. Such roots are called adventitious roots.

Functions of the root

- Roots fix the plant firmly to the ground.
- Plants need water and minerals to manufacture food. Roots absorb these from the soil and transport them to the leaves and stem for manufacturing of food.
- Soil particles remain stuck to the roots. This prevents the soil from being blown away by the wind or washed away by rain.

MODIFICATION OF ROOTS

Besides these primary functions, roots of some plants are modified to perform other functions also. These are

- to store food,
- to provide additional support to the plant,
- to help some plants in respiration, and
- to absorb more nutrients and water.

For storage of food

Roots of some plants get modified to store food. These roots look swollen because of the food stored in them. They acquire different shapes. Some examples of primary roots modified to store food are carrots, radishes and turnips (Fig. 5.3).

Some adventitious roots also get modified to store food. Some examples are sweet potato and dahlia.

For additional support

In plants like banyan tree and screwpine, aerial roots grow vertically downward from the branches. Most of them become long enough to reach deep into the soil. These roots provide additional support to the heavy branches, and are called **prop roots** (Fig. 5.4).

a. Radish **b.** Carrot **c.** Turnip

Fig. 5.3 Roots of some plants get modified to store food.

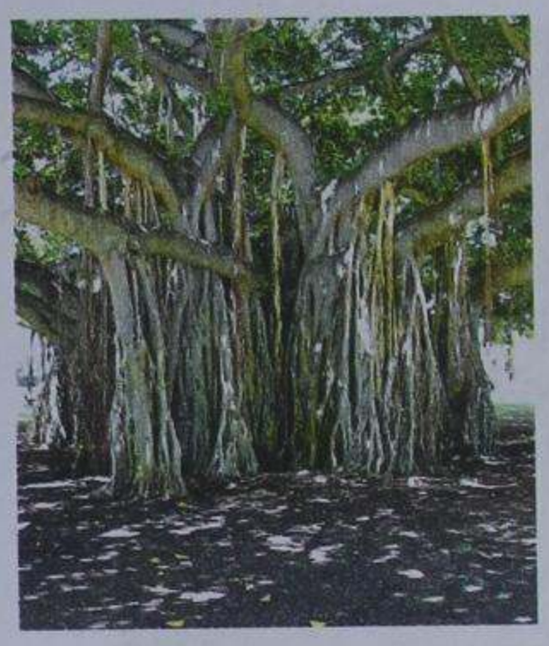


Fig. 5.4 Prop roots of banyan tree provide additional support to heavy branches.

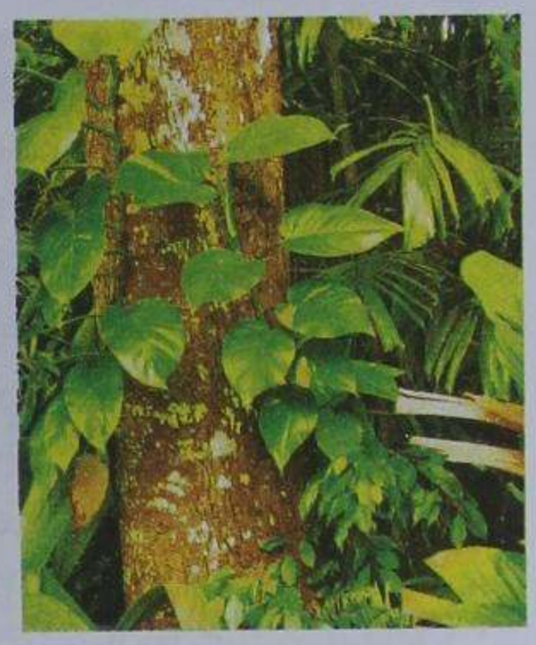


Fig. 5.5 Climbing roots help money plant to climb upwards.

In plants like sugar cane and maize where the stem is weak and tall, additional roots arise from the lower part of the stem and fix the plant firmly. Such roots grow obliquely and are called **stilt roots**.

In plants like money plants and Indian ivy having weak green stems, aerial roots develop in clusters from the stem. These roots help the plant to climb upwards by attaching themselves to a support. Such roots are called **climbing roots** (Fig. 5.5).

For respiration

In certain plants like mangroves growing in waterlogged areas, cone-shaped roots grow vertically upwards and come out of the ground. These roots are known as **pneumatophores** and have pores on them for taking in air from the atmosphere. This air is used for respiration.

For absorbing more nutrients and water

In plants like money plant, long, aerial, adventitious (fibrous) roots called **feeder roots** develop. These roots reach the soil and absorb more nutrients and water.

Did you know?

In plants like gram and pea (leguminous plants), small swellings called 'nodules' develop on the roots. These nodules contain bacteria which convert atmospheric nitrogen into soluble nitrates and thus, increases the fertility of the soil. Such roots may be termed as 'nitrogen-fixing roots'.

In some plants like orchids, aerial roots develop. Spongy cells on the tips of these roots help in absorbing moisture from the air.

In parasitic plants like dodder, sucking roots help in absorbing nutrients from the body of the host.

THE SHOOT SYSTEM

The aerial part of the plant which grows above the soil is called the **shoot system**. It consists of any or all of the following parts, that is, stem, leaves, buds, flowers and fruits. The stem is the main part of the shoot system. We see around us mostly herbs, shrubs and trees. These plants have different types of stems (see Table 5.1).

Table 5.1 Different plants and their stems

TYPE OF PLANT	KIND OF STEM
Herbs	Soft and green stem
Climbers/Creepers	Weak stem that need support to stand upright
Bamboo/Cane	Hollow stem
Shrubs	Hard and woody stem
Trees	Thick, hard and strong stem (called Trunks)

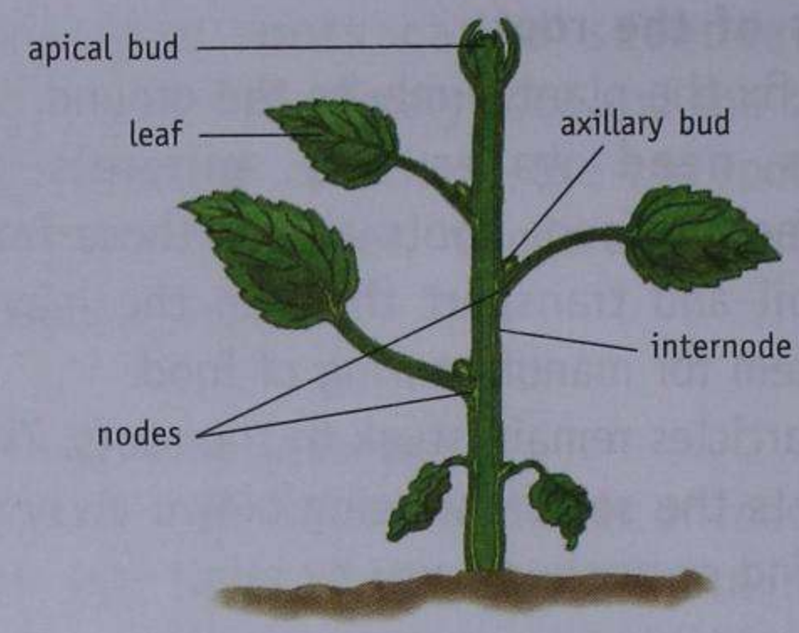


Fig. 5.6 The shoot system

The stem bears nodes, internodes and buds, and holds up the leaves, branches, flowers and fruits. The points on the stem from where leaves and branches arise are called **nodes**. The portion of the stem between two successive nodes is called an **internode**. Some small outgrowths can be seen on stems. These are called **buds**. The buds that grow at the tips of the stem or its branches are called **apical buds** or **terminal buds**. These buds have a young stem crowded with young leaves or flowers. The growth in a terminal bud leads to an increase in the length of the stem. Buds are also present in the axil of the leaf. An axil is the angle between a leaf and the stem. Such buds are called **axillary buds**. Axillary buds give rise to new branches.

Did you know?

Buds are of two types, that is, vegetative and floral. Vegetative buds give rise to branches and leaves whereas floral buds give rise to flowers.

Functions of the stem

- Stem (except in climbers and creepers) provides support to the branches, leaves, flowers and fruits, or the whole of the plant.

- Stem conducts water and minerals upwards, that is, from the root to the leaves, and transports food from leaves to all parts of the plant.
- In some plants, thick green stems rich in chlorophyll, carry out the function of manufacture food by photosynthesis.

MODIFICATION OF STEMS

Stems of some plants are modified to perform special functions such as making food, storing food and so on.

For storage of food—underground modifications of the stem

In some plants, stems do not grow above the soil but they grow underground. Such stems are called underground stems. These stems store large quantity of food in them. Modified underground stems have different structures, and are therefore given different names, as discussed below:

Rhizome

Rhizomes are swollen stems that grow horizontally. They are thick, and branched. They have nodes, internodes, prominent buds and scaly leaves. New leaves and flowers develop from a bud. Some examples are ginger, turmeric and ferns.

ACTIVITY 3

Take some specimens of underground stems such as potato, onion and ginger. Observe the nodes and internodes in them. Also draw their structures and compare them with each other.

Tuber

Tuber is an enlarged, roughly spherical-shaped stem storing food. Nodes and internodes are not distinct. Many buds, commonly called 'eyes' are present on these stems.

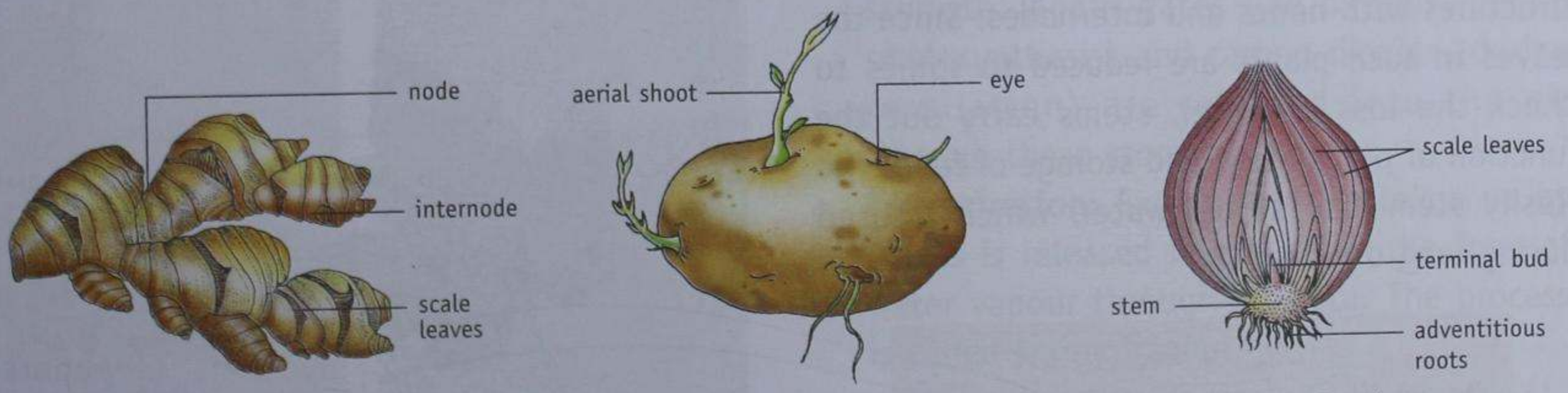
On sowing, these buds or 'eyes' can develop into new plants. Potato is the most common example of tuber.

Bulb

In a bulb, the stem is highly condensed into a flat disc at the bottom. It has a terminal bud which is covered by many scaly leaves. The inner scaly leaves are usually fleshy and store food and water. The outer scaly leaves are dry. Some examples are onion, tulip, lily and garlic.

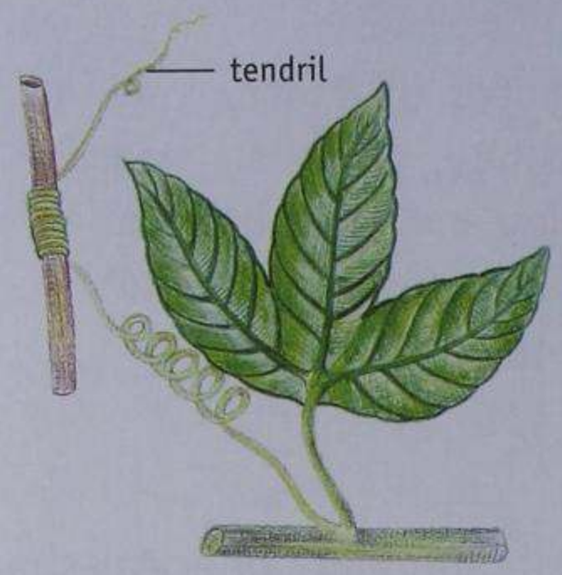
To provide protection, prepare food, provide support—aerial modifications of the stem

In some plants stems get modified to perform various functions. These are discussed here:

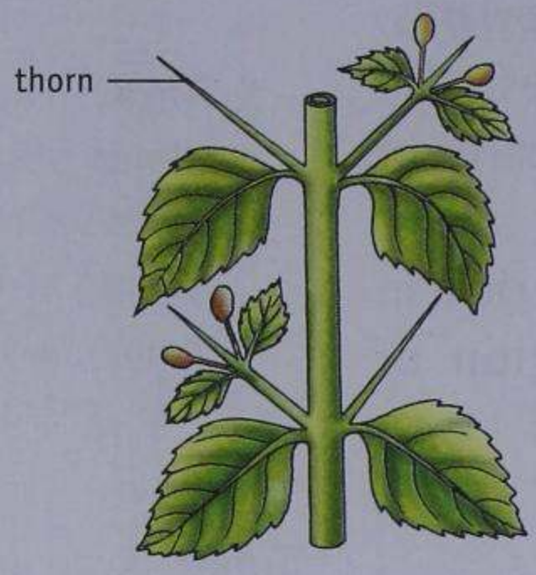


a. Rhizome of ginger **b.** Tuber of potato **c.** Bulb of onion

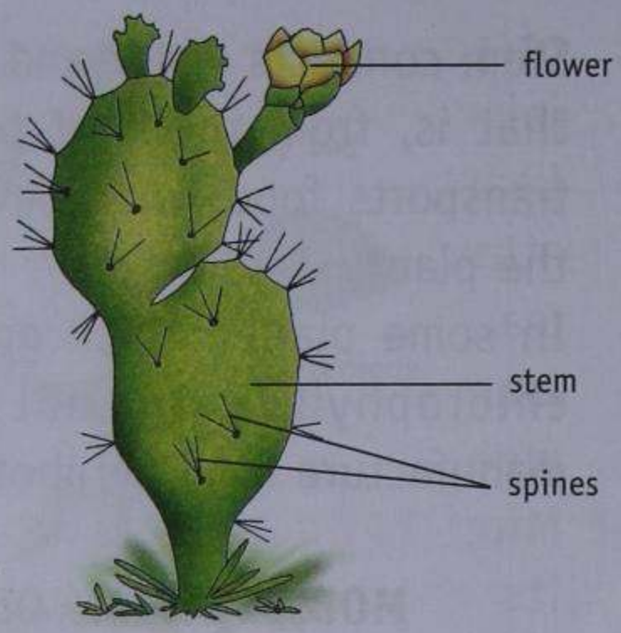
Fig. 5.7 In some plants, stems grow underground and store food.



a. Stem tendril in passion flower



b. Thorns in *Duranta*



c. Phylloclade in *Opuntia*

Fig. 5.8 In some plants, stems are modified to perform the various functions.

Stem tendril—to provide support

In certain plants like passion flower and grapevine which have weak stems, some axillary buds grow into thin, thread-like coiled structures called **tendrils**. Tendrils coil around some nearby object like a wall or tree and help the plant to climb.

Thorn—to provide protection

Some buds of certain plants such as rose and *Duranta* get modified into hard, pointed structures called **thorns**. These thorns act as defensive organs to keep grazing animals away from the plants. Also, thorns prevent excessive loss of water during transpiration.

Phylloclade—to prepare and store food

Stems of certain desert plants like *Opuntia* develop into thick, flat, short and green structures with nodes and internodes. Since the leaves in such plants are reduced to spines to check the loss of water, stems carry out the function of preparation and storage of food. The fleshy stem also stores water, which is used during long dry periods.

Did you know?

Desert lily has a bulb that sends up a stem in early spring which can be 1 to 4 feet high.

CHECK YOUR PROGRESS 1

Fill in the blanks.

1. The ends of primary or secondary roots have fine hair-like structures, called _____
2. Fibrous roots are found in _____ and _____
3. _____ fix the plant firmly to the soil.
4. _____ is an enlarged, roughly spherical-shaped stem storing food.
5. The region between two successive nodes of a stem is called _____

THE LEAF—STRUCTURE AND FUNCTIONS

The leaf is a thin, flat and generally green outgrowth of the stem. It develops from the node and a bud is usually present in the axil of a leaf. A leaf has following main parts:

- **Leaf stalk or petiole:** This is the portion

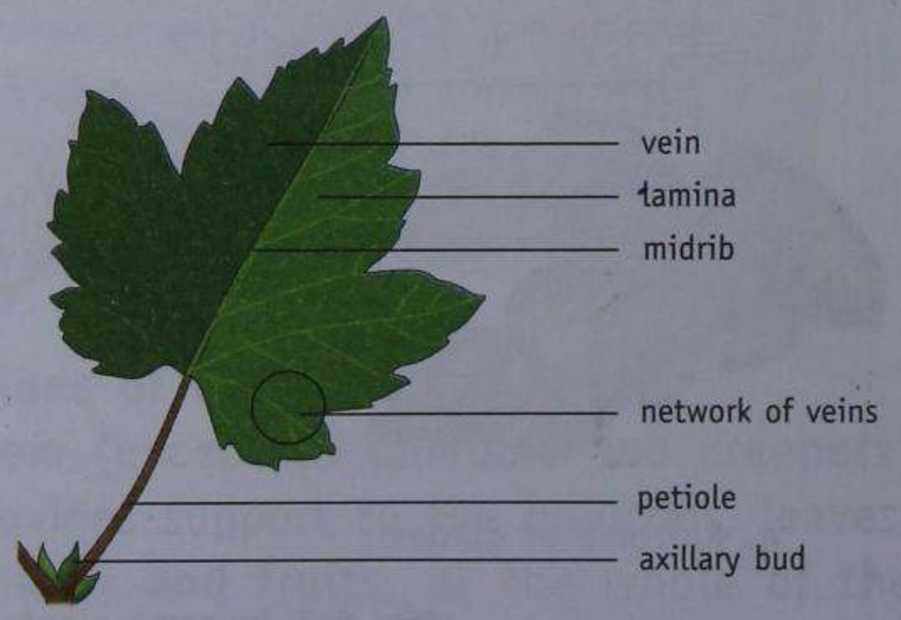


Fig. 5.9 Parts of a leaf

of the leaf with the help of which it is joined with the stem of the plant.

- **Leaf base:** The petiole or the leaf stalk is attached to the stem at a point called the leaf base.
- **Lamina or leaf blade:** Lamina is the flat, green, expanded portion of the leaf.
- **Midrib:** Petiole extends into the leaf along its centre, as the midrib. Many lateral branches, known as **veins**, arise from the midrib. Veins further branch out to form **veinlets**. In certain plants like *peepal*, you can actually feel the midrib and the other veins of the leaves with your fingers.

Venation

The arrangement of veins and veinlets on the lamina of a leaf is called **venation**. Venation is of two types:

ACTIVITY 4

Take a *peepal* leaf. Soak it in water for a week. Change the water every second day. Gently rub the lamina of the leaf with your fingers. The green portion of the leaf will come off.

You will be able to observe a very fine network of veins. This leaf can be used to make a beautiful greeting card.

a. Reticulate venation **b.** Parallel venation

Fig. 5.10 Types of venation

- **Reticulate venation:** The word 'reticulate' means resembling a network. In this kind of venation, veins and veinlets are irregularly distributed over the entire lamina, forming a network. For example, leaves of *peepal*, guava and mango.
- **Parallel venation:** In this type of venation, veins from the midrib run parallel to each other. For example, leaves of banana, grass and wheat plant.

Functions of the leaf

Leaves perform many functions as mentioned below:

- **Manufacturing of food (Photosynthesis):** Manufacturing of food is the main function of a leaf. Food is manufactured by green leaves that contain chlorophyll. These leaves produce glucose and oxygen from water and carbon dioxide, in the presence of sunlight. The process is called **photosynthesis.**

$$\text{Carbon dioxide} + \text{Water} \xrightarrow[\text{chlorophyll}]{\text{sunlight}} \text{Starch} + \text{Oxygen}$$

- **Gaseous exchange:** Many minute pores or openings called **stomata** are present on the lower surfaces of the leaves. Plants take in carbon dioxide during photosynthesis and oxygen during respiration through these stomata. Again gases like oxygen (during photosynthesis) and carbon dioxide (during respiration) are released into the air through these stomata.
- **Transpiration:** Excess of water taken up by plants is released in the air in the form of water vapour through stomata. The process is called **transpiration**.

Types of leaves

Basically leaves can be divided into two types—

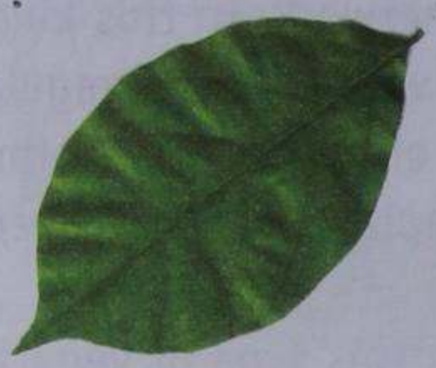


Fig. 5.11 In a simple leaf, there is a single leaf blade or lamina.

Fig. 5.12 In a compound leaf, the leaf blade is divided into many parts.

simple leaves and compound leaves.

- **Simple leaf:** In a simple leaf there is a single leaf blade or lamina. Cuts may be present but they do not touch the midrib or the petiole. An example is *peepal* (Fig. 5.11).
- **Compound leaf:** In a compound leaf the leaf blade is clearly divided into many parts. These parts are called leaflets. Some examples are *neem* and *Acacia* (Fig. 5.12).

Arrangement of leaves

- **Alternate arrangement:** In this type of arrangement only one leaf grows at each node. No two successive leaves are in the same direction, that is, they are in opposite directions. Some examples are rose, sunflower and China rose (Fig. 5.13a).
- **Opposite arrangement:** In this type of arrangement, two leaves arise from each node. The leaves are arranged opposite to each other. Some examples are basil, guava and jasmine (Fig. 5.13b).
- **Whorled arrangement:** In *oleander* and some other plants, a set of leaves grow from each node (Fig. 5.13c). These leaves are at the same level and form a whorl or a circle. Such an arrangement is called whorled arrangement.

MODIFICATION OF LEAVES

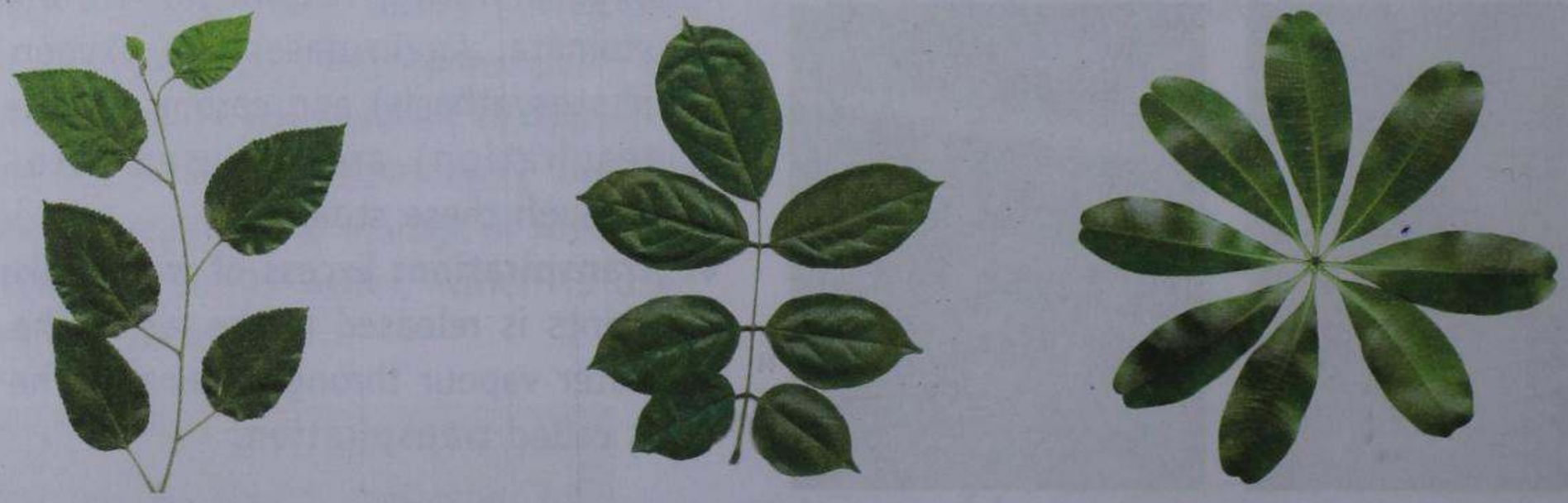
Though the main function of leaves is to manufacture food, some leaves are modified to perform special functions:

To provide support—leaf tendril

In some plants, the leaf is modified into a thin thread-like coiled structure called tendril. It stretches out and twines around any suitable support, thus, providing support to the weak stems. Leaf tendrils can be seen in pea plants (Fig. 5.14a).

To provide protection and reduce loss of water—leaf spines

In certain plants leaves or parts of leaves are modified into spines. Spines help to reduce the loss of water by transpiration. Spines also help to protect the plant from the grazing animals. Some examples where leaves are modified into spines



a. Alternate **b.** Opposite **c.** Whorl

Fig. 5.13 Arrangement of leaves

a. Leaf tendrils of pea plant

b. Leaf spines of Mexican poppy

c. Scale leaves of spinach

Fig. 5.14 In some plants, leaves are modified to perform various functions.

are prickly pear (*Opuntia*) and Mexican poppy (Fig. 5.14b).

To store food and water—scale leaves

In some plants leaves take up the function of storing food and water. For this purpose, they are modified as scale leaves. Scale leaves may be thin and dry as in ginger, or thick and fleshy as in onion and spinach (Fig. 5.14c). Scale leaves protect buds also.

Modifications of leaves in insectivorous plants

Pitcher plant

In pitcher plant, the leaf is modified into a pitcher. The pitcher has a lid which is an extension of the leaf apex. The petiole of the leaf coils like a tendril. Once an insect enters the pitcher through the opening, the lid closes and the animal protein gets digested by the juices released by the inner surface of the leaf.

a. Pitcher plant

b. Venus flytrap

Fig. 5.15 Some insectivorous plants

Bladderwort

The leaves of bladderwort are highly segmented. Some of the segments are modified to form tiny bladder-like structures with a trapdoor entrance. Organisms can enter through it but cannot come out as they get trapped inside and get digested there.

Venus flytrap

In a Venus flytrap plant, the edges of the leaf have long pointed hair. The leaf blade is divided into two parts and the midrib acts as a hinge. When an insect is caught the leaf suddenly closes. The leaf then secretes juices to digest it (Fig. 5.15b).

THE FLOWER—STRUCTURE AND FUNCTIONS

The flower is the reproductive part of the plant. Flowers differ in their size, shape, colour and in the arrangement of their various parts, yet most of them have a common structure. The function of a flower is to produce fruits and seeds.

Parts of a flower

A flower usually has four parts—**calyx** (sepals), **corolla** (petals), **androecium** (the male part)

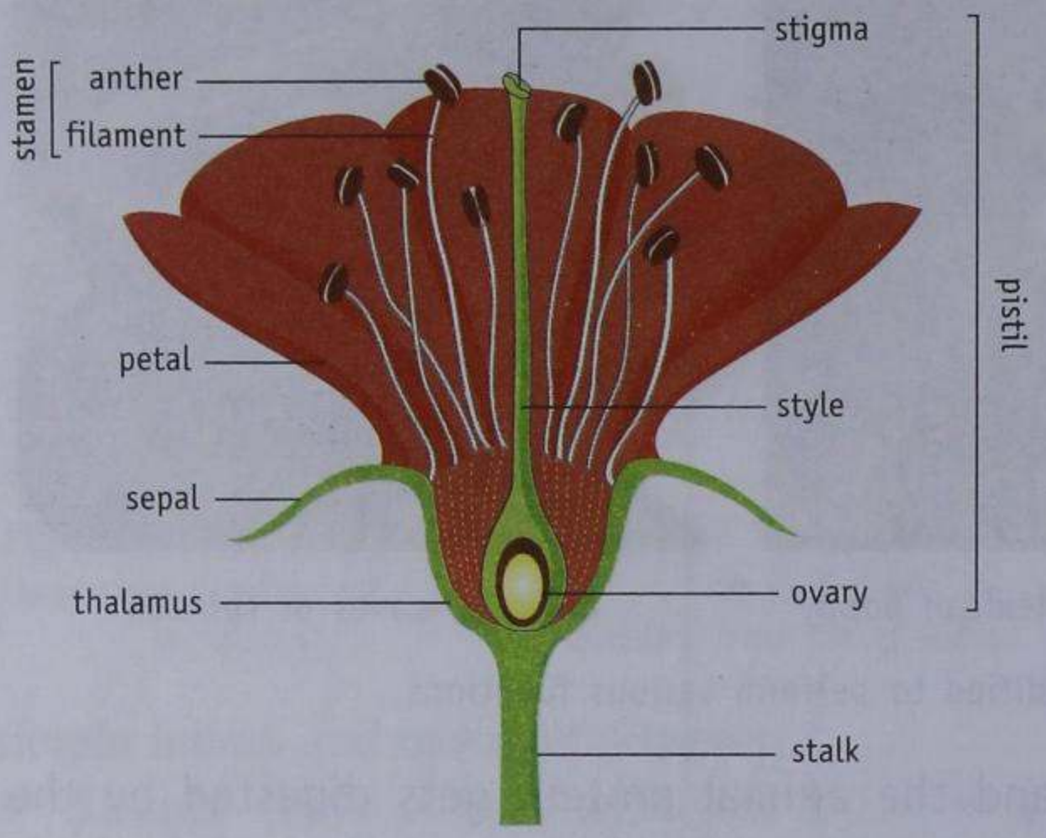


Fig. 5.16 Parts of a flower

and **gynoecium** (the female part). These four parts are arranged in four whorls. Flowers are generally attached with the stem through a **stalk** or a **pedicel**. Those flowers that do not bear a stalk are called **sessile flowers**. The four whorls arise from the tip of the pedicel. For this reason, the tip is swollen and is called the **thalamus**.

Calyx

The calyx is the outermost whorl. It consists of sepals which are green leaf-like structures. Sepals enclose and protect all parts of the flower at the bud stage.

Corolla

The corolla is the second whorl. It consists of petals which are brightly coloured. Petals surround and protect the reproductive parts of the flower. Insects get attracted because of their beautiful colours, and help in pollination.

Androecium

The androecium is the third whorl. It contains **stamens**, the male reproductive part of the flower. A stamen has two parts:

- a thin, hair-like, long and narrow stalk called **filament**, and
- a small two-lobed structure called **anther**. The anther consists of fine particles called **pollen grains** which take part in reproduction.

In some flowers, stamens are present in the joined form whereas in others they are free.

Gynoecium (pistil)

Gynoecium or pistil, is the innermost whorl of the flower. It contains **carpels**, the female reproductive part of the flower. A carpel has three parts:

- a swollen part called **ovary**, situated at the base of the carpel. It contains small, round egg-like structures called **ovules**.
- an extension of ovary into a long, narrow tubelike structure called **style**.
- a disc-like part at the top of the style, called **stigma**.

In some flowers, carpels are present in the joined form whereas in others they are free.

Types of flowers

Some plants have flowers which have both, the male reproductive part and the female reproductive part on the same flower. These flowers are called **bisexual flowers**.

Other plants have flowers which have only male reproductive part or female reproductive part. Such flowers are called **unisexual flowers**.

Functions of a flower

A flower is the reproductive part of a plant. The function of the flower is to produce seeds and fruits. Reproduction is a two step process. The first step is called **pollination** while, the second step is called **fertilization**.

POLLINATION

For the seeds to be formed, pollen grains produced in the anther must be transferred from

the anther to the stigma of the pistil. This transfer of the pollen grains from the anther to the stigma of a pistil is called **pollination.** Pollination is of two types:

Self pollination

In self pollination pollen grains are either transferred from the anthers to the stigma of the same flower, or, from the anthers of a flower to the stigma of another flower of the same plant.

Cross pollination

In most flowers, pollen grains are transferred from the anthers of a flower of one plant to the stigma of a flower of another plant but of the same type. This is called cross pollination.

Agents of pollination

Wind, water, insects, birds and other animals help in transferring of pollen grains from anther to the stigma of a flower. They are therefore, called the agents of pollination.

Pollination by wind

Flowers of plants like rice, maize and grasses are pollinated by wind. Wind-pollinated flowers show certain characteristics.

- Pollen grains are dry and light. Such pollen grains can be easily blown by wind.
- Pollen grains are produced in large quantity since a large number of pollen grains when blown by wind may not reach the stigma of a flower.
- Stigma is large and feathery and projects out.

Pollination by water

Pollination by water is brought about in aquatic plants like *Hydrilla* and *Vallisneria*.

In *Vallisneria* initially the male flower is submerged in water. On maturity, it gets detached and floats on water. The female flower that has a long stalk also floats on the surface of water. When male flowers, moving with the water current, come in contact with female flowers then the pollen grains are transferred to the stigma.

Pollination by insects

Most flowers are pollinated by insects. You must have seen bees and butterflies moving from one flower to another. The insects visit flowers to collect nectar and in the process pollen grains get stuck to their body parts. When they visit another flower, pollen grains get transferred to the stigma. Flowers pollinated by insects show certain characteristics.

- They have brightly-coloured petals like in rose and marigold to attract insects.
- Some flowers produce nectar. When insects visit flowers to collect nectar they carry pollen grains with them.

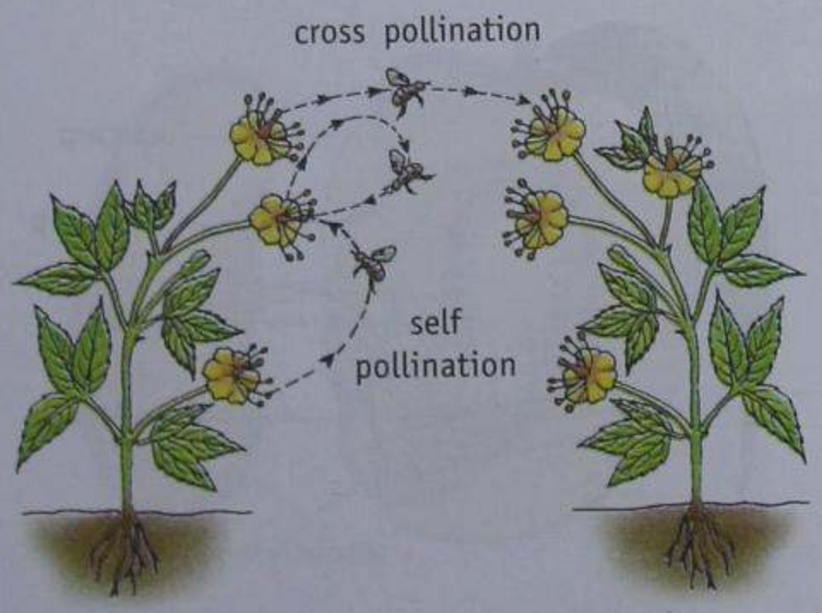


Fig. 5.17 Types of pollination

Fig. 5.18 Dry and light pollen grains of maize can be easily blown by wind.

Fig. 5.19 Pollen grains get stuck to the body parts of insects and get transferred.

Fig. 5.20 Birds bring about pollination in silk cotton tree.

- Most flowers are sweet smelling. Their scent attracts insects. An example of such a flower is that of night jasmine.
- Pollen grains and the stigma of most of these flowers are sticky.

Pollination by animals

Birds, squirrels and bats also act as agents of pollination. For example, birds bring about pollination in silk cotton tree.

FERTILIZATION

Once a pollen grain reaches the stigma, fertilization starts. Fertilization involves fusion of a male cell with a female cell to produce one single cell called **zygote**.

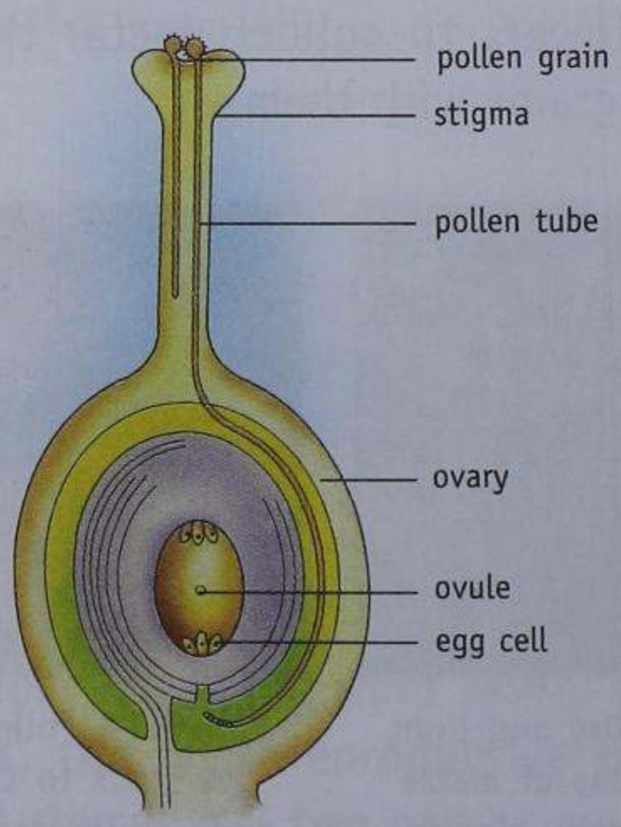


Fig. 5.21 The process of fertilization

When a pollen grain reaches stigma, it begins to grow a pollen tube. The pollen tube grows down through the style to the ovary. **Male cells** travel down the pollen tube and one of them unites with the **egg cell** in the ovule. The fusion of male cell with the female cell or egg cell is called **fertilization**. After the fertilization, the ovules grow into seeds and the ovary develops into the fruit. The petals and sepals die and wither.

THE FRUIT—PARTS AND FUNCTIONS

Fruit is nothing but a ripened ovary. A fruit consists of two parts—pericarp (or fruit wall) and seed.

Pericarp

The pericarp develops from the wall of the ovary. It may be thin or thick. It may also be soft and fleshy or dry. It consists of three parts (Fig. 5.22).

- **Epicarp:** The outer thin and leathery part is the epicarp. It is usually discarded.
- **Mesocarp:** It constitutes the sweet and fleshy part which is usually eaten.
- **Endocarp:** It is the innermost, hard portion that contains the seed.

The nature of the three parts varies in different fruits. In some fruits the pericarp is not differentiated into these three parts.

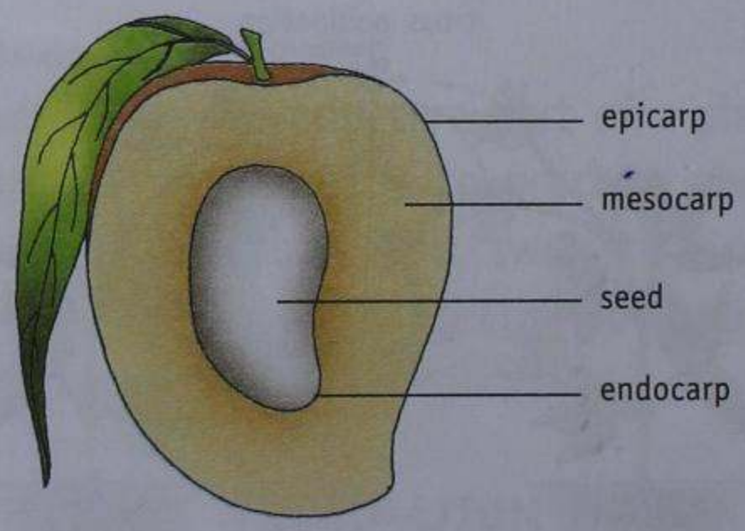


Fig. 5.22 Parts of a fruit

Functions of a fruit

- The fruit protects the immature seeds from animals and extreme climatic conditions.
- It also attracts animals who help in dispersing or scattering the seeds to distant places, which is of great biological significance.
- It stores food material.

Did you know?

A fruit is a ripened ovary whereas a vegetable can be any part of a plant.

Pumpkin, tomato and pea are not vegetables but fruits.

A fruit may be a dry fruit (like pea and gram) or a fleshy fruit (like tomato or papaya). Some fruits like apple and pear are false fruits because here ovary does not form the main fleshy part.

THE SEED

Ovules present in the ovary develop into seeds after fertilization. A fruit may have one seed, as in mango and plum or many seeds, as in apple, lemon, orange and tomato. Seeds of different plants show great diversity in size, shape and appearance.

The seed has an outer covering called the **seed coat**. On removing the seed coat are seen fleshy parts called **cotyledons**. Some seeds like

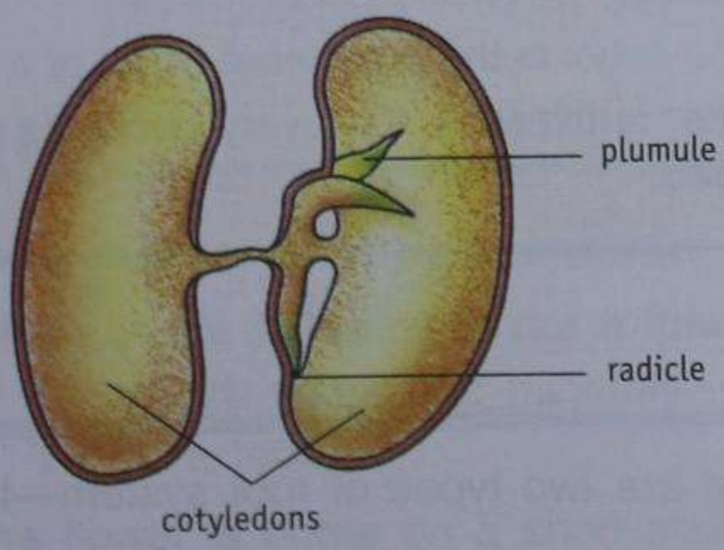


Fig. 5.23 Germination of seeds

ACTIVITY 5

Take a few pea, gram or bean seeds. You will observe a small scar. This is called hilum. The seeds are attached to the fruit wall by a small stalk at this point. Slightly below the hilum is a pore called the micropyle.

Soak the bean seeds overnight. Observe that the seeds have a smooth seed coat which can be easily removed after soaking the seeds.

rice and wheat have only one cotyledon (monocot seeds) while others have two (dicot seeds). Cotyledons reserve food inside them for the baby plant, **embryo**, present inside the seed. Cotyledons are attached to a short curved structure called **axis**. The axis consists of two parts, the **plumule** which develops into a shoot and the **radicle** which develops into a root.

Under favourable conditions which include water, air and the right temperature, the seed germinates to produce a new plant (Fig. 5.23).

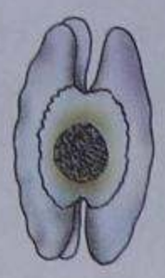
Dispersal of seeds

Plants produce large quantities of seeds. If all the seeds of a plant fall and germinate at the same place there would be a tough competition for light, water and minerals amongst seeds. There are chances that most seedlings may die due to overcrowding.

To overcome this, seeds are dispersed away to distant places by various agents, such as wind, water and animals.

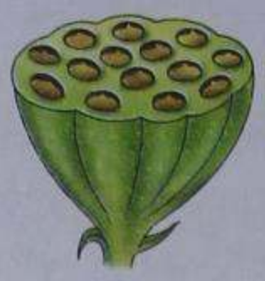
- **Dispersal by wind:** Seeds of some plants like cotton and drumstick have tufts of hair or wings and are easily dispersed by wind. Seeds of some plants are so light and minute in size that they may easily be carried away by the gentlest breeze.

Oroxylum



drumstick

Fig. 5.24 Seeds dispersed by wind



thalamus of lotus flower

coconut

Fig. 5.25 Fruits and seeds dispersed by water

- **Dispersal by water:** The seeds, for example, coconut, water lily, lotus which have a spongy or fibrous outer coat and are able to float are dispersed by water.
- **Dispersal by animals:** Several types of projections like hooks, barbs, spines, bristles and stiff hair on the surface of fruits and seeds help in their dispersal by animals. These seeds get attached to the skin of animals or to the clothes of human beings and are often carried to distant places. Some fruits are fleshy and edible. Human beings and birds eat the pulp or edible portion of the fruits and throw the seeds which germinate and develop into new plants when conditions are favourable. Animals like bats and squirrels also help in dispersal of seeds when undigested seeds are passed out in their droppings at various places. Some fruits dispersed by animals are *Xanthium*, *Urena*, *Boerhaavia* and *Martynia* (Fig. 5.26).

Xanthium

Urena

Boerhaavia

Martynia

Fig. 5.26 Fruits dispersed by animals

ROLE OF PLANTS

Plants play a very important role in the survival of animals on the earth. Some of the important uses of plants are listed below:

- **We get food from plants:** Plants are the ultimate food producers. As we have read that most green plants manufacture food through the process of photosynthesis. Thus, plants act as primary producers. All animals including human beings depend directly or indirectly on the food manufactured by plants.
- **Plants release oxygen:** Plants release oxygen as a by-product of photosynthesis. We cannot survive without oxygen, as it is needed for respiration.
- **We get timber, wood and paper from plants:** Most of our requirements of day-to-day life get fulfilled by plants in one way or the other.

CHECK YOUR PROGRESS 2

Write True or False.

1. In reticulate venation, veins are arranged parallel to each other towards the margin or the tip of the leaves.
2. The leaves of *peepal* trees are simple leaves.
3. The leaves of pea plant are modified into spines.
4. The calyx is the outermost whorl of a flower.
5. After fertilization, the ovary becomes the seed.

Now you know

- Flowering plants have a root and a shoot system. There are two types of root system—tap root and fibrous root.
- In some plants roots are modified to perform other functions like storage of food, providing

additional support to the plant, help plant in respiration and absorb more nutrients and water.

- The aerial part of the plant which grows upright above the soil from the plumule of the embryo is called the shoot system. It consists of any or all of the following parts—stems, leaves, buds, flowers and fruits.
- A stem bears leaves, flowers and fruits. It conducts minerals, water and food to all parts of the plant.
- In some plants stems are modified to perform special functions such as making food, storing food and providing protection.
- A leaf has a green, flat lamina and a petiole that joins it to the stem. The primary function of the leaves is to prepare food for the plant.
- The arrangement of veins and veinlets on the lamina of a leaf is called venation. The venation is of two types, that is, parallel and reticulate.
- Plants may bear simple or compound leaves. A leaf with single, undivided leaf blade is called simple leaf. The leaf blade of a compound leaf is divided into several leaflets.
- The leaves are arranged on the stem in various ways. A stem may bear one leaf at each node, two leaves opposite to each other at each node or several leaves at each node.
- Most flowers have four whorls—calyx (sepals), corolla (petals), androecium (anther and filament) and gynoecium (ovary, style and stigma).
- Transfer of pollen grains from the anther to the stigma of a flower is called pollination. It is of two types—self pollination and cross pollination.
- Pollen grains are mainly dispersed by insects, birds, wind and water.
- Pollination leads to fertilization which is the fusion of a male cell with an egg cell.
- The ovary develops into a fruit and the ovules change to seeds after fertilization.
- Each seed contains an embryo that develops into a new plant.
- Seeds are dispersed by air, water, animals and human beings.

Keywords

ADVENTITIOUS ROOT	a root growing in an unusual location, e.g. from stem
PROP ROOTS	roots that provide additional support to the heavy branches
NODES	the points on the stem from where leaves and branches arise
RHIZOMES	swollen stems that grow horizontally
PHYLLOCLADES	stems that develop into thick, flat and green structures
VENATION	the arrangement of veins and veinlets on the lamina of a leaf
FERTILIZATION	fusion of a male cell with a female cell

Exercises

A. Tick the most appropriate answer.

1. Which of the following is not a function of the roots?
   - **a.** To absorb water and minerals
   - **b.** To anchor the plant to the soil
   - **c.** To store food
   - **d.** To manufacture food
2. The flower is borne on a short stalk called
   - **a.** petiole.
   - **b.** filament.
   - **c.** pedicel.
   - **d.** plumule.

3. Which of the following roots give mechanical support to the plant?
   a. Prop roots
   b. Contractile roots
   c. Hanging roots
   d. Adventitious roots
4. The point on the stem where leaves arise is
   a. internode.
   b. node.
   c. bark.
   d. trunk.
5. The wide flat portion of the leaf is called the
   a. lamina.
   b. petiole.
   c. vein.
   d. midrib.
6. The calyx consists of
   a. sepals.
   b. stamens.
   c. anthers.
   d. petals.
7. The gynoecium consists of
   a. stigma and anthers.
   b. anthers and filaments.
   c. stigma, pollen grains and ovary.
   d. stigma, style and ovary.
8. Flowers with either male or female reproductive part are
   a. bisexual.
   b. hermaphrodite.
   c. unisexual.
   d. none of these
9. The transfer of pollen grains from the anther to the stigma is termed as
   a. fertilization.
   b. reproduction.
   c. fusion.
   d. pollination.
10. Which part of the flower gives rise to the seeds?
   a. Pollen grains
   b. Ovary
   c. Ovules
   d. Stigma

B. Fill in the blanks.

1. Primary root is _____ at its origin and _____ at the tip.
2. _____ are the additional roots that arise from the lower part of the stem and fix the plant firmly.
3. Plants with brightly coloured flowers are usually pollinated by _____
4. Cone shaped roots that grow vertically upwards and come out of the ground are known as _____
5. _____ is an enlarged, roughly spherical-shaped stem storing food.
6. In a _____ leaf the leaf blade is clearly divided into many parts.
7. A flower usually has four parts—calyx, corolla _____ and _____
8. Reproduction is a two step process. The first step is called _____ and the second step is called _____
9. Fruit is nothing but a ripened _____
10. A fruit may have one seed, as in _____ or many seeds, as in _____

C. Write true or false for each statement. Rewrite the false statements correctly.

1. The node is the portion of the stem between two internodes.

2. The stem helps in absorbing water from the soil.
3. Anther, style and stigma are the parts of a pistil.
4. Ovules develop into fruits.
5. A stamen has a long stalk called style.
6. The transfer of the pollen grains from the anthers to the stigma of a flower is called fertilization.
7. The leaves of *Opuntia* are modified into thorns.
8. The flat green portion of the leaf is called the leaf blade.
9. Mango and orange are fruits whereas cucumber and tomato are vegetables.
10. Cluster of roots of about the same size are present in the fibrous root system.

D. Name the type of stem present in the following.

1. Potato
2. Ginger
3. Onion
4. Cactus

E. Match the definitions with the terms. All the terms will not be used.

DEFINITION	TERMS
1. part of the flower that produces pollen grains	a. lamina
2. green leaf-like structure protecting the inner parts of flower	b. petiole
3. transfer of pollen grains from the anther to the stigma of the flower	c. pollination
4. root system where side roots develop from a main primary root	d. anther
5. fusion of the male reproductive cell with the egg cell	e. ovules
6. parts of a flower that develops into seeds	f. calyx
7. points on the stem at which leaves arise	g. tap root
8. wide flat portion of leaf	h. internodes
9. ripened ovules	i. fruit
10. ripened ovary	j. tap root
	k. fertilization
	l. seeds
	m. nodes

F. State the functions of the following.

1. Leaf spines
2. Phylloclade
3. Stem tendril
4. Stilt roots

G. We eat different parts of various plants. For each plant, write the part of the plant that we eat.

1. carrot _____
2. cucumber _____
3. radish _____
4. tomato _____
5. onion _____
6. potato _____
7. ginger _____
8. sugar cane _____
9. lady's finger _____
10. mint _____
11. fenugreek _____
12. pea _____
13. apple _____
14. groundnut _____

H. Find the odd one out. Give reasons.

1. stem, leaves, root, flowers
2. calyx, corolla, stamen, stem
3. ovules, lamina, midrib, petiole
4. leaf, stigma, style, ovary

I. Differentiate between:

1. cross pollination and self pollination
2. reticulate venation and parallel venation
3. prop roots and pneumatophores
4. simple leaf and compound leaf
5. terminal bud and axillary bud

J. State the agents of pollination for each of the following.

1. Sunflower
2. China rose
3. Rose
4. Maize
5. Jasmine
6. *Hydrilla*

K. Write short answers.

1. Give one example of modification of roots.
2. What are prop roots?
3. Define rhizome.
4. What is pollination?
5. What are the parts of a fruit?

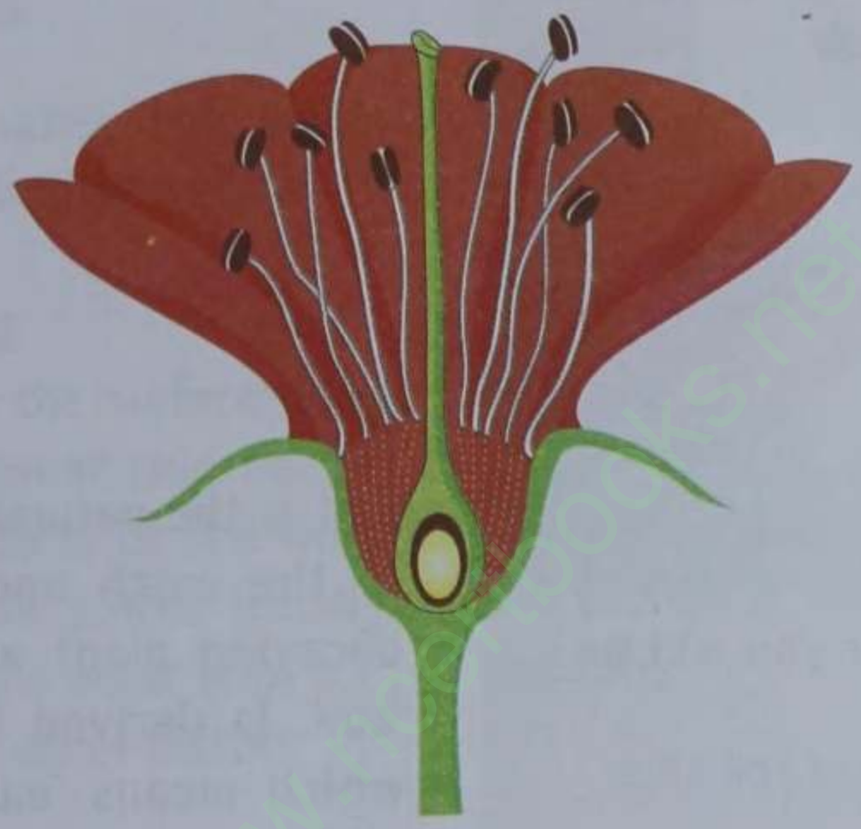
L. Answer in detail.

1. What are the functions of the root?
2. How is a tap root different from a fibrous root?
3. Write two important functions of the stem.
4. What are the main parts of a leaf?
5. What is venation? State its various types.
6. What is fertilization?
7. What is a fruit? State its function.
8. Draw a flowering plant and label all its parts.

9. Draw a diagram of a flower and label its various parts.
10. Why are seeds produced in large quantity?
11. Describe the special characteristics of flowers pollinated by insects.
12. Wind pollinated flowers produce pollen grains which are light and dry. Why?
13. What are the different agents of seed dispersal?
14. State various adaptations in the seeds dispersed by wind.
15. What are the various adaptations in seeds dispersed by animals?

M. Given below is a figure of a flower structure. Copy the diagram in your notebook and label the following parts in it.

thalamus, calyx, style, stigma, sepals, petals, androecium, stamens



Fun to do

1. Collect any five small plants with tap root and fibrous root. Observe their leaves. Is there any co-relation between the root system and the type of leaves?
2. Collect and dry five leaves each with reticulate and parallel venation.
3. Go out in the school garden. Identify plants with opposite, alternate and whorl type of leaf arrangements.
4. Make three groups. Each group collect five seeds—dispersed by air, animals and human beings. Mention the adaptation shown by each seed for its dispersal.