

THE PLANT : STRUCTURE
AND FUNCTIONS

SYLLABUS

The structure, functions and some modifications of plant parts :

1. Root — Storage roots : e.g. carrot, radish, turnip, beetroot
(without mentioning the terms - fusiform, napiform)
Support — prop roots - banyan
2. Stems — Underground stems : tuber, bulb, rhizome - suitable examples
Stem tendrils, thorns, climbing stems (with examples)
3. Leaves — venation, simple/compound leaves, arrangement
Some modification with examples (e.g. prickly pear)
4. Flowers — parts and their functions.
Pollination — agents and type of pollination
Fertilization — fruit, seed dispersal
 - * Parts of a flower — using specimens like lily/hibiscus. Students to observe/draw parts.
 - * Practical observation and drawing of the different parts of plants available in school garden/park, the variations in them (E).
(Teacher may also draw attention of students to the shape, texture, edge of leaves)
 - * Modifications — specimens - to be observed and drawn (E)

You see a variety of small and large plants in your surroundings such as, mint, rose, balsam, mango, neem, peepal, etc. They have variations in height, shape of leaves, colour of flowers, etc. Despite these variations they have some structural similarities for example, majority of plants have roots.



ACTIVITY 1

Carefully dig out a small plant like balsam from the soil. Gently wash the portion, which was under the ground, with water.

Take a large-sized beaker or tumbler containing some water. Keep the plant in it with its underground parts submerged in water.

Observe the plant carefully and compare its parts. Identify the two main parts of the plant — one which was under the ground known as the **root system**, and the other which was above the soil known as the **shoot system**.

PARTS OF A PLANT

Root system

Shoot system

Let us discuss both the systems in detail.

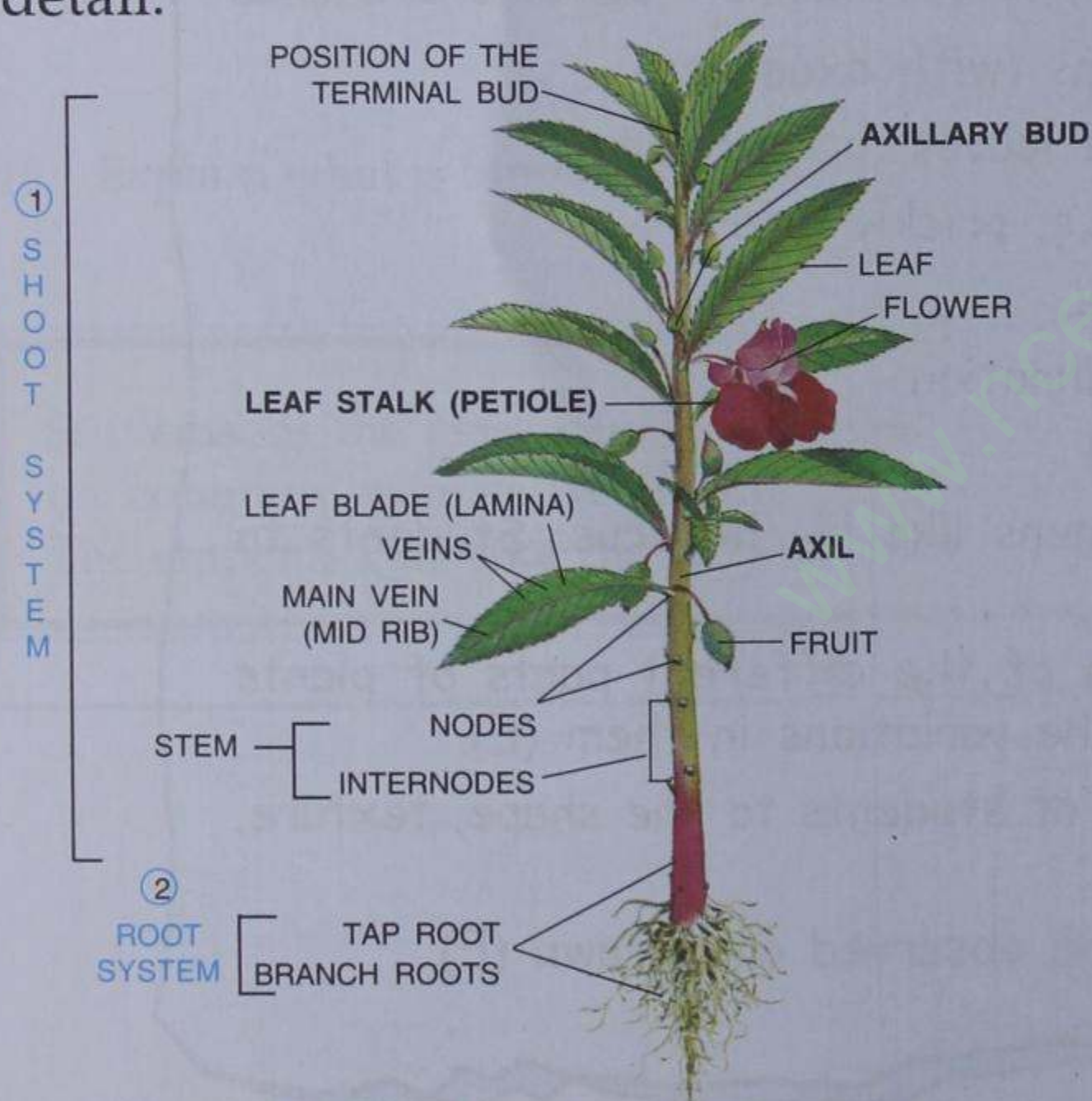


Fig. 4.1 Balsam plant showing the root system and the shoot system

A. THE ROOT SYSTEM

The underground part of the plant is called root. It has the following main characteristics :

1. It is not green in colour.
2. It grows downward into the soil away from the sunlight.

3. It never bears leaves, flowers, fruits or buds.
4. It has one main thick **primary root** with many **side branches**. The end parts of the root branches bear fine hair-like processes called **root-hairs**. The primary root with all its branches and the root-hairs is called the **root system**.

Types of Root System

The root system is of two types —

- (i) tap root system
- (ii) fibrous root system.

(i) Tap Root System (Fig. 4.2)

It has a thick main root called **primary root** and bears many side branches called **secondary roots**. Such a root system is found in dicot plants such as gram, pea, etc.

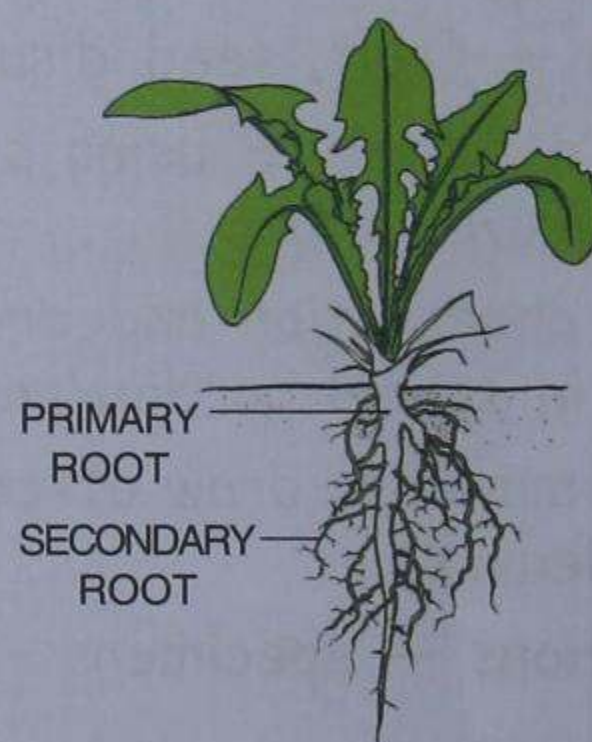


Fig. 4.2 Tap root system

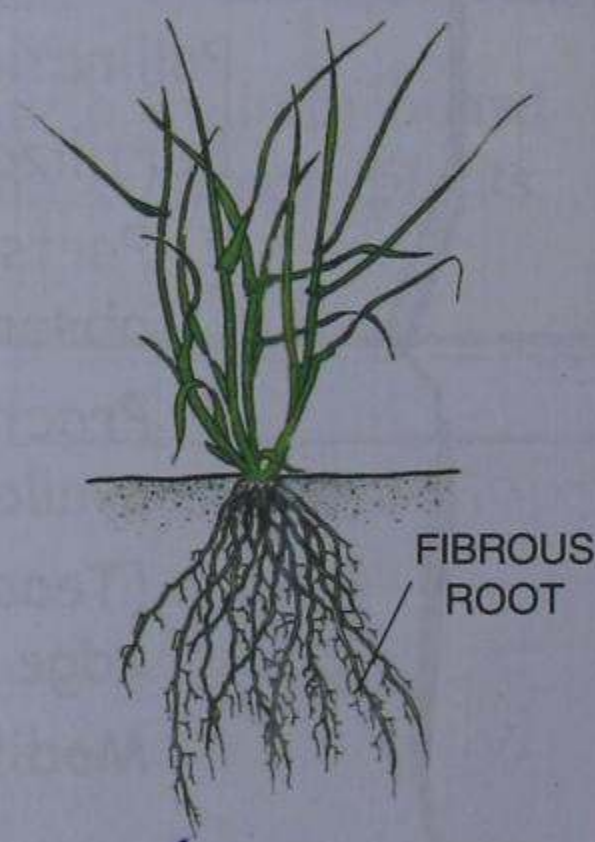


Fig. 4.3 Fibrous root system

(ii) Fibrous Root System (Fig. 4.3)

It has a cluster of roots of the same thickness and size arising from the base of the stem. This type of root system is found in monocot plants such as maize.

There is another way of classifying the roots on the basis of their origin — *True roots* and *Adventitious roots*.

True roots develop from the radicle (Fig. 4.4) of the germinating seed e.g., pea, carrot.

Adventitious roots grow from the stem or leaves, e.g., banyan tree (Fig. 4.5).

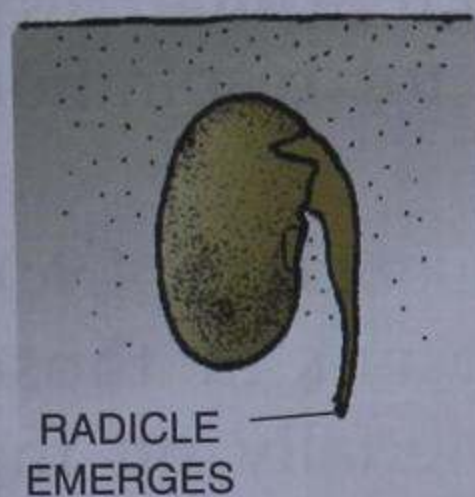


Fig. 4.4 Emergence of radicle



Fig. 4.5 Prop roots (Banyan)

MODIFICATIONS OF THE ROOT

The roots undergo modifications to perform mainly the following *two* functions:

- (i) Storage of food
- (ii) To provide additional support.

(i) Roots for Storage of Food

The primary roots usually get thickened to store food. They acquire several shapes. For example, *roundish* (turnip), *conical* (carrot) or *spindle-like* (radish) (Fig. 4.6).

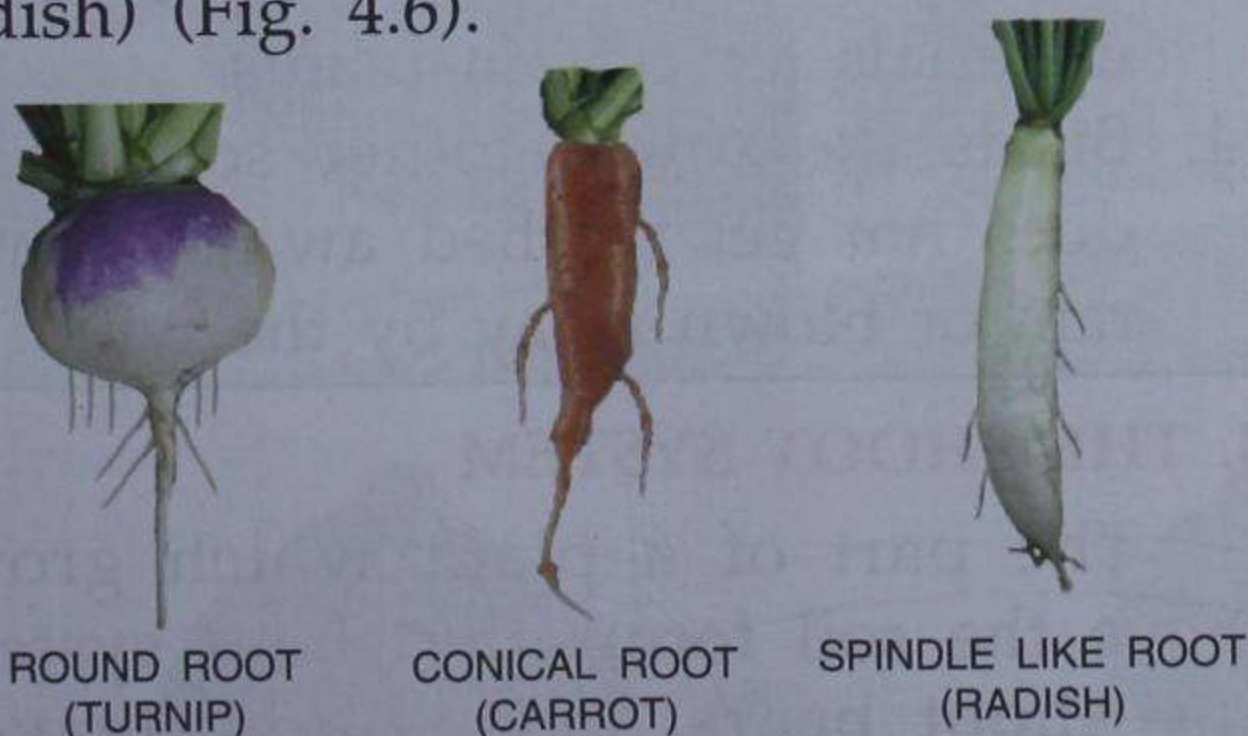


Fig. 4.6 Modifications of tap root

The adventitious roots are sometimes swollen to store food. Examples are :

- (1) **tuberous roots** (as in sweet potato, tapioca, etc.) (Fig. 4.7a).

- (2) **nodulose roots** (as in turmeric, arrow root, etc.) (Fig. 4.7b).

- (3) **fasciculated roots** (arranged in bundles as in dahlia, asparagus, etc.) (Fig. 4.7c).

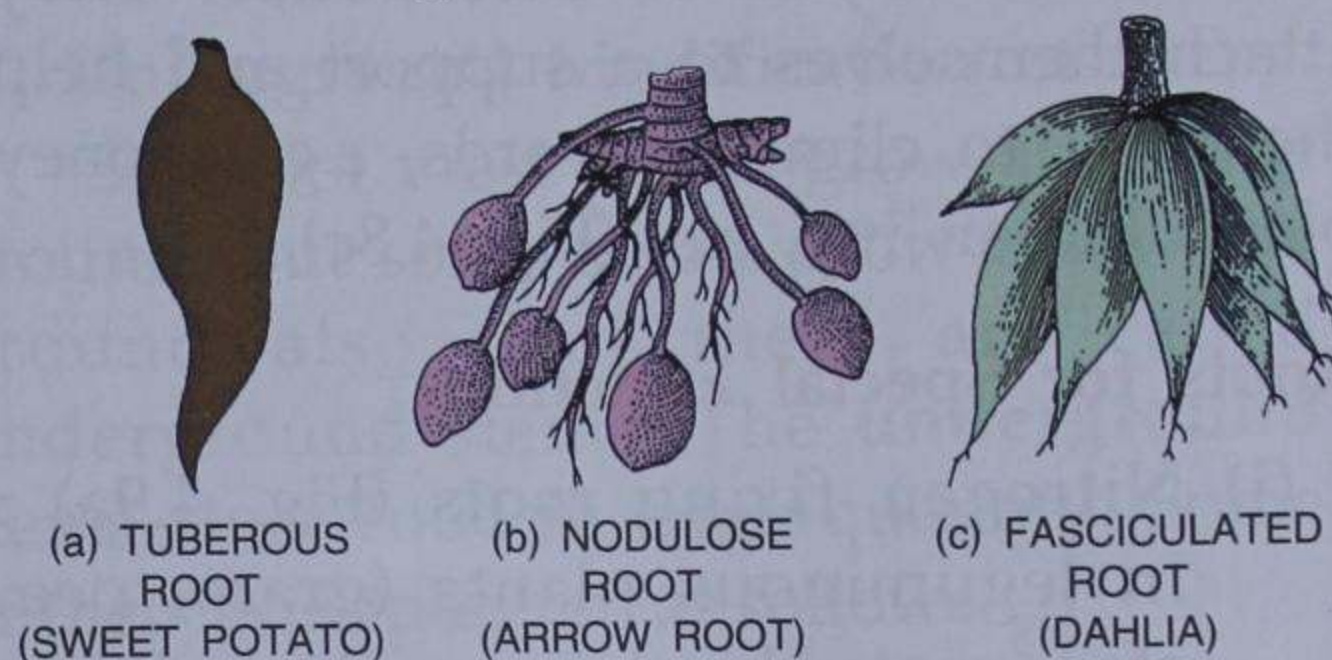


Fig. 4.7 Modifications of adventitious roots for food-storage

(ii) Roots for Additional Support

Sometimes, the roots such as **prop roots**, **stilt roots** and **climbing roots** get modified to give support to the plant.

(a) Prop roots — These are aerial roots which grow vertically downward from the horizontal branches. As they touch the ground, they go deep into the soil. They look like ropes or pillars, e.g., banyan, screw pine, etc. (Fig. 4.8a).

(b) Stilt roots — Plants with weak stem such as sugarcane, wheat, maize, etc., give rise to adventitious roots from

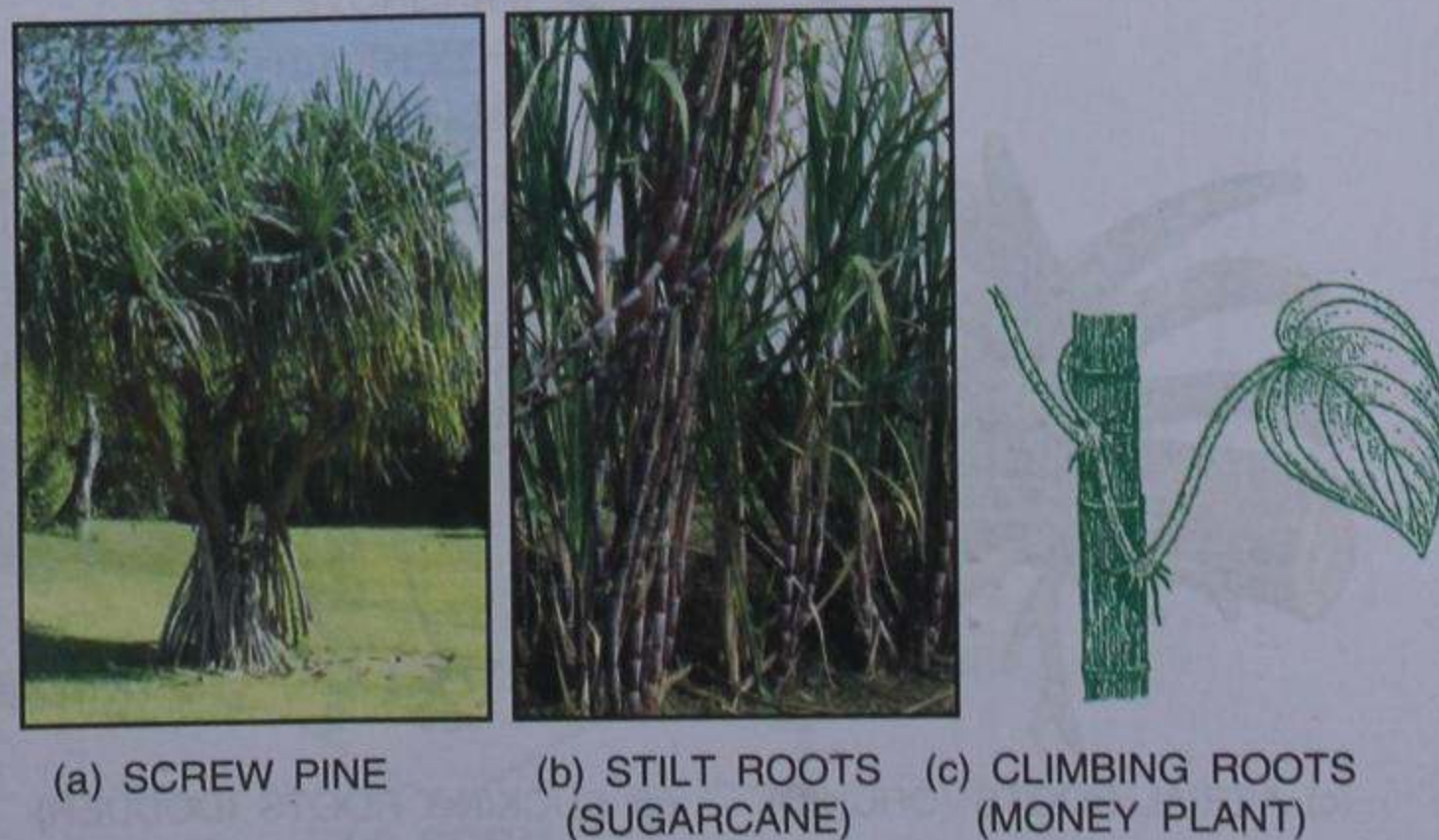


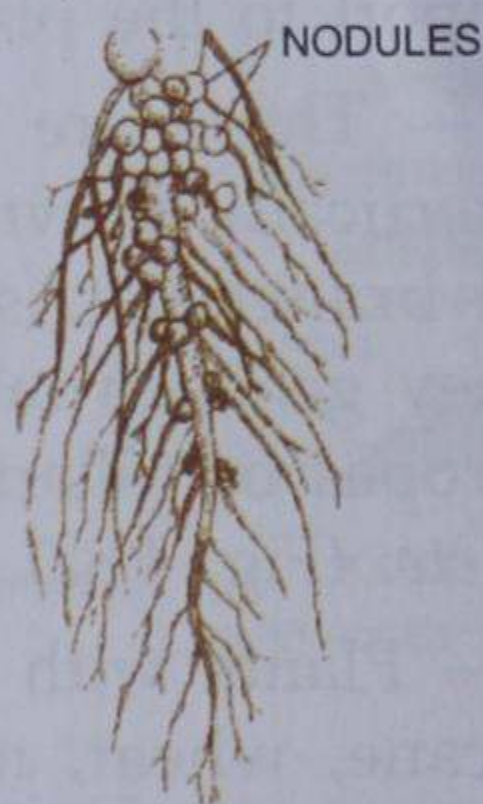
Fig. 4.8 Modifications of roots for support

the lower nodes. They grow obliquely downwards like stilts (Fig. 4.8b).

(c) **Climbing roots** — Weak green stem develops a cluster of aerial roots from their nodes or internodes. They attach themselves to a support and help the plant to climb upwards, e.g., money plant, Indian ivy, etc. (Fig. 4.8c).

Roots for Special Functions

(i) **Nitrogen fixing roots** (Fig. 4.9a) : In leguminous plants (gram, pea, etc.), roots develop small swellings called '**nodules**' which contain bacteria. These bacteria fix nitrogen of the soil into soluble nitrates which increases the fertility of the soil.



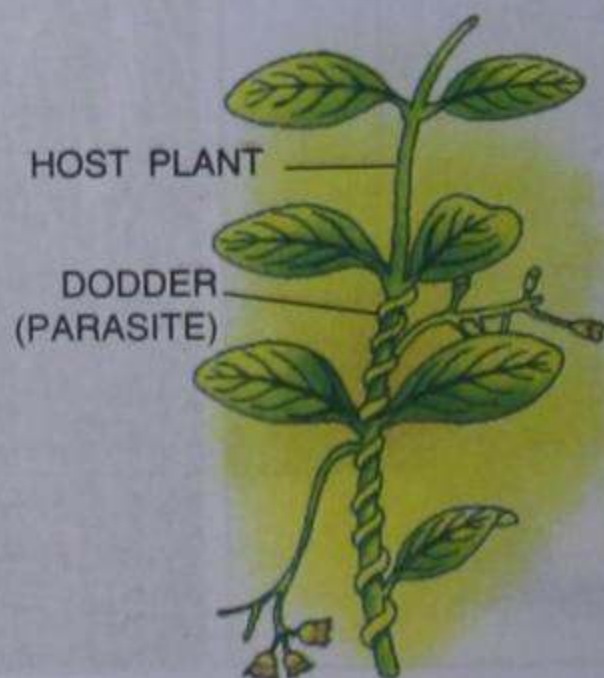
(a) NITROGEN FIXING ROOTS



(b) BREATHING ROOTS OF MANGROVE TREE



(c) AERIAL ROOTS (ORCHID)



(d) SUCKING ROOTS (DODDER)

Fig. 4.9 Modifications of roots for special functions

(ii) **Breathing roots or pneumatophores** (Fig. 4.9b) : In plants which are found in marshy or water logged land, the roots come above the ground like cones. They have minute pores through which they take atmospheric air for respiration e.g., white mangrove.

(iii) **Aerial or epiphytic roots** (Fig. 4.9c): These roots are present in those plants which grow aurally on the host plant, e.g., orchids. They have hanging roots which draw moisture from the air through spongy tissues found on their tips.

(iv) **Sucking roots (haustoria)** (Fig. 4.9d): They are found in parasite plants, e.g. dodder (*Cuscuta*). These plants send adventitious roots into the host to suck nutrients.

Functions of the Root

1. Fixes the plant in the soil.
2. Absorbs water and minerals from the soil for the growth of the entire plant.
3. Acts as a storage part for food materials for certain plants.
4. Binds the soil together so that it does not get washed away during rain or blown away by the wind.

B. THE SHOOT SYSTEM

The part of a plant which grows above the soil forms the **shoot system**. The shoot bears **stem, buds, leaves, flowers** and **fruits**.

(i) THE STEM

The stem is the main aerial part of the shoot system. The points on the stem from where the leaves and branches originate

are called **nodes**. The part of the stem between two nodes is called an **internode**. The undeveloped shoot called **bud** is present at the tip of the stem. The growing tip of the shoot is called **apical bud** or **terminal bud**.



Fig. 4.10 Apical and axillary bud on the stem

The buds present between the stem and the base of leaves are called **axillary buds**. The axillary buds produce new branches and help in growth.

Modifications of stem

Like roots, the stem also undergoes three categories of modifications to perform various functions — (a) under-ground, (b) sub-aerial and (c) aerial.

(a) Underground Modification of Stem

Stems of most plants grow above the ground. But some stems grow below the ground also, and these are called underground stems. The **underground stems store food** in large quantity. Some of their examples are as follows :

(1) **Tuber** (Fig. 4.11a) : Potato is an example of a tuber. The lower branches of its stem grow underground and swell up at the tips to store food. It has a number of buds called 'eyes'. Each "eye" can produce a shoot of the new plant on sowing.

(2) **Rhizome** (Fig. 4.11b) : Rhizome is irregular in shape and grows horizontally

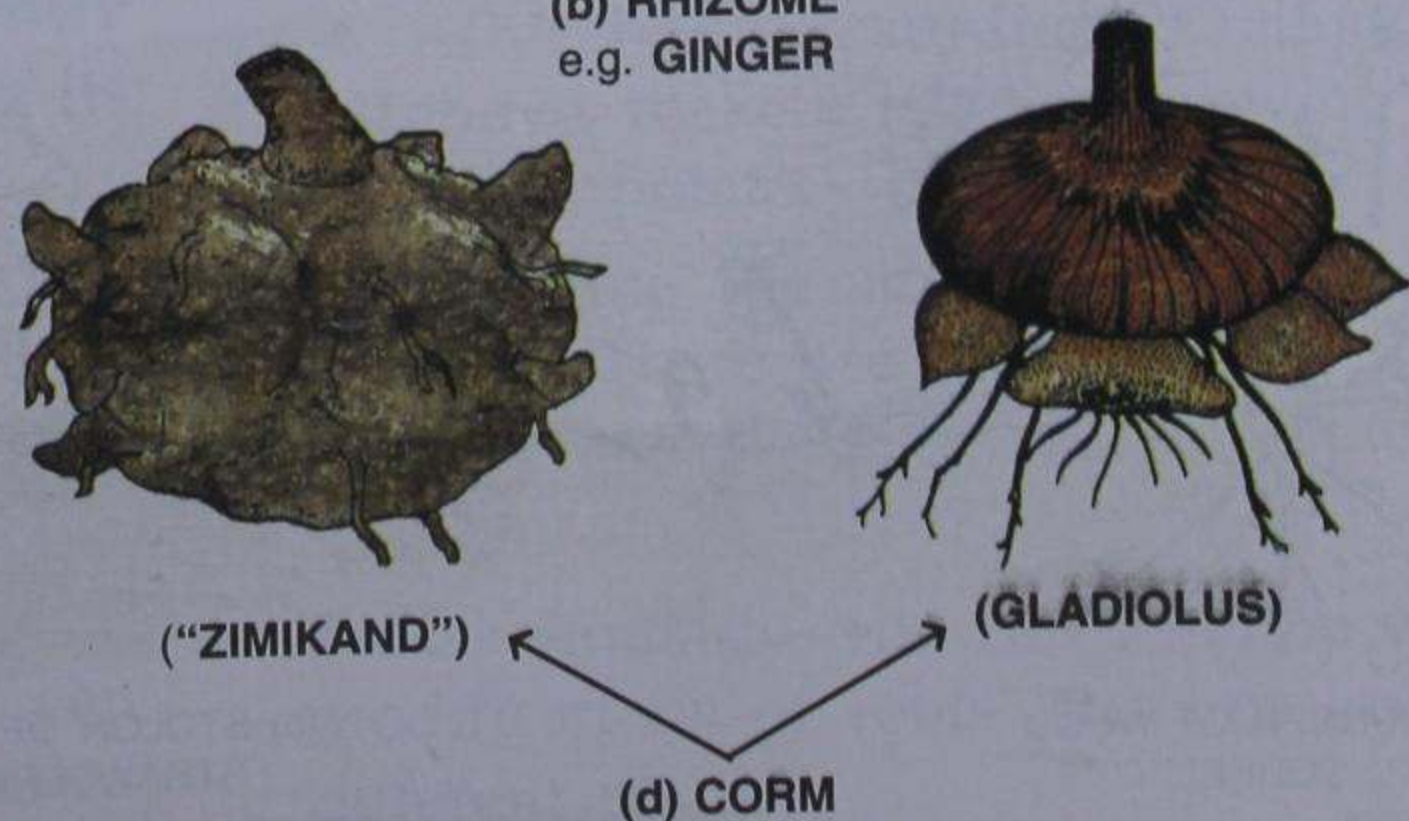
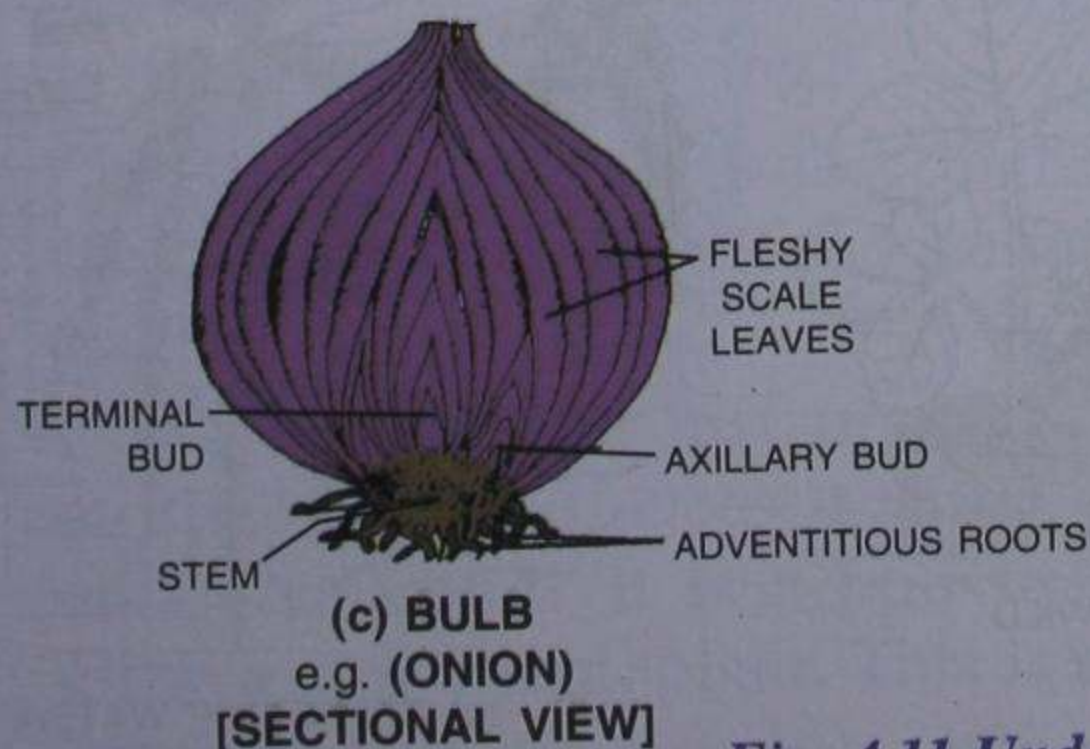
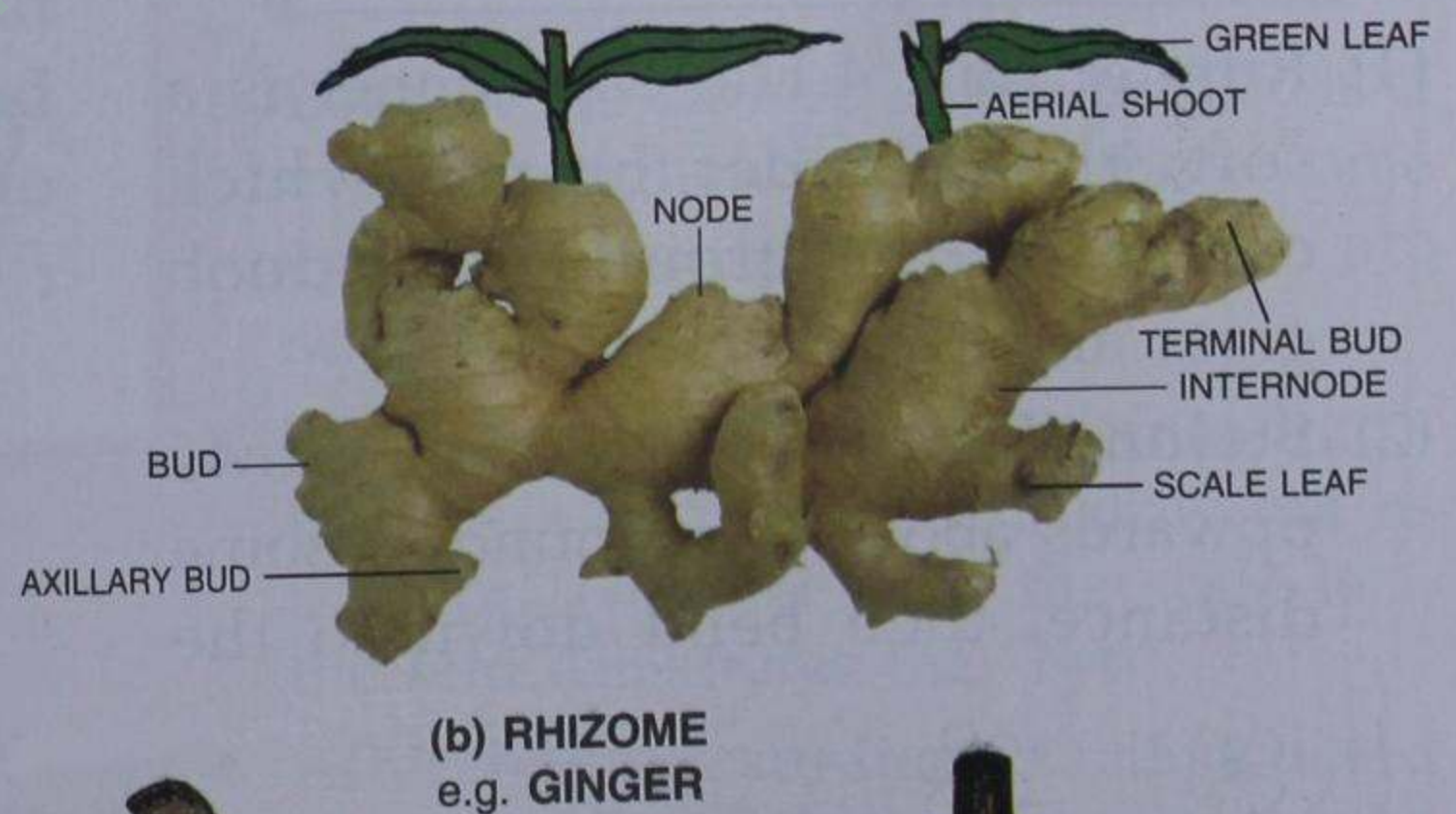
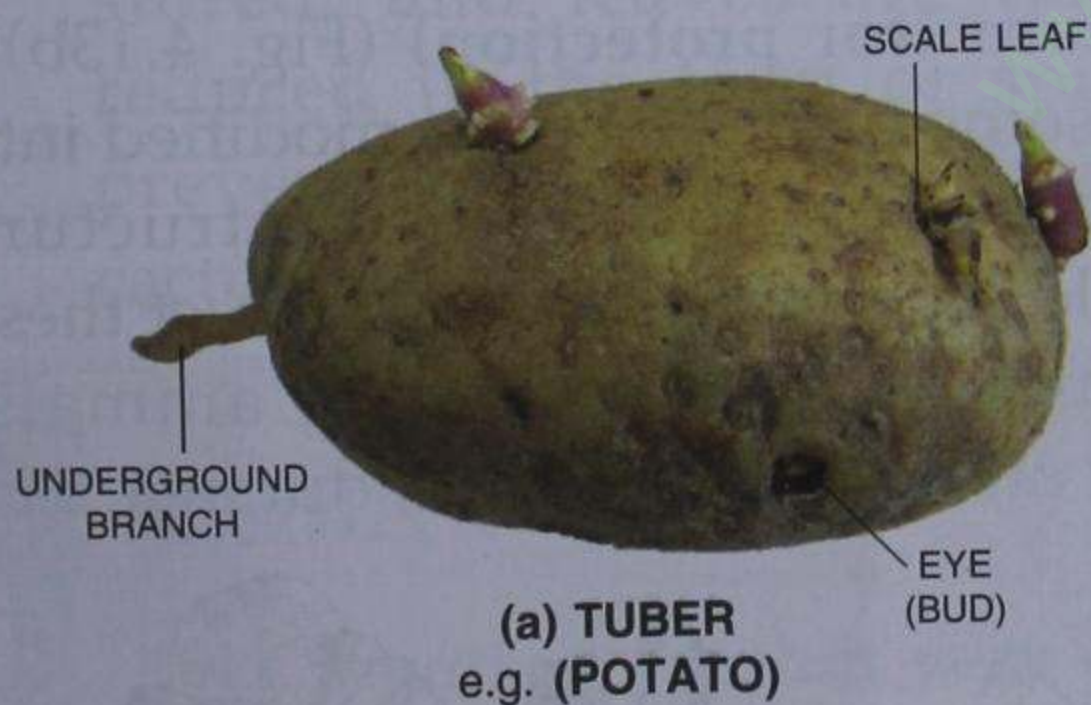


Fig. 4.11 Underground modifications of stem

below the soil. It has scaly leaves, buds, nodes and internodes. *Examples* : Ginger, banana, ferns.

(3) Bulb (Fig. 4.11c) : It has a condensed disc-shaped stem and a terminal bud overlapped by numerous scaly leaves. Inner leaves are fleshy, thick and store food. Outer dry and scaly leaves are protective. *Examples* : Onion, garlic, lily.

(4) Corm (Fig. 4.11d) : It is somewhat round, condensed, flattened from top to bottom and is covered by thin scaly leaves. *Examples* : Gladiolus, Amorphophallus (zimikand).

(b) Sub-aerial modifications of stem

Certain stems, which are weak and green, grow horizontally on the surface of the soil. Some of their types are as follows.

(1) Runner (Fig. 4.12a) : A runner is a soft, thin slender branch which creeps on the ground e.g., doob grass and wood-sorrel.

(2) Stolon (Fig. 4.12b) : Stolon grows upwards above the ground to some distance, then bend down to the

ground, e.g., mint and wild strawberry.

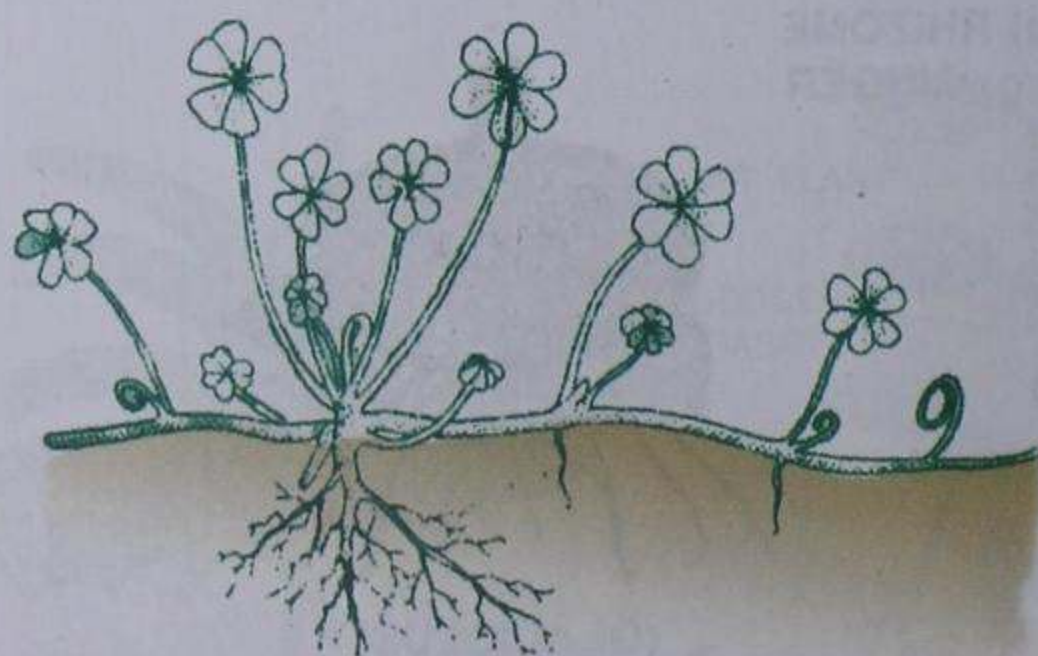
(3) Offset (Fig. 4.12c) : Offsets are like runners. They arise from the axil of the leaf and have thick internodes, e.g. water lettuce and water hyacinth.

(c) Aerial Modifications of Stem

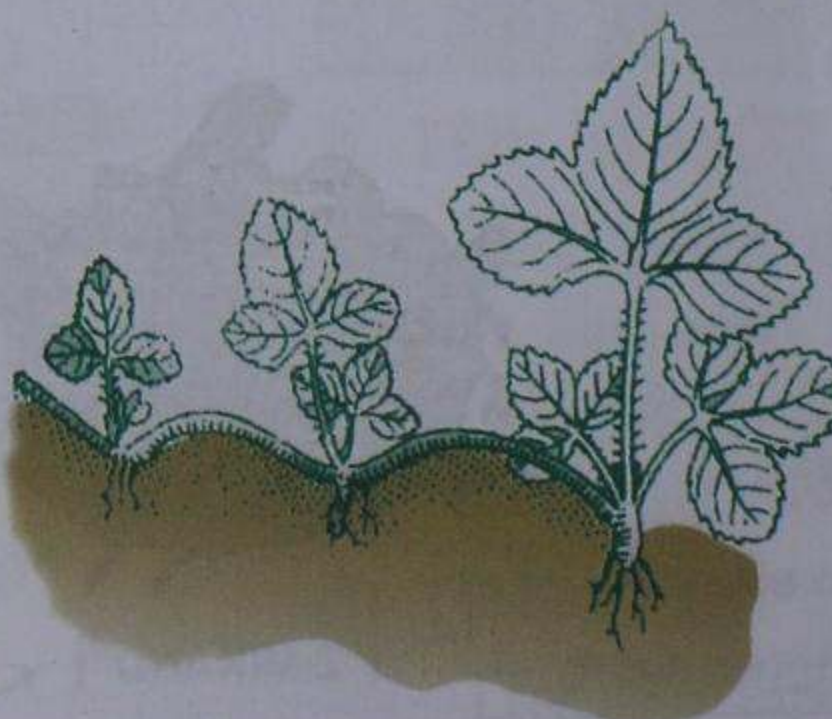
Certain stems modify aerially to perform various functions like protection, preparation of food, support and vegetative reproduction. Vegetative and floral buds grow into tendrils and thorns. Examples are given below :

(1) Tendril (for support) (Fig. 4.13a) : The stem of some plants occur in the form of thin thread-like leafless branch called **tendril**. The tendril coils around any object near it and helps the plant to climb up. *For example*, grapevine, gourds, etc.

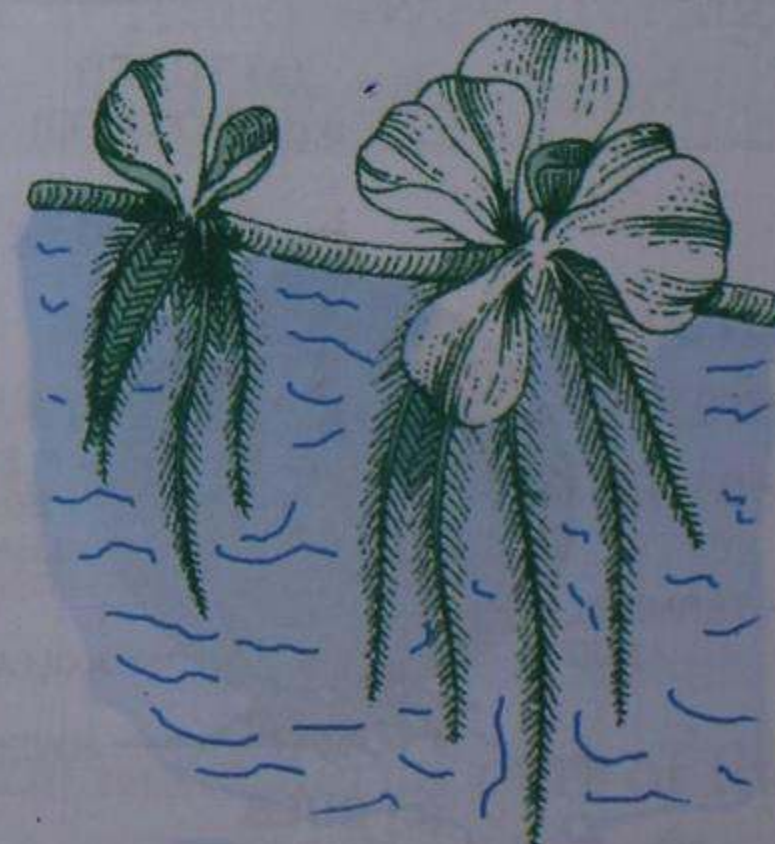
(2) Thorn (for protection) (Fig. 4.13b) : In some plants, a bud is modified into a hard, point like small structure called thorn. The thorns protect these plants from the grazing animals. *For example*, rose, lemon, duranta, etc.



(a) RUNNER OF WOOD
SORREL

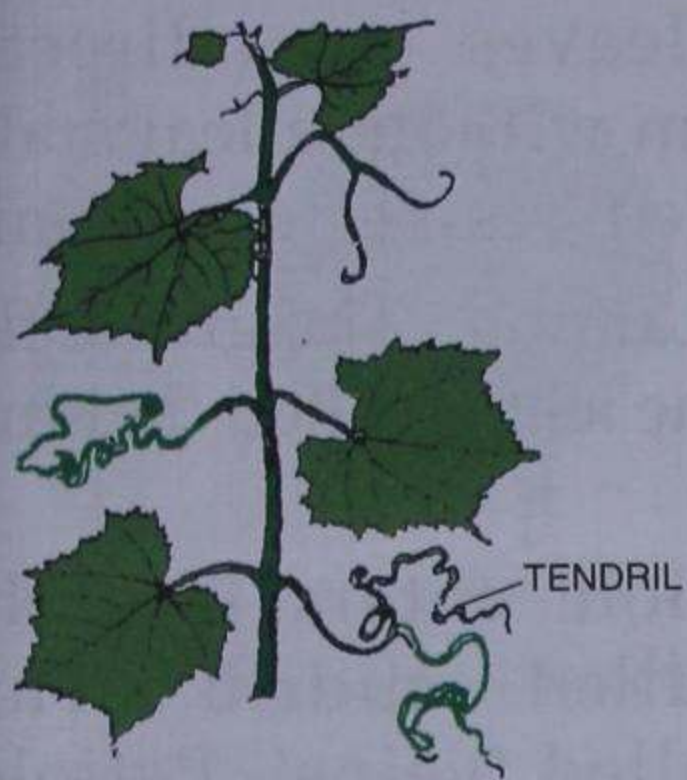


(b) STOLON OF WILD
STRAWBERRY

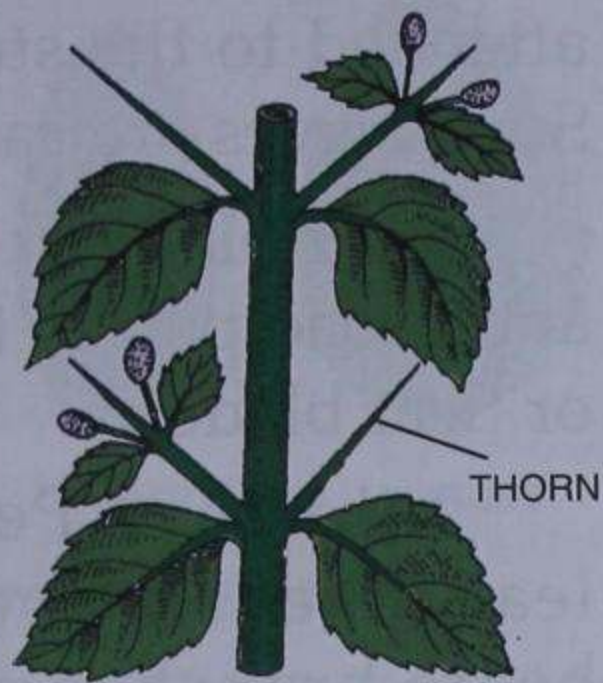


(c) OFFSET OF WATER
LETTUCE

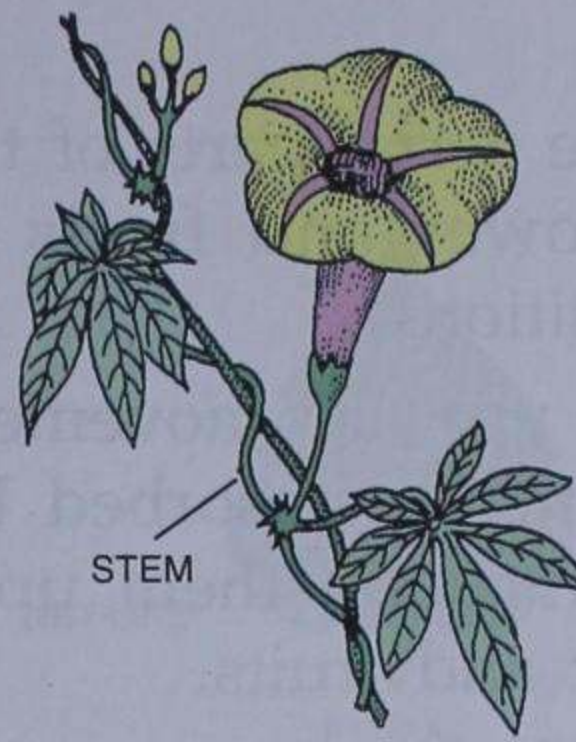
Fig. 4.12 Sub-aerial modifications of the stem



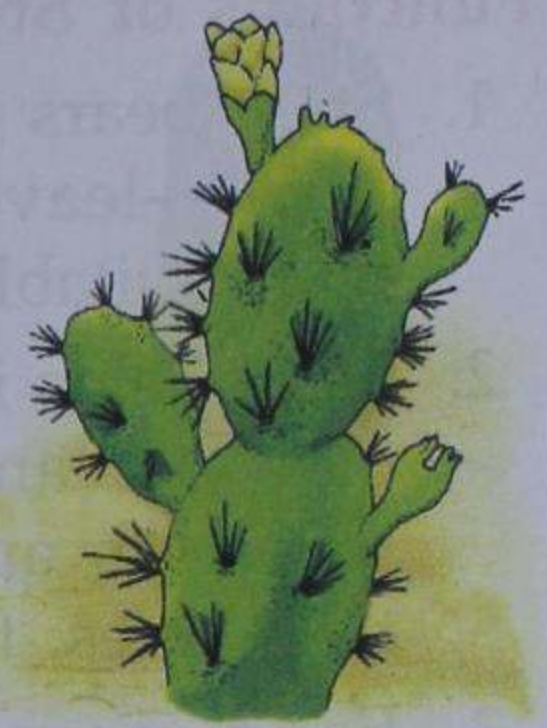
(a) TENDRIL OF GRAPEVINE



(b) THORN IN DURANTA



(c) TWINING STEM OF MORNING GLORY



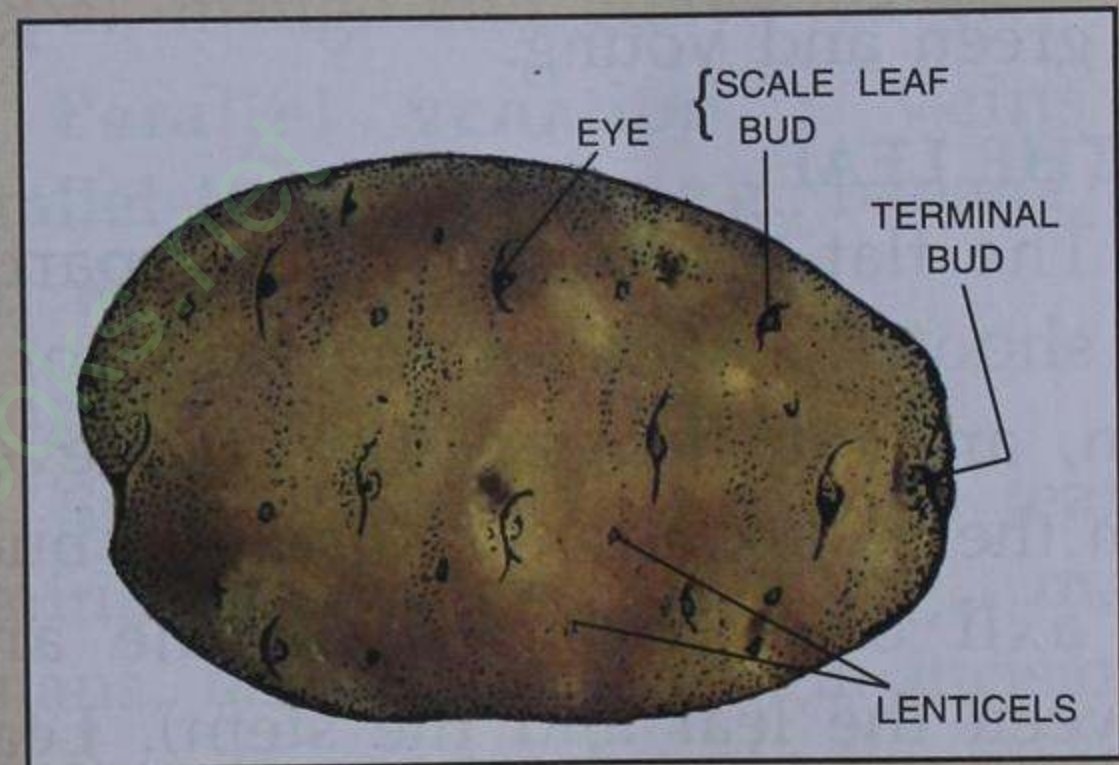
(d) PHYLLOCLADE OF OPUNTIA

Fig. 4.13 Aerial modifications of the stem

(3) Twiner (for climbing) (Fig. 4.13c) :

The stems of some plants like morning glory twine around their own stem. This twining helps the stem to climb up easily.

(4) **Phylloclade** (Fig. 4.13d) : In cactus like **opuntia**, the stem is thick, flat, green and with nodes and internodes. In such stems, food is prepared and stored, and leaves are thin and reduced in the form of spines to prevent loss of water. *Examples* : cactus, ruscus, etc.



- Look at the surface of the potato. Is it even throughout? Or, are there some eye-brow like impressions. These are scale-leaves.
- Just outward (facing terminal bud), there is a bud which can grow out as a shoot. Together with the scale leaf, the bud constitutes the "eye".
- After having studied, as instructed above, make a labelled drawing of the entire potato.
- Examine the surface in between the eyes. There are very minute "holes". These are the lenticels that allow entry of air.

Note : Similarly, you can describe various modifications of roots, stem or leaves in different plants.



ACTIVITY 2

Take a potato. Wash it very gently with clean water, without damaging its parts. Observe the following:

- The point where it was attached to the parent plant. Does it show a circular scar?
- Observe the point just opposite to it on the other end. Does it show a scar or a small bud? It is a bud that can grow a new shoot/plant. This is called terminal bud.

Functions of Stem

1. Stem bears all the aerial parts of the plant—leaves, flower and fruits in their suitable positions.
2. Stem helps in the upward movement of water and minerals absorbed by the roots and transports them upto the leaves, flower and fruits.
3. Food prepared by the leaves is conducted downwards to the root by the stem.
4. Stem also manufactures food when green and young.

(ii) THE LEAF

The flat, green and broad parts of the shoot, located on the node of the stem, are the 'leaves'. Leaves develop from the nodes. There is always a bud in the axil of a leaf (axil is the angle between the leaf and the stem). **Leaves do not continuously grow like the stem but stop growing on attaining full size.**

Parts of a Leaf (Fig. 4.14)

A typical leaf has the following parts:

Leaf base (Petiole) : The basal part of a leaf is like a stalk; with this, it attaches itself to the stem at the node.

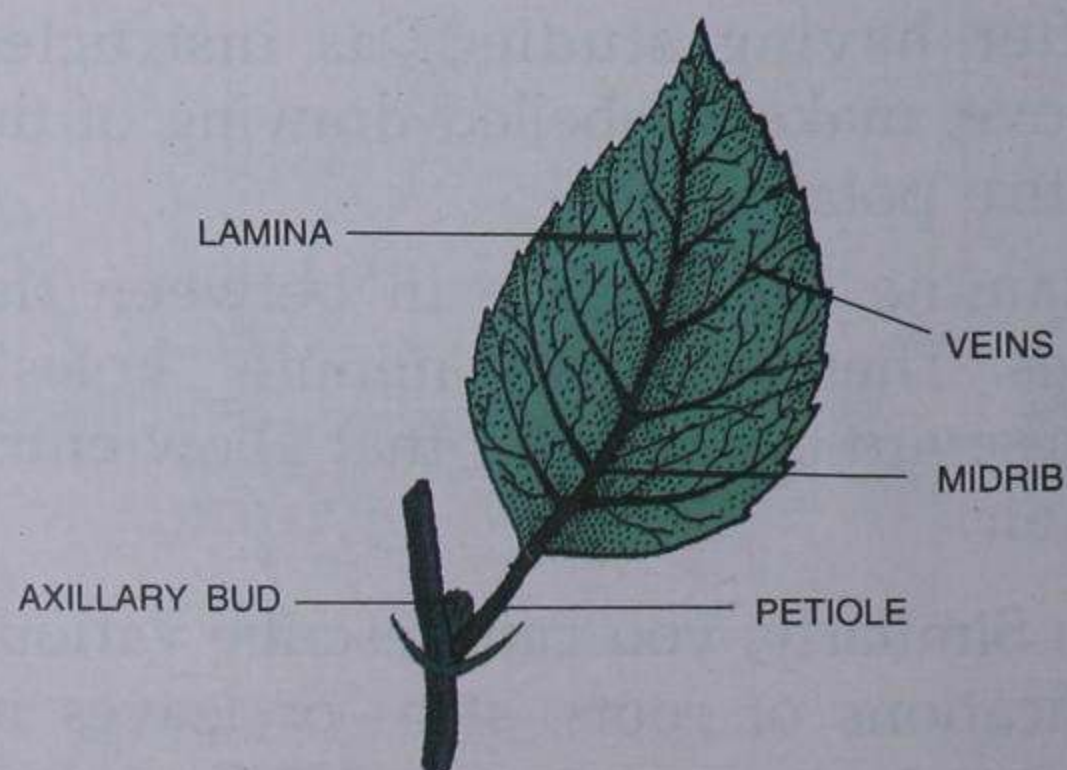


Fig. 4.14 Parts of a leaf

Sometimes, leaves are directly attached to the stem without a leaf stalk. Such leaves are called 'sessile', e.g., zinnia.

Leaf blade or Lamina : The green, flat and broad part of the leaf is called 'lamina' or 'leaf blade'.

Midrib : Petiole enters into the leaf like axis, called 'midrib'. This bears branches called 'veins'. Petiole, midrib, veins and veinlets (further branches of veins) conduct water. Veins also provide a skeleton or a supportive framework to the leaves.

TYPES OF LEAVES

Leaves can be classified in various ways :

On the Basis of Shape

- (i) Needle shaped, e.g., pine, onion.
- (ii) Oval, e.g., guava, apple.
- (iii) Heart-shaped, e.g., peepal.
- (iv) Oblong, e.g., banana.
- (v) Circular, e.g., lotus, nasturtium.
- (vi) Tapering, e.g., eucalyptus, ashoka.

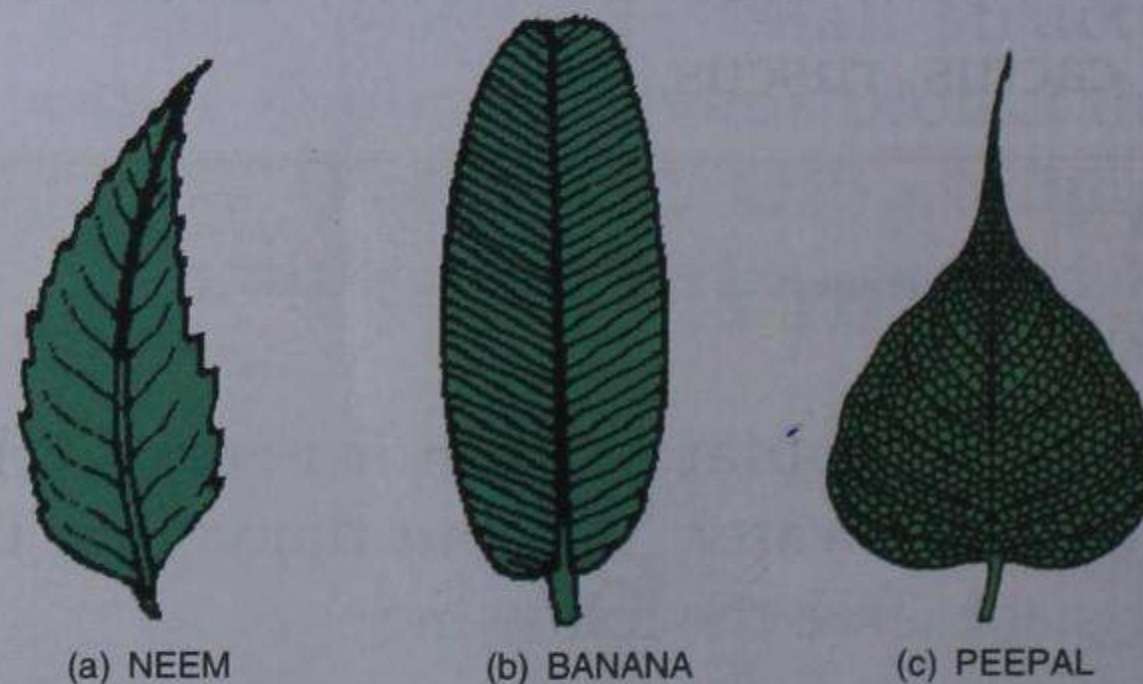


Fig. 4.15 Some of the different shapes of leaves

On the basis of margin

- (i) Complete or entire margin, e.g., peepal.
- (ii) Toothed or serrate margin, e.g., china rose, rose.
- (iii) Wavy margin, e.g., ashoka, mango

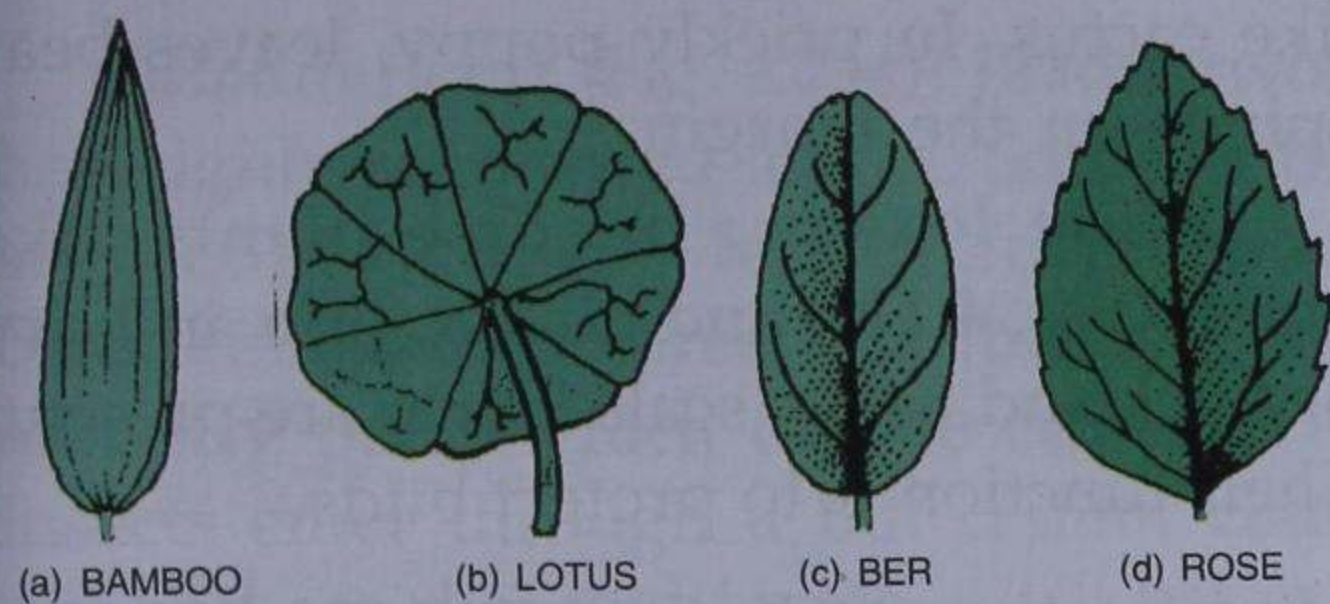


Fig. 4.16 Different margins of leaves

(iv) Spinous margin, e.g., prickly poppy.

Arrangement of Leaves

Alternate (Fig. 4.17a) : Only one leaf arises from each node. Every next leaf arises from the successive node in opposite direction. *Examples* : mint, peepal, china rose.

Opposite (Fig. 4.17b) : In plants like jasmine and guava, two leaves arise on each node opposite to each other. This is called opposite arrangement.

Whorled (Fig. 4.17c) : More than two leaves are attached at each node, arranged in a whorl, e.g., oleander (*Nerium*).

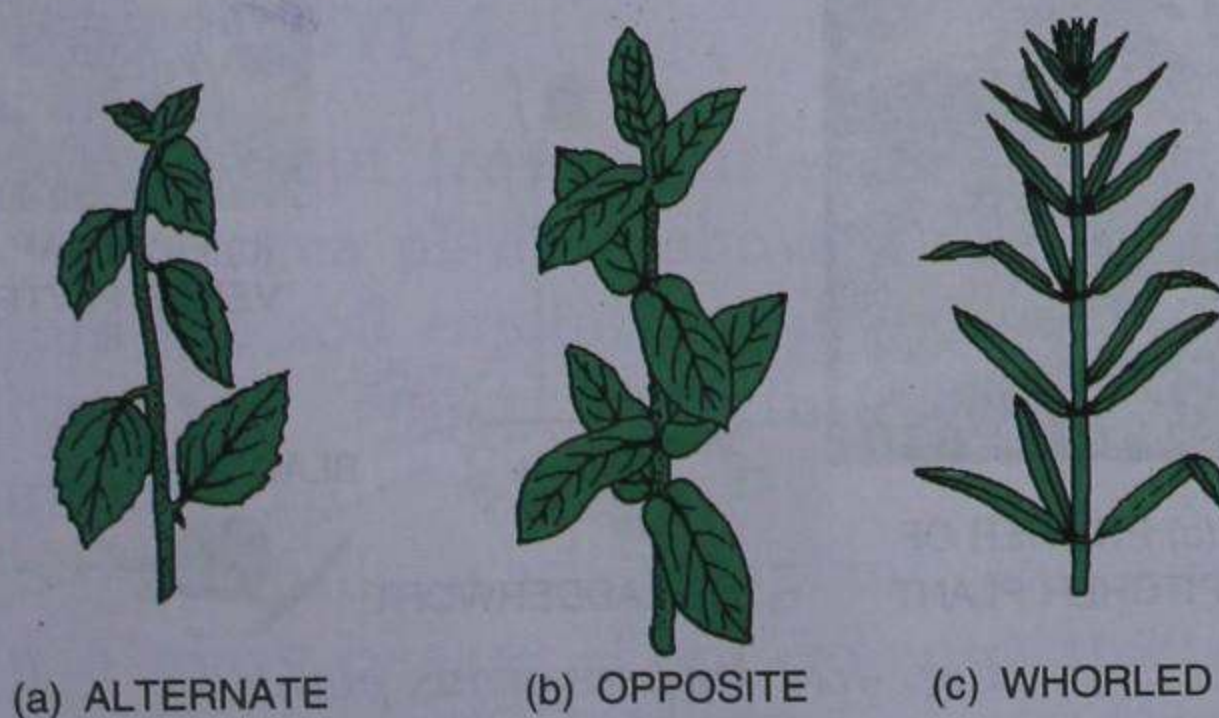


Fig. 4.17 Types of arrangement of leaves

Venation of Leaves

Arrangement of veins in a leaf blade lamina is called **venation**. It is mainly of two types.

Reticulate venation in which veins and veinlets are irregularly distributed in

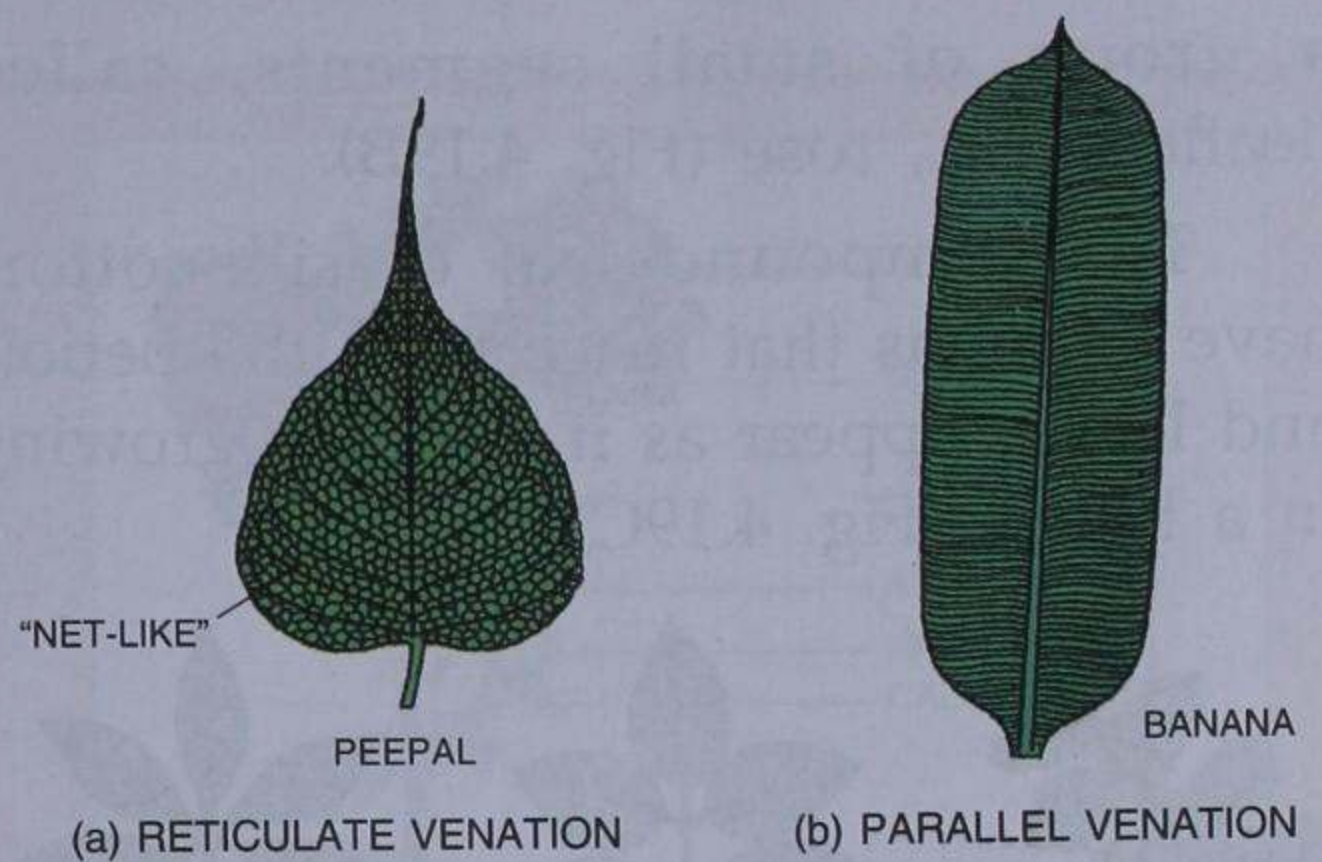


Fig. 4.18 Venation

the lamina, forming a **network**, e.g., peepal, mango and guava leaves.

Parallel venation : Veins run **parallel** to each other, e.g., banana, grass and wheat leaves.

Simple and Compound Leaves

Simple leaf : In a simple leaf, the lamina is a single piece, e.g., mango, banana, banyan, etc. Margin incisions, if present, do not reach upto the midrib or petiole, e.g., prickly poppy (Fig. 4.19A).



ACTIVITY 3

Take a peepal or a mango leaf. Soak it in water for a few days. Change the water every second day. Rub the leaf with your fingers gently. The green portion of the leaf will come out by rubbing.

You will observe a very fine network of veins. Dry it as it may contain moisture. You can use this leaf to make a birthday card for your friend.

Compound leaf : In a compound leaf, incisions reach upto the midrib or petiole. As a result, the leaf looks like

a group of small segments, called 'leaflets' e.g., rose (Fig. 4.19B).

The compound leaf of silk-cotton, have incisions that reach upto the petiole and leaves appear as if they are growing in a bunch (Fig. 4.19C).

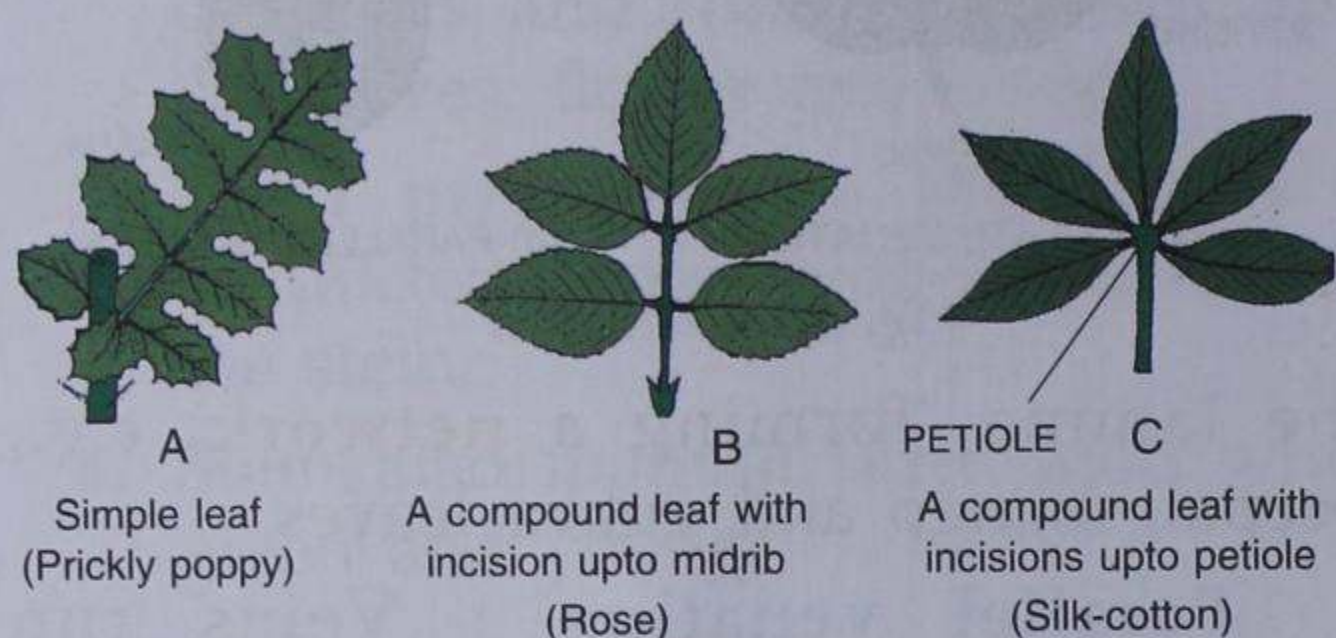


Fig. 4.19 Simple and compound leaves

Modification of Leaves

Sometimes, the complete leaf or a part of the leaf is modified to perform a special function.

Leaf tendril (Fig. 4.20a) : In case of certain weak plants, leaves or leaflets are modified into wiry, coiled structures called *tendrils*. They are sensitive to touch. As they touch any object, they coil around it and support the plant to climb up. *Example* : Sweet pea (upper leaflets are modified into tendrils).

Spines (Fig. 4.20b) : Leaves are modified into spines to reduce water loss by transpiration in certain desert plants

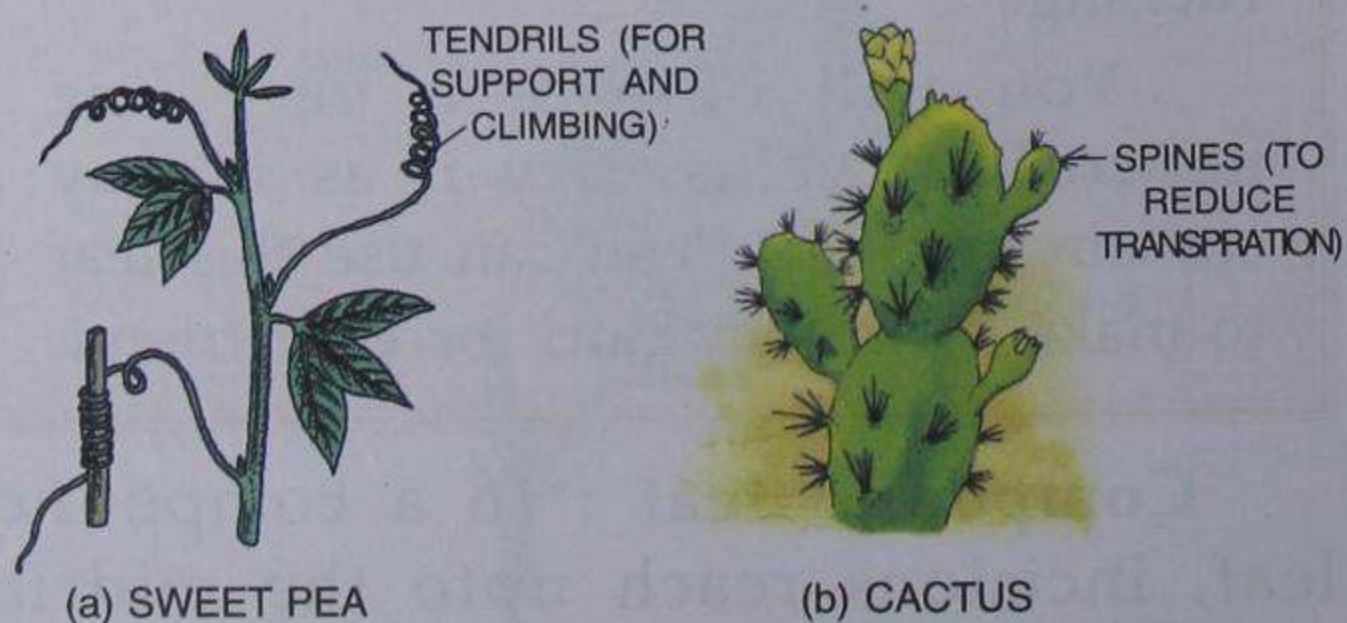


Fig. 4.20 Modifications of Leaves

like cactus. In prickly poppy, leaves bear spines on the margin.

Scale leaves : In some plants, like onion (Fig. 4.11c) and ginger, thin and dry or thick and fleshy scale leaves are present. Their function is to protect buds.

Modification of Leaves in Insectivorous Plants

Pitcher plant (Fig. 4.21a) : In pitcher plant, the lamina is modified into a pitcher. Apex of the leaf forms the lid and the petiole becomes leaf-like to manufacture food. Size of a pitcher varies from 10-20 cm. When some insect like an ant, sits on the rim of the pitcher, suddenly the lid closes. At the bottom of the pitcher, digestive juices are secreted which digest the animal protein. The pitcher plant is found in Garo and Khasi Hills in Meghalaya.

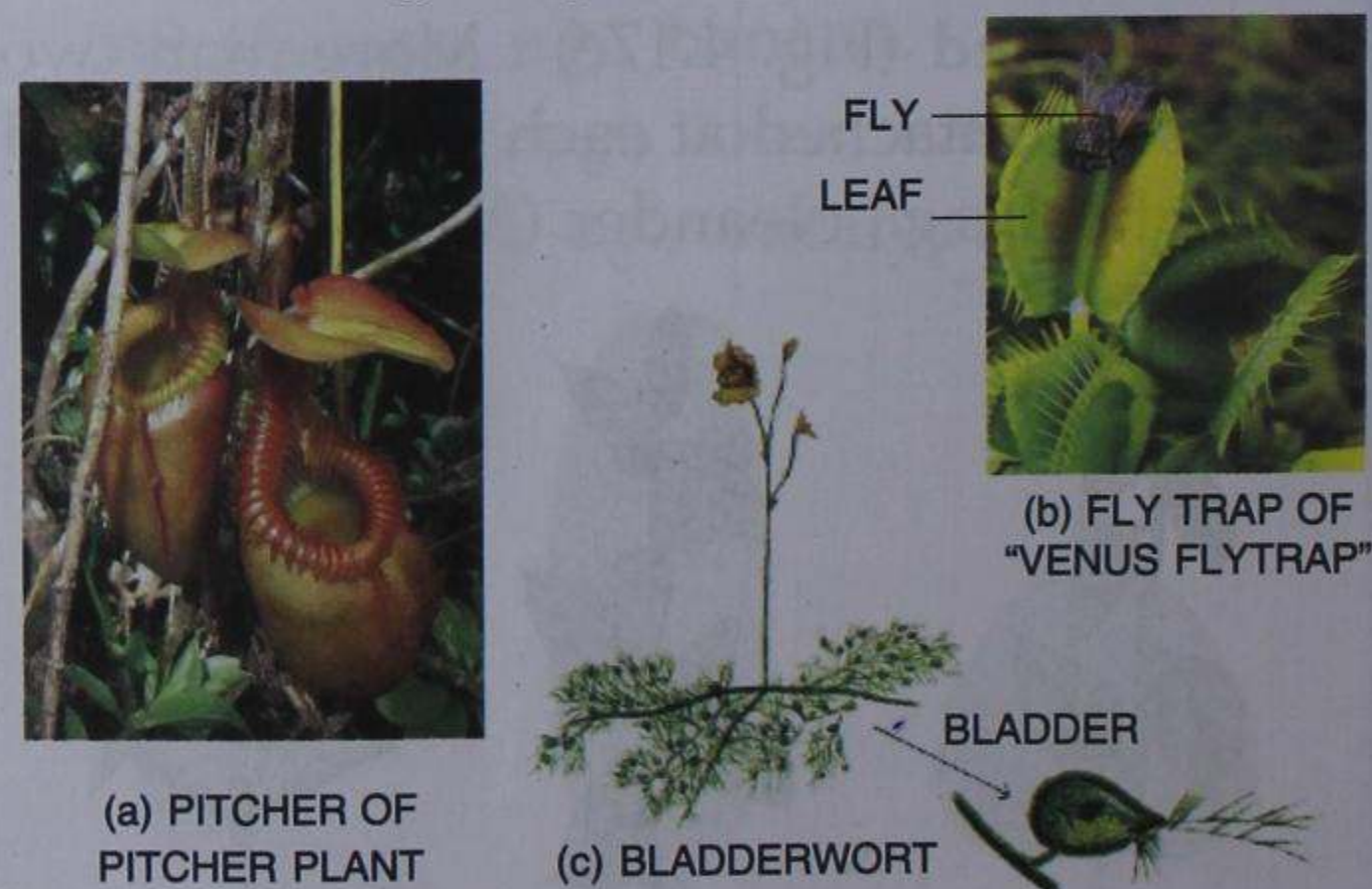


Fig. 4.21 Insectivorous plants

Venus flytrap (Fig. 4.21b) : The leaves of Venus flytrap have long pointed hair. It is divided into two parts having midrib in between like a hinge. When an insect visits the leaf, it closes its two parts and traps the insect. The insect is then digested by secreting digestive juices.

Bladderwort (Fig. 4.21c): Bladderwort has highly segmented leaves. Some of the segments of these leaves form small bladder like structures. The bladder has an entry point which can be closed. The insects enter through it but cannot come out and are digested inside.

Functions of the Leaf

Photosynthesis (production of food) is the main function of leaves. Green leaves containing **chlorophyll**, in the presence of sunlight, manufacture food in the form of **glucose** by using carbon dioxide and water. Leaves give out oxygen (produced during photosynthesis), which supports life on the earth.

Transpiration : This is the process of loss of water by evaporation from the surface of leaves. It has cooling effect, it causes suction force to make roots absorb more water with mineral ions.

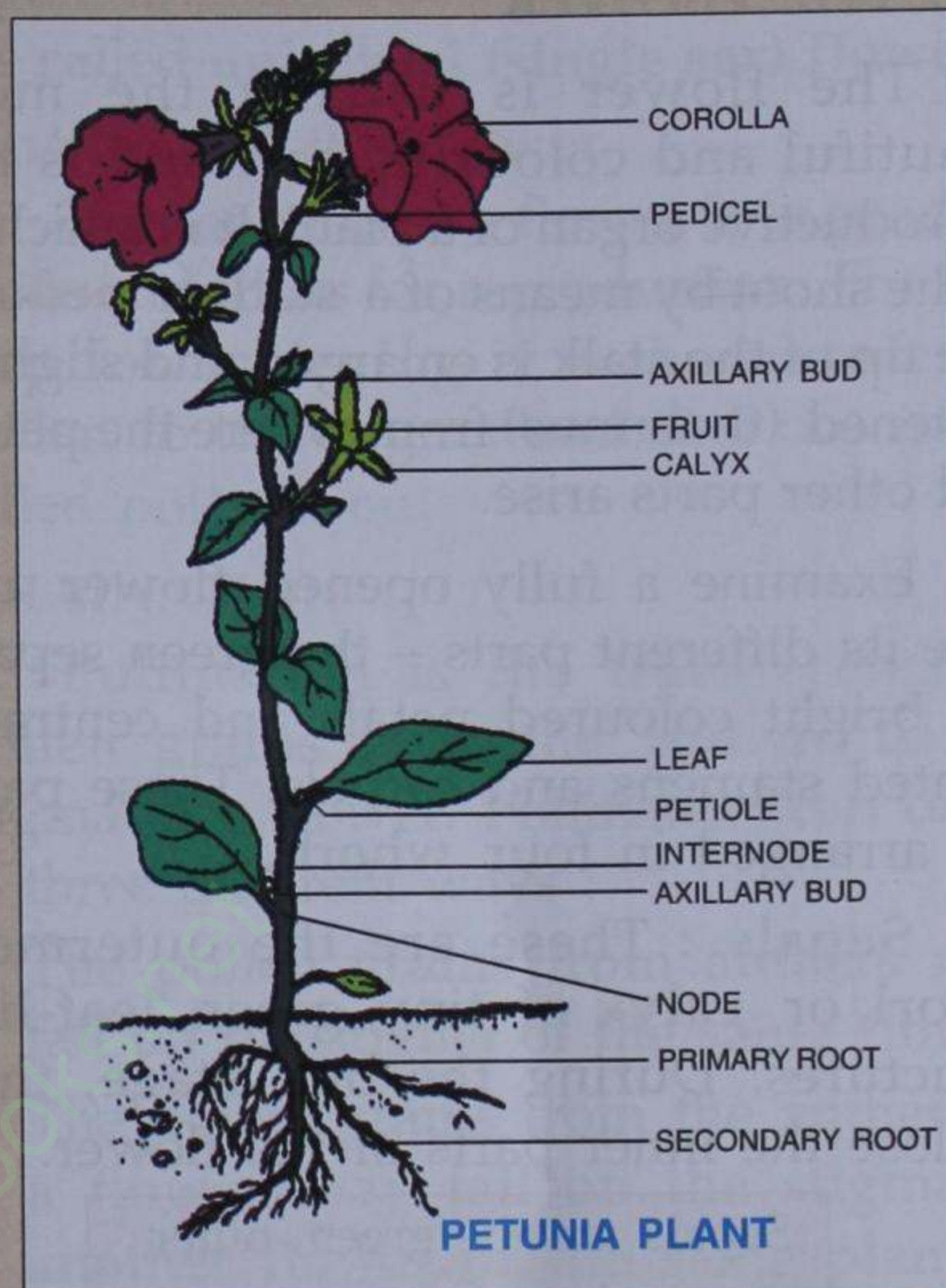


ACTIVITY 4

Dig out from your school garden, petunia plant of above 30 cm height from the soil carefully. Take special care that the roots remain intact and undamaged.

Carefully wash the plant, and keep in a glass beaker. Pour some water so that roots remain submerged in it. Draw the sketch of the plant and describe its parts as below :

- Make out the distinct main root (primary root) with side rootlets (secondary roots).
- Observe the nodes and the internodes in between the nodes.



- Look at the shape and the structure of leaves. Draw a diagram.
- The leaves are small and have a small petiole. They have fine hairs on the leaf blade on both upper and the lower surfaces.
- Observe the same type of plant that is much older. Does it show any flower buds or flowers ?
- Make out that each flower has five **green sepals** (calyx) and five whitish or **coloured petals** (corolla). The petals are united to form a bell-shaped structure. There are **five free stamens**, united to the petals at the base. The filaments are long with **green anthers**. There are two united carpels with a single long style and bifid stigma.

[**Note** : Similarly, you can describe other plants available in your school garden.]

(iii) THE FLOWER

The flower is usually the most beautiful and colourful part and is the reproductive organ of a plant. It is attached to the shoot by means of a **stalk** or **pedicel**. The tip of the stalk is enlarged and slightly flattened (**thalamus**) from where the petals and other parts arise.

Examine a fully opened flower and note its different parts – the green sepals, the bright coloured petals and centrally located stamens and carpels. These parts are arranged in four **whorls**.

Sepals : These are the outermost whorl or **calyx** of tiny green leaf-like structures. During the bud stage, they enclose the inner parts of the flower.

Sepals are the green, outer covering of the flower

Petals : Petals form the second inner whorl or **corolla** arranged next to the sepals. These are usually white or coloured but never green. The petals make the flower attractive.

Petals are the large bright attractive parts of the flower

Stamens (the male part) : The third whorl or **androecium** consists of delicate, filament-like structures called the **stamens**. Each stamen is formed of a long, narrow, hair-like **filament** and a broad sac-like **anther** at its tip. Pinch off a few anthers from an older flower and crush them between your fingers. You will find a powdery material coming out on your fingers. This powdery material consists of fine particles called the **pollen grains**.

Stamens are the male part of the flower

Carpels (the female part) : Carpels are the fourth innermost whorl or **gynoecium** of the flower (these may also be called **pistils**). Each carpel is formed of three parts – a swollen **ovary** at the base, a middle narrow thread-like **style**, and a terminal expanded **stigma**.

Carpels are the female part of the flower.

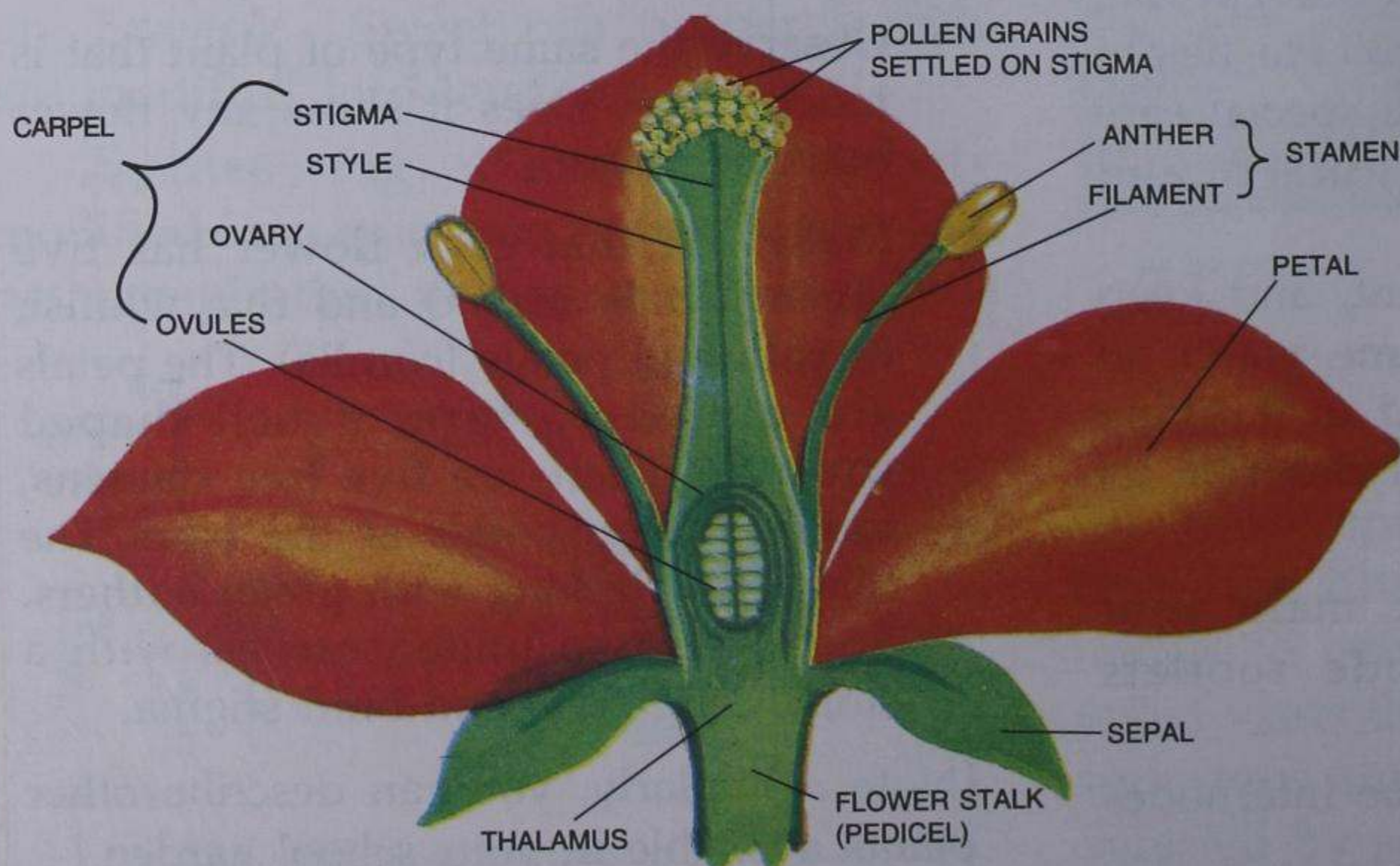


Fig. 4.22 A flower showing its internal parts

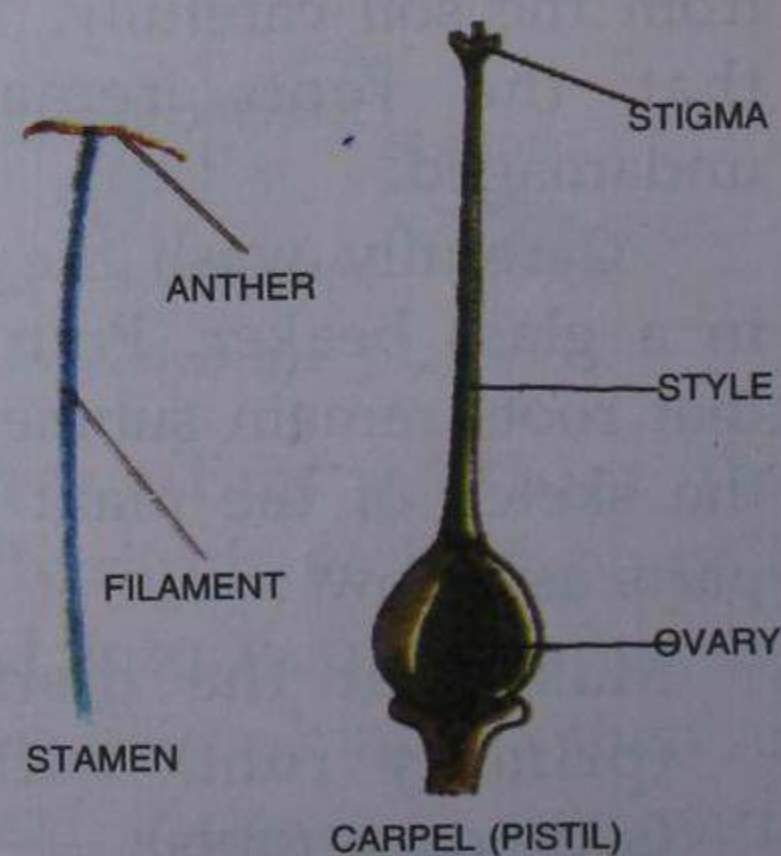


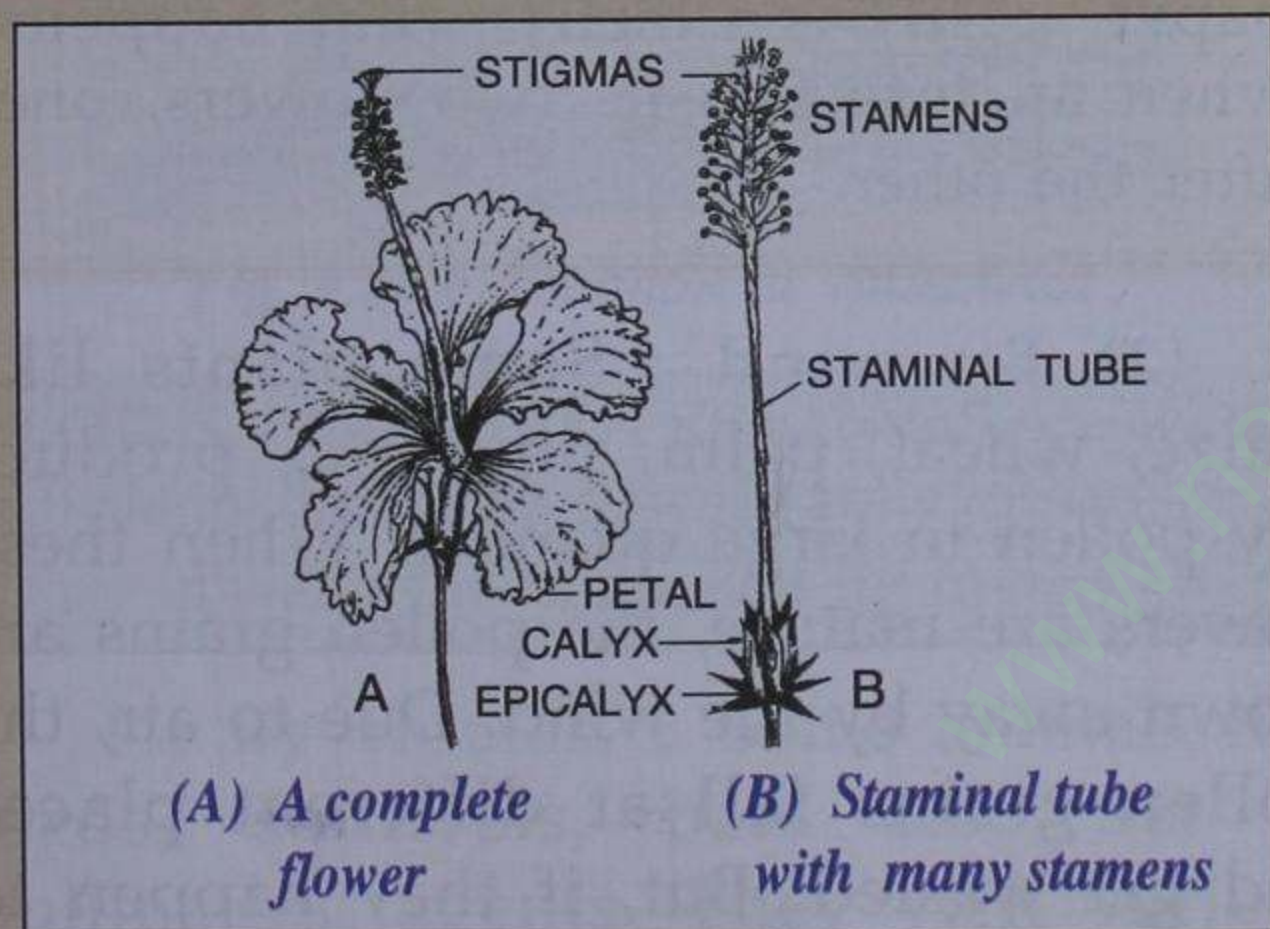
Fig. 4.23 The stamen and carpel (pistil)

Ovules (future seeds) : Slit open the ovary with the help of a needle. You will find some rounded bodies in it – these are the future seeds, which at this stage are called **ovules**.



ACTIVITY 5

Ask your teacher or the 'gardener' of your school to allow you to pluck one flower, such as shoe-flower (*Hibiscus*). Bring this flower to your classroom or laboratory. Draw and describe the flower as described in the text.



[**Note :** You can describe other flowers on the same pattern].

Types of Flowers

Depending on the presence of male and female reproductive parts, flowers can be divided into *two* types — **bisexual** and **unisexual**.

1. Bisexual flowers : Some plants have flowers with both male and female reproductive parts. They are called **bisexual** or **hermaphrodite flowers**.

2. Unisexual flowers : In certain plants the male and female reproductive

organs are found in separate flowers. They are called **unisexual (single sex) flowers**.

Functions of the Flower

The function of a flower is to produce seeds and fruits for reproduction. The first step for achieving it is the transfer of pollen to the stigma and this process is called **pollination**.

POLLINATION

Pollination is the transference of pollen grains from the anthers to the stigma of a flower. Pollination can occur in three different ways :

1. The pollen grains from anthers may fall on the stigma of the **same flower**.
2. The pollen grains from the anthers of a flower may fall on the stigma of **another flower of the same plant**.
3. The pollen grains from the anthers of a flower of one plant may reach the stigma of a flower of **another plant of the same kind**.

Types of Pollination

There are *two* types of pollination : **self-pollination** and **cross-pollination** (Fig. 4.24).

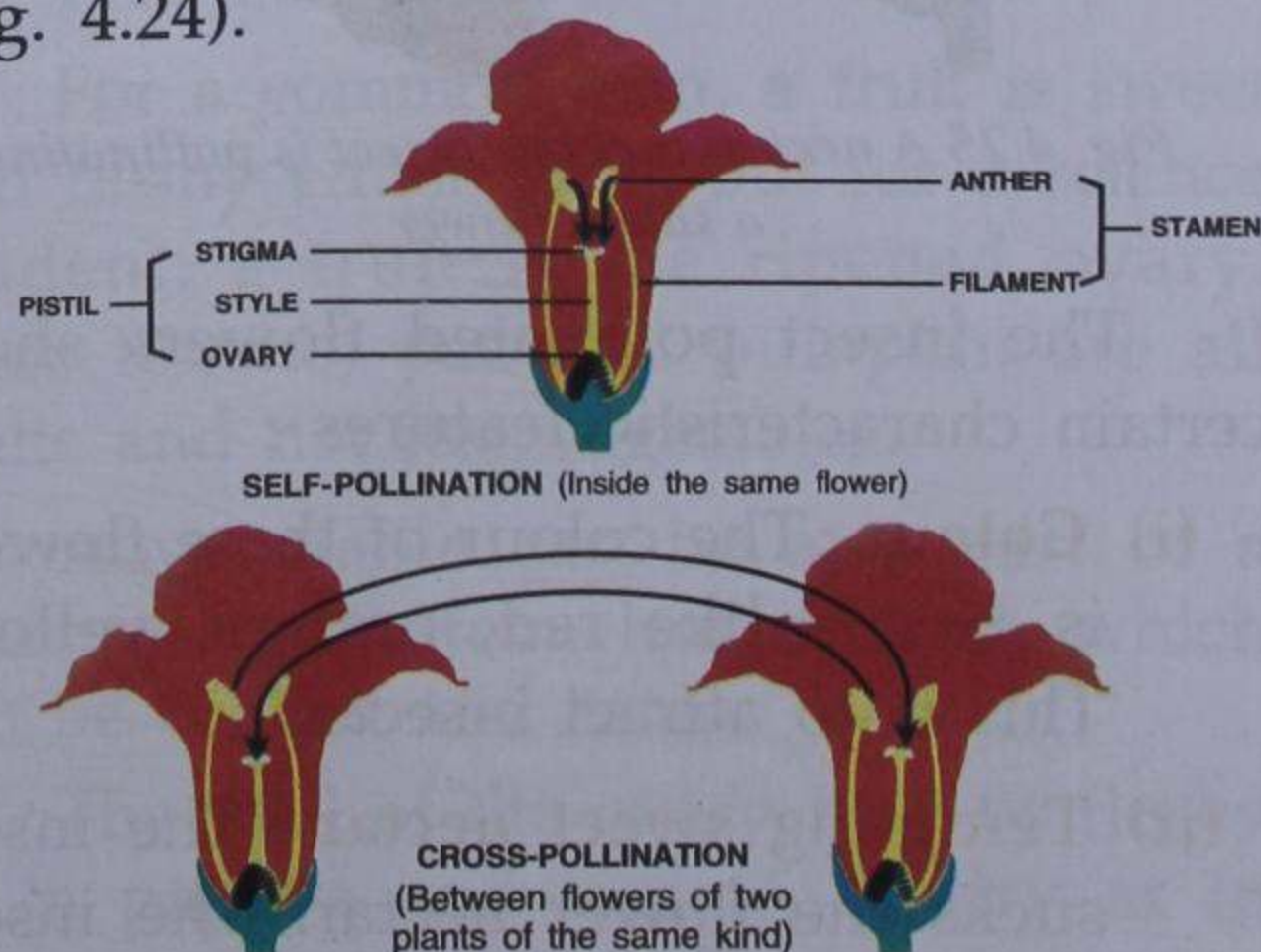


Fig. 4.24 Pollination – self-pollination and cross-pollination

1. Self-pollination is one that occurs within the same plant.
2. Cross-pollination occurs between two flowers of two different plants but of the same kind.

Agents of Pollination

There are mainly three agencies of cross pollination.

(1) By Insects : Butterflies, bees and other insects visit flowers for collecting nectar (honey). When the insect visits on a flower to collect nectar, the pollen grains stick to its mouth-parts, wings, legs, *etc.* When this insect visits another flower of the same kind, the pollen grains from its body may fall on its stigma. Such transfer of pollen is called **insect-pollination**. *Rose, marigold, dahlia, salvia* are some of the insect-pollinated flowers (Fig. 4.25).



Fig. 4.25 A nectar-sucking insect is pollinating a *salvia* flower

The insect pollinated flowers show certain characteristic features :

- (i) Colour :** The colour of these flowers is **bright** like red, orange, yellow. This is to attract insects.
- (ii) Tempting sweet nectar :** The insect sucks the flower nectar. The insect carries sticky pollen grains while sucking the nectar.

(iii) Sweet attractive fragrance : Their sweet fragrance attracts insects, for example, night jasmine.



ACTIVITY 6

Hold a flower, such as the shoe flower, in your hand. Gently touch its anthers with one finger of your other hand. Some powdery mass will stick to your finger. This powdery mass is the pollen consisting of fine particles, the **pollen grains**. Now, rub your finger on a sheet of paper. The pollen-grains will be transferred to the paper. This is exactly what happens when an insect visits two flowers, one after the other.

(2) By wind : Some plants like maize, wheat, palm, pine, *etc.*, produce dry pollen in large quantity. When these flowers are mature, the pollen grains are blown away by the wind. Due to air, the pollen grains fall at different places and get wasted. But, if they happen to fall on the stigma of a flower of the same type, then pollination is affected. Such type of pollination is called **wind pollination**.

(3) By Water (Fig. 4.26) : There are water-pollinated flowers like *Vallisneria*. These are aquatic plants whose male flowers that are submerged in water to start with, get detached when mature, and float on the surface of water. When these floating male flowers happen to come in contact with a female flower, the pollen grains are transferred to its stigma.



Fig. 4.26 Pollination in Vallisneria

LOTUS AND TRAPA ('Singhara') are water plants, but their flowers are exposed to air and are pollinated by insects.

(4) By animals : Some animals like birds, squirrels, bats also act as pollinating agents. They visit various flowers and spread pollen grains.

FERTILIZATION

Fertilization is the process of fusion of male and female sex cells (gametes).

After reaching the stigma of the flower of the same kind of plant, the pollen grain begins to form a tube which enters into the stigma. This tube is called the **pollen tube**.

The pollen tube lengthens through the style and enters the ovule. There, it releases its male cells which fuse with

the female cells to produce a **zygote**. The fusion of male and female sex cells is called **fertilization** (Fig. 4.27).

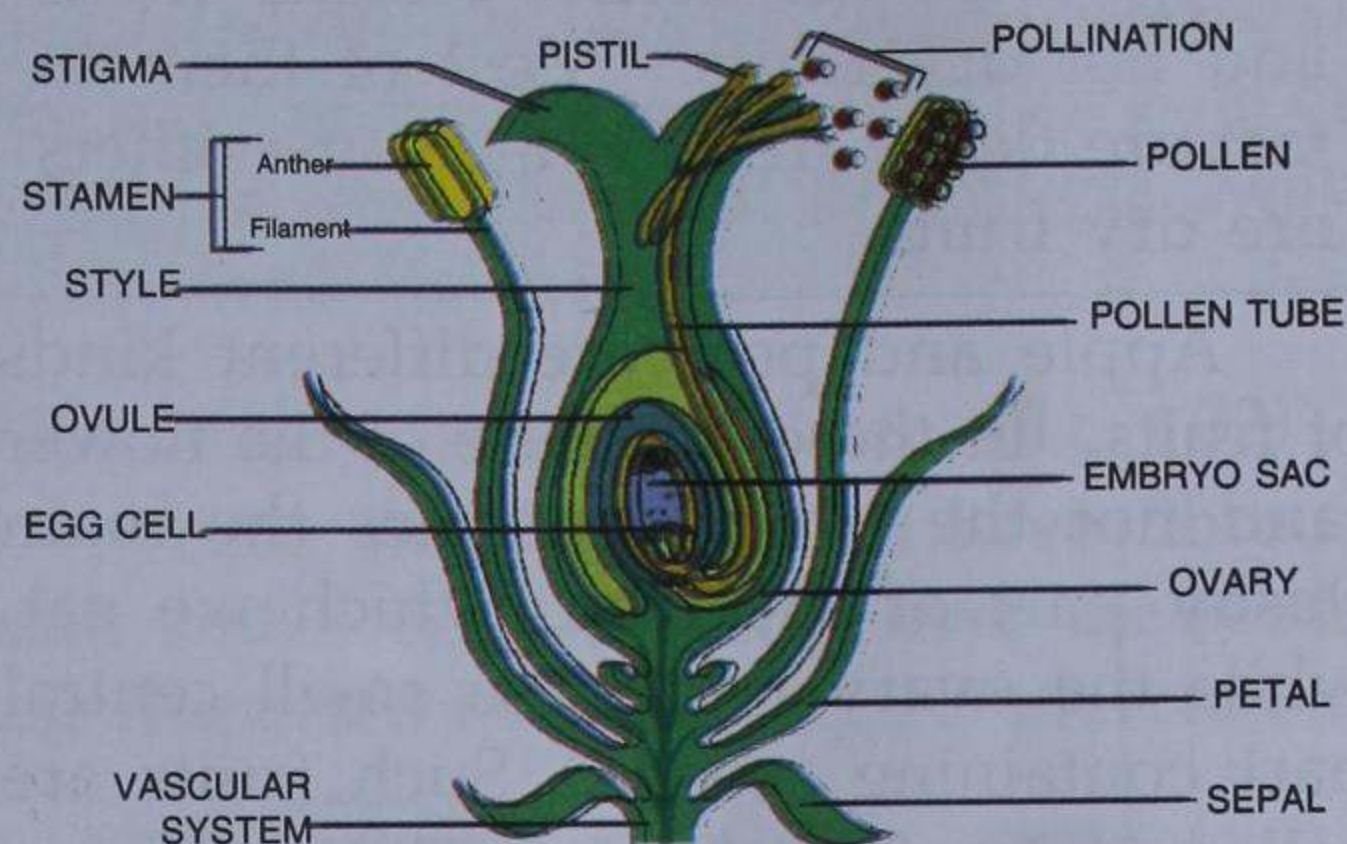


Fig. 4.27 Pollen tube entering into the ovule

The ovule containing the fertilized cell develops into a **seed**. The covering of the ovule gives rise to the seed coat and the ovary turns into a fruit containing the seeds.

The ovary remains attached to the stalk of the flower and grows into a **fruit**. The ovules inside the ovary develop into seeds. The other parts, like the sepals and petals, fall off.

(iv) THE FRUIT

For a common man, a fruit is sweet and fleshy edible item, but for a science student, a fruit is the ripened ovary. Thus tomato, pea and pumpkin are all fruits and not just vegetables.

A vegetable can be any part of a plant — root, stem, leaf or fruit, which can be cooked and eaten.

The wall of the ovary may be fleshy as in papaya and tomato, or dry as in pea, gram, maize, etc. Thus, a fruit may be a fleshy fruit or a dry fruit.

The so-called “dry fruits”, such as almond, cashewnut, walnut, pistachio, raisins, etc., are actually dried fruits and not dry fruits. Most of them in fact are fleshy fruits while some others are dry fruits.

Apple and pear are different kinds of fruits. In these, the base of the flower (and not the ovary) becomes the main fleshy part of the fruit, which we eat, while the ovary remains a small central part containing seeds. Such fruits are called “**false fruits**” (Fig. 4.28).

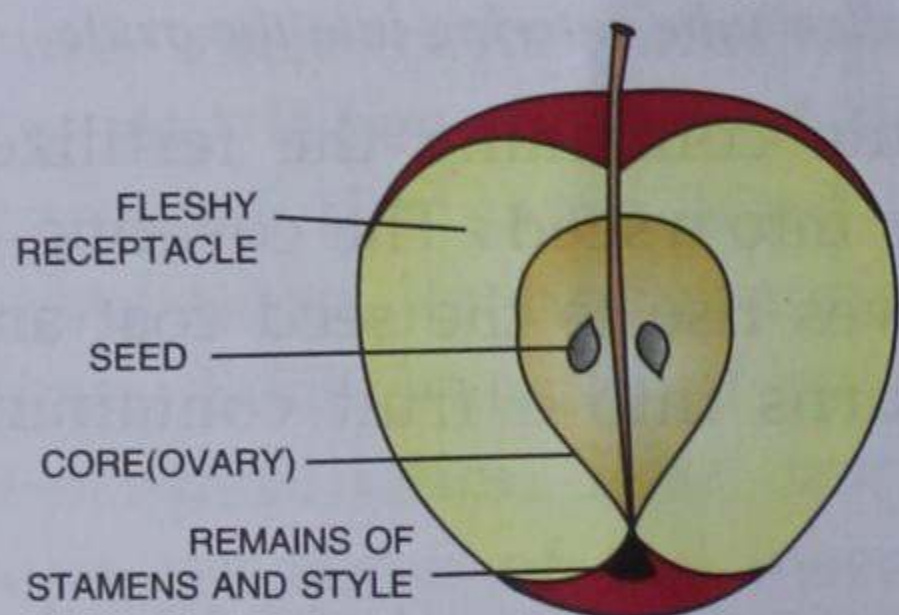


Fig. 4.28 Cut section of an apple (a false fruit)

Parts of a Fruit

A fruit contains two parts — a pericarp or fruit wall and seeds (Fig. 4.29).

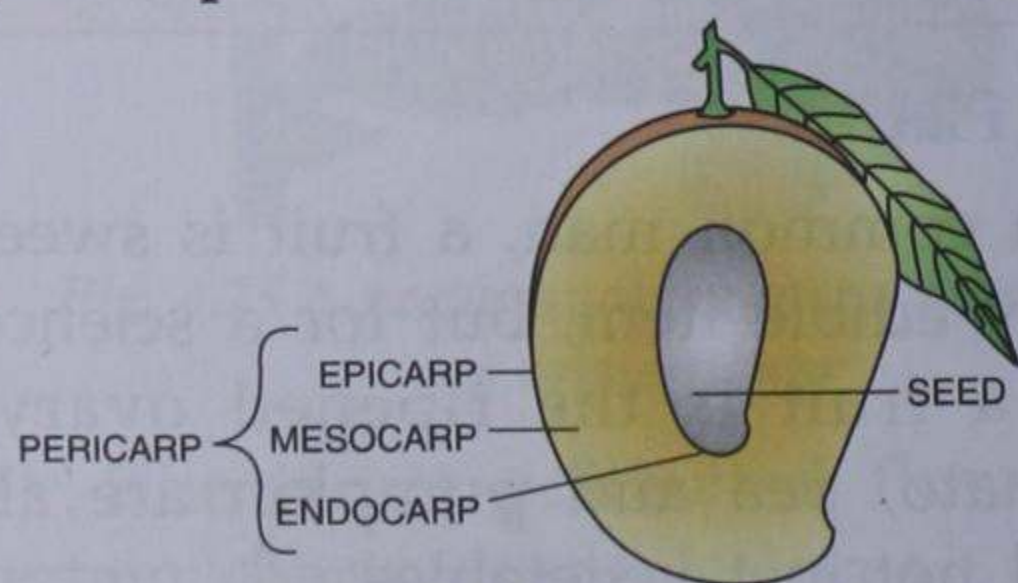


Fig. 4.29 Cut section of a mango

Pericarp

The pericarp or fruit wall develops from the wall of the ovary. It may be thick or thin depending on the kind of fruit. In tomato and papaya, it is soft and fleshy, while in gram, it is dry. The pericarp contain three parts.

Epicarp : The outer, thin covering of fruit is called epicarp.

Mesocarp : It is the sweet, fleshy middle layer.

Endocarp : It is the inner hard part, of the fruit that contains seeds.

Functions of Fruit

1. It protects seeds from the unfavourable environmental conditions.
2. It helps in the dispersal of seeds by developing various structural devices.
3. It stores food inside it, and is usually tempting to birds and animals to eat and disperse the seed for new plants to grow.

(v) THE SEED

After fertilization, ovaries develop into fruits and ovules into seeds.

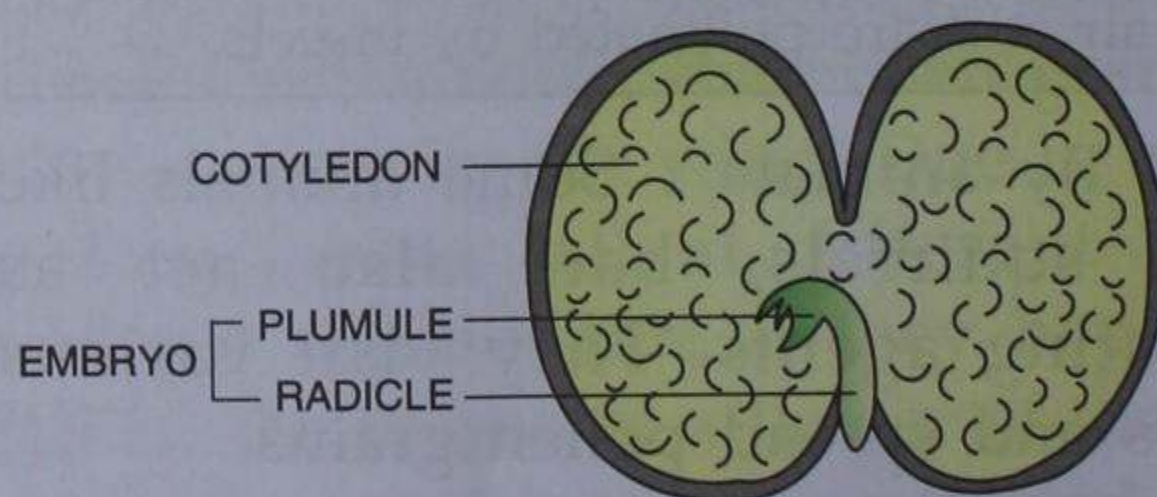


Fig. 4.30 Parts of a germinating bean seed

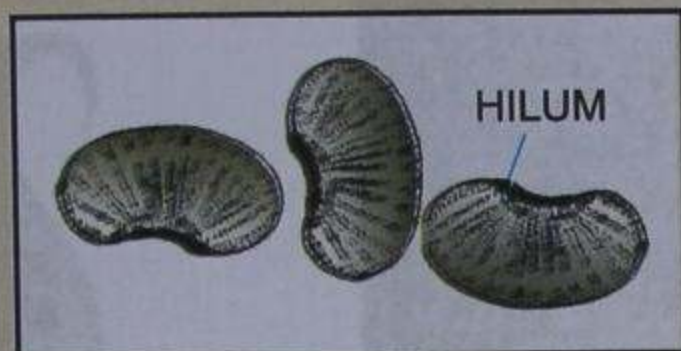
Seeds contain a baby plant, called an **embryo**, and reserve food in fleshy parts called **cotyledons**. An embryo has two important parts called **plumule** and a **radicle**. Seeds are classified into two types:

- (i) **Monocot Seeds (mono : single/one)** – are those which have one cotyledon, e.g. rice, wheat.
- (ii) **Dicot Seeds (di : two)** – are those which have two cotyledons, e.g., gram, bean, peas.



ACTIVITY 7

Take a few dry and a few soaked



bean seeds. Observe the dry seed. You will see a small scar on its surface. This is called **hilum** (Fig. 4.30). This is the point where seeds are attached carefully to the fruit wall. Break the seed carefully. You will see a small pore called micropyle, below the hilum.

Take a soaked, swollen seed now. Remove its seed coat. You can see two cotyledons inside it and a tiny embryo between the two cotyledons.

Dispersal of Seeds

Distribution of fruits and seeds away from the parent plant is called **dispersal**. It is to avoid overcrowding under the same plant, otherwise the seeds will fall there and will not be able to flourish.

Since plants do not move from one place to another, therefore, the seeds and fruits have to be dispersed to far away places. The dispersal of fruits and seeds is accomplished with the help of agencies like *water*, *wind* and *animals*.



COTTON SEED



DRUMSTICK SEED

Fig. 4.31 Seeds dispersed by wind

Dispersal of seed by Wind (Fig. 4.31)

Seeds and fruits, which are light in weight are dispersed by wind, e.g., *cotton*, *poppy*, *drumstick seeds*. These seeds are light in weight and have silky hair or wings so that they can be carried away easily with the wind.

Dispersal of seed by Water (Fig. 4.32)

Seeds and fruits which have fibrous coat with woody covering over the seeds are dispersed by water, e.g., *lotus*, *coconut*.

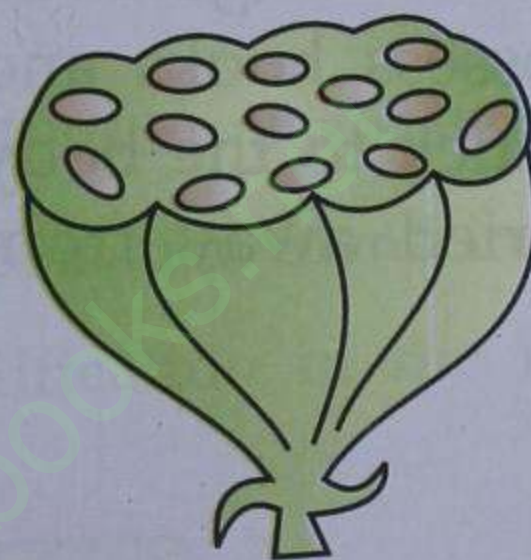


Fig. 4.32 Fruits and seeds dispersed by water

Dispersal of seed by Animals

Animals including humans help in the dispersal of seeds. Some seeds are either edible or they develop external structures like hooks, thorns, spines, bristles, stiff hair, etc. so that they can stick to the body of animals and are carried away from one place to another.

Seeds of some fruits like mango, orange, papaya, water melon, etc. are dispersed by the human beings. They eat away the fleshy part of the fruits and throw the seeds at various distant places. These seeds germinate into new plants when exposed to favourable conditions. Many animals like squirrel and birds feed on fruits. The seeds pass out undigested with their droppings and get dispersed at various places.



XANTHIUM



URENA



MARTYNIA

Fig. 4.33 Fruits dispersed by animals

Some fruits like **Xanthium** (gokhru), **Urena** and **Martynia** possess hooks and spines (Fig. 4.33). They stick to the body of animals and get carried away from one place to another.

Germination

The process by which the embryo in the seed becomes active in the presence of water, air and suitable temperature, and grows into a new young plant, is called **germination**.

REVIEW QUESTIONS

- Name the following :
 - The part of the plant which remains under the ground : _____
 - The part of the plant which remains above the soil : _____
- Differentiate between the following :
 - Tap root and fibrous root.
 - Prop root and stilt root.
 - Pneumatophore root and epiphytic root.
 - Tuber and rhizome.
 - Bulb and corm.
- What are the **four** functions of roots ?
- Mention the functions of the following :
 - Spines
 - Tendrils
 - Phylloclade
- What are adventitious roots ? Mention the types of modified adventitious roots.
- Write down various types of underground modifications of stem, giving **one** example of each.
- Define venation. What are the different types of venation found in the leaves ?

3. Match the modification of stem given under **column I** with their respective examples given under **column II** :

Column I

(Stem modification)

- (i) Stolon
- (ii) Runner
- (iii) Offset
- (iv) Tendril
- (v) Thorn
- (vi) Phylloclade

Column II

(Plants)

- (a) Water hyacinth
- (b) Mint
- (c) Grape vine
- (d) Opuntia
- (e) Doob grass
- (f) Rose

9. Describe the modifications of leaf in any **one** insectivorous plant.
10. Write the **two** main functions of leaves.
11. "The flower is the reproductive organ of plants." Justify this statement.
12. Define pollination. What are the **two** types of pollination found in the flowering plants.
13. Taking suitable examples, describe the modification in the insect-pollinated and the wind-pollinated flowers ?

A MINI PROJECT

Visit your school garden or a nearby park and collect the leaves of different plants by taking permission. Paste the leaves in a file and make a leaf-file.