



learnkwniy

MORPHOLOGY

OF FLOWERING

PLANTS

THE ROOT

In majority of the dicotyledonous plants, the direct elongation of the radicle leads to the formation of primary root which grows inside the soil.

It bears lateral roots of several orders that are referred to as secondary, tertiary, etc. roots. The primary roots and its branches constitute the tap root system.

Fibrous root

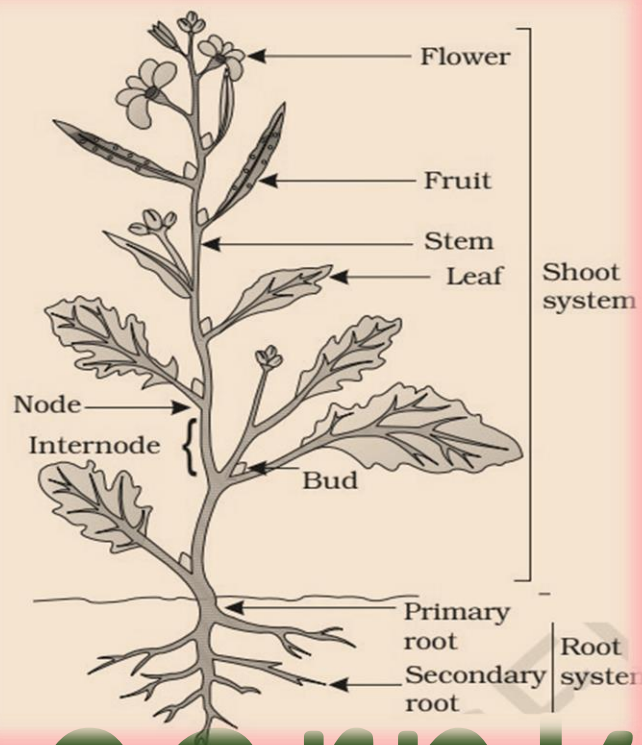
In monocotyledonous plants, the primary root is short lived and is replaced by a large number of roots. These roots originate from the base of the stem and constitute the fibrous root system.

Adventitious roots

In some plants, like grass, Monstera and the banyan tree, roots arise from parts of the plant other than the radicle and are called adventitious roots.

Function of Root

The main functions of the root system are absorption of water and minerals from the soil, providing a proper anchorage to the plant parts, storing reserve food material and synthesis of plant growth regulators.



Regions of the Root

Root cap

The root is covered at the apex by a thimble-like structure called the root cap . It protects the tender apex of the root as it makes its way through the soil.

Region of meristematic activity

Above the root cap is the region of meristematic activity. The cells of this region are very small, thin-walled and with dense protoplasm. They divide repeatedly.

Region of elongation

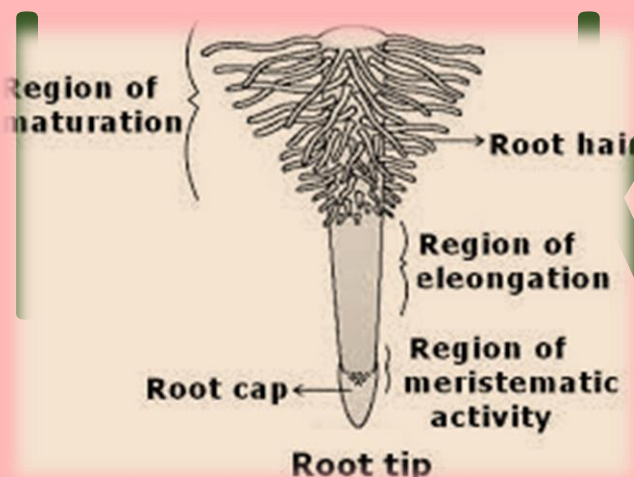
The cells proximal to this region undergo rapid elongation and enlargement and are responsible for the growth of the root in length. This region is called the region of elongation.

Region of maturation

The cells of the elongation zone gradually differentiate and mature. Hence, this zone, proximal to region of elongation, is called the region of maturation.

Root hairs

From this region some of the epidermal cells form very fine and delicate, thread-like structures called root hairs. These root hairs absorb water and minerals from the soil.



THE STEM

The stem is the ascending part of the axis bearing branches, leaves, flowers and fruits.

It develops from the plumule of the embryo of a germinating seed.

The stem bears nodes and internodes.

The region of the stem where leaves are born are called nodes while internodes are the portions between two nodes. The stem bears buds, which may be terminal or axillary.

Function

The main function of the stem is spreading out branches bearing leaves, flowers, and fruits.

It conducts water, minerals and photosynthates.

perform the function of storage of food, support, protection and of vegetative propagation

THE LEAF

The leaf is a lateral, generally flattened structure borne on the stem. It develops at the node and bears a bud in its axil.

The axillary bud later develops into a branch. Leaves originate from shoot apical meristems and are arranged in an acropetal order



A typical leaf consists of three main parts: leaf base, petiole and lamina.

The leaf is attached to the stem by the leaf base and may bear two lateral small leaf like structures called stipules.

In monocotyledons, the leaf base expands into a sheath covering the stem partially or wholly.

In some leguminous plants the leaf base may become swollen, which is called the pulvinus.

The petiole help hold the blade to light.

The lamina or the leaf blade is the green expanded part of the leaf with veins and veinlets.

There is, usually, a middle prominent vein, which is known as the midrib.

Veins provide rigidity to the leaf blade and act as channels of transport for water, minerals and food materials.

The shape, margin, apex, surface and extent of incision of lamina varies in different leaves.

Venation

The arrangement of veins and the veinlets in the lamina of leaf is termed as venation.

When the veinlets form a network, the venation is termed as reticulate.

When the veins run parallel to each other within a lamina, the venation is termed as parallel.

Leaves of dicotyledonous plants generally possess reticulate venation, while parallel venation is the characteristic of most monocotyledons.



Types of Leaves

Simple Leaf

A leaf is said to be simple, when its lamina is entire or when incised, the incisions do not touch the midrib.

Compound Leaf

When the incisions of the lamina reach up to the midrib breaking it into a number of leaflets, the leaf is called compound.

A bud is present in the axil of petiole in both simple and compound leaves, but not in the axil of leaflets of the compound leaf.

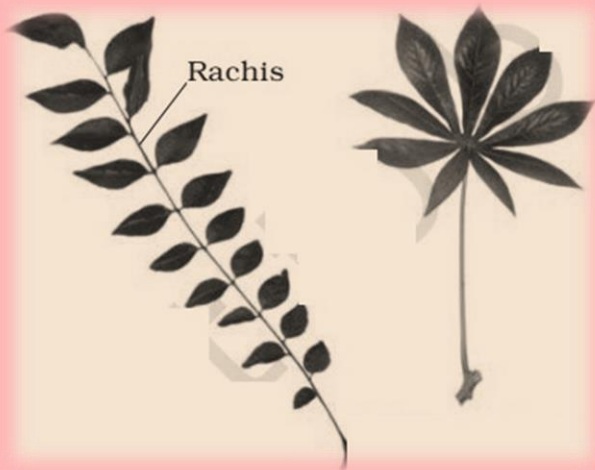
The compound leaves may be of two types.

Pinnately compound leaf

a number of leaflets are present on a common axis, the rachis, which represents the midrib of the leaf as in neem.

Palmately compound leaf

the leaflets are attached at a common point, i.e., at the tip of petiole, as in silk cotton.



Phyllotaxy

Phyllotaxy is the pattern of arrangement of leaves on the stem or branch.

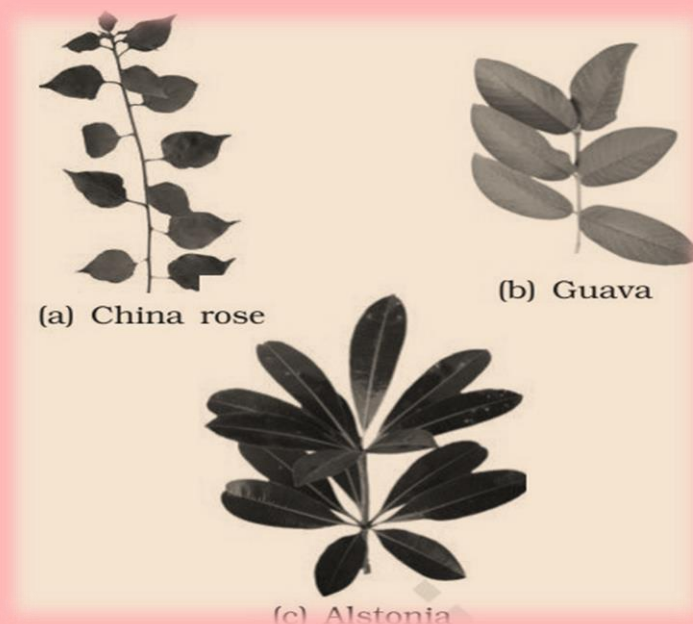
This is usually of three types – alternate, opposite and whorled.

In alternate type of phyllotaxy, a single leaf arises at each node in alternate manner, as in china rose, mustard plants.

opposite type, a pair of leaves arise at each node and lie opposite to each other as in Calotropis and guava plants.

Whorled more than two leaves arise at a node and form a whorl.

Example Alstonia



THE INFLORESCENCE

The arrangement of flowers on the floral axis is termed as inflorescence.

Depending on whether the apex gets developed into a flower or continues to grow, two major types of inflorescences are defined – racemose and cymose.

In racemose type of inflorescences, the main axis continues to grow, the flowers are borne laterally in an acropetal succession.

In cymose type of inflorescence the main axis terminates in a flower. The flowers are borne in a basipetal order.

THE FLOWER

A typical flower has four different kinds of whorls arranged successively on the swollen end of the stalk or pedicel, called thalamus or receptacle.

These are calyx, corolla, androecium, and gynoecium.

Calyx and corolla are accessory organs, while androecium and gynoecium are reproductive organs.

When a flower has both androecium and gynoecium, it is bisexual.

A flower having either only stamens or only carpels is unisexual.

Symmetry

Actinomorphic

When a flower can be divided into two equal radial halves in any radial plane passing through the centre, it is said to be actinomorphic, e.g., mustard, datura.

Zygomorphic

When it can be divided into two similar halves only in one particular vertical plane, it is zygomorphic, e.g., pea, gulmohur, bean.

A flower is asymmetric if it cannot be divided into two similar halves by any vertical plane passing through the centre, as in canna.

A flower may be trimerous, tetramerous, or pentamerous when the floral appendages are in multiple of 3, 4 or 5, respectively.

Flowers with bracts-reduced leaf found at the base of the pedicel - are called bracteate and those without bracts, ebracteate.

flowers are described as based on the position of calyx, corolla and androecium in respect of the ovary on thalamus

Hypogynous flower

the gynoecium occupies the highest position while the other parts are situated below it. The ovary in such flowers is said to be superior, e.g., mustard, china rose and brinjal.

Perigynous

If gynoecium is situated in the centre and other parts of the flower are located on the rim of the thalamus almost at the same level, it is called perigynous.

The ovary here is said to be half inferior, e.g., plum, rose, peach.

Epigynous flowers

the margin of thalamus grows upward enclosing the ovary completely and getting fused with it, the other parts of flower arise above the ovary.

Hence, the ovary is said to be inferior

Eg flowers of guava and cucumber.

Parts of a Flower

Each flower normally has four floral whorls, viz., calyx, corolla, androecium, and gynoecium.

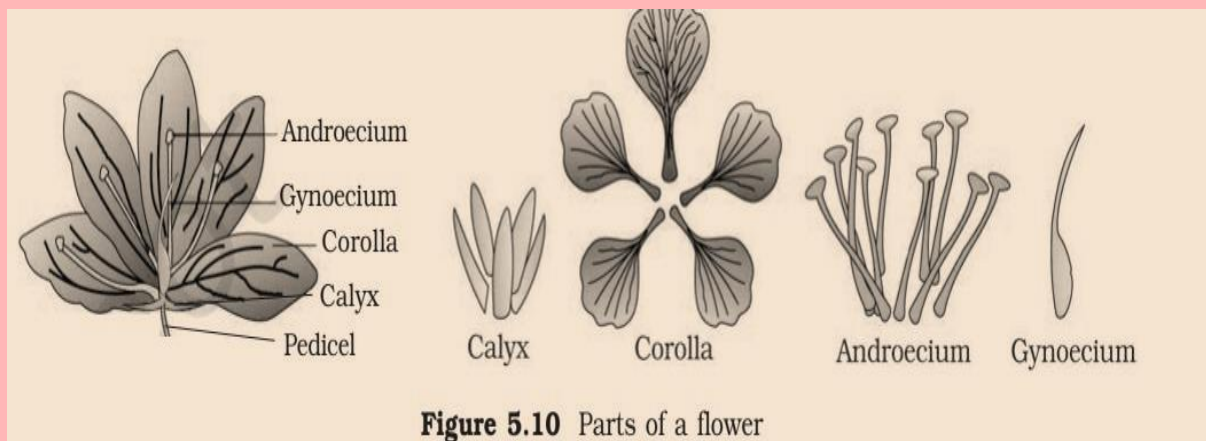


Figure 5.10 Parts of a flower

Calyx

The calyx is the outermost whorl of the flower and the members are called sepals.

sepals are green, leaf like and protect the flower in the bud stage.

The calyx may be gamosepalous (sepals united) or polysepalous (sepals free).

Corolla

Corolla is composed of petals.

Like calyx, corolla may also be gamopetalous (petals united) or polypetalous.

Corolla may be tubular, bellshaped, funnel-shaped or wheel-shaped.

Aestivation:

The mode of arrangement of sepals or petals in floral bud with respect to the other members of the same whorl is known as aestivation.

The main types of aestivation are valvate, twisted, imbricate and vexillary.

When sepals or petals in a whorl just touch one another at the margin, without overlapping, as in Calotropis, it is said to be valvate.

If one margin of the appendage overlaps that of the next one and so on as in china rose, it is called twisted.

If the margins of sepals or petals overlap one another but not in any particular direction as in Cassia is called imbricate.

the largest (standard) overlaps the two lateral petals (wings) which in turn overlap the two smallest anterior petals (keel); this type of aestivation is known as vexillary.

Androecium

Androecium is composed of stamens.

Each stamen which represents the male reproductive organ consists of a stalk or a filament and an anther.

Each anther is usually bilobed and each lobe has two chambers, the pollen-sacs. The pollen grains are produced in pollen-sacs.

A sterile stamen is called staminode.

When stamens are attached to the petals, they are epipetalous, or epiphyllous when attached to the perianth.

Gynoecium

Gynoecium is the female reproductive part of the flower and is made up of one or more carpels.

A carpel consists of three parts namely stigma, style and ovary.

Ovary is the enlarged basal part, on which lies the elongated tube, the style.

The style connects the ovary to the stigma.

The stigma is usually at the tip of the style and is the receptive surface for pollen grains.

Each ovary bears one or more ovules attached to a flattened, cushion-like placenta. When more than one carpel is present, they may be free and are called apocarpous.

They are termed syncarpous when carpels are fused, as in mustard and tomato.

After fertilisation, the ovules develop into seeds and the ovary matures into a fruit.

Placentation

The arrangement of ovules within the ovary is known as placentation.

The placentation are of different types namely, marginal, axile, parietal, basal, central and free central.

Marginal placentation

the placenta forms a ridge along the ventral suture of the ovary and the ovules are borne on this ridge forming two rows, as in pea.

Axial

When the placenta is axial and the ovules are attached to it in a multilocular ovary, the placentation is said to be axile, as in china rose, tomato and lemon.

Parietal placentation

the ovules develop on the inner wall of the ovary or on peripheral part. Ovary is one-chambered but it becomes two chambered due to the formation of the false septum, e.g., mustard and Argemone.

Free central

When the ovules are borne on central axis and septa are absent, as in Dianthus and Primrose the placentation is called free central.

In basal placentation, the placenta develops at the base of ovary and a single ovule is attached to it, as in sunflower, marigold.

THE FRUIT

The fruit is a characteristic feature of the flowering plants. It is a mature or ripened ovary, developed after fertilisation.

If a fruit is formed without fertilisation of the ovary, it is called a parthenocarpic fruit.

Generally, the fruit consists of a wall or pericarp and seeds.

The pericarp may be dry or fleshy. When pericarp is thick and fleshy, it is differentiated into the outer epicarp, the middle mesocarp and the inner endocarp.

THE SEED

The ovules after fertilisation, develop into seeds. A seed is made up of a seed coat and an embryo.

The embryo is made up of a radicle, an embryonal axis and one or two cotyledons.

Structure of a Dicotyledonous Seed

The outermost covering of a seed is the seed coat. The seed coat has two layers, the outer testa and the inner tegmen.

The hilum is a scar on the seed coat through which the developing seeds were attached to the fruit.

Above the hilum is a small pore called the micropyle.

Within the seed coat is the embryo, consisting of an embryonal axis and two cotyledons.

At the two ends of the embryonal axis are present the radicle and the plumule.

In some seeds such as castor the endosperm formed as a result of double fertilisation, is a food storing tissue and called endospermic seeds.

Structure of Monocotyledonous Seed

The endosperm is bulky and stores food.

The outer covering of endosperm separates the embryo by a proteinous layer called aleurone layer.

The embryo is small and situated in a groove at one end of the endosperm.

It consists of one large and shield shaped cotyledon known as scutellum and a short axis with a plumule and a radicle.

The plumule and radicle are enclosed in sheaths which are called coleoptile and coleorhiza respectively.

SEMI-TECHNICAL DESCRIPTION OF A TYPICAL FLOWERING PLANT

The plant is described beginning with its habit, vegetative characters – roots, stem and leaves and then floral characters inflorescence and flower parts.

After describing various parts of plant, a floral diagram and a floral formula are presented.

The floral formula is represented by some symbols.

In the floral formula,

Br stands for bracteate

K stands for calyx,

C for corolla,

P for perianth,

A for androecium

G for Gynoecium

G for superior ovary

\overline{G} for inferior ovary

♂ for male

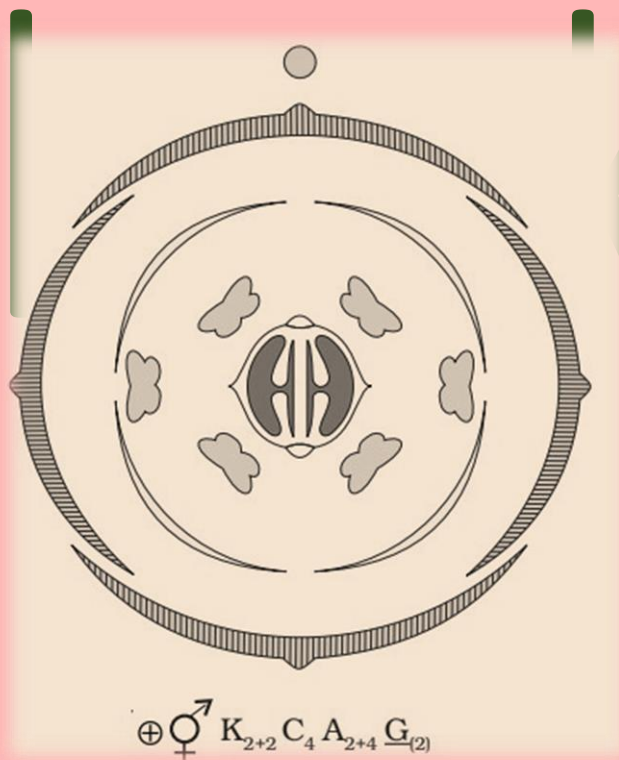
♀ for female

♂♀ for bisexual plants

⊕ for actinomorphic

% for zygomorphic nature of flower.

The position of the mother axis with respect to the flower is represented by a dot on the top of the floral diagram. Calyx, corolla, androecium and gynoecium are drawn in successive whorls, calyx being the outermost and the gynoecium being in the centre.



SOLANACEAE

Plants mostly herbs, shrubs and rarely small trees

Stem: herbaceous rarely woody, aerial; erect, cylindrical, branched, solid or hollow, hairy or glabrous, underground stem in potato

Leaves: alternate, simple, rarely pinnately compound, exstipulate; venation reticulate

Floral Characters

Inflorescence : Solitary, axillary or cymose as in Solanum

Flower: bisexual, actinomorphic

Calyx: sepals five, united, persistent, valvate aestivation

Corolla: petals five, united; valvate aestivation

Androecium: stamens five, epipetalous

Gynoecium: bicarpellary obligately placed, syncarpous; ovary superior, bilocular, placenta swollen with many ovules, axile

Fruits: berry or capsule

Seeds: many, endospermous

Floral Formula:



Economic Importance

Many plants belonging to this family are source of food (tomato, brinjal, potato), spice (chilli); medicine (belladonna, ashwagandha); fumigatory (tobacco); ornamentals (petunia).