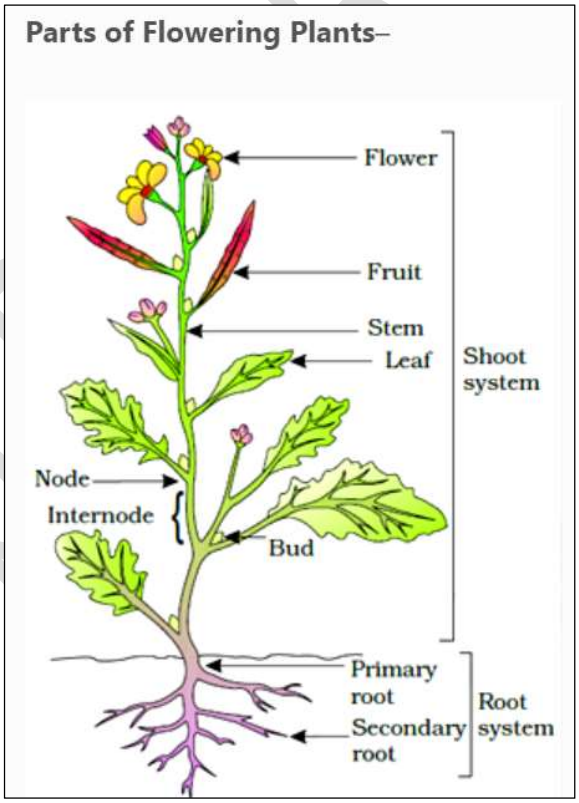
Chapter-5 Morphology of flowering Plants

Morphology of different parts of flowering plants- root, stem, leaf, inflorescence, flower, fruit and seed. Description of family solanaceae

- Morphology is the branch of biological science that deals with the study of form, size, colour, structure and relative position of various parts of organisms.

Importance of morphology-

- Knowledge of morphology is essential for recognition or identification of plants.
- It gives information about the range of variations found in species.
- Deficiency and toxicity symptoms are morphological changes that occur in response to shortage or excess of minerals.
- All the flowering plants have roots, stem, leaves, flower and fruits. The underground parts of flowering plant are the root system and the portion above the ground forms the shoot system.



- **External Morphology:** It deals with external forms like shape, size, colour, structure and relative position of different organs.
- **Internal Morphology:** Further divided into anatomy and histology.
- **Anatomy:** It deals with the study of internal structure exposed after dissection and opening of various parts of an organ.
- **Histology:** The study of tissues, their composition and structure.
- **Adaptation:** Any alteration in the structure or function of an organism or any of its part that results from natural selection and by which the organism becomes better fitted to survive and multiply in its environment.

The Root

The root is underground part of the plant and develops from elongation of radicle of the embryo.

Characteristics

- It lies inside the soil, chlorophyll is absent, absence of nodes and internodes, leaves and buds; positive geotropic and hydrotropic and negative phototropic.

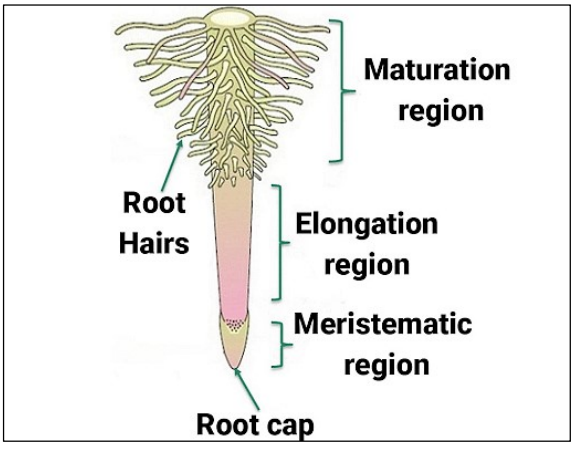
Various types of root

Tap root	Fibrous root	Adventitious root
Originates from radical	Originates from base of the stem	Originates from parts of the plant other than radicle
Dicotyledonous plants, *e.g.*, gram, pea, mango, mustard.	Monocotyledonous plants, *e.g.*, wheat, paddy, grasses.	Banyan tree (Prop roots) Maize (stilt roots) Rhizophora (Respiratory roots)

Main functions of root system

1. Absorption of water and minerals from the soil.
2. Provides anchorage to plant parts.
3. Stores reserve food material and synthesises plant growth regulators (cytokinins)

Regions of Roots



- **Root Cap:** The root is covered at the apex by the thimble-like structure which protect the tender apical part.
- **Region of meristematic activity:** Cells of this region have the capability to divide; cells are small, thin walled with dense protoplasm.
- **Region of elongation:** Cell of this region are elongated and enlarged. This region is responsible for the growth of root in length.
- **Region of Maturation:** This region has differentiated and matured cells. Some epidermal cells form very fine and delicate thread like structures called root hairs.

Modifications of Root:

Roots are modified for support, storage of food, respiration.

- **For support:** Prop roots in banyan tree, stilt roots inmaize and sugarcane.
- **For respiration:** Pneumatophores in Rhizophora (Mangrove).
- **For storage of food:** Fusiform (radish), Napiform (turnip), Conical (carrot), Fasiculated fleshy roots (Asparagus).

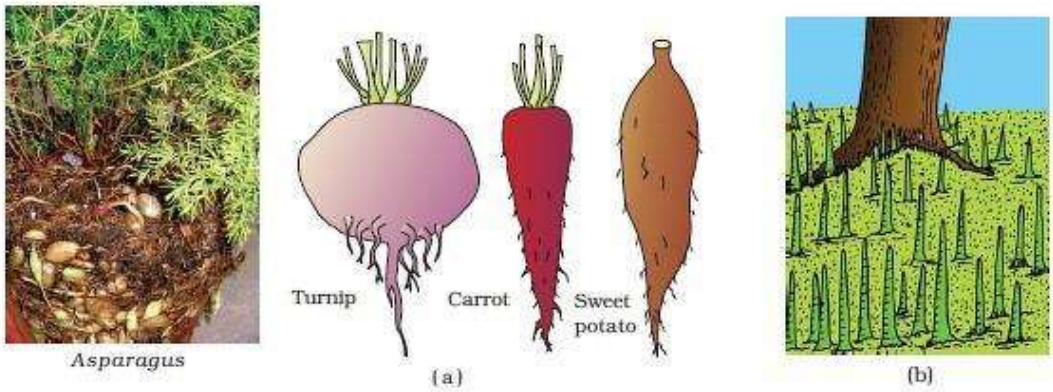


Figure 5.5 Modification of root for : (a) storage (b) respiration: pneumatophore in *Rhizophora*

The Stem

Stem is the aerial part of the plant and develops from plumule of the embryo. It bears nodes and internodes.

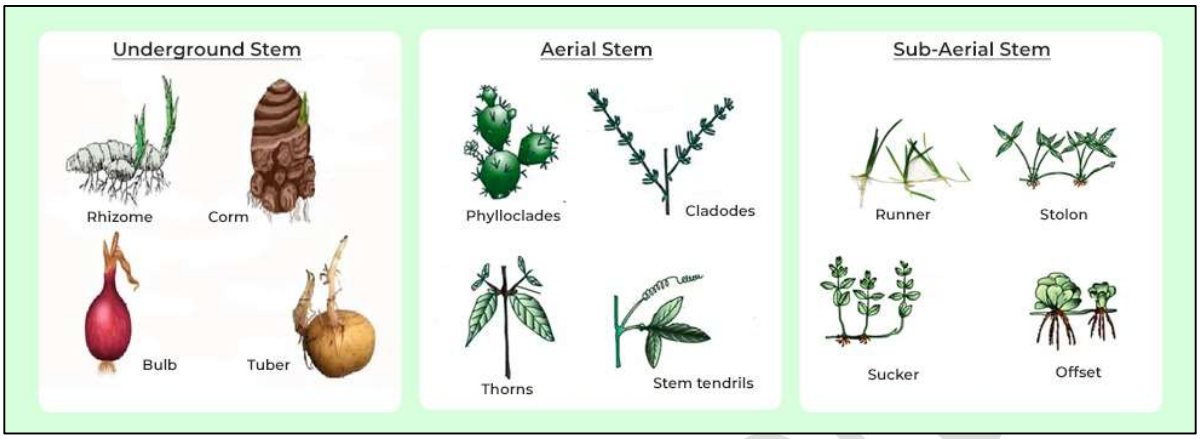
Functions of stem

- Exposure of leaves, conduction of water and minerals, translocation of food, exposure of flowers and fruits.

Modifications of Stem

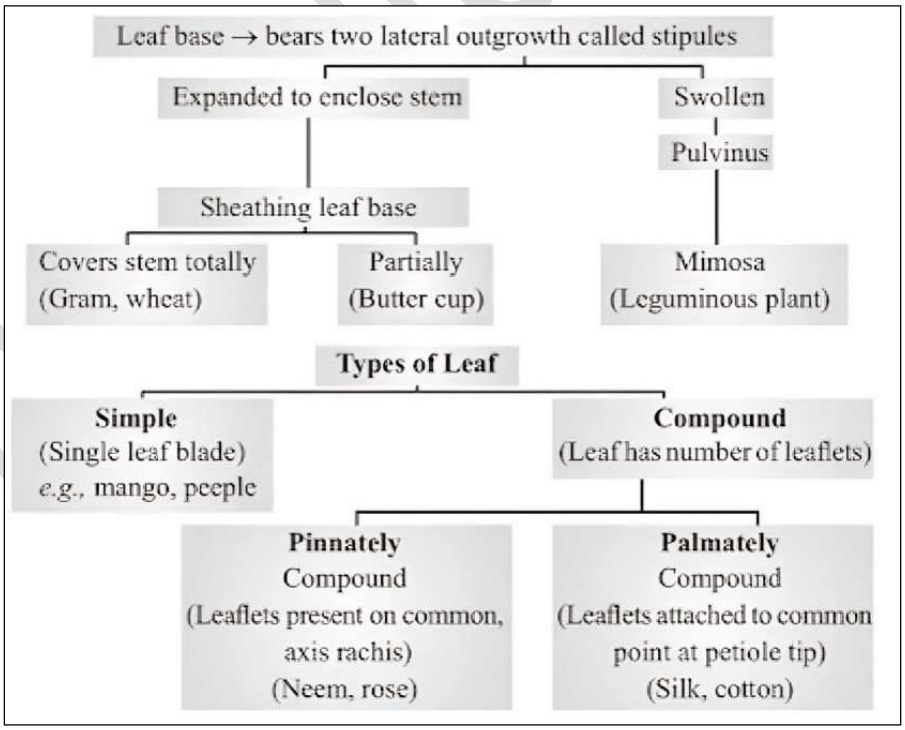
- In some plants the stems are modified to perform the function of storage of food, support, protection and vegetative propagation.
- For food storage: Rhizome (ginger, turmeric), Tuber (potato), Bulb (onion), Corm (*Colocasia, Amorphophallus/Zamin-kand*)
- For support: Stem tendrils of watermelon, grapevine, cucumber, pumpkins.
- For protection: Axilliary buds of stem of Citrus, Bougainvillea get modified into pointed thorns. They protect the plants from animals.
- For vegetative propagation: Underground stems of grass (runner), strawberry (stolons), lateral branches of mint and jasmine, *Eichhornia* (offsets).

- For assimilation of food : Flattened stem of *Opuntia* and cylindrical stem of *Euphorbia* contains chlorophyll and performs photosynthesis.



The Leaf

- Develops from shoot apical meristem, flattened, green structure acropetally arranged manufacture the food by photosynthesis. It has bud in axil.
- A typical leaf has leaf base, petiole and lamina (leaf blade).
- In some leguminous plants the leaf base may become swollen which is called as pulvinus.

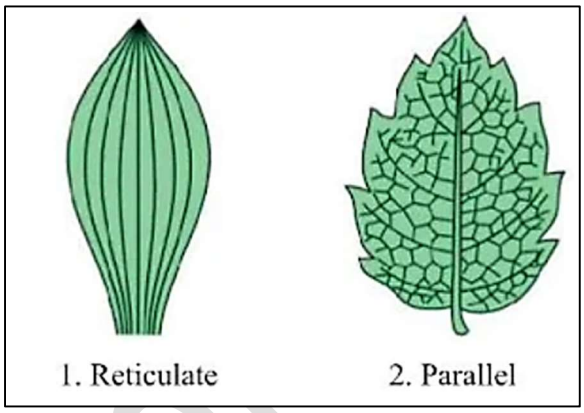


***Venation*:**

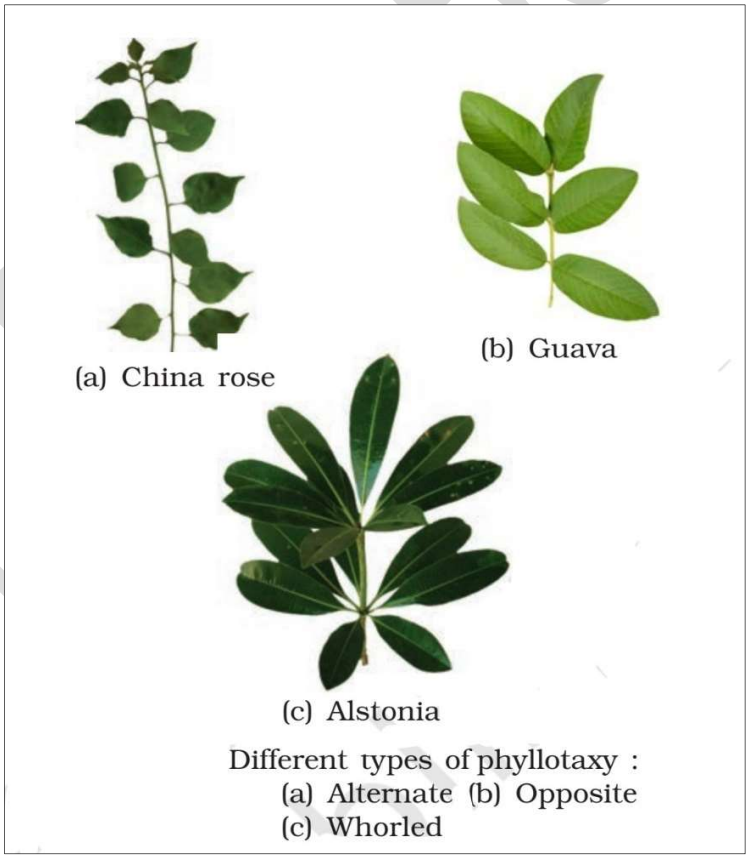
The arrangement of veins and veinlets in the lamina of leaf.

Types of Venation

- **Reticulate:** Veinlets form a network as in leaves of dicotyledonous plants (China rose, peepal).
- **Parallel:** Veins are parallel to each other as in leaves of monocotyledonous plants (grass, maize, sugarcane).



Phyllotaxy: The pattern of arrangement of leaves on the stem or branch.



Different types of phyllotaxy :
(a) Alternate (b) Opposite
(c) Whorled

Functions of Leaf

- Photosynthesis, gaseous exchange, transpiration, protection of buds and conduction.

Modifications of Leaves

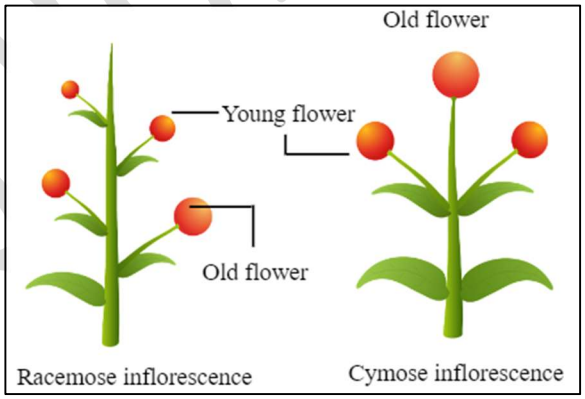
- Tendrils - Function: Climbing - Example: Sweet Pea, Pea
- Spines - Function: Protection - Example: Aloe, Opuntia, Argemone
- Pitcher - Function: Nutrition - Example: Nepenthes
- Hook - Function: Support - Example: Cat's nail
- Fleshy Leaves - Function: Storaged food - Example: Onion and Garlic

Inflorescene: The arrangement of flowers on the floral axis (Peduncle)

Main types of Inflorescence

(i) Racemose:

- It is indefinite inflorescence.
- Main axis continues to grow and flowers borne in acropetal succession.
- e.g.: ***Radish, Mustard, Amaranthus***



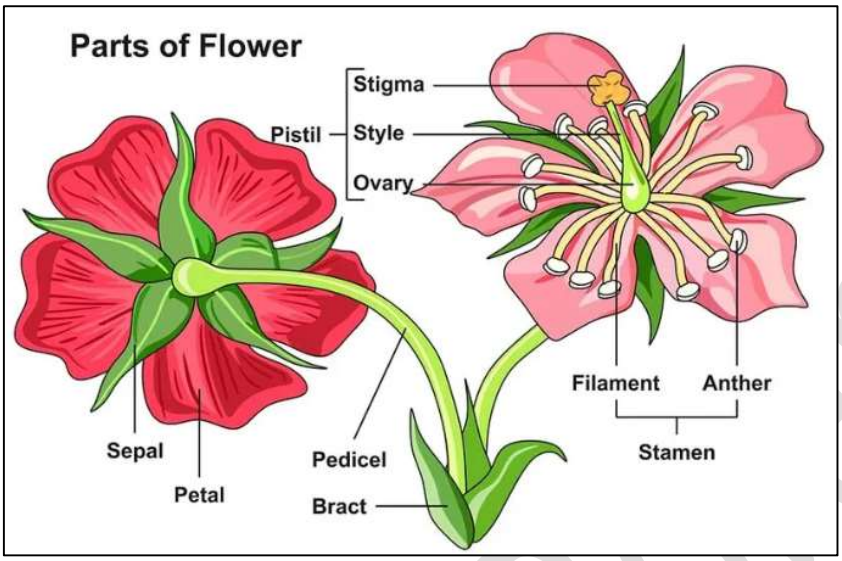
(ii) Cymose:

- It is definite inflorescence.
- Main axis terminates in flowers and the flowers borne in basipetal succession.
- e.g. : ***Cotton, Jasmine, Calotropis***

Special Inflorescence type- ***Ficus, Salvia, Euphorbia,Sunflower***

Racemose	**Cymose**
1. The main axis continuous to grow. 2. Flowers are borne laterally in an acropetal succession. 3. Example- Radish, Mustard.	1. Main axis terminates in flower having limited growth. 2. Flowers are borne in a basipetal succession. 3. Example- Jasmine, Bougainvillea.

The Flower



- Flower- Modified shoot meant for reproduction
- A typical flower has four whorls arranged on a swollen end of stalk or pedicel called thalamus. They are Calyx, Corolla, Androecium and Gynoecium.
- When a flower has both androecium and gynoecium, the flower is called bisexual and flower having either androecium or gynoecium only is called unisexual.

On the basis of symmetry flower can be

(i) Actinomorphic (Radial symmetry)

- Flower can be divided into two equal halves in any radial plane passing through centre. eg : ***Mustard, Datura, Chilli***

(ii) Zygomorphic (Bilateral symmetry)

- Flower can be divided into two similar halves only in one plane. eg : ***Pea, bean, Gulmohar, cassia***

(iii) Asymmetric (Irregular)

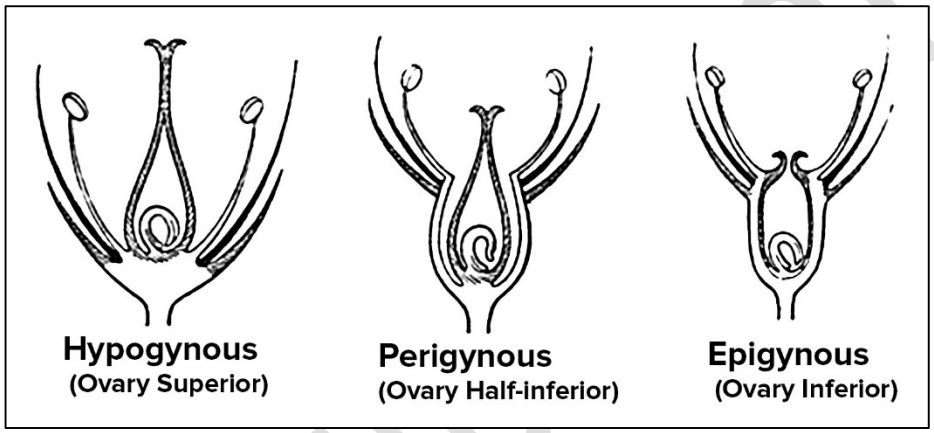
- Flower cannot be divided in two similar halves by any vertical plane passing through centre. eg : ***Canna***

On the basis of floral appendages flower can be:

- Trimerous (multiples of 3)
- Tetramerous (multiples of 4)
- Pentamerous (multiples of 5)

On the basis of position of Calyx, corolla and androecium in respect of ovary, flower can be:

- Hypogynous (Superior Ovary): eg. ***Mustard, China rose, Brinjal***
- Perigynous (Half inferior ovary): eg***. Plum, Rose, Peach***
- Epigynous (inferior ovary): eg. ***Guava, Cucumber, ray florets (sun flower)***



- **Thalamus/Receptacle:** Swollen end of flower stalk (pedicel) which bears four whorls of flower viz., Calyx (K), Corolla (C), Androecium (A) and Gynoecium (G).

- **Bract:** Reduced leaf base found at the base of pedicel. Flowers with bracts are called bracteate and without bracts are called ebracteate.

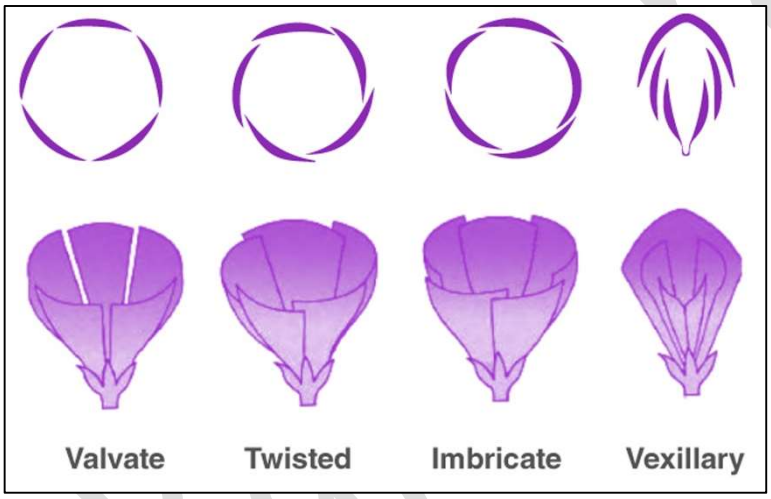
- **Perianth:** If calyx and corolla are not distinguishable, they are called perianth. Example : ***Lily***

Aestivation

The mode of arrangement of sepals or petals in floral bud.

Types of aestivation

1. **Valvate:** Sepals or petals just touch one another at the margin, withut overlapping. e.g., *Calotropis*
2. **Twisted:** Sepals or petals overlap the next sepal or petal e.g., *China rose, Cotton, lady's finger.*
3. **Imbricate:** The margins of sepals or petals overlap one another but not in any defintite direction, e.g., *Cassia, Gulmohar.*
4. **Vexillary:** The largest petal overlaps the two lateral petals which in turn overlap two smallest anterior petals, e.g., *Bean, Pea.*

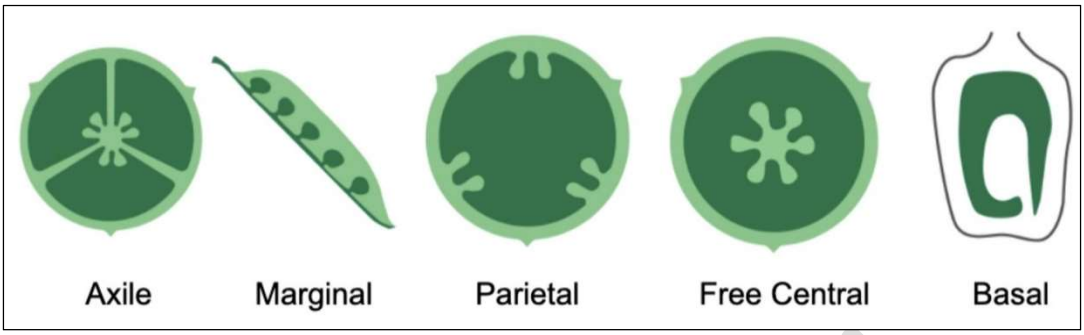


Placentation

The arrangement of ovules within the ovary.

Types of Placentation

- **Marginal:** Placenta forms a ridge along the ventral suture of ovary, e.g., ***Pea***.
- **Axile:** Margins of carpels fuse to form central axis, e.g., ***China rose, Tomato, Lemon***
- **Parietal:** Ovules develop on inner wall of ovary, e.g., ***Mustard, Argemone***
- **Free central:** Ovules borne on central axis, lacking septa, e.g., ***Dianthus, Primrose***
- **Basal:** Placenta develop at the base of ovary, e.g., ***Sunflower, Marigold***



- **Placenta**: Parenchymatous flattened cushion inside ovary where ovules are borne.

The Fruit

- Mature and ripened ovary developed after fertilisation is fruit. If a fruit is formed without fertilisation of ovary it is called parthenocarpic fruit.
- Fruit consists of seeds and pericarp. Thick and fleshy pericarp is three layered called epicarp, mesocarp and endocarp.

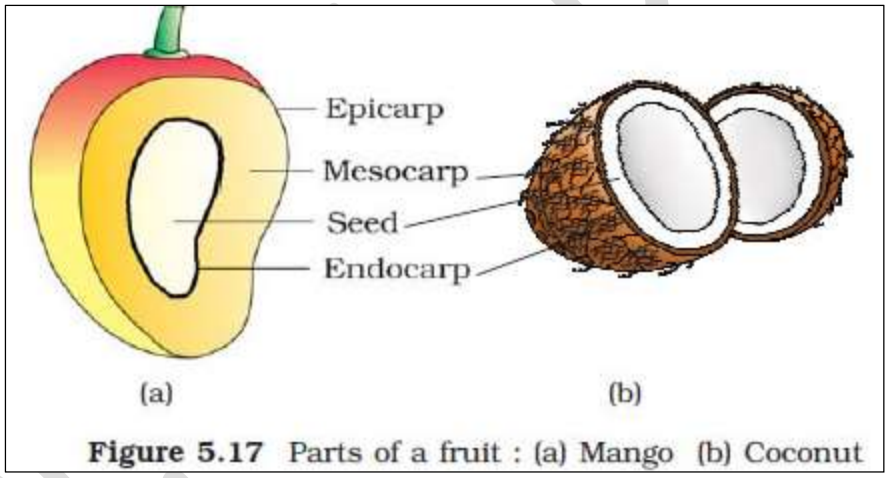
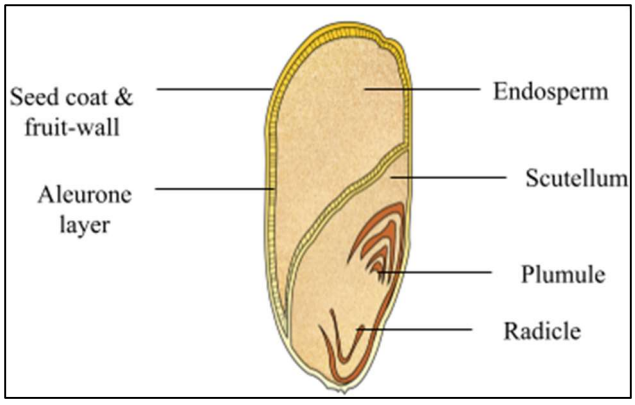


Figure 5.17 Parts of a fruit : (a) Mango (b) Coconut

The Seed:

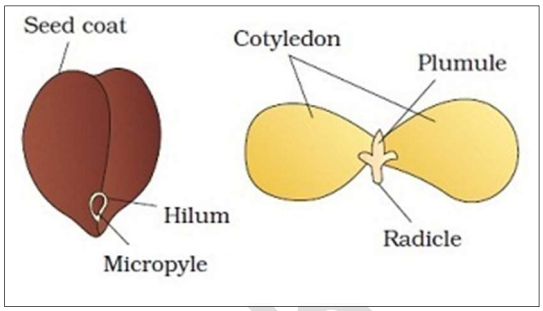
Monocotyledonous seed

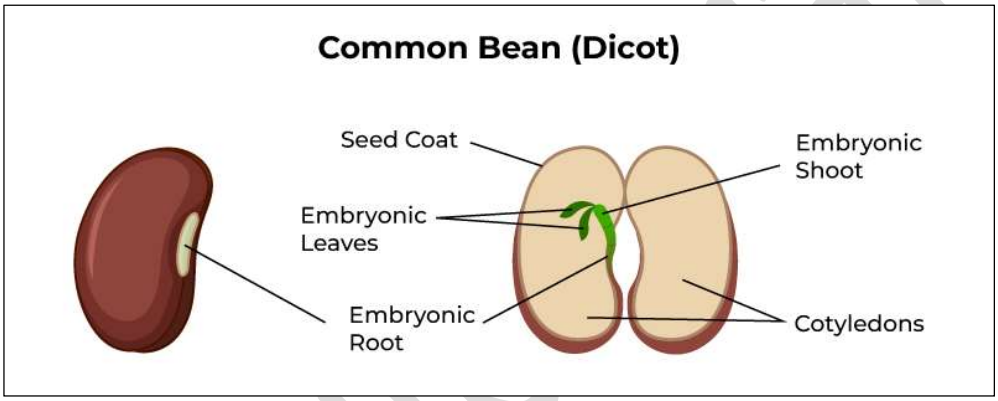
- Endosperm bulky and stores food, covered by proteinaceous Aleurone layer.
- Seed has single large cotyledon-scutellum.
- Plumule is enclosed in Coleoptile and Radicle is enclosed in Coleorrhiza.



Dicotyledonous Seed

- Cotyledons: two; freshly, full of preserve food materials
- Embryonal axis: Radicle and plumule.
- Endospermous seed: endosperm present in mature seed. eg. castor
- Non-endospermous seed: endosperm not present in mature seeds, eg. bean,
- Hilum: Is a scar on the seed coat through which seeds attached to the fruit.
- Micropyle: Small pore, above hilum



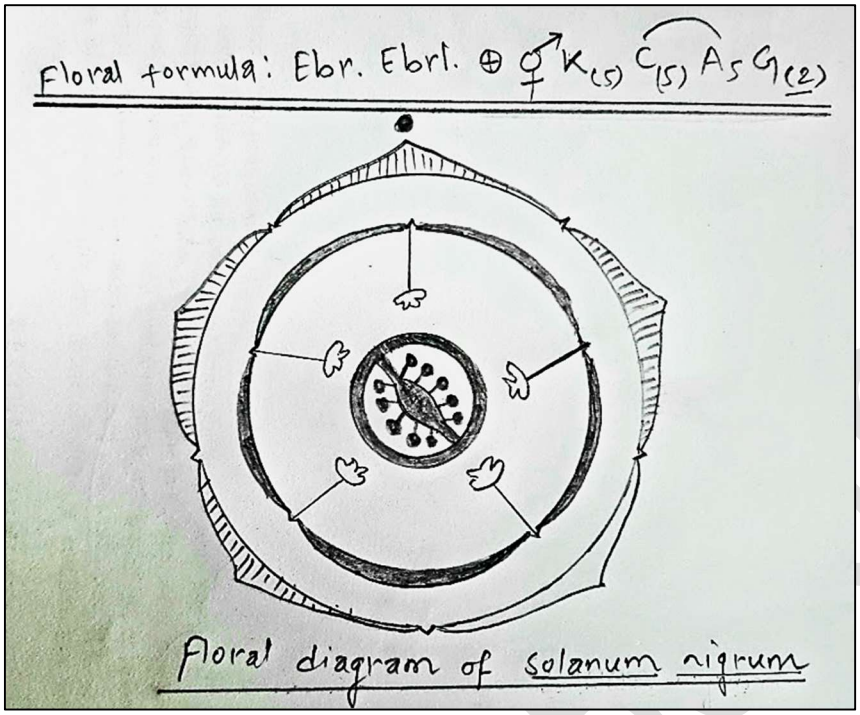


Description of family solanaceae

Family Solanaceae, commonly known as the nightshade family, encompasses a diverse group of flowering plants characterized by several distinctive features.

Description:

- Solanaceae includes many economically important plants such as tomatoes, potatoes, peppers, and eggplants.
- Most members of this family are herbaceous plants, though some are shrubs, trees, or vines.
- Leaves are typically alternate and simple, often with entire or lobed margins.
- Flowers are typically bisexual and usually pentamerous (with parts in multiples of five), although exceptions exist.
- The flowers are often radial or somewhat bilaterally symmetrical, with a fused corolla forming a tube, and a superior ovary.
- Solanaceae fruits vary widely and may be berries (like tomatoes), capsules (like tobacco), or dry berries (like bell peppers).
- Many species within the Solanaceae family are known for their toxicity, containing alkaloids that can be poisonous if ingested in large quantities.


Floral formula: Ebr. Ebrl. ⊕ ♀♂ K(5) C(5) A5 G(2)
Floral diagram of Solanum nigrum