

## Chapter-5

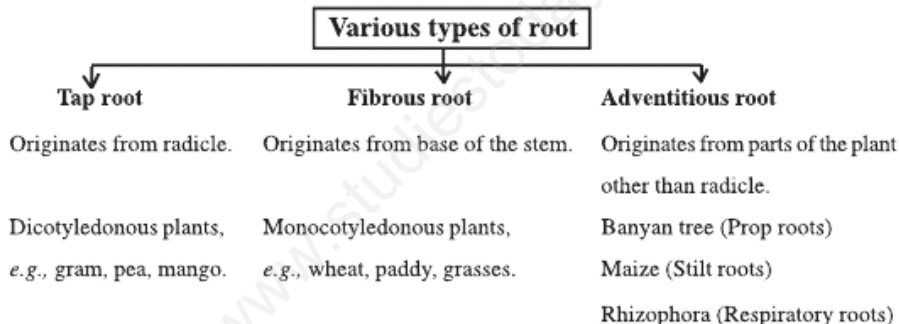
# MORPHOLOGY OF FLOWERING PLANTS

## POINTS TO REMEMBER

**Morphology** : The study of various external features of the organism is known as morphology.

**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.



**Root Cap** : The root is covered at the apex by the thimble-like structure which protects the tender apical part.

### Regions of the root :

**1. Region of meristematic activity** : Cells of this region have the capability to divide.

**2. Region of elongation** : Cells of this region are elongated and enlarged.

**3. Region of Maturation** : This region has differentiated and matured cells. Some of the epidermal cells of this region form thread-like root hairs.

### Modifications of Root :

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

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

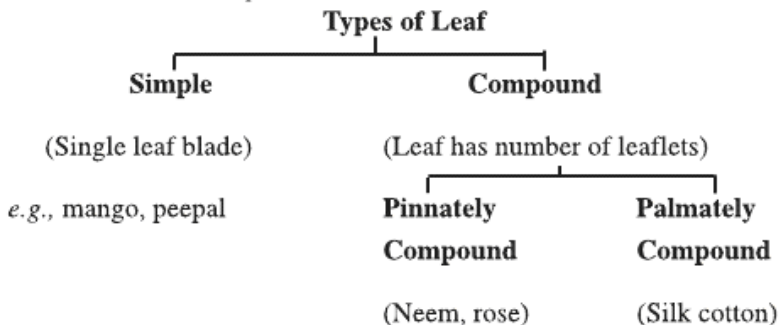
**The Stem** : Stem is the aerial part of the plant and develops from plumule of the embryo. It bears nodes and internodes.

### 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), Tuber (potato), Bulb (onion), Corm (colocasia).
- **For support** : Stem tendrils of watermelon, grapevine, cucumber.
- **For protection** : Axillary buds of stem of citrus, *Bougainvillea* get modified into pointed thorns. They protect the plants from animals.
- **For vegetative propagation** : Underground stems of grass, strawberry, lateral branches of mint and jasmine.
- **For assimilation of food** : Flattened stem of *Opuntia* contains chlorophyll and performs photosynthesis.

**The Leaf** : Develops from shoot apical meristem, flattened, green structure, manufacture the food by photosynthesis. It has bud in axil. A typical leaf has leaf base, petiole and lamina. 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 :**

**1. Reticulate :** Veinlets form a network as in leaves of dicotyledonous plants (China rose, peepal).

**2. 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.

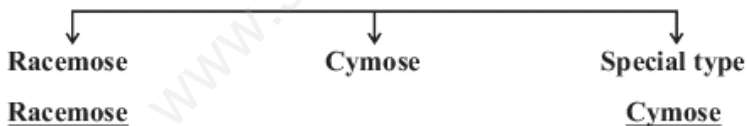
**Types of phyllotaxy**

<b>Alternate</b>	<b>Opposite</b>	<b>Whorled</b>
(Single leaf at a node) is alternate manner	(Two leaves at a node) is opposite manner	(More than two leaves in a whorl at a node) ( <i>Alstonia</i> )
e.g., China rose, Mustard	e.g., <i>Calotropis</i> , guava	e.g., Nerium, devil tree

**Modifications of Leaves :**

<b>Type</b>	<b>Function</b>	<b>Example</b>
• Tendrils :	(Climbing) –	Sweet wild pea
• Spines :	(Protection) –	<i>Aloe, Opuntia, Argemone</i>
• Pitcher :	(Nutrition) –	<i>Nepenthes</i>
• Hook :	(Support) –	Cat's nail

**Inflorescence :** The arrangement of flowers on the floral axis.

**Main types of Inflorescence****Racemose**

1. It is indefinite inflorescence
2. Main axis continues to grow and flowers borne in acropetal succession

eg : Radish, Mustard, Amaranthus

**Cymose**

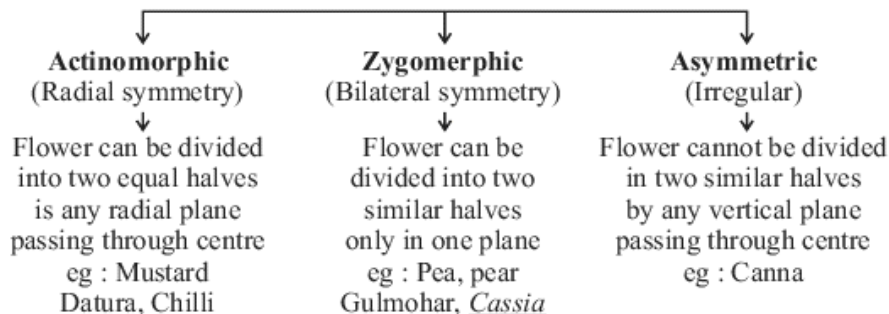
1. It is definite inflorescence
2. Main axis terminates in flowers and the flowers borne in basipetal succession

eg: Cotton, Jasmine, *Calotropis*

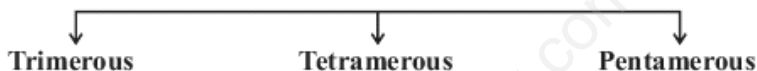
**Special type** - Ficus, Salvia, Euphorbia

**Flower** - Modified shoot meant for reproduction

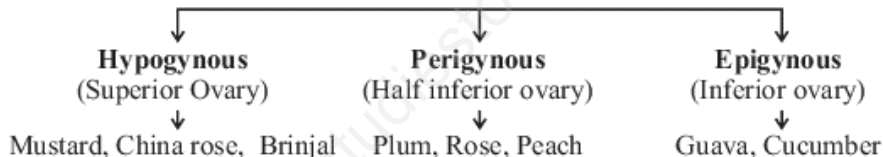
On the basis of symmetry flower can be :-



On the basis of floral appearance flower can be :-



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



**Parts of flower :**

- 1. Calyx :** Sepals, green in colour, leaf like.
- 2. Corolla :** Petals, usually brightly coloured to attract insects for pollination.
- 3. Androecium :** Stamens (filament, anther), male organ and produce pollen grains. Stamens may be epipetalous (attach to petals) or epiphyllous (attach to perianth). Stamens may be monadelphous (united into one bundle), diadelphous (two bundles) or polyadelphous (more than two bundles).
- 4. Gynoecium :** Made up of one or more carpels, female reproductive part, consists of stigma, style and ovary, ovary bears one or more ovules. Carpels may be apocarpous (free) or syncarpous (united). After fertilisation, ovules develop into seeds and ovary into fruit.

**Gamosepalous** – (Sepals united)

**Polysepalous** – (Sepals free)

**Gamopetalous** – (Petals united)

**Polypetalous** – (Petals free)

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

**Aestivation** : The mode of arrangement of sepals or petals in floral bud.

**Types of aestivation** :

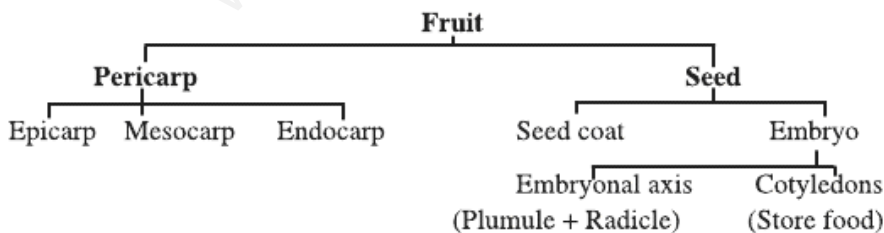
1. **Valvate** : Sepals or petals do not overlap the sepal or petal at margins. *e.g.*, *Calotropis*
2. **Twisted** : Sepals or petals overlap the next sepal or petal. *e.g.*, China rose, Cotton
3. **Imbricate** : The margins of sepals or petals overlap one another but not in any definite direction. *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

**Placentation** : The arrangement of ovules within the ovary.

**Types of Placentation** :

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

**The fruit** : After fertilisation, the mature ovary develops into fruit. The parthenocarpic fruits are formed from ovary without fertilisation.



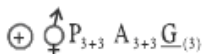
Seed Coat  $\begin{cases} \text{Testa (Outer layer)} \\ \text{Tegmen (Inner Layer)} \end{cases}$

**Monocotyledonous seed** - Endosperm bulky and stores food, proteinaceous layer - Aleurone layer is present. Seed has single large cotyledon - scutellum.

### QUESTIONS

#### Very Short Answer Questions (1 mark each)

1. Which part of opuntia is modified to form spines ?
2. Name one plant in which leaf is pinnately compound.
3. In mangroves, pneumatophores are the modified adventitious roots. How are these roots helpful to the plant ?
4. Which part of mango fruit is edible ?
5. Why do various plants have different type of phyllotaxy ?
6. State the main function of leaf tendrils.
7. Which plant family represent the following floral formula :



8. The endosperm is formed as a result of double fertilisation (triple fusion). What is its function ?
9. Which type of venation do you observe in dicot leaf ?
10. In pea flower, the aestivation in corolla is known as vexillary. Give reason.
11. What is the name given to the cotyledon in case of Monocots

#### Short Answer Questions-II (2 marks each)

12. Flower is a modified shoot. Justify.
13. Name the type of root for the following :
  - (a) Roots performing the function of photosynthesis.
  - (b) Roots come above the surface of the soil to absorb air.
  - (c) The pillar like roots developed from lateral branches for providing mechanical support.
  - (d) Roots coming out of the lower nodes of the stem and provide the support to the plant.

14. Fill up the blank spaces (a), (b), (c) and (d) in the table given below :

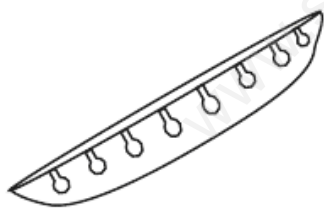
Type of flower	Position of calyx, corolla and androecium in respect of the ovary on thalamus	Type of ovary
Hypogynous	.....(a).....	Superior
Perigynous	On the rim of the thalamus almost at the same level of ovary.	.....(b).....
.....(c).....	.....(d).....	Inferior

15. Provide the scientific terms for the following :

- The leaf without a petiole (stalk).
- The flat and expanded portion of a leaf.
- Orderly arrangement of leaves on the node.
- Lateral appendages on either side of the leaf.

### Short Answer Questions - I (3 marks each)

16. Observe the given figure showing various types of placentation. Identify the type of placentation. Give one example of each.



(a)



(b)



(c)

- 'Potato is a stem and sweet potato is a root.' Justify the statement on the basis of external features.
- Define aestivation. Which type of aestivation is found in China rose, *Calotropis*, Gulmohar and pea.
- Explain the different types of phyllotaxy. Give one example of each type.

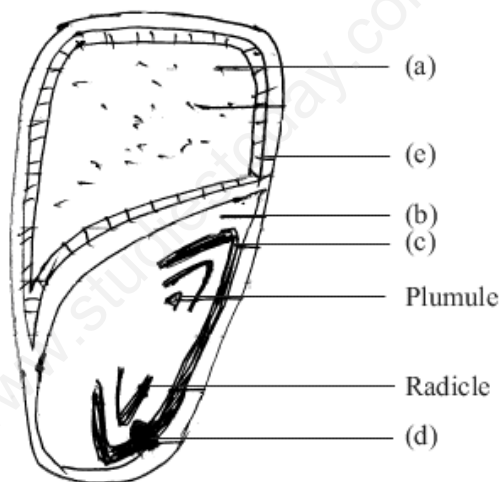


20. Differentiate between :

- (a) Actinomorphic flower and Zygomorphic flower
- (b) Apocarpous ovary and Syncarpous ovary
- (c) Racemose inflorescence and Cymose inflorescence

**(3 Mark Question)**

21. In the given structure of a Monocotyledonous seed label the parts a, b, c, d, e. Give the function of part 'a'



**Long Answer Questions (5 marks each)**

- 22. Describe various stem modifications associated with food storage, climbing and protection.
- 23. Give the distinguishing morphological features of gynoecium of family Fabaceae, Solanaceae and Liliaceae. Draw floral diagrams of Fabaceae and Solanaceae.



## ANSWERS

### Very Short Answers (1 mark each)

1. Leaves
2. Neem, Rose, Acacia.
3. Pneumatophores in mangroves help in respiration.
4. Mesocarp
5. For proper exposure of leaves to get sunlight.
6. The leaf tendrils help the plant for climbing.
7. Liliaceae
8. Endosperm stores the food.
9. Reticulate venation.
10. In peas, there are five petals. The largest one (standard) overlaps the two lateral petals (wings) which in turn overlap the two smallest anterior petals (keel).
11. Secutellum.

### Short Answers-II (2 marks)

12. The flower is considered to be a modified shoot because the internodes in a flower are highly condensed and the appendages such as sepals, petals, stamens and carpels (pistil) are generally large in number.
13. (a) Assimilatory roots                      (b) Respiratory roots  
(c) Prop roots                                  (d) Stilt roots
14. (a) Floral parts are situated below the ovary.  
(b) Half inferior  
(c) Epigynous  
(d) Floral parts are situated above the ovary.
15. (i) Sessile  
(ii) Lamina  
(iii) Phyllotaxy  
(v) Stipules

### Short Answer-I (3 marks each)

16. (a) Marginal placentration              – Pea  
(b) Parietal placentation                  – Mustard, *Argemone*  
(c) Free central placentation              – *Dianthus*, *Echinops*

**Short Answers-I (3 marks each)**

17. Potato is the swollen tip of an underground stem branch (stolon). It has nodes (eyes) which consist of one or more buds subtended by a leaf scar. Adventitious roots also arise during sprouting. On the other hand sweet potato is a swollen adventitious root (tuberous root). It has no nodes, internodes and buds like a stem.

18. The mode of arrangement of sepals or petals in a floral bud is known as aestivation.

China rose – twisted

*Calotropis* – valvate

Gulmohar – imbricate

Pea – vexillary

**19. Type of phyllotaxy****Examples**

(i) Alternate

China rose, mustard

(ii) Opposite

*Calotropis*, guava

(iii) Whorled

*Nerium*, *Alstonia*

**20. (a) Actinomorphic Flower****Zygomorphic flower**

(1) Two equal halves are formed by any vertical division passing through the centre.

Two equal halves are produced only by one vertical division.

(2) It has a radial symmetry.

It has a bilateral symmetry.

**(b) Apocarpous Ovary****Syncarpous Ovary**

(1) The flower has several free carpels (ovary).

The flower has fused carpels.

(2) On maturity it forms fruitlet of aggregate type.

On maturity it forms a single fruit.

**(c) Racemose Inflorescence****Cymose Inflorescence**

(1) The main axis has unlimited growth.

The main axis has a limited growth.

(2) Flowers are arranged acropetally i.e., the lower flowers are younger.

Flowers are arranged basipetally i.e., the lower flowers are older.

21. (a) Endosperm (b) Scutellum (c) Coleoptile (d) Coleorrhiza  
(e) Aleurone layer

Function of (a) - Provide nutrition.

**Long Answers (5 marks each)**

**22. Stem Modifications :**

- **For food storage** : Ginger (Rhizome), potato (Tuber), Onion (Bulb), *Colocasia* (Corm).
- **For climbing (support)** : Stem tendril (cucumber, grapevine, watermelon)
- **For protection** : Thorn (*Bougainvillea*, Citrus, *Duranta*)

**Description** : Refer page 68, NCERT, Text Book of Biology for Class XI.

**23. Gynoecium :**

**Family Fabaceae** : Ovary superior, monocarpellary, unilocular with many ovules, style single.

**Family Solonaceae** : Ovary superior, bicarpellary, syncarpous, bilocular, placenta swollen with many ovules.

**Family Liliaceae** : Ovary superior, tricarpeal syncarpous, trilocular with many ovules, axile placentation.

**Floral diagram :**

**Fabaceae** : Figure 5.21 (f), page 79, NCERT, Text Book of Biology for Class XI.

**Solanaceae** : Figure 5.22 (f), page 80, NCERT, Text Book of Biology for Class XI.