NCERT Solutions for Class-XI Biology

Chapter-5

1. What is meant by modification of root? What type of modification of root is found in the
(a) Banyan tree
(b) Turnip
(c) Mangrove trees

1. Roots of some plants change their shape and structure and become modified to perform certain functions other than absorption and conduction of water and minerals. It is called modification of roots. Roots are modified for support, storage of food and respiration, etc.
(a) Root modification in banyan tree : In banyan tree, the root modifies to form prop roots. Prop roots arise from branches and enter the soil. Thus, they provide mechanical support to densely branched, huge trees.
(b) Root modification in turnip : The modification of root found in turnip is napiform for food storage. The upper portion of these fleshy roots is inflated or swollen which tapers towards the lower end.
(c) Root modification in mangrove trees : In mangrove plants, i.e., plants growing in saline marshes, the branches of tap root come out of the ground and grow vertically upwards showing negative geotropism. These roots are called pneumatophores. They help to get oxygen for respiration.

2. Justify the following statements on the basis of external features
(i) Underground parts of a plant are not always roots
(ii) Flower is a modified shoot

2. (i) Various parts of plants are modified into underground structures to perform various functions such as stems, leaves, and even fruits.
The stems in ginger and banana are underground and swollen due to storage of food. They are called rhizomes. Similarly, corm is an underground stem in Colocasia and Zamin-khand. The tips of the underground stem in potato become swollen due to the accumulation of food and forms tuber. Tubers bear eyes, which are subtended by a leaf scar. Basal leaves in onions become fleshy because of the accumulation of food. In peanuts, the flower after fertilization gets pushed inside the soil by growing a flower stalk. The formation of fruits and seeds takes place inside the soil.
(ii) During the flowering season, the apical meristem gives rise to the floral meristem. The axis of the stem gets condensed, while the internodes lie near each other. Instead of leaves, various floral appendages arise from the node. Therefore, it can be said that the flower is a modified shoot.

3. How is pinnately compound leaf different from palmately compound leaf?

3. The compound leaves may be of two types, pinnately compound leaf and palmately compound leaf. In 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. Pinnately compound leaf may be of different types as unipinnate, bipinna te, tripinna te and decompound. In palmately compound leaf, the leaflets are attached at a common point, i.e., at the tip of petiole, as in silk cotton. Palmately compound leaf may be of different types as unifoliate, bifoliate, trifoliate, quadrifoliate and multifoliate.

4. Explain with suitable examples the different types of phyllotaxy

4. Phyllotaxy refers to the pattern or arrangement of leaves on the stem or branch of a plant. It is of three types, alternate, opposite, and whorled phyllotaxy.
In alternate phyllotaxy, a single leaf arises from the node of a branch. This type of phyllotaxy is observed in the sunflower, mustard, and peepal. Plants with opposite phyllotaxy have two leaves arising from the node in opposite directions. It is found in guava and *jamun* plants. Plants with whorled phyllotaxy have three or more leaves arising from the node. It is found in *Alstonia*

5. Define the following terms:
(a) Aestivation
(b) Placentation
(c) Actinomorphic
(d) Zygomorphic
(e) Superior ovary
(f) Perigynous flower
(g) Epipetalous Stamen

5. (a) Aestivation : The mode of arrange¬ment of accessory floral organs (sepals and petals) in relation to one another in floral bud is known as aestivation. The main type of aestivation are valvate, twisted, imbricate, and vexillary.
(b) Placentation : The arrangement of ovules within the ovary is known as placentation. The placentation are of different types namely, marginal, axile, parietal, basal, and free central.
(c) Actinomorphic : When flower can be divided into equal radial halves in any radial plane passing through the centre, it is said to be actinomorphic, e.g., mustard, Datura etc.
(d) Zygomorphic : When a flower can be divided into two similar halves only in one particular vertical plane, it is said to be zygomorphic, e.g., pea, gulmohar, bean, Cassia.
(e) Superior ovary : In 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, brinjal.
(f) Perigynous flower: 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. Here ovary is half superior, e.g., peach, plum.
(g) Epipetalous stamen : When stamens are attached to the petals, they are called epipetalous stamens e.g., brinjal.

6. Differentiate between

(a) Racemose and cymose inflorescence

(b) Fibrous roots and adventitious roots

(c) Apocarpous and syncarpous ovary

6.

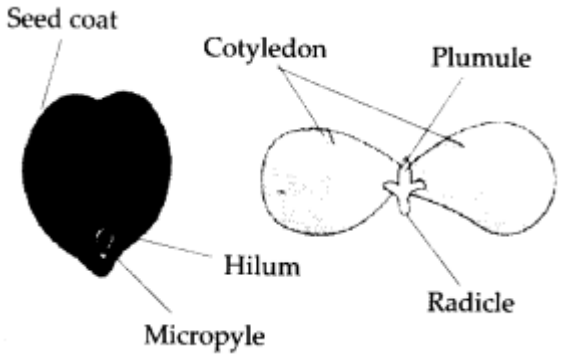
Racemose Inflorescence	Cymose Inflorescence
1) Younger flowers are present at the tip while older flowers are arranged at the base of this inflorescence. Such an arrangement is called acropetal succession. 2) The main axis in racemose inflorescence continues to grow and produce flowers laterally.	1) Younger flowers are present at the base of the inflorescence, while older flowers are present at the top. Such an arrangement is called basipetal succession. 2) The main axis in cymose inflorescence has limited growth, which later terminates into a flower.
Fibrous root	**Adventitious root**
1) In monocots, the primary root which develops from the radicle of the seed is short-lived and is replaced by a large number of roots arising from the base of the stem. 2) It is found in wheat and other cereals.	1) These roots arise from any part of the plant other than the radicle of seeds. 2) It is found in banyan, Monstera, and other plants.
Apocarpous ovary	**Syncarpous ovary**
1) The flowers with apocarpus ovary have more than one carpel. These carpels are free. 2) It is found in lotus and rose flowers.	1) The flowers with syncarpous ovary have more than one carpel. However, these carpels are fused. 2) It is found in the flowers of tomato and mustard.

7. Draw the labelled diagram of the following:

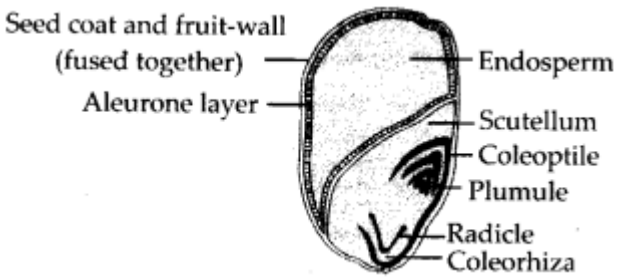
(i) Gram seed

(ii) V.S. of maize seed

7. (i) Gram seed



(ii) V.S. of maize seed



8. Describe modifications of stem with suitable examples

8. Stems of various plants have undergone modifications to perform different functions.

Underground stems or storage stems:

Examples: Rhizomes, Corms, tubers

In ginger and banana, the underground stem is called a rhizome. The underground stem in *Colocasia* (*arvi*) is known as corm. Rhizomes and corms are underground stems, modified for the storage of food. Also, these stems help in vegetative reproduction of these plants. The tips of the underground stem in potato plants become swollen due to the accumulation of food. The potato is a tuber that helps in the storage of food and bears eyes on it. Subtended by a leaf scar, these eyes bear buds that give rise to new plants.

Supportive stems

Example: tendril

The stem in some weak plants bear thin, slender, and spirally-coiled structures called tendrils that help the plant get attached to nearby structures for support. Tendrils are found in cucumbers, melons, and other members of the family Cucurbitaceae.

Protective stems

Example: Thorns

The stem in *bougainvillea* and citrus plants (like lemon and orange) bear sharp, pointed structures called thorns, which provide protection to the plant from herbivores.

Photosynthetic stems

Example: Opuntia

The stem in the Opuntia is green. It carries out the process of photosynthesis in the absence of leaves.

Others stem modifications

In some plants, underground stems such as grasses spread in the soil and help in perenation. These stems are called runners.

The short lateral stem called the offset in some aquatic plants (such as *Eichhornia*) bears leaves and tufts of roots at the node and gives rise to new plants.

9. Take one flower each of families Fabaceae and Solanaceae and write its semitechnical description. Also draw their floral diagrams after studying them.

9. Family Fabaceae (e.g., Pisum sativum) Systematic position:

Class – Dicotyledoneae

Subclass- Polypetalae

Series – Calyciflorae

Order – Rosales

Family – Fabaceae

Vegetative characters:

Habit: herb. Root: tap, branched, with root nodules.

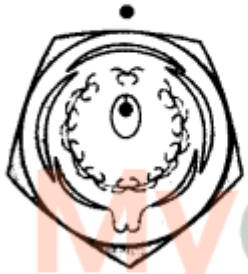
Stem: herbaceous, climbing.

Leaves : pinnately compound, leaf base pulvinate, stipulate, venation reticulate.

Floral characters:

Inflorescence: racemose.
Flower : bisexual, zygomorphic, irregular, hermaphrodite, white or pink, complete, hypogynous to perigynous.
Calyx : sepals five, gamosepalous, ascending, imbricate aestivation, campanulate calyx tube.
Corolla : petals five, polypetalous, vexillary aestivation, papilionaceous, consisting of a posterior standard or vexillum two lateral wings or alae, two anterior ones forming a keel.
Androecium : 10 stamens in two bundles (diadelphous) of (9) + 1, anthers dithecous (bilobed), basifixed, introrse.
Gynoecium : ovary superior, monocarpellary, unilocular with many ovules, marginal placentation, style bent and long, stigma simple and-hairy.
Fruit : legume; seeds one to many, non- endospermic.

Floral formula : $\% \, ♂ \, K_{(5)} \, C_{1+2+(2)} A_{(9)+1} \, \underline{G}_1$

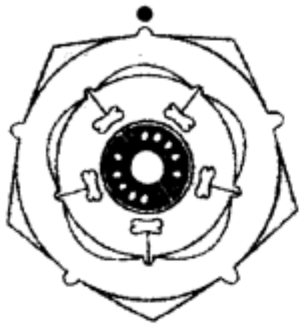


Floral diagram of *Pisum sativum*

Family Solanaceae (e.g., Solanum nigrum) Systematic position:
Class Subclass Series Order Family
Vegetative characters:
Habit: herbs Stem : herbaceous, aerial, erect, cylindrical, branched.
Leaves: alternate, simple, exstipulate, venation reticulate.
Floral characters:
Inflorescence: cymose.
Flower : ebracteate, ebracteolate, bisexual, actinomorphic, white, hypogynous.
Calyx : sepals five, gamosepalous, persistent, valvate aestivation.
Corolla : petals five, gamopetalous, valvate. aestivation.
Androecium : stamens five, epipetalous, polyandrous, anthers large, bithecous and basifixed.
Gynoecium : bicarpellary, syncarpous, ovary, obliquely placed carpels in the flower, bilocular, axile placentation, placenta swollen with many ovules.
Fruits : berry with persistent calyx.

$Ebr\ Ebrl\ \oplus ⚥\ K_{(5)}\ \widehat{C_{(5)}A_{(5)}}\ \underline{G}_{(2)}$

Floral formula :



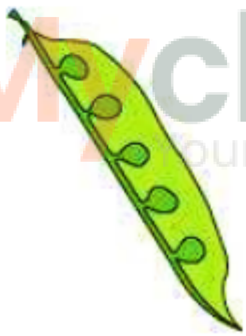
Floral diagram of *Solanum nigrum*.

10. Describe the various types of placentations found in flowering plants.

10. Placentation refers to the arrangement of ovules inside the ovary. It is of five basic types.

(A) Marginal placentation:

The ovary in which the placenta forms a ridge along the ventral suture of the ovary and the ovules develop on two separate rows is known to have marginal placentation. This type of placentation is found in peas.



(B) Parietal placentation

When the ovules develop on the inner walls of the ovary, the ovary is said to have parietal placentation.

(C) Axile placentation

In axile placentation, the placenta is axial and ovules are attached to it. Examples include China rose, lemon, and tomato.

(D) Basal placentation

The ovary in which the placenta develops from its base and a single ovule is found attached to the base is said to have basal placentation. It is found in marigold and sunflower.

(E) Free central placentation

In free central placentation, the ovules develop on the central axis while the septa are absent. This type of placentation is found in Dianthus and primrose.

11. What is a flower? Describe the parts of a typical angiosperm flower?

11. Flower is the reproductive unit in the angiosperms. It is meant for sexual reproduction. 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. In some flowers like lily, the calyx and corolla are not distinct and are termed as perianth. Some flowers have both androecium and gynoecium and are termed hermaphrodite flowers while some flowers have only one of these two whorls.

Calyx : The calyx is the outermost whorl of the flower and its units are called sepals. Generally, 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. Petals • are usually brightly coloured to attract insects for pollination. Like calyx, corolla may also be free (polypetalous) or united (gamopetalous). The shape and colour of corolla vary greatly in plants. Corolla may be tubular, bell-shaped, funnel-shaped or wheel-shaped.

Androecium : Androecium is the male reproductive part of the flower. It 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.

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 (as in lotus and rose) 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.

12. How do the various leaf modifications help plants?

12. The main function of the leaves is to carry out the process of photosynthesis. However, in a few plants, leaves are modified to perform different functions.

(a) Tendrils: The leaves of a pea plant are modified into tendrils that help the plant in climbing.

(b) Spines: The leaves in cactus are modified into sharp spines that act as an organ of defence.

(c) Phyllode: The leaves of some Australian acacia are short-lived and soon replaced by flattened, green structures called phyllodes that arise from the petiole of the leaves. The petioles in these plants synthesize food.

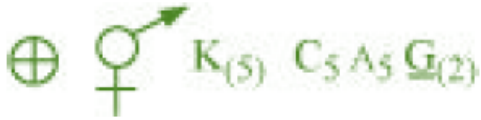
(d) Pitcher: The leaves of the pitcher plant are modified into pitcher-like structures, which contain digestive juices and help in trapping and digesting insects.

13. Define the term inflorescence. Explain the basis for the different types of inflorescence in flowering plants.

13. The arrangement of flowers on the floral axis is termed as inflorescence. A flower is a modified shoot wherein internodes do not elongate and the axis gets condensed. The apex produces different kinds of floral appendages laterally at successive nodes instead of leaves. When a shoot tip transforms into a flower, it is always solitary. Depending on whether the apex gets converted into a flower or continues to grow, two major types of inflorescence are defined – racemose and cymose. In racemose type of inflorescence the main axis continues to grow, the flowers are borne laterally in acropetal succession. In cymose type of inflorescence the main axis terminates in a flower, hence is limited in growth. The flowers are borne in a basipeta! order.

14. Write the floral formula of an actinomorphic bisexual, hypogynous flower with five united sepals, five free petals. Five free stamens and two united carpals with superior ovary and axile placentation.

14. The floral formula of the described flower is represented as:



Actinomorphic flowers are represented by the symbol ⊕.

A bisexual flower is indicated by  .

The calyx contains five united sepals which can be represented as $K_{(5)}$.

The corolla consists of five free petals and it represented as C_5.

The androecium consists of five free stamens and is represented by A_5.

The gynoecium consists of a superior ovary with two united carpels and axile placentations, which can be represented as $\underline{G}_{(2)}$.

15. Describe the arrangement of floral members in relation to their insertion on thalamus?

15. In a typical flower, the floral members like calyx, corolla, androecium and gynOecium are arranged over the thalamus! Based on the position of calyx, corolla and androecium in respect to ovary on thalamus, the flowers are described as hypogynous, perigynous and epigynous ones. In the 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. 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 or sub superior, e.g., plum, rose, peach. In epigynous flowers, the margin of thalamus grows upward enclosing the ovary completely and gets fused with it; the other parts of flower arise above the ovary. Hence, the ovary is said to be inferior as in flowers of guava and cucumber, and the ray florets of sunflower.