Aim : To study external features of root stem leaf and flower of monocot and dicot plants.

Apparatus and Materials Required

Glass slides, forceps, hand lens, scissors, dissecting microscope, a complete monocot plant such as onion or paddy or wheat or maize, and a complete dicot plant such as mustard or sunflower or pea

Theory

The flowering plants, or angiosperms, are differentiated into root, stem, leaves and flowers. They bear seeds enclosed in a fruit. They are divided into monocotyledons and dicotyledons on the basis of the kind of seeds they bear. Monocotyledons bear seeds which have a single cotyledon. The seeds of dicotyledons have two cotyledons.

Procedure

1. Take a monocot plant. Separate root, stem, a leaf and a flower of this plant with the help of scissors and place these parts on different slides separately with forceps.
2. Then take a dicot plant and repeat the process.
3. Now observe and compare the external features of root, stem, a leaf and a flower of the monocot and dicot plants using hand lens and subsequently by dissecting microscope.

Observation

Root

Identifying Features of Root

1. The part of a plant that generally develops from the radicle of embryo is called root.
2. It fixes the plant firmly into the ground and provides rigidity against wind and water.
3. It absorbs water and minerals from soil.
4. It grows towards the centre of gravity, i.e., it is positively geotropic.
5. It possesses unicellular root hairs.
6. It normally grows away from light, i.e., it is negatively phototropic.
7. It does not bear buds, leaves and flowers, and lacks nodes and internodes.
8. The root has four regions from the apex to the base:
   (i) Root cap
   (ii) Region of cell division (apical meristem)
   (iii) Region of elongation
   (iv) Region of maturation

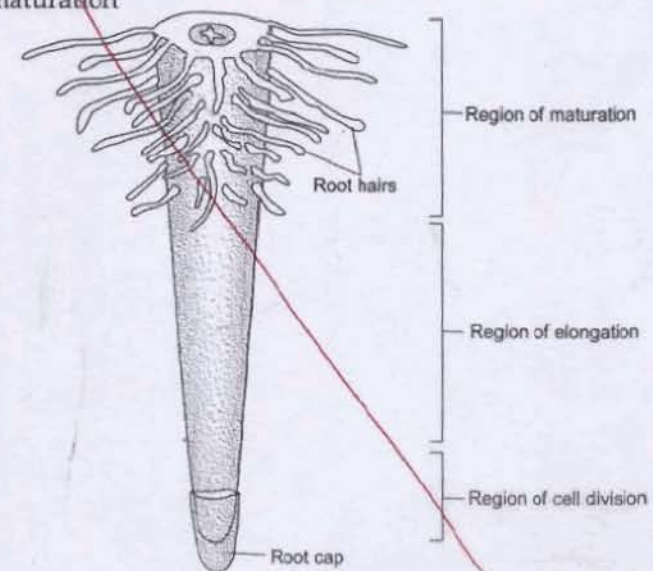

Fig. 7.19 Regions of the root

9. The root cap protects the growing root apex while the main growing region of the root lies just behind the root cap.

Monocot Root

1. In monocots, primary root does not persist for a longer period. It is soon replaced by a cluster of long, threadlike roots which originate from the base of the stem. These roots are called ***fibrous roots.***
2. Roots developing from any other part of the plant than radicle are called ***adventitious roots.***
3. Fibrous root is a type of adventitious root.
4. Due to absence of secondary growth in thickness these roots remain slender.

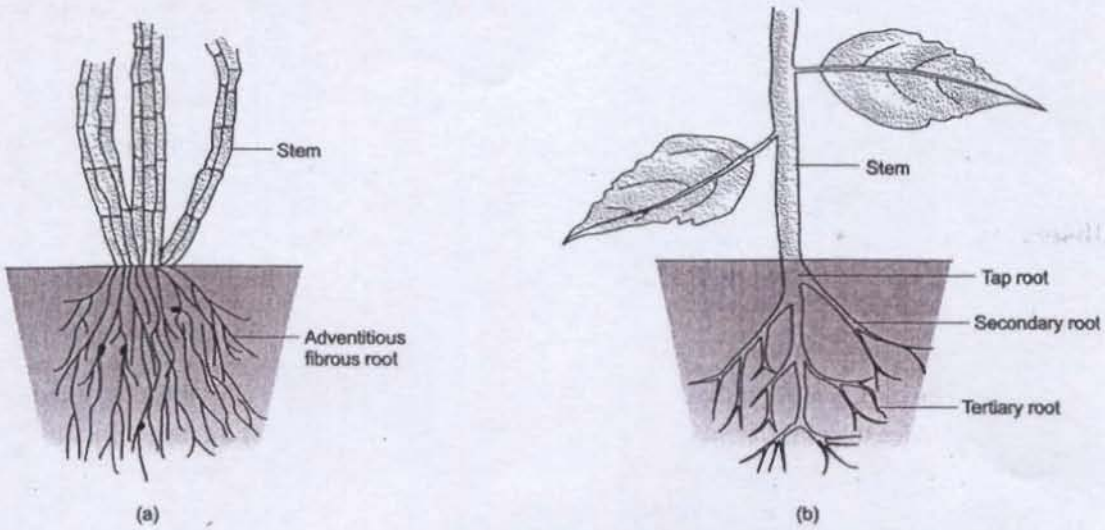

Fig. 7.20 Types of root (a) Monocot root (b) Dicot root

Dicot Root

1. In most of the dicots, root develops directly from the radicle.
2. It grows longer, thickens and is known as ***primary root.***
3. It persists and becomes stronger to form ***tap root.***
4. It generally produces lateral branches called ***secondary roots.***
5. Branches of the secondary roots are called ***tertiary roots.***
6. Tap root along with its branch system is called ***tap root system.***

Stem

Identifying Features of Stem

1. The part of the plant that develops from the plumule of embryo is called stem.
2. It forms the axis and is the ascending part of the plant.
3. It is differentiated into nodes and internodes.
4. It bears leaves and branches at the nodes. The part of stem that lies between two nodes is called internode.
5. It is positively phototropic, i.e., grows towards light and negatively geotropic, i.e., grows away from the gravity.
6. The shoot (stem and its branches) is usually green and photosynthetic.
7. The apex of stem is called shoot tip. It bears apical bud which is responsible for elongation of the plant. Shoot apex lacks cap.
8. Stem bears either unicellular or multicellular hair, or trichomes.

9. The main function of the stem is to support leaves and branches and hold them in a position to receive maximum light. Thus it forms the main skeleton of the plant.

Monocot Stem

1. It is aerial, erect, herbaceous or woody, usually unbranched.
2. It is usually differentiated into solid nodes and hollow internodes. In maize, internodes are also solid.
3. In some members stem is modified into underground organs like rhizome (e.g., ginger), corm (e.g., *Colocasia*) or bulb (e.g., onion).

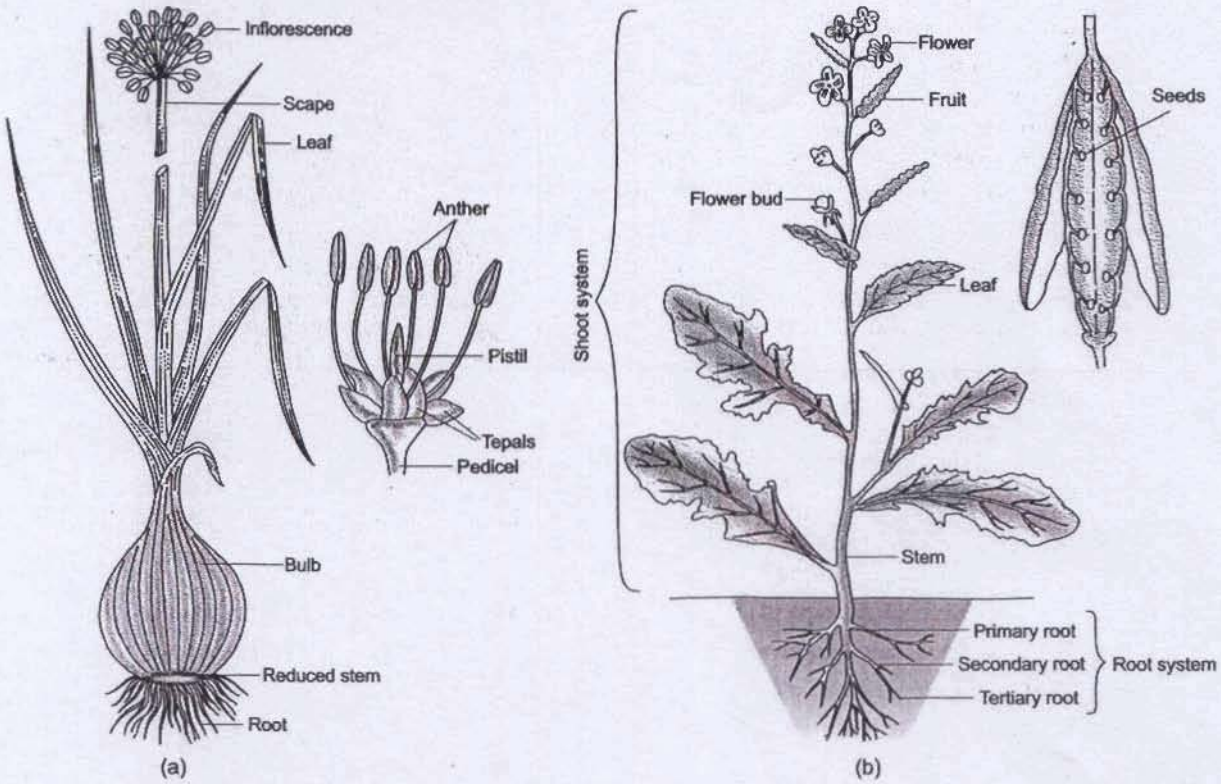

Fig. 7.21 External features of plants (a) A monocot plant (onion) (b) A dicot plant (mustard)

Dicot Stem

1. It is normally long, erect, herbaceous or woody, cylindrical and branched.
2. It has distinct nodes and internodes. Both the nodes and internodes are solid.
3. Sometimes it is creeping and modified into tendril.
4. It is often four-angled (quadrangular) or five-angled (pentangular).
5. In potato, the underground stem is modified into tubers.

Leaf

Identifying Features of Leaf

1. It is the lateral appendage of the stem that arises at the node.
2. It bears a bud in its axil.
3. It is attached to the stem with the help of a structure called the leaf base.
4. A stalk called petiole develops from the leaf base which bears a green flattened structure called lamina.
5. Lamina, or leaf blade, has midrib, veins, leaf apex and leaf margin.

6. The leaves are grouped into two categories—simple and compound—on the basis of incision. Simple leaves have a single lamina. When the incision of the lamina goes down to the midrib, the leaf becomes compound having a number of leaf segments called leaflets.
7. The main functions of leaves are synthesis of food (photosynthesis), transpiration, and exchange of gases through its pores called stomata.
8. Sometimes leaves get modified for storage, defence, support, reproduction and trapping insects.

Monocot leaf

1. Leaves are arranged ***isobilaterally***, i.e., both surfaces are similar.
2. The venation (arrangement of veins and veinlets on the lamina) is ***parallel.*** In monocots veins run parallel to each other from base to the tip of the lamina. Veinlets connecting the adjacent longitudinal veins are inconspicuous.
3. Leaves are usually long and narrow, running parallel to the stem.
4. Leaves are mostly simple.
5. Leaf sheath (expansion of leaf base into a broad sheath) is usually present.

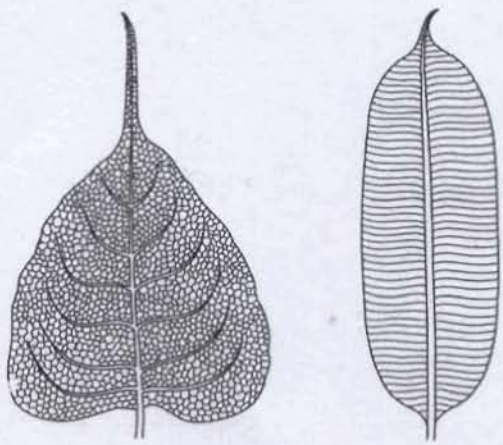

Fig. 7.22 Venation in leaves (a) Reticulate (b) Parallel

Dicot Leaf

1. Leaves are arranged ***dorsiventrally***, i.e., upper and lower surfaces are distinctly different.
2. In dicot leaves, venation is ***reticulate***, i.e., irregularly distributed to form a network.
3. In most dicots, the leaf base bears two lateral appendages called stipules.
4. Leaves are either simple or pinnately compound.
5. Leaf sheath is usually absent.

Flower

Identifying Features of Flower

1. The reproductive part of an angiospermic (higher) plant is flower, which develops from floral buds.
2. The flower is considered to be a modified shoot.
3. The stalk of the flower is called pedicel and the tip of the pedicel continues as an enlarged axis called thalamus or receptacle.
4. All the floral parts are arranged on the thalamus in a definite sequence.
5. A typical flower consists of four sets of floral parts, or whorls: calyx (sepals), corolla (petals), androecium (stamens) and gynoecium (carpels).
6. The first two whorls, i.e., calyx and corolla are not directly involved in reproduction and are called accessory whorls.
7. The inner two whorls, i.e., androecium and gynoecium are directly concerned with sexual reproduction and are called essential whorls.

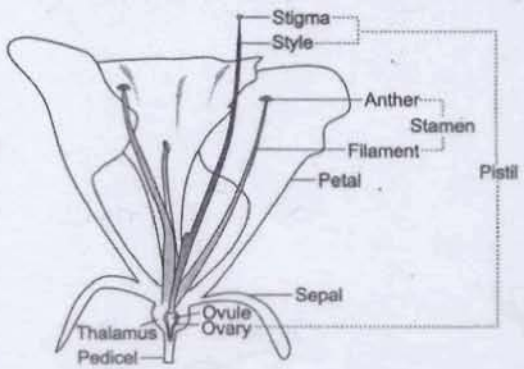

Fig. 7.23 Diagram of different parts of a flower

8. Sepals form the outermost whorl called calyx. They are usually green and leaflike, and arise at the base of the flower.
9. Petals form the *corolla*. They are generally brightly coloured and sometimes fragrant to attract insects.
10. The third whorl *androecium* is the male reproductive part of the flower and consists of stamens. Each stamen consists of a slender filament and an anther at the tip.
11. *Gynoecium*, or pistil, is the centrally placed fourth whorl which bears the female reproductive organ called carpel. Each pistil consists of a basal swollen ovary, a narrow stalklike style, and stigma at the tip. The ovary contains one or many ovules.

Monocot Flower

1. Calyx and corolla are not distinct in monocot flowers. Instead, perianth is present which is composed of tepals.
2. In monocots, flowers appear in clusters.
3. The flower is typically trimerous (each whorl is in multiple of three).
4. Stamens are usually versatile, i.e., filament is attached to the back of anther at a point only.

Dicot Flower

1. Dicot flowers usually have distinct floral parts, i.e., calyx, corolla, androecium and gynoecium.
2. Calyx is composed of sepals, and corolla is composed of petals.
3. Flower is mostly pentamerous (each whorl in multiple of five), sometimes tetramerous (each whorl in multiple of four).
4. In dicots, flowers usually appear separately.
5. Stamens are usually basifixed, i.e., filament is attached to the base of the anther.

VIVA VOCE

1. **Name the part of the plant which develops from the radicle in dicots.**
   Tap root or primary root
2. **Name the structure which protects the root tip.**
   Root cap
3. **Which part of the embryo forms the root in a plant?**
   Radicle
4. **Why is root said to be positively geotropic?**
   Because it grows towards the centre of gravity.
5. **What is the primary function of root?**
   It absorbs water and minerals from the soil.
6. **Which type of root is found in monocots?**
   Fibrous root
7. **Name the root that develops from any unusual part of the plant body.**
   Adventitious root
8. **Name the part of the plant which develops from plumule of embryo.**
   Stem
9. **Name the part of the stem that lies between two nodes.**
   Internode
10. **What is the main function of stem?**

8. Sepals form the outermost whorl called calyx. They are usually green and leaflike, and arise at the base of the flower.
9. Petals form the *corolla*. They are generally brightly coloured and sometimes fragrant to attract insects.
10. The third whorl ***androecium*** is the male reproductive part of the flower and consists of stamens. Each stamen consists of a slender filament and an anther at the tip.
11. ***Gynoecium,*** or pistil, is the centrally placed fourth whorl which bears the female reproductive organ called carpel. Each pistil consists of a basal swollen ovary, a narrow stalklike style, and stigma at the tip. The ovary contains one or many ovules.

Monocot Flower

1. Calyx and corolla are not distinct in monocot flowers. Instead, perianth is present which is composed of tepals.
2. In monocots, flowers appear in clusters.
3. The flower is typically trimerous (each whorl is in multiple of three).
4. Stamens are usually versatile, i.e., filament is attached to the back of anther at a point only.

Dicot Flower

1. Dicot flowers usually have distinct floral parts, i.e., calyx, corolla, androecium and gynoecium.
2. Calyx is composed of sepals, and corolla is composed of petals.
3. Flower is mostly pentamerous (each whorl in multiple of five), sometimes tetramerous (each whorl in multiple of four).
4. In dicots, flowers usually appear separately.
5. Stamens are usually basifixed, i.e., filament is attached to the base of the anther.

VIVA VOCE

1. **Name the part of the plant which develops from the radicle in dicots.**
   Tap root or primary root
2. **Name the structure which protects the root tip.**
   Root cap
3. **Which part of the embryo forms the root in a plant?**
   Radicle
4. **Why is root said to be positively geotropic?**
   Because it grows towards the centre of gravity.
5. **What is the primary function of root?**
   It absorbs water and minerals from the soil.
6. **Which type of root is found in monocots?**
   Fibrous root
7. **Name the root that develops from any unusual part of the plant body.**
   Adventitious root
8. **Name the part of the plant which develops from plumule of embryo.**
   Stem
9. **Name the part of the stem that lies between two nodes.**
   Internode
10. **What is the main function of stem?**

The main function of stem is to support leaves and branches and hold them in a position to receive maximum light.

11. **In which type of stem are internodes usually hollow?**
Monocot stem

12. **What is the difference between simple leaf and compound leaf?**
Simple leaf has single lamina whereas compound leaf has many leaflets.

13. **What is the importance of leaves?**
The leaves help in photosynthesis, transpiration and exchange of gases.

14. **What is the difference between monocot leaves and dicot leaves?**
Monocot leaves are isobilateral having parallel venation while dicot leaves are dorsiventral having reticulate venation.

15. **What is venation?**
The arrangement of veins and veinlets on the lamina is called venation.

16. **What is pedicel?**
The stalk of the flower is called pedicel.

17. **Define flower.**
Flower may be defined as a modified shoot which is essentially meant for reproduction of the plant.

18. **What are angiosperms?**
All flower-bearing plants are called angiosperms.

19. **Which type of flowers are usually found in monocots and dicots?**
Trimerous flowers in monocots, and pentamerous flowers in dicots

20. **Name the reproductive organs of a flower.**
Stamen and carpel

21. **Name the outermost whorl of a flower.**
Calyx

22. **Where are perianth found?**
In monocot flowers

23. **What is perianth?**
It is the outer part of monocot flower in which calyx and corolla are not always distinguishable.

8. LIFE CYCLE OF MOSQUITO

Experiment

Objective

To study the life cycle of mosquitoes

Apparatus and Materials Required

Specimens of different stages of life of mosquito, compound microscope

Theory

Mosquitoes are small harmful insects, found everywhere, especially in damp, dark places. They breed in stagnant water. Eggs develop into larvae, larvae into pupa, and pupa develop into imago, or an adult. The different stages are clearly distinguishable.

In India, ***Culex*** and ***Anopheles*** are mostly found.

Observation

Eggs

Collect eggs from stagnant water bodies such as the nearby drain or ditch, and keep them in a wide-mouthed bottle containing some water. Take the eggs by means of a dropper and put them on the glass slide and examine under the compound microscope.

Eggs are laid by the female mosquito in the night in stagnant water. Eggs are slightly brown and extremely small. But on taking a closer look they can be identified as rafts composed of cigar-shaped bodies glued together, or free boat-shaped bodies. Cigar-shaped eggs belong to ***Culex*** and boat-shaped ones belong to ***Anopheles***. At a time, ***Culex*** lays up to 300 eggs, and ***Anopheles***, 100 eggs. Eggs float on the surface of the water.

Examine the sample and note the shape and size of the eggs.

Draw a sketch of the shape of the eggs and infer whether they belong to ***Culex*** or ***Anopheles***.

After 2–3 days, you will notice that these eggs are ruptured, and from each one of them an elongated creature emerges. This is called larva.

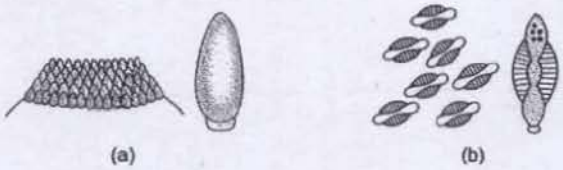

Fig. 7.24 Eggs of (a) *Culex* and (b) *Anopheles*

Larvae

Larvae are elongated, hairy, segmented creatures that move about and feed upon algae growing in water. They swim (wriggle) in a characteristic jerking manner and hence they are also called wrigglers. The anterior part of the body has somewhat indistinct head equipped with mouth parts, compound eyes, and antennae. The body is divided into ten segments. Each segment has a few bristles, or hairs. The posterior part of the larva bears gills, respiratory siphons, and the comb.

Examine the larvae under the compound microscope to observe the movement of the jaws and the body. You can count the number of segments in the body and observe gills and siphons located at the posterior end. Draw a sketch of a larva.

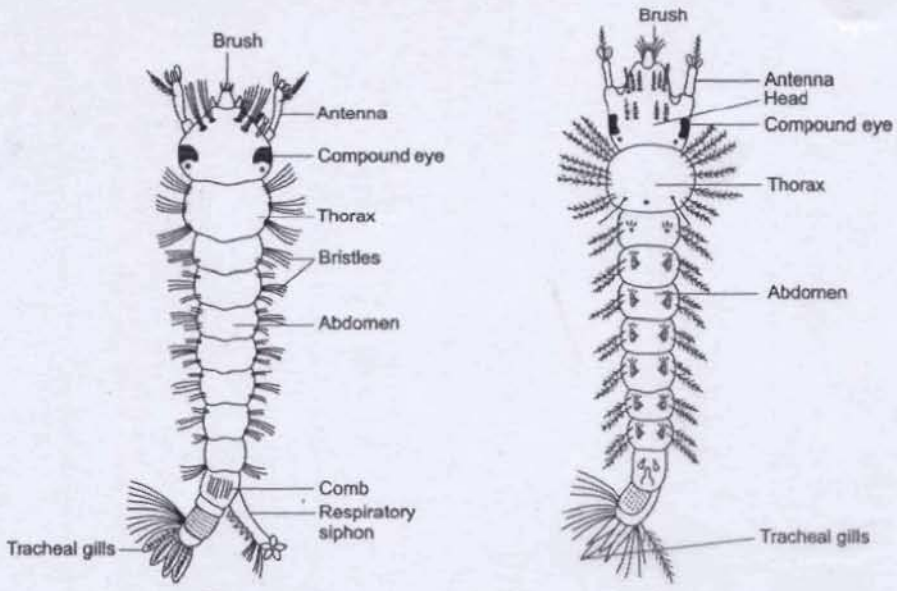

Fig. 7.25 Larvae of (a) *Culex* and (b) *Anopheles*

If you see the water surface of the cylinder or the container in which the larvae are kept, you will find larvae hanging by the air-water interface. The posterior part of the larva is always in contact with the meniscus, as respiratory siphons have to draw atmospheric air for respiration. The gills remain submerged in water to draw dissolved oxygen of water. The larva of *Anopheles* lies parallel to the water surface. The head of the larva of *Culex* hangs downward at an angle.

Larval life lasts for two weeks during which it casts its skin four times. After that the larva is transformed into another form called pupa.

Pupae

Pupal life is sluggish. There is no feeding, no movement except for occasional tumbling in water. That is why a pupa is called a tumbler. The head of the pupa is large, formed by the fusion of the head and thorax. Therefore, it is called cephalothorax, which bears on its dorsal surface two respiratory trumpets. Legs and wings, which are in the early stages of formation, lie on the ventrolateral surfaces. The pupal life lasts for a week.

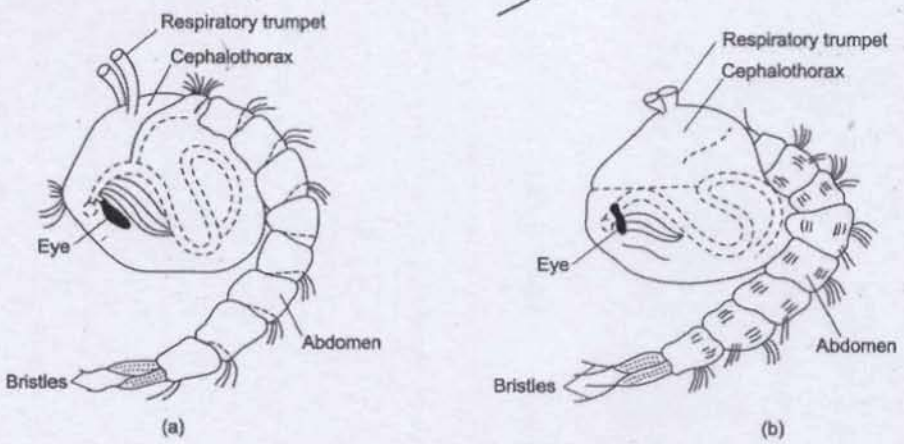

Fig. 7.26 Pupae of (a) *Culex* and (b) *Anopheles*

Imago (young adult)

At the end of pupal life, the skin (cuticle) of the pupa splits along mid-dorsal line, making it easy for the imago to come out. The wings of the newly emerged imago are dried and spread out, and it flies off to lead an aerial life.

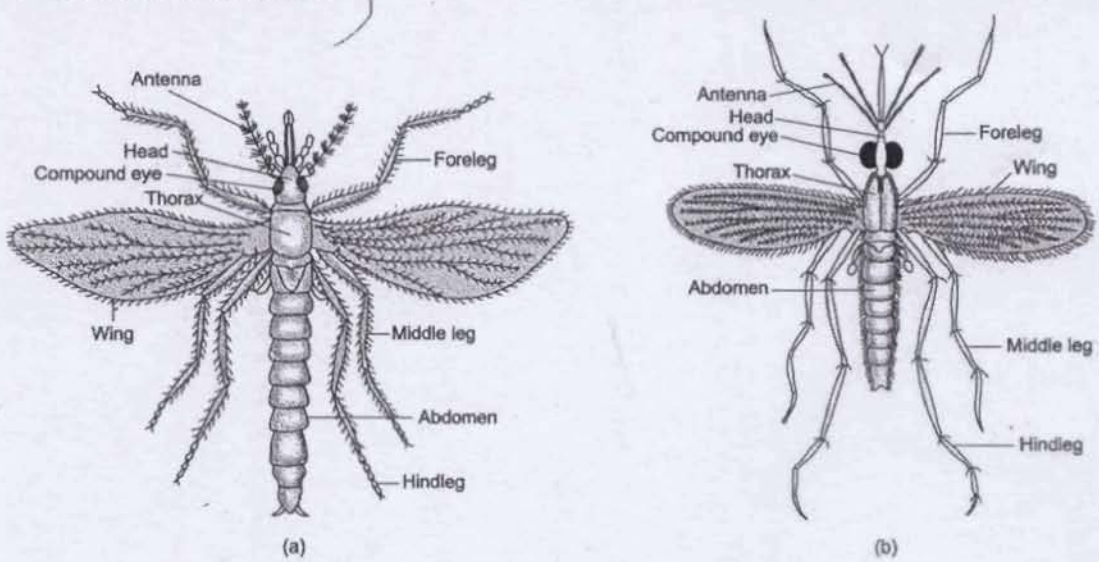

Fig. 7.27 (a) Adult *Culex* (b) Adult *Anopheles*