8. Study of plants found in xerophytic and aquatic conditions/ habitats. And comment on their adaptations.

Date : / /

Introduction :

- Adjustment (acclimatization) of plants and animals for their survival and perpetuation, to their environment by means of special structures or functions, is known as **adaptation**.
- The plants that can grow and survive in deserts, dry conditions of soil and high temperature, are called **xerophytes**.
- All xerophytes show adaptations to reduce the loss of water due to transpiration. Some xerophytes show presence of stored mucilage in the plant parts that help in retaining water. Some plants have latex, that help retaining water and sealing the place of injury. e.g. *Euphorbia*, *Calotropis*, *Acacia*, *Opuntia*.
- The plants that grow in abundance of water are, called hydrophytes. They are generally adapted to remain buoyant and avoid decaying and tearing effects of water. They have developed arenchyma tissue for bouyancy. e.g. *Hydrilla*, *Vallisneria*, *Eichhornia*, *Pistia*, *Nelumbo* (Lotus), *Typha*.

1. *Calotropis procera* (Ruee) :

Comments :

1. It is non-succulent, drought enduring, wild shrub of arid, desert and waste lands.
2. The leaves and young branches are covered by a mealy coating along with hair which acts as insulating covering.
3. The leaves are thick and somewhat leathery.
4. The plant posseses latex.

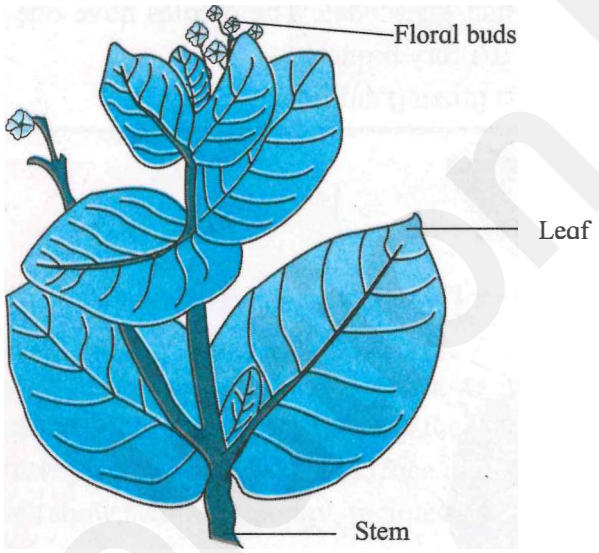

Fig. *Calotropis*

2. *Acacia arabica* (Babhool)

Comments :

1. It is a non-succulent xerophyte.
2. The leaves are bipinnately compound. Leaflets are very small in size to reduce transpiration.

3.. The stipules are modified into spines to reduce transpiration and also to protect plant agains marauding/ grazing animals.
4. The older parts of stem are covered over by thick, brown bark.

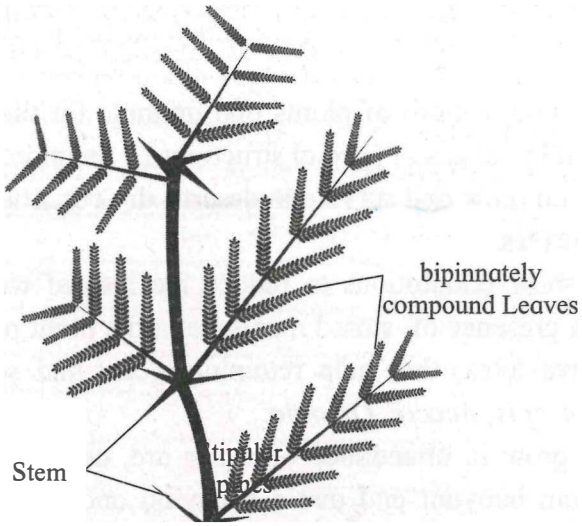

Fig. ***Acacia arabica***

3. *Opuntia dillenii* (Nagphani)

Comments :

1. It is a succulent (drought resisting or enduring) xerophyte.
2. The stem is flattened, jointed, green and is called phylloclade. It takes over the function o photosynthesis because the leaves are modified into spines.
3. The stem i.e. phylloclade is fleshy succulent due to presence of mucilage that retains wate (water storage tissue).
4. Phylloclades are with many nodes (areoles) and internodes. The areoles have one or mor spines which represent the modified leaves of axillary branch.
5. Bristles (Trichomes) provide protection against grazing animals.

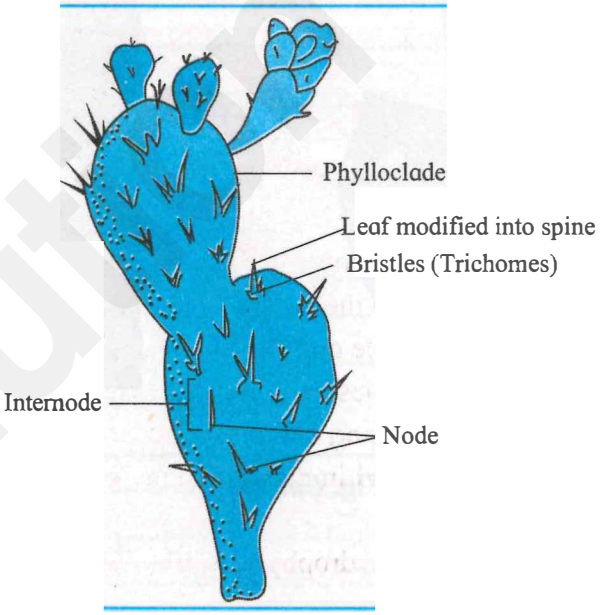

Fig. ***Opuntia***

4. *Hydrilla*

Comments :

1. It is a submerged hydrophyte i.e. grows entirely under water.
2. It is attached to the substratum by poorly developed adventitious roots in fresh water.
3. The stem is slender and soft. It is without mechanical tissue, hence it limps, when taken out of water.
4. Leaves are very thin, membranous and are arranged in whorls. They lack cuticle and stomata.
5. The entire plant is covered by mucilage that protects it from the rottening effect of water.

Vallisneria is another submerged hydrophyte.

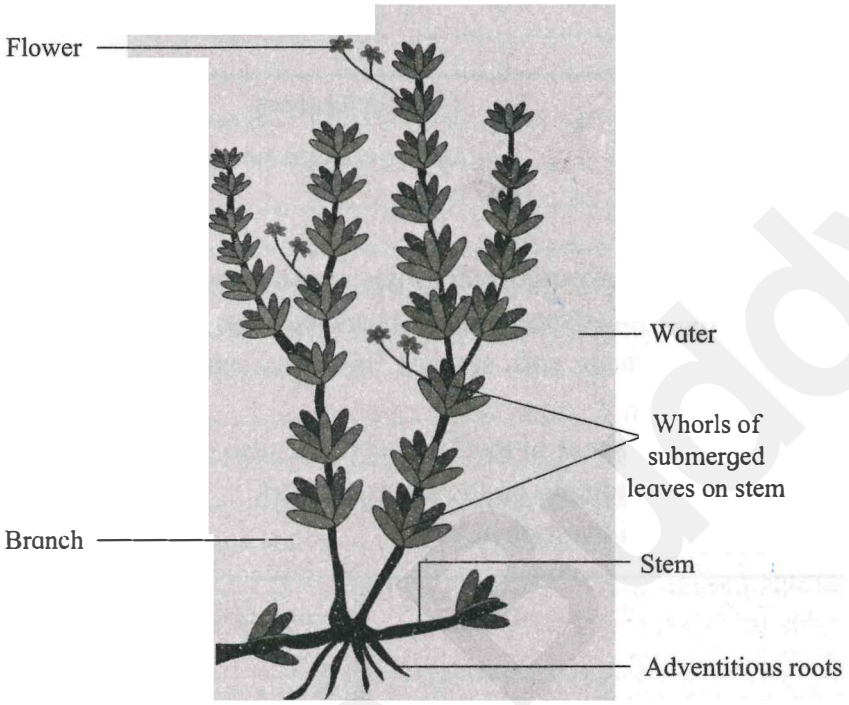

Fig. *Hydrilla*

5. *Eichhornia* (Water Hyacinth)

Comments :

1. It is a free floating hydrophyte that grows in fresh water ponds, lakes, etc.
2. The stem is short and spongy due to the aerenchyma that stores air. It is the offset that grows prostrate just below the water surface and serve as means for vegetative reproduction.
3. Leaves show swollen, spongy, petioles and arise in clusters at node. They have waxy coating in addition to cuticle to prevent wetting and rottening.
4. Adventitious roots are also produced in clusters at nodes. They act as balancers. They have root pockets. Root hair are absent.

Pistia is another free floating hydrophyte, while *Nelumbo* (lotus) is anchored or rooted hydrophyte with floating leaves.

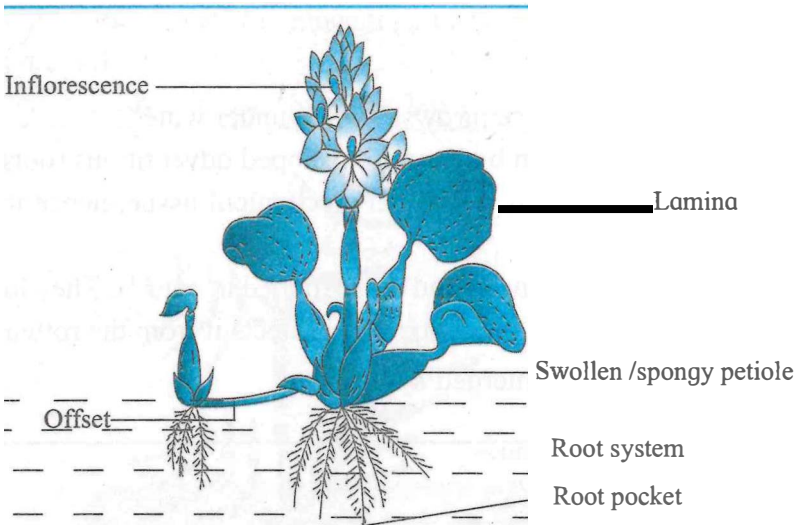

Fig. ***Eichhornia***

6. *Typha* (Cattail)

Comments :

1. It is an amphibious and anchored hydrophyte which grows in marshy places or shallow waters.
2. The stem is rhizome with adventitious roots and emergent leaves, coming out of water surface.
3. The leaves are long, linear, soft, spongy, thick and sub-cylindrical. They have aerenchyma tissue.
4. The leaves show the presence of mechanical tissue also and hence they are able to stand erect. They have cuticle and stomata on the emergent part.

   (Actually *Typha* is a hygrophyte)

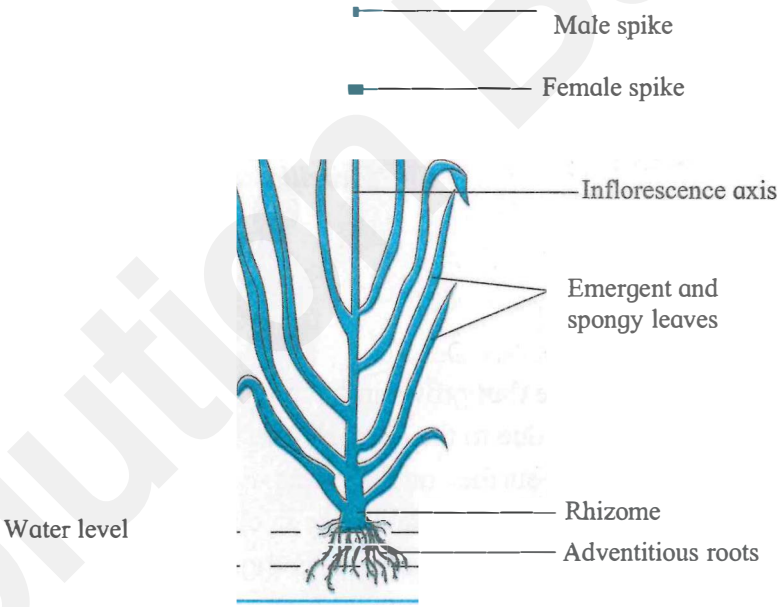

Fig. ***Typha***

Questions

1. Enlist the morphological adaptations in xerophytic plants.

Succulence: These plants have special cells with water holding capacity in low moisture conditions.
Reduced Leaves: The leaves are reduced to spines that help in reducing excess loss of water through transpiration.
Stomata: In these plants, the stomata are either few on in sunken pits below the surface of the leaves.
Waxy, hairy and spiny outer surfaces: The hair and spines scatter light to reduce sun's effect. The waxy covering holds in water.
Roots near the surface: These have the capacity of holding water quickly and can regenerate easily after rain.

2. Write anatomical adaptations in desert plants.

1. Root hairs and root caps are well developed in Opuntia.
2. Roots may become fleshy to store water as in Asparagus
3. In succulent xerophytes, stems possess a water storage region (thin walled parenchyma cells)
4. Stems of non-succulent xerophytes show a very thick cuticle, well developed epidermis with thickened cell wall, several layered and sclerenchymatous hypodermis e.g. Casuarina.
5. The stems have sunken stomata and well developed vascular and mechanical tissues.
6. Leaves show well developed cuticle, succulent leaves in Aloe, multilayered epidermis in Nerium, sclerenchymatous and several layered hypodermis in Pinus, bulliform cells in Sugarcane.
7. Mesophyll is well differentiated and vascular tissues and mechanical tissues are well developed.

3. Enlist the morphological adaptations in aquatic plants.

1. Root system is poorly developed.
2. Roots of floating hydrophytes show very poor development of root hairs, absence of true root caps, with root pockets to protect their tips from injuries. (e.g. Eichhornia)
3. Rooted hydrophytes like Hydrilla, Vallisnera, Elodia derive their nourishment through their body surfaces. More plants partly depend on their roots for the absorption of minerals from the soil. Roots are totally absent in Ceratophyllum, Salvinia, Azolla, Utricularia etc.,

4. Write anatomical adaptations in aquatic plants.

1. The root and shoot systems show common features such as cuticle which is very thin or absent.
2. Epidermis is usually a single layer of thin walled cells, not protective in function.
3. Cortex is well developed. It has numerous air chambers. It helps in buoyancy and rapid gaseous exchange.
4. Mechanical tissues are generally absent.
5. In the vascular tissue, xylem vessels are less common. Only tracheids are present in submerged forms.

5. Why petiole in *Eichhornica* plant is spongy ?

Eichhornia is a free-floating aquatic plant. The petiole bears a large membranous stipule, which forms a sheath around the next younger leaf. Petioles are spongy and form a bulbous float containing air-filled lacunate tissue.

6. What are the advantages of leaves modified into spines in cactus plant.

The leaves of cactus plant are modified into spine because it helps them to lose less water during transpiration and also protect from beings eaten by animal.

Remark and Signature of Teacher .....