For B.Sc. Part II (Sub.) Group B (Anatomy and Embryology)

ANATOMICAL ADAPTATIONS IN HYDROPHYTES

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Lecture No.35

Adaptation ????

Any features of an organisms or its part which enables it to exist under conditions of its habitat is called adaptations.

Adaptations are important for

✓ Withstand adverse conditions of environment

✓Utilize maximum benefit (nutrition or condition) of environment

Adaptation may be

✓Morphological

✓Anatomical

✓ Physiological

Classification of plant based on water relation by warming 1909

Hydrophytes: Plants growing in water or close to water

Xerophytes: Plants grows and adapt under adverse and very poor water environment

Mesophytes: Plant that grows in neither very dry nor very wet environment

Classification of Hydrophytes:

Based on water and air relation

1. Submerged hydrophytes
2. Floating Hydrophytes
3. Amphibious Hydrophytes

1. Submerged hydrophytes:

- Plants grow below water surface and no direct contact with air
- Submerged hydrophytes may be

(i) Rooted submerged hydrophytes: rooted to soil

examples: *Vallisneria, Hydrilla, Potamogeton*

(ii) Free floating hydrophytes: can move through water

examples: *Utricularia, Ceratophyllum*

2. Floating Hydrophytes

✓Float freely on water surface

✓Contact with both water and air

✓May be or may not be rooted

Examples

Free floating without rooted : *Wolffia microscopica*

Floating but rooted: *Nymphaea, Nelumbium, Victoria regia*

3. Amphibious Hydrophytes

✓Plant adapted for both aquatic and terrestrial mode of life

✓Grow on shallow water or muddy soil

✓Mainly observed in marshy area

✓ Shoot completely exposed to air but root completely buried in soil

Example: *Cyperus. Oryza sativa, Marsilea, Sagittaria* and *Typha*

Anatomical adaptations of Hydrophytes

The anatomical adaptations in hydrophytes are mainly

(i) The reduction of protective tissue (epidermis here is meant for absorption and not for protection).

(ii) The reduction of supporting or mechanical tissue (i.e., absence of sclerenchyma).

(iii) The reduction of conducting tissue (i.e., minimum evolution of vascular tissue).

(iv) The reduction of absorbing tissue (roots chiefly act as anchors, and root hairs are lacking).

(v) There is special evolution of air-chambers (aerenchyma) for aeration of internal tissues.

(i) The reduction of protective tissue

- ✓ In aquatic plants, the epidermis is not protective but absorbs gases and nutrients directly from the water.
- ✓ The epidermis in typical hydrophyte has an extremely thin cuticle or cuticle absent
- ✓ Epidermal cell contain chloroplast, especially when the leaves are very thin; these chloroplasts utilize the weak light under water for photosynthesis

(ii) The reduction of supporting or mechanical tissue

✓ Mechenical tissues absent or poorly developed.

✓ Submerged plants generally have few or no sclerenchymatous tissues.

✓ The water itself gives support to the plant, and protects it to some extent from injury.

✓ The thick walls of tissues, their density and the presence of collenchyma in certain plants give some rigidity.

✓ The strands of sclerenchyma occasionally exist, especially along the leaf margins, and increases tensile strength.

✓ In *Nymphaea* a special type of star-shaped lignified cells (asterosclereids) present which provide mechenical support.

(iii) The reduction of conducting tissue

✓ Vascular tissue poorly developed

✓ In the vascular tissues, the xylem visibles greatest reduction and in many aquatic plants consists of only a few elements, even in the stele and main vascular bundles.

✓In certain aquatic plants in the stele and large bundles, and frequently in the small bundles, xylem elements are lacking.

✓In these plants, there is well evolved xylem lacuna in the position of xylem.

✓ These lacunae resemble typical air-chambers (air-spaces).

✓ In several aquatic plants, the phloem is fairly well developed as compared with the xylem.

✓Secondary growth absent.

(iv) The reduction of absorbing tissue

✓The root-system in hydrophytes is feebly evolved and root hairs and root cap are absent.

✓ In some floating plants such as *Utricularia*, *Ceratophyllum*, etc., no roots are evolved, and in submerged plants such as *Vallisneria*, *Hydrilla*, etc., water dissolved mineral salts and gases are absorbed by their whole surface.

✓In hydrophytes the root system is functioning mainly as holdfasts or anchors, and a large apart of the absorption takes place through the leaves and stems.

(V) Development of air-chambers:

✓ Stomata completely absent in submerged parts

✓Sometimes vestegial stomata present

✓In floating plants stomata confined to upper epidermis.

✓ Chambers and passages filled with gases are usually found in the leaves and stems of hydrophytes.

✓ The air-chambers are large, generally regular, intercellular spaces extending through the leaf and often for long distances through the stem (e.g., *Potamogeton*, *Pontederia*).

✓ The spaces are generally separated by partitions of photosynthetic tissue only one or two cells thick.

✓ The chambers prepare and internal atmosphere for the plant. These air-chambers on the one hand give buoyancy to the plant for the floating and on the other they serve to store up air (oxygen and carbon dioxide).

✓The carbon dioxide that is given off in respiration is stored in these cavities for photosynthesis, and again the oxygen it is given off in photosynthesis during the daytime is similarly stored in them for respiration. The cross partitions of air passages, called diaphragms prevent flooding.

✓The diaphragms are provided with minute perforations through which gases but not water can pass.

✓Another specialized tissue frequently found in aquatic plants that gives buoyancy to the plant part on which it occurs is aerenchyma.

✓ Here, very thin partitions enclose air spaces and the entire structure consists of very feeble tissue.

✓Aerenchyma in phellem is formed by a typical phellogen of epidermal or cortical origin.

✓ At regular intervals individual cells of each layer of phellem elongate greatly in the radial direction which the other cells of such layer remain small.

✓However, the term aerenchyma is applied to any tissue with several large intercellular spaces.

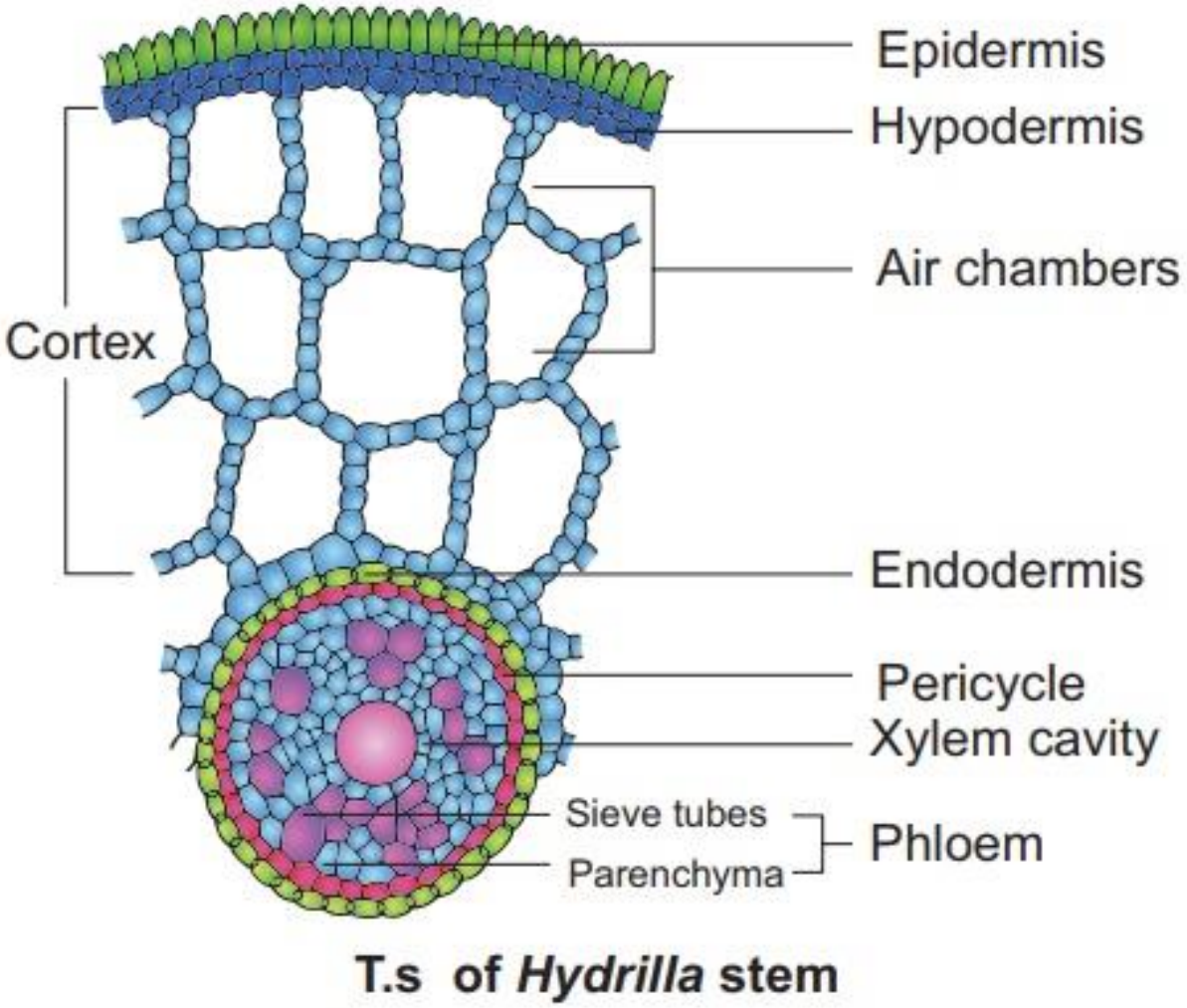

Figure: T.S of *Hydrilla* stem

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Thank You!!!