Topic: Anatomical Adaptation in Hydrophytes
B.Sc. Botany (Sub.) II
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Anatomical Adaptation in Hydrophytes

Plants that grow in water or very wet places are known as hydrophytes. They can be submerged or partly submerged, floating or amphibious. Their structural adaptations are chiefly due to the high water content and the deficient supply of oxygen.

The following anatomical adaptations are follows -

(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.

Epidermis

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, and the thin cellulose walls permit ready absorption from the surrounding water. Generally the chloroplasts are found in epidermal cells of leaves, especially when the leaves are very thin; these chloroplasts utilize the weak light under water for photosynthesis.

In submerged plants, stomata are not present, and exchange of gases takes place directly by the cell walls. The floating leaves of aquatic plants have abundant stomata on the upper surface.

Lack of Sclerenchyma

Submerged plants generally have few or no sclerenchymatous tissues and cells. 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. A few star-shaped idioblasts or sclereids are present, which give mechanical support to the body of aquatic plant.

Minimum Development of Vascular Tissue

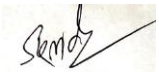
In the vascular tissues, the xylem visible greatest reduction and in many aquatic plants consists of only a few elements, even in the stele and main vascular bundles. In certain aquatic plants in the stele and large bundles, and frequently in the small bundles, xylem elements are lacking.

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. The endodermis is generally present around the stele, but it is weakly developed.

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 plants like Pistia, Eichhorma, etc., no root cap evolves, but root pocket is formed instead. An aquatic plant is, in reality, submerged in or floating up on a nutrient solution. 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.



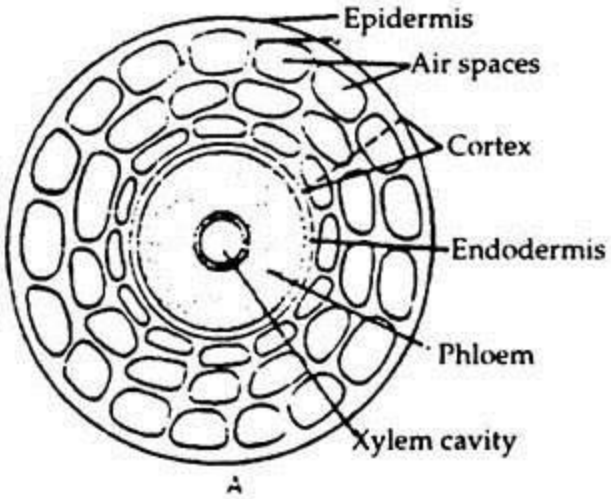
Development of Air-Chambers:

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.



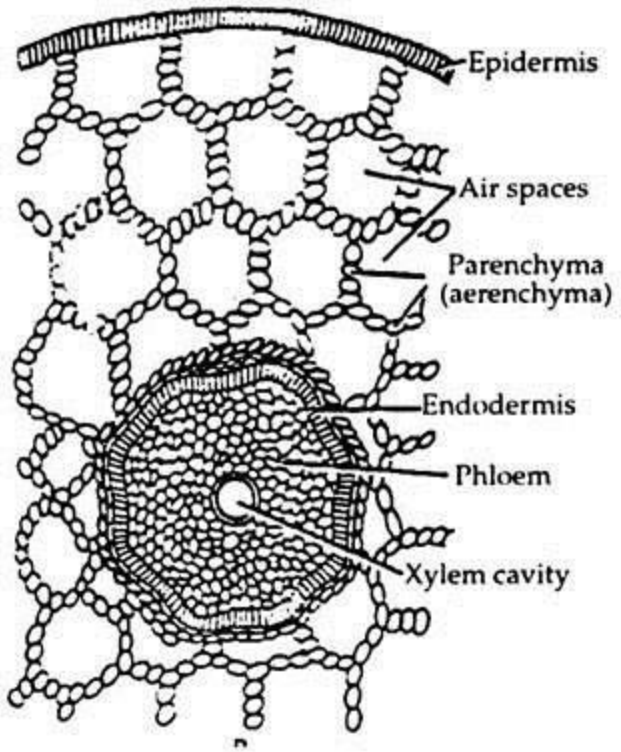


Fig. Anatomy of hydrophytic stem of *Hydrilla* (submerged monocot—T.S. of stem). A, diagrammatic; B, details of a sector and central stele.