ECOLOGICAL ADAPTATION IN HYDROPHYTES

BOTANY (MINOR) TOPICS
SEMESTER -3

A/C to FYUGP

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INTRODUCTION OF ADAPTATION

Any characteristics of an organism or its path which enable it to survive in its own particular habitat is called adaptation. It is also defined as adaptation is a evolutionary process whereby and organism becomes able to survive and reproduce in its habitat or habitats.

Adaptation is nothing but any changes in the structure or function of an organism or in any parts of its that results from natural selection and by which the organisms becomes better fitted to survive and multiply in its environment.

Adaptation is the adjustment or changes in behaviour, physiology, and structure of an organism to become more suited to an environment is called adaptation.

ECOLOGICAL ADAPTATION IN PLANT

- Plants have adaptations to help them live and grow in different environment.
- Plants can survive in many extreme environments.
- On the basis of their water availability the plant have been classified as follows:

1.XEROPHYTES- plants adapted to survive under the condition of very poor water supply of available water in the habitats.

2.HYDROPHYTES-plants growing in or near water.

3. MESOPHYTES- Plants growing in an environment which is neither very dry or nor very wet.

4. HALOPHYTES- Plants that are adapted to grow in environment with high salt concentration.

THREE TYPES OF ADAPTATION

As we know there are large variety of adaptation for just one type of environment and of that variety of adaptation there are just three types of behavioral structural and physiological adaptations.

- STRUCTURAL- Plants that have long narrow leaf structure in order to reduce water in a desert environment.

- PHYSIOLOGICAL- Animals that dilate or swell their blood vessels bringing them close to the surface of the skin to lose heat more rapidly in a high temperature environment (vasodilation).

- BEHAVIOURAL- Animals that burrow under the ground to avoid the sun in the desert environment.

HYDROPHYTES

INTRODUCTION

Hydrophytes are plants that grow in region, where there is a plenty of water supply or wet soil.

A plant which grows only in or on water is said to be hydrophytes. Plants live submerged in water, live in marshes ,swamps aquatic region.

ADAPTIVE FEATURES:

- Aeration tissue(lacunae)
- Absence of sclerenchyma and under developed xylem.
- Submerged leaves lack stomata.
- Floating leaves have stomata in the adaxial epidermal surface only.
- It tends to have large air spaces around the cell.
- Having waxy cuticles

CATEGORIES OF HYDROPHYTE

The hydrophytes are generally classified into the following five categories:

1. Free floating hydrophytes.
2. Submerged floating hydrophytes
3. Rooted submerged hydrophytes.
4. Rooted hydrophytes with floating leaves.
5. Rooted emergent hydrophytes.

1. FREE FLOATING HYDROPHYTES:

Free floating hydro fights the remain in contact with water and air but not soil. They float freely on the water surface. Leaves in some are very my nude while in others quite large.

Examples are wolffia, Lemna,Azolla,Eichhornia,Salvinia and Pistia etc

2. SUBMERGED FLOATING HYDROPHYTES:

The remain in contact with only water being completely submerge and not rooted in the mud. There is stems are long and leaf generally small. Roots are lacking even in embryo stage sometimes leafy branches being modified into rhizoids.

Examples are Najas,Ceratophyllum,Utricularia etc

3. ROOTED SUBMERGED HYDROPHYTES:

These are hydrophytes that remain completely submerged in water and rooted in soil their stem is long, bearing small leaves at the notes and some kind of ribbon shaped with fibrous root.

Example are hydrilla, Vallisneria, Chara,Isoetes.etc

4. ROOTED HYDROPHYTES WITH FLOATING LEAVES:

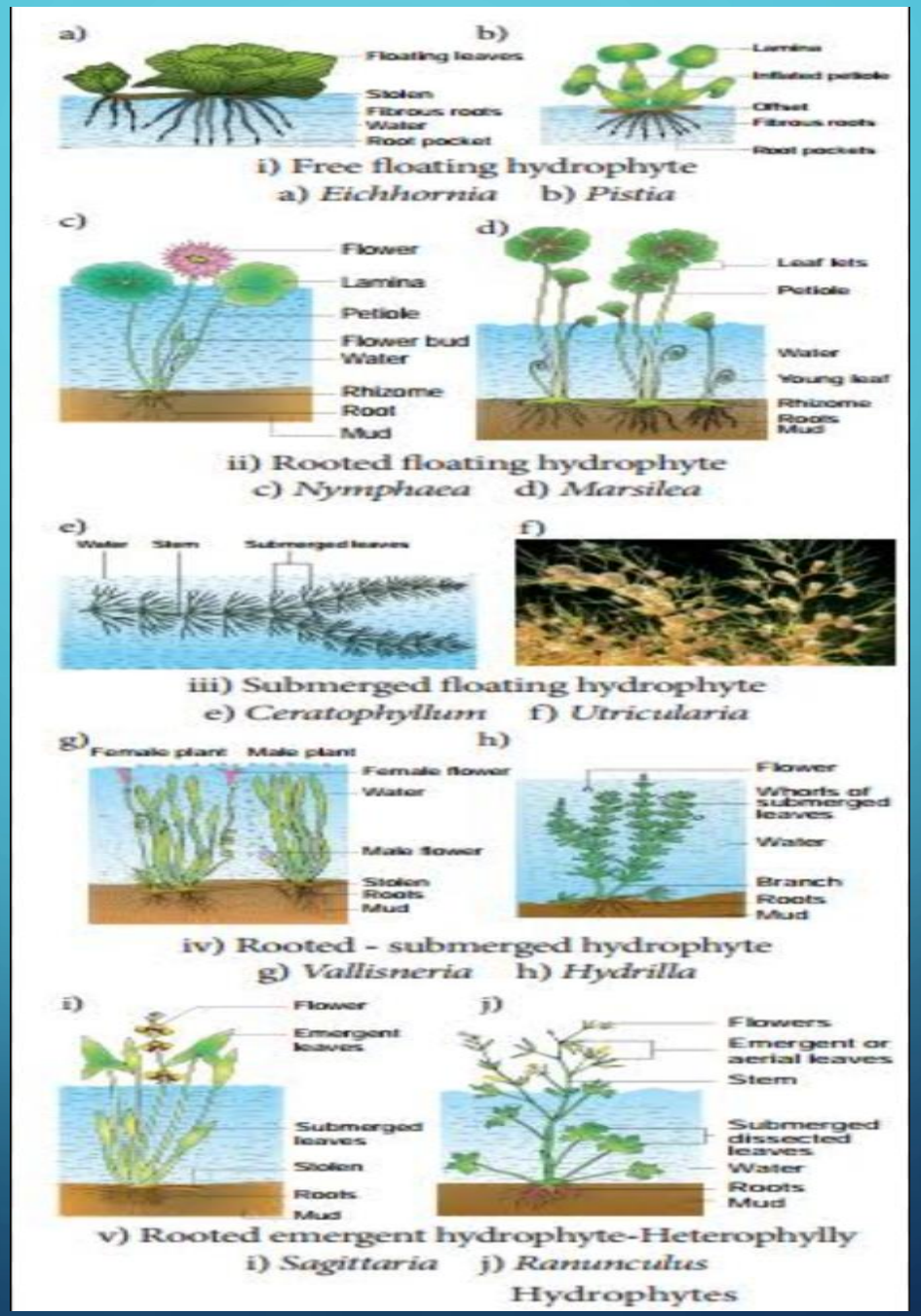
These roots are fixed in mud but leaves have long petiole which keep them floating on the water surface. Some of the rooted hydrophytes with floating leaves.

Examples are Trapa, Nelumba, Marsilea,Nymphaea etc

5. ROOTED EMERGENT HYDROPHYTES:

They grow in shallow waters. These are the hydrophilus form which altho require excess of water but their shoots are partially or completely exposed to air. The root system is completely underwater fix in soil.

Examples are Cyperus,Sagittaria, Scirpis , Ranunculus.etc


a)
Floating leaves
Stolen
Fibrous roots
Water
Root pocket
b)
Lamina
Inflated petiole
Offset
Fibrous roots
Root pockets
i) Free floating hydrophyte
a) Eichhornia b) Pistia
c)
Flower
Lamina
Petiole
Flower bud
Water
Rhizome
Root
Mud
d)
Leaf lets
Petiole
Water
Young leaf
Rhizome
Roots
Mud
ii) Rooted floating hydrophyte
c) Nymphaea d) Marsilea
e)
Water
Stem
Submerged leaves
f)
iii) Submerged floating hydrophyte
e) Ceratophyllum f) Utricularia
g)
Female plant
Male plant
Female flower
Water
Male flower
Stolen
Roots
Mud
h)
Flower
Whorls of submerged leaves
Water
Branch
Roots
Mud
iv) Rooted - submerged hydrophyte
g) Vallisneria h) Hydrilla
i)
Flower
Emergent leaves
Submerged leaves
Stolen
Roots
Mud
j)
Flowers
Emergent or aerial leaves
Stem
Submerged dissected leaves
Water
Roots
Mud
v) Rooted emergent hydrophyte-Heterophylly
i) Sagittaria j) Ranunculus
Hydrophytes

MORPHOLOGICAL ADAPTATION OF HYDROPHYTES

ROOTS: Root system of hydro fight is not of much important because they grow partially or completely in water. Roots are poorly developed,(example hydrilla, Vallisneria), reduced or completely absent (example Utricularia, Ceratophyllum).

STEM: In submerged hydrophyte the stem is long,slender thin , spongy and flexible. Example hydrilla. In free floating hydrophytes, the stem or stolon is horizontal spongy thick and short floating on the surface of water. Example Eichhornia, Azolla, Pistia while in rooted hydro fight like Nelumbium, Cyperus ,etc the stem is a rhizome.

PETIOLES: Some floating hydro fight shows special feature in the petioles. In free floating but rooted hydrophytes like Nymphaea and Neumbium, petiole are long slender and spongy while they are swollen, spongy and free floating hydrophytes like Eichhornia helps in floating.

LEAVES: In submerged hydrophytes the leaves are long narrow example Vallisneria while it is finely dissected eg. Ceratophyllum. In free floating hydrophyte, leaf lamina is shiny due to the decomposition of waxy material, smooth having a spongy and Swollen aur bulbous petiole which help in buoyancy while in floating but rooted hydrophytes like Nelumbium and Nymphaea the petios are long and the lamina are peltate with their lower surfaces in direct contact with water and the upper surface exposed to air. Some amphibious hydrophytes shows heterophylly in the presence of these two types of leaf.

ANATOMICAL ADAPTATION OF HYDROPHYTE

ROOT:

- Cuticle is very thin and absent.
- Root hair presence in amphibious hydrophyte.
- Epidermis is single lared made up of thin walled cell.
- Parenchymatous cortex is well developed has numerous chambers which help in floating and rapid gaseous exchange.
- Conducting tissue xylem and phloem developed poorly and less differentiated, only xylem tracheids are present in submerged form phloem is well differentiated in amphibious hydrophytes.
- Mechanical tissue are generally absent.
- Pith is absent.

STEMS:

- Cuticle is very thin, poorly developed or absent.
- Epidermis is single layer with thin walled parenchymatous cell.
- The rhizomes are well developed Epidermis.
- In floating form thin walled parenchymatous or colenchymatous hypodermis is present which is containing chloroplast.
- Parenchymatous cortex is well developed with number of air chamber Which help in floating and rapid gases exchange.

- Epidermis and pericycle are generally distinct.
- The vascular tissue xylem and phloem develop poorly thin walled except in amphibious hydrophyte.
- Mechanical tissue are poorly developed or absent.

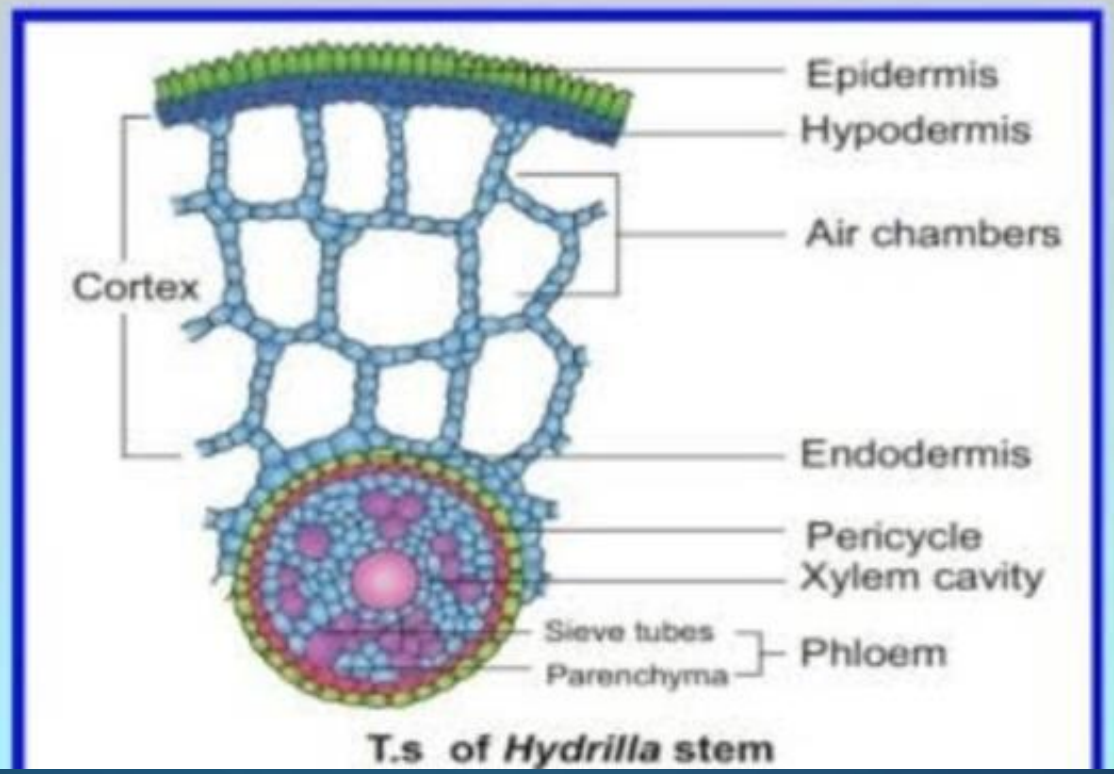
LEAVES:

- Cuticle are absent or poorly developed in Nymphaea leaves.
- Epidermis is single layered with thin walled parenchymatous cell.
- Chlorophyll found in all the tissues and the epidermal cell of leaf contain abundant chloroplast and they can function as photosynthetic tissue.
- Stomata are totally absent in submerged plants but in floating leaves stomata are present on the upper surface.
- In submerged plant mesophyll tissue are not differentiated while in other forms of hydrophytes these are well differentiated into spongy parenchyma and palisade tissues.They show sir cavities.
- In submerged leaves air chamber are filled with respiratory and other gases.
- Mucilage canal and musileej cells are present which helps to protect the plant body.
- Mechanical tissue are poorly developed and completely absent.

PHYSIOLOGICAL ADAPTATION OF HYDROPHYTE

- Osmotic concentration of cell SAP are low.
- Entire plant surface absorb water and nutrients.
- Hydrophytes maintain active photosynthesis as chloroplasts are distributed throughout the plant body.
- Carbon dioxide and oxygen involve during respiration and photosynthesis is stored in air chamber for future use.
- No transpiration from submerged plants.

ANATOMICAL ADAPTATION IN STEM OF HYDROPHYTES



T.s of *Hydrilla* stem

Anatomical adaptation of hydrophytes...

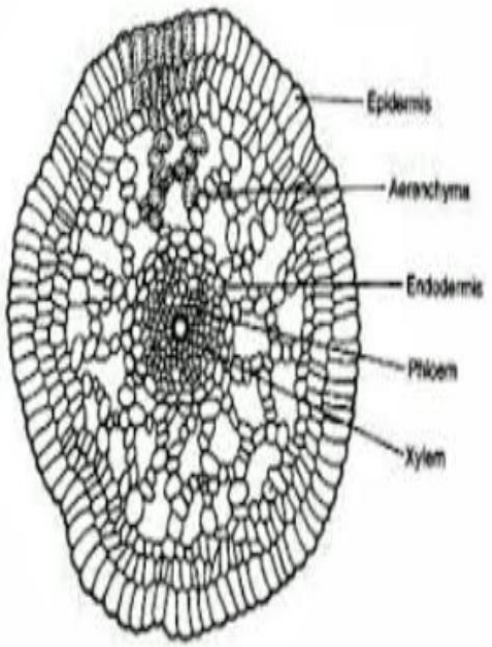


Fig. 8.8. T.S. of *Hydrilla* stem.

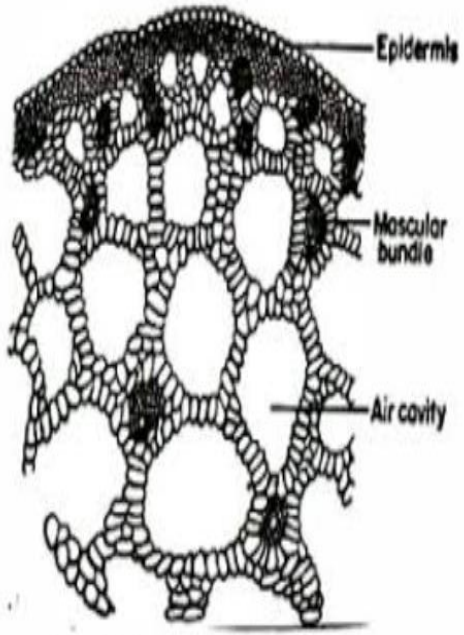


Fig. 8.5 : T.S. through *Eichhornia* petiole

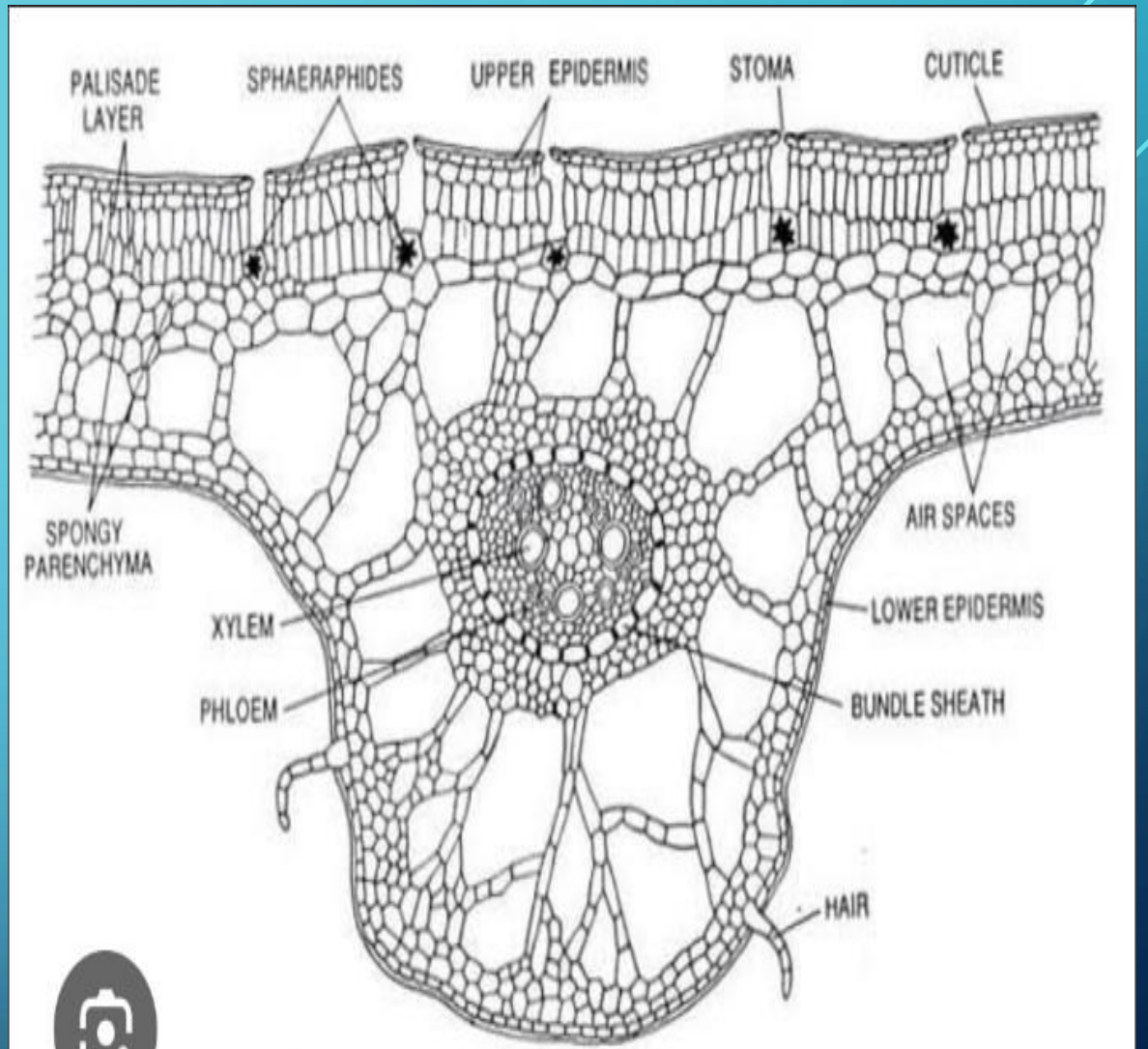


Fig. 41.25. Hydrophytes. T.S. floating leaf of *Trapa bispinosa*, showing big air spaces; the stomata confined to upper epidermis only.

THANKYOU