HALOPHYTES

- The plants which grow and flourish in saline soils are called halophytes.
- In saline or marshy soil, salts of sodium chloride, magnesium sulphate and magnesium chloride are abundant.
- Halophytes are represented by herbs in temperate regions and by dense trees in tropical and subtropical regions near sea shore.
- Warming (1909) recognized two types of halophytes – (i) littoral swamp or mangrove vegetation or salt marshes, or (ii) psammophilous halophytes.

General adaptive features of Halophytes: -

1. **Fixation** – In some halophytes such as *Rhizophora*, the stem is firmly anchored to the soil with the help of stilt roots. Since the soil is loose, normal roots will not be able to properly fix the plant.

2. **Respiratory roots or pneumatophores –** The saline soil which is generally waterlogged is poor in oxygen content. Hence the roots find it difficult to get the required amount of oxygen for their respiration. In order to overcome this, halophytic plants like *Avicennia* develop special roots called breathing roots or pneumatophores. These special branches of the roots grow apopgeotropically (against gravity) and come out of the soil and water. They have small pores called air pores which help in the absorption of oxygen from the atmosphere.

3. **Germination and vivipary –** The seeds of halophytic plants find it difficult to germinate in the saline soil as they have not developed the necessary physiological adjustments with respect to osmotic concentration. If the seeds fall on the soil, generally they fail to survive. In order to overcome this, halophytic plants, especially mangroves, develop vivipary i.e. the seeds germinate when they are still attached to the parent plant. The embryo will be nourished by the parent plant and grows into a seedling. Only a seedling is detached from the plant and it can grow in marshy soil. Vivipary is seen in *Rhizophora, Avicennia, Aegiceras*, etc.

4. **Means of migration –** Seedlings and seeds of halophytic plants are very light in weight due to the presence of air cavities. They can be easily dispersed to various places.

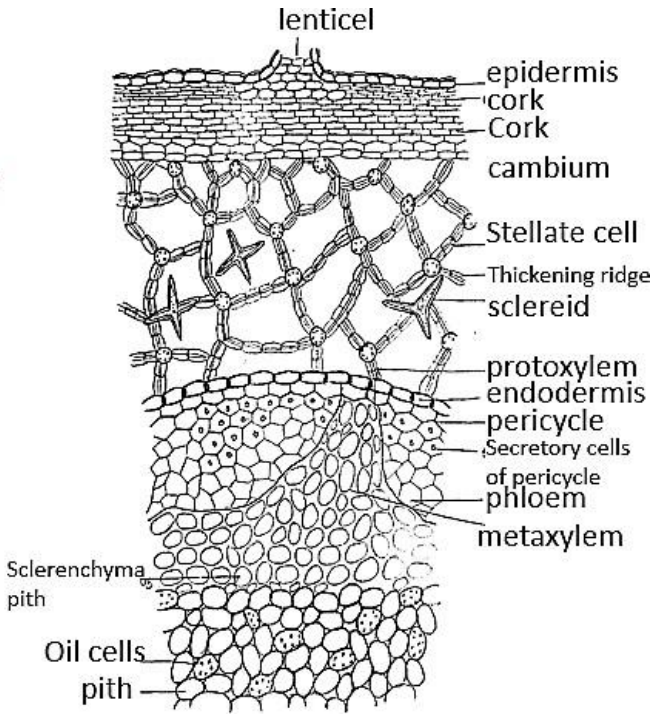
5. **Xerophytic structure –** Plants are generally bushy with stunted growth except in trees. Leaves are thick, leathery and often succulent. Hairy outgrowths present on stems and leaves. These hair function as salt

glands and excrete excess of salt present in the water to the exterior. Epidermal cells have thick cutinized walls. Stomata are often sunken.

- The xerophytic features seen in halophytes are because of physiological dryness.
- Even though the soil has water, it cannot be utilized by plants since it is highly concentrated with salts due to which water is unavailable to the plant and it behaves like a xerophyte.
- Such condition is known as physiological dryness as different from physical dryness of true xerophytes.

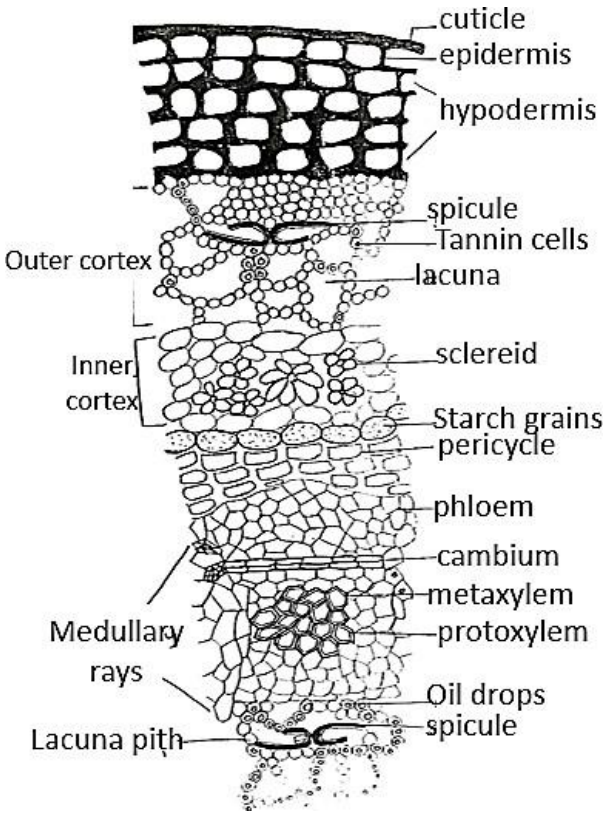
Ecological Adaptations in the Anatomy of Salt – excreting halophytes (Mangroves):

1. Internal structure of roots:



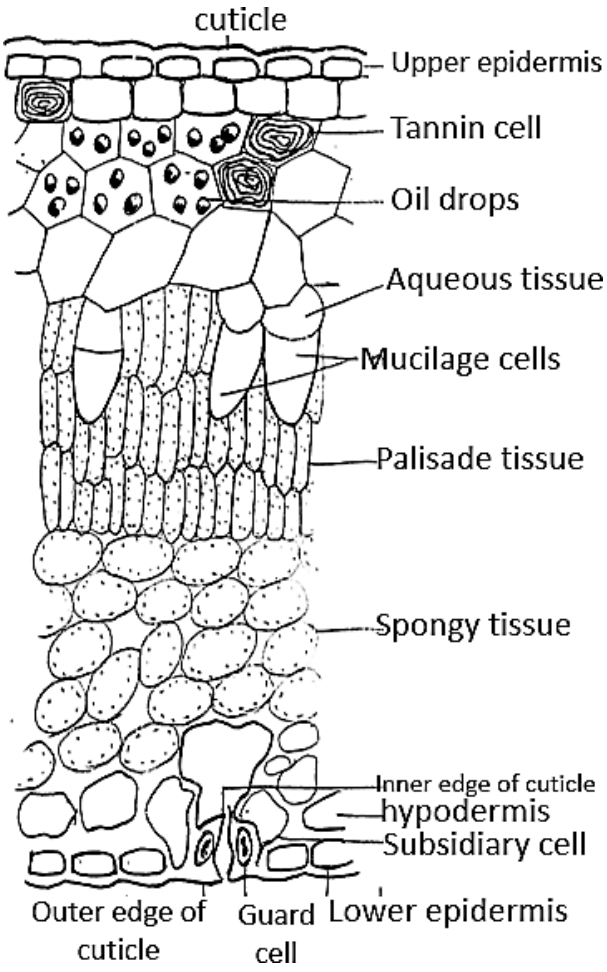
- The sub-terranean root in cross section shows cork consisting of several layers.
- Cortex made up of star-shaped or stellate cells, connected with each other by lateral arms. Cortical cells have peculiar thickening ridges which are lignified. Sclereids can be seen in the cortex. Some cells of cortex are filled with oil and tannin.
- Pith cells are thick-walled with pitted thickenings of lignin, and contain tannin and oil.
- Mechanical and vascular tissues well-developed.

2. Internal structure of stem:



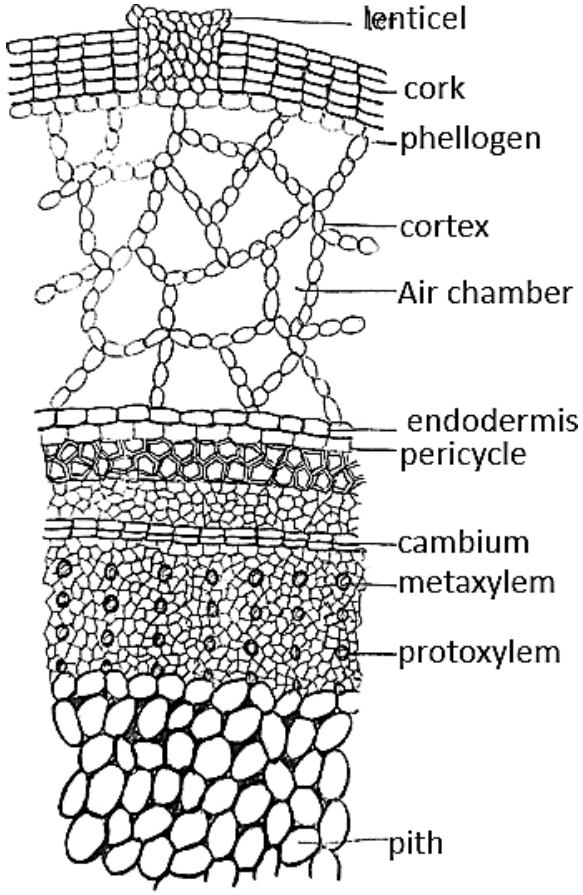
- Very thick cuticle even in young stage.
- Epidermal cells heavily thickened, almost squarish, filled with oil tannin.
- Hypodermis several layered, of heavily thick-walled cells.
- Primary cortex with no of lacunae, cells of which thickened, filled with tannin and oil. Some also contain Ca-oxalate crystals. H-shaped heavily thickened spicules present here provide mechanical strength.
- Inner cortex possesses no of branched thick-walled cells – sclereids that provide mechanical strength.
- Pericycle several-layered, sclerenchymatous.
- Pith also contains lacunae and H-shaped spicules.
- Vascular tissues well developed.

3. Internal structure of leaf (V.S. of *Rhizophora* leaf):



- Cuticle very well developed.
- Epidermal cells heavily thickened and may contain calcium oxalate crystals.
- Stomata, confined only to lower surface and sunken.
- Below upper epidermis several layers of thin-walled cells that remain filled with water, outer cells of this layer filled with oil and tannin. Cells of lowermost layer are mucilagenous that remain embedded into palisade tissue.
- Mesophyll well differentiated.
- Many corky areas present on ventral surface.

4. Internal structure of pneumatophore:



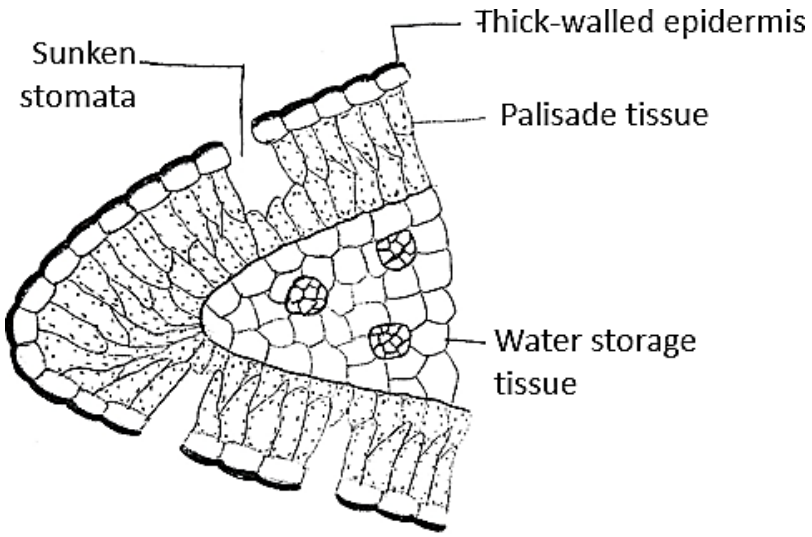
- Possess large number of lenticels.
- Cork layers are well developed. Three layers – outer layer cells rounded externally; middle layer cells tubular or rectangular; innermost layer cells radially elongated having rounded inner edges.
- Cortex in the distal parts of pneumatophore made up of rounded cells that enclose large air spaces, which are schizogenous in origin in all mangrove plants.
- Chloroplasts may be present in outer cells of the lacunate cortex.
- Cortex is strengthened by multiradiate sclereids, which can be present in abundance in distal regions in groups. Sclereids absent in proximal part of the roots.
- Pericycle made up of isolated patches of thick-walled cells capping the phloem.
- Vertical rows of crystalliferous cells present in secondary phloem.
- Pith in the distal region may possess sclereids.

PSAMMOPHILOUS (SALT – TOLERATING HALOPHYTES): -

- They may be annuals or perennials.
- Annuals live and grow during the rainy season. They do not have to face much difficulty as the perennials. They show fewer xerophytic characters.
- Perennials, on the other hand, show much xerophytic features as they have to face the intense isolation that they face along the sea shore during drier period of the year.
- E.g. *Suaeda fruticosa, Salsola foetida, Sesuvium*, etc.

Ecological Adaptations in the Anatomy of Salt – tolerating halophytes:

Internal structure of leaves: (T.S. of *Sesuvium* leaf):



- Leaves generally reduced and their photosynthetic function taken up by green stem.
- Epidermal cells in some cases get enlarged and store water.
- Well – developed aqueous tissue in the centre. Chlorophyllous palisade-like cells present.
- Older leaves serve as water storage organs for the younger leaves.
- Some cells in vascular bundles and pith also contain chloroplasts.

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