STUDY MATERIAL

ON

ECOLOGICAL CLASSIFICATION OF PLANTS

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ECOLOGICAL CLASSIFICATION OF PLANTS

Classification is the science of categorisation of living organisms according to their characteristics features and interactions with close relatives. Of let a comparatively new scheme of classification based on the habitat condition and allied adaptation is being practiced for ecological studies and is called ecological classification. Ecological classification of plants depends on the **adaptive features**, developed due to different types of stresses and external factors, those influence the plants living.

Stress can be defined as a reaction in living organisms, against any internal or external stimuli, in a way which has negative impact on the organism itself.

Otherwise it is defined as the body's reaction to a change that requires a physical or biochemical response.

The major factors working behind the ecological classification of plants are:

1. **Water stress:** in plants growing in water deficit region.
2. **Heat stress:** Plants exposed to high temperature.
3. **Frost stress:** In plants exposed to chilling cold.
4. **Salt stress:** In plants experiencing physiological draught.
5. **Nutrient stress:** In plants growing in nutrient deficient substratum.
6. **Chemical stress:** In organisms growing over acidic, sodic, chemically contaminated or toxic lands.

However, the environmental factors, which control such stresses are basically climatic, edaphic and in a few cases anthropogenic activities.

THE ECOLOGICAL TYPES OF PLANTS:

Hydrophytes: The types of plants adapted to live in water, either with partially or totally submerged body parts are known as hydrophytes. Hydrophytes may of different categories like,

- **Floating:** Floats at surface of water (*Pistia sp., Eichhornia crassipes*).
- **Submerged floating:** Floats just below the water surface (*Utricularia sp.*).
- **Submerged rooted:** Rooted plants with whole body remaining under water. (*Vallisneria sp.*).
- **Partially-submerged rooted:** Rooted plants with leaves and upper parts above water surface (*Nymphaea pubescens*).
- **Amphibious:** Plants growing in muddy substratum having both terrestrial and aquatic environment (*Centella asiatica*).

Important adaptations includes:

1. Broad flat leaves for floating and partially submerged plants.
2. Narrow, elongated, highly dissected leaves are present in submerged species.
3. Shiny or hairy surface in floating leaves, reduce stay of water.
4. Hairs sometimes trap air.
5. Thin cuticle and open stomata to encourage water loss.
6. Presence of aerenchyma tissues and air sacs in stems, leaves and other body parts.
7. In a few plants chloroplasts are present on the upper surface.
8. Long petioles rich in aerenchyma tissues are found in partially submerged rooted plants.
9. Root system is shallow. In case of floating plants roots are having strong root caps.

Mesophyte: Mesophytes are the major class of terrestrial trees, and hence do not have special adaptation for ecological set up. However, the adaptations and characteristics depend on the nature of substratum. A few basic character of mesophytes are:

1. Depending on the stem structure they may be categorized as herb, shrub or tree.
2. Well defined root system is available which may be composed of adventitious roots or main root system with taproot.

Xerophyte: The group of plants undergo regular water and temperature stresses are classified as xerophytes or desert plants. They are capable of surviving draught condition. Hence, shows adaptations which specifically help in **storage of water** and **reduce water loss** and **consumption**.

1. The leaves are having limited number of stomatal openings and sunken stomata which help in reducing the loss of water.
2. Curled leaves with long hair reduce evapo-transpiration loss.
3. In truly xerophytic plants stomata open at night to cut evaporation. **Crassulacean Acid Metabolism** (CAM) type of photosynthesis is found in these plants.
4. Often leaves are modified to spines or become rudimentary, that reduce transpiration.
5. Photosynthesis is carried out through modified petiole, stem etc. where due to absence of stomata no transpiration is possible.
6. Thick and fleshy succulent leaves helps in water storage.
7. The stems sometimes become succulent and participate in water storage.
8. Deep root system enables then to intake water from deep layers.
9. Specialized leaf hairs or trichome in *Tillandsia sp.* are capable of absorbing moisture for the air.

Halophyte: The group of plants that grow in the saline environment, and hence face a water stress are known as halophytes. Instead the water is available to the plants, due to high salinity a draught like condition prevails for the plants. The situation is known as ***Physiological draught***. Mangrove plants are the most predominant halophytes. Halophytes need to survive both the water and salt stress together and hence have several special adaptations.

The main adaptive strategy of halophytic adaptations are restricting water loss, excretion of salts and thrive the tidal effects.

1. The halophytes are having shiny, thick, sometimes succulent type of leaves with sunken stomata to reduce evapo-transpiration.
2. High chlorophyll content helps in effective photosynthesis and less stomatal opening time.
3. The waxy coating on the leave surface does not allow the water to stay.
4. Several common mangroves secrete salts from leaves and specific salt glands.
5. The leaves sequester excess electrolytes in the bladder cells, which release the salt back into the environment when they are ruptured.
6. To remain erect on the muddy soft substratum against coastal hazards the plants are equipped with stilt-roots, root buttresses and wide spread root network capable of holding the silt.

7. For continuous gaseous exchange during high tide and saline submerged condition some of the halophytes like *Avicennia sp.,* have pneumatophores.
8. Viviparous germination occurs.

Epiphyte: It a group of plants that grows upon another plant (such as a tree) non-parasitically or sometimes upon some other object (such as a building or a telegraph wire), derives its moisture and nutrients from the air and rain and sometimes from debris accumulating around it.

The most important adaptations of an epiphyte thus includes features that help in clinging and absorption of moisture and nutrients.

1. The epiphytes in most of the cases develop a special type of root system that holds then tight on the host – is known as clinging roots.
2. A unique soft tissue layer on the aerial roots of epiphytes, called Velamen helps in absorption of moisture from air and rain.
3. To reduce water loss, the leaves are often succulent and having thick leathery surface.

Lithophytes: The group of plants that grow on the surface of rocks or stones, which can colonize steeply inclined or bare rock.

Slope of the surface, which when steep has no loose soil or detritus, but when little inclined is covered with the latter, is one of the most important factor for lithophytes growth. The adaptations of Lithophytes, therefore includes features to grow in less water and nutrient content soil. Also specific adaptations are found depending on chemical compositions of the rock.

Chosmophytes: These are some specific type of lithophytes that grow in the crevices of the hills. Hence, it is adapted to survive in high slope and less nutrient availability.

Psammophyte: Plants that grow in loose sand. Therefore the members of the group have adaptations to fight severe water stress and substratum looseness.