Algae: Definition, Characteristics and Structure

Introduction to Algae:

The term algae (Latin — seaweeds) was first introduced by Linnaeus in 1753, meaning the Hepaticeae. The algae comprise of a large heterogeneous assemblage of plants which are diverse in habitat, size, organisation, physiology, biochemistry, and reproduction.

It is an important group of Thallophyta (Gr. Thallos — a sprout; phyton — a plant), the primitive and simplest division of the plant kingdom. The orderly systematic study of algae is called Phycology (Gr.phycos — seaweeds; logos — study or discourse).

The algae are chlorophyll-containing primitive plants, both prokaryotic and eukaryotic, with wide range of thaifi starting from unicellular to multicellular organisations. Autophytic (which can manufacture their own food) and thalloid plant bodies are also found in Bryophytes.

The sex organs, especially of female sex organ in algae are unicellular. 2. There is no embryo formation in algae. However, the reproductive structures of some groups of algae (e.g., Chlorophyceae) are apparently multicellular and the sterile tissue is generally considered as vegetative. Bryophytes onwards in the scale of evolution have the uniform multicellular sex organs, the archegonia, which are not found in algae. For that reason, bryophytes are usually called archegoniate plants.

Characteristics of Algae:

1. Algae are chlorophyll-bearing autotrophic thalloid plant body.

2. Almost all the algae are aquatic.

3. The plant body may be unicellular to large robust multicellular structure.

4. The multicellular complex thalli lack vascular tissue and also show little differentiation of tissues.

5. The sex organs are generally unicellular but, when multicellular, all cells are fertile and, in most cases, the entire structure does not have any protection jacket.

6. The zygote undergoes further development either by mitosis or meiosis, but not through embryo formation.

7. Plants having distinct alternation of generations. Both gametophyte and sporophyte generations — when present in the life cycle are independent.

Occurrence of Algae:

The algae are ubiquitous (present everywhere) in distribution, i.e., they are found in fresh water as well as marine water, on soil, on rock, as epiphytes or parasites on plants and animals, in hot springs, in desert, on permanent snow-fields etc. But they mainly dwell in aquatic environments.

Based on habitat the algae may be categorized as:

1. Aquatic algae

2. Terrestrial algae

3. Algae of remarkable habitats.

1. Aquatic Algae:

Aquatic algae may be fresh water (when salinity is as low-as 10 ppm) or marine (when salinity is 33-40%). Again, certain algae grow in brackish water which is unpalatable for drinking, but less salty than sea water.

The fresh water algae usually grow in ponds, lakes, tanks, ditches etc. The very common fresh water algae are *Chlamydomonas, Volvox, Ulothrix, Chara, Oedogonium, Spirogyra, Nostoc, Oscillatoria* etc. Some of the very common marine algae are *Sargassum, Laminaria*, *Ectocarpus, Polysiphonia*, etc.

Fresh water algae may be termed as planktonic when they grow and remain suspended on the upper part of water (e.g., *Volvox, diatom*), while the benthic algae are bottom- dwellers. The algae that grow at air-water interface are called neustonic.

The benthic algae may be epilithic, that grow on stones; epipelic attached to sand or mud; epiphytic — growing on plants; and epizoic — growing on animal body surface. The marine algae may be supralittoral or sub- aerial, as they grow above the water level and in the spray zone.

The intertidal algae grow in such a depth so that they are exposed periodically due to tides. Other marine algae are sublittoral, meaning that they are constantly submerged at depths as great as 30-60 metres (100-200 ft).

Again, the supralittoral algae may be edaphic— that grow in and on the soil, epilithic— growing on stones, epiphytic — growing on plants, epizoic— growing on animal body surface, and corticolous — growing on tree barks and parasitic on plants and animals. Some algae (e.g., Chlorella) live endozoically in various protozoa, coelenterates, molasses etc.

2. Terrestrial Algae:

Some algae are found to grow in terrestrial habitats like soils,' rocks, logs etc. The algae that grow on the surface of the soil are known as saprophytes. Many blue-greens, on the other hand, grow under the surface of the soil, and are called cryptophytes.

The algae growing in the desert soil may be typified as edaphic (living in soil), epidaphic (living on the soil surface), hypolithic (growing on the lower surface of the stones on soil), chasmolithic (living in rock fissures) and endolithic algae (which are rock penetrating). The common terrestrial members are Oscillatoria sancta, *Vaucheria geminata*, *Chlorella lichens*, Euglena sp., Fritschiella sp. and Phormidium sp.

3. Algae of Remarkable Habitats:

In addition to above mentioned habitats, some algae also occur in uncommon habitats and termed as:

1. Halophytic Algae (or Euryhaline): They grow in the highly concentrated salt lakes, and include *Chlamydomonas ehrenbergli, Dunaliell*a and *Stephanoptera* sp.

2. Symbiotic Algae: They grow in association with fungi, bryophytes, gymnosperms or angiosperms. The best examples of symbiotic algae found in association with fungi are *Nostoc, Gloeocapsa, Rivularia;* the members of Cyanophyceae and *Chlorella, Cytococcus, Pleurococcus*; the members of Chlorophyceae. This symbiotic association consisting of algae and fungi is called lichen. *Nostoc* may also associate with *Anthoceros* and *Anabaena* associates with the roots of *Cycas* to form coralloid roots.

3. Cryophyte Algae: This group of algae growing on ice or snow provides attractive colours to snow-covered mountains. The alpine and arctic mountains become red due to the growth of the *Haemotococcous nivalis*; green snow in Europe is due to the growth of *Chlamydomonas yellowstonensis. Scotiella nivalis* and *Raphidonema brevirostri* cause black colouration of snow, whereas *Ancyclonema nordenskioldii* is responsible for brownish purple colouration.

4. Thermophytes or Thermal Algae: This group of algae occurs in hot water springs (50-70°C) where normal life is not possible. Many blue-greens (e.g., *Oscillatoria brevis*, *Synechococcus elongates*, *Heterohormogonium sp*.) are grown in such hot springs.

5. Lithophytes: They grow on the moist surface of stones and rocks, e.g., *Nostoc, Gloeocapsa, Batrachospermum* etc.

6. Epiphytic Algae: They grow on other plants including other algal members.

a. Algae on Algae: *Diatoms* on *Oedogonium, Spirogyra* etc.

b. Algae on Bryophytes: Blue-green algae like *Nostoc, Oscillatoria, diatoms* etc. grow on different bryophytes.

c. Algae on Angiosperms: Algae like *Cocconis, Achnanthes* etc. grow epiphytically on *Lemna,* an aquatic angiosperm. Alga like *Trentepohlia* grows on the barks of different angiosperm plants, and is very common in Darjeeling (India).

7. Epizoic Algae: The algae growing on animals like fish, snail etc. are called as epizoic, e.g., *Stigeoclonium* are found in the gills of fishes.

8. Endozoic Algae: They grow in the tissues of animals, e.g., *Zoochlorella sp*. is found in *Hydra viridis.*

9. Parasitic Algae: Some algae grow parasitically on different plants and animals. a. *Cephaleuros* (Chlorophyceae) is parasitic and grows on the leaves of various angiosperms, such as tea (Camellia sinensis), coffee (Coffea arabica). The most important one is *Cephaleuros virescens,* which causes Red rust of tea.

Thallus Organisation in Algae:

Thalli of algae show a range of organisation starting from unicellular form to highly organised multicellular habit where the plant body is differentiated into root-like, stem-like, and leaf like structures giving a higher plant-like appearance. Their size ranges from a few micron to several metres. The algal thalli are grouped into the following, based on their organisation:

1. **Unicellular forms**

Body consists of a single cell performing all functions.

- Motile (flagellated): e.g., *Chlamydomonas*
- Non-motile: e.g., *Chlorella*

2. Colonial forms

- Cells group together but remain independent. Shows beginning of cooperation among cells.
- Motile colonies: e.g., *Volvox*
- Non-motile colonies: e.g., *Hydrodictyon*

3. Filamentous forms

Cells are arranged in a thread-like series. Some division of labour starts appearing.

- Unbranched filament: e.g., *Spirogyra*
- Branched filament: e.g., *Cladophora*

4. Heterotrichous forms

- Example: *Stigeoclonium*
  Thallus differentiated into two different planes one is prostrate(creeping part) and other is erect (upright part).
    - Example: *Fritschiella , Coleochaete*

5. Siphonous (coenocytic) forms

Aseptate Multinucleate condition is a unique feature in this type of thallus, tube-like structure without cross walls (septa).

- Example: *Vaucheria*

6. Parenchymatous forms

Parenchymatous thallus refers to a type of algal body made up of closely packed cells forming a tissue-like structure due to cell division in more than one plane.

- Example: *Ulva*.