**Lecture 1**

**Algae**

**The algae, it is a collective term for all those chlorophyll-bearing organisms, stoneworts, seaweeds and the like collectively known as the** **algae**.

All are chlorophyll-bearing plants with a plant body showing no differentiation into true tissue. It never form true roots, stems and leaves and thus called a **thallus**.

 The term is used even if the plant is a unicellular. The thallus is non-vascular and thus has no elements for transport of fluids.

They have non- jacketed, either unicellular sex organs or multicellular in which every cell produces a gamete. Most of them are among the simplest in the plant kingdom. In all, there are about 30000 species. On the basis of:

 **(a)** **Thallus like non-vascular plant body**.

 **(b) Simple, unicellular non-jacketed sex organs.**

 **(c) No embryo development after gametic union**

**Habit and habitat**

The algae are predominant aquatic and found in fresh or salt water forms occur abundantly in ponds, lakes, slow flowing stream and water reservoirs. In habit, they may be free swimming or free floating. Some are terrestrial, grow in wet situations, such as, on damp soil and walls or even rocks, and thus have adapted themselves to a life in the air**.**

 **So according to the habitat, the algae may be classified as follows**

**1-Aquatic algae**

**2- Terrestrial algae**

**3-Aerophytes**

**4- Cryophytes**

**5- Thermophytes**

**1-Aquatic algae:** Majority of the algal genera is aquatic and is found either completely submerged or free floating on the surface of water. Aquatic algae usually occur in ponds, pools, tanks or in slow running rivers and are called **freshwater** forms.

**2- Terrestrial algae:** Many algal genera are found on or beneath the moist soil surface and are called terrestrial algae.

**3- Aerophytes:**  such algal forms are adapted for aerial mode of life and occur on the tree trunks, moist walls, flower pots, rocks and get their water and carbon dioxide requirement completely directly from atmosphere are called **Aerophytes**.

**4- Cryophytes:**  these algae are found on the mountain peaks covered with snow and impart attractive colors to the mountains e.g., ***Haematococcus nivalis*** gives red color to Arctic and Alpine regions.

**5- Thermopytes:** these algae occurring in hot springs at quite high temperature are called thermophytes. There are certain algae which are known to tolerate the temperature up to 85 C̊ e.g., ***Oscillatoria brevis****.*

**Classification**

-**Algal characteristic basic to primary classification**

 **The primary classification of algae based on certain morphological and physiological features. The chief among these are**:

**a) Pigment of the cell.**

**b) Chemical nature of stored food material.**

**c) Kind, number and relative length of the flagella on the motile cell.**

**d) Chemical composition of cell wall.**

**e) Presence or absence of nucleus in the cell.**

**Strucutre of algal cell**

The cells constituting the algal thalli are basically of two kinds: **prokartotic** and **eukaryotic**. The prokaryotic cell which constitute thalli of cyanophytes (blue green algae) it have a cell wall which contain a specific strengthening component not found in the cell walls of other algae, it is called **mucopeptide.** The prokaryotes cells lacking a membrane-bound nucleus, mitochondria and plastids and do not divided by mitosis. Eukaryotes cells with a nucleus plus typical membrane organelles and have the same structure as is typical of the higher plants.

**Algal pigments**

The color of the algal thallus which varies in different classes of algae is due to the presence of definite chemical compounds in their cells. There are called the **pigments**.

 Each group has its own particular combination of pigments and a characteristic color which is not found in the other algae groups. The photosynthetic pigments in algae are of three kinds, namely: **chlorophylls, carotenoids** and **phycobilins** or **biliproteins.**

Cartenoids are fat soulable yellow colored pigments and subdivided into **carotene, xanthophylls** and **cartenoid acids.**

Phycobilins are water soluble **blue (phycocyanin)** and **red (phycoerythrin)** colored pigments and are present in the members of Cyanophyceae and Rhodophyceae.

**Algal flagella**

The motile cells of algae are provided with fine, protoplasmic, whip-like threads called the **flagella.** The flagella on the cell may be equal **(isokont)** or unequal (**heterokont**) in length.

There are two main types of flagella, **whiplash** and **tinsel.** The whiplash flagellum has a smooth surface. The tinsel flagellum bears longitudinal rows of fine, minute flimmer hairs arranged along the axis almost to the tip of the flagellum.

**Nutrition**

With respect to their nutrition, the algae are **autotrophic**. All or most of the cells of the thallus normally contain chlorophyll. The green cells can manufacture their own carbohydrate food from carbon dioxide and water through the agency of sunlight. The aquatic forms obtain water and caron dixiode by osmosis and diffusion respectively from the medium in which they grow.

**Reproduction in algae**

There are two types of reproduction, **asexual** and **sexual.**

**i) Asexual reproduction:** it consists in the separation from the parent of a highly specialized cell or a group of cells which directly develops into a new individual resembling the parent. This type of reproduction take place in a variety of ways:

**1-** **Spore formation:** the spore are reproductive units specialized for asexual reproduction. Each unit can grow into a new organism by itself.

There are many types of spores, the most important ones are:

1. **Zoospores**: formation of zoospores is the most characteristic method of asexual reproduction in most of the green algae.
2. **Aplanospores**:they are non-motile and constitute a normal means of asexual reproduction in the terrestrial species of the yellow green algae e.g., *Vaucheria*.
3. **Hypnospores**: Under certain extreme environmental condition the aplanospores in green algae secrete thicker walls around them and they called hypnospores**.**
4. **Akinetes**: they are resting cells which mainly serve as means of perennation rather than multiplication. During the sever conditions the cell wall of akinetes thickened. The akinete contain abundant reserve food.
5. **Carpospores**: spores produced directly in the carpogonium after fertilization of the egg are called carpospores.
6. **Tetraspores**: in brown alga (phaeophyta) non-motile spores known as tetraspores are produced in specialized cells known as tetrasporangia.
7. **Pseudohormocytes**: are clusters of cells formed terminally on erect branches of westiellopsis- blue green alga. These are formed after repeated transverse and longitudinal divisions of terminal cells.

**2- Fission:** It is simple division of a unicellular alga into two new daughter cells.

**3- Fragmentation:** it is the breaking away of a few or many celled segments of a filament. Such bits of living cells are calledthe **fragments.**

**4- By the formation of adventitious branches.**

**5- By the formation of tubers.**

**6- Budding.**

**ii) Sexual reproduction:** it involves the fusion of two specialized reproductive cells called the gametes. Fusion may occur between two vgametes from the same plant **(monoecious**) or from different plants (**diocious**). The process of fusion called the **fertilization**. And the product of fusion called the zygote.

In general, it is of two main types, **isogamous** and **heterogamous.**

1. **Isogamy:** It is the simplest and the most primitive type of sexual reproduction. It consists in the fusion of morphologically identical gametes, which they are similar in size and structure and are called the **isogametes**. The act of fusion in isogamy is called **conjugation** and the product of fusion called **zygospore.**

**b)Heterogamy**: It includes the fusion of dissimilar gametes. The fusing gametes differ in size, structure and physiology.

Heterogamous sexual reproduction is of two types:

**1- Anisogamy**: It involves the fusion of gametes which are dissimilar and are produced in modified vegetative cells called the **gametangia.**

**2-** **Oogamy**: The gametes are produced in special sexual organs which are differentiation from ordinary vegetative cells. The female sex organ is enlarged, it is called **oogonium.** While the male sex organ is smaller in size and is called the **antheridium**