Algae

The algae are a large, varied, heterogenous group of organisms with diversity of forms, structures, reproductive systems & life histories (Fritsch 1935)

- Consisting predominantly of aq. plants showing relatively little differentiation of tissues & organs.

Def^n i) The algae are those chlorophyll bearing organisms which are thalloid i.e., having no true roots, stems & leaves or leaf-like organs. - G. M. Prescott (1969)

ii) Simple plants with an autotrophic mode of nutrition - G. M. Smith (1955)

The word 'algae' is derived from a Latin word 'alga' (means seaweeds)

- The science that deals with their study is called algology

- The Greek word for algae is phykos ∴ their study is called phycology (Gk. phykos = sea-weeds; logos = study / discourse)

- Approx - 1800 genera & 21,000 spp.

General Characters of Algae:

1. Algae are the simplest, green, mostly aquatic plants.

2. They are non-flowering, non-vascular, autotrophic plants.

3. Plant body is called Thallus. It is very simple, not differentiated into root, stem and leaves.

4. (Algae show a great variation in Thallus structure.)
Thallus organization in algae varies greatly and shows a clear range.

5. The thallus may be unicellular & multicellular (colonial), sigle celled or colonial, branched or unbranched, filamentous or non-filamentous.

6. The size of the algae also varies greatly. most of them are microscopic and many are even unicellular (Chlamydomonas) Dunaliella attaining a maximum size of 0.5 cm in diameter.
On the other hand, there are macroscopic genera attaining size of 30 m or even more eg. Macrocystis.

7. Each cell is bound by a typical cell wall (exception Euglena & Gymnodinium - pellicle is present)

- The cell wall is double layered in most of the algal members.
- The outer layer is made up of pectin & inner layer is made up of cellulose.

8. Motile members (zoospores & gametes of many) of algae bear flagella which are the means of motility.
- They may be equal or unequal (may be Tinsel or whiplash).
- The whiplash type is smooth & regular throughout its length, whereas the tinsel type has small outgrowths throughout the length & appear like a feather.

9. The cells are prokaryotic (blue green algae) or eukaryotic.

10. The cytoplasm of eukaryotic algae cells contain well defined nucleus, contractile vacuoles, mitochondria, eyespot, Golgi bodies, pyrenoids various types of pigment.
However, in prokaryotic cell mitochondria, Golgi bodies, E.R & definite nucleus are absent.

11. Important pigments in algae are chl-a, chlorophyll b, β-carotene, xanthophylls & phycobilins.

12. Reserved food material is in the form of starch, fats, oils, leucosin granules, volutin granules, carbohydrates like mannitol, laminarin & floridian starch.

13. Growth is controlled by the hormones or hormone like growth regulators present within the cell.

14. Reproduction in algae takes place by all the three means i.e. vegetative, asexual & sexual.

15. Various means of vegetative repn. are fragmentation, fission, akinete, tuber, hormogonia, etc.

16. Sexual reproduction varies from simple isogamy to advanced oogamy.

17. The sex organs are unicellular without sterile jacket.

18. Gametophyte is dominant phase in the life cycle.

19. Few groups of Algae also show a distinct & well defined isomorphic & heteromorphic alternation of generation.

* Ecology & Distribution

The algae are aquatic, both marine & fresh water & occur on and within soil and on moist stones & wood as well as in association with fungi & certain animals.

1. Hydrophytes:
They are completely submerged or free floating on the surface of water.
eg. Chara, spirogyra, diatoms, Nostoc, chlamydomonas.

2. Edaphophytes:
Such algae are also called terrestrial algae. They are found upon or inside the surface of the earth.
eg. Vaucheria, Nostoc, Anabaena, & Euglena (in paddy field)

3. Aerophytes:
Such algae are aerial in habitat. They are found upon the trunks of trees, walls, fencing wires, rocks & animals & so many other aerial substrata.

4. Cryophytes: The algae found on ice & snow.

5. Symbionts: Many algae grow in symbiotic association with other plant.
eg. Lichen - Algae found in symbiotic association with fungi.

- Anabaena azollae is found inside the leaves of Azolla (a pteridophyte)

6. Parasite
Certain algae are parasites upon other plants
eg Cephaleuros virescens - causes the havoc of tea foliage in Assam called red rust of tea.

- The algae are of great importance as 1° producers
- They form the basis of food cycle of all aq. animal life.

- It is thought that 90% of the photosynthesis on earth is carried by aq. plants & planktonic (suspended) algae are chiefly responsible for this.

- During photosynthesis produce O_2

Range of Thallus Organization:

- The range of thallus (somatic structure) of algae can be divided into different types as follows

1. Motile forms:

a. Unicellular motile form:

- Simplest type of body of algae is motile and unicellular.
- It is found in all major groups except phaeophyceae, Rhodophyceae, Bacillariophyceae & Myxophyceae.
- The distinguishing feature is the presence of a unicellular plant body bearing means of motility i.e. flagella.

eg. Chlamydomonas.

- It is biflagellated plan body surrounded with a definite cell wall, enclosing a cup shaped chloroplast, one or more pyrenoid two contractile vacuoles, an eyespot, other cell organelles and a nucleus.

b) Multicellular motile form:

- These are colonial members of algae whose cells bear the means of motility i.e Flagella.
- Innumerable number of cells are present in the colony.

eg Volvox

- 500 to 50,000 cells are interconnected with each other with the help of protoplasmic connections in Volvox.
- It is hollow, spherical & contain a single layer of cells arranged on the periphery.
- All the cells are chlamydomonad in structure

2. Non-motile form:

a. Unicellular non-motile form:

- They posses unicellular plant body with no-flagella.

eg. Chlorella

- It possesses microscopic spherical cells, each with nucleus & cup-shaped chloroplast.

b. Multicellular non-motile form

- The algae posses definite number of cells
- The cells are non-motile and do not have flagella or any other means of motility

eg- Hydrodictyon

In Hydrodictyon the cells remain connected in the form of groups of 5 or 6, forming pentagonal or hexagonal structure.

3. Palmelloid form:

- These are the colonial algae surrounded by mucilagenous covering.
- The number, shape and size of the cell is not constant.
- All the cells are quite independent of one another and fulfil all functions of an individual.

eg. In chlamydomonas temporary palmelloid stage is present They loose flagella, undergo division, form 6-18 cells and get surrounded by mucilage.
During favourable condition mucilage gets dissolve and all cells are set free.

. In tetraspora palmelloid habit is the permanent feature

4. Dendroid form
(Dendroid means tree like)
eg. Prasinocladus of chlorophyceae
The plant body appears like microscopic tree.
. The Dendroid type is the variant of the palmelloid type in which mucilage is produced only at the base of cells.

5. Coccoid form:
. In coccoid form the flagella have been lost and plant body becomes rounded.
. This rounded body has no power of division and can not reproduce vegetatively.
. It is very common in order Chlorococcales
eg. Chlorococcum humicola

6. Filamentous form:
. Many cells are arranged one upon the other in a definite sequence or row and form a filament.
. The filament may be unbranched or branched.
i. Unbranched
eg. Spirogyra, Zygnema, Oedogonium, Nostoc
ii) Branched
eg Cladophora, Bulbochaete, Callithamnion

7. Heterotrichous form:
(Hetero = different, trichous = filament)
. The plant body is much evolved & consist of more than one type of filament.
eg. Drapanaldia, Fritschiella

- Usually the plant body consist of a prostrate system from which develop an erect system of filaments called primary projecting system.
- It may also divide into many branches representing secondary and tertiary projecting system.

8. Siphonous forms
- The plant body consist of branching filaments having many nuclei & no partition walls.
- Because of the presence of many nuclei such an organization of plant body is called coenocyte.
- The cross walls appears only at the time of formation of reproductive bodies.
- Present in the ~~orders~~ chlorophyceae and Xanthophyceae.

eg. Vaucheria

9. Uniaxial form:
(Uni = one ; axial = axis)
- The plant body is made up of such pseudoparenchymatous thalli in which one main axis () is present and all others are side branches.

eg. Batrachospermum

10. Multiaxial form:
(Multi = more than one; axial = axis)
- The thallus construction is such that there are present a number of threads in close position, giving the appearance of more than one axes.

- Different filaments of central and side axes form more or less a compact cortex.
eg. Polysiphonia.

II. Parenchymatous form:
- Abundant septation of a filament in two or more planes resulting in the formation of a parenchymatous body in some algae.
- It may be foliose and flat eg. Ulva, tubular eg. Enteromorpha.
- Macrocystis become so complicated that even sieve tube like structure are also developed similar to higher plants.

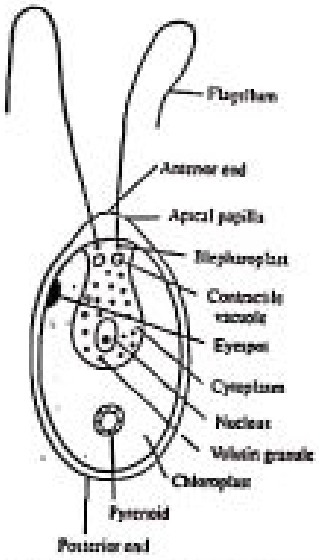


Fig. 6.2 A vegetative cell of *Chlamydomonas*.

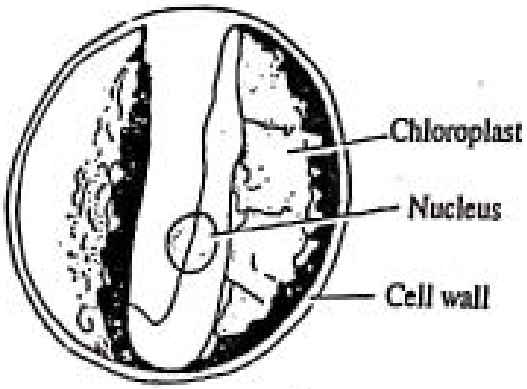
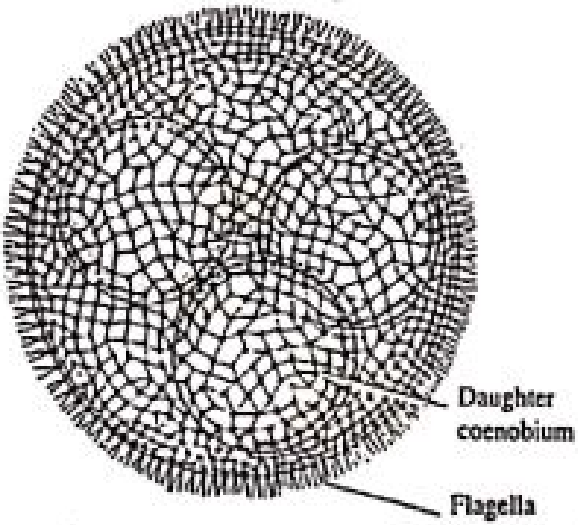
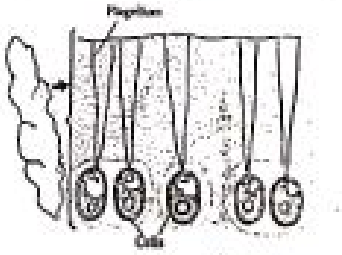


Fig. 6.3 A cell of *Chlorella*.





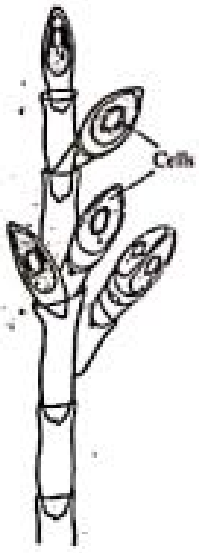


Fig. 6.8 Dendroid habit of *Prasinocladus*. (after Fritsch)

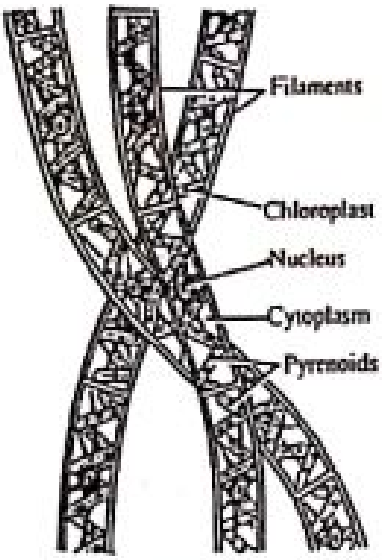


Fig. 6.9 Three unbranched filaments of *Spirogyra*.

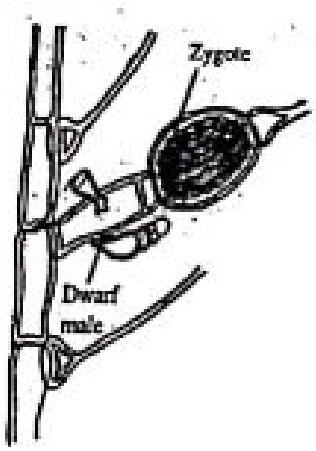


Fig. 6.10 Branched filament of *Bulbochaete*.

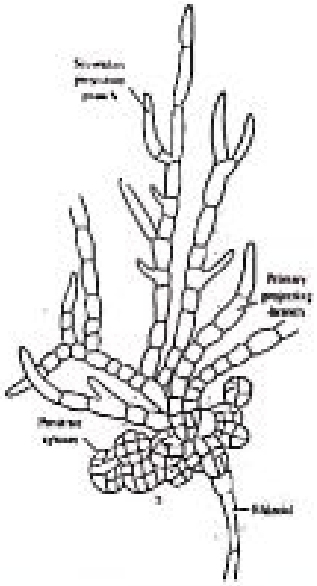


Fig. 6.11 [illegible]

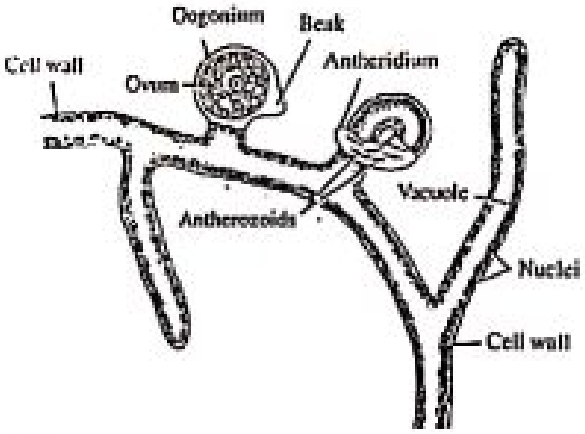


Fig. 6.12 *Vaucheria* showing siphonous habit.

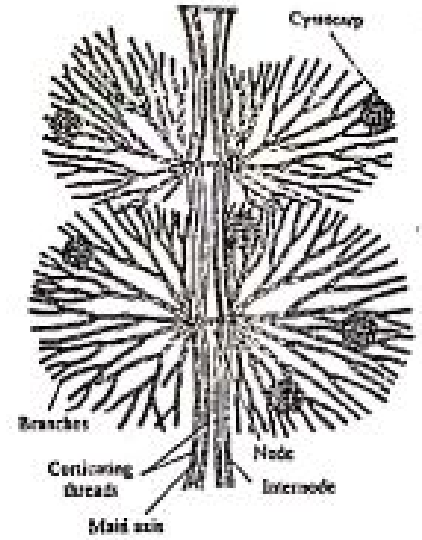


Fig. 6.13 A part of thallus of *Bakachosperma* showing uniaxial habit.

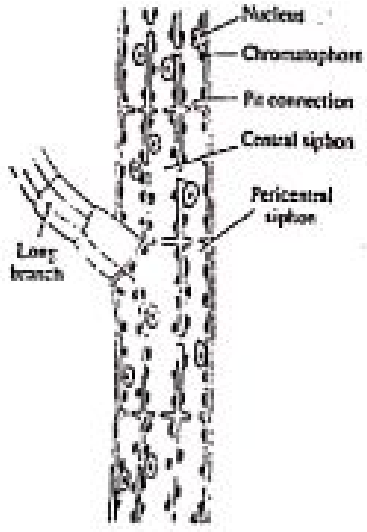


Fig. 6.14 A part of thallus of Polysiphonia showing central and pericentral siphons.