ALGAL ECOLOGY

Algal relations with Environment

ALGAE

- The algae comprise a large varied, heterogenous , group of organisms with enormous diversity of form structure,reproduction system and life history
- The algae are thallophytes (plant lacking roots ,stems and leaves) that have chlorophyll ‘a’ as their primary photosynthesis pigment and lack a sterile covering of cells arround the reproductive cells

HABITS AND HABITATS OF ALGAE

- There are over 35,000 species of algae wich live in all sorts of habits and show a high degree and biochemical plasticity some algae are uni cellular & multi cellular
- The most habitats they function as the primary producers in the food chain producing organic material from sunlight, carbon-dioxide and water
- Beside forming the basic food source in the food chain they also provide the oxygen necessary for the metabolism of the consumer organism

ALGAL ECOLOGY

- Algal ecology is the study of the distribution and abundance of algae, of the environment in which they exist, and of the interaction between the algae and other organisms
- Algae are important components of aquatic ecosystems because they reflect the health of their environment through their density, abundance and diversity in any habitat

Ecology of algal forms can be studied under following heads:

- Ecological Classification – Ecologically algal forms are divided on the basis of Location of algae in different ecosystem
- Factors affecting algal growth
  - Biotic
  - Abiotic
- Role of algae in complex ecosystem

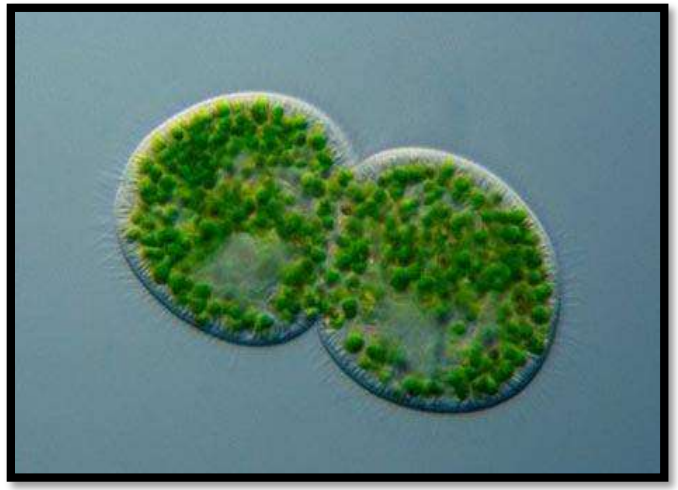
1. Location of Algae in different ecosystems

- **Planktonic algae** – Floating or free swimming algae
  - ✓Planktonic forms – Cholrella, chlamydomonas, Volvox, Microcystis, Anabaena, Spirulina, Oscillatoria
- **Benthic algae –** Attached to one or more substratum
  - ✓ Cladophora, Chara, Polysiphonia, Ulva, Ectocarpus
- **Thermal algae –** Tolerate very high temperature up to 85^{o}C or boiling water
  - ✓Myxophyceae, some Cholrophyceae and Bacillariophyceae

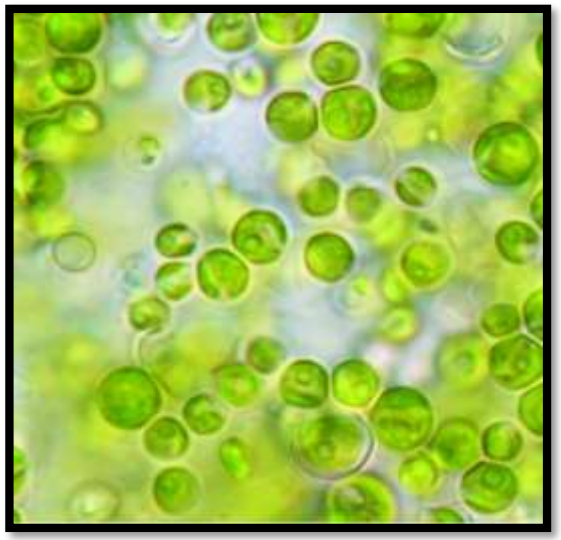
- **Soil algae** – also called Terrestrial algae or Edapophytes
  - ✓ Vaucheria, Oedogonium, Nostoc, Oscillatoria
- **Crybophytes –** Algae growing on snow covered peaks of high mountains
  - ✓ Chlamydomonas, Cylindrocystis, Protoderma
- **Lithophytes –** Algae growing attached to stones and rocky surfaces
  - Epilithic – On surface of rock
    - ✓Calothrix, Rivularia, Gloeocapsa, Ectocarpus
  - Endolithic – Live inside rock
    - ✓ Podocapsa
- **Epiphytes –** Algae growing attached on the other plants for support only
  - ✓ Oedogonoium, Coleochaete, Chara, Nitella

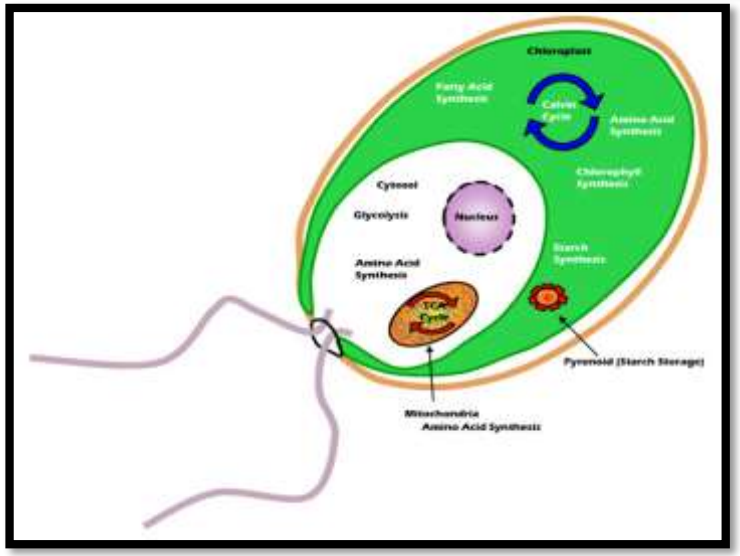
- **Halophytes –** High salt concentration water habitat
  - ✓ Chlamydomonas, Ulothrix
- **Symbiont –** Live in assosiation with other dissimilar organisms for mutual advantage
  - ✓ Nostoc in Anthoceros, Anabaena in Cyacada, Lichens
- **Endozoic algae** – Inhabiting the protopalm of other organisma
  - ✓ Chlorella within Paramecium, Hydra and Molluscs
- **Parasitic algae** – Growing on plants for food
  - ✓Cephaleuros on leaves of angiosperms like mango, Rhododendron

PLANKTONIC ALGAE



Chlorella





Chlamydomonas

Benthic Algae

Figure 3. Benthic algae at a Russian River recreation beach

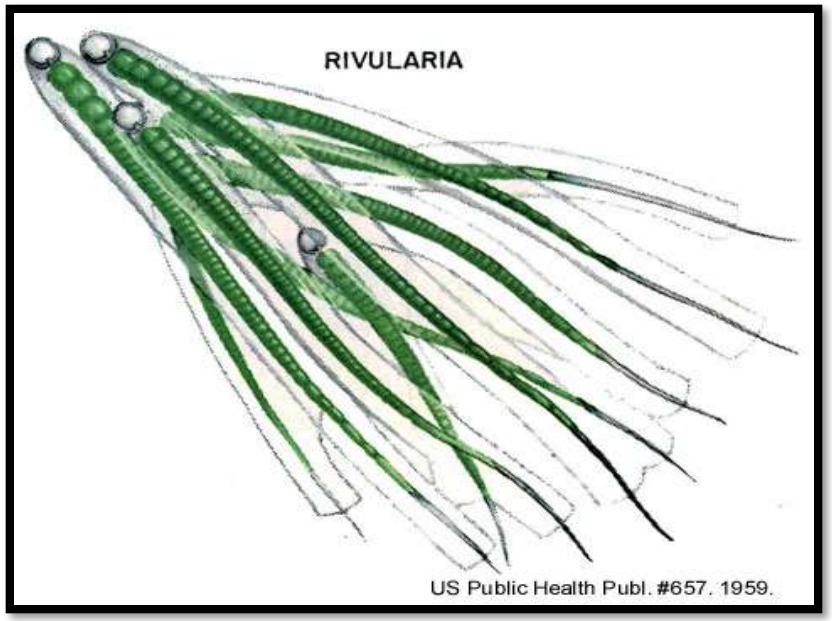
Chara

Cladophora

SOIL ALGAE

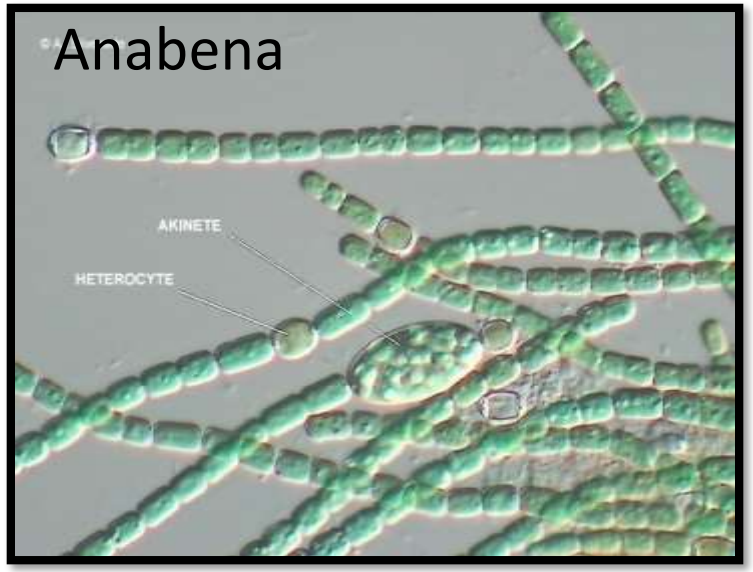
Vaucheria

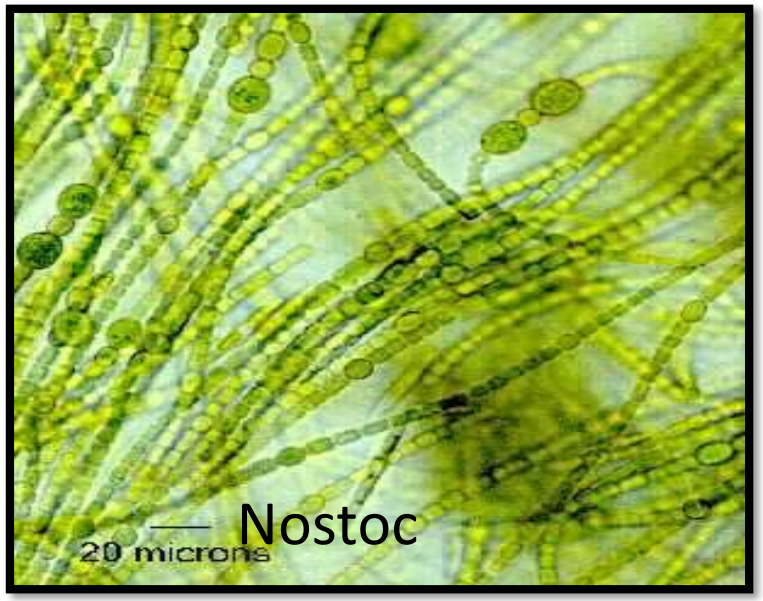
LITHPHYTES



Rivularia

SYMBIOTIC ALGAE





Factors affecting Algal Growth

Abiotic

- Light
- Temperature
- Salinity
- Nutrients
- Water motion
- Tides
- Sand Burial

Biotic

- Herbivory
- Epiphytism
- Competition

LIGHT

- Amount of radiant energy impinging on a unit of surface area

Light affecting

- ✓ Latitude
- ✓ Seasonal changes
- ✓ Surface waves
- ✓ Turbidity due to silt, particulate matter, phytoplankton

- ✓ Long wavelength, low energy wavelengths absorb first
- ✓ High energy, short wavelengths scatter due to water molecule and particulates
- ✓ Different divisions have different pigments, allow potentially different depth distributions
- ✓ Red, green and brown algae mixed throughout tidal zonation complexity
- Within species, ratio of accessory pigments, up regulation of pigments and size of thallus mainly affect photosynthetic activity
- Morphological factors like surface area and thallus thickness affect positively

TEMPERATURE

Affects all levels of biological organization – molecules, cells

- ✓ Photosynthetic efficiency
- ✓ Enzymatic activity
- Increase in dispersal rate
- Change in dispersal pattern
- Shifting boundaries

SALINITY

- Measurement through refractometer- light refraction
- Causes Osmoregulation changes in sea weeds
- Pumping ion both in out in sea weeds alters
- Resulted in plasmolysis or osmotic stress
- Gametes and spores are more sensitive

Euryhaline : Species that can handle wide range of salinities

Stenohaline: Species that can only survive in a narrow range of salinities

NUTRIENTS

- Macro nutrients necessary for algal growth

C, H, O,K,N, Ca, F, Mg and P

Algae require N for amino acids, protein synthesi and nucleic acid synthesis

It get available in the form of Ammonium (NH_4), and Nitrate (NO_2)

Some Cyanobacteria can fix atmospheric nitrogen

WATER FLOW

- All macroalgae have a boundary layer of water around the thallus, affects contact with nutrients and gasses
- Algae depend on water motion to deliver gasses nutrients and remove O_2 from their surface
- In still water condition maximum uptake of nutrients possible

Complicated effects of Water flow

Positive effects

- Reduce shading by rearranging thalli
- Mixing of nutrients
- Reduce boundary layer
- Dispersal of spores, gametes, zygotes

Negative effects

- Damage, destruction
- Loss of setting zygote and germlings
- Energetic expense of structure
- Inhibits external fertilization in some sp.

Tidal Zonations

- Low tide zones exert boitic interaction
- High tidal zones exert physical factors

Adaptations to living intertidally

- Wicked hold fast for attachment
- Small morphology
- Tolerant to high temp., desiccation
- Abundance of photoprotective pigments

SAND BURIAL

- Recover or resist
- Opportunistic species – Ectocarpus, Ulva
- Stress tolerators – Gymnogongrus, Laminaria

ROLE OF ALGAE IN COMPLEX ECOSYSTEM

Abundant growth of algae in natural waters may bring about significant changes in the quality of water

- **Discoloration of water due to dominant growth: blooms**
- **Reduction of water clarity**
- **Toxin production**
- **Alteration of food web**
- **Leading to water pollution: Eutrophication**
- **Algae are accountable for the net primary production of 52,000 of organic carbon produced on earth each year they constitute a group of 40,000 species**