Ist semester (1st Paper)

BIOLOGICAL AND ECONOMIC IMPORTANCE OF ALGAE

SUBTOPICS

A. General Uses

B. Algae In Medicine

C. Role Of Algae In Industries

D. Negative Role Of Algae

INTRODUCTION

- Algae are ubiquitous, practically occurring in every habitable environmental across the globe. Majority of algae are abundant in stagnant waters.
- They have also been reported in habitats like hot water springs, ice, damp soils, rocks crevices, tree trunks, old walls, garbage pits and waste bunks.
- Free floating assemblage of algae also constitute a huge group of algae which are known as phytoplankton.

INTRODUCTION

- A number of algae live inside tissue of other members of plant kingdom which are known as endophytes. In some cases symbiotic association i.e mutual benefit sharing, and epiphytic association i.e without causing harm to the host, is also common.

INTRODUCTION

- The photoautotrophic algae are the major producers of organic materials and they play a key role at the base of food chain in aquatic and semi-aquatic habitats.
- The algae constitute a source of base food wherein their chemical extracts have a potential in manufacture of synthetic food and other useful products.

INTRODUCTION

- Some times the algae are labeled as phycotoxins as they secrete certain toxins which cause poisoning.
- Certain algae also play “nuisance role” wherein they tend to block water supply canals or filtration units due to eutrophication of reservoirs and connecting tubes or canals.

ECONOMIC IMPORTANCE

- A. General Uses

1. Primary Producers

- Algae are the main Oxygen producers in aquatic areas. They are also useful in decreasing water pollution by realizing Oxygen. 10% of total photosynthesis carried out by plants is carried out by the algae.
- These activities of algae forms 1.6-15.5 x 10 to the power of 11 tones of carbonic material like food.

2. Algae as food

- Algae species are used as food in several countries and in several forms.
- Algae species have proteins, vitamins (A, B, C and E), lipids, and minerals. *Laminaria* species is the important edible seaweed in Japan and the food item 'Kombu' is prepared from it.
- 'Aonori' from *Monostroma*; 'Asakusa Nori' from *Porphyra* are prepared in different countries. *Porphyra* has 35% protein, 45% carbohydrates, Vitamins B and C and Niacin. *Nostoc* is used as food material in South America

3. Algae as fodder for cattle

- *Rhodymenia palmata* is used as food for sheep in Narvey.
- *Laminaria saccharina*, *Pelvitia, Ascophyllum*, etc. species are used as food for cattle.

4. Algae as fertilizers

- Blue-green algae are treated as bio-fertilizers from olden days.
- *Nostoc, Oscillatoria, Scytonema, Spirulina*, etc. are used as fertilizers to rice fields.
- All these algae fix the atmospheric nitrogen.
- Cultivation of *Spirulina* is gaining importance as feed for fish, poultry and cattle.

5. Algae in Pisi culture

- Sea algae are used as food for fishes. So they play an important role in Pisi culture.
- Some green-algae, diatoms, some blue-green algae are used as food material to fishes.
- These are also making the water clean, by realizing Oxygen.

6. Algae in reclamation of alkaline or usar soils

- Our country has more number of alkaline soils or sterile soils. Blue-green algae like *Nostoc, Oscillatoria, Scytonema, Spirulina* are used to modify these soils in to fertile soils.
- Because they fixed nitrogen in to soil. Nearly they fixed 400kg. of nitrogen per year.
- Soil erosion is also reduced by these algae.

7. Algae in industry

- Iodine industry is mainly depended upon algae.
- Algae belonging to Phaeophyceae, like *Laminaria, Ecklonia*, *Eisenia*, etc. are used in the industry to prepare iodine.
- *Phyllophora* is used to prepare iodine in Russia.

8. Antibiotics

- Antibiotic Chlorellin, obtained from Chlorella is effective against a number of pathogenic bacteria.
- Extracts from *Cladophora, Lyngbya* can kill pathogenic Pseudomonas and Mycobacterium. *Laminaria* is used as one of the modern tools for abortion.
- Seaweeds have beneficial effect on gall bladders, pancreas, kidneys, uterus and thyroid glands.

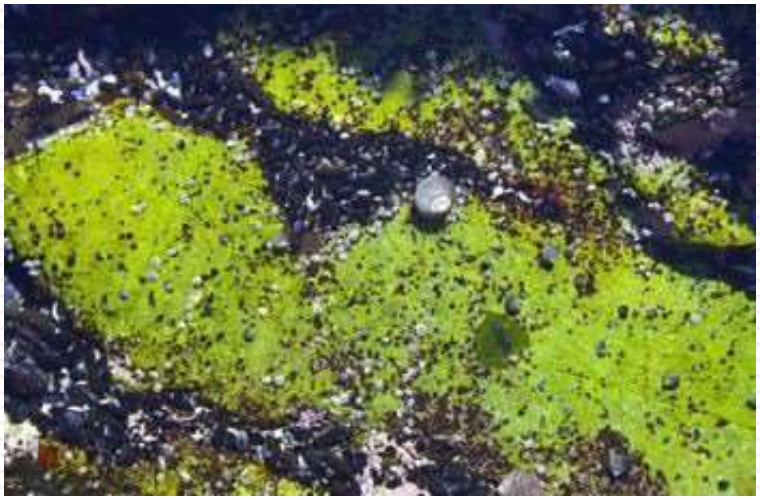
9. Role of algae in sewage disposal

- Some species like *Chlamydomonas, Scenedesmus, Chlorella, Pondorhina*, *Euridina*, etc. are living in sewage water.
- They are mainly useful to clean the water by releasing oxygen.
- They also modify the carbonate material in the water into N, P, K fertilizers.

9. Role of algae in sewage disposal

Various types of algae being used for power generation, soil fertility improvement and wastage treatment

9. Role of algae in sewage disposal



Various types of algae being used for power generation, soil fertility improvement and wastage treatment

9. Role of algae in sewage disposal

A and B Marine blue green algae and freshwater green algae used for various manufacturing processes like medicine and preservatives

ECONOMIC IMPORTANCE

A and B green algae accumulating in stagnant waters helping in improving water quality for irrigation of commercial crop fields

10. Algae as research material

- In biological research, algae are useful because of their rapid growth, brief life span and easy mode of cultivation.
- *Chlorella, Scenedesmus* and *Anacystis* are used in investigations in photosynthesis.
- Blue-green algae are used in studies on nitrogen fixation.
- Researches in genetics and cytology are carried out on *Acetabularia*.

11. Algae in space

- *Chlorella* and *Synechococcus* are finding application in space ships and nuclear submarines as oxygen regenerating and food and water recycling organisms.

12. Algae recreational use

- Some select algae are grown in recreational areas like lakes and streams along with fish.
- *Trentophila* giving reddish colour to land looks beautiful, *Oedocladium* imparts valvety appearance to the soil, *Vaucheria* gives parrot-green colour to gardens.

13. Algae as fertilizer

- Many algae increase the water-holding capacity besides the addition of their chemical constituent in the soil.
- In India, *Turbinaria* is used around palm tree while as sea weeds are used as compost.

14. Algae in soil fertility and land reclamation

- The species of *Nostoc, Syctonema, Aulosira, Lyngobya, Microcoleus, Aphanothece, Anabaena*, etc. show adaptability to moist soil surfaces and most of these can fix atmospheric nitrogen and increase the soil fertility.
- Due to their mucilaginous sheath, they are able to prevent soil erosion by binding the soil particles firmly.

B. Algae In Medicine

B. Algae In Medicine

15. Brown algae mainly used in manufacture of various goitre medicines due to their high iodine content.

- The main alga used for this purpose include *Sargassum* and members of Laminariales.
- The extract of *Corallina, Digenia, Codium, Alsidium* and *Durvilla* are used for treatment of veromious diseases

B. Algae In Medicine

16. Some algae, like *Gelidium* are used for treatment of kidney, bladder and lung diseases while *Laminaria* is used as surgical tool in the opening of wound due to its gentle swelling property.

B. Algae In Medicine

17. Antibiotic chlorellin is extracted from Chlorella vulgaris, which inhibits the growth of certain bacteria and a few algae.

Rhodomela larix, Ascophyllum nodosum, Pelvetia etc. have also shown antibiotic properties.

B. Algae In Medicine

18. *Acetabularia* major is used in treatment of kidney and bladder problems.

B. Algae In Medicine

19. *Ulva* is used in treatment of glandular troubles.

B. Algae In Medicine

20. Algae are also used as growth promoting substances. Many algae such as *Phormidium tenue* have been reported to induce greater height and yield in rice. It has also been seen to increase protein content of rice grains.

B. Algae In Medicine

21. In Japan *Spirogyra* is used in manufacture of lens paper, suitable for cleaning of optical instruments.

B. Algae In Medicine

22. Members of blue-green algae, green algae, red algae group have been seen to synthesize and deposit calcium carbonate in the substratum, thus playing a vital role in formation of limestone beds.

B. Algae In Medicine

23. Algae have also been reported to play an important role in indicating pollution.

In certain algae, the growth retards in response to polluted water, while as in some the growth is highly influenced by increase in pollution level of the basic substratum.

In highly polluted areas members of Cyanophyceae and a few euglenoids are common, which destroy the economically important algae like Laminaria.

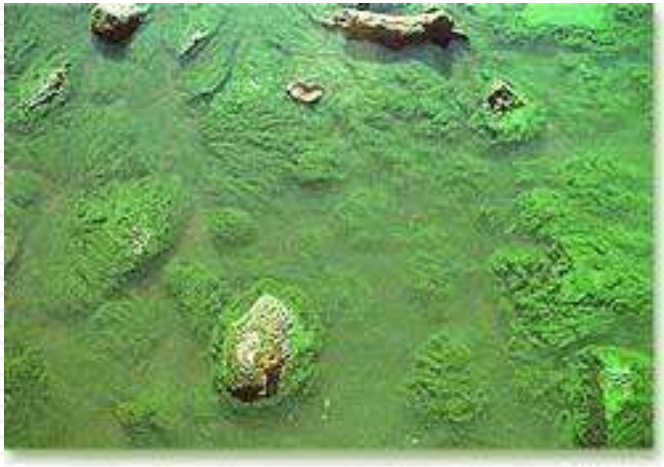
Such contamination also increases growth of benthic marine algae. Water purity is depicted by appearance of diatoms and filamentous green algae.

B. Algae In Medicine

24. Certain algae have been identified as tracers of high organic wastes. A list of about 850 such algae is known, among which some common species are: *Anabaena constricta, Oscillatoria* spp., *Chlamydomonas reinhardii, Chlorella* spp. *Euglena* spp. *Lepocinclis* spp., *Phacus spp*. Etc.

A B

A and B depicitng the huge deposition of algae in stagnant water bodies causing problems of water flow thus, affecting irrigation channels



A **B**

A and B blue green and green algae sometimes alter the colour of ponds and canals of tourist resorts, gardens and parks thus depicting their decorative potential

A

B

C

D

A-D Domesticated algae mainly used for power manufacture

c. ROLE OF ALGAE IN INDUSTRIES

- Many commercial products are extracted from different alga and used as basic raw material in certain commercial industries. These include:

c. ROLE OF ALGAE IN INDUSTRIES

25. Source of alginates: Certain algae like *Macrocystic, Laminaria, Ascophyllum, Lessonia* are used for alginates extraction wherein the seasonal content variation has been reported.

c. ROLE OF ALGAE IN INDUSTRIES

26. Agar-agar: Many red algae are used as the basic raw material for extraction of gel-like non-nitrogenous extract. This material is mainly used in preparation of microbial culture media. Some of the important Agar sources are - *Gelidium, Gracilaria, Pterocladia, Gigartina, Ceramium, Chondrus,* etc.

c. ROLE OF ALGAE IN INDUSTRIES

27. Carrageenan: A mucilage extracted from *Chondrus crispus* and *Gigartina* is a combination of a few polysaccharides which are used in food preparation, textile manufacture, leather manufacture, in pharmaceutical manufacture and brewing industries.

c. ROLE OF ALGAE IN INDUSTRIES

28. Algae as source of iodine: some algae like *Laminaria digitata*, *Fucus* spp., *Ecklonia* spp. etc. are known as important sources of iodine

c. ROLE OF ALGAE IN INDUSTRIES

29. Algae as source of funori and funorin: *Gloeopeltis furcata, Chondrus, Iridaea,* and *Gratilaupia* have been identified as important sources of sizing agents funori and funorin.

c. ROLE OF ALGAE IN INDUSTRIES

30. Algae as source of diatomite: *Diatom* walls are constantly being deposited in fresh water and marine sediments. This in turn deposits a high content of silicon dioxide which ultimately facilitates formation of diatomite. This diatomite is used industrially for filtration processes, refining industries, brewing industries and manufacture of dynamite.

d. NEGATIVE ROLE OF ALGAE

1. Many blue green algae like *Microcyctis, Anabaena, Aphanizamenon*, etc. produce certain toxic compounds which have been seen to either induce harmful effects like loss of weight, weakness, abortion, etc. or have been seen to cause death of domestic animals and fish.

d. NEGATIVE ROLE OF ALGAE

2. Phycocyanin pigment of blue-green algae has been reported to cause burning of internal cells if consumed, and sometimes causes peeling off of skin if applied externally

d. NEGATIVE ROLE OF ALGAE

3. Direct or indirect consumption of dinoflagellates like Gonyaulax with shell-fish has been reported to cause paralysis, respiratory failure and death within hrs (2-12hrs).

d. NEGATIVE ROLE OF ALGAE

4. Members of Cyanophyceae, Bacillariophyceae, Chlorophyceae, Euglenophyceae, Dinophyceae and Chrysophyceae have been seen to cause destruction of water storage sites by interfering with filtration process, facilitates slime formation, cause colouration of water, corrosion of pipes, and interfere with in disinfection process byimparting turbidity.

d. NEGATIVE ROLE OF ALGAE

5. Majority of filamentous algae, like *Cladophora glomerata, Spirogyra, Rhizoclonium, Enteromorphia, Thorea, Compsopogon* have been seen to cause eutrophication of lentic waters like reserviors and lakes.

d. NEGATIVE ROLE OF ALGAE

6. Most of the Cyanophyceae members have been reported to cause poisoning of animals.

- Among these three species *Microsystis aeruginosa, Anabaena* flos-aquae and *Aphanizomenon flosacqae*, are confirmed producers of toxins. Some other toxic blue green algae are *Coelosphaerium, Gloeotrichia, Lyngbya, Nodularia* and *Nostoc*.

d. NEGATIVE ROLE OF ALGAE

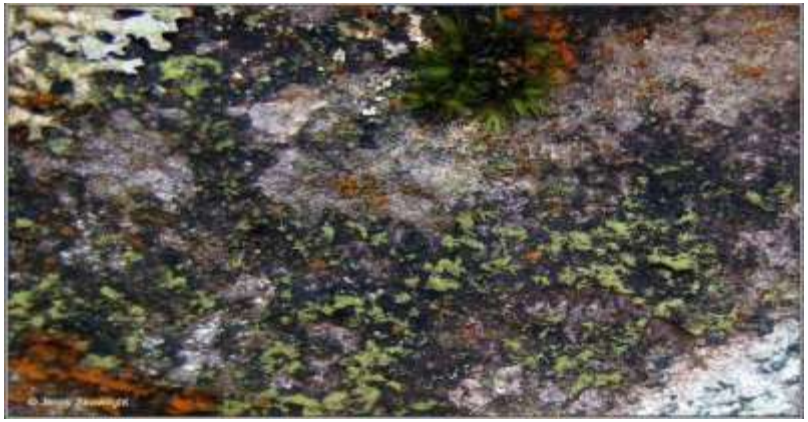
- In marine habitats *Prymnesium parvum* is labeled as the potent exotoxin producer which causes extensive fish mortalities.

d. NEGATIVE ROLE OF ALGAE

- Dinoflagellates are reported to cause paralytic shellfish poisoning (PSP) or neurotoxic shell fish poisoning (NSP). Among these the most drastic damage is caused by *Gonyaulax cantenella.*

d. NEGATIVE ROLE OF ALGAE

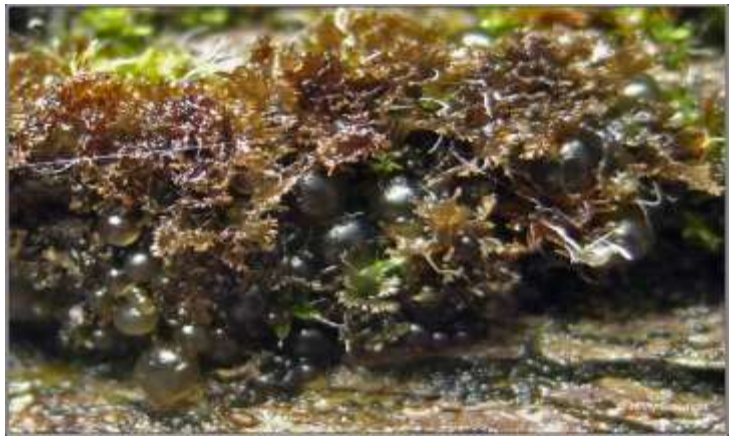
- Organic extract of Chaetomorpha minima is reported to have hemolytic activity and causes fish toxicity



A

B

C



D

A and B *Desmococus* and Fig “c” and “d” *Nostoc* depicitng dense colonial growth in nutrient rich soils