

FYBSC Paper I Semester I

Plant Life And Utilization I

Chapter –II- Algae

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- **Sex differentiation:**
- The conjugating cells of the filaments of spirogyra behave as gametangia since the entire content of each cell metamorphoses into a gamete.
- The gametes produced are morphologically similar and are thus isogametes, but they exhibit differences in their behaviour. One of them is active and moves from the cell of the filament where it is developed to another, where its fusing partner awaits for fusion with it.
- This situation may be defined as primitive anisogamy or physiological heterogamy. The active gamete thus behaves as male and the passive as female. The filaments whose cells produce active gametes are sexually distinct from that whose cells produce passive gametes.

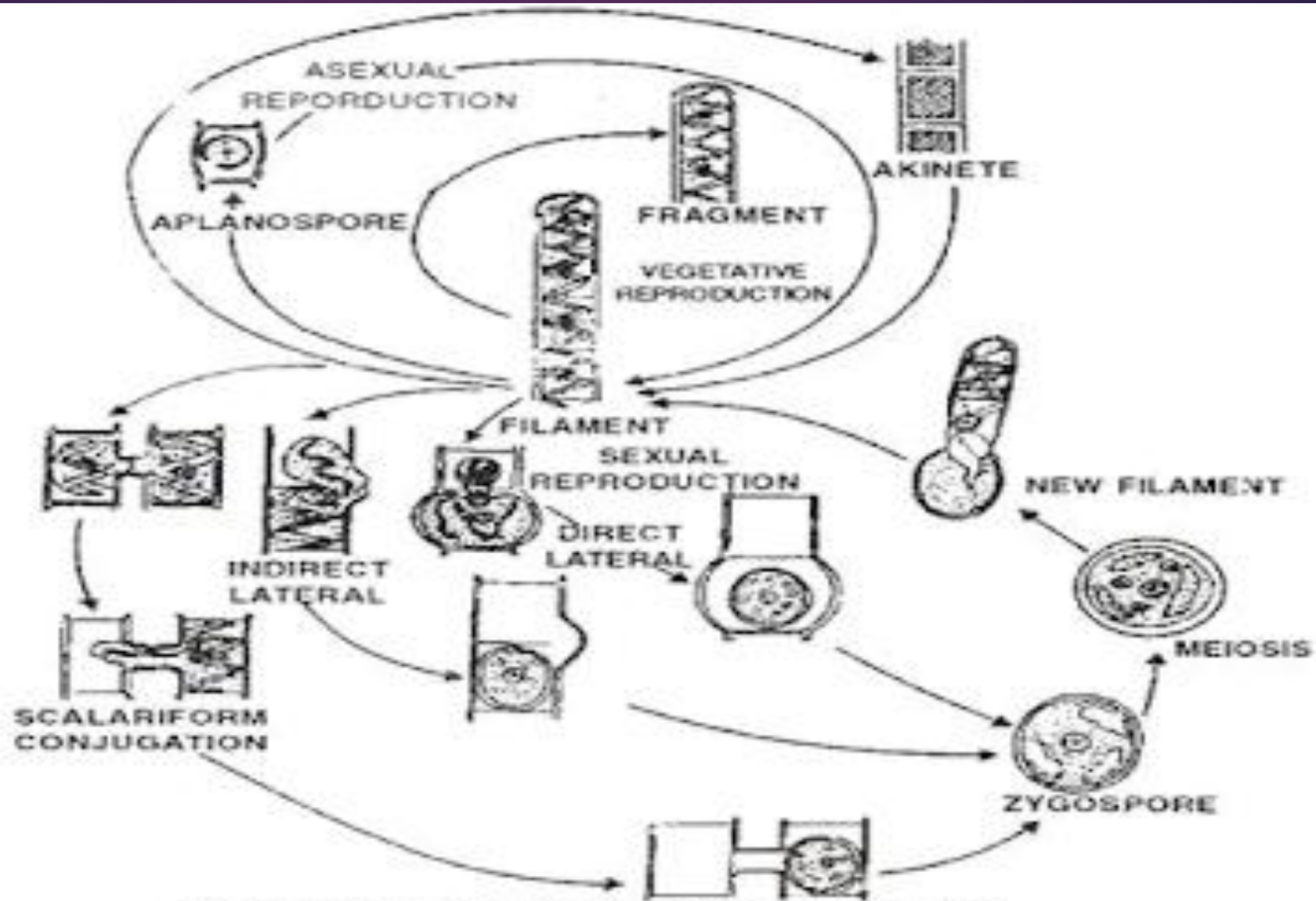


Figure 5.11 Diagrammatic life cycle of *Spirogyra*.

- . Both the filaments are thus unisexual. In spite of such sex differentiation, the sexual reproduction in spirogyra is isogamous since there is no other visible difference between the fusing gametes.

Systematic Position Of *Spirogyra*

Division: Chlorophyllta

1. Dominant pigments are chlorophyll a and b, carotene and xanthophylls.
2. The reserved food material is starch.
3. Motile reproductive cells are bi or quadriflagellate, flagella are equal, whiplash type.

Order: Zygnematales

1. Lacking zoospores
2. Sexual reproduction by conjugation of amoeboid gametes

Family: zygnemataceae

1. The having a filamentous body
2. genus: *Spirogyra*

Algae in biofuel industry:

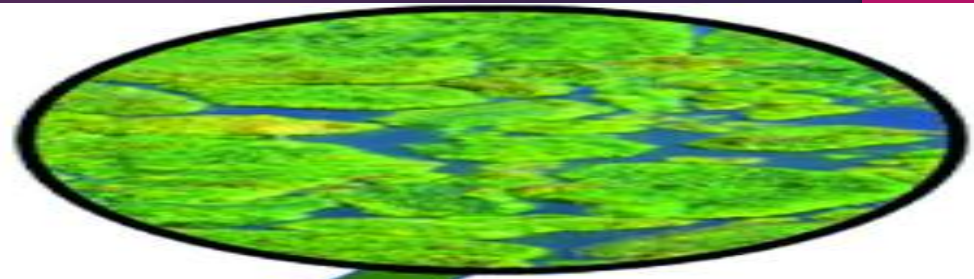
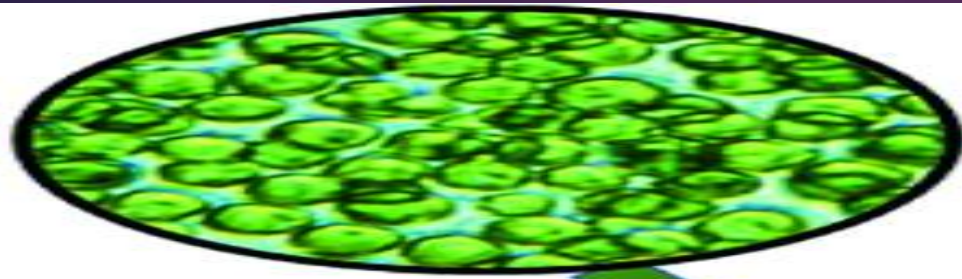
- It is generally believed that, like coal, these fuels owe their energy into to photosynthesis in ancient plants.
- Unlike coal, however, which was are laid down in inland swamps, oil and gas were formed from organic ne matter in marine environments.
- The plankton of the oceans was probably of the greatest importance as a source of this organic matter.
- Some marine algae capture the energy of sunlight, which was or in turn transferred to the animals that fed upon them.
- Organic compounds derived from the plankton, both plant and animal, accumulate in mud deposits in shallow water of the ocean floor.

Algae Biofuel Production Process



- In the source, materials were buried by sedimentary action and, in an oxygen-free environment, gradually converted into oil and gas. Some natural gas is largely methane (CH₄), which can be produced by certain kinds of anaerobic bacteria.
- Gas is generally associated with oil and can result from the action of methane-producing bacteria upon organic compounds. Present day fossil fuel is derived from marine algae.

- **Algae in agriculture:**
- The value of seaweeds in fertilizing the soil was discovered early in the history of agriculture in coastal Asia.
- These days seaweed extract is used to spray all the commercial crops for increasing yield. In the united states, long before the recognition of their potash content, seaweeds were used for fertilizers by the farmers.
- Not only the chemical fertilization, but also the water-holding capacity of Fragments of the algae in the soil proved effective.
- These provided valuable small reservoirs of water in close contact with the roots of the cultivated plants. Furthermore, the bulky organic substances decay slowly in the soil and form humus.



**Algal
biomass**

Agriculture

- 1. Nitrogen fixation**
- 2. Uptake of phosphorus**
- 3. Algae as a source of organic matter**
- 4. Plant growth substances**

- .Again, yield of paddy is increased substantially when paddy field is inoculated with nitrogen fixing blue-green algae.
- Some of them are: *Anabaena oryzae*, *Anabaenopsis arnoldii* *Nostoc commune*, and *Cylindrospermum bengalense*. *Tolypothrix tenius*, *Auloxira fertilissima*, *Calothrix confervicola*.
- Heterocyst in these algae is the site of N₂ fixation. Huge amount of atmospheric N₂ is fixed into the soil by different members of blue-green algae. They form commercial BGA-biofertilizers used today by farmers on large scale for paddy, banana and many other crops.
- The sea weeds extract which is very rich in minerals, vitamins, amino acids, PGRS is today very popular among farmers especially engaged in organic farming. These marine algal species are commercially exploited

- **Algae in pharmaceuticals:**
- Medicinal applications of plants are almost as old as their food uses. From earliest times the chinese used **Sargassum** and various laminariales for treatment of goiter and other glandular troubles.
- **Gelidium** very early employed for stomach disorders and for heat induced illness.
- The gentle swelling of dried **laminaria** stipes upon exposure to moisture make them surgical tool in the opening of wounds.
- Similarly, the orientals have employed the same technique in child-birth for expansion of the cervix.

SI314
60 Tablets



- Perhaps the algae used most widely and for the longest time for medicinal purposes and from which agar is extracted are the agarphytes, including *Gelidium*, *Pterogladi*a And *Gracilaria*.
- The name agar-agar' is of malay origin and means 'jelly'. This jelly was obtained by boiling up seaweeds and cooling the resulting liquid.
- Agar early became useful for stomach disorders and as a laxative, and was once employed as a dietetic.
- It was originally produced and marketed in china, but the japanese took over production in about 1662 and maintained a world monopoly till 1940. The most significant date in the utilization of agarphytes was 1881, when Robert Koch proved the value of agar in the cultivation of bacteria.

. Since that time it has become essential to the work of hospitals and medical research laboratories throughout the world. Besides these, chlorella is used for the preparation of antibiotic **chlorellin**.

Algae as food:

Large number of algae have entered into the diets of human beings from ancient times. The earliest records are those of the chinese, who mentioned such food plants as *Laminaria And Gracilaria* in their 'materia medica' several thousand years ago. The ancient inhabitants of japan were eating *Porphyra* as a healthful supplement to their rice diet. Its use became widespread, not only in Japan, But In China in course of *time*. "**Kombu**", a japanese food is prepared from stipes of species of *laminaria*.



- The most diversified dietary use of seaweeds was developed by the Polynesians and reached its peak in Hawaii, where during the nineteenth century at least 75 species were separately named and used regularly as food in that island world. The Hawaiians called them 'limu' and considered
- The best known and most widely used food alga in Western Europe in recent centuries was Irish moss, or Carrageen (*Chondrus crispus*), which was cooked with milk, seasoned with vanilla or fruit, and made into a highly palatable dish known, as "blancmanges". The jellying qualities of Irish moss gave the alga an early food use. It was a necessary staple of their daily diet.

- Man, thus obtains carbohydrates, vitamins (algae are especially rich in vitamins A and E, and they contain sortie C and D), and inorganic substances, e.g ., iodine (goiter is' unknown among the people who eat seaweeds), not to mention the benefits of the mild laxative action of the ingested algae. Witsch (1959) stated that vitamin R value of young cultures of *chlorella* equals that of lemon.
- In japan, powdered *chlorella ellipsoidea* has been used mixing with green tea.
- In germany and in the united states considerable work is being carried out on the suitability of mass cultures of *chlorella* as an alternative source of human vegetable food.

- Spirulina is highly important in human diet. (SCP single cell protein) vitamins amino acids essential elements required for human .
- *Spirulina* culturing is a big industry today in India and abroad.

- **Algae as fodder:**
- The orientals developed wide human uses for marine algae, but europeans profited by extensive use of these plants for stock feed.
- In ice. Land and Scandinavia, in the British Isles, and along the coast of france, stock has long been driven or allowed to wander to the seashore at low tide to feed on seaweeds. Some kinds of algae, such as *Rhodymenia Palmata And Alaria Esculenta*, are favourable food of goats, cows, and sheep, and in scotland and ireland the stock actively hunt the shores at low tide for particular algae, especially the former.
- The milk does not have any taste of algae, nor is the meat inferior because of the seaweed diet.



- Such animals, that have for several generations been nourished on algae, show. better ability to digest it than those not so habituated.
- The shortage of grain in many parts of Europe during world first led to considerable experimentation with the use of seaweeds food **for cows and horses**.
- Stockfeed factories were established In France, Norway, Denmark and Germany, and various methods treating and reducing seaweeds to meal or powder were developed.
- The favorable results in animal husbandry in Europe led to the industrial processing of the great pacific-coast kelp (*Macrocystis*) for animal rations. Seaweed-meal factories have been operating in the united states for several decades, providing supplementary feeds for poultry, cattle and dogs.

- The high mineral and vitamin C content of kelp meal has made possible its use in various poultry and other animal feeds.

