المجاميع النباتية (5)
المرحلة الثانية

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Rhodoophyta (red algae)

Lecture 5

General features and distribution

- A majority of the seaweeds are red algae, and there are more Rhodophyceae (about 4000 species) than all of the other major seaweed groups combined.
- There are few species in **polar** and **sub Polar Regions** where brown algae predominate, but in **temperate and tropical regions** they far outnumber these groups. The average size of the plants differs according to geographical region.
- The Rhodophyceae also have the ability to live at greater depths in the ocean than do members of the other algal classes.

- About 200 species of Rhodophyceae are found in fresh water, The majority of fresh water red algae occur in running waters of small to mid-sized streams.
- The Rhodophyceae lack flagellated cells have chlorophyll a, phycobiliproteins, **floridean starch** as a storage product, and thylakoids occurring singly in the chloroplast.
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- **Morphology**

- In fact, they are the only eukaryotic algae, which produce no motile stage. Even the reproductive cells are non-flagellated. Unicellular and colonial forms are rare. ***Porphyridium*** is the common unicellular red algae.

- thallus which is very diverse in form. It may be filamentous (***Goniotrichum***), ribbon-like or plate parenchymatous (***poryphyra***). The filamentous thallus is most beautiful of all the algae. It is mostly branched and tufted.

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Cell structure

- The major features of a red algal cell are a chloroplast with one thylakoid per band. **floridean starch grains** in the cytoplasm outside the chloroplast, **no flagella, pit connections** between cells are present.

Pit connections

- The higher orders of red algae are unique in having pits on the cell walls of adjacent cells. These pits assist in **maintaining protoplasmic continuity allowing the passage of metabolites to the developing reproductive cells between these cells.** The pit connection may function as a **site of structural strength** on the thallus.

• A pit connection consists of a proteinaceous plug core in between two thallus cells. There are two types of pit connections. **Primary pit connections** are formed between two cells during cell division. **Secondary pit connections** result when two cells fuse. Both types of pit connections have the same structure. Fig. 1 shows the formation of a pit connection in a red alga.

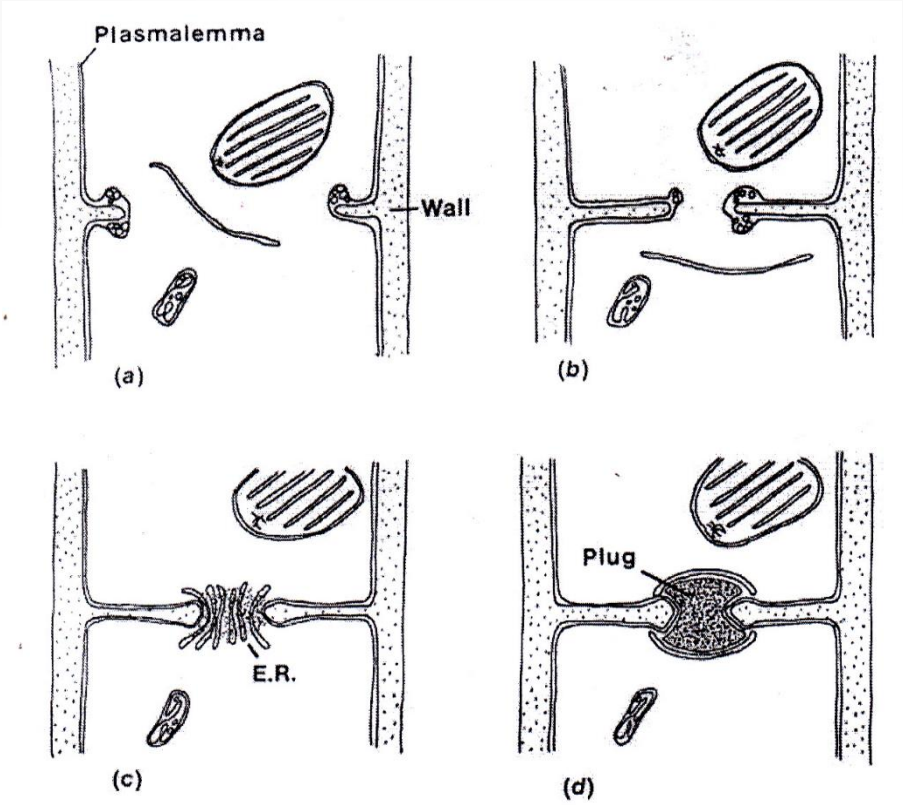

Fig. 1: Semi diagrammatic drawing of the formation of a pit connection in a red alga

- **Pigments**

- The photosynthetic pigments which are located in chromatophores include **chlorophyll –a**, **chlorophyll-d**, carotenes, xanthophylls and biliproteins (**r-phycoerythrin** and **r-phycocyanin**).

- The red algae have the ability for self-adaptation for light intensity. Therefore, these algae could live in the surface water or down in the benthic water. However, in benthic position, the phycoerythrin will be increased and so it will be decreased on the surface water which the green pigment chlorophyll will increased.

- This phenomenon called the **chromatic adaptation**. Phycoerythin reflects red light and absorbs blue light (bluish portion of the spectrum has the shortest wavelength and the highest energy. So, this bluish component is able to penetrate deep down in the ocean depths).Because blue light penetrates water to a greater depth than light of longer wavelengths, these pigments allow red algae to photosynthesize and live at somewhat greater depths than most other algae.

- **Reproductive structures**

- The Rhodophyceae have no flagellated cells. In the life cycle of ***Polysiphonia*** occur three separate kinds of plants. These are the **gametophyte,** the **carposporophyte** and the **tetrasporophyte**

- The gametophyte is a free living haploid plant.it is concerned with the sexual reproduction, the carposporophyte is the diploid plant developed from the zygote and it remains attached to the female gametophyte plant on which it is parasitic. The carposporophyte is concerned with the production of diploid spores called the **carpospores** which each carpospores germinated to give rise to the **tetrasporophyte.** The tetrasporophyte is independent plant like the gametophyte. It is sexless and concerned with the production of the haploid tetraspores. The haploid gametophyte and the diploid tetrasporophyte plants are similar in their vegetative structure but can be distinguished by the differentreproductive organs (Fig. 2). **spermatia** (spherical or oblong cells produced in **spermatangium,** which represents the male organ) which are carried passively by water currents to the female organ, the **carpogonium** which contain the **zygote**

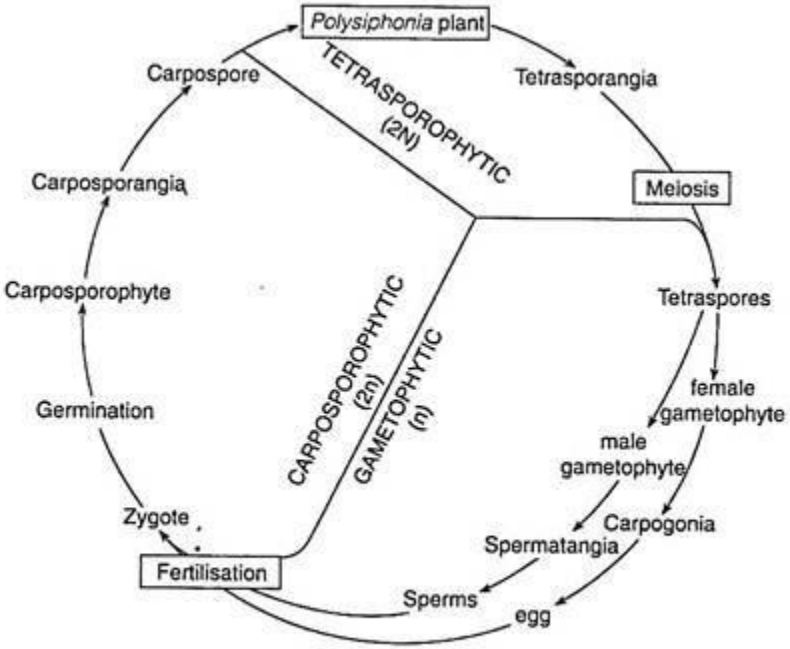

Fig. 3.138 : Graphic life cycle of *Polysiphonia* sp.

Economic importance •

- 1-Red algae used as food for both human being and animals.
- 2-The two most important polysaccharides derived from the Rhodophyceae are **agar** and **carrageenan**. Agar (its melting point is between 90 and 100 C) is obtained commercially from species of ***Gelidium.*** It is almost necessity in research as it used as a base for culture media for bacteria.

- **Uses and applications of carrageenan**
- Desserts, ice cream, cream, yogurts, salad dressings, sweetened condensed milks.
- Sauces: to increase viscosity
- Toothpaste: stabilizer to prevent constituents separating.
- Shampoo and cosmetic creams: thickener.
- Shoe polish: to increase viscosity.
- **Biotechnology**: to immobilize cells and enzymes.
- Soy milk and other plant milks: to thicken.
- Diet sodas: to enhance texture and suspend flavours