ALGAE: General Characteristics & Classification proposed by FRITSCH

BOTANY (MAJOR) SEM-1
UNIT-3

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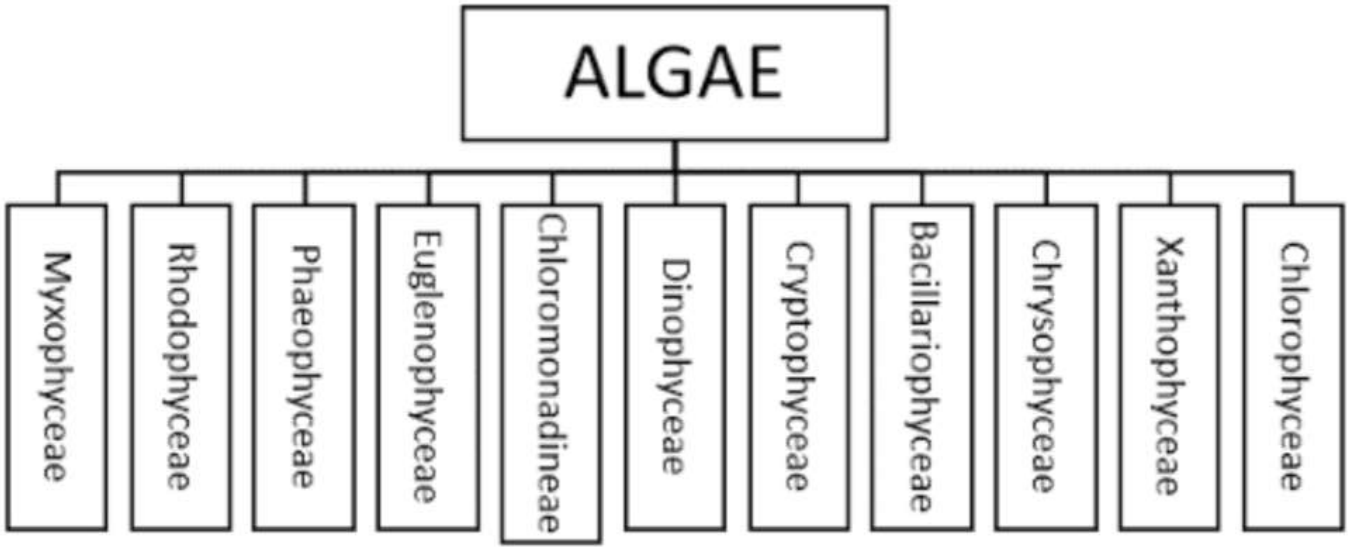
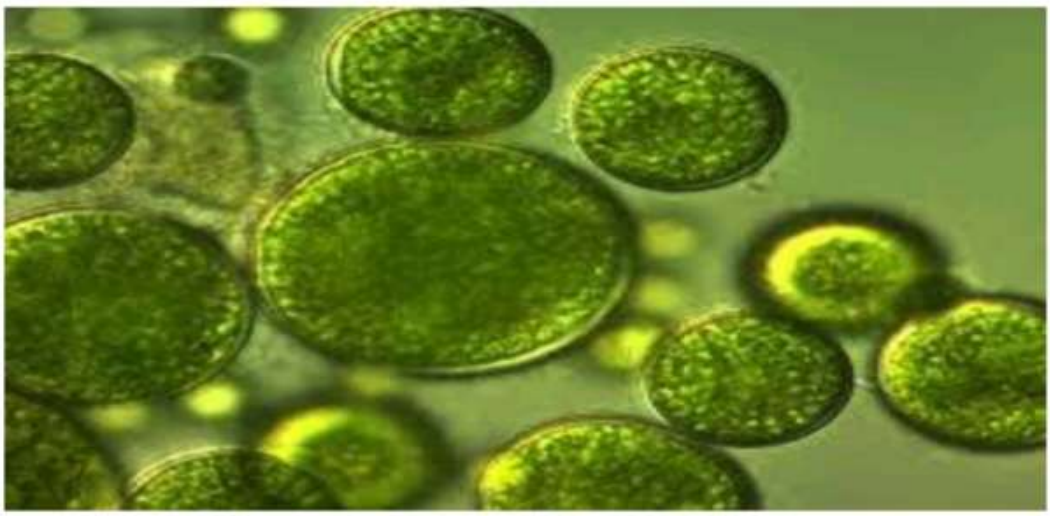
Fritschiella (Fritsch)



CLASSIFICATION OF ALGAE BY FRITSCH



❖ The first most comprehensive classification of algae was given by **F.E Fritsch** in his book "**The structure and reproduction of the Algae**".

Classification of Fritsch was based on the following criteria

✓Pigmentation

✓Types of flagella

✓Assimilatory products

✓Thallus structure

✓ Method of reproduction

❖ Fritsch divided algae into the following 11 classes

1.Chlorophyceae

2. Xanthophyceae

3. Chrysophyceae

4. Bacillariophyceae

5. Cryptophyceae

6. Dinophyceae

7. Chloromonadineae
8. Euglenineae
9. Phaeophyceae
10. Rhodophyceae
11. Myxophyceae

1. Class Chlorophyceae (green algae)

- The main pigments are essentially identical to those found in higher plants.
- They are chlorophyll a and b, carotenoids and xanthophylls.
- Chloroplast usually have pyrenoids
- The food reserve is **starch**, which frequently aggregate around the pyrenoids.
- The cell wall is composed of cellulose and the cell are typically eukaryotic
- Flagella if present are of equal length and are usually inserted at interior end
- Reproduction takes place by vegetative, asexual and sexual (iso, aniso and oogamous) methods.

➢ Class chlorophyceae have been divided into **nine orders**

Order I:Volvocales (eg., *Volvox*)

Order II : Chlorococcales (eg., *Chlorella*)

Order III: Ulothrichales (eg., *Ulothrix*)

Order IV: Cladophorales (eg., *Cladophora*)

Order V: Chaetophorales (eg., *Fritschiella)*

Order VI: Oedogoniales (eg., *Oedogonium*)

Order VII: Conjugales (eg., *Zygnema*)

Order VIII: Siphonales (eg., *Vaucheria*)

Order IX: Charales (eg., *Chara*)

2. Class Xanthophyceae (Heterokontae or Yellow-green algae)

- The main Pigments are chlorophyll a and e, β carotene and xanthophylls.
- Plastids **without pyrenoids**
- Reserve food material is **oil**
- Cell wall mainly composed of pectic substances with little cellulose
- The cell is typical eukaryotic with anteriorly inserted 2 unequal flagella
- Shorter flagella are whiplash type and longer one tinsel type.
- Reproduction by vegetative , asexual and sexual (Isogamous) methods.
- Class Xanthophyceae has been divided into **4 orders**

  Order 1: Heterochloridales (e.g., *Heterochloris*, *Chloramoeba*)

  Order 2: Heterococcales (e.g., *Myxochloris*)

  Order 3: Heterotrichales(e.g., *Tribonema*)

  Order 4: Heterosiphonales (e.g., *Botrydium*)

3. Class Chrysophyceae

➢**Phycochrysin** is the dominant pigment which imparts brown or orange colour to these algae.

➢The chromatophores have naked pyrenoid like bodies.

➢The food reserve is **chrysolaminarin** and **leucosin**.

➢The cell wall is calcified and non cellulosic.

➢The motile cell have two anteriorly inserted unequal flagella.

➢Sexual reproduction is very rare when present it is isogamous type.

Class chrysophyceae includes **three orders**

Order 1: Chrysomonadales (e.g., *Chrysodendron*)

Order 2: Chrysosphaerales (e.g, *Chrysosphaera*)

Order 3: Chrysotrichales (*Chrysoclonium*)

4. Class Bacillariophyceae (Diatoms or golden brown algae)

➢Member of this class is characterized by the dominance of golden brown pigments fucoxanthin, diatoxanthin, and diadinoxanthin .

➢The chromatophores pyrenoids and the photosynthetic products are **fat** and **volutin**.

➢Cell wall is pectic and silicified and variously ornamented.

➢Cell wall consist of two halves which are radially or bilaterally symmetrical.

➢The motile cell usually have single flagellum.

➢The sexual reproduction takes place by fusion and by the formation of gametes or auxospores.

Class Bacillariophyceae have **two orders**

Order 1: Centrales (e.g., *Cyclotella*, *chaetoceras*)

Order 2: Pennales (e.g., *Grammatophora* , *Navicula*)

5. Class Cryptophyceae

- The main pigment is xanthophyll which imparts brown or red colour to these algae
- Pyrenoids like bodies are present but they are often independent of chromatophores.
- The photosynthetic products are starch or oil.
- The motile cells are dorsiventral with two anteriorly inserted unequal flagella.
- A complex **vacuolar system** is present in the cell.
- Sexual reproduction is rare and when present it is of isogamous type.

This class includes **two orders**

Order 1: Crptomonadales (e.g., *Cryptomonas*)

Order 2: Cryptococcales (e.g.,*Tetragonidium*)

6. Class Dinophyceae (Peridinieae)

- These algae contain many discoid chromatophores .
- The main pigment is xanthophyll which imparts brown or red color
- The food reserve are starch and fat.
- The cell wall is cellulosic.
- Most of the cells of this class are motile unicells with two flagella
- Many species are colorless saprophytes and show holozoic mode of nutrition.
- Sexual reproduction is rare but if present it is of isogamous type.

This class includes six orders

7. Class Chloromonadineae

➢Members of this class have numerous discoid chromatophores; they provide bright green tint due to presence of excess of xanthophyll.

➢Pyrenoids are lacking and the reserve food is fat and oil

➢The motile forms are with two almost equal flagella.

➢Sexual reproduction is absent.

➢Multiplication takes place by longitudional division of cells.

This class have only one order

Order : Chloromonadales (e.g., *Trentonia*)

8. Class Euglenineae

➢There are highly specialized unicellular green flagellates.

➢The cell has usually many chromatophores.

➢Pyrenoid like bodies are present in some forms.

➢The main pigment is chlorophyll and product of photosynthesis is a polysaccharide paramylon.

➢Most of the members have one or two flagella which arise from base of a canal like invagination at the anterior end .

➢This algae possess a complex vacuolar system.

➢The multiplication by cell division.

➢Sexual reproduction is present only in a few forms and is of isogamous type.

9. Class Phaeophyceae (Brown algae)

➢The Structurally the most complex algae

➢ Simple filaments to massive plant bodies.

➢ Pigments include chlorophyll a and c, β-carotene. Chromatophores besides other pigments contain fucoxanthin.

➢ Reserve food in the form of laminarin (polysaccharide) and mannitol (form of alcohol)

➢cell wall is mainly composed of cellulose with alginic and fucinic acids.

➢The motile reproductive cells have two lateral or sub apical flagella , one directed forward and other directed backward.

➢Sexual reproduction ranges from isogamy to oogamy.

This class consist of nine orders

Order 1: Ectocarpales (e.g., *Ectocarpous*)

Order 2: Tilopteridales (e.g., *Tilopteris*)

Order 3: Cutleriales (e.g., *Cutleria*)

Order 4: Sporochnales (e.g., *Sporochnus)*

Order 5: Desmarestiales (e.g., *Desmarestia)*

Order 6: Laminariales (e.g., *Laminaria, Macrocystis)*

Order 7: Sphacelariales (e.g., *Sphacelaria, Haploteris*)

Order 8: Dictyotales (e.g., Dictyota)

Order 9: Fucales (e.g., *Fucus, Sargassum*)

10. Class Rhodophyceae (Red algae)

- Most of these algae are marine with uniaxial or multiaxial thalli.
- Pigment contents are chlorophyll a and d, α- and β-carotene and xanthophyll's,
- Besides other pigments chromatophores contain r-phycoerythrin and r-phycocyanin which impart red color to these algae.
- The food reserve in the form of floridean starch (a polysaccharide)
- The outer cell wall is pectic and inner cell wall is cellulosic.
- The reproductive cells are non motile.
- The sexual reproduction is advanced oogamous type.
- This class is divided into seven orders

Order 1: Bangiales (e.g., *Bangia*, *Porphyra*, *Porphyridium*)

Order 2: Nemalionales (e.g., *Batrachospermum, Nemalion*)

Order 3: Gelidiales (e.g., *Gelidium*)

Order 4: Cryptonemiales (e.g., *Corallina)*

Order 5: Gigartinales (e.g., *Gigartina, Gracilaria*)

Order 6: Rhodymeniales (e.g., *Champia, Rhodymenia*)

Order 7: Ceramiales (e.g., *Ceramium, Polysiphonia*)

11. Class Myxophyceae (Cyanophyceae or blue green algae)

- The algae are characterized by the presence of very rudimentary nucleus and they do not have well organized chromatophores (i.e. cell organization is prokaryotic) .
- The chief pigment is chlorophyll a, β-carotene and c phycocyanin.
- Cell wall is made up of mucopolymer.
- The food reserve is cyanophycean starch.
- Sexual reproduction is absent.
- Asexual reproduction by harmogonia or akinetes.

This class consist of five orders

Order 1: Chroococcales (e.g., *Gleocapsa, Microcystis)*

Order 2: Chamaesiphonales (e.g., *Chamesiphon, Dermocarpa)*

Order 3:Pleurocapsales (e.g., *Pleurocapsa)*

Order 4: Nostocales (e.g., *Nostoc, Oscillatoria, Gloeotrichia, Rivularia, Scytonema, Spirulina*)

Order 5: Stigonematales (e.g., *Nostochopsis, Stigonema, Mastigocladium*)