B.Sc. Semester I

Botany

Unit III - Phycology

Reproduction in Algae

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Reproduction in Algae:

Algae reproduce by a variety of means-

- Vegetative,
- Asexual and
- Sexual

VEGETATIVE REPRODUCTION

Vegetative Reproduction in Algae

Whole plant is produced from an organ or vegetative part of the plant.

Some of the vegetative methods of reproduction are:

1.Fragmentation: The fragments or pieces of the parent become detached and grow into new individuals. Eg. in Hormidium, Ulothrix, Stichococcus.

2.Hormogonia : In cyanophyceae, small fragments of trichomes are cut off by formation of necridia or separation disc. Hormogonia are actively mobile and form new thallus e.g., Oscillatoria, Lyngbya, Scytonema etc.

3. Budding: A lateral bud is formed by the vesicles in Protosiphon. This bud separates and develops into another vesical with its own rhizoid.

Vegetative Reproduction in Algae

4. Propagules or bulbils: The propagates or bulbils are modified branches, rich in stored food material, and on being detached they develop into new plants. eg. *Sphacelaria*

5.Akinetes: An akinete is a vegetative cell that develops a thickened cell wall with stored food reserves and help the alga to survive unfavourable environmental conditions and thus help in perennation. E.g., *Pithophora, Nostoc, Gloeotrichia, Cylindrospermum* etc.

Vegetative Reproduction in Algae

6. Cell division: in desmids and diatoms, cell division is a common method of vegetative reproduction. In diatoms , cell division occurs after a period of increase in cell volume. Cell divisions resulting in progressive reduction in cell size.

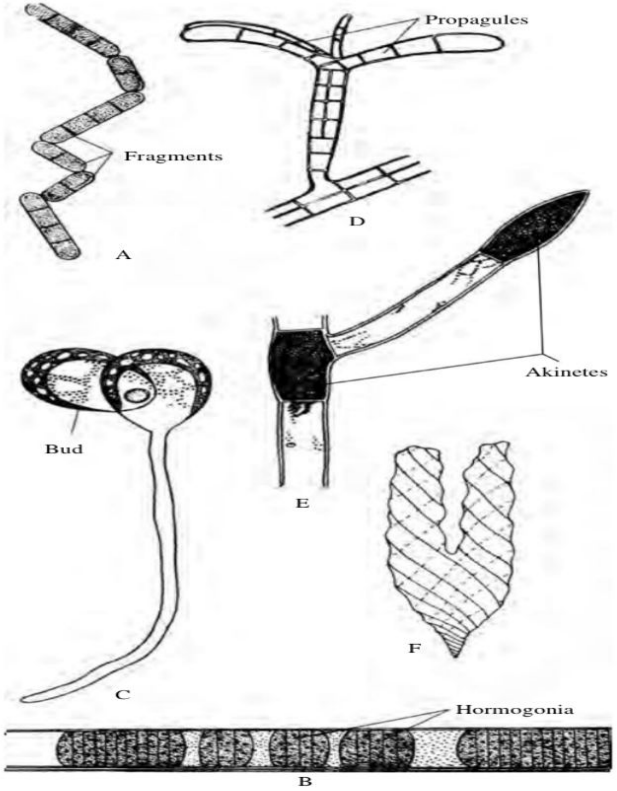
7. Fission: In unicellular flagellates example *Euglena*, the vegetative reproduction takes place by longitudinal fission of the cell. Fission usually starts at the anterior end and progress is downward.

Vegetative Reproduction in Algae

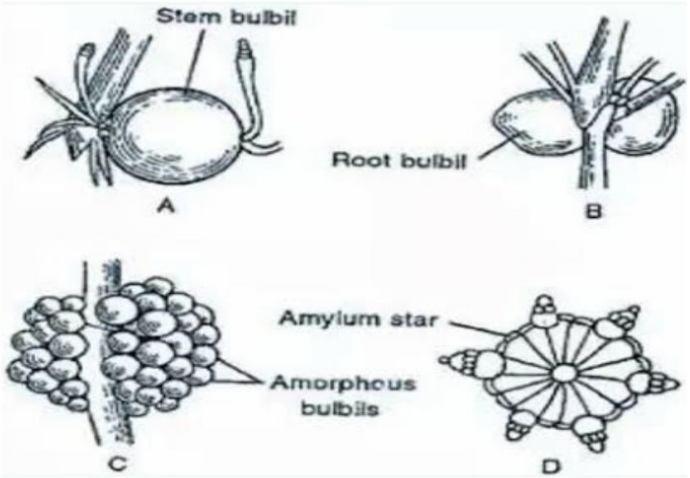
8. Abscissed pinnules or proliferous shoots: Abscission of older pinnules in *Bryopsis* and proliferous shoots in *Caulerpa* are also the means of vegetative reproduction.

9. Amylum stars and protonema: In *Chara*, star-like aggregates of cells develop on the lower nodes. They are filled with starch and when they fall they develop into a new plant.

Sometimes protonema like filamentous outgrowths also develop on the lower nodes in Chara, both these vegetative structures give rise to new plants.



Vegetative reproduction in Algae: A. Fragmentation (Klebsormidium); B. Hormogonia (Oscillatoria); C. Bud (Protosiphon); D. Propagules (Sphacelaria); E. Akinete (Pithophora);F. Fission (Euglena)



Vegetative reproduction in Chara: A. Stem bulbils; B. Root bulbils; C. Amorphous bulbils; D. Amylum star

ASEXUAL REPRODUCTION IN ALGAE

Asexual Reproduction in Algae

Asexual is a type of reproduction where the protoplast is released from the cell and germinates into a new plant. This type of reproduction does not involve fusion of sex cells from two different parents. The protoplast may be released as motile or nonmotile spores.

some of the types of the spores responsible for asexual reproduction in algae are:

1. Zoospores: Zoospores are unicellular,flagellated reproductive cells that may be produced within vegetative cells or in specialized cells, depending on the organism. Zoospores are usually devoid of cell walls. Eg. *Chlamydomonas, Cladophora*

2. Aplanospores: Non- motile thin walled spores are termed aplanospores. E.g. *Chlamydomonas, Vaucheria* etc.

Asexual Reproduction in Algae

3. Hypnospores: Non motile aplanospores with very thick wall are called hypnospores as in *Chlamydomonas, Ulothrix, Botrydium, Vaucheria* etc.

4. Autospore or monospore production: Autospores and monospores are also non motile spores, but unlike aplanospores, lack the capacity to develop into zoospores. They typically look like miniature versions of the parental cell in which they form . e.g. *Chlorella, Scenedesmus*

5. Autocolony formation: In coenobia, a cell goes through a number of successive divisions giving rise to a daughter colony. Cells arrange themselves in a pattern identical to that of the parent colony. eg. *Volvox*

Asexual Reproduction in Algae

6. Tetraspores: In some Rhodophyceae and Phaeophyceae, instead of mitosis, the spores are formed after meiosis and are called tetraspores. These are haploid, thin walled, non motile spores formed after reduction division in tetrasporangia e.g. *Polysiphonia, Dictyota*.

7. Exospores: In *Chamaesiphon* cell membrane burst at the apex, exposing the protoplast, which soon become fragmented into spherical spores called exospores.

8. Endospores: In *Dermocarpa*, the successive divisions of cell content results in formation of endospores.

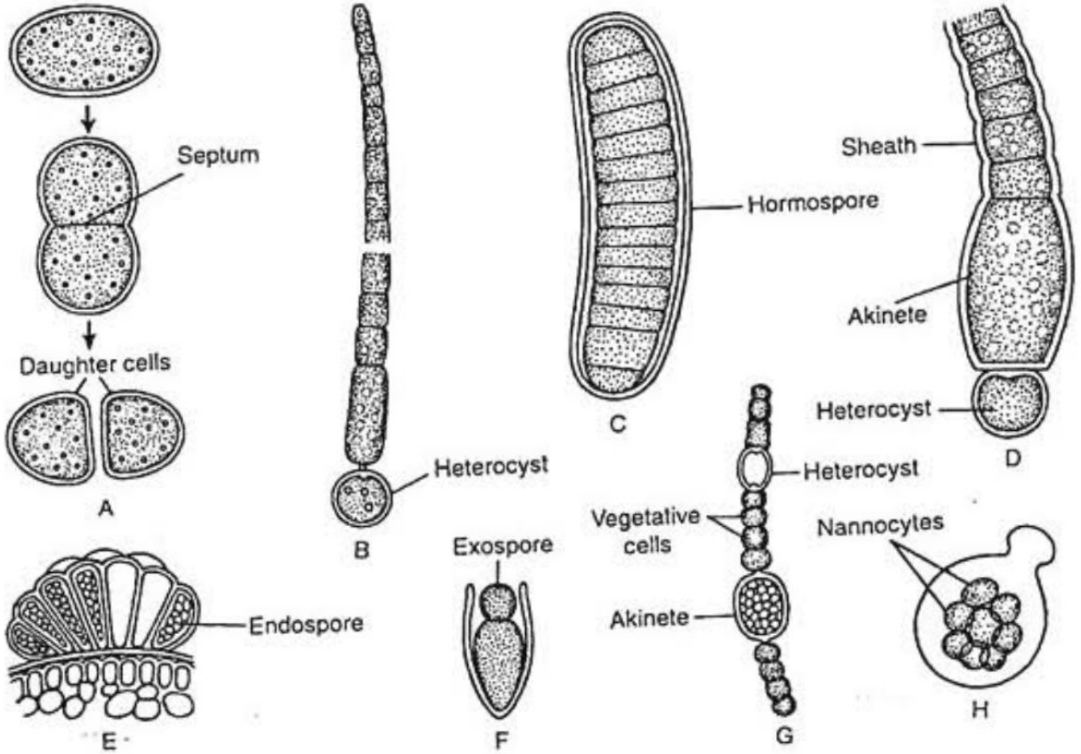
9. Nannocytes: In some Chroococcales e.g. *Gloeocapsa, Microcystis*, the cell contents divide repeatedly to form endospores like structures called nannocytes.

Asexual Reproduction in Algae

10. Carpospores: These are non motile spores formed by the division of zygote in some red algae. They are formed in carposporangium of carposporophytic stage. e.g. *Batrachospermum and Polysiphonia*

11. Cysts: Cysts are resting stages of many algae. In *Vaucheria*, amoeboid multinucleate cysts develop which on liberation germinate into new thallus. Cysts also form in *Botrydium, Acetabularia* etc. Smooth walled or ornamented thick walled cysts called statospores are found in some members of Bacillariophyceae, Chrysophyceae and Xanthophyceae.

12. Neutral spores: The vegetative cells in some algae e.g. *Bangia* transform directly into the spores called neutral spores. On being liberated, they become round and develop into new filaments by transverse divisions.



Asexual reproduction in Cyanophyceae

A.Cell division (*Synechococcus* sp.); B. Fragmentation of filament (*Cylindrospermum muscicola*); C. Hormospore (*Westiella lanosa*); D. Akinete (*Gloeotrichia natans*); E. Endospore (*Dermocarpa prasina*); F. Exospore (*Chamaesiphon incrustans*), G. Akinete (*Anabaena* sp.); H. Nannocytes (*Aphanothece*)

SEXUAL REPRODUCTION IN ALGAE

Sexual Reproduction in Algae

Sexual Reproduction involves the fusion (syngamy) of two gametes and their nuclei. In sexual reproduction, plasmogamy- fusion of haploid reproductive cells (gametes)-is followed by karyogamy (nuclear fusion), to form a diploid zygote. Sexual reproduction in algae is of following types:

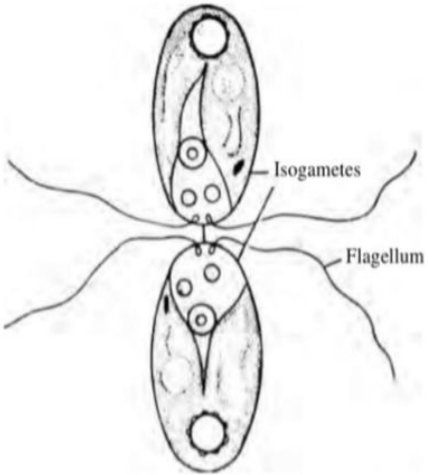
1. Isogamous
2. Anisogamous
3. Oogamous

Sexual Reproduction in Algae

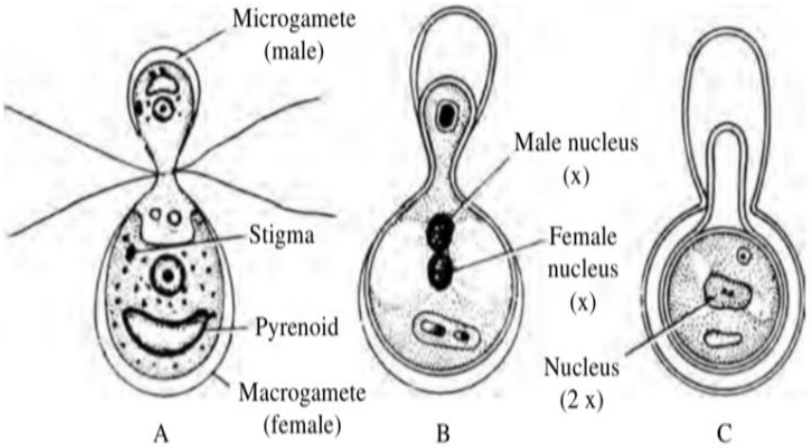
Isogamy: In isogamous sexual reproduction (isogamy), motile gametes that are morphologically identical and have the same size and shape fuse with each other. The iso gametes are normally naked Nucleate fragments of Qutub lost. They are generally flagellated but in genera like *Spirogyra* and *Zygnema*, the gametes are non flagellated and amoeboid.

Anisogamy: In anisogamy, two motile gametes of different size, motility or behavior fuse to form zygote. E.g. *Chlamydomonas braunii, Pandorina* etc.

Sexual Reproduction in Algae: Isogamy & Anisogamy



Isogamy - *Chlamydomonas*



Anisogamy- *Chlamydomonas braunii*

Sexual Reproduction in Algae: Isogamy & Anisogamy

In anisogamous and oogamous species, the two types of gametes may be produced by the same individual, in which case the species is termed monecious.

If they are produced by separate individuals, it is said to be dioecious.

When gametes from the same individual are able to fuse and produce viable offspring, the organism is termed homothallic (self-fertile).

If such gametes are incompatible, then two individuals of different genetic makeup are required for successful mating, and the organism is termed heterothallic (self-sterile).

Sexual Reproduction in Algae: Oogamy

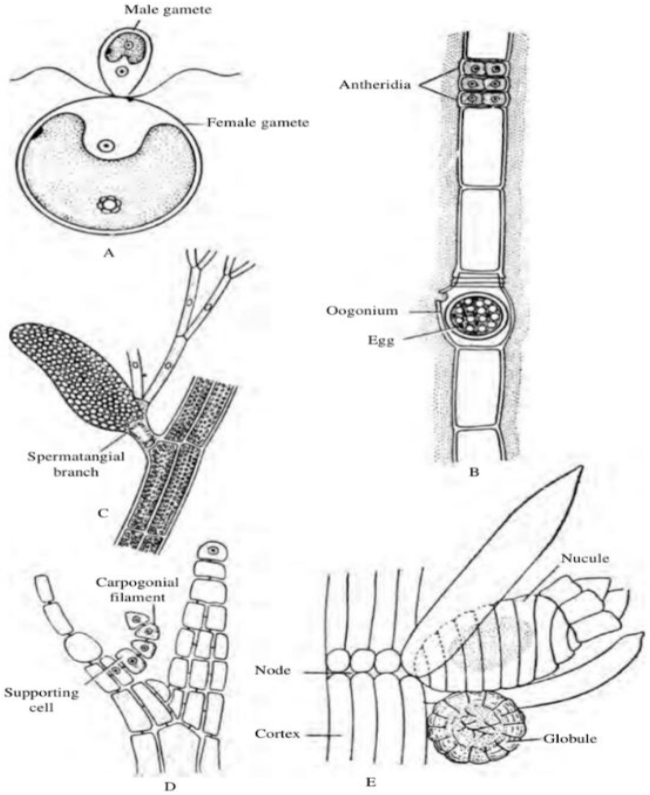
Oogamy: Male gamete is small, flagellated or non flagellated , fuses with a larger immobile egg. E.g. *Chlamydomonas coccifera, Oedogonium* etc.

Usually the male gametes are liberated from the male gametangium, whereas, the female gamete is retained within the oogonium.

In *Chara* and *Nitella*, gametangia (Globule and Nucule) are complex and jacketed.

In Rhodophyceae, both male and female gametes are nonmotile. Male gametes are produced in spermatangia and female gametes are produced in carpogonia respectively.

Sexual Reproduction in Algae: Oogamy



Oogamy -A. *Chlamydomonas coccifera,* B. Oedogonium, C.,D. Polysiphonia E. Chara

Sexual Reproduction in Algae: Primitive Oogamy

Primitive type of oogamy

Algae such as *Chlamydomonas coccifera* and species of *Eudorina* Develop distinct sex organs.

The Male sex organs are called antheridia and female sex organs are called oogonia.

Male gametes are motile and smaller the female gametes are usually nonmotile and larger.

These gametes fuse this type of sexual reproduction is a well marked heterogamy or primitive type of oogamy.

Sexual Reproduction in Algae: Advanced Oogamy

Advanced oogamy

Species of *Vaucheria* and *Oedogonium* show advanced oogamy, in which eggs are non motile and fertilization is also in situ I.e., inside the oogonium.

Chara shows advanced oogamy . The two sex organs are called globule and Nucule that are surrounded by a sterile layer of jacket cells The female egg is non motile and fertilization by motile male gamete takes place in situ ie., inside the nucule.

More advanced type of oogamy is seen in some red algae (eg., *Polysiphonia*), where both male gametes (spermatia) and female gamete (egg) are non motile. Spermatia develop in spermatangia while egg develop in female gametangia more called carpogonium which is flask shaped bearing a long neck called trichogyne.

Among algae, oogamous sexual reproduction is thought to represent the derived condition, and isogamy and anisogamy, the primitive and intermediate conditions, respectively.

Isogamy - Primitive condition

Anisogamy - Intermediate

Oogamy - Derived and Advanced condition

Let’s revise

Q.1 Write a note on vegetative reproduction in algae.

Q.2 Write a short note on vegetative reproduction in Chara.

Q.2 What are the different type of asexual spores found in algae?

Q.3 What is the difference between isogamy, anisogamy and oogamy?

Q.4 Write a note on sex organs of Chara.

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Recommended Books:

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