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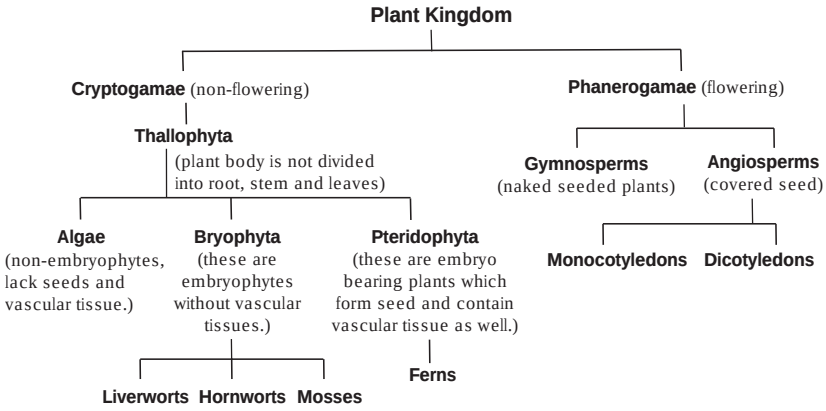
Plant Kingdom

Plants : Producers of the Ecosystem

Plants are multicellular, photoautotrophic and embryo forming (excluding algae) organisms placed in kingdom–Plantae. They have cell wall, which is made up of cellulose and reserve food material in the form of starch (sometimes fat as in seeds).

Plants are referred to as producers, because they have unique ability to fix solar energy in the form of chemical energy, through the process of **photosynthesis**. They supply the energy in ecosystem to other living organisms, hence they are referred to as producers.

The plant kingdom is classified as



Algae (L. Alga–sea weeds)

These are eukaryotic, autotrophic (holophytic), chlorophyll containing, non-vascular thallophytes. These are characterised by the absence of embryonic stage and presence of non-jacketed gametangia. Mostly, they are of aquatic habitat (both freshwater and marine).

The branch of Botany which deals with the study of algae is termed as 'Algology or Phycology'. **FE Fritsch** is known as 'Father of Algology'. (Prof. MOP Iyengar is regarded as Father of Indian Algology).

Classification of Algae (FE Fritsch; 1935)

Algal Class	Colour	Reserve Food	Examples
Chlorophyceae	Grass green	Starch	**Chlamydomonas** and **Spirogyra**.
Xanthophyceae	Yellow-green	Fat	**Microspora** and **Botrydium.**
Chrysophyceae	Yellow-green and golden-brown	Carbohydrate and leucosin	**Amphipleura** and **Chrysosphaera**.
Bacillariophyceae	Brown and green	Fat and volutin	**Pinnularia** and **Melosira**.
Cryptophyceae	Red and green-blue	Carbohydrate and starch	**Cryptomonas**.
Dinophyceae	Dark yellow, brown-red	Starch and oil	**Peridinium** and **Glenodinium.**
Chloromonadineae	Bright green	Fatty compounds	**Vaucheria** and **Trentonia.**
Euglenophyceae	Grass green	Paramylum	**Euglena** and **Phacus.**
Phaeophyceae	Brown coloured	Laminarin and mannitol	**Laminaria** and **Fucus.**
Rhodophyceae	Red coloured	Floridean starch	**Polysiphonia** and **Batrachospermum.**
Myxophyceae	Blue-green	Protein granules	**Nostoc** and **Anabaena.**

Characteristics of Algae

Important characteristics of algae are given below

Structure

Algae may be unicellular and multicellular.

1. **Unicellular**

It is of two types

(i) **Motile**, **e.g., Chlamydomonas**, etc.
(ii) **Non-motile**, **e.g., Chlorella**, etc.

2. **Multicellular**

It is of following types

(i) **Colonial**, **e.g., Volvox, Hydrodictyon,** etc.
(ii) **Aggregation**, **e.g., Tetraspora, Prasinocladus,** etc.
(iii) **Filamentous**, **e.g., Ulothrix, Cladophora,** etc.
(iv) **Pseudoparenchymatous**, **e.g., Nemalion,** etc.
(v) **Siphonous**, **e.g., Vaucheria,** etc.
(vi) **Parenchymatous**, **e.g., Ulva, Fritschiella,** etc.
(vii) **Well-developed thallus**, **e.g., Chara, Sargassum,** etc.

Nutrition

Mostly algae are autotrophic, due to the presence of chlorophyll. Some are parasitic, **e.g., Cephaleuros** that causes rust of tea.

Reproduction

Algae reproduce by

(i) Vegetative methods
(ii) Asexual methods
(iii) Sexual methods

Vegetative Reproduction

Algae reproduce vegetatively by two methods

(i) Fragmentation, **e.g., Fucus, Chara,** etc.
(ii) By hormogones, **e.g., Oscillatoria, Nostoc,** etc.

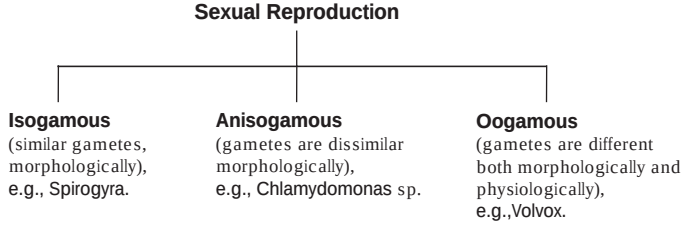
Asexual Reproduction

In this process, some cells form motile or non-motile spores. After release, these spores give rise to new plants. **Following spores are involved**

(i) By zoospore, **e.g., Ulothrix, Oedogonium,** etc.
(ii) By aplanospore, **e.g., Chlorella**, etc.
(iii) By hypnospore, **e.g., Vaucheria**, etc.
(iv) By palmella stage, **e.g., Chlamydomonas, Ulothrix,** etc.
(v) By endospore, **e.g., Anabaena, Nostoc**, etc.
(vi) By akinete, **e.g., Chara, Oedogonium,** etc.

Sexual Reproduction

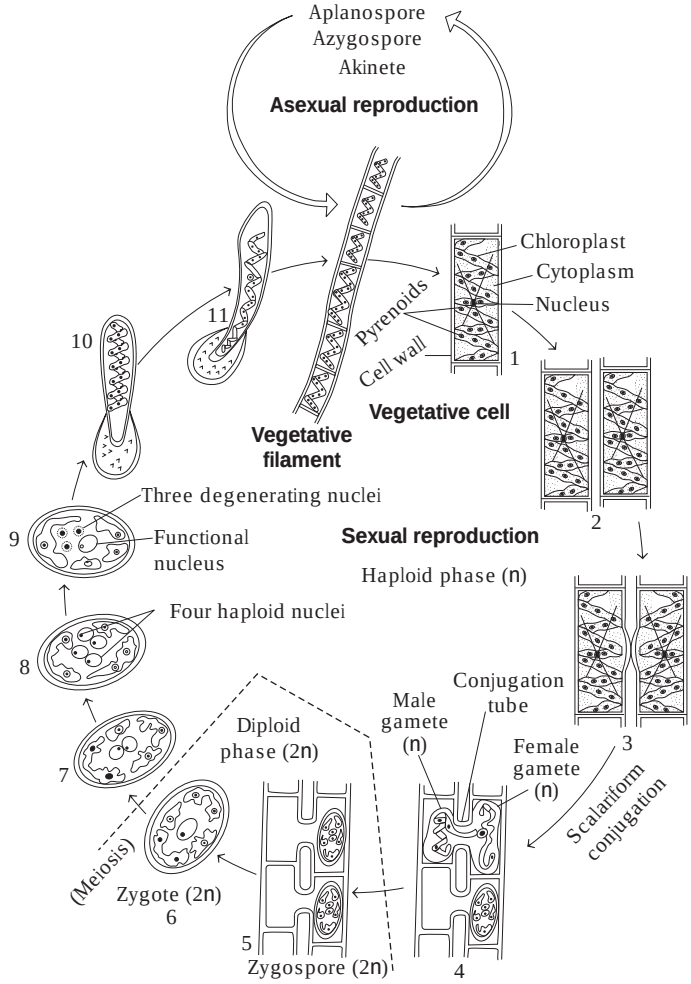
On the basis of shape, size, morphology and behaviour of gametes, **the sexual reproduction is of following types**



Life Cycle of Algae

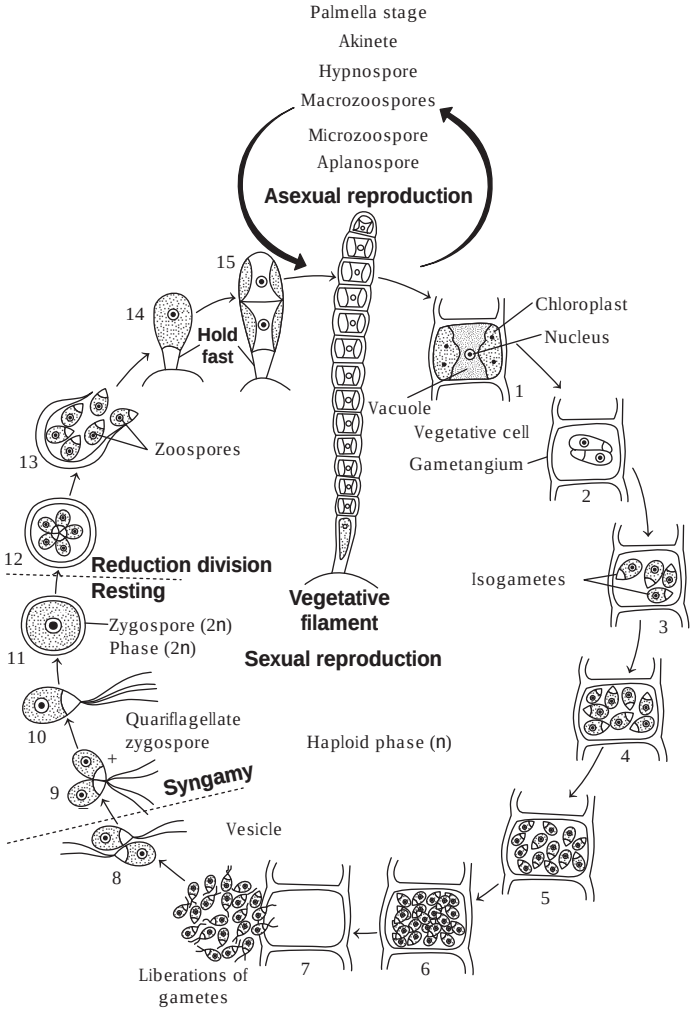
Various algae show different types of life cycles. Life cycles of **Spirogyra** and **Ulothrix** are discussed here.

Life cycle of Spirogyra It is a green alga of filamentous shape. **The detailed life cycle is given below.**



Life cycle of Spirogyra

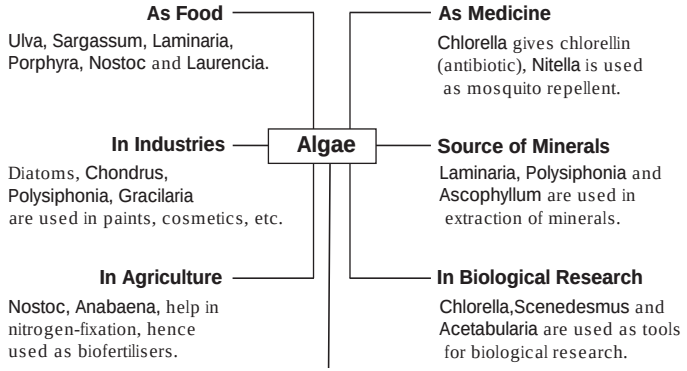
Life cycle of Ulothrix The diagrammatic representation of life cycle of **Ulothrix** is given below.



Life cycle of Ulothrix

Economic Importance

Algae can be both useful and harmful. **Several useful algal species with their uses are mentioned here**



Useful applications of algae

Algin, Carrageenan and Agar

- **Algin,** used as **artificial fibre** to control blood flow in surgery and in production of non-inflammable films, is extracted from **marine brown algae**.
- **Carrageenan,** extracted from seaweeds is used in **cosmetics**, **boot polish**, **ice cream**, **paints**, etc.
- **Agar**, extracted from **Gelidium** and **Gracilaria** is used in culture medium, **biscuits for diabetic patients**, etc.
  - **Sargassum** is used as **food** and **fodder**.
  - **Laminaria**, **Fucus** are used in extraction of **iodine**, **bromine** and **potash**.

Harmful Algae

Group of algae like **Microcystis**, **Oscillatoria** and **Anabaena** cause water blooms (eutrophication) and death and reduction of aquatic organisms.

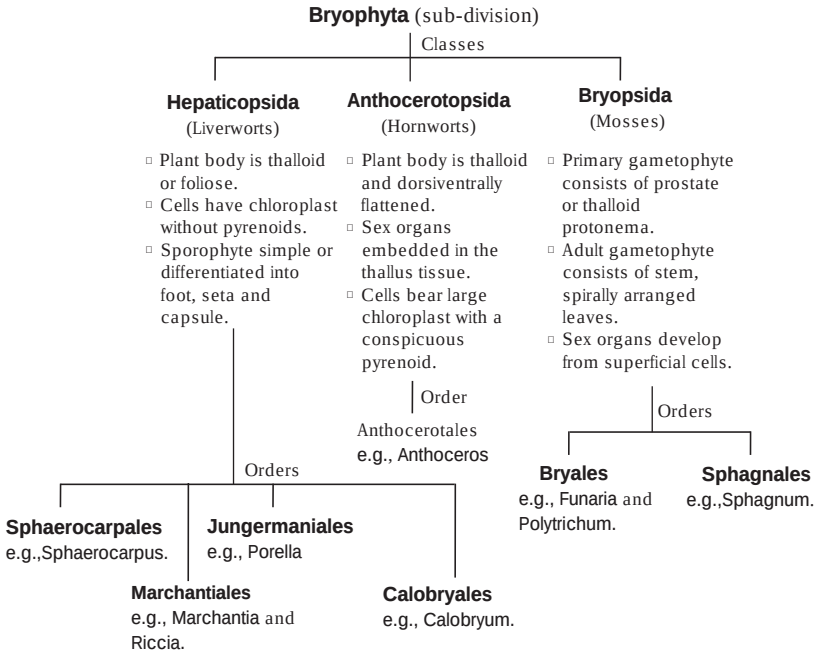
Bryophyta (L. Bryon–leaf-like; phyton–plant body)

It is the simplest and primitive group of land plants. They are also known as **amphibians of plant kingdom** because of their habitat adaptability in both aquatic and terrestrial environment. They are the **connecting link between algae and pteridophytes**. Bryophytes

are autotrophic, non-seeded, **cryptogamic** plants. The plant body is gametophytic and may be differentiated into stem, leaves and rhizoids.

- Bryophytes do not have true vascular tissue (xylem and phloem), but some of them have **hydroids** (similar to xylem) and **leptoids** (similar to phloem) which help in the conduction of water and food, respectively.
- The sex organs in bryophytes are multicellular, male sex organ is called **antheridium** and female sex organ is called **archegonium**. Sexual reproduction in bryophytes is mainly **oogamous type**.

Classification of Bryophyta



Reproduction in Bryophytes

Bryophytes reproduce by both vegetative and sexual methods of reproduction.

Vegetative Reproduction

Following methods of vegetative reproduction are reported in bryophytes

(i) **By fragmentation** The two fragments resulted by progressive death and decay of thallus, produce new thallus, **e.g., Riccia.**

(ii) **By adventitious branches** Special adventitious branches arise from the mid-ventral surface of the thallus, **e.g., Riccia fluitans**.

(iii) **By tubers** Some species form perennating tubers at the apices of thallus, **e.g., Riccia, Marchantia,** etc.

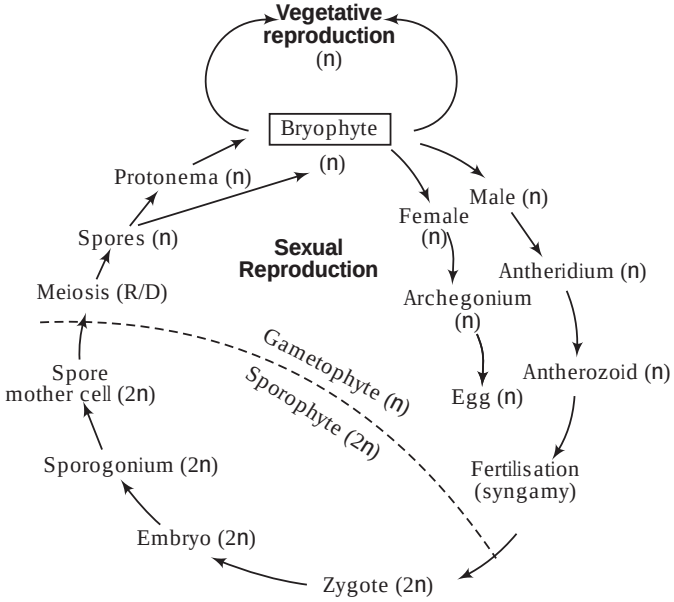
(iv) **By persistent apices** The underground part of thallus in soil remains living and grows into plant, **e.g., Riccia, Pellia,** etc.

Sexual Reproduction

The sex organs are highly differentiated and well-developed in bryophytes. The **antherozoids** or **sperms** (minute, slender, curved body, having two whiplash flagella) are released from antheridium and reach to archegonium through neck canal cells. The antherozoid fuses with **egg cell** to produce sporophytic generation.

Life Cycle of Bryophytes

A typical bryophyte shows following type of life cycle



Graphic representation of the life cycle of bryophyte (R/D refers to reductional division)

Economic Importance

Bryophytes have limited economic importance, **they can be used in following ways**

(i) They help in **soil formation** (pedogenesis) and act as agent for biological succession.

(ii) Peat from **Sphagnum** can be used as fuel and in preparation of ethyl alcohol.

(iii) They help in protecting soil from erosion.

(iv) Some bryophytes are used as **fodder** for cattle.

(v) Due to high water retention capacity, **Sphagnum** can be used in preserving living materials and used in **grafting of plants**.

Pteridophyta (L. pteron–feather; phyton–plant)

Pteridophytes are seedless, vascular cryptogams. They reproduce by means of spores and can reach to the tree-like heights (30-40 feets).

General Characteristics

(i) The plant body is differentiated into **root**, **stem** and **leaves**.

(ii) The stem may be aerial or underground and is generally herbaceous, rarely solid and stout.

(iii) Vascular tissues consist of **xylem** (without vessels) and **phloem** (without companion cells).

(iv) **Alternation of generations** is found here, gametophyte is autotrophic and independent.

(v) Sporangia containing leaves are called **sporophylls**.

(vi) Antherozoids (flagellated male gametes) are formed in **antheridia**.

(vii) Reproduction is of both vegetative and sexual types.

(viii) On the basis of development of sporangia, **they are of two types**

(a) **Eusporangiate** From a group of superficial initial cells.

(b) **Leptosporangiate** From a single superficial initial cell.