BIOLOGY

PLANT KINGDOM

What are Plants

Plant kingdom classification has changed a number of times over the years. For instance, blue-green algae were once considered to be part of the plant kingdom, but today, they are classified under Kingdom Eubacteria. Similarly, lichen was once considered a plant; however, they are composite organisms. In other words, lichens are comprised of two individual organisms a fungus and a plant. Historically, organisms that could not be classified under animals were grouped under plants.

Whittaker classified the whole living organism into five kingdoms based on the complexity of cell structure (Prokaryotic and Eukaryotic), the complexity of the body (unicellular and multicellular), and mode of nutrition (autotrophs and heterotrophs).

Classification of the Plant Kingdom

All the classification systems, starting from that of Aristotle to the 20thcentury, can be divided into three types:

- **Artificial System:** In this system, the classification is based on few morphological characters. Theophrastus, Pliny, and Linnaeus used an artificial system of classification.
- **Natural System:** In this system, the classification is based on all the important related characters. Both external and internal. Bentham and hooker, Adanson, Candolle used a natural system of classification.
- **Phylogenetic System:** Classification based on the evolutionary relationship of plants. The use of phylogeny for classification was done by Eichler, Blessy.

Numerical Taxonomy

Taxonomy based on statistical methods with equal importance using computers.

Cytotaxonomy

Taxonomy that is based on cytology or structure of the cell (chromosome number, shape, behaviour, etc).

Chemotaxonomy

Taxonomy based on chemical constituents of plants (nature of the protein, DNA sequence, taste, smell, etc).

Eichler Classification

The classification of Plant kingdom depending on flowering. Divided into two-Cryptogamae (non-flowering, seedless plants) and Phanerogamae (flowering, seed-bearing plants).

Based on the Plant Body Cryptogamae is divided into Thallophyta, Bryophyta, and Pteridophyta.

- **Thallophyta:** The plant body is thallus-like (undifferentiated plant body).
- **Bryophyta:** Plant body with a root-like structure, stem-like structure, vascular tissues are absent).
- **Pteridophyta:** The plant body is differentiated into true root, stem, and leaves. Vascular

Thallophytes Again Divided Into:

- Algae (pigmented thallophytes).
- Fungi (non-pigmented thallophytes).
- Lichens: Symbiotic association between algae and fungi.

Phanerogamae is Divided Into Two:

- Gymnosperms (naked seed plants)
- Angiosperma (covered seeded plants)

Angiosperms Are Again Divided Into Two:

- Monocots (bearing single cotyledon, fibrous root system, and parallel venation).
- Dicots (have two cotyledons, taproot system, and reticulate venation).

Algae

1. **Phycology:** Branch of Biology that deals with the study of algae
   Phycos = Seaweed
   Logos = Study
2. Fritch - Father of phycology.
3. M.O.P. Iyengar is the father of Indian phycology.

   Algal members are pigmented thallophyte

Habitat

Hydrophytes: Water is their habitat. In aquatic habitat:

- Freshwater (Spirogyra) and marine (Sargassum).
- Floating- Chlamydomonas, Spirogyra
- Benthophytes - These plants remain attached to the bottom of their habitat. Example Chara (stoneworts)
- Xerophytes: Their habitat is desert.
- Mesophytes- They grow in medium habitats.
- Epiphytes- They grow on plant body (Cladophora)
- Epizoic- growing on the animal body (Trichophillus)
- Lithophytes- They grow on rocks.
- Halophytes- They grow in salty areas.
- Moist soil-terrestrials (Fritschiella).

Plant Body

- The vegetative plant body of algae is a haploid gametophyte.
- They may be unicellular, flagellated (Chlamydomonas), or non-flagellated (Chlorella).

Multicellular:

- Coenobium- It is a colony with a fixed number of cells and also the division of labor is fixed. E.g.: Volvox.
- Aggregation-indefinite colony. E.g., Tetraspora
- Filamentous-unbranched. E.g.: Ulothrix
- Filamentous branches. E.g.: Cladophora
- Siphonous- multinucleate. E.g.: Vaucheria
- Parenchymatous. E.g.: Ulva the,
- Branched like higher plants. E.g.: Sargassum, Chara

Nutrition:

- Autotrophs - Photosynthetic (most of them)
- Parasitic forms (rare). E.g.: Cephaleuros.

Pigments:

- Chlorophyll- a, b, c, d.
- Carotenoids- carotene and xanthophyll-fucoxanthin are dominating pigments in brown algae.
- Phycobillins- phycocyanin and phycoerythrin.

Reproduction

Vegetative reproduction: Reproduction Using the Vegetative Parts.

Different Types are:

- Fission
- Fragmentation
- Budding
- Tubers
- Gemmae

Asexual Reproduction: Without the Fusion of Gametes.

Mainly by:

- Zoospores within sporangia
- Aplanospores
- Akinete
- Hypnospores
- Endospore
- Exospore
- Monospore
- Auxospore.

Palmella Stage

In this stage of asexual reproduction the spores become colonial and appear like the algae named Palmella. E.g.: Ulothrix, Chlamydomonas.

Sexual Reproduction

Homogametes: Similar gametes.

Heterogametes: Dissimilar gametes.

Isogamy: Fusion of morphologically and physiologically similar gametes. Isogamy- flagellated (Chlamydomonas) and non-flagellated (Spirogyra).

Anisogamy: Fusion of morphologically or physiologically dissimilar gametes. Morphologically dissimilar gametes' fusion occurs in Chlamydomonas. Physiologically dissimilar gametes' fusion occurs in Spirogyra.

Oogamy: It is the fusion of morphologically and physiologically dissimilar gametes that are small motile male gamete and large nonmotile female gamete. E.g.: Fucus, Volvox.

Exceptional Cases:

Unicellular antheridium and oogonium. E.g.: Oedogonium.

Special Reproductive Structures:

Conceptacles- E.g.: Sargassum

Globule (antheridium) and nucule (oogonium) E.g.: Chara

Conjugation

A special type of sexual reproduction called conjugation is found in spirogyra. The life cycle exhibits two phases-haploid and diploid and some of them exhibit alternation of generation. The diploid phase is alternated with the haploid phase.

Classification of Algae

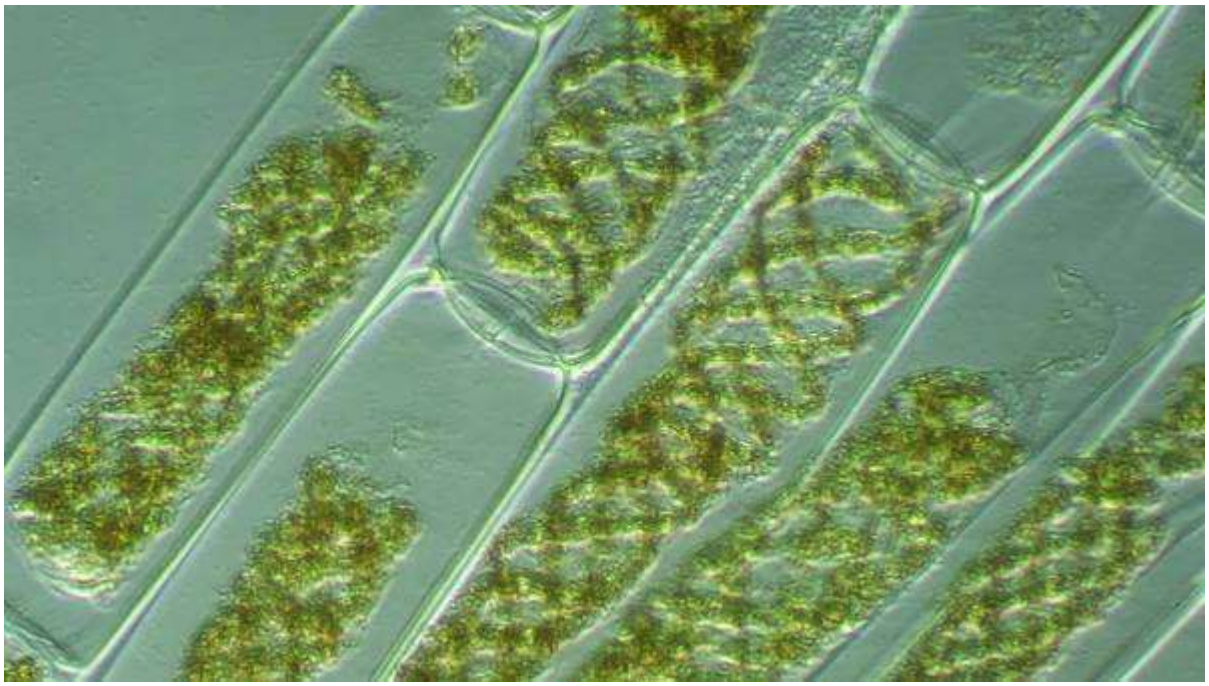
They are classified into three:

- Chlorophyceae
- Phaeophyceae
- Rhodophyceae

Chlorophyceae: In Chlorophyceae, the plant body is unicellular as in Chlamydomonas or colonial as in Volvox or filamentous as in Spirogyra.

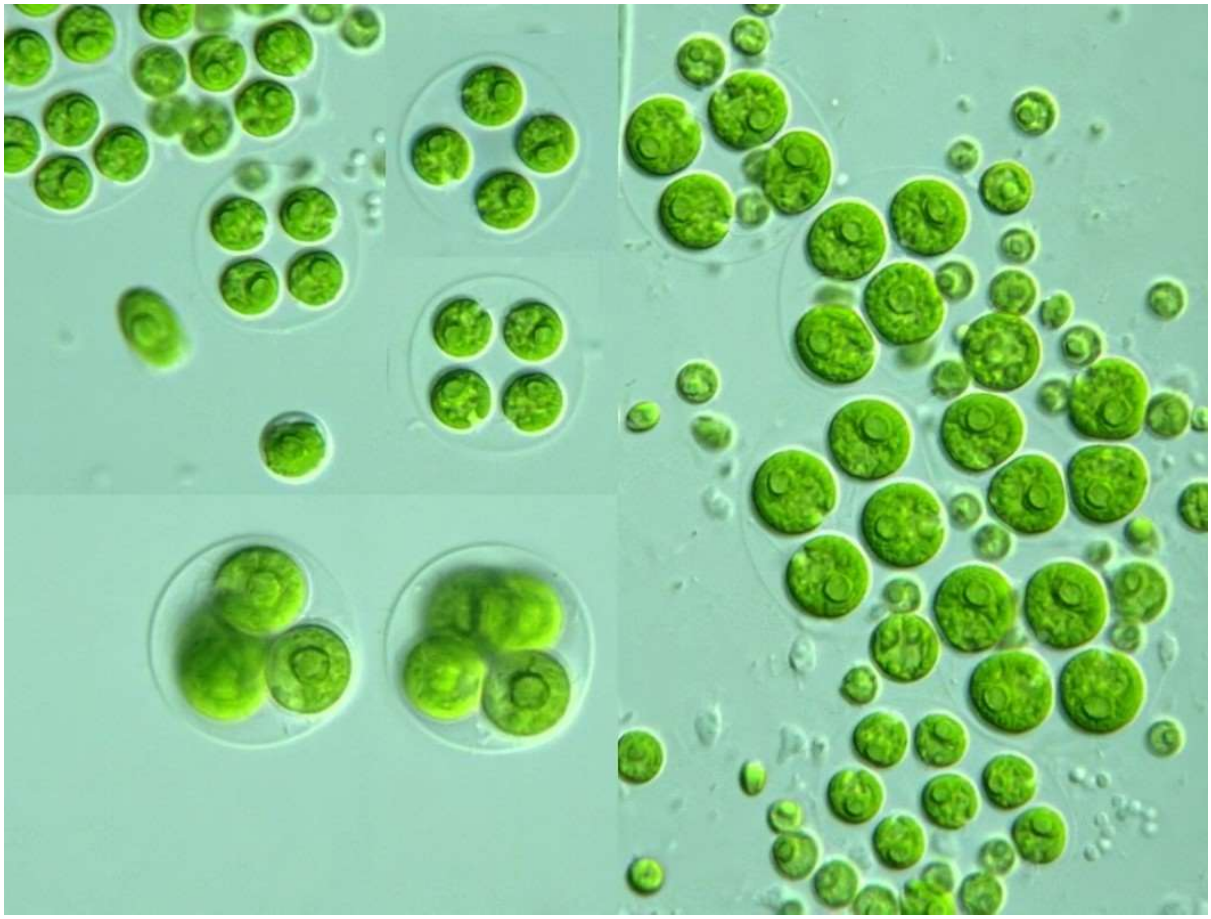
Different Shapes for the Chloroplast:

1. Ribbon shaped and spiral in Spirogyra

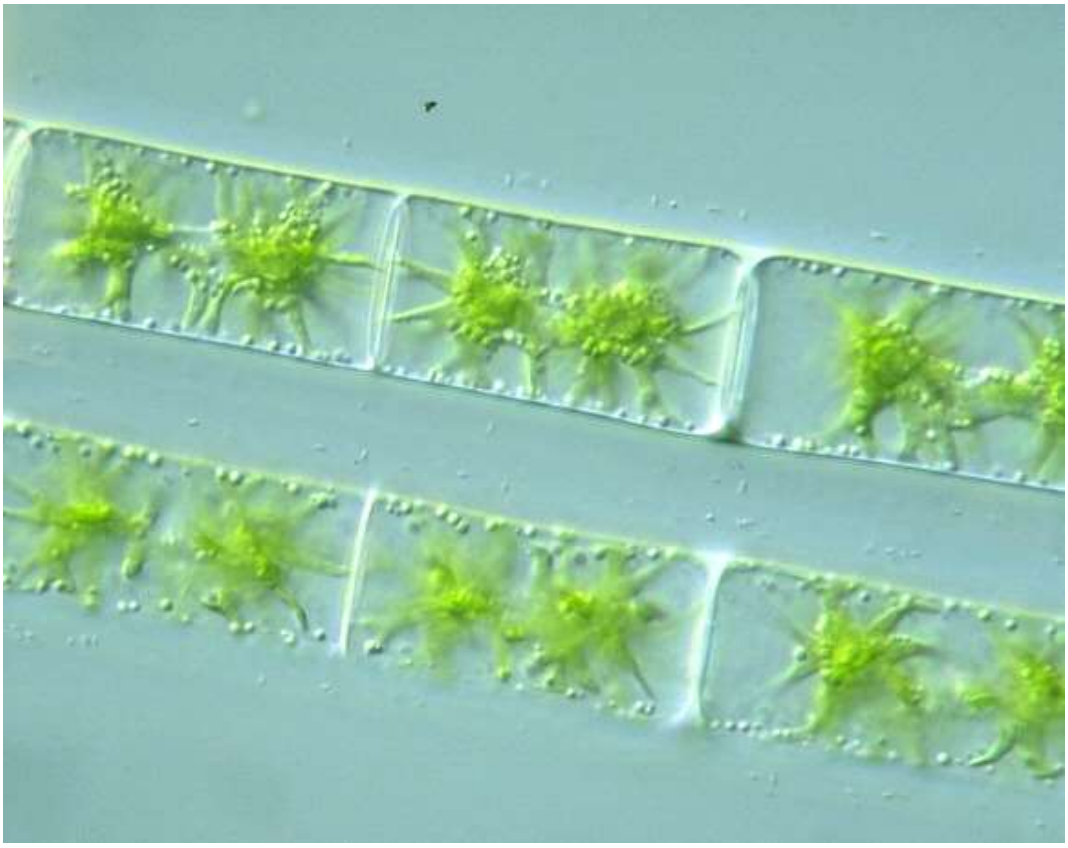


2. Girdle shaped in Ulothrix

3. Cup shaped chloroplast in Chlamydomonas.



4. Star-shaped in Zygnema.



5. Disc-shaped in Caulerpa

6. Reticulate in Oedogonium.

- Photosynthetic pigments are chlorophyll a and b.
- Food is stored in the form of starch and some are stored in the form of oil droplets.
- Pyrenoids are present, which are the storage bodies.
- The inner layer of the cell wall is made up of cellulose and the outer layer is made up of pectose.

The members reproduce:

- Vegetatively by fragmentation
- Asexually by flagellated zoospores
- Sexually by isogamy, anisogamy, and oogamy.

Common Chlorophyceae members are: Chlamydomonas, Chlorella, Volvox, Ulothrix, Ulva, Caulerpa, Chara, Acetabularia etc.

Brown Algae or Phaeophyceae

- They are marine.
- Simple branched and filamentous as in Ectocarpus, or flat ribbon-shaped in Sargassum, Laminaria, Fucus, etc.
- The giant brown algae Kelps are the largest sea plants, some are free-floating as in Sargassum and some are epiphytes on other plants like Ectocarpus.

The Plant Body has Three Parts:

- Fixing structures called a holdfast.
- The stalk-like structure called a stipe.
- The leaf-like structure is called a frond.

Rhodophyceae (Red Algae)

Red algae Rhodophyceae (red algae) include members like Porphyra, Porphyridium, Polysiphonia (multi-axial body), Batrachospermum (Frog spawn alga), Gelidium, Gracilaria, Gleopeltis, Chondrus, Corallina, Harveyella (colourless parasitic red alga). Habitat Mostly they are marine. Found in warmer oceans.

Economic Importance of Algae:

- In the food chain algae are the primary producers. The basis of the food cycles of all aquatic animals is formed by the algae.
- On earth, half of the total carbon dioxide fixation is carried out by algae through the process of photosynthesis.
- In the purification of air and water it plays a very important role.
- Some algae are edible. E.g.: Chlorella, Laminaria, Porphyra, Sargassum, Ulva, Spirulina.
- Some algae are used as fodder. E.g.: Laminaria, Sargassum, Fucus.
- It also acts as a food supplement for space travelers. E.g.: Chlorella, Spirulina.
- From red algae, algin and carrageenan are obtained which are water-holding substances or hydrocolloids.
- Agar is obtained by Gelidium and Gracilaria. It is used to grow microorganisms.
- Used in the preparation of culture medium in tissue culture experiments.
- It has medicinal values as antibiotics are prepared from them.
- Also used as a source of minerals- Polysiphonia, Laminaria
- Has importance in biological research: Chlorella, Acetabularia.
- E.g.: Chlorella, Polysiphonia.

Common Names of Algae:

- Water silk-Spirogyra
- Sea lettuce- Ulva
- Umbrella plant-Acetabularia (Largest unicellular algae)

Bryophytes

- Simplest non-vascular land plants with undifferentiated plant bodies.
- Bryology: Study of Bryophytes.
- Hedwig: Father of bryology.

- S.R. Kashyap: Father of Indian bryology.
- The bryophytes are also called the amphibians of the plant kingdom due to their unique characteristics.
- Bryophytes grow in dense patches on moist shady places like walls, damp soil, tree trunks, etc.

Features

- Habitat: Mainly terrestrial but some are aquatic. E.g.: Riccia fluitans
- Epiphyllous E.g.: Radula
- Plant body Thallus and Prostate. E.g.: Riccia, Anthoceros, Marchantia or Erect. E.g.- Moss.
- Root-like structures called rhizoids help in fixing them in the soil.
- The body of the plant is differentiated into stem-like and leaf-like structures.
- Vascular tissues are absent.
- Vegetative reproduction occurs by fragmentation, budding, tubers, etc.
- Asexual reproduction occurs by Gemmae- asexual buds in liverworts.
- Sexual reproduction occurs. The vegetative plant body acts as the gametophyte and all the members are homosporous.
- Multicellular sex organs are present that are found in clusters.
- The club-shaped antheridium is the male reproductive organ and it produces biflagellate antherozoids which are motile too.
- The flask-shaped archegonium is the female reproductive organ and it produces the egg.
- To form the zygote the antherozoid fuses with the egg.
- The sporophyte is not free-living and it derives nutrients from the photosynthetic gametophyte.
- After meiosis, the haploid spores are formed in the sporophyte and the spore germinates to form the gametophyte.
- Alternation of generation is present where the haploid phase alters with the diploid phase.
- Both the phases are multicellular.
- The gametophyte is the dominant photosynthetic free-living stage.
- The sporophyte is short-lived and it highly depends on the gametophyte.

- For fertilization, water is very much essential.

Classification of Bryophytes: It has three classes.

- Hapticospida (liverworts).
- Anthocerotopsida (Hornworts).
- Bryopsida. (Moss).

Hepaticopsida or Liverworts

A class of lower green plants called liverworts that belong to the division Bryophyta. The class Hepaticopsida, also called Marchantiopsida, comprises the liverworts, which are nonvascular land plants. Although there is a great diversity of external form, most of the gametophytes (gamete-producing plants) are dorsoventrally differentiated.

Bryopsida (Moss)

- They are higher bryophytes.
- The gametophyte consists of two stages-protonema and the leafy stage.
- Protonema is green filamentous, branched, creeping structures that directly develop from the spore on germination, and they also bear branched rhizoids and lateral buds.
- The leafy stage is developed as a lateral bud from the secondary protonema.
- The plant body consists of root-like, stem-like, and leaf-like structures. Eg: Funaria.
- Rhizoids are multicellular and branched also.
- The leafy stages bear the sex organs.
- Vegetative reproduction occurs by the process of fragmentation and budding in the secondary protonema.

Economic Importance:

- They are used as food by herbaceous animals.
- Sphagnum (Moss) occurs in the form of peat and is used as fuel.
- Because of its water holding capacity, the mosses are also used for the trans-shipment of living material.
- Moses also prevents soil erosion.
- They are the first colonizers on barren rocks along with lichens.
- For the growth of the higher plants or succession, they decompose rocks for making substrate.

Pteridophytes

- They are the first terrestrial plant to bear vascular tissue such as xylem and phloem. So they are also called vascular cryptogams.
- Commonly known as a botanical snake.
- The plant body is differentiated into true root, stem, wind-needle-like, and leaf.
- The plant body is the sporophytic generation.
- The stem is rhizomatous and they regenerate when aerial parts are destroyed.
- Leaves may be small known as microphyll as in Selaginella or large known as macrophyll as in ferns.

Pteridophytes are further classified into four classes:

- Psilopsida (Psilotum)
- Lycopsida (Selaginella)
- Sphenopsida (Equisetum)
- Pteropsida (Pteris).

Economic Importance:

- **Some members are Medicinal:** Dryopter is Helps in Soil binding & Used as Ornamental plants.
- **Edible plants:** Marcelia Used in Crop rotation- Azolla & Helps in Symbiotic nitrogen fixation.
- Play an important role in the succession of plants on bare rocks or soil.
- Sphagnum is used to keep seedlings in gardens and also in keeping cut plant parts moist during transportation and propagation.

Common Names:

- Creeping pine/ Club moss- Lycopodium
- Spike moss (Resurrection plant- Selaginella
- Water fern- Azolla (smallest pteridophyte)
- Walking fern (Maiden Hall fern)- Adiantum
- Adder's tongue fern- Ophioglossum
- Fossil pteridophyte- Cooksonia
- Leafless Pteridophyte- Psilotum
- Horsetail- Equisetum

Gymnosperm

The word “Gymnosperm” comes from the Greek words “gymnos”(naked) and “sperma”(seed), hence known as “Naked seeds.” Gymnosperms are the seed-producing plants, but unlike angiosperms, they produce seeds without fruits. These plants develop on the surface of scales or leaves, or at the end of stalks forming a cone-like structure.

Gymnosperms belong to kingdom ‘Plantae‘ and sub-kingdom ‘Embryophyta’. The fossil evidence suggested that they originated during the Paleozoic era, about 390 million years ago.

Basically, gymnosperms are plants in which the ovules are not enclosed within the ovary wall, unlike the angiosperms. It remains exposed before and after fertilisation and before developing into a seed. The stem of gymnosperms can be branched or unbranched. The thick cuticle, needle-like leaves, and sunken stomata reduce the rate of water loss in these plants.

The family of gymnosperms consist of conifers, the cycads, the gnetophytes and the species of Gynkgophyta division and Ginkgo biloba.

Let us have an overview of the characteristics, examples, classification and examples of gymnosperms.

Angiosperm

A plant of a large group that comprises those that have flowers and produce seeds enclosed within a carpel, including herbaceous plants, shrubs, grasses, and most trees. Compare with gymnosperm.

Alternation of generations:

- The diploid sporophyte has a structure called a sporangium.
- The sporangium undergoes meiosis and forms haploid spores.
- The spore develops into a gametophyte which is haploid in nature.
- The gametophyte has the reproductive organs which undergo mitosis to form haploid gametes.
- The gametes fertilize to form a haploid zygote which matures into a mature sporophyte. This cycle keeps repeating.

Monocot

In this type of angiosperms, only one cotyledon is present. Also, leaves are parallel-veined, and vascular bundles are scattered. The root system is adventitious. Examples: Wheat, Maize, Rice etc.

Dicot

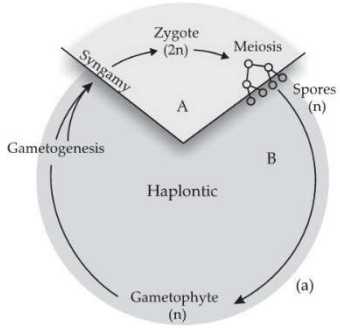
There are two seed leaves present in dicot angiosperms. Vascular bundles are in a ring and veins are branched. Also, tap roots are present. Examples: Potato, Pea, Banyan etc.

CHAPTER : 3 PLANT KINGDOM

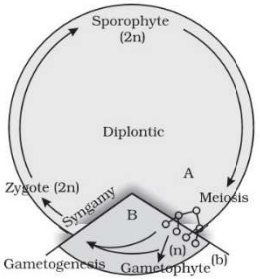
Classes	Common Name	Major Pigments	Stored Food	Cell Wall	Flagellar Number and Position of Insertions	Habitat
Chlorophyceae	Green algae	Chlorophyll *a, b*	Starch	Cellulose	2-8, equal, apical	Fresh water, brackish water, salt water
Phaeophyceae	Brown algae	Chlorophyll *a, c,* fucoxanthin	Mannitol, laminarin	Cellulose and algin	2, unequal, lateral	Fresh water (rare) brackish water, salt water
Rhodophyceae	Red algae	Chlorophyll *a, d,* phycoerythrin	Floridean starch	Cellulose, pectin and poly sulphate esters	Absent	Fresh water (some), brackish water, salt water (most)

Plant Kingdom

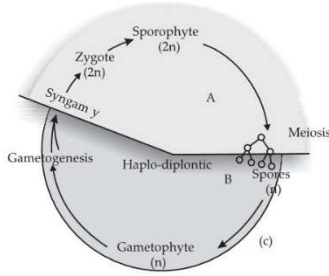
- Algae
- Bryophyta
  - Liverworts — Example– *Marchantia*
  - Mosses — Example– *Funaria*
- Pteridophyte
  - Psilopsida — Example – *Psilotum*
  - Lycopsida — Example – *Selaginella*
  - Sphenopsida — Example – *Equisetum*
  - Pteropsida — Example – *Dryopteris*
- Gymnosperm — Plant with naked seeds. E.g: Cycas
- Angiosperm
  - Dicotyledonae — Has two cotyledons in their seeds. E.g: Mustard, Pea, Beans etc.
  - Monocotyledonae — Have one cotyledon in their seeds. E.g: Grasses, Wheat, Rice etc.
- Plant life cycle
  - Haplantic — Example–In algae such as *Spirogyra*



  - Diplontic — Example– Gymnosperm, angiosperm



  - Alternation of generation — Example– bryophyte, pteridophyte.



Important Questions

Multiple Choice questions-

1. Agar is obtained from
   - **A.** Laminaria
   - **B.** Porphyra
   - **C.** Sargassum
   - **D.** Gelidium
2. Red algae resemble blue green algae in the presence of
   - **A.** Similar cell wall constitutents
   - **B.** Phycobilins
   - **C.** Similar reserve food
   - **D.** Similar mode of reproduction
3. The colour of brown algae is due to
   - **A.** Phycoerythrin
   - **B.** Phycocyonin
   - **C.** Fucoxanthin
   - **D.** Carotenes
4. All algae possess
   - **A.** Chlorophyll (b) and carotenes
   - **B.** Chlorophyll (a) and corotenes
   - **C.** Chlorophyll (a) and chlorophyll (c)
   - **D.** Chlorophyll (a) and chlorophyll (b)
5. Flagellate cells are absent in
   - **A.** Brown algae
   - **B.** Red algae
   - **C.** Green algae
   - **D.** Chlamydomonas.
6. Sex organs are unicellular and non-jacketed in
   - **A.** Algae

B. Bryophyta

C. Gymnosperms

D. Pteridophyta.

7. In green algae meiosis occurs in

A. Gametangia

B. Sporangia

C. Zoospore

D. Zygospore.

8. Protonema stage is found in

A. Green algae

B. Liveworts

C. Ferns

D. Mosses.

9. Pyrenoids are present in

A. Brown algae

B. Red algae

C. Green algae

D. Blue green algae.

10. Sporophyte of riccia is made of

A. Capsule only

B. Foot, seta and capsule

C. Seta and capsule

D. Foot and capsule.

11. A fern differs from a bryophyte in having.

A. Parasitic sporophyte

B. Independent gametaphyte

C. Independent sporophyte

D. Parasitic gametophyte.

12. Seedless vascular plants are

A. Mosses

B. Liver worts

C. Ferns

D. Cycads.

13. Gymnosperms are characterised by

A. Naked ovules

B. Large leaves

C. Scale leaves

D. Ciliated sperms.

14. Which of these algae is very rich in protein.

A. Ulothrix

B. Oscillatoria

C. Chlorella

D. Spirogyra.

15. Multicelluilar branched rhizoids and leafy gametophytes are found in

A. All bryophytes

B. Some bryophytes

C. Some pteridophytes

D. All pteridophytes

Fill in the blanks

1. In this chapter we will describe _____ under algae, _____ Pteridophytes, _____and angiosperms.
2. Such systems were _____because they separated closely related species since they were based on few characteristics.
3. At prasent _____based on evoiutionory relationships between the various organisms are acceptable.
4. Fusion between one large, _____ (static) female gemete and a smaller, motile male gamete is termed _____
5. Certain marine brown and red algae produce large amounts of hydrocolloids (water holding substances) e.g. _____ (of brown algae) and carrageen (of red algae) are used commercially.
6. The algae are divided into three main classes: _____ and _____
7. The plant body of _____is more differentiated than that of _____
8. The predominant stage of the life cycle of a moss is the gametophyte which consists of

_____

9. Each of the cells of an _____are haploid.
10. The _____and _____degenerate after fertilisation.
11. The dominant, photosynthetic phase in such plants is the _____the gametophyte. This kind of life-cycle is termed as _____
12. The gameto phytic phase is represented by the single to few celled haploid gametophyte. This kind of life-cycle is termed as _____
13. The diploid sporophyte is represented by a dominant, independent, _____vascular plant body.

True (T) or False (F)

1. Numerical Taxonomy which is now easily carried out using computer is based on ail the observable charateristics.
2. The algae reproduce by only vegetative methods.
3. At least a half of the total carbon-dioxide fixation on earth is carried out by algae through photosyntheses.
4. Algae are of paramount importance as primary producers of energy-rich compounds which form the basis of the food cycles of all aquatic animals.
5. The algae are divided into two main classes: Rhodophyceae and chlorophyceae.
6. Majority of the red algae are found on land with greater concentrations found in the warmer areas.
7. The bryophytes are divided into: liverworts and mosses.
8. The liverworts grow usually in moist shady habitats such as banks of streams, marshy ground, damp soil, bark of trees and deep in the woods.
9. The first stage is the leafy stage which develops from the secondary protonema as a lateral bud.
10. Water is required for transfer of antherozoids— the male gametes released from the antheridia, to the mouth of archegonium.
11. Unlike bryophytes and pteridophytes, in gymnosperms the male and the female gametophytes have independent free-living existence.
12. Angiosperms provide us with food, fodder, fuel, medicines and several other commercially important products. They are divided into two classes: the dicotyledons and the monocotyledons.

Very Short Questions :

1. Define pyrenoid.

2. Define ramenta.
3. What is the function of mucilage in aquatic plants?
4. How much water can Sphagnum absorb?
5. What is the function of air vesicles in brown algae?
6. Why is Adiantum called a 'walking fern'?
7. Give one example of the monocarpic plant.
8. What are sori?
9. What are rhizoids?
10. Which pigments are found in green algae?

Short Questions :

1. Why are red algae able to survive in the deep-sea?

2. What are the features that have led to the success and dominance of vascular plants?

3. Define monopodial growth?

4. Why do marine algae have no mechanical tissue?

5. Explain the different types of sexual reproduction in green algae.

6. Why are seed plants considered the most successful land plants?

7. Give five distinguishing characteristics of red algae.

8. Discuss the development of seed habit.

Long Answer Type

1. What are angiosperms? Give their characteristic features.

2. Write brief notes on

3. Discuss the development of seed habit.

4. What are the different lifestyles shown by Angiosperms?

Assertion Reason Question-

1. In these questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

   (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

   (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

   (c) If Assertion is true but Reason is false.

   (d) If both Assertion and Reason are false.

Assertion: Algae and fungi are grouped in thallophyta.

Reason: Algae and fungi show no differentiation in thallus.

2. In these questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) If Assertion is true but Reason is false.

(d) If both Assertion and Reason are false.

Assertion: Chlorella could be utilised to keep the air pure in space vehicles.

Reason: The space travelers feed on Chlorella soup.

Case Study Based Question-

1. Direction Read the following and answer the questions that follow

Algae are diverse group of aquatic organisms that have the ability to conduct photosynthesis. They are unicellular or multicellular and undifferentiated organisms that occur in variety of forms and sizes. Algae belong to a polyphyletic group, i.e. the organisms of this group are not necessarily related to each other. Based on the pigment, composition and reserved food material, algae has been divided into three major classes, viz. Chlorophyceae, Phaeophyceae and Rhodophyceae.

The members of these classes also differ in cell wall composition, stored food material, body structure, mode of reproduction, etc.

(i) A representative organism of class- Rhodophyceae is

(a) Spirogyra

(b) Fucus

(c) Polysiphonia

(d) Chlorella

(ii) Multicellular, saline forms are found in

(a) Rhodophyceae

(b) Chlorophyceae

(c) Phaeophyceae

(d) All of the above

(iii) Stored food material in class– Phaeophyceae is

(a) mannitol and laminarin

(b) floridean starch

(c) pyrenoids

(d) All of the above

(iv) Cell wall of Porphyra (red algae) contains

(a) cellulose

(b) pectins

(c) polysulphate esters

(d) All of these

(v) Consider the following statements.

I. Large amounts of hydrocolloids are produced by certain marine red and brown algae.

II. Algin and carrageenan are commercially used as water holding materials.

Choose the correct option.

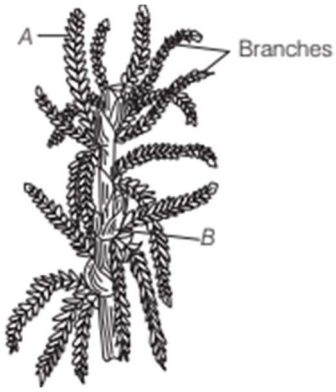
(a) Statement I is correct, but II is incorrect

(b) Statement I is incorrect, but II is correct

(c) Both statements I and II are correct

(d) Both statements I and II are incorrect

2. Identify the given bryophyte and answer the questions as follows



(i) Which of the following statements are correct for the given bryophyte species above.

I. The given diagram represents Sphagnum gametophyte.

II. The given species is a liverwort.

III. It provides peat.

IV. Scales and elaters are not found in it.

Codes

(a) II and III

(b) I and IV

(c) II, III and IV

(d) I, III and IV

(ii) A bryophyte found in dry habitat is

(a) Polytrichum

(b) Marchantia

(c) Riccia

(d) All of these

(iii) The thallus of bryophytes

(a) possesses roots

(b) bears very small leaves

(c) is more differentiated than that of algae

(d) All of the above

(iv) The female sex organ in bryophytes is

(a) conspicous and reduced

(b) flask-shaped structure of thallus

(c) called sporophyll

(d) Both (a) and (b)

(v) Marchantia is a bryophyte used to cure

(a) lung infection

(b) skin rashes

(c) joint pain

(d) All of these

ANSWER KEY –

➢ Multiple Choice Answer :

1. Gelidium
2. Phycobilins
3. Fucoxanthin.
4. (b) Chlorophyll (a) and carotenes.

5. Red algae.
6. Algae.
7. Zygospore.
8. Mosses.
9. Green algae.
10. Capsule only.
11. Independent sporophyte.
12. Ferms.
13. Naked ovules.
14. Chlorella.
15. Some bryophytes.

➢ Fill in the blanks :

1. Plantae, Bryo- phytes, Gymnosperms
2. artificial
3. Phylogenetic classification systems
4. non-motile, oogamous
5. algin
6. Chlorophyceae, Phaeophyceae, Rhodophyceae
7. Bryophytes, algae
8. two stages.
9. embryo-scarsac
10. ynergids, antipodals
11. free-living, haplontic
12. Diplontic

➢ Write true (T) or false (F) :

1. True
2. False
3. True
4. True
5. False

6. False
7. True
8. True
9. False
10. True
11. False
12. True

➢ Very Short Answer :

1. Pyrenoid is a starch storing organelle present in green algae.
2. The hair-like structure present on the younger stem, petiole, and rachis of mature leaves is known as ramenta.
3. Mucilage protects the algae from epiphytic growth and the decaying effect of water.
4. Sphagnum can absorb water up to 18 times its weight.
5. The air vesicles in brown algae maintain buoyancy.
6. Adiantum is known as 'walking fern' because the leaf tips come in contact with the soil, They strike adventitious roots and develop into a new plant.
7. Bamboo.
8. They are groups of separation found in Dryopteris fern.
9. They are slender unicellular or multicellular hair-like structures that penetrate in the moist soil and absorb the water for the plants.
10. Chlorophyll 'a' and 'b' and 'Beta' carotene.

➢ Short Answer :

1. Red algae contain phycoerythrin and phycocyanin pigments. Phycoerythrin is able to absorb the blue wavelengths of light and thus can photosynthesize. Since red algae can utilize blue and green rays they can live at greater depths.

2. (1)Development of deep penetrating roots to anchor the plant in soil and absorb water and minerals for the plants from the deeper layers of the soil.

(2)Development of cutin as a waterproof layer on leaves to reduce transpiration.

(3)Development of mechanical tissue to provide support.

(4)Development of a well developed vascular system.

3. When the main axis of the trunk rises straight from the base and reaches up to the tip, this type of growth is known as monopodial growth.

4. Marine algae have no mechanical tissue because buoyancy holds them erect under the sea surface.
5. Sexual reproduction in green algae can be of three different types:

   1.Isogamy: Both the fusing gametes are morphologically and physiologically similar.

   2.Anisogamy: The fusing gametes are structurally similar but differ in size and behaviour.

   3.Oogamy: The female gamete is bigger, food-laden and non-motile, whereas the male gamete is smaller, without food reserve and motile.

➢ Long Answer :

1. Growth Unicellular and multicellular organisms increase their mass and number through cell-division. Non-livings increase their size by the accumulation of matter.

   a) Cell has protoplasm which is living matter. Cell before division increases their mass through replication of genetic matter. It is absent in non-livings.

   b) Metabolic Activity: Anabolic and catabolic reaction constantly occurs in living organisms, formation and conversion of biomolecules is metabolism.

'In Vitro, such reactions can be maintained. In non-living, there is the absence of metabolism.

2. For classification, systematic studies have to carried out.

   1. First, the organisms have to be described for all their morphological and other characteristics.
   2. Based on its characteristic, it is seen whether it is similar (or different) to any known group or taxa-identification is carried out.
   3. Based on its similar characteristic it is then placed in known taxa or the organism is classified. Sometimes organisms are very different from the ones already described anywhere in the world, then they are placed in a new group or 'taxa' and named.
   4. Once the organism has been placed in the right taxa-the last step is nomenclature or naming. If the organism is already known-its the correct name is determined. If an organism is not described before-it is given a new name.

3. The seed plants have two kinds of sporangia. These sporangia are born on the sporophylls.

   One type of sporangia are ovule or megasparangium. The other type of sporangia is the pollen sac or archegonium. The egg develops a pollen sac or microsporangium. The egg develops in the ovule from the megaspores. Many pollen grains are produced in the pollen sac.

   The pollen grains are dispersed by the air! They reach the ovule. The male gamete and the female egg cell fuse together. The zygote is formed as a result of fertilization. Later on, the zygote forms the embryo. The seed is developed from the ovule. The development of seed habit in gymnosperm and angiosperm do not require liquid water during fertilization.

4.

1. Hydrophytic plants are the plants that live in water or swampy places. Hydrophytes are categorised into, two groups:
   (a) Submerged plants like Hydrilla, Vallisneria, Utriculria and
   (b) Floating plant-like Nymphea, Wolffia and Pistia.
2. Xerophytic plants are those plants that live in the scarcity of water e.g. cactus.
3. Halophytes are a type of xerophytic plants that are present in saline conditions.
4. Insectivorous plants-A few angiosperms, though green and autotrophic trap insects to overcome the shortage of nitrogen. For example, pitcher plant, sundew, bladderwort.

Assertion Reason Answer-

1. (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

   Explanation: On the basis of

   (i) Thallus like non-vascular plant body.

   (ii) Simple, unicellular non-jacketed sex organs and

   (iii) No embryo development after gametic union, the algae and fungi have long been grouped together in thallophyta. The algae and fungi are the result of parallel development and do not indicate any phylogenetic relationship.

2. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

   Explanation: Chlorella could be utilised to keep the air in space vehicles pure and supply food in space stations and prolonged space flight trips. The space travellers could feed on Chlorella soup. It is nourishing but not appetizing food.

Case Study Answer-

1. Answer:

(i) (c)

(ii) (a)

(iii) (a)

(iv) (d)

(v) (c)

2. Answer:

(i) (d)

(ii) (a)

(iii) (c)

(iv) (b)

(v) (a)