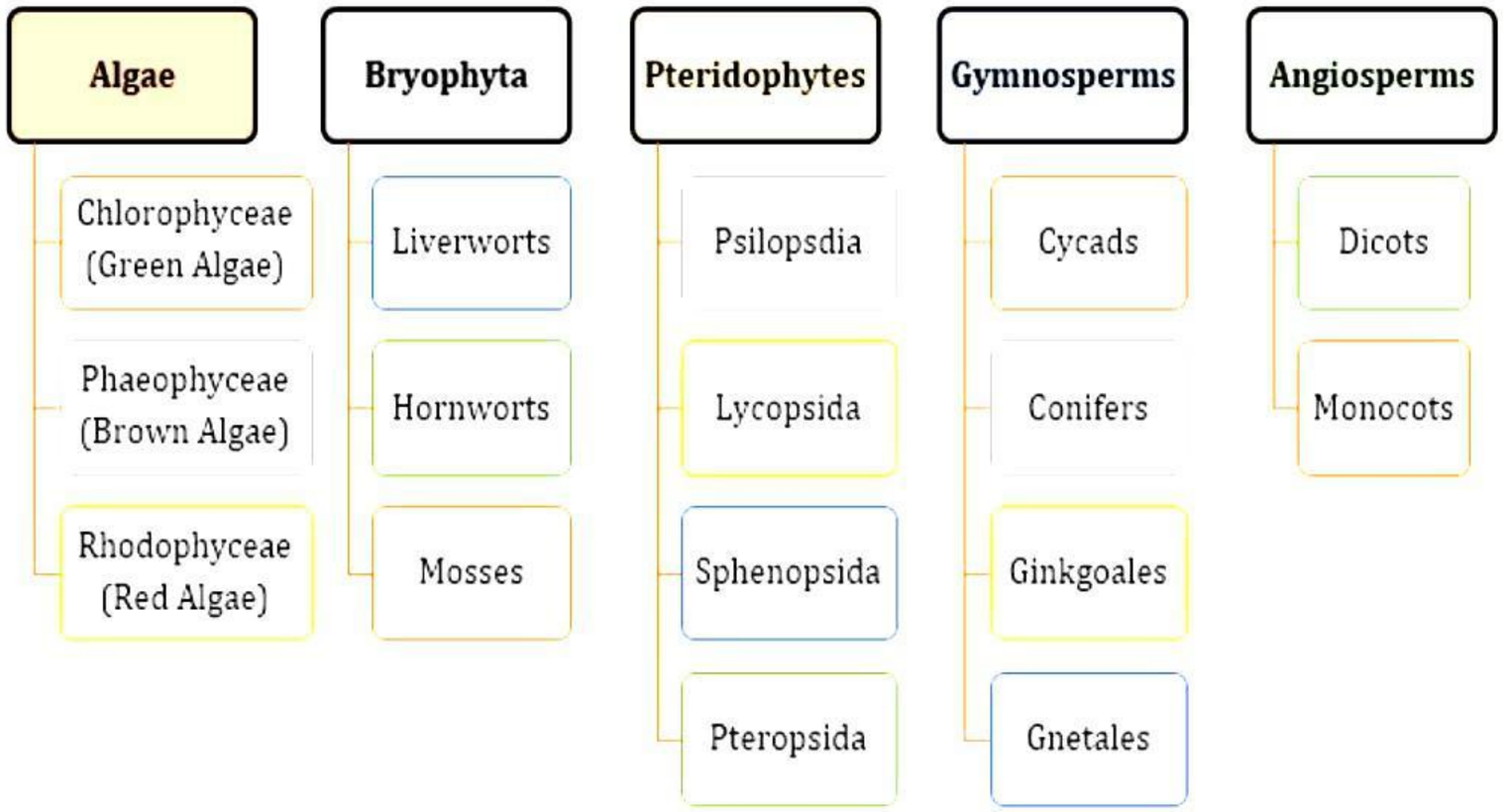
CHAPTER 2: PLANT KINGDOM

Eukaryotic, multicellular, chlorophyll containing and having cell wall, are grouped under the kingdom Plantae. It is popularly known as plant kingdom.



Types of Classification System

These includes artificial system, natural system and phylogenetic system of classification.

Artificial System of Classification

This system is based on comparison of one or a few superficial characteristics, which are helpful in easy identification of organisms. This system use only few superficial characters (i.e., habits, numbers, colours and shapes of leaves, etc) which leads to

many organisms grouped together,

Natural System of Classification

It is also known as phenetic system of classification. The natural system of classification is based on natural affinities among the organisms. It considers both external and internal features like structure, anatomy, embryology and phytochemistry.

Phylogenetic System of Classification

The phylogenetic system of classification indicates the evolutionary as well as genetic relationships among organisms. This system is based on fossil records of biochemical, anatomical, morphological, physiological, embryological and genetical.

If there is no supporting fossil evidences, we now use information from many other sourses to help to resolve the difficulties in classification.These are the following branches

- **Numerical Taxonomy** use computer by assigning code for each character and analyzing the features.
- **Cytotaxonomy** is based on cytological information like chromosome number, structure and behaviour.
- **Chemotaxonomy** uses chemical constituents of plants to resolve the confusion.

ALGAE: These include the simplest plants which possess undifferentiated or **thallus like forms**, reproductive organs single celled called gametangia. It includes only Algae.

Characteristic of Algae

- Plant body is thallus, which may be unicellular, colonial, filamentous or parenchymatous.
- Usually aquatic but a few are also found in moist terrestrial habitats like tree trunks, wet rocks, moist soil, etc.
- Vascular tissues and mechanical tissues are absent.
- Reproduction is vegetative by fragmentation, asexual by spore formation (zoospores) and sexual reproduction by fusion of two gametes which may be Isogamous (*Spirogyra*), Anisogamous (*Chlamydomonous*) or Oogamous (*Volvox*).
- Life cycle is various- haplontic, diplontic or diplohaplontic.

Green Algae	Brown Algae	Red Algae
Mostly fresh water and sub aerial.	Mostly marine.	Mostly marine.
Unicellular organisms abundant.	Unicellular species are absent. The plant body has holdfast, stipe and frond	Unicellular species fewer.
Chlorophyll a,b	Chlorophyll a, c ,Fucoxanthin	Chlorophyll a,d ,Phycoerythrin
Reserve food is starch. Members have storage bodies	Reserve food is laminarin.	Reserve food is floridean starch.

called **pyrenoids** in chloroplast		
Cell wall is of cellulose.	Cell wall contains cellulose and algin.	Cell wall contains cellulose and poly-sulphate esters.
Zoospores present.2-8 equal flagella,apical	Zoospores are pyriform.2 flagella,unequal and lateral	Zoospores absent.Sexual reproduction is oogamous . Post fertilisation developments present
Chlamydomonas, Ulothrix, spirogyra.	Focus, Sargassum, ectocarpus.	Polysiphonia, Gelidium, Porphyra etc.

Economic importance-

1. A number of brown algae (*Porphyra,Laminaria, Sargassum*) are used as food in some countries.
2. Fucus, and Laminaria are rich source of Iodine.
3. Certain brown algae and red algae produce large amount of hydrocolloids (Algin and carageen)
4. Agar obtained from Gelidium and Gracilaria used to grow microbes,used for the preparation of icecreams and jelliies
5. Chlorella,a unicellular green algae is used as a food suppliment

BRYOPHYTES – They are non-vascular mosses and liverworts that grow in moist shady region. They are called amphibians of plants kingdom because these plants live on soil but dependent on water for sexual reproduction.

Characteristic features-

- Live in damp and shady habitats, found to grow during rainy season on damp soil, rocks, walls, etc. Sporophyte is dependent on gametophyte for nourishment
- The dominant phase or plant body is free living gametophyte.
- Roots are absent but contain rhizoids
- Vegetative reproduction is by fragmentation, tubers, gemmae, buds etc. sex organs are multicellular and jacketed. The male sex organ is called **antheridium.** They produce biflagellate antherozoids. The female sex organ called **archegonium** is flask-shaped and produces a single egg.

Economic importance

- Some mosses provide food for herbaceous animals
- Peat moss Sphagnum provide peat that have long been used as fuel,packing materials for transhipment of living materials
- Mosses along with lichens are the first organism to colonise on rocks
- Prevent soil erosion

Bryophytes are classified into-

1. **Liverworts.**

- The plant body of a liverwort is thalloid, e.g., Marchantia. The thallus is dorsiventral and closely appressed to the substrate.
- Asexual reproduction in liverworts takes place by fragmentation, or by the formation of specialised structures called **gemmae.**
- Gemmae are green, multicellular, asexual buds, which develops in small receptacles called gemma cups. The gemmae becomes detached from the parent body and germinate to form new individuals
- During sexual reproduction, male and female sex organs are produced either on the same or on different thalli. The sporophyte is differentiated into a foot, seta and capsule. Spores produced within the capsule germinate to form free-living gametophytes.

2. **Mosses**

- The gametophyte consists of two stages- the first stage is **protonema** stage, which develops directly from spores. It is creeping, green and frequently filamentous. The second stage is the **leafy stage**, which develops from secondary protonema as lateral bud having upright, slender axes bearing spirally arranged leaves.
- Vegetative reproduction is by the fragmentation and budding in secondary protonema. In sexual reproduction, the sex organs antheridia and archegonia are produced at the apex of the leafy shoots.
- Sporophytes in mosses are more developed and consist of foot, seta and capsule.Common examples are *Funaria, Polytrichum, Sphagnum* etc.

PTERIDOPHYTES

- They are seedless vascular plants that have sporophytic plant body and inconspicuous gametophyte. Sporophytic plant body is differentiated into true stem, roots and leaves.
- Vascular tissue are present but vessels are absent from xylem and companion cells and sieve tube are absent.
- Sporophytes bear sporangia that are subtend by leaf like appendages called **sporophylls**. In some plants (*Selaginella*) compact structure called strobili or cone is formed.
- Sporangia produce spores by meiosis in spore mother cells. Spores germinate to produce multicellular thalloid, **prothallus.**
- Gametophyte bears male and female sex organ called antheridia and archegonia. Water is required for fertilisation of male and female gametes.
- Most of Pteridophytes produce spores of similar kind (**homosporous**) but in *Selginella* and *Salvinia*, spores are of two kinds (**heterosporous**) larger called megaspore that produce female gametophyte and smaller microspore that produce male gametes.
- Heterospory is a precursor to seed habit:The development of zygote into young embryos takes place within the female gametophyte which is retained on the parent sporophyte.This event is a precursor to seed habit.

GYMNOSPERMS:

- Gymnosperms are those plants in which the ovules are not enclosed inside the ovary wall and remain exposed before and after fertilisation.

- They are perennial and woody, forming either bushes or trees. Some are very large (*Sequoia sempervirens*) and others are very small (*Zamia pygmia*).
- Stem may be unbranched(Cycas) or branched(Pinus). Root is taproot. Leaves may be simple or compound.
- Roots of Pinus have fungal association to form mycorhiza
- Cycas have small specilised roots called coralloid root which are associated with nitogen fixing cyanobacteria.
- Leaves of gymnosperms are well adapted to withstand extreme environmental conditions.Eg.Needle leaves reduce surface area,sunken stomata,thick cuticle
- They are heterosporous, produce haploid microspore and megaspore in male and female Strobili respectively.
- Male and female gametophytes do not have independent free-living existence. Pollination occurs through air and zygote develops into embryo and ovules into seeds. These seeds are naked.
- Example- Pines, Cycus, Cedrus, Ginkgo, etc.

ANGIOSPERMS

- Pollen grain and ovules are developed in specialized structure called flower. Seeds are enclosed inside the fruits.
- Size varies from almost microscopic Wolfia (0.1cm)to tall tree Eucalyptus (more than 100m
- The male sex organs in a flower is the stamen. It contains pollen grain.
- The female sex organs in a flower is the pistil or the carpel. Pistil consists of an ovary enclosing one or many ovules. Within ovules are present highly reduced female gametophytes termed **embryo-sacs**.
- Each embryo-sac has a three-celled egg apparatus – one egg cell and two synergids, three antipodal cells and two polar nuclei. The polar nuclei eventually fuse to produce a diploid secondary nucleus.

Angiosperms are further classified into:

- Monocotyledons
- Dicotyledons

Monocotyledons	Dicotyledons
1. Single cotyledons. 2. Parallel venation. 3. Fibrous root system. 4. Closed vascular bundle. 5. More number of vascular bundles. 6. Banana, wheat, rice.	1. Two cotyledons. 2. Reticulate venation. 3. Tap root system. 4. Open vascular bundle. 5. Less number of vascular bundles. 6. Gram, mango, apple.

- **Double fertilisation-** Each pollen grain produce two male gametes. One gametes fuse with egg to form embryo. This is called Syngamy. Other gametes fuse with two polar nuclei to form endosperm, triple fusion. Since fertilisation takes place twice, it is called double fertilisation.

Alternation of generation

Different plant groups complete their life cycles in different patterns. Angiosperms complete their life cycle in two phases- a diploid sporophytes and haploid gametophyte. The two follows each other. This phenomenon is called alternation of generation.

Haplontic- Saprophytic generation is represented by only the one-celled zygote. Meiosis in zygote results into haploid spores to form gametophytes, which is the dominant vegetative phase. Example- Volvox, Spirogyra etc.

Diplontic- Diploid sporophytes is dominant, independent, photosynthetic plants. The gametophyte is represented by single to few celled. All seed bearing plants fall under this category.

Haplo-diplontic- Both phases are multicellular and intermediate condition is present. It is present in Bryophytes and Pteridophytes.