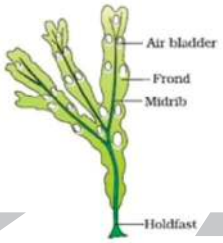

Chapter - 3

Plant Kingdom

Points to Remember

Classification :

- **Artificial System of Classification**
  - By Carolus Linnaeus, based on androecium structure and vegetative characters.
- **Natural System of Classification**
  - Based on natural affinities among organisms
  - Included external as well as *internal features*
  - By Geroge Bentham and J.D. Hooker
- **Phylogenetic System of Classfication**
  - Based on evolutionary relationships between the various organisms By Hutchinson

Numerical Taxonomy :

- Carried out using computers
- Based on all observable characteristics
- Data processed after assigning number and codes to all the characters.

  Advantages : Each character gets equal importance and a number of characters can be considered.

Cytotaxonomy :

- Based on *cytological informations.*
- Gives importance to chromosome number, structure and behaviour.

Chemataxonomy :

- Based on Chemical constitutents of the plants.

Algae :

- Chlorophyll bearing, simple, thalloid, autotrophic and largely aquatic organisms.

Importance of Algae :

- Help in carbon dioxide fixation by carrying out photosynthesis and have immense economic importance.
- At least half of the total carbon dioxide fixation on earth carried out by them.
- Increases dissolved oxygen level in their environment.
- Many species like ***Laminaria, Sargassum, Porphyra*** etc. are used as food.
- ***Agar*** obtained from ***Gelidium***and ***Gracilaria*** which is used in ice-creams and jellies and to grow microbes.
- ***Algin*** obtained from brown algae and ***carrageen*** from red algae used commercially as ***hydrocolloids.***
- ***Chlorella*** and ***Spirullina*** are unicellular algae, rich in protein and used even by space travellers.
- Algae are unicellular like ***Chlamydomonas***, colonial like ***Volvox*** or or filamentous like ***spirogyra*** and ***Ulothrix.*** Occur in water, soil, wood moist stones etc.

Algae are divided into 3 classes.

(i) Chlorophyceae

- Green algae, Main pigment is chlorophyll 'a' and 'b'.
- Cell wall has inner layer of cellulose and outer layer of pectose.
- Has pyrenoids made up of starch and proteins.
- Pigment and pyrenoids are located in ***Chloroplast***.

e.g., ***Chlamydomonas, Volvax, Spirogyra, Ulothrix, Chara.***

(ii) Phaeophyceae

- Brown algae are brown coloured due to main pigments chlorophyll 'a', 'c' and fucoxanthin (xanthophyll)
- Cell wall has cellulose with gelantionous coating of algin.
- Has mannitol and laminarin (complex carbohydrate) as reserve food material.
- Body divisible into holdfast, stipe and frond.
- *e.g.,* ***Ectocarpus, Fucus, Laminaria, Dictyota, Sargassum***

(iii) Rhodophycease

- Red algae are red coloured due to pigments chlorophyll 'a', 'd' and r-phycoerythrin.
- Found on surface as well great depths in oceans.
- Cell wall has cellulose.
- Reserve food material is floridean starch.

e.g., ***Polysiphonia, Porphyra, Gelidium,Gracilaria.***

Reproduction in Algae

Vegetative reproduction : by fragmentation

Asexual Reproduction : Flagellated zoospores in Chlorophyceae, Biflagellated zoospores in Phaeophycease, By non-motile spores in Rhodophyceae.

Sexual Reproduction : Isogamous, anisogamous or oogamous in chlorophyceae and Phaeophyceae.

By non-motile gametes and oogamous in Rhodophyceae.

Bryophytes :

- 'Amphibians of plant kingdom'.
- Occur in damp, humid and shaded places.
- Lack true roots, stem or leaves.
- Main plant body is haploid and thallus like (prostrate or erect)
- **Economic Importance :** Food for herbaceous animals.

Sphagnum in from of peat is used as fuel and also used as packing material for trans-shipment of living material, as it has water holding capacity.

Prevents soil erosion, alongwith lichens are first colonizers on barren rock.

- Is divided into two classes ***Liverworts*** (thalloid body, dorsiventral, *e.g.,* ***Marchantia***) and ***Mosses*** (have two stages in gametophyte–creeping, green, branched, filamentous ***protonema stage*** and the ***leafy stage*** having spirally arranged leaves *e.g.,* ***Funaria, Polytrichum and Sphagnum***).

Reproduction in Bryophytes

- Vegetative reproduction by fragmentation.
- Asexual reproduction by gemmae formed in gemma cups.
- Sexual reproduction : Main plant body is haploid, produces gametes and so called ***Gametophyte***. By fusion of antherozoids produced in antheridium and egg cell produced in archegonium, results in formation of zygote which develops into sporophytic structure differentiated into foot, seta and capsule. ***Spores*** produced in a capsule germinate to from free-living gametophyt e (Protonema). ***Sporophyte*** is not free living but attached to photosynthetic gametophyte from which derives nutrition.

Pteridophytes :

- First terrestrial plants.
- Prefer cool, damp and shady places to grow.
- Grown as ornamentals.
- Used for medicinal purpose, as soil binder.

- Main plant body is sporophyte which is differentiated into true root, stem and leaves.
- Leaves may be small (microsphorophyll) as in ***Selaginella*** or large (macrophyll) as in ferms.
- Sporangia having spores are subtended by leaf-like appendages called sporophylls. (Sporphylls may be arranged to form strobili or cones.)
- In Sporangia, the spore mother cells give to sproes after meiosis.
- Spores germinate to form haploid gametophytic structure called **prothallus** which is free living, small, ulticellular and photosynthetic.
- Prothallus bears antheridia and archegonia which bear antherozoids and egg cell respectively which on fertilisation from zygote. Zygote produces multicellular, well differentiated sporophyte.
- The four classes are : Psilopsida (*Psilotum*), Lycopsida (*Selaginella*), Sphenopsida (*Equisetum*) and Pteropsida (*Pteris*).

Heterospory : Two kinds of spores *i.e.,* large (macro) and small (micro) spores are produced. *e.g.,Selaginella* and *Salvinia.*

Seed Habit : The development of zygote into young embryos takes place within the female gametophyte which is retained on parent sporophyte. This event is precursor to seed habit and this is an important step in evolution and is found ***Selaginella*** and ***Salvinia*** among the pteridophytes.

Gymnosperms :

- Have naked seeds as the ovules are not enclosed by any ovary wall and remain exposed.
- Includes shrubs and trees (medium and tall sized).
- Have generally tap roots, stem may be unbranched (***Cycas***) or branched (***Pinus, Cedrus***), leaves–needle like (***Pinus***) and pinnate (***Cycas***).
- Roots of ***Pinus*** have fungal association in the form of mycorrhiza.
- Cycas have small specialized roots called ***coralloid root*** which are associated with N_2 fixing cyanobacteria.
- Heterosporous–Produce haploid microspores and megaspores.
- Male cone has microsporophylls which bear microsporangia having microspores which develop into reduced gametophyte called pollengrain.
- Female cone has megasporophylls which bear megasporongia having megaspores which are enclosed within the megasporangium (Nucellus). One megaspore develops into female gametophyte bearing two or more archegonia.

- Pollen grains carried in air currents reach ovules, form pollen tube which reach archegonia and release male gametes which fertilise egg cell and form zygote which produce embryos. Ovules develop into seeds which are not covered.

Angiosperms :

- Called flowering plants and have seeds enclosed in fruits.
- Divided into two classes–Dicotyledons (have two cotyledons) and Monocotyledons (have one cotyledon).
- **Smallest angiosperm :** *Wolfia*
- **Large tree :** *Eucalyptus* (Over 100 meters)
- Stamen has filament and anther. Anthers bear pollen grains. Pollen grains have two male gametes.
- Pistil has stigma, style and ovary. Ovary has ovule in which female gametophyt e (embryo sac) develops.
- Embryo sac has 7 cells and 8 nuclei.One egg cell 2 synergids, 3 antipodals and two polar nuclei which fuse to form secondary nucleus.
- Pollen grain is carried by wind, water, insects and other agents reaches to stigma and produces pollen tube which enters embryo sac.
- **Double fertilisation :** One male gemate fuses with egg cell (Syngamy) to form zygote which develops into embryo.

Other male gamete fuses with secondary nucleus (triple fusion) which forms triploid primary endosperm nucleus (PEN). PEN develops into endosperm which nourishes the developing embryo.

- Ovules developo into seeds and ovaries into fruits.

Life Cycle and Alternation of Generations

- *Plants* complete their *life cycle* in two phase–a diploid *sporophyte phase* and the haploid *gametophyte phase*. These two phase follow each other rigidly. This phenomenon is called *alternation of generations.*
- Life cycle of different plant group/individuals can be of following patterns.

1. **Haplontic Life Cycle**—Gametophyte phase — longer and dominant (haploid).

   Sporphyte phase—Zygote (diploid) stage.

   Example—Mostly in Algae (*Volvox, Spirogyra, Chlamydomonas*)

2. **Diplontic Life Cycle—**

Gametophyte Phase — Short, represented by single to few celled haploid gametophyte (pollen/ embryosac)

Sporophyte phase — Longer and dominant (diploid).

Example—All seed bearing plants (gymnosperms & angiosperms) *Fucus.*

3. **Haplo-diplontic life cycle**—(With intermediate condition)

(a) Gametophyte phase — dominant, independent, haploid, thalloid/erect phase.

Sporophyte phase — Totally or partially dependent on gametophyte for anchorage and nutrition (short lived)

Example—Bryophytes

(b) Gametophyte phase — Independent short lived, multicellular haploid,saprophytic/autotrophic.

Sporophyte phase — dominant, diploid, independent vascular plant body.

Example—Pteridophytes

(c) Other examples are *Ectocarpus, Polysiphonia*, Kelps.

Questions

Very Short Answer Question (1 mark each)

1. What is a pyrenoid body ?
2. Define gemma.
3. Which group of plants is regarded as first terrestrial plants ? Why ?
4. Which organism is regarded as one of the tallest tree species ?
5. The gametes and spores of phaeophyceae have a distinct morphology. Give its name.
6. Which substance has structural similarity to floridean starch ?
7. Name the oranisms which exhibit heterospory and seed habit.

Short Answer Question-I (2 marks each)

8. *Sphagnum* has a lot of economic importance. Justify.
9. Gymnosperms can show polyembryony. Why do you think so ?

10. How is leafy stage formed in mosses ? How is it different from protonema ?

Short Answer Question-II (3 marks each)

11. The leaves in gymnosperms are adapted to withstand xerophytic conditions. Justify.
12. The gametophytes of bryophytes and pteridophytes are different from that of gymnosperms. How ?
13. Roots in some gymnosperms have fungal or algal association. Give examples, their names and role in the plants.
14. Why is presence of water a must for fertilisation in pteridophytes ?

Long Answer Questions (5 marks each)

15. Draw the life cycle of an angiosperm alongwith a brief note on double fertilisation.
16. Explain alternation of generation in plants.

Answers

Very Short Answers (1 mark each)

1. Proteinaceous body usually surrounded by starch found in algae.
2. Gemma are green, multicullular, asexual buds which develop in receptacles called as gemma cups.
3. Pteriodphytes. As they possess vascular tissues–xylem and phloem.
4. *Sequoia*
5. Pyriform (pear-shaped), bear two laterally attached flagella.
6. Amylopectin and glycogen.
7. *Selaginella* and *Salvinia*.

Short Answers-I (2 marks each)

8. Provide peat used as fuel : used as packing material for trans-shipment of living material.
9. Have two or more archegonia, so polyembryony can occur.
10. Leafy stage develops from secondary protonema as a lateral bud. Protonema is creeping, green, branched frequently filamentous stage whereas leafy stage is upright with spirally arranged leaves.

Short Answers-II (3 marks each)

11. Gymnosperms like conifers have : needle shaped leaves to reduce surface area, thick cuticle and sunken stomata to reduce water loss.
12. Male and f emale gametophyte have free existence in bryophytes and pteridophytes but not in Gymnosperms. They remain within sporangia retained on sporophytes.
13. *Pinus* has fungal association to form mycorrhiza which helps in absorption of water and minerals. Cycas has algal association in coralloid roots which are associated with N_2 fixing cyanobacteria.
14. The antheridia produces male gametes, antherozoids which swim in water to reach archegonia, bearing non-motile egg. Thus fertilisation can occur only when water is present in the surrounding medium.

Long Answers (5 mark each)

15. Refer Figure 3.6, page no. 41, NCERT, Text Book of Biology for Class XI.
16. Refer 'Points to Remember' and Page No. 42,NCERT, Text book of Biology for class XI.