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 George Bentham and J. D. Hooker
- **Phylogenetic System of Classification**
  - 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.

Chemotaxonomy :
- Based on chemical constituents of the plants.

Importance of Algae :
- At least half of the total carbon dioxide fixation on earth carried out by them.
- Increase oxygen level in the environment.
- Many species like ***Laminaria, Sargassum*** etc. are used as food.

- Agar obtained from ***Gelidium*** and ***Gracilaria*** which is used in ice-creams and jellies.
- Algin obtained from brown algae and carrageen from red algae used commercially.
- ***Chlorella*** and ***Spirullina*** are unicellular algae, rich in protein and used even by space travellers.

Algae divided into 3 classes :

- Algae are unicellular like ***Chlamydomonas***, colonial like ***Volvox*** or filamentous like ***Spirogyra***.
- Are simple, thalloid, autotrophic and occur in water, soil, wood etc.
- Help in carbon dioxide fixation by carrying out photosynthesis and have immense economic importance.

(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.
  e.g., ***Chlamydomonas, Volvox, Spirogyra.***

(ii) Phaeophyceae

- Brown algae are brown coloured due to main pigments chlorophyll 'a', 'c' and fucoxanthin.
- Cell wall has cellulose and lignin or gelantinous coating of algin.
- Has mannitol and laminarin as reserve food material.
- Body divisible into holdfast, stipe and frond.
- *e.g.,* ***Ectocarpus, Fucus, Laminaria.***

(iii) Rhodophyceae

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

REPRODUCTION IN ALGAE

Vegetative reproduction : by fragmentation

Asexual Reproduction : Flagellated zoospores in Chlorophyceae

Biflagellated zoospores in Phaeophyceae

By non-motile spores in Rhodophyceae.

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

By non-motile gametes in Rhodophyceae.

BRYOPHYTES : 'Amphibians of plant kingdom'

- Occur in damp, humid places.
- Lack true roots, stem or leaves.
- Main plant body is haploid.
- **Economic Importance :** Food for herbaceous animals.

Sphagnum in form of peat is used as fuel and also used for trans-shipment of living material, as it has water holding capacity, prevents soil erosion, along with lichens are first colonisers on barren rocks.

• 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***.)

REPRODUCTION IN BRYOPHYTES

• Vegetative reproduction by fragmentation.

• Asexual reproduction by gemmae formed in gemma cups.

• Sexual reproduction : By fusion of antherozoids produced in antheridium and egg cell produced in archegonium. This results in formation of zygote which develops into a sporophytic structure differentiated into foot, seta and capsule. Spores produced in a capsule germinate to form free-living gametophyte (Protonema).

PTERIDOPHYTES :

• Main plant body is sporophyte which is differentiated into true stem and leaves.

• Leaves may be small (microsporophyll) as in ***Selaginella*** or large (macrophyll) as in ferns.

• Sporangia having spores are subtended by leaf-like appendages called sporophylls. (Sporophylls may be arranged to form strobili or cones.)

• In Sporangia, the spore mother cells give rise to spores after meiosis.

• Spores germinate to form haploid gametophytic structure called **prothallus** which is free living, small, multicellular and photosynthetic.

• Prothallus bears antheridia and archegonia which bear antherozoids and egg cell respectively which on fertilisation form 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 is an important step in evolution and is found in ***Selaginella*** and ***Salvinia*** among the pteridophytes.

GYMNOSPERMS : • Have naked seeds as the ovules are not enclosed by any ovary wall and remain exposed.

• Male cone has microsporophylls which bear microsporangia having microspores which develop into reduced gametophyte called pollen grain.

• 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*

• 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 gametophyte (embry 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 reaches to stigma and produces pollen tube which enters embryo sac.

• **Double fertilisation :** One male gamete fuses with egg cell to form zygote which develops into embryo.

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

• Ovules develop into seeds and ovaries into fruits.

Alternation of generation : Haploid gametophytic and spore producing sporophytic generation alternate with each other in this process.

Haplontic : Gametophytic phase dominant. *e.g.,* ***Chlamydomonas***

Diplontic : Sporophytic phase dominant. *e.g.,* Angiosperms and Gymnosperms

Haplo-Diplontic : Intermediate like stage where gametophytic and sporophytic stage partially dominate at different stages. *e.g.,* Bryophytes and Pteridophytes.

Exceptions : *Ectocarpus, Polysipnonia* are Haplo-diplontic algae.

Fucus is diplontic alga.

QUESTIONS

Very Short Answer Questions (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 organisms which exhibit heterospory and seed habit.

Short Answer Questions- II (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 Questions-I (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.

Long Answer Questions (5 marks each)

14. Draw the life cycle of an angiosperm along with a brief note on double fertilisation.

ANSWERS

Very Short Answers (1 mark each)

1. Proteinaceous body usually surrounded by starch found in algae.
2. Gemma are green, multicellular, asexual buds which develop in receptacles called as gemma cups.
3. Pteridophytes. 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-II (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 polymebryony 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-I (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 female gametophyte have free existence in bryophytes and pteridophytes but not in Gymnosperms.

13. *Pinus* has fungal association to form mycorrhiza which helps in absorption of water and minerals.

    Cycas has cyanobacteria in its roots which forms coralloid roots and helps in nitrogen fixation.

Long Answers (5 marks each)

14. Refer Figure 3.6, page no. 41, NCERT, Text Book of Biology for Class XI.