3. **Haplo-diplontic life cycle**

Answer:

1. Haplontic life cycle- Volvox
2. Diplontic life cycle- All seed-bearing plants
3. Hapiodiplontic life cycle- Bryophytes

Q4:Cyanobacteria are classified under which kingdom?

Answer:

Cyanobacteria are classified under kingdom Monera.

Q5:What do you mean by anisogamy?

Answer:

It is a type of sexual reproduction that involves the fusion of two motile gametes that are dissimilar in size.

Q6: How many cells an embryo sac is made of?

Answer:

The embryo sac is made up of two synergids, one egg cell, three antipodal cells, and one secondary nucleus.

Q7: What are the three groups of plants that bear archegonia?

Answer:

Bryophytes, pteridophytes, and gymnosperms are the three groups of plants that bear archegonia.

Q8:Why are both gymnosperms and angiosperm in spite of both bearing seeds?

Answer: This happens because in gymnosperms the seeds are not present inside the fruit, while in angiosperms they are enclosed inside the fruit.

Q9:What is an artificial system of classification?

Answer: In-Plant kingdom, the artificial system of classification is based on the vegetative characters and androecium structure.

Q10:What is the Botanical name of sea palm?

Answer: The Botanical name of sea palm is Postelsia palmaeformis.

4 Mark Questions

Q1:Why are bryophytes considered amphibians of the plant kingdom?
Answer:Bryophytes are considered amphibians of the plant kingdom because they depend on water for the movement of male gametes called antherozoids to reach archegonium for fertilization.

Q2:Compare the various reproductive parts of pteridophytes and gymnosperms with those of angiosperms.
Answer:

Reproductive parts of pteridophytes and gymnosperms	**Reproductive parts of angiosperms**
Cone	Flower
Megasporophyll	Anther
Megasporangium	Ovule
Microsporangium	Stamen
Microsporophyll	Pistil/Carpel

Q3: Does heterospory have some evolutionary significance in the plant kingdom?

Answer: Pteridophytes are intermediate between bryophytes and gymnosperms. Primitive pteridophytes are homosporous while the later pteridophytes are heterosporous. Bryophytes are homosporous and gymnosperms are heterosporous.

Q4: What is the basis of classification of algae?

Answer: Fritsch (1935), has classified algae considering phylogeny, affinities and inter-relationships of various forms. He classified algae mainly on the basis of the characters like structure of plant body, nature of the pigments, reserve food material, number and position of flagella, chemistry of cell wall and methods of reproduction etc. Algae is divided into 11 classes but among them 3 main classes are Chlorophyceae, Phaeophyceae and Rhodophyceae.

Q5: Discuss the phylogenetic relationship of Cycas with any other group of plants.

Answer: Cycas is an evergreen plant that looks like a palm. It exhibits a phylogenetic relationship with pteridophyte. The evolutionary characters include:

- Shedding of seed when the embryo is immature.
- Slow growth.
- Monocyclic wood.
- Little secondary growth.
- Leaf-like megasporophylls.
- Circinate ptysix.
- Persistent leaf bases.
- Arrangement of microsporangia is well-defined archegonia.

Q6: Describe the life cycle and nature of a fern prothallus.

Answer: The life cycle of Prothallus: The life cycle of fern exhibits alternation of generations. The fern prothallus is multicellular, free-living, haploid, autotrophic, and thalloid structure. It is developed from the spores produced after reduction division by saprophyte. These spores germinate with a germ tube. It forms a filament of 3-6 cells and rhizoids at the base which develops into a gametophytic plant later.

Q7: Mentiontheploidyofthefollowingrprotonemal cell of a moss; primary endosperm nucleus in dicot, leaf cell of a moss; prothallus cell of a fern; gemma cell in Marchantia; meristem cell of monocot, ovum of a liverwort,

and zygote of a fern.
Answer: Protonemal cell of a moss – haploid. Primary endosperm nucleus in dicot – triploid.
Leaf cell of a moss – haploid.
Prothallus cell of a fern – haploid.
Gemma cell in Marchantia – haploid. Meristem cell of monocot – diploid.
Ovum of a liverwort – haploid.
Zygote of a fern – diploid.

Q8:Mycorrhiza and coralloid roots are found in which plants? What do these terms mean?
Answer: Mycorrhiza is the symbiotic association between fungus and roots of vascular plants. The mycorrhizal association is present in conifers such as Pinus, Cedrus, etc. Coralloid roots are present in Cycas. Coralloid roots are present in clusters at the base of the stem and protrude over the ground. It is greenish in colour and dichotomously branched.

Q9: The heterosporous pteridophytes exhibit certain characteristics which are precursors to the seed habits in gymnosperms. Explain.
Answer: Heterospory is the production of two types of spores; the megaspores and the microspores. The microspores produce male gametophyte which produces male gametes, while the megaspores produce female gametophyte which produces archegonia and provides nourishment to the embryo. Thus, heterospory leads to a reduction of the gametophyte. Thus, heterospory in pteridophytes forms the base of seed habits in gymnosperms.

Q10:What is the importance of Algae?

Answer:

Algae are economically important in different ways and are discussed below:

1. Helps in carbon dioxide fixation.
2. They are the simplest forms of producers in a food chain.
3. Helps in increasing the dissolved oxygen level in the environment.
4. There are different species of algae, which are used as a source of food.
5. They are a source of crude oil and also for many pharmaceutical and industrial products that are used by humans.

7 Mark Questions

Q1:When and where does reduction division take place in the life cycle of a liverwort, a moss, a fern, a gymnosperm and an angiosperm?

Answer:

All of these plants show life cycle with one gametophytic (n) generation and one sporophytic (2n) generation. Reduction division or meiosis that produces haploid (n) cells from diploid cells (2n) is necessary in their life cycles to restore gametophyte generation after sporophytic generation. It occurs in different body structures according to the basic body design of these groups. Reduction division in a liverwort and moss takes place at the end of the sporophytic generation, where haploid spores are formed by reduction division of spore mother cell inside capsule. Spores germinate to produce dominant gametophytic generation. Reduction division in fern takes place at the end of the dominant sporophytic generation inside the sporangium from spore mother cell by reduction division. Spores may be of one type (homospory) or of two types (heterospory).

Reduction division in gymnosperms takes place at the end of dominant sporophytic generation. Megaspore and microspores are produced by the reduction division of diploid megaspore mother cell and diploid microspore mother cell respectively, inside megasporangium and microsporangium. Reduction division in angiosperms takes place at the end of dominant sporophytic generation. The haploid pollen grain or microspore and the haploid egg cell are produced by the reduction division of diploid (microspore) mother cell and diploid megaspore mother cell respectively. Microsporic division occurs inside anther and megasporic division occurs inside gynoecium (ovary).

Q2:What is heterospory? Briefly comment on its significance. Give two examples.

Answer:

The occurrence of two kinds of spores in the same plant is called as heterospory. Among them the smaller spore is called microspore and the larger spore is called megaspore. Heterospory first evolved in pteridophytes. Significance of heterospory (i) Heterospory is associated with the sexual differentiation of gametophyte /.<?., a microspore develops into a male gametophyte whereas a megaspore develops into

a female gametophyte.
(ii)In homosporous pteridophytes spores have to germinate on soil thus face more environmental problems. In heterosporous pteridophytes, spores germinate within the sporangium and the gametophytes are retained inside for variable periods of time. Hence, germinating gametophyte has better chances of survival. This lays the foundation of complete retention of gametophytes within sporophytes in angiosperms and gymnosperms.
(iii)Heterospory is the basis of development of seed habit in higher plants.

Q3:Name three groups of plants that bear archegonia. Briefly describe the life cycle of any one of them.

Answer:

The three groups of plants that bear archegonia are bryophytes, pteridophytes and gymnosperms.

Life cycle of a bryophyte is as follows : The main plant body of bryophyte is gametophytic (n), which is independent and may be thallose (no differentiation in root, stem, leaves) e.g., Riccia, or may be foliose (having leafy axis) e.g., Funaria. The dominant phase in the life cycle of Funaria is the gametophyte, which occurs in two stages, the protonema stage and the erect, leafy gametophytic plant.
The leafy gametophyte consists of an upright, slender axis (stem-like) that bears spirally arranged leaves and is attached to the substratum by multicellular, branched rhizoids. Vegetative reproduction takes place
by fragmentation; by the buds formed in secondary protonema etc. The sex organs, antheridia and archegonia are produced in dusters at the apices of the leafy shoots. Antheridia produces antherozoids and archegonia produces egg. Antherozoid (male gamete) and egg (female gamete) fuses and form zygote.Zygote develops into a sporophyte; which is differentiated into foot, seta and capsule and spores are produced in the capsule.

Spores on reaching a suitable substratum germinate to produce a filamentous juvenile stage, .called the primary protonema, which later produces secondary protonema that forms erect leafy plants

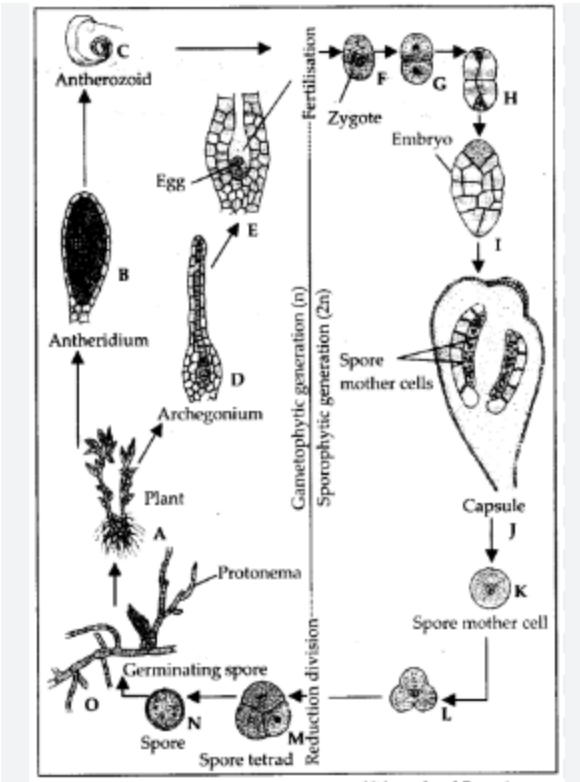

Fig.: Diagrammatic representation of life cycle of *Funaria*

Q4:Write a note on economic importance of algae and gymnosperms.

Answer:

Economic importance of algae is as follows:

The group Algae plays both economically beneficial as well as harmful roles.

Beneficial importance :

(i) People of coastal countries have been using sea weeds & certain other algae as source of food, e.g., Porphyra, Ulva, Laminaria, etc.

(ii)Some algae are used as food for marine as well as domestic animals, e.g., Sargassum, Macrocystis.

(iii)Algae are useful source of many commercial products like agar, a jelly like substance (complex polysaccharide) is extracted from species of red algae belonging to the genera Gelidium, Gracilaria etc. Agar is also used as base in culture media. Carrageenin occurs as a cell wall polysaccharide, esterified with sulphate. It is extracted from red alga like Chondrus Crispin, etc. is used in pharmaceutical emulsifier and textile, leather, cosmetic industries. Alginates are salts of alginic acid found in the cell wall of phaeophyceae (brown algae) like Fucus, Laminaria etc.

(iv)Algae are also useful in medicine industry. Antibiotic chlorellin is obtained from Chlorella. Extracts of Cladophora, Lyngbya kill strains of Pseudomonas and

Mycobacterium like bacteria. Nitella is used to destroy mosquitoes growth in ponds and hence used in control of malaria.
(v) Some algae are used in agriculture like Nostoc, Anabaena etc. are used to convert atmospheric N2 into nitrogenous compounds which are absorbed by higher plants. Some sea weeds like Fucus, Litlwphyllum, Lycophyllum etc. are rich io K, P, trace elements and growth substances and are used as fertilisers by coastal people.
(vi)Some algae like Chlorella, Chlamydomonas, etc. are used in sewage disposal in ponds. These algae help in bacterial decomposition by providing 02.
(vii)Some algae like Chlorella, Synecoccus, etc are used in space travels. A person inside a spaceship will need a device to get rid of C02 and other body wastes and will require sources of Oz and food. These algae are very useful for this purpose.
(viii)A large amount of iodine (mineral element present in thyroxine hormone of thyroid gland) is extracted from kelps (brown sea weeds or members of phaeophyceae) like Laminaria, Fucus, Ascophyllum etc. Similarly red algae like Rhodomela, Polysiphonia, Rhodymenia are sources of bromine.
Harmful importance:
(i) Some blue green and green algae like Chroococcus, Oscillatoria grow over the surface of water bodies in abundance and cause water bloom. On death and decay these algae give off bad smell. Some algae secrete poisonous or toxic substances.
(ii)Parasitic algae like Cephaleuros virescens causes red rust of tea, coffee etc.
Economic importance of gymnosperms is as follows:
(i)Some species of Cycas like C. revoluta, C. rumphii look like palm tree and are used for decoration purposes as they remain fresh for long period.
(ii)Stem portion of Cycas revoluta is a good source of ‘sago’, a kind of starch used in making bread by poor people. Seeds of some species of Cycas are roasted and taken as food. Young succulent leaves of some species of Cycas are cooked as vegetable.

(iii)Many gymnospersm have medicinal value. The fresh juice extracted from the Cycas circinalis leaves is used as medicine for stomach disorders, blood vomiting and other skin diseases. Pollen grains of some Cycas plants are reported to have some narcotic effect.
(iv)Some gymnosperms like Pinus, Abies, Cedrus are the chief source of various types of woods. The wood of Juniperus is used in making pencils, scales, holders etc.
(v)Some species of Pinus is a good source of turpentine, wood gas, wood alcohol.

Q5:Explain briefly thefollowing terms with suitable examples.
(i) Protonema (ii) Antheridium
(iii)Archegonium (iv) Diplontic (v) Sporophyll (vi) Isogamy
Answer:

i) Protonema : It is the first, usually branched, green and filamentous structure produced by a germinating moss or fern spore. The protonema of mosses bears buds that develop into the gametophyte plant. In fern the protonema becomes the prothallus.
(ii)Antheridium : The male sex organ of cryptogams (algae, fungi, bryophytes and pteridophytes) is known as antheridium. It produces the male gametes or anthero-zoids. It may consist of a single cell or it may have a wall that is made up of one or several layers forming a sterile jacket around the developing gametes.
(iii)Archegonium : The multicellular flask shaped female sex organ of bryophytes, pteridophytes and many gymnosperms is known as archegonium. Its dialated base called the venter contains the female gamete or egg or oosphere. The cells of the narrow neck of archegonium liquify to allow the male gametes to swim towards the oosphere.
(iv)Diplontic : It is the kind of life cycle in which the diploid sporophyte is dominant and this diploid phase is photosynthetic. The gametophytic phase is represented either by gametes only, that are formed through meiosis or by a highly reduced few celled gametophyte. E.g., all seed-bearing plants (gymnosperms and angiosperms).
(v) Sporophyll : It is a type of leaf bearing sporangia. In ferns, the sporophylls are the normal foliage leaves, but in other plants the sporophylls are modified and arise in specialised structure such as the strobili of club-moss, gymnosperms and the flower of angiosperms. In most plants sporophylls are of two types – microsporophylls and megasporophylls.
(vi)Isogamy: It is a type of sexual reproduction where fusion takes place between two identical gametes. The gametes are similar in size and structure and they show equal motility during sexual reproduction, e.g., Spirogyra (algae).

Q6:Describe the important characteristics of gymnosperms.
Answer:

The term gymnosperm is derived from two Greek words: Gymnos = naked + Sperma = seed, i.e., naked seeded plants. So gymnosperms are a group of plants inwhich the ovules are freely exposed on open megasporophylls. The important characteristics of gymnosperms are :
– Living gymnosperms are perennial and vary from predominantly medium – sized trees (Cycas) to tall trees (Pinus) and shrubs (Ephedra).
– Plants possess tap root system. Some genera possess symbiotic relationship of N2 fixing algae in coralloid roots (Cycas) and fungi in mycorrhizal roots (Pinus).
– The stems are aerial, erect, branched (unbranched in Cycas) and woody.
– The leaves may be simple or compound. They are scaly and foliage also. Leaves are well adapted to withstand extremes of temperature, humidity and wind.
-Roots are characterised by the presence of diarch to polyarch vascular bundles. Xylem is exarch.
-Stems are provided with collateral, endarch and open vascular bundles which are arranged in a ring. Secondary growth is present and annual rings are formed.
-Xylem contains xylem parenchyma and tracheids with bordered pits and vessels are absent (except in Gnetum; Ephedra and Wehmtschia).
-Phloem contains sieve cells and phloem parenchyma and companion cells are absent (except in Gnetum; Ephedra and Weluhtschia).
-Leaves are protected by thick layers of cuticle. Sunken stomata are present. Mesarch xylem and transfusion tissues are found in the leaves. Palisade tissue and spongy parenchyma may be present in mesophyll or it may be undifferentiated.
-The reproductive organs form cones or strobilus except female organs of Cycas.
-The male cone is made of overlapping microsprophylls that bear micros¬porangia on the abaxial side which produce microspores.
-Female cone is formed by overlapping megasporophylls which bear ovules (megasporangia).
-Ovule is orthotropous, unitegmic with 3 layers i.e. outer fleshy, middle stony and inner fleshy.
– The nucellus of ovule contains single megaspore mother cell which undergoes reduction division to form 4 megaspores, out of which 3 degenerate and only one survives.
– So gymnosperm is heterosporous i.e. producing microspores and megaspores.
– Single megaspore forms haploid female
gametophyte or endosperm before fertilisation. .
– At micropylar end of female gametophyte 2 or more archegonia are produced. Archegonium is with reduced neck (with no neck canal cell).
– Microspores are released from microsporangium and are carried in air currents and come in contact with the micropyle of the ovules.
– Pollen tube carrying the male gametes grows towards archegonia and discharges

its contents near the mouth of the archegonia.
– After fertilisation zygote or oospore gives rise to embryo proper and the ovules develop into seeds.
– Polyembryony i.e., development of more than one embryo is an usual feature of gymnosperms but only one of them survives at later stage.
– In embryo 2 or many cotyledons are present.
– The seeds of gymnosperms are uncovered.

Q7:Differentiate between the following:

(i) red algae and brown algae

(ii) liverworts and moss

(iii) homosporous and heterosporous pteridophyte

(iv) syngamy and triple fusion

Answer:

Following are the differences:

i)

1. Red algae contain chlorophyll a and chlorophyll d but brown algae contain chlorophyll a and c.

2. In red algae, Phycobilins are present but brown algae do not have phycobilins.

3. If red algae reserve food in the form of floridian starch, it is laminarin in brown algae.

4. Red algae are not flagellated, and brown algae are flagellated.

ii)

1. There is no protonema phase in the liverworts and the life cycle in the moss begins with the protonema

2. If the plant body is dorsoventral in liverworts, the algal plant body is separated into a stem-axis.

iii) Homosporous possesses only one type of spores whereas heterosporous will have morphologically different spores in different sporangia.

iv) Syngamy is the fusion of the male gamete with the ovum whereas triple fusion is the fusion of another male gamete with two polar nuclei.

Q8: How would you distinguish monocots from dicots?

Answer:

Monocots	**Dicots**
Have single cotyledon seed	Seeds having two cotyledons
Flowers are trimerous	Flowers are tetramerous or pentamerous
Venation in leaves is parallel	Have reticulate venations in leaves
Vascular bundle is scattered	Vascular bundle are organised in a ring
Absence of vascular cambium	Presence of vascular cambium
Primary root replaced by adventitious roots and are short-lived	Primary roots occur in a few cases. Primary root is long-lived

Multiple Choice Questions

1. Which of the plant groups needs both land and water to complete their life cycle?

a. Tracheophyta
b. Pteridophyta
c. Thallophyta
d. Bryophyta

Answer: Bryophyta

2. A plant that has seeds but no flowers and fruits?

a. Bryophytes
b. Gymnosperms
c. Mosses
d. Pteridophytes

Answer: Gymnosperms

3. Most primitive vascular plants?

a. Mosses
b. Cycads
c. Kelps
d. Ferns

Answer: Ferns

4. Plants that possess spores and embryo but lack vascular tissues and seeds?

a. Rhodophyta
b. Bryophyta
c. Pteridophyta
d. Phaeophyta

Answer: Bryophyta

5. Which one is not an exception in angiosperms?

a. Double fertilization
b. Secondary growth
c. Presence of vessels
d. Autotrophic nutrition

Answer: Double fertilization

6. Pteridophytes differ from mosses in

a. Independent gametophyte
b. Dependent gametophyte
c. Flagellate antherozoids
d. Independent and dominant sporophyte

Answer: Independent and dominant sporophyte

7. Angiosperms are the dominant flora because of

a. Domestication by man
b. Power of adapting in diverse habitats
c. Self-pollination property
d. Property of producing a large number of seeds

Answer: Power of adapting in diverse habitats

8. Plants reproducing by spores are grouped under

a. Bryophytes
b. Sporophytes
c. Cryptogams
d. Thallophytes

Answer: Cryptogams

9. Plants having vascular tissue without seeds

a. Angiosperm
b. Pteridophytes
c. Bryophytes
d. Gymnosperms

Answer: Pteridophytes

10. The plant group that posses the largest ovule, largest gametes, and largest tree

a. Angiosperms
b. Gymnosperms
c. Pteridophytes
d. Bryophytes

Answer: Gymnosperms

Macthing

Match the following:

Column I	**Column II**
Chlamydomonas	**Moss**
Cycas	**Pteridophyte**
Selaginella	**Algae**
Sphagnum	**Gymnosperm**

Answer:Chlamydomonas-Algae Cycas-Gymnosperm Selaginella-Pteridophyte Sphagnum-Moss

SUMMARY

Plant kingdom includes algae, bryophytes, pteridophytes, gymnosperms and angiosperms. Algae are chlorophyll-bearing simple, thalloid, autotrophic and largely aquatic organisms. Depending on the type of pigment possesed and the type of stored food, algae are classfied into three classes, namely Chlorophyceae, Phaeophyceae and Rhodophyceae. Algae usually reproduce vegetatively by fragmentation, asexually by formation of different types of spores and sexually by formation of gametes which may show isogamy, anisogamy or oogamy. Bryophytes are plants which can live in soil but are dependent on water for sexual reproduction. Their plant body is more differentiated than that of algae. It is thallus-like and prostrate or erect and attached to the substratum by rhizoids. They possess root-like, leaf-like and stem like structures. The bryophytes are divided into liverworts and mosses. The plant body of liverworts is thalloid and dorsiventral whereas mosses have upright, slender axes bearing spirally arranged leaves. The main plant body of a bryophyte is gamete-producing and is called a gametophyte. It bears the male sex organs called antheridia and female sex organs called archegonia. The male and female gametes produced fuse to form zygote which produces a multicellular body called a sporophyte. It produces haploid spores. The spores germinate to form gametophytes. In pteridophytes the main plant is a sporophyte which is differentiated into true root, stem and leaves. These organs possess well-differentiated vascular tissues. The sporophytes bear sporangia which produce spores. The spores germinate to form gametophytes which require cool, damp places to grow. The gametophytes bear male and female sex organs called antheridia and archegonia, respectively. Water is required for transfer of male gametes to archegonium where zygote is formed after fertilisation. The zygote produces a sporophyte. The gymnosperms are the plants in which ovules are not enclosed by any ovary wall. After fertilisation the seeds remain exposed and therefore these plants are called naked-seeded plants. The gymnosperms produce microspores and megaspores which are produced in microsporangia and megasporangia borne on the sporophylls. The sporophylls – microsporophylls and megasporophylls – are arranged spirally on axis to form male and female cones, respectively. The pollen grain germinates and pollen tube releases the male gamete into the ovule, where it fuses with the egg cell in archegonia. Following fertilisation, the zygote develops into embryo and the ovules into seeds.