Chapter: Plant Kingdom

Exercise

Question 1: What is the basis of the classification of algae?

Answer:

Mainly the algae are classified into three such as Chlorophyceae, Phaeophyceae, and Rhodophyceae.

The provided divisions are based on the major photosynthetic pigments present in the form of stored food, cell wall composition, and the number of flagella and position of insertion in various species.

Class I – Chlorophyceae

The common name of the above class is – Green algae.

The major pigments present are – Chlorophylls a and b.

They stored food inside the– Starch Cell.

The cell wall composition is– Cellulose

The number of flagella is -28

The position is – equal and apical

Class II – Phaeophyceae

The common name of the above class is – Brown algae.

The major pigments present are – Chlorophylls a and c and fucoxanthin.

They stored food inside the– Mannitol and laminarin.

The cell wall composition is– Cellulose and algin.

The number of flagella is -2.

The position is – unequal and lateral.

Class III – Rhodophyceae

The common name of the above class is – Red algae.

The major pigments present are – Chlorophylls a and b, and phycoerythrin.

They stored food inside the– Floridean starch.

The cell wall composition is– Cellulose, pectin, and polysulphate esters.

The number of flagella is -Absent.

Question 2: 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:

1. Liverwort – In liverworts the main plant-body is haploid (n).
   It bears both the male and the female sex organs which produces the gametes. These gametes fuse for the formation of the zygote. The development of the zygote takes place on the gametophytic plant-body for the formation of a sporophyte. The sporophyte is divided into the foot, seta, and capsule. Many of the haploid spores are produced due to the reduction division happening inside the capsule.

2. Moss – In mosses, the primary protonema which is developed in the first stage further develops into the secondary protonema. Both these stages can be haploid (n) or gametophytic. The secondary protonema undergoes the sex organs which results in the production of gametes. These gametes form a zygote by undergoing fusion. The zygote further develops into a sporophyte. Many spores are formed due to which the reduction division occurs in the capsule of this sporophyte.

3. Fern – In ferns, saprophytic is the main plant body. The leaves of this are called the sporophylls and these bear the sporangia. The reduction division takes place inside these sporangia and hence produces many spores.

4. Gymnosperm – In gymnosperms, sporophytic is the main plant-body. They produce two types of leaves – one is microsporophyll and the other is megasporophyll. The reduction division takes place inside the microsporangia which are present on the microsporophyll by producing pollen grains and on the mega sporangia present on the megasporophylls.

5. Angiosperm – In angiosperms, sporophytic is the main plant body and produces flowers. The stamen is the male sex organ in the flower while the pistil is the female. The reduction division takes place inside the anthers of the stamen by producing haploid (n) pollen grains and in the ovary of the pistil by producing eggs.

Question 3: Name three groups of plants that bear archegonia? Briefly describe the life cycle of any one of them.

Answer:

The archegonium is the female sex organ that helps to produce the female gamete or egg. It can be seen in the different life cycles such as bryophytes, pteridophytes, and also in gymnosperms.

The life cycle of a fern – The Dryopteris (fern) is a common fern having pinnately-compound leaves. The sporophytic is the main plant body. Many sporangia are formed on the lower surfaces of its mature leaves. Each one of the sporangia has spore mother cells that bear meiosis for the production of haploid spores. On maturing, these spores undergo the process of dehisce and germinate further to give rise to a gametophyte called the prothallus. The prothallus includes both the male and female sex organs called the antheridia and archegonia respectively. The antheridia help in the production of sperms that swim in the water to reach the archegonia. The egg is produced by the archegonia. Due to the process of fertilization formation of a zygote takes place. The zygote forms an embryo, which further develops into a new sporophyte. Then the young plant formed from the archegonium of the parent gametophyte.

Question 4: Mention the ploidy of the following:

a. protonemal cell of a moss;
b. primary endosperm nucleus in dicot,
c. leaf cell of a moss;
d. prothallus cell of a fern;
e. gemma cell in Marchantia;
f. meristem cell of monocot,
g. ovum of a liverwort, and
h. Zygote of a fern.

Answer:

a. The protonemal cell of moss is – Haploid (n) in nature.
b. The primary endosperm nucleus in a dicot is – Triploid (3n) in nature.
c. The leaf cell of moss is – Haploid (n) in nature.
d. The prothallus of a fern is – Haploid (n) in nature.
e. The gemma cell in Marchantia is – Haploid (n) in nature.
f. The meristem cell of a monocot is – Diploid (2n) in nature.
g. The ovum of the liverwort is – Haploid (n) in nature.
h. The zygote of a fern is – Diploid (2n) in nature.

Question 5: Write a note on the economic importance of algae and gymnosperms.

Answer:

- Economic importance of algae :

The algae have many economic uses. They perform fifty percent of the total carbon dioxide fixation on the earth with help of the process called photosynthesis by acting as the primary producers in the aquatic habitats.

a. Food source: Most of the species of marine algae such as *Porphyra*, *Sargassum*, and *Laminaria* are edible. Chlorella and *Spirulina* are rich in proteins. Therefore, these are used as food supplements.

b. Commercial importance: The agar is used in the preparation of jellies as well as in the making of ice cream. It is produced from *Gelidium* and *Gracilaria*. The carrageenan is used as an emulsifier in chocolates, paints, and kinds of toothpaste. It can be produced from red algae.

c. Medicines: Many red algae such as *Corallina* are used in the treatment of the infection caused by worms.

- Economic importance of gymnosperms

a. For construction purposes: Many of the conifers such as pine, cedar, etc., are the main sources of the softwood used in the construction and packing.
b. For medicinal uses: An anticancer drug Taxol is produced from *Taxus*. Most species of *Ephedra* are responsible for the production of ephedrine, which can be used to treat asthma and bronchitis.
c. The food source: The seeds obtained from *Pinus gerardiana are called chilgoza* and are edible.

d. The source of resins: The resins are used commercially for manufacturing sealing waxes and water-proof paints. Any type of resin known as turpentine is produced from different species of *Pinus*.

Question 6: Both gymnosperms and angiosperms bear seeds, then why are they classified separately?

Answer:

The gymnosperms and angiosperms are the seed-producing plants that consist of diplontic life cycles.

- In the gymnosperms, sporophylls are aggregated for the formation of compact cones. The microsporophylls are broad and are not divided into filaments and anthers. The megasporophylls have no ovary, style, or stigma, due to which the ovules lie exposed. The female gametophyte contains archegonia. The process of fertilization includes the fusion of both a male and a female gamete. Their endosperm is present in haploid (n). Since there is no fruit formation, the produced seeds are naked.
- The angiosperms are also called flowering plants. They have sporophylls that aggregate for the formation of flowers with the perianth. In the microsporophylls, there is a presence of stamens that contain the pollen sacs. These sacs bear the male gametes called pollen grains. The megasporophylls are rolled which results in the formation of carpals that contain the ovary, style, and stigma. The ovules can be seen inside the ovary. The archegonium can be replaced by an egg apparatus. At the time of fertilization, two male gametes enter the egg apparatus. From which one male gamete fertilizes the egg and the other one fuses with the diploid (2n) secondary nucleus for the formation of an endosperm. Hence the produced endosperm is triploid (3n). The development of seeds takes place inside the fruits in the angiosperms.

Question 7: What is heterospory? Briefly comment on its significance. Give two examples.

Answer:

The heterospory is a process in which two kinds of spores are produced by the same plant. These spores have different sizes. The smaller one is called the microspore and the larger one is called the megaspore. The microspore germinates for the formation of the male gametophyte and the megaspore germinates for the formation of the female gametophyte. The male gametes released from the male gametophyte reach the female gametophyte to fuse with the egg. The process of development of the zygote takes place inside the female gametophyte.

This process of retention and germination of the megaspore within the megasporangium ensures the proper development of the zygote. The development of the zygote takes place inside the future sporophyte. The evolution of the seed is related to the retention of the megaspore.

Hence the heterospory is considered an important step in evolution as it is a precursor to the seed habit. The heterospory evolved first in pteridophytes Selaginella and *Salvinia.*

Question 8: Explain briefly the following terms with suitable examples:-
(i) protonema

(ii) antheridium

(iii)archegonium

(iv)diplontic

(v) sporophyll

(vi)isogamy

Answer:

(i) Protonema – It is the first stage in the life cycle of a moss that develops directly from the spore. It consists of creeping, green, branched, and filamentous structures.

(ii) Antheridium – It is the male sex organ present inside the bryophytes and pteridophytes and is surrounded by a jacket of sterile cells. It encloses the sperm mother cells, which helps to give rise to the male gametes.

(iii) Archegonium – It is the female sex organ seen in the bryophytes, pteridophytes, and gymnosperms. Inside the bryophytes and pteridophytes, a swollen venter can be observed which has a tubular neck and has the female gamete called the egg.

(iv) Diplontic – This term is used for the life cycles of seed-bearing plants like gymnosperms and angiosperms. Inside these plants, the diploid (2n) sporophyte is dominant, photosynthetic, and independent. The gametophyte can be represented by a single-celled structure.

(v) Sporophyll – Inside the pteridophytes, the body of the sporophytic plant is sporangia. These sporangia are subtended by leaf-like appendages called the sporophylls. Inside the gymnosperms, the microsporophylls and megasporophylls can be seen. These are microspores and megaspores respectively.

(vi) Isogamy – This type of sexual reproduction includes the fusion of morphologically-similar gametes. Hence it results in the same size of the gametes but performs different functions. This type of reproduction can be observed in *Spirogyra*.

Question 9: 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:

i. Red algae and brown algae

	Red algae		**Brown algae**
1.	Under the class Rhodophyceae, the red algae are grouped.	1.	Under the class Phaeophyceae, the brown algae are grouped.
2.	These have floridean starch as their stored food.	2.	These have mannitol or laminarin as their stored food.
3.	The photosynthetic pigments present here are chlorophylls a and d, and phycoerythrin.	3.	The photosynthetic pigments present here are chlorophylls a and c, and fucoxanthin.
4.	The cell wall is made up of cellulose, pectin, and phycocolloids.	4.	The cell wall is made up of cellulose and algin.

5.	There is an absence of Flagella.	5.	Flagella are present in two numbers.

(ii) Liverworts and moss

Liverworts		Moss	
1.	This contains unicellular rhizoids.	1.	This contains multicellular rhizoids.
2.	The scales can be seen very often.	2.	Scales are absent here.
3.	Generally thalloid can be seen with dichotomous branching.	3.	They are foliage present along with lateral branching.
4.	Presence of gemma cups.	4.	Absence of gemma cups.
5.	In this, the sporophyte has little amount of Photosynthetic tissue.	5.	This sporophyte has abundant photosynthetic tissue.

(iii) Homosporous and heterosporous pteridophyte

Homosporous pteridophytes		Heterosporous pteridophytes	
1.	They have spores of the same type.	1.	They have two kinds of spores such as – microspores and megaspores.
2.	The production of gametophytes is bisexual.	2.	The production of gametophytes is unisexual.
3.	These types of pteridophytes have a small structure and are difficult to be separated by sex.	3.	There are two types of spores found in this type of pteridophytes and possible to be separated by sex.
4.	Examples are- Club and puzzle mass	4.	Examples are- Salvinia and Selaginella

(iv) Syngamy and triple fusion

Syngamy	Triple fusion

1.	It is the method of fusion of the male gamete with the egg inside an angiosperm.	1.	It is the method of fusion of the male gamete with the diploid (2n) secondary nucleus inside an angiosperm.
2.	There is a formation of diploid zygotes which results in syngamy.	2.	There is a formation of a triploid primary endosperm which results in triple fusion.
3.	The end product obtained is a diploid (2n) structure.	3.	The end product obtained is a triploid (3n) structure.
4.	Syngamy can be seen in plants, animals, and also in other organisms.	4.	Triple fusion can be seen in the seed plants.

Question 10: How would you distinguish monocots from dicots?

Answer:

Characteristic	Monocot	Dicot
Roots	Fibrous roots present	Taproots present
Venation	Parallel venation can be observed	Reticulate venation can be observed
Flowers	Flowers are timorous	Flowers are pentamerous flowers
Cotyledons in seeds	single	Double
No. of vascular bundles in the stem	Many	Usually 2 to 6
Cambium	Absence of cambium	Presence of cambium
Leaves	Leaves are iso-bilateral	Leaves are dorsiventral

Question 11: Match the followings (column I with column II)

Column I		Column II	
(a)	***Chlamydomonas***	**(i)**	**Moss**
(b)	***Cycas***	**(ii)**	**Pteridophyte**

(c)	***Selaginella***	**(iii)**	**Algae**
(d)	***Sphagnum***	**(iv)**	**Gymnosperm**

Answer:

Column I		Column II(Answer)	
(a)	*Chlamydomonas*	(iii)	Algae
(b)	*Cycas*	(iv)	Gymnosperm
(c)	*Selaginella*	(ii)	Pteridophyte
(d)	*Sphagnum*	(i)	Moss

Question 12: Describe the important characteristics of gymnosperms.

Answer:

Important features of gymnosperms are as follows:

a) The term gymnosperm refers to the plants having naked seeds which means that the seeds of these plants are not enclosed inside the fruits.
b) The plant-body present here ranges from medium to tall trees and shrubs. The big giant redwood tree *Sequoia* is an example of one of the tallest trees in the world.
c) The root system includes tap roots. The coralloid roots present in *Cycas* are related to dorsiventral the nitrogen-fixing cyanobacteria.
d) The stem present can be branched or unbranched.
e) The leaves can be seen in a simple or compound manner. The leaves have a needle-like structure with a thick cuticle and sunken stomata. These help them to prevent water loss.
f) The gymnosperms are heterosporous. They are two kinds of spores – one is microspores and the other one is megaspores.
g) There are no flowers. The microsporophylls and megasporophylls are arranged in such a manner that they form a compact male and female cone.
h) Mostly the pollination occurs through wind and pollen grains then reaches the pollen chamber of the ovule with the help of the micropyle.