# 2 Kingdom Plantae

## 2.0 : Introduction :

**Q.1. Which are the most essential biotic components of an ecosystem?**
**Ans:** Plants are the most essential biotic components of an ecosystem.

**Q.2. Why are plants called as most essential biotic components of the ecosystem?**
**Ans:** i. Plants are the main producers on land and in water.
ii. Chlorophylls which are green pigments present in plants synthesize carbohydrates and release oxygen in air on which other organisms are dependent.
Thus, plants are called as most essential biotic components of the ecosystem.

**Q.3. What are the general characteristics of Kingdom Plantae?**
**Ans: General characteristics of Kingdom Plantae:**
i. Kingdom Plantae includes multicellular, eukaryotic organisms.
ii. All these organisms show photosynthetic mode of nutrition.
iii. These organisms are commonly called plants.
iv. They are the main producers on land and in water.
v. Plants synthesize carbohydrates and release oxygen in air.
vi. They are the most essential biotic components of an ecosystem.

**Q.4. Which are the two sub - kingdoms of Kingdom Plantae?**
**Ans:** The two sub - kingdoms of Kingdom Plantae are Cryptogamae and Phanerogamae.

**Q.5. Both gymnosperms and angiosperms bear seeds. But, then why are they classified separately?**
**Ans:** i. Both gymnosperms and angiosperms belong to Phanerogamae. They have seeds.
ii. The seeds of gymnosperms are naked, i.e. not enclosed in a fruit.
iii. But, in angiosperms, seeds remain enclosed within the fruit.
Thus, gymnosperms and angiosperms are classified separately.

**Q.6. Distinguish between Cryptogams and Phanerogams.**
**Ans:**

| No. | Cryptogams | Phanerogams |
|---|---|---|
| i. | These are non–flowering plants. | These are flowering plants. |
| ii. | These plants do not bear flowers, fruits and seeds. | These plants bear flowers, fruits and seeds. |
| iii. | It is further divided into three divisions, viz: Algae, Bryophyta and Pteridophyta. | It is further divided into two divisions, viz: Gymnosperms and Angiosperms. |
| iv. | An ovule is not formed. | An ovule is formed. |

**Q.7. What are Cryptogams? Name the three divisions of Cryptogams.**
**Ans: Cryptogams:** Cryptogams are non-flowering spore producing plants.
The three divisions of Cryptogams are:
a. Algae b. Bryophyta c. Pteridophyta

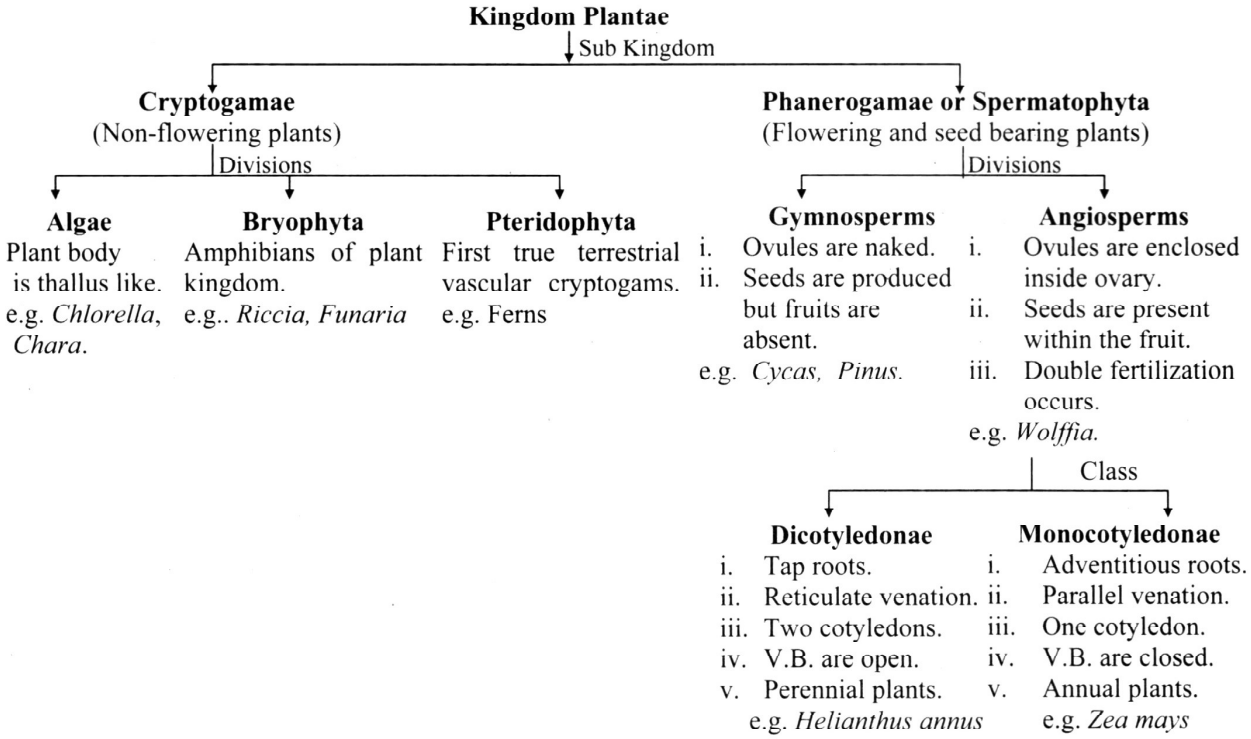
**Q.8. Enlist the salient features of Cryptogamae.**
**Ans:** Salient features of Cryptogamae (Kryptos: concealed, gamos: marriage):
i. Members of Cryptogamae are spore producing plants.
ii. They do not produce seeds and flowers.
iii. They reproduce sexually by gametes.
iv. Sex organs are concealed.

**Q.9. What are Phanerogams? State their divisions.**

**Ans:** Phanerogams are the flowering and seed producing plants, also commonly known as seed plants. Phanerogams are further divided into two divisions as Gymnospermae and Angiospermae.

**Q.10. Give an outline of classification of Kingdom Plantae with one example each.**

**Ans:**




## 2.1 : Salient features of major plant groups :

**Q.11. Give the general characters of algae with two examples.**

**Ans: General characteristics of Algae:**

i. **Habitat:** Algae occur in a variety of habitats from aquatic to terrestrial. A few algae grow on other plants. Aquatic algae grow in marine water or fresh water. Most of them are free-living, whereas some are symbiotic.

ii. **Structure:** The vegetative structure of algae is called as thallus and is much variable. They may be small, unicellular, microscopic, like Chlorella (non-motile), Chlamydomonas (motile) or huge multicellular forms such as sea weeds which measure more than 60m in length, e.g. Sargassum. Some are branched filamentous, e.g. Chara; whereas some are unbranched filamentous, e.g. Spirogyra.

iii. **Cell wall:** In algae, the cell wall consists of two layers, i.e. inner cellulosic and outer made up of pectin.

iv. **Reserve food material:** The reserve food material is in the form of starch, laminarin-starch, mannitol and floridean starch, etc.

v. **Photosynthetic pigments:** The algae consists of various types of photosynthetic pigments. Chlorophyll-a (Essential photosynthetic pigment) is present in all groups of algae. The accessory pigments are chlorophyll-b, chlorophyll-c, chlorophyll-d, carotenes, xanthophylls and phycobilins. Phycobilins are of two types, i.e. phycocyanins and phycoerythrins.

vi. **Reproduction:** Algae reproduce by three different methods:
   a. Vegetative reproduction occurs by fragmentation and cell division.
   b. Asexual reproduction occurs by the formation of various types of non-motile or motile spores.
   c. Sexual reproduction takes place by formation and fusion of gametes.

vii. **Life cycle:** The life cycle of algae exhibits the phenomenon of alternation of generations (two phases: haploid and diploid).
Examples: Chlorella, Spirogyra, Chara and Ectocarpus.

**Q.12. Explain in detail the classification of Algae.**

**Ans:** Algae are divided into the following groups:

i. **Chlorophyceae (Green algae)**
Photosynthetic pigments present in green algae are chlorophyll-a and chlorophyll-b.
Reserve food is stored in the form of starch. Cell wall is made up of cellulose.

*Spirogyra*

*Chlamydomonas*

Motile cells possess 2-8, equal sized, apical flagella. (Isokont flagellation)
These algae commonly occur in fresh water and sometimes in marine and brackish water.
e.g. Chlamydomonas, Spirogyra, Chara, etc.

ii. **Phaeophyceae (Brown algae)**
Photosynthetic pigments include chlorophyll-a, chlorophyll-c and fucoxanthin.
Reserve food is mannitol and laminarin.
Cell wall is made up of cellulose associated with algin.

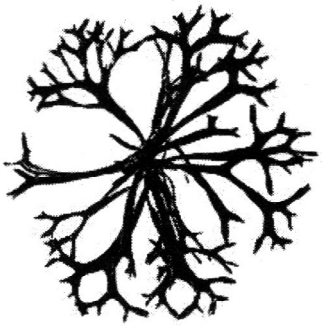
*Sargassum*

The motile spores are biflagellated with two unequal lateral flagella. (Heterokont flagellation)
These algae are commonly found in marine water and brackish water, some are seen in fresh water.
e.g. Ectocarpus, Sargassum, Fucus, etc.

iii. **Rhodophyceae (Red algae)**
Photosynthetic pigments are chlorophyll-a, chlorophyll-d, phycoerythrin.
Reserve food is a special kind of starch called floridean starch.
Cell wall is made up of pectin in addition to cellulose and other carbohydrates.
Motile cells are absent.
Red algae are mostly found in marine water and brackish water, but rarely fresh water.
'Agar' which is used as solidifying agent in tissue culture is obtained from red algae.

e.g. Chondrus, Gelidium, Polysiphonia, etc.

*Gelidium*



*Chondrus*

**Q.13. Name the pigment which gives red colour to red algae.**
**Ans:** Phycoerythrin gives red colour to red algae.

**Q.14. Give the name of brown pigment of phaeophyta.**
**Ans:** Fucoxanthin is the brown pigment of phaeophyta ..

**Q.15. Name the group of algae from which agar is obtained.**
**Ans:** Agar is obtained from group Rhodophyceae (Red algae)

**Q.16. What is the basis of classification of algae?**
**Ans: Criteria taken for classification of algae are:**
Photosynthetic pigments, nature of stored food, nature of cell wall, flagellar number and position of insertion and habitat.

**Q.17. Differentiate between red algae and brown algae.**
**Ans:**

| No. | Red algae | Brown algae |
|---|---|---|
| i. | Photosynthetic pigments are chlorophyll-a, chlorophyll-d and phycoerythrin. | Photosynthetic pigments are chlorophyll-a, chlorophyll-c and fucoxanthin. |
| ii. | Reserve food is floridean starch. | Reserve food is mannitol and laminarin. |
| iii. | Motile cells are absent. | Biflagellated motile cells are present. |
| iv. | e.g. *Chondrus, Gelidium, Polysiphonia,* etc. | e.g. *Ectocarpus, Sargassum, Fucus,* etc. |

**Q.18. Name the reserve food material present in algae.**
**Ans:** The reserve food material in algae is in the form of starch, laminarin starch, mannitol and floridean starch.

**Q.19. Name the accessory pigments of algae.**
**Ans:** Chlorophyll-b, chlorophyll-c, chlorophyll-d, carotenes, xanthophylls and phycobilins are the accessory pigments of algae.

**Q.20. Give the salient features of division Bryophyta with two examples.**
**Ans:** General characteristics of division Bryophyta:

i. **Special feature:** The bryophytes are mostly terrestrial plants which depend on external water for fertilization and completion of their life cycle. Hence, they are called 'amphibian plants'.
ii. **Habitat:** Bryophytes generally grow in moist, cool and shady places such as moist walls, damp rocks, moist soil and on decaying logs.
iii. **Body:** Plant body is thalloid (not differentiated into roots, stem and leaves) as in liverworts. Some

Bryophytes show foliose thallus, it bears leaf-like structures (e.g. Moss), but they are not true leaves. They do not produce flowers or seeds as well.

iv. **Rhizoids:** Rhizoids are present instead of true roots.
Rhizoids are unicellular in liverworts, while multicellular in mosses. Rhizoids absorb water and minerals. They also fix the plant to the substratum.

v. **Vascular tissues:** The vascular tissues are absent. However, in some bryophytes like mosses, a conducting strand of few thick-walled cells is present.

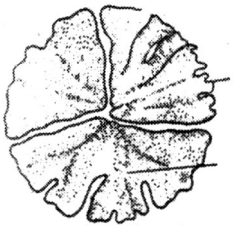
vi. **Reproduction:** Bryophytes reproduce by:
a. vegetative means by tubers and gemmae.
b. asexual reproduction by spore formation
c. sexual reproduction by the formation of gametes.

vii. **Alternation of generations:**
The Bryophytes show two distinct generations, i.e. the gametophytic and the sporophytic generations. They alternate with each other to complete their life cycle. This is known as heteromorphic alternation of generations.
The gametophyte is the dominant, green, haploid and independent phase; while sporophyte is diploid, recessive and partially dependent on gametophyte.
**Examples:** Liverworts: e.g. Riccia, Marchantia; Hornworts: e.g. Anthoceros; Mosses: e.g. Funaria, Polytrichum.

**Q.21. Give any two examples of Bryophyta.**
**Ans:** Riccia, Funaria.

**Q.22. Explain in detail the classification of Bryophytes.**
**Ans:** Bryophytes are divided into two groups as follows:

i. **Liverworts (Hepaticae)**
They are found in moist shady places.
Thallus is dorsiventral, prostrate, with unicellular rhizoids.
Some liverworts have stem-like axis and leaf-like appendages, such liverworts are called foliose liverworts.
Vegetative reproduction either by fragmentation or by formation of small, green, cup-like buds called gemmae.
Gemma on detachment develops into a young plant.



*Riccia*

Sexual reproduction occurs by formation of male and female sex organs, borne on the same or different plants.
Diploid sporophyte is formed after fertilization.
Sporophyte is differentiated into foot, seta and capsule.
Capsule contains haploid spores produced by meiosis.
These haploid spores germinate to form haploid young plants or gametophytes.
e.g. Riccia, Marchantia, etc.

ii. **Mosses (Musci):**
These posses erect plant body.
The gametophytic phase of life cycle includes two stages, namely protonema stage and leafy stage. .

The protonema is prostrate, green, branched and filamentous.
Protonema possess many buds and from each bud leafy stage is produced
Protonema helps in vegetative propagation.
Leafy stage has erect, slender main axis and a branch bearing spiral leaf-like structures.
Multicellular branched rhizoids help in fixation of plant in soil.

*Funaria*

Sexual reproduction takes place by formation of antheridia and archegonia.
Both sex organs are produced in clusters at the tip of stem like axis.
Clusters of sex organs are concealed by a whorl of leafy appendages.
Fertilization results in formation of zygote, zygote develops into sporophyte, which is differentiated, into foot, seta and capsule.
Capsule contains haploid spores formed by meiosis and spores are released by dehiscence of capsule.
e.g. Funaria, Polytrichum, etc.

**Q.23. Differentiate between liverwort and moss.**
**Ans:**

| No. | Liverwort | Moss |
|---|---|---|
| i. | Thallus is dorsiventral. | Thallus is erect. |
| ii. | Gemma cup helps in vegetative propagation. | Protonema helps in vegetative propagation. |
| iii. | Unicellular rhizoids are present. | Multicellular rhizoids are present. |
| iv. | Juvenile protonema stage absent. | Juvenile protonema stage present. |
| v. | Capsules split along the sides often into 4 parts. | Capsules open at the end to let the spores out. |
| vi. | e.g. *Riccia, Marchantia, etc.* | e.g. *Funaria, Polytrichum, etc* |

**Q.24. What are the structures responsible for vegetative reproduction in Bryophyta?**
**Ans:** Tubers and gemmae are the structures responsible for vegetative reproduction in Bryophyta.

**Q.25. Why are Bryophytes known as "Amphibians of the plant kingdom"?**
**Ans:** Bryophytes are mostly terrestrial plants, but they depend on external water for fertilization and completion of their life cycle.
Thus, Bryophytes are known as "Amphibians of the plant kingdom."

**Q.26. Which era is regarded as the era or age of pteridophytes?**
**Ans:** Late Paleozoic era is regarded as the age of pteridophytes.

**Q.27. Which plants are vascular cryptogams?**
**Ans:** Pteridophytes are described as vascular cryptogams.

**Q.28. Distinguish between: Thallophyta and Bryophyta.**
**Ans:**

| No. | Thallophyta | Bryophyta |
|---|---|---|
| i. | Mostly aquatic in habitat. | Mostly terrestrial, occurs on moist and shady places. |
| ii. | Thallus may be uni or multicellular. | Thallus is multicellular. |
| iii. | Motile and non motile forms are present. | Non-motile forms present, except male gametes. |
| iv. | Rhizoids are absent. | Rhizoids are present. |
| v. | Embryo is not formed | Embryo is formed. |
| vi. | May or may not show alternation of generation. | Show alternation of generations. |

**Q.29. Enlist the general characters of Pteridophyta with two examples.**
**Ans: General characteristics of Division Pteridophyta:**

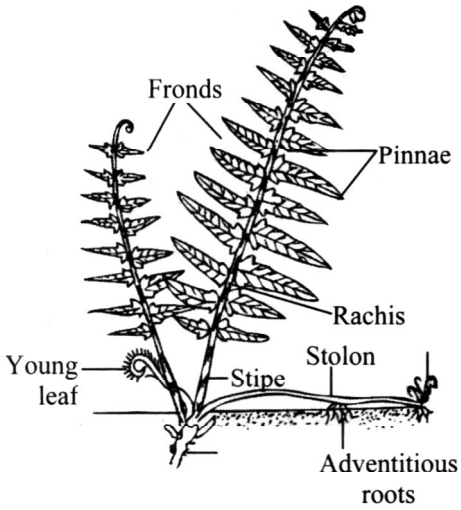
i. **Structure:**
The plants are small and are either annual or perennial, do not produce flowers, fruits and seeds.

ii. **Habitat:**
They are shade-loving and grow luxuriantly in moist and shady places. They may be terrestrial (ferns), aquatic (Azolla, Mars ilea) , xerophytic (Equisetum), epiphytic (Lycopodium) and even growing on large trunks of trees.

iii. **Primary Root:**
The primary root is short lived and is soon replaced by adventitious roots.

iv. **Stem:**
The stem may be aerial or underground.

v. **Leaves:**
The leaves maybe scaly (Equisetum), simple and sessile (Lycopodium) or large and pinnately compound (Ferns).




*Nephrolepis*

vi. **Vascular tissues:**
These plants have a primitive conducting system and they are the only cryptogams with vascular tissue. The xylem consists of only tracheids and phloem consists of sieve cells only.

vii. **Secondary growth:**
Secondary growth is not seen in pteridophytes due to the absence of cambium.

viii. **Reproduction:**

**Sporophyte:**
The sporophyte shows asexual reproduction and produces spores by meiosis from which the gametophyte develops.

**Gametophyte:**
The gametophyte is haploid, recessive but independent and reproduce sexually. Product of sexual reproduction, i.e. zygote produces diploid sporophyte.

**Spores:**
The plants are heterosporous (producing different types of spores), small microspores and large megaspores, while many are homosporous producing only one type of spore.
Spores are produced in special multicellular structures called sporangia.
Pteridophytes show the following methods other than normal modes of reproduction:

a. **Apogamy:** It is the development of the sporophyte without the fusion of male and female gametes. It arises directly from the gametophyte. Here, the sporophyte is haploid. /
b. **Apospory:** It is the development of the gametophyte from any cell of the sporophyte other tgab the spores. Such gametophyte is diploid in nature.

ix. **Alternation of generations:** Pteridophytes show two distinct heteromorphic generations in their life cycle namely: sporophytic and gametophytic generations, which alternate with each other.
e.g. Nephrolepis, Lycopodium, Selaginella, Mars ilea, etc.

**Q.30. Which phase is dominant in the life cycles of Bryophyta and Pteridophyta?**
**Ans:** Gametophyte is the dominant phase in Bryophyta, while sporophyte is the dominant phase in Pteridophyta.

**Q.31. What is meant by heterosporous plants?**

**OR**

**What is heterospory?**

**Ans:** The plants which produce two different types of spores: small microspores and large megaspores are known as heterosporous plants such condition is known as heterospory.
Heterosporous Pteridophytes: e.g. Selaginella
Homosporous Pteridophytes: e.g. Marsilea, Lycopodium

**Q.32. Explain the terms apogamy and apospory.**
**Ans: i. Apogamy:**
It is the development of the sporophyte without the fusion of male and female gametes.
It arises directly from the gametophyte. Hence, the sporophyte is haploid.

**ii. Apospory:**
It is the development of the gametophyte from any cell of the sporophyte other than the spores. Such a gametophyte is diploid in nature.

**Q.33. Distinguish between Bryophytes and Pteridophytes.**
**Ans:**

| No. | Bryophytes | Pteridophytes |
|---|---|---|
| i. | Bryophytes are non-vascular cryptogams. | Pteridophytes are vascular cryptogams. |
| ii. | Plant body is thalloid, i.e. not differentiated into root, stem and leaves. | Plant body is divided into true root, stem and leaves. |
| iii. | The gametophyte is the dominant phase in the life cycle of Bryophytes. | The sporophyte is the dominant phase in the life cycle of Pteridophytes. |
| iv. | The sporophyte remains attached to the gametophyte. | The sporophyte is never attached to the gametophyte. |
| v. | The sporophyte is dependent upon the gametophyte for its nourishment. | The sporophyte is not dependent upon the gametophyte. |
| vi. | e.g. *Riccia, Marchantia, Funaria.* | e.g. *Nephrolepis, Equisetum, Lycopodium.* |

**Q.34. Explain briefly the following terms:**

i. **Protonema** ii. **Antheridium**
iii. **Archegonium** iv. **Sporophyll**

**Ans: i. Protonema:**
The protonema is prostrate, green, branched and filamentous.
Protonema possess many buds and from each bud leafy stage is produced.
Protonema helps in vegetative propagation.

**ii. Antheridium:**
Antheridium is multicellular, jacketed, male sex organ.
Antheridium contains mass of antherozoid mother cells/androcytes which on meiosis give sperms or male gametes.

**iii. Archegonium:**
Archegonium is a female sex organ in bryophytes, pteridophytes and gymnosperms.
It contains egg or female gamete.

**iv. Sporophyll:**
It is a leaf like structure present in pteridophytes and gymnosperms.
Sporangia are borne on it.

**Q.35. Who first used the term "Gymnosperms"?**
**Ans:** Theophrastus first used the term "Gymnosperms".

**Q.36. Write the most important character of gymnosperms.**
**Ans:** Gymnosperms are the plants with naked seeds and also known as 'phanerogams without ovary'.

**Q.37. Describe the important characteristics of gymnosperms.**
**Ans: Important characteristics of gymnosperms:**

i. **Types:** Most of the Gymnosperms are evergreen, perennial woody trees or shrubs.
ii. **Vascular tissues:** They are vascular plants. They show xylem with tracheids and phloem with sieve cells.
iii. **Flower:** They are non-flowering plants. The plants produce seeds that are naked, i.e. ovules are not enclosed within ovary, hence fruit formation does not occur.
iv. **Body:** The plant body, i.e. sporophyte is differentiated into root, stem and leaves.
v. **Roots:** The plants possess a well developed tap root system. In some members, root shows association with blue-green algae. e.g. Coralloid root of Cycas.
Roots of Pinus show association with endophytic fungi called mycorrhizae.
vi. **Stem:** Stem is mostly erect, aerial, solid, cylindrical and branched. In Cycas, it is usually unbranched.
vii. **Leaves:** The leaves are dimorphic. The foliage leaves are green, simple, needle-like or pinnately compound, whereas scale leaves are minute, membranous and brown.
viii. **Secondary growth:** Secondary growth, is seen in Gymnosperms due to presence of cambium.
ix. **Vegetative reproduction:** Vegetative reproduction takes place with the help of bulbi Is.
x. **Spores:**
Gymnosperms are heterosporous. They produce microspores in microsporangia and megaspores in megasporangia.
Microsporangia are produced on the microsporophylls, while megasporangia are formed on the megasporophylls.
The microsporophylls and megasporophylls are usually arranged in compact structures called cones or strobili.
The microsporangium (pollen sac) produces large number of spores (microspores or pollen grains) which are light in weight.
Each megasporangium (ovule) is surrounded by integuments. The ovule is orthotropous, i.e. upright.
xi. **Sexual reproduction:**
The pollination in Gymnosperms is anemophilous (wind pollination) and direct as the pollen grains are received directly in the pollen chamber of the ovule.

Fertilization occurs through a pollen tube. This process is called siphonogamy.

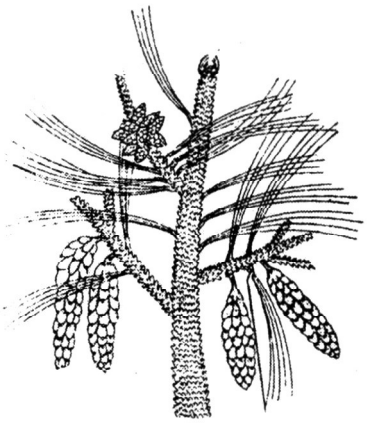
**xii. Alternation of generation:**

Gymnosperms show a distinct heteromorphic alternation of generations.

The sporophyte is diploid, dominant, autotrophic, independent; while gametophyte IS haploid, recessive and dependent.

e.g. Cycas, Pinus, Ginkgo.

*Cycas*



*Pinus*

**Q.38. Define the term 'siphonogamy'.**

**Ans:** Siphonogamy is the phenomenon in plants in which fertilization is achieved by the formation of a pollen tube.

**Q.39. Name the tallest and smallest living gymnosperm plant in the world.**

**Ans:** Tallest gymnosperm: Sequoia sempervirens (coast redwood of California) ; 366 feet height.
Smallest gymnosperm: Zamia pygmaea; 25 cm (length).

**Q.40. To which group does Ginkgo belong?**

**Ans:** Ginkgo belongs to group Gymnosperms.

**Q.41. Pinus, Cedrus and Cycas belong to which group of plant kingdom?**

**Ans:** Pinus, Cedrus and Cycas belong to group Gymnosperms of plant kingdom.

**Q.42. How does pollination take place in Gymnosperms?**

**Ans:** The pollination in gymnosperms is anemophilous (wind pollination) and direct.

**Q.43. Distinguish between Pteridophytes and Gymnosperms.**

**Ans:**

| No. | Pteridophytes | Gymnosperms |
|---|---|---|
| i. | They grow in moist places. | They grow in dry places. |
| ii. | Seeds absent. | Seeds present and exposed. |
| iii. | Pollen grains not produced. | Pollen grains produced. |
| iv. | Male gamete is transferred to female gamete through water. | Male gamete is transferred to female gamete through wind. |
| v. | e.g. *Nephrolepis, Adiantum, Azolla* | e.g. *Cycas, Pinus, Ginkgo* |
| vi. | May be homosporous/heterosporous. | All are heterosporous. |
| vii. | Mostly annual. | Mostly perennial. |

**Q.44. What are angiosperms?**

**Ans:** Angiosperms are flowering plants in which seeds are enclosed within a fruit.

**Q.45. Enlist the general characters of Angiosperms with two examples.**

**Ans: General characteristics of Angiosperms:**

i. **Habitat:** The Angiosperms are group of highly evolved plants, primarily adapted to terrestrial habitat.

ii. **Alternation of generations:**
Angiosperms show heteromorphic alternation of generations in which the sporophyte is diploid dominant, autotrophic and independent, while the gametophytes are recessive, haploid and dependent \ on the sporophyte.

iii. **Body:** The body of sporophyte is divisible into root, stem and leaves. It has flowers, fruits and seeds.

iv. **Vascular tissues:** Vascular tissues are well differentiated. Xylem shows vessels or tracheae, while phloem has sieve tubes and companion cells.

v. **Spore:**
Heterospory is exhibited by all Angiosperms. Microspores (also called pollens) are formed in microsporangia. They develop on highly specialized microsporophylls or stamens, while megaspores are formed in megasporangia (or ovules) borne on highly specialized megasporophylls called carpels.

vi. **Sporophylls:**
Besides the essential whorls of microsporophylls (Androecium) and megasporophylls (Gynoecium), there are accessory whorls of sepals (calyx) and petals (corolla), clustered together into flowers.

vii. **Pollination:** The pollination is indirect and maybe self or cross.

viii. **Sexual reproduction:**
There is typically double fertilization, one male gamete fusing with egg cell and another fusing with secondary nucleus.
The zygote continues to develop within the ovule until seed is developed. The ovary simultaneously ripens into a fruit.
e.g. Helianthus annus, Zea mays.

**Q.46. Name the smallest and tallest angiosperm.**

**Ans.** Wolffia is the smallest angiosperm (1 mm is size) and Eucalyptus is the tallest angiosperm (grows to over 100 meters).

**Q.47. Which are the essential whorls of a flower?**

**Ans:** Androecium and gynoecium are the essential whorls of a flower.

**Q.48. What is double' fertilization?**

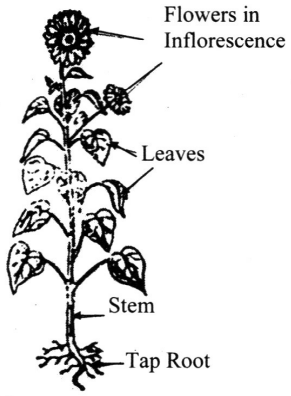
**Ans:** Double fertilization is the process in which one male gamete fuses with egg cell and another male gamete fuses with secondary nucleus, to form an embryo and endosperm respectively.

**Q.49. What do you mean by indirect pollination?**

**Ans:** The process of pollination in which pollen grains are received on stigma is known as indirect pollination.

**Q.50. Write a note on the class Dicotyledonae.**

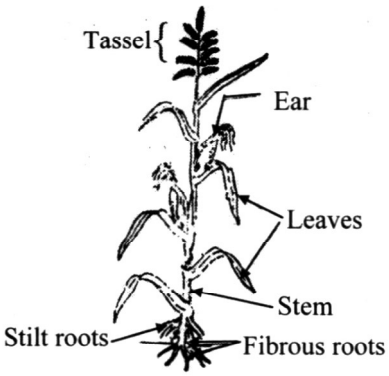
**Ans: Class Dicotyledonae:**




**Dicot plant e.g. Sunflower**

i. These plants have two cotyledons in the embryo.
ii. They have-a tap root system.
iii. The stem is profusely branched.
iv. The leaves show reticulate venation.
v. The flowers show tetra or pentamerous symmetry.
vi. The vascular bundles are conjoint, collateral and open.
vii. Secondary growth is common.
e.g. Helianthus annus (Sunflower), Hibiscus rosa sinensis (China rose).

**Q.51. Write a note on the class Monocotyledonae.**
**Ans: Class Monocotyledonae:**




**Monocot plant e.g. Maize**

i. These plants have single cotyledon in the embryo.
ii. The plants have adventitious root system.
iii. Stem is rarely branched.
iv. The leaves generally have sheathing leaf base and parallel venation.
v. The flowers are generally trimerous.
vi. The vascular bundles are conjoint, collateral and closed.
vii. Secondary growth is usually absent, due to the absence of cambium.
e.g. Zea mays (Maize), Sorghum vulgare (Jowar).

**Q.52. Distinguish between:**
**i. Dicotyledonae and Monocotyledonae.**
**Ans:**

| No. | Dicotyledonae | Monocotyledonae |
|---|---|---|
| i. | These plants bear two cotyledons in their seeds. | These plants bear one cotyledon in their seeds. |
| ii. | They posses tap root system. | They posses adventitious root system. |
| iii. | Leaves show reticulate venation. | Leaves show parallel venation. |
| iv. | Flowers show tetramerous or pentamerous symmetry. | Flowers show trimerous symmetry. |
| v. | Stem is generally branched. | Stem is rarely branched. |
| vi. | Secondary growth is common due to presence of cambium. | Secondary growth is absent due to absence of cambium. |
| vii. | e.g. *Helianthus annus* (Sunflower), *Hibiscus rosa sinensis* (China rose). | e.g. *Zea mays* (maize), *Sorghum vulgare* (Jowar). |

**ii. Gymnosperms and Angiosperms.**
**Ans:**

| No. | Gymnosperms | Angiosperms |
|---|---|---|
| i. | In gymnosperms, the seeds are naked. | In angiosperms, the seeds are enclosed within the fruit. |
| ii. | They are non–flowering plants. | They are flowering plants. |
| iii. | Plants are woody, perennial trees or shrubs. | Plants are annual, biennial or perennial herbs, shrubs or trees, either woody or herbaceous. |
| iv. | Xylem is made up of tracheids only. | Xylem is made up of vessels and tracheids. |
| v. | Phloem is with sieve cells only. | Phloem is with sieve tubes and companion cells. |
| vi. | Pollination is direct. | Pollination is indirect. |
| vii. | Usually two types of leaves are present, i.e. green foliage leaves and brown scale leaves. | Leaves are of usually one type only, such as green foliage leaves. |
| viii. | Double fertilization absent. | Double fertilization occurs. |
| ix. | Endosperm is formed before fertilization. | Endosperm is formed after fertilization. |

**Q.53. Name various groups of vascular plants. Give one characteristic feature of each group.**
**Ans:** There are 3 groups of vascular plants:

i. Pteridophytes ii. Gymnosperms iii. Angiosperms

**Characteristics of Pteridophytes:** Pteridophytes are the only cryptogams with vascular tissue.
**Characteristics of Gymnosperms:** Gymnosperms are the plants which possess naked seeds.
**Characteristics of Angiosperms:** Angiosperms are the flowering plants in which the seeds remain enclosed within the fruits.

## 2.2 : Botanical Gardens and Herbaria (Taxonomic Aids) :

**Q.54. Write a note on Botanical Gardens.**
**Ans:** i. **Botanical garden:** A botanical garden is a place where there is an assemblage of living plants maintained for botanical teaching and research purpose.

ii. Botanical gardens are important for their records of local flora.
iii. Botanical gardens provide facilities for the collection of living plant materials for botanical studies.
iv. Botanical gardens also supply seeds and material for botanical investigations.
v. The development of botanical gardens in any country is associated with its history of civilization, culture, heritage, science, art, literature and various other social and religious expressions.
vi. Botanical gardens besides possessing an outdoor garden may contain herbaria, research laboratory, green houses and library.
vii. Botanical gardens are not only important for botanical studies, but also to develop tourism in the country.
viii. **Botanical Gardens of India:**

| No. | Botanical Gardens of India | Location |
|---|---|---|
| i. | The Indian Botanical Garden | Kolkata |
| ii. | Lloyd Botanical Garden | Darjeeling |
| iii. | National Botanical Garden | Lucknow |
| iv. | Botanical Garden of the Forest Research Institute | Dehradun |
| v. | The State Botanical Garden | Lalbagh, Bangalore |
| vi. | Botanical Garden | Saharanpur |
| vii. | Government Botanical garden | Ootacamund |

**Q.55. Give a brief account of herbaria.**
**Ans: Herbarium:**

A herbarium is a collection or deposition of dried plant material, which is preserved by various techniques of preservation and arranged in a sequence of an accepted classification.

The preservation techniques include mostly the pressing and drying of the plant material.
The plants are usually pressed and mounted on the sheet of paper known as herbarium sheets. Some plants are not suitable for pressing or mounting, like succulents, seeds, cones, etc. They are preserved in suitable liquid like formaldehyde, acetic alcohol, etc. .
Herbaria can be classified into three types:

i. Regional herbaria ii. Local herbaria
iii. Herbaria of educational institutions including school, colleges and universities.

**Importance of herbarium:**

i. Herbaria preserve local, regional and national plant wealth.
ii. Herbaria play major role in carrying out research programmes of fundamental or of applied value.
iii. Herbaria also facilitates exchange and loan of preserved plant material for various purposes like exhibitions, research, etc.
iv. Herbaria fulfils public demand by supplying. plant material and giving scientific information regarding plants by arranging training courses.

**Q.56. Enlist important herbaria of India.**
**Ans:** Some of the important herbaria of India are as follows :

| No. | Important Herbaria in India | Location | No. of specimens |
|---|---|---|---|
| i. | Central National Herbarium | Kolkata | 20,00,000 |
| ii. | Industrial Section Botanical Survey of India, museum | Kolkata | 50,000 |
| iii. | Herbarium of the Forest Research Institute | Dehradun | 3,00,000 |
| iv. | Herbarium of the National Botanical Research Institute | Lucknow | 80,000 |
| v. | The Southern Circle Herbarium | Coimbatore | 1,90,000 |

**Q.57. Name the processes involved in a herbarium technique.**
**Ans:** A herbarium technique involves collection, drying, poisoning, mounting, stitching, labelling and deposition of plant material.

## 2.3 : Taxonomic key :

**Q.58. Write a short note on taxonomic key.**
**Ans:** i. Taxonomic key is an analytic key which helps in analysis of similarities and dissimilarities.
ii. There is a separate taxonomic key for each taxonomic category.
iii. The key uses couplets each made up of a pair of contrasting characters.
iv. Each statement of the key is called a lead.

**Q.59. Which are the taxonomic aids used in taxonomic studies?**
**Ans:** Taxonomic aids used in taxonomic studies are manuals, catalogues, morographs, floras, etc.

## 2.4 : Plant life cycles :

**Q.60. Which are the two phases of plant life cycle?**
**Ans:** Plant life cycle includes two phases, namely sporophytic (diploid = 2n) and gametophytic (haploid = n)

**Q.61. Explain the phenomenon of alternation of generation.**
**Ans.** i. The life cycle of a plant includes two generations, sporophytic (diploid = 2n) and gametophytic (haploid = n)
ii. Some special diploid cells of sporophyte divide by meiosis to produce haploid cells.
iii. These haploid cells divides mitotically to prod~ce gametophyte.
iv. On maturation, gametophyte produces gametes which fuse during fertilization and ptoduce diploid zygote.
v. Diploid zygote divides by mitosis and forms diploid sporophyte.
vi. Thus, sporophytic and gametophytic generations generally occur alternately in the life cycle of a plant.

**Q.62. Which two plant groups show distinct alternation of generation?**
**Ans:** Bryophytes and Pteridophytes show distinct alternation of generation.

**Q.63. What are sporophylls?**
**Ans:** Sporophylls are spore producing leaves

## Additional Theory Questions :

Q.1. Give the general characteristics of Pteridophyta. Refer Q.29.

Q.2. Draw a neat labelled diagram of Nephrolepis. Refer Q.29.

Q.3. Give examples of homosporous and heterosporous Pteridophytes. Refer Q.31.

Q4. Draw a neat labelled diagram of Helianthus annus (sunflower). Refer Q.50.

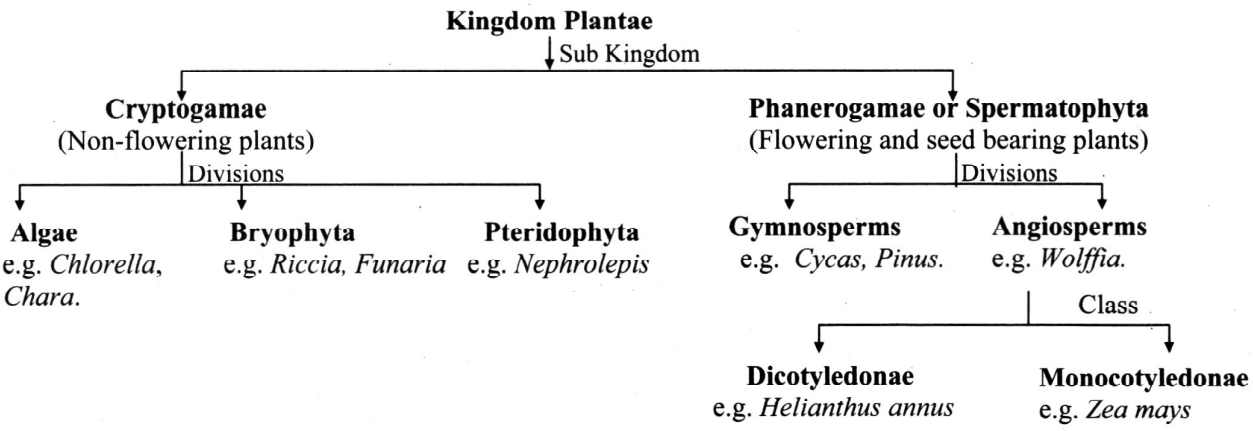
Q.5. Draw a neat labelled diagram of Maize Plant. Refer Q.51.

Q.6. Give the importance of botanical gardens. Refer Q.54. points (ii) to (vii)

Q.7. What is the meaning of botanical garden? List some botanical gardens ofIndia.
Refer Q.54. point (i) and (viii)

Q.8. Give the importance of herbaria. Refer Q.55.

## Quick Review :



## Multipal Choice Question's

1. Algae are mostly
   a) aquatic b) parasitic
   c) terrestrial d) saprophytic
2. Unicellular, non-motile alga is
   a) Riccia b) Chlorella
   c) Funaria d) Chlamydomonas
3. Outer cell wall in alga consists of
   a) cellulose b) starch
   c) pectin d) phycoerhrin
4. Which of the following are the amphibians of the lant kingdom?
   a) Pteridophytes b) Bryophytes
   c) Gymnosperms d) Angiosperms
5. Presence of rhizoids in place of true roots is a characteristic feature of
   a) Gymnosperms b) Bryophyta
   c) Pteridophyta d) Angiosperms
6. Bryophytes reproduce by vegetative means through
   a) tubers and gemmae
   b) spore formation
   c) formation of gametes
   d) fragmentation
7. Riccia is also called
   a) Liverwort b) Homworts
   c) Mosses d) Pteridophytes
8. Bryophytes show leaf like structure in
   a) Spirogyra b) Riccia
   c) Homworts d) Mosses
9. Aquatic pteridophyte is
   a) Azolla b) Equisetum
   c) Pteris d) Lycopodium
10. The first vascular plants are
    a) algae b) bryophytes
    c) pteridophytes d) angiosperms
11. Pteridophyta include about _____ genera.
    a) 100 b) 170
    c) 210 d) 400
12. The xylem of Pteridophytes contains _____ only.
    a) vessels
    b) tracheids
    c) xylem parenchyma
    d) xylem sclerenchyma
13. _____ era is regarded as the age of
    a) Cenozoic b) Mesozoic
    c) Late Paleozoic d) Archeozoic
14. Both homosporous and heterosporous plants are found in the group _____
    a) algae b) bryophytes
    c) pteridophytes d) gymnosperms
15. In ferns, spores are produced in
    a) oogonium b) sporangium
    c) stomium d) archegonium
16. The fern leaves are known as
    a) lamina b) fronds
    c) sporophyll d) blades
17. Which is the dominant phase of pteridophyte?
    a) Capsule b) Gametophyte
    c) Sporophyte d) Embryo
18. Bryophytes differ from Pteridophytes in being
    a) vascular b) seeded
    c) non-vascular d) sporophytic
19. Distinct alternation of generation is observed in Bryophytes and _____
    a) Bacteria b) Pteridophytes
    c) Fungi d) Protists
20. Gymnosperms are characterized by the absence of _____
    a) tracheids in xylem
    b) sieve cells in phloem
    c) heterosporous condition
    d) fruit formation
21. In gymnosperms, vegetative reproduction takes place by
    a) tuber b) runner
    c) leaf d) bulbils
22. The smallest gymnosperm among the following is
    a) Wolffia
    b) Zamia pygmaea
    c) Sequoia sempervirens
    d) Taxodium mucronatum
23. Pinus produces.
    a) no seeds
    b) flowers
    c) no vascular tissue
    d) naked seeds in cone
24. Endophytic fungi or mycorrhizae are found in the roots of
    a) Cycas b) Pinus
    c) Equisetum d) Hibiscus
25. Ginkgo biloba are called
    a) tallest plant b) smallest plant
    c) living fossils d) fossils
26. In monocotyledons, the leaves
    a) arise at the tip of stem only
    b) do not sheath the stem
    c) sheath the stem
    d) shed off
27. Fruits in angiosperms develop from
    a) ovary b) ovule

c) archegonium d) strobili

**28.** The transfer of pollen grains from anther to stigma is called
a) fertilization b) pollination
c) fragmentation d) sporulation

**29.** The type of pollination in angiosperm is
a) self pollination only
b) cross pollination only
c) indirect pollination
d) direct pollination

**30.** Double fertilization is a rule in
a) pteridophytes b) gymnosperms
c) bryophytes d) angiosperms

**31.** A characteristic of angiosperms is
a) presence of xylem and phloem
b) presence of tap roots
c) presence of photosynthetic leaves
d) presence of triploid endosperm

**32.** The dicotyledonous leaf shows the following venation
a) parallel b) palmate
c) pinnate parallel d) reticulate

**33.** Parallel venation is a characteristic feature of
a) Monocotyledons b) Dicotyledons
c) Pteridophytes d) Bryophytes

**34.** Secondary growth is absent in
a) monocotyledons b) dicotyledons
c) all angiosperms d) gymnosperms

**35.** Gymnosperms and angiosperms are similar in having
a) triploid endosperm
b) naked seeds
c) fruits
d) haploid pollen

**36.** The Lloyd botanical garden is located at
a) Darjeeling b) Shillong
c) Pune d) Nainital

**37.** The National Botanical Garden is located at
a) Delhi b) Lucknow
c) Mysore d) Darjeeling

**38.** Herbarium is
a) a garden where herbs are cultivated
b) a type of nursery
c) a collection of living plants which are medicinally important
d) a collection of well dried and nicely preserved plants which are correctly identified and arranged according to approved system of classification

**39.** The Central National Herbarium is located at
a) Chennai b) Hyderabad
c) Delhi d) Kolkata

**40.** The Southern Circle Herbarium is located at
a) Chennai b) Coimbatore
c) Madurai d) Mumbai

## Answer Keys

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1. a) | 2. b) | 3. c) | 4. b) | 5. b) | 6. a) | 7. a) | 8. d) | 9. a) | 10. c) |
| 11. d) | 12. b) | 13. c) | 14. c) | 15. b) | 16. b) | 17. c) | 18. c) | 19. b) | 20. d) |
| 21. d) | 22. b) | 23. d) | 24. b) | 25. c) | 26. c) | 27. a) | 28. b) | 29. c) | 30. d) |
| 31. d) | 32. d) | 33. a) | 34. a) | 35. d) | 36. a) | 37. b) | 38. d) | 39. d) | 40. b) |