Division: Bryophyta (mosses) > General Characters:-

- 1- Are non-vascular plants.
- 2- They are distinguished from liverworts by:-
- The presence of clearly differentiated "stem" and "leaves"
- by the presence of branched, multi-cellular rhizoids at the base of the stem.
- 3- The stem may be erect or prostrate.
- 4- The anatomy of stem shows slight internal differentiation, without true vascular system.
- 5- The leaves may be small outgrowths or may be flat and expanded like the leaves of higher plants.
- Leaves are spirally arranged on the stem, usually making 3 rows.
- The leaf is usually one layer in thickness except at the midrib which is more than one cell in thickness.

6- mosses have a gametophyte (1N)-dominant life cycle.

7- Sporophyte (2N) is short-lived and lives dependent on the gametophyte.

This is in contrast to the seed plants, for example, in which the haploid generation is represented by the pollen and the ovule, whilst the diploid generation is the familiar plant.

- 8- The sex organs are either produced:
- A- on separate plants,
- B- on separate branches of the same plant
- C- on the same branch of the same plant.

- 9- The sporophyte shows a marked degree of development and complexity. Why?
- It possesses chloroplasts and stomata.
- Spores, on germination, give rise to protonema.
- The protonema is a prostrate filament; that has oblique transverse walls and gives rise to leafy branches (gametophores). After the death of protonema the gametophores continue to grow as independent gametophytes.

Life Cycle of a Typical Moss



Sexual Reproduction

- Sex organs are borne in clusters, terminally on gametophytes.
- Plants may be homothallic or heterothallic.
- Usually the terminal part of the stems which carry the sex organs is flattened to form a receptacle. Around the receptacle there is a rosette of leaves known as involucre.
- Antheridia are oval, club-shaped or spindleshaped are found in clusters usually intermingled with multicellular hairs (the paraphysis) with thickened apices.
- Archegonia are also produced in clusters at the apices of stems; intermingled with normal paraphysis.





General Characters:-

1- Funaria is a typical moss; in that the gametophyte consists of stem and thin small leaves.

- 2- At maturity gametophyte carries developing sporophyte.
- 3- Sporophyte is distinguished into foot, seta and capsule.
- Foot acts to absorb food from gametophyte,
- <u>Seta</u> is involved in food transfer to the capsule
- <u>Capsule</u> contains the sporogenous tissue.

- 3- The capsule of *Funaria* is oval in shape.
- At its base there is a mass of tissue containing chloroplasts and stomata known as apophysis.
- > In the center of the capsule, there is a large-celled tissue known as the columella.
- > Around the columella lies the sporogenous tissue; outside which there are air cavities traversed by green filaments known as trabeculae.
- The outer wall of the capsule is made up of several layers of cells rich in chloroplasts and is covered by an epidermis containing stomata.

- At the top of the capsule there is the operculum which is inserted on a ring of thin-walled cells known as annulus.
- Below the annulus there is a rim of thick walled cells to which is attached a plate made up of teeth known as peristome teeth.
- 4- The capsule and operculum are in turn sheathed by a haploid calyptra which is the remains of the archegonial Venter.
- The calyptra usually falls off when the capsule is mature.
- > Within the capsule, spore-producing cells undergo meiosis to form haploid spores.

Capsule Of Funaria





• The life starts from a haploid spore, which germinates to produce protonema. This is a transitory stage in the life cycle.

 From the protonema grows the gametophyte that is differentiated into stems and leaves.

 From the tips of stems or branches develop the sex organs (antheridia and archegonia), enclosed by protective filaments (the involucre) and clustered in structures called moss flowers. Mosses can be either dioecious or monoecious.

In the presence of water, biflagellate sperm released from the antheridia swim to the archegonia and fertilization occurs, leading to the production of the diploid sporophyte.

The developing sporophyte pushes its way out of the archegonial Venter.



Male moss flower and female moss flower

Moss

neck

egg

ventor

stalk

Economic Importance

- 1. Decaying biomass of the genus *Sphagnum* is the major component of peat, which is "mined" for use as fuel, as a horticultural soil additive and in smoking malt in the production of Scotch whisky.
- 2. In World War II, *Sphagnum* mosses were used as first-aid dressings on soldiers' wounds; as these mosses are highly absorbent and have mild antibacterial properties. Some early people used it as a diaper due to its high absorbency.
- 3. Sphagnum moss, is harvested while still growing and is dried out to be used in nurseries and horticulture as a plant growing medium.

4- In rural U. K., Fontinalis antipyretica was traditionally used to extinguish fires as it could be found in substantial quantities in slow-moving rivers and the moss retained large volumes of water which help in extinguishing the flames. This historical use is reflected in its species Latin/Greek name, the approximate meaning of which is "against fire".

5- In Finland, peat mosses have been used to make bread during famines.

6- Moss is used as a Christmas decoration.

Pteridophytes

General Characters:-

1- They are vascular plants that neither flower nor produce seeds; hence they are called vascular cryptogams.

2- They reproduce and disperse only via spores.

- 3- Pteridophytes include several divisions;
- The most important are the <u>Lycopodiophyta</u> (club mosses and spike mosses), the <u>Equisetophyta</u> (horsetails).
- The **Psilotophyta** and the **Pteridophyta** (true ferns).
- In addition to these living groups of pteridophytes there are several extinct groups (known only from fossils) such as the <u>Rhyniophyta</u>.

4- These plants are generally sporophyteoriented; that is the normal plant is the diploid sporophyte, with the haploid phase (the gametophyte) being reduced. This basic pattern is like that found in the seed plants but with an important exception.

5- Unlike the seed plants, the pteridophytes have a gametophyte stage that is free-living. As a result, pteridophyte sexuality is more complicated than that of the seed plants.

6- <u>There are several basic categories of</u> <u>sexuality in pteridophytes</u>:

1. <u>Diocious</u> pteridophytes produce only antheridia or archegonia on a single gametophyte body.

2. <u>Monocious</u> pteridophytes produce both antheridia and archegonia on the same gametophyte body.

3. **<u>Protandrous</u>** pteridophytes produce antheridia first and then archegonia.

4. <u>Protogynous</u> pteridophytes produce the archegonia first, followed by the antheridia.

Main Characters

(1) Sporophyte is differentiated into stem, root and leaves.

(2) Leaves are sporophyllous and induce the formation of leaf gaps.

(3) The leaves are differentiated into petiole and large blade which is usually dissected.

(4) Most Pteridophytes are homosporous (with some exceptions).

(5) Spore on germination gives rise to green free-living gametophyte, which is usually heart-shaped.

(6) Stelar structure is variable and is mainly of the primitive types such as protostele and siphonostele.

Adiantum

- General Characters:-
- 1- The sporophyte is perennial with a prostrate rhizome bearing on its upper surface large branched sporophylls (fronds).
- 2-The blade of the sporophyll is dissected into pinnae, which in turn are further dissected into pinnules.
- The edge of the pinnule is folded downwards to form a false induseum enclosing a sorus of sporangia.
- Sporangia are oval in shape with the wall consists of <u>two regions</u>:
- a region of thin-walled cells called the stomium and a region of thick-walled cells called the annulus.

3- Sporangia produce haploid spores after meiosis. Spores germinate to give the heart-shaped gametophyte.

4- Adventitious roots emerge from the lower surface of the rhizome.

- 5- Young fronds are circinately coiled.
- The frond has a petiole (stalk or stipe) and blade (lamina)
- The axis (midrib) of which is known as the rachis. Petioles, rachis and young rhizomes are usually covered with stiff hairs called ramenta.

- 6- Plants are usually perennial with creeping rhizome grows a few centimeters below the soil surface.
- 7- The rhizome is dichotomously branched
- and is capable of indefinite growth.
- 8- The rhizome carries numerous slender adventitious roots.
- 9- Leaves are carried alternatively at irregular intervals.



Sporophyte (A) and Gametophyte (B) of Adiantum



Leptosporangium

meiospore