TP 03: Bryophytes and Pteridophytes

I-BRYOPHYTES: Bryophytes are non-vascular plants that include mosses (Bryophyta), liverworts (Marchantiophyta), and hornworts (Anthocerotophyta). They play crucial roles in ecosystems, such as regulating moisture, preventing soil erosion, and providing habitats for microfauna.

Characteristics of bryophytes

Lack of vascular tissue, dominant gametophyte stage, moisture dependency (bryophytes require water for reproduction), no true roots, stems, or leaves.

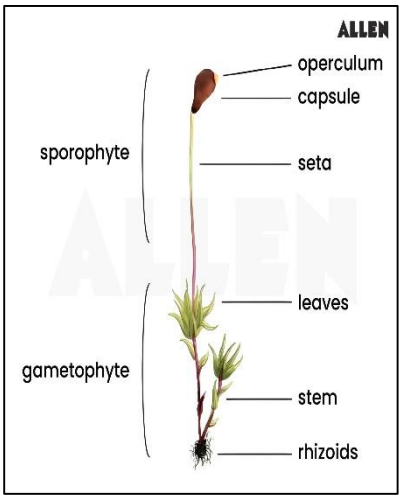
Classification of bryophytes

1. **Mosses (Bryophyta)** – These are the most diverse group, with small, leafy gametophytes and upright sporophytes containing a capsule (sporangium) that releases spores.
2. **Liverworts (Marchantiophyta)** – These can be thalloid (flat and ribbon-like) or leafy. Their gametophytes often have a distinct lobed structure, and they reproduce using gemmae cups for asexual reproduction.
3. **Hornworts (Anthocerotophyta)** – These have a unique sporophyte that is elongated and horn-like, with continuous spore production due to an active growth zone.

Ecological importance: Soil formation and stability, water retention, carbon sequestration, bioindicators of environmental health.

Genus *Funaria*

The genus funaria belongs to the division bryophyta and the class bryopsida. It includes small, fast-growing mosses commonly found in moist, disturbed habitats. The most well-known species is *funaria hygrometrica*, often called cord moss due to its twisted stalk that reacts to humidity changes.



Funaria sp

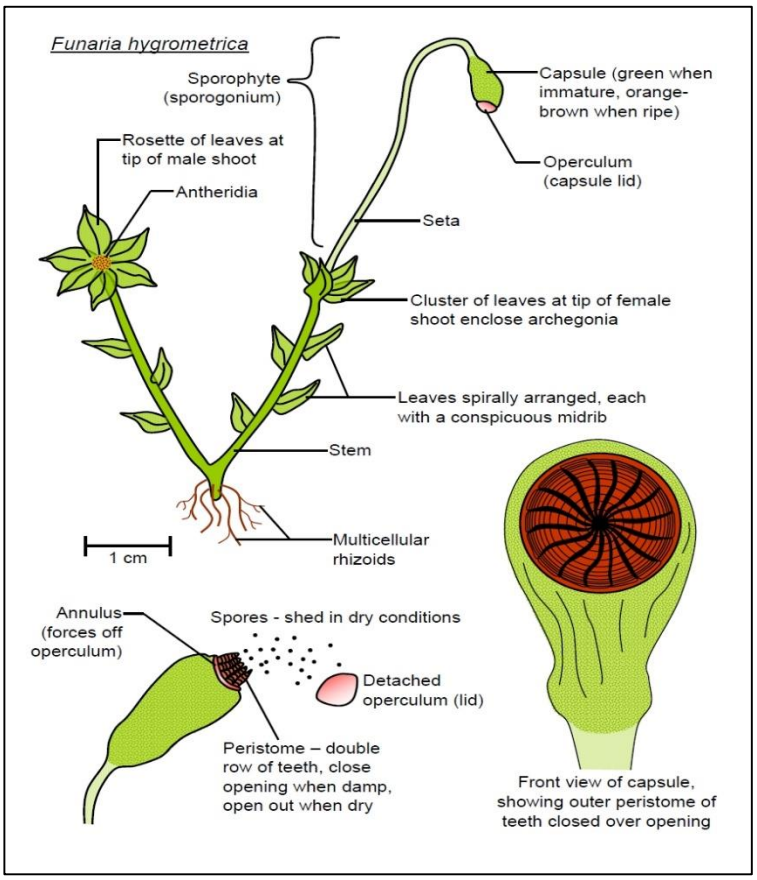
Morphological characteristics

Gametophyte (dominant phase)

Forms dense, green, cushion-like colonies.

Leafy shoots with small, simple, ovate leaves (phylloides) arranged spirally.

Has rhizoids that anchor it to the substrate.



Sporophyte (short-lived phase)

Consists of a long, slender seta (stalk) that curves as it matures.

Capsule (sporangium) is large, pear-shaped, and inclined, helping in efficient spore dispersal.

Has a peristome (a ring of teeth) that helps in the gradual release of spores.

Reproduction

Asexual reproduction: Occurs through fragmentation and gemmae (small vegetative propagules).

Sexual reproduction (oogamous): *funaria* is monoicous (male and female reproductive organs on the same plant). Antheridia (male) produce sperm, which swim to the archegonia (female) in the presence of water. Fertilization results in a zygote, which develops into the sporophyte.

Ecological importance:

- Pioneer species – colonizes disturbed soils, aiding in ecological succession.
- Soil stabilizers – prevents erosion by retaining moisture.
- Pollution indicators – sensitive to air and soil pollution, useful in biomonitoring.

Genus *Marchantia*

The genus *Marchantia* belongs to the division marchantiophyta (liverworts) and the class marchantiopsida. These liverworts are commonly found in moist, shaded environments, such as damp soils, rocks, and near water bodies. *Marchantia* shares some features with thallophytes (simple body, no vascular tissues) but it is classified as a bryophyte (liverwort), meaning it is closer to land plants (Embryophytes) than algae (Thallophytes).

Marchantia sp

Morphological characteristics

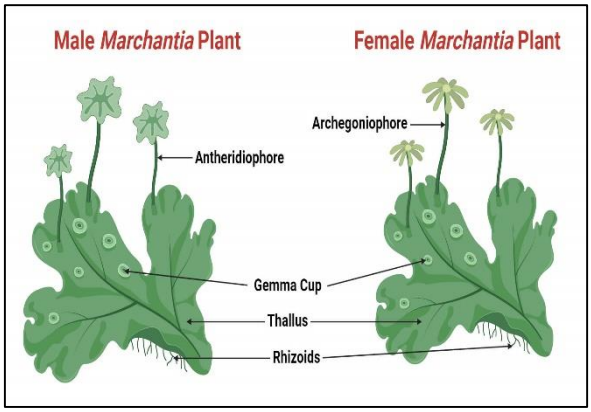
Thallus (gametophyte stage - dominant)

Flattened, dichotomously branched thallus (forks into two equal parts).

Dark midrib running through the center, helping with support and conduction.

Has pore-like openings on the surface (analogous to stomata but passive).

Rhizoids (unicellular, hair-like structures) anchor the plant to the substrate.



Scales on the underside provide additional protection and support.

Sporophyte (dependent on gametophyte)

Develops inside a specialized structure called the archegoniophore. Consists of a foot, seta, and capsule, which releases spores.

Reproduction in *Marchantia*

<u>Asexual reproduction</u>

Gemmae cups: Small, cup-like structures on the thallus. Contain gemmae, which are clonal propagules dispersed by rainwater.

Fragmentation: the thallus can break apart and regenerate into new plants.

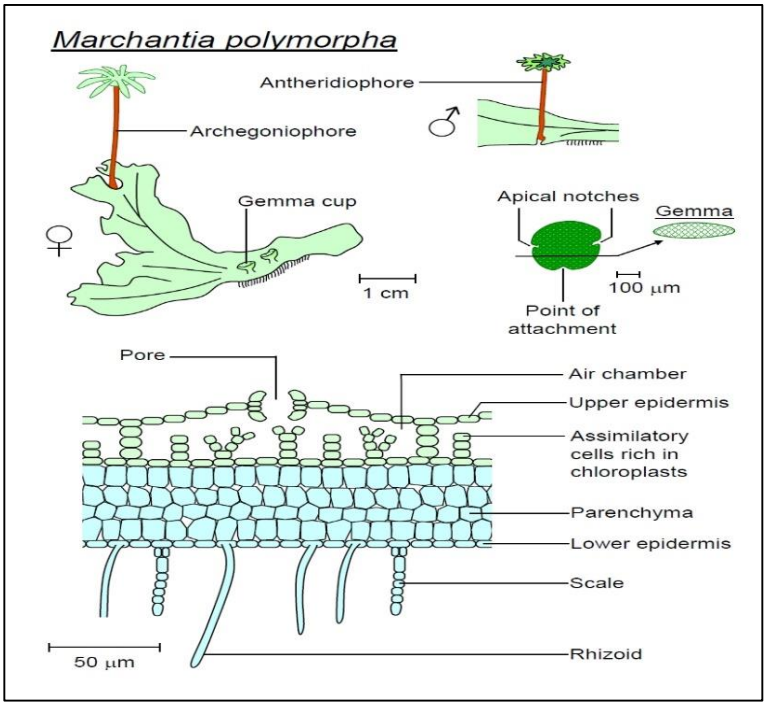
Sexual reproduction (oogamous)

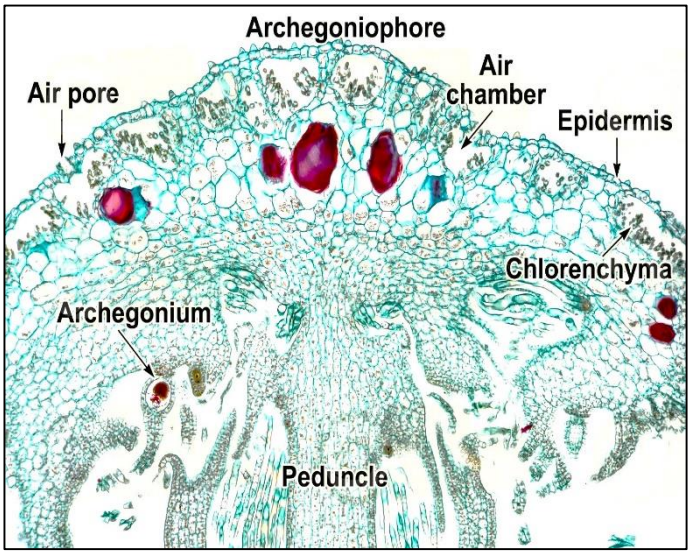
Marchantia is dioicous, meaning male and female reproductive structures develop on separate plants.

Antheridiophores: Umbrella-shaped structures that bear antheridia (male organs), which produce sperm.

Archegoniophores: Palm-tree-like structures that bear archegonia (female organs), which produce eggs.

Fertilization occurs when sperm, carried by water, reaches an egg in the archegonium. The zygote develops into a sporophyte, which produces haploid spores for dispersal.





Ecological and biological importance: Pioneer species, Moisture retention, Medicinal uses: traditionally used for treating wounds and infections, Model organism: *Marchantia polymorpha* is widely used in plant biology research.

Work to be done:

Observation and drawing of a ***Funaria sp*** moss plant, and ***Marchantia sp***.

II-PTERIDOPHYTES: Pteridophytes (pteron= feather, phyton= plant, i.e. plants with feather like leaves). A group of vascular plants that have roots, stems, and leaves. Pteridophytes do not produce flowers or seeds. Instead, they reproduce via spores, which are usually found on the underside of their leaves in specialized structures called sori.

They are classified as vascular cryptogams because they possess vascular tissues but reproduce without visible reproductive organs like flowers. Their life cycle is characterized by alternation of generations, involving a dominant diploid sporophyte phase (the fern plant we usually observe) and a smaller, independent haploid gametophyte phase (called the prothallus).

Pteridophytes typically thrive in moist, shaded environments where water is available for fertilization, as their sperm cells are motile and require a thin film of water to reach the egg. They play important ecological roles in forest understories and can be indicators of healthy, humid environments.

One of the most common and accessible species for study is ***Polypodium vulgare***, or common polypody, a fern widely distributed, often growing on rocks, walls, and tree trunks in temperate, shaded areas.

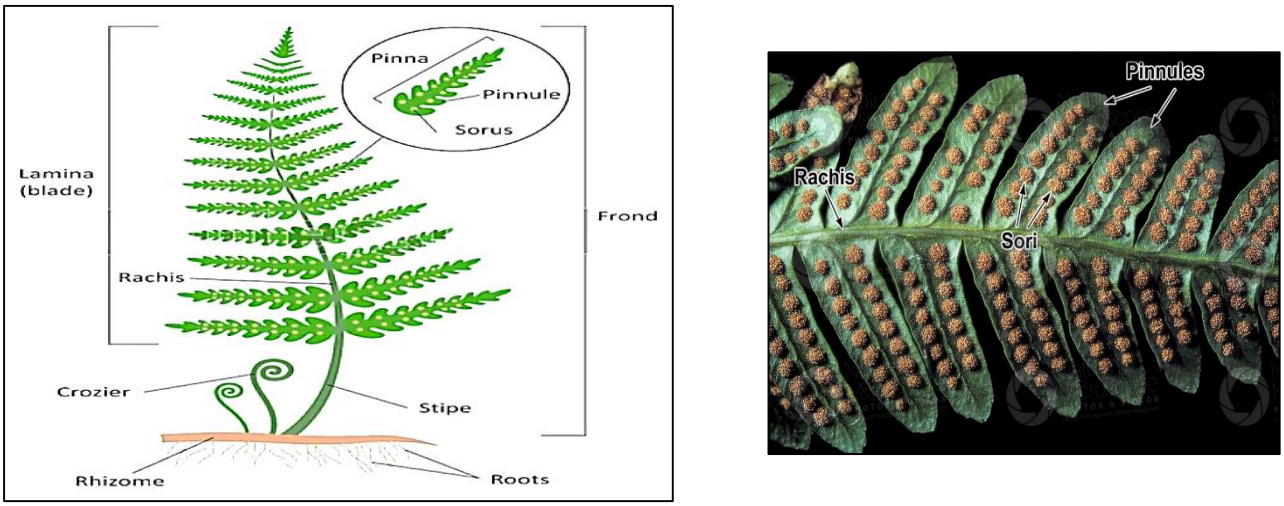


Figure : Polypodium vulgare

Classification:

- Kingdom: Plantae
- Division: Pteridophyta
- Class: Polypodiopsida
- Order: Polypodiales
- Family: Polypodiaceae
- Genus: *Polypodium*
- Species: *P. vulgare*

Objective:

To observe and identify the main morphological features of Pteridophytes.

Work to do:

Observe and draw a ***Polypodium vulgare*** fern plant.