SPHAGNUM

Kingdom- Plantae (Plant)

Division- Bryophyta

Class- Musci (Moss)

Order- Sphagnales

Family- Sphagnaceae

Genus- Sphagnum

• Sphagnum is popularly known as **bog moss**, **peat moss** or **turf moss** because of its ecological importance in the development of peat or bog.

• The plants are perennial and grow in swamps and moist habitat like rocky slopes where water accumulates or where water drips.

Structure of Sphagnum

External Morphology

• The gametophyte phase of Sphagnum is represented by two distinct stages namely, (a) **juvenile protonema**, and (b) **mature leafy or gametophore stage.**

• Very young gameto-phytes bear multicellular rhizoids with oblique septa.

• Mature gametophytes, how-ever, do not bear rhizoids.

• Gametophyte is differentiated into an upright branched axis and leaves.

Main Axis and Branches:

• The main axis is soft and weak at young stage, but becomes erect and stout at maturity. However, the main axis is much longer in aquatic species, but is relatively short in terrestrial form due to the progressive death of the older basal part.

• The axis branches profusely on the lateral sides. Single branch or in tufts of 3 to 8 branches arise from the axils of every fourth leaf of the main axis.

• At the apex of the main stem, many small branches of limited growth are densely crowded forming a compact head called coma.

• The coma is formed near the apex due to the condensed growth of apical internodes. As the stem grows in length these short branches elongate and become normal branches.

• The terrestrial species pro-duce two types of branches viz., (i) **pendent branches**, and (ii) **upwardly divergent branches.**

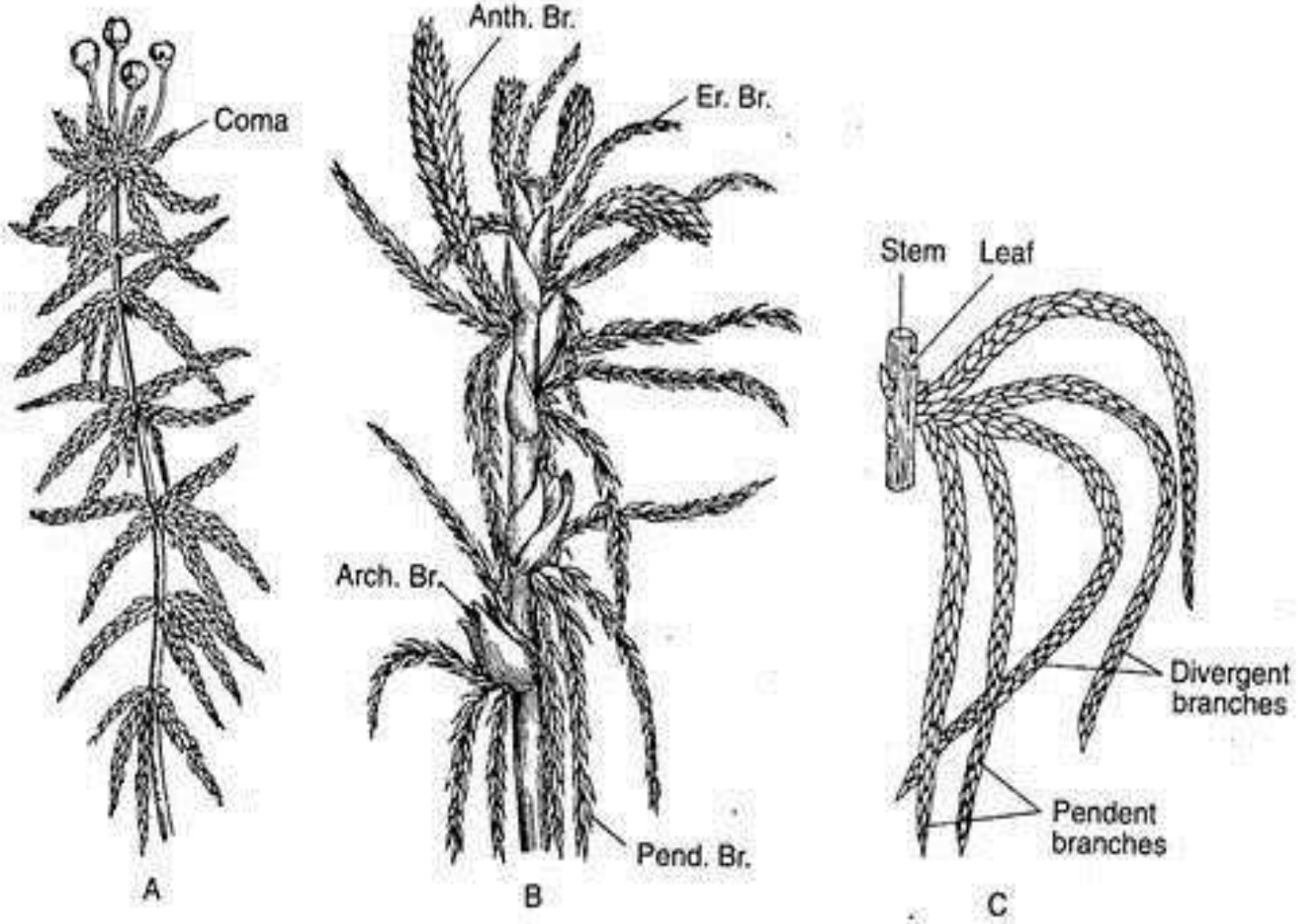


Fig. 6.38 : A. Gametophyte plant of *Sphagnum palustre*, bearing terminal cluster of sporogonia. B. Part of *Sphagnum nemoreum* gametophyte showing antheridial branches (Anth. Br.), archegonial branches (Arch. Br.), erect branches (Er. Br.) and pendent branches (Pend. Br.) (after Schimper). C. Divergent and pendent branches on the main axis

Pendent Branches

• These are long slender loosely arranged, turn downwards and then grow parallel to the main axis. They are also termed flagelliform or de-current branches.

Divergent Branches

• These are short and stout branches which grow outwards and upwards. They are also termed ex-current bran-ches. Sometimes, one divergent branch in each node develops strongly than others and ultimate-ly gives rise to a new plant when it becomes detached from the mother plant.

Leaves

• The leaves occur both on the main axis as well as on the branches (Fig. 6.38C). On the branches, the leaves are closely set and, there-fore, overlapping and are placed apart on the main axis. The leaves are arranged in spiral phyllotaxy.
• In general, the leaves are small, sessile, entire, thin and scale--like with acute apex and without a midrib.

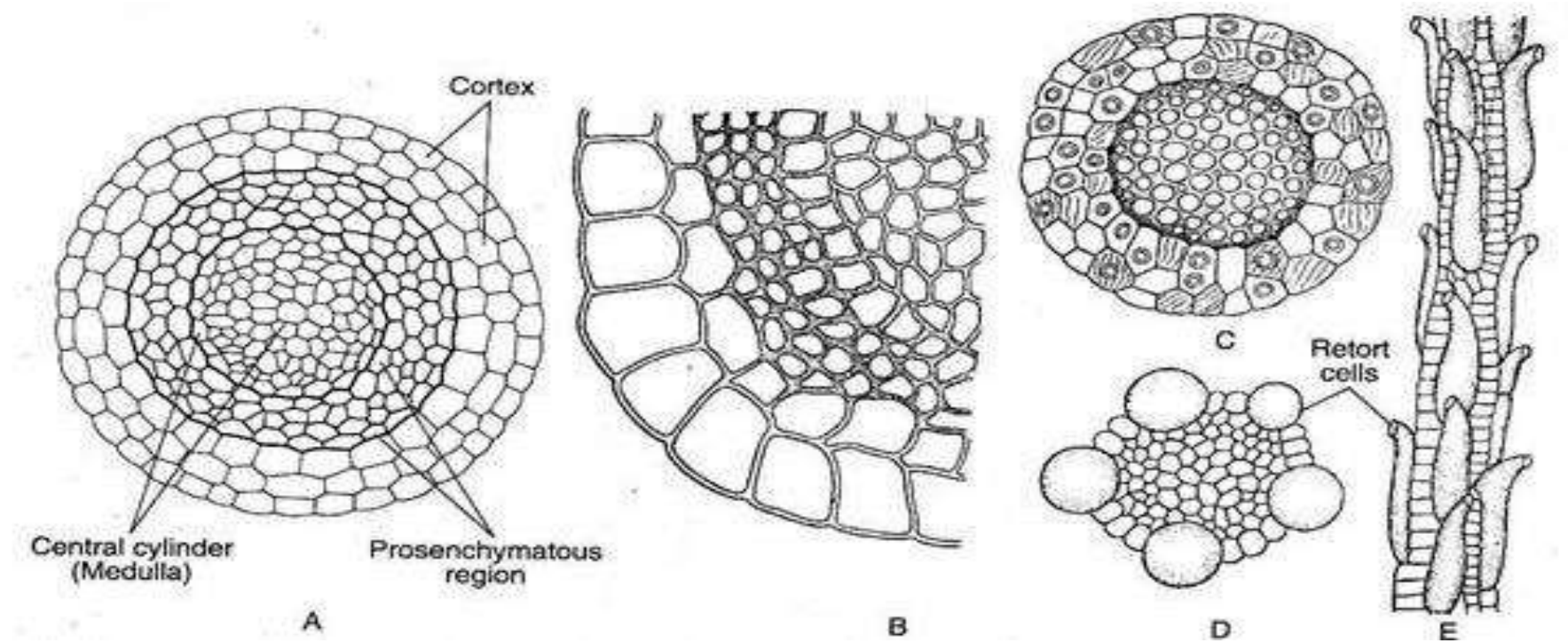
Internal structure

T.S. of Stem

•T.S. of stem shows 3 regions. The **outer cortex** or **hyalodermis** is about 3-6 layers of compactly arranged cells, in older stems. It stores water. he mature corti-cal cell is devoid of protoplasm. In some species (S. tenellum, S. molluscum), some outer cortical cells enlarge peculiarly and become bottle or retort-shaped. The neck of each cell is turned outward away from the axis and has a pore at the distal end. These are called retort cells. They accumulate water and inhabited by small microscopic animals.

•The **middle region** is **hadrome**. It comprises of prosenchymatous cells. It provides mechanical support.

•The inner most region is **medulla**, made up of colourless parenchymatous cells.



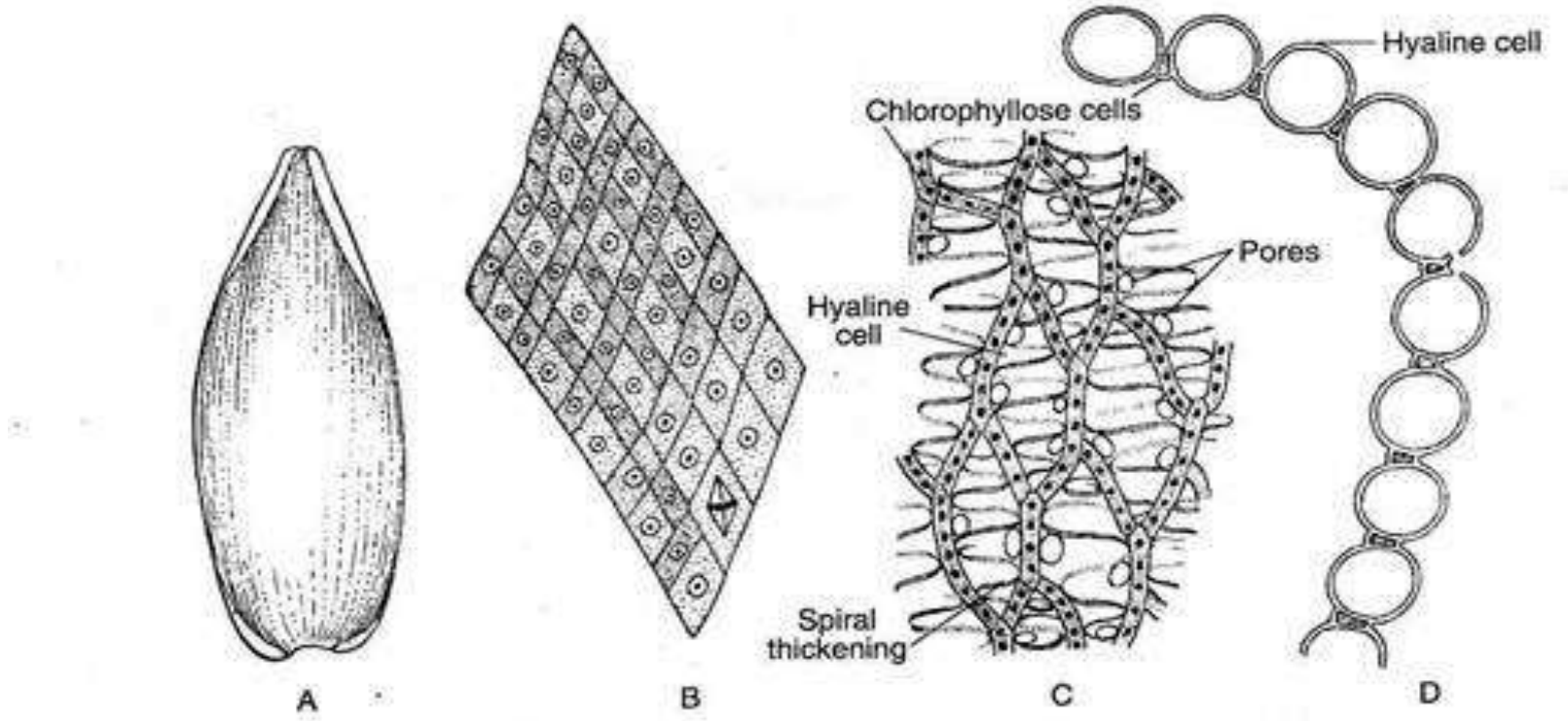
T.S. of leaf

• Leaves of sphagnum are unique in structure. They have a single layer of cells in thickness. The cells are of two types: Narrow, chlorophyll containing cells are called **assimilatory cells/ cholorophyllous cells** .

• The **assimilatory cells** are small triangular or biconvex living cells with many discoid chloroplasts and have their photosynthetic ability

•Large, rhomboidal dead cells are called **hyaline cells**. These two types of cells are arranged alternatively in the leaf , to form a net-like structure.

• The hyaline cells have a remar-kable capacity of absorption and retention of water .



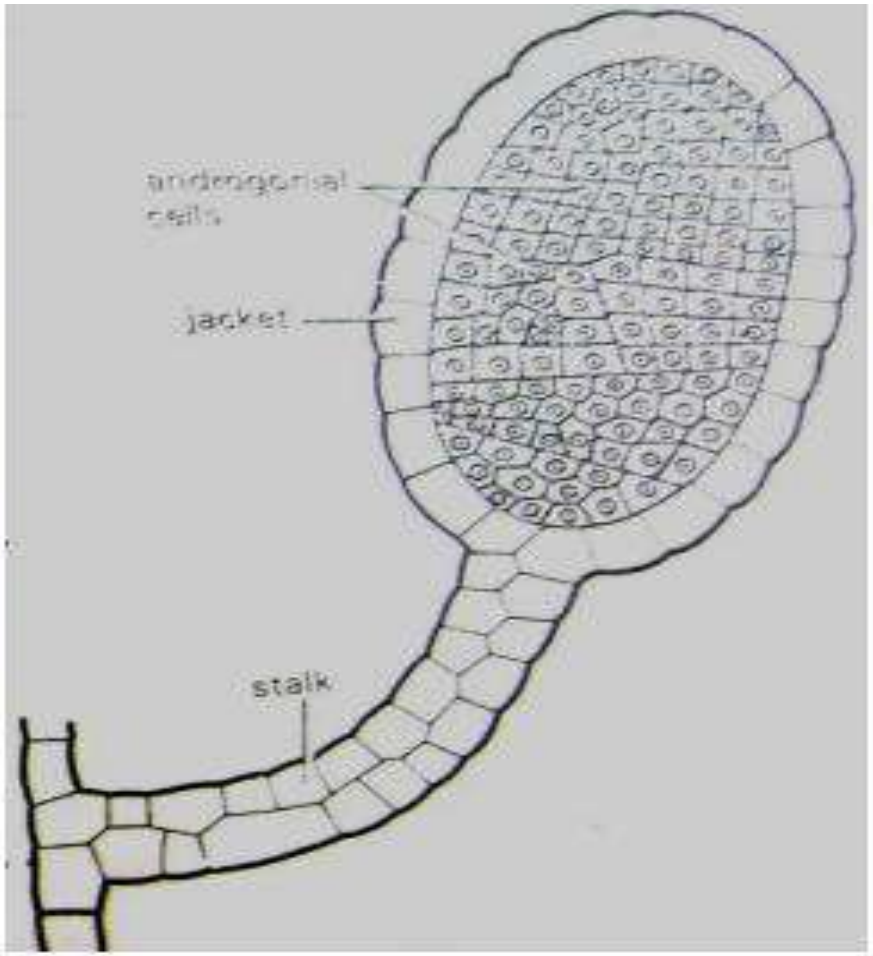
II. Sexual Reproduction:

• It is advanced oogamous type. Antheridia and archegonia are produced in special branches called antheridial or male and archegonial or female branches, in same (monoecious) or different (dioecious) plants. These branches occur at the tip of the stem (in the coma) or at the lower nodes.

• **Structure of antheridial branch and antheridia**: Antheridial branches are shorter than the vegetative branches and appear like catkins. They are covered with red/brown coloured leaves.

- Antheridia are arranged acropetally in the axils of the leaves of these branches.
- Antheridia are club shaped with a long, multicellular stalk and a globular body.
- The body is covered with a single layered jacket which surrounds numerous androgonial cells.
- The androgonial cells develop into antherozoids or sperms.
- Each sperm is spirally coiled, elongated structure with a pair of flagella.
- Mature sperms are released from the antheridium by the
- separation of the jacket cells.

Antheridial branch



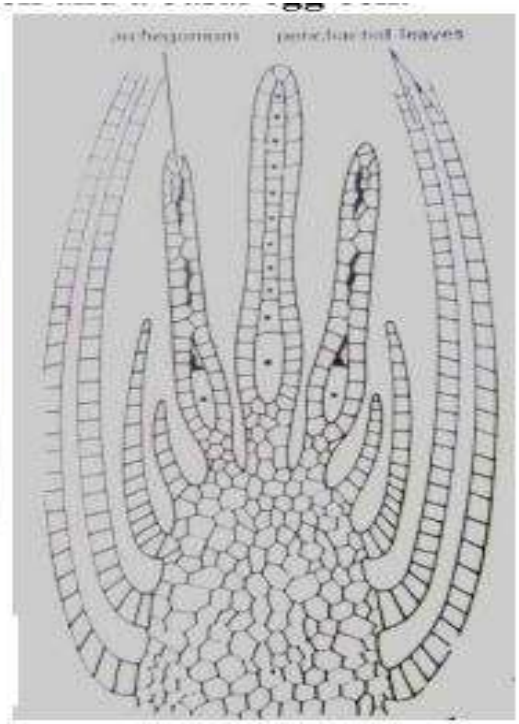
L.S. of Antheridial branch

Structure of archegonial branch and archegonia:

•The archegonial branches are very short and thick. They are purple in colour. They are covered with large leaves called **perichaetial leaves**. Goups of 3-5 archegonia are found at the tip of the each branch.

- The mature archegonium is flask shaped with a long twisted neck and a swollen **venter**.
- The neck is covered with 6 vertical rows of neck cells and cover cells. It encloses 8-9 neck canal cells.
- The venter is covered by 2-3 layers of cells. It encloses a venter canal cell and a basal egg cell.

Archegonial branch



L.S. of Archegonial branch

Fertilization

- The process of fertilisation takes place only in the presence of water.
- The antherozoids swim freely in water and reach the archegonia. At maturity, the neck canal cells and the ventral canal cell disorganise and form a passage for the antherozoids.
- The antherozoids reach near the archegonia attracted chemotactically and pass into the passage to reach the egg. Ultimately, only one antherozoid fuses with the egg and forms a **zygote (2n).**

Sporophyte

Development of the Sporophyte

- The diploid zygote is the first cell of the sporophytic generation. Among the few archegonia only one is developed to form embryo in an archegonial branch.
- The zygote enlarges and undergoes transverse division to form 6- or 7-celled filamentous structure.
- The lower half of the filament undergoes irregular divisions forming a parenchymatous bulbous **foot**. The foot acts as a haustorium and obtain food from archegonium untill complete development.

• The upper cells of the filament divide by two vertical divisions at right angle to each other — a quadrant is formed. The cells of the quad-rant divide periclinally to form an **inner endothecium** and an **outer amphithecium.**

• The cells of the endothecium repeatedly divide and form a central sterile part, **columella**.

• The amphithecium divides peri-clinally to differentiate an inner **2-4 layered archesporium** and the outer **3-7 layered capsule wall**.

• The **archesporium** forms a dome-shaped arch over the columella.

• The cells of the **archesporium** later develop into **2-4 layered sporogenous tissue**.

• All **sporogenous cells** function as **spore mother cells** that divide meiotically and form **haploid spores**. The spores are enclosed within a spore sac developed from the surroun-ding sterile tissue.

• There is only a **short neck like inconspicuous seta** connecting the upper capsule and the lower bulbous **foot**.

Structure of Sporophyte

The ripe sporophyte is a dark brownish-black coloured spherical structure appearing at the tip of the female branch. It is found on a stalk called the The mature sporophyte consists of a **bulbous foot** and a **spherical capsule**. The two are connected by a narrow neck-like region which represents the **seta**. The foot is embedded in the tissue of the **pseudopodium** of the gametophyte. It absorbs nutrition and water for the growing sporophyte. The capsule has the following parts:

- A massive central column of sterile cells called columella.
- A thin dome shaped spore sac overarching the columella. It contains haploid spores.
- **Elaters are absent**.
- The 4-6 layered capsule wall surrounds the columella and spore sac. Its outer layer is called epidermis and it consists of many **non-functional stomata**.
- A convex disc-shaped **operculum** or lid is found at the top of the capsule. It is separated from the rest of the capsule by a ring like groove of thin cells called **annulus**.
- The remains of archegonia form a calyptra which cover the tip of capsule.
- When the sporophyte is mature, the operculum is blown off forcefully, by the rupturing of the annulus cells. The spores are also released into the air like a cloud.
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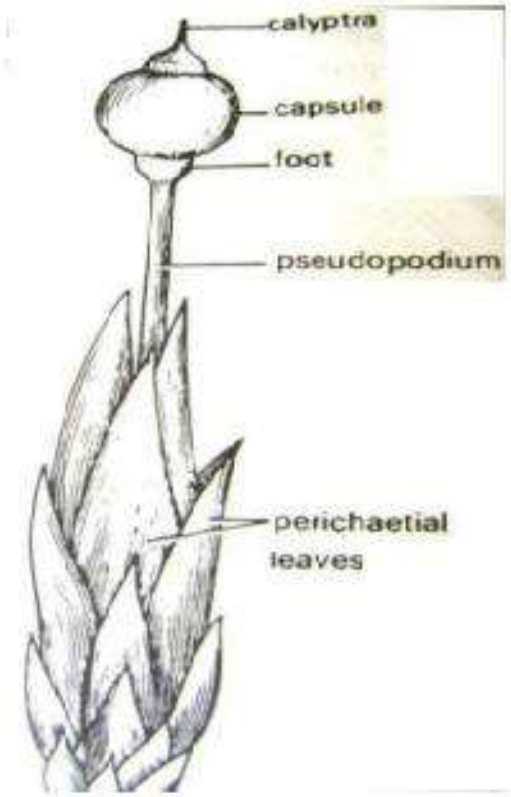
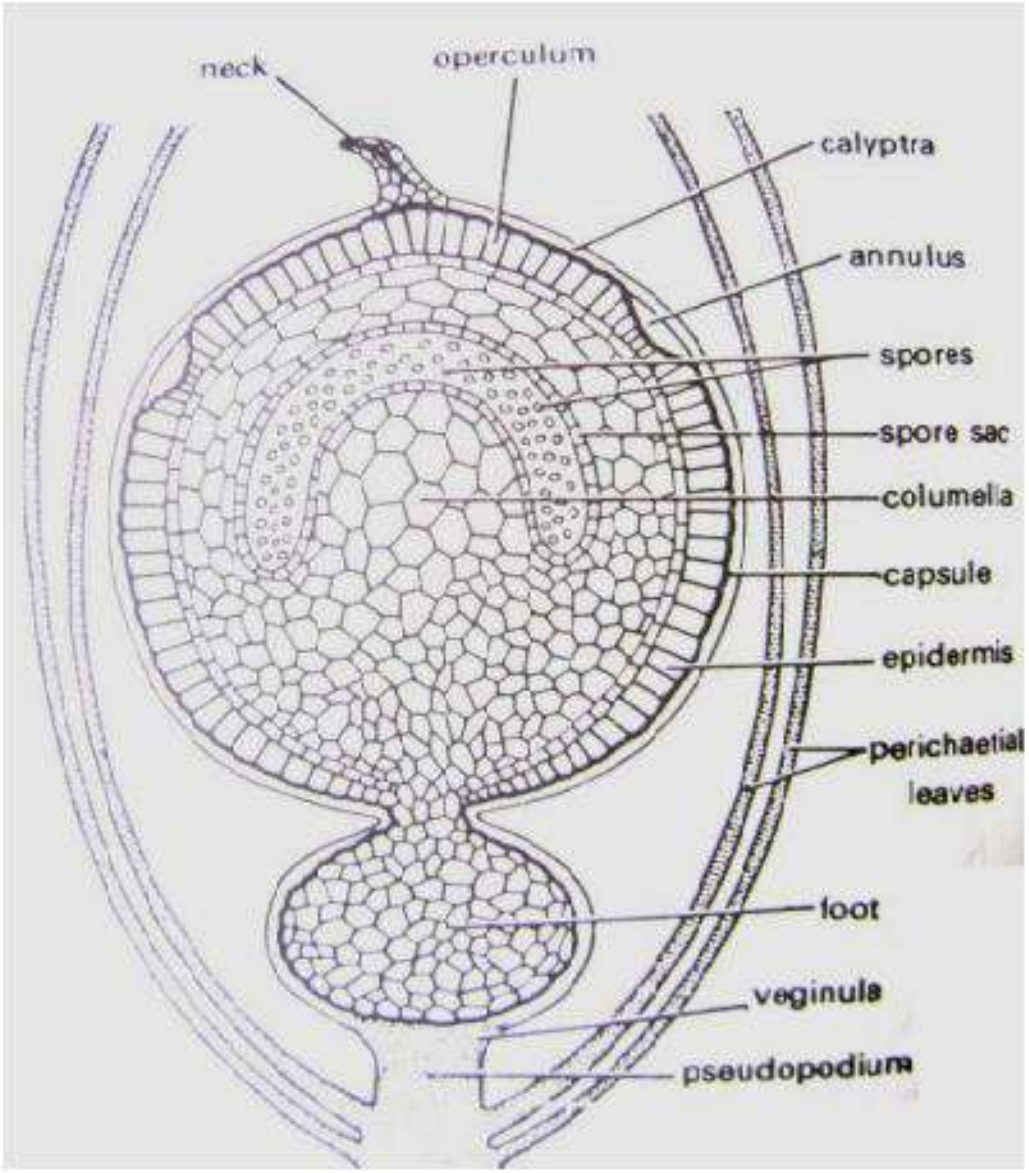


A mature sporophyte



Internal structure of sporophyte

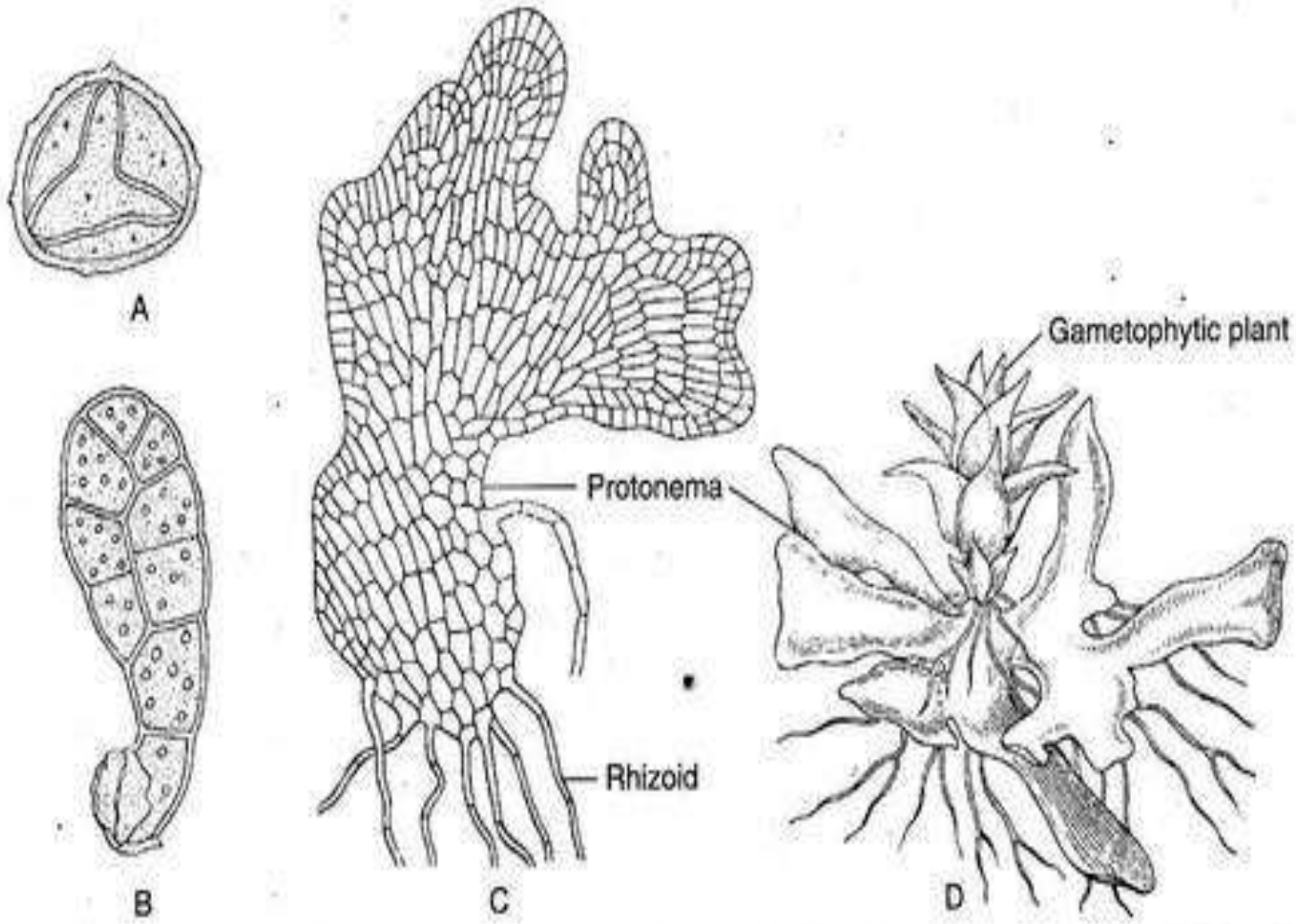
Dehiscence of the Capsule

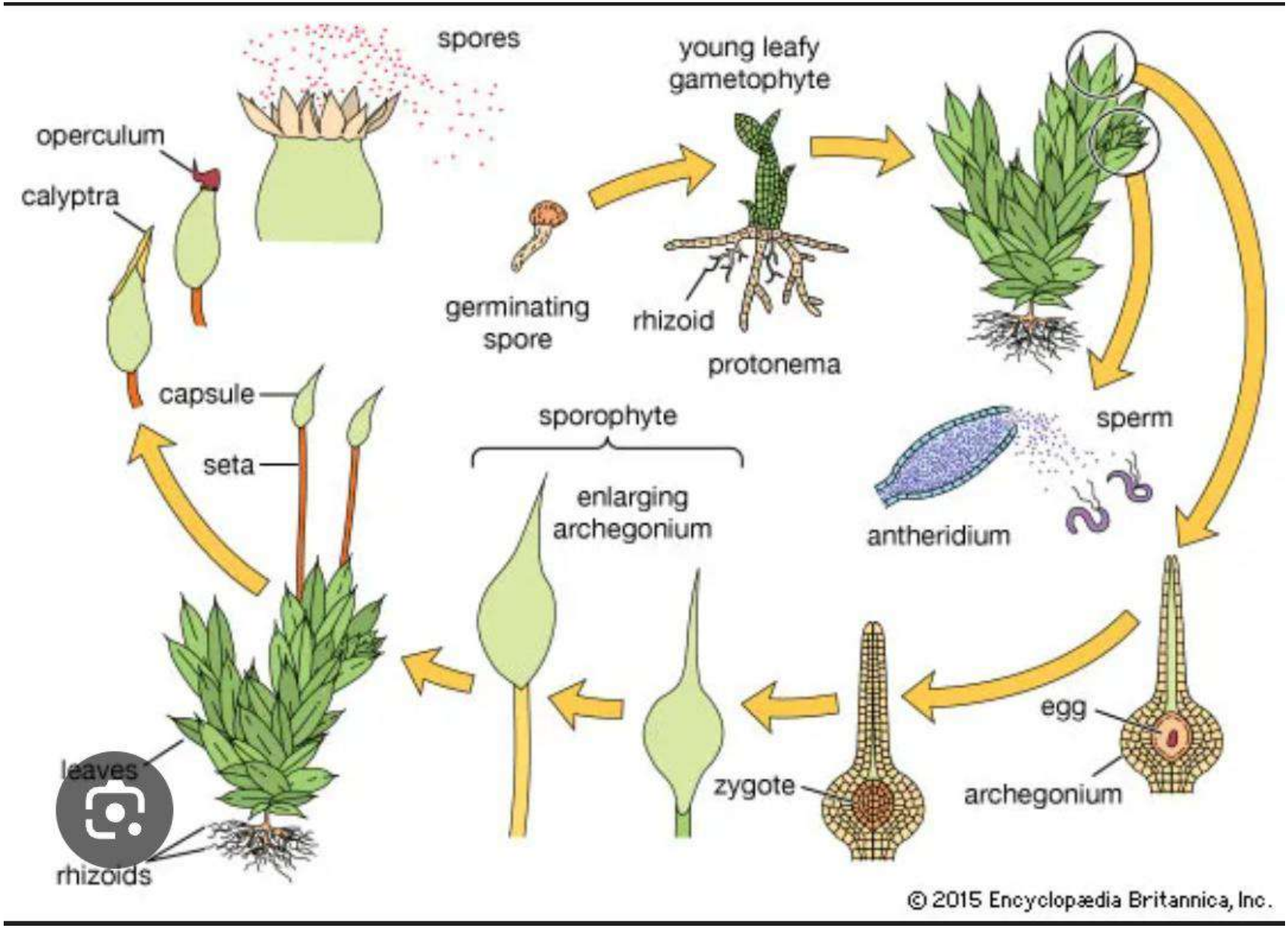
• The capsule dehisces on a bright sunny day by an **explosive mechanism**. The capsule wall and columella become dry and shrivel due to heat. This results in the formation of a large air space below the spore-sac.
• The spherical capsule gradually becomes cylindrical and, therefore, an over-pressure of 4-6 atmospheres builds up inside the capsule. Under this condition its operculum bursts open through the annulus with an audible sound. The spores are catapulted up to 20 cm and release in the air. The process is known as **air-gun mechanism** of spore dis-persal.

Germination of spores

• Like other bryophytes, the spore is the first cell of the gametophytic generation.
• Initially, the spores are arranged in tetrahedral tetrads. Each spore has a distinct triradiate ridge.
•The wall of the spore is differentiated into an outer smooth granular or **papillate exine** and an **inner thin intine**.
•The spores germinate when the conditions are favorable to develop into a green, flat, irregularly lobed, thallus like structure called **primary protonema**. It is photosynthetic and bears **rhizoids**. From the marginal cells of this protonema, a bud like structure develops which further grow to form the young erect gametophyte.

Germination of spores into new gametophyte




spores
operculum
calyptra
young leafy gametophyte
germinating spore
rhizoid
protonema
capsule
seta
sporophyte
enlarging archegonium
sperm
antheridium
egg
archegonium
zygote
leaves
rhizoids
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