

# Introduction

- Bryophyte is a traditional name used to refer to *all land plants that do not have true vascular tissue* and are therefore called "non-vascular plants"
- They have no wood to lend them structural support, *nor do they have large leaves or showy cones or flowers*



Bryophyta (**Braun**) (Gr. Bryon = moss; phyton = plant), a division of kingdom Plantae comprises of Mosses, Hornworts and Liverworts. They are groups of green plants which occupy a position between the thallophytes (Algae) and the vascular cryptogams (Pteridophytes).

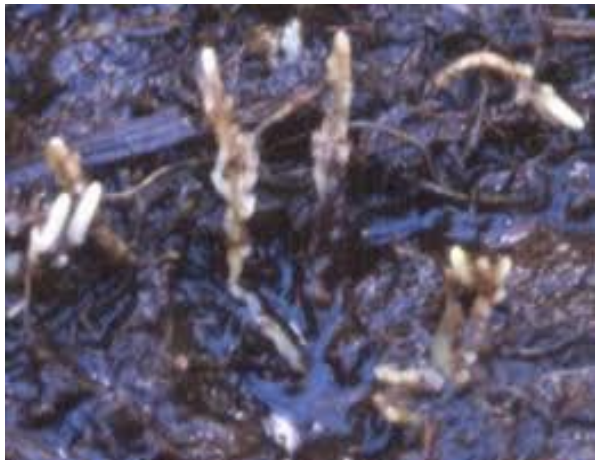
Bryophytes produce embryos but lack seeds and vascular tissues. They are the most simple and primitive group of Embryophyta. They are said to be the first land plants or non-vascular land plants (Atracheata). Presence of swimming antherozoids is an evidence of their aquatic ancestry.

## **Distribution of Bryophytes:**

- Bryophytes are represented by 960 genera and 24,000 species. They are cosmopolitan in distribution and are found growing both in the temperate and tropical regions of the world at an altitude of 4000-8000 feet.
- In India, Bryophytes are quite abundant in both Nilgiri hills and Himalayas; Kullu, Manali, Shimla, Darjeeling, Dalhousie and Garhwal are some of the hilly regions which also have a luxuriant growth of Bryophytes. Eastern Himalayas have the richest in bryophytic flora. A few species of Riccia, Marchantia and Funaria occur in the plains of U.P., M.P. Rajasthan, Gujarat and South India.
- In hills they grow during the summer or rainy season. Winter is the rest period. In the plains the rest period is summer, whereas active growth takes place during the winter and the rainy season. Some Bryophytes have also been recorded from different geological eras e.g., *Muscites yallourensis* (Coenozoic era), *Intia vermicularies*, *Marchantia* spp. (Palaeozoic era) etc.

# Habitat of Bryophytes:

- Bryophytes grow densely in moist and shady places and form thick carpets or mats on damp soils, rocks, bark of trees especially during rainy season.
- Majority of the species are terrestrial but a few species grow in fresh water (aquatic) e.g., *Riccia fluitans*, *Ricciocarpos natans*, *Riella* etc. Bryophytes are not found in sea but some mosses are found growing in the crevices of rocks and are being regularly bathed by sea water e.g., *Grimmia maritima*.
- Some Bryophytes also grow in diverse habitats e.g., *Sphagnum*-grows in bogs, *Dendroceros*-epiphytic, *Radula protensa*. *Crossomitrium* -epiphyllous, *Polytrichum juniperinum*- xerophytic, *Tortula muralis*-on old walls. *Tortula desertorum* in deserts, *Porella platyphylla*-on dry rocks, *Buxbaumia aphylla* (moss), *Cryptothallus mirabilis* (liverwort) are saprophytic.



- Bryophytes are *gametophyte dominant*, meaning that the more prominent, longer-lived plant is the *haploid* gametophyte.
- The *diploid sporophytes* appear *only occasionally* and remain attached to and nutritionally dependent on the gametophyte.



# General Characters of Bryophytes:



1. Plant body is gametophytic, independent, dominant, autotrophic, either thalloid (i.e., thallus like, not differentiated into root, stem and leaves) or foliose, containing a rootless leafy shoot.

2. Plant body is very small and ranges from a few mm. to many cm. *Zoopsis* is the smallest bryophyte (5 mm.) while the tallest bryophyte is *Dawsonia* (50-70 cms.).

3. Leaves and stems found in vascular plants are absent, Koch (1956) termed these 'leaf' and 'stem' like structures as 'axis' and 'phylloid' respectively.

4. Roots are absent. Functions of the roots are performed by rhizoids. Cells are also capable to absorb moisture directly from the ground or atmosphere. Therefore, Bryophytes can also survive on the moist soils.

5. Rhizoids may be unicellular, un-branched (e.g., *Riccia*, *Marchantia*, *Anthoceros*) or multicellular and branched (e.g., *Sphagnum*, *Funaria*)

6. In members of order Marchantiales (e.g., *Riccia*, *Marchantia*) scales are present. These are violet coloured, multicellular and single cell thick. They protect the growing point and help to retain the moisture.

7. Vascular tissue (xylem and phloem) is completely absent. Water and food material is transferred from cell to cell. However, in some Bryophytes (e.g., mosses) a few cells in groups of 2-3 are present for conduction of water and food (photo assimilate). These cells are known as hydroid (collectively hydrom) and leptoids respectively. Cuticle and stomata are absent.





## Sporangium and Spores



- **Absence of specialized *tissues for transporting water and dissolved food throughout the organism* limits terrestrial forms to being very short plants, since the only way to move substances through the plant body is by osmosis and diffusion from surface moisture.**
- **Bryophytes *do not have roots*, but *have rhizoids*, which are relatively simple, sometimes *multicellular filaments of thin-walled cells***

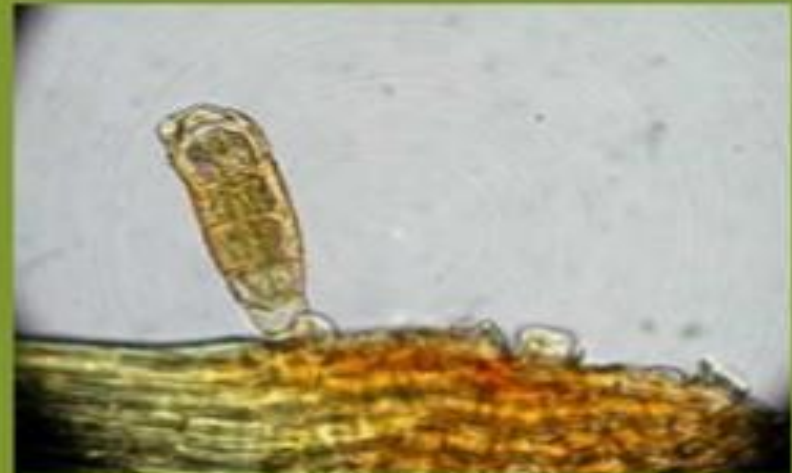




# Reproduction and Life cycle

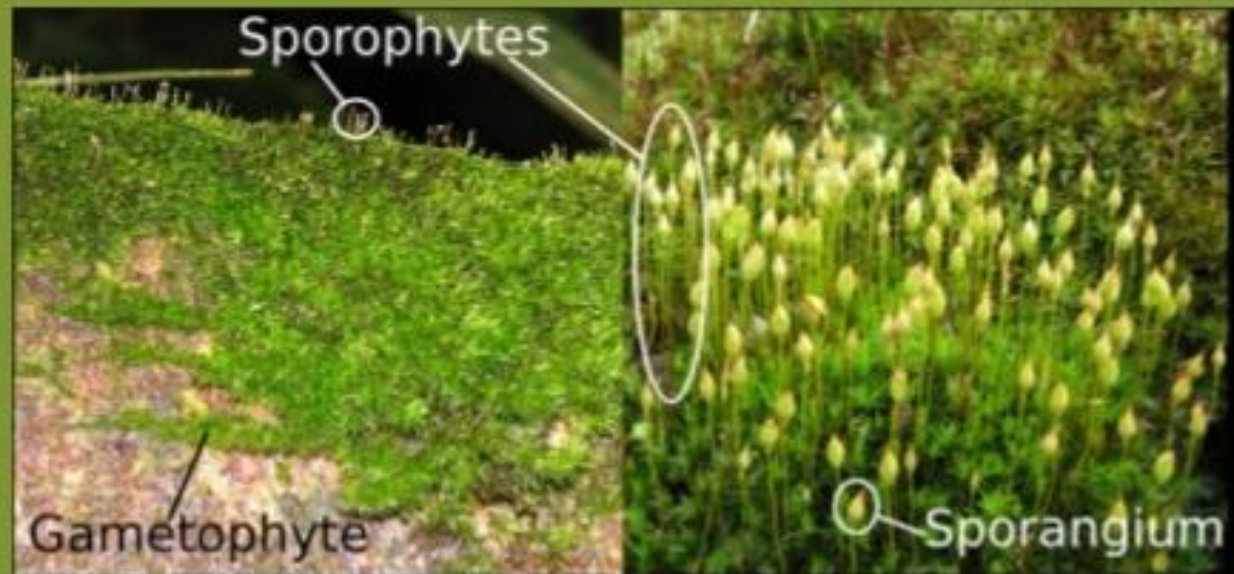
## Vegetative reproduction

- *A piece that breaks off a gametophyte and then lands in a suitable habitat will grow into a new gametophyte .*
- **The breakage may be *accidental*, such as animal trampling or erosion leading to fragmentation of an existing bryophyte colony.**



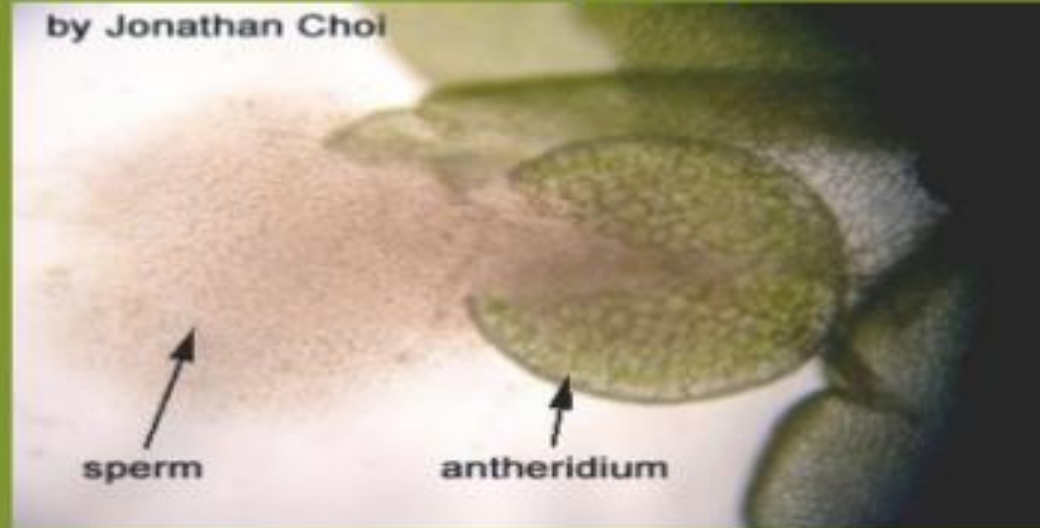
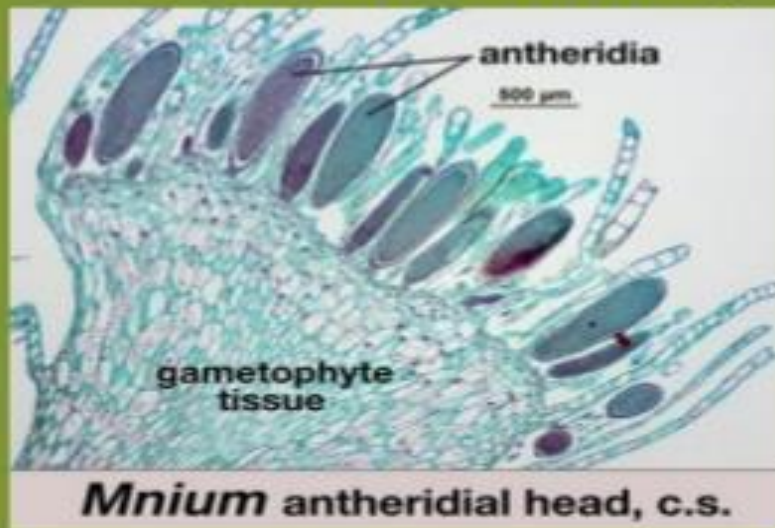
# Sexual Reproduction

- This cycle of *fertilization* and *meiosis* involves an *alternation of generations between the haploid gamete-producing stage (gametophyte) and the diploid organism (sporophyte)*.
- In the bryophytes, it is the *haploid gametophyte* that *produces the leaves and thali* and therefore predominates.





- The process requires the production of *male gametes* (sperm), *female gametes* (eggs) and some means of getting the sperm to the eggs.
- The gametes are produced on the *gametophytes*.
- The sperm are produced within tiny, typically stalked, club-shaped structures called *antheridia*.
- Each antheridium produces *numerous sperm*.

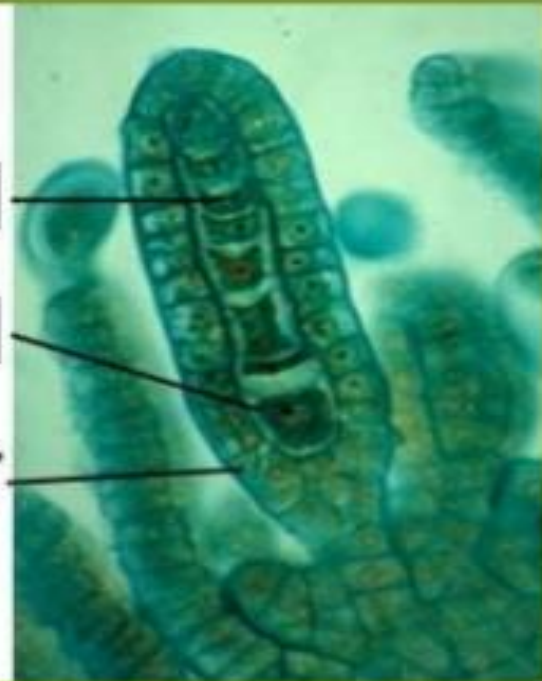


- The *eggs* are produced in tiny, typically somewhat flask-like structures called *archegonia*.
- Each archegonium holds *one egg* (in a swollen section called the *venter*).
- The *sperm enter through the channel* in the narrower, tubular section (or neck).

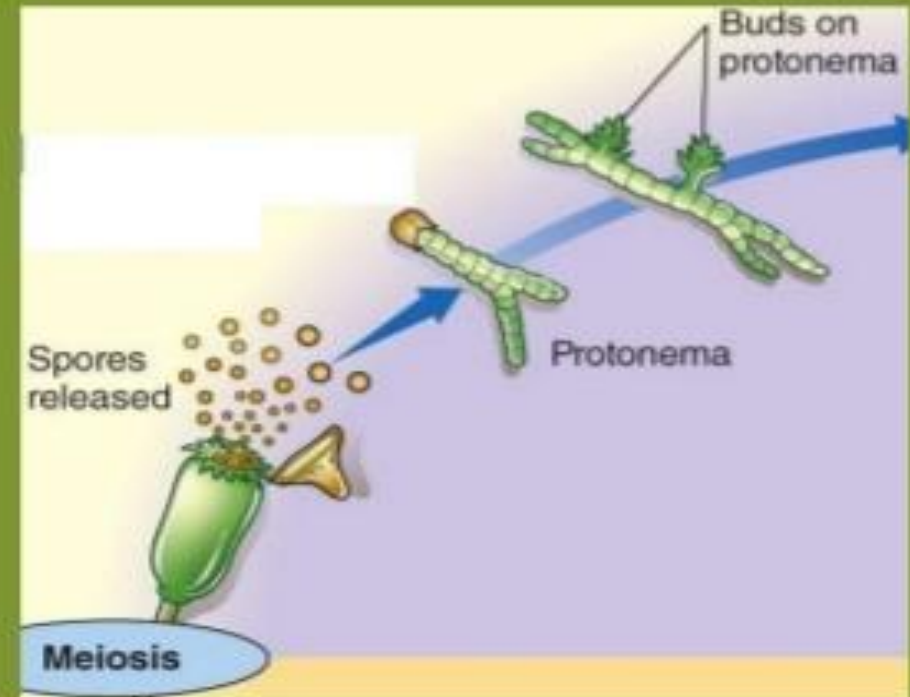
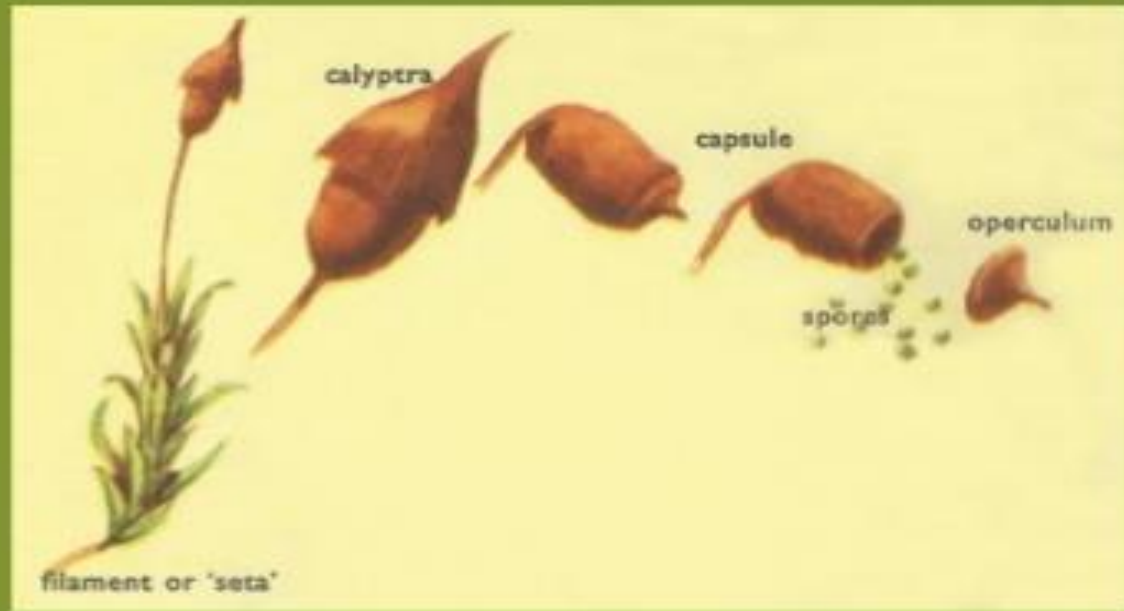


*Mnium* archegonial head, c.s.

neck canal  
egg cell  
venter



- A fertilized egg in an archegonium develops into the **sporophyte**.
- The sporophyte consists of a *spore-containing capsule* which, depending on the species, may be stalked or stalkless. Each spore contains a *mix of genes* from the two parents and on successful germination will give rise to a *new gametophyte*.



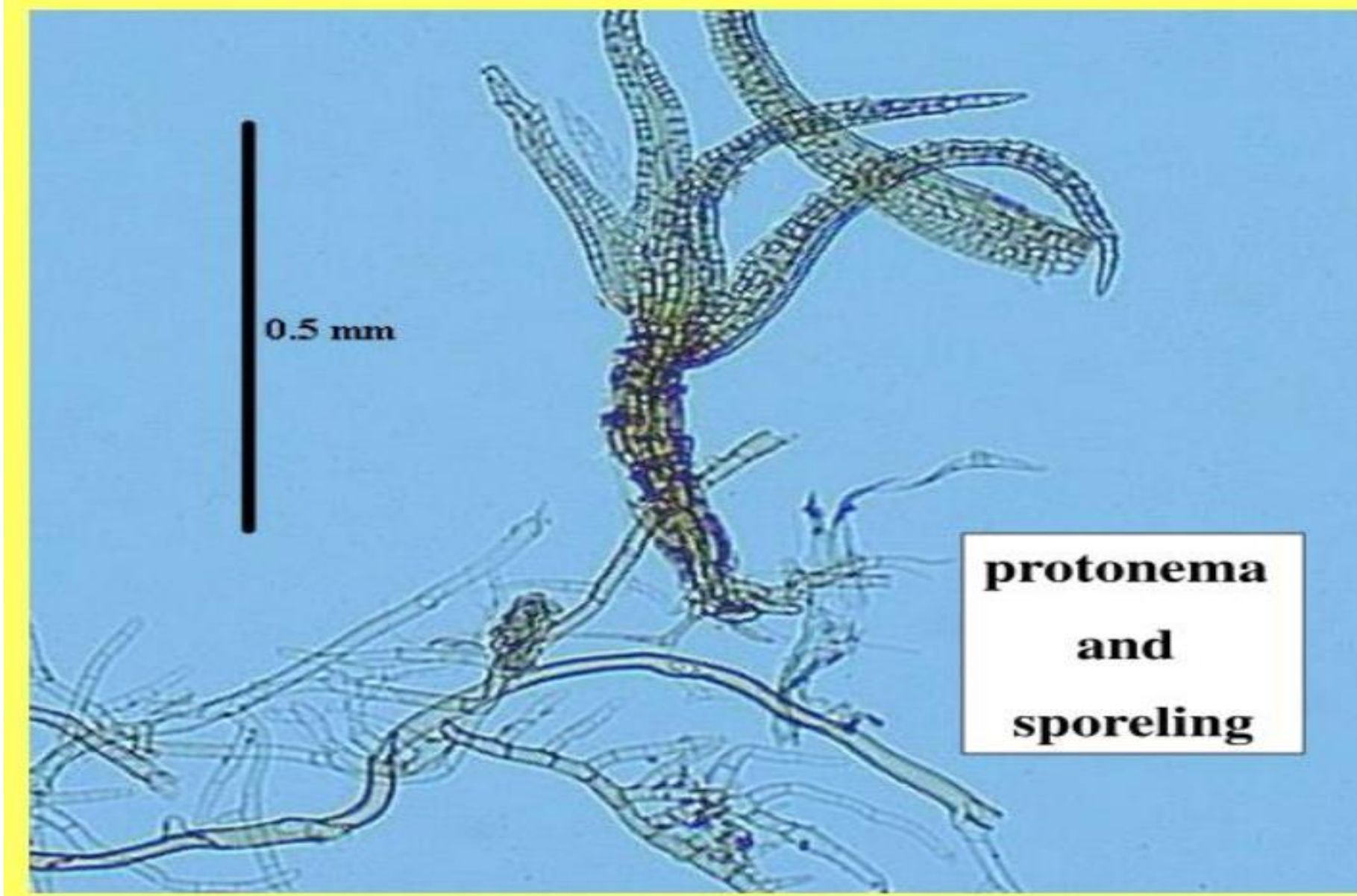
# Marchantiopsida

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spor

gam





0.5 mm

**protonema  
and  
sporeling**

