

UNIT-5

BRYOPHYTE

LIFE CYCLE OF *Marchantia* sp

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SYSTEMATIC POSITION

Division : Bryophyta

Class : Hepaticopsida

Order : Marchantiales

Family : Marchantiaceae

Genus : *Marchantia*

OCCURENCE

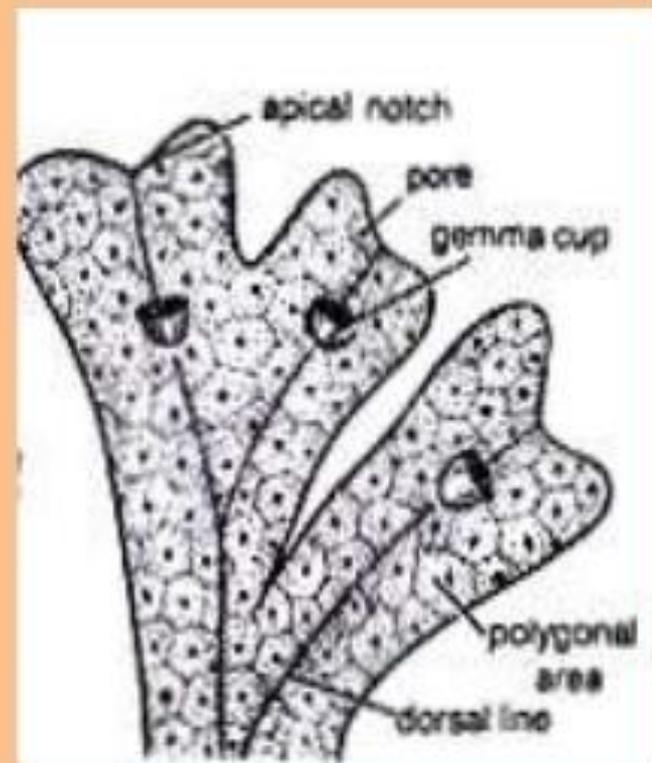
- The genus *Marchantia* includes about 65 species distributed all over the world. In India, only 11 species have been reported.
- All the species are terrestrial growing on moist shady places, damp soil, moist rocks and banks of streams.
- Common Indian species are : *M. polymorpha*, *M. palmata*, *M. nepalensis*, *M. indica*, *M. simlana*

GAMETOPHYTIC GENERATION

VEGETATIVE STRUCTURE : Dorsal Surface

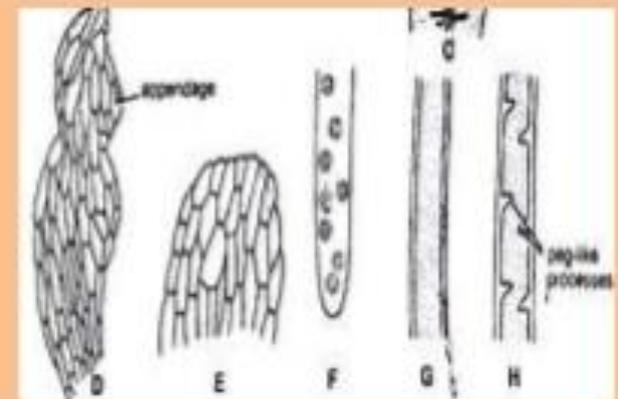
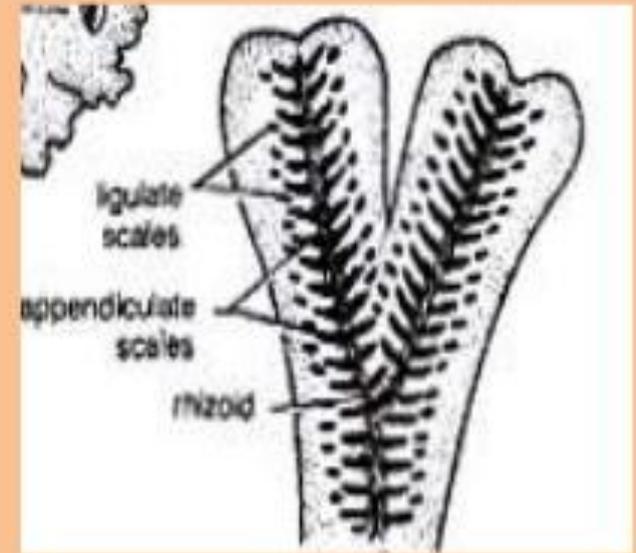
- prominent mid rib which deepens at the apex
- presence of gemma cups which enclose a number of gemmae
- gemmae are the means of asexual reproduction
- sex organs are borne on special upright branches :

antheridiophores bear the antheridia
whereas **archegoniophores** bear the archegonia



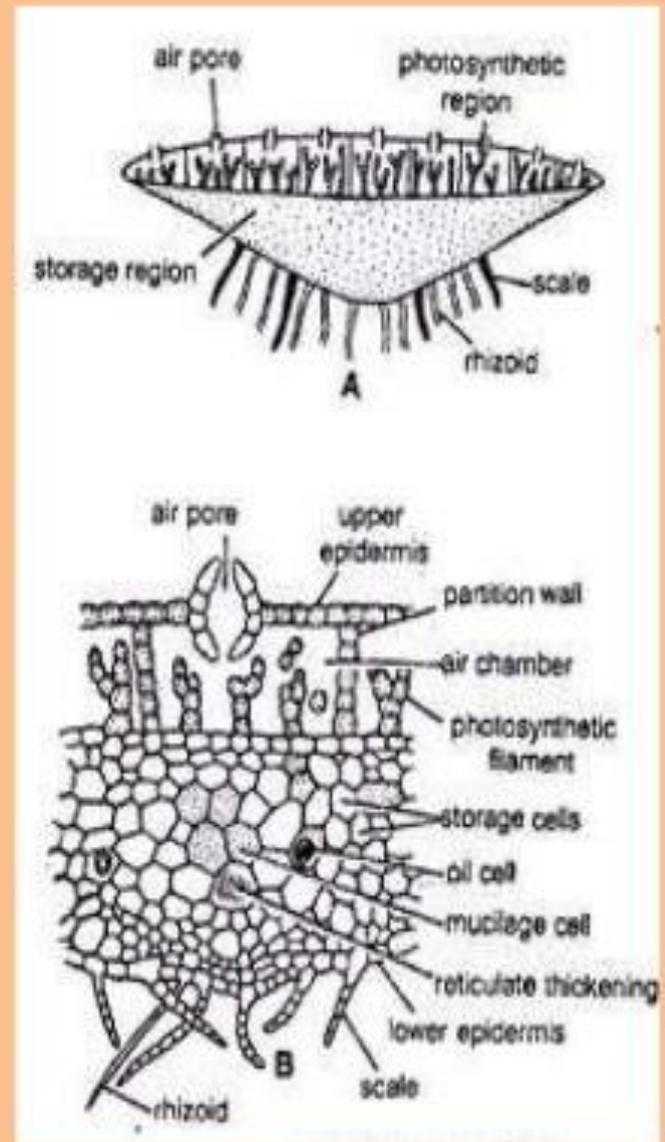
VEGETATIVE STRUCTURE : Ventral Surface

- shows median groove
- rhizoids and scales are attached
- rhizoids are of two types :
 - 1) **Smooth walled (G)** : inner walls smooth, living cells, fix the plant body to substratum and absorb water and soil solutes
 - 2) **Tuberculate (F,H)** : peg like ingrowths in their inner walls, living in the beginning but lack protoplasm at maturity, helps to retain moisture in the ventral surface and carry water to all the absorptive parts
- scales are of two types :
 - 1) **Appendiculate (D)**: large, wedge shaped, bear an appendage at their tips
 - 2) **Ligulate (E)**: simple, small, tongue shaped and without appendage
- scales secrete mucilage and protect the growing point from desiccation



INTERNAL STRUCTURE

- 1) Epidermal region** : well marked upper and lower epidermis. upper epidermis is interrupted by barrel - shaped air pores. function of air pores is to facilitate gaseous exchange.
- 2) Photosynthetic Zone** : consists of regularly arranged air chambers separated with each other by septa. a large number of photosynthetic or assimilatory filaments arise from the floor of air chambers. perform the function of photosynthesis.
- 3) Storage Zone** : consists of compact, colourless, thin walled parenchymatous cells which store starch grains and protein bodies. A few cells are filled with mucilage and oil bodies.



REPRODUCTION

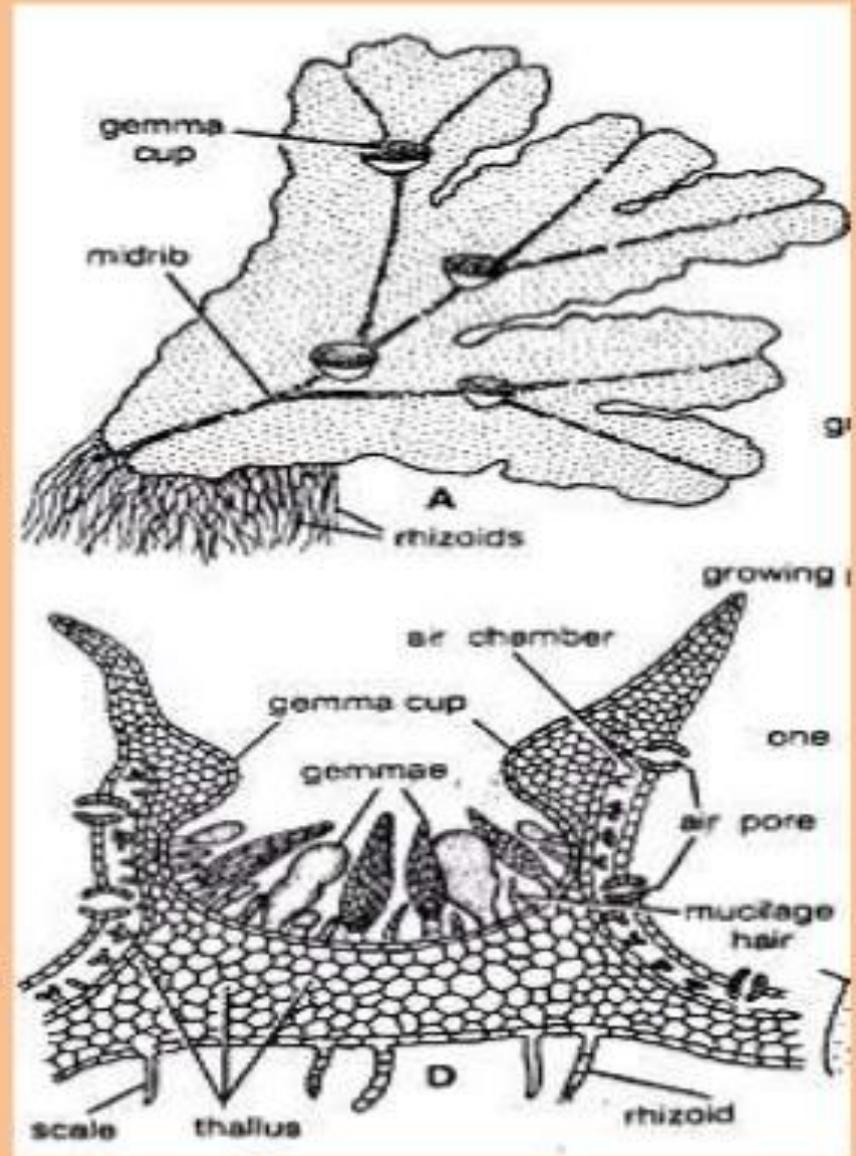
- Vegetative Reproduction :

- 1) Fragmentation

- 2) Adventitious branches

- 3) The Gemmae :

- produced inside the gemma cups
- these cups are produced on the dorsal surface of thallus



- Sexual Reproduction :

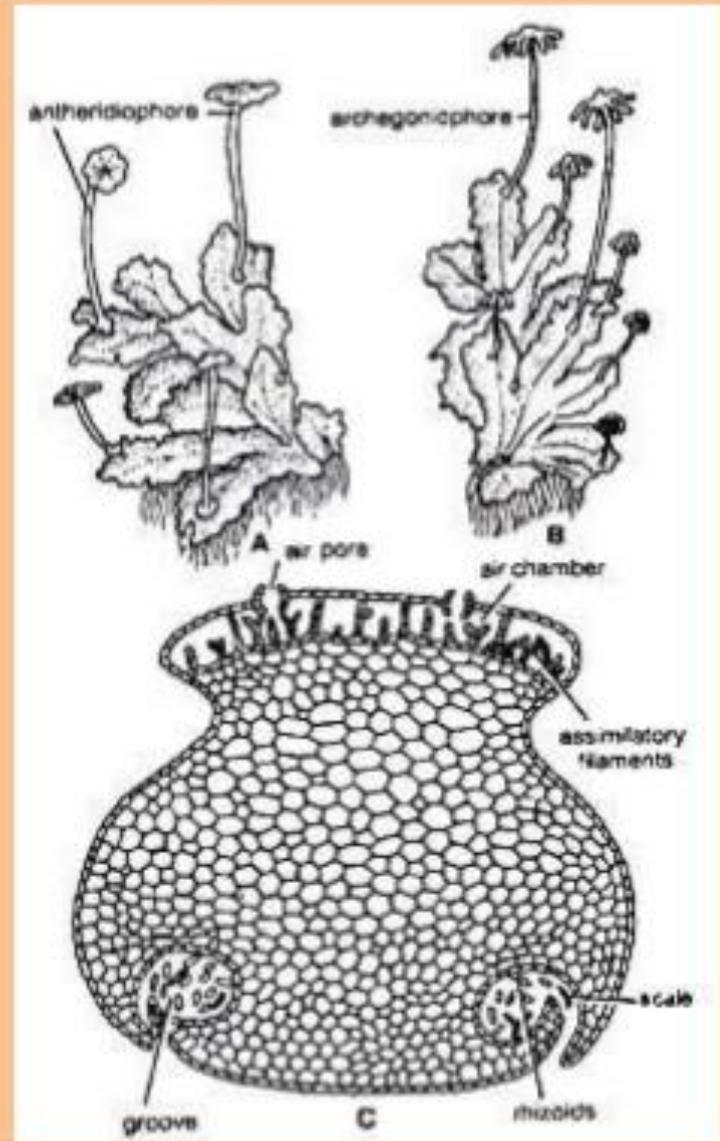
- oogamous

- all the species are dioecious

- male sex organs are antheridia and female sex organs are called archegonia.

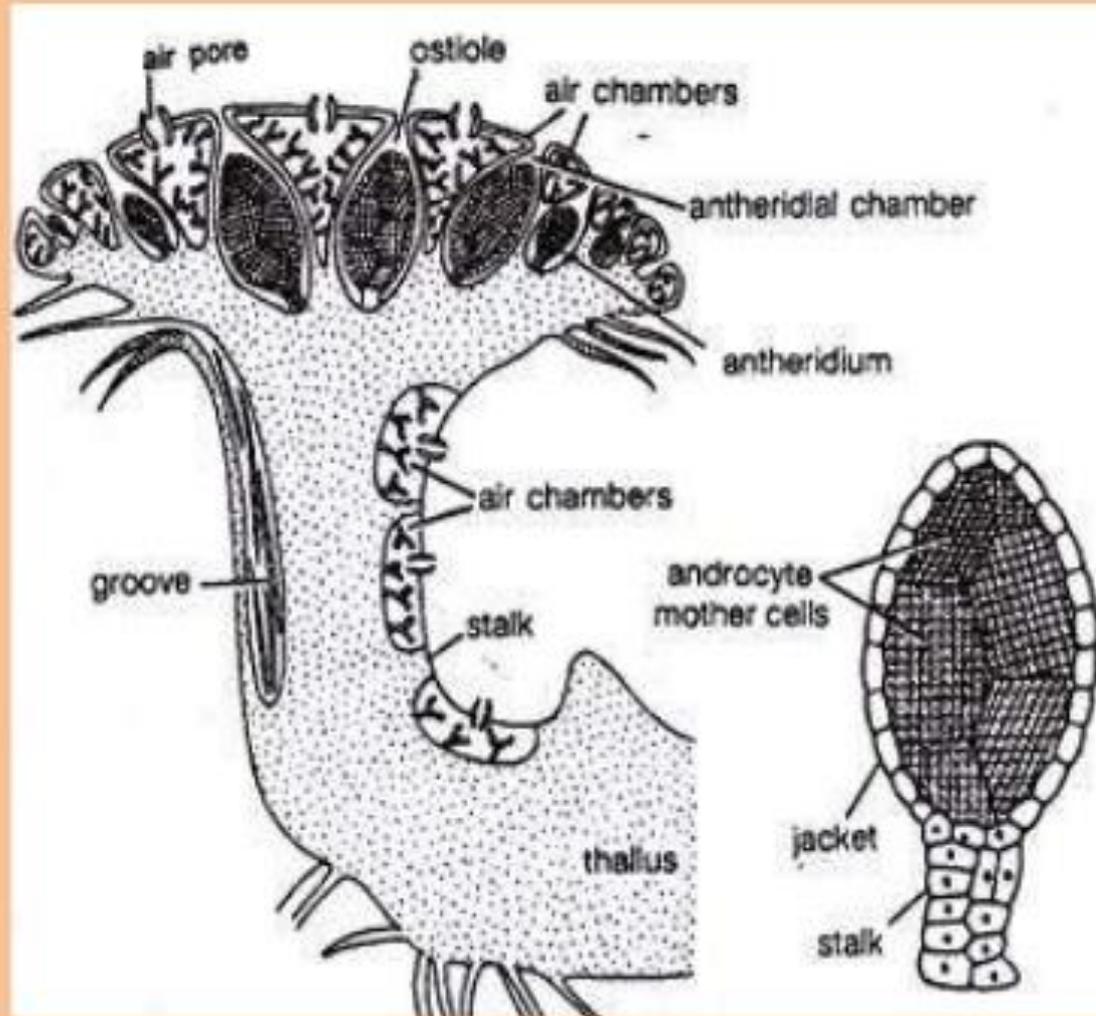
POSITION OF SEX ORGANS

- borne on special erect and stalked branches called gametophores or receptacles.
- receptacle bearing antheridia is called antheridiophore and that bearing archegonia is called archigoniophore.
- stalk of both antheridiophores and archigoniophores are morphologically and structurally similar.
- the side corresponding to morphologically dorsal surface of thallus photosynthetic zone.
- the other side of stalk corresponds to the lower ventral side of thallus.



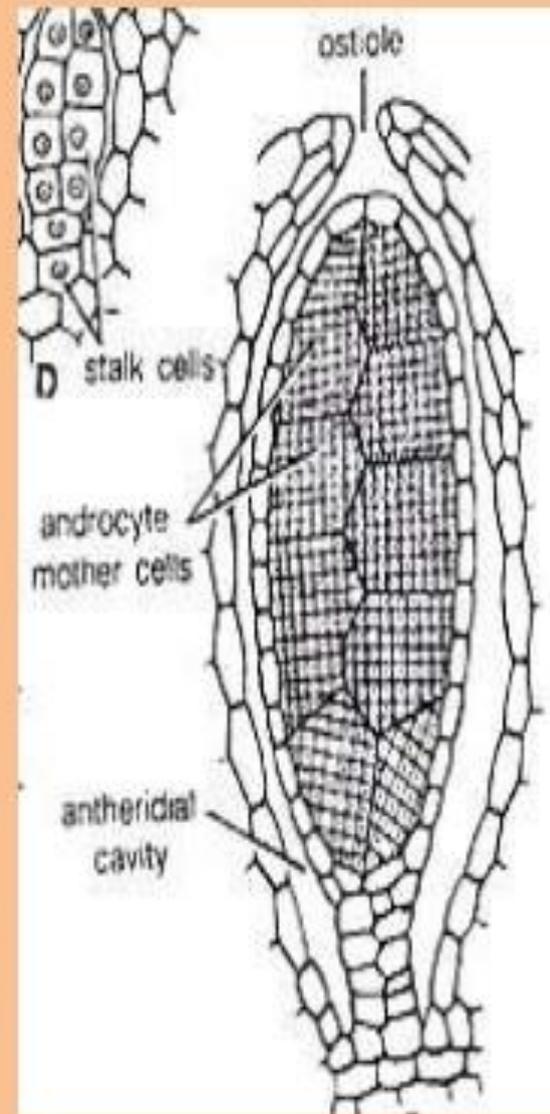
THE ANTHERIDIOPHORE

- differentiated into into a long stalk and a terminal disc
- disc is eight lobed
- upper zone of disc consists of air chambers alternating with antheridial chambers
- air chambers possess assimilatory filaments which perform photosynthesis
- antheridia are borne singly inside the antheridial chambers
- antheridia are borne in acropetal succession



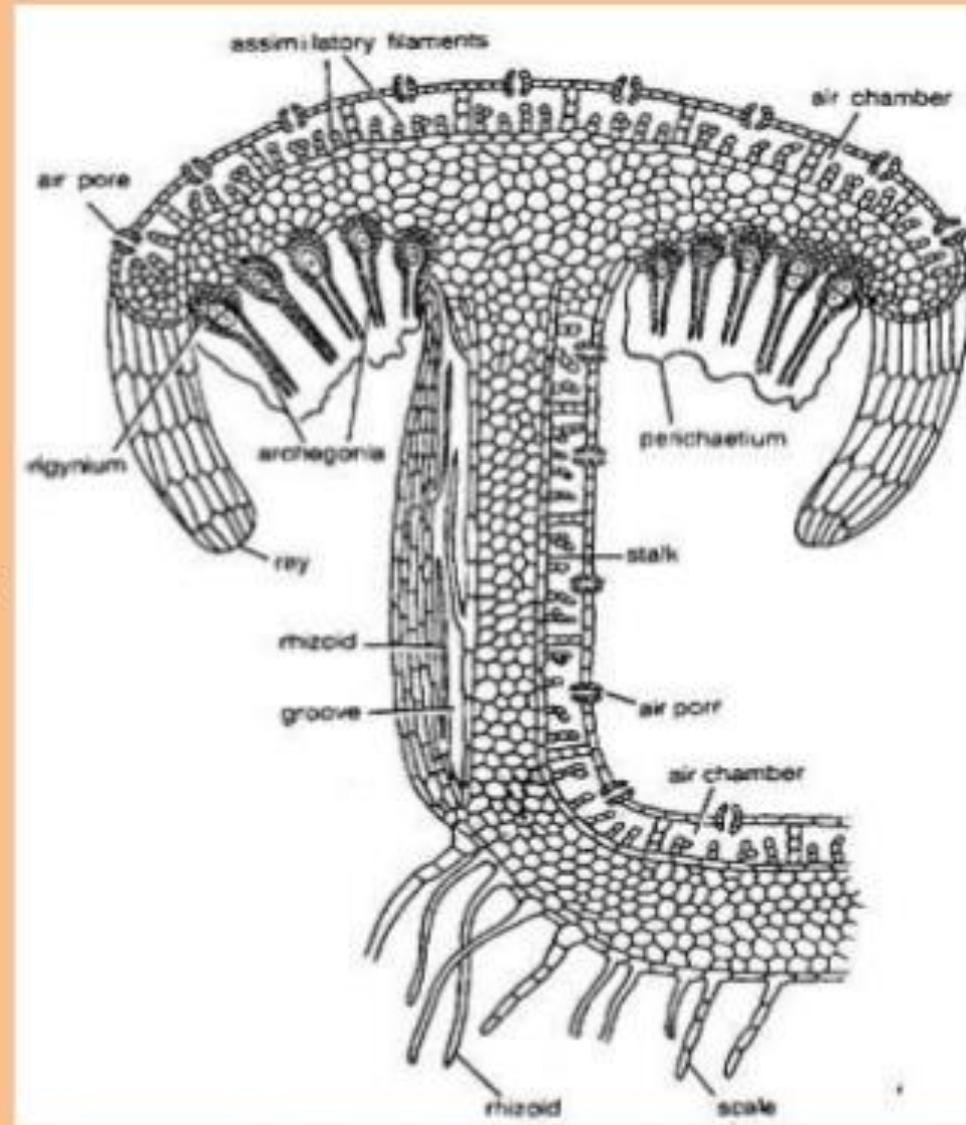
MATURE ANTHERIDIUM

- differentiated into a short stalk and a large body
- body has single layered sterile jacket
- it encloses a large number of androcytes which metamorphose into antherozoid
- antherozoids are small, uninucleate and biflagellate
- morphologically, antheridia consists of three parts :
 - 1) **Head piece** : comprising of basal bodies with two long and equal flagella attached to it
 - 2) **The nuclear portion** : consisting of long narrow rod- shaped and coiled nucleus
 - 3) **The cytoplasmic portion** : comprising of a thin film of cytoplasm with a few plastids and mitochondria



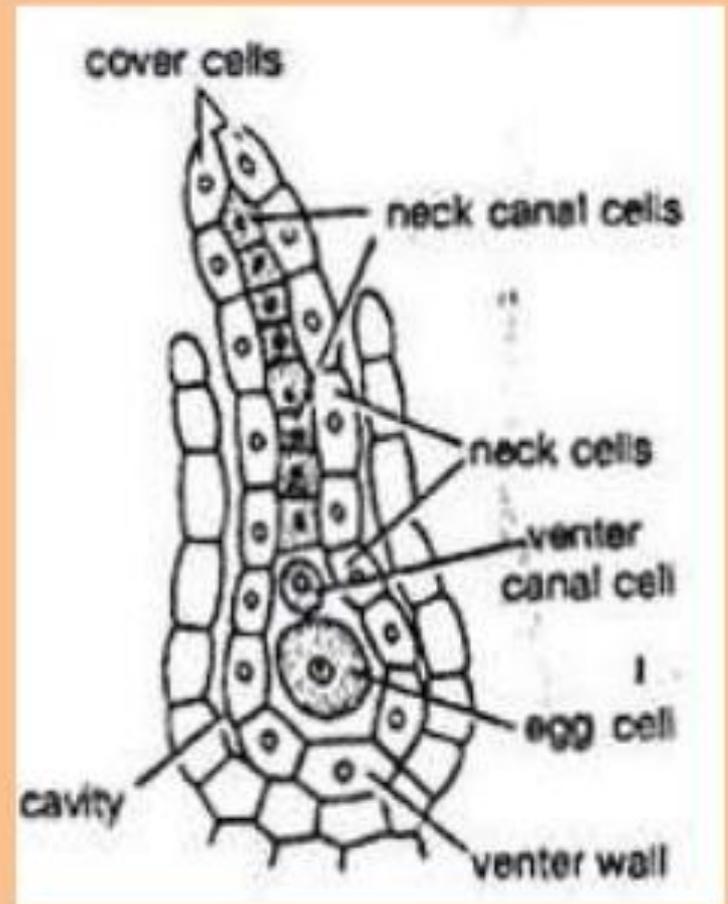
THE ARCHIGONIOPHORE

- it is the reproductive branch bearing archegonia
- it is differentiated into stalk and disc
- disc consists of eight lobes directed away from the centre
- the archegonia develop on the upper surface of disc in arranged in eight rows
- after fertilization central portion of disc buldges out and becomes convex pushing the archegonia at the periphery
- the archegonia are inverted and hang downward from the tissue of disc
- each archegonium has an extra sheath called **perigynium**
- each group of archegonia is enclosed within a two lipped, curtain like involucre called **perichaetium**

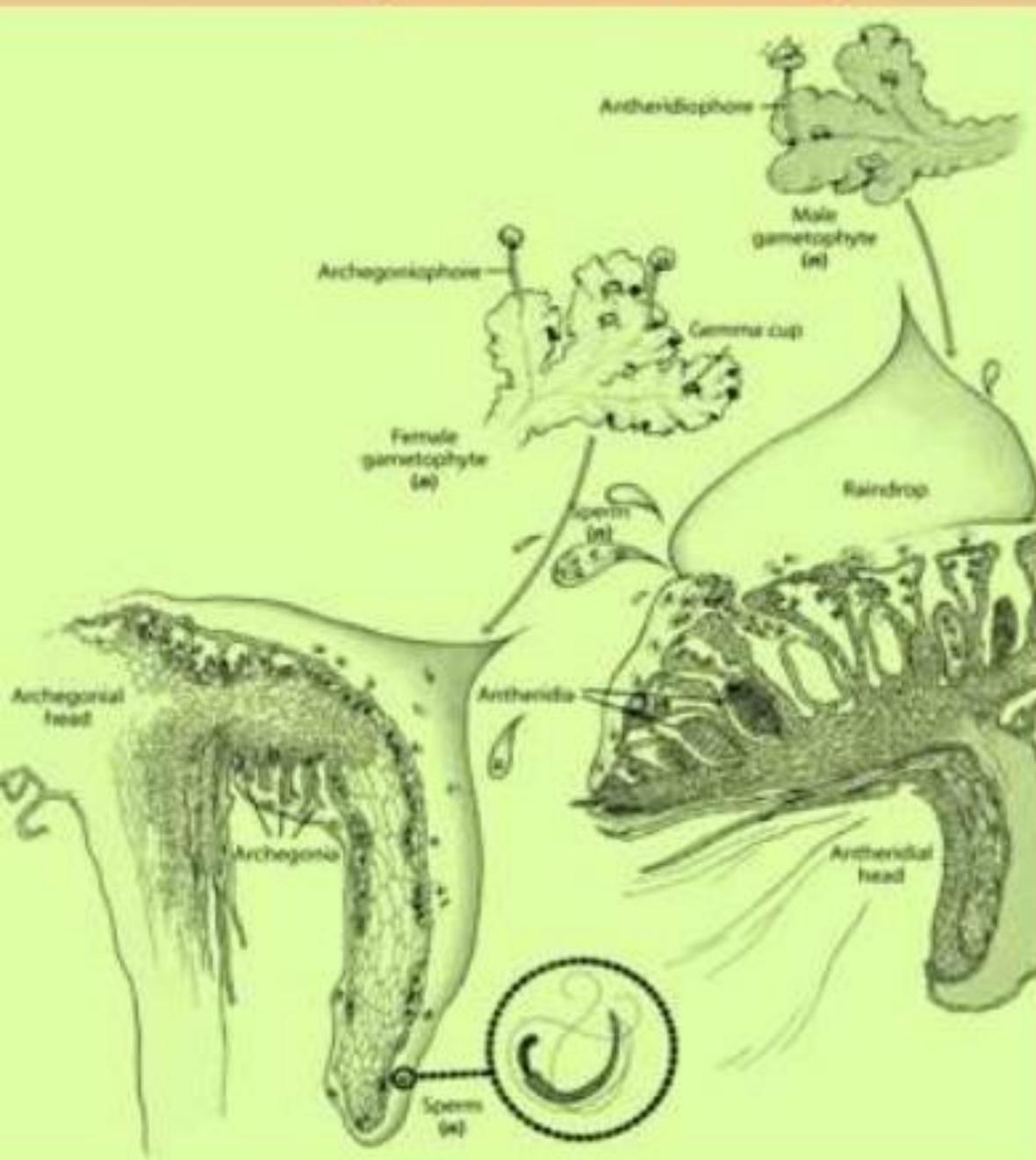


STRUCTURE OF MATURE ARCHEGONIUM

- mature archegonium is flask shaped
- it consists of a short few celled **stalk**, a globular **venter** and a long **neck**
- the apical part of neck is covered by 4 cover cells
- the swollen venter consists of single layered jacket and encloses a venter canal cell and a large egg



FERTILIZATION

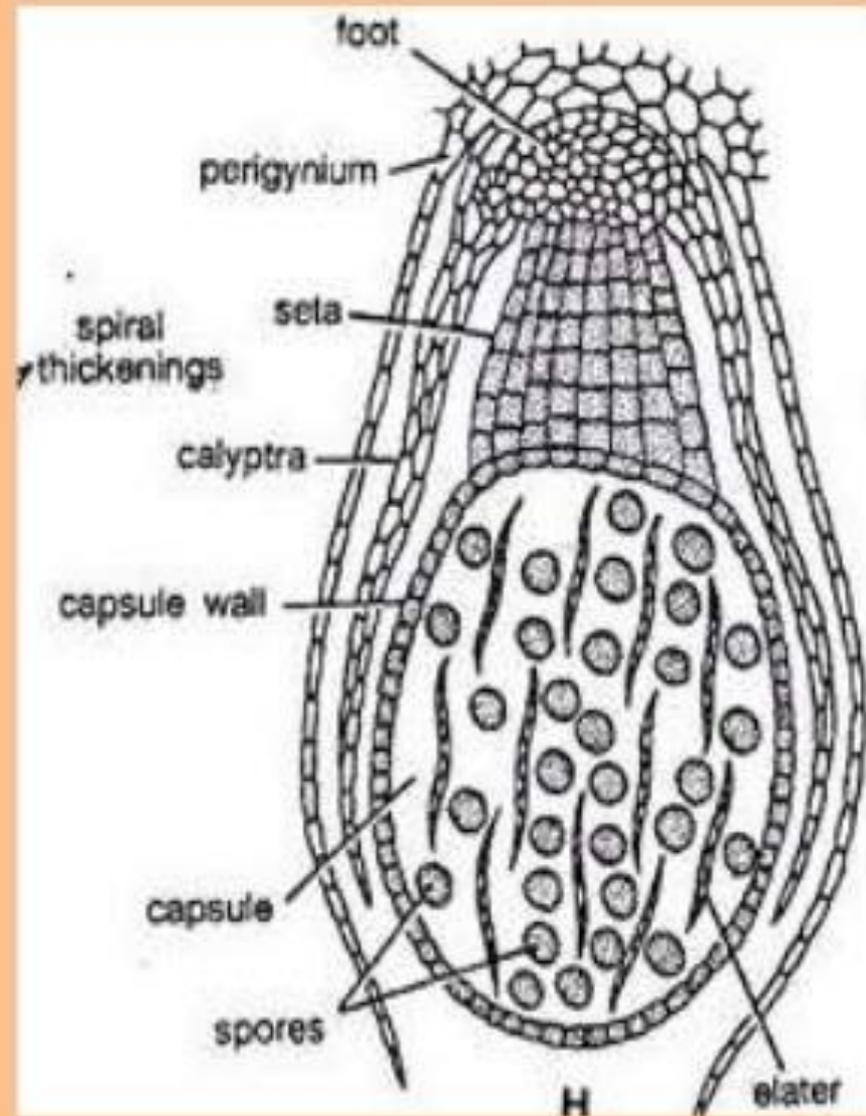


- The presence of water is necessary for fertilization
- The antheridiophore has a slightly concave disc, antherozoids swim in the concavity of disc
- The transfer of antherozoids from the disc of antheridiophore to the convex disc of archigoniophore occurs by dripping and splashing of rain drops
- The mucilaginous substance in the archegonial neck attract the antherozoids
- Finally the antherozoids swim down to the wide open passage of neck and one fuses with the egg
- Resulting in the formation of zygote
- The gametophytic phase of the life cycle ends with the formation of zygote

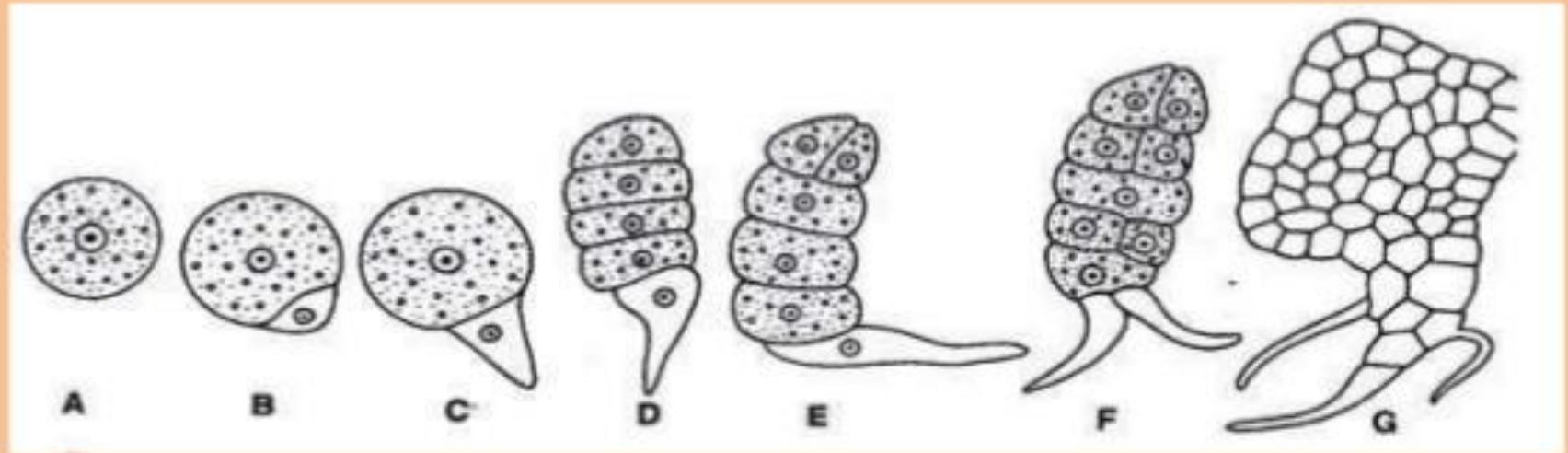
SPOROPHYTIC GENERATION

STRUCTURE OF MATURE SPOROGONIUM

- Each sporogonium is differentiated into foot, seta and capsule
- it is enclosed within a protective covering called **calyptra**
- the other protective coverings are **perigynium** (pseudoinvolucre) which encloses single sporogonium and **perichaetium** (involucre) which covers the group of sporogonia
- Foot** : it anchors the sporogonium and absorbs water and nutrients from the gametophyte
- Seta** : it connects the capsule with foot
- Capsule** : it has single layered wall enclosing a mass of spores and elaters. Elaters are hygroscopic and in this way help in spore dispersal
- The sporophytic generation of lifecycle ends with the formation of spores
- The spores are carried away wind or rain



THE YOUNG GAMETOPHYTE



- Spore is the first cell of gametophytic generation
- Spore has thick wall differentiated into outer, thick exine and inner, thin intine
- Each spore mother cell of *Marchantia* produces 4 spores, out of which 2 develop into male thalli and 2 develop into female thalli
- Thus *Marchantia* shows physiological heterospory

ALTERNATION OF GENERATIONS

-Since the plant bodies of two generations are morphologically dissimilar, it is called **heterologous type** of alternation of generations - and the life cycle is **diplohaplontic**

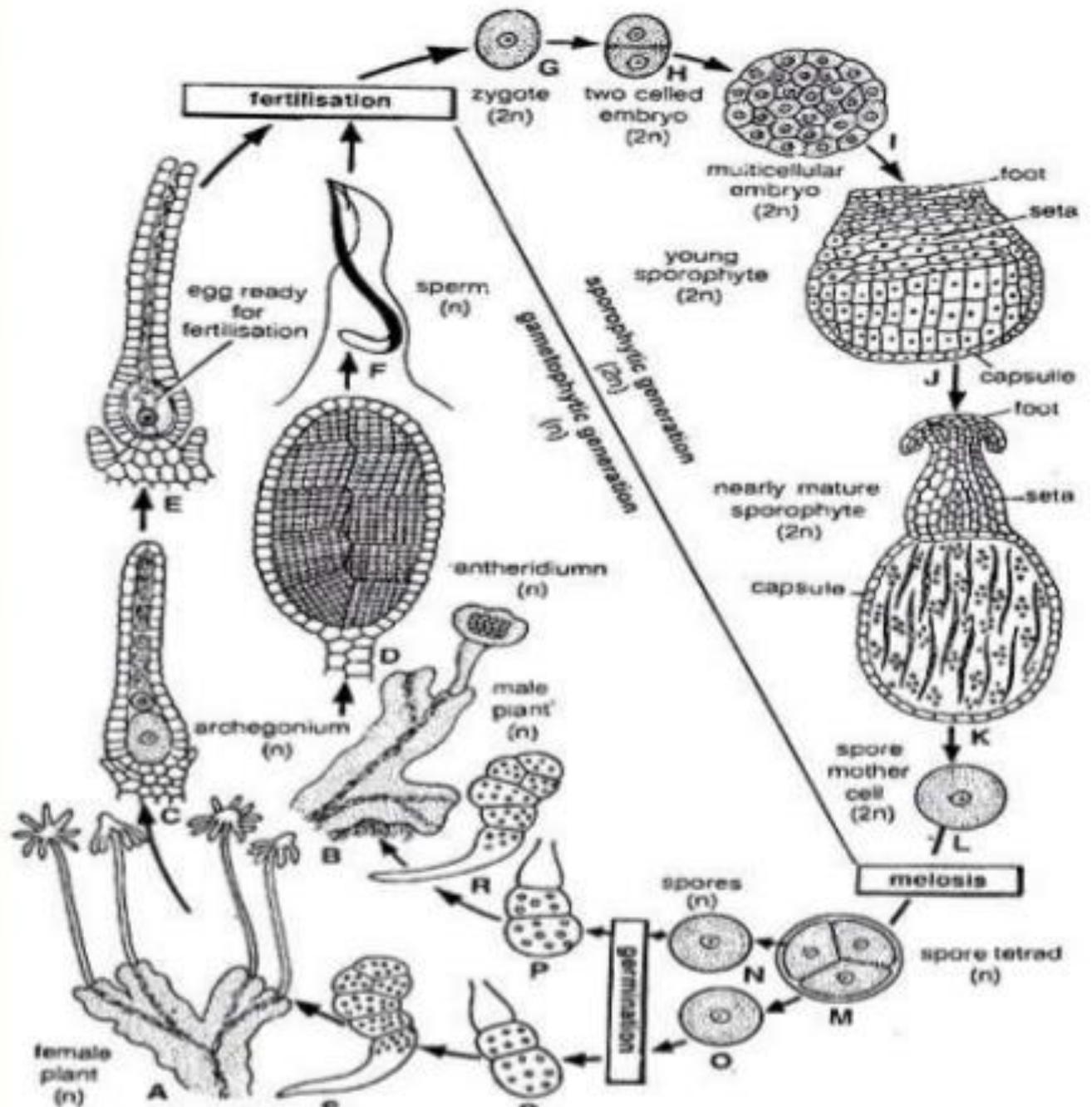


Fig. 15. *Marchantia*. Diagrammatic representation of the sexual life cycle.

Acknowledgement

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