

**B. Sc. Part I SEMESTER –I**

• **Section II**

- **BIODIVERSITY OF ARCHEGONIATE Bryophytes, Pteridophytes, Gymnosperms**

**Dr. P. P. Jadhav**

**Vivekand College Kolhapur**

# 1. BRYOPHYTES



- General characters, Adaptation to land habit, Classification –as per G. M. Smith up to order, Alternation of Generation.
- Economic Importance.
- Morphology, anatomy and life cycle (excluding developmental stages) of following type.
- Hepaticopsida: *Riccia*
- Bryopsida- *Funaria*
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# BRYOPHYTES: CHARACTERISTICS



## *Bryophytes*

- Bryophytes are the most simplest and most primitive land plants
- Name bryophyte is derived from two words:
  - 'Bryon' = moss
  - 'phyton' = plant
- At present the phylum Bryophyta includes:
  - Genera: ~ 960
  - Species: ~ 24000



# BRYOPHYTES: CHARACTERISTICS



## *Habit and Habitat of Bryophytes*

- Cosmopolitan in distribution
- Uncommon in marine environments
- They are terrestrial plants but require water at every stages in their life cycle
- They grow in moist and shady places
- They fail to complete its life cycle in the absence of water



# BRYOPHYTES: CHARACTERISTICS



## *Habit and Habitat of Bryophytes*

- Few bryophytes are truly aquatic and underwater forms (*Riccia fluitans*)
- Peat moss (*Sphagnum* moss) grown in bogs and marshy areas
- *Porella* is an epiphytic bryophyte that grow on tree trunks
- *Radulla protensa* is an epiphyllous bryophyte grow on the surface of leaves
- *Tortula desortorum* is a xerophytic bryophyte growing in deserts



# BRYOPHYTES: CHARACTERISTICS



## *Land adaptations of bryophytes:*

- Bryophytes are fundamentally land plants, their land adaptations are:
  - Possess root like rhizoids to absorb water from soil
  - Free surface of epidermis is coated with water proof waxy coating to prevent water lose and protect against desiccation
  - Possess stomata like structures for gaseous exchange
  - Possess multicellular sex organs surrounded by sterile jacket
  - After fertilization the zygote is left inside the archegonium to provide nutrition for the sporophyte development

*These features helps bryophytes to live in land condition*

# BRYOPHYTES: CHARACTERISTICS



## *Why Bryophytes the Amphibians of Plant Kingdom?*

- Amphibians in the animal kingdom lives in water as well as in land
- Similarly bryophytes represented by liverworts, hornworts and mosses grow well in the areas between water and terrestrial habitats (amphibious zone)
- Bryophytes are dependent on water to complete their life cycle



# BRYOPHYTES: CHARACTERISTICS



## *Why Bryophytes the Amphibians of Plant Kingdom?*

- Bryophytes are dependent on water to complete their life cycle
- Presence of water is required and essential for the:
  - *Dehiscence of mature antheridia*
  - *Liberation of antherozoids form antheridia*
  - *Transfer of antherozoids form antheridia to archegonia*
  - *Opening of archegonial neck*
  - *Movement of flagellated antherozoids into the archegonial neck*
- Life cycle of bryophytes will not complete in the absence of water
- Thus they are called as the amphibians of plant kingdom.



# BRYOPHYTES: CHARACTERISTICS



## *Gametophyte of bryophyte*

- Life cycle consists of gametophytic and sporophytic phases (generations)
- Gametophytic and sporophytic generations are physically connected
- Gametophytic and Sporophytic phases are Heteromorphic (morphologically distinct)



# BRYOPHYTES: CHARACTERISTICS



## *Characteristic of gametophytic generation of Bryophyte:*

- Gametophytic generation is more conspicuous phase in life cycle
- Gametophytic generation is long lived and prominent phase
- It is independent, green autotrophic phase
- Gametophytic plant is fleshy
- In lower forms gametophyte is undifferentiated and thalloid
- In higher forms, gametophyte is differentiated into root like, leaf like and stem like structures



# BRYOPHYTES: CHARACTERISTICS



## *Characteristics of sporophytic generation of Bryophyte:*

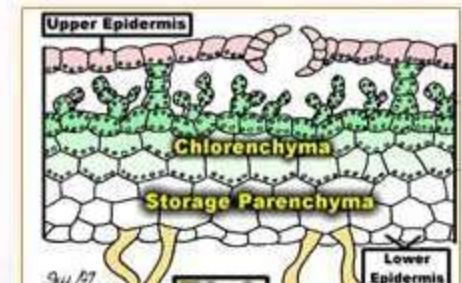
- Sporophytic generation is less conspicuous phase in life cycle
- Sporophytic generation is short lived
- Sporophyte is completely dependent on gametophytic plant for nutrition
- Usually differentiated into foot, seta and capsule

# BRYOPHYTES: CHARACTERISTICS



## *Gametophyte of bryophyte*

- In primitive forms (*Riccia* and *Marchantia*) gametophyte is undifferentiated, prostrate and thalloid
- In advanced forms (mosses) plant body is erect, differentiated into stem (axis), lateral appendages (leaves) and rhizoids
- True roots are absent in bryophytes
- Rhizoids are present, rhizoids helps in anchorage and absorption
- Rhizoids may be unicellular and un-branched to multicellular branched
- Sometimes multicellular scales may be present
- Scales helps to protect growing region of the thallus



# BRYOPHYTES: CHARACTERISTICS



## *Bryophyta reproduction:*

- They reproduce by vegetative and sexual reproduction
- Vegetative multiplication takes place by:
  - Death and decay of older parts
  - Fragmentation of thallus
  - Adventitious branches
  - Tuber formation
  - Production of gemmae on gemmae cups



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# BRYOPHYTES: CHARACTERISTICS



## *Sexual reproduction in bryophytes:*

Sexual reproduction is oogamous type

Sex organs are multicellular

Sex organs are more complex than thallophytes (algae, fungi and lichens)

Male sex organ is called antheridia

Antheridia are stalked and globose

They have one cell thick sterile jacket around it for protection

Jacket surrounds a solid mass of fertile cells called antherocytes

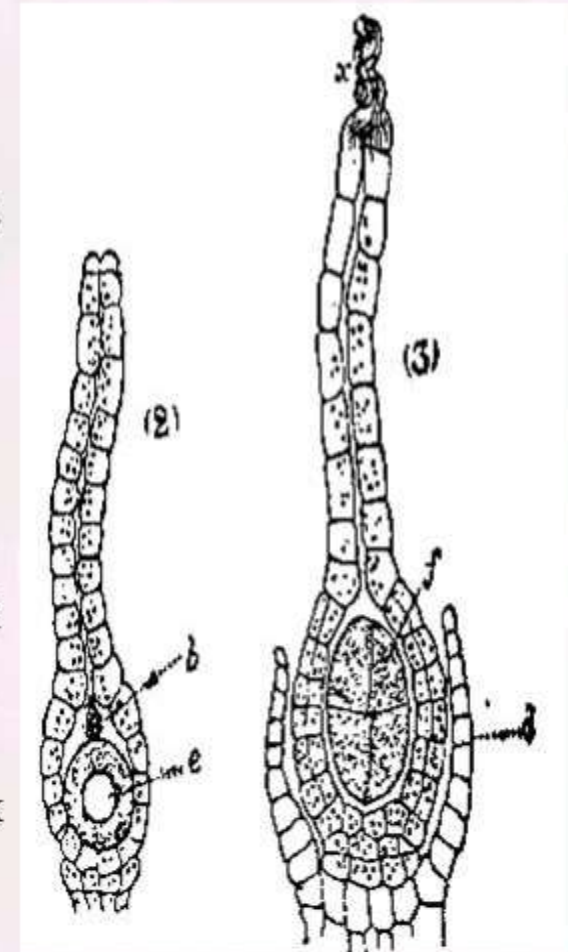


# BRYOPHYTES: CHARACTERISTICS



## *Sexual reproduction in bryophytes:*

- Antherocytes metamorphose into antherozoids
- Antherozoids are biflagellate and thus they are motile (can swim in water)
- Female sex organs is called archegonia
- Archegonia is a flask shaped structure
- Archegonia have basal swollen venter and an elongated upper part called neck
- The ventre and neck are surrounded by one layer thick sterile jacket cells
- Four to six neck canals cells and one venter canal cell is present



# BRYOPHYTES: CHARACTERISTICS



## *Fertilization in bryophytes*

- Water is necessary for fertilization
- When antheridia matures, their sterile jacket disintegrate and liberate the motile antherozoids to the surrounding thin film of water
- When archegonia matures, the neck canal cells and venter canal cell disintegrate and forms a mucilage mass
- Antherozoids are attracted by chemicals present in the mucilage and move towards it by chemotaxis through the thin film of water
- Antherozoids enters into the archegonium through neck and venter
- Antherozoids fuse with egg to form a diploid zygote

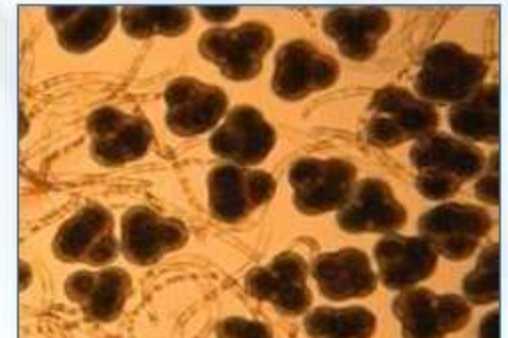
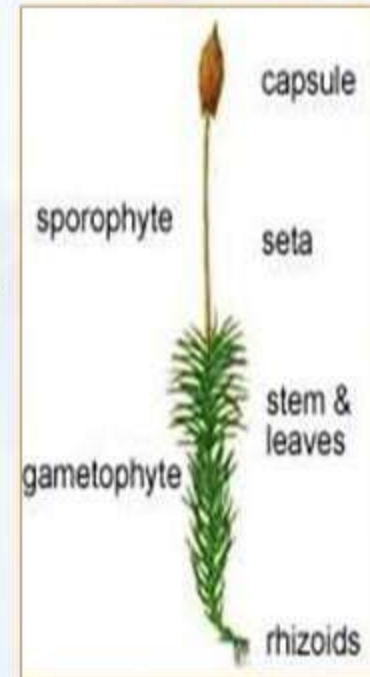


# BRYOPHYTES: CHARACTERISTICS



## *Sporophyte of bryophyte*

- Sporophyte develop from embryo
- Zygote is the first stage in the diploid sporophytic generation
- Zygote does not have any resting period
- Zygote mitotically divide immediately after fertilization
- Bryophyts shows exoscopic mode of embryo development
- First division of zygote is always transverse to produce two cells (outer cell and inner cell)
- Outer cell give rise to embryo



# BRYOPHYTES: CHARACTERISTICS



## *Sporophyte of bryophyte*

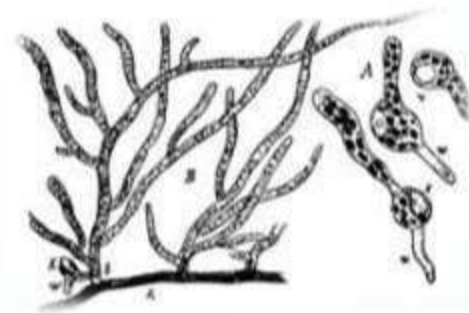
- Embryo develops within the ventre of archegonium
- Sporophyte is simple structure without rhizoids stem or leaves
- Sporophyte is completely dependent on gametophyte for nourishment
- Sporophyte is s projecting structure in most of the forms, it project out from the gametophytic tissue
- Sporophyte is differentiated into foot, seta and capsule
- Sporogenous cells present in the capsule divide meiotically to produce haploid spores
- All spores are similar in shape and size (homosporous)

# BRYOPHYTES: CHARACTERISTICS



## *Sporophyte of bryophyte*

- Sometimes elaters are present
- Elaters are hygroscopic and they helps in spore dispersal
- Spores are non-motile and they disperse exclusively by wind
- Under favorable condition the spores germinate to form the gametophyte
- In lower forms, the germination of spores is by the formation of a germ tube which later divide to give rise the younger gametophyte (Riccia, Marchantia)
- In advanced forms (mosses) spores germinate to form a filamentous branched protonema
- From the protonema, many gametophytic plants arises



# BRYOPHYTES: CHARACTERISTICS



## *Bryophyta Life Cycle (Life cycle of mosses)*

- Life cycle of bryophytes is characterized by the alternation of two morphologically distinct phases
- One phase is haploid gametophyte
- Other phase is diploid sporophyte
- Gametophytic phase is independent, autotrophic haploid and bears gametes
- It develops from the spores produced by sporophyte
- Male and female gametes represent the last phase of gametophytic generation
- Haploid male and female gametes fuse to form a diploid zygote

# BRYOPHYTES: CHARACTERISTICS



## *Bryophyta Life Cycle (Life cycle of mosses)*

- Zygote represent the first phase of sporophytic generation
- Sporophyte is simple, completely dependent on gametophyte for nutrition
- Sporogenous tissue in the sporophyte divide meiotically to produce haploid spores
- The spores germinate to form haploid gametophyte

# BRYOPHYTES: CHARACTERISTICS



## *Economic importance of Bryophytes:*

- Mosses used for soil conditioning
- Helps to increase aeration & water holding capacity of soil
- Sphagnum moss is used extensively in potting mixtures
- Sphagnum moss is also used in air layering
- Bryophytes are ecological indicators
- Bryophytes indicate moist, and wet weather condition
- Some mosses are air pollution indicators, absence indicate air pollution
- Some bryophytes indicate copper in the soil (*Mielichhoferia elongata*)
- *Sphagnum* indicate acid condition in the soil

# BRYOPHYTES: CHARACTERISTICS



## *Economic importance of Bryophytes:*

- Used to prevent soil erosion (Barbula, Bryum)
- *Anthoceros* can fix nitrogen and can enrich the soil nutrients
- Many mosses are attractive and they are used in gardening
- Some mosses are used as packing materials
- Peat moss is a good fuel, it is extensively used in many European countries
- Sphagnum moss is used for the preparation of absorbent bandages, they also have good antiseptic properties.
- *Marchantia polymorpha* is used in the treatment of pulmonary tuberculosis
- *Polytrichum* has been used for the treatment of kidney stones

# BRYOPHYTES: CHARACTERISTICS



## *Key questions:*

1. What is bryophyte and what are bryophytes?
2. What are the characteristics of bryophytes?
3. Explain the life cycle of bryophytes.
4. Explain the reproduction in bryophyte.
5. Explain the structure of Antheridium and Archegonium of Bryophyta.
6. Explain alternation of generation in bryophytes.
7. What are the economic importance of bryophytes?
8. What are the ecological importance of bryophytes?



**THANK  
YOU**

