First CBZ – Botany

First Semester

Paper I
Bryophytes

Dr. A. Sujatha, Department of Botany, MVR
DEgree College, Gajuwaka, VSP

Introduction to Bryophytes

Dr. A.Sujatha
Department of Botany
M.V.R Degree College
UG &PG Courses
Gajuwaka, Visakhapatnam

Bryophytes; General Characters, Classification and Alteration of Generations

- The word **Bryophyta** derived from Greek: ‘Bryon’ means **moss**; ‘Phyton’ means **plant**. These are the simplest and most primitive terrestrial plants. They include liverworts, hornworts and mosses.

General Characters:

Occurrence:

- The bryophytes number about **24000** species which are grouped under **960** genera. However, they never form a dominant plant association. They are world-wide in distribution and occur in all climates wherever there is enough moisture to sustain plant life. Although bryophytes are terrestrial plants, yet water is necessary to complete their life cycle. Therefore, they are commonly known as **Amphibians of the plant kingdom.**
- Bryophytes usually grow in moist and shady places like the sides of ditches, ponds, lakes, on the banks of streams damp soil, moist rocks, wet hills and many other suitable habitats.

Life cycle of Bryophytes consists two stages..

They are

1. Gametophyte: Gametophyte is long lived autotrophic and dominant phase in the life cycle. It reproduces sexually by advanced **oogamy.**
2. Sporophyte: Sporophyte is either completely or patially dependent on gametophyte. It reproduces through spores.

The Plant Body (Gametophyte):

The plant body is gametophyte, it is haploid, mainly concerned with the production of gametes. The gametophytic plant body is independent and longer lived.

The plants are relatively simple, varying in size and stucture. In size they range from sixteenth of an inch (e.g. *Zoopsis argentia*) to about 24 inches (e.g. *Dawsonia superba*). In structure the plant body is either thallose or foliose. Plant body is of three types. Such as

(i) Thallose forms: The plant body in Hepaticae (Hepaticopsida) is thallose and liver like. Thalli are dorsiventrally flattened and dichotomously branched. They lack stems and leaves. Rhizoids and scales are present on the ventral surface of the thallus.

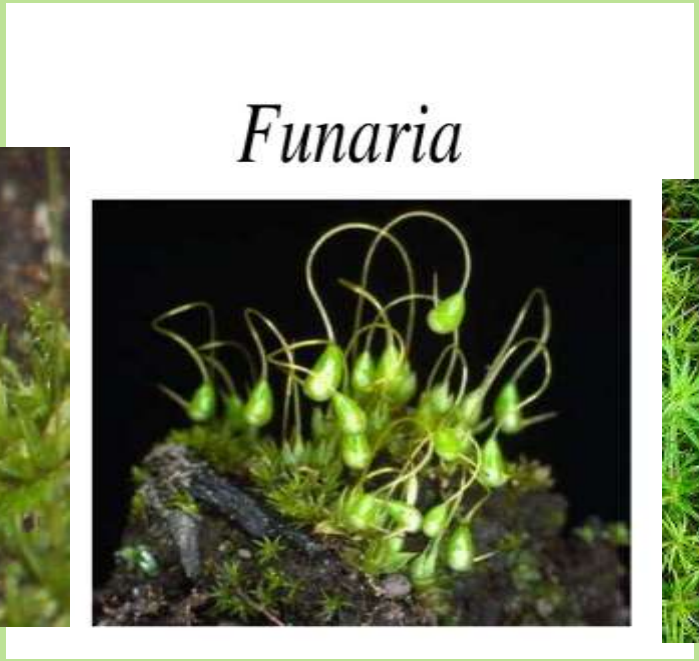
- **ii) Foliose forms:** In various members of Acrogynous Jungermanniales, like *Porella*, the plant body is differentiated into stem and leaves. The plant is prostrate to decumbent, dorsiventral, branched and leafy. The stem is covered by three rows of leaves. Two rows are on the dorsal side, one on each side of the stem. The third row consists of small leaves called the **amphigastria**, present on the ventral side.

Diplophyllum albicans

Porella sp.

- **(iii) Musci (Bryopsida):** the gametophyte is differentiated into rhizoid, stem and leaves. Rhizoids are multicellular with oblique septa. Papery green leaves are spirally arranged on the stem. The leaf has a single mid-rib. The shoot may be radial (e.g. *Funaria, Polytrichum*) or dorsiventral (e.g. *Hylocomium*). Branching is usually lateral, but not axillary.

Funaria



Polytrichum

Reproduction:

Vegetative Reproduction:

- Bryophytes largely multiply by means of vegetative propagation. Such as
  - **Death and decay of older parts:** Ex: *Riccia, Marchantia, Anthoceros*
  - **Persistent Apices:** Ex: *Riccia,*
  - **Adventitious branches:** Ex: *Riccia fluitans, Marchantia palmata.*
  - **Gemmae:** Ex: *Marchantia,Anthoceros*
  - **Tubers:** Ex: *Anthoceros*
  - **Primary Protonema:** Ex: *Funaria, Polytrichum*

Gemma Cups in *Marchantia sp.*

Sexual Reproduction:

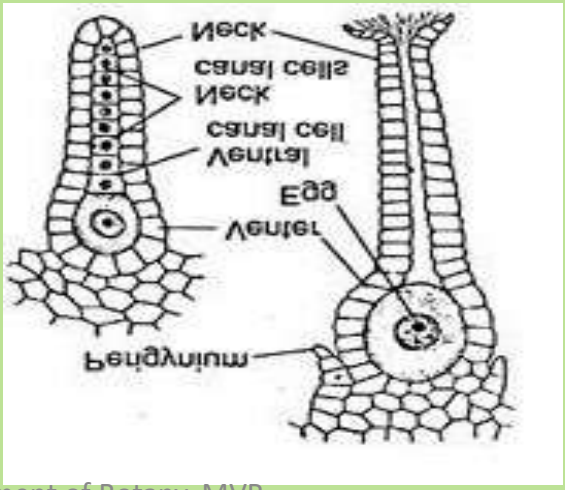
It occurs when the sex organs are mature. The bryophytes show **oogamous** type of sexual reproduction i.e the male gametes are small and motile **antherozoids** and the female gametes are large and non-motile **eggs**.

The male sex organ is called as **antheridium** and **sperms** are the male gametes produced inside the antheridium and the female reproductive organ is called as **archegonium** and it produces **egg**.

Fertilization takes place in the presence of water. The spermatozoid swims in to the neck of archegonium. It passes through the neck canal and fuses with the egg to form the zygote.

Antheridium

Archegonium



- **The sporophyte:**

- After fertilization the secondary phase will enter into the life cycle of the bryophytes i. e. sporophytic phase. The diploid zygote is the first cell of the sporophyic generation.
- The embryo is not liberated, but is retained within the archegonium. Where it develops into a sporophytic plant body called the sporogonium. It is completely dependent on the gametophyte for water and mineral supply. The sporophyte remains attached to the gametophytic plant body throughout its life.
- The sporogonium in most cases is differentiated into **foot, seta** and **capsule**. Foot is embedded in the tissue of the parent gametophyte. It absorbs nutrition for the sporogonium. However, foot and seta are absent in *Riccia* and *Marchantia* and the seta is absent in *Corsinia* and *Anthoceros,* and the seta elevates the capsule higher up for easier dispersal of spores. On the other hand, in Mosses, the seta elongates into a slender and tough structure, which bears the capsule. Seta serves as the supporting and conducting organ of the capsule.
- The sporogonium is concerned with the production of spores. The spores are highly specialized cells formed after meiosis in spore mother cells. The spore mother cells originate from the archesporium. Thus, archesporium represents the first cell generation of sporogenous tissue. The spores produced in the capsule and all the bryophytes are homosporous.

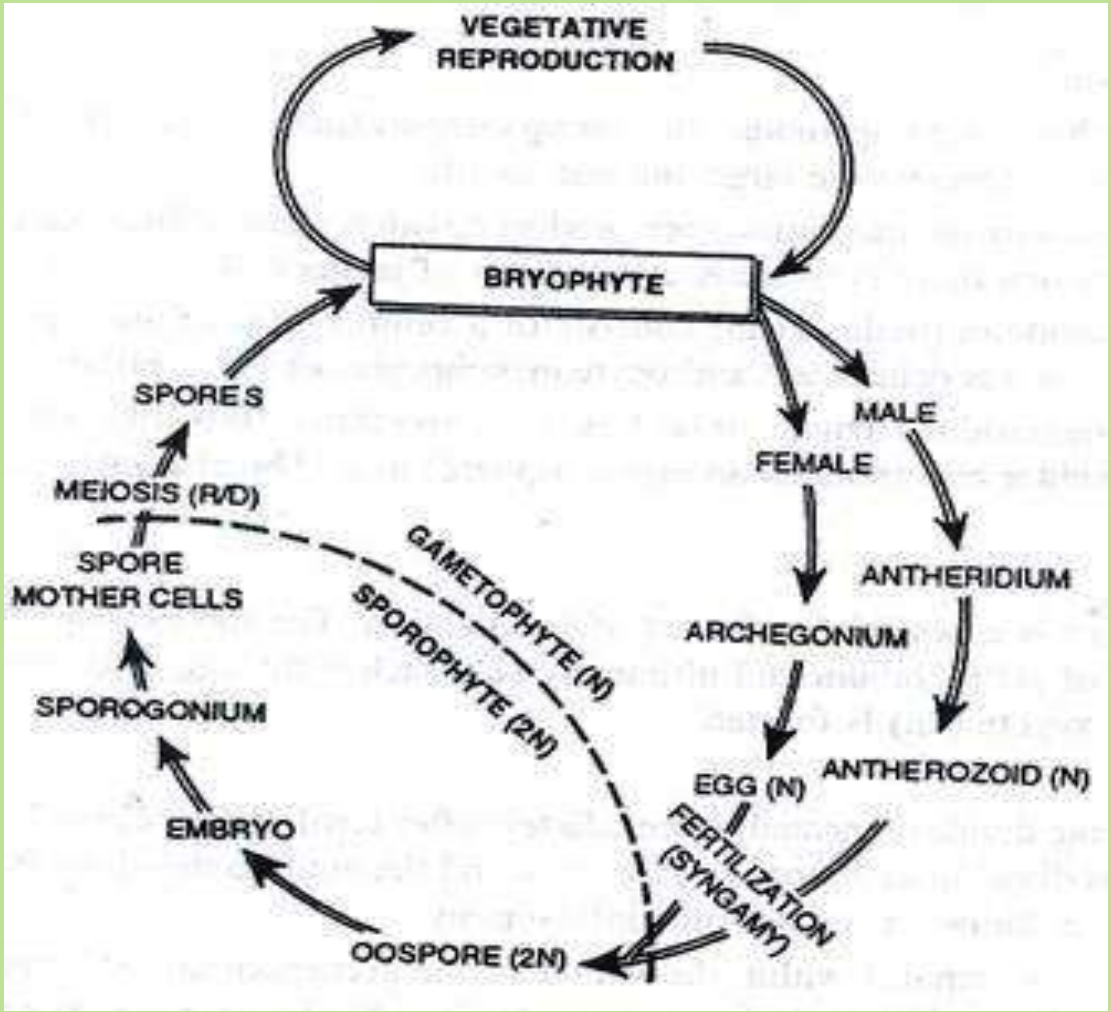
Spores:

- ✓ spores produced in the capsule and all the bryophytes are homosporous.
- ✓ The spores are cutinized and non-motile. They are concerned with the wind dispersal. The individual spores seperates from tetrad before they are discharged from the capsule.
- ✓ The spore germinates under suitable conditions give rise to the new gametophytic plant.

Life Cycle (Alteration of Generations):

- The life cycle of bryophytes is very interesting and consists of two distinct phases:
- (i) the gametophyte, and (ii) the sporophyte.
- The two phases come one after the other in alternating manner.
- The **gametophytic phase** is followed by **sporophytic phase** and the later is followed by the gametophytic phase. Occurrence of these two generations one after the other in the life cycle is called alteration of generations. The plant bodies of the two generations differ in form and morphology. Thus, the bryophytes exhibit **heteromorphic** type of alternation of generations.

Pattern of life cycle in Bryophytes



- **Classification of Bryophytes**:
- The most widely accepted classification of Bryophyta is as follows:
- The division Bryophyta has been divided into three classes-

1. Hepaticopsida
2. Anthocerotopsida
3. Bryopsida.

Division-Bryophyta

1. Hepaticopsida	2. Anthocerotopsida	3. Bryopsida
Orders:		
1. Sphaerocarpales	1.Anthocerotales	1.Sphagnales
2. Marchantiales		2. Funariales
3. Jungermanniales		3. Polytrichales
4. Calobryales		

Class 1: Hepaticopsida

- These are popularly known as **Liverworts** since the thallus shows liver shaped lobes. It includes 280 genera and 9,500 species.
- The gametophyte is usually dorsiventral thallose (e.g. *Marchantia, Pellia*) or foliose axis (e.g. *Porella*). In foliose forms the leaves present in 2-3 rows, without midrib.

Class-2: Anthocerotopsida

- The class anthocerotopsida is represented by a single order **Anthocerotales** and a single family Anthocerotaceae. The family comprises **6** genera and **300** species
- The gametophyte is a dorsiventrally lobed thalus without any internal differentiation of tissues. On the ventral side of the thallus, scales are absent and unicellular smooth walled rhizoids are present.
- There are no air chambers or air pores but there are mucilaginous cavities that open out on the ventral side of the thallus. Each cell of the thallus has a single (or two) laminate **Chloroplasts** with a **pyrenoid.** The cells do not contain oil bodies.

Class-3 Bryopsida:

- They are commonly called as mosses and they are much greater in number and more widely distributed than the liverworts.

- It consists about **660** genera and **14,500** species, being the largest class of Bryophyta. They constitute the dominant vegetation in bogs, alpine and arctic regions. They occur even in polluted urban areas, as dark green cushions between having-stones.

- The gametophyte is distinguished as a branched prostrate filamentous juvenile stage called **protonema** and an erect leafy shoot called **gametophore**. The protonemal stage is transitory while the gametophore is persistent.

- The gametophore consists of stem and spirally arranged leaves. It bears sex organs. The sex organs show a definite apical cell in the earlier stage of their development.

- The sporophyte consists of foot, seta and a capsule. The growth of the sporophyte is definite. Seta is absent in Sphagnales and a gametophytic pseudopodium rises up the sporogonium.

The end

Thank you