PLANT KINGDOM

BRYOPHYTES

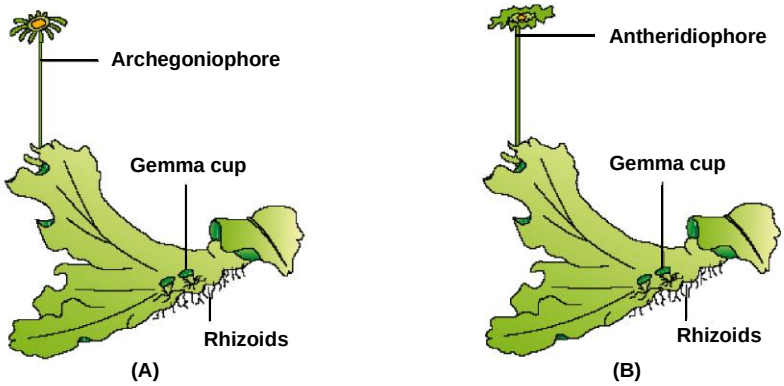
BRYOPHYTA

- The term "**Bryophyta**" was proposed by "**Robert Braun**".
- The study of Bryophytes is known as **Bryology**.
- **Hedwig** is considered to be the **father of Bryology**. But according to some scientist it is believed that **Cavers** is the father of Bryology.
- Father of Indian Bryology is **Prof. Shiv Ram Kashyap**.

GENERAL FEATURES

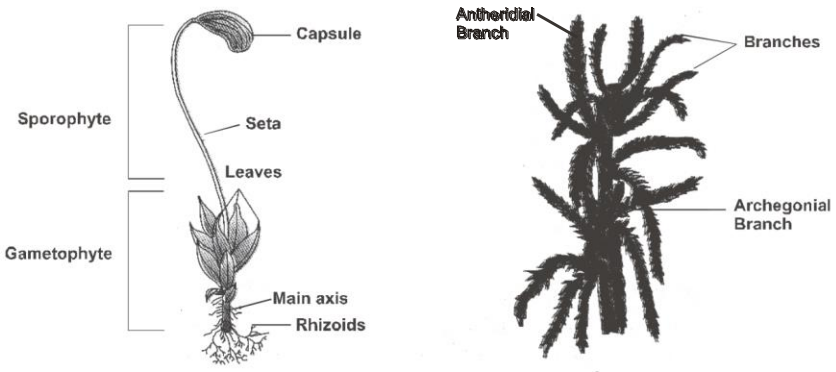
- Bryophytes are the **first land plant**.
- It is believed that, they **originated from aquatic plant** and they come on land through water. Because some bryophytes have features similar to **aquatic** plants (eg. presence of **air canals**)
- Bryophytes are known as **amphibians** of the plant kingdom, because they **live in soil** but **need water** to complete their life cycle during **sexual reproduction**.
- Bryophytes are **not** considered as the successful land plants because **vascular tissue** is absent and they need water for fertilization.
- Due to the absence of vascular tissue bryophytes can not grow **very tall**.
- The process of **water conduction** in bryophytes takes place with the help of **parenchyma** or **Hardom tissue (Sphagnum)**
- Parenchyma is a living tissue, while **Hadrom is dead**
- The plant body is dominantly **haploid**, more differentiated than algae i.e. **Multicellular**, **thalloid**, **parenchymatous**.
- **Lower** bryophytes **thalloid, higher** are **branched** (prostate or erect) with **stem** or **leaf like structure**.
- **Roots are absent** in bryophytes (**Rhizoids unicelled / multicelled present**).
- **Stem** and **leaves** of **higher bryophytes** are functionally similar to the stem and leaves of **higher plants**.
- Bryophytes are **sciophytes**, i.e., bryophytes prefer to grow in **moist (wet)** and **shady** places.

- **Vegetative reproduction is quite common** through fragmentation, **tubers, gemmae** (**inside gemma cup**), buds, adventitious branches etc.



(i) Body form:

- The plant body of bryophytes is more differentiated than that of algae.
- **It is thallus-like (liverworts) and prostrate or erect (Mosses) and attached to the substratum by unicellular and unbranched rhizoids (Liverworts) or multicellular and branched rhizoids (Mosses).**
- **They lack true roots, stem or leaves. They may possess root-like (rhizoids), leaf-like (Phylloid) or stem-like (cauloid) structures**.
- Thallus is multicellular, thick and **dichotomously branched.**
- The main plant body of the bryophyte is haploid. It produces gametes, hence is called a gametophyte.



(a) (b)

Fig. (a) Funaria (b) Sphagnum (TB)

(i) **Vascular tissues (xylem and phloem) are absent** in both gametophytic and sporophytic phases. The **conduction** takes place through **specialized parenchyma**.

(ii) **Reproduction:**

(a) Asexual reproduction –

Vegetative propagation takes place in **liverworts by fragmentation, and gemmae** while in **mosses by fragmentation and budding in secondary protonema.**

(b) Sexual reproduction – Oogamous type

- Sex organs are multicellular and surrounded by **single layered sterile jacket**.
- **Male sex organ** is called **antheridium** which is globular or club shaped and forms **biflagellated antherozoids or sperms (motile male gamete)**.
- **Flask shaped female sex organ** is called **archegonium** that consists of **a swollen venter** and **a tubular neck**.
- Neck is composed of **6 vertical rows of cells** and encloses **4–10 neck canal cells** while venter has **venter canal cell** and a **single egg cell or oosphere (nonmotile female gamete)**.
- **Water is essential for fertilization**. **Archegonia** secretes **mucilage** rich in **potassium salts / proteins/sucrose** for attracting antherozoids in water.
- Fertilization is internal and takes place by **zoodiogamy**. Diploid zygote formed in the venter by the fusion of one antherozoid with egg cell.
- After fertilization zygote immediately divides mitotically and form multicellular embryo.

- **Embryo gives rise to multicellular sporogonium or sporophyte. The latter differentiates into foot, seta and capsule. Sporophyte is completely (e.g.*Riccia*) or partially (e.g. *Funaria*) parasite on gametophyte.**
- **Some cells of the sporophyte capsule called as Spore mother cells or sporocytes** undergo **sporic meiosis** and form haploid **meiospores** which are alike or **homosporous**.
- **On germination, spore forms new gametophytic plant either directly (e.g. liverworts and hornworts) or indirect by juvenile filamentous, green, multicellular protonema stage (e.g. moss).**

LIFE CYCLE OF BRYOPHYTES

(1) The plant in bryophytes is **gametophyte**. It is **haploid**.

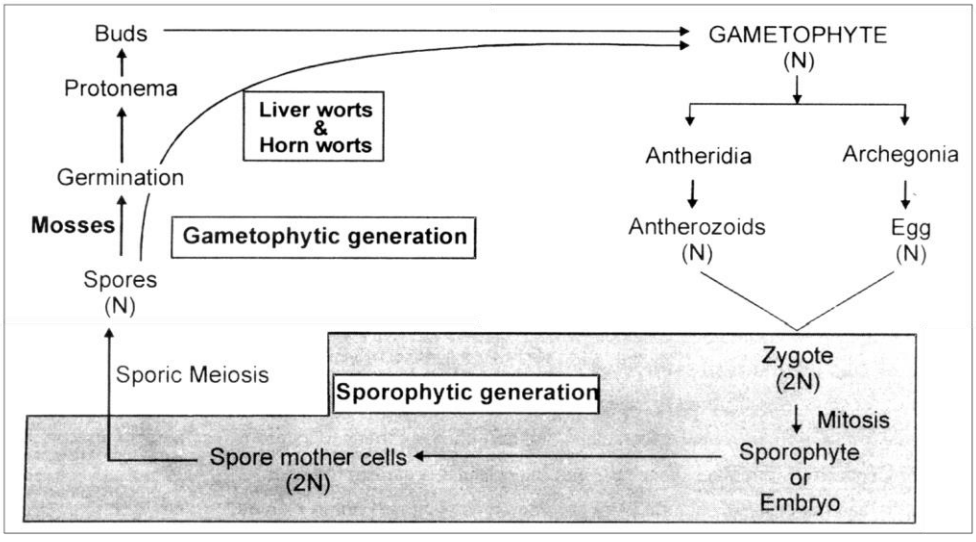
(2) Sex organs are formed on gametophyte.

(3) Sex organs are **multicellular** and **jacketed** in bryophytes.

(4) **Male** sex organs are called as **antheridium** and **female** sex organs are called as **archegonium** (**Ist Archegoniate plant**)

(5) The male gametes of bryophytes are **motile**. These motile male gametes are called as **antherozoids**.

Antherozoides are **comma shaped** and **biflagellate**. Female gamete is called **egg**.



In Bryophyta, **fertilization** is done by **zoodiogamy** i.e. male gamete reaches the female gametes (for **which water is essential)** and fertilizes it.

- As a result of fertilization, a **diploid zygote** is formed.
- The zygote initiates the **sporophytic** generation. Sporophytic generation is a **diploid** stage.
- **Zygote** develops **inside archegonia** and divides by **mitosis** to produce **embryo** (so these are considered as **first embryophytes**).
- The **embryo** develops further into a sporophyte **which is parasitic over the gametophyte** (may be **partial parasite** as in **mosses**).
- The sprophyte of bryophytes is also called **sporogonium, it is composed of three parts** viz. **capsule, seta** and **foot**.
- It produces **meiospores** or **haploid spores** inside the **capsule** part (after **meiosis** in spore mother cells), while attached to the gametophyte.
- All bryophytes produce only **one type** of spores (**Homosporous**).

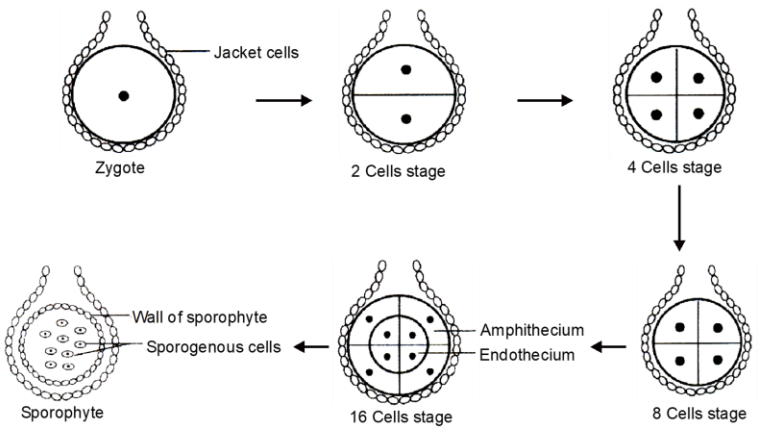
DEVELOPMENT OF SPOROPHYTE

- During the development first division is **transverse** in **zygote** and second division is **vertical.**
- Third division is also **vertical** but at **right angle to second** division, therefore an **eight celled** embryo is formed.
- Now a **periclinal** division takes place in **eight** celled embryo. as a result of it a **16 celled** embryo is formed.
- Now these **sixteen cells** are arranged in two layers.

  Outer 8 cells - **Called Amphithecium**

  Inner 8 cells - **Called Endothecium**
- Now cells of **endothecium** divided and form many cells which are known as **sporogenous cells**.
- **Some sporogenous cells** become **sterile** and called **nurse cells** (2n).

  Remaining sporogenous cells function as **spore mother cells**.
- Now **meiosis** takes place in **spore mother cells**, result of it **haploid spores** are formed.
- **Nurse** cells provide **nutrition** to **spore mother cells** and **spore**.
- The germination of spores is **direct** or **indirect**.
- In **Liverworts** & **Hornworts** the germination of spore is **direct** i.e. each spore forms a gametophyte after germination i.e. each spore forms one **thallus**.



The germination of spores in **Mosses** is **indirect**. i.e. a **multicellular filament** is formed after the germination of spore. This filament is known as **protonema**.

- Now **buds** are formed on every cells of protonema. Each bud develops into a gametophyte plant.
- Indirect germination is **best** for survival.
- Mosses are **gregarious** in nature because they appear in **group**.

POINT TO BE REMEMBER

- Sexual reproduction in bryophytes is **oogamous** type and life cycle is **haplo-diplontic** type.
- In Bryophyta the **sporophyte is depend on gametophyte**. (May be **completely** or **partially**) This is a **unique character** of broyphyta.

Classification of Bryophyta:

Bryophyte sis divided into three classes

1. **Hepaticopsida**
2. **Anthocerotopsida**
3. **Bryopsida or Musci**