Bryophytes occupy a position just intermediate between the green thallophytes (Algae) and the vascular cryptogams (Pteridophytes). The objective of this unit is to make the students familiar with the characters & classification of Bryophytes.

1.1 Introduction :

Bryophytes are plants of amphibious zone. During the dry period they become almost brittle in texture. With the onset of rainy season the apparently dried, brittle thalli turn green and become active to carry out the normal life functions.

The group Bryophyta (Greek word; Byon = moss, Phyton = plant) includes the simplest and most primitive land plants. About 960 genera & 24,000 species have been reported in Bryophyta. Most of the Bryophytes are land dwellers which inhabit damp, shaded and humid localities. They are essentially terrestrial but they fail to complete their life cycle without water. Thus due to

peculiar type of their habitats, they are neither treated as perfect land plants nor aquatic. They are therefore, most appropriately called as **amphibians** of the plant kingdom. However] a few grow under diverse habitat such as aquatic submerged in water (eg. *Riella, Riccia fluitans, Ricciocarpus),* in bogs (e.g. *Sphagnum),* as epiphytes on tree trunks and branches (e.g. *Dendroceros),* epiphyllous (e.g. *Radula protensa)* or even in desert (e.g. *Tortula desertorum*).

1.2 Characters of Bryophytes :

Habitat

(1) The plants usually grow in moist and shady places. They are terrestrial but require presence of water to complete their life cycle. The group Bryophyta, therefore, regarded as amphibians of the plant kingdom.

Gametophytic plant body

(2) The plant body is gametophyte which is haploid and bears gametes.

(3) The plants are small and inconspicuous ranging from a millimetres to 30-40 centimeters or more.

(4) The plant body may be thallus like i.e. , not differentiated into trueroots, stem and leaves (e.g. *Riccio, Marchantia, Pellia* etc.) or leafly shoots. The leafy shoots may be dorsiventral (e.g. *Porella*) or erect, differentiated into stem like central axis and leaf -like appendages (e.g. *Funaria, Polytrichum* etc.).

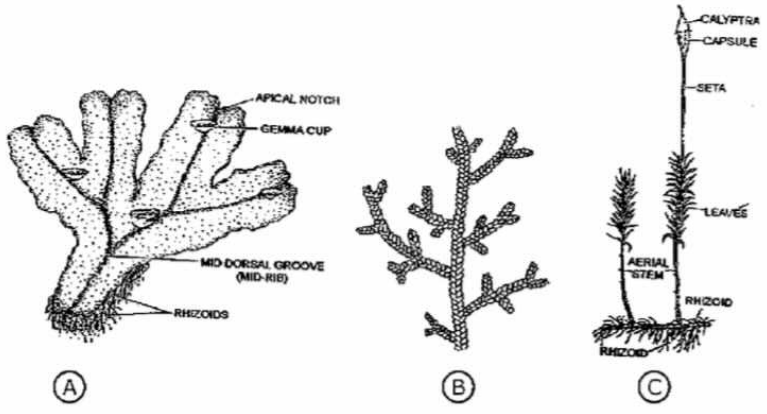


Fig-1.1 : Different types of Gametophyte
A. Marchantia; B. Frullania; C. Polytrichum

(5) The plant body is attached to the substratum by means of branched, multicelluar rhizoids apparently resembling the roots. True roots are completely absent.

(6) The plants are green and possess chloroplasts. They are autotrophic. However, a few species such as *Buxbaumia aphylla* (Mosses) and *Cryptothallus mirabilis* (liverwort) are saprophytes and lead a heterotrophic mode of nutrition.

(7) The vascular tissues (i.e., xylem & phloem) are completely absent. However, in few mosses the xylem like hydroids, which conduct water and phloem like leptoids, which conduct the assimilates have been reported e.g., *Polytrichum.*

(8) The gametophyte which bears gametes is concerned with sexual reproduction and constitutes the most conspicuous, nutritionally independent phase in the life cycle.

Reproduction

(9) Sexual reproduction is always oogamous type. (i.e., the male gametes are small, motile antherozoids and the female gametes are large, and non motile eggs).

(10) The gametes are produced in complex multicellular jacketed sex organs.

(11) Both kind of sex organs may be developed on the same individual or on different plants. The former are called monoeicous and the latter as dioecious.

(12) The male reproductive organs are antheridia and female reproductive organs are archegonia.

(13) The antheridium is ellipsoidal or club - shaped sometimes spherical in form. It is differentiated into a stalk and a body. The stalk attaches it self to the gametophyte tissue. The body of antheridium has wall of a single layer of sterile cells. It surrounds a mass of small squarish or cubical cells called the androcytes.

(14) The androcytes produce the biflagellate male gametes called as sperms. Several sperms are produced in each antheridium. Each sperm usually consists of a minute, slender, spirally-curved body with two long, terminal whiplash type flagella.

(15) The archegonia are flask.- shaped stalked organ. The slender and elongated upper portion is called neck and the lower sac - like, swollen portion, the venter. The neck encloses variable numbers of neck canal cells, whereas venter encloses venter canal cell, and a large egg.

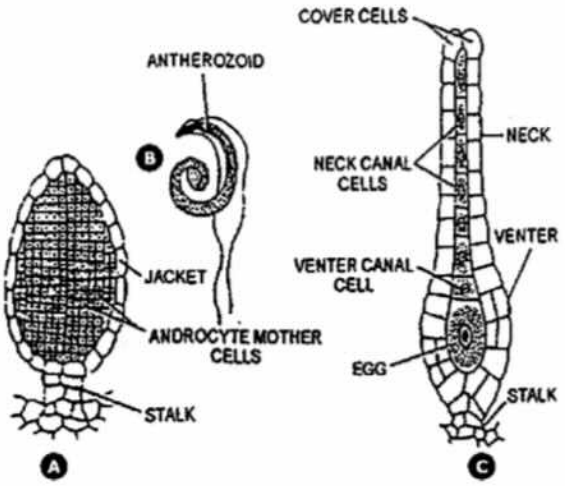


Fig-1.2 : Sex organs of Bryophytes
A. Antheridia; B. Antherozoid; C. Archegonia

Fertilization

(16) Water is essential for fertilization. The mature antheridium ruptures at its apex liberating the sperm. At the same time the axial row of neck canal cells including the ventral canal cell in the mature archegonium disorganize and the tip of the archegonia also opens. The liberated sperms swimming in thin film of water reach the archegonia and competable one reach there and fuses with egg. The fertilized egg (zygote) is retained within the venter and undergoes repeated division to form an embryo.

The gametes (sperms and eggs) are the last structures of the gametophytes generation.

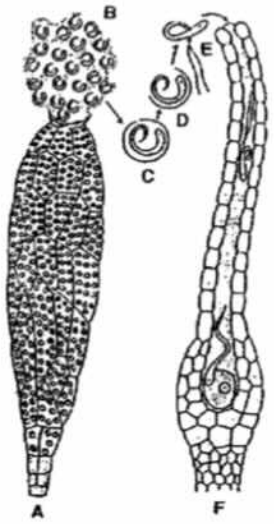


Fig-1.3 : Dehiscence of sex organs and fertilization in moss plant.

Sporophyte

(17) The dipliod zygote is the first cell of sporophyte generation. Within Venter of the archegonium, the zygote undergoes segmentation and develops without a resting period into a multicellular, undifferentiated embryo. It obtains its nourishment directly from the thallus.

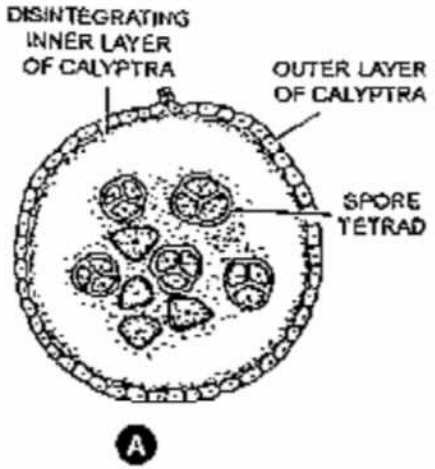
(18) The embryo by further segmentation and differentiation finally develop into a full-fledged sporophyte which is called as **sporogonium.**

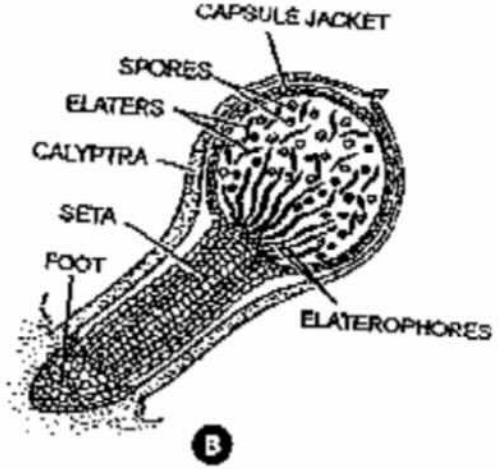
(19) The sporogonium in most of the cases, gets differentiated into foot, seta and capsule. However, the foot and seta are absent in *Riccia* and the seta is absent in *Corsinia* and *Anthoceros.*

(20) The sporogonium is completely dependent on the gametophyte for water and mineral supply and in most of the cases, partly or wholly for organic nutrition. The sporophytes remains attached to the gametophytic plant body throughout its life.

(21) The foot is embedded in the tissue of the parent gametophyte. It absorbes nutrition for the sporogonium. The seta conducts the food absorbed by the foot to the capsule. The terminal capsule is mainly concerned in the production of spores which are non-motile and wind disseminated.

(22) The spores are morphologically similar in size and shape (i.e.; homosporous). However, in *Marchantia,* out of 4 spores produced from one spore mother cell, two produce male thalli and the other two female thalli.





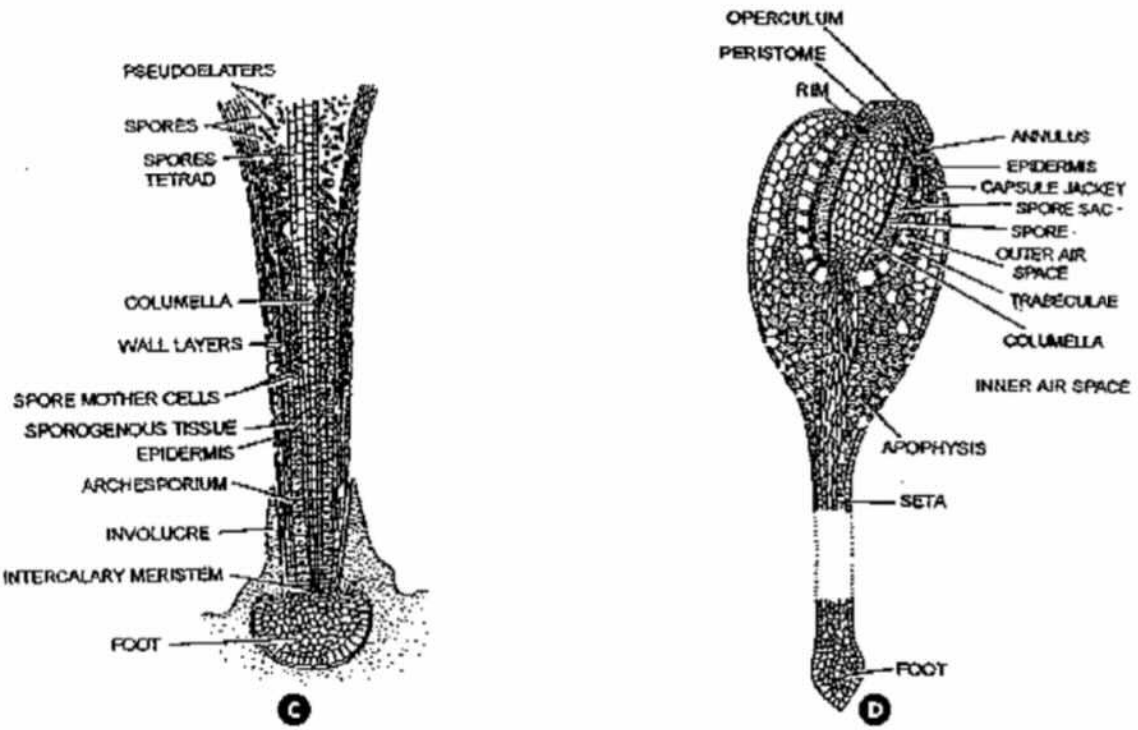


Fig-1.4 : Sporophytes of Bryophyte
A. Riccia; B. Pellia; C. Anthoceros; D. Funaria

The Young gametophyte

(23) The spores, produced from sporogonium,are haploid. They are the first cells of gametophytic generation.

(24) Each spore while falling on a suitable soil germinates to give rise the gametophyte plant either directly (e.g; *Riccia, Marchantia* etc.) or indirectly as a lateral bud from the protonema (e.g. *Funaria).*

(25) The occurrence of heterologous or heteromorphic type of alternation of generation is a constant feature of the life cycle of Bryophytes in which alternating individual are dissimilar. The distinct phases are -

(i) The gametophytic phases and

(ii) The sporophytic phase

The haploid spore, produced from the diploid sporophyte, on germination produce gametophytic plant body(n). The haploid gametophyte is mainly concerned with the production of haploid male & female gametes. These gametes after fertilization form diploid zygote which is the first cell of sporophytic

generation. It is retained within the archegonium and multiplies to produce the embryo, which later develops into sporophytic plant body, the sporogonium. The diploid spore mother cell of sporogonium after meiosis produces haploid spores which is the first cell of gametophytic generation.