

Classification of Bryophytes

The term Bryophyta was first introduced by Braun (1864), however, he included algae, fungi, lichens and mosses in this group. Later, algae, fungi and lichens were placed in a separate division Thallophyta and liverworts, mosses in division Bryophyta. The rank of division Bryophyta to this well-defined group of plants was first given by Schimper (1879).

Eichler (1883) was the first to divide Bryophyta into two groups:

Group I. Hepaticae

Group II. Musci.

Engler (1892) recognised Hepaticae and Musci as two classes and divided each class into the following three orders:

Division. Bryophyta:

Class I. Hepaticae divided into three orders:

Order 1. Marchantiales

Order 2. Jungermanniales

Order 3. Anthocerotales

Class II. Musci divided into three orders:

Order 1. Sphagnales

Order 2. Andreaeales

Order 3. Bryales.

Due to isolated characters of Anthoceros and related genera, Howe (1899) raised the order Anthocerotales to the rank of a class and divided division Bryophyta into three classes:

Class I. Hepaticae

Class II. Anthocerotes

Class III. Musci.

This system of classification was followed by Smith (1938, 1955), Takhtajan (1953), Wardlaw (1955) and Schuster (1958) but preferred to call class Anthocerotes as Anthocerotae. International code of

Botanical Nomenclature (ICBN) suggested in 1956-that the suffix-opsida should be used for the classes and such usage had already been proposed by Rothmaler (1951) for the classes of Bryophytes.

He changed the class names as:

Class I. Hapaticae as Hepaticopsida.

Class II. Anthocerotae as Anthocerotopsida

Class III. Musci as Bryopsida.

Proskauer (1957) suggested that the class name Anthocerotopsida should be ch; _ Anthocerotopsida.

Parihar (1965) and Holmes (1986) followed Proskauer's sysuaa classification and divided Bryophyta into three classes : Class I. Hepaticopsida Class II. Anthocerotopsida Class III. Bryopsida.

Class I. Hepaticopsida (Liverworts):

General Characters:

1. This class includes about 280 genera and 9500 species.
2. The name of this class is derived from a latin word Hepatica which means liver. Hence members of this class are commonly known as liverworts.
3. Plant body is gametophytic and the gametophyte is either thalloid or foliose.
4. Thalloid forms are prostrate, lobed, dorsiventral and dichotomously branched.
5. In foliose forms, '**leaves**' are entire, lobed or divided and without '**midrib**'. 'Leaves arranged in two to three rows on the axis.
6. Rhizoids are unicellular and branched.
7. Photosynthetic cells contain many chloroplasts.
8. Pyrenoids are absent.
9. Sex organs are borne dorsally or apically, superficial or embedded in gametophytic tissue
10. Members may be monoecious or dioecious.
11. Sporophyte is either simple or represented by capsule only (e.g., Riccia) or may differentiated into foot, seta and capsule (e.g., Marchantia).
12. Archegonium is endothecial in origin.

13. Sporogenous tissue either forms only spores (e.g., *Riccia*) or is differentiated into sterile elater mother cells and fertile spore mother cells.
14. Columella is absent in the capsule.
15. Elaters are unicellular, hygroscopic with spiral thickenings.
16. Capsule wall is one to several layers thick and without stomata.
17. Dehiscence of the capsule is irregular or in definite number of valves.
18. Spores on germination form the gametophytic plant body.
19. Plants show heteroinorphic alternation of generation.

Campbell (1936) divided the class Hepaticopsida into four orders:

Order 1. Marchantiales (e.g., *Riccia*, *Marchantia*).

Order 2. Sphaerocarpaceae (e.g., *Sphaerocarpos*).

Order 3. Jungermanniales (e.g., *Pellia*).

Order 4. Calobryales (e.g., *Calobryum*).

Schuster (1953, 1958) divided the class Hepaticae into two sub-classes:

Sub-class 1. Jungerinanniae. It includes four orders:

Order I. Calobryales (e.g., *Calobryum*)

Order 2. Takakiales (e.g., *Takakia*)

Order 3. Jungermanniales (e.g., *Pellia*)

Order 4. Metzgeriales (e.g., *Metzgeria*)

Sub-class 2. Marchantiae.

It includes three orders:

Order 5. Sphaerocarpaceae (e.g., *Sphaerocarpos*)

Order 6. Monocleales (e.g., *Monoclea*)

Order 7. Marchantiales (e.g., *Marchantia*).

Class II. Anthocerotopsida (Hornworts):

General Characters:

1. This class is represented by about 6 genera and 300 species.
2. Plant body is flat, dorsiventral, thalloid, gametophytic and variously lobed.
3. Smooth walled rhizoids are present.
4. Tuberculated rhizoids and scales are absent.
5. Internally the thallus is not differentiated into zones.
6. All cells are alike.
7. Air chambers or air pores are absent.
8. Each cell has a single chloroplast and each chloroplast contains a single pyrenoid.
9. Mucilage cavities open on the ventral surface by slime pores.
10. Sex organs are embedded in the thallus.
11. Antheridia develop either singly or in groups in closed cavities called antheridial chambers.
12. The sporophyte is differentiated into foot, an intermediate zone or meristematic zone and capsule.
13. Due to the presence of the meristematic zone, the sporophyte shows indeterminate growth i.e., it continues to grow indefinitely.
14. Archegonium is amphithecial in origin.
15. Sporogenous tissue forms the fertile spores and sterile elaters. Elaters do not have spiral thickenings and are known as pseudo elaters.
16. Capsule wall is four to six layered thick and epidermis has the stomata.
17. Capsule matures from apex to base and usually dehisce by two valves.

The class Anthocerotopsida has only a single order Anthocerotales. Muller (1940), Proskauer and Reimers (1954) divided the order Anthocerotales in two families:

Family 1. Anthocerotaceae (e.g., Anthoceros)

Family 2. Notothylaceae (e.g., Notothylas).

Class III. Bryopsida (Mosses):

General Characters:

1. It is the largest class in Bryophyta and includes about 700 genera and 14,000 species.
2. The main plant body is gametophytic and can be differentiated into two stages-juvenile stage and leafy stage or gametophore.
3. Juvenile stage is represented by green, filamentous branched structures called protonema. It develops from the germination of the spore.
4. Gametophores are erect leafy branches which develop on the protonema.
5. Gametophores can be branched or un-branched and can be differentiated into three parts-rhizoids, '**stem**' and '**leaves**'.
6. Branches arise below the '**leaves**'.
7. '**Leaves**' are with midrib, un-lobed and arranged spirally in three to eight rows on the axis or
8. Rhizoids are multicellular, filamentous, branched with oblique septa.
9. The axis is differentiated into central conducting strand enclosed by cortex.
10. Sex organs borne apically in the groups on main '**stem**' or a branch.
11. The sporophyte is green in early stages and can be differentiated into foot, seta and capsule.
12. The seta is usually elongated and rigid.
13. Columella is usually present and endothelial in origin.
14. Archesporium (spore forming tissue) is differentiated only in spores.
15. Elaters are absent.
16. Dehiscence of capsule takes place by separation of lid or operculum.
17. Peristome helps in the dispersal of spores.
18. Spores on germination produce the protonema.

Bower (1935), Wettstein (1933-1935), Campbell (1940) divided the class Bryopsida into that orders:

Order 1. Sphagnales

Order 2. Andreaeales

Order 3. Bryales.

Dixon (1932) gave the above orders the rank of sub-class and divided the Bryopsida into three sub-classes:

Class. Bryopsida (Musci)

Sub-class I. Sphagnales

Sub-class II. Andreaeales

Sub-class III. Bryales.

Smith (1938, 1955) divided the class Bryopsida into three sub-classes:

Sub-class 1. Sphagnobrya

Sub-class 2. Andreaeobrya

Sub-class 3. Eubrya.

Reimers (1954) divided the class Bryopsida into 5 sub-classes and he used suffix-idae for the sub-class:

Sub-class 1. Sphagnidae-1 order. Sphagnales-1 family.

Sub-class 2. Andreaeidae-1 order. Andreaeales-1 family.

Sub-class 3. Bryidae-12 orders

Sub-class 4. Buxbaumiidae-1 order. Buxbaumiales-2 families.

Sub-class 5. Polytrichidae-2 orders. Polytrichales and Dawsoniales-2 families.

Parihar (1955) divided the class Bryopsida into 3 sub-classes:

Sub-class 1. Sphagnidae

Sub-class 2. Andreaeidae

Sub-class 3. Bryidae.

