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An Initiatory Review on Bryophytes Diversity

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Abstract: The varied group of terrestrial plants known as bryophytes is tiny in stature but has significant ecological effects. The biggest group of terrestrial plants, excluding flowering plants, they have over 23,000 known species worldwide. Mosses, hornworts, and liverworts are among the three phylogenetically separate lineages that make up the category. Mosses are typically regarded as a "key group" in our comprehension of the phylogenetically relatedness and origin of contemporary land plants (embryophytes). Bryophytes are able to live in a wide range of settings and have various growth habits. Although, mosses exhibit high species diversity, a major limitation in using mosses as study organisms has been the lack of basic floristic, ecological, and alpha-taxonomical knowledge of plants in many regions.
Keywords: Bryophytes, plants, Diversity, mosses, liverworts, hornworts etc.

I. INTRODUCTION

Bryophytes are spore-producing, non-vascular terrestrial plants. They are the second largest plant genus after the flowering plants, but are less well known due to their size (Chandra et al., 2017). Mosses include a very separate group in the vegetation of land plants. They comprise around 23,000 species and form the most species-rich group of land plants. They have evolved to be an incomparable variety in size and structure. In India, mosses are represented by about 2850 taxa (Singh and Hajra 1996) and the Western Himalayas, Eastern Himalayas and Western Ghats represent biodiversity hotspots and acquire numerous endemic mosses. They can grow in extreme conditions. Most mosses are small, but some reach heights of up to half a meter or a little more. They can store large amounts of water, nutrients and carbon in their biomass. In most ecosystems, especially in peatlands, mosses act as carbon sinks, which is of great importance given the increasing levels of carbon dioxide around the world. Most mosses are ectohydric; they have the ability to absorb water, inorganic nutrients and mineral elements directly from the atmosphere rather than from the soil and substrate. Bryophytes are widely considered to be the oldest living land plants (Shaw and Renzaglia 2004). The properties of mosses relate them to green algae and both seem to have a common ancestor. Bryophytes have a short-lived dominant sporophytic and gametophytic phase. Bryophytes have a basal phylogenetic position among extant land plants, remnants of lineages that survived the spectacular radiation of land plants in the Devonian period (400 million years ago). Recent phylogenetic reconstructions of family relationships suggest that toadstools are the basic group of higher land plants; Moss and liverwort form a monophyletic sister group. By adapting to the irregular subaerial water supply, mosses in generally employed the alternative strategy of developing drought tolerance, photosynthesizing and growing during wet periods, and suspending metabolism during dry periods. Growth and sexual reproduction of mosses depend on external water and are therefore favored by a humid microclimate. They have a remarkable ability to regenerate from any plant fragment. Various reproductive modes play an important role in the life cycle of mosses, particularly in heavily disturbed stands (during 1997). Small, short mosses move their sperm with the help of early morning dewdrops. Moss spores travel long distances even with the help of the wind moving between continents by jet streams. The spore walls are highly protective and some spores are reported to remain viable for up to 40 years. Bryophytes can survive under stressful conditions such as cold, dry, shady. Bryophytes play an efficient role in filtering the nutrients that enter the soil by absorbing them directly from the atmosphere in the liquid phase. Bryophytes protect soil from erosion due to their interconnected, convoluted protonemata and gametophores, which cover exposed substrates and help increase the soil's water-holding capacity. The role of mosses in an ecosystem is determined by four properties: their ability to form soils, trap and retain moisture, exchange cations, and tolerate desiccation. These qualities are enhanced by its ability to multiply through frequent branching. Mosses such as Atrichum, Nardia, Pogonatum, Pohlia and Trematodon are soil erosion inhibitors due to their rigid structure and ability to regenerate. Bryophytes have an ecological association with microorganisms, protozoa, rotifers, Nematodes, earthworms, mollusks, insects, spiders and many other invertebrates (Gerson, 1982), as well as mosses in the ecosystem of 281 other plants and fungi.

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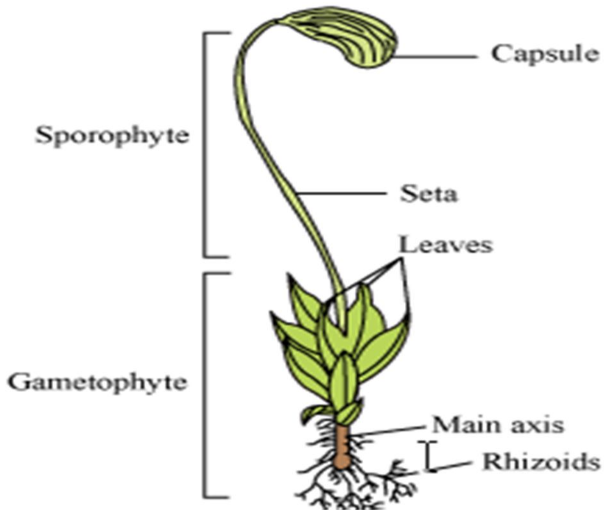

Fig 1: Sporophytic and Gametophytic body of Bryophytes

II. DIVERSITY IN MORPHOLOGICAL FORMS

Bryophytes are divided into three groups, namely liverworts, hornworts and musci. Cell ultrastructure and molecular biology confirmed that mosses themselves have three separate evolutionary patterns crowning liverworts (Hepaticopsida), tomentosum (Anthocerotopsida), and mosses (Bryopsida) (Shaw and Goffinet 2000).

A. Liverworts

The estimated number of hepatica species ranges from 6000 to 8000. Hepaticas are represented by about 850 species belonging to 141 genera and 52 families (Singh 2001). The leaf forms (young Maniopsid) are represented by almost 85% of liverwort species exhibit enormous morphological, anatomical and ecological diversity. Plants with leaf shoot systems are the most common habit in this class, S.., Cololejeunea, Frullania, Jubulopsis and Radula thalloid forms, e.g., Metzgeriales and Marchantiales are widely distributed in moist, shady, terrestrial, semiaquatic locations, especially in high altitude, dense subalpine and moist temperate forests. The spores are spread by the rotating movement of the wing blades and by the division of the sporophyte into four segments.

Fig 2: Mosses, Liverworts and Hornworts

B. Hornwort

Hornwort consists of about 100-150 species in the world (Renzaglia and Vaughn 2000). They resemble some hepaticas only in the case of unspecialized thalloid gametophytes. Hornwort, they have colonies of Nostoc ventrally on their thallus. This alga exhibits a symbiotic nature that provides organic nitrogen for the metabolism of the toadstool thallus and provides nourishment (carbohydrates) and protection to the thallus. They possess a Cylindrical, horn-shaped sporangia (sporophyte). The release of the spores from the sporophyte occurs gradually over a long period of time. Its spores are spread by the movement of the water and not by the wind.

C. Mosses

Mosses show the highest biodiversity with species number estimates between 10,000 and 15,000. In India, mosses are represented by 2,300 species in 330 genera. Peat mosses are one of the most important groups of mosses from an ecological and economic point of view.

III. HABIT AND HABITAT DIVERSITY

Moss plants are typically smaller than maximum different vascular plants. Dawsonia superba is the tallest moss, reaching a height of up to 70 cm; Polytrichum commune grows in humid conditions and can reach a height of 50 cm. Other hanging mosses such as Meteoriopsis spp. and the water moss Fontinalis spp. They can reach a height of up to 1 meter. Some of the Bryophytes are quite small; the smallest tiny Cephalooziella plants are visible only under the microscope and some mosses such asMicromittrium species. Moist evergreen forests have a variety of microhabitats. Bryophytes are important components of temperate and tropical forests where they are found as carpets on damp soil, boulders, living and dead trunks, hanging from branches and on leaves. The distribution of mosses is first influenced by microclimatic factors, i.e., precipitation and temperature, latitude and altitude (Sveinbjörnsson and Oechel 1992), and by micro-environmental conditions such as shade, moisture, humus and temperature (Alpert 1991). The moss vegetation can be influenced by additional factors, e.g. soil age, rock, forest soil composition, moisture content (Sillett and Neitlich 1996) and by substrate such as pH and humus status (Batty et al.).2003). Bryophytes have a special nature to grow in specific habitats such as B. preferred rocks, special barks, rotted logs and stumps, in soils that have adequate moisture and humus, exposure and pH. The moss carpet on the forest floor provides a suitable substrate for seed germination and seedling growth of higher plants. Many Sphagnum species are aquatic and will eventually form swimming pairs. Riccia fluitans is also an aquatic moss. The special thing about mosses is that they absorb water in a short time and become fresh when they dry out under unfavorable conditions, which is why they are also called "resurrection plants". Mosses like Sphagnum species are able to change their environment and thus influence the life of other organisms.

Fig 3: Thalloid body of Bryophytes

IV. BRYOPHYTES OF SPECIEAL HABITATS

1) *Epiliths (Saxicolous):* Some mosses that only grow on rocks have some adaptation and special requirements, perhaps for a more permanent habitat, need less water and their adaptability to grow on such substrates.
2) *Xerophytic Mosses:* They are able to colonize moving sand. Under unfavorable conditions they remain buried in the ground and can reappear shortly after a rain or humidity shower.

A. Bryophytes Association With Animals

The extent to which different taxonomic groups share similarities in diversity patterns has attracted increasing attention, but such studies of stream biota are lacking. The environment correlates patterns of species richness of mosses, micro-invertebrates and fish in streams. Bryophytes and micro-invertebrates showed the highest degree of similarity, but even this relationship had relatively weak predictive power. The growth forms of the mosses play an important role as a shelter for other organisms. Therefore, they form an attractive habitat for many invertebrates that get shelter, sustenance from them even in adverse conditions, e.g., Frullania and Herbertus harbor a range of rotifers, nematodes, invertebrates and algae in their lobes. Some, aquatic mosses are the best habitats for snails to lay eggs. Insects suck the sap from the cells of gametophores and sporangia. Spiders, mites, centipedes, centipedes and ants find shelter here within these mosses. This invertebrate activity within the moss supports the circulation of minerals that fuel the growth of this vegetation. Some insects transport the spores from the mature sporangia to the nitrogen substrate, where this spore can germinate and grow. Many birds use mosses to build their nests. Shoots of pleurocarp moss collected by birds to build their nests because these mosses are lighter compared to others Vegetation and are easy to weave and isolate into the desired pattern. In relation to alpine regions, mosses are a suitable habitat for lichens.

B. Ecological Importance

Bryophytes have a variety of uses. Some of the important uses of mosses are listed below:

Pioneer colonizers in succession Mosses colonize dry soils that are poor in nutrients and where no other plant can/p>grow. After a long rest, these moss colonies have accumulated an organic layer on this sterile soil that supports the growth of microorganisms. These microbes change the mineral state of the substrate and the site becomes Suitable for the establishment of other vegetation. This creates a new sequence with the change of humidity, lighting regime and with the decomposition of the wood.

Pollution and Heavy Metals Indicators Bryophytes are bioindicators of air and water pollution and heavy metal accumulators. Under such disturbed environmental conditions (air pollution), moss, lichen and liverwort communities decrease over a period of time.

C. Threats To Bryophytes

Developmental activities result in habitat loss at both macro and micro levels. The root cause these lower plants threaten the clearing of the forest to convert it to agricultural land and other means such as shelter, sanitation, road, dam, etc. All these activities are entirely responsible for the habitat loss of the mosses. Global warming is making the climate arid, moisture loss and a drier microclimate are responsible for the loss of mosses. Unplanned forest management further increases the loss of these valuable lower plants by knowledge.

The wildfire, whether natural or man-made, causes a subsequent drought that affects the growth of mosses and other plants. According to Hilton-Taylor (2000), 36 species of Bryopsida, 2 of Anthocerotopsida and 42 of Marchantiopsida are threatened and 2 species of Bryopsida and 1 Marchantiopsida species are extinct.

Some of the causes threatening moss diversity are listed below:

1) Land use Change.
2) River Valley Projects.
3) Invasion of exotic species.
4) Climate change.
5) Road construction.

V. CONCLUSION

Mosses, liverworts, and hornworts are the three types of non-vascular plants that make up the bryophytes, an unofficial division of plants. The absence of actual roots, stalks, and leaves is one of mosses' distinguishing characteristics. The rhizoids also act as roots, ultimately holding the plants to the ground. Rhizoids do not, however, absorb nutrients like conventional plant roots. For mosses to flourish and spread, a high humidity climate or closeness to a body of water is crucial. However, several moss species are known to thrive in deserts and other arid and semi-arid conditions.

They may entirely dry up and enter a state of suspended animation in such circumstances. They resurrect and carry on growing when they come into contact with water once more.

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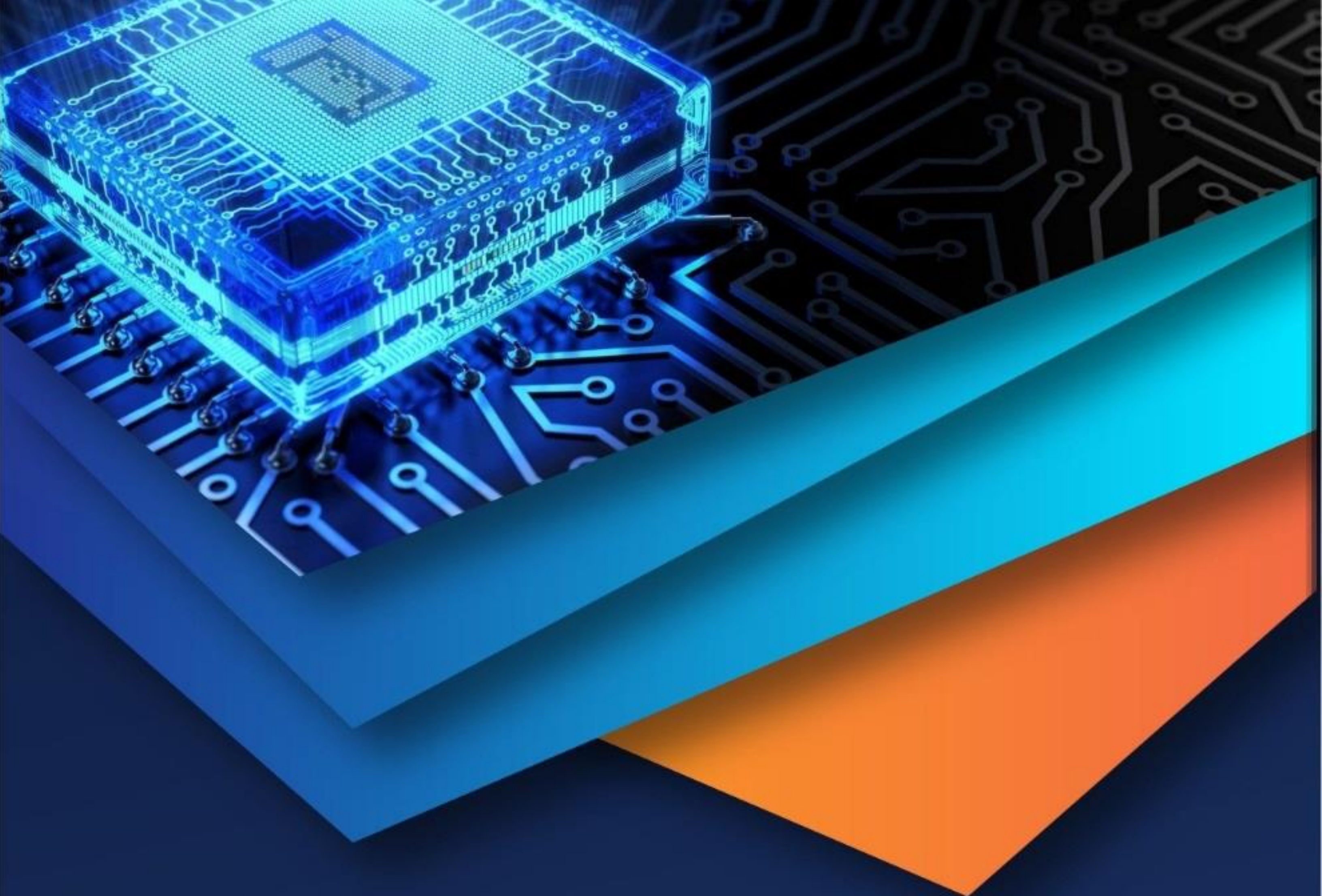

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