

## Bryophytes-boon to mankind- A Review

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### ABSTRACT

Bryophytes represents a diverse group of first green lower land plants to develop during the process of evolution. They were taxonomically placed between the algae and the pteridophytes and more than 20,000 species are known worldwide. In recent years there has been a huge progress made in bryological researches in the country in taxonomy, morphology, cytology, tissue culture, morphogenesis, physiology and pharmaceutical studies. This brief review focus on useful applications of this ancient group of simple plants.

**Key words:** Bryophytes, Economy, Horticulture, Indicator, Medicines.

Bryophytes were divided morphologically into three classes Hepaticae (liverworts 6000 species), Musci (mosses 14,000 species) and Anthocerotae (hornworts 300 species). These plant groups are closely linked with civilization, culture beliefs and ethics of humankind (Glime and Saxena, 1990).

Traditional cultures in India and N. America uses bryophytes such as *Bryum*, *Mnium*, *Philonotis* and *Polytrichum* for healing burns, bruise and wounds. Despite the fact that the uses of the bryophytes may not be as frequent as the uses of their tracheophyte cousins, there are a number of interesting records of bryophyte use around the world (Harries, 2008). Bryophytes were useful in various purposes including ecology, horticulture, construction, medicines, food and in household purposes. Due to mentioned utilities, bryophytes were named as 'Green Brain.'

**As indicator:** Bryophytes are good indicator of environmental condition due to lack of cuticle and leaves with one-cell thickness. *Mielichhoferia elongat*, *M. mielichhoferi* and *Scopelophila* etc were copper mosses grow in copper rich soil. *Brachythecium rivulare* accumulate iron compounds in it (Taylor, 1919). *Polytrichum* shows the presence of acid rich soil (Crum, 1973). *Marchantia* is used as lead indicator. *Polytrichum*, *Bryum* and *Hypnum* as cd, cu and zn indicator. Other bioindicators are *Fontinalis sps*. *Leptodictyum riparium*, *Platyhypnidium riparioides* and *Scapania undulata*.

**Medicinal:** Generally bryophytes are not damaged by insects, snails, slugs and other small animals due to biological active compounds in them. The use of bryophytes in herbal

medicines has been common in China, India and Native America due to cooler, softer and less irritating quality of *Sphagnum*, it is used to retard bacterial growth (Banerjee 1974). A mixture of moss ashes with fat and honey was used on cuts, burns and wounds by Himalayan Indians (Pant *et al.*, 1986). The antibiotic property of *Sphagnum* is used to make a salve by Alaska Indians by mixing moss with fat (Schofield, 1969, Miller and Miller, 1979). In Britain, it was used to treat boils (Bland 1971). Non-ionized organic acids and polyphenolic compounds contribute towards the antibiotic properties of bryophytes against both gram positive and gram negative bacteria (Mc Cleary and Walkington, 1966). Degree of antibiotic activity in a given species may depend on age of the gametophyte (Banerjee and Sen, 1979). Antileukemic activity was noted in leafy liverworts due to bioactive compounds in it and sesquiterpenoids costunolide and tulipinolide tumor growth – inhibiting substances were isolated from *Conocephalum supradecompositum*, *Frullania monocera*, *F. tamarisci*, *Marchantia polymorpha*, *Porella japonica* and *Wiesnerella denudate* (Asakawa 1981, 1982 b). Marchantin A from *Marchantia palacea*, *M. polymorpha* and *M. tosana* riccardin from *Riccardia multifida* and perrottetin E from *Radula perrottetii* all show cytotoxicity against the KB cells (Asakawa *et al.* 1982). *Physcomitrella patens* moss is used to produce human proteins (Hohe *et al.*, 2002).

**Pollution controller:** Abundance of mosses, their reproduction and capsule formation were hindered in the presence of SO<sub>2</sub> (Gilbert 1967, 1968). *Hypnum yokohamae*, *Entodon compressus*, *Aulacopilum subhumile*, *Frullania*

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*muscicola* epiphytic bryophytes were used to assess SO<sub>2</sub> sensitivity in Japan ( Taoda, 1972). European congress practiced the use of bryophytes to monitor air pollution caused by factory emissions and the use of cryptogamic epiphytes as pollution indicator were strongly recommended in the first European congress (Gilbert, 1969).

**As soil binder:** The protonemata of *Barbula*, *Weissia* bind the substrate (Welch, 1948). In Japan, *Atrichum*, *Pogonatum*, *Pohlia*, *Trematodon*, *Blasia* and *Nardia* were used to prevent soil erosion ( Ando, 1957).

**Nitrogen fixer:** Generally bryophytes crust were endowed with nitrogen-fixing cyanobacteria. In Anthoceros, cyanobacteria helps to convert atmospheric nitrogen to ammonia and amino acids ( Saxena, 1981).

**Waste treatment:** Sphagnum – peat moss commonly used for the ecofriendly purpose (Taylor and Smith 1980).

**Horticulture:** *Sphagnum* is used for shipping live plants and burning it to produce a smoke screen against frost.

**Soil conditioning:** *Sphagnum* on soil crust retain moisture and prevents weed growth and also discourages damping off fungi (Miller and Miller, 1979). Coarse-textured mosses increase water storage capacity and fine-textured mosses provide air spaces (Ishikawa, 1974).

**Culturing:** *Sphagnum* moss is tied with plastic around a plant stem to retain moisture and encourage the growth of adventitious roots. Such paddings were used to graft fruit trees ( Pant, 1989). *Hypnum plumaeforme*, *Leucobryum bowringii* were mixed with soil to cultivate Rhododendron plant in Japan (Ando, 1957).

**Moss industry:** 100-200 million tons of oil or half the known gas reserves were equivalent to annual peat production from peat resources worldwide (United Nations, 1981). Native peat deposits of Canada create more energy than forest and natural gas reserves (Taylor and Smith, 1980)

TABLE 1: Bryophytes used for various economical purposes as under:

Purpose	Plant used
As medicine	<i>Marchantia polymorpha</i> , <i>Rhodobryum giganteum</i> , <i>Polytrichum juniperinum</i> , <i>Radula spp.</i> ,
Indicator	<i>Dicranum scoparium</i> , <i>Conocephalum conicum</i> , <i>Riccia</i> , <i>Plagiochasma appendiculata</i>
Horticulture	<i>Rhacomitrium himalayanum</i> , <i>Hyophila involuta</i> ,
Pollution	<i>Mielichhoferia elongate</i> , <i>Scopelophila cataractae</i> , <i>Hypnum</i> , <i>Sphagnum</i> , <i>Polytrichum</i> .
Construction	<i>Radula complanata</i> , <i>Hypnum cupressiforme</i> ,
Vegetation pioneer	<i>Amblystegium riparium</i> , <i>Scapania spp.</i>
Erosion	<i>Fontinalis</i> , <i>Sphagnum</i> , <i>Neckera</i>
Decoration	<i>Andreaea</i> , <i>Funaria</i> , <i>Polytrichum</i> , <i>Ceratodon</i>
Packing	<i>Bryum</i> , <i>Barbula</i> , <i>Weissia</i> , <i>Ceratodon</i> , <i>Atrichum</i> <i>Climacium americanum</i> , <i>Hylocomium splendens</i> <i>Sphagnum spp.</i>

**Moss gardens:** *Dicranella heteromalla*, *Dicranum scoparium*, *Hylocomium Splendens* , *Neckera crispa* , *Plagiomnium undulatum*, *Polytrichum commune* are common bryophytes. *polytrichum commune* used in home gardens of poet laureate W. Wordsworth (Ando, 1972)

**Construction:** In moss rich countries they were commonly used in construction purposes. It is used as fillers between wooden posts of walls and shingles of roofs in the Philippines (Tan, 2003). *Fontinalis antipyretica* is used as fire insulation between the chimney and walls in Nordic countries(Thieret, 1956). mosses *Actinotuidium hookeri*, *Anomodon minor*, *Entodon*, *Floribundaria floribunda*, *Leucodon sciuroides*, *Philonotis*, *Thuidium delicatulum*, *Plagiochila* and *Scapania* were used as chinking in temporary summer homes by shepherds of Indian Himalaya ( Pant & Tewari 1989). *Rhytidiadelphus triquetrus* are popular as green carpets for floral exhibitions (Thieret 1956)

**Clothing:** *Sphagnum*, *Dicranum scoparium* mosses were popular for diaper lining .Michigan’s Chippewa Indians used them for keeping babies clean and warm (Crum, 1973). Native of Philippines use mosses to decorate headware and clothing (Tan, 2003). Womens of Kumaun regions use *Hylocomium*, *Hypnum*, *Trachypodopsis* stuff mosses into cloth sacks to make head cushions(sirona) to absorb water leakage (Pant and Tewari ,1989).

**Household goods and furnishings:** The durability and elasticity of *Hypnum* moss is used in stuffing balls and dolls in Japan (Pant and Tewari, 1990). Smoke filters , door covers were made of mosses in India (Pant 1989). Pharki , a kind of door were made with mosses and bamboo in Himalayas (Glime and Saxena, 1991). Brooms of *Polytrichum long* , stiff stems were used as duster of carpets and curtains (Crum, 1973). Cracks of boats and canoes were sealed by *Eurhynchium striatum* and *Neckera complanata* (Pant and Tewari, 1990).

*Hypnum plumaeforme*, *Thuidium kanedae* were used to stop a leakage from log dam in timber harvest operation in Japan (Ando 1957). *Hylocomium splendens* were used to make roses (Thieret 1956). *Dicranum scoparium* and *Climacium americanum* is popular for shop window and to make wreaths and crosses. *Hylocomium splendens*, *Rhytidiadelphus loreus* and moss and ash mixture were used to clean household utensils (Pant, 1989).

**Packing:** Mosses were used by Himalayans as insect repellents in stored food. They were dried , powdered and sprinkled over grains (Pant and Tewari, 1989). *Brachythecium salebrosum* , *Hypnum cupressiforme*, *Neckera crenulata*, *Thuidium tamariscellum* and *Sphagnum* were used to wrap apples and plums in the Himalayas(Pant and Tewari, 1989).

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