

Group Name: BRYOLOGY

Bryology laboratory at CSIR-NBRI is the only centre of Bryological researches in India among the CSIR Laboratories which works for assessment of Bryophyte resources in India and their conservation strategy. It looks forward to train the postgraduate students, researchers & young scientists and capacity building in the field of Bryology.

Group works on:

- Assessment of bryodiversity in India
- Floristics, monograph and revision of Hepatics, Anthocerotales & Mosses
- Ultrastructure studies on Bryophytes
- Conservation and reproductive biology of Bryophytes
- Heavy metal accumulation in Bryophytes
- Antimicrobial activities of Bryophytes

Objectives:

- To explore and assess the diversity of Indian Bryophytes and preparation of an account of Bryophyte resources of India.
- Enrichment of CSIR-N.B.R.I., Herbarium, Lucknow (LWG) represented by bryophytes from various Bio-geographical regions of India.
- To explore the economic & medicinal importance of Indian Bryophytes for Human Welfare.
- To standardize the protocol for *in vitro* propagation and multiplication of RET and potential Bryophytes.
- Introduction, acclimatization and maintenance of living germplasm of significant bryophytes in Moss House at Botanic Garden for educative purpose and general awareness of people.

Achievements:

Up to 11th Five year Plan

New species: *Phaeoceros udarii*, *Orontobryum darjeelingensis*, *Frullania udarii*, *Lopholejeunea nongstoinii*, *Calypogeia khasiana*, *Drepanolejeunea mawtmiana*, *Jungermannia (Solenostoma) amakawana*, *Jungermannia (Solenostoma) erectii*, *Jungermannia (Solenostoma) mairangii*, *Sphenolobus langkyrdumii*, *Drepanolejeunea longifolia*, *Trocholejeunea meghalayensis*. Apart from this a number of taxa have been identified as new records to India and new reports to different bryogeographical regions of country.

Floristic studies carried out

- Meghalaya (North- eastern hills), eastern Himalaya
- Manipur, (North-eastern hills), eastern Himalaya

- Darjeeling, eastern Himalaya
- Singalila National Park, eastern Himalaya
- Garhwal hills, western Himalaya
- Jim Corbett National Park, western Himalaya
- Valley of Flowers, western Himalaya
- Achanakmar & Amarkantak Biosphere Reserve, central India
- Pachmarhi Biosphere Reserve, central India
- Kanha National park, central India
- Tamia & Patakot valley, central India
- Bhimbetka world heritage site, central India

Monographic and revisionary studies:

- Indian Ricciaceae
- Indian *Marchantia*
- Indian Frullaniaceae (now Jubulaceae)
- Indian hornworts (Anthocerotae)

Digitization of Bryophytes

As a part of database development of Bryophytes, digitization of 500 liverworts belonging to 27 families have been carried out and completed with morphological and anatomical features, distribution, range, threat status etc. of each species.

Ultrastructure studies carried out on sporoderm: Rare and interesting Indian liverworts viz., *Petalophyllum indicum*, *Schiffneria hyalina*, *Sauteria spongiosa*, *Cryptomitrium himalayense* and *Anthoceros alpinus*; Indian mosses viz. *Atrichum pallidum*, *A. flavisetum*, *Pogonatum himalayanum*, *Bartramia pomiformis*, *Brachymenium indicum*, *Entodon rubicundus*, *Thuidium minusculum*, *Brachythecium buchananii* var. *cuspidiferum*, *Anoetangium strachyanum*, *Funaria hygrometrica*.

Studies on Heavy metal accumulation:

A critical study has been carried out on heavy metal accumulation in selected bryophytes at Mussoorie (Garhwal), Nainital (Kumaun) and Lucknow in order to monitor the environmental pollution caused by these metals and their effect on growth of these plants.

Antimicrobial activity of Bryophytes:

Several liverworts and mosses have been tested and found to possess antimicrobial activity against fungal and bacterial pathogens. Scientific validation of wound healing property of *P. appendiculatum* has been done with the help of Laboratory experiments at Pharmacognosy laboratory.

Moss House

A Moss House has been developed at the Institute, which is a repository of living germplasm of Bryophytes brought from various places of country. It is equipped with water fogging and

micro-irrigation system to provide a suitable cool and moist climate for the growth of bryophytes. It is first of its kind in India. At present it possesses about twenty taxa, these plants exhibit different growth forms which is very significant for educative purpose to students as well as for general public. Introduction, multiplication and acclimatization of living germplasm of bryophytes are the wide objectives for the development of this house which facilitates the conservation of RET and potential taxa, besides availability of living germplasm for experimental research aspects.

Conservation and reproductive biology

In vitro and reproductive biology studies have been carried out on liverworts viz., *Targionia hypophylla*, *Lunularia cruciata*, *Asterella wallichiana*, *Reboulia hemispherica*, *Riccia billardieri* and *Marchantia papillata* ssp *grossibarba*, hornworts viz., *Anthoceros bharadwajii*, *Phaeoceros carolinianus*, mosses viz., *Funaria hygrometrica*, *Brachymerium capitulatum*, *Atrichum undulatum* var. *gracilisetum*, *Pogonatum microstomum*, *Physcomitrium eurystomum*, *Bartramia leptodonta*, *Ditrichum tortuloides*, *Bryoerythrophyllum recurvirostrum* and *Entodon laetus* etc. including endemic and threatened liverwort *Cryptomitrium himalayense*.

Desiccation tolerance study

Desiccation tolerance study has been carried on some liverworts and mosses and one moss belonging to family Pottiaceae was identified as efficient to withstand desiccation stress. Investigations have also been carried out on physiological response of selected taxa in desiccated and rehydrated state using different parameters: Maximum quantum yield of PSII (Fv/Fm), Water potential, Light saturation point, Fluorescence yield, Non-photochemical quenching, Photochemical quenching etc. with Physiology group.

Projects Completed

Sponsored by outside agencies

- Department of Science & Technology sponsored Project "Diversity and Distribution of Hepaticae and Anthocerotae (Bryophyta)" in N.E. hills in Meghalaya.
- Council of Science & Technology, U.P. sponsored Project "Ecological and Floristic studies on liverworts (Bryophyta)" of Garhwal hills, U.P.
- Department of Biotechnology sponsored Project "Biosystematic and conservation studies on a potential liverwort: *Plagiochasma appendiculatum* L. et L."
- Ministry of Environment & Forests sponsored Project "Studies on the biological resource & documentation of traditional knowledge on Amarkantak biosphere reserve, Madhya Pradesh and Chhattisgarh".
- Ministry of Environment & Forests sponsored project entitled "Studies on the bryophyte diversity in Pachmarhi Biosphere Reserve and their conservation strategies".
- Ministry of Environment & Forests sponsored project entitled "Bryodiversity in Meghalaya and Manipur (North-eastern hills).

NBRI In House Projects

- Floristic survey, assessment and documentation of biodiversity of Cryptogams of the Indian region
- CSIR Network Programme on Pollution monitoring mitigation systems and devices: Pollutant (metal) specific bioindicators (plants).

In 12th Five year Plan:

Milestones (2012-2017)

- Bryophyte resource mapping of Govind Wildlife Sanctuary (Garhwal), Uttarakhand
- Taxonomic studies and assessment of plant diversity of Bryophytes, in the Upper Gangetic Plains (UGP) region of Uttar Pradesh.
- Reproductive biology, ex-situ conservation and mass multiplication of some RET & economically important plant species. Digitization of plant diversity information in the UGP.
- Bryophyte Diversity in Eastern Ghats.
- Development and Organization of CSIR - NBRI Herbarium (National Facility).
- Introduction and maintenance of living germplasm of bryophytes in Moss House.

Achievements (up to March, 2013)

- Exploration and field survey of the various localities of Govind Wild Life Sanctuary has been done, a wide range of liverworts, mosses and hornworts have been identified which revealed some new additions of taxa to the west Himalayan bryoflora.
- *In vitro* propagation of *Anomobryum filiformae* var. *concinatum*, *Bryum coronatum*, *Erthrodontium julaceum*, *Philonotis thwaitesii*, *Brachythecium plumosum* and *Plagiochasma appendiculatum* has been carried out

Ongoing projects

- CSIR XIIth FYP Project: Bio-prospection of plant resources and other natural products

In house projects

- Taxonomic studies and digitization of plant diversity of India
- Digitization and Organization of CSIR - NBRI Herbarium (National Facility)

Forthcoming Sponsored projects by outside agencies

- Department of Science & Technology sponsored Project “Studies on morphogenesis, reproductive biology and *ex situ* conservation of some endangered, threatened and potential bryophytes”
- Ministry of Environment & Forests sponsored Project “Assessment of Bryophytes’ diversity in Eastern Ghats”.

Foreign Collaborations:

Areas open for collaboration:

Publications:

Research Papers – 135

Book- 1; Books (edited) - 2

Review articles- 2

Chapter in Book- 1

Popular articles - 12

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