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THE BRYOPHYTES OF RAJASTHAN

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ABSTRACT: Rajasthan is the second largest state of India, located between the latitude 23° 3' N to 30° 12' N and longitudes 69° 30' E to 78° 17' E spread over an area of 3, 42,274 sq. km. The climate of Rajasthan shows great variations in changes of temperature precipitation, humidity and wind conditions. The diurnal fluctuation in temperature is the most important characteristic feature of the climate of this state. The northwestern part of the soil lacks vegetation or vegetation with important ecological adaptations. The change of temperature from day to night is sudden and very high i.e. 3.40 C to 200 C in January and 300 C to 50 C in May and June. This climatic condition is extremely unsatisfactory for the vegetation in general and bryophytes in particular. The xerothermic index of Rajasthan does not afford much attention on the bryophytes. Legris and Viart (1959), recorded very useful information on the xerothermic of this state. However Bapna (1962, 1975, 1980) Deora and Chaudhary (1995, 1996) Chaudhary and Deora (1996, 2001) made a good contribution to study the bryophytes of this region. Bapna and Vyas (1962) studied preliminary accounts of hepataceae of Mt. Abu with their ecological aspects. Mahabale and Kharadi (1946) while describing the ecological features of the vegetation of Mt. Abu mentioned some liverwort species but overall a comprehensive study of this state particularly to bryophytes ecology, phytogeography and perennation in drought condition is an important area. On the basis of compilation of earlier reports and results of fresh exploration, the present work provides a list of 113 bryophyte taxa from Mount Abu, Rajasthan including 24 taxa as new to the Mount Abu area. Out of these, 14 are new records to Rajasthan state, while 07 taxa are new to Central Indian bryo-geographical region.

KEYWORDS-Rajasthan, bryophytes, vegetation, ecology, climate, drought

I. INTRODUCTION

Mount Abu is an ignored mountain range to some extent by Indian bryologists. Very little information is available regarding bryoflora of this mountain range. In present study an attempt has been made to provide an updated checklist of moss flora of the region. The study is based on previous as well as newly collected moss taxa from the region. The new addition to the region include *Anoetangium clarum*, *Brachymenium indicum*, *Bryum uliginosum*, *Entodon plicatus*, *Entodon concinnus*, *Fissidens sylvaticus* var. *taraicola*, *Fissidens sylvaticus* var. *auriculatus*, *Hyophila spathulata*, *Plagiothecium cavifolium* and *Stereophyllum tavoyense*.

Riccia robusta The gametophyte is the dominant phase of bryophytes; Therefore, the main plant body (the thallus) of *Riccia robusta* represents a well developed gametophytic phase [1,2,3]

Funeria hygrometrica The adult gametophytic plants are short about 1-3 cm, high, and green and branched. The plant body consists of a small erect axis (stem) surrounded by spirally arranged leaves and numerous rhizoids at its base. The presence of bryophyte in this desert region is very important for soil fertility and to maintain ecosystem stability. The Western part of India particularly Rajasthan is one of the country's most overlooked bryological region due to its harsh environmental condition. But being a desert it also has certain localities which are instrumental in nurturing these amphibians of plant kingdom. The present study is an effort to explore the region and provide consolidated account of bryo-diversity which will fill the existing lacuna in bryological research. A revised list has been prepared incorporating the new findings. This list includes 27 species belonging to 13 genera distributed to 8 families. The thalloid taxa are predominant with Ricciaceae having 9 taxa followed by Aytoniaceae and Pottiaceae (4 taxa), Anthocerotaceae and Cythodiaceae having 2 taxa each and Targionaceae, Marchantiaceae and Fossombroniaceae with one taxon each. The maximum similarities in bryo-diversity is with Central India followed by Western Himalaya and then Eastern Himalayas and least with south India. [4,5,6] The present communication provides 24 recognized taxa excluding some earlier dubious reports having no specific epithet or without complete details, in addition it also provides an updated enumeration of the bryophyte taxa from Ranthambhore Tiger Reserve and its environs with a hope that further explorations may prove to be highly worthwhile in our understanding of the bryodiversity of the region [7,8,9]

II. DISCUSSION

The western part of Rajasthan comprising nearly 60% of the total area of this state is mostly sandy and 200-400 meters above MSL. The area today comprises the modern administrative districts of Bikaner, Barmer, Ganganagar, Jaisalmer, Jhunjhunu, Jaipur, Jodhpur, Churu, Pali and Sikar. Due to low rainfall and high temperature the vegetation is very poor, represented mainly by xeric forms.[10,11,12] This well defined region is practically devoid of bryophyte vegetation which occurs on most sand dunes of near water sources during the rainy season. This area remain dry for a long period and among this exceptionally few species growing near water reservoirs' are *Riccia discolor*, *R.tuberculata*; *Marchantia polymorpha*, *Plagiochasma appendiculata*; *Funaria hygrometrica*, *Hyophila involuta* and *Brachymenium exile* etc.

The Plateau Region

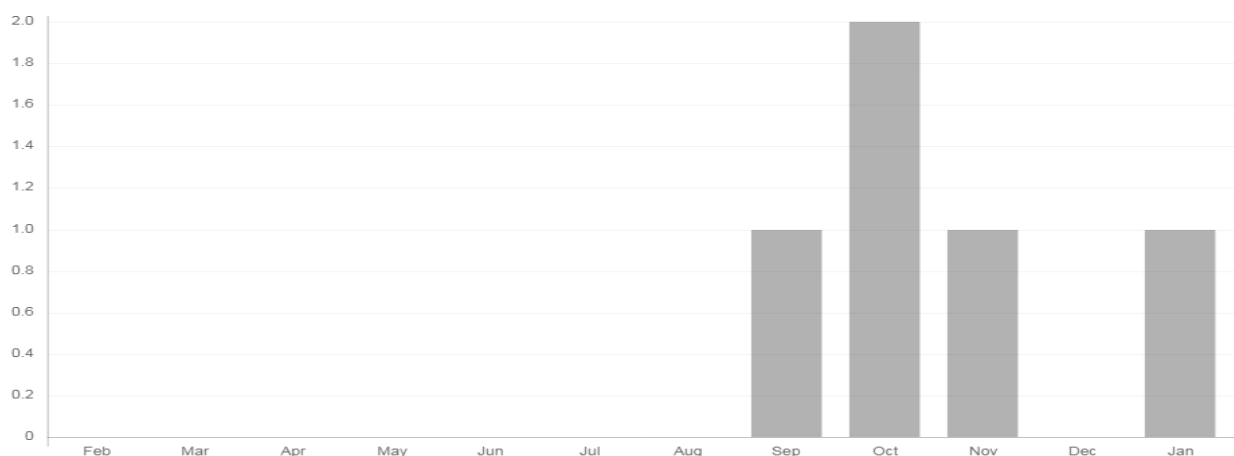
This area extends around Aravalli ranges and is about 257- 486 meters above MSL. The is region contrast with the arid and semi arid areas, the soil in the valleys being frequently black; loam, alluvium, and comparatively more fertile. The districts of Beawar, Ajmer, Jaipur, Alwar, Sawai Madhopur, Bhilwara, Chittorgarh, and Kota are situated within this region. The area consists of dissected broadly hilly belts. Numerous outlying hills and mounts, 400 meters to 800 meters high are found with wide valleys. Here a few species of liverworts and mosses are found in crevices of rocks or on moist soil or in humid areas. A few common species are *Riccia discolor*, *R.plana*, *R.crystallina*; *Plagiochasma appendiculata*, *Fissidens sylvaticus*, *Semibarbula orientalis*, *Hyophila involuia* and *Gymnostomiella vernicosa* etc[13]

Southern Region

This region may be described as a fairly well defined zone which is dominated by the Aravalli ranges. There are a series of hills (600 to 1201. M.alt) intersected by many small streams that cut deep valleys. This region includes mainly Mt. Abu, Sirohi, Kumbhalgarh, Dungarpur, Parasramji, Udaipur, and Banswara. The area is botanically the most important part of the Rajasthan, here the climate is more humid and environmental conditions are quite favorable for the growth of natural vegetation. The soil was collected from various localities where the bryophytes grow. It was found to be calcareous in texture and rich in calcium carbonate, potassium, phosphates and nitrates were also present and well suited for the normal growth of bryophytes. Soil watercontent at ordinary temperature varied from 22% to 30%. Most of the part of this region is covered with forest. Many plants uncommon in adjoining areas are found here. High humidity and low temperature favour the growth of bryophytes. Besides the rich angiosperm flora important liverworts and mosses of this zone are *Fossombronia himalayensis*, *Pellia epiphylla*, *Asteralla blumeana*; *A angusta*; *Plagiochasma appendiculata*, *P. articulata*, *Targionea hypophijilla*, *Cyathodium barodae*, *C.tuberosum*; *Riccia melanospora*, *R. discolor*, *R.aravalliensis*, *R.gangetica*, *R.plana*, *R.fluitans*, *R.crystallina*, *R.frosti*, *Anthoceros erectus*, *A.subtilis*, *Phaeoceros himalayensis*, *Notothylus indica*, *Notothylus levieri* etc. Common mosses are *Bryum dichotomum*, *B.recurulum*, *Timmia anomala*, *Mnium species*, *Entodon prorepens*, *E.myrus*, *Fissidens diversifolius*, *F.sylvaticus*, *Funaria hygrometrica*, *F.nutans* *Gymnostomiella vernicosa*, *Philonotis mollis*, *anomobryum auratum*, *Fabronia minuta*, *Dlaphnodon procumbence* and *Wijkia tanytricha* etc[14,15,16]

III. RESULTS

The bryophyte flora of Rajasthan particularly of the Southern area is composed mainly of ubiquitous species which occur in the East, North West and South.



Bryophyte number of species according to different climatic periods in Rajasthan

This may be due to the disposition of the Aravalli ranges, many species growing in this area are common to North as well as South and thus from a connecting link between the Northern and Southern elements. Rajasthan remains dry for a considerable part of the year. Most of the species appear just after the first showers of rains and complete their life cycle within a short period of one to three months. Most of the species get dried up before completing their life cycle due to high temperature and low rainfall. [17]The species found in arid and semi-arid regions or in the plains of Rajasthan are annuals and depend entirely on the spores for propagation and survival as the temperature during summer is quite high and plants get completely dried up. It was observed that on the approach of favorable conditions, the plant parts e.g. stem, rhizoids and leaves revive their growth with the first showers of rain and multiply through regeneration. Each plant part is giving one or more apical shoots while the older portion dies. In plants growing under xeric condition after a few days of drought, the leaves become enrolled and scattered on the soil or on the rocks along with their stem portions. Such plants readily revive and resume their growth after a shower of rain (in any season). It was observed that sterile plants were in great abundance as compared to fertile one. In species like *Physomitrium japonicum* underground gemmae are formed for perennation during unfavorable period. These develop on the rhizoids and are red in colour. During the unfavourable conditions, the parent plant dies but gemmae remain in the resting stage throughout the seasons, In favourable conditions, new gametophyte sprout from these resting gemmae However, no underground gemmae have been observed in other species of mosses. Gemmae formation has also been observed in *Semibarbula orientalis* and *Hyophila rosea*. In *Semibarbula orientalis* gemmae develop on the apex of shoot and in axil of leaves of middle portion of stem but in *Hyophila rosea* these multicellular vegetative bodies occur only in axil of leaves. During the unfavorable conditions plants completely get dried and these gemmae were scattered on the substratum. In favorable conditions these gemmae revive and give rise to new moss plant[18]

IV. CONCLUSION

- *Bryophytes are of great ecological importance.* They usually grow densely and hence act as soil binders. Such vegetation checks soil erosion.

- Liverworts and mosses, growing on rocks, add organic matter to the substratum after their death. Thus, these plants have an important role in ecological succession.

Other Uses

Medicinal Uses:

- *Marchantia polymorpha* has been used to cure pulmonary tuberculosis.
- The decoction prepared by boiling dried *Sphagnum* in water is used in the treatment of hemorrhage and eye diseases.
- Tea prepared from *Polytrichum commune* is used to dissolve kidney and gall bladder stones.
- Antibiotic properties: Certain bryophytes possess antibiotic properties and can be used to extract number of antibiotic substances.
- Water retention: *Sphagnum* retains 18-26 times more water than its weight. Therefore, moist *Sphagnum* is used by gardeners and horticulturists to prevent desiccation of seedlings, cut plants, vegetables fruits, bulbs, tubers, etc. during transport and keeping for propagation. It can also function as absorbent cotton.
- Food: Mosses constitute food of many small animals. Some birds (e.g., Grouse Chicken) feed on capsule of *Bryum* and *Polytrichum*.
- Indicator plants: Some of the bryophytes grow in specialized areas and, therefore, used as indicator plants. *Leucobryum glaucum*, *Polytrichum* and *Rhacomitrium* indicate the acidity of soil. *Tortell tortusa* and *Nickera crispa* grow well on soils rich in lime or other bases and occur as calcicoles.

Environmental

- Soil Conditioning
- Bioindicators
- Moss gardens

- Pesticides

Characteristics of bryophytes make them useful to the environment. Depending on the specific plant texture, bryophytes have been shown to help improve the water retention and air space within soil.^[48] Bryophytes are used in pollution studies to indicate soil pollution (such as the presence of heavy metals), air pollution, and UV-B radiation.^[48] Gardens are designed with moss to create peaceful sanctuaries. Some bryophytes have been found to produce natural pesticides. The liverwort, *Plagiochila*, produces a chemical that is poisonous to mice. Other bryophytes produce chemicals that are antifeedants which protect them from being eaten by slugs. When *Phytilium sphagnum* is sprinkled on the soil of germinating seeds, it inhibits growth of "damping off fungus" which would otherwise kill young seedlings^[19].

Commercial

- Fuel
- Packaging
- Wound Dressing

Peat is a fuel produced from dried bryophytes, typically *Sphagnum*. Bryophytes' antibiotic properties and ability to retain water make them a useful packaging material for vegetables, flowers, and bulbs. Also, because of its antibiotic properties, *Sphagnum* was used as a surgical dressing ^[20]

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