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Present Status of Genus *Bryum* Hedw., (Bryophyta) in Rajasthan, India

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ABSTRACT

The present study attempts with the objective to provide the current status of the bryophyte genus *Bryum* Hedw., in Rajasthan. A total of 15 taxa of *Bryum* belonging to Bryophyta have been investigated from various localities of Rajasthan, among these *B. pseudotriquetrum* var. *subrotundum* and *B. thomsonii* are new additions to the bryoflora of this state. It is observed that terricolous and saxicolous forms are the most dominant in the area.

1) INTRODUCTION

India, with very significant topographical variations harbours luxuriant and diversified bryophytic vegetation, but the floristic study of mosses in Indian subcontinent has received little attention throughout the past. This group forms the largest group of land plants in terms of species, after the angiosperms. Moss flora of Indian subcontinent is not fully and thoroughly explored. A few treatise [1-5] are available in the subject in form of comprehensive manuals.

Rajasthan is the second largest state in India which stretches between $23^0$3' N to $30^0$12' N latitudes and $69^0$30' E to $78^0$17' E longitudes with an area of 3,42,274 sq. km. It is bordered by Pakistan in the west and north-west, Punjab and Haryana in the north, Uttar Pradesh in the north-east and Madhya Pradesh in the east and south-east. The geology of Rajasthan is highly varied, complex and remarkable continuous geological sequence of Precambrian rocks which go far down towards the Archean base and form the Aravalli mountain system, which runs across the state from the north of Delhi in the north-east to the Gulf of Cambay in the south-west. This state has a tropical desert climate and consist a wide range of climate varying from extremely arid to humid zone. To the west of the Aravallis, the most characteristic feature of Rajasthan is low rainfall, extremely diurnal fluctuations in temperature, low humidity and high velocity winds. In the east of the Aravallis, the climate is semi-arid to sub-humid and characterized by lower wind velocity, higher humidity and better rainfall.

The study on the flora of Rajasthan has for a long time, focused on vascular plants [6-14], with few studied being undertaken on liverworts [15-18] and mosses [19-24].

Bryum Hedw., is a highly diversified genus inhabiting all climatc zones from plains to the higher altitudes of the Himalayas. The high variability in their forms at times possess problem in ascertaining the identity of species. The genus has a reputation as one of the systematically most difficult genera of mosses. As traditionally understood, the genus *Bryum* is widely distributed in tropical and subtropical regions of the world and also represented in India. However, there is only few record of this genus from Rajasthan in earlier works are available. Six species of *Bryum* namely, *B. argenteum*, *B. capillare*, *B. cellulare*, *B. paradoxum*, *B. plumosum* and *B. recurvulum* are reported from different parts of Mount Abu [21-22, 25]. During a tour of Rajasthan, bryophytes were collected extensively from the desert of Rajasthan and *B. argenteum*, *B. rubens* were reported from Gogunda (Udaipur district), *B. coronatum*, *B. dunense* from Kumbhalgarh (Rajsamand district), *B. bicolor* from Samode Bagh (Jaipur district), *B. bornholmense* from Gajner Palace (Bikaner district) and *B. dunense* and *B. bornholmense* were treated as new to Asia, whereas *B. klinggraeffii* Schimp. were collected from various localities of Jaipur, Bikaner, Udaipur and Alwar and reported for the first time from India [26]. *B. dunense* and *B. uliginosum* were reported from Mount Abu for the first time [27-28].

In checklist of Indian mosses *B. argenteum*, *B. bicolor*, *B. bornholmense*, *B. coronatum*, *B. klinggraeffii* were listed from Rajasthan [29], whereas *B. capillare* from Mount Abu and *B. coronatum* from Rajasthan [30].

The main objective of the present study is to enumerate the genus with their range of distribution in Rajasthan, based on herbarium specimens and literature available so far (**Fig. 1 and Table 1**).

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Table 1: *Bryum* taxa occurring in various localities of Rajasthan

S. No.	*Bryum* taxa	Alwar	Bikaner	Jaipur	Kumbhalgarh	Mount Abu	Udaipur
1.	*B. apiculatum*	-	-	-	+	+	-
2.	*B. argenteum*	-	-	-	+	+	+
3.	*B. bornholmense*	-	+	-	-	-	-
4.	*B. capillare*	-	-	-	-	+	-
5.	*B. cellulare*	-	-	-	-	+	-
6.	*B. coronatum*	-	-	-	+	-	-
7.	*B. dichotomum*	-	-	+	-	-	-
8.	*B. dunense*	-	-	-	+	+	-
9.	*B. klinggraeffii*	+	+	+	-	-	+
10.	*B. paradoxum*	-	-	-	-	+	-
11.	**B. pseudotriquetrum* var. *subrotundum*	-	-	-	-	+	-
12.	*B. recurvulum*	-	-	-	-	+	-
13.	*B. rubens*	-	-	-	-	-	+
14.	**B. thomsonii*	-	-	-	-	+	-
15.	*B. uliginosum*	-	-	-	-	+	-
Total		1	2	2	4	10	3

* = New record for Rajasthan

Fig. 1. Map showing distribution of genus *Bryum* Hedw. in Rajasthan



1. *B. apiculatum* Schwaegr.
2. *B. argenteum* Hedw.
3. *B. bornholmense* Wink. & Ruthe
4. *B. capillare* Hedw.
5. *B. cellulare* Hook.
6. *B. coronatum* Schwaegr.
7. *B. dichotomum* Hedw.
8. *B. dunense* Smith *et* Whitehouse
9. *B. klinggraeffii* Schimp.
10. *B. paradoxum* Schwaegr.
11. *B. pseudotriquetrum* var. *subrotundum* (Brid.) Gangulee
12. *B. recurvulum* Mitt.
13. *B. rubens* Mitt.
14. *B. thomsonii* Mitt.
15. *B. uliginosum* (Brid.) Bruch, Schimper & W. Gümbel

2) MATERIALS AND METHODS

The study is based on the specimens available at the Bryophyte Herbarium of the CSIR-National Botanical Research Institute, Lucknow (LWG) earlier collected from various localities of Mount Abu (2006) and specimens of *B. argenteum, B. bornholmense, B. coronatum, B. dichotomum, B. dunense, B. klinggraeffii* and *B. rubens*, borrowed from private herbarium of Dr. R.C. Stern (RCS).

3) FLORISTIC LIST

1. *Bryum apiculatum* Schwaegr., Sp. Musc. Frond., Suppl. 1(2): 102. f. 72. 1816.
Ecology: Saxicolous and terricolous.
Rajasthan: Kumbhalgarh Wildlife Sanctuary; Mount Abu-Sunset point area, Traver tal.
Specimens examined: Mount Abu, near Dilwara Temples, alt. *ca* 1125 m, 12.10.2006, Leg.: *V. Nath* and *party* 229259, 229260, 229276 (LWG).
2. *Bryum argenteum* Hedw., Sp. Musc. Frond. 181. 1801.
Ecology: Saxicolous.
Rajasthan: Kumbhalgarh, Mount Abu-on way to Traver tal, Sunset point area; Udaipur.
Specimen examined: N.W. of Udaipur district, Gogunda, alt. *ca* 1000 m, 21.02.1999, Leg.: *R.C. Stern* (RCS).
3. *Bryum bornholmense* Wink. & Ruthe, Hedwigia 38 (Beibl. 3): 120. 1899.
Ecology: Terricolous.
Rajasthan: Bikaner, Gajner Palace.
Specimen examined: Near Bikaner, Gajner Palace, alt. *ca* 242 m, 14.02.1999, Leg.: *R.C. Stern*, Conf.: *A.C. Crundwell* and *H.L.K. Whitehouse* (RCS).
4. *Bryum capillare* Hedw., Sp. Musc. Frond., 182. 1801
Ecology: Saxicolous, terricolous and corticolous. Plants are found growing in association with *Fissidens sylvaticus* Griff., *Entodon* sp. and *Hyophila involuta* (Hook.) Jaeg.
Rajasthan: Mount Abu-near Nakki lake, Sunset point area.
Specimens examined: Mount Abu, near Dilwara temples, alt. *ca* 1125 m, 12.10.2006, Leg.: *V. Nath* and *party* 229263, 229269 (LWG); Guru Shikhar, alt. *ca* 1277 m, 12.10.2006, Leg.: *V. Nath* and *party* 229280, 229283B, 229284, 229285, 229287, 229288, 229289C (LWG); Shri Raghunath Rai Inn., alt. *ca* 912 m, 12.10.2006, Leg.: *V. Nath* and *party* 229295B (LWG).
5. *Bryum cellulare* Hook. *in* Schwaegr. Sp. Musc. Frond., Suppl. 3(1): 214. 1827.
Ecology: Saxicolus and terricolous, growing in association with *Hyophila involuta* (Hook.) Jaeg., *Fissidens sylvaticus* Griff., *Plagiochasma articulatum* Kash., *Semibarbula orientalis* (Web.) Wijk & Marg and *Anthoceros bharadwajii* Udar & A.K. Asthana.
Rajasthan: Mount Abu - Achalgarh, Sunset point area.
Specimens examined: Mount Abu, near Dilwara temples, alt. *ca* 1125 m, 12.10.2006, Leg.: *V. Nath* and *party* 229273, 229274C, 229278B (LWG).
6. *Bryum coronatum* Schwaegr., Sp. Musc. Frond., Suppl. 1(2): 103. pl. 71. 1816.
Ecology: Saxicolous, plants growing in association with small Barbuloid moss.
Rajasthan: Kumbhalgarh.
Specimen examined: Kumbhalgarh, Rajasthan, alt. 1100 m, 22.02.1999, Leg.: *R.C. Stern* (RCS).
7. *Bryum dichotomum* Hedw., Sp. Musc. Frond. 183. 1801.
Ecology: Terricolous.
Rajasthan: Jaipur.
Specimen examined: N. of Jaipur, Samode Bagh, Samode, 03.03.1999, Leg.: *R.C. Stern* (RCS).
8. *Bryum dunense* Smith & Whitehouse, J. Bryol. 10: 41. 1978.
Ecology: Saxicolous and terricolous, growing in association with *Bryum apiculatum* Schwaegr.
Rajasthan: Kumbhalgarh, Mount Abu.
Specimens examined: Mount Abu, near Dilwara temples, alt. *ca* 1121 m, 12.10.2006, Leg.: *V. Nath* and *party* 229260B (LWG); Kumbhalgarh district, alt. *ca* 1100 m, 22.02.1999, Leg.: *R.C. Stern*, Conf.: *A.J.E. Smith* and *H.L.K. Whitehouse* (RCS).
9. *Bryum klinggraeffii* Schimp. *in* Klinggr., Höh. Crypt. Preuss. 81. 1858.
Ecology: Terricolous.
Rajasthan: Alwar-Sariska; Bikaner-Gajner Palace; Jaipur-Samode Bagh; Udaipur-Sahelion ki Bari.
Specimen examined: Udaipur Dist., alt. *ca* 570 m, 25.02.1999, Leg.: *R.C. Stern*, Conf.: *A.C. Crundwell*, 6/99 (RCS).
10. *Bryum paradoxum* Schwaegr., Sp. Musc. Frond., Suppl. 3, 1(1): 224a. 1827.
Rajasthan: Mount Abu - near Nakki Lake, way to Traver tal.
11. *Bryum pseudotriquetrum* var. *subrotundum* (Brid.) Gangulee, Mosses E. India, 4: 994. 1974.
Ecology: Saxicolous.
Rajasthan: Mount Abu.
Specimen examined: Mount Abu, near Dilwara Temples, alt. *ca* 1125 m, 12.10.2006, Leg.: *V. Nath* and *party* 229258 (LWG).
12. *Bryum recurvulum* Mitt., J. Proc. Linn. Soc., Bot., Suppl. 1: 74. 1859.
Rajasthan: Mount Abu - near Nakki lake, Traver tal.
13. *Bryum rubens* Mitt., Hooker's J. Bot. Kew Gard. Misc. 8: 232. 1856.
Ecology: Terricolous.
Rajasthan: Udaipur.
Specimen examined: Udaipur Dist., Sahelion Ki Bari, Rajasthan, alt. *ca* 570 m, 25.02.1999, Leg.: *R.C. Stern*, Conf.: *A.C. Crundwell* (RCS 6/99).
14. *Bryum thomsonii* Mitt., Jour. Proc. Linn. Soc., Bot., Suppl. 1: 73. 1859.
Ecology: Saxicolous.
Rajasthan: Mount Abu.
Specimen examined: Mount Abu, near Dilwara temples, alt. *ca* 1125 m, 12.10.2006, Leg.: *V. Nath* and *party*, 229268 (LWG).
15. *Bryum uliginosum* (Brid.) Bruch, Schimper & W. Gümbel *in* Bryol. Eur. 4: 88. 1839.
Rajasthan: Mount Abu.

4) DISCUSSION

Besides several factors, the habitat diversity and the abundance of moss taxa also depends on the substrate features. It has been found that the mosses are adopted to a wide range of habitat. Similarly, in Rajasthan, *B. bornholmense, B. dichotomum, B. klinggraeffii* and *B. rubens* are found to be as terricolous, whereas *B. coronatum, B. pseudotriquetrum* var. *subrotundum* and *B. thomsonii* are saxicolous. *B. argenteum* was found growing on the stone roof of buildings only,

whereas *B. apiculatum, B. cellulare* and *B. dunense* were reported growing on rocks as well as on soil covered rocks. Thus in the present study area, it can be concluded that saxicolous and terricolous (8 species each) are most dominant habitat for *Bryum* species in Rajasthan.

Prior to this, the investigation on altitudinal distribution of above 15 taxa enumerates that 10 species are reported between the altitude 1000-1125 m, while plants of *B. bornholmense* are found at low altitude of 242 m and *B. klinggraeffii, B. rubens* are found at 570 m. Meanwhile, *B. capillare* is the high altitudinal species in the region reported at altitude between 912-1277 m.

The present study provides the current status of genus *Bryum* in Rajasthan with its biogeographic distribution in this state. It can be inferred that Mount Abu harbours maximum number of 10 taxa (66.6%) of the total *Bryum* taxa occur in Rajasthan followed by Kumbhalgarh with 4 taxa (26.6%) and Udaipur with 3 taxa (20%). Bikaner and Jaipur exhibits scarce diversity with only 2 species (13.3%) each, whereas Alwar has poor diversity represented by single species (6.6%).

5) CONCLUSION

The present study revealed that this genus show wide diversity in Mount Abu represented by ten taxa grow on various habitats. Five taxa are saxicolous; four are terricolous; whereas only one species is epiphytic. *B. capillare* shows wide substrate preference as it was found growing on all the three habitats; on soil, rocks and on tree barks. *B. klinggraeffii* is widely distributed species in Rajasthan reported from Alwar, Bikaner, Jaipur and Udaipur followed by *B. argenteum* which is found only in Kumbhalgarh, Mount Abu and Udaipur.

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