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GENUS *PHYSCOMITRIUM* (BRID.) FUERNR (BRYOPHYTA) IN DISTRICT BANSWARA OF SOUTH RAJASTHAN

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Abstract

Bryophytes are the second largest group of land plants after the angiosperms and are generally found in moist and damp habitats. Banswara district is located in southern Rajasthan with an area of 5,037 square kilometers. Due to heavy rainfall (averaging around 1200 mm per annum) with plenty of humidity, it becomes one of the richest spot for the growth of Bryophyte vegetation in Rajasthan. An extensive study on the mosses of District Banswara has revealed the occurrence of 3 taxa of the genus *viz.*, *Physcomitrium cyathicarpum* Mitt., *Physcomitrium eurystomum* Sendtn. and *Physcomitrium japonicum* (Hedw.) Mitt. Present paper provides the current status and morpho-taxonomic details of above mentioned species of *Physcomitrium* in District Banswara of Rajasthan.

Key words : Moss, Tripura Sundari, Banswara, Rajasthan, *Physcomitrium*.

Introduction

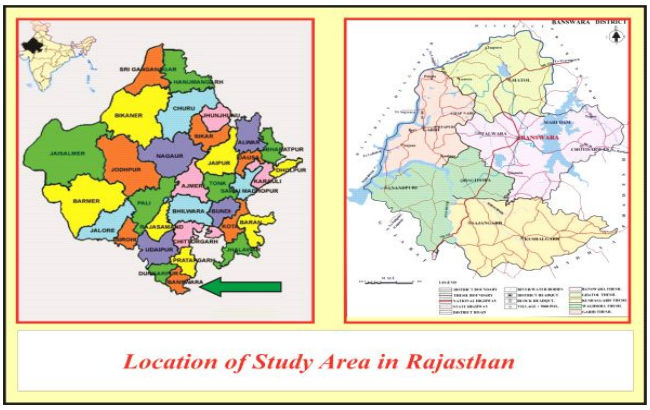
Bryophytes are non-flowering, small miniature cryptogams, without vascular elements, and are very distinct from other land plants. They are the second largest group of land plants after the angiosperms and are generally found in moist and damp habitats. They are positioned between Algae and Pteridophytes, and play a major role in soil management, formation of fertile substrata for other plants, and are an important component of ecosystems. They are divided into three groups, liverworts, hornworts and mosses. Mosses are the largest group among bryophytes and constitute comprise about 13,000 species (Goffinet *et al.*, 2009). They are differentiated from other two groups by the presence of a distinct juvenile gametophytic phase called the protonema stage. The bryophyte diversity in India is represented by 2489 species (Dandotiya *et al.*, 2011) of which includes 1786 species of mosses under 355 genera. The present study is focused on a moss genus *Physcomitrium* which belongs to family Funariaceae. The family Funariaceae comprises 16 genera of short-lived, weedy, soil-inhabiting mosses and has a worldwide distribution (Goffinet *et al.*, 2012). The family is represented by only three genera: *Physcomitrium* (Brid.) Fuernr., *Entosthodon* Schwaegr and *Funaria* Hedw. in India. The *Physcomitrium* has a cosmopolitan distribution with about 80 species distributed over moist and cool regions of the globe (Fife 1985) and eight species in India (Lal 2005). There are three species collected from the study area.

Materials and Methods

Study Area

The study area, Banswara district is located in southern Rajasthan with an area of 5,037 square kilometers (1,945 sq mile) in between 23.11° N to 23.56° N latitudes and 73.58° E to 74.49° E longitudes. The region represents a rugged terrain undulated by short ridges at west. The eastern part of the district is occupied by flat-topped hills of the Deccan trap. The district has the southern end of the Aravali Mountains, the drainage system belongs to the Mahi River and its main tributaries are Anas, Chap, Erav, Hiran and Kagdi. Banswara has plenty of rainfall and on the whole has a salubrious climate. Further, it has a highly varied physiography, from plateau lands to hilly tracts. Due to heavy rainfall (averaging around 1200 mm per annum) with plenty of humidity, it becomes one of the richest spot for the growth

of Angiospermic vegetation in Rajasthan. It includes variety of trees, shrubs, herbs, climbers and grasses. The subtropical evergreen forest of Banswara consists of mixed tree growth with *Tectona grandis* L. f. Nom Cons. as a predominant species followed by *Anogeissus latifolia* (Rxb.ex DC.) Wall.ex Guill & Perr., *Diospyros melanoxylon*L. Roxb., *Madhuca indica* J.F. Gmelin, *Dendrocalamus strictus* (Roxb.) Nees. and *Ficus religiosa* L.



Location of Study Area in Rajasthan

Collection, Laboratory analysis and identification

Extensive and intensive collection of moss plant species were done by visiting various places throughout the Banswara district in the months of July to October and January to February including Madareshwar Hill, Tripura Sundari, Kagdi Right Main Canal, Bai Talab Tank, Bhandariya Hanuman Temple, Peepalkhunt Hilage and Forest Valley. All the specimens were brought to the laboratory in sealed polyethylene bags. Field notes were taken at the time of collection to observe habit, habitat, abundance and ecological conditions. Mosses were dried and stored in well-labelled standard size packets. For morphological and anatomical study plant samples were soaked in water, washed and mounted on glass micro slides in 30% glycerin to investigate under microscope. They were dissected and Camera Lucida drawings were made. For the identification and description of taxa, papers and standard books by Chopra (1975), Gangulee (1969-1980,1985), Chaudhary and Deora (1993), Dabhade (1998), were consulted.

Key to the taxa of genus *Physcomitrium* (Brid.) Fuernr in district Banswara

1. Seta short, capsule immersed, plant sturdy……*P. cyathicarpum*

   Seta long, capsule exserted…..……2

2. Capsule mouth wide, leaves broader lanceolate or spathulate……. *P. eurystomum*

   Capsule mouth narrower, leaves narrower, ovate-lanceolate……..... *P. japonicum*

Taxonomic Description

1. *Physcomitrium cyathicarpum* Mitt. in Musci Ind. Or. 54. 1859

Plants small but sturdy, caespitose often forming wide patches, bright green. Stem short, slender, erect, often branched at base, 4.5 mm. long. Lower leaves smaller, upper ones clustered, erect-spreading (in both dry and wet conditions), oblong obovate, acuminate, margin serrulate above. Costa strong, percurrent in upper leaves, may end below apex in lower small leaves. Basal leaf cells thin-walled, rectangular, up to 180 x 40 µm. Upper cells become narrower and shorter, 90 µm long, becoming hexagonal or rhomboidal at top; border cells not differentiated. Seta slender, short, not exserting the capsule, 0.6 mm. high. Capsule globose, 1 mm. high and 0.8 mm. in diameter, with a lid-like operculum. Operculum apiculate. Calyptra small, not lobed. Exothecial cells hexagonal, thin-walled to collenchymatous. Spores bright red-brown, round or flattened, warty-papillose, 24-28 µm in diameter.

Field notes

Plants grow on wet soil near irrigation canal at Tripura Sundari and moist soil along the sides of Right Main Canal Kagdi.

Distribution

Cosmopolitan

2. *Physcomitrium eurystomum* Sendtn., In Denkschr. Bayer Bot. Ges. Regensburg 3: 142.1841

Scattered to gregarious, small to medium, green plants, 3 to 8 mm. high with leaves. Stem short and slender, 2 to 5 mm. high, simple or branched at base. Leaves clustered above, erectopatent to erecto-spreading, shrunk when dry, soft, and ovate-lanceolate to oblong-lanceolate, acuminate with acute apex, 3.45 x 1 mm; margin flat, dentate in the upper part. Costa strong, 75 µm wide at base, percurrent in the sharp apex or short excurrent. Lamina cells thin-walled, short rectangular, up to 45 x 23 µm at apex, 60 x 17 µm at middle, large rectangular (up to 120 x 32 µm) at base; bordered by one row (becomes double-layered at places) of narrow elongated cells (up to 150 x 12 µm) which causes the serration above and the row is tinted at middle of leaf; cells narrower near border at middle and at base. Seta slender, 4-10 mm long. Capsule short pyriform, with a distinct short apophysis, 1.8 mm. high and 0.9 mm. in diameter. Operculum as wide as capsule top, 0.8 mm. in diameter, conical convex, shortly rostrate, with radiating rows of rectangular cells up to 30 µm long. Spores rounded, deep brown, spinose-

papillose, 25 to 28 µm in diameter.

Field notes

Plants growing on the wet agriculture soil near running water (irrigation canal) and found densely distributed on whole shaded area, in association with *Physcomitrium japonicum* at Tripura Sundari, Peepalkhunt Hilage and Bhanriya hanuman Temple Area.

Distribution

Lower Bengal (Hoogli), Kumaon, North Vietnam, Taiwan, China, Japan, England, France, Central and South Africa.

3. *Physcomitrium japonicum* (Hedw.) Mitt. Trans. Linn. Soc. Bot. London. Ser. 2, 3: 164. 1891.

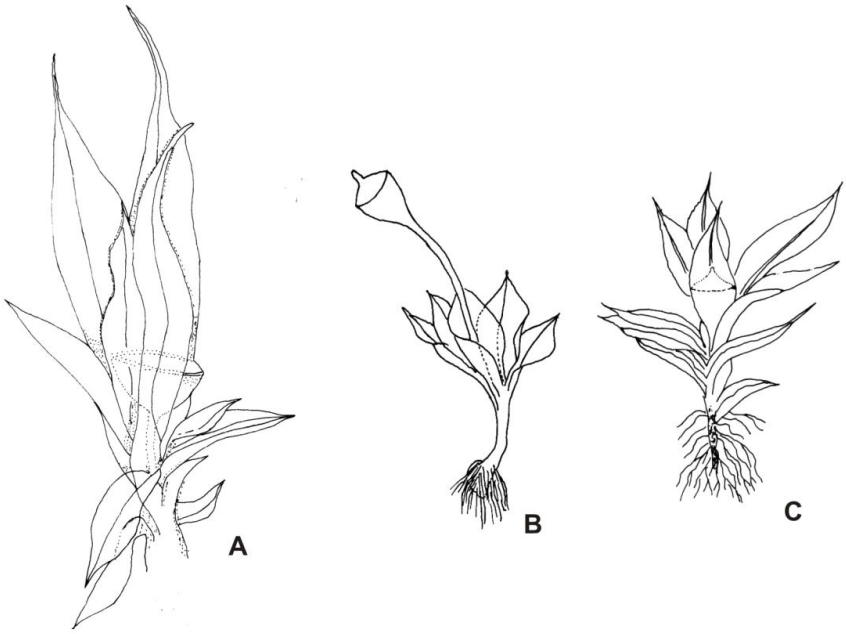
Gregarious, terrestrial, green plants usually about 5 mm high (reported up to a cm or more). Stem simple usually. Leaves clustered on top, erecto-patent (shrunk and appressed to stem when dry), spathulate-lanceolate to oblong-lanceolate, 2.1 x 1 mm. (reported longer), acuminate; margin flat, mildly denticulate on top to almost entire lamina. Costa distinct, percurrent or short excurrent. Lamina cells thin-walled, long rectangular at base (up to 100 x 38 µm), becoming shorter upward, rhomboid-quadrate (45 x 22 µm) at apex, narrower towards margins. Border irregular, usually with a row of narrower cells at top which may be 2 or even 3 rowed below. Seta apical, erect, 5 mm in this specimen but reported to be much longer in other specimen. Capsule short pyriform, 2 mm high and 2 mm diameter with a narrower mouth. Exothecial cells hexagonal with several layers of flattened rectangular cells near rim. Operculum low conical, apiculate. Spores brown, round, papillose, 19 to 22 µm in diameter.

Field notes

Plants found widely distributed in all parts of the study area. It was found growing on wet soil of agriculture land near an irrigation canal at Tripura Sundari, Right Main Canal of Kagdi, Peepalkhunt Forest Area near a Perennial running water body. It was also collected from the surface of rock in Peepakhunt forest.

Distribution

Nainital, Mussoorie, Assam, Sikkim, Rajasthan, Sri Lanka, Myanmar, Pakistan, Korea, Formosa, China and Japan.



A. Physcomitrium cyathicarpum B. Physcomitrium eurystomum C. Physcomitrium japonicum

Results and Discussion

In the present study a total 3 species have been collected from different parts of the study area. All three species were collected with sporophytes. *P. cyathicarpum* is characterized by its immersed and unexposed capsules due to short seta, typical leaf shape. *P. eurystomum* and *P. japonicum* resembles in the length of seta and their exposed capsule t they are distinct in the opening of their capsules. Both are distinct in their leaf shape also. All three species were found in the Terricolous moist soil habitat but *Physcomitrium japonicum* was found in Lithocolous habitat on the surface of moist rocks also. Among the three species described above the most widely distributed species is *Physcomitrium japonicum* while *P. cyathicarpum* show fewer occurrences in the study area. *Physcomitrium japonicum* shows wide distribution in different geographical regions of India *viz.*, Eastern Himalaya, Western Himalaya, Central India, Gangetic Plains and South India, *P. eurystomum* is distributed in Eastern Himalaya and South India and Central India while *P. cyathicarpum* is distributed in Eastern Himalaya and study area only.

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