



Research article

Genus *Brachymerium* Schwägr. (Bryophyta) at Pachmarhi Wildlife Sanctuary (Madhya Pradesh), India

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Abstract: The present work describes the genus *Brachymerium* Schwägr. at Pachmarhi Sanctuary that is a protected unit of Pachmarhi Biosphere Reserve in central India. *Brachymerium* belongs to family Bryaceae which is a dominant family of mosses in India in terms of species diversity as well as their occurrence. Four species of the genus were encountered at the Sanctuary which have been collected from terrestrial habitats. Three species provided in the present study are new additions to the moss flora of central India viz. *B. bryoides* Hooker ex. Schwägr., *B. acuminatum* Harv. and *B. ptychothecium* (Besch.) Ochi. The account provides the current status of the genus at the Pachmarhi Sanctuary.

Keywords: Moss - *Brachymerium* - Central India - New additions.

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INTRODUCTION

Pachmarhi Biosphere Reserve (PBR) situated at Madhya Pradesh (India) is eminent for its bryophyte vegetation with commendable bryophyte species being scattered throughout the region mostly in dense, damp and shady pockets. PBR acquires an expanse of 4987.38 km² and offers a perfect niche to cryptogams of central India. The geological significance of being a Gondwanaland region and connecting link between Himalayan and Western Ghats biodiversity belts further adds to the importance of this conservation unit. The reserve area has three conservation units viz. the Pachmarhi Sanctuary, Bori Sanctuary and Satpura National Park. Presently, the current status of *Brachymerium* Schwägr. at Pachmarhi Sanctuary is being explicated. The Sanctuary occupies an area of approx. 417.78 km² and lies between 22° 11' to 22° 56' N latitudes and 77° 47' to 78° 52' E longitudes. Among the bryophyte flora of Pachmarhi Sanctuary, mosses form a major and dominant part.

Previous workers have listed bryophyte flora of Pachmarhi and neighbouring areas (Kaul 2001, Singh & Kaul 2002, Handoo *et al.* 2009, Sharma & Alam 2011) but only few detailed accounts of genera and family have been provided (Nath & Gupta 2009, Nath *et al.* 2011, 2011a). The urgent need to provide comprehensive illustrated account of the important families and genera at Pachmarhi region is apparent. The dominant families of the reserve area include Bryaceae, Pottiaceae, Dicranaceae and Hypnaceae.

Bryaceae is a prominent family of acrocarpous mosses that is well distributed throughout the world. The family is recognized among bryologists for its substantially divergent morphological characters. Genus *Brachymerium* Schwägr. belongs to family Bryaceae and is represented by nearly 70 species worldwide (Ochi 1992, 1994), while in India 14 species were reported by Gangulee (1974–77) and Lal (2005) and most recently Dandotiya *et al.* (2011) have reported 26 species. The genus is well adapted to hot and humid climate and species are abundantly found in the tropical belt (Gangulee 1974–77). The plants are characterized by erect, green habit forming dense mats, branched by 2–4 subfloral innovations, matted together at base. Leaves are erectopate, ovate lanceolate to oblong – lanceolate densely arranged on stem, acuminate, with flat to recurved margin that may be dentate at apex, may be bordered or non-bordered with shortly excurrent or long costa. *Brachymerium* is a difficult genus in terms of taxonomy and identification. It was initially divided into four sections (Brotherus 1924) and later workers have sporadically revised the status of this genus (Ochi 1972, 1980, 1992, 1994, Spence 1987). Some recent revisions based on molecular approach have also been provided by Spence (2005). The present work is an attempt to describe the current status of the genus at Pachmarhi Sanctuary. During the present investigation, four species of the genus namely *Brachymerium bryoides* Hooker

ex. Schwägr, *B. sikkimense* Renaud & Cardot, *B. acuminatum* Harv. and *B. ptychothecium* (Besch.) Ochi have been unveiled from the study area. Among these, three taxa viz. *B. bryoides*, *B. acuminatum* and *B. ptychothecium* are new additions to central India. Previously Singh & Kaul (2002) have reported two other species viz. *B. exile* (Dozy & Molk.) Bosch & Sande Lac. and *B. nepalense* Hook Schwägr. from Pachmarhi region. Thus total six species of *Brachymenium* are now known from the Wildlife Sanctuary. Four are being described in the present contribution.

MATERIALS AND METHODS

The specimens were collected during field excursions in different years from localities of Pachmarhi Sanctuary in an altitudinal range of approximately 880 to 1050 meters a.s.l. The plants were collected from terrestrial habitats such as soil covered rocks and wet rocks, and have been deposited in the Bryophyte herbarium, CSIR-National Botanical Research Institute, Lucknow (LWG), India. The material was studied in detail and the taxonomic observations were recorded to perform the identification and proper illustrations were made.

TAXONOMIC OBSERVATIONS

Key to the species of genus Brachymenium at Pachmarhi Sanctuary:

1. Plants smaller (up to 4mm), not much changed when dry, leaves bordered 2
Plants larger (up to 10 mm), contorted when dry, leaves not distinctly bordered 3
2. Leaves appressed to stem, leaf margin flat *B. bryoides*
Leaves erectopatent, leaf margin irregularly recurved *B. sikkimense*
3. Plants smaller (up to 6 mm), pale yellowish, leaves small, margin entire *B. acuminatum*
Plants larger (up to 10 mm), glossy green, branched, leaves larger, margin dentate *B. ptychothecium*

Brachymenium bryoides Hooker ex. Schwägr., Sp. Musc. Suppl. 2(1): 134. 1824. (Fig. 1A–L)

Plants green, forming dense mats, stem short, ± 3 mm, erect, branched by 2–3 subfloral innovations, matted together at base. **Stem** ovate-circular in cross section, irregularly sized cells without any distinction of cortical or medullary region. **Leaves** erectopatent, ovate lanceolate, dense, $\pm 0.85 \times 0.185$ mm in size, acuminate, margin flat, entire; **costa** excurrent in a short arista, ± 1.7 mm long. **Leaf cells** elongated, rhomboidal $\pm 35 \times 6.4$ μm at apex, 37×6.4 μm at middle sub quadrate to rectangular at base, $\pm 32 \times 7$ μm , marginal row of cells narrower, sporophyte not seen.

Ecology & Distribution: Plants growing on dry rocks at Pandav Caves and Rajat Prapat, 988–1004 m.

Range of Distribution: Antarctica, Brazil, India: Central India (Pachmarhi), Eastern Himalaya (Darjeeling, Khasia hills), South India (Nilgiri, Sherveroy hills), Western Himalaya (Almora, Simla), Papua New Guinea, Phillipines, Sri Lanka, Nepal.

Specimens examined: India, Madhya Pradesh, PBR: Pandav Caves, elv. 1004 m, on dry rocks, 07.11.2011, A.K. Asthana & R. Gupta 263114 (LWG); near Rajat Prapat, elv. 988 m, on rocks, 07.11.2011, A.K. Asthana & R. Gupta 263133A (LWG).

Brachymenium sikkimense Renaud & Cardot, Bull. Soc. R. Bot. Belg., 38(1): 12. 1900. (Fig. 1M–W)

Plants small, glossy green, densely tufted, stem erect, up to 4 mm long, branched by several (2–4) sub floral innovations, matted together by rhizoids at base. **Stem** broadly circular in cross section, uniformly medium sized cells without any demarcation of cortical and medullary regions. **Leaves** erectopatent, ovate-lanceolate, 0.82×0.38 mm in size, broad at base, acuminate, margin flat to recurved, entire; **costa** brown, strong, excurrent in an arista 0.18 mm in size. **Leaf cell** rhomboidal $\pm 28 \times 6$ μm at apex, $\pm 28.5 \times 6$ μm at middle, sub-rectangular to sub rectangular at base, $\pm 36 \times 9.25$ μm ; marginal row of cells narrower, forming indistinct border. Sporophyte not seen.

Ecology & Distribution: Plants growing at Pandav Caves, near Rajat Prapat and Pachmarhi Lake, on dry rocks from 988–1050 m.

Range of Distribution: India: Central India (Gujarat, Pachmarhi), Eastern Himalaya (Darjeeling).

Specimens examined: India, Madhya Pradesh, PBR: Pandav Caves, elv. 1004 m, on dry rocks, 07.11.2011, A.K. Asthana & R. Gupta 263119 (LWG); near Rajat Prapat, elv. 988 m, on rocks, 07.11.2011, A.K. Asthana & R. Gupta 263133B (LWG); Pachmarhi Lake, elv. 1050 m, on dry rocks, 09.11.2011, A.K. Asthana & R. Gupta 264827A (LWG).

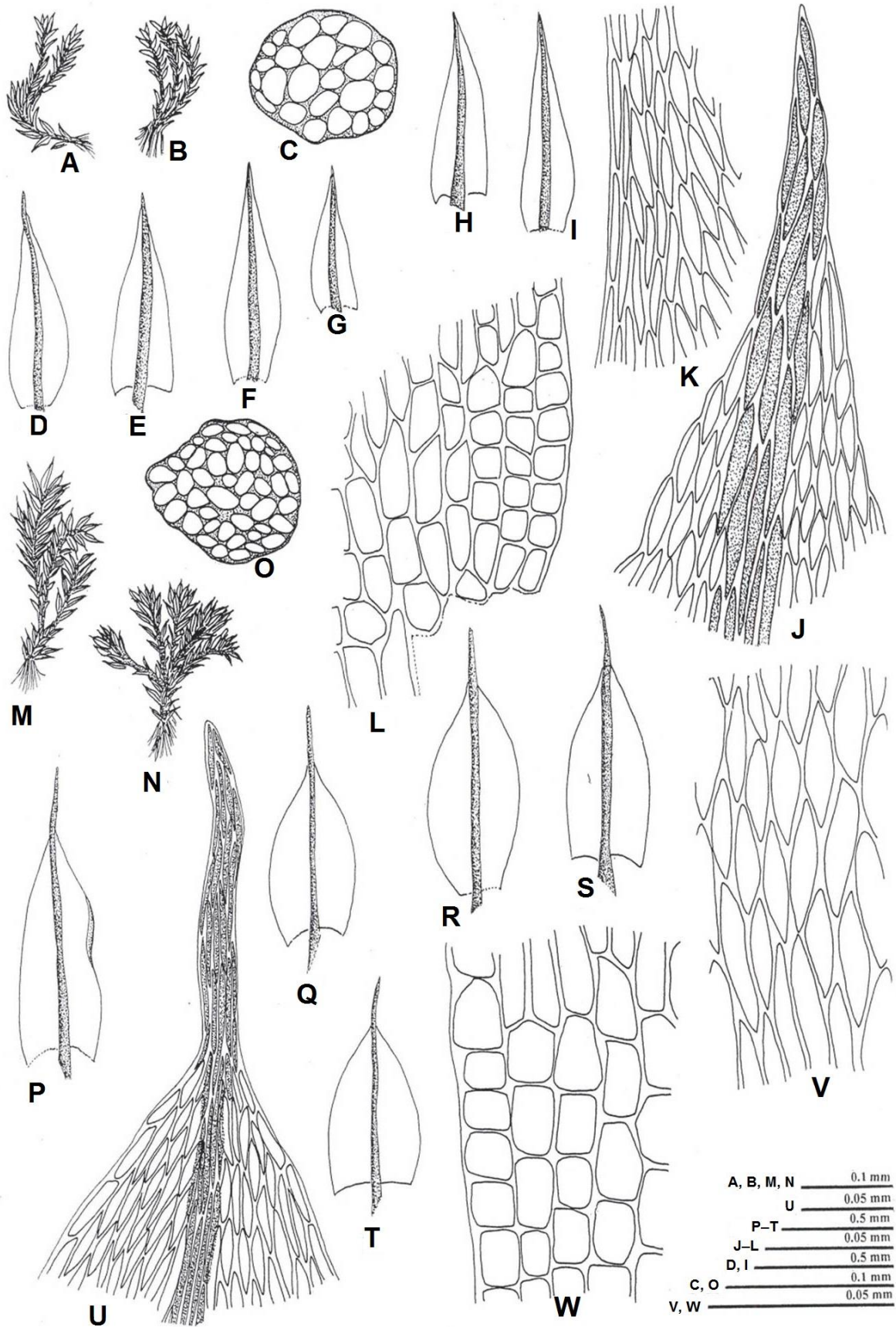


Figure 1. A–L, *Brachymenium bryoides* Hooker ex Schwägr. (A,B, vegetative plants; C, cross section of axis; D–I, leaves; J, apical leaf cells; K, median leaf cells; L, basal leaf cells); M–W, *Brachymenium sikkimense* Renaud & Cardot. (M,N, vegetative plants; O, cross section of axis; P–T, leaves; U, apical leaf cells; V, median leaf cells; W, basal leaf cells).

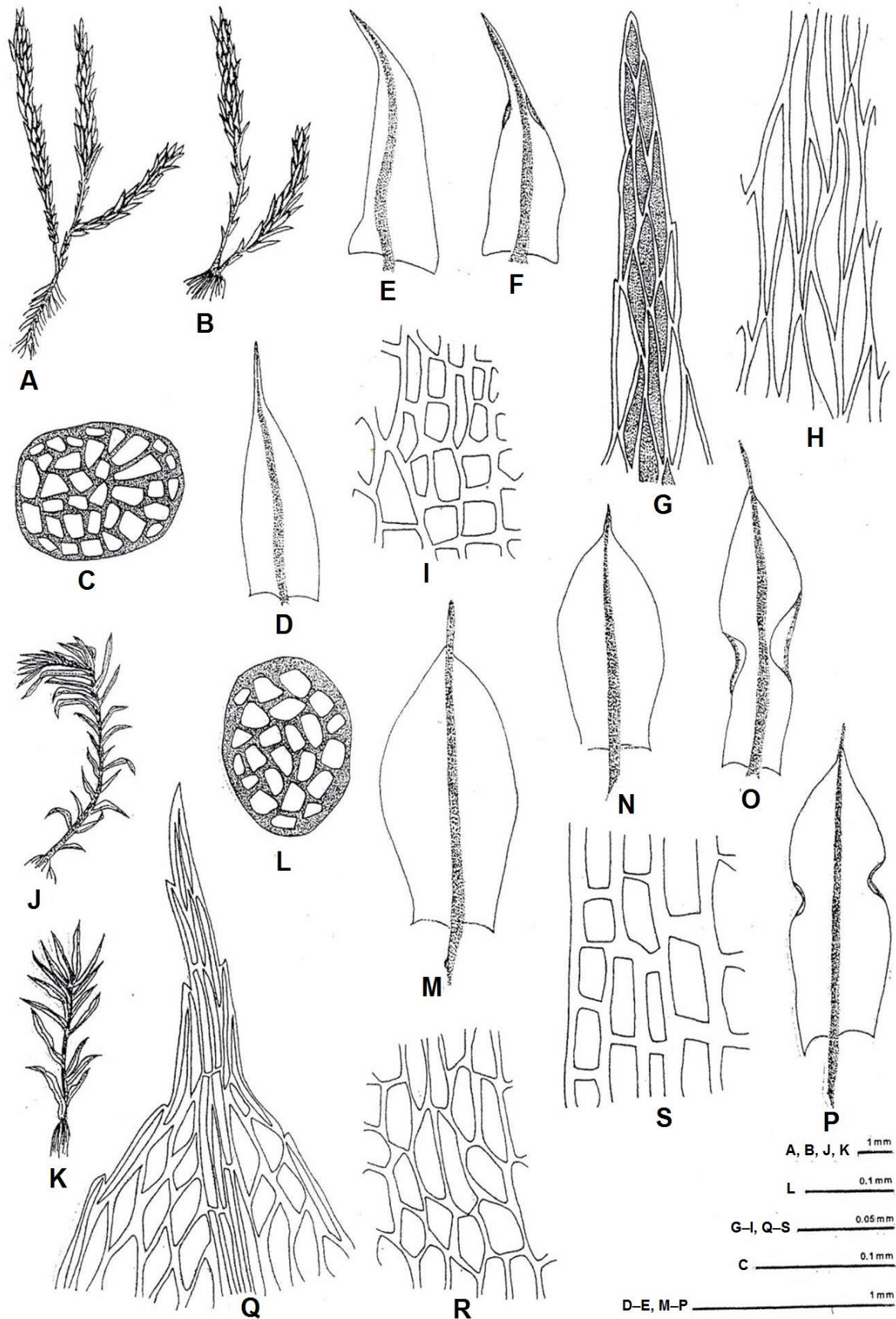


Figure 2. A–I, *Brachymenium acuminatum* Harv. (A,B, vegetative plants; C, cross section of axis; D–F, leaves; G, apical leaf cells; H, middle leaf cells; I, basal leaf cells); J–S, *Brachymenium ptychothecium* (Besch.) Ochi. (J,K, vegetative plants; L, cross section of axis; M–P, leaves; Q, apical leaf cells; R, middle leaf cells; S, basal leaf cells).

Brachymenium acuminatum Harv., Icon. Pl. Rar, 1:19. 1836.

(Fig. 2A–I)

Plants erect, terrestrial, pale to yellowish green plants in dense mats, up to 6 mm high, branched by several subfloral innovations, matted by tomenta. **Stem** circular in cross section, outer cells smaller, getting slightly larger towards centre, innermost cells again smaller. **Leaves** densely and uniformly arranged on stem, imbricate, erect, oblong-lanceolate up to 1.2 mm long and 0.42 mm wide, acuminate, margin entire; **costa** strong, excurrent in an arista ± 0.11 mm long. **Leaf cells** rhomboid, up to $75 \times 12 \mu\text{m}$ at apex, gradually getting rectangular at base, $50 \times 16 \mu\text{m}$ in size; marginal cells narrower but no distinct margin seen. Sporophyte not seen.

Ecology & Distribution: Plants growing on soil and soil over rocks, at Jambu Dweep at 900m.

Range of Distribution: Argentina, Australia, Bolivia, Botswana, Chile, China, Cong, India: Central India (Pachmarhi), Eastern Himalaya (Darjeeling, Sikkim), South India, Lesotho, Madagascar, Malawi, Mauritius, Mexico, Myanmar, Namibia, Nepal, Nicaragua, Peru, Philippines, Reunion, South Africa, Swaziland, Zimbabwe.

Specimens examined: India, Madhya Pradesh, PBR: Jambu Dweep, elv. 900 m, growing on soil, 17.12.1993, V. Nath & A.K. Asthana 205598 (LWG); 17.12.1993, Jambu Dweep, elv. 900 m, growing on soil over rock, V. Nath & A.K. Asthana 205599 (LWG).

Brachymenium ptychothecium (Besch.) Ochi, Adv. Front. Pl. Sc., 4: 108. 1963.

(Fig. 2J–S)

Plants, erect, terrestrial, tufted, glossy, green, reddish at base, up to 10 mm high, with subfloral innovations. **Stem** oval in cross section, outer cortical cells smaller, inner cells larger. **Leaves** distantly arranged on the stem, erectopatent, curled when dry, oblong-spathulate, bordered and apiculate, ± 1.93 mm long and ± 65 mm broad at middle, margin entire below, slightly dentate at apex, usually revolute from base to mid leaf; **costa** strong, deep brownish, excurrent in a slightly denticulate arista, ± 0.27 mm in size. **Leaf cells** rhomboid to hexagonal at apex, $\pm 37.5 \mu\text{m}$ long and $\pm 17.7 \mu\text{m}$ wide; basal cells sub rectangular, $\pm 41.7 \times 19.8 \mu\text{m}$; marginal cells elongated, narrow, forming an indistinct border of 2–3 rows. Sporophyte not seen.

Ecology & Distribution: Plants growing on moist rocks, at Down Fall at 900 m.

Range of Distribution: China, India: Central India (Pachmarhi), Eastern Himalaya (Darjeeling, Sikkim).

Specimens examined: India, Madhya Pradesh, PBR: Down Fall, elv. 884m, growing on moist rock, 28.11.2006, V. Sahu & V. Awasthi 227601 (LWG).

DISCUSSION

Among the four species of *Brachymenium*, *B. bryoides* and *B. sikkimense* have distinctly bordered leaves whereas in case of *B. acuminatum* and *B. ptychothecium* leaves are less clearly bordered. *B. bryoides* and *B. sikkimense* both have very short stems (up to 4 mm). The primary distinguishing point between these two species is that the leaves are closely appressed to the stem and margin is flat in former while in the latter, leaves are erectopatent and leaf margin is irregularly recurved. In *B. acuminatum* and *B. ptychothecium* the stem is larger, ranging from 6 to 10 mm or more. In case of *B. acuminatum*, the leaves are densely and uniformly arranged on stem, larger in size and the leaf margin is revolute towards the apex which can be discriminated from *B. ptychothecium* as its leaves are distantly arranged on stem, smaller in size and have entire margin. In the former species the marginal cells do not form a distinct border while in the latter, indistinct border cells can be identified.

Table 1. Habitat and geographical distribution of the species of *Brachymenium* at Pachmarhi Sanctuary.

S.No.	Plant Name	Habitats					Distribution in India						
		S	DR	WR	SCR	E	WH	EH	PR	GP	CI	SI	
1.	<i>Brachymenium bryoides</i> Hooker ex. Schwägr.	-	+	-	-	-	+	+	-	-	+	+	
2.	<i>Brachymenium sikkimense</i> Renauld & Cardot	-	+	-	-	-	-	+	-	-	+	-	
3.	<i>Brachymenium acuminatum</i> Harv	+	-	-	+	-	-	+	-	-	+	+	
4.	<i>Brachymenium ptychothecium</i> (Besch.) Ochi	-	-	+	-	-	-	+	-	-	+	-	
5.	<i>Brachymenium exile</i> (Dozy & Molck.) Bosch & Sande Lac.*			Not available			+	+	+	-	+	+	
6.	<i>Brachymenium nepalense</i> Hook Schwägr.*			Not available			-	-	-	-	+	-	

Note: * Species reported previously from Pachmarhi region, but not found during present study; S= soil; DR= dry rocks; WR= wet rocks; soil covered rocks; E= epiphytic; WH= western Himalaya; EH= eastern Himalaya; PR= Punjab & Rajasthan Plains; GP= Gangetic Plains; CI= central India; SI= South India.

Among the species studied, all are distributed in eastern Himalaya where as two taxa viz. *B. bryoides* and *B. acuminatum* are found in South India also (Table 1). *Brachymenium bryoides* is most widely distributed in India. The central Indian bryogeographical zone has been under explored for mosses till recent years and this account adds to the knowledge of the mosses of this region.

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