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Present Status of Family Dicranaceae (Bryophyta) in Pachmarhi Wildlife Sanctuary, Central India

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ABSTRACT: The present study outlines the current status of moss family Dicranaceae in Pachmarhi Sanctuary, a part of Pachmarhi Biosphere Reserve. During the taxonomic evaluation of the moss flora of this Reserve, eight taxa of Dicranaceae have been encountered belonging to three genera viz. *Campylopus* Bridel, *Dicranella* C. Muell. And *Leuculoma* Bridel. Among these, *Campylopus gracilis* (Mitt.) A. Jaeger, *Campylopus flexuosus* (Hedw.) Bridel, *Dicranella leptoneura* Dixon and *Leucoloma taylorii* (Schwaegr.) Mitt., are new additions to the moss flora of central Indian bryogeographical region.

KEY WORDS: Dicranaceae, Moss, Gondwanaland, Pachmarhi Sanctuary, Satpura Range.

INTRODUCTION

Pachmarhi Biosphere Reserve (PBR) lying in the Hoshangabad, Betul and Chindwara Districts of Madhya Pradesh is the eighth largest Biosphere Reserve in terms of area among the total 18 in India. It was designated under Man and Biosphere (MAB) Programme in 1999. With an area of 4987.38 km^2, PBR encompasses three conservation units viz., the Pachmarhi Wildlife Sanctuary, Satpura National Park and Bori Wildlife Sanctuary along with the areas surrounding these. The importance of this region is that the central Indian belt, especially the Satpura Mountain range forms the connecting link between the diversity of eastern Himalaya and South Indian region specially the Western Ghats, the two important hotspots of biodiversity.

As far as the cryptogamic flora of the Pachmmarhi Wildlife Sanctuary is concerned, researchers have ventured into the studies of algae, lichens, bryophytes and Pteriodophytes from latter part of the 20th century. Interestingly the studies on bryophytes of Pachmarhi region were initiated way back in 1950s by Pande and Srivastava (1952) probably due to the substantial number of bryophytes anticipated from the region. Further workers listed few species of bryophytes from the area (Lal and Parihar, 1979; Jain and Kaul, 1985; Patidar *et al.* 1985; Kaul *et al*. 1995; Kaul *et al.* 1995; Sharma and Alam, 2011). The moss flora prevailing at the area has however received attention only recently and merely two listings are available of the region (Singh and Kaul, 2002; Handoo *et al*., 2009). During the course of present study, more additions to the moss flora have been provided (Nath and Gupta, 2009; Nath *et al.*, 2011, 2011a, 2012; Gupta *et al.*, 2013). Central India has representation of few members of Dicranaceae listed by workers who have provided data on other regions of central India (Lal, 2005). The central Indian bryogeographical region in general and Pachmarhi Biosphere Reserve in particular has not been explored thoroughly and this could be one reason for fewer species of Dicranaceae being reported from this expanse.

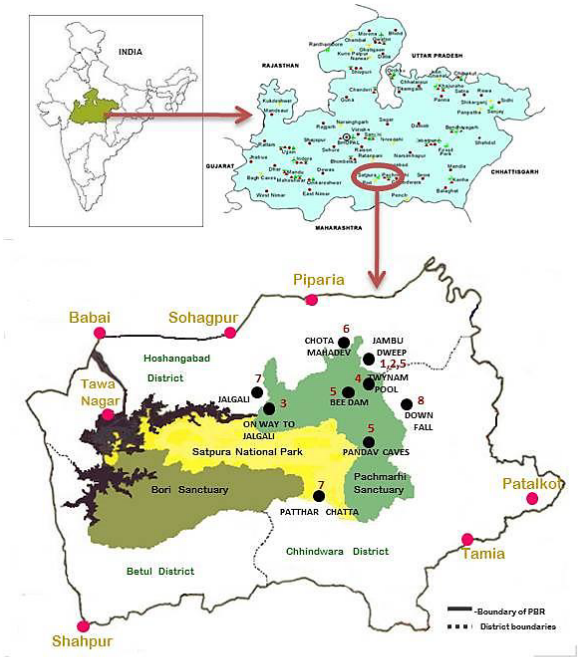
The present work elaborates the current status of family Dicranaceae Schimp. at Pachmarhi Wildlife Sanctuary. Dicranaceae is one of the dominant families of acrocarpous mosses in the world. It was first described by Bruch *et al.*, (1836–1855) and later classified by Brotherus (1924) who divided the family into six subfamilies. Numerous revisions have been provided from time to time by workers where several taxonomic treatments have been applied and combinations were suggested (Giese and Frahm 1985, 1985a; Rushing, 1986; Muller and Frahm, 1987; Allen, 1994; Stech, 1999). Later, Farge *et al.* (2002) have provided a circumscription of Dicranaceae based on molecular analysis. The family initially included 55 genera (Vitt, 1984) but at present represented by 47 genera (Goffinet *et al*., 2008). In India, it is represented by nearly 27 genera and 70 species (Gangulee, 1969–72; Lal, 2005; Dandotiya *et al*., 2011). However recently, Frahm (2012) re-classified and revised the scattered accounts of Indian genera and species under Dicranaceae and reduced the number of taxa to 20 accepted and valid names.

Distinctive characters of this large acrocarpous family include the erect, often tomentose stems; mostly narrow, lanceolate, occasionally falcate or falcate-secund leaves, with a single, narrow to broad costa, with or without rhizoids at the base, sometimes ending in a hyaline, occasionally toothed apex, costa in cross section with or without stereid bands, leaf cells usually smooth, sometimes mamillose, or rarely with a single papilla on one or both sides, proximally, papillose distally.

During the taxonomic evaluation of the moss flora of PBR, eight taxa of Dicranaceae have been encountered

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from nine sites in Pachmarhi Sanctuary (Fig.1), belonging to three genera viz. *Campylopus* Bridel, *Dicranella* C. Muell. and *Leuculoma* Bridel. Among these, *Dicranella leptoneura* Dixon, *Campylopus gracilis* (Mitt.) A. Jaeger, *Campylopus flexuosus* (Hedw.) Bridel and *Leucoloma taylorii* are new additions to the moss flora of central India.



1=Dicranella leptoneura, 2= Campylopus fragilis subsp. *goughii, 3= Campylopus gracilis, 4 = Campylopus savannarum, 5= Campylopus ericoides, 6= Campylopus flexuosus, 7= Leucoloma taylorii , 8= Leucoloma amoeno-virens*

Fig1: Collection sites at Pachmarchi Biosphere reserve.

TAXONOMIC OBSERVATIONS

Key to the genera of Dicranaceae in Pachmarhi Wildlife Sanctuary:

1a. Plants smaller, up to 10 mm in size, in dense tufts, leaves abruptly narrowed to form subulate point, alar not differentiated…… ……..... ***Dicranella***

1b. Plants larger, 10 to 20 mm in size, in lax tufts, leaves gradually narrowed to form subula, alar well differentiated……..……2

2a. Leaf without distinct border, costa broad, upper leaf cells smaller, clear ……..……***Campylopus***

2b. Leaf with distinct border, costa narrow, upper lamina cells obscure, incrassate ……..……..……***Leucoloma***

Genus: *Dicranella* C. Muell.

Dicranella leptoneura Dixon, J. Bombay Nat. Hist. Soc., 39: 774. 1937. **Fig.2:1-12**

Plants caespitose, pale green to brown, up to 10 mm in size, unbranched. Stem circular in cross section, outer cortical cells smaller compared to medullary cells which are irregular and large. Leaves covering the stem laxly below, densely at apex; erect, lanceolate, smaller below, ± 1.4 × 0.23 mm, larger near the apex, ± 2.1 × 0.32 mm, base wide, concave, tapering above, passing into canaliculated acute subula; leaf lamina incurved at places, usually at apex; costa very slightly darker than leaf color, broader at base, narrowing upwards, smooth, may be slightly irregular at extreme apex. Leaf cells elongated, rectangular or slightly spindle shaped, ± 24 × 19 µm, basal cells broader, up to 10.4 × 17 µm; leaf cell size increases from margin towards costa. Anthredial cluster present at apex, surrounded by large leaves. Antheridia broadly spindle shaped, sometimes slightly broader at upper region as compared to lower region. Female plants or sporophyte not seen.

Ecology and Distribution: Plants growing epiphytically (on tree bark) near Jambu Dweep at 853 m.

Range of Distribution: China, India.

Specimens examined: India, Madhya Pradesh, PBR: near JambuDweep, alt. ca 853 m, epiphytic, 29 Nov. 2006, 227643 (LWG), leg. V. Sahu and V. Awasthi.

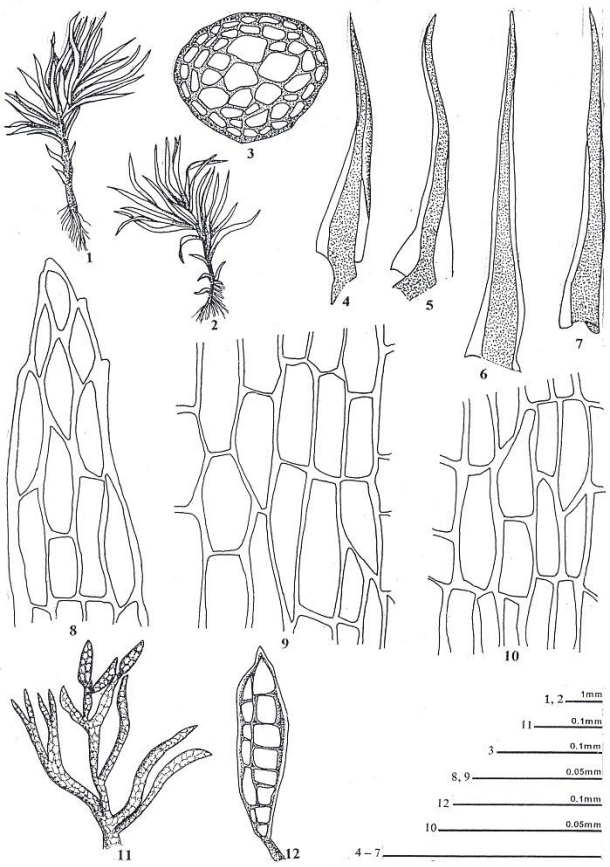


Fig. 2: ***Dicranella leptoneura*** Dixon**. 1,2.** plants, **3.**cross section of axis, **4-7**. leaves, **8.** apical leaf cells, **9.** median leaf cells, **10.** basal leaf cells, **11.** antheridial cluster, **12.** Antheridium.

Genus: *Campylopus* Bridel

Key to the species of genus *Campylopus* at Pachmarhi Wild Life Sanctuary:

1a. Costa almost homogenous, without stereids……..... ***C. gracilis***

1b. Costa with stereids on dorsal or ventral leaf surface …… 2

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2a. Lamina cells quadrate to rhomboidal, stereids on dorsal leaf surface ……..…… 3
2b. Lamina cells slender to slightly rhomboidal, stereids on ventral leaf surface…….…….... ***C. ericoides***
3a. Plants larger (up to 20 mm), alar region inflated to bulging ……..…..…….…. 4
3b. Plants smaller (up to 12 mm), alar region not much inflated or bulging……..... ***C. savvanarum***
4a. Plants up to 15 mm in size, stereid bands very thick walled, alar cells hyaline……....***C. fragilis*** subsp. ***goughii***
4b. Plants up to 20 mm in size, stereid bands less thick walled, alar brownish…….…….…... ***C. flexuosus***

Campylopus ericoides (Griffith) A. Jaeger, Ber. S. Gall. Naturn.Ges. 1870-71: 424. 1872. **Fig. 3**
Basyn: *Dicranum ericoides* Griffith, Cal. J. Nat. Hist., **2**: 499. 1842.

Plants erect, comose, green, ± 18 mm, covered with leaves becoming denser at apex, unbranched. Stem quadrate-oval in cross section with larger cortical cells, medullary cells smaller, thick walled, concentrated at centre. Leaves erectopatent, ± 2.6 × 0.57 mm in size, extending into canaliculated subula, upper leaf margin dentate, stereid bands present on ventral leaf surface, thickened cells present at the dorsal side but not very prominent; rhizoids growing from leaf base; costa light yellow, covering up to 1/2 of the leaf base. Leaf cells slender, rhomboidal, smaller, ±12 × 8 µm, middle cells larger, ± 16 ×12 µm becoming larger and rectangular at base, ± 48 × 18 µm, alar well developed, slightly inflated, colourless to hyaline. Sporophyte not seen.

Ecology and Distribution: plants growing on soil covered rocks and moist rocks near Jambu Dweep and Pandav Caves from 700–800 m.

Range of Distribution: China, India: central India [PBR (Madhya Pradesh)], Gangetic plains (West Bengal), eastern Himalaya [Darjeeling (West Bengal), Khasi Hills (Meghalaya), Manipur], South India [Agasthyamala, Chinnar Wildlife Sanctuary (Kerala), Tirunelveli (Tamil Nadu)], Indonesia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam.

Specimens examined: **INDIA:** Madhya Pradesh, PBR: near Jambu Dweep, alt. ca 793 m, on moist rocks, 29 Nov. 2006, 227652B, 227655B (LWG); Pandav Caves, alt. ca 715 m, on rocks, 1 Dec. 2006, 227683A (LWG), leg. V. Sahu and V. Awasthi; Bee Dam, alt. ca 976 m, on soil covered rocks, 8 Nov. 2011, 263191 (LWG), leg. A.K. Asthana and R. Gupta.

Campylopus flexuosus (Hedw.) Bridel ,Mant. Musc.4: 71. 1819. **Fig. 4: 1-9**
Basyn: *Dicranum flexuosum* Hedw., Sp. Musc.: 145. 1801.

Plants erect, shiny green in dense tufts, variable in size, ± 20 mm dichotomously branched. Stem circular in cross section, outer cortical cells small, inner madullary cells larger. Leaves flexuose, erectopatent, ± 4.25 ×± 0.68 mm broad, narrowing into a canaliculated subula; margins incurved, leaf tip serrate, not hyaline; costa brownish, covering 2/3 rd of base, whole of tip; sterieds on dorsal side, dorsal surface smooth. Leaf cells short rectangular, ± 14 × 6.02 µm near costa, marginal cells

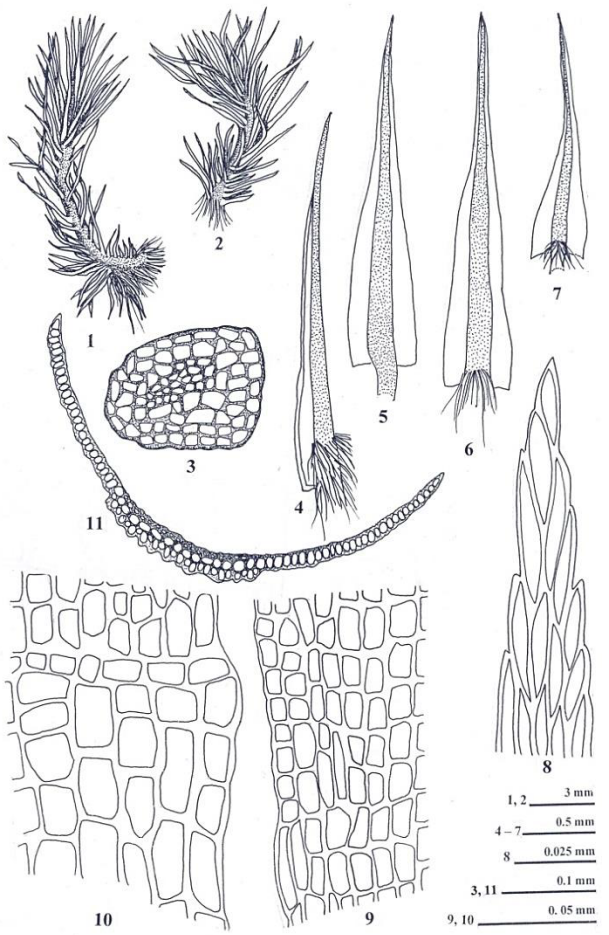


Fig. 3: ***Campylopus ericoides*** (Griff.) A. Jaeger. **1,2.** Vegetative plants, **3.** cross section of axis, **4-7.** leaves, **8.** apical leaf cells, **9.** median leaf cells, **10.** basal leaf cells, **11.** cross section of leaf.

narrow, basal cells rectangular, ± 30 × 8.4 µm, alar slightly inflated, bulging, reddish to dull hyaline cells. Sporophyte not seen.

Ecology and Distribution: plants growing on rocks on way to Chota Mahadev, 853 m.

Range of Distribution: Algeria, Argentina, Australia, Austria, Belgium, Bolivia, Canada, Caribbean, Chile, China Colombia, Congo, Costa Rica, Cuba, Czech Republic, Denmark, Dominic Republic, Ecuador, Salvador, France, Germany, Greenland, Guatemala, Haiti, Honduras, Iceland, India: central India [PBR (Madhya Pradesh)], eastern Himalaya, South India [Eravikulum National Park, Idduki Distt., Wayanad (Kerela) Shervaroy hills (Tamil Nadu)], Ireland, Jamaica, Japan, Madagascar, Mauritius, Mexico, Netherlands, New Zealand, Norway, Panama, Peru, Poland, Portugal, Puerto Rico, Reunion, Rwanda, Saint Helena, Soapstone and Principe, Siberia, Spain, Sweden, Switzerland, Tanzania, Thailand, United Kingdom, United States, Venezuela, Vietnam.

Specimens examined: **INDIA**: Madhya Pradesh, PBR: Chota Madadev, alt. ca 853 m, on rocks, 29 Nov. 2006, 227631 (LWG), leg. V. Sahu and V. Awasthi.

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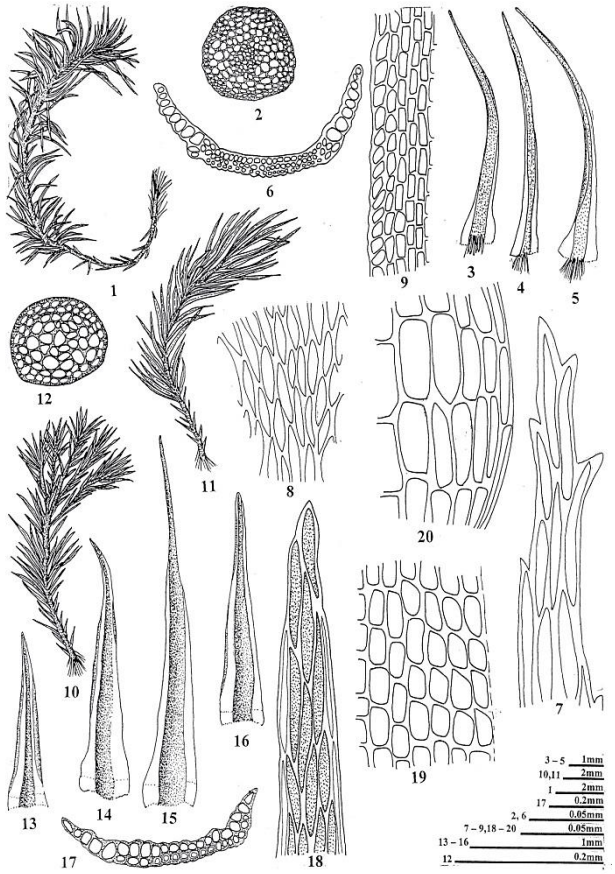


Fig. 4: **1-9.** ***Campylopus flexuosus*** (Hedw.) Brid.**1.** vegetative plants, **2.** cross section of axis, **3-5.**leaves, **6.** cross section of leaf, **7.** apical leaf cells, **8.** median leaf cells, **9.** basal leaf cells; **10-20.** ***Campylopus gracilis*** (Mitt.) A. Jaeger. **10, 11.**vegetative plants, **12.** cross section of axis, **13-16.** leaves, **17.** cross section of leaf, **18.** apical leaf cells, **19.** median leaf cells, **20.** basal leaf cells.

Campylopus fragilis (Brid.) B.S.G. subsp. ***goughii*** (Mitt.) J.P. Frahm,Trop. Bryol. 4: 61. 1991. **Fig. 5**

Basyn: *Dicranum goughii* Mitt.,Musc. Ind. Or.:17. 1859.
Syn: *Campylopus goughii* (Mitt.) A. Jaeger ,Ber. S. Gall. Naturw. Ges.,1870-71: 424. 1872.

Plants, erect, caespitose, dull brown stem, green leaves, ± 15 mm, unbranched. Stem circular in cross section, outer cortical cells smaller, medullary cells larger, innermost cells small, thick walled, forming distinct conducting region. Leaves densely arranged on stem, smaller below, larger upwards, erectopatent, ± 3.03 × 0.43 mm dense at apex, lanceolate, extending into canaliculated subula; margin smooth, dentated slightly at tip; stereid band present at the dorsal surface, thin walled cells on ventral side; costa light, occupying half width at leaf base ± 220 µm wide. Leaf cells smaller, rhomboidal, ± 21 × 6.8 µm at apex, basal cells larger, ± 41.7 x 20.1µm, becoming narrower towards the margin, alar distinct, not bulging, inflated, ± 42 × 28 µm, hyaline. Sporophytes not seen.

Ecology and Distribution: plants growing on wet rocks near Jambu Dweep at 793 m.

Range of Distribution: China, Bhutan, India: central India [PBR (Madhya Pradesh)], eastern Himalaya [Darjeeling, Sikkim (West Bengal) Khasi Hills (Meghalaya)], western Himalaya, western Ghats [Tirunelveli - Travancore Hills, Palni (Tamil Nadu)], Nepal, Sri Lanka.

Specimens examined: INDIA: Madhya Pradesh, PBR: near Jambu Dweep, alt. ca 793 m, on wet rock, 29 Nov. 2006, 227652B, 227655B (LWG), leg. V. Sahu and V. Awasthi.

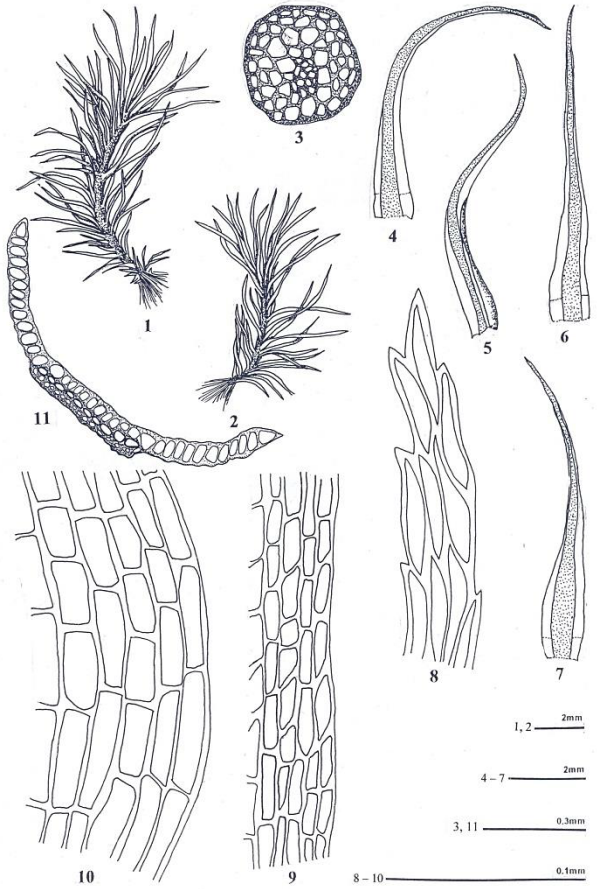


Fig. 5: ***Campylopus fragilis*** (Brid.) B.S.G. subsp ***goughii*** (Mitt.) A. Jaeg.**1, 2.** Vegetative plants, **3.** cross section of axis, **4-7.** leaves, **8.** apical leaf cells, **9.** median leaf cells, **10.** basal leaf cells, **11.** cross section of leaf.

Campylopus gracilis (Mitt.) A. Jaeger,Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1870–71: 427. 1872. **Fig.4:10-20**

Basyn: *Dicranum gracile* Mitt. Musc. Ind. Or. 17. 1859.
Syn: *Campylopus latinervis* (Mitt.) A. Jaeger, Ber. S. Gall. Naturw. Ges., 1870-71: 426. 1872.
Syn: *Dicranum latinervis* Mitt., Musc. Ind. Or.: 17.1859.

Plants erect, up to 18 mm long, branched by proliferations. Stem circular in cross section, outer cortical cells small, graduating into larger medullary cells, small cells at extreme centre. Leaves erectopatent, ± 4.02 mm × 0.68 mm in size, lanceolate, subulateextending into canaliculated subula, margin inflexed, tipdenticulate, not

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hyaline; costa strong, dull yellow, covering whole apex. Leaf shows absence of stereids, large irregular thin walled cells. Leaf cells elongated ± 24 × 8 µm, rectangular towards apex, narrow at margins broad at base, 32 × 20 µm; alar cells large, hyaline not inflated, not-auriculate. Sporophyte not seen.

Ecology and Distribution: plants growing epiphytically on way to Jalgali towards Dhoopgarh, 1056 m.

Range of Distribution: Africa, Antarctica, Austria, Canada, China, Faroe Islands, India: central India [PBR (Madhya Pradesh)], eastern Himalaya [Darjeeling, Sikkim (West Bengal), Manipur], South India [Nilgiri (Tamil Nadu)], western Himalaya [Kumaon (Uttarakhand)], Ireland, Japan, Nepal, Norway, Peru, Sri Lanka, Thailand, United Kingdom, United States.

Specimens examined: **INDIA**: Madhya Pradesh, PBR: on way to Jalgali towards Dhoopgarh, alt. ca 900 m, epiphytic, 16 Dec. 1993, 205541A (LWG), leg. V. Nath and A.K. Asthana.

Campylopus savannarum (C. Mull) Mitt., J. Linn. Soc. Bot. 12: 85. 1869. **Fig.6**

Syn: *Dicranum laeteum* Mitt. In Musc. Ind. Or.: 19. 1859.
Syn: *Campylopus laetus* (Mitt.) A. Jaeger, Ber. S. Gall. Naturw. Ges., 1870- 71: 417. 1872.

Plants erect, caespitose, deep green up to 12 mm (can be more due to proliferation), unbranched. Stem oval in cross section, shows smaller outer cortical cells followed by larger medullary cells; extreme central cells small and thick walled forming a distinct conducting zone. Leaves densely arranged throughout the stem, erectopatent, long, lanceolate, ± 2 × ± 0.5 mm in size, extending into a long subula, margin incurved mostly at apex, sometimes at lower leaf as well, serrated at apex; stereidal bands present on dorsal surface, thin walled cells on ventral surface; costa strong, brownish yellow, ± 270 µm wide, extending into the tip. Leaf cells irregular at apex, rectangular to rhomboidal, ± 24 × 6 µm in size, getting larger towards base, rectangular, up to 50.0 × 20.9 µm, alar not bulging, cells large, hyaline, ± 63.5 × 33.4 µm in size; cross section of leaf shows stereides on both sides. Sporophytes not seen.

Ecology and Distribution: plants growing epiphytically (on tree bark) at Twynam Pool at 853 m.

Range of Distribution: Angola, Australia, Belize, Bolivia, Brazil, Burundi, Cambodia, Cameroon, Colombia, Comoros, Congo, Costa Rica, Ecuador, El Salvador, French Guiana, Gabon, Guatemala, Guyana, Honduras, India: central India [PBR (Madhya Pradesh)], eastern Himalaya (Darjeeling, Sikkim (West Bengal), Khasi Hills (Meghyalaya), South India [Palni, Tirunelveli - Travancore Hills (Tamil Nadu)], Indonesia, Madagascar, Malaysia, Mexico, Nicaragua, Niger, Panama, Philippines, Reunion, Rwanda, Sao Tome and Principe, South Africa, Suriname, Taiwan, Tanzania, Thailand, Trinidad and Tobago, United States, Venezuela, Zambia.

Specimens examined: **INDIA**: Madhya Pradesh, PBR: Twynam Pool, alt. ca 853 m, epiphytic, 29 Nov. 2006, 227619 (LWG), leg. V. Sahu and V. Awasthi.

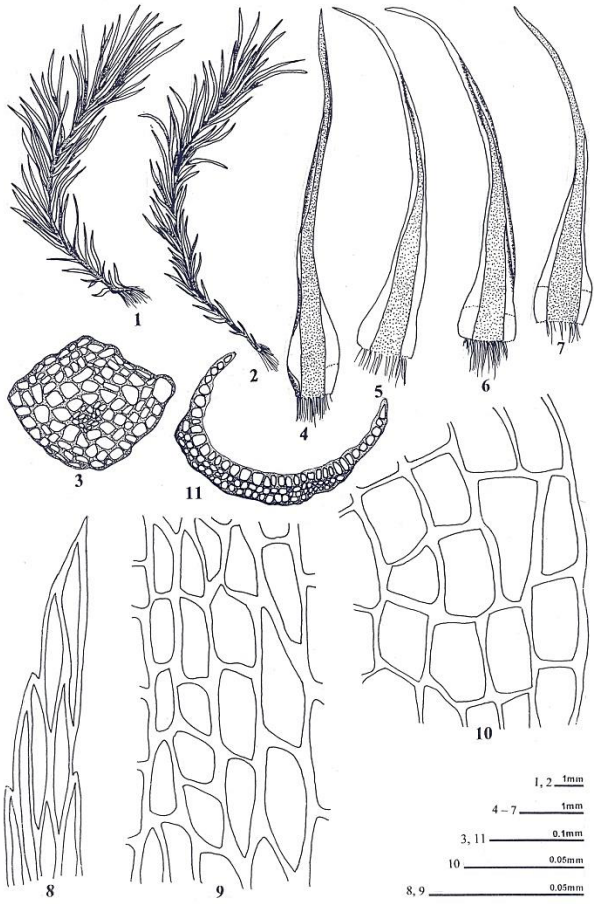


Fig. 6: ***Campylopus savvanarum*** (C. Műll) Mitt. **1,2.** plants, **3.** cross section of axis, **4-7.** leaves, **8.** apical leaf cells, **9.** median leaf cells, **10.** basal leaf cells, **11.** cross section of leaf.

Genus: *Leucoloma* Bridel.

Key to the species of genus *Leucoloma* at Pachmarhi Wildlife Sanctuary:

1a. Plants slender, rarely branched, alar hyaline towards margin, reddish towards costa ……..... ***L. taylorii***
1b.Plants robust, frequently branched, alar reddish – orange uniformly ……..…… ***L. amoene-virens***

Leucoloma taylorii (Schwaegr.) Mitt., Musci India. Or.: 13. 1859**.** **Fig.7: 1-9**

Basyn: *Sryrrhopodon taylorii* Schwaegr., Sp. Musc. Suppl., 2 (2): 115. 1824.

Plants erect, yellowish-green up to 15 mm long, scarcely branched. Stem ovato-circular in cross section with irregularly scattered thick walled cells. Leaves erectopatent, secund, densely arranged on stem, up to 3.8 mm long, ± 2.5 mm broad, narrowing towards apex; costa narrow reddish brown completely occupies tip, rough and obscure. Leaf cells quadrate, incrassate, ± 8

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µm in diameter at apex, middle leaf cells elongate - rectangular at costa, getting narrower towards margin, basal cells ± 26 × 8.5 µm, rectangular, alar bulging, cells rectangular, hyaline at periphery, brown towards interior, margin bordered by 2–3 rows of very narrow elongated cells. Sporophyte not seen.

Ecology and Distribution: plants growing epiphytically at Jalgali and PattharChatta (near water stream), at 900–1000m.

Range of Distribution: Antarctica, India: central India [PBR (Madhya Pradesh)], South India (Kerala), Malaysia, Myanmar, Nepal, Philippines, Thailand, USA.

Specimens examined: **INDIA**: Madhya Pradesh, PBR: Jalgali alt. ca 900 m, epiphytic, 16 Dec. 1993, 205580 (LWG); Patthar Chatta, alt. ca 1000 m, epiphytic, 18 Dec. 1993, 295650C (LWG), leg. V. Nath and A.K. Asthana.

Leucoloma amoeno-virens Mitt. Musc. Ind. Or.:13. 1859. **Fig. 7: 10–19**

Plants erect, yellowish green, up to 20 mm long, branched. Stem circular in cross section, scattered irregular thick walled cells. Leaves lanceolate, carinate, wider at base narrowing towards apex into a canaliculated tip, ± 3 × 0.45 mm in size, margin recurved; costa light brown, occupying apex majorly, extending into the subula. Leaf cells incrassate, papillose towards apex ± 8 × 4 µm, getting obscure at subula, elongated towards base, ± 27 × 6.8 µm, border rows of transparent, thin slender cells, up to 2/3 rd of leaf length. Sporophyte not seen.

Ecology and Distribution: plants growing epiphytically at Down Fall, 884 m.

Range of Distribution: Sri Lanka, Thailand, India: central India [PBR (Madhya Pradesh)], eastern Himalaya [Khasi hills (Meghalaya)], South India (Kerala; Nilgiri hills, South western Ghats (Tamil Nadu)].

Specimens examined: **INDIA**: Madhya Pradesh, PBR: Down fall, alt. ca 884 m, epiphytic, 28 Nov. 2006, 229400 (LWG), leg. V. Sahu and A. Awasthi.

DISCUSSION

The overview of distribution of Dicranaceae in Pachmarhi Sanctuary suggests that the taxa encountered from this area are more similar in distribution to the taxa found in South India and eastern Himalaya. All these taxa except *Dicranella leptoneura* are common to South India whereas, all the taxa except *Dicranella leptoneura* and *Leucoloma taylorii* are common to eastern Himalaya. Interestingly, these mosses are not distributed in Punjab and Rajasthan plains and only single taxon viz. *Campylopus ericoides* is known from the Gangetic plains (Table 1). The occurrence of similar species of Dicranaceae in South India as well as in eastern Himalaya and PBR substantially supports the theory that PBR is the connecting belt of the flora of these two hotspots of India.

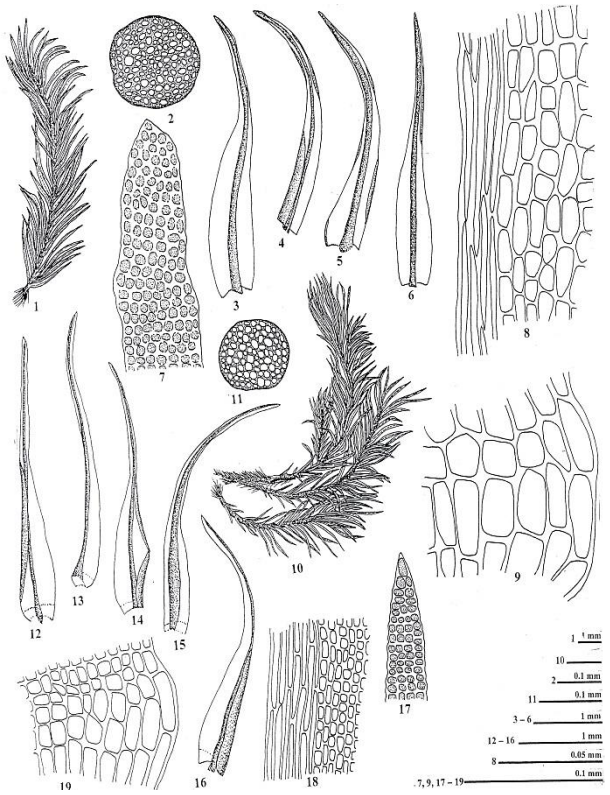


Fig. 7: 1–9. ***Leucoloma taylorii*** (Schwaegr.) Mitt. **1.** vegetative plant, **2.** cross section of axis, **3–6.** leaves, **7.** apical leaf cells, **8.** median leaf cells, **9.** basal leaf cells; **10–19.** ***Leucoloma amoeno-virens*** Mitt. **10.** vegetative plant, **11.** cross section of axis, 12-16. leaves, **17.** apical leaf cells, **18.** median leaf cells, **19.** basal leaf cells.

Among the three genera, *Campylopus* emerges to be the dominant genus in Pachmarhi Wildlife Sanctuary, with five species present in the region out of which *Campylopus ericoides* was found distributed at many sites of collection. Further, considering the habitat diversity of the studied taxa, five out of the eight taxa were epiphytic whereas the rest were found on rocks and soil covered rocks. Epiphytic mosses of Dicranaceae were therefore dominant at the Pachmarhi Wildlife Sanctuary.

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