
Bruchiaceae collected in Karnataka, India, with a synopsis of the family in India

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During the exploration of the bryophyte flora of Karnataka, India, 2 species belonging to the family of Bruchiaceae, *Trematodon longicollis* and *Trematodon schmidii*, were found. Both species are illustrated. An overview about all the 10 species of Bruchiaceae in India, inclusive a key, short description and line drawings are provided.

1. Introduction

The rich bryoflora of the state of Karnataka in Southern India is poorly explored which became obvious during the compilation of a recent checklist by SCHWARZ (2013). Ongoing collections since 2012, in particular in the Western Ghats, as well as studies on the collected material reveal species that have so far only been found in the “classical collection areas” like the Nilgiri and Palni Hills. The family of Bruchiaceae can also be taken as a good example for this.

Without a comprehensive bryoflora for India in place it is always challenging to come to a reasonable conclusion during the identification. Even though GANGULEE (1969-1980) and CHOPRA (1975) provide a very good indication both of them can't reflect the development of the last 30 years. Therefore a synopsis of the family based current status of the author's knowledge is provided. Information about the distribution of the species in India can only be preliminary as not all of the approximately 1500 articles about Indian bryology have been analyzed so far. Drawings are either taken from the original articles or reliable works. Since some of the articles were only available in electronic format without an indication of the magnification during the scan process, no scales are added. Information about the size of plants and cells have to be taken from the short descriptions.

2. Bruchiaceae collected in Karnataka

The genus *Trematodon* is currently only known by *T. longicollis* in the state of Karnataka based on *T. ceylonensis* MÜLL. HAL. and *T. paucifolius* MÜLL. HAL. which were reported by BROTHERUS 1899 and meanwhile have been synonymized to *T. longicollis*. SCHWARZ & FRAHM 2013 also reported *T. longicollis* from the same area. They also mentioned a second, unidentified *Trematodon* species with shorter seta and an apophysis only as long as the urn. Further studies revealed that these plants belong to *T. schmidii* MÜLL. HAL. which was so far only known from

Tamil Nadu. Besides *T. longicollis* and *T. schmidii* only *T. brevicalyx* DIXON EX MATHUR and *T. conformis* MITT. has been reported from southern India. Based on DANDOTIYA et al. (2011) the *T. conformis* was found in Sanyasi Hills (Tirukkalukkundram) and Nilgiri Hills in the state of Tamil Nadu. The author hasn't found any detailed records for *T. brevicalyx* in Southern India.

2.1 *Trematodon longicollis* MICHX.

Trematodon longicollis was first collected in southern India by PERROTTET near Neddoubetta (Nilgiri Hills, Tamil Nadu) and published by MONTAGNE (1842). MONTAGNE. WALKERS collections from Coorg that comprises *T. ceylonensis* and *T. paucifolius* which were later on synonymized to *T. longicollis* were published by BROTHERUS (1899). Further collections from southern India have been made from Perumalmalai and Shembaganur (Palni Hills, Tamil Nadu) by Foreau in 1923 and 1959 and according to MANJU et al. (2005, 2006) from Kerala (Wayanad, Chinnar Wildlife Sanctuary).

The (1) well-developed peristome, the (2) long, strumose apophysis, that is at least 2-3 times as long as the urn and the (3) distinct sheeting lower lamina are characteristic. Those characters can also be observed in forms that have been treated as separate species.

Forms, like *T. ceylonensis* differ according to ROTH 1911 only by its smaller cells, larger spores and the serrate leaf apex. He already indicated that *T. ceylonensis* rather makes the impression of a variety than a good species. The plants collected in 2012 and 2013 do show the high similarity to *T. ceylonensis*.

CAO & GAO 1988 state that *T. paucifolius* is a small form with an apophysis 2-2.4 mm and the capsule 1-1.2 mm long which lies within the variability of the main form.

The Karnataka plants grew along a sunny slope on bare soil. They were associated with *Trematodon schmidii* MÜLL. HAL., *Garckea flexuosa* (GRIFF.) MARGAD. & NORK., *Microdus brasiliensis* (DUBY) THÉR., *Ditrichum difficile* (DUBY) M. FLEISCH., *Pogonatum neesii* (MÜLL. HAL.) DOZY, *Dicranella* spec. and *Philonotis* spec. The composition of species doesn't seem frequent in the area visited. Though *Garckea*, *Pogonatum* and *Philonotis* are common the right development status of these ephemeral localities alongside with the particular exposure and shading hasn't been observed elsewhere.

Records for Karnataka:

- Kodagu district (Coorg), Madikeri, leg. T.L. Walker, 1899, no. 17 (as. *T. ceylonensis*)
- Kodagu district (Coorg), Madikeri, leg. T.L. Walker, 1899, no. 24, 28 (as. *T. paucifolius*)
- Kodagu district (Coorg), Sidapur, leg. T.L. Walker, 1899, no. 268 (as. *T. paucifolius*)
- Kodagu district (Coorg), Virajpet, leg. T.L. Walker, 1899, no. 162 (as. *T. paucifolius*)
- Kodagu district (Coorg), Way from Kabbe Holiday Homestay to the Big Hill (N 12.193883°, E 75.66495 °), 1160 m, on soil, 3 November 2012, leg. J.-P. FRAHM, F. SCHUMM, U. SCHWARZ. *Herbarium U. Schwarz no. 11007, 11032* (both with *Microdus brasiliensis*).
- Kodagu district (Coorg), Bank along the road between Mysore and Madikeri (N 12.441167 °, E 75.792617 °), 1110 m, on soil, 10 November 2012, leg. U. SCHWARZ. *Herbarium U. Schwarz no. 11068*.
- Kodagu district (Coorg), Coffee Plantation north to Honey Valley Home Stay (N 12.219056 °, E 75.656472 °), 1180 m, on soil, 02 November 2013, leg. U. SCHWARZ, H. WINKELMANN. *Herbarium U. Schwarz no. 12296*.

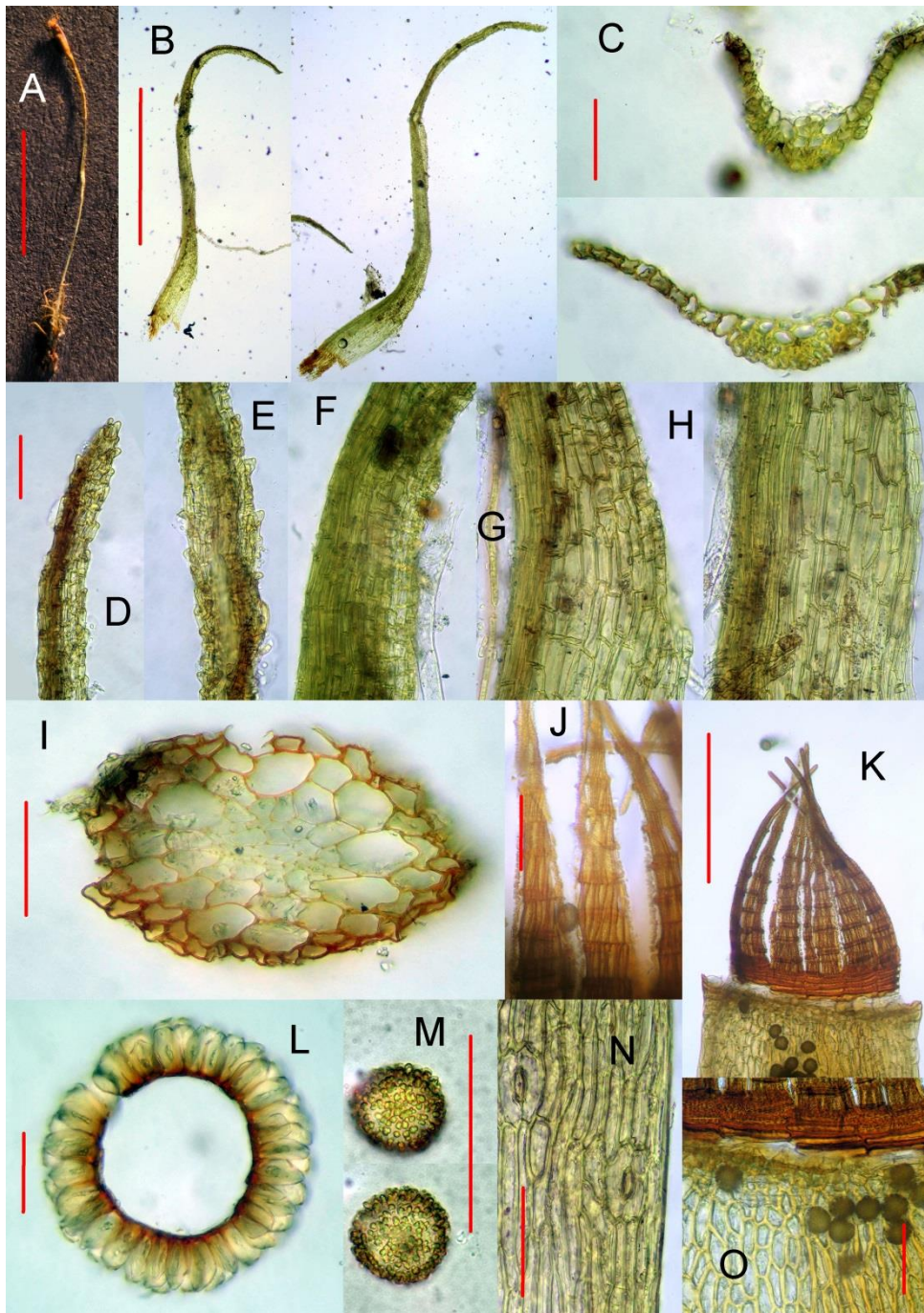


Plate 1: *Trematodon longicollis* MICHX. A Plant, B Leaves, C Leaf cross sections, D Leaf apex, E Below leaf apex, F Upper leaf half, G Sheeting lamina area, H Leaf base, I Stem cross section, J Peristome (from outside), K Peristome (from inside), L Annulus, M Spores, N Stomata in apophysis area, O Capsule mouth (from inside) (scale: A – 5 mm, B – 1 mm, all other 50 μ m)

2.2 *Trematodon schmidii* MÜLL. HAL.

T. schmidii was first collected in the Nilgiri Hills of Tamil Nadu by L.B.E. SCHMID in 1864 (BM000964881, BM000964882, BM000964883, BM000964884). There is only one additional record from Perumalmalai (Palni Hills), based on a collection of G. FOREAU in 1926.

The most distinguishing characters are the (1) absence of a peristome, (2) the strumose apophysis that is as long as the capsule and (3) the less sheeting leaf base.

It seems that *T. schmidii* grows on similar habitats as *T. longicollis*. Whereas *T. longicollis* was also found on less diverse ephemeral habitats *T. schmidii* was only found intermixed with *Trematodon longicollis* MICHX., *Garckea flexuosa* (GRIFF.) MARGAD. & NORK., *Microdus brasiliensis* (DUBY) THÉR., *Ditrichum difficile* (DUBY) M. FLEISCH., *Pogonatum neesii* (MÜLL. HAL.) DOZY, *Dicranella* spec. and *Philonotis* spec.

Records from Karnataka:

- Kodagu district (Coorg), Way from Kabbe Holiday Homestay to the Big Hill (N 12.193883°, E 75.66495 °), 1160 m, on soil, 3 November 2012, leg. J.-P. FRAHM, F. SCHUMM, U. SCHWARZ. *Herbarium U. Schwarz* no. 11033.
- Kodagu district (Coorg), Area around and east of the Kabbe Holiday Homestay (N 12.199833 °, E 75.665217 °), 1050 m, on soil, 2 November 2012, leg. J.-P. FRAHM, F. SCHUMM, U. SCHWARZ. *Herbarium U. Schwarz* no. 11059.



Figure 1: Collection location of *Trematodon schmidii*, along the way from Kabbe Holiday Homestay to the Big Hill, herbar no. 11033

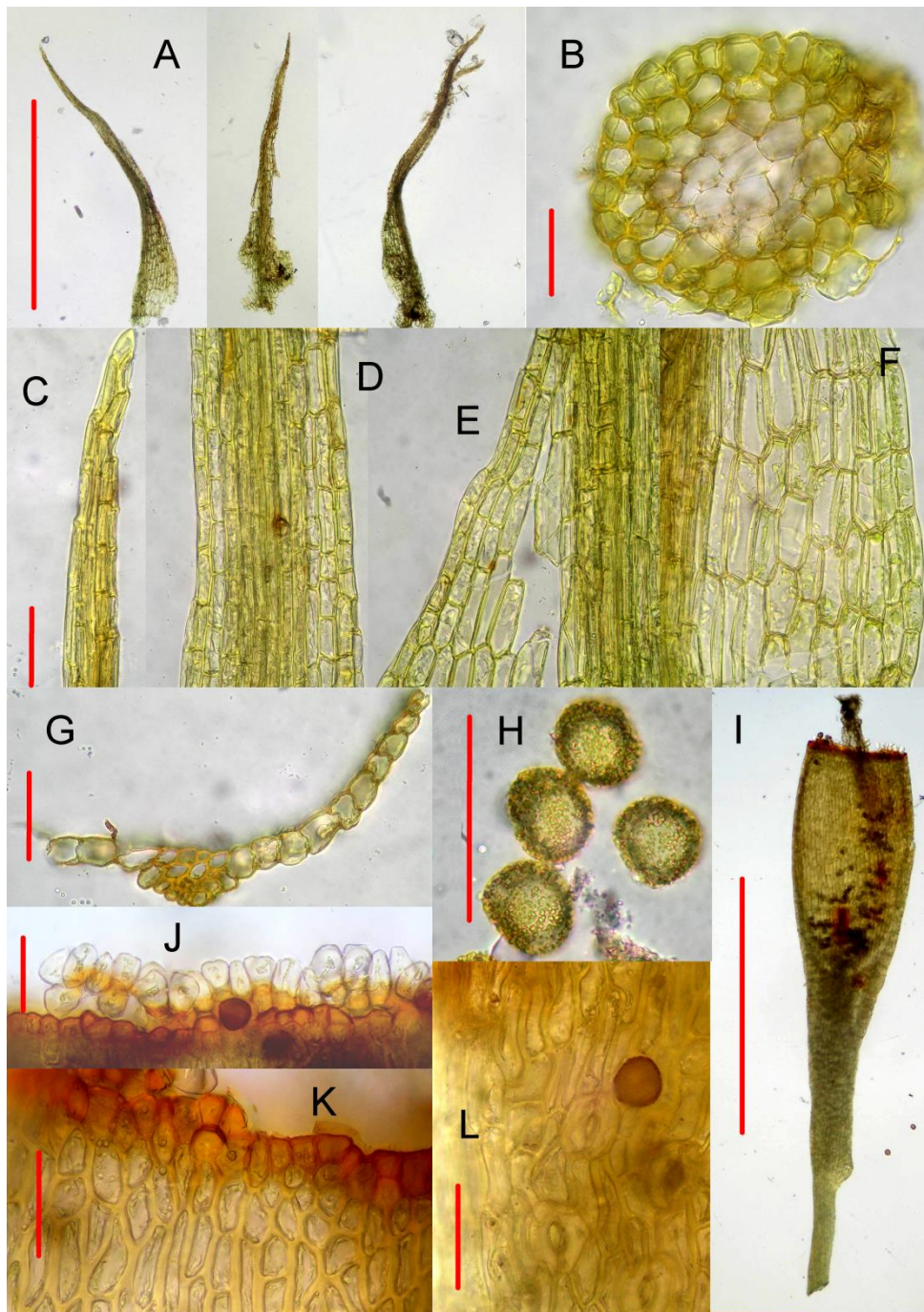


Plate 2: *Trematodon schmidii* MÜLL. HAL. A Leaves, B Stem cross section, C Leaf apex, D Lamina above shoulder area, E Shoulder area, F Leaf base, G Leaf cross section, H Spores, I Capsule, J Annulus, K Capsule mouth, L Stomata in apophysis area (scale: A, I – 1 mm, all other 50 µm)

3. Synopsis of the Bruchiaceae of India

Bruchiaceae SCHIMP. Corollarium Bryologiae Europaeae. 6. 1856

Plants small to medium sized, alar cells not differentiated, capsule with elongated necks, spores mostly with trilete markings, usually strongly ornamented. The family is only represented by the genus *Trematodon* in India.

Trematodon MICHX. Flora Boreali-Americana. 2. 289. 1903

Gregarious or loosely turfed plants, stem mostly simple, but with innovations at the base. Leaves either lanceolate or from sheeting base merging into a subulate apex. Costa percurrent or excurrent, sometimes filling out the complete leaf apex. Basal cells elongated rectangular or hexagonal, upper cells similar but shorter, sometimes papillose. Capsule with more or less long clavate neck and often curved. Apophysis often strumose. Annulus differentiated. Peristome present, rarely absent. Peristome teeth undivided and perforated, sometimes upwards unequally forked. Operculum with long oblique beak. Calyptra inflated, cucullate.

Key to taxa:

- 1 Leaves ovate-lanceolate to lanceolate, sheeting base not or only slightly developed 2
- 2 Lamina cells smooth 3
- 3 Apophysis strumose, as long as the capsule, peristome absent, consisting of a hyaline membrane *Trematodon schmidii* – p. 8
- 3 Apophysis not strumose, twice as long as the capsule, peristome well developed *Trematodon brevicalyx* – p. 8
- 2 Lamina cells papillose *Trematodon kurzii* – p. 8
- 1 Sheeting leaf base distinctly developed 4
- 4 Apophysis of mature capsule not or scarcely strumose 5
- 5 Plants 10 - 20 mm tall, seta up to 2 cm long, apophysis as long as the capsule *Trematodon hookeri* – p. 8
- 5 Plants approx. 2 mm tall, seta approx. 1 cm long, apophysis twice or more as long as the capsule 6
- 6 Apophysis gradually merging into the capsule, capsule 1.8 mm long, upper leaf margin denticulate *Trematodon assamensis* – p. 8
- 6 Apophysis abruptly merging into the capsule, capsule 0.8 mm long, upper leaf margin entire *Trematodon subulosus* – p. 9
- 4 Apophysis of mature capsule distinctly strumose 7
- 7 Lower lamina cells more than 20 µm wide, upper lamina cells slightly papillose *Trematodon conformis* – p. 8
- 7 Lower lamina cells less than 20 µm wide, upper lamina cells more or less smooth 8
- 8 Apophysis as long as the capsule *Trematodon capillifolius* – p. 8
- 8 Apophysis twice or more as long as the capsule 9
- 9 Plants up to 15 mm tall, urn about 2 mm long, apophyses rather short *Trematodon megapophysatus* – p. 8
- 9 Plants 2-7 mm tall, urn more than 2.5 mm long, apophysis very long, up to 9 mm *Trematodon longicollis* – p. 8

1. Trematodon assamensis BROTH. IN G. ROTH. Die Aussereuropäischen Laubmoose. 278. pl. 28, fig. 1. 1911. – Fig. 1

Plants 2 mm tall. Leaves with sheeting base. Sheeting base 1/5 of the leaf length. Upper margin denticulate. Costa reaching to leaf apex. Basal cells rectangular, 14 µm wide, upper cells short

rectangular, 6 μm wide, smooth. Seta 1.1 cm long. Capsule 1.8 mm long. Apophysis twice as long as as the capsule, not strumose. – *Meghalaya*

2. *Trematodon brevicalyx* DIXON EX MATHUR. *Journal of the Indian Botanical Society*. 4:294. 1925. – Fig. 2

Plants 2-5 mm tall. Leaves lanceolate. Upper margin entire. Costa reaching to leaf apex. Basal cells rectangular - hexagonal, upper cells short rectangular, smooth. Seta 1-1.5 cm long. Capsule 2-3 mm long. Apophysis twice as long as as the capsule, not strumose. Peristom present. – *Delhi, South India, Western Himalayas, Gangetic Plain*

3. *Trematodon capillifolius* MÜLL. HAL. EX G. ROTH. *Die Aussereuropäischen Laubmoose*. 296. pl. 28, fig. 3. 1911. – Fig. 3

Plants 4 mm tall. Leaves with sheeting base. Upper margin denticulate. Costa reaching to leaf apex. Basal cells rectangular, 15-18 μm wide, upper cells short rectangular, 10 μm wide, smooth. Seta 1-1.5 cm long. Capsule 1.5 mm long. Apophysis as long as as the capsule, strumose. Peristom present. Spores 20-25 μm . – *Uttar Pradesh, Uttarakhand*

4. *Trematodon conformis* MITT. *Journal of the proceedings of the Linnean Society. Botany. Suppl.* 1:12. 1859. [syn. *Trematodon indicus* MITT. EX MÜLL. HAL.] – Fig. 4

Plants 8 mm tall. Leaves with sheeting base. Sheeting base 1/3 of the leaf length. Upper margin denticulate. Costa reaching to leaf apex. Basal cells rectangular, 22.5 μm wide, upper cells short rectangular, slightly papillose. Seta 1-2 cm long. Capsule 2 mm long. Apophysis 1.5 times as long as as the capsule, strumose. Peristom present. Spores 17-23 μm . – *Arunachal Pradesh, Sikkim, Tamil Nadu, West Bengal, Western Himalayas*

5. *Trematodon hookeri* MÜLL. HAL. *Botanische Zeitung (Berlin)*. 22:350. 1864. – Fig. 5

Plants 10-20 mm tall. Leaves with sheeting base. Sheeting base 1/4 of the leaf length. Upper margin denticulate. Costa reaching to leaf apex. Basal cells rectangular, 12 μm wide, upper cells short rectangular, 6 μm wide, smooth. Seta 2 cm long. Capsule 3.5 mm long. Apophysis as long as as the capsule, not strumose. Peristom present. Spores 25 μm . – *Sikkim, West Bengal*

6. *Trematodon kurzii* HAMPE EX GANGULEE. *Mosses of Eastern India and adjacent regions. Fasc.* 2. 222. fig. 100. 1971. – Fig. 6

Plants 2-3 mm tall. Leaves lanceolate, sheeting base scarcely developed. Upper margin entire. Costa reaching to leaf apex. Basal cells rectangular - hexagonal, 25 μm wide, upper cells short rectangular, 8 μm wide, papillose. Seta 2-3 cm long. Capsule 3 mm long. Apophysis 1.5 times as long as as the capsule, not strumose. Peristom present. Spores 14 μm . – *West Bengal, Eastern Himalayas*

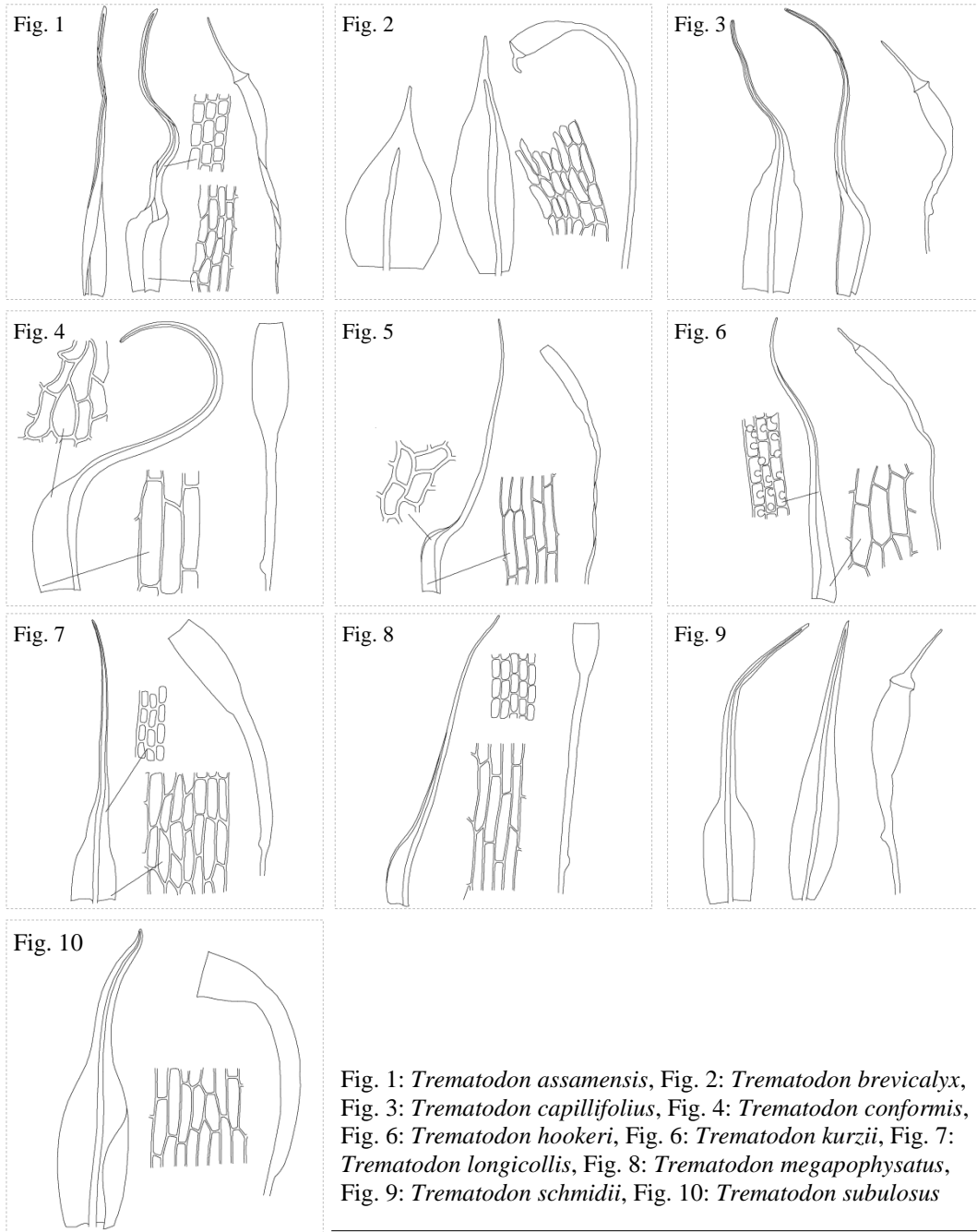
7. *Trematodon longicollis* MICHX. *Flora Boreali-Americana* 2. 289. 1803. [syn. *Trematodon ceylonensis* MÜLL. HAL., *Trematodon paucifolius* MÜLL. HAL.] – Fig. 7

Plants 2-7 mm tall. Leaves with sheeting base. Sheeting base 1/5 of the leaf length. Upper margin denticulate. Costa reaching to leaf apex. Basal cells rectangular, 11-14 μm wide, upper cells short rectangular, 5-8 μm wide, smooth. Seta 2-3 cm long. Capsule 2-3 mm long. Apophysis 2-3 times as long as as the capsule, strumose. Peristom present. Spores 18-22 μm . – *Arunachal Pradesh, Assam, Jharkhand, Karnataka, Kerala, Manipur, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal, Central India, Gangetic Plain*

8. *Trematodon megapophysatus* MÜLL. HAL. *Botanische Zeitung (Berlin)*. 22:350. 1864. – Fig. 8

Plants 15 mm tall. Leaves with sheeting base. Sheeting base 1/4 of the leaf length. Upper margin entire. Costa reaching to leaf apex. Basal cells rectangular, 14 μm wide, upper cells short

rectangular, 6 μm wide, smooth. Seta 3 cm long. Capsule 2 mm long. Apophysis 3 times as long as the capsule, strumose. Peristom present. Spores 19-22 μm . – Sikkim, West Bengal



9. *Trematodon schmidii* MÜLL. HAL. *Botanische Zeitung (Berlin)*. 11:40. 1853. – Fig. 9

Plants 2-3 mm tall. Leaves lanceolate. Upper margin entire. Costa excurrent. Basal cells rectangular - hexagonal, 15-20 μm wide, upper cells rectangular - hexagonal, 9-10 μm wide, smooth. Seta 0.6 - 0.8 cm long. Apophysis as long as as the capsule, strumose. Peristom absent, consisting of a hyaline membrane. Spores 20-30 μm . – *Tamil Nadu*

10. *Trematodon subulosus* GRIFF. *Calcutta journal of natural history*. 2:493. 1842. [syn. *Trematodon sabulosus* GRIFF.] – Fig. 10

Plants 2 mm tall. Leaves with sheeting base. Upper margin entire. Costa reaching to leaf apex. Basal cells rectangular, 17 μm wide, upper cells short rectangular, 7 μm wide, smooth. Seta 0.8 cm long. Capsule 0.8 mm long. Apophysis 3 times as long as as the capsule, not strumose. Peristom present. Spores 14-17 μm . – *Arunachal Pradesh, Assam, Punjab, Rajasthan, Western Himalayas, Eastern Himalayas*

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