

Diversity and Distribution of the Family Pottiaceae (Bryopsida) from Pachamalai Hills, Eastern Ghats of Tamil Nadu

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Abstract- Bryophytes are the most diverse group among the terrestrial plants next to angiospermic plants. Even though there is an increase in the floristic study of bryophytes in many parts of the world and in India, the Eastern Ghats remains more or less an unexplored or underexplored region in terms of bryophyte diversity. Pachamalai Hills is an important range of mountains of Eastern Ghats known for its rich diversity of plants. However moss flora of Pachamalai Hills has not been recorded previously. Hence a floristic study of mosses was carried out in this study area. It revealed that the family Pottiaceae is the dominant one with 13 species belonging to 8 genera. Of these 13 species of Pottiaceae, *Trichostomum brachydontium* and *T. criotum* were found to be the new records to Tamilnadu.

INTRODUCTION

Even though the economic importance of mosses and liverworts are not much pronounced, their relative important role in water retention, nutrient recycling and soil stabilization is obvious. Bryophytes are able to occupy variety of habitats in diverse ranges of growth forms because of their ability to survive in adverse conditions. They are integral part of natural environment of forest ecosystems. In spite of their species diversity, the lack of basic floristic, ecological and alpha-taxonomic knowledge of the plants in many regions could be attributed as a major limitation in the use of bryophytes as study organisms (Mohan Bahuguna et al, 2014). Realizing the significant role, bryophytes could play a major role in future research; it has been felt that it is vital to make a floristic study in the major bryogeographical zones worldwide. Floristic studies of mosses carried out by Kumar and Krishnamurthy (2007), Sahaya Sathish et al. (2013), Biju and Daniels

(2016) and Palani et al. (2017) show that this region is also rich in bryophyte diversity. Pachamalai Hills is a part of Eastern Ghats, located at Tamil Nadu where an attempt was made to enumerate the species of Bryopsida.

EARLIER REPORTS ON POTTIACEAE IN INDIA

Pottiaceae is the most dominant erect moss family of India. Its species represent more than 10% of the moss species known from the whole world. Gangulee (1969-1980) has prepared taxonomic description of 73 taxa coming under 24 genera from Eastern India. Daniels (2003) has enumerated 10 taxa belonging to five genera from Western Ghats, India. Aziz & Vohra (2008) have provided the taxonomic account for 130 species under 29 genera in India. Manju et al. (2008) collected 17 taxa under this family from Kerala. Daniels (2010) has reported 39 taxa and 16 genera from Tamil Nadu. Dandotiya et al. (2011) prepared a list of 206 taxa from 40 genera distributed in India. A total number of 130 species and 26 genera have been enumerated by Nath et al. (2011) from Central India. Alam (2013) has reported 116 species belonging to 32 genera from Western Himalayas, India. Alam et al. (2015) recorded 34 taxa under 19 genera from Central India. Vidya et al. (2015) reported 18 species among 13 genera of Kerala, India. Sahu & Asthana (2015) have documented a total number of 6 taxa of five genera from Uttar Pradesh. From Gangetic Plains of India, Rawat et al. (2016) have reported 17 taxa belonging to 9 genera.

MATERIALS AND METHODS

Study area

The Eastern Ghats is a long stretch of hills covering various states of South India viz., Odissa, Andhra Pradesh, Tamil Nadu and some parts of Karnataka. In Tamil Nadu it is spreading over three Districts namely Perambalur, Salem and Tiruchirappalli. The Pachamalai Hills of Tiruchirappalli District is geographically situated between 78° 31' E and 11° 28' N to 78° 20' E and 11° 10' N occupying an area of about 527.61 km². The climate is tropical with temperature ranging between 25 to 30°C and a minimum temperature range of 12 to 18°C with an annual rainfall of 800-900 mm in the altitude of 1015 MSL. The vegetation has mixed forests of deciduous and evergreen trees and shrubs.

Field visits were carried out for three years from 2013 to 2015 covering pre monsoon, monsoon and post monsoon seasons. Plants were gently scraped out from the substrates with the help of sharp edged knife and spatula. The materials were collected in the polythene cover. The collected materials were washed gently to remove the soil and debris adhering to them. Finally the collected parts were carefully pressed out without damaging the fragile plant parts. The excess amount of water from the plants was removed using blotting papers. Herbaria were prepared by air drying the materials at room temperature. The dried specimens were stored in brown paper packets of dimensions 5" x 4" inches. The packets were labeled with the necessary information and they were stored and kept away from insects. The plants were identified with the help of Gangulee's 'Mosses of Eastern India and Adjacent Regions' (1969-1980), 'Bryophytes of Wayanad in Western Ghats' (Manju et al. 2005) and Checklist of the Bryophytes of Tamil Nadu, India (Daniels, 2010). Voucher specimens were deposited in the Centre for Cryptogamic Studies Herbarium (CCSH), Department of Botany, St. Joseph's College (Autonomous), Tiruchirappalli - 620 002, Tamil Nadu, India.

TAXONOMIC OBSERVATION

The present study reports a total number of 13 taxa belonging to 8 genera in Pachamalai Hills. The taxonomic description, locality and the habitat are given. The voucher numbers were prepared for the taxa.

1. *BARBULA INDICA* (HOOK.) SPRENG., NOMENCL. BOT. 2: 72. 1824.

Semibarbula orientalis (Web.) Wijk et Marg., Taxon, 8: 75. 1959.

Plants are pale green in colour, appearing as dense tufts; stem branched, up to 1.5 cm in height; leaves ovate-spathulate, arranged spirally around the stem, margin serrated; costa strong, light greenish with slightly excurrent; apical cells are irregularly shaped, 5-8 µm, thickly papillose; cells round in the middle leaf, thickly packed, papillose; polygonal cells at leaf base, 25x10 µm, smooth; small rectangular cells at costal region of leaf, smooth, thick, elongated rectangular cells at leaf margin, smooth, hyaline.

Specimen examined: Nagoor, CCSH 1679, 13.07.2013.

Habitat & Distribution: Rupicolous. Tamil Nadu, Kerala, Himalayas, Nepal, Uttar Pradesh, Darjeeling, Arunachal Pradesh, Bengal, Odissa and Sri Lanka.

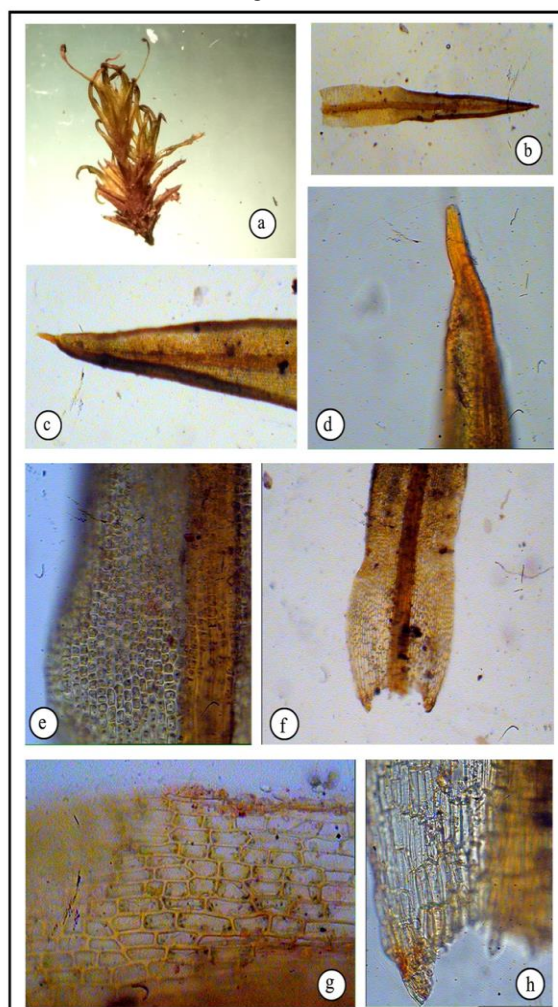


Figure-1. *Barbula indica* (Hook.) Spreng., a. habit, b. leaf, c. leaf apex, d. enlarged leaf cells, e. cells of median leaf, f. leaf base with margin, g. enlarged portion of leaf base, h. leaf basal cells.

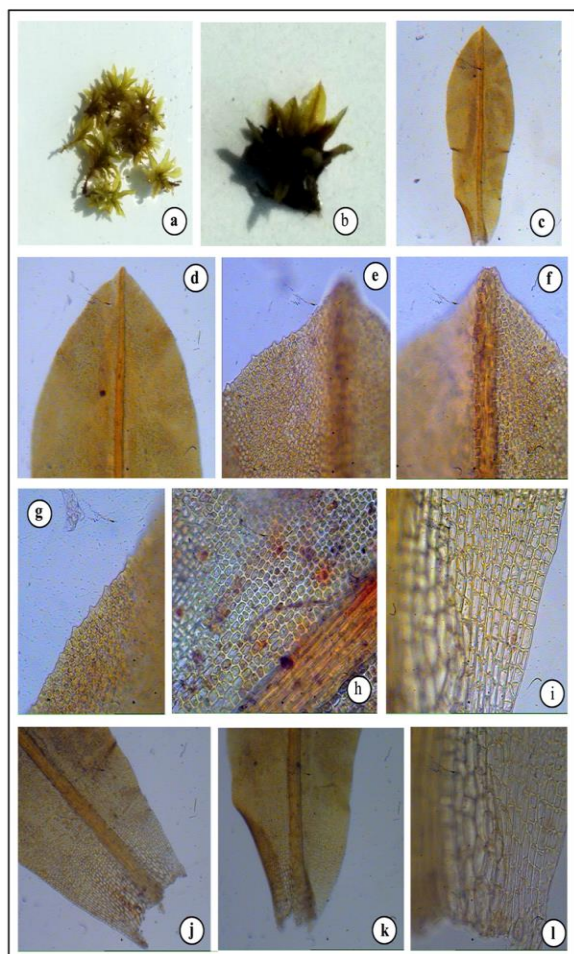


Figure-2. *Hyophila involuta* (Hook.) A. Jaeger, a-b. habit, c. leaf, d. leaf apex, e. enlarged portion of leaf apex with margin, f. enlarged portion of leaf cells, g. leaf margin, h. median cells of leaf, i. enlarged portion of leaf cells, j-k. leaf base, l. enlarged portion of leaf basal cells.

2. *BARBULA TENUIROSTRIS* BRID., BRYOL. UNIV. 1: 826. 1827.

Tortula angustifolia Hook. & Grev., Edinburgh J. Sci. 1: 298. 12. 1824.

Plant yellowish green, dense tufts, branched, 6-9 mm long. Leaves lanceolate, pale green in colour, 3.5 x 0.6 mm; costa brown, prominent, excurrent, margin wavy; hexagonal cells at leaf tip, papillose; leaf middle cells thickly arranged with papillose, hexagonal cells; rectangular cells at leaf base,

papillose; cells at costal region elongated, loosely arranged, rectangular.

Specimen examined: Periyakattu solai, CCSH 1789, 03.09.2013.

Habitat & Distribution: Terricolous. Tamil Nadu, Kerala, Manipur, Nepal, Uttar Pradesh, Western Himalaya, Madhya Pradesh, Bihar, West Bengal, Darjeeling, Arunachal Pradesh and Sri Lanka.

3. *HYMENOSTOMUM EDENTULUM* (MITT.) BESCH., BULL. SOC. BOT. FRANCE 34: 95. 1887.

Hymenostomum pantherianum (Besch.) A. Jaeger, Ber. Thatigk. St. Gallischen Naturwiss. Ges. 1877-78: 366.

Plant yellowish green, 2-8 cm high, forming dense mats on soil; stem simple or branched, branches erect, leaves lanceolate, up to 3 mm long, apex narrow pointed, margin serrated, costa prominent, excurrent; smooth cells at base, cells rounded to quadrate at apex, up to 9 µm wide, papillose.

Specimen examined: Periyamangalam, CCSH 1632, 26.07.2015

Habitat & Distribution: Terricolous. Tamil Nadu, Kerala, Andaman & Nicobar Islands and Sri Lanka

4. *HYMENOSTYLUM RECURVIROSTRUM* (HEDW.) DIXON, REV. BRYOL. LICHENOL. 6: 96. 1933.

Hymenostylium annotinum Mitt. ex Dixon, J. Bot. 48: 308. 11. 1910.

Plants yellowish green, forming dense tufts, up to 3 mm high, branched, leaves curled when dry, linear-lanceolate, up to 1.5 mm long, leaf margin wavy, apex acute, costa prominent, strong, ending below apex, upper cells are chlorophyllous, 6-8 µm, papillose, rounded; hyaline cells at median leaf, cells rectangular in the leaf base, cells near costa are becoming shorter towards margin.

Specimen examined: Ponavarai, CCSH 1489, 06.07.2013.

Habitat & Distribution: Terricolous. Kerala, Eastern & Western Himalaya, Kashmir, South India and Tamil Nadu.

5. *HYOPHILA INVOLUTA* (HOOK.) A. JAEGER, BER. THATIGK. ST. GALLISCHEN NATURWISS. GES. 1871-72: 354. 1873.

GYMNOSTOMUM INVOLUTUM HOOKER, MUSCI EXOTICI. 2: 154. 1819.

Plants yellowish green in colour, erect, simple or branched, 6 mm high, upper leaves spreading in rosettes, leaves erect spreading, ligulate to spathulate; costa prominent, strong, ends at the leaf tip; serrated margin at tip, apex pointed, basal region is wider; leaf tip cells small, hexagonal cells with papillose, 6-10 µm in diameter, elongated smooth cells found at base; large and elongated cells near costal region of leaf.

Specimen examined: Nalamanthi, CCSH 1611, 13.07.2013.

Habitat & Distribution: Rupicolous. Tamil Nadu, Kerala, Karnataka, Uttar Pradesh, Uttarakhand, Andaman and Nicobar Islands, Gujarat, Arunachal Pradesh, Assam, Darjeeling, Meghalaya, West Bengal, Rajasthan, Jharkhand and Himachal Pradesh.

6. HYOPHILA KURZIANA GANGULEE, NOVA HEDWIGIA 12: 422. PL. 4. 1966.

Plant forming mats, up to 5.5 mm; rhizoids red in colour; stem branched, radiculose; leaves uniform, curled, inrolled at margin when dry, erecto-patent, up to 3mm in length, spathulate, carinate, apex apiculate, the cells are oblong, semi-sheathing, hyaline at base; incrassate cells found at apical and median leaf 5-11 x 4-10 µm, rounded-quadrate, mamilllose; thin-walled rectangular cells at extreme base, hyaline; costa excurrent, brown in colour.

Specimen examined: Puthur, CCSH 1813, 26.07.2015.

Habitat & Distribution: Terricolous. Tamil Nadu and West Bengal.

7. HYOPHILA ROSEA R.S. WILLIAMS, BULL. NEW YORK BOT. GARD. 8 (31): 341. 1914.

Hyophila comosa Dixon, Arch. Bot. Bull. Mens. 1(8-9): 166. 5 f. 2. 1927.

Plants dioicous, tufted, green, simple or branched, up to 7 mm high; leaves forming rosette tufts at apex, erectopatent, curled when dry, 3 x 0.8 mm, lingulate from a narrower base, keeled, sheathing, base short, apex acuminate, margin usually slightly involutes towards base; costa brown, papillose, percurrent, laminal cells chlorophyllose, multipapillose, obscure, hexagonal to round, smooth at basal portion, pellucid, rectangular cells, becoming smaller towards apex and margin.

Specimen examined: Cinnamangalam, CCSH 1686, 13.07.2013.

Habitat & Distribution: Corticolous & Tamil Nadu, Himalayas, Rajasthan

8. OXYSTEGUS CYLINDROTHECUS (MITT.) GANGULEE, NOVA HEDWIGIA 12: 430. 1966.

Barbula cylindrotheca (Mitt.) A. Jaeger, in Ber. Scnckenberg. Naturf. Ges. 1871-72: 416. 1873.

Plant up to 1.5 cm height, caespitose; stem dichotomously branched; leaves uniform, erectopatent to spreading, 3 x 0.5 mm, ligulate, carinate, apex apiculate and entire; chlorophyllose cells at apical and median region, incrassate, multipapillate, rounded-quadrate cells; basal cells are thin-walled, rectangular, hyaline; costa excurrent.

Specimen examined: Periyapakalam, CCSH 1513, 06.07.2013.

Habitat & Distribution: Corticolous. Tamil Nadu, Sikkim and West Bengal.

9. SEMIBARBULA RANUII GANGULEE, NOVA HEDWIGIA 8: 148. PL. 5. 1964.

Plants forming loose tufts, stem not branched, up to 1.3 mm high; leaves, oblong-lanceolate, erectopatent, 2 x 0.5 mm; leaf margin flat, apex broadly acuminate; costa prominent, golden brown in colour, excurrent in a short apiculus, coarse papillae on lower side, rounded-quadrate to hexagonal cells at upper lamina, multipapillose, rectangular cells at basal lamina, hyaline.

Specimen examined: Cinnamangalam, CCSH 1652, 13.07.2013.

Habitat & Distribution: Corticolous. Tamilnadu and East Nepal.

10. TORTELLA TORTUOSA (HEDW.) LIMPR., LAUBM. DEUTSCHL. 1: 604. 1888.

Tortula tortuosa Hedwig, Sp. Musc. Frond., 124. 1801.

Plant yellowish green in colour, forming dense tufts, stem erect, up to 8 mm height; leaves curled, lanceolate, narrow, broad at base; costa light brown in colour, prominent, excurrent, leaf margin crenulate at apex, leaf up to 5 mm long, rounded to quadrate cells at leaf tip, thickly packed, papillose; elongated rectangular cells at base, thin walled, hyaline.

Specimen examined: Top Sengattupatti, CCSH 1746, 03.09.2013.

Habitat & Distribution: Terricolous. Tamil Nadu, Kerala, Kashmir, Uttarakhand and Nepal.

11. *TRICHOSTOMUM BRACHYDONTIUM* BRUCH, FLORA 12: 393. PL. 3. 1829.

Trichostomum mutabile Bruch ex De Not., Syllab. Musc. 192. 1838.

Plant yellowish green to dark green, forming patches or tufts, up to 4 cm height; leaves tongue shaped, 3 x 0.7mm, tip shortly excurrent, slender or tapering at tip, recurved, crisped and incurved when dry, margin narrowly recurved; upper lamina cells incrassate, chlorophyllose, quadrate, papillose; basal cells rectangular, hyaline.

Specimen examined: Cinnamangalam, CCSH 1651, 13.07.2013.

Habitat & Distribution: Corticolous. Darjeeling and Kashmir.

12. *TRICHOSTOMUM CRIOTUM* R.H. ZANDER, BULL. BUFFALO SOC. NAT. SCI. 32: 92. 1993.

Hyophila perannulata Renault & Cardot, Bull. Soc. Roy. Bot. Belgique 34 (2): 60 1896.

Plants dioicous, tufted, green in colour, usually unbranch, up to 5 mm height, showing rosette appearance; leaves broadly lingulate, erectopatent to spreading, curled and involute when dry, 3 x 0.5 mm, apex broadly acuminate, leaf margin usually flat and unbroken when moist, not denticulate; costa light brown in colour, excurrent; chlorophyllose cells at upper lamina, irregularly rounded-hexagonal, multipapillate, obscure; leaf base formed of lax, thin walled, smooth, pellucid cells, becoming shorter and narrower towards margin; rectangular to hexagonal cells at middle lamina.

Specimen examined: Puthur, CCSH 1807, 26.07.2015.

Habitat & Distribution: Terricolous. Eastern Himalaya, Khasia Hills, Vietnam, Thailand and Kerala.

13. *TRICHOSTOMUM TENUIROSTRE* (HOOK. & TAYLOR) LINDB., OFVERS. FORH. KONGL. SVENSKA VETENSK.-AKAD. 21: 225. 1864.

Oxystegus cylindricus (Bruch ex Brid.) Hilp., Beih. Bot. Centralbl., Abt. 2 50 (2): 620. 1933.

Plant up to 5 mm height, forming mats or tufts; stem simple; leaves uniform, curled and erectopatent, spatulate, carinate, 3 - 4.5 x 0.5 mm, entire, sometimes faintly toothed at apex; chlorophyllose cells at apical and middle portions of leaf, incrassate, mamillate, rounded-quadrate cells; basal cells thin-

walled, rectangular, hyaline; costa percurrent, red-brown in colour.

Specimen examined: Periya mangalam, CCSH 1602, 13.07.2013.

Habitat & Distribution: Terricolous. Tamil Nadu, Western Himalayas, West Bengal, Nepal and Sri Lanka.

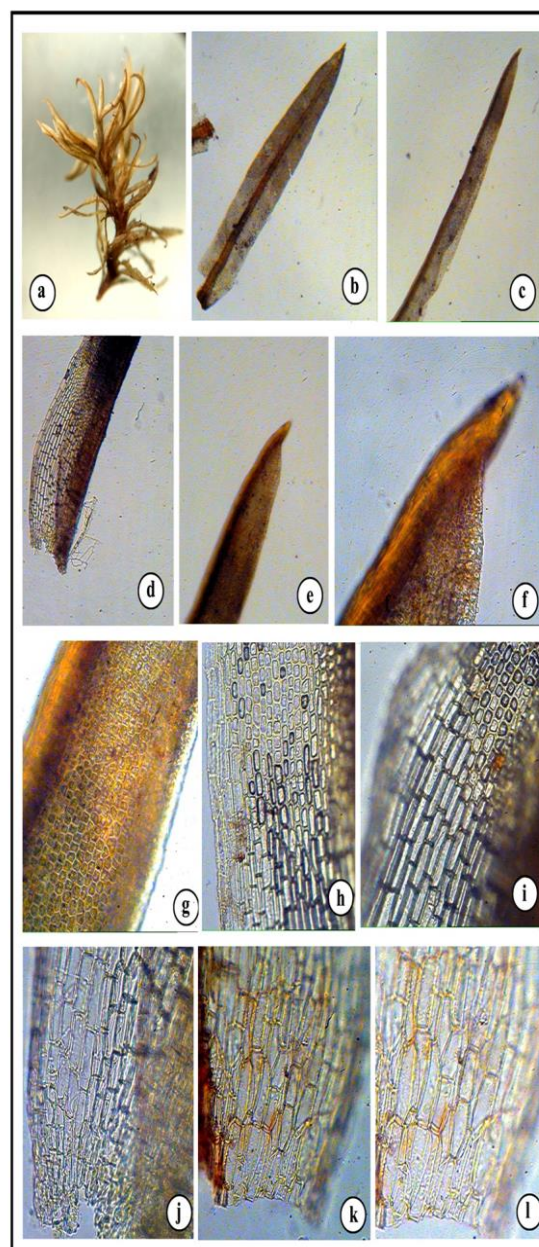


Figure-3. *Oxystegus cylindrothecus* (Mitt.) Gangulee, a. habit, b-c. leaf, d. leaf base, e. leaf apex, f. enlarged portion of leaf apex, g. cells of leaf apex, h-i. median cells with margin, j-l. cells at leaf base.

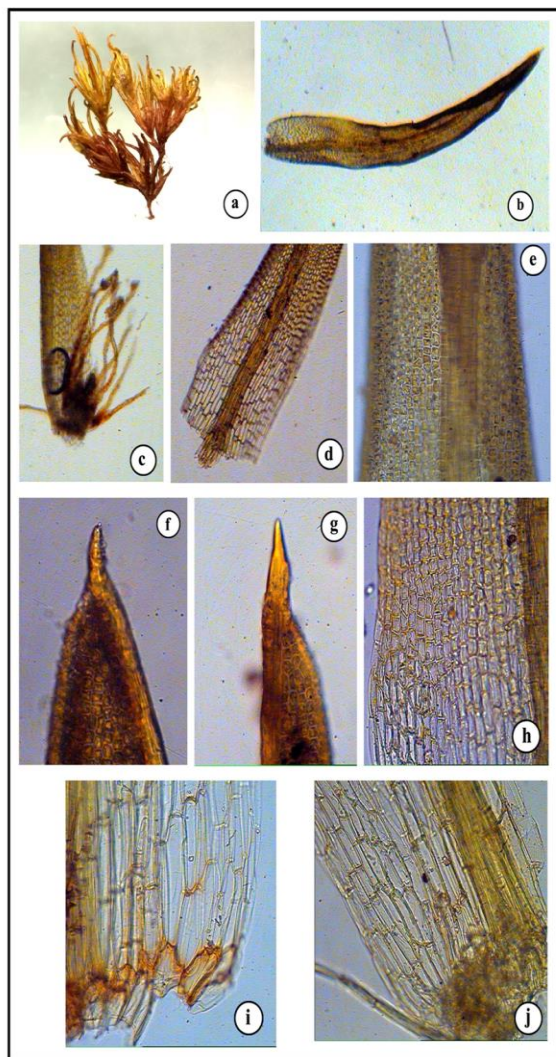


Figure-4. *Tortella tortuosa* (Hedw.) Limpr., a. habit, b. leaf, c-d. leaf base, e. enlarged portion of median leaf, f-g. excurrent costa, h. median cells with margin of leaf, i-j. basal cells of leaf.

DISCUSSION

The family Pottiaceae is the most abundant one among other families of Bryopsida, which is reported in the bryo-geographical zones in India. The previous reports have clearly indicated that this family as the most common and represented by a number of taxa in many regions of India. These species were widely reported from various localities of India (Chaudhary et al. 2006, Chaudhary & Sharma, 2007, Nath & Gupta, 2007, 2008, Aziz & Vohra, 2008, Nath & Bansal, 2009, Manju et al. 2008). Among the members of the family Pottiaceae, two taxa, *Barbula*

indica, and *Hyophila involuta* were reported as the most widely distributed taxa in India. They have been reported from all the bryo-geographical zones of India. The ability of these species to adapt to various climatic conditions may attribute for their wider distribution.

From Palni Hills, a total number of 4 species from 3 genera were reported by Alam et al. (2011) namely *Bryoerythrophyllum recurvistrum*, *Hyophila involuta*, *H. kurziana* and *Trichostomum orthodontum*. The distribution of members of Pottiaceae has been reported from other parts of Eastern Ghats also. Four taxa viz., *Hyophila comosa*, *H. involuta*, *Trichostomum tenuirostre* and *Leptodontium viticulosoides* were reported from Kolli Hills (Sahaya Sathish, 2013). Another report of 12 taxa and 10 genera were made from Bodamalai Hills (Palani et al. 2017). (Sahaya Sathish et al. 2014) have reported four taxa (*Hyophila ranuii*, *H. involuta*, *H. kurziana* and *Trichostomum tenuirostre*) from Kalyaran Hills. In the present study maximum of 13 taxa from the family Pottiaceae have been reported from Pachamalai Hills, Tamil Nadu. Among 13 species, *Trichostomum brachydontium* and *T. criotum* were reported for the first time in Tamil Nadu.

ACKNOWLEDGEMENTS

The authors are thankful to the University Grants Commission (UGC), New Delhi - for financial support (F. No. 41-449/2012(SR) Dt.07/07/2012). We also thank Dr. Manju C.N., Assistant Professor, Department of Botany, Zamorin's Guruvayurappan College, Kozhikode, Kerala for her kind help in conforming the specimens.

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