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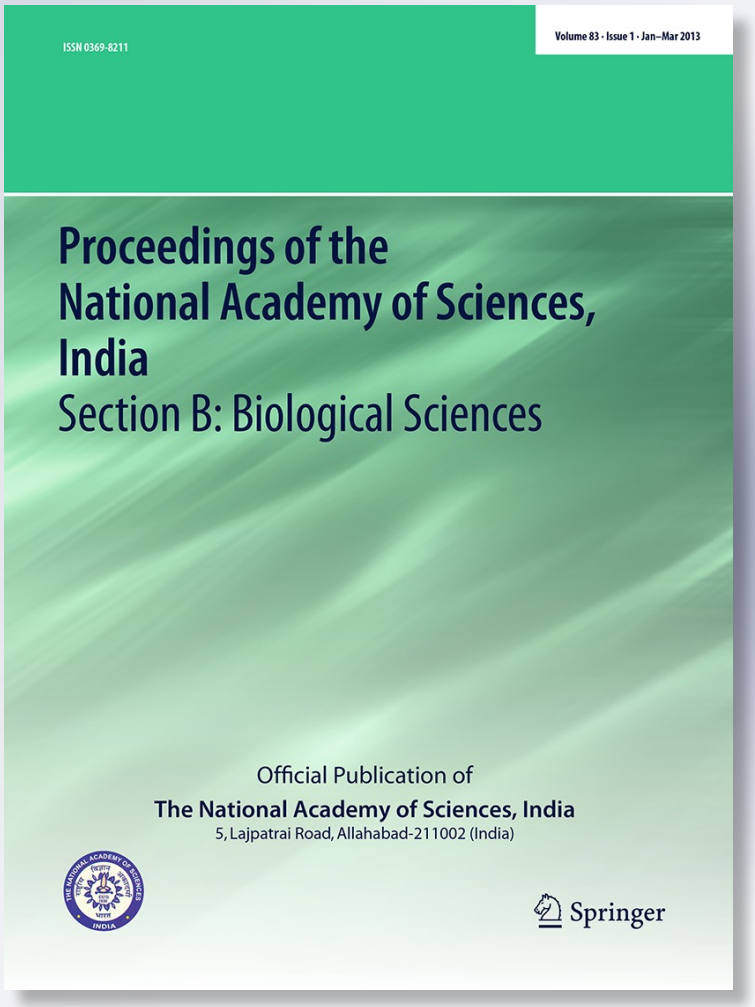

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REVIEW

An Appraisal of the genus *Marchantia* in India with a Note on *Marchantia emarginata* subspecies *emarginata* in Indian Himalayan Region

Devendra Singh · D. K. Singh

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Abstract The genus *Marchantia* Linnaeus is widely distributed in all the bryogeographical regions of the country and forms a part of undergraduate and post graduate syllabi of most Indian universities. The paper reviews the taxonomic status of various species of the genus described/recorded from the country so far and describes *Marchantia emarginata* Reinwardt, Blume and Nees subspecies *emarginata*—a taxon hitherto known in Indian bryology from Western Ghats and Andaman and Nicobar Islands, for the first time from the Indian Himalayan region. Out of 23 binomial/trinomials recorded under the genus from India so far, only 10 are currently accepted. A key, distribution and habitat of the Indian taxa of the genus have been provided.

Keywords *Marchantia* · India review

Introduction

The genus *Marchantia* L. is represented by 36 species in the world distributed mostly in tropical–subtropical or temperate regions [1]. The various species of the genus are referable to three subgenera, viz. *Marchantia*, *Chlamidium* (Chorda) Bischl. and *Protomarchantia* R.M.Schust., of which subgenus *Chlamidium* is further divided into three sections, viz. *Chlamidium*, *Paleaceae* Bischl. and *Papillatae* Bischl., while subgenus *Protomarchantia* is divided into two sections, viz. *Subgeminatae* Bischl. and *Protomarchantia* [2].

In India the genus was first recorded by Gottsche et al. [3], who described *M. nitida* Lehm. and Lindenb. from Nilgri hills in Western Ghats and *M. squamosa* Raddi ex Lehm. and Lindenb. from India. A couple of years later Griffith [4, 5] described *M. polymorpha* L. and instituted a new species, *M. assamica* Griff. from Assam. Subsequently, Mitten [6] recorded six species, viz. *M. assamica* (Assam), *M. linearis* Lehm. and Lindenb. (Meghalaya, Sikkim), *M. nitida* Lehm. and Lindenb. (Sikkim, Uttarakhand), *M. polymorpha* (Jammu and Kashmir and Sikkim), *M. squamosa* (India) and *M. subintegra* Mitt. (Sikkim). Stephani [7] in his world monograph on Hepaticae recorded six species from India viz. *M. simlana* Steph. from Shimla (Himachal Pradesh), *M. assamica* from Assam and *M. subintegra* from Assam and Darjeeling (West Bengal), *M. polymorpha*, *M. nepalensis* Lehm. and Lindenb. and *M. palmata* Reinw. et al. from the Himalaya. Kashyap [8] described four species viz. *M. nepalensis*, *M. polymorpha*, *M. palmata* and *M. simlana* from Western Himalaya and the Punjab plain. Chopra [9] listed five species viz. *M. nepalensis* (Darjeeling), *M. nitida* (Sikkim), *M. palmata* (Sikkim, West Bengal), M. *polymorpha* L. (Darjeeling) and *M. subintegra* Mitt. (Darjeeling). In the same year he [10] listed four species from South India, viz. *M. indica* Kashyap ex R.S.Chopra from Madras, *M. palmata* from Nilgiris, Kodaikanal, Negapatam and Palni Hills, *M. nepalensis* from Madras and *M. polymorpha* from Kotagiri, Madras, Kodaikanal and Negapatam. A year later, Srinivasan [11] also recorded *M. palmata* from Nilgiris.

Chopra [12] in his census of Indian Hepaticae included 11 species of the genus, viz. *M. assamica, M. geminata* Reinw. et al., *M. indica, M. linearis, M. nepalensis,*

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M. nitida, M. palmata, M. polymorpha, M. simlana, M. squamosa, M. subintegra. Kachroo [13] recorded *M. assamica*, *M. nepalensis*, *M. linearis* and *M. palmata* from Assam; Pandé and Srivastava [14] reported *M. nepalensis* and *M. palmata* from Central India, while Bapna [15] described *M. polymorpha* from Mt. Abu in Rajasthan. Udar and Chandra [16] recorded *M.* cf. *grisea* Burgeff. from Ootacamund, and two years later, Amakawa [17] described *M. papulosa* Amakawa from Darjeeling and Sikkim and *M. togashii* Amakawa from Darjeeling. In his part revision of the genus in India, Singh [18] described 7 species, viz. *M. assamica*, *M. geminata*, *M. linearis*, *M. nepalensis*, *M. palmata*, *M. polymorpha* and *M. subintegra* from India. In yet another census of Indian hepatics, Kachroo et al. [19] listed 10 species of the genus from different parts of the country, viz. *M. polymorpha* (Eastern Himalaya, Western Himalaya, Western Ghats), *M. palmata* and *M. paleacea* (Western Himalaya, Eastern Himalaya, Central India and Gangetic Plains), *M. assamica* (Eastern Himalaya), *M. indica* (Western Ghats), *M. geminata* (Eastern Himalaya and Western Ghats), *M. linearis* (Eastern Himalaya), *M.* cf. *grisea* (Western Ghats) and *M. papulosa* and *M. togashii* (Eastern Himalaya). Udar and Shaheen [20] treated *M. indica* as an illegitimate name, not validly published, and described a new species *M. kashyapii* Udar and Shaheen based on the plants, collected from Kodaikanal, Palni Hills and Nilgiris, referable to the former. Parihar et al. [21] listed 11 species of the genus in their annotated checklist of Indian hepatics and anthocerotes, which excluded *M. nepalensis, M. nitida* and *M. squamosa* of Chopra's [12] and *M.* cf. *grisea* and *M. indica* of Kachroo et al. [19] census respectively, but included *M. kashyapii* described about a decade earlier by Udar and Shaheen [20].

Bischler [2], in her critical revision of the genus in Asia and the Oceania, synonymised *M. kashyapii* under *M. pappeana* Lehm. subsp. *robusta* (Steph.) Bischl., *M. papulosa* under *M. subintegra* and *M. palmata* under *M. emarginata* Reinw. et al. subsp. *emarginata* and redefined the status of several other Indian species. She [2] assigned the plants from different parts of the Indian subcontinent, till then referred to *M. palmata*, to three different taxa, referring the populations of *M. palmata* from Central and North India to *M. papillata* Raddi subsp. *grossibarba* (Steph.) Bischl. and those from South India to *M. emarginata* subsp. *emarginata*, except the one described by Srinivasan [11] from Madras which were referred to *M. pappeana* subsp. *robusta*. Raising doubts about the status of *M. assamica* she [2] stated that the specimens "7000 hb Mitten" and "Upper Assam, Griffith", bearing its name, in the herbarium of the New York Botanical Garden (NY) belonged to *M. hartlessiana* and *Conocephalum conicum* L. respectively, whereas the description and illustrations of Griffith [4] did not help establish the identity of the species either as *M. papillata* subsp. *grossibarba* or *M. linearis*. Similarly, the specimens ascribed to this species by Singh [18], belonged to *M. linearis*. Her treatise also reaffirmed the status of *M. nepalensis* and *M. nitida* as synonyms under *M. paleacea* subsp. *paleacea* and *M. togashi* as being conspecific with *M. papillata* subsp. *grossibarba*. She, thus recognised only 9 taxa from India, viz. *M. emarginata* subsp. *emarginata* from Karnataka, Kerala and Tamil Nadu; *M. geminata* from Andaman Islands; *M. hartlessiana* from Assam, Darjeeling and Sikkim; *M. linearis* from Punjab; *M. paleacea* subsp. *paleacea* from Assam, Himachal Pradesh, Jammu and Kashmir, Sikkim, Uttar Pradesh and West Bengal; *M. pappeana* subsp. *robusta* from Tamil Nadu; *M. papillata* subsp. *grossibarba* from Arunachal Pradesh, Assam, Himachal Pradesh, Meghalaya, Nagaland, Punjab, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal; *M. polymorpha* subsp. *polymorpha* from Assam, Himachal Pradesh, Jammu and Kashmir, Meghalaya, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal and *M. subintegra* from Assam, Sikkim and West Bengal.

Recently, Long [22] reported *M. polymorpha* L. subsp. *ruderalis* Bischl. and Boisselier-Dubayle from Himachal Pradesh in Western Himalaya and Sikkim in the Eastern Himalaya. Thus, at present the genus *Marchantia* is represented in India by 10 taxa, representing all the three subgenera [2, 18, 20, 22]. These are referable to sections *Protomarchantia* (*M. geminata, M. hartlessiana* and *M. subintegra*), *Chlamidium* (*M. linearis* and *M. pappeana* subsp. *robusta*), *Papillatae* (*M. emarginata* subsp. *emarginata* and *M. papillata* subsp. *grossibarba*) and *Paleaceae* (*M. paleacea* subsp. *paleacea*). The remaining two taxa, *M. polymorpha* subsp. *polymorpha* and *M. polymorpha* subsp. *ruderalis* belong to subgenus *Marchantia*.

During the course of the studies on liverworts and hornworts in Sikkim, *M. emarginata* subsp. *emarginata*—a species so far known in Indian bryoflora from western Ghats and Andaman and Nicobar Islands only, was found growing in Indian Himalayan region as well. The same has been described and illustrated in the present communication. As the genus is wide spread in different biogeographical regions of the country and is a part of the syllabi of undergraduate and postgraduate courses of Indian Universities, a detailed note on the diversity and distribution of the species with updated nomenclature and key to Indian taxa have also been provided. While, the status of *M. assamica* is still unresolved, occurrence of *M. squamosa*, recorded in Indian Bryoflora could never be credibly confirmed.

Key to the Indian Taxa of the genus *Marchantia*

1a Ventral scales in 4–6 rows, broader than long, without apical papillae; median scales of male receptacles

without or with rounded appendages; female receptacles deeply divided into terete rays; spores 9–12 μm in diameter ……..……..…… 2

1b Ventral scales in 4 rows, longer than wide, with apical papillae; median scales of male receptacles with acute appendages; female receptacles shallowly divided with lobes apically flat; spores 19–41 μm in diameter……..…….. 3

2a Thallus with continuous dark median band on the dorsal surface, margins usually entire; epidermal pores small (mean diameter: 39 μm); appendages of median scales with entire or nearly entire margins …… *M. polymorpha* subsp. *polymorpha*

2b Thallus with a discontinuous dark median band on the dorsal surface, margins usually crenulate; epidermal pores large (mean diameter: 56–61 μm); appendages of median scales with sharply toothed margins ……..…… *M. polymorpha* subsp. *ruderalis*

3a Female receptacles with involucres alternating with lobes; number of lobes usually uneven 5–13; lobes rounded–truncate or emarginated apically, without median grooves …… 4

3b Female receptacles with involucres located underneath the lobes; number of lobes usually even (2–) 4 (–8); lobes split apically, with median grooves ……... 8

4a Appendage of median scales 17–24 cells wide; stalk of gametophores basally surrounded by large scales but without appendage; spores *paleacea*-type (19–24 μm diameter, distal surface smooth, with irregular breaks, proximal surface irregularly vermiculate, trilete mark not well marked, equatorial portion smooth, thickened)…… *M. paleacea* subsp. *paleacea*

4b Appendage of median scales 6–18 cells wide; stalk of gametophores basally not surrounded by large scales; spores *papillata* (19–35 μm in diameter, distal surface with irregular, conspicuous smooth ridges or rounded thickenings and sparsely ornamented small depressions, proximal surface irregularly tuberculate, trilete mark partially thickened, equatorial portion smooth, thickened) or *chenopoda* (20–32 μm in diameter, distal surface with irregular, smooth, thick ridges and rather wide depressions filled with irregular, rounded thickenings, proximal surface irregularly tuberculate, trilete mark partially thickened, equatorial portion more or less thickened)-type……..... 5

5a Female receptacles without or with shallow median projections, shallowly divided; lobes not convex basally, not broadened apically…… 6

5b Female receptacles with conspicuous median projections, deeply divided; lobes convex basally, broadened apically…… 7

6a Ventral scales large, 0.4–1.0 × 0.4–0.6 mm, margins angular or bluntly toothed; male receptacles with narrow rays; female receptacles 7–11-lobed …… *M. pappeana* subsp. *robusta*

6b Ventral scales small, 0.3–0.5 × 0.2–0.3 mm, margins sharply toothed; male receptacles with wide rays; female receptacles 5–9-lobed …… *M. linearis*

7a Appendage of median scales with length–breadth ratio 1.6–1.8: 1, with a row of 2–3 cells uniseriate towards apex; scales of female receptacles with a row of 3–6 cells uniseriate towards apex…… ……..…… *M. emarginata* subsp. *emarginata*

7b Appendage of median scales with length–breadth ratio 1.3 : 1, mostly with a single cell apically; scales of female receptacles with 1–2 cells uniseriate towards apex…… ……..…… *M. papillata* subsp. *grossibarba*

8a Female receptacles deeply dissected; dorsal surface not verrucose; spore ornamentation *chenopoda*-type (distal surface with irregular, smooth, thick ridges and rather wide depressions filled with irregular, rounded thickenings, proximal surface irregularly tuberculate, trilete mark partially thickened, equatorial portion more or less thickened …… *M. geminata*

8b Female receptacles shallowly dissected; dorsal surface verrucose with large, projecting epidermal pores; spore ornamentation *miqueliana*-type (distal surface with tuberculate–vermiculate ridges and large tuberculate and vermiculate depressions, proximal surface vermiculate, trilete mark more or less thickened, equatorial portion more or less thickened, tuberculate–vermiculate…… 9

9a Ventral tissue of thallus with numerous mucilage cavities; length-breadth ratio of the appendage of median scales 2.2–3.3:1; 4–7 cells uniseriate towards apex, margins with few pluricellular teeth; male receptacles with (4–) 6 rays ….. *M. subintegra*

9b Ventral tissue of thallus without mucilage cavities; length-breadth ratio of the appendage of median scales 1.5–2.5:1; 1–3 cells uniseriate towards apex; margins entire or nearly entire; male receptacles with (5–) 8–10 (–14) rays ……..…… *M. hartlessiana*

Marchantia (subgen. *Chlamidium*, sect. *Papillatae*) *emarginata* Reinw. et al. in Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 12: 192. 1824; Bischl. in Bryophyt. Biblioth. 38: 183. 1989. *Marchantia palmata* Reinw. et al. in Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 12: 193. 1824. subsp. *emarginata.* Figs. 1, 2, 3, 4 (1)

Plants light green–green when fresh, yellowish brown in herbarium; 15.0–30.0 mm long, 3.0–4.0 mm wide, dichotomously branched. Thallus linear, apex notched,

margin entire–slightly wavy, purplish; mid-dorsal line distinct on dorsal surface, blackish, midrib ventrally convex; upper surface areolate, pores barrel-shaped, circular–oval, 62.5–90.0 × 55.0–87.5 μm in diameter, surrounded by 3–4 concentric rings of 6–8 cells each, innermost ring with 5–6 cells, inner opening bordered by cells with straight or more or less convex inner walls, boundaries of air cavities 3–4 cells high; epidermal cells sub quadrate–rectangular or polygonal, 35.0–62.5 × 22.5–35.0 μm, thin-walled; air chambers in single layer, occupied by irregularly branched, 3–4 cells high chlorophyllose assimilatory filaments, the uppermost cells usually in contact with epidermis; storage tissue with parenchymatous cells, 13–20 cells high in the middle, sclerotic (thickened) cells present, mucilage cavities not seen. Ventral scales purplish, arranged in 4 rows, 2 on either side of the midrib, broadly-ovate, 1.1–1.6 × 0.7–1.0 mm, longest in decurrent base, oil-cells scattered in scale body; appendage oblong-ovate, 0.35–0.55 × 0.25–0.30 mm, 7–12 cells wide in the middle, base cordate, apex apiculate, 2–3 cells uniseriate towards apex, margins strongly toothed, teeth 1–3 cells long, 1–2 cells wide at base, often curved towards the base of appendage, terminal cells light in colour, oil-cells infrequent; laminar scales purplish, oblong–obovate, 0.6–1.0 × 0.45–0.62 mm, apex obtuse. Rhizoids smooth and tuberculate. Gemma cup not seen.

Dioecious. Antheridophore terminal on main thallus or on branches; stalk more or less quadrangular in outline in transverse section, 0.75–1.0 × 0.65–0.8 mm with 1–2 narrow bands of air chambers and 2–4 rhizoidal furrows; receptacle 8.0–15.0 mm in diameter, deeply dissected into 7–9 narrow rays, asymmetrical, dorsal surface with distinct median projection, lobes convex, costate, truncate or emarginate at apex; median scales of receptacle purplish, with lanceolate appendage, 3–6 cells wide in the middle; antheridia not seen. Archegoniophore terminal on main thallus; stalk more or less obovate in outline in transverse section, 0.6–0.8 × 0.55–0.65 mm with 1–2 bands of air chambers and 2–4 rhizoidal furrows; receptacle 5.0–7.0 mm in diameter, deeply 8–11-lobed; lobes with short median groove, symmetrical–sub symmetrical, dorsal surface flat, apex truncate–emarginated, margins entire–slightly crenulate; median scales of female receptacle linear with long acuminate appendages, appendage margin lobed or toothed, 3–6 cells wide; involucres light purplish, bivalved, present on the ventral surface of female receptacle lobe, surrounded by a thin calyptra and a campanulate pseudoperianth. Seta circular in outline in transverse section, 0.30–0.4 × 0.26–0.35 mm in diameter, 12–15 cells across; capsule globose–sub globose, 0.5–0.7 mm in diameter, dehiscing into 4-valves; capsule wall unistratose; cells of the capsule wall rectangular, 37.5–62.5 × 12.5–25.0 μm, with semi annular thickening bands extending on radial and inner tangential walls. Spores yellowish, trilete, globose–subglobose, 22.5–25.0 μm in diameter; sporoderm irregularly lamellate distally, more or less reticulate proximally with distinct, or sometimes broken, tri-radiate mark. Elaters yellowish, fixed ones short, stumpy, 25.0–62.5 μm long, 20.0–45.0 μm wide, 2–3-spiraled; free ones long, slender, 160.0–420.0 μm long, 10.0–12.5.0 μm wide, bispiraled.

SEM study revealed a double sculptured sporoderm on the distal surface with irregular, almost smooth, ridges or lamellae enclosing variously shaped verrucae. The proximal surface is densely ornamented with narrow lamellae anastomosing to form false reticulations, and shows a distinct or interrupted tri-radiate mark.

Habitat: Terrestrial, growing in shady or exposed places on the retaining wall along the road side between 1400–1650 m altitudes, often in association with *Wiesnerella denudata* (Mitt.) Steph.

Specimens examined: India, Eastern Himalaya, Sikkim, East district, Rewtey, ca 1600 m, 28.04.2004, D.K. Singh and D. Singh 35034 (CAL); Saramsa garden, ca 1400 m, 03.03.2005, D. Singh 36426 (CAL); on way from Kue khola–Nimachen, ca 1740 m, 06.06.2006, D.K. Singh and D. Singh 39831 (CAL); Rokdong, ca 1640 m, 11.06.2006, D.K. Singh and D. Singh 40937A (CAL).

Distribution: India [Eastern Himalaya (Sikkim—present study), Western Ghats (Karnataka [2], Kerala [2], Tamil Nadu [2]), Andaman and Nicobar Islands (Andaman Islands [2])], China [23], Indonesia [2], Japan [24], Korea [25], Malaysia [2], Moluccas [2], New Britain [2], New Guinea [2], Philippines [2], Solomon Island [2], Sri Lanka [2], Thailand [2].

Note: Kashyap [8], Khanna [26], Chopra [9, 12], Pandé and Srivastava [14], Singh [18], Mehra [27], Bir and Chopra [28], recorded *M. palmata* from India (Assam, Kashmir, Himachal Pradesh, Sikkim, Uttarakhand, West Bengal, Madhya Pradesh and Punjab), Bangladesh, Myanmar and Pakistan. However, as Bischler [2], who treated *M. palmata* as synonym under *M. emarginata* subsp. *emarginata*, referred the specimens cited by them under the former to *M. papillata* subsp. *grossibarba*, the present study constitutes the first record of this species from Indian Himalayan region.

M. emarginata subsp. *emarginata* is characterized by distinct mid-dorsal line present on thallus (Fig. 1: 1 and 2), oblong-ovate, apiculate appendages of ventral scales with 2–3 cells uniseriate towards apex, margins strongly toothed, teeth 1–3 cells long (Fig. 1: 12–15), stalk of the antheridophore with 2–4 rhizoidal furrows (Fig. 2: 1 and 2), receptacle 7–9-lobed (Fig. 2: 3 and 4), stalk of archegoniophore with 2–4 rhizoidal furrows (Fig. 2: 10 and 11), receptacle 8–11-lobed (Fig. 2: 12–14), trilete spores with irregular, smooth, ridges or lamellae enclosing

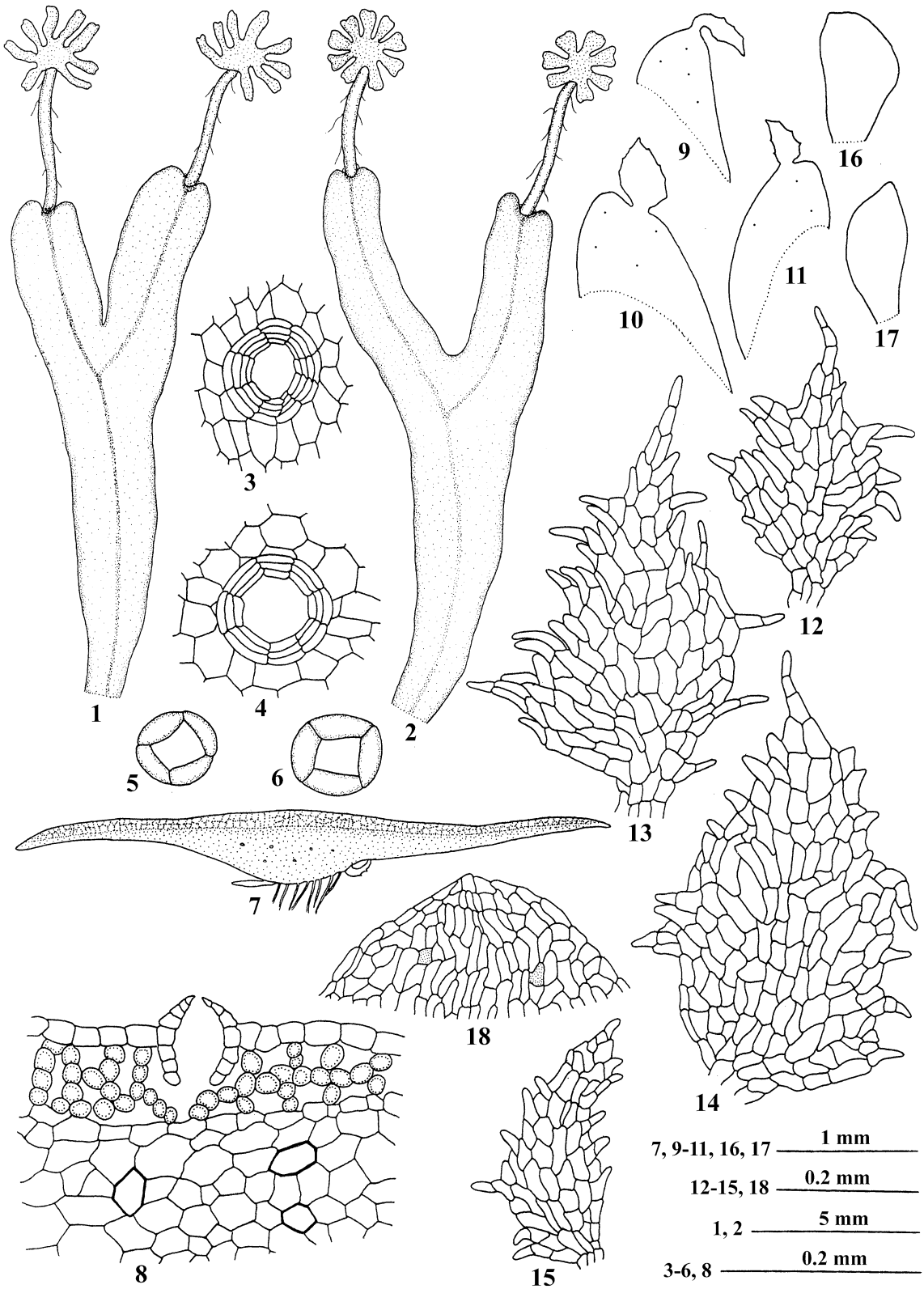

Fig. 1 *Marchantia emarginata* subsp. *emarginata. 1* A male plant. *2* A female plant. *3, 4* Dorsal pores. *5, 6* Inner openings of the epidermal pores. *7* Transverse section of thallus (semidiagramatic). *8* A portion of the same enlarged showing pore. *9–11* Ventral scales. *12–15* Appendages. *16, 17* Laminar scales. *18* A portion of the same enlarged towards apex (fig. 9, 13 drawn from D. K. Singh and D. Singh 39831; others from D. K. Singh and D. Singh 40937A)

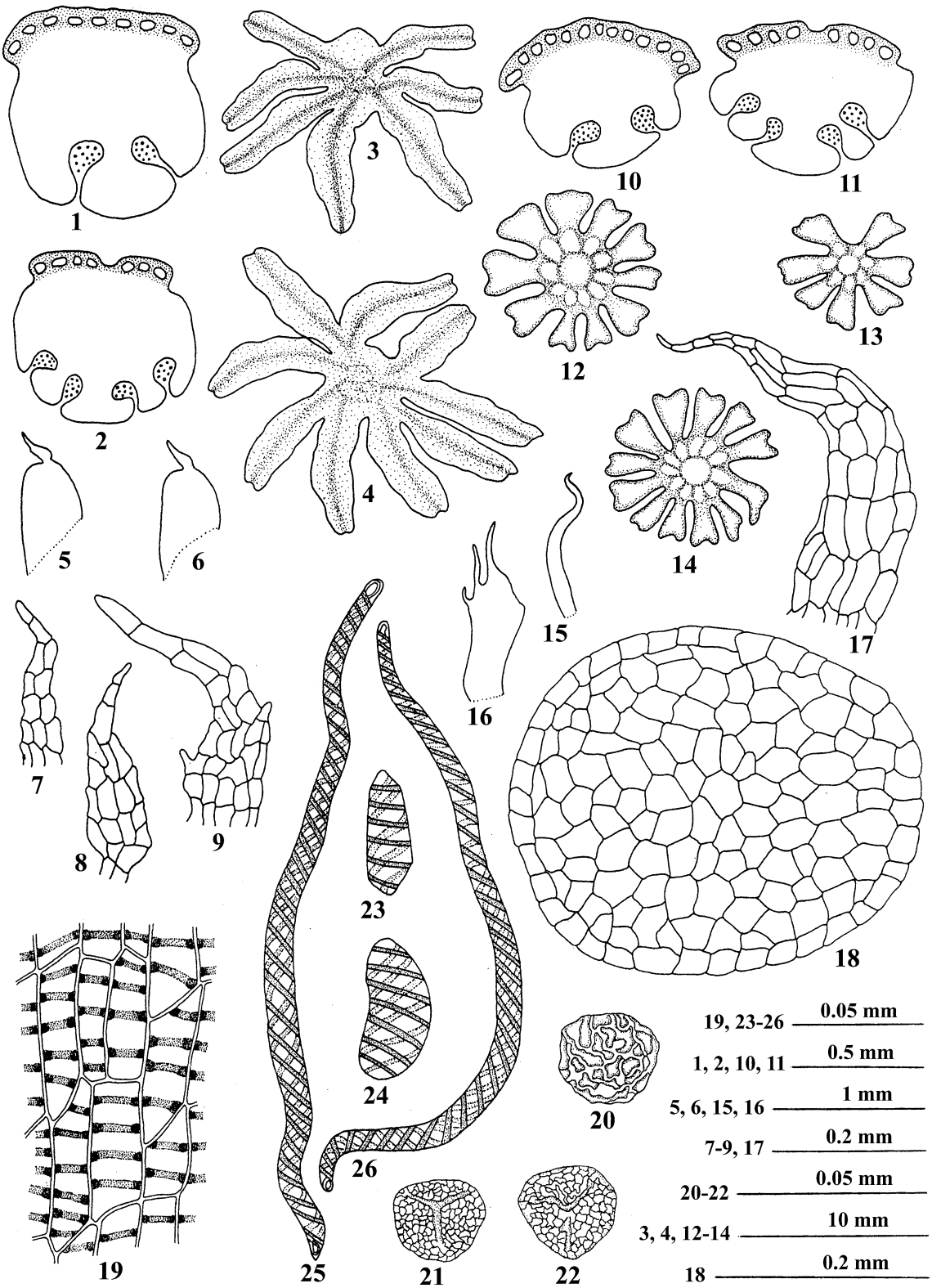

Fig. 2 *Marchantia emarginata* subsp. *emarginata. 1, 2* Transverse section of antheridiophore stalks. *3, 4* Male receptacles. *5, 6* Median scales from male receptacles. *7–9* Appendages of male receptacle scale. *10, 11* Transverse section of archegoniophore stalk. *12–14* Female receptacles. *15, 16* Scales from female receptacle. *17* Appendage of female receptacle scale. *18* Transverse section of seta. *19* Capsule wall. *20* A spore in distal view. *21, 22* The same in proximal view. *23, 24* Fixed elaters. *25, 26* Free elaters (All figures drawn from D.K. Singh and D. Singh 40937A)

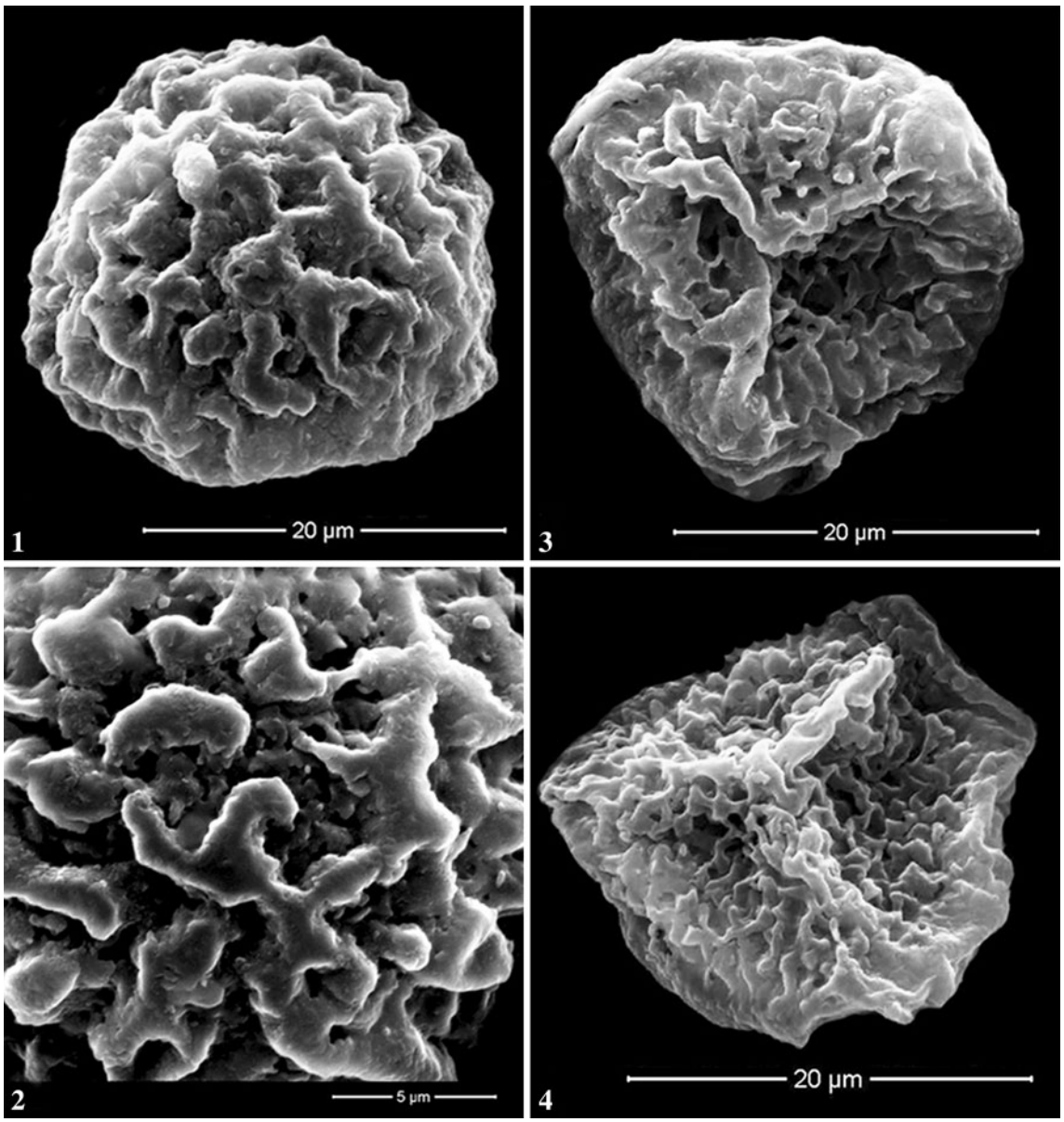

Fig. 3 *Marchantia emarginata* subsp. *emarginata. 1* A spore in distal view. *2* A portion of the same enlarged. *3, 4* Spores in proximal view (All microphotographs from D.K. Singh and D. Singh 40937A)

variously shaped verrucae and proximal surface with narrow lamellae anastomosing to form false reticulations (Fig 2: 20–22; Fig 3: 1–4). Among the Indian species of the genus it comes close to *M. linearis* in having the mid-dorsal line on thallus, presence of sclerotic (thickened) cells, shape of ventral scales. But it differs from the latter in margin of ventral scales with 1 (– 2) cells long or angular, stalk of male and female antheriodiophores with 2 rhizoidal furrows and female receptacle with 5–9-lobed [2].

Marchantia (subgen. *Protomarchantia,* sect. *Protomarchantia*) *geminata* Reinw. et al. in Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 12: 194. 1824; Bischl. in Bryophyt. Biblioth. 38: 261. 1989.

Habitat: Terrestrial, growing in shady or exposed places between 500–2300 m altitudes.

Distribution: India [Eastern Himalaya (Meghalaya [29]), Andaman and Nicobar Islands (Andaman Islands [2])], Indonesia [2], Malaysia [30], Philippines [31].

Note: The report by Singh [18] from Sikkim and Darjeeling in West Bengal probably belongs to *Marchantia subintegra* Mitt. (*fide* Bischler [2]).

Marchantia (subgen. *Protomarchantia,* sect. *Protomarchantia*) *hartlessiana* Steph. ex Bonner in Candollea 14:

Fig. 4 *1 Marchantia emarginata* subsp. *emarginata.*, male and female plants. *2 Marchantia linearis* Lehm. and Lindenb., male and female plants. *3a Marchantia paleacea* Bertol. subsp. *paleacea* (*inset* gemma cup). *3b* The same, an archegoniophore. *4a Marchantia polymorpha* L. subsp. *ruderalis* Bischl. and Boisselier-Dubayle, female plants. *4b* The same, an archegoniophore; *5 Marchantia subintegra* Mitt., male plants. *6* The same, female plants

107. 1953; V.B.Singh in Bull. Lucknow Natl. Bot. Gard. Bull. 125: 23. 1966. Bischl. in Bryophyt. Biblioth. 38: 240. 1989. Sushil K.Singh and J.P.Ghosh in Bull. Bot. Surv. India 49: 162. 2007.

Habitat: Terrestrial, growing in shady or exposed places on thick soil or on the retaining wall along the road side reaching up to 2500 m altitudes.

Distribution: India [Eastern Himalaya (Assam [2], Sikkim [2], West Bengal–Darjeeling [2]), Gangatic plains (West Bengal–Howrah [32])], Bhutan [33], Nepal [2].

Marchantia (subgen. *Chlamidium,* sect. *Chlamidium*) *linearis* Lehm. and Lindenb. in Lehmann, Nov. stirp. pug. 4: 8. 1832; Mitt. in J. Proc. Linn. Soc., Bot. 5: 125. 1861; Bischl. in Bryophyt. Biblioth. 38: 164. 1989. *M. assamica* auct. non.;V.B.Singh in Bull. Lucknow Natl. Bot. Gard. 125: 13. 1966. Fig. 4 (2).

Habitat: Terrestrial, growing in moist, shady or exposed places over rocky soil or on the walls covered with thick soil between 600–2100 m altitudes.

Distribution: India [Eastern Himalaya (Assam [18], Manipur [34], Meghalaya [29], Sikkim [35], West Bengal [12]), Central India (Madhya Pradesh [36]), Punjab and West Rajasthan (Punjab [2]), Western Ghats (Kerala [37]), Andaman and Nicobar Islands (Andaman Islands [38])], Indonesia [2], Malaysia [30], Nepal [2], Pakistan [2].

Note: According to Bischler [2], the plants described by Singh [18] under the name *M. assamica* belongs to *M. linearis*.

Marchantia (subgen. *Chlamidium,* sect. *Paleaceae*) *paleacea* Bertol. in Opusc. Sci. 1: 242. 1817. *Marchantia nepalensis* Lehm. and Lindenb. in Lehmann, Nov. stirp. pug. 4: 10. 1832. V.B.Singh in Bull. Lucknow Natl. Bot. Gard. 125: 15. 1966. *Marchantia nitida* Lehm. and Lindenb. in Lehmann, Nov. stirp. pug. 4: 11. 1832; Mitt. in J. Proc. Linn. Soc., Bot. 5: 125. 1861; Bischl. in Bryophyt. Biblioth. 38: 93. 1989. subsp. *paleacea*. Fig. 4 (3a, b).

Habitat: Terrestrial, growing in moist, shady or exposed places over thick soil or on the walls covered with soil reaching up to 2850 m.

Distribution: India [Western Himalaya (Jammu and Kashmir [8], Himachal Pradesh [39], Uttarakhand [40]), Eastern Himalaya (Arunachal Pradesh [41], Assam [18], Meghalaya [18, 29], Nagaland [42], Sikkim [35], West Bengal–Darjeeling [43]), Punjab and West Rajasthan (Punjab–Gurdaspur [44]), Gangetic plains (West Bengal–Kolkata [18]), Central India (Madhya Pradesh [14]), Western Ghats (Kerala [45], Tamil Nadu [46]), Deccan plateau and Eastern Ghats (Tamil Nadu–Chennai [10])], Africa [47], Bhutan [33], China [23], Europe [48], Indonesia [49], Japan [24], Myanmar [2], Nepal [2], New Zealand [2], North America [50], Pakistan [51], Papua New Guinea [2], Philippines [31], Russia [52], South America [2], Taiwan [53], Vitenam [2].

Marchantia (subgen. *Chlamidium,* sect. *Papillatae*) *papillata* Raddi subsp. *grossibarba* (Steph.) Bischl. in Cryoptogamie, Bryol. Lichénol. 10: 78. 1989 and in Bryophyt. Biblioth. 38: 210. 1989. *Marchantia grossibarba* Steph. in Mem. Soc. Sci. Nat. Cherbourg 29: 221. 1894. *Marchantia palmata* auct. non; R.S.Chopra in Proc. Indian Acad. Sci. 8B: 429.1938; V.B.Singh in Natl. Bot. Gard. Bull. 125: 17. 1966. *Marchantia simlana* Steph., Spec. hepat. 1: 173. 1899. *Marchantia togashii* Amakawa in S.Hatt. in Hara, The Flora of Eastern Himalaya 536. 1966.

Habitat: Terrestrial, growing in moist, shady or exposed places over thick soil between 900–3300 m altitudes.

Distribution: India [Western Himalaya (Jammu and Kashmir [8], Himachal Pradesh [8] Uttarakhand [8, 40]), Eastern Himalaya (Arunachal Pradesh [41], Assam [18], Meghalaya [2, 29], Nagaland [42], Sikkim [17, 35], West Bengal [9, 12]), Central India (Madhya Pradesh [14]), Gangetic plains (Uttar Pradesh [18]), Punjab and West Rajasthan (Punjab [2, 44], Rajasthan [2]), Western Ghats (Kerala [54], Tamil Nadu [46]), Deccan plateau and Eastern Ghats (Tamil Nadu [10])], Afghanistan [2], Bangladesh [2, 8], Bhutan [33], China [23], Myanmar [2], Nepal [2], Pakistan [2, 8], Sri Lanka [2], Thailand [55].

Marchantia (subgen. *Chlamidium,* sect. *Chlamidium*) *pappeana* Lehm. subsp. robusta (Steph.) Bischl. in Bryoph. Biblioth. 45: 91. 1993. *Marchantia robusta* Steph. in Bonner, Candollea 14: 111. 1953. *Marchantia indica* Kashyap ex R.S.Chopra in Proc. Indian Acad. Sci, sect. B, 7: 24. 1938. *Marchantia kashyapii* Udar and F.Shaheen in Indian J. Bot. 5: 3. 1982. *Marchantia palmata* auct. non; Srinivasan in Proc. Indian Acad. Sci. 10B: 88–97. *Marchantia* cf. *grisea* auct. non; Udar and Chandra in Curr. Sci. 33: 254.

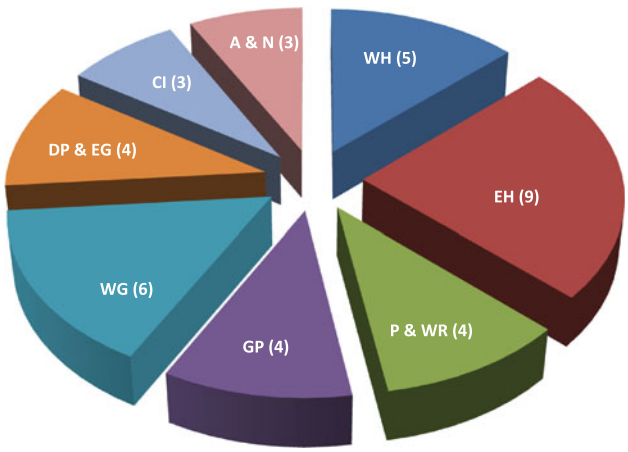

Fig. 5 Distribution of the genus *Marchantia* in different bryogeographical regions of India. *WH* Western Himalaya; *EH* Eastern Himalaya; *P and WR* Punjab and Western Rajasthan; *GP* Gangetic Plain; *WG* Western Gahts; *DP and EG* Deccan Plateau and Eastern Ghats; *CI* Central India; *A and N* Andaman and Nicobar Islands

Habitat: Terrestrial, growing in moist, exposed places over thick soil between 1500–2700 m altitudes.

Distribution: India [Western Himalaya (Jammu and Kashmir [56]), Western Ghats (Kerala [54], Tamil Nadu [10, 16, 20, 46], Deccan plateau and Eastern Ghats (Tamil Nadu [10, 46])], Sri Lanka [2, 57].

Marchantia (subgen. *Marchantia* L.) *polymorpha* L., Sp. pl. 2: 1137. 1753; Mitt. in J. Proc. Linn. Soc., Bot. 5: 125. 1861; V.B.Singh in Bull. Lucknow Natl. Bot. Gard. 125: 20. 1966; Bischl. Bryophyt. Biblioth. 38: 74. 1989. subsp. *polymorpha*.

Habitat: Terrestrial, growing in moist exposed places over thick soil in tropical–temperate forests reaching up to 2850 m altitude.

Distribution: India [Western Himalaya (Jammu and Kashmir [8, 56], Himachal Pradesh [39], Uttarakhand [8]), Eastern Himalaya (Assam [2], Meghalaya [18, 29], Nagaland [42], Sikkim [18, 35], West Bengal–Darjeeling [2, 9]), Gangetic plains (Uttar Pradesh [2]), Punjab and West Rajasthan (Punjab [2], Rajasthan [15]), Western Ghats (Tamil Nadu [10, 46]), Deccan plateau and Eastern Ghats (Tamil Nadu [10, 46)], Afghanistan [2], Africa [2], Australia [58], Bhutan [33], China [23], Europe [48] Indonesia [49], Iran [2], Iraq [2], Israel [2], Japan [24], Lebanon [2], Macquarie Is. [2], Malaysia [30], Nepal [2], New Guinea [2], New Zealand [2], North and South America [2], Pakistan [2], Philippines [31], Russia [52], Sri Lanka [2], Syria [2], Tadzhikistan [2], Taiwan [53], Turkey [2], Uzbekistan [2], Vietnam [2].

Marchantia (subgen. *Marchantia* L.) *polymorpha* L. subsp. ruderalis Bischl. and Boisselier-Dubayle in J. Bryol. 16: 364. 1991. D.G.Long in Cryptog. Bryol. 27: 126. 2006. Fig. 4 (4a, b).

Table 1 Distribution of genus *Marchantia* L. in different bryogeographical regions of India

Sl. No.	Name of the taxa	Distribution								Reference
		WH	EH	P and WR	GP	WG	DP and EG	CI	A and N	
1.	*M. emarginata* Reinw. et al. subsp. *emarginata*	−	+	−	−	+	−	−	+	Chopra [10] as *M. palmata*; present study
2.	*M. geminata* Reinw. et al.	−	+	−	−	−	−	−	+	Bischler [2]; Singh and Nath [29].
3.	*Marchantia hartlessiana* Steph.	−	+	−	+	−	−	−	−	Singh [18] as *M. subintegra*; Bischler [2]; Long and Grolle [33]; Singh and Ghosh [32].
4.	*M. linearis* Lehm. and Lindenb.	−	+	+	−	+	−	+	+	Bischler [2]; Chopra [12]; Singh [18] as *M. assamica*; Nair et al. [37]; Asthana and Nath [36]; Singh and Nath [29]; Singh et al. [35]; Singh et al. [38].
5.	*M. paleacea* Bertol. subsp. *paleacea*	+	+	+	+	+	+	+	−	Chopra [9, 10, 12]; Kashyap [8]; Hattori [43]; Singh [18]; Singh [41]; Chaturvedi and Chaturvedi [42] as *M. nepalensis*; Singh et al. [44] as *M. paleacea*; Bischler [2]; Long and Grolle [33]; Singh and Nath [29]; Singh and Singh [39].
6.	*M. papillata* Raddi subsp. *grossibarba* (Steph.) Bischl.	+	+	+	+	+	+	+	−	Kashyap [8]; Chopra [12]; Pandè and Srivastava [14] as *M. palmata*; Singh [18]; Singh [41]; Kachroo et al. [19]; Chaturvedi and Chaturvedi [42] as *M. palmata*; Stephani [7] as *M. simalana*; Amakawa [17] as *M. togashii*; Bischler [2]; Singh et al. [44] *as M. palmata*; Long and Grolle [33]; Singh et al. [35]; Singh and Singh [40].
7.	*M. pappeana* Lehm. subsp. *robusta* (Steph.) Bischl.	+	−	−	−	+	+	−	−	Udar and Chandra [16] as *M.* cf. *grisea*; Udar and Shaheen [20] as *M. kashyapii*; Bischler [2] as *M. robusta*; Langer and Tanwir [56] as *M. kashyapii*.
8.	*Marchantia polymorpha* L. subsp. *polymorpha*	+	+	+	+	+	+	−	−	Kashyap [8]; Chopra [12]; Hattori [43]; Singh [18]; Bischler [2]; Long and Grolle [33]; Singh and Nath [29]; Chaturvedi and Chaturvedi [42]; Singh et al. [35]; Singh and Singh [40].
9.	*Marchantia polymorpha* L. subsp. *ruderalis* Bischl. and Boisselier-Dubayle	+	+	−	−	−	−	−	−	Long [22].
10.	*M. subintegra* Mitt.	−	+	−	−	−	−	−	−	Amakawa [17] as *M. papulosa*; Bischler [2]; Chopra [12]; Long and Grolle [33]; Singh et al. [34]; Singh et al. [35]; Hattori [59]

WH Western Himalaya; *EH* Eastern Himalaya; *P and WR* Punjab and Western Rajasthan; *GP* Gangetic Plain; *WG* Western Gahts; *DP and EG* Deccan Plateau and Eastern Ghats; *CI* Central India; *A and N* Andaman and Nicobar Islands

Habitat: Terrestrial, growing in moist, exposed and very cool places over thick soil between 1795–3100 m altitudes, reaching up to 4440 m in alpine regions.

Distribution: India [Western Himalaya (Himachal Pradesh [22]), Eastern Himalaya (Sikkim [22])], Africa [57], Bhutan [22], China [22], Europe [48], Nepal [22], Russia [52].

Marchantia (subgen. *Protomarchantia,* sect. *Protomarchantia*) subintegra Mitt. in J. Proc. Linn. Soc., Bot. 5: 125. 1861. *M. hartlessiana* auct. non; V.B.Singh in Bull. Lucknow Natl. Bot. Gard. Bull. 125: 23. 1966. *Marchantia papulosa* Amakawa in Hara, The Flora of Eastern Himalaya 535. 1966. Fig. 4 (5, 6).

Habitat: Terrestrial, growing in moist and shady or partially exposed places up to 3700 m altitudes.

Distribution: India [Eastern Himalaya (Arunachal Pradesh [33], Assam [2], Manipur [34], Sikkim [12, 17, 35, 59], West Bengal [2, 17])], Bhutan [33, 59], Nepal [59].

Diversity and Distribution of genus in India

The genus *Marchantia* is widely distributed in all the bryogeographical regions of the country. The East Himalayan region with 9 taxa shows the maximum diversity, followed by the Western Ghats with 6 taxa, Western Himalaya with 5 taxa, Gangetic plains, Deccan plateau and Eastern Ghats and Punjab and West Rajasthan with 4 taxa each, and Central India and the Andaman and Nicobar Islands with 3 taxa each (Fig. 5; Table 1). It is rather interesting to note that none of the taxon of genus is present in all the bryogegraphical regions of the country. While, *M. paleacea* subsp. *paleacea* and *M. papillata* subsp. *grossibarba* are the most widely distributed taxa present in all the bryogeographical regions, except the Andaman and Nicobar Islands, *M. subintegra*—a species otherwise confined to the Central and the Eastern Himalaya, is restricted to the East Himalayan territory, including the North-eastern region, in Indian bryoflora (Table 1).

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