

SOME NEW AND NOTEWORTHY RECORDS OF FAMILY LEJEUNEACEAE (MARCHANTIOPHYTA) FROM SIKKIM, INDIA

DEVENDRA SINGH¹ AND D. K. SINGH^{2*}

¹Botanical Survey of India, Central National Herbarium, Howrah-711103

²Botanical Survey of India, CGO Complex,

3rd MSO Building, Block F (5th floor), Salt Lake Sector I, Kolkata-700 064

*E-mail : singh_drdk@rediffmail.com

ABSTRACT

Seven species of liverworts of the family Lejeuneaceae have been recorded from Sikkim, India. Of these, *Acrolejeunea pusilla* (Steph.) Grolle & Gradst. and *Cololejeunea pluridentata* P.C. Wu & J.S. Lou are new to India and *Cololejeunea ceratilobula* (P.C. Chen) R.M. Schust., *C. chenii* Tixier, *C. nilgiriensis* G. Asthana & S.C. Srivast., *C. serrulata* Steph. and *Lejeunea bidentula* Herzog are new to the State of Sikkim.

Keywords : Liverworts, Lejeuneaceae, New records, Sikkim, India

INTRODUCTION

With its extraordinary ecosystem diversity and the cool, humid climate, Sikkim provides one of the most congenial conditions for the growth of liverworts, or the marchantiophytes, in India. So far, 342 taxa of liverworts belonging to 88 genera in 44 families have been recorded from Sikkim (Dey & al., 2007, 2008a, 2008b, 2009, 2010, 2011; Singh & al., 2008; D. Singh & al., 2008, 2010, 2012; D. Singh & Singh, 2009, 2011a, 2011b, 2012, 2013; Singh & D. Singh, 2009; Váňa & Long, 2009; Váňa & al., 2010; D. Singh, 2012; Dey & Singh, 2011a, 2012), which is nearly 40 per cent of the total liverwort flora of the country. Lejeuneaceae is the most dominant family of liverworts in the state, followed by Plagiochilaceae and Scapaniaceae with the three families together accounting for about 41 per cent of liverwort taxa in Sikkim.

Lejeuneaceae is the largest family of liverworts with nearly 1000 species recorded globally under 68 currently accepted genera (Gradstein, 2013). In India, the family is represented by over 195 taxa belonging to 24 genera (Udar, 1976; Srivastava, 1993, 1998; D.K. Singh, 2001; Manju & al., 2005, 2006, 2012; Asthana, 2007; Singh & al., 2006a, 2006b; Dey & al., 2007, 2008a, 2008b, 2009, 2010; Das & Singh, 2008, 2009, 2012; D. Singh & al., 2008, 2010; Daniels & Daniel, 2009a, 2009b; Asthana & Shukla, 2009, 2010a, 2010b; Daniels & al., 2010; Daniels & Raja, 2011; Asthana & Saxena, 2011; Singh & Dey, 2010; Dey & Singh, 2011a, 2011b, 2012; S.K. Singh, 2011, 2013; S.K. Singh & Dey, 2012; S.K. Singh & Barbhuiya, 2013; Singh Deo & D.K. Singh 2013; Daniels & Kariyappa, 2013; Gradstein, 2013; Verma & Rawat, 2013), of which 72 taxa spreading across 14 genera have been recorded from Sikkim so far (Singh & al., 2008; Dey & al., 2007, 2008a, 2008b, 2009, 2010; D. Singh & al., 2008, 2010, 2012; Dey & Singh, 2011a, 2012; D. Singh, 2012).

The recent identifications of the collection of liverworts from Sikkim, have revealed two more species, *Acrolejeunea pusilla* (Steph.) Grolle & Gradst. and *Cololejeunea pluridentata* P.C. Wu & J.S. Lou as new to India and *Cololejeunea ceratilobula* (P.C. Chen) R.M. Schust., *C. chenii* Tixier, *C. nilgiriensis* G. Asthana & S.C. Srivast. *C. serrulata* Steph. and *Lejeunea bidentula* Herzog as the new records for Sikkim. In the present state of our knowledge, therefore, the liverwort flora of Sikkim comprises of 349 taxa with the number of lejeuneoid taxa going up to seventy nine.

DESCRIPTION

Acrolejeunea pusilla (Steph.) Grolle & Gradst., J. Hattori Bot. Lab. 38: 332. 1974; Gradst., Bryophyt. Biblioth. 4: 59. 1975. *Archilejeunea pusilla* Steph., Sp. Hepat. 4: 731. 1911. (Figs. 1, 2)

Plants brownish green when fresh, reddish brown in herbarium; shoot 8 - 14mm long, 0.75 - 1.20mm wide, irregularly branched. Stem oval - suborbicular in outline in transverse section, 0.087 - 0.10 × 0.075 - 0.087mm,

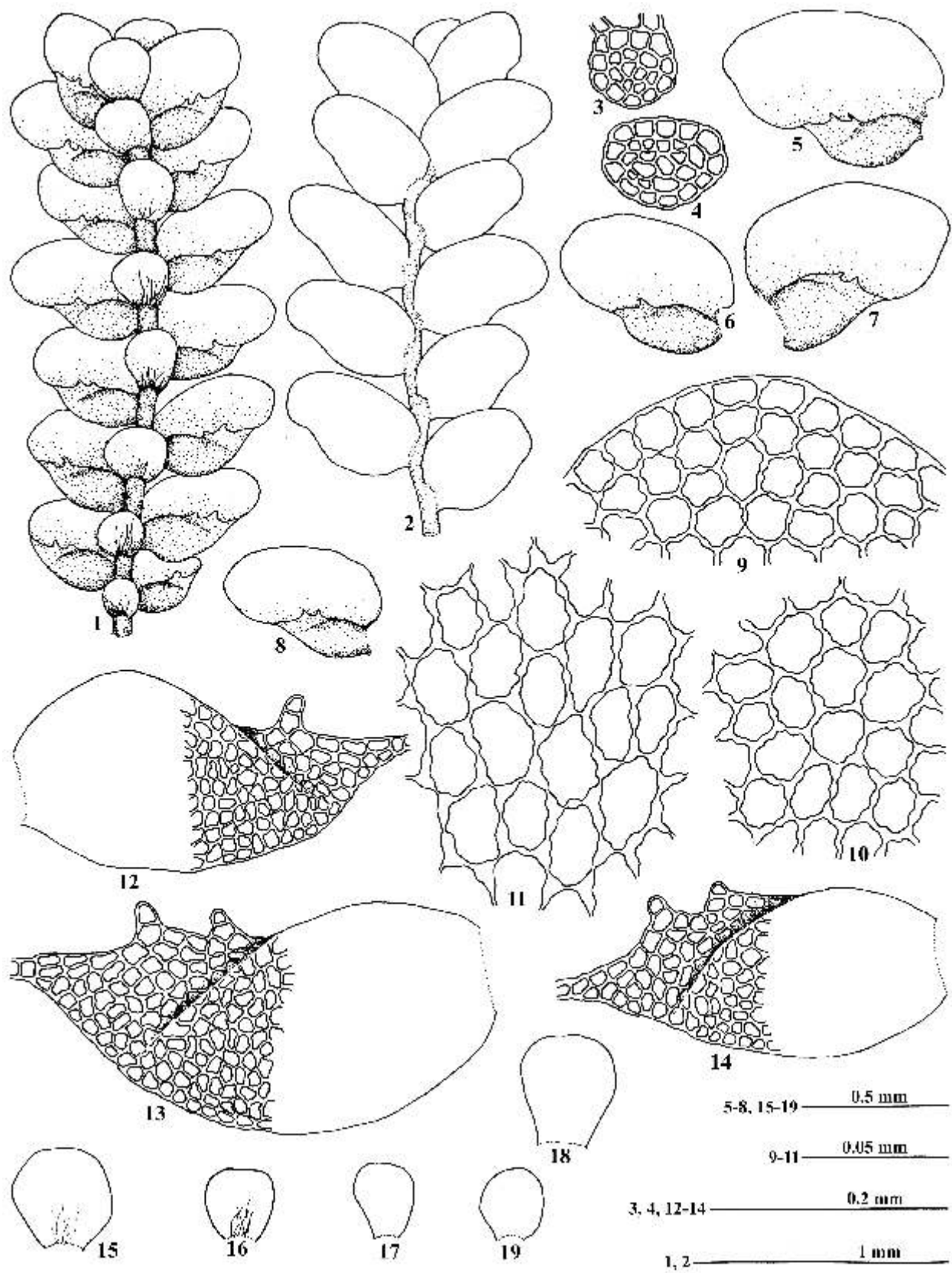


Fig. 1 : *Acrolejeunea pusilla* (Steph.) Grolle & Gradst. 1. A portion of plant in ventral view; 2. The same in dorsal view; 3, 4. Transverse sections of stem; 5-8. Leaves; 9. Apical leaf cells; 10. Median leaf cells; 11. Basal leaf cells; 12-14. Leaf lobules; 15-19. Underleaves (Figure 3 and 4 drawn by D. Singh; others drawn by D.K. Sah from D. Singh 60635C).

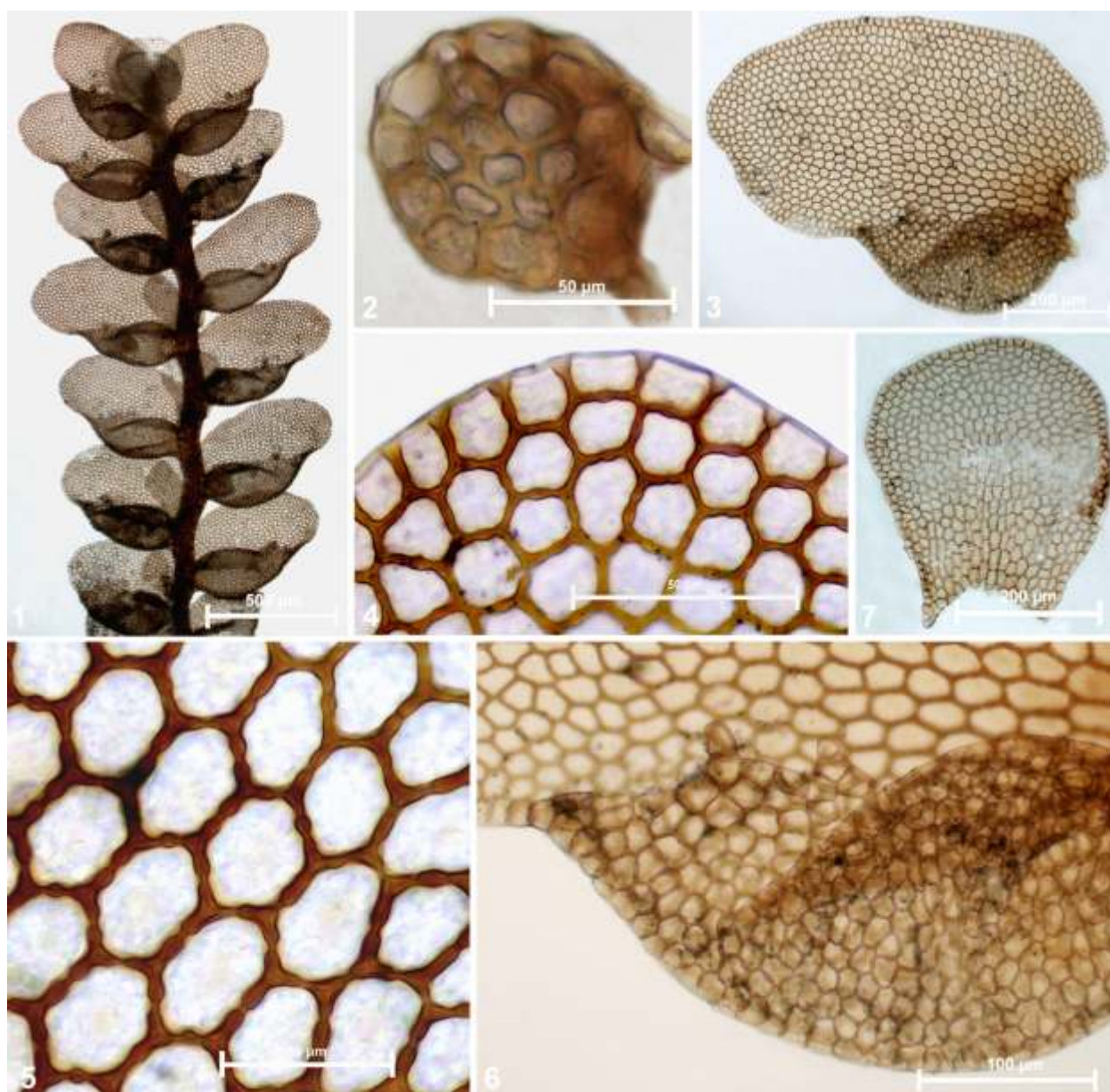


Fig. 2 : *Acrolejeunea pusilla* (Steph.) Grolle & Gradst. 1. A portion of plant in ventral view; 2. Transverse section of stem; 3. A leaf; 4. Apical leaf cells; 5. Median leaf cells; 6. Apical portion of leaf lobule; 7. An underleaf (All photomicrographs from D. Singh 60635C).

5 - 7 cells across the diameter; cortical cells in 11- 13 vertical rows, rectangulate - subrectangulate, thin-walled, dorsal cortical cell larger, $17.5 - 25.0 \times 12.5 - 20.0 \mu\text{m}$, thin-walled; ventral cortical cells smaller, $10.0 - 15.0 \times 8.5 - 12.5 \mu\text{m}$; medullary cells in 8 - 14 vertical rows, rectangular - subrectangular or polygonal, $10.0 - 20.0 \times 7.5 - 17.5 \mu\text{m}$, moderately thick-walled. Leaves imbricate - contiguous in older portion of the plants, obliquely spreading; leaf lobe ovate, 0.50 - 0.70mm long, 0.35 - 0.56mm wide, apex rounded, margin entire, dorsal margin strongly arched, ventral margin almost straight - slightly arched; apical leaf cells subquadrate - polygonal, $10 - 20 \times 10 - 15 \mu\text{m}$; median leaf cells polygonal, $17.5 - 27.5 \times 12.5 - 17.5 \mu\text{m}$; basal leaf cells slightly elongated, polygonal, $17.5 - 35.0 \times 12.5 - 17.5 \mu\text{m}$, thin-walled with medium sized trigones, intermediate thickenings present; cuticle smooth; oil-bodies not seen; leaf lobule strongly inflated, usually 1/2 or sometimes 2/3 as long as the leaf lobe, ovate with an oblique apex, 0.34 - 0.40mm long, 0.14 - 0.20mm wide, free margin more or less plane, gradually curved towards apex and continuing up to incurved ventral margin of the lobe, sinuate-dentate with (1 -) 2 erect tooth; tooth 1 - 2 (-3) cells long, 1 cell wide, separated from each other by 2 - 4 marginal cells;

Table 1 : Comparative morphological account of Indian species of the genus *Acrolejeunea*

Character	<i>A. pusilla</i>	<i>A. parvula</i>	<i>A. fertilis</i>	<i>A. sikkimensis</i>	<i>A. recurvata</i>	<i>A. pycnoclada</i>
Plant	8 – 14 mm long, 0.75 – 1.20 mm wide	10 mm long, 0.5 – 0 mm wide	40 mm long, 10 – 1.6 mm wide	20 mm long, 1.5 mm wide	30 mm long, 0 – 1.2 – 2.0 mm wide	40 mm long, 0.9 – 1.2 mm wide
Stem width	0.075 – 0.10 mm	0.06 – 0.09 mm	0.10 – 0.17 mm	0.15 mm	0.15 mm	0.075 – 0.1 (-0.13) mm
Cortical cells	11-13	11-15	14-17	13-14	15-22	13-17
Medullary cells	8-14	10-14	24-28	20	25-35	15-20
Leaves	Ovate, 0.50 – 0.70 mm long, 0.35 – 0.56 mm wide	Ovate-orbicular to oblong, 0.50 – 0.80 mm long, 0.3 – 0.5 mm wide	Ovate-orbicular, 0.80 – 1.2 mm long, 0.6 – 0.9 mm wide	Ovate-obovate, 0.8 – 1.4 mm long, 0.5 – 0.7 mm wide	Orbicular-ovate, 0.90 – 1.6 mm long, 0.6 – 1.4 mm wide	Ovate-oblong, 0.50 – 1.20 mm long, 0.3 – 0.9 mm wide
Leaf lobule	1/2 or sometimes 2/3 as long as the leaf lobe, 0.34 – 0.40 mm long, 0.14 – 0.20 mm wide.	1/2 – 2/3 as long as the leaf lobe, 0.25 – 0.30 mm long, 0.15 mm wide	1/2 as long as the leaf lobe, 0.35 – 0.50 mm long, 0.25 – 0.35 mm wide	1/2 as long as the leaf lobe, 0.3 – 0.5 mm long, 0.20 – 0.34 mm wide	1/2 as long as the leaf lobe, 0.35 – 0.60 mm long, 0.2 – 0.3 mm wide	1/2 – 2/3 as long as the leaf lobe, 0.3 – 0.6 mm long, 0.15 – 0.25 mm wide
Lobule tooth	(1 –) 2 erect tooth; tooth 1 – 2 (– 3) cells long, 1 cell wide,	1 (–2) tooth; tooth small, 1 cell long and wide	(4–) 5-9 tooth; 1 – 3 cell long and 2 – 3 cells wide at base	(3–) 4-5 tooth; first tooth 2 cell long other 1 cell long	3-6 tooth; 1 – 2 (–3) cell long and 1 cells wide	2-3 tooth; 1 – 2 (–3) cell long and 1 cells wide at base and first tooth situated at the extreme end of the free margin
Underleaves	Distant (barely overlapping), obovate-subrectangulate – orbicular, 0.26 – 0.34 mm long, 0.24 – 0.30 mm wide	Imbricate, orbicular - subrectangulate, 0.25 – 0.35 mm long, 0.2 – 0.35 mm wide	Imbricate, ovate, 0.25 – 0.40 mm long, 0.4 – 0.6 mm wide	Imbricate, subrectangulate, 0.6 mm long, 0.5 mm wide	Imbricate, ovate, 0.2 – 0.3 mm long, 0.6 – 0.8 mm wide	Imbricate, orbicular-quadrangle, 0.25 – 0.35 mm long, 0.25 – 0.45 mm wide

keel strongly arched, gradually flattened above, smooth. Underleaves distant, 2 times as wide as the stem, obovate-subrectangulate - orbicular, 0.26 - 0.34mm long, 0.24 - 0.30mm wide, apex rounded - more or less truncate, margin entire. Rhizoids few, fasciculate near the base of underleaves, yellowish. Androecial and gynoecial branches not seen.

Habitat : Epiphyllous, growing in very moist and shady places on the leaves of Angiosperm, in association with *Cololejeunea serrulata* Steph. and *Lejeunea wallichiana* (Lehm.) Gottsche & al.,

Distribution : India [Eastern Himalaya (Sikkim - present study)], China, Japan, Nepal, Taiwan (Gradstein, 1975; Piippo, 1990; Yamada & Iwatsuki, 2006; Pradhan & Joshi, 2009; Wang & al., 2011).

Specimen examined : India, Eastern Himalaya, Sikkim, North district, Thulung, 27°38'13.2" N, 88°27'41.1"E, c. 2449m, 03.04.2013, D. Singh 60635C (CAL).

A. pusilla is characterized by very small size of plants; 5 - 7 cells thick stem with 11 - 13 cortical cells and 8 - 14 medullary cells (Fig. 1: 3, 4; Fig. 2: 2); ovate leaf lobes (Fig. 1: 5 - 8; Fig. 2: 3); 0.34 - 0.40mm long leaf lobules, usually 1/2 or sometimes 2/3 as long as the leaf lobe, sinuate-dentate with (1 -) 2 erect tooth, 1 - 2 (- 3) cells long, 1 cell wide (Fig. 1: 12 - 14; Fig. 2: 6).

The genus *Acrolejeunea* was so far represented in Indian bryoflora by five species, viz. *A. fertilis* (Reinw., Blume & Nees) Gradst. (Andaman Islands), *A. parvula* (Mizut.) Gradst. (Andaman Islands), *A. pycnoclada* (Taylor) Schiffn. (Andaman Islands), *A. recurvata* Gradst. (Sikkim, West Bengal), *A. sikkimensis* (Mizut.) Gradst. (Sikkim) (Gradstein, 1975; Udar & Awasthi, 1981; Joshi, 2001; Zhu & Long, 2003). Indian plants of *A. pusilla* are slightly atypical in having 8 - 14 vertical rows of medullary cells as against only 7 - 9 medullary cells and usually distant underleaves (except towards apex) as compared to 'barely overlapping' reported by Gradstein (1975). Among the Indian species of the genus, *A. pusilla* resembles *A. parvula* in the size of plants and stem anatomy. However, it is readily distinguished from the latter which has smaller leaf lobules (0.25 - 0.30mm long) with a single, 1 (- 2)-celled tooth (Gradstein, 1975). A comparative analysis of the morphological features exhibited by different Indian species is presented in Table 1. It is rather interesting to note that the Indian taxa of the genus are confined either to Andaman & Nicobar Islands or the Sikkim Himalayan region with both the territories sharing them equally.

Cololejeunea ceratilobula (P.C.Chen) R.M.Schust., Beih. Nova Hedwigia 9: 179. 1963; R.L.Zhu & M.L.So, Beih. Nova Hedwigia 121: 258. 2001. G.Asthana & S.C.Srivast., Bryophyt. Biblioth. 60: 32. 2003. *Leptocolea ceratilobula* P.C.Chen, Feddes Repert. 58: 49. 1955.

Habitat : Epiphyllous, growing in moist and shady places on the leaves of Angiosperm, in association with *Lejeunea obscura* Mitt.

Distribution : India [Eastern Himalaya (Arunachal Pradesh, Assam, Sikkim - present study), Western Ghats (Tamil Nadu)], Cambodia, China, Indonesia, Japan, Malaysia, Sri Lanka, Vietnam (Onraedt, 1981; Zhu & So, 1998, 2001; Asthana & Srivastava, 2003; Yamada & Iwatsuki, 2006; Daniels, 2010; Barbhuiya & S.K. Singh, 2012; Dey & Singh, 2012).

Specimen examined : India, Eastern Himalaya, Sikkim, North district, Bay, 27°38'13.1"N, 88°27'41.3" E, c. 1488m, 04.04.2013, D. Singh 60646A (CAL).

Note : *C. ceratilobula* is characterized by the leaf margin bordered by 2 - 3 rows of hyaline sigmoid cells, devoid of intermediate thickenings; 6 - 8 cells long, lanceolate - ciliate leaf lobule which is 3 - 4 cells wide at base and 4 - 6 cells uniseriate towards apex and 16 - 20-celled discoid gemmae devoid of adhesive cells. It closely resembles *C. desciscens* Steph. in the nature of marginal leaf cells and more or less similar, linear, 4 - 6 cells long leaf lobule. It can, however, be easily differentiated from the latter which has leaf cells with intermediate thickenings throughout, uniseriate leaf lobules and larger, 36 - 62-celled gemmae with adhesive cells (Zhu & So, 2001; Singh & al., 2006b).

Cololejeunea chenii Tixier, Bryophyt. Biblioth. 27: 219. 1985; Sushil K. Singh & H.A. Barbhuiya, Acta Bot. Hung. 55: 135. 2013.

Habitat : Epiphyllous, growing in moist and shady places on the leaves of Angiosperm, in association with *Microlejeunea punctiformis* (Taylor) Steph.

Distribution : India [Eastern Himalaya (Mizoram), Sikkim - present study)], China, Laos, New Guinea, Vietnam (Tixier, 1985; Zhu & So, 2001; Pócs & Piippo, 2011; Pócs, 2012; S.K. Singh & Barbhuiya, 2013).

Specimens examined : India, Eastern Himalaya, Sikkim, North district, Nomu, 27°30'03.5" N, 88°32'05.5" E, c. 917m, 01.04.2013, D. Singh 60587A (CAL).

Note : Recently S.K. Singh and Barbhuiya (2013) recorded *C. chenii* for the first time in Indian bryoflora from Mizoram. It is characterized by subacute - obtuse leaf apex, crenulate - minutely spinose leaf margin and the leaf cells with small trigones but without intermediate thickenings, dorsal protrusion 4 - 12µm in height and 3 - 6µm in width, highly reduced leaf lobule (0.05 - 0.06mm long, 0.03 - 0.05mm wide), minute, 3 - 11-celled, apex obliquely truncate, first tooth unicellular or sometimes indistinct, second tooth usually obsolete. It is somewhat similar to *C. spinosa* (Horik.) Pandé & Misra in having ovate leaf lobes with dorsal protrusion. But the latter differs from *C. chenii* in having larger papillae (16.3 - 24.4µm in height, 8.1 - 12.2µm in width), larger leaf lobules (0.11 - 0.16mm long, 0.06 - 0.09mm wide), first tooth (1-) 2 cells long, 1 cell wide, second tooth small, unicellular (Asthana & Srivastava, 2003; Dey & Singh, 2012).

Cololejeunea nilgiriensis G. Asthana & S.C. Srivast., Bryophyt. Biblioth. 60: 27. 2003; Sudipa Das & D.K. Singh, Nelumbo 51: 194. 2009. **(Fig. 4: 7 - 10)**

Habitat : Epiphyllous, growing in very moist and shady places on the leaves of *Plagiogyria pycnophylla* (Kunze) Mett., in association with mosses.

Distribution : India [Eastern Himalaya (Arunachal Pradesh, Sikkim - present study), Tamil Nadu)], endemic (Asthana & Srivastava, 2003; Das & Singh, 2009).

Specimens examined : India, Eastern Himalaya, Sikkim, North district, Thulung, 27°38'13.2" N, 88°27'41.1" E, c. 2449m, 03.04.2013, D. Singh 60634A (CAL).

Note : *C. nilgiriensis* is characterized by very small, 3 - 4mm long, 0.3 - 0.5mm wide plants with distant leaves (Fig. 4: 7); ovate, slightly falcate leaf lobes, 0.16 - 0.30mm long, 0.12 - 0.22mm wide with rounded - obtuse apex and crenate margin (Fig. 4: 8, 9); papillose cuticle (Fig. 4: 9); inflated leaf lobules with 1-celled first and second tooth separated by slight indentation (Fig. 4: 10). The Himalayan plants fully conform with those from Tamil Nadu except for slightly falcate leaf lobes. *C. nilgiriensis* somewhat resembles *C. longiana* Grolle & Mizut. in overall appearance of the plants. However, latter differs from the former in having larger, 7 - 12mm long, 0.9 - 1.5mm wide plants with oblong-ovate leaf lobes and leaf lobule with 2-celled, uniseriate first tooth and 1-3-celled second tooth (Dey & Singh, 2012).

Cololejeunea pluridentata P.C. Wu & J.S. Lou, Acta Phytotax. Sin. 16: 105. 1978; R.L. Zhu & M.L. So, Beih. Nova Hedwigia 121: 331. 2001. **(Figs. 3, 4)**

Plants yellowish green when fresh, whitish yellow in herbarium; shoot 5 - 8mm long, 1.0 - 1.3mm wide, irregularly branched. Stem orbicular - suborbicular in outline in transverse section, 0.075 - 0.10 × 0.072 - 0.095mm, 3 cells across the diameter; cortical cells in 5 vertical rows, oblong - tangentially flattened, subquadrate - rectangulate, 25.0 - 50.0 × 12.5 - 27.5µm, thin-walled; medullary cell one, polygonal, 17.5 - 30.5 × 12.5 - 25.0µm, thin-walled; ventral merophytes of stem 1 cell wide. Rhizoids numerous, hyaline, fasciculate. Leaves loosely imbricate - contiguous, spreading from stem at an angle of 90 - 120°; leaf lobe broadly ovate, 0.45 - 0.60mm long, 0.35 - 0.50mm wide, apex rounded or sometimes subacute, margin irregularly serrulate-serrate - distantly minutely dentate; dorsal margin strongly arched, basal region usually entire; ventral margin nearly straight - slightly arched; apical leaf cells subquadrate - polygonal, 10.0 - 17.5 × 10.0 - 15.0µm; median leaf cells polygonal, 15.0 - 25.0 × 10.0 - 22.5µm; basal leaf cells slightly elongated, polygonal, 20 - 40 × 10 - 20µm; walls

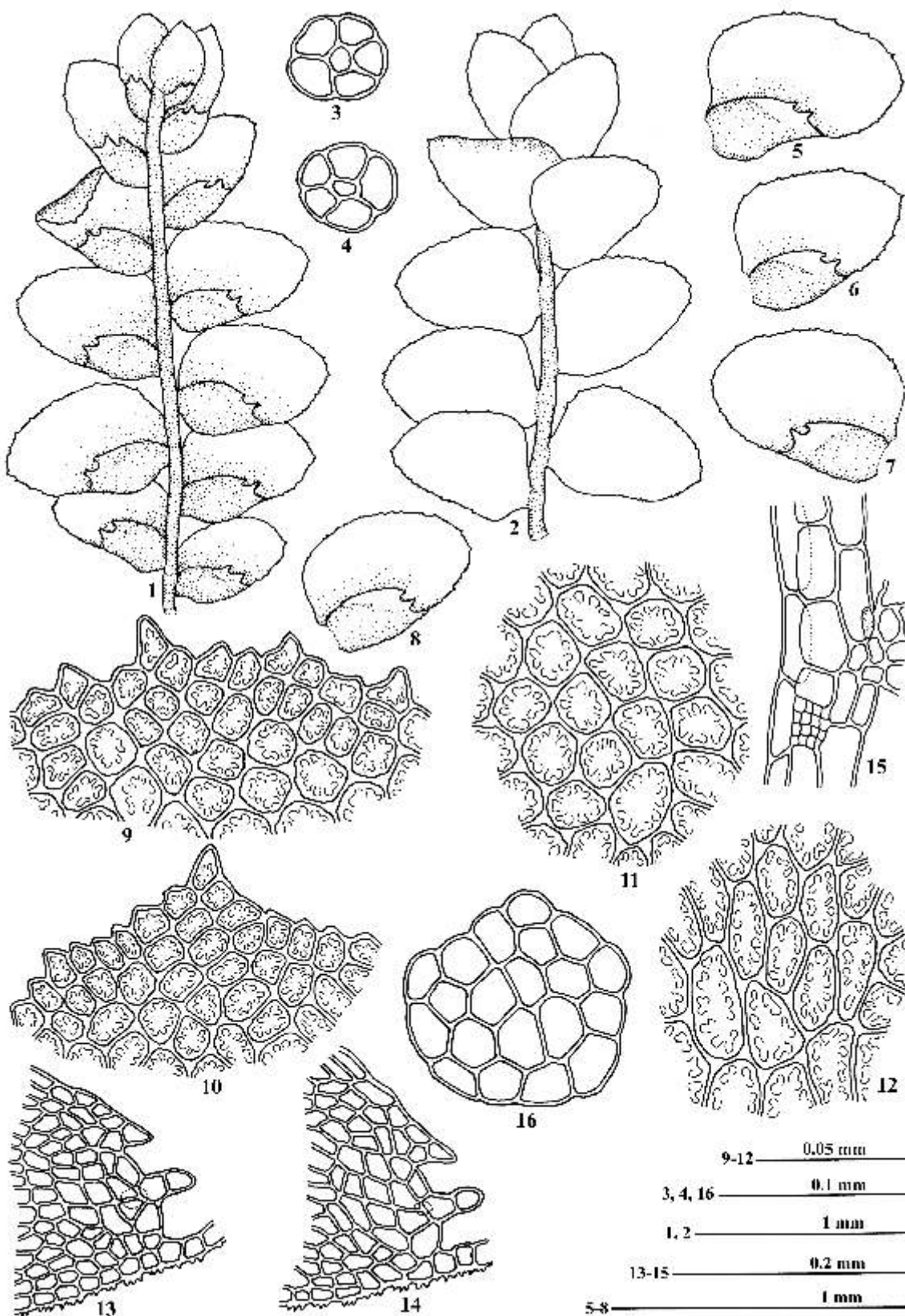


Fig. 3 : *Cololejeunea pluridentata* P.C. Wu & J.S. Lou 1. A portion of plant in ventral view (rhizoids not drawn); 2. The same in dorsal view; 3, 4. Transverse sections of stem; 5 - 8. Leaves; 9, 10. Apical leaf cells showing cuticle; 11. Median leaf cells showing cuticle; 12. Basal leaf cells showing cuticle; 13, 14. Apical portion of leaf lobules; 15. Base of leaf lobule and portion of stem showing unicellular stylus in ventral view; 16. A gemmae (Figure 3, 4, 9 - 16 drawn by D. Singh; others drawn by D.K. Sah from D. Singh 60649A).

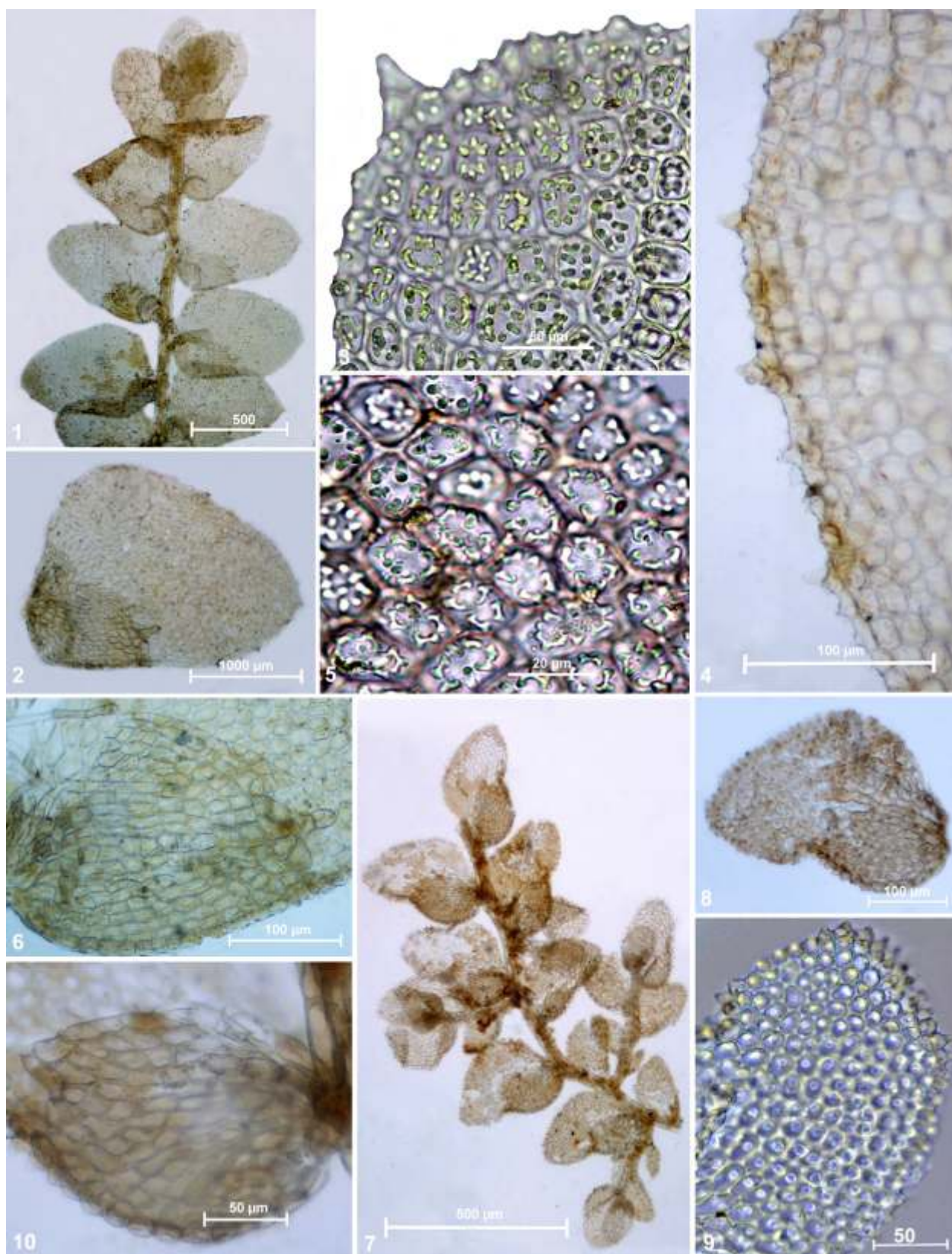


Fig. 4 : *Cololejeunea pluridentata* P.C.Wu & J.S.Lou 1. A portion of plant in ventral view; 2. A leaf; 3. Apical leaf cells showing cuticle; 4. Marginal leaf cells showing dentations; 5. Median leaf cells showing cuticle; 6. A leaf lobule. *Cololejeunea nilgiriensis* G.Asthana & S.C.Srivast. 7. A portion of plant in ventral view; 8. A leaf; 9. Apical and median leaf cells showing cuticle; 10. A leaf lobule (Photomicrographs 1- 6 from D. Singh 60649A; 7 – 10 from D. Singh 60634A).

thin with small triradiate trigones, intermediate thickenings absent; dorsal protrusion of leaf cells stellate, (3 –) 4 – 8 (– 9) per cell; oil-bodies not seen; vitta and ocelli absent; leaf lobule inflated, $1/3 - 1/2$ as long as the lobe, oblong-ovate, 0.26 - 0.32mm long, 0.15 - 0.20mm wide, apex bidentate; first tooth 2 cells long, 1 cell wide; second tooth 1 - 2 cells long, 1 - 2 cells wide, hyaline papilla present at the inner surface of the base of first tooth; keel arched, irregularly papillose; stylus unicellular. Gemmae discoid, on the ventral surface of leaf lobe, 16 - 20-celled, $87.5 - 100 \times 70 - 90\mu\text{m}$, adhesive cells not seen. Androecial and gynoecial branches not seen.

Habitat : Epiphyllous, growing in moist and shady places on the leaves of angiosperms, in association with *Cololejeunea trichomanis* (Gottsche) Steph. and *C. serrulata* Steph.

Distribution : India [Eastern Himalaya (Sikkim, North district - present study)], China, (Zhu & So, 2001).

Specimens examined : India, Eastern Himalaya, Sikkim, North district, Thulung, $27^{\circ}38'13.2''\text{N}$, $88^{\circ}27'41.1''\text{E}$, c. 2449m, 03.04.2013, D. Singh 60649A (CAL).

C. pluridentata is characterized by broadly ovate leaf lobes spreading from stem at an angle of $90 - 120^{\circ}$ (Fig. 3: 1, 2; Fig. 4: 1) with the margin irregularly serrulate-serrate – distantly minutely dentate (Fig. 3: 5 - 10; Fig. 4: 2, 4); oblong-ovate, bidentate leaf lobule, $1/3 - 1/2$ as long as the leaf lobe with the first tooth 2 cells long, 1 cell wide and second tooth 1 - 2 cells long, 1 - 2 cells wide (Fig. 3: 13, 14; Fig. 4: 2, 6) and stellate dorsal protrusions of leaf cells (Fig. 3: 9 - 12; Fig. 4: 3, 5).

C. pluridentata, so far known from China only, is easily distinguishable from all other Indian taxa of the genus by its stellate dorsal protrusions of leaf cells. Indian plants of the species broadly conform to their Chinese counterpart except that only 1-celled second tooth of the leaf lobule, which is sometimes indistinct, has been reported in the latter (Zhu & So, 2001).

Cololejeunea serrulata Steph., Hedwigia 34: 252. 1895; R.L.Zhu & M.L.So, Beih. Nova Hedwigia 121: 299. 2001; M.Dey & D.K.Singh, J. Bryol., 33: 166. 2011.

Habitat : Epiphyllous, growing on the leaves of *Rhododendron* sp. and other angiosperms in moist and shady places, in association with *Acrolejeunea pusilla*, *Cololejeunea pluridentata*, *C. pseudofloccosa* (Horik.) Benedix, *C. spinosa* (Horik.) Pandé & Misra, *Drepanolejeunea erecta* (Steph.) Mizut., *D. longii* Grolle & R.L. Zhu, *Lejeunea flava* (Sw.) Nees, *L. obscura* Mitt. and *Microlejeunea punctiformis* (Taylor) Steph.

Distribution : India [Eastern Himalaya (Arunachal Pradesh, Sikkim - present study, West Bengal)], China, Indonesia, Malaysia, Vietnam (Zhu & So, 2001; Zhu & al., 2004; Chuah-Petiot, 2011; Dey & Singh, 2011a).

Specimens examined : India, Eastern Himalaya, Sikkim, North district, Thulung, $27^{\circ}38'13.2''\text{N}$, $88^{\circ}27'41.1''\text{E}$, c. 2449 m, 03.04.2013, D. Singh 60635B, 60637C, 60638, 60641B, 60644, 60649B, 60747C (CAL).

Note : Dey and Singh (2011a) recently recorded *C. serrulata* in Indian bryoflora from Arunachal Pradesh and West Bengal. It is characterized by ovate - subelliptical leaf lobes with irregularly serrulate margins, thin-walled leaf cells with minute - indistinct trigones and absence of intermediate thickenings; leaf lobule $1/3 - 2/5$ as long as the leaf lobe with 2 cells long, 1 cell wide first tooth, 1 - 2-celled or indistinct second tooth and 1-celled stylus. *C. serrulata* somewhat resembles *C. trichomanis*. But, the latter differs from the former in having oblong - ovate leaf lobes with nearly entire - crenate margins and 3 - 8 cells long uniseriate stylus (Zhu & So, 2001; Asthana & Srivastava, 2003; Dey & Singh, 2012).

The genus *Cololejeunea* (Spruce) Schiffn. was so far represented by 48 species in India, 17 of which were reported to occur in Sikkim (Dey & al., 2010; Dey & Singh, 2012; S.K. Singh & Barbhuiya, 2013). With these additions, the number of taxa recorded from the country has gone up to 49 and those in Sikkim to twenty two.

Lejeunea bidentula Herzog in Hand.-Mazz. Symb. Sin. 5: 51. 1930; Mizut., J. Hattori Bot. Lab. 34: 446. 1971; G.Asthana & Murti Saxena, J. Bryol. 33: 90. 2011.

Habitat : Corticolous, growing in moist and shady places on the bark of *Rhododendron* sp.

Distribution : India [Western Himalaya (Uttarakhand), Eastern Himalaya (Sikkim - present study)],

Bhutan, China, Nepal, Taiwan (Mizutani, 1971; Long & Grolle, 1990; Piippo, 1990; Pradhan & Joshi, 2009; Asthana & Saxena, 2011; Wang & al., 2011).

Specimens examined : India, Eastern Himalaya, Sikkim, North district, Shingba *Rhododendron* Sanctuary, 27°42'20.8 "N, 88°44'34.7" E, c. 3200m, 26.11.2009, D. Singh 46517 (CAL).

Note : This species was earlier reported from Uttarakhand only in Indian bryoflora (Mizutani, 1971; Asthana & Saxena, 2011). Bapna and Kachroo (2000) mentioned its distribution from Sikkim as well, but without any specific locality, reference or details of exsiccata. Therefore, the present study constitutes its first authentic record from the State of Sikkim.

L. bidentula is characterized by the stem having 10 - 12 medullary cells; large, 0.95 - 1.0mm long, 0.50 - 0.62mm wide, 5 (- 6)-keeled perianth with 6 - 8 cells long beak. The plants from Sikkim are slightly atypical in often having 6-keeled parianth. Among the Indian species of the genus, *L. bidentula* closely resembles *L. kodamae* Ikegamie & Inoue in the leaf cells and multicellular leaf lobule. However, it differs from the latter in having 4 - 7 medullary cells, small, 0.5 - 0.6mm long, 0.30 - 0.40mm wide perianth with 3 - 4 cells long beak (Mizutani, 1971; Asthana & Saxena, 2011).

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भारत के सिक्किम राज्य से लिजुनिऐसी (मार्केशियोफाइटा) कुल के कुछ नए एवं उल्लेखनीय अभिलेख

देवेंद्र सिंह एवं डी.के. सिंह

सारांश

भारत के सिक्किम राज्य से लिवरवर्ट्स की सात प्रजातियाँ जो लिजुनिऐसी कुल का प्रतिनिधित्व करती हैं, प्रस्तुत आलेख में इनका वर्णन किया गया है। इनमें से *एक्रोलिजुनिया पूसिला* (स्टेफ.) ग्रोले एव. ग्रडेस्ट., *कोलोलिजुनिया प्लुरोडेंटेटा* पी.सी.वू एवं जे.एस.लौऊ भारत के लिये नए अभिलेख हैं। *कोलोलिजुनिया नीलगिरिएन्सिस* सि.जी. अस्थाना एवं एस.सी.श्रीवास्त. हिमालय के लिये नवीन अभिलेख है तथा *कोलोलिजुनिया सिराटीलोब्यूला* (पी.सी.चेन) आर.एम.शूश्ट, *कोलोलिजुनिया चेन्नीटिक्सियर*, *कोलोलिजुनिया सेरुलाटा* स्टेफ. एवं *लिजुनिया बाईडेंटुला* हेर्जोंग सिक्किम राज्य के लिये नवीन अभिलेख हैं।