Two New Epiphyllous *Leptolejeunea* (Hepaticae: Lejeuneaceae) from Eastern Himalaya, India

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ABSTRACT: Two new epiphyllous species of the genus *Leptolejeunea* (Spruce) Schiffn., viz. *L. mirikana* M. Dey et D. K. Singh sp. nov. and *L. udarii* M. Dey et D. K. Singh sp. nov., are described from Darjeeling district of West Bengal and East district of Sikkim respectively in Eastern Himalaya, India. While, the former is characterized by obovate leaf lobes with acute – subacute leaf apices and entire margin; rectangular – trapezoid underleaves with rectangular – lanceolate lobes which are 3-4 cells long, 2-3 cells wide, or rarely 1 cell wide at apex, and crenulate – denticulate margin; presence of ocelli in female bracts and bracteoles and obconical perianth with truncate apices and 5 obliquely – horizontally spreading horn-like keels extending from apex to 1/2-3/5 of perianth length, the latter is distinct in having small length-breadth ratio of the leaves ranging between 1.2:1-1.3:1; obovate leaf lobes with subacute apices; terminal as well as intercalary androecia with male bracteoles present throughout; numerous ocelli scattered on female bracts, bracteoles and perianth and obconical – campanulate perianth with 5 smooth, erect – obliquely spreading horn-like keels. A key to the Indian species of the genus has been provided.

KEY WORDS: *Leptolejeunea mirikana*, *Leptolejeunea udarii*, Lejeuneaceae, New Species, Eastern Himalaya, India.

INTRODUCTION

The taxonomy of genus *Leptolejeunea* (Spruce) Schiffn. has received considerable attention in Indian bryology (Herzog, 1942, 1950; Udar and Awasthi, 1979, 1982; Awasthi, 1986; Joshi, 2001; Zhu and Long, 2003; Lal, 2003; Daniels and Daniel, 2004; Singh et al., 2006a, 2006b, 2008; Das and Singh, 2008). The genus is represented in Indian bryoflora by nine species, viz. *L. arunachalensis* Sudipa Das & D.K. Singh, *L. balansae* Steph., *L. elliptica* (Lehm. & Lindenb.) Schiffn., *L. epiphylla* (Mitt.) Steph., *L. foliicola* Steph., *L. latifolia* Herzog, *L. maculata* (Mitt.) Schiffn., *L. sikkimensis* Udar & U.S. Awasthi and *L. subdentata* Schiffn. ex Herzog, distributed in the Eastern Himalaya (8 species), Andaman & Nicobar Islands (5 species) and the Western Ghats (4 species). Interestingly, except *L. epiphylla*, which is confined to Andaman & Nicobar Islands in Indian bryoflora, all other species occur in the Eastern Himalaya. Seven of the Indian species of the genus are epiphyllous with only *L. arunachalensis* and *L. sikkimensis* being epiphytic.

The recent studies on the epiphyllous liverworts of Eastern Himalaya revealed some interesting plants of the genus from Darjeeling district of West Bengal and East district of Sikkim, which are hitherto undescribed (Herzog, 1942, 1950; Mizutani, 1961; Udar and Awasthi, 1979, 1982; Awasthi, 1986; Onraedt, 1991; Zhu and So, 2001; Daniels and Daniel, 2004; Singh et al., 2006a; Das and Singh, 2008), hence merit the status of new species. Thus, in the present state of our knowledge, the genus is represented in the country by 11 species, nine of which are epiphyllous.

TAXONOMIC TREATMENTS

Leptolejeunea mirikana M. Dey et D.K. Singh, sp. nov. Figs. 1 & 2: 1-5

Leptolejeuneae sikkimensis Udar & U.S.Awasthi et *Leptolejeuneae subdentatae* Schiffn. ex Herzog affinis sed ab *L. sikkimensis* folio-lobis obovatis, grandioribus, 0.72-0.92 x 0.40-0.58 mm; infero-foliis ad marginem crenulatis – denticulatis, lobis 2-3-cellulo-latis et rare apice 1-cellulo-latis et ab *L. subdentatae* foliis apice subacutis ad acutis, margine integris; lobis infero-foliorum 3-4-cellulo-longis, 2-3-cellolo-latis et rare apice 1-cellulo-latis ; femineo-bracteis et bracteolis ocellatis differt.

Holotype: India. Eastern Himalaya, West Bengal, Darjeeling district, near Mirik lake, *ca* 1700 m, 18. 01. 2005, *D. Singh & M. Dey* 36289 (CAL).

Paratype: India. Eastern Himalaya, West Bengal, Darjeeling district, near Mirik lake, *ca* 1700 m, 18. 01. 2005, *D. Singh & M. Dey* 36293, 36294, 36299, 36300 (CAL).

Plants small, olive green – brownish green in herbarium; shoot 6.0-11.0 mm long, 1.1-1.6 mm wide; branching irregular, *'Lejeunea'* type. Stem orbicular – oval in outline in transverse section, 75.0-87.5 x 65.0-82.5 µm, 4 cells across the diameter; cortical cells

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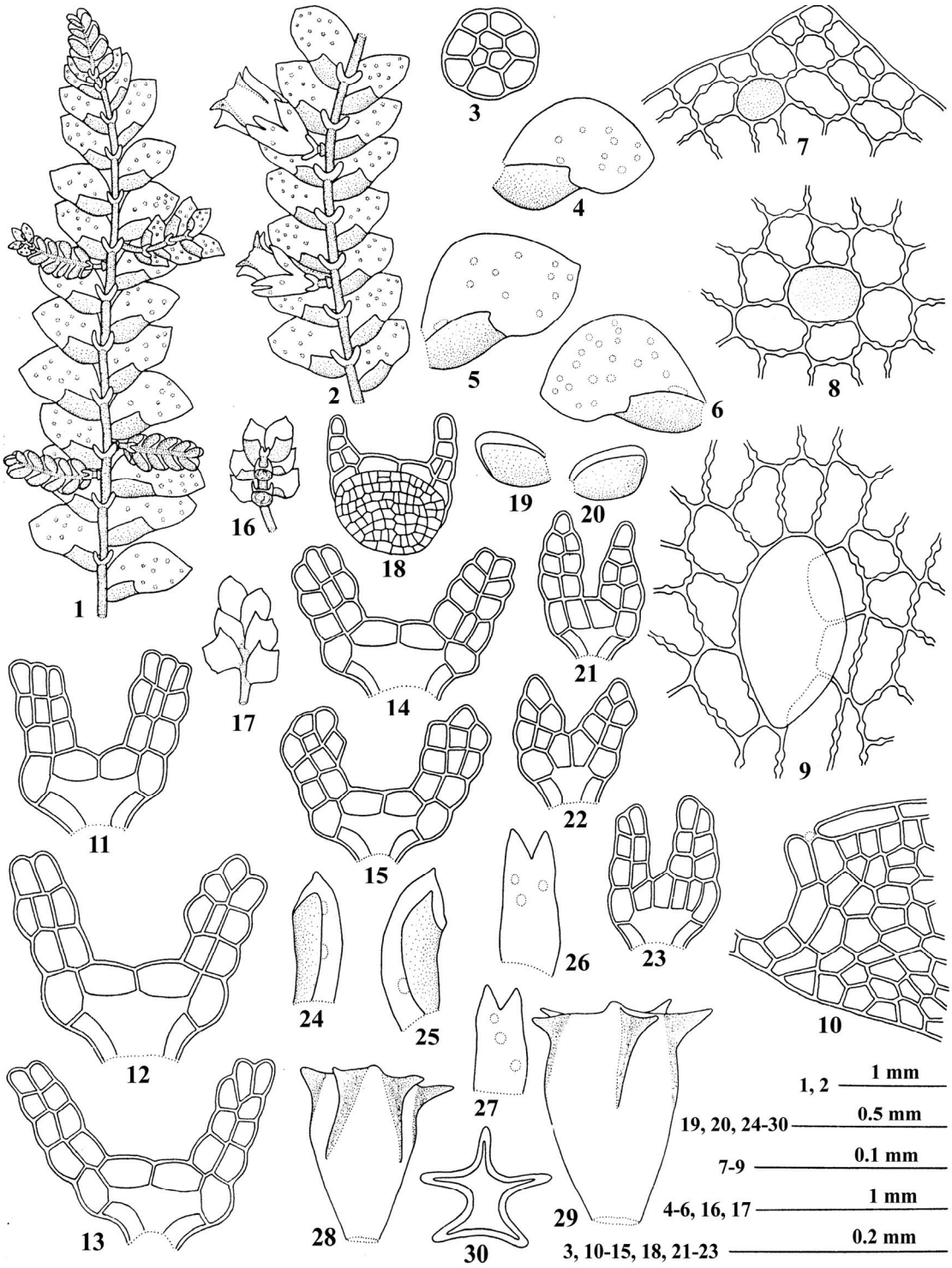


Fig. 1. ***Leptolejeunea mirikana*** **M. Dey & D.K. Singh. 1: A portion of male plant in ventral view (rhizoids not drawn). 2: A portion of female plant in ventral view (rhizoids not drawn). 3: Transverse section of stem. 4-6: Leaves. 7: Apical leaf cells, showing ocellus. 8: Median leaf cells, showing ocellus. 9: Basal leaf cells, showing basal ocellus. 10: Apex of leaf lobule. 11-15: Underleaves. 16: A brood branch in ventral view. 17: The same in dorsal view. 18: An underleaf of brood branch. 19, 20: Male bracts. 21-23: Male bracteoles. 24, 25: Female bracts. 26, 27: Female bracteoles. 28: A perianth in ventral view. 29: The same in dorsal view. 30: Transverse section of perianth. [All figures drawn from** ***D. Singh & M. Dey*** **36289].**

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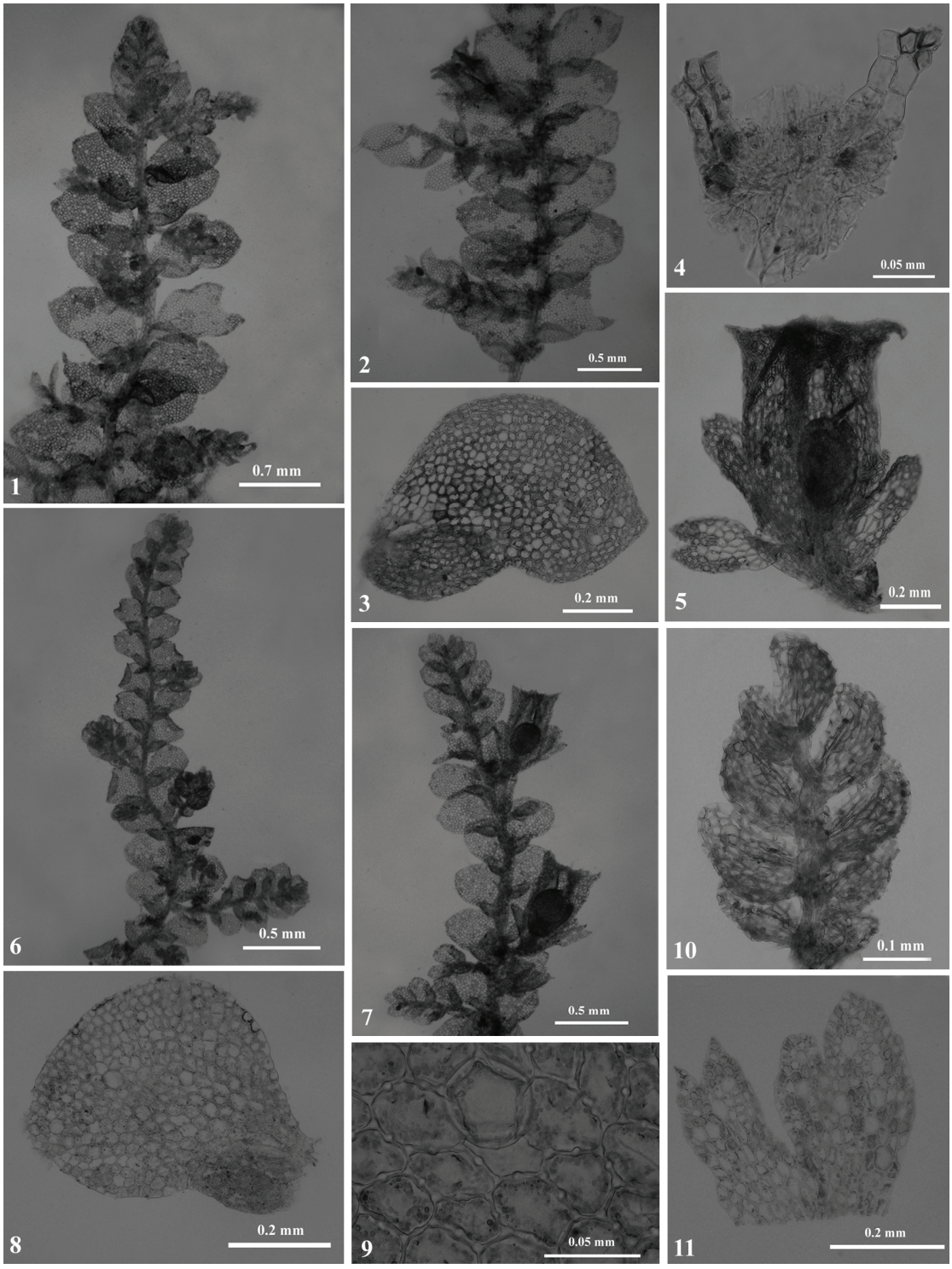


Fig. 2. ***Leptolejeunea mirikana*** **M. Dey & D.K. Singh. 1: A portion of male plant in ventral view. 2: A portion of female plant in ventral view. 3: A leaf. 4: An underleaf. 5: A perianth.** ***Leptolejeunea udarii*** **M.Dey & D.K.Singh. 6: A portion of male plant in ventral view. 7: A portion of female plant in ventral view. 8: A leaf. 9: Median leaf cells showing ocelli. 10: An androecial branch. 11: Female bract and bracteole. [1-5 from** ***D. Singh & M. Dey*** **36289; 8, 9 from** ***D. Singh*** **36911A; others from** ***D. Singh*** **36711A].**

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in 7 vertical rows, subquadrate – rectangular, 20.0-32.5 x 15.0-27.5 µm, thin-walled; medullary cells in 3 vertical rows, polygonal, 17.5-25.0 x 10.0-17.5 µm, thin-walled. Leaves loosely imbricate – contiguous, obliquely spreading; leaf lobe obovate, 0.72-0.92 mm long, 0.40-0.58 mm wide, apex acute – subacute, margin entire, dorsal margin strongly arched, ventral margin slightly arched; apical leaf cells subquadrate – polygonal, 12.5-22.5 x 15.0-25.0 µm; median leaf cells polygonal, 20.0-35.0 x 15.0-27.5 µm; basal leaf cells elongated, polygonal, 27.5-52.5 x 20.0-32.5 µm; walls thin with distinct trigones, intermediate thickenings 1-3 along each side of the wall; cuticle smooth; oil-bodies not seen; ocelli 7-20 per leaf lobe, irregularly scattered, suprabasal ocellus 1, larger than median ocelli, elliptical, 102.5-115.0 x 50.0-62.5 µm; median ocelli 6-19 smaller, suborbicular – oval, 27.5-50.0 x 22.5-35.0 µm; leaf lobule inflated, 2/5-1/2 as long as the leaf lobe, oblong-ovate, 0.37-0.44 mm long, 0.20-0.25 mm wide, bidentate; first tooth unicellular, formed of an oblong cell; second tooth obsolete; hyaline papilla at the proximal side of first tooth; keel arched, smooth. Underleaves distant, 2-3 times as wide as stem, rectangular – trapezoid, 0.15-0.20 mm long, 0.15-0.23 mm wide, bilobed to 1/2 – 2/3 of underleaf length, margin crenulate – denticulate; lobes rectangular – lanceolate, 3-4 cells long, 2-3 cells wide, rarely 1 cell wide at apex, subparallel – slightly divergent; lamina composed of 6 marginal cells surrounding numerous small rhizoid initial cells. Rhizoids numerous, hyaline, fasciculate, arising from basal disc of underleaves. Brood-branches 0.55-0.75 mm long, 0.30-0.45 mm wide; lobe of first and second pair of leaves 0.17-0.20 mm long, 0.22-0.25 mm wide with 2-3 teeth; lobule reduced; underleaves rectangular, 0.11-0.14 mm long, 0.10-0.13 mm wide; deeply bilobed, lobes 2-3 cells long, 1-2 cells wide at base, uniseriate above, the first two underleaves develop an adhesive disc or paramphigastrium.

Dioecious. Androecia terminal on main shoot as well as short lateral branches, sometimes intercalary, 0.5-1.3 mm long, 0.3-0.4 mm wide; bracts in 3-9 pairs, densely imbricate; bract lobe ovate – oblong-ovate, 0.19-0.26 mm long, 0.11-0.17 mm wide, apex obtuse, margin entire; bract lobule strongly inflated, almost as long as the bract lobe; bracteoles 1-2, present only at the base of androecia, rectangular, 0.10-0.15 mm long, 0.09-0.12 mm wide, deeply bilobed; lobes lanceolate, 3-4 cells long, 2 cells wide throughout or 1 cell wide at apex, subparallel, lamina composed of 6 marginal cells surrounding numerous small rhizoid initial cells. Gynoecia terminal on short lateral branches without subfloral innovations; bracts connate with bracteole on both sides at base, bract lobe oblong, 0.35-0.52 mm long, 0.16-0.20 mm wide, apex acute – apiculate, margin entire; bract lobule oblong, 3/4-4/5 as long as the bract lobe, apex acute – subacute; ocelli 2-3 per bract; bracteole oblong, 0.40-0.47 mm long, 0.16-0.21 mm wide, bilobed to 1/5-1/4 of bracteole length, margin entire; ocelli 2-3 per bracteole; perianth obconical, 0.55-0.75 mm long, 0.47-0.57 mm wide, apex truncate with 5 distinct (2 ventral, 2 lateral, and 1 dorsal), obliquely – horizontally spreading horn-like keels extending from apex to 1/2-3/5 of perianth length; ocelli not seen. Mature sporophyte not seen.

Habitat: Epiphyllous, growing in very moist and shady places on the leaves of angiosperms.

Other specimens examined: *Leptolejeunea sikkimensis* Udar & U.S. Awasthi. India – Eastern Himalaya, Sikkim, East district, Nathula Pass, *ca* 2100 m, 28. 12. 1977, *R. Udar & U.S. Awasthi* 3119/77 (Isotype: LWU!); North district, 2 km from Nampringdong towards Passidong, *ca* 1650 m, 29. 11. 2009, *D. Singh* 46750 (CAL). *Leptolejeunea subdentata* Schiffn. ex Herzog. Indonesia, Java, Tjiburrum, Massart *s.n.* (Type: 14376 JE!); India – Eastern Himalaya, Arunachal Pradesh, West Siang district, on way to Mechuka from Rego, *ca* 1700 m, 21. 12. 1984, *D.K. Singh* 922B/1984 (ASSAM); Lower Debang Valley district, Mehao Lake No. 2 (on way to Deopani), *ca* 1750 m, 23. 11. 2000, *D.K. Singh* 98385B, 98386B, 98387 (BSD); Sikkim, East district, Burtak falls, *ca* 1650 m, 04. 01. 2005, *D. Singh & M. Dey* 35857, 35858, 35859, 35860A, 35861, 35862, 35863A, 35865, 35866, 35867, 35868, 35869, 35870 (CAL); West Bengal, Darjeeling district, Takdah, *ca* 1650 m, 17. 01. 2005, *D. Singh & M. Dey* 36231A, 36237B, 36238B, 36242 (CAL).

Note: *L. mirikana* is characterized by obovate leaf lobes with acute – subacute leaf apices and entire margin (Figs. 1: 1, 2, 4-6; 2: 1-3); oblong-ovate, inflated leaf lobule, 2/5-1/2 as long as the leaf lobe (Figs. 1: 4-6; 2: 3); rectangular – trapezoid, 1/2-2/3 bilobed underleaves with subparallel – slightly divergent, rectangular – lanceolate lobes which are 3-4 cells long, 2-3 cells wide, or rarely 1 cell wide at apex, and crenulate – denticulate margin (Figs. 1: 11-15; 2: 4); androecia terminal as well as intercalary (Figs. 1: 1; 2: 1) and obconical perianth with truncate apices and 5 distinct, obliquely – horizontally spreading horn-like keels extending from apex to 1/2-3/5 of perianth length (Figs. 1: 2, 28-30; 2: 2, 5).

L. mirikana resembles *L. sikkimensis* in having leaves with acute apices and entire margins, similar number of ocelli per leaf lobe, and similar sized underleaves with 3-4 cells long lobes. But, the latter differs in having elliptical-ovate leaf lobes which are smaller (0.48-0.74 mm long, 0.30-0.40 mm wide) in size; smaller, 57.5-87.5 x 30.0-37.5 µm basal ocelli; underleaves with smooth margins and usually biseriate lobes (see also Udar and Awasthi, 1979). The present species also shows some similarity with *L. subdentata* in the size of the plant, thickness of the stem, size of the leaf lobule and dioecious sexuality. However, it is considerably distinct from the latter which has leaves with apiculate apices and 3-6 blunt teeth towards apex; underleaf lobes 2-3 cells long, 2 cells wide at base, 0-2 cells uniseriate at

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apex and the female bracts and bracteoles devoid of ocelli (see also Zhu and So, 2001; Singh et al., 2006a).

Leptolejeunea udarii M. Dey et D.K. Singh, sp. nov. Figs. 2: 6-11; 3

Leptolejeuneae latifoliae Herzog et *Leptolejeuneae sikkimensis* Udar & U.S.Awasthi affinis, sed ab *L. latifoliae* lobis foliorum obovatis; ratione longitudinis – latitudinis folii parva; foliis apice subacutis; mediano-ocellis magnioribus, 25-65 x 25-50 µm; ocellis in femineo-bracteas, bracteolas et perianthia praesentibus; perianthiis brevioribus, 0.55-0.75 x 0.33-0.40 mm, carinis erectis ad oblique patentibus, laevigatis et ab *L. sikkimensis* folio-lobis obovatis; ratione longitudinis – latitudinis parva, 1.2:1-1.3:1; foliis apice subacutis, mediano-ocellis (25-65 x 25-50 µm) et basalio-ocellis (87.5-107.5 x 62.5-75 µm) magnioribus; folio-lobulis longitudine 1/3 to 2/5 partes folio-lobi aequantibus; lobis infero-foliorum ad basim (1-) 2-cellulo-latis, insuper semper uniseriatis differt.

Holotype: India. Eastern Himalaya, Sikkim, East district, Rolep, *ca* 1300 m, 30. 10. 2005, *D. Singh* 36711A (CAL).

Paratype: India. Eastern Himalaya, Sikkim, East district, Busuk, *ca* 1340 m, 10. 11. 2005, *D. Singh* 36844 (CAL); Busuk – near Pamtenj military house, *ca* 1340 m, 22. 02. 2006, *D. Singh* 36911A (CAL).

Plants yellowish green in herbarium, closely appressed forming mats or rosettes; shoot 6.0-11.0 mm long, 0.8-1.1 mm wide, irregularly branched; branching *Lejeunea*- type. Stem orbicular – oval in outline in transverse section, 85.0-100.0 x 77.5-87.5 µm, 4 cells across diameter; cortical cells in 7 vertical rows, polygonal, 27.5-35.0 x 12.5-30.0 µm; medullary cells in 3 vertical rows, polygonal, 20.0-27.5 x 15.0-20.0 µm. Leaves imbricate, obliquely spreading; leaf lobe obovate, 0.40-0.65 mm long, 0.33-0.50 mm wide, apex subacute, margin entire; apical leaf cells subquadrate – rectangulate, 10.0-17.5 x 15.0-25.0 µm, walls thin, trigones prominent, cordate, intermediate thickenings nodulose, 1(-2) per wall; median leaf cells polygonal, 22.5-37.5 x 20.0-30.0 µm, walls thin, trigones prominent, cordate, intermediate thickenings nodulose, 1 – 2 per wall; basal leaf cells polygonal, elongated, 32.5-47.5 x 20.0 – 37.5 µm, walls thin, trigones prominent, cordate, intermediate thickenings nodulose, 1-3 per wall; ocelli 8 – 11 per leaf lobe, irregularly scattered, basal ocellus 1, larger, 87.5-107.5 x 62.5-75.0 µm; median ocelli 7-10, 25.0 -65.0 x 25.0-50.0 µm; leaf lobule 1/3-2/5 as long as the lobe, inflated, rectangulate, 0.20 – 0.23 mm long, 0.12 – 0.13 mm wide, bidentate; first tooth small, unicellular, hyaline papilla at the proximal side of first tooth; second tooth minute. Underleaves distant, 2-3 times as wide as the stem, 0.10-0.12 mm long, 0.16-0.21 mm wide, bilobed to 1/2 the underleaf length; lobes slightly – widely spreading, 3-4 cells long, rarely 2 cells long, 2 cells wide at base, rarely 1 cell wide at base, always uniseriate above; lamina composed of 6 rectangular – polygonal cells, encircling numerous small rhizoid initial cells. Rhizoids numerous, fasciculate, arising from basal disc of underleaves, yellowish brown towards base, hyaline above.

Dioecious: Androecia on long or short branches, terminal as well as intercalary, 0.40-0.95 mm long, 0.3-0.4 mm wide; bracts in 2-7 pairs, densely imbricate; bract lobe ovate, 0.15-0.25 mm long, 0.11-0.20 mm wide, apex subacute – obtuse, margin entire; bract lobule almost as long as the bract lobe; ocelli 1-2 per bract; bracteole 0.06-0.09 mm long, 0.06-0.08 mm wide, present throughout the androecium, those towards the apex of androecia not fully developed; lobes almost parallel, 1-2 cells long, uniseriate, lamina composed of 6 rectangular – polygonal cells. Gynoecia terminal on very short branches; subfloral innovations absent; bract lobe oblong-ovate, 0.43-0.55 mm long, 0.15-0.20 mm wide, apex acute – subacute, margin entire; bract lobule 3/4-4/5 as long as lobe, apex subacute – acute; ocelli 7-13 per bract, irregularly scattered; bracteoles oblong, 0.43-0.50 mm long, 0.12-0.13 mm wide, bilobed to 1/6-1/5 their length, margin entire; ocelli 3-4 per bracteole, irregularly scattered; perianth obconical – campanulate, 0.55-0.75 mm long, 0.33-0.40 mm wide, keels 5 (2 ventral, 2 lateral and 1 dorsal), smooth, horn-like, erect – obliquely spreading; ocelli several, irregularly scattered. Capsule globose, green, 0.20-0.23 mm in diameter; capsule wall bistratose, cells of the outer layer rectangular – polygonal, 10.0-25.0 x 12.5-27.5 µm; those of the inner layer rectangular – polygonal, 20.0-47.5 x 12.5-32.5 µm; walls thin, thickenings absent; seta 135.0-150.0 µm in diameter in transverse section, with 12 outer and 4 inner cells. Mature spores and elaters not seen.

Habitat: Epiphyllous, growing in moist and shady places on the leaves of *Polystichum* sp. in association with *Lejeunea tuberculosa*, and on the leaves of *Pandanus* sp. in association with *Lejeunea obscura*.

Etymology: The species has been named after late Prof. Ram Udar, F.N.A., who added new dimensions to hepaticological research in India.

Other specimens examined: *Leptolejeunea latifolia* Herzog. India – Eastern Himalaya, West Bengal, Darjeeling district, Lloyd Botanic Garden, *ca* 2070 m, 02. 08. 1992, *D.G. Long* 23013 (E!); 3 km above Mungpoo, *ca* 1580 m, 03. 08. 1992, *D.G. Long* 23026a (E!). *Leptolejeunea elliptica* (Lehm. & Lindenb.) Schiffn. India – Eastern Himalaya, Arunachal Pradesh, Dibang Valley district, Hunli (Roing – Anini), *ca* 1350 m, 13. 01. 1984, *D.K. Singh* 463/1984 (ASSAM); Sikkim, East district, Busuk, *ca* 1340 m, 22. 02. 2006, *D. Singh* 36921 (CAL); West district, Khechiperi lake, *ca* 1400 m, 06. 03. 2005, *D. Singh* 36553B, 36555 (CAL).

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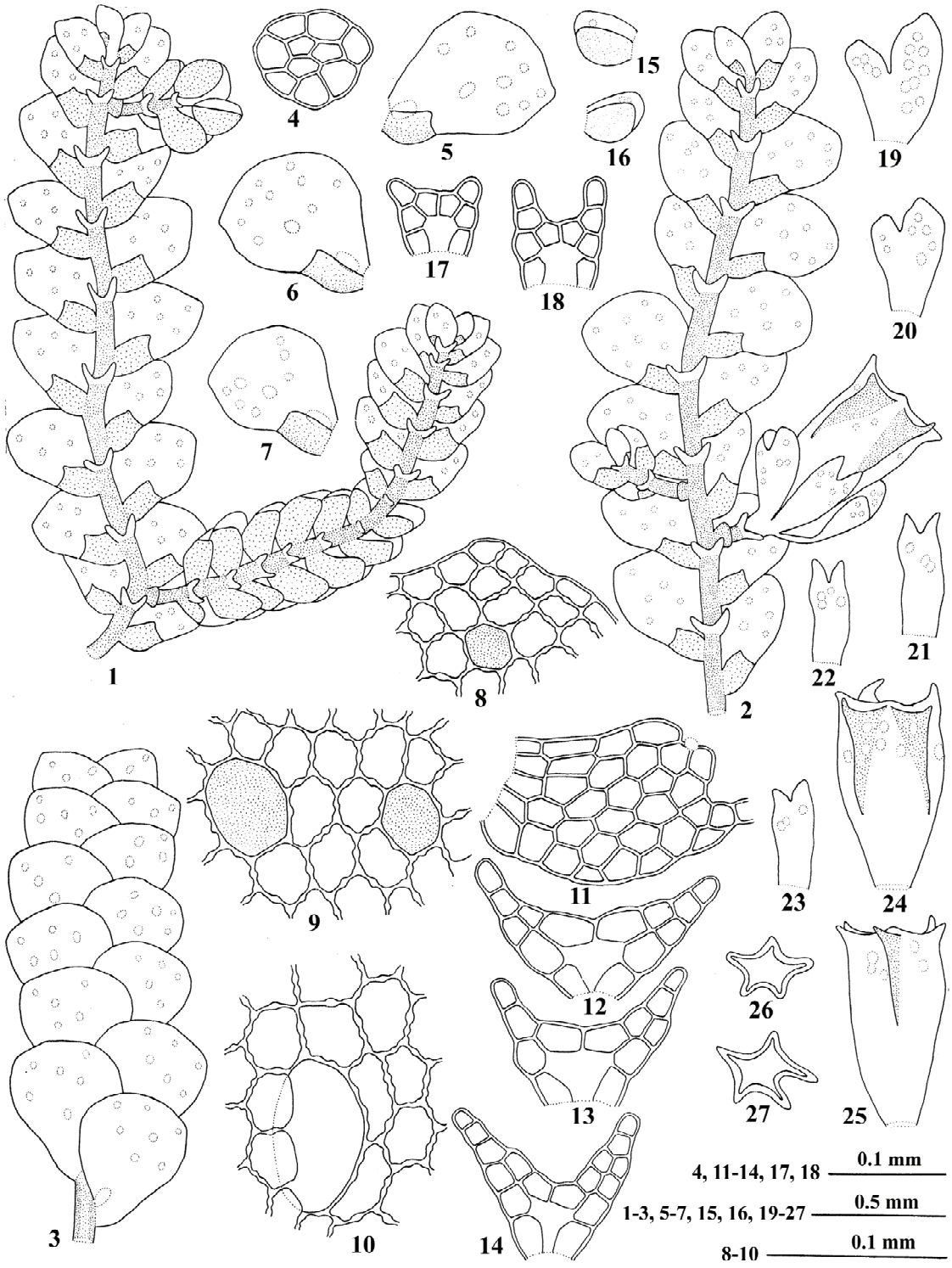


Fig. 3. ***Leptolejeunea udarii*** **M. Dey & D.K. Singh. 1: A portion of male plant in ventral view (rhizoids not drawn). 2: A portion of female plant in ventral view (rhizoids not drawn). 3: A portion of vegetative plant in dorsal view. 4: Transverse section of stem. 5-7: Leaves. 8: Apical leaf cells showing ocellus. 9: Median leaf cells showing ocelli. 10: Basal leaf cells showing basal ocellus. 11: A leaf lobule. 12-14: Underleaves. 15, 16: Male bracts. 17, 18: Male bracteoles. 19, 20: Female bracts. 21-23: Female bracteoles. 24: A perianth in ventral view. 25: The same in dorsal view. 26, 27: Transverse sections of perianth. [Figures 3-14 from** ***D. Singh*** **36911A; others from** ***D. Singh*** **36711A].**

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Note: The most distinguishing feature of *L. udarii*, which separates it from all other known species of the genus, is the small length-breadth ratio of the leaves ranging from 1.2:1-1.3:1 (Figs. 2: 8; 3: 5-7). The other considerably significant morphological characters are obovate leaf lobes with subacute apices and 8 – 11 ocelli scattered throughout; leaf lobule 1/3-2/5 of lobe length (Figs. 2: 8; 3: 5-7); (2-) 3-4 cells long underleaf lobes which are terminally uniseriate and (1-) 2 cells wide at base (Figs. 3: 12-14); terminal as well as intercalary androecia with male bracteoles present throughout (Figs. 2: 6, 10; 3: 1) and numerous ocelli scattered on female bracts, bracteoles and perianth (Figs. 2: 11; 3: 19-25).

L. udarii approaches *L. latifolia* in having similar stem thickness, leaf margin, number of ocelli, and shape of underleaf lobes. But, the latter differs in having oblong-ovate – ovate leaf lobes; larger, 1.6:1-1.7:1 leaf length – breadth ratio; apiculate – acute leaf apices; smaller, 22.5-42.5 x 22.5-32.5 µm median ocelli; absence of ocelli in female bracts, bracteoles and perianth and larger, 0.75-0.91 mm long, 0.60-0.71 mm wide perianth with obliquely – horizontally spreading dentate keels (see also Herzog, 1950). In some of these features, like thickness of the stem, leaf margin as well as the length of underleaf lobes the present species also resembles *L. sikkimensis,* but can be easily distinguished from the latter which has elliptical-ovate leaf lobes with larger length – breadth ratio (1.6:1-1.8:1) and acute apex; smaller, 22.5-37.5 x 20.0-35.0 µm and 57.5- 87.5 x 30.0-37.5 µm median and basal ocelli respectively; larger leaf lobule reaching half the length of lobe and usually biseriate underleaf lobes (see also Udar and Awasthi, 1979). In the presence of leaves with entire margin, 8-11 ocelli per leaf lobe, leaf lobule 1/3-2/5 as long as the lobe and perianth with obliquely – erectly spreading keels, *L. udarii* is also comparable with *L. elliptica*. But, the latter is considerably distinct from the former in having much delicate stem (48.0-60.0 µm in diameter in cross-section); ovate – elliptical leaf lobes with larger length – breadth ratio (1.5:1-1.6:1) and male bracteoles absent or present only at the basal portion of the androecium (see also Zhu and So, 2001).

Based on our examination of all the species of the genus *Leptolejeunea* recorded from India so far, we feel that the shape of leaves (including the characteristics of its apex, margin and the length/breadth ratio), number of ocelli per leaf lobe, size of lobule, size and shape of underleaf lobes, presence or absence of ocelli in female bracts, bracteoles and perianth and nature of perianth keels provide vital parameters for taxonomic delimitation of species. These morphological features have been found to be fairly consistent across the populations of various species, growing under similar or different ecological conditions, hence a combination of these traits can be justifiably used for their identification.

Key to the Indian species of *Leptolejeunea*

1. Leaf lobe obovate – fan shaped ……..…… 2
1. Leaf lobe ovate, oblong ovate, elliptical or oblong ……..…..… 5
2. Leaf lobe with apiculate apices and entire – wavy margins, often weakly denticulate or with 3-6 teeth near apex ……..…… 3
2. Leaf lobe with subacute – acute apices and entire margins ……..…… 4
3. Length-breadth ratio of leaves 2:1 – 2.3:1, leaf lobule 1/2 – 3/5 as long as the lobe, female bracts with acute – apiculate apices, ocelli present in female bracts and bracteoles ..…… *L. foliicola*
3. Length-breadth ratio of leaves 1.3:1 – 1.4:1, leaf lobule 1/3 – 1/2 as long as the lobe, female bracts with rounded – obtuse apices, ocelli absent in female bracts and bracteoles ..…… *L. subdentata*
4. Length-breadth ratio of leaves 1.6:1 – 1.8:1, leaf lobe 0.72 – 0.92 mm long, underleaf lobes 2 – 3 cells wide, rarely 1 cell wide at apex, male bracteoles present only at the basal portion of androecium with 3 – 4 cells long lobes, female bracts with 2 – 3 ocelli per bract ……..…….. *L. mirikana*
4. Length-breadth ratio of leaves 1.2:1 – 1.3:1, leaf lobe 0.40 – 0.65 mm long, underleaf lobes (1–) 2 cells wide at base, uniseriate above, male bracteoles present throughout the androecium with 1 – 2 cells long lobes, female bracts with 7 – 13 ocelli per bract …… *L. udarii*
5. Leaf lobe oblong with serrate margin, underleaf lobes 4 – 5 cells long ……..…….. *L. maculata*
5. Leaf lobe ovate, oblong-ovate or elliptical with entire margin, underleaf lobes 2-4 cells long ……..…… 6
6. Leaf lobe with truncate, rounded-obtuse, obtuse or subacute apices, underleaf lobes uniseriate throughout ……..…… 7
6. Leaf lobe with acute – apiculate apices, underleaf lobes biseriate throughout or biseriate at base, uniseriate above ……..…… 9
7. Plants 0.3-0.5 mm wide, length-breadth ratio of leaves 1.1:1 – 1.2:1, ocelli 1 – 2 per leaf lobe, underleaf lobes 2 cells long ……..…… ……. *L. arunachalensis*
7. Plants 0.5-0.9 mm wide, length-breadth ratio of leaves 1.5:1-1.9:1, ocelli 3-5 (-15) per leaf lobe, underleaf lobes 3-4 cells long ……..… 8
8. Leaf lobe with ocelli arranged in non continuous longitudinal series, lobule reduced, composed of 5-10 cells, underleaf lobes spreading from stem at an angle of 60° – 90°, perianth with wing like, horizontally spreading keels ……..…….. *L. epiphylla*
8. Leaf lobe with ocelli irregularly scattered throughout, lobule 1/3 – 2/5 as long as the lobe, underleaf lobes spreading from stem at an angle of 45°, perianth with horn like, obliquely – erectly spreading keels ……..……..…. *L. elliptica*
9. Leaf lobe elliptical ovate, lobule 1/2 as long as the lobe, underleaf lobes biseriate throughout, rarely biseriate at base, uniseriate above ……..…….. *L. sikkimensis*
9. Leaf lobe ovate – oblong ovate, lobule 1/4-1/3 as long as the lobe, underleaf lobes biseriate at base, uniseriate above ……..…… 10
10. Stem 48.0-56.0 µm in diameter, ocelli 1-3 (-5) per leaf lobe, female bracts with obtuse – acute apices, perianth obovate, 0.60 mm long, 0.36 mm wide ……..……..…… *L. balansae*
10. Stem 72.5-97.5 µm in diameter, ocelli 5-11 (-14) per leaf lobe, female bracts with acute – apiculate apices, perianth obconical, 0.75-1.0 mm long, 0.50-0.71 mm wide …… *L. latifolia*

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LITERATURE CITED

Awasthi, U. S. 1986. The genus *Leptolejeunea* (Spruce) Steph. in India. J. Indian Bot. Soc. **65**: 117-123.

Daniels, A. E. D. and P. Daniel. 2004. *Leptolejeunea balansae* Steph. (Hepaticae: Jungermanniales) – A new record of bryoflora from the Indian mainland. J. Bombay Nat. Hist. Soc. **101**: 333-334.

Das, S. and D. K. Singh. 2008. *Leptolejeunea arunachalensis* (Lejeuneaceae, Hepaticae) – a New Species from India. J. Jap. Bot. **83**: 343-346.

Herzog, T. 1942. Revision der Lebermoosgattung *Leptolejeunea* Spr. in der Indomalaya. Flora **135**: 377-434.

Herzog, T. 1950. Miscellanea bryologica II. Palaeotropica. – Mem. Soc. Fauna Flora Fenn. **26**: 37-66.

Joshi, D. Y. 2001. A floristic analysis of the liverworts from Andaman Islands, India. In: Nath, V. and A. K. Asthana (eds.), Perspectives in Indian Bryology. Bishen Singh Mahendra Pal Singh, Dehra Dun, India. pp. 135-148.

Lal, J. 2003. Studies in Epiphyllous liverworts of India – Its present position. Bull. Bot. Surv. India **45**: 179-186.

Mizutani, M. 1961. A revision of Japanese Lejeuneaceae. J. Hattori Bot. Lab. **24**: 115-302.

Onraedt, M. 1991. Bryophytes des Iles Philippines. I. Le Genre *Leptolejeunea* (Spruce) Steph. J. Hattori Bot. Lab. **70**: 157-166.

Singh, D. K. 1996. Hepaticae (Bryophyta). In: Hajra, P. K. (ed), A contribution to the flora of Namdapha Arunachal Pradesh. Botanical Survey of India, New Delhi, India. pp. 46-67.

Singh, D. K., D. Singh and M. Dey. 2008. A Catalogue of the Hepaticae and Anthocerotae of Sikkim. In: Mohamed, H., B. B. Baki, A. Nasrulhaq-Boyce and P. K. Y. Lee (eds.), Bryology in the New Millennium. University of Malaya, Kuala Lumpur, Malaysia. pp. 93-135.

Singh, D. K., S. Das and M. Dey. 2006a. *Leptolejeunea subdentata* Schiffn. ex Herzog (Hepaticae: Lejeuneaceae) New to India. Indian J. Forest. **29**: 339-342.

Singh, D. K., S. K. Singh and M. Dey. 2006b. On a collection of Hepaticae from Andaman Islands. Phytotaxonomy **6**: 99-104.

Udar, R. and U. S. Awasthi. 1979. A new species of *Leptolejeunea* from India. Misc. Bryol. et Lichenol. **8**: 115-117.

Udar, R. and U. S. Awasthi. 1982. *Leptolejeunea foliicola* St. – New to Indian Bryoflora. J. Indian Bot. Soc. **61**: 299-301.

Zhu, R. L. and D. G. Long. 2003. Lejeuneaceae (Hepaticae) from several recent collections from the Himalaya. J. Hattori Bot. Lab. **93**: 101-115.

Zhu, R. L. and M. L. So. 2001. Epiphyllous liverworts of China. Beih. Nova Hedwigia **121**: 1-418.

印度東喜瑪拉雅山薄鱗蘚屬 (薄鱗蘚科) 葉附生植物二新種

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摘要：本文描述印度東喜瑪拉雅山附生於葉的二新種薄鱗蘚屬植物，包括密利湖薄鱗蘚及尤氏薄鱗蘚。密利湖薄鱗蘚分布於西孟加省大吉嶺區，主要特徵為葉片倒卵形，頂部銳尖或亞銳尖，葉緣全緣；腹葉二裂，裂片披針形 3-4 細胞長，2-3 細胞寬，邊緣具圓齒；雌苞葉具油細胞，蒴萼倒圓錐形，口部截狀，具五個 1/2-3/5 蒴萼長的角狀脊。尤氏薄鱗蘚分布於錫金省的東區，主要特徵為葉長寬比為 1.2-1.3: 1，葉片倒卵形，葉尖亞銳尖；雄枝頂生或側生，具雄苞葉；雌苞葉及蒴萼具油細胞，蒴萼倒圓錐狀，具五個脊。本文同時提供印度薄鱗蘚屬之檢索表。

關鍵詞：密利湖薄鱗蘚、尤氏薄鱗蘚、薄鱗蘚科、新種、東喜瑪拉雅山、印度。

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