Drepanolejeunea fleischeri (Steph.) Grolle & R. L. Zhu (Hepaticae: Lejeuneaceae): an addition to Indian Himalaya

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ABSTRACT

Dey M. & Singh D. K. 2010. *Drepanolejeunea fleischeri* (Steph.) Grolle & R. L. Zhu (Hepaticae: Lejeuneaceae): an addition to Indian Himalaya. Geophytology 39(1-2): 65-71.

Drepanolejeunea fleischeri (Steph.) Grolle & R. L. Zhu is reported for the first time from Himalayan ranges of Arunachal Pradesh and West Bengal. A key to the Indian species of the genus *Drepanolejeunea* (Spruce) Schiffn. is provided here.

Key-words: *Drepanolejeunea fleischeri*, Lejeuneaceae, new record, Indian Himalaya.

INTRODUCTION

The genus *Drepanolejeunea* (Spruce) Schiffn., represented in the Indian bryoflora by 13 taxa (Udar & Awasthi 1982, 1984, Grolle & Zhu 2000, Zhu & So 2001, Asthana 2007, Singh & Nath 2007, Asthana & Shukla 2009), is distributed in East Himalayan and Western Ghats bryogeographical regions of India. Of these, *D. erecta* (Steph.) Mizut., *D. foliicola* Horik. (=*Rhaphidolejeunea foliicola* (Horik.) P. C. Chen), *D. herzogii* R. L. Zhu & M. L. So (=*Strepsilejeunea ocellata* Herzog), *D. longifolia* A. P. Singh & V. Nath, *D. mawtmiana* A. P. Singh & V. Nath, *D. pulla* (Mitt.) Grolle and *D. vesiculosa* (Mitt.) Steph. are restricted to Eastern Himalaya only in Indian bryoflora, *D. fleischeri* (Steph.) Grolle & R. L. Zhu, *D. pentadactyla* (Mont.) Steph. *D. ternatensis* (Gottsche) Steph. var. *ternatensis* and *D. ternatensis* var. *lancispina* Herzog are restricted to Western Ghats, whereas *D. angustifolia* (Mitt.) Grolle and *D. yunnanensis* (P. C. Chen) Grolle & R. L. Zhu (=*Rhaphidolejeunea. yunnanensis* P. C. Chen) are distributed both in the Eastern Himalaya as well as the Western Ghats.

During the course of studies on the epiphyllous liverworts of Eastern Himalaya, the authors came across some interesting specimens of the genus. A subsequent morpho-taxonomic investigation on the specimens and the review of relevant literature (Udar & Awasthi 1982, 1984, Grolle & Zhu 2000, Zhu & So 2001, Singh & Nath 2007, Asthana & Shukla 2009) revealed that the plants belonged to *D. fleischeri*, a species known only from China and Sri Lanka till Asthana and Shukla (2009) reported it recently from Western Ghats (Karnataka) in India. The same is described and illustrated in the present communication.

DESCRIPTION AND DISCUSSION

Drepanolejeunea fleischeri (Steph.) Grolle & R. L. Zhu

Plate 1, figures 1-2, Text figures 1-2

Nova Hedwigia 70: 379. 2000; G. Asthana & A. Shukla in J. Bryol. 31: 139. 2009.

Leptolejeunea fleischeri Steph., Sp. Hepat. 5: 382. 1913.

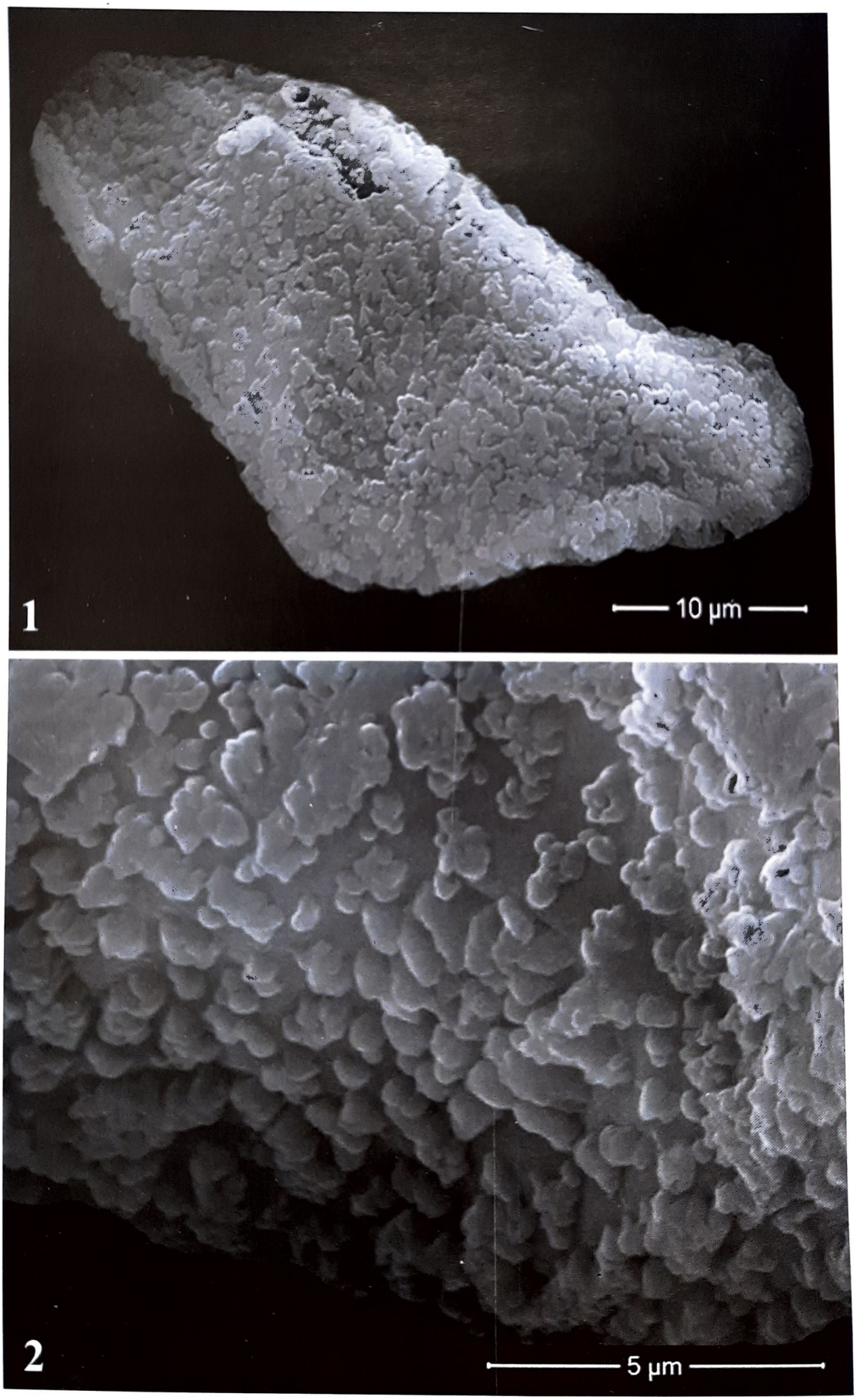


Plate 1

1-2. *Drepanolejeunea fleischeri* (Steph.) Grolle & R. L. Zhu (from D. K. Singh 283A/1984). 1. A spore under SEM. 2. Enlarged portion of the same, showing rosettes of spines.

Description: Plants small, light green-yellowish green when fresh, yellowish brown in herbarium; shoot 6.0-11.0 mm long, 0.7-1.1 mm wide; branching '*Lejeunea* type', throughout the plant. Stem orbicular – sub orbicular in outline in transverse section, 45.0-55.0 x 45.0-50.0 μm, 4 cells across the diameter; cortical cells in 7 vertical rows, rectangular-polygonal, 12.5-17.5 x 10.0-15.0 μm, slightly thick-walled; medullary cells in 3 vertical rows, rectangular-polygonal, 12.5-16.3 x 8.7-13.8 μm, slightly thick-walled; ventral merophytes of stem 2 cells wide. Leaves imbricate-contiguous, slightly obliquely spreading; leaf lobe oblong ovate-ovate, 0.33 – 0.52 mm long, 0.20-0.32 mm wide, apex acute, margin slightly denticulate, dorsal margin arched, ventral margin almost straight-very slightly arched; apical leaf cells quadrate-sub quadrate, polygonal, 5.0-7.5 x 5.0-8.0 μm; median leaf cells hexagonal, 10.0-16.3 x 10.0-15.0 μm; basal leaf cells polygonal, 15.0-32.5 x 7.5-15.0 μm; walls slightly thick with small or indistinct trigones, intermediate thickenings absent; cuticle smooth-verrucose; oil-bodies not seen; ocelli 1 (-2) per leaf lobe, suprabasal, polygonal, 47.5-65.0 x 22.5-32.5 μm; leaf lobule inflated, 1/3 as long as the lobe, ovate, 0.13-0.17 mm long, 0.08-0.12 mm wide, bidentate, first tooth unicellular, elongate, strongly curved; second tooth obsolete; hyaline papilla at the proximal side of first tooth; free lateral margin bordered by 7-12 sub quadrate-rectangular cells; keel arched, smooth. Underleaves distant, 5-7 times as wide as stem, 0.06-0.12 mm long, 0.25-0.38 mm wide, bilobed to 3/4 of underleaf length; lobes linear-lanceolate, 6-10 cells long, 2 cells wide at base, 2-4 cells uniseriate at apex, very widely spreading, nearly horizontal. Rhizoids numerous, hyaline, fasciculate at the base of underleaves. Asexual reproduction by means of brood branches, 0.50-0.60 mm long, 0.38-0.42 mm wide; the lobe of the first three leaves highly dentate; lobule reduced; the first underleaf with an adhesive disc or paramphigastrium.

Dioecious. Androecia terminal or sometimes intercalary on main shoot or lateral branches, 0.40-0.75 mm long, 0.26-0.38 mm wide; bracts in 3-7 pairs, densely imbricate; bract lobe ovate, 0.18-0.25 mm long, 0.12-0.16 mm wide, apex acute, margin entire; bract lobule strongly inflated, almost as long as the bract lobe; bracteole 1-2, present only at the basal portion of androecium, 0.12-0.20 mm long, 0.10-0.12 mm wide, bilobed to 2/3-3/4 of bracteole length; lobes linear-lanceolate, 5-7 cells long, 2 (-3) cells wide at base. Gynoecia terminal on short lateral branches without sub floral innovations; bract lobe oblong ovate, 0.24-0.38 mm long, 0.13-0.17 mm wide, apex acute, margin serrulate-dentate towards apex; bract lobule about 4/5 as long as the bract lobe, apex acute, margin serrulate-dentate towards apex; bracteole oblong ovate, 0.31-0.34 mm long, 0.15-0.17 mm wide, bilobed to 1/4-2/5 of bracteole length; perianth pyriform, 0.42-0.48 mm long, 0.35-0.45 mm wide; keels 5 (2 lateral, 2 ventral, 1 dorsal), horizontally spreading, sharp, horn-like, slightly dentate towards apex, extending from apex to 3/5 of perianth length; beak 2 cells long. Seta 120.0-140.0 μm in diameter in transverse section, with 12 outer cells surrounding 4 inner cells; capsule globose, blackish brown, dehiscing into 4 valves; capsule wall bistratose, cells of the outer layer with trigonous-nodular thickenings, those of the inner layer with irregular nodular thickenings; spores irregularly oblong, 27.5-52.5 x 20.0-27.5 μm, surface granulose; elaters trumpet shaped, 150.0-202.5 μm long, 7.5-10.0 μm wide, wall with sinuate thickenings.

Under SEM the sporoderm shows papillate ornamentation, with the papillae usually fusing with each other giving it an interesting lamelloid-reticuloid appearance. The rosettes on the sporoderm comprise 12-16 triangulate spines radially arranged in 2-3 layers.

Habitat: Epiphyllous, growing on the leaves of *Polystichum* sp., *Phrynium* sp., *Calamus* sp., *Zizyphus* sp. and others in moist and shady places, in association with *Plagiochila nepalensis, Radula acuminata, R. assamica, R. tjibodensis, Cheilolejeunea imbricata, Cololejeunea ceylanica, C. latilobula, C. longifolia, C. pseudofloccosa, C. spinosa, C. tixieriana, C. trichomanis, C. truncatifolia, C. yipii, Colura tenuicornis, Drepanolejeunea erecta, D. herzogii, Lejeunea flava, L. obscura, L. punctiformis, L. tuberculosa, Leptolejeunea balansae, L. elliptica, L. foliicola, L. subdentata* and *Ptychanthus striatus*.

Specimens examined: India - Eastern Himalaya, Arunachal Pradesh, Lohit District, Madhuban (Namsai), ca. 550 m, 30.12.1983, D. K. Singh 46B/1983 (Assam); Kharang – Metaliang, ca. 1250 m, 09.10.1985, D. K. Singh 14/1985 (Assam); Mailiang – Chaglagam, ca. 1600 m, 11.10.1985, D. K. Singh 73/1985 (Assam); Dibang Valley District, 24th km, Roing – Hunli Road, ca. 1500 m, 12.01.1984, D. K. Singh 377B/1984 (Assam); on way to Dessali from Hunli, ca. 1150 m, 15.01.1984, D. K. Singh 671B/1984 (Assam); Lower Dibang Valley District, Mayodia Pass, ca. 2655 m, 16.11.2000, D. K. Singh 98154 (BSD); Mehao Lake, ca. 1775 m, 22.11.2000, D. K. Singh 98277 (BSD); Mehao Lake-Gahori camp, ca. 1950 m, 25.11.2000, D. K. Singh 98439B (BSD); West Siang District, on way to Bulli from Kaying, ca. 950 m, 04.12.1984, D. K. Singh 283A/1984, 292/87/1984 (Arunachal Pradesh); on way to Shikar from Bulli, ca. 2000 m, 05.12.1984, D. K. Singh 430A/1984 (Assam); on way to Billey from Dupu, ca. 650 m, 30.12.1984, D. K. Singh 1009/1984 (Assam); Upper Siang District, Payum – Gaseng, ca. 1200 m, 29.01.1988, D. K. Singh 62D/1988 (Arunachal Pradesh); Sirang – Migging, ca. 1500 m, 31.01.1988, D.K. Singh 80A/1988 (Assam); West Kameng District, Tipi – Sessa, ca. 750 m, 21.04.1982, D. K. Singh s.n./1982 B (Arunachal Pradesh); West Bengal, Darjeeling District, 3 mile, Teesta road, ca. 1500 m, 19.12.2004, K. P. Singh 36415A (Cal).

Distribution: India [Eastern Himalaya (Arunachal Pradesh, West Bengal) – present study, Western Ghats (Karnataka)], Sri Lanka, China (Grolle & Zhu 2000; Zhu & So 2001; Asthana & Shukla 2009).

D. fleischeri is characterized by oblong ovate – ovate leaf lobes with acute apices and slightly denticulate margin (Text-figure 1: 5 – 8); slightly thick-walled leaf cells with small or indistinct trigones, lacking intermediate thickenings (Text-figure 1: 8 – 10); ovate, inflated leaf lobule, 1/3 as long as the leaf lobe with the free lateral margin bordered by 7 – 12 sub quadrate – rectangular cells (Text-figure 1: 1, 5 – 7, 11); 3/4 bilobed underleaves with very widely spreading, nearly horizontal, linear – lanceolate lobes which are 6 – 10 cells long, 2 cells wide at base, 2 – 4 cells uniseriate at apex (Text-figure 1: 1, 12, 13); terminal as well as intercalary androecia with 3 – 7 pairs of bracts and 1 – 2 bracteoles, present only at the basal portion of androecial branch (Text-figure 2: 1); and pyriform perianth with 5 horizontally spreading, sharp, horn-like keels which are slightly dentate towards apex (Text-figure 2: 2, 11, 12).

Among the Indian species of the genus, *D. fleischeri* resembles *D. foliicola* in the presence of divergent underleaf lobes and 1 – 2 male bracteoles confined to the basal portion of androecial branch. However, it can be easily distinguished from the latter which has leaf lobules with the free lateral margins bordered by 4 (5 – 7) strongly elongated rectangular cells and perianth with entire keels. *D. fleischeri* also resembles *D. yunnanensis* in having free lateral margin of leaf lobule bordered by 7 or more rectangular cells; divergent underleaf lobes and horizontally spreading, horn-like perianth keels, but differs considerably from the latter having male bracteoles present throughout the androecial branch (Grolle & Zhu 2000). The discovery of *D. fleischeri* in Indian Himalayan bryoflora interestingly bridges the gap in its northern and southern limits of distribution.

KEY TO THE INDIAN SPECIES OF *DREPANOLEJEUNEA*

1a. Leaf lobes triangulate, ovate-lanceolate – lanceolate, falcate, apex usually incurved 2

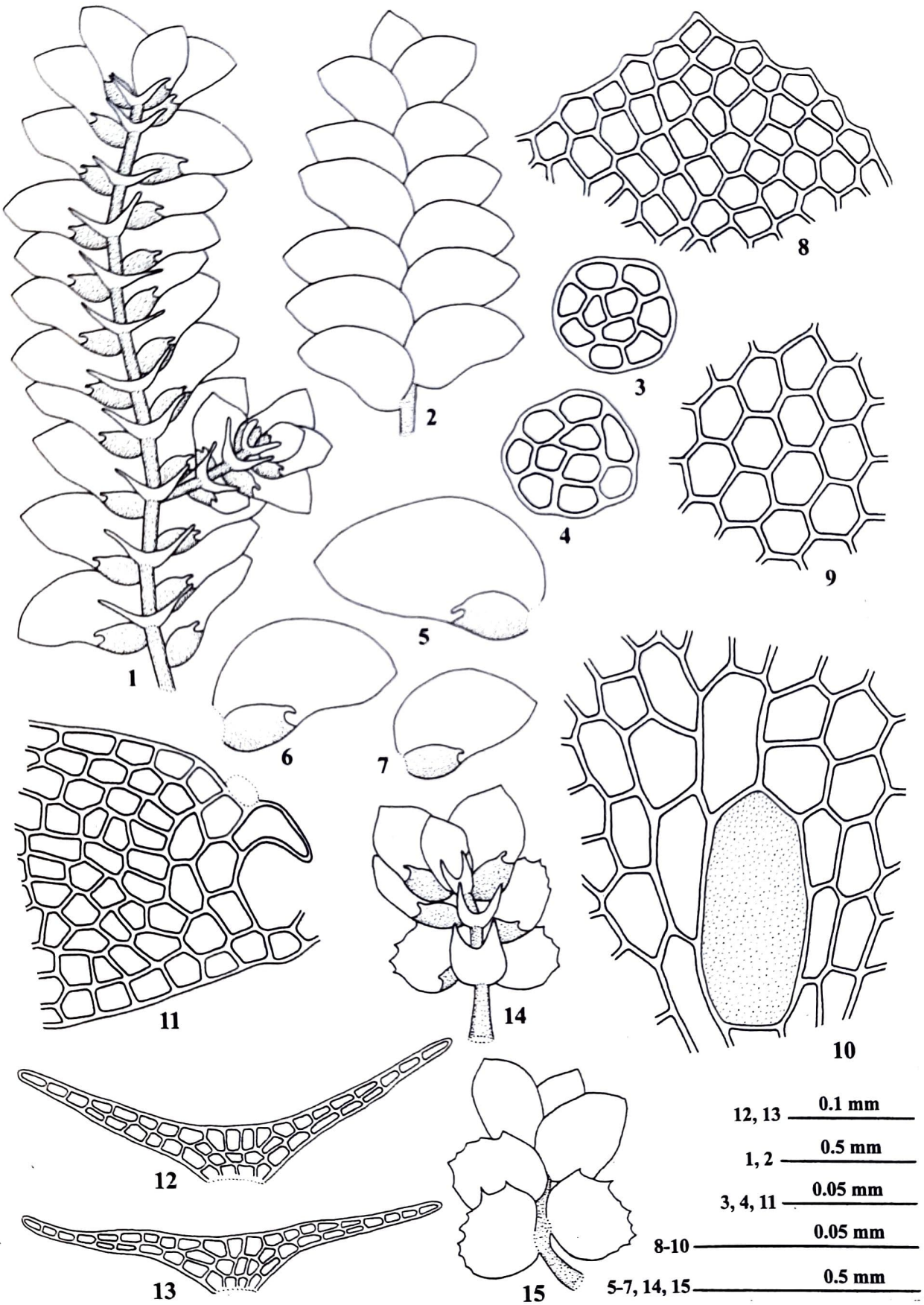
1b. Leaf lobes ovate – oblong-ovate, non falcate, apex not incurved 6

2a. Leaves obliquely spreading; underleaf base not differentiated into marginal and inner cells..... ..... *D. vesiculosa*

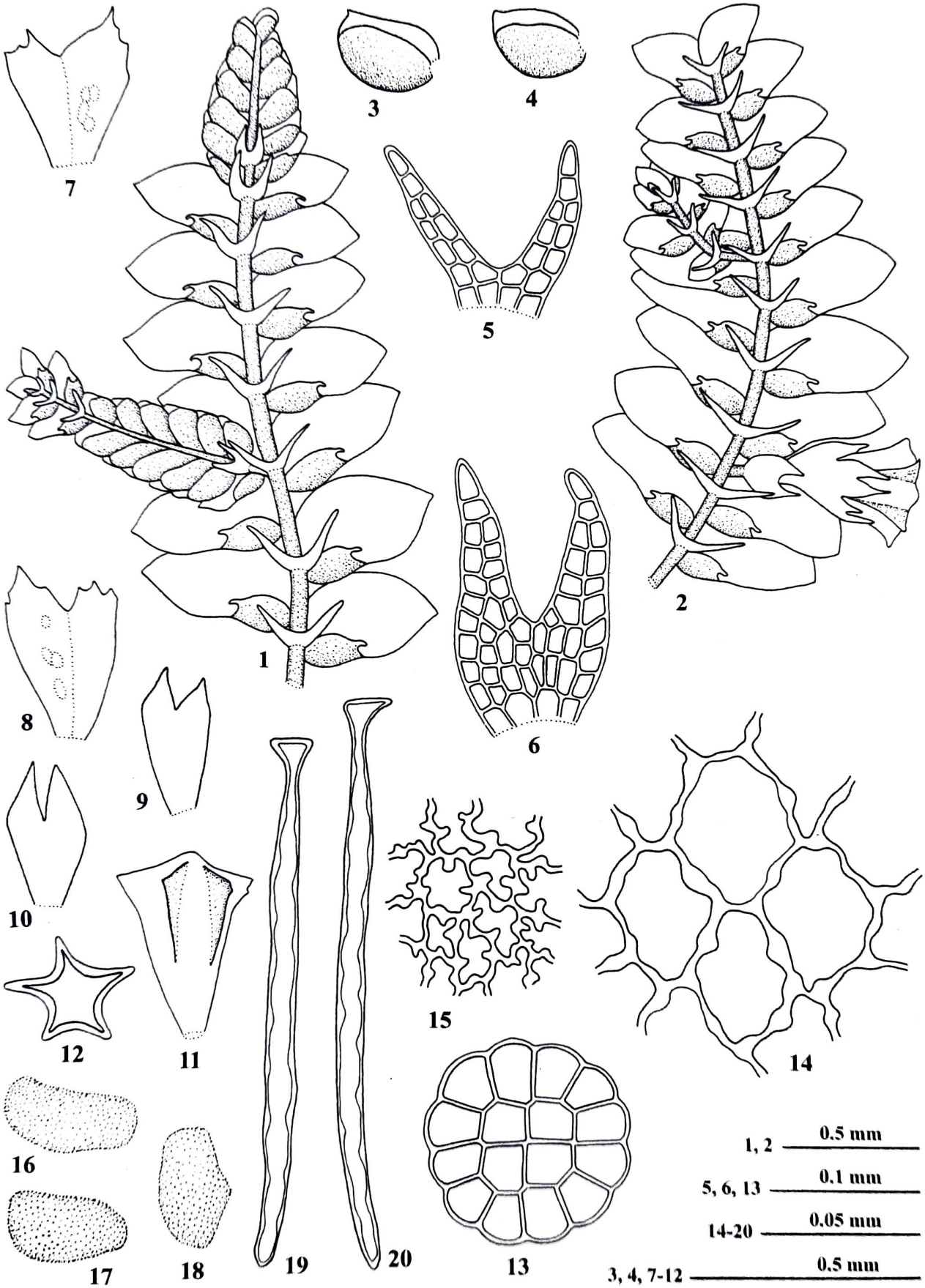
2b. Leaves erect spreading; underleaf base differentiated into 6 marginal and 2 – 4 inner cells ... 3

3a. Leaves caducous; leaf lobe with dentate – denticulate margins, dorsal margin with (0 –) 2 – 4 elongate teeth; leaf cuticle with well developed dorsal protrusions 4

3b. Leaves non caducous; leaf lobe with entire – serrulate margins, dorsal margin without elongate teeth; leaf cuticle smooth or rarely with inconspicuous dorsal protrusions 5



Text-figure 1. *Drepanolejeunea fleischeri* (Steph.) Grolle & R. L. Zhu (drawn from D. K. Singh 283A/1984). 1. A portion of plant in ventral view (rhizoids not drawn). 2. The same in dorsal view. 3-4. Transverse sections of stem. 5-7. Leaves. 8. Apical leaf cells. 9. Median leaf cells. 10. Basal leaf cells, showing basal ocellus. 11. Apex of leaf lobule. 12-13. Underleaves. 14. Abrood branch in ventral view (rhizoids not drawn). 15. The same in dorsal view.



Text-figure 2. *Drepanolejeunea fleischeri* (Steph.) Grolle & R. L. Zhu (drawn from D. K. Singh 283A/1984). 1. A portion of male plant in ventral view (rhizoids not drawn). 2. A portion of female plant in ventral view (rhizoids not drawn). 3-4. Male bracts. 5-6. Male bracteoles. 7-8. Female bracts. 9-10. Female bracteoles. 11. A perianth in ventral view. 12. Transverse section of perianth. 13. Transverse section of seta. 14. Outer layer of capsule wall. 15. Inner layer of capsule wall. 16-18. Spores. 19-20. Elaters.

4a. Leaf margin dentate, dorsal margin with 2 – 4 elongated teeth ..... *D. ternatensis* var. *ternatensis*

4b. Leaf margin denticulate, dorsal margin without elongated teeth .... *D. ternatensis* var. *lancispina*

5a. Plants 2 – 4 mm long; leaves 0.20 – 0.27 mm long; leaf cuticle smooth or sometimes with inconspicuous dorsal protrusions ..... *D. angustifolia*

5b. Plants 20 mm long; leaves 0.40 – 0.45 mm long; leaf cuticle always smooth ..... *D. longifolia*

6a. Underleaf lobes linear, very widely spreading – horizontal 7

6b. Underleaf lobes subtriangular – triangular, rarely lanceolate, parallel – slightly spreading 10

7a. Leaf lobe margin with 2 – 5 teeth, teeth 2 – 3 cells long, 2 – 3 cells wide at base .... *D. pentadactyla*

7b. Leaf lobe margin serrulate – slightly denticulate, without teeth 8

8a. Free lateral margin of leaf lobule bordered by 4 (5 – 7) strongly elongated rectangular cells; perianth keels smooth ..... *D. foliicola*

8b. Free lateral margin of leaf lobule bordered by 7 – 12 subquadrate – rectangular cells; perianth keels slightly dentate towards apex 9

9a. Male bracteoles present throughout the androecium ..... *D. yunnanensis*

9b. Male bracteoles present only at the base of androecium ..... *D. fleischeri*

10a. Stem in transverse section 0.09 mm in diameter; leaf lobes with entire margins .... *D. mawtmiana*

10b. Stem in transverse section 0.05 – 0.07 mm in diameter; leaf lobes with denticulate margins 11

11a. Leaves oblong-ovate, 0.20 – 0.30 mm long, 0.09 – 0.15 mm wide; underleaf lobes 2 – 3 cells wide at base ..... *D. pulla*

11b. Leaves ovate, 0.35 – 0.64 mm long, 0.23 – 0.45 mm wide; underleaf lobes 3 – 6 cells or 4 – 12 cells wide at base 12

12a. Free lateral margin of leaf lobule bordered by 7 – 12 subquadrate – rectangular cells; gynoecial innovation absent ..... *D. herzogii*

12b. Free lateral margin of leaf lobule bordered by 4 elongate cells; gynoecial innovation usually present ..... *D. erecta*

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