

Two Species of *Drepanolejeunea* (Family Lejeuneaceae) Newly Recorded to Taiwan

臺灣產角鱗蘚屬(細鱗蘚科)2個新紀錄種

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Abstract

There are nine species of liverworts belonging to the genus *Drepanolejeunea* (Lejeuneaceae) that have been reported from Taiwan. This paper describes *Drepanolejeunea longicornua* (Herz.) Mizut. and *Drepanolejeunea spicata* (Steph.) Grolle & R. L. Zhu as two newly recorded species to the flora of Taiwan. Their illustrations and a key to the species of *Drepanolejeunea* in Taiwan are provided for the identification. Information on their habitats and distribution are also provided.

摘要

角鱗蘚屬隸屬於細鱗蘚科，臺灣本屬原記載有9種。本文增加2個新紀錄種，長角角鱗蘚(新擬中名)及尖角鱗蘚(新擬中名)，文中附有此2種新紀錄種之形態描述、圖片及棲地與分布等資料，以及臺灣產本屬物種之檢索表。

Key words: Lejeuneaceae, *Drepanolejeunea longicornua*, *Drepanolejeunea spicata*, liverworts, Taiwan

關鍵詞：細鱗蘚科、長角角鱗蘚、尖角鱗蘚、蘚類、臺灣

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Introduction

Drepanolejeunea is a large pantropical genus of the family Lejeuneaceae, consisting of about 100 species worldwide (Gradstein and Costa 2003). It is characterized by (1) epiphyllous or occasionally epiphyte, (2) underleaves remote, deeply bifid with very slender and diverging lobes, (3) leaf-lobules inflated, the first tooth acute, consisting of a single elongate cell, more or less curved toward keel, the second tooth reduced, (4) oil bodies finely granular, ocelli present, (5) gynoecia usually with one subfloral innovation, and (6) vegetative reproduction by cladia (Yang 2009). *Drepanolejeunea* is closely related to *Leptolejeunea*; the latter differs from the former in having rhizoid initials differentiated from six much elongated surrounding cells in underleaf base, first tooth of leaf lobule straight, and gynoecial innovation absent (Zhu and So 2001; Yang 2009). Nine species belonging to the genus have been reported from Taiwan. They are

D. angustifolia (Mitt.) Grolle, *D. commutata* Grolle & R. L. Zhu, *D. dactylophora* (Nees *et al.*) Schiffn., *D. erecta* (Steph.) Mizut., *D. foliicola* Horik., *D. pentadactyla* (Mont.) Steph., *D. ternatensis* (Gott.) Steph., *D. vesiculosa* (Mitt.) Steph., and *D. yunnanensis* (P.C.Chen) Grolle & R. L. Zhu. (Lin 2000; Piippo 1990; Wang *et al.* 2011; Yang 2009; Zhu and Grolle 2003; Zhu and So 2001).

In our recent plant inventory survey of Taiwan, we have collected specimens of *D. longicornua* (Herz.) Mizut. and *D. spicata* (Steph.) Grolle & R. L. Zhu, and found to be two new records to the liverwort flora of Taiwan. This paper briefly describes their morphological features with illustrations and provides information on the habitat and distribution. A key to the species of *Drepanolejeunea* in Taiwan are also provided. The voucher specimens are deposited at the Herbarium of Endemic Species Research Institute (TAIE).

Taxonomic Treatment

Drepanolejeunea (Spruce) Schiffn., in Engler & Prantl, Nat. Pflanzenfam. 1, 3:119, 126. 1893. 角鱗蘚屬

Key to the Species of *Drepanolejeunea* in Taiwan (Yang 2009, modified)

1. Plants medium in size, with leaves not less than 0.5 mm wide and apex of leaf lobes rounded to obtuse
 2. Leaf lobe with scattered ocelli at middle; first tooth of leaf lobule not curved toward keel.....
.....*D. longicornua*
 2. Leaf lobe without ocelli at middle; first tooth of leaf lobule curved toward keel
 3. Underleaf lobes triangular, parallel to stem, 3–6 cells wide.....*D. erecta*
 3. Underleaf lobes linear, very widely divergent, 1–2 (3) cells wide
 4. Free lateral margin of leaf lobule proximal to the notch bordered by 4 strongly elongate rectangular cells
 5. Perianth with long tubular horns, spreading horizontally.....*D. spicata*
 5. Perianth with triangular, acute horns, spreading erectly or horizontally
 6. Male bracteoles confined to the base of the androecium..... *D. foliicola*
 6. Male bracteoles throughout the androecium.....*D. commutata*
 4. Free lateral margin of leaf lobule proximal to the notch bordered by (6–) 8 or more subquadrate to shortly rectangular cells.....*D. yunnanensis*
1. Plants small in size, with leaves less than 0.5 mm wide and apex of leaf lobes acute to apiculate
 7. Margins of leaf lobes toothed; ocelli present in the middle part of leaf lobe.
 8. Leaf lobe densely toothed, usually with more than 5 teeth; keels of perianth toothed.....
.....*D. dactylophora*
 8. Leaf lobe loosely toothed, usually with less than 5 teeth; keels of perianth almost entire.....
..... *D. pentadactyla*
 7. Margins of leaf lobes serrulate or nearly entire; ocelli absent in the middle part of leaf lobe
 9. Lobes of underleaves with 2–3 rows of cells..... *D. vesiculosa*
 9. Lobes of underleaves with a single row of cells
 10. Leaves usually non-caducous; leaf cells and keel of leaf lobule usually smooth..*D. angustifolia*
 10. Leaves caducous; leaf cells and keel of leaf lobule papillose.....*D. ternatensis*

Drepanolejeunea longicornua (Herz.) Mizut., J. Hattori Bot. Lab. 68: 368. 1990.

Drepanolejeunea levicornua Steph. var. *longicornua* Herz., Ann. Bryol. 3:142. 1930.

長角角鱗蘚

Figs. 1–2 & 4a–b

Descriptions: Plants small, olive green to brownish green in fresh, brown or dark brown in herbaria. Stems up to 12 mm long, 58–90 μm in diameter, with leaves 0.6–1.1 mm wide, densely and irregularly branched. Leaf-lobes imbricate, widely spreading, obliquely ovate, 0.41–0.57

mm long, and 0.33–0.47 mm wide; apices acute to obtuse, slightly incurved; ventral margins nearly straight, minutely dentate; dorsal margins dentate, with straight or slightly sinuate bases; marginal cells 10–18 × 9–15 µm; median cells 18–30 × 13–20 µm, thin walled, trigones and intermediate thickenings large; basal cells about 34 × 19 µm; cuticle smooth. Oil-bodies up to 8 per cell, oblong to orbicular, granular. Ocelli 3–10, scattered, 22–42 × 13–23 µm. Leaf-lobule oblong, inflated, 1/3–2/5 as long as the lobe; free margin involute; apex obliquely truncate; apical tooth obtuse; keel nearly straight or slightly arched. Underleaves distant, 70–90 µm long, 0.2–0.3 mm wide; lobes lanceolate, widely to horizontally spreading, 3–6 cells long and 2 cells wide at base. Dioicous. Androecium not seen. Gynoecium terminal on very short branch, with 1 subfloral innovation; bract-lobes oblong, about 0.4 mm long and about 0.23 mm wide, apex acute or acuminate, margin dentate, dorsal bases shortly connate with each other; bract-lobule oblong, 1/2–2/3 as long as bract-lobe, margin dentate; bracteole oblong, about 0.4 mm long and 0.2 mm wide, base connate with bracts at both sides, about 1/3 bifide, margin dentate. Perianths not seen. Vegetative reproduction by cladia.

Habitats: *D. longicornua* is epiphyllous. It is common in Southeast Asia at elevations of 50–1,350m (Mizutani 1986, 1990). In Taiwan it is found in the Hengchun Peninsula of the southern Taiwan at an elevation 1,000m with vegetations resembling those in Southeast Asia.

Distribution: Borneo, Malaya, Java, Seram, and New Guinea (Mizutani 1986, 1990). New to Taiwan.

Specimens examined :

Pingdong County: Hengchun peninsula, Mt. Lilong, mixed hardwood forest near the ridge, on leaves of *Cyclobalanopsis championii* (Benth.) Oerst. ex Schott., mixed with *Drepanolejeunea dactylophora*, *D. foliicola*, *D. angustifolia*, *Colura tenuicornis*, *Cololejeunea magnilobula*, and *Metalejeunea cucullata*, at elevation 1,000 m, 120°43' 56" E; 22°9' 53" N, Mar. 12, 2008, J. -D. Yang 4855c (TAIE). Hengchun peninsula, Mt. Lilong, mixed hardwood forest near the ridge, on leaves of *Plagiogyria* sp., mixed with *Drepanolejeunea dactylophora*, *D. angustifolia*, *Colura tenuicornis*, *Cololejeunea goebelii*, *C. spinosa*, *Frullania* sp., and *Radula* sp., at elevation 1,000 m, 120°43' 56" E; 22°9' 53" N, Mar. 12, 2008, J. -D. Yang 4858g (TAIE).

Remarks: *D. longicornua* is distinguishable from other *Drepanolejeunea* species from Taiwan by its medium size; leaf lobe with 3–10 scattered ocelli at middle, and first tooth of leaf lobule not curved toward keel. *D. longicornua* is closely related to *D. thwaitesiana* (Mitt.) Steph., one of the commonest epiphyllous species of *Drepanolejeunea* in the southeastern Asia (Mizutani 1990; Zhu and So 2001). However, the latter differs from the former by its large size of plants, leaf lobe with 10–30 scattered ocelli at middle, and the cell just below apical tooth

of leaf lobule is about twice as large as the neighboring cells (Mizutani 1990).

Drepanolejeunea spicata (Steph.) Grolle & R.L.Zhu, Nova Hedwigia 70: 384. 2000.

Leptolejeunea spicata Steph., Hedwigia 35: 108. 1896.

Rhaphidolejeunea spicata (Steph.) Grolle, J. Hattori Bot. Lab. 28: 53. 1965.

尖角鱗蘚

Figs. 3 & 4c–e

Descriptions: Plants yellowish green to olive green in color. Stems up to 12 mm long and 39–52 μm in diameter, with leaves 0.4–0.7 mm wide. Leaves imbricate; lobes ovate, 0.30–0.41 mm long, 0.18–0.27 mm wide, with apex rounded or sometimes obtuse and margin nearly entire. Cells of leaf lobes thin-walled, trigones and intermediate thickenings indistinct, with marginal cells quadrate to rectangular, 13–16 \times 6–10 μm , median cells isodiametric to hexagonal, 13–22 \times 11–15 μm , and basal cells rectangular 18–31 \times 10–16 μm . Cuticle smooth. Oil-bodies up to 15 per cell, oblong to orbicular, granular. Ocelli moniliate, 2 near the base of leaf lobe, 31–50 \times 16–22 μm . Leaf lobules about 1/3 as long as lobe, inflated, with keel arched, free lateral margin of leaf lobule bordered by 4 strongly elongate rectangular cells; the first tooth acute, consisting of a single elongate cell, curved toward keel, with hyaline papilla on its proximal base; the second tooth reduced. Underleaves distant, deeply bilobed, wide spreading, 6–9 cells long, 2 cells wide at th base; margins entire. Dioicous. Androecia on a short or long branch,

terminal, or rarely intercalary; bracts in 3–6 pairs; bracteoles limited to the base of the androecium. Gynoecia usually on short lateral branches, occasionally with one subfloral innovation; bracts lobe ovate, about 0.34 mm long and about 0.16 mm wide with middle ocelli; bract lobule slightly shorter than bract lobe; bracteole oblong, about 0.38 mm long and 0.14 mm wide, bilobed to 1/4 in length, margins usually dentate. Perianth obovate, inflated, with 5 long tubular horns, spreading horizontally; apex obtuse to rounded. Vegetative reproduction by cladia.

Habitats: *D. spicata* is epiphyllous. In Ryukyus, it grows on fern fronds and shady evergreen leaves in wet evergreen hardwood forests along streams (Zhu *et al.* 1999). In Taiwan it grows in a hardwood forest in the Hapen Nature Reserve area with the sub-tropical humid and wet climate.

Distribution: Borneo (Mizutani 1966), Cambodia, China (Hong Kong, Yunnan, and Hainan), India (Assam), Japan (Ryukyu), Laos, Sumatra, Sarawak, Thailand and Vietnam (Zhu *et al.* 1999; Grolle and Zhu 2000; Zhu and So 2001). New to Taiwan.

Specimens examined : **New Taipei City:** Fushan Reservoir, Hapen Nature Reserve, Hapen Trail near the 7 km trail marker, mixed hardwood forest, epiphyllous on leaves of the fern *Blechnum orientale* L., mixed with *Cololejeunea peraffinis*, *C. goebelii*, *C. ceratilobula*, *C. floccosa*, *C. ocellata*, *Diplasiolejeunea cavifolia*, *Leptolejeunea elliptica*,

Lejeunea ulicina, *Stenolejeunea apiculata*, and *Radula* sp., at an elevation of 545m, 121°33'32.5" E; 24°45'41" N, Sep. 14, 2007, *J. -D. Yang 4573m (TAIE)*. Fushan Reservoir, Hapen Nature Reserve, Hapen Trail near the 4.5 km trail marker, mixed hardwood forest, epiphyllous on leaves of the fern *Diplazium dilatatum* Blume, mixed with *Aphanolejeunea angustiloba*, *Cololejeunea goebelii*, *C. spinosa*, *C. ceratilibula*, *Leptolejeunea elliptica*, *Lejeunea anisophylla*, *L. flava*, *L. ulicina*, *Metalejeunea cucullata*, *Stenolejeunea apiculata*, and *Radula* sp., at an elevation of 500m, 121°32'30" E; 24°46'17.5" N, Sep. 14, 2007, *J. -D. Yang 4596b (TAIE)*. Fushan Reservoir, Hapen Nature Reserve, Hapen Trail near the 4.5 km trail marker, mixed hardwood forest, epiphyllous on leaves of the fern *Diplazium doederleinii* (Luer) Makino, mixed with *Aphanolejeunea angustiloba*, *A. grossepapillosa*, *Cololejeunea goebelii*, *C. tenella*, *Drepanolejeunea foliicola*, *Leptolejeunea elliptica*, *Lejeunea anisophylla*, *L. flava*, *Metalejeunea cucullata* and *Radula* sp., at an elevation of 500m, 121°32'30" E; 24°46'17.5" N, Sep. 14, 2007, *J. -D. Yang 4598a (TAIE)*.

Remarks: *D. spicata* is easily distinguishable from all other congeners by the present of five very long tubular horizontal horns of perianth with entire margin, male bracteoles only at the basal portion of the androecium, free lateral margin of leaf lobule bordered by four strongly elongate rectangular cells, and two moniliate basal ocelli in leaf lobe.

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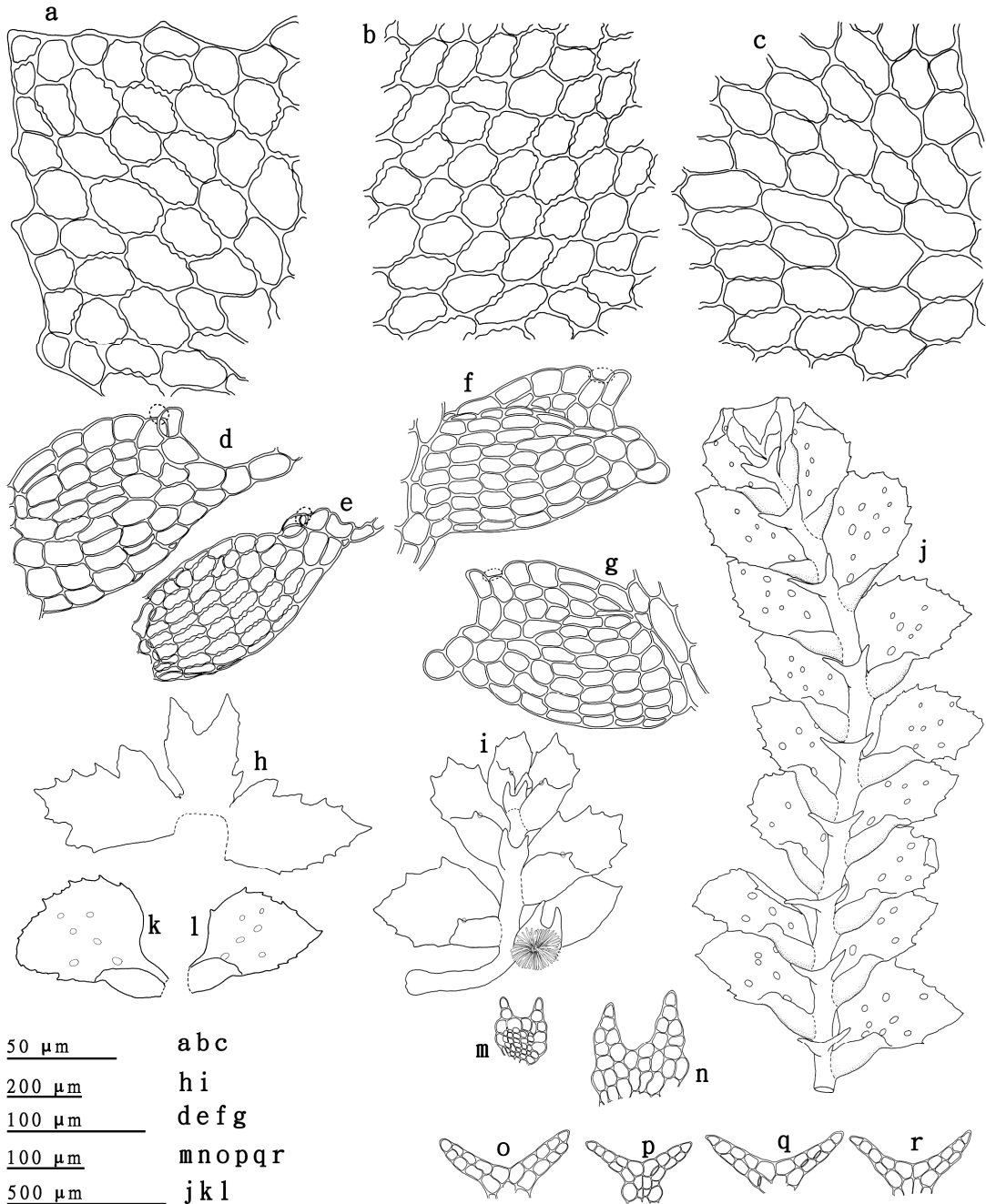


Fig. 1. *Drepanolejeunea longicornua* (Herz.) Mizut. (a, cells near the leaf apex; b, median cells of leaf lobe; c, cells near the leaf base; d-g, leaf-lobules; h, female bracts and bracteole; i, ventral view of cladium; j, ventral view of a portion of sterile plant; k-l, ventral view of leaves; m-n, underleaves of the cladium showing the rhizoid disc; o-r, underleaves). Drawn from *J. -D. Yang 4855c*.

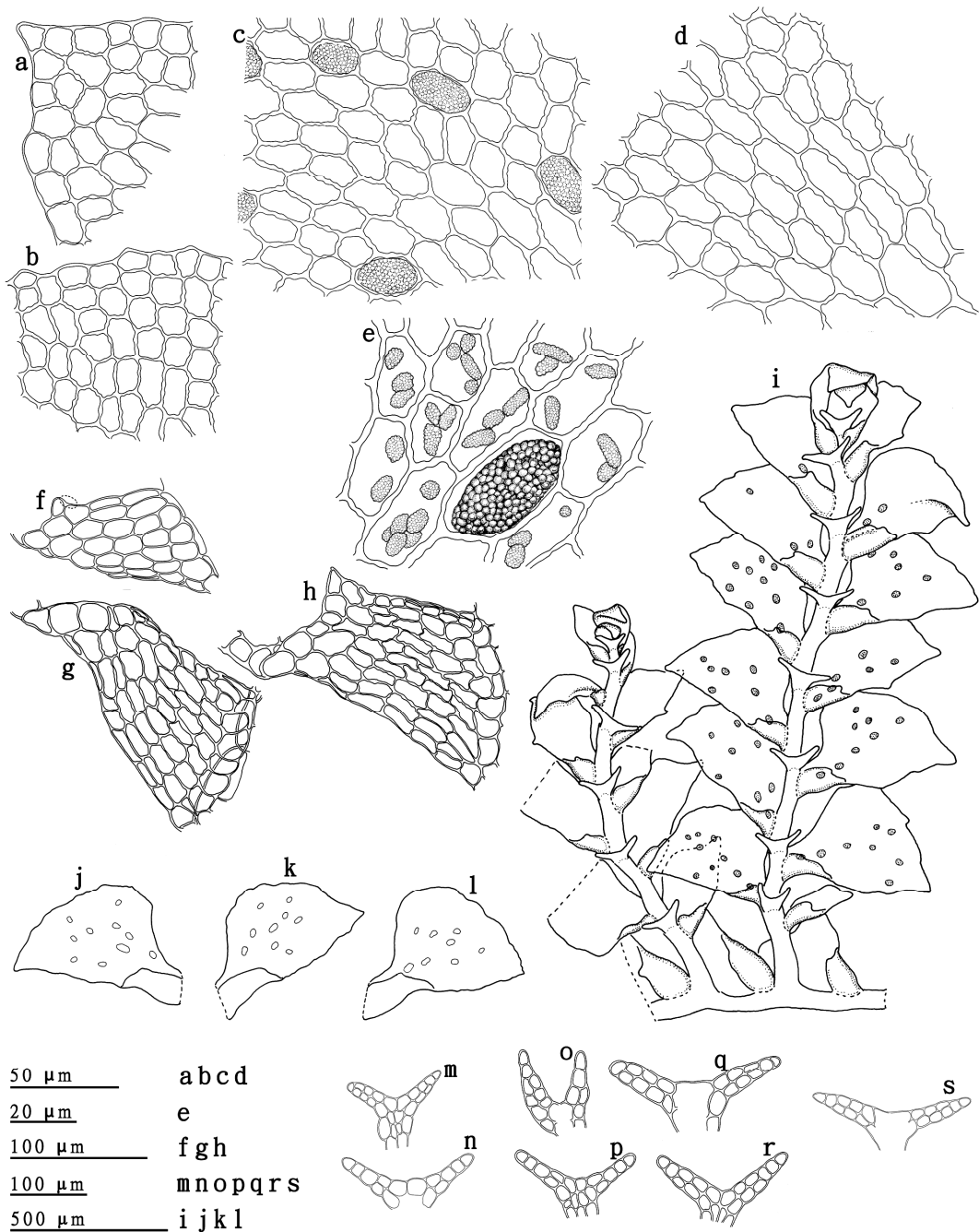


Fig. 2. *Drepanolejeunea longicornua* (Herz.) Mizut. (a, cells near the leaf apex; b, marginal cells of leaf lobe; c, median cells of leaf lobe, showing the scattered ocelli; d, cells near the leaf base; e, ocellus and oil bodies in the cells near the leaf base; f-h, leaf-lobules; i, ventral view of a portion of sterile plant; j-l, ventral view of leaves, ; m-s, underleaves). Drawn from *J. -D. Yang 4858g*.

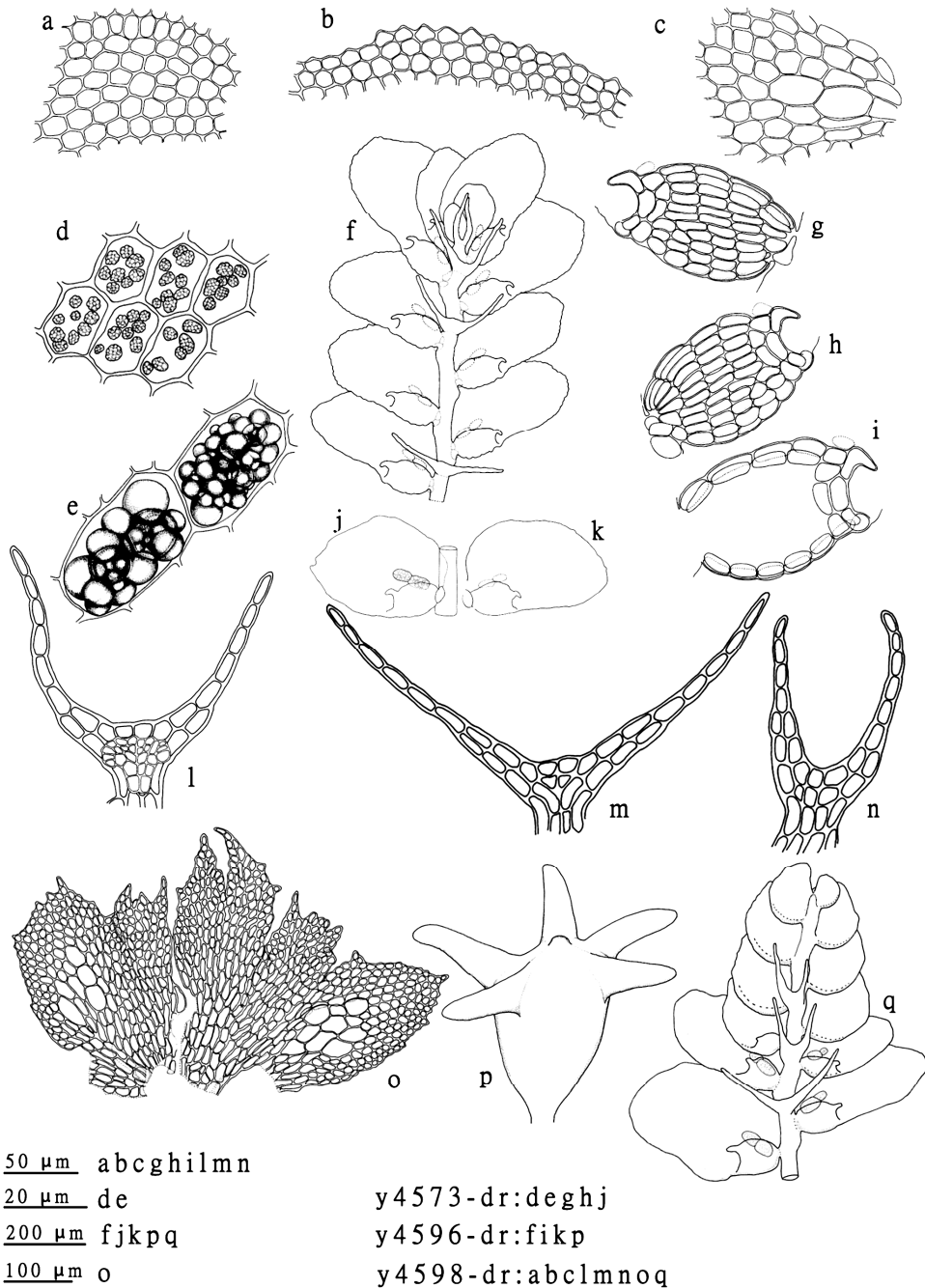


Fig. 3. *Drepanolejeunea spicata* (Steph.) Grolle & R. L. Zhu (a, median cells of leaf lobe; b, marginal cells of leaf lobe; c, cells near the leaf base; d, oil bodies in the median cells of leaf lobe; e, ocelli in the cells near the leaf base; f, ventral view of a portion of sterile plant; g-i, leaf-lobules; j-k, ventral view of leaves; l-n, underleaves; o, female bracts and bracteole; p, perianth; q, ventral view of androecium). Drawn from *J. -D. Yang 4573m, 4596b, 4598a*.

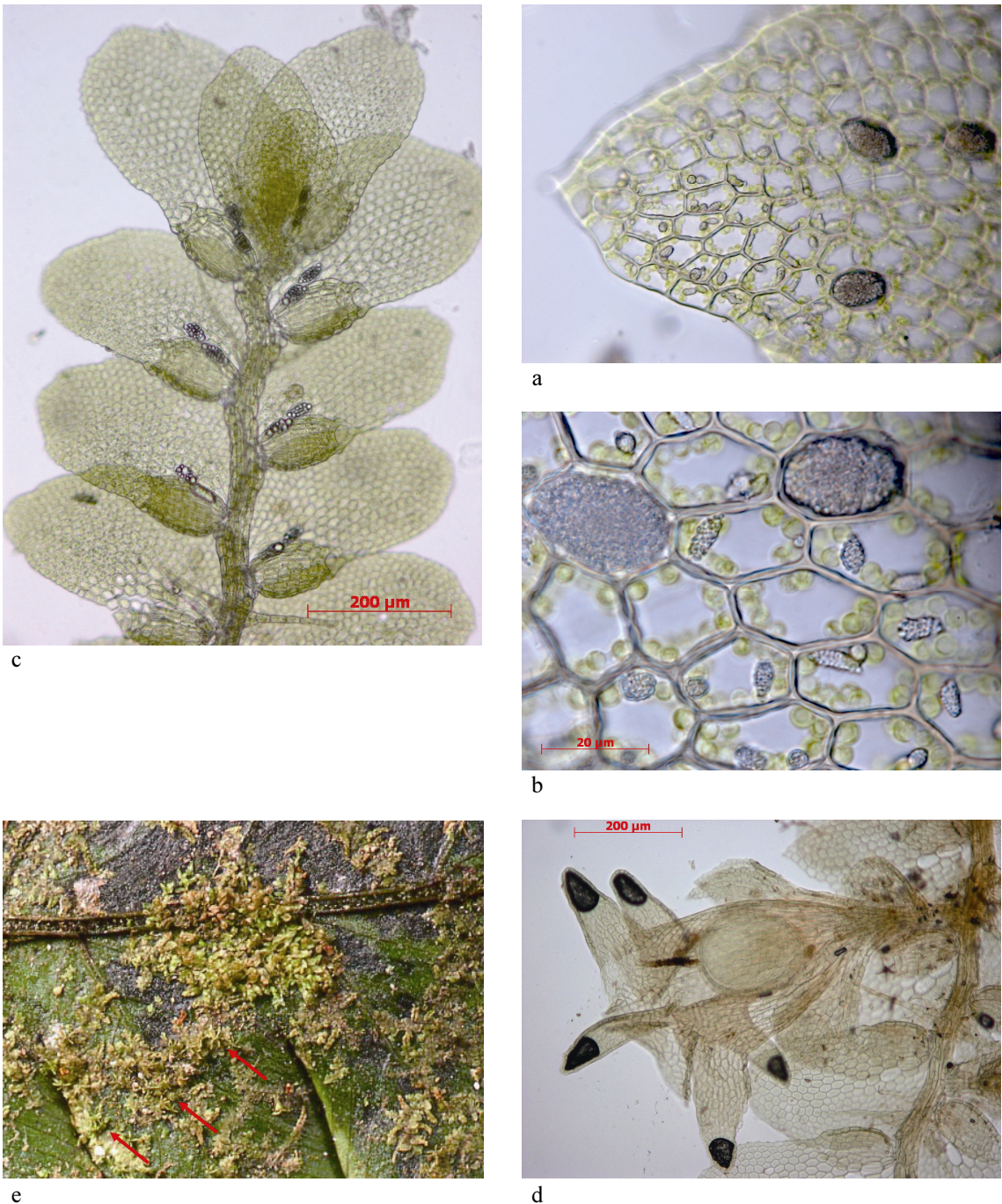


Fig. 4. Photographs of *Drepanolejeunea longicornua* (Herz.) Mizut.(a, leaf apex, showing ocelli and oil bodies; b, ocelli and oil bodies in the median cells of leaf lobe) and *Drepanolejeunea spicata* (Steph.) Grolle & R. L. Zhu (c. ventral view of a portion of sterile plant; d. perianth; e. epiphyllous on leaves of the fern *Diplazium doederleinii*, the red arrows show the perianths).

