

Type studies on *Pycnolejeunea* (Lejeuneaceae, Hepaticae). V. On the identity of *Pycnolejeunea spinistipula* Mizut. and *Lepidolejeunea queenslandica* Thiers

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On the basis of this study, *Pycnolejeunea spinistipula* Mizut. is transferred to *Leptolejeunea* (Spruce) Schiffn., as *Leptolejeunea spinistipula* (Mizut.) He and *Lepidolejeunea queenslandica* Thiers is transferred to *Rectolejeunea* Evans, as *Rectolejeunea queenslandica* (Thiers) He. Complete descriptions and illustrations are provided.

Key words: Hepaticae, Lejeuneaceae, *Leptolejeunea*, *Pycnolejeunea*, *Rectolejeunea*

Leptolejeunea spinistipula (Mizut.) X.-L. He, *comb. nov.* (Fig. 1)

Basionym: *Pycnolejeunea spinistipula* Mizut., Journ. Hattori Bot. Lab. 33: 255. 1970. — Type: Malaysia. Borneo. Sabah, around Borneo Mining Co. camp, Mt. Silam SW of Lahad Datu, East Coast, alt. 330 m, on root of tree, *Z. Iwatsuki* 4744 (NICH-254744!, holotype); Mt. Silam, SW of Lahad Datu, East Coast, alt. 220–250 m, on rotten log, *Z. Iwatsuki* 5621 (NICH-255621!, paratype).

Autoicous. Plants delicate, shoots < 1.5 mm wide, yellowish green or whitish brown in dry condition, on bark, tightly attached to substratum. Branching *Lejeunea* type, growth habit irregularly pinnate. Stems 63–112 µm in diam., stem cells rectangular, on the ventral side 30–58 µm long and 20–30 µm wide, in cross-section composed of 7 epidermal cells surrounding 6–10 medullary cells, epidermal cells rectangular or suborbicular,

11–23 µm long, 10–15 µm wide, cell walls thickened, medullary cells somewhat smaller than epidermal cells, isodiametric, 11–15 µm long, 8–13 µm wide; ventral merophytes on stems 2 cells wide. Leaves imbricate or contiguous, widely spreading, flat when moist, insertion line J-shaped, short; lobes oblong to ovate, symmetrical or sub-symmetrical, widest at or near middle, gradually narrowed to base, 0.30–0.80 mm long and 0.25–0.55 mm wide, dorsal margin broadly and strongly arched, ventral margin arched with a gentle angle near the lobule apex, margins entire, plane, apex rounded; lobe cells isodiametric to rectangular, apical marginal cells 15–20 × 13–15 µm, median cells 18–35 × 15–20 µm, basal cells 25–74 × 14–25 µm, trigones lacking or poorly developed, intermediate thickenings lacking, cuticle smooth; ocelli scattered, 5–47 per leaf lobe, basal ocelli 1–7, commonly 2 basal ocelli present on the lobe,

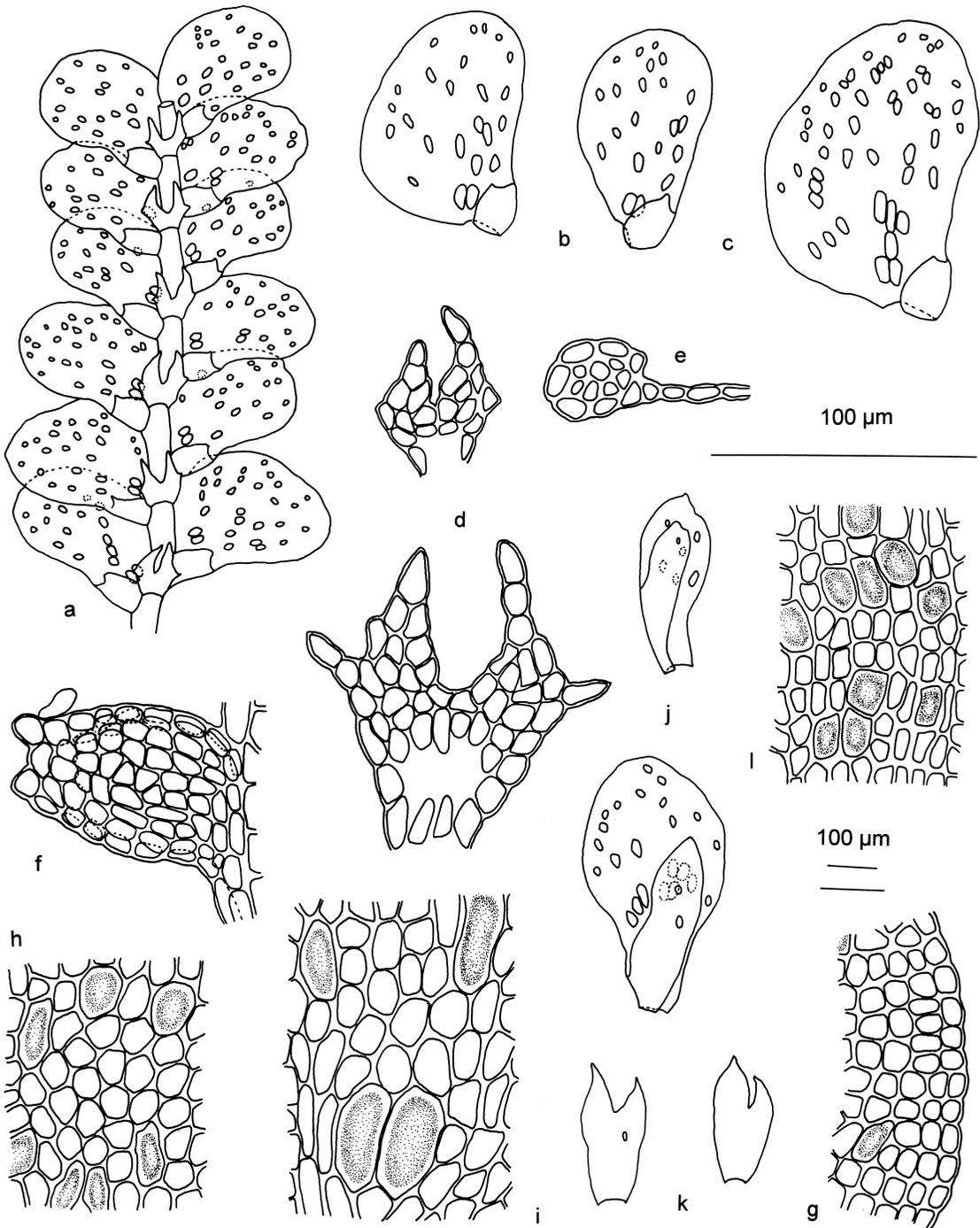


Fig. 1a–l. *Leptolejeunea spinistipula* (Mitsu.) X.-L. He (a, c, d, f, j–l drawn from *Meijer 4733*, L-955,87.222; b, d, e, g–i drawn from *Iwatsuki 5621*, NICH-255621). — a: Habit. — b, c: Leaves. — d: Underleaves. — e: Cross-section of the stem. — f: Leaf lobule. — g: Cells from apical leaf margin.. — h: Cells from middle portion of leaf. — i: Cells from basal portion of leaf. — j: Female bracts. — k: Female bracteoles. — l: Cells from middle portion of perianth. — Use the shortest 100 µm scale for a, the shorter 100 µm scale for b, c, j and k, and the longest 100 µm scale for d–i and l.

remaining scattered ocelli larger or slightly larger than surrounding cells, oil bodies not seen. Lobule ovate, inflated, 0.2–0.3 (–0.5) of lobe length, cells irregularly quadrate, 19–23 μm long and 15–18 μm wide, keel arched, 0.2–0.3 of lobe length, without wing, free margin strongly incurved to the apex of lobule, the first tooth usually large, obtuse, the second tooth indistinct, the hyaline papilla large, situated at the proximal side of the first tooth. Underleaves small, distant, 1.5–2.0 \times stem width, basal discal portion strongly transverse, surrounded by larger cells, lobed 0.5–0.7 of their length, lobes triangular or lanceolate, usually with one or two 1–2-celled teeth on the outer margins, apex acute, sinus narrow to broad, margins entire, plane. Rhizoid disc well developed at the underleaf base, rhizoids numerous. Androecia on short specialized branches, terminal in position, spicate, bracts in 1–3 pairs, saccate, imbricate or contiguous, ocelli scattered, few; male bracteoles 1, small, strongly transverse, restricted to the base of spike. Gynoecia on short, lateral branches, innovation lacking; female bracts in one pair, suberect, slightly shorter than vegetative leaves, bract ovate-oblong to oblong, 0.50–0.74 mm long and 0.19–0.45 mm wide, apex usually obtuse, margins entire, plane, ocelli scattered, few to numerous, bract lobule 0.5–0.8 of bract length, oblong to linear, or lingulate, apex obtuse or acute, margins entire, keel 0.25–0.50 of bract length, without wing, bracteole oblong to lingulate, 0.33–0.38 mm long and 0.17–0.19 mm wide, the apex 2-lobed to 0.4–0.7 of bracteole length, lobe apex acuminate to acute, ocelli few or obscure, sinus narrow or V-shaped, margins entire, plane, female bracts and bracteole connected at base. Perianths oblong to obconic, usually narrow at base, wide at apex, sharply 5-keeled, usually the keels somewhat extending upwards and outwards, ocelli numerous, scattered, beak short.

Distribution: Malaysia, Borneo; Indonesia, Tarakan.

Additional specimen examined: Indonesia: East Borneo, Nunulan, N of Tarakan, *Meijer 4733* (L-955,87.222).

Mizutani (1970) placed the above species in the genus *Pycnolejeunea*, and he had some uncertainty about the generic placement. According to my studies, the distinctive features of this species are: the very small size of the plants; the

numerous scattered ocelli in the leaf lobes, female bracts and perianths, a few ocelli in the male bracts, male and female bracteoles; the small, distant underleaves, with a strongly transverse disc portion and one or two distinctive teeth on outer margins; the connected base of female bracts and bracteole; the absence of innovations; and the somewhat upwardly and outwardly expanded keels of perianths. These characters convinced me that *Pycnolejeunea spinistipula* requires removal from the genus *Pycnolejeunea* and can be naturally placed in *Leptolejeunea*.

The occurrence of 6–10 medullary cells in cross-section of the stem, and the commonly 2 or more basal ocelli in leaf lobes are the notable features of *Leptolejeunea spinistipula*. In most species of *Leptolejeunea*, the number of medullary cells in cross-section of stem is 3, and there is only a single basal ocellus (Herzog 1942, Bischler 1969, Schuster 1980). Only two Asiatic species, *Leptolejeunea amphiophthalmia* Zwickel from Borneo (Zwickel 1933) and *L. picta* Herz. from Sumatra (Herzog 1942) have been reported and illustrated with 2 or more basal ocelli, however; the number of medullary cells in cross-section of stem of these two species remains unknown.

In *Leptolejeunea spinistipula*, the scattered ocelli are usually larger than the surrounding cells, and so cannot be considered as “laminar ocelli”, which are equal in size or very similar to the surrounding cells (Zwickel 1932ab, Piippo 1986). I think that Zwickel’s proposal of the occurrence of two types of “basal” and “laminar” ocelli in the Lejeuneaceae should be reconsidered. It seems that the variation of ocelli characters provides important taxonomic evidence.

The taxonomic revisions on the genus *Leptolejeunea* have been done on Indomalayan (Herzog 1942) and South American (Bischer 1969) species. However, the stem and underleaf structures, the ocelli position and the branching characters still need more study.

Rectolejeunea queenslandica (Thiers) X.-L. He, *comb. nov.* (Fig. 2)

Basionym: *Lepidolejeunea queenslandica* Thiers, Mem. New York Bot. Gard. 45: 556–560. 1987. — Type: Australia, Queensland, Cook Dist., Mossman Gorge National Park, ca. 5 km W of Mossman, along Mossman River, on

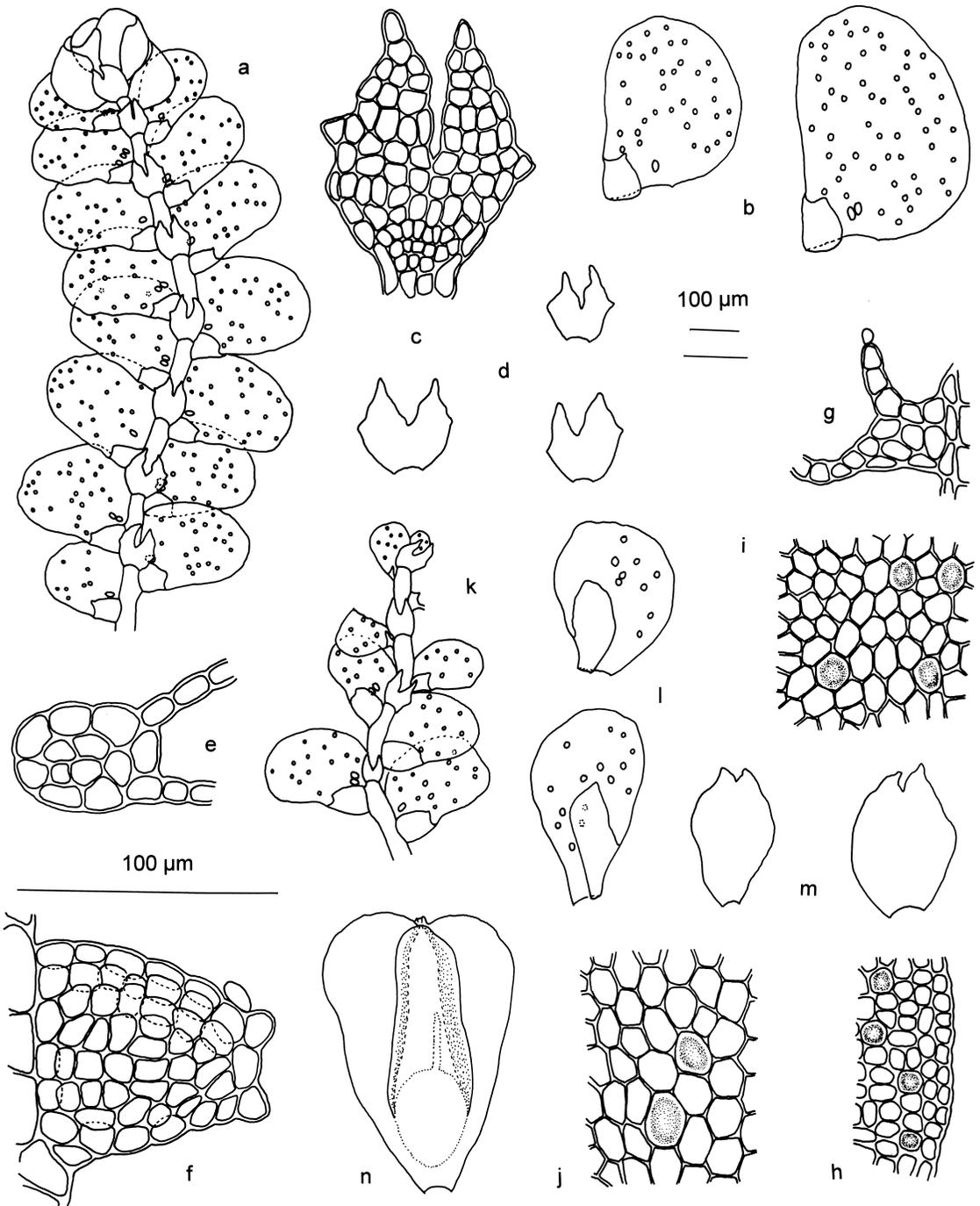


Fig. 2a–n. *Rectolejeunea queenslandica* (Thiers) X.-L. He (drawn from Thiers & Halling 2575, H). — a: Habit. — b: Leaves. — c, d: Underleaves. — e: Cross-section of the stem. — f: Leaf lobule. — g: Reduced leaf lobule. — h: Cells from apical leaf margin. — i: Cells from basal portion of leaf. — j: Cells from middle portion of leaf. — k: Plant with caducous leaves. — l: Female bracts. — m: Female bracteoles. — n: Perianth. — Use the shortest 100 µm scale for a, the shorter 100 µm scale for b, d, k and l–n, the longest 100 µm scale for c and e–j.

fronds of Hymenophyllaceae, 150 m, VII.1984, *Thiers & Halling 2575* (H!, NY!, isotypes); Cook Dist., Mossman Gorge National Park, ca. 5 km W of Mossman, along Mossman River, growing over mosses, 150 m, VII.1984, *Thiers & Halling 2592* (NY!, paratype).

Autoicous. Plants rather small, shoots < 0.8 cm long and < 1.0 mm wide, pale green in dry condition, on leaves of *Crepidomanes barnardianum* (F. M. Bail.) Tindale or on mosses, tightly creeping on substratum. Branching *Lejeunea* type, ramification pattern irregularly pinnate. Stems 63–100 μm in diam., stem cells rectangular, on the ventral side 15–40 μm long and 10–20 μm wide, in cross-section composed of 7 epidermal cells surrounding 5–8 medullary cells, epidermal cells rectangular, cell walls thickened, medullary cells somewhat smaller than epidermal cells, isodiametric; ventral merophytes on stems 2 cells wide. Leaves fragile, contiguous or distant, widely spreading or directed obliquely upwards, insertion rather shallow, insertion line slightly arched; lobes ovate, 0.26–0.55 mm long and 0.21–0.43 mm wide, dorsal margin strongly arched, ventral margin straight or slightly arched, apex rounded, margins entire; lobe cells usually small, subquadrate to rectangular, apical marginal cells 11–15 \times 6–11 μm , median cells 18–23 \times 11–15 μm , basal cells 20–30 \times 8–25 μm , trigones and intermediate thickenings lacking, ocelli scattered, 7–50 per leaf lobe, basal ocelli 1–3, the other scattered ocelli almost the same size as the surrounding cells; oil-bodies not seen. Lobule dimorphic, normal lobules ovoid to rectangular, inflated, 0.2–0.3 of lobe length, cells rectangular to isodiametric, 13–18 \times 9–13 μm , keel short, straight to slightly arched, free margin entire, flattened to slightly involute to the lobule apex, the apex somewhat semicircular, the first tooth 1-celled, obtuse, hyaline papilla situated at the proximal base of the first tooth; when lobule reduced to a small rectangular to triangular fold, lobule tooth 2–4 cells long, obliquely upwards, hyaline papilla terminal. Underleaves small, distant, 1.2–2.0 \times stem width, orbicular to ovate, lobed ca. 0.5 of their length, usually with a 1–2-celled, distinct tooth on the outer margin, lobes triangular, acute to obtuse, sinus narrow to V-shaped, margins entire, insertion line slightly arched. Rhizoids few or abundant at the base of underleaves. Caducous leaves usually present,

unmodified, lobules of caducous leaves usually remaining attached to the stem. Androecia on short specialized or elongated branches, terminal in position, spicate, bracts in 2–8 pairs, male bracteole 1, restricted to the base of the spike, margins entire, plane. Gynoecia on short branches, innovations single, innovation leaf sequence pycnolejeuneoid, female bracts in one pair, suberect, bract lobes oblong, 0.37–0.58 mm long and 0.22–0.35 mm wide, apex rounded, margins entire; bract lobule 0.5–0.7 of bract length, lingulate, apex obtuse or acuminate, keel 0.20–0.44 of bract length; without wing; bracteole ovate to oblong, 0.32–0.42 mm long and 0.18–0.23 mm wide, the apex 2-lobed 0.13–0.20 of bracteole length, lobe apex acute, sinus usually narrow. Perianths emergent, large, obovate to obconic, compressed, 5-keeled, lateral keels sharp, auriculately expanded, ventral keels smooth, usually extending almost to base of perianth, margins entire or slightly crenulate with protruding cells, dorsal keel weak, but distinct; beak short.

Distribution: Australia, Queensland.

The species was originally placed in *Lepidolejeunea* Schust., subgenus *Kingiolejeunea* (Robins.) Schust. Thiers (1987) noted that “Although *Lepidolejeunea queenslandica* fits easily within the boundaries set for *Lepidolejeunea* by Piippo (1986), the inclusion of this species raises some problems with the infrageneric classification”. Indeed, the species does not fit either section of the subgenus currently recognized by Piippo.

The small size of the plants, the shallow lateral leaf attachment to the stem, the reduction of the leaf lobule, the presence of basal ocelli, and the absence of ocelli in the underleaves and the perianths indicate that this species is isolated remarkably from *Lepidolejeunea* as defined by Piippo (1986). I believe that *Lepidolejeunea queenslandica* cannot remain in the genus *Lepidolejeunea*.

The distinctive features of the present species are: the small size of the plants; the basal and laminar ocelli present in leaves, female bracts and bracteoles; the reduction of leaf-lobules; the small and distant underleaves; the presence of caducous leaves and the obcordate, compressed perianths. Based on the above characters, *Lepidolejeunea*

queenslandica must be transferred to *Rectolejeunea* Evans, subgenus *Rectolejeunea* Evans.

Rectolejeunea queenslandica resembles *Leptolejeunea spinistipula* in size and habit, however, I do not think these two species are closely related. The differences between the species are distinct and unmistakable. The key to the main differences of the two species is given below:

1. Scattered ocelli usually of the same size as the surrounding cells, lacking in perianths; underleaf base without transverse disc portion; caducous leaves present; innovation leaf sequence pycnolejeunoid; perianths compressed *Rectolejeunea queenslandica*
1. Scattered ocelli usually larger than surrounding cells, present in perianths; underleaf base with a strongly transverse disc portion; caducous leaves lacking; innovation leaf sequence lacking; perianths inflated
..... *Leptolejeunea spinistipula*

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