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Pycnolejeunea minutilobula, a newly recorded liverwort from Orchid Island of Taiwan

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One species of the genus *Pycnolejeunea* (Lejeuneaceae), represented by *Pycnolejeunea grandiocellata* Steph., has been reported from Taiwan. This paper based on Taiwanese material describes and illustrates *Pycnolejeunea minutilobula* (Amakawa) Amakawa, previously endemic to Japan, as a new record of Taiwan, and provides with information on its habitats and distribution.

Pycnolejeunea minutilobula (Amakawa) Amakawa was previously known only to be endemic to Ryukyu Islands of Japan (Yamada and Iwatsuki 2006, Higuchi 2011). Recently, in our studies on Lejeuneaceae of Taiwan, we found it in the Orchid Island (Botel Tabago) about 62 km off the southeastern coast of Taiwan. Based on the Taiwanese material collected, this paper describes it as a newly recorded species to Taiwan, and provides information on its habitats and distribution. The voucher specimens are deposited at the Herbarium of Endemic Species Research Institute (TAIE) and Tunghai University (TUNG).

Pycnolejeunea minutilobula (Amakawa) Amakawa, J. Jap. Bot. 40: 310. 1965.
Cheilolejeunea minutilobula Amakawa, J. Jap. Bot. 35: 365. 1960. (Fig. 1, 2)

Plants small, yellowish brown to brown when dried. Stems up to 15 mm long, 101–152 μm in diameter, with leaves 0.88–1.16 mm wide, irregularly branched in *Lejeunea*-type; ventral merophyte of the stem 2–4 cells wide; cross-section of the stem consisting of 11–14 epidermal cells and 12–19 smaller medullary cells. Rhizoids numerous, fasciculate, at base of underleaves. Leaf-lobes imbricate, widely spreading, ovate, 0.42–0.72 mm long, 0.39–0.55 mm wide, apex rounded, slightly incurved; margin entire. Cells of leaf lobes thin-walled, trigones and intermediate thickenings small; marginal cells 14–22 × 9–15 μm, median cells 18–30 × 17–26 μm, basal cells 25–36 × 15–19 μm. Cuticle smooth. Ocelli in similar size as basal cells, up to 7 per leaf lobe, superbasal, aggregated. Oil bodies not seen. Leaf lobules subrectangular to ovate, 1/5–1/4 as long as the lobe, 0.12–0.18 mm long, 0.07–0.12 mm wide, inflated; free margin slightly incurved; apex usually constricted; the apical tooth one-celled, obtuse slightly curved; the hyaline papilla on the proximal side of the apical tooth; keel straight to slightly arched. Underleaves distant, 2–3 times as wide as the stem, 0.19–0.31 mm long, 0.23–0.35 mm wide, bilobed to ca 1/3 of the underleaf length, transversely to subtransversely inserted. Autoicous. Androecia usually terminal on lateral short branch; bracts 5–8 pairs, closely imbricate; bracteoles 1–2, restricted to the base. Gynoecia usually terminal on lateral branch, subfloral innovation absent; bract lobes oblong, 0.89–0.97 mm long, 0.45–0.63 mm wide, with rounded apex and entire margin; bract lobules sublinear, ca 1/2–3/5 as long as bract lobe; bracteole oblong to ovate, ca 0.8 mm long and 0.4 mm wide, with entire margin. Perianth obovate, inflated, with five smooth keels.

Habitat. In the Ryukyu Islands of Japan *P. minutilobula* is found on boulders, and barks and roots of trees in lowland forests at elevations of 100–500 m (Amakawa 1960, 1965, Mizutani 1978). In Taiwan, *P. minutilobula* was collected from soil, stones and humus in the tropical monsoon forests of Orchid Island at elevations of 100–200 m.

Distribution. Japan (Ryukyu Islands) and Taiwan (Orchid Island).

Specimens examined. Taiwan: Taitung County: Orchid Island, the trailhead to the Mt. Chientu, on stones, mixed with *Frullania* sp., at 100–120 m in elevations, 22°04'N, 121°34'E, 24 July 1997, Leg. Chi-Da Wu 1079a; Orchid Island, near the Hsiaotienchih, wind gap, on soil, mixed with *Frullania moniliata*, at 200 m in elevation, 22°04'33"N, 121°30'35"E, 23 July 1997, Leg. Chi-Da Wu *et al*. 1137a; same locality, on soil, mixed with *Cheilolejeunea nipponica* and *Frullania moniliata*, 23 July 1997, Leg. Chi-Da Wu *et al*. 1178a; same locality, on stones, mixed with *Lejeunea wightii*, *Cheilolejeunea nipponica*, *Lepidolejeunea bidentula* and *Metalejeunea cucullata*, 23 July 1997, Leg. Chi-Da Wu *et al*. 1187a; same locality, on soil, 23 July 1997, Leg. Chi-Da Wu *et al*. 1255; same locality, on humus, 23 July 1997, Leg. Chi-Da Wu *et al*. 1267.

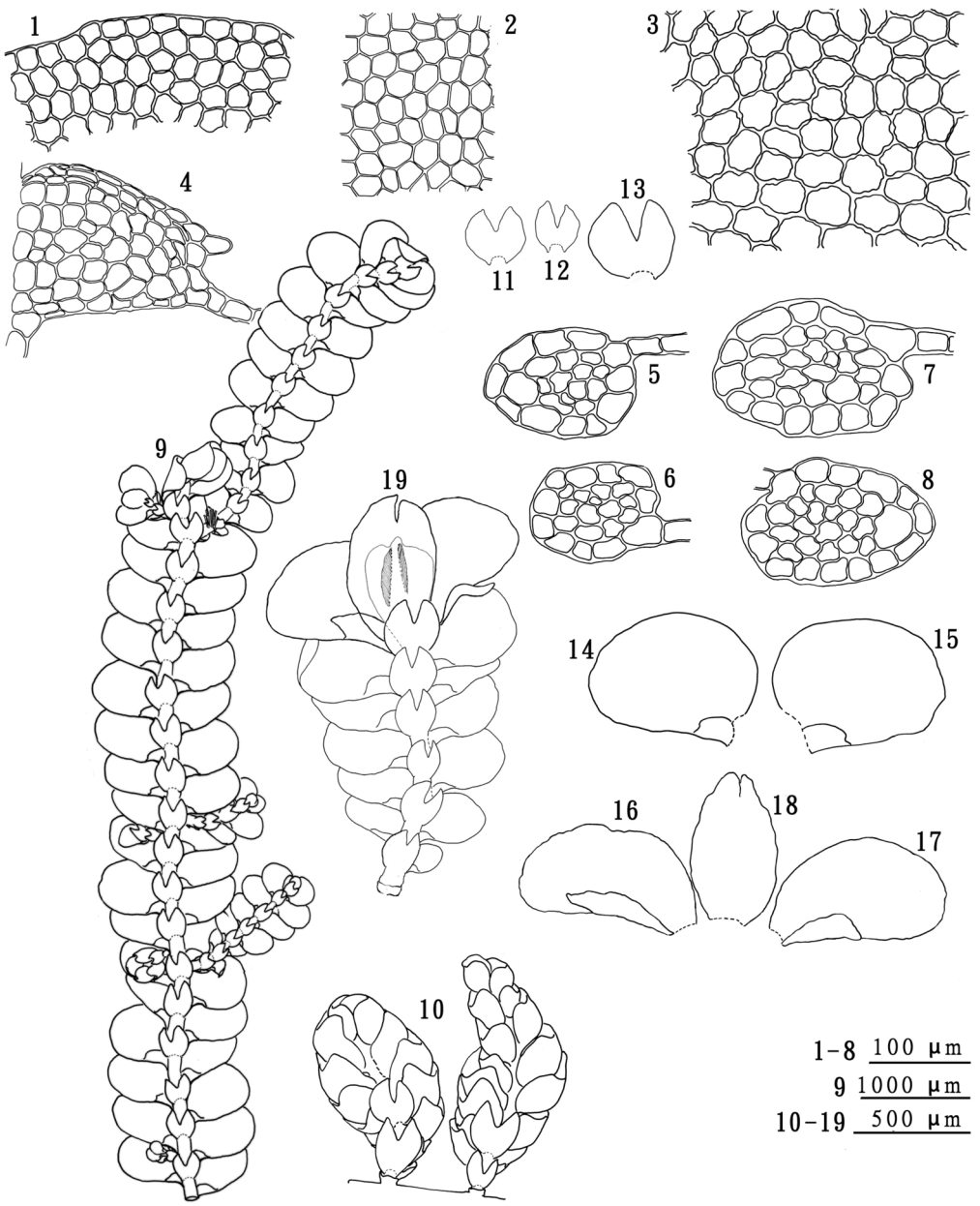

Figure 1. *Pycnolejeunea minutilobula* (Amakawa) Amakawa (1) marginal cells of leaf lobe. (2) median cells of leaf lobe. (3) cells near the leaf base; (4) leaf-lobule. (5–8), cross-section of stems. (9) ventral view of a portion of plant. (10) Androecia, ventral view. (11–13) underleaves. (14, 15) leaves, ventral view. (16, 17) female bracts. (18) female bracteole. (19) gynoecial branch, ventral view. (2)–(5), (9), (10), (13)–(19) from Chi-Da Wu 1079a; and (1), (6)–(8), (11), (12) from Chi-Da Wu et al. 1137a.

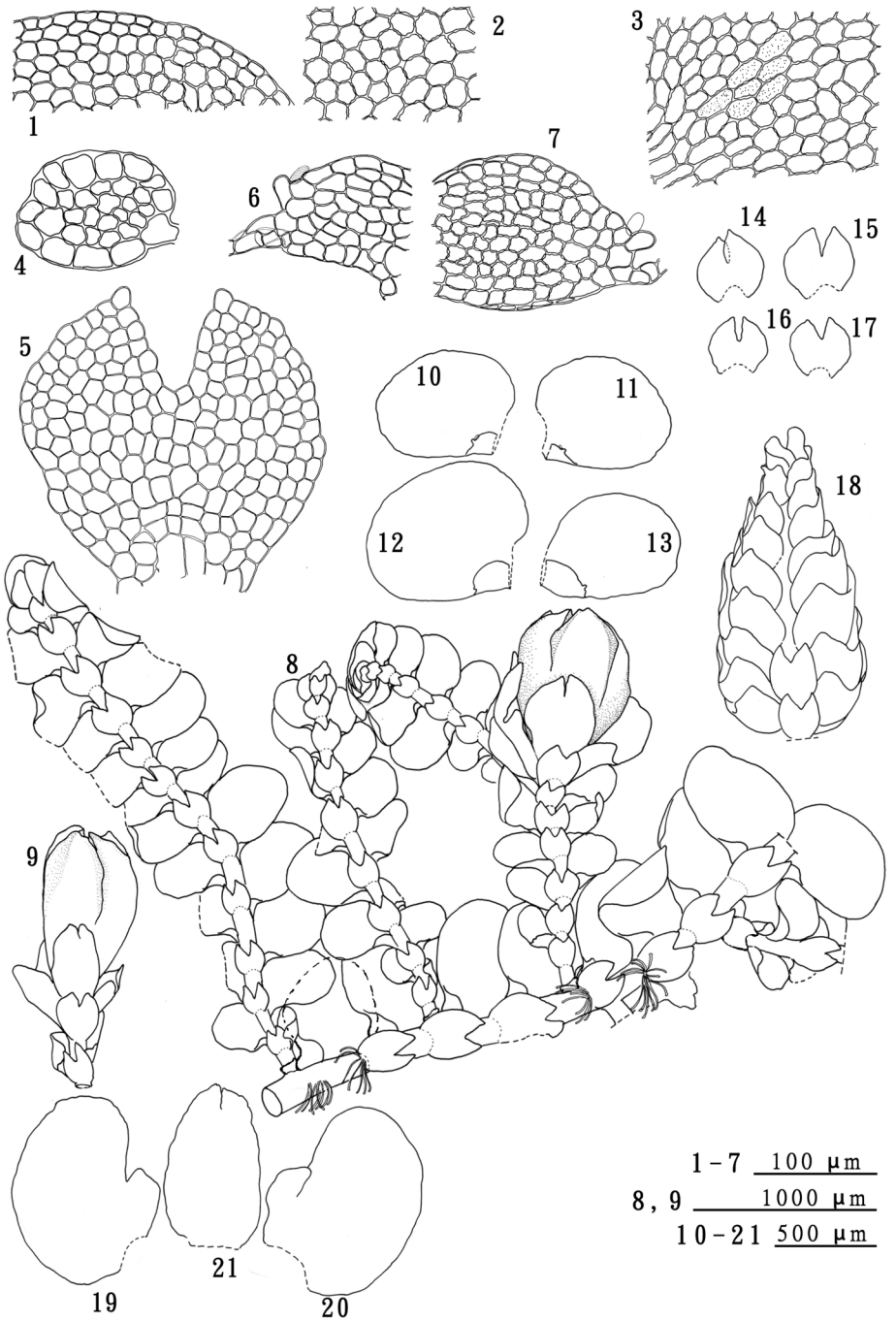

Figure 2. *Pycnolejeunea minutilobula* (Amakawa) Amakawa (1) marginal cells of leaf lobe. (2) median cells of leaf lobe. (3) cells near the leaf base. (4) cross-section of stem. (5) underleaf. (6, 7) leaf-lobules. (8) ventral view of a portion of plant bearing a gynoecial branch. (9) gynoecial branch. (10–13) leaves, ventral view. (14–17) underleaves. (18) Androecium, ventral view. (19, 20) female bracts. (21) female bracteole. (1)–(4), (7), (12)–(15) from Chi-Da Wu et al. 1178a, and (5), (6), (8)–(11), (16)–(21) from Chi-Da Wu et al. 1187a.

Discussion

Pycnolejeunea minutilobula is characterized by 1) small size, usually less than 15 mm in length and 1.2 mm in width, 2) branching in *Lejeunea*-type, 3) leaf lobule minute, with an apical tooth, and the hyaline papilla on the proximal side of the tooth, 4) cells of leaf lobes thin-walled, with small trigones and intermediate thickenings, 5) cuticle smooth, 6) leaf lobe with aggregated ocelli, 7) underleaves small and distant, 8) the bracteoles of androecium restricted to the base, and 9) subfloral innovation absent. The species was transferred to *Lejeunea* by He (1999) after she examined the type specimens, and did not observe ocelli in leaf lobes. But according to Furuki (2001), *P. minutilobula* is common species in Ryukyu Islands, with superbasal type ocelli and 2–3 grape-cluster type oil-bodies in each cell, and these characters indicate that it is better placed in *Pycnolejeunea*.

Pycnolejeunea minutilobula is closely related to its congeneric species *Pycnolejeunea grandiocellata* Steph. in Taiwan (Yang and Lin 2011). However, *P. grandiocellata* is distinguishable from *P. minutilobula* by its larger plant size, cells of leaf lobes with large trigones and well developed intermediate thickenings, ocelli 7–15 per leaf lobe, and underleaves contiguous to imbricate. A poorly developed plant of *P. minutilobula* is fairly similar to *Cheilolejeunea ryukyuensis* Mizut. from Japan and China. However, *C. ryukyuensis* differs in its distal hyaline papilla and absent of ocelli (Mizutani 1982). Based on this study, the southernmost distribution range of *P. minutilobula* that previous known to be the Ishigaki Island of Japan is extended southward to Orchid Island (22°04'N, 121°34'E) of Taiwan.

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