Tonan Ajia Kenkyu (*The Southeast Asian Studies*) Vol. 6, No. 3 December, 1968

Studies on the hepaticae of Thailand*

III.** The genus *Leucolejeunea*

by

Naofumi KITAGAWA

The genus *Leucolejeunea* was first proposed by Evans (1907) for the North American species *Archilejeunea clypeata*. He emphasized, as the differential characters from *Archilejeunea*, the antheridial spike on a short branch with bracteoles limited to the base as well as the several vegetative features including the pigmentation of plants, the position of hyaline papillae in the leaf-lobules and the thickenings of leaf-cells. Verdoorn (1934) noted that the large oil-bodies offered another generic character for *Leucolejeunea*. Owing to the entire underleaves, the genus has been placed in Holostipae but its close relationships to *Cheilolejeunea*, *Pycnolejeunea* or *Euosmolejeunea*, all of which belong to Schizostipae, have repeatedly been recognized by Evans (1907), Verdoorn (1934), Mizutani (1961), Schuster (1963), etc. Indeed, *Leucolejeunea turgida*, a rather rare species in the northern highlands of Thailand, resembles some robust species of *Cheilolejeunea* so closely in general appearance that it is hardly possible to distinguish them in the field. It seems quite reasonable that Mizutani (1961) excluded *Leucolejeunea* from his subfamily Ptychanthoideae (nearly equivalent to earlier Holostipae) and placed it next before *Cheilolejeunea* in another subfamily Lejeuneoideae (Schizostipae). Schuster (1963) also suggested the derivation of the *Cheilolejeunea* complex from *Leucolejeunea*-like antecedents, and this leading to a dissolution of the earlier system concerning Holostipae and Schizostipae.

There is known from Thailand only a single species of *Leucolejeunea*, which was first described by Stephani (1911) under the name of *Archilejeunea hossei*. In his revision of Indomalayan Lejeuneaceae Holostipae, Verdoorn (1934) fully treated *Leucolejeunea xanthocarpa*, and under this species he extended his discussion to the related species, *Lejeunea turgida* Mitt., *Archilejeunea hossei* Steph. and *A. sikkimensis* Steph.

* Acknowledgement is made of the partial financial support of this investigation through a grant for Scientific Research from the Ministry of Education.

** The preceding papers of this series are :

I. The genus *Bazzania*, with general introduction. *Journ. Hattori Bot. Lab.*, no. 30, pp. 249–270, figs. 1–7, 1967.

II. *Cephalozia* and *Cephaloziella*. *Journ. Hattori Bot. Lab.*, no. 32 (in press).

He reduced the latter two species under the synonym of the first, which was, at the same time, transferred to *Leucolejeunea*. In our collection from Thailand, I have found three species of *Leucolejeunea*, which are separated by the following key.

Before going further, I should express my sincere thanks to Drs. W. C. Steere and C. T. Rogerson of the New York Botanical Garden for their kindness to send me the type material of *Lejeunea turgida*.

Key to the Species

1. Leaf-lobe strongly involute for its whole margin except for the dorsal base; underleaf reniform, wider than long; leaf-cells without nodulose trigones, each containing a single large oil-body ..... *L. xanthocarpa*
1. Leaf-lobe not strongly involute but nearly plane or incurved at the apex; underleaf orbicular, as long as wide; leaf-cells with large nodulose trigones, each containing two or three large oil-bodies 2
   2. Plant larger, usually more than 1.5 mm wide, loosely prostrate, dioicous; leaf-lobe incurved at the apex, typically, falcate when expanded ..... *L. turgida*
   2. Plant smaller, less than 1.5 mm wide, firmly attached to substrata, paroicous; leaf-lobe not incurved at the apex, never falcate ..... *L. paroica*

Leucolejeunea xanthocarpa (Lehm. et Lindenb.) Evans

Torreya **7**: 229 (1907). ..... *Jungermannia xanthocarpa* Lehm. et Lindenb. in Lehm., Stirp. Pugillus **5**: 8 (1832). ..... *Lejeunea xanthocarpa* (Lehm. et Lindenb.) Lehm. et Lindenb. in Gott., Lindenb. et Nees, Synop. Hepat. 330 (1845). ..... *Archilejeunea xanthocarpa* (Lehm. et Lindenb.) Schiffn., Consp. Hepat. Archip. Ind. 316 (1898).

Specimen examined. THAILAND. Loey: Mt. Phu Luang, 1400 m alt., on tree-trunk, *M. T. & N. K. T 1336.*

Range. Having a world-wide range, from tropical to warm temperate regions.

This species is known from various localities in the world; in Asia, from Japan, Taiwan, China (Kwantung, Kwangsi), Java, Borneo, Celebes and Ceylon. Recently, it has been recorded also from Vietnam (Pócs 1965) and Malaya (Inoue 1967) but never from Thailand.

This species is easily recognized by the pale green or glaucous color of plants, the densely imbricate leaves with lobes strongly involute along ventral and apical margins, the large, unlobed underleaves which are reniform and much wider than long, and the large oil-bodies of the grape-cluster type occurring a single in each leaf-cell.

The plants of Thailand fully exhibit these specific characters and well agree with

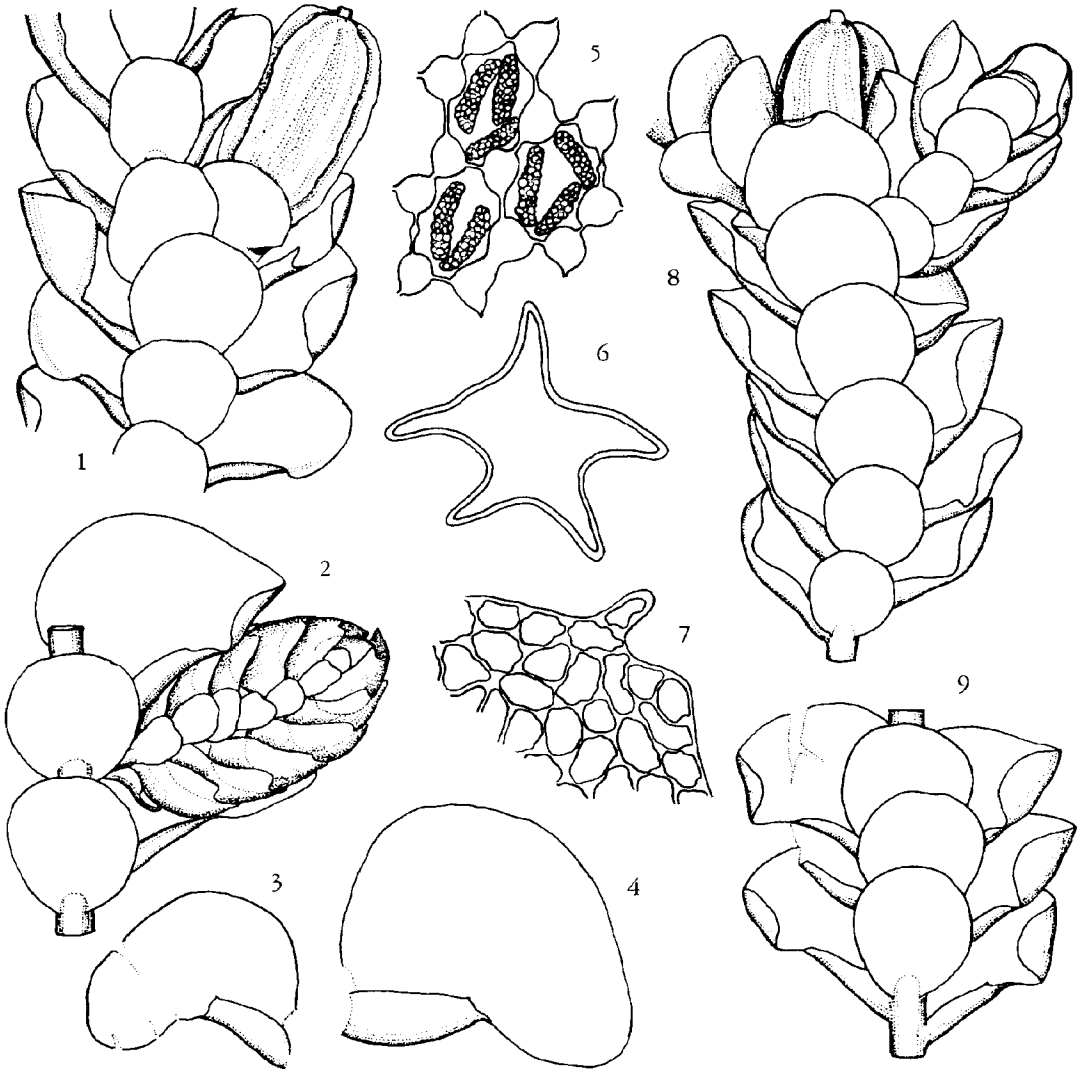
the detailed descriptions and figures given by Evans (1908), Hattori (1944), Mizutani (1963), etc.

Leucolejeunea turgida (Mitt.) Verd. (Figs. 1～9)

Ann. Bryol. Suppl. **4**: 71 (1934). …… *Lejeunea turgida* Mitt., Journ. Proc. Linn. Soc. London **5**: 110 (1861). …… *Archilejeunea turgida* (Mitt.) Steph., Spec. Hepat. **4**: 733 (1911). …… *Archilejeunea hossei* Steph., l. c. 732 (1911). …… *Archilejeunea sikkimensis* Steph., l. c. 732 (1911).

Plants fairly robust, glaucous green to pale brown, in loosely adnate patches on tree-trunks or scattered over other corticolous bryophytes; shoots loosely prostrate, irregularly pinnate to nearly simple, up to 35 mm long, 1.5～2.3 mm wide. Stems 130～220 μ thick, composed of 13～20 rows of cortical cells and 20～30 rows of medullary cells; cells of both rows very thick-walled, mostly 20～30 μ in cross-section; rhizoids numerous, fasciculate, very short, hyaline. Leaves rather densely imbricate, obliquely spreading: lobes more or less deflexed at the apices (strongly so in dry condition), obliquely triangular ovate, more or less falcate, mostly 0.9 ～ 1.4 mm long, 0.6 ～ 1.0 mm wide at the middle; antical margins amplicate, arching across the stem; insertion rather short: lobules obliquely oblong, 400 ～ 500 μ long, 200 ～ 250 μ wide near the base, 70 ～ 100 μ wide near the apex, somewhat inflated; free margins slightly involute; the apices obliquely truncate; proximal tooth of a single projecting cell; the distal tooth indistinct, only of an obtuse marginal edge; hyaline papilla on the sinus between two teeth. Cells of the leaf-middle 24～32×16 ～ 22μ, of the basal medium occasionally to 50×25 μ; walls rather thin, sometimes with intermediate thickenings; trigones very large, nodulose; cuticle smooth; oil-bodies 2 ～ 3 (rarely 4) per leaf-cell, very large and filling most of lumen, ellipsoidal, 16～22×5 ～ 7 μ, of grape-cluster type. Underleaves loosely imbricate, orbicular, 550 ～ 750 μ long and wide, with insertion strongly arching upward.

Plants dioicous. Male plants different from the female ones in slenderer shoots and in bearing many microphyllous short branches; androecia on abbreviated lateral branches but rarely terminal on elongated branches, compactly capitate to spicate, usually 0.5 ～ 1.0 mm long, 0.4 ～ 0.7 mm wide (but occasionally to 2.5 mm long); bracts much smaller than leaves, usually in 4 ～ 6 pairs but rarely to 12 pairs, closely imbricate, strongly saccate; bracteoles present throughout the androecium, becoming smaller upward. Gymnoecia terminal on leading shoots, with a single or more rarely 2 innovations; bracts similar to leaves but their lobules less involute; bracteoles similar to underleaves; perianth obovoid, ca. 1.1 mm long, 0.7 mm wide, nearly half-emergent, sharply 5-keeled to the base (1 dorsal, 2 lateral and 2 ventral); every keel nearly



Figs. 1~9 *Leucolejeunea turgida* (Mitt.) Verd.

1. Part of female shoot, with a perianth, ×25. 2. Part of male shoot, with an androecium, ×30. 3~4. Leaves, ×25. 5. Cells of leaf-middle, showing oil-bodies, ×450. 6. Cross-section of perianth, ×20. 7. Apical part of leaf-lobule, ×300. 8. Part of female shoot, with a perianth, ×25. 9. Part of sterile shoot, ×25. Figs. 1, 4 ~ 7 were drawn from the specimen *N. K. T 3697*, 2 from *M. T. & N. K. T 4241*, others from the type.

smooth.

Specimens examined. THAILAND. Chiang Rai: Mt. Doi Pacho (Doi Langka), 1700 m alt., *N. K. T 3697, T 3731.* Chiang Mai: Mt. Doi Chiang Dao, 2100 m alt., *M. T. & N. K. T 4241, T 4306.* Loey: Mt. Phu Luang, 1500 m alt., *M. T. & N. K. T 1659*; Mt. Phu Kradung, 1200 m alt., *M. T. & N. K. T 696, T740.* INDIA. Sikkim: Parkeen, on *Sendtnera juniperina*, 8000 ft., *J. D. Hooker 1456*, type of *Lejeunea turgida* (NY); Mts. Khasia, on *Dicranum*, 5000 ft., *J. D. Hooker 1373.*

Range. Eastern Himalayas, Thailand, Ceylon (?).

This species can readily be distinguished from other *Leucolejeuneae* by its robust plants creeping loosely attached to substrata with strongly deflexed leaves. Seemingly, the species resembles more closely some robust species of *Cheilolejeunea* but is immediately distinguished from them by the entire underleaves. The plants exhibit a wide range of variation concerning the size of plants and the form of leaves. The highly dwarfed form may be confused with *L. paroica*, under which the distinctions are given. As a whole, the plants of Thailand show some differences from the type material from Sikkim in the wider leaves with less falcate lobes as well as in the larger leaf-cells with more distinctly bulging trigones. Another difference is seen in the subfloral innovation; in the former, the innovation always sprouts from only one side and is, even in its basal portion, as large as the main shoot and therefore, superficially, it looks an upper part of the main shoot from which the perianth is borne laterally, while, in the latter, the gymnoecium is apparently terminal on a leading shoot and bearing one or two smaller innovations.

This species is unusual among *Leucolejeuneae* in some respects; the male bracteoles are present throughout the androecial branch, the plants are robust and loosely prostrate (not firmly appressed to substrata), and the leaf-cells have very large, nodulose trigones. This species is, however, essentially assignable to *Leucolejeunea*, because of such other important features as the glaucous plants, the 5-keeled perianth, the entire underleaves, the leaf-lobules with the distinct proximal and blunt distal teeth and with the distal hyaline papillae, and the few, botryoidal large oil-bodies.

This species was described by Mitten (1861) from the eastern Himalayas and Ceylon. I have examined a specimen from Ceylon which was attached on the same sheet of the type material and thus probably used by Mitten in his original record and found that it was not identical with *L. turgida* but with *L. xanthocarpa*! In Thailand, *L. turgida* has a range restricted to northern mountainous areas. The plants occur always on tree-branches or tree-trunks standing at the ridges or around the summits of high mountains but not in deep forests.

Leucolejeunea paroica N. Kitag.

Acta Phytotax. Geobot. **18**: 190, fig. 1 (1960).

Specimens examined. THAILAND. Loey: Mt. Phu Luang, 1000 m alt., *M.T. & N.K. T1897*. JAPAN. Wakayama: Kumanogawa-cho, 150 m alt., *N.K. 2046*, type of this species (KYO).

Range. Japan, Thailand.

This species has been known only from a few localities in southern Japan. The most salient feature is the paroicous inflorescence which *L. paroica* shares with no

other species of *Leucolejeunea*. The species seems to be most closely related to *L. turgida*. Typically, *L. paroica* is quite different from it in the smaller size of plants attached firmly to substrata, the ovate leaf-lobes not falcate nor deflexed, the larger (2~3 cells in length) proximal teeth of leaf-lobules, and the paroicous inflorescences. In the extremely dwarfed plants, however, *L. turgida* becomes close to *L. paroica* in the size of plants as well as in the form of leaves. In this cases, the inflorescence offers the most reliable character to distinguish these species from each other.

The plant of Thailand is somewhat different from that of Japan in the insertion of underleaves; the insertion is deeply arching upward forming an inverted U-shaped line in the former, while it is nearly transverse or slightly arching in the latter. There is no discrepancy between them in any other significant feature.

References

Evans, A. W. "*Leucolejeunea*, a new genus of hepaticae." *Torreya*, vol. 7, no. 12, pp. 225-229, 1907.

Evans, A. W. "Hepaticae of Puerto Rico IX. *Brachiolejeunea*, *Ptychocoleus*, *Archilejeunea*, *Leucolejeunea*, and *Anoplolejeunea*." *Bull. Torrey Bot. Club*, vol. 35, no. 4, pp. 155-179, pls. 6-8, 1908.

Hattori, S. "Contributio ad floram hepaticarum austro-kiushiuensem." *Bull. Tokyo Sci. Mus.*, no. 11, pp. 1-203, 1944.

Inoue, H. "Studies on oil-bodies of some Malayan liverworts." *Journ. Hattori Bot. Lab.*, no. 30, pp. 54-65, pls. I-VI, 1967.

Mitten, W. "Hepaticae indiae orientalis: an enumeration of the hepaticae of the East Indies." *Journ. Proc. Linn. Soc. London*, vol. 5, pp. 89-128, 1861.

Mizutani, M. "A revision of Japanese Lejeuneaceae." *Journ. Hattori Bot. Lab.*, no. 24, pp. 115-302, 1961.

Pócs, T. "Prodrome de la bryoflore de Vietnam." *Ann. Acad. Ped. Agriensis, nova ser.*, vol. 3, pp. 453-495, 1965.

Schuster, R. M. "An annotated synopsis of the genera and subgenera of Lejeuneaceae I. Introduction; annotated keys to subfamilies and genera." *Nova Hedwigia*, Heft. 9, pp. 1-203, 1963.

Stephani, F. Species Hepaticarum, vol. IV; Geneva (*Archilejeunea*~*Leucolejeunea*, pp. 703-739), 1911.

Verdoorn, F. "Studien über asiatische Jubuleae. De Frullaniaceis XV. Die Lejeuneaceae Holostipae der Indomalaya unter Berücksichtigung sämtlicher aus Asien, Australien, Neu-Seeland und Ozeanien angeführten Arten." *Ann. Bryol.*, suppl. vol. 4, pp. 40-192, 1934.