

## A new species of *Diplasiolejeunea* (Lejeuneaceae, Jungermanniopsida) from Sumatra, and a key for the genus in Asia

Alfons SCHÄFER-VERWIMP

**Abstract:** SCHÄFER-VERWIMP, A. 2006. A new species of *Diplasiolejeunea* (Lejeuneaceae, Jungermanniopsida) from Sumatra, and a key for the genus in Asia. – *Herzogia* 19: 239–244.

Another new species of the genus *Diplasiolejeunea*, *D. ingekarolae* from Sumatra, is described and figured. It is highly distinct by its relatively large size, the long, narrow and inflated lobule with two prominent teeth and very large underleaves with broadly triangular, acute lobes. An updated key for the currently known species of *Diplasiolejeunea* in Asia is presented.

**Zusammenfassung:** SCHÄFER-VERWIMP, A. 2006. Eine neue Art von *Diplasiolejeunea* (Lejeuneaceae, Jungermanniopsida) von Sumatra, und ein Schlüssel für die Gattung in Asien. – *Herzogia* 19: 239–244.

Eine weitere neue Art der Gattung *Diplasiolejeunea*, *D. ingekarolae* aus Sumatra, wird beschrieben und abgebildet. Sie ist durch ihre relative Größe, den langen, schmalen und aufgeblasenen Lobulus mit zwei gut entwickelten Zähnen sowie durch die sehr großen Unterblätter mit breit dreieckigen, zugespitzten Lappen unverwechselbar. Ein aktualisierter Schlüssel für *Diplasiolejeunea* in Asien wird vorgelegt.

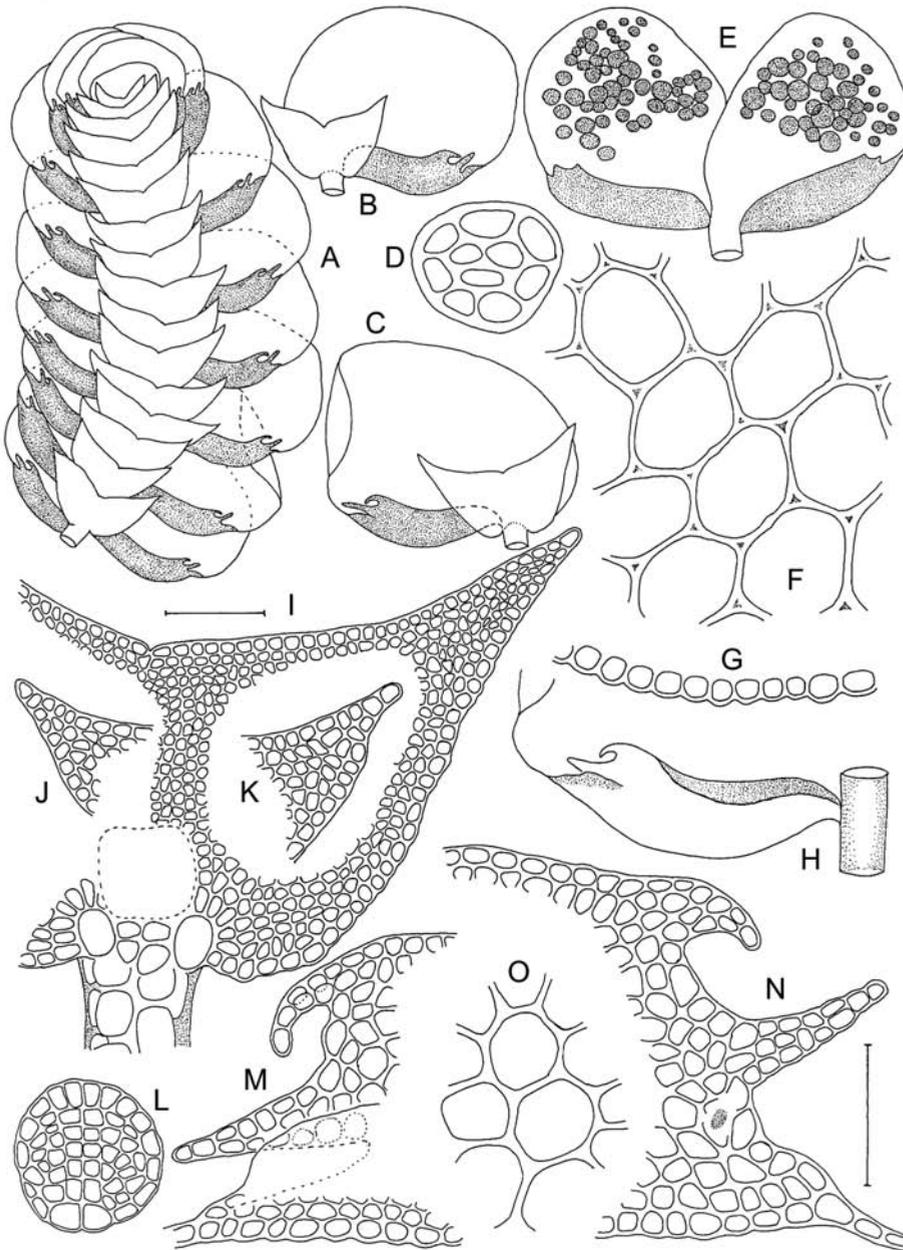
**Key words:** Indonesia, bryophytes.

Recent field work in Sumatra brought to light an interesting species of *Diplasiolejeunea* new to science which is described as follows:

*Diplasiolejeunea ingekarolae* Schäfer-Verwimp, **sp. nov.** (Fig. 1)

Dioica (?). Planta magna, ramicola, ad substratum appressa. Caules usque ad 8–10 mm longi, usque 150 µm crassi, cum foliis 2–2,4 mm lati. Lobus foliorum 1,25–1,5 mm longus, 1–1,3 mm latus. Cellulae lobi quadratae (-rotundatae) ad irregulariter hexagonales, 20–25 µm latae, (25–)30–35 µm longae, cum trigonis triangularis minutis, cellulae marginales subquadratae, 12 × 16–20 × 20 µm. Lobulus in situ anguste oblongus, inflatus, 3–3,2× longior quam latus, carena arcuata et crenulata. Dens apicalis magnus, hamatus, usque 4(5) cellulae longus, 2(3) cellulae latus, dens medius erectus, triangularis, usque 8 cellulae longus, 3 cellulae latus. Amphigastria ad partem 0,2–0,3 bifida, lobis 0,36–0,41 mm latis, 0,45–0,5 mm longis, apicibus acutis. Gynoecia et androecia ignota.

**HOLOTYPUS:** INDONESIA, Sumatra, Nord-Sumatra, Hochland von Brastagi, Aufstieg vom See Lau Kawar zum Gunung Sinabung, ca. 3,2°N/98,4°E (UTM 47 433335 E, 350035 N), Kulturzone, in der Kronenregion eines umgefallenen Baumes, 1520 m, 18. Mai 2005, leg. Schäfer-Verwimp & Verwimp 24906/B (JE).



**Fig. 1:** *Diplasiolejeunea ingekarolae* Schäfer-Verwimp, sp. nov. **A** – habit of plant (2,4 mm wide), ventral view; **B, C** – leaf lobes (1,3 mm long) with underleaves; **D** – cross section of stem, 150 µm in diameter; **E** – two terminal brood body producing leaves (1,35 mm long), underleaves removed; **F** – cells of central leaf lobe, 30–35 µm long; **G** – keel of lobule, scale as in **N**; **H** – lobule, 750 µm long; **I** – part of underleaf, scale = 100 µm; **J, K** – apex of underleaf lobes, scale as in **I**; **L** – brood body, 85 µm in diameter; **M, N** – part of lobule, hyaline papilla stippled in **N**, scale = 100 µm; **O** – cells of upper half of leaf lobe, c. 25 µm in diameter; (all figs from the type).

The species epithet is dedicated to my wife, for her keen eye and true companionship on numerous field trips to the tropics and elsewhere.

Dioecous(?). **Plants** relatively large, up to 8–10 mm long and 2–2,4 mm wide, light-green when dry, in a small dense patch on the branch of a fallen tree. **Stems** up to 150  $\mu\text{m}$  in diameter (100–110  $\mu\text{m}$  in branches), in cross section with 3 medullary and 7 cortical cells. **Leaves** densely imbricate,  $\pm$  horizontally spreading, widely crossing the stem, lobe strongly convex (if seen from dorsal), appressed to substrate, slightly asymmetric, broadly oval, up to 1,3–1,5 mm long and 1–1,3 mm wide, apex broadly rounded, margins entire. Cells of lobe  $\pm$  quadrate (to rounded) to irregularly hexagonal, 20–25  $\times$  (25–)30–35  $\mu\text{m}$ , with small but distinct triangular trigones, occasionally some inconspicuous nodulose intermediate thickenings present, cells becoming smaller towards margin, the marginal cell row consisting of subquadrate cells measuring only 12  $\times$  16–20  $\times$  20  $\mu\text{m}$ , the basal cells becoming larger,  $\pm$  rectangular to narrowly oval, up to 30–35  $\times$  70–90  $\mu\text{m}$ . Oil bodies probably (5–)8–12(–15) per cell, a few weeks after collection already in state of decomposition or completely destroyed, 15–25(?) dispersed ocelli present, curiously seen only in brood body producing leaves, already in state of desintegration. Ocelli of the same size as normal cells, rapidly desintegrating after desiccation and not more recognizable in dead herbarium material. **Lobules** narrowly oblong to rectangular, more or less strongly inflated throughout, 3–3,2 $\times$  longer than wide, c. 250  $\mu\text{m}$  wide and 750  $\mu\text{m}$  long, about half as long as total leaf lobe, reaching  $\frac{3}{4}$  of leaf apex, free margin inflexed for  $\frac{2}{3}$ – $\frac{3}{4}$  of its length, the keel curved and crenulate by slightly bulging cells. **First tooth** (median tooth) prominent, narrowly triangular, up to (5–)8 cells (120–150  $\mu\text{m}$ ) long and (2)3 cells (50–60  $\mu\text{m}$ ) wide at base, consisting of c. (12–)15–20 cells and tipped by a single cell or 2 superimposed cells; it is usually partly covered by shortly inflexed or undulate upper ventral part of the lobule (see Fig. 1: H, M). **Second tooth** (apical tooth) well developed, 4–5 cells (50–65  $\mu\text{m}$ ) long and 2(3) cells (30–50  $\mu\text{m}$ ) wide at base, conspicuously curved towards the first tooth, often somewhat twisted, the bases of the two teeth separated by 2–3, rarely 4 cells. **Hyaline papilla** entally displaced at base of first tooth, (short) oval, very small, only 6  $\times$  12  $\mu\text{m}$ . **Underleaves** about 5–6(–7) $\times$  stem width, c. 0,9–1 mm wide (distance between apices of lobes), divided to 0,2–0,3 (more deeply divided only in uppermost, still not fully developed underleaves), densely imbricate, the stem not visible, sinus mostly very shortly acute (see Fig. 1: A, I), lobes at an angle of 150°–170°(–180°), broadly triangular, about 360–410  $\mu\text{m}$  (18–22 cells) wide from a slightly auricled base to near sinus and 450–500  $\mu\text{m}$  long; about 27–30 marginal cells from sinus to apex and 30–36 marginal cells from base to apex of lobe, apex acute, tipped by single cell or 2 superimposed cells, two large rounded-oval cells at base of underleaf, c. 40  $\times$  60  $\mu\text{m}$  each (see Fig. 1: I), cells similar to those in leaf lobe but slightly smaller, quadrate or shortly rectangular to irregularly hexagonal, from 10  $\times$  15  $\mu\text{m}$  up to 20  $\times$  30  $\mu\text{m}$ ; rhizoid disc rounded-subquadrate, retuse or slightly emarginate above. Leaves and underleaves of branches considerably smaller, reaching only  $\frac{1}{2}$ – $\frac{2}{3}$  the size of those in main stems. Male and female organs not seen. **Asexual reproduction** by brood body producing leaves, the disk shaped brood bodies 7–8 cells [(75–)80–90(–100)  $\mu\text{m}$ ] in diameter, consisting of about 50–55 cells when mature (Fig. 1: L). There are a few plants with two terminal leaves (hardly different from normal leaves) which produce gemmae only on ventral side of leaf lobe in considerable quantity. The lobule teeth of the brood body producing leaves are often highly reduced, the first tooth consisting only of 2–5 cells and the second of a single small cell.

## Ecology

The single collection of *Diplasiolejeunea ingekarolae* has been gathered from the crown of a fallen tree in the culture zone at the very base of Gunung Sinabung which is covered by dense primary rain forest, at an altitude of 1520 m. The c. 6–8 m high deciduous tree once stood along a trail between pastures and vegetable fields. Stem and branches of the tree were densely covered by mostly small pioneer bryophytes and lichens, among which could be identified so far *Cololejeunea inflectens* (Mitt.) Benedix (superficially very similar to the new species at hand), *Lopholejeunea nigricans* (Lindenb.) Schiffn., *Frullania arecae* (Spreng.) Gottsche, *Frullania serrata* Gottsche, *Lejeunea exilis* (Reinw. et al.) Grolle and the lichens *Bacidia* aff. *heterochroa* (Müll. Arg.) Zahlbr., *Cratiria aggregiens* (Stirton) Marbach, *Dirinaria confusa* Awasthi, *Heterodermia diademata* (Taylor) Awasthi, *Heterodermia paradoxa* Schumm & Schäf.-Verw. (sp. nov., see this vol.), *Physcia integrata* Nyl., *Ramalina subpusilla* (Nyl.) Krog & Swinscow, and *Rimelia reticulata* (Taylor) Hale & Fletcher (all lichens det. F. Schumm). In the small type specimen could be found spurs of *Microlejeunea*, *Cheilolejeunea* and *Frullania* spec. Further collections from this tree include the genera *Lejeunea*, *Cheilolejeunea*, *Cololejeunea*, *Frullania* and *Thysananthus*, also, some *Usnea* has been seen.

## Discussion

*Diplasiolejeunea ingekarolae* is highly distinct by the combination of the following characters: (1) the relatively large size of the plants (2–2,4 mm wide), (2) the narrowly oblong, more or less strongly inflated lobule 3× longer than wide, (3) the two prominent lobule teeth, the second tooth conspicuously curved, and (4) the very large underleaves with broadly triangular lobes and acute apices. Indeed, there is no single Asiatic (or African) congener with such large underleaves (GROLLE 1966, 1978), and *D. ingekarolae* may therefore be separated at once geographically by this character alone. There are a few species in the Neotropics which show similar large underleaves, but only those of *D. papilionacea* R.M. Schust. (SCHUSTER 1978) are reaching the dimensions of the underleaves of *D. ingekarolae* or even may overtop these. However, the underleaf lobes in *D. papilionacea* are broadly rounded at apex and are often overlapping each other at the deep sinus. Further on the lobule structure is quite different, being at most twice as long as wide in *D. papilionacea*, and the second tooth is very small, consisting only of 1–2 cells. Other species with large underleaves, for example *D. involuta* Winkler (WINKLER 1967), *D. columbica* Tixier, *D. pauckertii* (Nees) Steph. (TIXIER 1973) or *D. pluridentata* Schäf.-Verw. (SCHÄFER-VERWIMP 2001) all differ by different shape of underleaves (divided usually at least 0,33 or more, the lobe tips being broadly acute to narrowly obtuse) as well as quite different lobule structure [lobule c. 2(–2,5)× longer than wide, second tooth very small and often inconspicuous].

*Diplasiolejeunea ingekarolae* is best placed in subgenus *Diplasiolejeunea* as defined by SCHUSTER (1971) and TIXIER (1985) because of the large underleaves, the occurrence of dispersed ocelli, and asexual reproduction by discoid gemmae. The two prominent lobule teeth and the acute underleaf lobes may suggest the placement in section *Pellucidiae* as defined by TIXIER (1985); however, the first tooth is never T-like and a hyaline margin is completely absent. A placement in section *Villaumeae* (TIXIER 1985), too, may not be quite satisfactorily because species with only first tooth well developed and rounded – obtuse apex of underleaf lobes belong here.

*Diplasiolejeunea* is a pantropical genus with about 65–70 species, most of which are known from the Neotropics and Africa. In Asia currently eight species are recognized, including *Diplasiolejeunea cavifolia* Steph. (= *D. brachyclada* Evans, = *D. javanica* Steph.), *D. cobrensis* Gottsche ex Steph. (= *D. incurvata* Jovet-Ast & Tixier), *D. ingekarolae*, *D. jovet-astiae* Grolle, *D. longilobula* Herzog, *D. onraedtii* Grolle, *D. patelligera* Herzog (= *D. neobrachyclada* Hattori) and *D. rudolphiana* Steph. *Diplasiolejeunea pellucida* (Meissn. em. Evans) Schiffn. is restricted to the Neotropics as pointed out by GROLLE (1966 and 1995, see also ZHU & SO 2001), though it has been mentioned from Asia by various authors (PIIPPO 1990, HE 1997). The Asian species may be separated by the following key (see also the key in GROLLE 1966):

- 1 Underleaves very small, deeply bilobed nearly to the base, the lobes only 1–2 cells wide at base, often ending in a row of 3–5 superimposed cells, 1–2 (supra-)basal ocelli conspicuously larger than surrounding cells. Pantropical, in Asia known from Borneo, China and Vietnam. .... *D. cobrensis*
- 1\* Underleaves larger, the lobes at base at least (3)4–6 cells wide or more, never ending in more than (2)3 superimposed cells, ocelli, if present, hardly different in size from surrounding cells. .... 2
- 2 Leaf lobe spatulate or longly obovate, about twice as long as wide. .... 3
- 2\* Leaf lobe rounded-oval to broadly ovate, 1,1–1,4× longer than wide. .... 4
- 3 Leaf lobe spatulate, lobule  $\frac{1}{2}$  as long as the lobe, underleaf lobes ovate-lanceolate, the apex tipped by a single cell, 8–11 marginal cells from sinus to apex, (5)6(7) cells wide at base. Sri Lanka. ... *D. onraedtii*
- 3\* Leaf lobe longly obovate, lobule little more than  $\frac{1}{2}$  lobe length, underleaf lobes narrowly triangular-lanceolate, tipped by 2 superimposed cells, 8(9) marginal cells from sinus to apex, (3)4(5) cells wide at base. Neuguinea, Borneo, Sumatra, Pen. Malaysia. .... *D. jovet-astiae*
- 4 Underleaf lobes oval to oval-lanceolate, at apex rounded to narrowly obtuse, 7–12 cells wide at base, 10–16 marginal cells from sinus to apex, first tooth of lobule linear-lanceolate, 6–15 cells long, 2–3(4) cells wide at base, always uniseriate apically, second tooth 2–4-celled, usually inflexed. Pantropical, in Asia known from Cambodia, China, Sri Lanka and Vietnam. .... *D. rudolphiana*
- 4\* Underleaf lobes narrowly to broadly triangular, acute. .... 5
- 5 Cells in upper half of leaf lobe with distinct nodulose trigones and intermediate thickenings. Neuguinea, Java, Sumatra. .... *D. patelligera*
- 5\* Leaf cells without trigones and intermediate thickenings, or these small, triangular and  $\pm$  inconspicuous. .... 6
- 6 Underleaves very large, the lobes broadly triangular, at base c. 20 cells wide, 27–30 marginal cells from sinus to apex, both lobule teeth well developed, the first tooth never T-like. Sumatra. .. *D. ingekarolae*
- 6\* Underleaves much smaller, the lobes at base 4 or 8–10 cells wide, the first tooth of the lobule often T-like. .... 7
- 7 Underleaf lobes at base 4(5) cells wide, 10–12 marginal cells from sinus to apex, leaf lobule  $\frac{2}{3}$ – $\frac{3}{4}$  as long as the lobe, linear-oblong, first tooth (always?) T-like, with 1–2 basal and 2 horizontal cells. Borneo (type only). .... *D. longilobula*
- 7\* Underleaf lobes (7)8–10 cells wide at base, (14–)16–20(–22) marginal cells from sinus to apex, leaf lobule  $\frac{1}{3}$ – $\frac{1}{2}$  as long as the lobe, oblong-ovate, first tooth 2–4 cells long, 1–2 cells wide, sometimes T-like. Pantropical, common; in Asia reported from Cambodia, China (Hainan), Java, Sumatra, Luzon, Malaysia, Sri Lanka, Taiwan, New Caledonia (beside unpubl. records of the author from Bali). .... *D. cavifolia*

## Acknowledgements

The author is very grateful to Dr. T. Pócs (Eger, Hungary) for kindly reviewing the manuscript, and Dr. F. Schumm (Wangen, Germany) for determination of associated lichens.

## Literature

- GROLLE, R. 1966. Über *Diplasiolejeunea* in Asien. – Feddes Repertorium **73**: 78–89.
- GROLLE, R. 1978. Eine neue *Diplasiolejeunea*-Art aus Sri Lanka. – Feddes Repertorium **89**: 301–305.
- GROLLE, R. 1995. The Hepaticae and Anthocerotae of the East African Islands. An annotated catalogue. – Bryophytorum Bibliotheca **48**: 1–178.
- HE, X.-L. 1997. A review and checklist of the Lejeuneaceae in China. – Abstracta Botanica **21**: 69–77.
- PIIPPO, S. 1990. Annotated catalogue of Chinese Hepaticae and Anthocerotae. – J. Hattori Botanical Laboratory **68**: 1–192.
- SCHÄFER-VERWIMP, A. 2001. *Diplasiolejeunea pluridentata* (Lejeuneaceae, Marchantiopsida), eine neue Art aus Costa Rica. – Haussknechtia **8**: 71–78.
- SCHUSTER, R. M. “1970” 1971. Studies on Hepaticae, XLIX–LIII. New Lejeuneaceae from Dominica and Jamaica. – Bulletin of the Torrey Botanical Club **97**: 336–352.
- SCHUSTER, R. M. 1978. Studies on Venezuelan Hepaticae, II. – Phytologia **39**: 425–432.
- TIXIER, P. 1983. La notion d'espèce dans le genre *Diplasiolejeunea* 2. – *Diplasiolejeunea pauckertii* (Nees) Steph. et *D. columbica* sp. nov. – Cryptogamie, Bryologie, Lichénologie **4**: 231–236.
- TIXIER, P. 1985. Contribution à la connaissance des Cololejeunoideae. – Bryophytorum Bibliotheca **27**: 1–439.
- WINKLER, S. 1967. Die epiphyllen Moose der Nebelwälder von El Salvador C. A. – Revue Bryologique et Lichénologique **35**: 303–369.
- ZHU, R.-L. & SO, M. L. 2001. Epiphyllous Liverworts of China. – Nova Hedwigia, Beiheft **121**: 1–418.

Manuscript accepted: 12 January 2006.

## Address of the author

Alfons Schäfer-Verwimp, Mittlere Letten 11, D-88634 Herdwangen-Schönach, Deutschland.  
E-mail: moos.alfons@herter.de