

Taxilejeunea pulverulenta* (Lejeuneaceae, Jungermanniopsida), a poorly known species from the Neotropics, is transferred to *Lejeunea

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Abstract – *Lejeunea pulverulenta* comb. nov. (basonym *Taxilejeunea pulverulenta*), a species known from Guadeloupe, Ecuador and Mount Roraima, Guyana is described and illustrated. The species is characterized by its yellowish-green and dull colour in the herbarium, cells with trigones, intermediate thickenings and strongly papillose and water-repellent surface, small inflated lobules, imbricate and large underleaves with auriculate bases, gynoecia terminal on short branches with again fertile innovations, up to three gynoecia in a row. A comparison of *Lejeunea pulverulenta* with the morphologically closely related *L. cerina* and *L. controversa* is provided. Characteristics of the genus *Taxilejeunea* are briefly discussed. A lectotype for *Taxilejeunea pulverulenta* is designated.

Jungermanniopsida / Lejeuneaceae / *Taxilejeunea* / *Lejeunea pulverulenta* comb. nov. / Neotropics / taxonomy / lectotypification

INTRODUCTION

During the revision of the genus *Lejeunea* for the Neotropics, a few collections of an interesting taxon were found that did not match any of the studied *Lejeunea*-types. The species, collected on Mount Roraima (Guyana) and in Ecuador, stands out on account of its strongly papillose cells, the large underleaves with auriculate bases and the gynoecia terminal on short branches with a single innovation that is often again fertile, with (1-)2(-3) gynoecia per branch, resembling the cymose row found in *Taxilejeunea*. Searching under the latter genus, *Taxilejeunea pulverulenta* Gottsche ex Steph., based on plants from Guadeloupe and Brazil, proved to be conspecific with the taxon in study. The main diagnostic characteristic of the genus *Taxilejeunea* (Spruce) Schiffn. is the arrangement of the gynoecia, with female branches repeatedly innovating and fertile, with up to ca. 10 gynoecia in a row, an arrangement that has been referred to as the “taxilejeuneoid inflorescence” (Schuster, 1980; Reiner-Drehwald, 2000; Evans, 1921). Also the pendulous habit and pale yellowish to greenish colour of the plants, the stem with 7 large rows of epidermal cells and numerous smaller medullary cells, large underleaves with auriculate bases, small lobules and apiculate leaves, often with teeth

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I would like to dedicate this paper to the late Dr. Riclef Grolle, in gratitude for his invaluable advice and support during many years of Lejeuneaceae research.

near the apex, are characteristic for *Taxilejeunea*. Nevertheless, the transition of these character states to those found in *Lejeunea* species is \pm continuous. To better understand the relationship between these two large genera of Lejeuneoideae a revision of *Taxilejeunea*, a genus with 218 published names (Geissler & Bischler, 1990), including 142 names in America, is urgently needed.

The species under consideration here, *Taxilejeunea pulverulenta*, is morphologically closely related to two known and typical “*Lejeunea*” species, namely *Lejeunea cerina* (Lehm. & Lindenb.) Gottsche, Lindenb. & Nees (type of subgenus *Hygrolejeunea*, Grolle 1988) and *L. controversa* Gottsche (a member of the former subgenus *Crossotolejeunea*, Reiner-Drehwald & Goda (2000)). *Taxilejeunea pulverulenta* is therefore transferred to *Lejeunea*. The necessary new combination, a complete description, illustrations and scanning electron micrographs of the species, as well as a comparison with closely related taxa is presented.

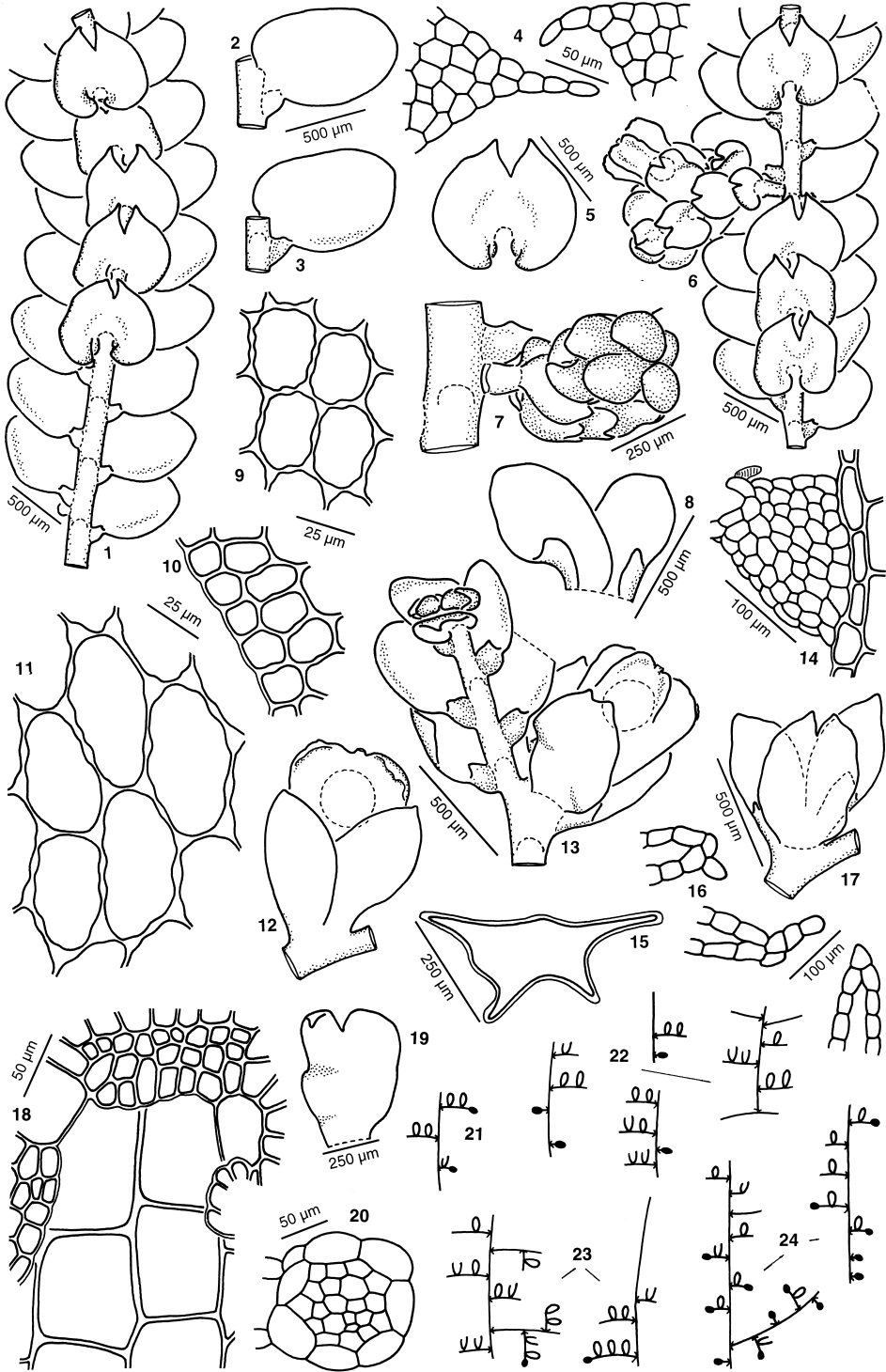
DESCRIPTION

Lejeunea pulverulenta (Gottsche ex Steph.) E.Reiner **comb. nov.** (Figs 1-2)

Taxilejeunea pulverulenta Gottsche ex Steph., *Spec. hepat.* 5: 477. 1914. Type. Windward Islands. Guadeloupe. *L’Herminier s.n.* (**lectotype, here designated**, G 52572 [autoicous, c. per.]; paralectotypes, G 52576 [autoicous, c. per.], G 52577 [autoicous, c. per.]).

Plants dull, yellowish-green in herbarium, 1.2-2 mm wide, 4 cm long, growth habit excurrent, irregularly pinnate. Vegetative branches of *Lejeunea*-type, few, smaller or similar to main stem, collars small, most branches fertile. **Stem** straight, 150-175 μm wide, epidermal cells in ventral view rectangular, 60-70 \times 85-105 μm , papillose. Stem in cross-section suborbicular, epidermis of 7 rows of cells surrounding 21 rows of smaller medullary cells, epidermal cells 20-32 \times 50-60 μm , medullary cells 17-23 \times 20-30 μm , cell walls hyaline to yellowish, thin; ventral merophyte 2 cells wide. **Leaves** imbricate, obliquely spreading. **Lobe** oblong to rounded-rectangular to lingulate, plane to slightly concave, 700-950 μm long, 500-600 μm wide, margin entire, apex widely rounded, plane, dorsal margin straight, ventral margin straight to slightly arched. Marginal leaf cells quadrate to rectangular, 10-15 \times 15-20 μm , median cells oval to hexagonal, 20-30 \times 30-40 μm , basal cells elongated, 30-35 \times 60-65 μm , cell walls thin, with medium-sized trigones and 0-2 rounded to elongated intermediate thickenings per wall; cells in leaves (lobe

Fig. 1. *Lejeunea pulverulenta* (Gottsche ex Steph.) E. Reiner. **1.** Habit, ventral view, underleaves partially removed. **2.** Leaf, dorsal view. **3.** Leaf, ventral view. **4.** Underleaf apices. **5.** Underleaf. **6.** Habit with perianth, ventral view. **7.** Portion of stem with androecium incurved at the apex, ventral view. **8.** Female bracts, ventral view. **9.** Median leaf cells. **10.** Marginal leaf cells. **11.** Basal leaf cells. **12.** Gynoecium with perianth, dorsal view. **13.** Portion of shoot with gynoecium and an incurved androecium terminal on the innovation, underleaves removed, ventral view. **14.** Lobule. **15.** Cross section of perianth. **16.** Details of keels from cross section of perianth. **17.** Female bracts and bracteole, ventral view. **18.** Detail of underleaf insertion with rounded base at left and auriculate base at right. **19.** Female bracteole. **20.** Cross section of stem. **21-24.** Cladographs of fertile plants, solid ellipse = androecium, open ellipse = gynoecium with perianth, U = gynoecium without perianth. (1-20, 22 from *Gradstein 5279*; 21 from *Aptroot 17086*; 23 from *Gradstein 5388*; 24 from *Thiers 4697*).



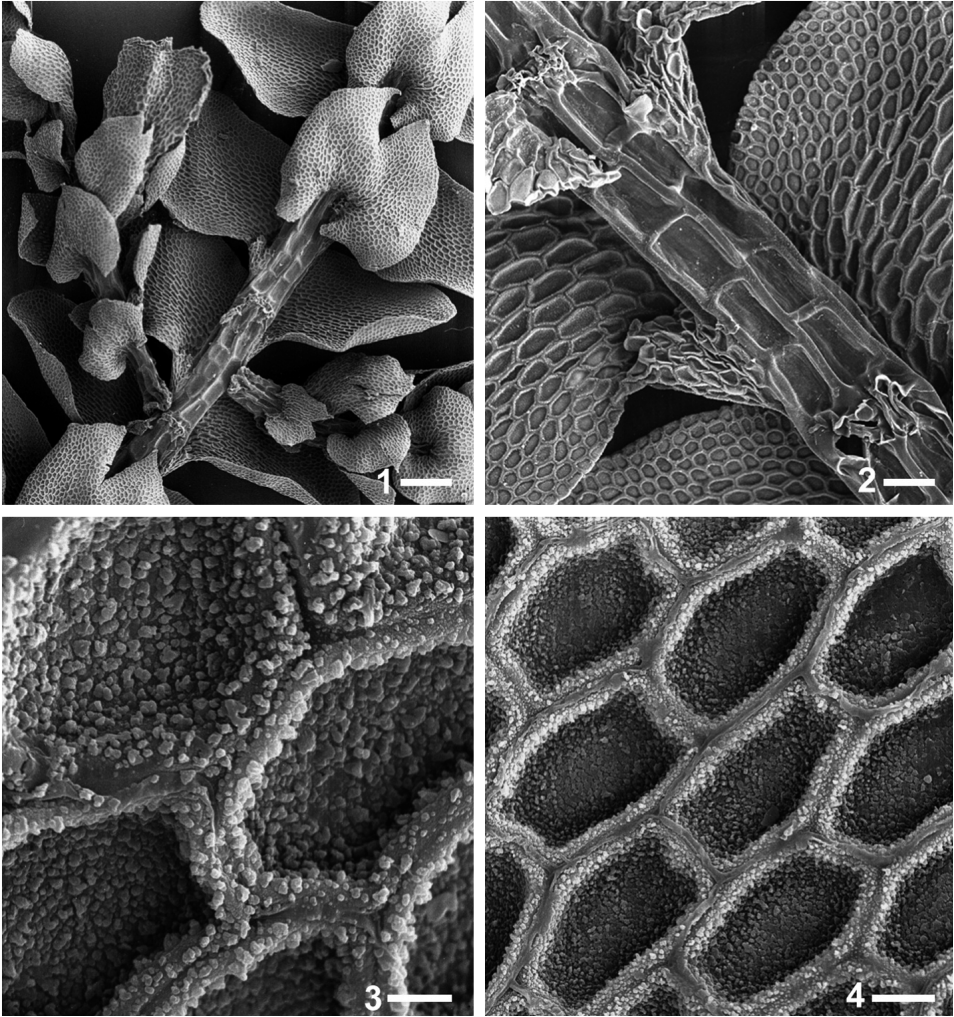


Fig. 2. Scanning electron micrographs of *Lejeunea pulverulenta* (Gottsche ex Steph.) E.Reiner. **1.** Habit, with perianth, ventral view, underleaves partially removed. **2.** Detail of stem, lobule and leaf cells, ventral view, underleaves removed. **3.** Underleaf cells. **4.** Median leaf cells, ventral view. (all from *Gradstein 5279*, U, air dried). Scale bars: 1 = 200 μm , 2 = 50 μm , 3 = 5 μm , 4 = 10 μm .

and lobule), underleaves, female and male bracts strongly papillose. Oil bodies allanthoid, 17-20 μm long, brownish, surface asperulate (fide Dauphin 2003 as *Lejeunea anomala*). **Lobule** usually well developed, triangular to ovate, strongly inflated, 150-200 μm long, 100-150 μm wide, $< 1/5 \times$ the lobe length, lateral margin flattened to incurved, 4-5 cells long, first tooth slightly falcate, 15 \times 35 μm , hyaline papillae proximal, apical margin lunulate, 3 cells long, keel arched, at the union with ventral margin of lobe strongly angled ($\pm 90^\circ$). **Underleaves** imbricate, margins concave, suborbicular, 700-870 μm wide, 630-780 μm long, wider than long,

4.5-5.1 × the stem width, 22-32 % bifid, sinus V-shaped, underleaf lobes triangular, straight to connivent, apex acute, 2-3 cells in a row, margins entire, base auriculate and concave near the insertion and convex to the margin, insertion line slightly arched, rhizoid initial cells usually well developed. **Autoicous**, but shoots often only with gynoecia. **Androecium** terminal on short branches without vegetative leaves at the base or terminal on innovations, male spike incurved, ± 5 pairs of bracts, imbricate, bracts subequally bilobed, keel strongly arched, margin crenate, 1-2 bracteoles at the base of the spike (number of bracteoles in only few androecia studied), antheridium not seen. **Gynoecium** terminal on short branches, with 1-2 pairs of vegetative leaves and 1-2 underleaves at the base, with one innovation of the lejeuneoid-type, innovation usually fertile and then (1-)2(-3) gynoecia in a row per branch, occasionally gynoecium without innovation, often innovation with terminal androecium. Female bract lobe oval, 550-700 µm long, 300-400 µm wide, margin entire, apex rounded to obtuse; bract lobule oval to linear, 200-300 µm long, 60-110 µm wide, margin entire, apex rounded to obtuse, keel arched to straight; bracteole oval to oblong, 400 µm wide, 550-600 µm long, apex 15-25 % bifid, free at the base. **Perianth** emergent 1/3 - 1/2 its length, pyriform, 500-630 µm wide, 700-950 µm long, occasionally stipitate (stalk up to 250-300 µm long), 5-keeled, dorsal keel very short and less distinct, keels extending 2/3 the length of the perianth, lateral keels ± expanded above, keels 2-winged, wings 1-4 cells wide and often incurved, irregular with teeth and short cilia, beak 25-35 µm (2 cells) long, surface strongly papillose. **Vegetative reproduction:** not seen. **Sporophyte:** not seen.

Distribution and ecology: *Lejeunea pulverulenta* has been found in the West Indies (Guadeloupe), Ecuador (near Puyo) and on the north slope of Mount Roraima between 700-1600 m, in Guyana. The ecology of the species is only known for the specimens from Guyana, where the plants grow in ca 25 m tall, mixed, humid, mossy forests, ± appressed on trunks or pendulous. The distribution range of the species will probably prove to be larger, especially after examination of the numerous collections of unidentified *Taxilejeuneas* or “Lejeuneaceae” specimens in different herbaria.

Additional specimens examined: **GUYANA.** Upper Mazaruni District, North slope of Mount Roraima, 1200-1600 m, 05°17'N, 60°43'W, 14-18 Feb 1985, *Gradstein* 5279 (U), 5388 (U), 5390 (GOET). *Idem*, 700 m, 05°17'N, 60°46'W, 12-19 Feb 1985, *Aptroot* 17086 (U). **ECUADOR. PASTAZA:** Baños-Puyo road, along Río Alpayacu, 15 km W of Puyo, *Thiers* 4697 (NY; specimen cited as *Lejeunea anomala* by Dauphin 2003).

DISCUSSION

In the protologue of *Taxilejeunea pulverulenta* Stephani (1912-1917) mentioned “*Brasilia orientalis. Insulae antillanae*”. Six specimens labeled *T. pulverulenta* are deposited in G, where Stephani’s original herbarium is located. Three of them are collections of *L’Herminier* from the Antilles (Guadeloupe), all fertile with mature perianths. These plants perfectly match the description of the species by Stephani (*loc. cit.*), and were used for the illustrations in the *Icones Hepaticarum* (Stephani, 1985: Nr. 10055-57). The other three specimens in G, two of them from Brazil and one from Sto. Domingo, are not *Taxilejeunea pulveru-*

Table 1. Comparison of *Lejeunea pulverulenta* with *L. cerina* and *L. controversa*

	<i>Lejeunea pulverulenta</i>	<i>Lejeunea cerina</i>	<i>Lejeunea controversa</i>
Plant width	1.2-2 mm	1-1.9 mm	0.9-1.2 mm
Lobe	without teeth on the dorsal margin near the apex	without or with 1-3 teeth on the dorsal margin near the apex	occasionally with few teeth on the dorsal margin near the apex
Leaf apex	widely rounded	apiculate, 1-2 cells in a row, occasionally widely rounded	subacute to apiculate, up to 2(-3) cells in a row, occasionally widely rounded
Underleaf base	auriculate	rounded to slightly auriculate	rounded
Sexuality	autoicous (but often only with gynoeccia)	dioicous	autoicous, often sterile
Androecium	male spike incurved	male spike not incurved	male spike not incurved
Perianth keels	2-winged, wings 1-4 cells wide and often incurved, irregular with teeth and short cilia	rounded or slightly 2-winged, wings 1 cell wide, crenate without ornamentation	2-winged, wings 1-3 cells wide, with teeth, cilia and lacinia
References	this paper	Grolle, 1988; Reiner-Drehwald in prep.	Reiner-Drehwald & Goda, 2000; Reiner-Drehwald in prep.

lenta, but rather represent *Lejeunea cerina* (G 52575: Dominican Republic, Sto. Domingo, río Mameyes, Eggers 2651; G52573: Brazil, Thoreau 29, + *Cheilolejeunea* sp.) and *Taxilejeunea* sp. (G 52574: Brazil, Apiahy, Puiggari 740). Therefore, the specimen from Guadeloupe in which "original" is written on the label in Stephani's handwriting is chosen here as lectotype; it is also the largest collection.

Lejeunea pulverulenta is characterized by large shoots (up to 2 mm wide), yellowish-green, dull colour in the herbarium, plane leaves with rounded apex, cells with trigones, intermediate thickenings and strongly papillose (epithet "pulverulenta", Fig. 2: 3-4) and water-repellent surface, small inflated lobules hidden under the underleaves, imbricate and large underleaves with auriculate bases and acute lobes, androecium often terminal on the innovation, male spike incurved, gynoeccia with one often fertile innovation and (1-)2(-3) gynoeccia in a row, perianth with dorsal keel less distinct, lateral keels expanded above and keels 2-winged, the wings irregularly ornamented with teeth and small cilia. The leaves are also characterized by a \pm sharp "border" of 5-6 rows of smaller marginal cells, whose orientation seems to be perpendicular to the central cells (Fig. 2: 2).

Lejeunea pulverulenta is morphologically closely related to *L. cerina* and *L. controversa*. They share similar leaf cells with trigones, intermediate thickenings and a strongly papillose surface. The differences between these taxa are summarized in Table 1.

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REFERENCES

- DAUPHIN G., 2003 — *Ceratolejeunea*. *Flora Neotropica Monograph* 90. New York, The New York Botanical Garden Bronx.
- EVANS A.W., 1921 — *Taxilejeunea pterogonia* and certain allied species. *Bulletin of the Torrey Botanical Club* 48: 107-136, pl. 2.
- GEISSLER P. & BISCHLER H., 1990 — *Index Hepaticarum* 12. *Racemigemma to Zoopsis*. Berlin, Stuttgart, Cramer.
- GROLLE R., 1988 — Zur Kenntnis der Lejeuneoideae in Cuba (2): *Lejeunea* subg. *Macrolejeunea* Spruce. *Wissenschaftliche Zeitschrift der Friedrich-Schiller-Universität Jena, Mathematisch-Naturwissenschaftliche Reihe* 37: 169-176.
- REINER-DREHWALD M.E., 2000 — Las Lejeuneaceae (Hepaticae) de Misiones, Argentina. VI. *Lejeunea* y *Taxilejeunea*. *Tropical Bryology* 19: 81-131.
- REINER-DREHWALD M.E. & GODA A., 2000 — Revision of the genus *Crossotolejeunea* (Lejeuneaceae, Hepaticae). *Journal of the Hattori Botanical Laboratory* 89: 1-54.
- SCHUSTER R.M., 1980 — *The Hepaticae and Anthocerotae of North America*. Vol. IV. 1-1334. New York, Columbia University Press.
- STEPHANI F., 1912-1917 — *Species Hepaticarum* V: 1-1044. Genève et Bâle, Lyon, Georg & C^{ie}.
- STEPHANI F., 1985 — *Icones Hepaticarum*. Leiden, Microfiche ed. IDC.