

**The Genus *Diplasiolejeunea*  
(Lejeuneaceae, Marchantiopsida)  
in the Tropical Andes, with description of two new species**

Alfons SCHÄFER-VERWIMP\*

Mittlere Letten 11, D-88634 Herdwangen-Schönach

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**Abstract** — Two new species of the genus *Diplasiolejeunea* from the Andes of southern Ecuador, *D. erostrata* and *D. grandirostrata*, are described and figured. A key to and a synopsis of the Andean species of *Diplasiolejeunea* are presented. *Diplasiolejeunea caribea* subsp. *latetruncata*, *D. caribea* subsp. *microstipulata*, *D. caribea* subsp. *subcaribea*, *D. arietina*, *D. caricae*, *D. crassidentata*, and *D. reyesiana* are considered to be conspecific with *D. caribea*.

***Diplasiolejeunea* / Ecuador / Andes / South America**

**Zusammenfassung** — Aus den Anden Ecuadors werden zwei neue Arten der Gattung *Diplasiolejeunea*, *D. erostrata* und *D. grandirostrata* beschrieben und abgebildet. Ein Bestimmungsschlüssel und eine Zusammenstellung der andinen Arten der Gattung *Diplasiolejeunea* werden vorgelegt. *Diplasiolejeunea caribea* ssp. *latetruncata*, *D. caribea* ssp. *microstipulata*, *D. caribea* ssp. *subcaribea*, *D. arietina*, *D. caricae*, *D. crassidentata*, and *D. reyesiana* werden als neue Synonyme zu *D. caribea* gestellt.

During the study of neotropical *Diplasiolejeunea* numerous specimens were sent to me for identification. Among these, two new species from Ecuador were discovered, both distinguished by their small size, scattered ocelli, strongly inflated and involute lobules and, especially, by eplicate and inflated perianths.

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

*Autoica. Planta parva, ramicola. Caules pauciter ramosi, usque ad 10 mm longi, 0,1-0,12 mm crassi, cum foliis 1,5-2 mm lati. Lobus foliorum valde asymmetricus, 0,8-1 mm longus, 0,6-0,8 mm latus, margine supero maxime arcuato, apice rotundato, integerrimo. Cellulae lobi quadratae ad irregulariter hexagonales, 15 × 15 µm vel 20-30 × 35-40 µm, trigonis minutis. Lobulus in situ anguste oblongus, ± tubulatus, 3-3,5 x longior quam latus, usque ad dimidiam lobi. Amphigastria ad 0,45-0,55 bifida, 440-480 µm longa, 300-360 µm lata. Perianthia oblongo-obovata, (1,2-)1,5-1,8 mm alta, 0,7-0,8 mm longa, inflata, eplicate et erostrata.*

\* Correspondence and reprints: Moos.Alfons@t-online.de

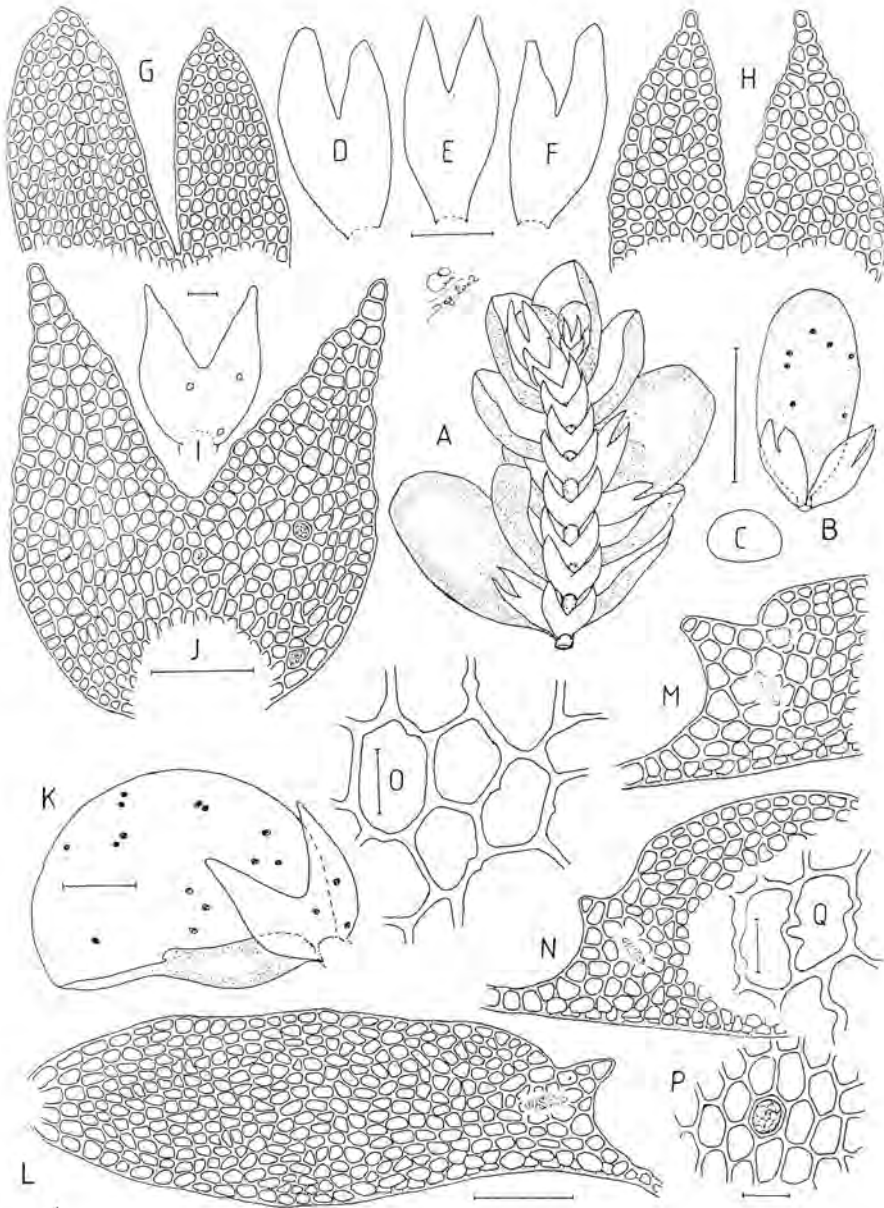


Fig. 1. *Diplasiolejeunea erostrata* Schäfer-Verwimp, sp. nov. — **A**: Habit of plant, scale = 1 mm; **B**: perianth with one female bract and bracteole, scale as in A; **C**: cross section of perianth; **D, E, F**: female bracts and bracteole, scale = 200  $\mu$ m; **G, H**: upper part of female bract, scale = 100  $\mu$ m; **H**: upper part of bracteole, scale as in G; **I**: underleaf, scale = 100  $\mu$ m; **J**: the same underleaf as in I, scale = 100  $\mu$ m; **K**: lobe with ocelli and underleaf, scale = 200  $\mu$ m; **L**: lobule with hyaline papilla, scale = 100  $\mu$ m; **M, N**: part of lobules with hyaline papillae, scale as in L; **O**: mid leaf cells, scale = 20  $\mu$ m; **P**: ocellus with surrounding cells, scale = 40  $\mu$ m; **Q**: cells at leaf base, scale = 20  $\mu$ m. (all Figs from the type).

**Holotypus:** ECUADOR, Prov. Loja, Cordillera Oriental, Parque Nacional Podocarpus, Cachanuma, Sendero de Mirador, alt. 2950-3050 m; Yalca, subpáramo, mosaic of oreale elfin woodland and grassy and bromeliad-rich páramo vegetation, epiphytic on trees (trunks and branches), 7.10.2002, *H. Kürschner, G. Parolly & D. Wagner 02-1042*, GOET; **Isotypes:** B, LOJA, hb. Schäfer-Verwimp. **Paratypes:** ECUADOR, same locality, 3000 m, on branches of shrubs, 15.4.2003, *A. Schäfer-Verwimp & M. Preussing 23280* (EGR, G, GOET, LOJA, NY, STU, hb. Drehwald, hb. Schäfer-Verwimp), -, 3050 m, *23285/A* (LOJA, hb. Schäfer-Verwimp); Prov. Zamora-Chinchipe, road Loja - Zamora 30 km, NE slope of Cordillera Numbala, Reserva Biológica San Francisco, trail to summit ("Antennes"), 3°58'S, 79°04'W, in wet, shrubby subpáramo vegetation (0.5-2.0 m high), forming bright-green patches on twigs of isolated shrubs, 2800-3000 m, 30.9.2002, *S. R. Gradstein & N. Nöske 10088* (GOET, LOJA, hb. Schäfer-Verwimp); -, same locality, 2600 m, on shrub, 21.4.2003, *A. Schäfer-Verwimp & M. Preussing 23481* (hb. Schäfer-Verwimp); -, 2830 m, on shrub, *A. Schäfer-Verwimp & M. Preussing 23494* (LOJA, hb. Schäfer-Verwimp); -, 2900-3000 m, abundant on shrubs, *A. Schäfer-Verwimp & M. Preussing 23506* (EGR, GOET, STU, hb. Schäfer-Verwimp); -, road Loja - Zamora 10 km, open shrubby vegetation at highest point "El Tiro", 2750-2780 m, on shrubs, 17.4.2003, *A. Schäfer-Verwimp & M. Preussing 23310, 23315, 23321* (JE, LOJA, MO, PRC, hb. Schäfer-Verwimp).

**Autoicous. Plants** small, up to 1 cm long and 1,5-2 mm wide, light-green when dry, in dense patches on twigs and branches of shrubs. **Stems** up to 100-120  $\mu\text{m}$  in diameter, in cross section with 3 medullary and 7 cortical cells. **Leaves** densely imbricate, obliquely spreading, lobe convex (in dorsal view), usually somewhat elevated from substrate, asymmetric, nearly semicircular, up to 0,8-1,0 mm long and 0,6-0,8 mm wide, margins entire. **Ventral margin** mostly incurved from lobule to the apex. **Cells of lobe** slightly longer than wide, the smallest  $\pm$  quadrate,  $15 \times 15 \mu\text{m}$ , most cells  $\pm$  irregularly hexagonal to short rectangular, up to  $20-30 \times 35-40 \mu\text{m}$ , rarely twice as long as wide ( $20 \times 40 \mu\text{m}$ ), trigones triangular, small but distinct, cells in midleaf sometimes with irregularly nodulose intermediate thickenings, these more conspicuous towards leaf base. **Oil bodies** (2-)-3-4(-5) per cell, very variable in outline from rounded-oval to spindle-shaped, *ca*  $4-6 \times 5-15 \mu\text{m}$ , sharply crenulate, larger than chloroplasts; ocelli scattered throughout leaf lobes (*ca* 12-18, in some leaves less than 10), underleaves (2-5), bracts and bracteole (2-4) and perianths (*ca* 15-20), more or less equal in size to surrounding cells and recognizable only in living plants or fresh herbarium material, up to  $25-30 \times 35-40 \mu\text{m}$ , homogeneous or consisting of 2-10 (rarely more) large globules. **Lobules**  $170-200 \times 600 \mu\text{m}$ , strongly inflated throughout,  $\pm$  tubulate, 3-3,5  $\times$  as long as wide, *ca* half as long as leaf lobe, free margin strongly involute at least up to and sometimes beyond first tooth. First tooth (median tooth) normally well developed, consisting of 3-4(-7) cells, shortly triangular with up to 3 cells wide at base and a single cell or 2 superimposed cells at the tip, when less well developed consisting only of 2 superimposed cells. Second tooth (apical tooth) blunt, 1-celled and normally hidden, in many leaves apparently lacking. **Hyaline papilla** entally displaced at base of first tooth, ovoid. Cells of lobules somewhat smaller than lobe cells, from  $12 \times 12 \mu\text{m}$  up to  $20 \times 30 \mu\text{m}$ . **Underleaves** about 3-3,5  $\times$  stem width, *ca*  $300-360 \mu\text{m}$  wide,  $440-480 \mu\text{m}$  long, divided to 0,45-0,55, sinus rounded, lobes at an angle of  $70^\circ-90^\circ$ , triangular, about  $180 \mu\text{m}$  wide at base (10-12 cells) and  $250 \mu\text{m}$  long (12-14 cells), apex acute, tipped by single cell or 2 superimposed cells; rhizoid disc  $\pm$  rounded. **Androecia** lateral (gyrothecal?) on very short branches, bracts smaller than leaves, in 3-5 pairs, subequally bilobed, one bracteole per pair of bracts;

antheridia not seen. **Gynoecea** without subgynoecial innovations. **Perianth** oblong-obovate in outline, *ca* (1,2-)1,5-1,8 mm long, 0,7-0,8 mm wide, inflated, totally eplicate and erostrate, perianth mouth slightly crenulate by a circle of a single row of slightly enlarged cells. Female bracts 450-550  $\mu\text{m}$  long, 230-260  $\mu\text{m}$  wide, mostly less than half bifid, lobe oblong-obovate, rounded obtuse or subacute at apex, lobule oblong, slightly shorter or as long as lobe, mostly acute to subacute at apex. Female bracteole long ovate, 500-550  $\mu\text{m}$  long, 270-290  $\mu\text{m}$  wide, 0,3-0,4 bilobed with sharp sinus, lobes acute, at base 120  $\mu\text{m}$  wide, tipped by a single cell or 2 superimposed cells, margin slightly crenulate. Asexual reproduction not observed.

**Discussion.** *Diplasiolejeunea erostrata* is well characterized by its small size, strongly inflated lobules, ventrally inflexed margin of leaf lobe up to the apex, densely imbricate leaves, scattered ocelli, relatively large underleaves, and especially by its inflated, erostrate and completely eplicate perianth which is produced often very abundantly, thus the plants appearing in field usually as small clusters of perianths only. There are few species of *Diplasiolejeunea* with eplicate perianths, among them *D. armatiloba* Steph. and its nearest relative *D. leiocarpa* Jovet-Ast, both from the West Indies, and both at once distinguished from *D. erostrata* by broad hyaline margin of leaf lobes. Our species shares more similarities with *D. zakiae* Tixier from Madagascar, which also has an eplicate and erostrate perianth; however, it is clearly different in having conspicuously distant spaced leaves, distinctly smaller underleaves and a rather different shape of leaf lobe; furthermore it is exclusively epiphyllous in lower mountain forest between 700-1000 m (Tixier, 1977). Another species which may be similar to *D. erostrata*, is *D. guadalupensis* Steph., hitherto known only from Guadeloupe. The perianth in the latter species is described and figured as eplicate and rostrate by Stephani (1916, 1985); however, Jovet-Ast (1950) showed the presence of a distinctly 5-plicate and nearly erostrate perianth in the type material. An examination of the type in G (16496) showed that *D. guadalupensis* indeed has a 5-plicate perianth, and furthermore obovate leaf lobes, lobe cells with knot-like trigones and intermediate thickenings, and underleaves with lobes 4-6 cells wide at base. A hyaline border as mentioned by Lücking (1995: 84) has not been observed. *Diplasiolejeunea guadalupensis* is similar to *D. replicata* and readily distinguished from *D. erostrata* by 5-plicate perianth, smaller underleaves and knot-like trigones and intermediate thickenings of leaf cells. *Diplasiolejeunea alata* Jovet-Ast is another small species with strongly inflated lobules and similar lobule structure; however, it is easily distinguished by lack of ocelli, leaf cells without trigones and intermediate thickenings, smaller, few-celled underleaves with lobes at base only 2-4 cells wide and especially by long stalked and conspicuously 5-plicate perianth. The Andean *D. replicata* (Spruce) Steph. seems at least gametophytically closely related to *D. erostrata* by its relatively small size, scattered ocelli, inflated lobules with involute free margin, leaf cells with trigones and intermediate thickenings, spreading leaves which are usually not appressed to the substrate. Both species are predominantly growing epiphytically as pioneers on branches and twigs of shrubs in upper mountain forest up to the páramos. However, *D. replicata* is readily distinguished by smaller underleaves (consisting of fewer cells, with lobes at base only 4-6 cells wide) and by perianth which is distinctly 5-plicate and has a characteristically flaring beak. The most closely related species seems to be *D. grandirostrata* Schäfer-Verwimp, spec. nov. which is similar in many respects (described below) but is distinguished at once by the large beak of the perianth.



***Diplasiolejeunea grandirostrata* Schäfer-Verwimp, sp. nov.** (Fig. 2)

*D. erostratae* Schäfer-Verwimp affinis, sed differt (1) lobulo ca  $2 \times$  longiore quam lato (non  $3-3,5 \times$  longiore quam lato), (2) perianthio distinctissime rostrato (non erostrato).

**Holotype:** ECUADOR, Prov. Zamora-Chinchipe, Estación Científica San Francisco at highway from Loja to Zamora, km 30;  $3^{\circ} 58' 18''$  S,  $79^{\circ} 04' 44''$  W, páramo with shrubs, 3000-3200 m, on twigs of shrub, 24.5.2001, I. Holz EC 01-560B, GOET (**isotypes:** LOJA, hb. I. Holz, hb. Schäfer-Verwimp).

**Autoicous. Plants** small, up to 7 mm long and 1,7-2 mm wide, yellow-green when dry, in dense patches on twigs of shrubs. **Stems** up to ca 110-120  $\mu$ m in diameter, in cross section with 3 medullary and 7 cortical cells. **Leaves** densely imbricate, spreading, usually somewhat elevated from the substrate, leaf lobe strongly convex in dorsal view, asymmetric, short oval, up to 0,9-1,1 mm long and 0,7-0,8 mm wide, margins entire. **Ventral margin** of lobe involute from lobule to apex. **Cells of lobe**  $\pm$  hexagonal, the smallest only  $14 \times 16 \mu$ m, most cells on average  $20-24 \times 24-30 \mu$ m, single ones up to  $25 \times 35 \mu$ m, with small but distinct trigones and occasional intermediate thickenings, cells at base of lobe with more irregular nodulose thickenings, sometimes even with sinuose cell walls (Fig. 2R). **Oil bodies** probably 4-8, crenulate (in state of decomposition when studied), ca 6-10 scattered ocelli in leaf lobe still recognizable,  $\pm$  equal in size to surrounding cells and recognizable only in living plants or fresh herbarium material (in the type collection after 18 months the ocelli were already not recognizable). **Lobules** ca  $190-220 \times 400-420 \mu$ m, about twice as long as wide, strongly inflated throughout, ca  $0,4 \times$  leaf length, free margin strongly involute, usually obscuring the two teeth. First tooth prominent,  $\pm$  triangular, composed of (4-) 6 (-8) cells, often 3 cells wide at base, tipped by a single cell or rarely 2 superimposed cells, often crowned by a hyaline papilla. Second tooth 1-2-celled, usually inflexed and inconspicuous. **Hyaline papilla** entally displaced at base of first tooth, narrowly ovoid. Cells of lobule slightly smaller than cells of lobe. **Underleaves** ca  $3-3,5 \times$  stem width, 280-350  $\mu$ m wide, 340-400  $\mu$ m long, divided to 0,55-0,6, lobes at an angle of  $70^{\circ}-80^{\circ}$ , rarely up to  $100^{\circ}$ , sinus rounded, lobes  $\pm$  triangular, at base 100-160  $\mu$ m wide (ca 6-10 cells broad), 200-260  $\mu$ m long (10-14 cells long), apex acute to acuminate, tipped by (1-)2, but more commonly 3-4 superimposed cells; rhizoid disc rounded to short oval. **Androecia** lateral on very short branches, bracts smaller than leaves, in 2 series and 3-4 pairs, subequally bilobed, two antheridia per bract, one bracteole per pair of bracts, bracteoles narrower and lobes more acuminate than in underleaves. **Gynoecea** without or occasionally with one subgynoeceal innovation. **Perianth**  $\pm$  oval to broadly elliptical in outline, 1,3-1,5 mm long (including beak) and 0,7-0,85 mm wide, strongly inflated and thus appearing almost globose, completely eplicate, with a very large, short-cylindrical beak up to 210  $\mu$ m wide and 320  $\mu$ m long, not flaring at mouth, beak reaching 1/4-1/5 of total perianth length and about 1/4 of total width, in young perianths reaching even 1/3-1/4 of total length and 1/3 of whole width; perianth mouth (= apex of the beak) crenulate by a circle of one row of  $\pm$  quadrate cells with normal (thick) cell walls at base but conspicuously thinner distal walls, the cells  $\pm$  equal in size, ca  $24 \times 24 \mu$ m. Female bracts ca 280-350  $\mu$ m wide, 600-700(-750)  $\mu$ m long, ca 0,3-0,4 bifid, sinus sharp, lobe and lobule nearly equal in size and outline, obovate to rectangular,  $\pm$  truncate at apex. Female bracteole longly ovate, 300-350  $\mu$ m wide, 600-750  $\mu$ m long, ca 0,3-0,45 bifid, sinus acute, lobes acute to acuminate, often tipped by a row of 2-3(-4)

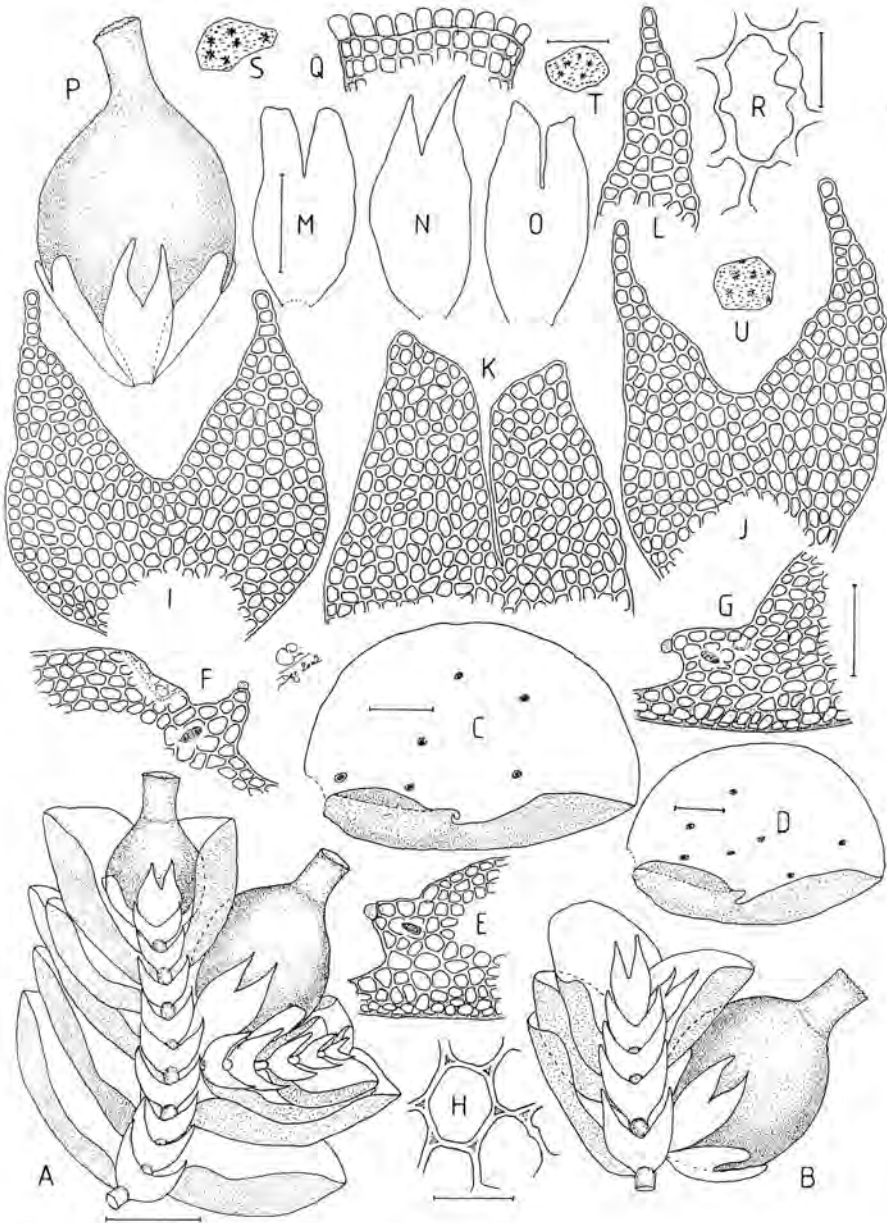


Fig. 2. *Diplasiolejeunea grandirostrata* Schäfer-Verwimp, sp. nov. — **A-B**: habit of plant, scale = 0,5 mm; **C-D**: 2 leaves showing scattered ocelli, scale each = 200 µm; **E-G**: part of lobules with teeth and hyaline papillae, scale = 100 µm; **H**: midleaf cells, scale = 30 µm; **I, J**: underleaves, scale as in G; **K**: upper part of female bract, scale as in G; **L**: upper part of female bracteole, scale as in G; **M-O**: female bracts and bracteole, scale = 300 µm; **P**: perianth with bracts and bracteole, 1,5 mm long; **Q**: cells at perianth mouth, scale as in G; **R**: cells at base of leaf, scale = 20 µm; **S-U**: spores, scale = 40 µm. (all Figs from the type).

superimposed cells, margin slightly crenulate. **Spores** irregularly polygonal in outline, quare-like, papillose, ornamented by several star-like sculptures (rosettes), from  $40 \times 50 \mu\text{m}$  to  $30 \times 60 \mu\text{m}$  (Fig. 2 S-U). Asexual reproduction not observed.

**Discussion.** The most striking and unique feature of *D. grandirostrata* is the strongly inflated, completely eplicate perianth with an unusually large beak, allowing for easy recognition. The most closely related species seems to be *D. erostrata*, which is distinguished at once by its erostrate perianth. Further differences include the different rates of lobule length to width (3-3.5:1 in *D. erostrata*, 2:1 in *D. grandirostrata*), the different female bracts and bracteole (see description above and figures 1 D-H, 2 K-O), as well as the more conspicuously acuminate underleaf lobes of *D. grandirostrata*. For a comparison with other species see under *D. erostrata*.

The two new species *D. erostrata* and *D. grandirostrata* grow in the same general area in the mountains of southern Ecuador, but *D. grandirostrata* was found only once in the páramo belt above 3000 m whereas *D. erostrata* was more frequently found at slightly lower elevation in the subpáramo belt between 2600 and 3050 m. Both are pioneers occurring in humid open vegetation with high frequency of fog, primarily growing on the outer parts of the twigs of shrubs. *Diplasiolejeunea erostrata* was associated with other pioneers like *Colura tenuicornis*, *Blepharolejeunea incongrua*, *Diplasiolejeunea alata*, *D. involuta* subsp. *andicola*, *D. pauckertii*, *D. replicata*, *Leucolejeunea xanthocarpa*, *Drepanolejeunea inchoata*, *D. granatensis*, *D. anoplantha*, *Frullanooides densifolia*, *Radula tenera*, *Daltonia stenophylla*, *D. longifolia*, as well as by some species of the genera *Frullania*, *Metzgeria*, *Cheilolejeunea* and *Microlejeunea*.

Following the infrageneric classification of Schuster (1971), both *D. erostrata* and *D. grandirostrata* would belong to the subgenus *Diplasiolejeunea*. However, in both species the leaves are not appressed to the substrate, and gemmae have not been observed. In fact, the two species are more similar to members of the subgenus *Austrolejeuneopsis*, from which they differ by the scattered ocelli. Within the subgenus *Diplasiolejeunea* the two new species do not fit into any of the sections as defined by Tixier (1985: 335 f). A new infrageneric classification of the genus *Diplasiolejeunea* seems to be necessary to accommodate the two new species (see also Morales & Gradstein (1995) who found no adequate subgenus for *D. involuta*).

### SYNOPSIS OF THE ANDEAN SPECIES OF THE GENUS *DIPLASIOLEJEUNEA*

- |    |  |                      |
|----|--|----------------------|
| 1  | Leaf lobe lanceolate, plants small, epiphyllous at lower altitudes. . . . .                                  | <i>D. lanceolata</i> |
| 1* | Leaf lobe rounded at apex, never lanceolate . . . . .  | 2                    |
| 2  | Leaf lobe bordered by hyaline cells (almost exclusively epiphyllous at lower to medium elevations) . . . . . | 3                    |
| 2* | Leaf lobe without hyaline border . . . . .   | 8                    |
| 3  | Second tooth of lobule short and incurved. First tooth straight, mostly 4 cells long . . . . .               | <i>D. pellucida</i>  |
| 3* | Second tooth of lobule straight and short or long and falcate, not incurved. . . . .                         | 4                    |
| 4  | First tooth never T-like. . . . .  | 5                    |
| 4* | First tooth at least partly T-like . . . . .   | 6                    |

- 5 Second tooth short, 1(-2) cells long, not falcate, first tooth consisting mostly of 2 superimposed cells . . . . . *D. inermis*
- 5\* Second tooth 2-3(-4) cells long, often falcate, first tooth mostly 3-4 cells long and 1-3 cells wide at base . . . . . *D. evansii*
- 6 First tooth partly to predominantly T-like, very variable, usually with 1-4(-6) vertical and 2(-3), rarely up to 4 horizontal cells, second tooth short to long, usually not reaching or overlapping the first tooth . . . . . *D. caribea*
- 6\* First tooth always T-like (very rarely as a long spine in *D. pocsii*), with one vertical cell and 4-6 horizontal cells, horizontal cells often twice as long as wide obliquely spreading or curved, second tooth usually long and falcate, often reaching or overlapping the first tooth . . . . . 7
- 7 Underleaf lobes acute, usually tipped by 2-3 superimposed cells, perianth strongly 5-plicate . . . . . *D. pocsii*
- 7\* Underleaf lobes obtuse, perianth eplicate . . . . . *D. armatiloba*
- 8 Perianth completely eplicate, inflated, lobules strongly inflated-involute . . . 9
- 8\* Perianth distinctly 5-plicate, at least in upper part, lobules with strongly involute to flat free margin . . . . . 10
- 9 Perianth erostrate, lobule *ca* 3 × as long as wide. . . . . *D. erostrata*
- 9\* Perianth distinctly rostrate, lobule *ca* 2 × as long as wide. . . . . *D. grandirostrata*
- 10 Underleaves small, 1,5-2 × stem width, lobes of underleaves 2-4(-5) cells wide at base, tipped by a row of 2-3 superimposed cells. Leaf lobes without ocelli. Trigones lacking or inconspicuous. Perianth long exerted, stalked at base, sharply and deeply 5-keeled. . . . . *D. alata*
- 10\* Underleaves 2,5-5(-7,5) × stem width. Lobes usually 5-6 cells wide at base or more (up to 28 cells wide). Perianth not long exerted and not stalked at base . . . . . 11
- 11 First tooth (usually deeply) divided into two rows of cells (close examination is required). . . . . 12
- 11\* First tooth not divided (rarely partly divided in *D. papilionacea*?) . . . . . 13
- 12 Underleaves relatively small, lobes (4-)-6-8 cells wide at base. Perianth beak conspicuous, typically flaring at mouth . . . . . *D. replicata*
- 12\* Underleaves large, lobes *ca* 15-22 cells wide at base. Perianth beak less conspicuous, not flaring at mouth. . . . . *D. columbica*
- 13 Lobules inflated to strongly swollen-involute . . . . . 14
- 13\* Lobules flat or weakly inflated, never strongly swollen-involute . . . . . 16
- 14 Well-developed lobules with 2-3 additional teeth at free margin, these usually inflexed and each consisting of mostly 2 cells . . . . . *D. pluridentata*
- 14\* Lobules never with additional teeth at free margin (at most rarely with a few projecting cells) . . . . . 15
- 15 Lobule very large, covering usually more than 50% of leaf lobe (*ca* 45-85%), strongly inflated, free margin including both well developed teeth involute, first tooth ± triangular, consisting of *ca* 10-15(-17) cells . . . . . *D. involuta*
- 15\* Lobule smaller, covering *ca* 20-35(-45)% of leaf lobe, first tooth very small, commonly 1-celled (rarely consisting of 2-3 cells), second tooth obscure . . . . . *D. pauckertii*
- 16 Lobes of underleaves (narrowly) triangular, acute at apex, diverging at an angle of 90°-120°-150° . . . . . 17
- 16\* Lobes of underleaves variously ovate, obtuse to rounded at apex, diverging at an angle of 60°-90°(-120°). . . . . 19
- 17 First tooth of lobule straight, finger-like, consisting of (2-)-4-10(-12) cells, tipped by a row of 2-4 superimposed cells. Second tooth ± well developed, incurved and therefore often hidden. . . . . *D. brunnea*



- 17\* First tooth of lobule at least in some leaves T-like, second tooth straight . . . 18
- 18 First tooth, when T-like, consisting typically of 3 cells, one vertical and 2 horizontal, occasionally up to 3(-5) vertical and up to 3 horizontal cells. Second tooth tipped by a single cell . . . . . *D. cavifolia*
- 18\* First tooth always T-like, consisting mostly of 1 vertical and (3-)4 horizontal cells. Second tooth tipped by (1-)2-3 superimposed cells. . . . . *D. zacatepecensis*
- 19 Underleaves large, 6-7,5 × stem width, lobes at base 18-24(-28) cells wide, broadly rounded at apex. First tooth usually 4-7 cells long and 2 cells wide over nearly the whole length, tipped by a single, rarely two superimposed cells. Free margin of lobule often with 1-2(-3) projecting cells. . . . *D. papilionacea*
- 19\* Underleaves smaller, up to 5 × stem width, lobes at base 8-12(-14) cells wide, at apex rounded to obtuse. Free margin of lobule rarely with projecting cells . . . . . 20
- 20 First tooth 2-3(-4) cells long and 2(-3) cells wide at base, tipped by a single or 2 superimposed cells. Second tooth of 2 cells which lie over each other. Lobes of underleaves broadly rounded at apex. Ventral margin of leaf lobe strongly involute. . . . . *D. johnsonii*
- 20\* First tooth (3-)5-12 cells long, tipped by a row of 3-5 superimposed cells. Lobes of underleaves narrowly rounded to obtuse. Ventral margin of leaf lobe usually flat . . . . . 21
- 21 First tooth of lobule very large, mostly 6-12 cells long and 2-3 cells wide in lower part, often ± parallel to the stem. Second tooth smaller but well developed, consisting of 3-5 cells, normally inflexed or incurved . . . *D. rudolphiana*
- 21\* First tooth smaller, mostly 3-5 cells long and 2 cells wide at base, obliquely spreading, not parallel to the stem. Second tooth consisting of only 1 cell, sometimes reduced . . . . . *D. unidentata*

1. *Diplasiolejeunea alata* Jovet-Ast, *Revue Bryologique et Lichénologique* 17: 31, Fig. III. 1948.

Predominantly epiphytic on branches and twigs of shrubs, more rarely epiphyllous, as pioneer in rather open, well-illuminated locations, from 700 up to 3200 m. Widespread in the Neotropics, from Central America to the West Indies and from the Andes to SE Brazil (Guadeloupe, Dominica, Costa Rica, El Salvador, Venezuela, Brazil). **New to Bolivia and Ecuador:** Bolivia, road La Paz – Coroico, Yungas rain forest near Chuspipatta, epiphytic on shrub, 3200 m, 13.10.1989, *Schäfer-Verwimp & Verwimp 11908* (hb. Schäfer-Verwimp). Ecuador, Prov. Zamora-Chinchipec, road Loja – Zamora km 35, Reserva Biologica San Francisco, from lower montane forest up to the subpáramo belt, 1790-2900 m, April 2003, *Schäfer-Verwimp & Preussing 23217/A, 23435/B, 23479, 23495* (JE, LOJA, hb. Schäfer-Verwimp).

**Illustrations:** Jovet-Ast, 1948: 30, fig. III; Schuster, 1971, figs 5-6; Schuster, 1992: 352, fig. 12 (oil bodies).

2. *Diplasiolejeunea brunnea* Steph., *Species Hepaticarum* 5: 922. 1916.

Mainly epiphyllous on living leaves, more rarely on bark, mostly in undergrowth of rain forests, from sea level up to 2500 m. Widespread in tropical America and one of the most common species of the genus.

**Illustrations:** Jovet-Ast, 1956, figs. 1-21, as *D. galloana*; Reyes, 1983, fig. 3, as *D. brunnea*, fig. 8, as *D. galloana*; map: fig. 4, as *D. brunnea*, fig. 9, as *D. galloana*; Tixier, 1985: 391, fig. 20; Stephani 1985, Icones no. 002386; Lücking, 1995, fig. 40: A-B.

3. *Diplasiolejeunea caribea* Tixier, *Bryophytorum Bibliotheca* 27: 377, Fig. 14. 1985. [subsp. *caribea*]

**Type:** La Guadeloupe, Palmiste, bois Joseph, 620 m, 20.12.1960, *Le Gallo s.n.*, PC! = *Diplasiolejeunea caribea* Tixier subsp. *latetruncata* Tixier, *Bryophytorum Bibliotheca* 27: 384, Fig. 17. 1985; **syn. nov.** – **Type:** La Guadeloupe, Matouba, près du pont de la rivière Rouge, 750 m, 8.5.1968, *Le Gallo* 380, PC (type not seen, synonymized only by description and figures).

= *Diplasiolejeunea caribea* subsp. *microstipulata* Tixier, *Bryophytorum Bibliotheca* 27: 380, Fig. 15. 1985; **syn. nov.** – **Type:** La Guadeloupe, “Forêt des Palmistes, 620 m, 21.12.1960, *Le Gallo* 633 (Holotype PC)” [the specimen *Le Gallo* 633 is labelled as follows: “La Guadeloupe, Grand Etang de Capsterre, 420 m, 19.2.1960, *Le Gallo* 633”, PC!] La Guadeloupe, Forêt de Duclos, 23.7.1953 [“1853”], *Le Gallo* 1005, labelled as holotype specimen in PC! There is some confusion concerning the citation of specimens including the type specimen in Tixier (1985: 382).

= *Diplasiolejeunea caribea* Tixier subsp. *subcaribea* Tixier, *Bryophytorum Bibliotheca* 27: 382, Fig. 16. 1985; **syn. nov.** – **Type:** La Guadeloupe, Vernon, pont de la Rivière Corossol, 300 m, 25.9.1964, *Le Gallo s.n.*, PC!

= *Diplasiolejeunea arietina* Tixier, *Bryophytorum Bibliotheca* 27: 362, Fig. 7. 1985; **syn. nov.** – **Type:** La Guadeloupe, Pigeon, Trou du Diable, 300 m, 19.2.1960, *Le Gallo s.n.*, PC!

= *Diplasiolejeunea caricae* Tixier, *Bryophytorum Bibliotheca* 27: 373, Fig. 12. 1985; **syn. nov.** – **Type:** La Guadeloupe, Forêt Bains Chauds Papaye, 950-1100 m, 25.11.1959, *Le Gallo* 509 p.p., PC!

= *Diplasiolejeunea crassidentata* Tixier, *Bryophytorum Bibliotheca* 27: 375, Fig. 13. 1985; **syn. nov.** – **Type:** La Guadeloupe, Route Mahaut, Vernon, axe central, 450 m; 30.12.1964, *Le Gallo s.n.*, PC!

= *Diplasiolejeunea reyesiana* Tixier, *Cryptogamie, Bryologie-Lichénologie* 16: 230. 1995; **syn. nov.** – **Type:** Guyana, Kanuku Mts., Cool-wind Mt., 03 08 N, 59, 21 W, 500-800 m, high forest, *M.J. Jansen-Jacobs et al.* 390 J (GOET, ex U)!

Mainly epiphyllous on living leaves in the undergrowth of rain forests from sea level to 2180 m. Widespread and frequent in the Caribbean region, scattered in South America, hitherto known from Guayana (as *D. reyesiana*) and Brazil (Tixier, 1985), but probably more widespread. **New to Ecuador:** Prov. Zamora-Chinchipec, road Loja – Zamora km 35, Reserva Biologica San Francisco, upper montane forest on transect 1, epiphyllous in undergrowth, 2180 m, 18.4.2003, Schäfer-Verwimp & M. Preussing 23364/A (LOJA, hb. Schäfer-Verwimp).

**Illustrations:** Tixier, 1985, fig. 14, fig. 15 (as *D. caribea* subsp. *microstipulata*), fig. 16 (as *D. caribea* subsp. *subcaribea*), fig. 17 (as *D. caribea* subsp. *latetruncata*), fig. 12 (as *D. caricae*), fig. 13 (as *D. crassidentata*); Tixier, 1991, fig. 17 (as *D. reyesiana*).

*Diplasiolejeunea caribea* is best recognized by its (partly) T-like first tooth combined with a straight or curved (not incurved) second tooth, acute underleaf lobes and hyaline leaf margin. Both teeth of the lobule are rather variable, especially the first tooth, which may be T-like or not; when T-like, it may be made up of only 3 cells with one vertically and 2 horizontally oriented cells or larger and consisting of up to 6-8(-9) cells with the vertically oriented cells in two rows and the horizontal ones in 2-3(-4) rows; both extremes can be observed on the same plant. The second tooth varies considerably in length and orientation, it may be short and straight or long and curved towards the first tooth. In the type specimen of *D. caribea* subsp. *caribea* the whole variability has been observed. Further

differences given in the key by Tixier (1985), such as the more or less narrowly truncate lobule, the rounded or elongated keel and the frequency of the T-like first tooth, are not constant at all and do not allow segregation even on infraspecific level. Therefore, the subspecies *latetruncata*, *microstipulata* and *subcaribea* as well as *D. caricae*, *D. crassidentata* and *D. reyesiana* are placed in the synonymy of *D. caribea*. Also differences in female bracts and bracteole hardly serve to segregate these taxa as these features show considerable infraspecific variability.

In the type specimen of *D. arietina* many T-like first teeth have been observed, along with finger-like teeth on the same plant, and the second tooth is long or short; therefore I consider this species best placed in the synonymy of *D. caribea*.

4. *Diplasiolejeunea cavifolia* Steph., *Engler's Botanisches Jahrbuch für Systematik* 20: 318. 1895.

**Syn.:** *Diplasiolejeunea brachyclada* Evans, *Bulletin of the Torrey Botanical Club* 39: 216. 1912.

On bark and on living leaves, from sea level to about 2400 m. Pantropical, widespread and frequent in the Neotropics from the West Indies, Central America, Mexico, and northern South America to SE Brazil.

**Illustrations (selected):** Evans, 1912, pl. 16 (10-18); Reyes, 1983, fig. 5, map: fig. 6; Tixier, 1985: 404, fig. 26; Stephani, 1985, Icones no. 002385, as *D. brachyclada*, 002368-69, as *D. cavifolia*, 002373, as *D. ocellata*; Wu & Lin, 1978, fig. 8: 1-14, map: fig. 3, as *D. brachyclada*; Zhu & So, 2001, fig. 88.

5. *Diplasiolejeunea columbica* Tixier, *Cryptogamie, Bryologie-Lichénologie* 4(3): 233, Fig. 2. 1983.

On bark, known only from the type from Colombia: Bogotá, Tequendama, 2500 m; seems to be a very distinct and rare species (type not available). One further collection: Colombia: Depto. Huila. Mnpio. La Plata. Vereda Candelaria. Headwaters of rio La Candelaris. *Blechnum-Sphagnum* bog with *Hypericum laricifolium* and *Espeletia*, on twigs, 2300 m, 1.10.1984, J. Aguirre, S. R. Gradstein, B. O. v. Zanten & E. Linares nr. 6561 (GOET).

**Illustration:** Tixier, 1983, fig. 2.

6. *Diplasiolejeunea erostrata* Schäfer-Verwimp  
– see this paper –

7. *Diplasiolejeunea evansii* Tixier, *Bryophytorum Bibliotheca* 27: 360, Fig. 6. 1985.

On living leaves from near sea level to ca 1500 m, known from Cuba, Guadeloupe, and Venezuela (Tixier, 1985).

This taxon is weakly separated from *D. inermis* by slightly longer teeth of the lobule and may prove to be synonymous with the latter. In the paratype specimen from Venezuela (*Onraedt* 78.V.5650, PC), the second tooth is short and straight to long and curved, no T-like teeth have been observed. Two further paratype collections from Guadeloupe (*Le Gallo* 956, *Le Gallo* 1, PC) and the specimen *Le Gallo* 489 (PC, under *D. evansii*) proved to belong to the rather variable *D. caribea*. A conclusive decision about the taxonomic status of *D. evansii* cannot be made until the type has been seen.

**Illustration:** Tixier, 1985: 361, fig. 6.

8. *Diplasiolejeunea grandirostrata* Schäfer-Verwimp  
– see this paper –

9. *Diplasiolejeunea inermis* Tixier, *Bryophytorum Bibliotheca* 27: 365, Fig. 8. 1985.

On living leaves at lower altitudes, from sea level to ca 850 m; known from Brazil, Jamaica, Costa Rica, and Guatemala. New to Bolivia: Dept. Beni, Prov. Ballivian, Serranía del Pilon Lágas, 67° 02' W, 15° 11' S, S. R. Gradstein 7331 (GOET).

**Illustrations:** Tixier, 1985: 365, fig. 8: 1-9; Lücking, 1995, fig. 40: C-D.

*Diplasiolejeunea inermis* is possibly conspecific with *D. pellucida*. The size of the first tooth is variable and intergrades with that of “typical” *D. pellucida*, and the second tooth is not always straight but sometimes ± incurved along the free margin of the lobule. In *D. pellucida*, on the other hand, the second tooth occasionally is not incurved but ± straight as in *D. inermis* (see also fig. 41B, C in Lücking, 1995). The type has to be studied before a final conclusion about the taxonomic status of *D. inermis* can be taken (type not available). See also under *D. evansii*.

10. *Diplasiolejeunea involuta* Winkler, *Revue Bryologique et Lichénologique* 35: 320, Fig. 4. 1967.

Usually epiphytic on branches and twigs of shrubs in rather open vegetation, occasionally on living leaves from ca 1900-3450 m. Known from El Salvador and Costa Rica; the subsp. *andicola* Pócs, which differs by underleaves with narrower lobes and by more rough granulose oil bodies, is reported from Venezuela (type) and Ecuador (Nöske et al. 2003 and collections of the author).

**Illustrations:** Winkler, 1967, fig. 4; Morales & Gradstein, 1995, figs. 1-10; Léon et al., 1998, fig. 6: 2 (oil bodies), fig. 7 (subsp. *andicola*).

11. *Diplasiolejeunea johnsonii* Evans, *Bulletin of the Torrey Botanical Club* 39: 603. 1912.

On bark, occasionally on living leaves, from ca 700-2300 m. Known from Cuba, Jamaica, Mexico, Costa Rica, and Ecuador.

**Illustrations:** Evans, 1912a, pl. 45: 1-6; Reyes, 1983, fig. 10, map: fig. 11; Stephani, 1985, Icones no. 002391.

12. *Diplasiolejeunea lanceolata* Grolle, *Beiträge zur Phytotaxonomie* 15: 107, Fig. 2. 1992.

Reportedly epiphyllous in cloud forest at 500 m; a highly distinct species, known only from the type from Ecuador.

**Illustration:** Grolle 1992: 108, Abb. 2a-k.

13. *Diplasiolejeunea papilionacea* R.M. Schust., *Phytologia* 39(6): 431. 1978.

On bark and rotting *Chusquea*, from 1850-3500 m. A rather rarely collected species known from Venezuela and Colombia (Gradstein, 1995). New to Ecuador: Prov. Zamora-Chinchiipe, road Loja – Zamora km 35, Reserva Biológica San Francisco, edge of lower montane forest, 1850 m, epiphytic on shrub in small quantity, 13.4.2003, Schäfer-Verwimp & Preussing 23216/B (hb. Schäfer-Verwimp).

**Illustration:** none.



14. *Diplasiolejeunea pauckertii* (Nees) Steph., *Species Hepaticarum* 5: 924. 1916.

**Syn.:** *Diplasiolejeunea reflexiloba* (Gottsche) Steph. 1916 (Tixier, 1983: 233, *Lejeunea reflexiloba* as syn. of *D. pauckertii*).

Epiphytic on tree trunks, branches and twigs of shrubs in open and humid vegetation, occasionally on rotting wood, from about 1000-4150 m. Widespread in the Neotropics and known from Costa Rica, Venezuela, Colombia, Ecuador, Bolivia, Peru, and SE Brazil.

**Illustrations:** Tixier, 1983: 232, fig. 1: 1-8; Stephani, 1985, Icones no. 002392 (+ 93?), as *D. pauckertii*, 002395, as *D. reflexiloba*.

15. *Diplasiolejeunea pellucida* (Meissn.) Schiffn., in Engler & Prantl, *Natürliche Pflanzenfamilien* 1, 3: 121. 1893.

Almost exclusively epiphyllous, very rarely on bark, often in the undergrowth of rain forest predominantly at lower to medium altitudes, from sea level to ca 2500 m. A common species widely distributed in tropical America.

**Illustrations:** Evans, 1912: pl. 16, figs 1-9 + p. 223, fig. 2; Reyes, 1983, fig. 12, map: fig. 13; Stephani, 1985, Icones no. 2394; Tixier, 1985: 350, fig. 1; Lücking, 1995: 83, Abb. 41.

16. *Diplasiolejeunea pluridentata* Schäfer-Verwimp, *Hausknechtia* 8: 71, Figs 1-2. 2001.

Predominantly epiphytic on shrubs, rarely epiphyllous, in humid open vegetation or as crown epiphyte, from 1950-3400 m. Known from Costa Rica (type) and Ecuador (Nöske *et al.*, 2003 and collections of the author).

**Illustration:** Schäfer-Verwimp 2001, figs 1-2.

17. *Diplasiolejeunea pocsii* Reyes, *Acta Botanica Academiae Scientiarum Hungaricae* 28: 173, Fig. 19. 1983 "1982".

An epiphyllous species hitherto known only from Cuba and Dominica at altitudes of 350-400 m. **New to Ecuador and South America:** Prov. Zamora-Chinchipe, road Loja – Zamora km 10, humid, open shrubby vegetation near the pass "El Tiro", 2780 m, epiphyllous on terrestrial bromeliad, 17.4.2003, Schäfer-Verwimp & Preussing 23320, conf. T. Pócs (EGR, GOET, JE, LOJA, STU, hb. Schäfer-Verwimp).

18. *Diplasiolejeunea replicata* (Spruce) Steph., *Species Hepaticarum* 5: 926. 1916.

Usually epiphytic on shrubs, more rarely on living leaves, from about 1200-3400 m. Widespread in the Neotropics, known from Costa Rica, Colombia, Ecuador, Peru, and SE Brazil. New to Bolivia and Venezuela: Bolivia, Dep. Cochabamba, Prov. Chapare, along old Chapare road 7 km S of Incachasa, ca 3400 m alt., *S. R. Gradstein 7402b* (JE), 7384b (GOET); Venezuela, Est. Merida, Libertador, Parque Nacional Sierra Nevada, Estacion La Aguada, 3300 m, *S. & T. Pócs, R. Rico 9736/C* (EGR) (Léon *et al.*, 1998, as *D. alata*).

**Illustration:** Stephani, 1985, Icones no. 2396.

19. *Diplasiolejeunea rudolphiana* Steph., *Hedwigia* 35: 79. 1896.

Usually on bark, occasionally epiphyllous, in various types of vegetation, from sea level to about 1000 m. Pantropical and widespread in the Americas from Florida and Mexico southwards to Santa Catarina in S Brazil.

**Illustrations (selected):** Evans, 1912, pl. 17, figs 13-17; Reyes, 1983, fig. 15, map: fig. 16; Schuster, 1980, figs 753-754 (optime!); Stephani, 1985, Icones no. 2397, as *D. rudolphiana*, 002400 erroneously as *D. unidentata*; Zhu & So, 2001, fig. 87.

*Diplasiolejeunea rudolphiana* Steph. var. *inflata* Herzog (*Feddes Repertorium* 57: 200. 1955) is most probably a separate species closely related to *D. brunnea* and in need of further study.

**20.** *Diplasiolejeunea unidentata* (Lehm. & Lindenb.) Schiffn., *Engler's Botanisches Jahrbuch für Systematik* 23: 583. 1897.

Epiphytic on tree stems and on twigs and branches of shrubs, rarely epiphyllous, mainly between sea level and 1000 m, in the Andes up to 2550 m. Widespread in the Americas from Mexico and the West Indies to SE and S Brazil.

**Illustrations (selected):** Evans, 1912, pl. 17, figs 1-12; Reyes, 1983, fig. 17, map: fig. 18; Stephani, 1985, Icones no. 2398 (002399 ?, 2401 ?; 002400 belongs to *D. rudolphiana*).

**21.** *Diplasiolejeunea zacatepecensis* Tixier, *Bryophytorum Bibliotheca* 27: 399, Fig. 24. 1985.

Usually epiphytic on twigs of shrubs in humid open vegetation, more rarely on living leaves, from about 500-2550 m. Hitherto known only from Guadeloupe and Mexico. **New to South America:** Venezuela, Estado Merida, "páramo" de Chacantá, arriba y al sur de Pueblo Nuevo, bosque andino intervenido con *Trixis neriifolius*, 2550 m, 13.2.1985, *D. Griffin, III & J. Dugarte PV-810* (GOET, as *D. brachyclada*).

**Illustration:** Tixier 1985: 400, fig. 24.

### Excludenda

*Diplasiolejeunea armatiloba* Steph., *Hedwigia* 35: 80. 1896.

The occurrence of this species in Ecuador as reported by Reyes (1983: 150, without citing a specimen) is considered doubtful. It is known from Cuba, Guadeloupe and Dominica, and reported from Mexico.

**Illustrations:** Jovet-Ast, 1947: 32, fig. VII: 1-23, as *D. allorgeorum*; Tixier, 1985: 369, fig. 10; Stephani, 1985, Icones no. 002380-81 (+ 82?). The fig. 1 in Reyes (1983) does not belong to *D. armatiloba* but is representing something else.

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