

## NEW OR LITTLE KNOWN EPIPHYLLOUS LIVERWORTS, IX TWO NEW NEOTROPICAL *COLOLEJEUNEA* SPECIES

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*Cololejeunea ecuadoriensis* and *Cololejeunea schusteri* are described from Ecuador and from Brazilian Amazonia. *C. ecuadoriensis* by its filamentous stylus and *C. schusteri* by its falcate leaves with its first tooth curved down are well separated from all Neotropical species of the genus.

Key words: Amazonia, Brazil, *Cololejeunea*, Ecuador, epiphylls, Lejeuneaceae

### INTRODUCTION

During the revision work of Latin American *Cololejeunea* species I came across two new taxa. The first was a specimen collected by the lichenologist Robert Lücking in Ecuador, while the second by Rudolf M. Schuster within the framework of Projeto Flora Amazônica, Hepaticae of Amazonas, Brazil, along the Rio Negro between Manaus and São Gabriel. Till now there were 34 widely accepted *Cololejeunea* species known from the Neotropics of which 21 are present in Brazil while from the very poorly known epiphyllous flora of Ecuador only 3 (Benedix 1953, Evans 1902, 1911, 1918, Gradstein *et al.* 2001, Herzog 1931, 1951, Horikawa 1931, Mizutani 1961, Montagne 1842, Morales and Dauphin 1998, Pócs 1996, 2002, Reiner-Drehwald 1994, Robinson 1964, Schäfer-Verwimp 1989, 1996, Schäfer-Verwimp and Vital 1989, Schuster 1955, 1956, 1963, 1980, Smith 1806, Spruce 1884–85, Stephani 1895, Thiers 1988, Tixier 1980, 1985, 1991, 1994, 1995, Yano 1984, Zhu and So 1999). Now these numbers increase to 36, 22 and 4, respectively. (Among these are not counted those taxa which were or are to be transferred into the genus *Aphanolejeunea* in the sense of Evans 1911, Herzog 1952, Schuster 1980, Thiers 1982, Pócs 1984, 2002, Reiner-Drehwald 1995, Pócs and Lücking 1997, Pócs and Piippo 1999).

## DESCRIPTION OF THE NEW SPECIES

*Cololejeunea ecuadoriensis* Pócs, sp. nov.Subgen. *Cololejeunea* (Spr.) Schiffn.

(Figs 1–3)

*Planta epiphylla magnitudine media, pallide virens, surculis 3–4 mm longis et 0.9–1.4 mm latis. Caulis diametro 46–80 µm. Foliae sigmoideo-ovatae, acutae, 400–900 µm longae et 280–500 µm latae saepe cum cellula apicalis hyalina unica. Stylus filamentosus cellulis 3–8 uniseriatis compositus. Lobulus ovato-lanceolatus dentibus primis bicellularibus, erectis, dentibus secundis obsoletis. Cellulae totae plantae laeves, superficiei sine papillae vel protuberantiae conicae. Gemmae late ellipsoideae vel biapiculatae, 64–68 cellulares, 100–120 µm longae et 120–170 µm latae.*

*Probabiliter dioica, solum plantae femineae videtur perianthiis pyriformibus, 4–5 carinatis, mature ad 780 µm longis et 500 µm latis, innovationibus solitaribus. Seta ad 1500 µm longa. Sporangium ellipsoideum, 300–350 µm longum et 200 µm latum, elateribus 10 (3 vel 2 pro valvis). Sporae protonematales quadricellulares (vel octocellulares), elongato-ellipsoideae, ad 75 µm longae et 20–25 (–40) µm latae, verrucibus sparsim ornatae.*

*Cololejeunea biddlecomiae* (Aust.) A. Evans speciei boreoamericanae affinis sed bene differt magnitudine multo maiore, cellula hyalina apicalis foliae et superficibus cellularum totae plantae laevibus.

Medium sized, pale green plantlet with irregularly branching (*Lejeunea* type branches), 3–4 mm long and 0.9–1.4 mm wide shoots creeping on leaves. Stem 46–80 µm in diameter, composed of 1 row of medullary and 5 rows of cortical cells, of which 1 cell row corresponds the ventral merophyte.

Leaves contiguous to imbricate, falcato-ovate with acute or obtuse apex often tipped by one hyaline cell. Their axis inclines at 70–85° to the stem. Insertion very short bilobed. Central cells of the lobe slightly elongated polygonal, 20–25 × 25–30 µm, the marginal ones isodiametric, 10–15 µm while the basal up to 15 × 35 µm in size. Cell walls slightly incrassate with small trigones but without intermediate thickenings, their surface is completely smooth, without conical protuberances or papillae.

Lobule ovato lanceolate, about 2/5 of lobe length and width, with a bicellular, erect first tooth. Hyaline papilla ental at the inner side of tooth base, in central position. Second tooth obsolete and mostly involute. Stylus filamentosus, uniseriate, 3–8 cells long (up to 500 µm length), oriented parallel to the stem or to the free lobule edge. In the latter case sometimes is hidden by the involute margin. Rhizoid plates 6–8 celled, rhizoids short, densely branching, hyaline. Gemmae relatively rare, wide ellipsoid or kidney shaped, 64–68

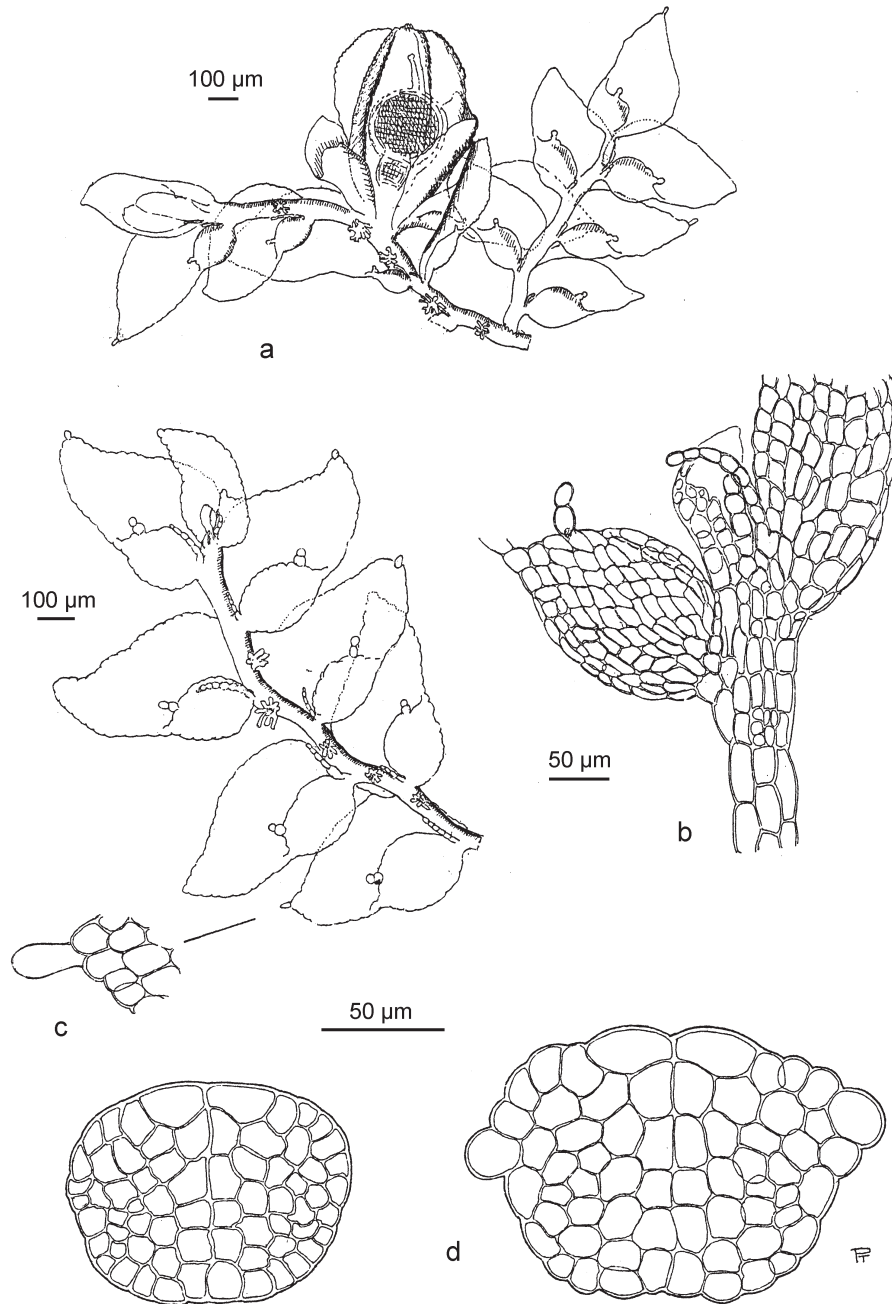


Fig. 1. *Cololejeunea ecuadoriensis* Pócs, sp. nov. – a = Habit, ventral view. b = Growing point, ventral view. c = Hyaline cell on the lobule tip. d = Gemmae. (All drawn from the type)

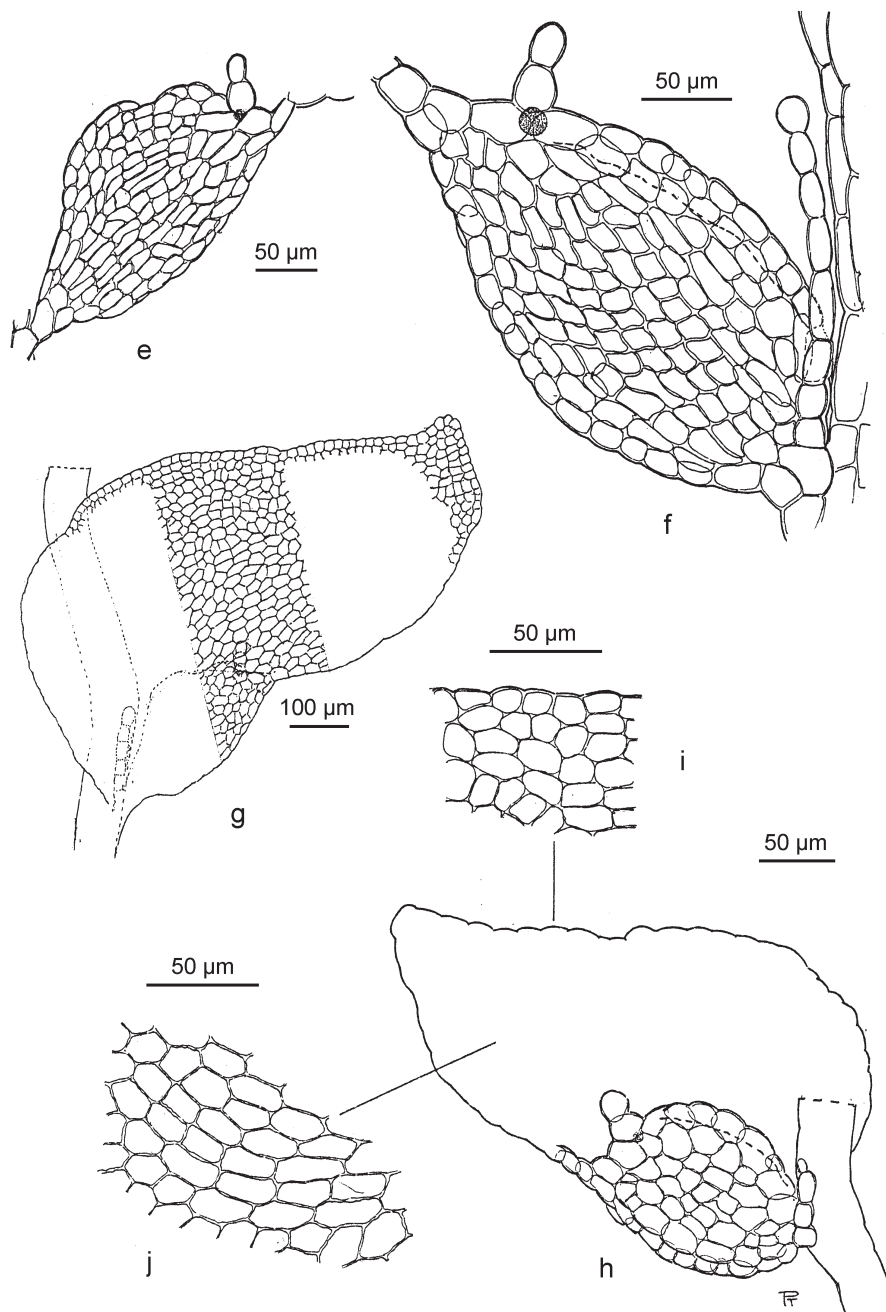


Fig. 2. *Cololejeunea ecuadoriensis* Pócs, sp. nov. – e and f = Lobules, ventral view. g = Leaf, dorsal view. h = Leaf, ventral view. i = Cells from the antical margin of lobe. j = Cells from the centre of lobe. (All drawn from the type)

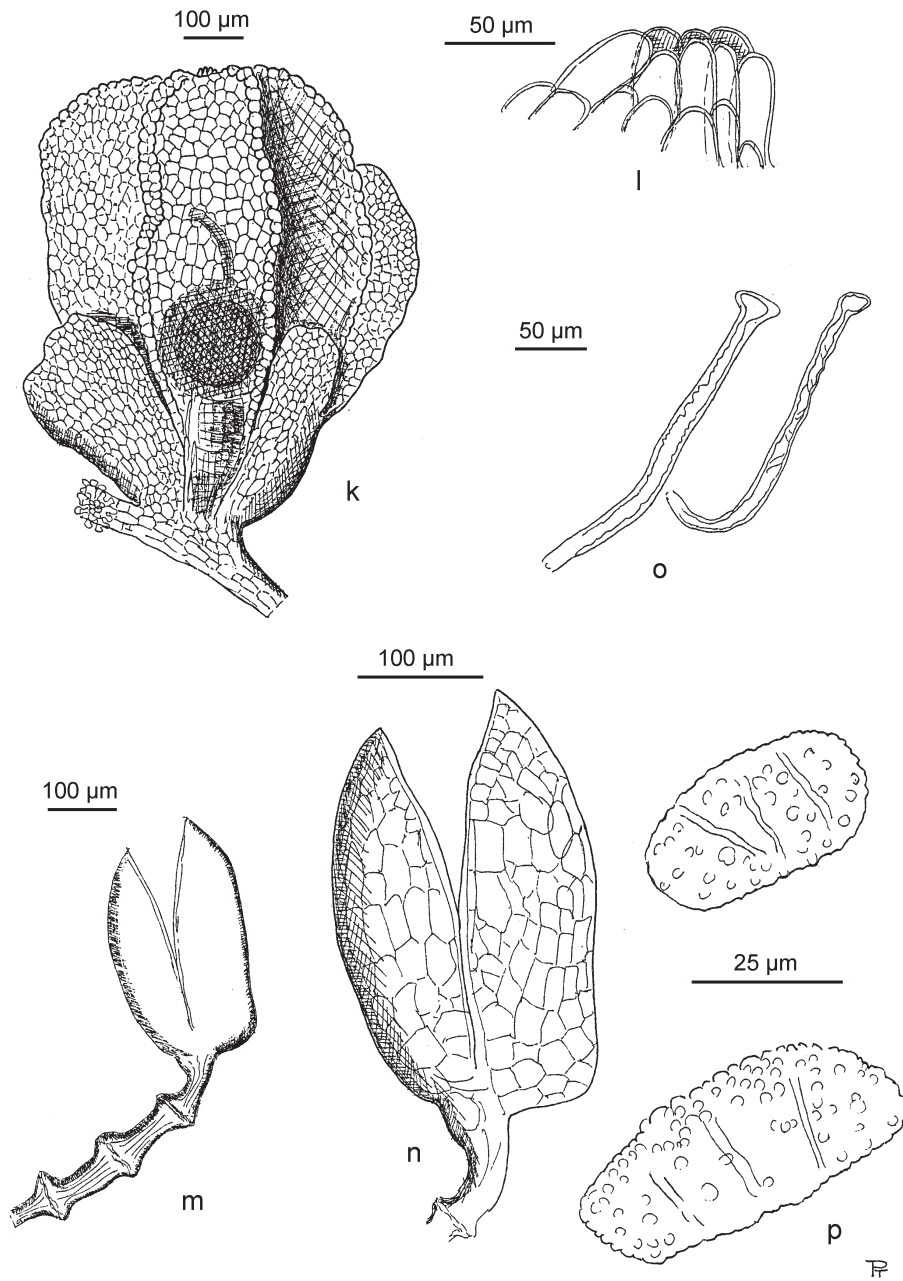


Fig. 3. *Cololejeunea ecuadoriensis* Pócs, sp. nov. – k = Gynoecium, ventral view. l = Perianth beak. m = Upper part of sporophyte. n = Capsule. o = Elaters. p = Multicellular, protonematal spori. (All drawn from the type)

celled, 100–120  $\mu\text{m}$  high and 120–170  $\mu\text{m}$  wide, attached to the lower surface of postical lobule margin.

Probably dioecious, as in the small sample only female plants are present. Gynoecia develop on sessile branches, always subtended by one subfloral innovation, which repeatedly can produce other gynoecia. Bracts of about 3/4 length of mature perianth with obtuse lobule of various length. Perianth up to 780  $\mu\text{m}$  length and 500  $\mu\text{m}$  width, pear shaped with 4 or 5 wings along its whole length. Beak of 1 (seldom 2) cell rows high. Seta 8 articulate, up to 1500  $\mu\text{m}$  length. In elongated state each internode formed by 120–200  $\mu\text{m}$  long cells. Capsule ellipsoid, 300–350  $\mu\text{m}$  long and 200  $\mu\text{m}$  wide. Valves bear 3 or 2, together 10 hyaline elaters with rudimentary spiral thickening. Spori 4 or 8 celled, released in protonematal stage, elongate-ellipsoid, to 75  $\mu\text{m}$  long and 20–25  $\mu\text{m}$  (in 8-cellular stage 40  $\mu\text{m}$ ) wide.

In the Americas only two species, the boreo-temperate *Cololejeunea biddlecomiae* (Aust.) A. Evans and to some extent *Cololejeunea ornata* A. Evans are comparable to the new species by their filamentous stylus. But both North American species are much smaller (the largest leaves of *C. biddlecomiae* are only 400  $\times$  250  $\mu\text{m}$  and the gemmae only 26–32 celled and 60  $\times$  72  $\mu\text{m}$  in size, *C. ornata* is even smaller) and their whole surface (both leaves and perianths) are covered by conically protuberant papillae, which make also the leaf margins denticulate. On the contrary, the leaves of *C. ecuadoriensis* are 400–900  $\mu\text{m}$  long with its surface completely smooth, without any protuberances. In addition the leaf apex of the latter species is often tipped by a solitary hyaline cell.

*Holotype*: Ecuador. Pichincha Province, Guajalito Biological Station 45 km W of Quito, on W slope of Cordillera Occidental, km 59 on old road towards Sto. Domingo de los Colorados, 00°09'S, 78°39'W, 1,800 m, tropical montane rainforest. Coll. R. Lücking s.n., May 1996, EGR (microslide). *Isotype*: QCNE (microslide).

*Distribution*: For the moment the new species seems to be very rare and endemic to Ecuador.

*Cololejeunea schusteri* Pócs, sp. nov.

Subgen. *Platycolea* Schust.

(Figs 4–5)

*Planta epiphylla magnitudine minuta, pallide-viridis, sicca saepe brunnescens, surculis 8–18 mm longis et 0.5–0.75 mm latis, ad folia caespites diametro 1–3 cm formans. Caulis diametro 28–35  $\mu\text{m}$ . Folia asymmetrico falcato-ovata, 300–400  $\mu\text{m}$  longa et 150–200  $\mu\text{m}$  lata, acuta vel obtusa, apicem 1–9 cellulis hyalinis digitiformibus fimbriata. Lobulus ovato-lanceolatus, dentibus primis bicellularibus falcatis, secundis*

*obsoletis. Stylus hyalinus, unicellularis. Gemmae 14–20 cellulares, late ovatus vel rotundatus, diametro ad 70 µm.*

*Autoica. Androecia in caule sub gynoeceo posita, longe pedicellata, 1–4 jugata, bractee archegoniis singularibus. Gynoecea bracteis inaequaliter bilobatis, perianthiis 5-carinatis, obcordatis, carinis tuberculosus, ad 500 µm longis et 400 µm latis. Sporae verrucibus minutis dense ornatae.*

*Cololejeunea cardiocarpae (Mont.) Schust. affinis, sed abhorrens foliis assimetrico-falcatis cellulis lobuli elongatis, dentem primum lobuli incurvati cum papilla hyalina ad basim proximam disposita.*

*Species nova in honorem Professoris Rudolphi M. Schuster, hepaticologi illustrissimi nominata.*

Epiphyllous, pale green, in herbarium mostly brownish, with 8–18 mm long, 0.5–0.75 mm wide, irregularly branching shoots (*Cololejeunea* type branches), forming 1–3 cm large patches on the leaves of higher plants. Stem of 28–35 µm diameter, composed of 1 row of medullary and 5 rows of cortical cells of which 1 represents the ventral merophyte.

Leaves contiguous, asymmetric falcato-ovate with a sinus between the keel and postical margin, 300–400 µm long and 150–200 µm wide. Leaf axis inclines at 45–60° to the stem. Leaf insertion short J shaped. Leaf apex obtuse or acute with 1–9 hyaline cells, restricted to the apical area. Central and basal lobe cells elongate polygonal, 25–35 × 20–25 µm, marginal cells 15–25 × 10–15 µm, with small trigones and with uneven cell wall, often with 1–2 nodulose intermediate thickenings, especially near the base. Lobule about 1/3 of lobe length, ovato-lanceolate, its free margin longer than the keel. The first tooth bicellular, curved downwards, the second tooth is obsolete. The hyaline papilla is proximally disposed to the first tooth. The lobule cells are elongate or sigmoid, much longer than wide, 20–40 × 10–15 µm, with even, thin walls. Style represented by one hyaline cell. Rhizoid plate of 4–8 cells, rhizoids adherent to the substrate leaf surface, often form very regular round shaped, disc-like adhesive structures of 20–100 µm diameter (see Fig. 5e), which, when detached, probably serves also for vegetative propagation. 14–20 celled gemmae up to 70 µm diameter abundantly (up to 12) develop on the lower leaf surface of some plantlets.

Autoecious. Long stalked male branches develop in large number below the gynoeceum, consisting of 1–4 pairs of acute bracts, each with one androeceum. Gynoeceum usually on shoot tips, always with one innovation. Female bracts 1/2–1/5 length of mature perianth, with a much shorter and narrower lobule. Perianth obcordate, slightly flattened, 5 carinate with tuberculate margin only in its upper part. Beak 25–30 µm high, formed by one row of 6–10 cells, each curved slightly inwards. Spore unicellular, irregularly elongate-quad-rangular, 45–50 × 12–25 µm with densely and minutely verruculose surface.



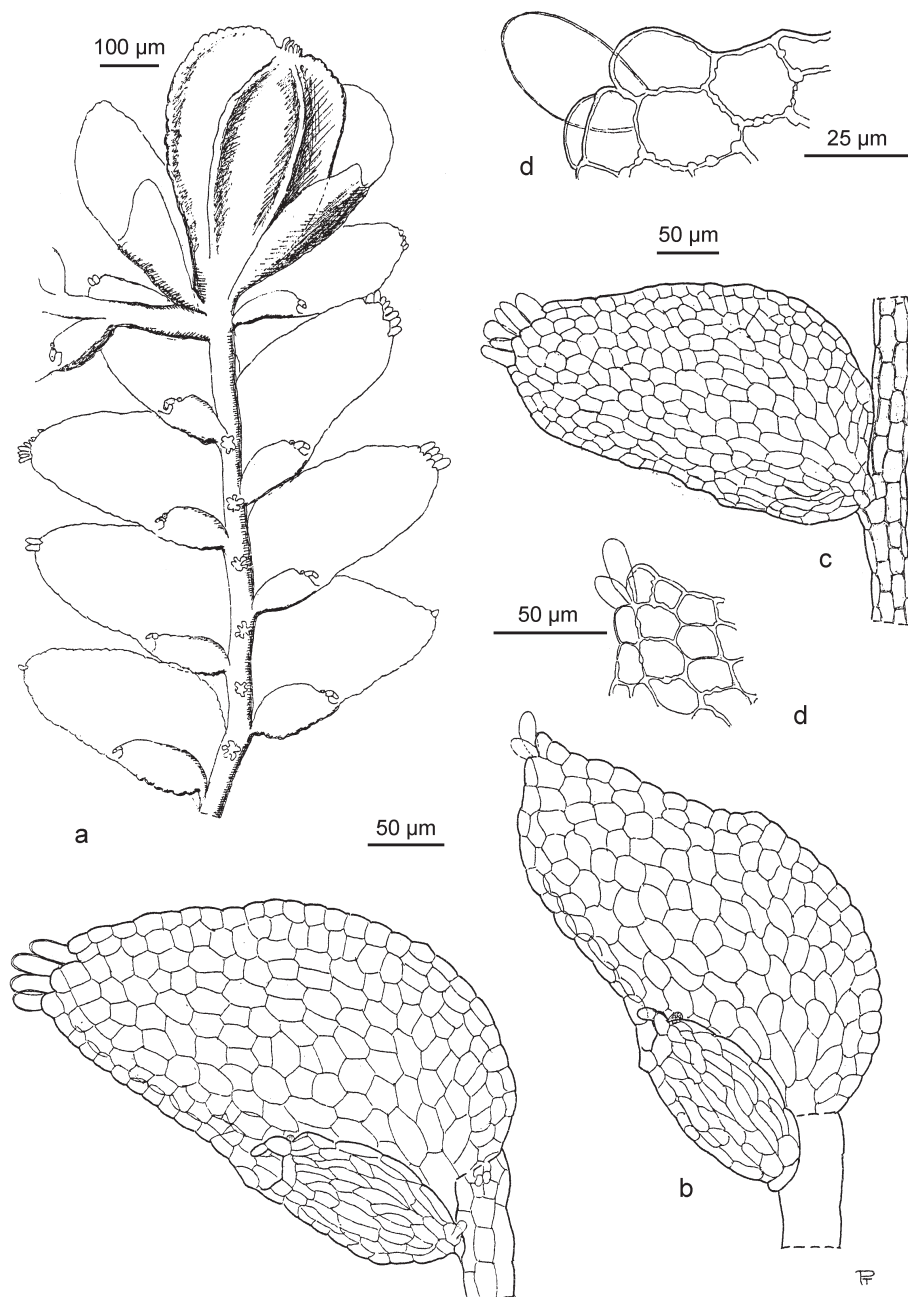


Fig. 4. *Cololejeunea schusteri* Pócs, sp. nov. – a = Habit, ventral view. b and c = Leaves, ventral view. d = Hyaline cells at leaf apex. (All drawn from the type)



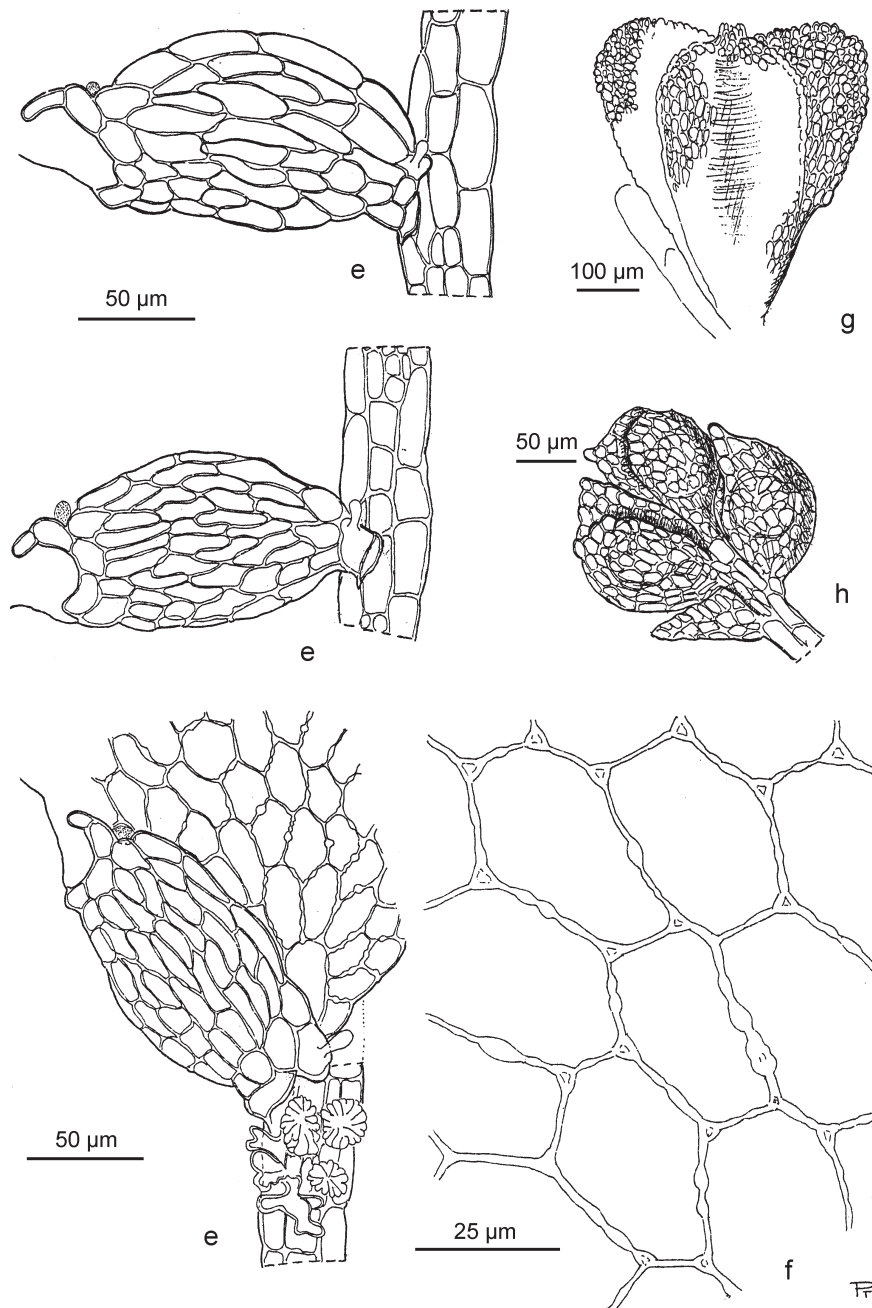


Fig. 5. *Cololejeunea schusteri* Pócs, sp. nov. – e = Leaf bases with lobule and style, ventral view. f = Cells from the lobe centre. g = Perianth. h = Male branch. (All drawn from the type)

The species belongs to a group (Cardiocarpae) best represented by the Pantropical *Cololejeunea cardiocarpa* (Mont.) Schust., characterised by the finger-like hyaline cells restricted to the uppermost, apical part of the lobe. In the Neotropics this group is represented by several species (*C. cardiocarpa*, *C. micrandroecia*, *C. subcardiocarpa*, *C. minutilobula*, *C. verwimpai*), but *Cololejeunea schusteri* differs from all of them by its falcate leaf shape, with downward curved first lobule tooth and by the very elongate, sometimes sigmoid lobule cells. The species is named to honour its collector, Professor Rudolf M. Schuster, the renowned hepaticologist.

*Holotype*: Brazil, Amazonia, along Rio NW of São Gabriel, near the mouth of Rio Uaupes, riverside forest; 00°05'–08'S, 67°10'W, together with *Aphanolejeunea gracilis* Jovet-Ast, *Cololejeunea subcardiocarpa* Tixier and *Cololejeunea surinamensis* Tixier. Coll. R. M. Schuster, No. 79–20–1040; Date 21 July 1979. NY. Isotype: EGR.

*Paratype*: Same locality. Coll. R. M. Schuster, No. 79–20–1042; Date 21 July 1979. NY. Isoparatype: EGR.

*Distribution*: The species seems to be widespread in the central Amazonian Hylea.

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## REFERENCES

- Benedix, E. H. (1953): Indomalayische Cololejeuneen. Eine Revision tropischer Lebermoose. – *Feddes rept., Beih.* **134**: 1–88, T. 1–31.
- Evans, A. W. (1902): The Lejeuneaceae of the United States and Canada. – *Mem. Torrey Bot. Club* **8**: 113–183, Pl. 16–22.
- Evans, A. W. (1911): Hepaticae of Puerto Rico. 10. Cololejeunea, Leptocolea and Aphanolejeunea. – *Bull. Torrey Bot. Club* **38**: 251–286, Pl. 11–12.
- Evans, A. W. (1918): Noteworthy Lejeuneae from Florida. – *Amer. J. Bot.* **5**: 131–150.
- Gradstein, S. R., Churchill, S. P. and Salazar-Allen, N. (2001): Guide to the bryophytes of tropical America. – *Mem. N. Y. Bot. Garden* **86**: 1–577.
- Herzog, Th. (1931): Die Moose der Ph. v. Lützelburgschen Reisen durch Nordbrasilien. – *Hedwigia* **71**: 332–350.
- Herzog, Th. (1951): Hepaticae Standleyanae Costaricensis et Hondurenses. Pars II. – *Rev. Bryol. Lichénol.* **20**: 126–175.
- Herzog, Th. (1952): Hepaticae Ecuadorienses a Cl. D:re Gunnar Harling annis 1946–1947 lectae. – *Svensk Bot. Tidskr.* **46**: 62–108.

- Horikawa, Y. (1931): Studies on the Hepaticae of Japan IV. – *J. Sc. of Hiroshima Univ., Ser. B., Div. 2*(1): 13–35.
- Mizutani, M. (1961): A revision of Japanese Lejeuneaceae. – *J. Hattori Bot. Lab.* **24**: 115–302.
- Montagne, C. (1842): *Plantes Cellulaires, Familia X. Hepaticae, Juss.* – In: de la Sagra, R. (ed.): *Histoire physique, politique et naturelle de l'île Cuba, Botanique I.* pp. 427–492, pl. 18–19.
- Morales, M. I. and Dauphin, G. (1998): A new species of Cololejeunea (Lejeuneaceae: Cololejeuneoideae) from Panama. – *Tropical Bryology* **14**: 133–136.
- Pócs, T. (1984): Present knowledge on Aphanolejeunea Evans. – *J. Hattori Bot. Lab.* **55**: 307–313.
- Pócs, T. (1996): Epiphyllous liverwort diversity at worldwide level and its threat and conservation. – *Anales Inst. Bot., UNAM, Ser. Bot.* **67**(1): 109–127.
- Pócs, T. (2002): Aphanolejeunea, Cololejeunea. – In: Gradstein, S. R. and Pinheiro da Costa, D. (eds): *The Hepaticae and Anthocerotae of Brazil. – Mem. N. Y. Bot. Garden* **88**. [in press]
- Pócs, T. and Lücking, A. (1997): The genus Aphanolejeunea A. Evans in the Guianas. – *Haussknechtia, Beih.* **7**: 26–27.
- Pócs, T. and Piippo, S. (1999): Bryophyte flora of the Huon Peninsula, Papua New Guinea. LXIV. Aphanolejeunea (Lejeuneaceae, Hepaticae). – *Acta Bot. Fennica* **165**: 85–102.
- Reiner-Drehwald, M. E. (1994): Las Lejeuneaceae (Hepaticae) de Misiones, Argentina II. Cololejeunea. – *Tropical Bryology* **9**: 79–88.
- Reiner-Drehwald, M. E. (1995): Las Lejeuneaceae (Hepaticae) de Misiones, Argentina IV. Aphanolejeunea. – *Tropical Bryology* **10**: 29–39.
- Robinson, H. (1964): New taxa and new records of bryophytes from Mexico and Central America. – *Bryologist* **67**(4): 446–458.
- Schäfer-Verwimp, A. (1989): New or interesting records of Brazilian bryophytes, II. – *J. Hattori Bot. Lab.* **67**: 313–321.
- Schäfer-Verwimp, A. (1996): New or interesting records of Brazilian bryophytes, V. – *Candollea* **51**: 283–302.
- Schäfer-Verwimp, A. and Vital, D. M. (1989): New or interesting records of Brazilian bryophytes. – *J. Hattori Bot. Lab.* **66**: 255–261.
- Schuster, R. M. (1955): North American Lejeuneaceae II. Paradoxae: the genera Aphanolejeunea and Leptocolea. – *J. Elisha Mitchell Sci. Soc.* **71**(1): 126–148.
- Schuster, R. M. (1956): North American Lejeuneaceae IV. Paradoxae: Cololejeunea (Concl.), Diplasiolejeunea. – *J. Elisha Mitchell Sci. Soc.* **72**(1): 88–125.
- Schuster, R. M. (1963): An annotated synopsis of the genera and subgenera of Lejeuneaceae. I. – *Nova Hedwigia, Beih.* **9**: 1–203.
- Schuster, R. M. (1980). *The Hepaticae and Anthocerotae of North America, east of the Hundredth Meridian*. Vol. IV. – Columbia University Press, New York.
- Smith, J. E. (1806): *Jungermannia minutissima*. – In: Sowerby, J. (ed.)(1790–1841): *English Botany*. London, **36**: Pl. 1633.
- Spruce, R. (1884–1885): Hepaticae amazonicae et andinae. (Hepaticae of the Amazon and of the Andes of Peru and Ecuador). – *Trans. Proc. Bot. Soc. Edinburgh* **15**: 1–530, Pl. 1–22.
- Stephani, F. (1895): Hepaticarum species novae. VIII. – *Hedwigia* **34**: 232–253.
- Thiers, B. (1982): Branching in the Lejeuneaceae I: A comparison of branch development in Aphanolejeunea and Cololejeunea. – *Bryologist* **85**: 104–109.
- Thiers, B. (1988): The Australian species of Cololejeunea. – *Nova Hedwigia, Beih.* **90**: 113–146.

- Tixier, P. (1980): Contribution à l'étude du genre *Cololejeunea* (Lejeuneaceae) IX. Espèces nouvelles du sous genre *Pedinolejeunea* (Ben.) Mizutani en région néotropicale. – *Bradea* **3**(6): 35–44.
- Tixier, P. (1985): Contribution à la connaissance des *Cololejeuneoideae*. – *Bryophytorum Bibliotheca*, Cramer, Vaduz, **27**: 1–439.
- Tixier, P. (1991): Bryophyta exotica. 9. Quelques Lejeuneaceae (Hépatiques) nouvelles pour l'Amérique du Sud. – *Candollea* **46**: 267–302.
- Tixier, P. (1994): Contributions à la biogéographie dans l'hémisphère austral, distribution de quelques hépatiques tropicales. – *Mém. Soc. Biogéogr.* **4**: 95–110.
- Tixier, P. (1995): Rectifications nomenclaturales. Typification. – *Cryptogamie, Bryol. Lichénol.* **16**: 229–230.
- Yano, O. (1984): Checklist of Brazilian liverworts and hornworts. – *J. Hattori Bot. Lab.* **56**: 481–548.
- Zhu, R-L. and So, M. L. (1998): Notes on the taxonomy and distribution of *Cololejeunea platyneura* (Hepaticae, Lejeuneaceae). – *Ann. Bot. Fennici* **35**: 229–232.