

Liverworts new to Ecuador with description of *Plagiochila priceana* sp. nov. and *Syzygiella burghardtii* sp. nov.

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Abstract – Based on our ongoing studies of the bryophyte flora of Ecuador we report fifteen liverwort species new to the country: *Cheilolejeunea ornata*, *Drepanolejeunea integribracteata*, *Frullania lindenbergii*, *Kymatocalyx rhizomatica*, *Lejeunea corynantha*, *Leptoscyphus cleefii*, *L. spectabilis*, *Plagiochila bicuspidata*, *P. cuatrecasii*, *P. priceana*, *Radula xalapensis*, *Symphyogyna trivittata*, *Syzygiella burghardtii*, *S. contigua* and *S. trigonifolia*. Notes are provided on the distribution, habitat and taxonomic differentiation of the species. *Plagiochila priceana* and *Syzygiella burghardtii* are new to science and *Plagiochila inouei* is a new synonym of *P. bicuspidata*. Keys are presented to northern Andean species of *Leptoscyphus* and *Syzygiella*.

***Leptoscyphus* / liverworts / Marchantiophyta / new floristic report / *Plagiochila* / *Syzygiella* / taxonomy**

Resumen – Basado en nuestros estudios florísticos de briófitas en Ecuador se registraron quince especies de hepáticas nuevas para Ecuador: *Cheilolejeunea ornata*, *Drepanolejeunea integribracteata*, *Frullania lindenbergii*, *Kymatocalyx rhizomatica*, *Lejeunea corynantha*, *Leptoscyphus cleefii*, *L. spectabilis*, *Plagiochila bicuspidata*, *P. cuatrecasii*, *P. priceana*, *Radula xalapensis*, *Symphyogyna trivittata*, *Syzygiella burghardtii*, *S. contigua* and *S. trigonifolia*. Se proporciona información del hábitat y distribución geográfica para todas las especies, así como también las diferencias taxonómicas. *Plagiochila priceana* y *Syzygiella burghardtii* son nuevas para la ciencia y *Plagiochila inouei* es un nuevo sinónimo de *P. bicuspidata*. Se presentan claves de las especies de *Leptoscyphus* and *Syzygiella* para Ecuador y Colombia.

Ecuador / hepáticas / *Leptoscyphus* / Marchantiophyta / nuevos registros florísticos / *Plagiochila* / *Syzygiella* / taxonomía

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INTRODUCTION

Ecuador has a very rich bryophyte flora. More than 1720 species have been recorded, including over 950 mosses and 770 liverworts (Churchill *et al.*, 2000; León-Yáñez *et al.*, 2006; Schäfer-Verwimp *et al.*, 2013). The country has almost as many species as Colombia even though the surface area of Ecuador is more than four times smaller. In recent years, much attention has been given to liverworts of Ecuador (see Schäfer-Verwimp *et al.*, 2013 for review) and as a result the total number of liverwort species recorded from the country has increased with about ten percent since the publication of the most recent checklist (León-Yáñez *et al.*, 2006). On average, one new liverwort species per year has been described from Ecuador during the last ten years, and this trend is continuing (Crandall-Stotler & Gradstein, 2017; Gradstein & León-Yáñez, 2017).

Based on our ongoing studies on the liverwort flora of Ecuador we have detected 15 species new to the country. Two of these, *Plagiochila priceana* Gradst. & Benitez and *Syzygiella burghardtii* Gradst. & Benitez, are new to science. Here we present the new records together with notes on the taxonomy, distribution and habitats (Figs 1-5) of the species. Specimens have been deposited in the herbaria of the Universidad Técnica Particular de Loja (HUTPL) and the Pontificia Universidad Católica del Ecuador, Quito (QCA), with duplicates in GOET and PC.

RESULTS AND DISCUSSION

Cheilolejeunea ornata C.Bastos

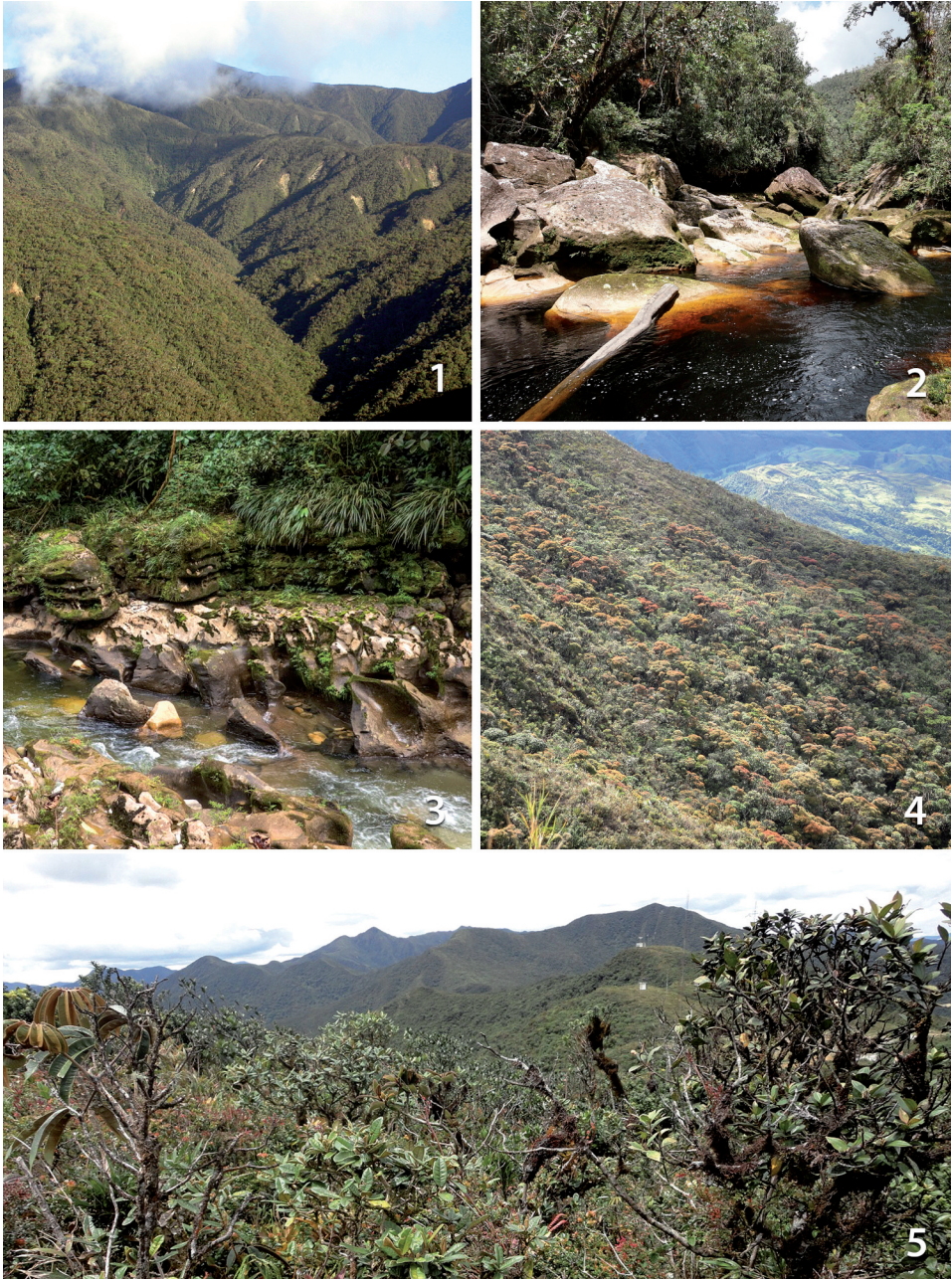
SPECIMEN EXAMINED. Zamora Chinchipe: Reserva Biológica San Francisco (Fig. 1), 1890 m, on bark of tree in lower montane rainforest, April 2003, A. Schäfer-Verwimp & M. Preußing 23259A (PC, hb. Schäfer-Verwimp). GENERAL DISTRIBUTION: eastern Brazil (Bahia), Ecuador (new).

Cheilolejeunea ornata is a rare species from eastern Brazil that is reported here as new to Ecuador. The species is similar to *C. oncophylla* in general habit but is readily distinguished from the latter by the large, 7-10 μm high, tubercle-like papillae (one per cell) on leaf lobe, lobule and keel (Bastos, 2011). In *C. oncophylla* the papillae are low, lens-shaped, 2-3 μm high. Moreover, *C. ornata* is dioicous (*C. oncophylla* is autoicous). The Ecuadorian specimen slightly differs from the type by the obtuse to subacute leaf apex (acute to apiculate in the type).

Drepanolejeunea integribracteata Bischler

SPECIMEN EXAMINED. Zamora Chinchipe: Reserva Biológica Cerro Plateado, Río Numputakaima (Fig. 2), 1540 m, on wet soil along river, periodically submerged, 20 August 2012, A. Benitez 548 (HUTPL, PC). GENERAL DISTRIBUTION: Brazil (upper Rio Negro), Ecuador (new).

Drepanolejeunea integribracteata was known only from the type locality along the upper Rio Negro, Brazil, and is here newly reported from Ecuador. The species is close to *D. crassiretis* A.Evans from the West Indies, Brazil and Ecuador. Both have convex, suberect, rather short and broad leaves (1.5-2 \times longer than wide) with a conspicuously dilated dorsal leaf margin and 2 ocelli in an unbroken row at the leaf base. *Drepanolejeunea integribracteata* differs from *D. crassiretis* by the sharp angle between keel and ventral lobe margin, and by the



Figs 1-5. Localities of liverwort species new to Ecuador. 1. Reserva Biológica San Francisco. 2. Río Numpatakaima, Reserva Biológica Cerro Plateado. 3. Río Anzu Forest Reserve. 4. Parque Nacional Podocarpus (Cajanuma). 5. Pass El Tiro. Photographs by A. Benitez (2, 4, 5), J. Homeier (1) and L. Jost (3).

lobule not being prolonged along the ventral margin (keel and ventral lobe margin forming a continuous line and lobule prolonged along the ventral margin in *D. crassiretis*). The Ecuadorian material of *D. integribracteata* deviates slightly from the type by having obtuse to subacute leaves, with the tip consisting of a single cell. In the type material the leaf tip consists of 2 superposed cells.

***Frullania lindenbergii* Lehm.**

SPECIMENS EXAMINED. Zamora Chinchipe: Reserva Biológica San Francisco (Fig. 1), ca. 1900 m, on canopy branches of trees in disturbed montane forest and isolated trees in meadows, 2002, *N. Nöske* 391, 1729 (GOET). GENERAL DISTRIBUTION: East Africa, Tristan da Cunha, southern Brazil, Dominican Republic, Ecuador (new).

Frullania lindenbergii is a common East African species that is rare in tropical America (Schäfer-Verwimp & Pócs, 2009). The species is recognized by: 1) plants small (ca. 1 mm wide), creeping, pale reddish-brown, densely (bi)pinnately branched with numerous small, microphyllous branches; 2) leaf apices rounded on main stems and rounded to bluntly apiculate on branches; 3) leaf-like appendage at the ventral base of *Frullania*-type branches undivided; 4) lobules cylindrical, positioned at considerable distance from stem; 5) leaf cells \pm isodiametric, with distinct trigones distinct and not lined by a darkish wall; 6) underleaves 2-4 \times stem width, outer margin entire or toothed; 8) autoicous, female bracts and bracteoles entire or toothed.

Frullania lindenbergii superficially resembles *F. exilis* but the latter species is readily separated from *F. lindenbergii* by the presence of a group of large, ocelli-like cells at the leaf base. Nöske *et al.* (2003) recorded the paleotropical *F. serrata* Gottsche from the same locality as *F. lindenbergii*. We have not seen the material of *F. serrata* but suggest that it might possibly belong to *F. lindenbergii* because “*F. serrata*” in the key to *Frullania* species in Gradstein & Costa (2003) refers to *F. lindenbergii*.

***Kymatocalyx rhizomatica* (Herzog) Gradst. & Vána**

SPECIMEN EXAMINED. Pichincha: old road from Quito to Santa Domingo, Río Toachi, 1100 m, on moist earth along the road, July 1991, *T. Arts* 17/007 (PC). GENERAL DISTRIBUTION: widely distributed in the Tropics but highly scattered; recorded from Borneo, Madagascar, Panama, French Guiana (?; see Gradstein & Ilkiu-Borges, 2009), Colombia, Ecuador (new).

Kymatocalyx Herzog is represented in the Neotropics by two species, *K. dominicensis* (Spruce) Vána and *K. rhizomatica* (Gradstein & Vána, 1999). The latter species is separated from *K. dominicensis* by its very small size (stem only a few mm long in the Ecuadorian plant), pale green color and elongate, short-bifid leaves (dark green, leaves suborbicular, undivided or emarginate in *K. dominicensis*). Moreover, the leaves in *K. rhizomatica* are more laterally attached to the stem and the leaf-free strip on the dorsal side of stem is wider, 2-6 cells wide.

***Lejeunea corynantha* Spruce**

SPECIMEN EXAMINED. Azuay: páramo de Patococha, 3700 m, on litter in humid páramo with *Plagiochila cuatrecasii*, 2009, *V. Caden* s.n. (QCA, det. M.E. Reiner-Drehwald). GENERAL DISTRIBUTION: West Indies, Panama, Ecuador (new).

Lejeunea corynantha is a rare Caribbean species that is newly reported here from Ecuador. The species resembles the widespread *L. capensis* Gottsche in having terete perianths but differs by larger lobules (1/2 \times lobe length), smaller underleaves (ca. 2 \times stem width), strongly convex leaf lobes, a smooth cuticle and longly exerted perianths without beak (Reiner-Drehwald & Schäfer-Verwimp, 2008).

Leptoscyphus cleefii Fulford

SPECIMEN EXAMINED. Pichincha: road Quito to Baeza, páramo southwest of Papallacta pass, 4056 m, on wet ground in boggy grass páramo, 0°20'54"S 78°12'46"W, April 2008, *M. Burghardt et al. s.n.* (QCA). GENERAL DISTRIBUTION: northern Andes (Colombia, Ecuador).

Leptoscyphus cleefii is a rare species of páramo bogs that is recognized by the leaves with 1-4 long cilia on the lower half of the ventral leaf margin. In addition, a few scattered cilia may be present higher up along the ventral margin, up to the apex. The plants are flaccid, brown to blackish in color and rather small (ca. 1.5-2.5 mm wide), and the leaves are asymmetrically ovate-orbicular with a rounded apex and an expanded ventral margin that is often recurved near the base. The leaf cells are thin-walled with small trigones and a smooth to finely papillose cuticle, and the underleaves are small (to 2× stem width), deeply bifid and with a long tooth on the outer margins. *Leptoscyphus cleefii* approaches *L. spectabilis* but clearly differs from the latter species by the asymmetrical leaves with strongly arched and often recurved ventral margin.

Leptoscyphus spectabilis (Steph.) Grolle

SPECIMENS EXAMINED. Loja: Podocarpus National Park, Cajanuma (Fig. 4), 2850-2900 m, on humic soil in humid upper montane forest, 12 September 2009, *A. Benitez & S.R. Gradstein* 295 (HUTPL); *ibid.*, January 2011, *A. Schäfer-Verwimp & M. Nebel* 31838 (PC, hb. Schäfer-Verwimp). GENERAL DISTRIBUTION: southeastern Brazil, Ecuador (new).

Leptoscyphus spectabilis is a rare Brazilian species that is reported here for the first time from Ecuador and the Andes. The species resembles the common *L. amphibolius* (Nees) Grolle in the subsymmetrical leaves with a rounded, entire apex but differs by the presence of 1-3 cilia on the ventral leaf margin (Fulford, 1976, as *H. arnellii* Fulford). The discovery of *L. cleefii* and *L. spectabilis* raises the number of *Leptoscyphus* species known from Ecuador and the northern Andes to 15 (Gradstein, in prep.).

The northern Andean species of *Leptoscyphus* are keyed out as follows:

1. Plants autoicous and always highly fertile, with numerous perianths. Perianth inflated, terete, apex rounded and with a very small opening (= mouth). On twigs in (sub)páramo, only known from Ecuador *L. autoica* (J.J.Engel & Gradst.) Vanderp. *et al.*
1. Plants dioicous, fertile or sterile. Perianth (when present) ± laterally compressed, apex broadly truncate and with a wide mouth, the mouth about as wide as the perianth 2
 2. Leaf apex toothed in all leaves 3
 2. Leaf apex in most leaves entire (but ventral leaf margin sometimes toothed) 4
3. Leaf margin bordered by thicker-walled cells. Leaves with 2-4 cilia near apex. Leaf cells very thin-walled, with small trigones *L. leoniae* (Gradstein & León-Yáñez, 2017)
3. Leaf margin not bordered by thicker-walled cells. Leaves with (3)-4-15 cilia. Leaf cells with small to large trigones *L. trapezoides* (Mont.) L.Söderstr.
 4. Ventral leaf margin with one or more teeth (sometimes only with a short tooth at the base) 5
 4. Ventral leaf margin fully entire 8
5. Trigones of leaf cells very large, bulging, cell-lumina stellate. Teeth on leaves restricted to the ventral leaf base 6

5. Trigones small, not bulging, cell-lumina rounded. Teeth not restricted to the ventral leaf base7
6. Plants robust, 4-5 mm wide. Ventral leaf base with one short tooth. Leaf cells 25-40 μm in diameter in the upper half of the leaf.....*L. hexagonus* (Nees) Grolle
6. Plants smaller, 2-3 mm wide. Ventral leaf base with 1-3 teeth. Leaf cells 20-30 μm in the upper half of the leaf.....*L. jackii* (Steph.) Grolle
7. Leaves asymmetrical, ventral margin expanded (more strongly arched than the dorsal margin) and often recurved in the lower half. In páramo bogs .. *L. cleefii*
7. Leaves subsymmetrical, ventral margin not expanded, plane. On soil in upper montane forest.....*L. spectabilis*
8. Plants tiny, thread-like, less than 2 mm wide. Underleaves undivided or bifid. Cells in the upper part of leaf 15-24 μm in diameter9
8. Plants larger. Underleaves bifid. Cells in the upper part of leaf larger, (20-)25-35 μm10
9. Underleaves mostly undivided, lanceolate*L. cuneifolius* (Hook.) Mitt. subsp. *fragilis* (J.B.Jack & Steph.) Grolle
9. Underleaves bifid*L. intermedius* Grolle
10. Trigones small, cell-lumina rounded.....*L. amphibolius*
10. Trigones large, cell-lumina sinuate to stellate11
11. Underleaves small, 1-2 \times stem width, bifid to more than half of underleaf length. Ventral leaf base not expanded, leaves symmetrical12
11. Underleaves larger, 3-5 \times stem width, bifid to less than half of underleaf length. Ventral leaf base \pm expanded, leaves asymmetrical.....13
12. Leaf apex undivided, rounded. Perianth mouth \pm entire.....*L. porphyrius* (Nees) Grolle
12. Leaf apex emarginate to short-bifid with rounded lobes. Perianth mouth coarsely toothed.....*L. obcordatus* (Spruce) Grolle
13. Underleaves emarginate or short-bifid to 1/5, the two lobes short obtuse to acute. Outer margins of underleaves entire or with 1-2 obscure teeth. Cuticle smooth.*L. physocalyx* (Hampe & Gottsche) Gottsche
13. Underleaves more deeply bifid, the two lobes long acuminate. Outer margins of underleaves with one or several long teeth. Cuticle striate-papillose or smooth....14
14. Cuticle of leaves striate-papillose towards leaf base. Underleaf bases connate with leaves on both sides. Occurrence in Ecuador questionable (see Schäfer-Verwimp *et al.*, 2013).....*L. gibbosus* (Taylor) Mitt.
14. Cuticle of leaves fully smooth. Underleaf bases free*L. sotiauxii* Vanderp. *et al.*

Plagiochila bicuspidata Gottsche

SPECIMENS EXAMINED. Azuay: El Cajas, 3930 m, on bark of *Polylepis reticulata* in humid *P. reticulata* forest in páramo, 2°46'27"S, 79°13'14"W, 2 March 2017, S.R. Gradstein, A. Benitez & S. León-Yáñez 12647, c.gyn. (PC, QCA). Galápagos Islands: Isabela, Cerro Azul, 750 m, on lava rock, 22 Juni 1976, S.R. Gradstein H426, ster., type of *P. inouei* Grolle, **syn. nov.** (**isotype**: U); Santa Cruz, Mt. Crocker, 800 m, on exposed lava rock, 15 April 1976, S.R. Gradstein H37, ster., paratype of *P. inouei* Grolle, (**isoparatype**: U). GENERAL DISTRIBUTION: scattered in Central America (Mexico, Costa Rica) and the northern Andes (Venezuela, Ecuador) above 3000 m; at lower elevation on the Galápagos Islands and in Chile.

Plagiochila bicuspidata is rare in the Neotropics (Groth *et al.*, 2004) and is newly recorded from the mainland of Ecuador. It was described from the Galapagos Islands as *P. nudiuscula* Inoue nom. illeg. (Inoue, 1977) (= *P. inouei* Grolle), which is a synonym. Characters of *P. bicuspidata* include: 1) plants small, ca. 2 mm wide, when fresh usually with a peppermint smell; 2) leaves distant, ventrad, narrowly oblong, 1.8-2.3× longer than wide, bifid to 1/4-1/3, margins entire or dorsal margin with a tooth, leaf bases not or little decurrent; 3) cells 25-33 µm wide in midleaf, 1-1.5× longer than wide, trigones conspicuous, vitta lacking, cuticle smooth; 4) vegetative reproduction by caducous leaves. By the small plants with narrowly oblong, bifid leaves, *P. bicuspidata* resembles *P. cuneata* and *P. tenuis* but *P. cuneata* has fragmenting leaf lobes and *P. tenuis* has a papillose cuticle.

***Plagiochila cuatrecasii* H. Rob.**

SPECIMEN EXAMINED. Azuay: páramo de Patococha, 3700 m, on litter in humid páramo vegetation with *Lejeunea corynantha*, 2009, V. Cadena *et al. s.n.*, c.gyn. (PC, QCA). GENERAL DISTRIBUTION: Colombia, Ecuador (new).

Plagiochila cuatrecasii is one of the smallest species in the genus and a rare páramo element. Characteristic are: 1) plants less than 1 mm wide, branching intercalary, rhizomatous base lacking; 2) leaves distant, ovate-orbicular to subquadrate, apex rounded to retuse, margins entire, plane or dorsal margin slightly recurved, bases hardly decurrent; 3) cells ca. 20-25 µm wide in midleaf, trigones large, cuticle smooth. By its entire leaves *P. cuatrecasii* approaches *P. cleefii* and *P. revolvens*, which are also characteristic of páramo. The latter two species, however, are larger (plants more than 1 mm wide), the dorsal leaf bases are longly decurrent and a short vitta is present in the leaves. *Plagiochila cleefii*, moreover, is yellowish-green to yellowish-brown in color, not dark brown. *Plagiochila cuatrecasii* is confusingly similar to *Leptoscyphus cuneifolius*, which may occur in the same habitat. However, *L. cuneifolius* has underleaves.

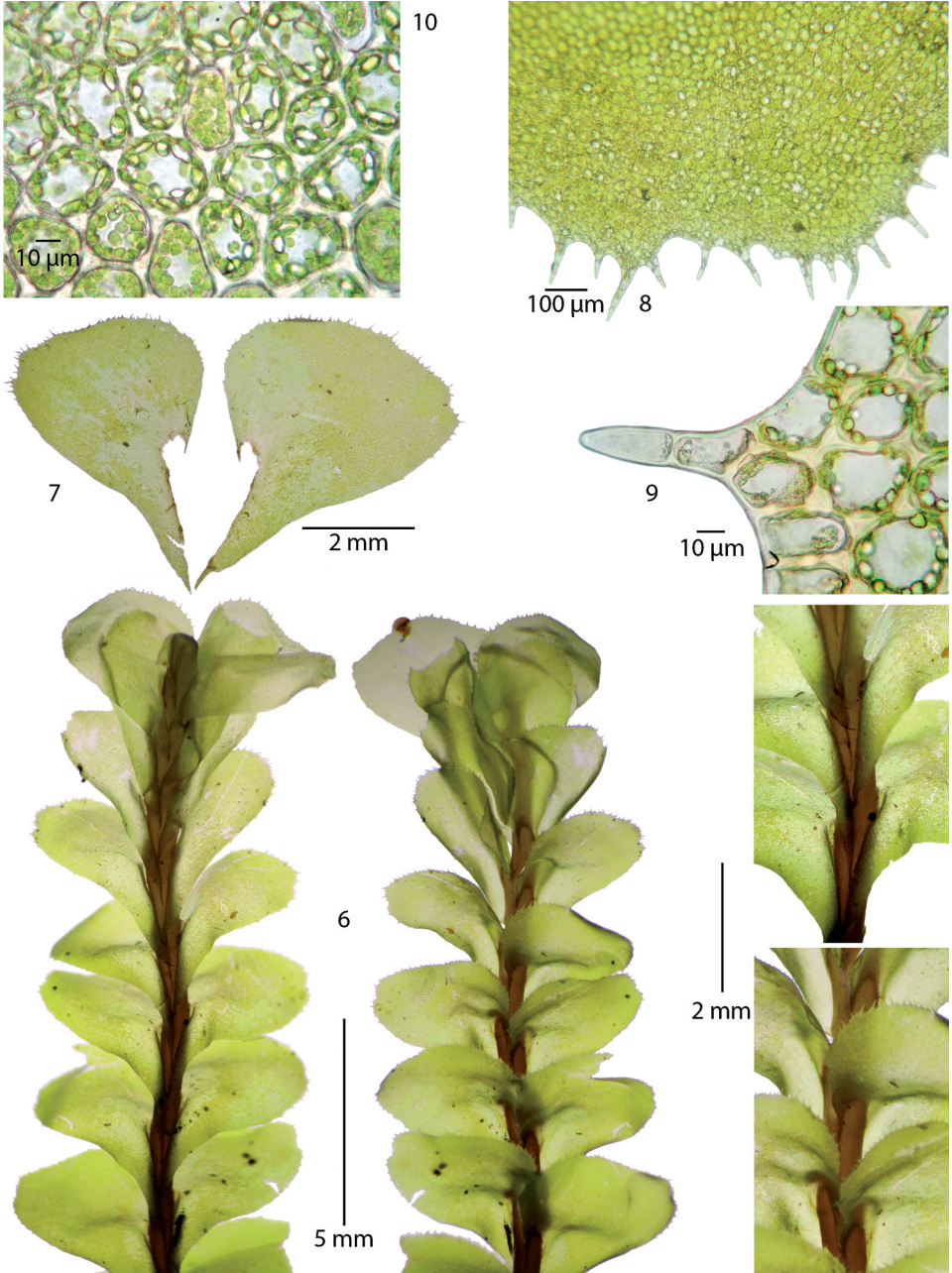
***Plagiochila priceana* Gradst. & Benitez sp. nov.**

Figs 6-10

Close to *P. ovata* but differing by leaves ovate-triangular, with 35-65 teeth and without border of thick-walled cells.

Type. Azuay: El Cajas, 3930 m, on humus over large rock in humid *Polylepis reticulata* forest in páramo, 2°46'27"S, 79°13'14"W, 2 March 2017, S.R. Gradstein, A. Benitez & S. León-Yáñez 12647, ster. (**holotype**: QCA; **isotypes**: G, HUTPL, PC 0728079). **Paratype.** Ibid., on the floor of *Polylepis reticulata* forest, damp condition, 5 October 1995, M. Price 30, ster. (PC 0728078, QCA). GENERAL DISTRIBUTION: only known from *Polylepis reticulata* forest in the páramo of El Cajas, Ecuador.

Plants robust, ca 10-13 cm long, ca 5 mm wide when moist, bright yellowish-green, becoming pale brown in older parts, growing in dense upright tufts, leafy stems arising from a short, creeping, rhizome-like shoot with reduced leaves, stems very sparsely branched, branching lateral-intercalary. **Stems** in cross section suborbicular to ellipsoid, 0.8-1 mm wide and 0.7-0.8 mm high, made up of a cortex of 2-3 rows of small cells with thick, dark brown walls surrounding a medulla of larger, thin-walled, hyaline cells. **Leaves** imbricate, alternate, ventrad, broadly ovate-triangular, ca 3-4 mm long and 3-3.5 mm wide with a rounded apex, ventral base ampliate but not forming a crest; dorsal leaf bases longly and rather broadly decurrent, the decurrent part 2-2.5 mm long, ca 2/3 the length of the leaf lamina, swollen and fully covering the stem when leaves densely imbricate; ventral leaf base shortly and narrowly decurrent; leaves finely toothed along the ventral margin,



Figs 6-10. *Plagiochila priceana* Gradst. et Benitez sp. nov. 6. Habit in dorsal and ventral view, with dorsal and ventral leaf bases shown in detail. 7. Leaves. 8-9. Portion of the leaf margin showing short-linear teeth and absence of a leaf border. 10. Midleaf cells. All from the isotype (HUTPL).

the apex and the upper part of the dorsal margin, with 30-65 short-linear teeth, the teeth 1-4(-5) cells long, consisting of elongate cells, lower half of dorsal margin and ventral base without teeth. **Leaf cells** isodiametrical to slightly elongate, ca 30-40 wide μm wide in midleaf, with small to large, simple to radiate trigones, intermediate thickenings \pm absent, cells near leaf base more elongate, forming a broad, ill-defined vitta, cells at leaf margin with trigones similar to those of inner cells or slightly larger, but leaf border of thick-walled lacking; cuticle smooth. **Oil bodies** globose to ellipsoid, 5-10 μm long, 4-10 per cell in midleaf, finely granular-papillose, **Underleaves** lacking. **Rhizoids** not seen. **Gametoecia** and sporophyte not seen.

Plagiochila priceana grows together with *P. ovata* and other robust *Plagiochilas* (*P. dependula*, *P. ensifolia*, *P. fuscolutea*) on the floor of *Polylepis reticulata* forest in the páramo of El Cajas, and approaches *P. ovata* in the leaf margins with short-linear teeth. The new species differs from *P. ovata*, however, by the ovate-triangular leaf shape, the lesser number of teeth, 35-65 per leaf, and the absence of a leaf border. *Plagiochila ovata* has ovate-orbicular leaves with (85-)110-250 teeth all around the leaf and a leaf border of thick-walled cells in 1-3 rows (Müller *et al.*, 1999).

The discovery of *Plagiochila bicuspidata*, *P. cuatrecasii* and *P. priceana* in Ecuador raises the number of *Plagiochila* species known from this country to 55 (Gradstein, in prep.). Most of them are also known from Colombia. For a key to Colombian species of *Plagiochila* see Gradstein (2016).

Radula xalapensis Nees & Mont.

SPECIMEN EXAMINED. Zamora Chinchipe: Reserva Biológica San Francisco (Fig. 1), ca. 1900 m, pendent on twigs of shrubs, 29 April 2008, *M. Burghardt et al.* 6889 (PC, QCA). **GENERAL DISTRIBUTION:** tropical Andes (Gradstein *et al.*, 2016); new to Ecuador.

Radula xalapensis (= *R. frondescens* Steph.) is a rather robust species with densely bi-pinnately branched stems and with small, distant lobules with a rounded and sometimes slightly coiled base that extends widely across the stem, to ca. 4/5 of stem width or more. By its robust habit and bipinnate branching *R. xalapensis* resembles *R. voluta* but the lobules in the latter species are much larger, imbricate, and the lobule base extends far across and beyond the stem and is much more strongly coiled.

Symphyogyna trivittata Spruce

SPECIMEN EXAMINED. Pastaza: ca.10 km N of Mera, Río Anze Rainforest Reserve (Fig. 3), 1100 m, on moist soil along the river, 19 September 2008, *S.R. Gradstein & L. Jost* 12125 (PC, QCA). **GENERAL DISTRIBUTION:** West Indies, Colombia, Ecuador (new).

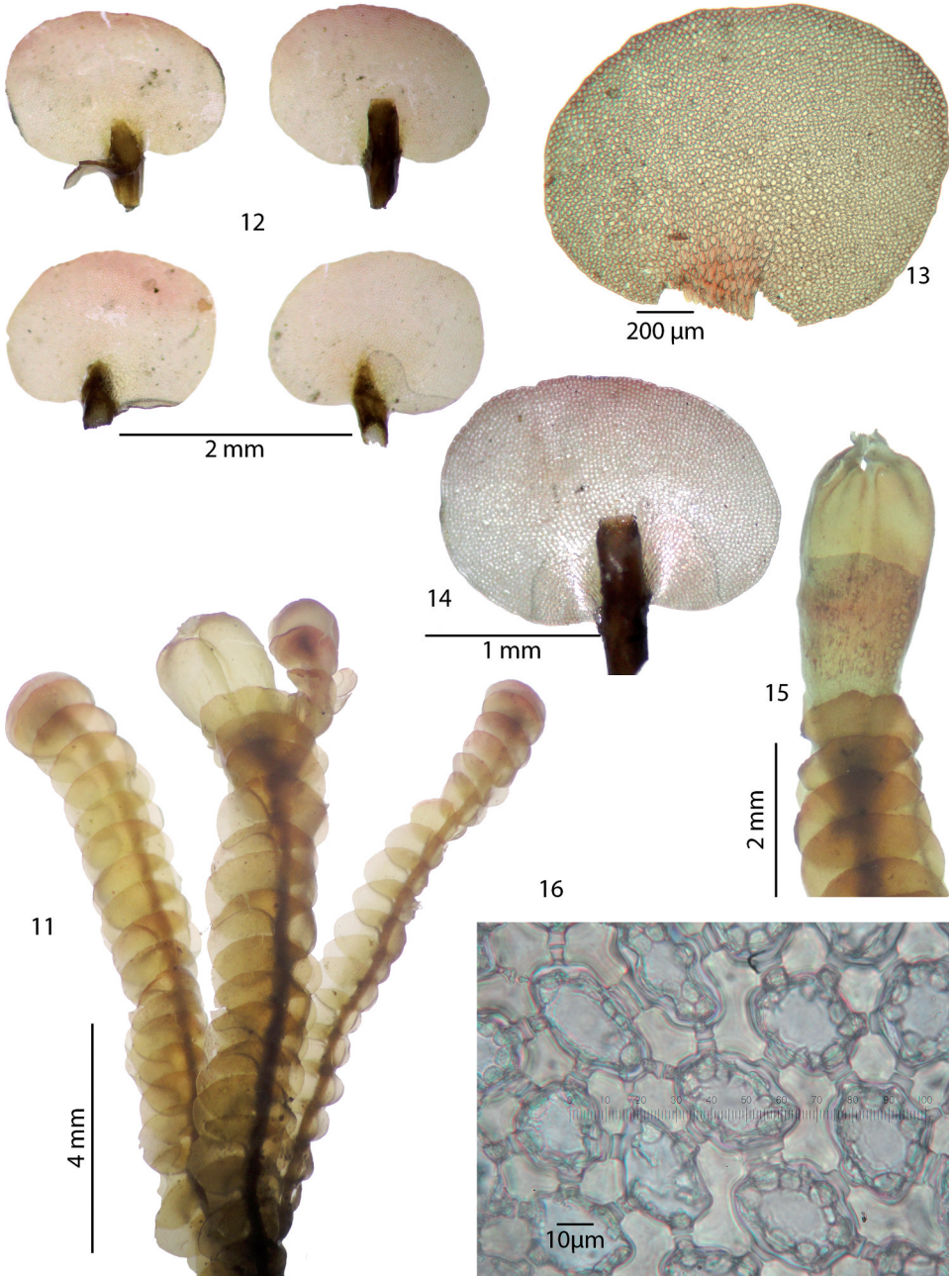
Symphyogyna trivittata resembles the common *S. brasiliensis* but differs by the midrib on the main axis with 2-3 central strands (1 strand in *S. brasiliensis*) and the presence of small slime papillae on the thallus margins (papillae absent in *S. brasiliensis*). The thallus wings in this species are sometimes undulate. Sterile material of *S. trivittata* may be confused with *Pallavicinia lyellii* but in the latter species the midrib has only one central strand and the slime papillae have a 2-3 cells long stalk.

Syzygiella burghardtii Gradst. et Benitez sp. nov.

Figs 11-16

Differs from *Syzygiella setulosa* Steph. by reniform leaves, larger leaf cells, a faintly papillose cuticle and entire female bracts.

Type. Loja / Zamora Chinchipe: pass El Tiro (Fig. 5), 2900-3000 m, epiphyte in shrubby subpáramo, 24 April 2008, *M. Burghardt, X. Haro-Carrion & A. Moscoso* MB7054 (**holotype:** PC 0728083; **isotypes:** HUTPL, QCA). **GENERAL DISTRIBUTION:** only known from the type locality in southern Ecuador.



Figs 11-16. *Syzygiella burghardtii* Gradst. et Benitez sp. nov. 11. Habit. 12-14. Leaves. 15. Gynoecial shoot with perianth. 16. Midleaf cells. All from the isotype (HUTPL).

Plants rather robust, 2-4 cm long, 2 mm wide in lateral view, 0.75 mm wide in dorsal view, reddish brown, leaf shoots ascending, without stoloniform base, stem apex straight, branches lateral-terminal (*Frullania*-type) and long or ventral-intercalary and rather short, all leafy. **Stems** dark brown, rigid, elliptical, somewhat flattened, 0.4 mm high and 0.3 mm high, 1.5× wider than high, ca 12 cells high and 18 cells wide, with a brown, 2-layered or partially 3-layered cortex of thick-walled cells surrounding a colorless medulla of slightly larger and thinner-walled cells. **Leaves** transverse and laterally appressed with a very oblique insertion, asymmetrically reniform with the dorsal portion of the leaf slightly larger than the ventral part, 1.6-1.7 mm long, 1.1-1.2 wide, 1.4× wider than long, opposite, the opposite dorsal and ventral bases touching each other but not broadly connate, apex broadly rounded, margin entire, plane, leaf surface slightly convex; dorsal and ventral leaf bases not decurrent, somewhat clasping the stem. **Leaf cells** quadrate to subrectangular in midleaf, 30-40 × 28-35 μm, walls with huge, trabeculate and often confluent trigones, huge, confluent, cuticle faintly and finely papillose; cells at leaf margin smaller, quadrate, 25-30 μm, cells at leaf base larger and more elongate, to 60 μm long. **Underleaves** and paraphyllia absent. **Rhizoids** scarce, scattered but most common near leaf bases. **Dioicous**. **Androecia** not seen. **Gynoecea** terminal on long stems, usually with 1-2 innovations, bracts and bracteoles in 2 series, connate, inner bracts reniform, similar to leaves, enveloping the lower half of the inflated perianth, undivided, apex broadly rounded, margins entire, plane or slightly undulate; bracteole broadly lanceolate, shorter than the bracts and broadly connate with the bracts in the lower half, margin entire, apex obtuse. **Perianth** fully developed even though the archegonia are unfertilized, obpyriform, longly exserted, ca 3 mm long and 2 mm wide, inflated and somewhat bilaterally flattened, surface smooth or with 1-4 straight and broad pleats, apex broadly truncate, contracted to a white, colorless beak, the beak consisting of rectangular, evenly thick-walled cells very different from the perianth surface cells (which are more similar to leaf cells), beak margin crenate and with a few one-celled teeth, inside surface of the beak rough by projecting cell tips. **Archegonia** numerous, unfertilized. **Mature sporophyte** and androecia not seen.

Syzygiella burghardtii occurred together with *S. setulosa* and resembled the latter species in the transverse, laterally appressed, opposite leaves, leaf cells with large trigones, and, especially, perianths with a whitish beak. Within *Syzygiella* the latter character is only seen in *S. burghardtii* and *S. setulosa* (J. Váña, pers. com.) *Syzygiella burghardtii* differs from *S. setulosa* in the following characters: 1) leaves reniform, 1.4× wider than long (1.0-1.2× wider than long in *S. setulosa*); 2) leaf cells 30-40 μm long in midleaf (ca. 25 μm in *S. setulosa*); 3) cuticle faintly and finely papillose, almost smooth (with large, rounded papillae in *S. setulosa*); 4) female bracts fully entire, similar to leaves (toothed in *S. setulosa*). Reniform leaves are unusual in neotropical *Syzygiella* species and are otherwise seen only in *S. renifolia* Gradst. et D.P.Costa from Pico do Neblina, Brazil (Gradstein & Costa, 2016).

Syzygiella contigua Steph.

SPECIMEN EXAMINED. Zamora Chinchipe: pass El Tiro (Fig. 5), 2900-3000 m, epiphyte in shrubby subpáramo, 13 January 2017, A. Benitez 1299 (HUTPL). **GENERAL DISTRIBUTION:** scattered in tropical America; new to Ecuador.

Syzygiella contigua (= *S. integerrima* Steph.) is recognized by the suborbicular, opposite leaves, leaf cells with large trigones and a smooth cuticle, and entire female bracts. The leaves are connate both dorsally and ventrally (Inoue, 1966; Feldberg *et al.*, 2010).

***Syzygiella trigonifolia* (Steph.) Herzog**

SPECIMEN EXAMINED. Azuay: El Cajas, 3930 m, on rock in *Polylepis reticulata* forest in páramo, 2°46'27"S, 79°13'14"W, 2 March 2017, S.R. Gradstein, A. Benitez & S. León-Yáñez 12651 (PC, QCA). GENERAL DISTRIBUTION: Colombia, Ecuador (new), Bolivia, southeastern Brazil.

Syzygiella trigonifolia (= *S. liberata* Inoue) is a rather robust species, to 8 cm long and 5 mm wide, with asymmetrically ovate, plagiochiloid leaves, which are alternate on the dorsal side and opposite on the ventral side. The entire leaf apex, the recurved dorsal leaf margin and the smooth cuticle are further characteristics of this species (Vaña *et al.*, 2014). The material from Azuay stands out by having a few leaves at the stem apex with two small teeth at the leaf apex, or being short-bifid. Possibly these leaves are young female bracts (but archeogonia not seen).

The discovery of *Syzygiella burghardtii*, *S. contigua* and *S. trigonifolia* in Ecuador raises the number of *Syzygiella* species known from the country, and from Colombia, to 18 (Gradstein, in prep.).

The species of *Syzygiella* from Ecuador and Colombia are keyed out as follows:

1. Underleaves large, almost as long as leaves when well-developed, narrowly lanceolate or ligulate. Leaves fragile..... *S. uleana* Steph.
1. Underleaves absent or minute. Leaves not fragile.....2
 2. Ventral leaf bases alternate.....3
 2. Ventral leaf bases opposite (when in doubt try both leads).....6
3. Stem base with stolons. Leaf cells with thin or evenly thickened walls, without distinct trigones, quadrate, cuticle smooth. Plants green to dark brown to blackish. Perianth keels spirally twisted near the apex in mature perianths *S. sonderi* (Gottsche) Feldberg *et al.*
3. Stolons lacking. Leaf cells with trigones, cuticle usually papillose (\pm smooth in *S. autumnalis*). Plants yellowish-green to orange-brown to reddish-brown. Perianth keels straight, not spirally twisted4
 4. Leaf cells \pm smooth, with small trigones. Leaves usually wide-spreading. Plants creeping. On rotten wood and peaty soil. Known from Colombia; to be expected in Ecuador *S. autumnalis* (DC.) Feldberg *et al.*
 4. Leaf cells with large papillae and huge trigones. Leaves subtransverse and often laterally appressed, not wide-spreading. Plants usually growing erect5
5. Dorsal leaf bases longly decurrent and \pm undulate, completely covering the stem. Rare species of páramo..... *S. undata* (Mont.) Feldberg *et al.*
5. Dorsal leaf bases shortly decurrent, not undulate, not completely covering the stem. Common in páramo and the upper montane forest belt *S. rubricaulis* (Nees) Steph.
6. Leaves ovate-triangular, asymmetrical, dorsal leaf margin recurved and conspicuously decurrent (like in *Plagiochila*). Leaves usually tapering to a narrow apex, the apex entire, toothed or bilobed. Plants robust, usually more than 3 mm wide.....7
6. Leaves rounded to ovate-oblong, subsymmetrical, dorsal leaf margin \pm plane, not or shortly decurrent. Leaf apex broadly rounded, entire. Plants smaller, 1-3 mm wide.....13
7. Leaf apex with a few very long, whitish, hair-like teeth, consisting of up to 10 cells in a row..... *S. ciliata* Gradst. & Benitez
7. Leaf apex without whitish, hair-like teeth8

8. Dorsal leaf bases free. Leaf apex entire. Cuticle smooth
 *S. trigonifolia* (Steph.) Herzog
8. Dorsal leaf bases connected. Leaf apex entire or toothed. Cuticle smooth or papillose 9
9. Cuticle smooth 10
9. Cuticle papillose 11
10. Leaf apex entire or with 1-2 small teeth... *S. manca* (Mont.) J.B. Jack & Steph.
10. Leaf apex in at least part of the leaves with more than 2 teeth
 *S. tonduzana* Steph.
11. Leaf apex deeply bilobed, lobes acuminate, sinus between the lobes narrow. Auricle at ventral leaf base very large, squarrose. Rare species
 *S. bilobata* Inoue
11. Leaf apex entire, shallowly bilobed or with 2 teeth, sinus between the lobes or teeth wide. Auricle at ventral leaf base small, not squarrose 12
12. Leaves 1.7-2.5× longer than wide. Leaf apex with 2 sharp teeth. Rare species
 *S. pectiniformis* Spruce
12. Leaves 1-1.5× longer than wide. Leaf apex entire or shallowly bilobed with obtuse to subacute lobes. Common *S. anomala* (Lindenb. & Gottsche) Steph.
13. Leaves ovate-oblong, 1.3-2× longer than wide 14
13. Leaves suborbicular or reniform, 0.7-1.2× longer than wide 15
14. Cuticle papillose, papillae rounded. Trigones large, ± bulging and sometimes confluent. Underleaves lacking. Female bracts toothed
 *S. perfoliata* (Sw.) Spruce
14. Cuticle smooth or slightly striate-papillose, papillae narrowly elongate. Trigones small, not bulging and not confluent. Rudimentary underleaves frequently present, filiform, attached to the leaf base. Female bracts entire..
 *S. concreta* (Gottsche) Spruce
15. Leaves reniform *S. burghardtii*
15. Leaves orbicular or longer than wide 16
16. Cuticle smooth *S. contigua*
16. Cuticle papillose 17
17. Papillae large, 3-10 papillae above the lumen of each cell in the upper half of the leaf. Female bracts toothed *S. setulosa*
17. Papillae small, 10-20 papillae above the lumen of each cell in the upper half of the leaf. Female bracts entire *S. campanulata* Herzog

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