

## New records of liverworts and hornworts from the Sierra Nevada de Santa Marta, Colombia

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**Abstract** – The Sierra Nevada de Santa Marta (5775 m) it is the highest peak of Colombia and the highest coastal mountain in the world. Liverworts and hornworts of the Sierra Nevada de Santa Marta have been relatively little studied. In this paper a considerable number of new species records from the Sierra Nevada are presented with brief notes on morphology, distribution and habitat of the taxa. Ten species and the genus *Notothylas* Sull. (2 spp.) are new to Colombia. The Asiatic *Metzgeria lindbergii* Schiffn. (= *M. saxbyi* Pearson, *syn. nov.*) is shown to be a pantropical species and is newly recorded from Africa and the New World. The lectotypification of *Radula xalapensis* Nees & Mont. is discussed.

**Anthocerotophyta / Colombia / Department of Magdalena / *Metzgeria lindbergii* / *Metzgeria saxbyi* / Marchantiophyta / New floristic report / *Notothylas* / *Radula xalapensis***

### INTRODUCTION

The Sierra Nevada de Santa Marta is a large, isolated mountain massif in the north of Colombia. With its summit reaching to 5775 m, at a distance of just 42 km from the Caribbean coast, it is the highest peak of Colombia and the highest coastal mountain in the world. Although geologically part of the Andes, the Sierra Nevada is separated from the Andean cordilleras by a deep and wide depression, descending to 160 m elevation. The climate varies considerably with elevation and the vegetation ranges from thorn scrub and remnant deciduous or evergreen forest at the Caribbean coast to very humid evergreen forest and páramo higher up the mountain (van der Hammen & Ruiz, 1986). Because of its high degree of endemism among animals and vascular plants, the Sierra Nevada de Santa Marta is sometimes considered a separate biogeographic region of Colombia (Van der Hammen & Ruiz, 1986; Mayr, 1998; Bernal, 2016).

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The bryophyte diversity of the Sierra Nevada de Santa Marta has been subject of only a limited number of studies. Winkler (1976) collected liverworts on the northwest slope, from the town of Santa Marta at sea level to the Cuchilla de San Lorenzo (2900 m), as well as on the south slope between 2900–4500 m, and reported 234 species including 14 new to science. A considerable number of these species were misidentified, however, and most of the new ones are now considered synonyms (Uribe & Gradstein, 1998; Gradstein, 2016). Nevertheless, Winkler's overview of elevational diversity of liverworts on the Sierra Nevada remains a very useful synthesis. Van Reenen & Gradstein (1983, 1984) and van Reenen *et al.* (1986) studied the bryophyte vegetation of the mountain along an altitudinal transect from 500–4100 m on the north slope along the Río Buritaca, in the framework of the "ECOANDES" project (van der Hammen & Ruiz, 1986), and recorded 179 species (90 liverworts, 89 mosses) including 23 species new to Colombia. Interesting liverwort taxa reported by the latter authors included *Ruizanthus venezuelanus* R.M.Schust., a rare species known only from páramo of Venezuela, Costa Rica and the Sierra Nevada de Santa Marta (Gradstein *et al.*, 2001). Further bryophyte species from the Sierra Nevada were recorded by Mägdefrau (1983) and others. These studies clearly indicate that the area has a very rich bryophyte flora.

Although a checklist of the bryophytes of the Sierra Nevada de Santa Marta is lacking, a good impression of the bryophyte flora of the mountain may be obtained from the bryophyte catalogue of Colombia (Churchill, 2015; Gradstein & Uribe, 2015a, 2015b) since almost all bryophyte species recorded from the mountain are from the department of Magdalena, few from the neighbouring department of Cesar. In total, 483 species are recorded from Magdalena in the catalogue, including 233 mosses, 245 liverworts and 3 hornworts (*Dendroceros crispus* (Sw.) Nees, *Phaeomegaceros fimbriatus* (Gottsche) Duff *et al.*, *Phaeoceros laevis* (L.) Prosk.).

During November and early December 2015 the authors have collected liverworts and hornworts on the northeast slope of the Sierra Nevada de Santa Marta, between Minca and San Lorenzo at ca. 650–2200 m. A few species were collected near the coast in the vicinity of the town of Santa Marta. The collections yielded a considerable number of taxa new to the department of Magdalena; ten species, including the genus *Notothylas* (2 spp.), proved to be new to the country of Colombia. In addition, the presence in Colombia could be confirmed of several rare species that had previously been recorded from the country only once. In this paper the new floristic records are presented together with notes on morphology, distribution and habitat of the species. Specimens were deposited in the Center for Biological Collections of the University of Magdalena (CBUMAG) with duplicates in COL, PC and BM.

## RESULTS AND DISCUSSION

Taxa new to Colombia are marked by two asterisks, those new to the department of Magdalena and the Sierra Nevada de Santa Marta by a single asterisk.

### 1. HORNWORTS (ANTHOCEROTOPHYTA)

\*\**Anthoceros tuberculatus* Lehm. & Lindenb.

**Fig. 4**

**Specimen examined.** Road Minca to San Lorenzo, on weathered granite soil on vertical earth banks along the road, 1100 m, 5 Dec 2015, Duckett *et al.* Co-8 (CBUMAG, BM, COL).

*Anthoceros tuberculatus* has been reported from the West Indies, Central America, Bolivia and the Amazon region of Brazil (Hässel de Menéndez, 1990; Gradstein & Costa, 2003), and is new to Colombia. The species grows on soil in cultivated areas at rather low elevations, and is recognized by the small spores (less than 40 µm in diameter) and the presence of a prominent, large tubercle in the center of each of the triangular areas of the inner spore surface. The plants are dioicous and the thalli in our material were densely covered by numerous multicellular gemmae, resembling small thalli.

\**Nothoceros aenigmaticus* (R.M.Schust.) J.C.Villarreal & K.D.McFarland

**Specimen examined.** San Lorenzo, on shaded rock near the station growing over a bryophyte mat, with *Lejeunea* cf. *angusta*, 2250 m, 14 Nov 2015, *Gradstein et al. 12541* (CBUMAG, PC).

*Nothoceros aenigmaticus* is known from eastern U.S.A. (Schuster, 1992) and from high elevation in the Neotropics, from Mexico to Bolivia (Villarreal & Renner, 2014). The species has been recorded once from Colombia, from the department of Nariño (Villarreal *et al.*, 2012); this is the second record from the country. The identification of our material is tentative as the plants are sterile and rather small, c. 12 mm long and 3-4 mm wide. They fit *N. aenigmaticus*, however, by the elongate, irregularly pinnate thallus, the strongly ruffled thallus margins, and the presence of only one chloroplast in the epidermis cells (exceptionally 2), without pyrenoid.

\**Nothoceros vincentianus* (Lehm. & Lindenb.) J.C.Villarreal (= *Megaceros columbianus* Steph. *fide* Villarreal *et al.*, 2015).

**Specimens examined.** Road to San Lorenzo, on wet stones on the road near waterfall, 2040 m, 14 Nov 2015, *Gradstein et al. 12564* (CBUMAG, COL, PC); road above Pozo Azul, on wet rocks in rivulet, 950 m, 5 Dec 2015, *Duckett et al. Co-10* (CBUMAG, BM).

A widespread neotropical species, described by Stephani under at least nine different names (Villarreal & Renner, 2014; Villarreal *et al.*, 2015). *Nothoceros vincentianus* was previously known in Colombia from the departments of Cundinamarca and Tolima, at much higher elevation, between 2500-3000 m. The species is monoicous and usually fertile.

\*\**Notothylas* Sull.

The genus *Notothylas* is reported here for the first time from Colombia. Two different species were collected near Santa Marta, *N. breutelii* and *N. orbicularis*; a key to these species is provided by Gradstein & Costa (2003). Note, however, that an error has occurred in this key: names must be switched between *N. vitalii* (elaters lacking, capsule opening by an operculum) and *N. orbicularis* (elaters present, capsule opening by 2-4 longitudinal valves).

\*\**Notothylas breutelii* (Gottsche) Gottsche

**Specimen examined.** Road Minca to La Victoria, on a vertical, shaded rock growing with *Fissidens* sp., under dense vegetation of ferns etc., 920 m, 5 Dec 2015, *Duckett et al. Co-12* (CBUMAG, BM).

*Notothylas breutelii* is widespread in the West Indies and Brazil, and in addition occurs in southeastern U.S.A., Hawaii and the Philippines (Hasegawa, 1986). The new record from Colombia is the first one from the Andes.

The Neotropical-Asian range of *N. breutelii*, usually referred to as “amphipacific tropical” disjunction (Thorne, 1972), is unique among hornworts. Among

liverworts and mosses several genera have amphi-Pacific tropical ranges (Gradstein *et al.*, 2014), but at the species level this type of distribution is largely unknown in these groups as well. The explanation of amphi-Pacific tropical disjunctions remains largely controversial. Although dispersal scenario's are frequently proposed, the possibility of erroneous taxonomy or insufficient collecting (occurrence in Africa?) should also be taken into account (Gradstein *et al.*, 2014).

\*\**Notothylas orbicularis* (Schwein.) Sull.

**Fig. 3**

**Specimens examined.** Pozo Azul, on moist soil in lettuce field growing with *Fissidens* sp. and *Philonotis* sp., 740 m, 5 Dec 2015, Duckett *et al.* Co-20 (CBUMAG, BM, COL).

*Notothylas orbicularis* is widespread in temperate regions of eastern North America, Central Europe and eastern Asia (China, Korea, Japan). In addition, the



Figs 1-4. Three remarkable bryophyte species from the Sierra Nevada de Santa Marta. **1.** Mass occurrence of *Asterella pringlei* near Minca. **2.** *Asterella pringlei*. **3.** *Notothylas orbicularis*. **4.** *Anthoceros tuberculatus*.

species is known from a few scattered localities in tropical America (Cuba, eastern Brazil, Mexico?) and East Africa (Uganda, Zaire); the old record from the Galapagos Islands (Müller, 1951-1958) is erroneous and refers to *N. galapagensis* Howe. The new record from Colombia is the first genuine record of the species from the Andes.

\**Phaeoceros carolinianus* (Michx.) Prosk.

**Specimens examined.** Road Minca to Pozo Azul, on vertical earth bank along road, 680 m, 7 Nov 2015, *Gradstein et al. 12473* (CBUMAG, COL, PC); above Pozo Azul, on vertical earth bank along road, 1100 m, 5 Dec 2015, *Duckett et al. Co-7, Co-16* (CBUMAG, BM); road Minca to San Lorenzo, on vertical earth bank along road, 1450 m, 14 Nov 2015, *Gradstein et al. 12535* (CBUMAG, PC).

This subcosmopolitan species was recorded from Colombia only once, from the department of Nariño (Villarreal *et al.*, 2012). In the area visited by us it was frequently found growing on road banks, between 700-1500 m. Winkler (1976) failed to record *P. carolinianus* from the Sierra Nevada but instead reported the occurrence of *P. laevis* (L.) Prosk. in the area. Since these two species are closely related and are sometimes united in *P. laevis* as subspecies or varieties, it may be that Winkler's material belonged to *P. carolinianus*; this needs further study. *Phaeoceros* is well characterized by the monoicous thallus and by the spores with numerous small spines on the outer surface and groups of small papillae on each of the three facets of the inner surface. Spore size, which is rather variable in the *P. carolinianus/laevis* complex (Schuster, 1992), measured 30-38 µm in our material.

## 2. LIVERWORTS (MARCHANTIOPHYTA)

\**Asterella macropoda* (Spruce) A. Evans

**Specimen examined.** Road to San Lorenzo, on wet concrete wall along the road at waterfall, 2040 m, 14 Nov 2015, *Gradstein et al. 12566* (CBUMAG, COL).

This widespread Andean species (Costa Rica to Argentina) was previously known from nine different departments of Colombia, between 2300-3700 m.

*Asterella pringlei* Underw. (= *Fimbriaria bakeri* Steph.)

**Figs 1-2**

**Specimens examined.** Road Minca to San Lorenzo, mass occurrence on steep, cut road bank, on soil over rock, 840 m, 7 Nov 2015, *Gradstein et al. 12520* (CBUMAG, COL, PC), 5 Dec 2015, *Duckett et al. Co-19* (CBUMAG, BM).

*Asterella pringlei* is a rare species from Mexico and Guatemala, that has been collected once in Colombia, in the surroundings of Santa Marta (Bonda) in 1898 (leg. Baker). Our gatherings confirm the occurrence of the species near Santa Marta, the only known locality of the species outside Mesoamerica (Long, 2005). The species was growing in great abundance on soil over rock on a steep, cut roadbank and was readily recognized by the rather small thalli (3-5 mm wide) and very short-stalked archegoniophores (stalk 10-15 mm long) with unlobed receptacles (Long, 2005). It may be noted that the Colombian records are from lower elevation (to 840 m) than those from Mexico and Guatemala, where the species occurs exclusively above 1000 m altitude.

\**Bazzania cuneistipula* (Gottsche *et al.*) Trevis.

**Specimen examined.** San Lorenzo, on tree trunk in montane rainforest, 2060 m, 14 Nov 2015, *Gradstein et al. 12557* (CBUMAG, PC).

Neotropical species, previously recorded from eight different departments of Colombia, between 1600-2500 m.

\**Calypogeia rhombifolia* (Spruce) Steph.

**Specimen examined.** Road Minca to San Lorenzo, on vertical earth bank along road in deep shade, 1410 m, 14 Nov 2015, *Gradstein et al. 12528* (CBUMAG, PC).

Neotropical species, previously recorded from eight different departments of Colombia, from sea level to 1700 m.

\**Cheilolejeunea trifaria* (Reinw. *et al.*) Mizut.

**Specimen examined.** Road Minca to San Lorenzo, on earth bank along road in partial shade, 1120 m, 7 Nov 2015, *Gradstein et al. 12524* (CBUMAG).

Pantropical species, previously recorded from four departments of Colombia, between 100-2000 m.

\*\**Cololejeunea camillii* (Lehm.) Pócs (= *Aphanolejeunea camillii* (Lehm.) R.M.Schust.)

**Specimen examined.** Road Minca to San Lorenzo, abundant on leaves of *Piper* sp. in small river valley along the road, 1420 m, 14 Nov 2015, *Gradstein et al. 12536* (CBUMAG, COL, PC).

*Cololejeunea camillii* is widely distributed in tropical America and known from many localities in Ecuador (Schäfer-Verwimp *et al.*, 2013). Its occurrence in Colombia, where it is newly recorded, was therefore to be expected. The species is readily distinguished by the rhombic to ovate-lanceolate leaves with acute apices and without well-developed lobules. Reiner-Drehwald (1995) provided a detailed description and illustration of the species under the name *Aphanolejeunea misionensis* E.Reiner, which is a synonym of *C. camillii*.

Winkler (1970, 1976) recorded *Cololejeunea ensifolia* (Spruce) Steph. from Colombia, which is a synonym of *C. camillii* according to Pócs *et al.* (2014). However, examination of the voucher in COL (*Winkler C72*) showed that the material is a poorly developed phenotype of another, unknown species of *Cololejeunea* (T. Pócs, per. com.).

*Cyathodium cavernarum* Kunze *ex* Lehm.

**Specimens examined.** Road Minca to Pozo Azul, on vertical earth bank along road, growing well-exposed, 680 m, 7 Nov 2015, *Gradstein et al. 12476*, c.gyn. & andr. (CBUMAG, COL, PC); road Minca to San Lorenzo, on vertical earth bank along road in partial shade, 940 m, 7 Nov 2015, *Gradstein et al. 12521* (CBUMAG), 1160 m, 5 Dec 2015, *Duckett et al. Co-18* (CBUMAG, BM).

*Cyathodium cavernarum* is a pantropical species (Srivastava & Dixit, 1996) that is common in tropical Africa and Asia but rather rare in tropical America, where it is known from Mexico, Costa Rica, Panama, Cuba, Colombia and Brazil (Salazar Allen, 2005). The species has previously been recorded twice from Colombia, from the departments of Magdalena (Winkler, 1976) and Huila (Acevedo, Río Suaza, 2100 m, *J.E. Castillo 2413a*, COL!). Our examination of the material from Huila shows it was misidentified and belongs to \*\**Cyathodium foetidissimum* Schiffn., a pantropical species that is very rare in the Neotropics and previously unknown in Colombia (Salazar Allen, 2005). We have not examined the material of *C. cavernarum* from Magdalena collected by Winkler, but since it was from the same locality as our material (Minca) we assume that Winkler's identification was correct. Minca thus remains the only known locality of *C. cavernarum* from Colombia. The species is readily recognized by the very thin, bright light metallic-green thalli with numerous large, whitish epidermal pores and with smooth-walled rhizoids. The plants are monoicous, antheridia are produced on minute thallus branches and the capsules (on

the underside of the thallus, near the thallus apex) contain dark brown spores with numerous short spines (Salazar Allen, 2005).

**\**Diplasiolejeunea brunnea* Steph.**

**Specimen examined.** San Lorenzo, on leaves of shrubs in montane rainforest, 2060 m, 14 Nov 2015, *Gradstein et al. 12563* (CBUMAG, PC).

Neotropical species, previously recorded in Colombia from the departments of Chocó, Huila and Santander between 100-2500 m.

**\**Dumortiera hirsuta* (Sw.) Nees**

**Specimens examined.** Road Minca to Pozo Azul, on wet soil along rivulet, 730 m, 7 Nov 2015, *Gradstein et al. 12506* (CBUMAG), *Duckett et al. Co-21* (CBUMAG, BM); road Minca to San Lorenzo, on wet soil along rivulet, 1420 m, 14 Nov 2015, *Gradstein et al. 12531* (CBUMAG, COL); above Pozo Azul, on rock in river, 1150 m, 5 Dec 2015, *Duckett et al. Co-14* (CBUMAG, BM).

Pantropical and northern warm-temperate species, previously recorded from nine departments of Colombia, between 1000-3300 m.

**\**Frullania ericoides* (Nees) Mont.**

**Specimen examined.** Road Minca to Pozo Azul, on trunk of roadside tree, 680 m, 7 Nov 2015, *Gradstein et al. 12495* (CBUMAG).

Pantropical species, previously recorded from nine departments of Colombia, between 100-2800 m.

**\**Frullanoides liebmanniana* (Lindenb. & Gottsche) Slageren**

**Specimen examined.** Road Minca to Pozo Azul, on trunk of roadside tree, 680 m, 7 Nov 2015, *Gradstein et al. 12493* (CBUMAG, COL).

Neotropical species, previously recorded from five departments of Colombia (elevation unknown).

**\**Lejeunea phyllobola* Nees & Mont.**

**Specimens examined.** Road Minca to Pozo Azul, on trunks of roadside trees, common, 680 m, 7 Nov 2015, *Gradstein et al. 12489, 12491* (CBUMAG, PC); road Minca to San Lorenzo, on trunk of roadside tree, 1340 m, 7 Nov 2015, *Gradstein et al. 12525* (CBUMAG, COL).

Neotropical species, previously recorded from four departments of Colombia, between 300-2100 m.

**\**Lunularia cruciata* (L.) Dumort.**

**Specimens examined.** San Lorenzo, on soil and rock in the garden at the station, with *Marchantia chenopoda* and *M. polymorpha*, 2250 m, 14 Nov 2015, *Gradstein et al. 12538* (CBUMAG, COL, PC).

*Lunularia cruciata* is widespread Mediterranean species that is rare in the Tropics (the statement of Schuster (1992) that “the species is absent from the entire tropical belt” is incorrect, however). The species was previously known in Colombia only from the city of Bogotá, where it was collected in 1946 by R.E. Schultes (COL) and very recently by one of us (on damp banks along the summit trail of Cerro de Montserrate, Bogotá, 2900 m, 12 Dec 2015, *Duckett Co-25*, BM). *Lunularia cruciata* grows in the Tropics both in natural and man-made habitats, and is a characteristic species of hot greenhouses and gardens. Its occurrence in the garden of the station of San Lorenzo is undoubtedly due to introduction but on Cerro de Montserrate it is almost certainly native.

\*\**Metzgeria lindbergii* Schiffn., *Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl.* 67: 182, 1898; *Metzgeria conjugata* Lindb. var. *minor* Schiffn., *Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur.* 60: 271, 1893. Type: Java, 1889, *Goebel s.n.* (holotype, FH-Schiffner barcode 00304554!). The lectotypification of *M. lindbergii* by So (2002) based on a specimen collected in Java by Schiffner (*Schiffner 340*, FH-Schiffner barcode 00304548!), is erroneous and must be rejected as this specimen was not cited with the first description of the taxon (under *M. conjugata* var. *minor*).

*Metzgeria saxbyi* Pearson, *Ann. Cryptog. Exot.* 4 (2): 70, 1931. Type: Ghana, Tarkwa, *Saxby s.n.* (isotype, BR-34501!), *syn. nov.* Although cited as having been deposited in MANCH (Pearson, 1931) or CGE (Vanden Berghen, 1948), the holotype is missing in there and may be lost (Ms L. Loughtman, Manchester, pers. com.; Ms C. Bartram, Cambridge, pers. com.).

**Specimen examined.** San Lorenzo, forest reserve El Dorado, on tree trunk in montane rainforest, 2140 m, 14 Nov 2015, *Gradstein et al. 12547*, c.gyn. & andr. (CBUMAG, COL, PC).

*Metzgeria lindbergii*, a widespread species of tropical Asia, Australasia and the Pacific region (So, 2002, 2003), is reported here for the first time from Colombia and the New World. In addition, the species appears to occur in Africa, where it was known as *M. saxbyi* Pearson (So, 2004; Wigginton, 2004). Characteristic of *M. lindbergii* are the flat thallus with mostly plane margins, hairs on thallus margins scarce and one per cell (exceptionally two), and monoicour sexuality. Large parts of the thallus margins may be devoid of hairs. The holotype material and Schiffner's descriptions of *M. lindbergii* (e.g., Schiffner, 1900) perfectly match our material. The species is considered closely related to *M. conjugata* Lindb., the only other monoicous species of the genus in the Neotropics (Costa, 2008), and has sometimes been considered a subspecies or variety of the latter. However, *M. conjugata* clearly differs from *M. lindbergii* by the convex thallus with distinctly recurved margins, which are densely hairy and with hairs mostly in pairs, two per cell. It thus appears that *Metzgeria lindbergii* is a pantropical species. Because of its occurrence in tropical Asia and South America, the presence of *M. lindbergii* in Africa was to be expected (*Gradstein et al.*, 2014, p. 505).

\**Microlejeunea acutifolia* Steph.

**Specimens examined.** Road Minca to Pozo Azul, on trunks of roadside trees, common, 680 m, 7 Nov 2015, *Gradstein et al. 12488, 12490, 12497, 12499* (CBUMAG).

Neotropical species, previously recorded from lowland rainforest along the Pacific coast of Colombia (departments Chocó and Valle), between 10-200 m.

\**Plagiochila adianthoides* (Sw.) Lindenb.

**Specimen examined.** San Lorenzo, forest reserve El Dorado, on tree trunks in montane forest, 2120 m, 14 Nov 2015, *Gradstein et al. 12551* (CBUMAG, COL, PC), 2060 m, *Gradstein et al. 12558* (CBUMAG).

Neotropical species, previously recorded from nine departments of Colombia, between 1500-3200 m.

\**Plagiochila distinctifolia* Lindenb. (= *P. lindigiana* Gottsche)

**Specimen examined.** San Lorenzo, forest reserve El Dorado, on tree trunks in montane forest, 2030 m, 14 Nov 2015, *Gradstein et al. 12552* (CBUMAG, COL).

Neotropical species, in Colombia recorded once from Cundinamarca (*Lindig 1729*, July 1860, type of *P. lindigiana* Gottsche; see *Gradstein, 2016*).



**\*\**Plagiochila lingua* Steph.**

**Specimen examined.** Road Minca to Pozo Azul, on base of large roadside tree, 680 m, 7 Nov 2015, *Gradstein et al. 12485* (CBUMAG, COL, PC).

*Plagiochila lingua* is a rare neotropical species, that is known from southeastern Brazil (Gradstein & Costa, 2003) and Bolivia (Churchill *et al.*, 2015), and is newly recorded from Colombia. The species is characterized by intercalary branching (sparse), widely spreading ovate-oblong leaves (ca. 1.2-1.4× longer than wide) with fully entire margins and a rounded to truncate to retuse apex, and thin-walled leaf cells without or with very small trigones. The species may be confused with entire-leaved phenotypes of *P. patula* (Sw.) Lindenb. but differs from the latter by having shorter, ovate-oblong leaves, less than 1.5× longer than wide (ca. 2-2.5× longer than wide in *P. patula*) and a less longly decurrent ventral base. Moreover, the leaf cells in *P. lingua* are thinner-walled, without or with minute trigones.

**\*\**Plagiochila subundulata* Lindenb.**

**Specimen examined.** Road to San Lorenzo, on wet rock at the base of waterfall, 2040 m, 14 Nov 2015, *Gradstein et al. 12567*, c.gyn. (CBUMAG, COL, PC).

Like *P. lingua*, *P. subundulata* is a rare species and was thus far known from southeastern Brazil (Gradstein & Costa, 2003). The species is characteristic of wet rock in rivers and near waterfalls, and occurs in Brazil at ca. 1400-1800 m. It is recognized by the rather small plants with obliquely spreading, strongly ventrad, ovate to ovate-oblong leaves (ca. 1.2-1.3× longer than wide), slightly toothed leaf margins with 2-7 small, triangular teeth that are 1-2(-3) cells long and sometimes broken, thin-walled leaf cells with a smooth cuticle, and a short vitta. The species seems to be related to the common *P. bifaria* (Sw.) Lindenb. but differs from the latter by the leaves with much fewer and smaller teeth and by the thin-walled leaf cells.

**\**Radula xalapensis* Nees & Mont. (= *R. frondescens* Steph.)**

**Specimen examined.** San Lorenzo, forest reserve El Dorado, on tree trunk in montane forest, 2130 m, 14 Nov 2015, *Gradstein et al. 12550* (CBUMAG, PC).

*Radula xalapensis*, a widespread Andean species, was previously known in Colombia from the departments of Cundinamarca and Risaralda (Gottsche, 1864; Jans, 1979 as *R. frondescens*). There has been some confusion about the identity of this species. It was first briefly described in 1836 based on two collections, one from Mexico (Jalapa, in Herb. Nees ex hb. Funck) and the other from Peru (“ad *Stictam cometiam*”, *d’Orbigny 213*) (Nees & Montagne, 1836). Gottsche *et al.* (1844-1847) found that the two collections belonged to different species and retained the name *R. xalapensis* for the Peruvian plant, which had been described and illustrated in detail by Montagne (1839). The Mexican plant was newly described as *R. quadrata* Gottsche. The material from Peru should therefore be considered the lectotype of *R. xalapensis*, in spite of its name (*xalapensis* = from Jalapa, Mexico). The first author has checked the lectotype material of *R. xalapensis* (PC-Montagne PC0723919!; isolectotype PC0723920!) and found it to be identical to *R. frondescens* Steph. as described by Castle (1966) and Yamada (1982, 2000). *Radula xalapensis* is recognized by the rather robust, regularly bipinnately branched plants and the rather small, distant lobules with a conspicuously expanded base, which extends across almost the whole stem but not beyond. The species approaches *R. jamesonii* Spruce but branching in the latter species is irregular and the lobule base covers only 1/4-1/3 of stem width.

\*\**Riccia* cf. *vitalii* Jovet-Ast

**Specimen examined.** Dry coastal area West of Santa Marta, Puerto Luz, at the north side of Rodadero beach, *Acacia-Cactus* woodland, on roadbank in northern exposure near the beach, 29 Nov 2015, C. Morales 51 (CBUMAG, PC).

*Riccia vitalii* is a characteristic species of dry caatinga in eastern Brazil. In addition, it has been found in Paraguay and on the dry west coast of Costa Rica. Characteristic of *R. vitalii* are the very small plants with 1-1.5 mm wide, dark green thallus lobes and with large, dark violet scales, which extend beyond the thallus margins and are bordered by large, hyaline cells. Dry thalli are dark purplish due to the scales covering the inrolled thallus. The most outstanding character of the species is the occurrence of two long, longitudinal strips of thickening in the green cells of the dorsal half of the thallus (cross section), running closely parallel through the cells (see Bischler *et al.*, 2005, Fig. 54N). This feature is otherwise only seen in *R. weinonis* Steph., a widespread and common neotropical species, and the rare *R. ridleyi* A.Gepp known from Fernando Noroñho (Brazil), Peru and northern Venezuela. Since these three species are mainly differentiated by spore characters and our material is sterile, the identification of our collection remains tentative. Interestingly, *R. weinonis* is known from the *Acacia-Cactus* woodlands of Santa Marta (Bischler *et al.*, 2005). However, the latter species is a larger plant and the scales in *R. weinonis* do not extend beyond the thallus margins (Bischler *et al.*, 2005).

\*\**Riccia stenophylla* Spruce

**Specimen examined.** Road Minca to San Lorenzo, on trail between the road and coffee plantation, very scarce, 1340 m, 14 Nov 2015, Gradstein *et al.* 12526, ster. (CBUMAG, PC).

*Riccia stenophylla* is widespread in the Neotropics and occurs on moist sandy or clayey soil in cultivated areas, in gardens, plantations and along forest margins, between ca. 1000-2000 m (Bischler *et al.*, 2005). Its occurrence in Colombia, where it is new, was to be expected.

\**Schiffneriolejeunea polycarpa* (Nees) Gradst.

**Specimen examined.** Road Minca to Pozo Azul, in the crown of fallen roadside tree, 680 m, 7 Nov 2015, Gradstein *et al.* 12487 (CBUMAG, PC).

Pantropical species, previously recorded from seven departments of Colombia, between 100-1700 m.

*Solenostoma amoenum* (Lindenb. & Gottsche) Váňa *et al.* (= *Plectocolea subamoena* S.Winkl.)

**Specimen examined.** Road Minca to San Lorenzo, on vertical earth bank along road, in deep shade, 1450 m, 14 Nov 2015, Gradstein *et al.* 12534 (CBUMAG, COL).

This neotropical species has been recorded from the central and western cordilleras of Colombia (Quidio, Risaralda, Valle), at ca. 1500 m. From Magdalena it was recorded by Winkler (1976) under the name *Plectocolea subamoena* S.Winkl., which was collected in the same locality as our material but at slightly higher elevation. The latter species is considered “probably conspecific with *Solenostoma amoena*” in the *World Checklist of hornworts and liverworts* (Söderström *et al.*, 2016). Our material fits the description and illustration of *P. subamoena* perfectly and fully supports the suggested synonymy. The type of *P. subamoena*, which is presumably kept in ULM, has not yet been studied (J. Váňa, pers. com.).

\**Solenostoma callithrix* (Lindenb. & Gottsche) Steph.

**Specimen examined.** Road to San Lorenzo, on vertical earth bank along road, 2000 m, 14 Nov 2015, *Gradstein et al.* 12577 (CBUMAG).

Neotropical species, previously recorded from seven departments of Colombia, between 1200-3000 m.

*Targionia hypophylla* L.

**Specimens examined.** Road Minca to Pozo Azul, on vertical earth bank along road, ca. 680 m, 7 Nov 2015, *Gradstein et al.* 12472, c.gyn. (CBUMAG, COL, PC); road Minca to San Lorenzo, on steep, cut road bank, on soil over rock, 930 m, 5 Dec 2015, *Duckett et al.* Co-II (CBUMAG, BM).

*Targionia hypophylla* has long been known in Colombia only from the Sierra Nevada de Santa Marta, where it was collected by Winkler (1976) in the same area where we gathered the species. Recently, the species has additionally been recorded from the departments of Meta, Santander and Tolima (Bischler *et al.*, 2015; Gradstein & Uribe, 2015a). The species typically grows on moist soil overlying calcareous or volcanic rock and has a broad elevational range, from 600 to over 4000 m.

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