

North American *Platylomella lescurii* (Sull.) Andrews has a limbidium that is 2–4-stratose in the upper leaf, whereas the margin is unistratose below. In *P. lescurii* the margin is also denticulate or finely so in large parts, the median laminal cells are smaller and shorter than in *V. salina* ( $6.5\text{--}38.0 \times 4.0\text{--}8.5$ , vs.  $19.0\text{--}71.5 \times 6.5\text{--}11.0 \mu\text{m}$ ), it has paraphyllia, and the axillary hairs have 3–6 upper cells.

*Vittia salina* was collected in two high altitude rivulets with fast running, saline water. It grew on rocks and banks, mostly well below the water surface at the time of collection. However, the collections were made in the rainy season and the areas covered by *V. salina* are probably above the water surface for most of the year, although always in the splash zone. The general area where *V. salina* was collected is characterized by a high altitude mountain climate, thus cold and very dry. The relative air humidity is also very low. The vegetation consists of an open steppe, dominated by tussocks of *Stipa chrysophylla* E. Desv. ('coirón amargo'), *S. frigida* Phil. ('vizcachera'), and *Adesmia* spp. Areas close to water courses, which are rare and almost all of them saline, are dominated by *Oxychloe andina* Phil. Despite the presence of running water, mosses are rare due to the high salt content of the water. In the holotype locality – Las Lozas, a streamlet of highly saline water – the only mosses besides *V. salina* were *Henmediella heimii* (Hedw.) R.H.Zander and *Pohlia integra* (Cardot) A.J.Shaw. These grew at tussock bases outside the splash zone and were common around streams above 3000 m a.s.l. In the other locality – Rumi Rayana, located at an altitude 700 m below the former – the stream is wider, still highly saline, and the aquatic species *Drepanocladus aduncus* (Hedw.) Warnst., *D. longifolius* (Mitt.) Paris, and *Bryum* sp. were found.

*Vittia pachyloma*, the other member of the genus occurring in southern South America, grows on rocks and boulders in brooks and rivers, in waterfalls, and sometimes also on wet rocks between 2600–4050 m in the Andes.

According to Ochyra (1987b) it generally grows in acidic habitats. The only thing known about *Limbella bartlettii* is that it grows in running water. *Platylomella lescurii* grows in brooks, waterfalls, or on cliffs with dripping water, both in calcareous and acidic habitats (Crum, 1972).

*Additional specimen seen (paratype)*: Argentina: Catamarca, Tinogasta, Rumi Rayana, 27°43'S, 67°58'W, 3000 m a.s.l., fast running salt water stream in acidic area, 10 February 1999, B. Biasuso, R. Farías & J. Muñoz 99-56a, MA-Musci (n° 14872), MO, S.

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TAXONOMIC ADDITIONS AND CHANGES: *Vittia salina* L.Hedenäs & J.Muñoz, sp. nov.

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## Contribution to the bryoflora of Bolivia. I. Lowland mosses from two protected areas in the Department of Santa Cruz

The bryoflora of the Santa Cruz Department lowlands in eastern Bolivia is by far one of the least known in South America. Few botanists have collected mosses there in the past, and the situation has not changed much in recent

times (Churchill, Griffin & Muñoz, 2000). Reasons for this may be that mosses are not an important component of the Neotropical dry lowland vegetation, either in terms of frequency or cover, and that no professional bryologist

has ever worked in the area or even visited it. Indeed, the main collections of mosses from the area have been done by students of the 'Noel Kempff Mercado' Museum of Natural History herbarium in Santa Cruz (USZ) within the context of vascular plant floristic studies or ecological analyses oriented to the protection of selected areas. A revision of the literature on the Bolivian bryoflora, as well as that of tropical Andean countries, can be found in Churchill *et al.* (2000). The most striking feature in the Neotropical lowlands, with regard to mosses, is the low diversity found. The Amazonas basin has 311 species of mosses (Churchill, 1998), and only 137 species of mosses have been reported from Paraguay (Buck, 1985). The studied sites are not an exception, and show diversity at the levels of other lowland tropical areas that are relatively well known.

In the current contribution we present a list of mosses from occasional collections in two protected areas: 'Noel Kempff Mercado' National Park and the 'Kaa-Iya del Gran Chaco' National Park, both in the lowlands of the Department of Santa Cruz.

'Noel Kempff Mercado' National Park is located in north-eastern Santa Cruz (13°30'–15°00'S, 60°00'–61°45'W), including an area of 1,523,000 hectares. Average yearly temperature ranges between 26–27°C and precipitation between 1400–1500 mm yr<sup>-1</sup>. There is a dry period spanning at least two months during the austral winter (May–August). The National Park represents a transitional zone where Amazonian forest intergrades with the dry forest and savanna habitats of the Cerrado biogeographic province. A preliminary study of the plant diversity and ecological units can be found in Killeen & Schulenberg (1998). The only source of information regarding mosses of the area is Churchill (1998), who recorded six species in his checklist of the Amazonian mosses.

Within the limits of the National Park two major geomorphologic units can be recognized: the Huanchaca Plateau to the east and a peneplain related to the 'Chiquitania' region to the west (Killeen, 1998). The Huanchaca is a flat range formed by Precambrian sandstone and quartzite rocks. Elevation averages 600 m, reaching 900 m at the highest point. It is believed that erosional cycles that began approximately 20 million years ago separated this plateau from other similar table mountains in central Brazil, with which the area exhibits a strong biogeographical relationship. The top of the plateau is covered with savanna vegetation, from open grassland to dense shrubland of the Brazilian 'Cerrados' type. The slopes are covered with semi-deciduous forest, whereas the small valleys contain gallery forests that represent outlier islands of semi-evergreen Amazonian forest.

The western peneplain exhibits an undulating landscape, reaching an altitude of between 200 and 300 m. The area is blanketed with Tertiary sediments that have been eroded by zones to expose the Precambrian granitic bedrock of the Brazilian Shield. The vegetation cover is a complex

mosaic dominated by semi-evergreen Amazonian forests with isolated semi-deciduous forest on the rocky outcrops. There are also forests subject to seasonal flooding and scattered humid savannas.

'Kaa-Iya del Gran Chaco' National Park, located in southern Santa Cruz (17°30'–20°05'S, 60°00'–62°30'W). This is the largest protected area in Bolivia, with 3,441,115 hectares. The climate is dry, with an average yearly temperature between 24–26°C, and precipitation ranging from 475 in the southwest to 800 mm yr<sup>-1</sup> in the north. The dry period is longer than in the previous area and can span 6–8 months. The primary vegetational formations are dry Chaco forests that grade into semi-deciduous Brazilian–Paranean forests to the north-east. There are also scattered gallery forests, and to a lesser extent, dry psammophyllous savannas.

As in the previous case, two major geomorphologic units can be differentiated inside its limits (Navarro & Fuentes, 1999). The western part varies in altitude between 200 and 300 m. Soils are of recent alluvial origin, and extensive sandfields become common to the south (Jordan, 1983). Biogeographically, forests in this western part pertain to the Chaco formation (Navarro & Fuentes, 1999).

In contrast, the eastern part of 'Kaa-Iya del Gran Chaco' is a gentle plateau higher in elevation than the western unit, reaching 849 m. The bedrocks are limestone and sandstone of Paleozoic origin blanketed partially by alluvial sediments and partially by eolian deposits. Main vegetation types in the area pertain to Brazilian–Paranean forests influenced by Chaco flora and Cerrado relicts (Navarro & Fuentes, 1999).

The catalogues of each area are presented separately for convenience. Nomenclature follows Crosby *et al.* (1999). Specimens are deposited at USZ and MA. Species new to Bolivia are indicated with two asterisks (\*\*). Those new to Santa Cruz, with one (\*).

#### 'Noel Kempff Mercado' National Park

\*\**Bryum duplicatum*. In crevices of rocks surrounding a pool formed by a waterfall. *Fuentes 1081*. *Bryum duplicatum*, previously known only from the type locality in the Brazilian Mato Grosso, pertains to the *B. billarderi* group (Ochi, 1980), although it was not treated in the monograph of the complex by Mohamed (1979). It is characterized by rosulate stems, obovate leaves 3–5 mm long, and double marginal teeth in leaf distal half. Among Neotropical *Bryum*, only *B. densifolium* and *B. procerum* have such double marginal teeth, and those taxa are the main source of confusion with *B. duplicatum*. *Bryum procerum*, which also has obovate leaves, differs from *B. duplicatum* in having *rhodobryum*-type costa in cross-section (i.e. with weak or absent dorsal stereids and several outer rows of enlarged, hyaline cells on the dorsal side). *Bryum densifolium* and *B. duplicatum* have a *bryum*-type costa, (i.e. with well-developed dorsal stereid band), but the first has

- narrow, oblong to lanceolate leaves uniformly distributed along the stem.
- \*\**Callicostella depressa*. On tree trunk. *Fuentes 1051*.
- \**Callicostella pallida*. In crevices of rocks surrounding a pool formed by a waterfall. *Fuentes 1079*.
- \*\**Campylopus savannarum*. On ground. *Fuentes 1106*.
- \**Chryso-hypnum diminutivum*. On fallen, decaying, trunks. *Fuentes 1059A, 1065A*.
- \**Cyclodictyon roridum*. In crevices of rocks surrounding a pool formed by a waterfall. *Fuentes 1078, 1084A*.
- \**Cyrto-hypnum ciliatum*. On fallen, decaying, trunks. *Fuentes 1059B, 1065B*. Not reported in Churchill (1998), it is known from Bolivia at higher elevation (Churchill *et al.*, 2000).
- Ectropothecium leptochaeton*. On rocks and fallen, decaying, trunks. *Fuentes 1050, 1080*.
- \**Entodon beyrichii*. On dry rocks. *Fuentes 1115*.
- \**Entodontopsis leucostega*. On rocks and decayed bark. *Fuentes 1063A, 1105*.
- \**Hydropogon fontinaloides*. On branches submerged in a stream with slow current. *Fuentes 1100*.
- \**Isopterygium tenerum*. On decayed matter on the ground. *Fuentes 1040B*.
- \**Lepidopilum scabrisetum*. On tree trunk. *Fuentes 1087*.
- \*\**Leucoloma tortellum*. On rocks in streams. *Fuentes 1062*.
- \*\**Macromitrium podocarpii*. On tree trunks and forks. *Fuentes 1049, 1086*.
- Ochrobryum gardneri*. On fallen, decaying trunks. *Fuentes 1064*.
- Octoblepharum albidum*. On stumps, tree trunks and forks. *Fuentes 1053, 1063*.
- \**Philonotis hastata*. On wet, rocky bank. *Fuentes 1082*.
- \**Philonotis uncinata*. On tree base in outcrop. *Fuentes 1061*.
- Pilosium chlorophyllum*. On rocks. *Fuentes 1109*.
- \**Pirella pohlii*. On tree trunks. *Fuentes 1060, 1084, 1090A*.
- \**Racopilum tomentosum*. On decayed vegetal matter on the ground. *Fuentes 1083B*.
- \**Schlotheimia rugifolia*. On tree trunks and forks. *Fuentes 1055*.
- \*\**Sematophyllum adnatum*. On rocks, tree bases, and decayed vegetal matter on the ground. *Fuentes 1108*.
- \**Sematophyllum subsimplex*. On rocks, tree trunks, and organic substrates on pools shores. *Fuentes 1039, 1040, 1046, 1048, 1114*.
- \**Syrrhopodon prolifer* var. *acanthoneuros*. In crevices of rocks on slopes. *Fuentes 1066, 1116*.
- \**Taxithelium planum*. On bark of *Macrobium* sp. *Fuentes 1112*.
- \**Trachyxiphium guadalupense*. On decayed matter on the ground. *Fuentes 1083C*.
- Thuidium tomentosum*. On decayed matter on the ground. *Fuentes 1083A*.

- \**Vesicularia vesicularis*. On rocks surrounding waterfall. *Fuentes 1089*.

#### 'Gran Chaco' National Park

- \**Bryum subapiculatum*. On compacted sandy soil. *Fuentes 2107A*.
- \**Entodontopsis leucostega*. On tree trunks. *Fuentes 1977, 1999*.
- \**Erpodium coronatum*. On *Tabebuia nodosa* (Griseb.) Griseb. and *Geoffroea spinosa* Jacq. trunks. *Fuentes 1998B, 2497*.
- Fabronia ciliaris*. On *Tabebuia nodosa* trunks. *Fuentes 1998A*.
- \**Fissidens zollingeri*. On clay-sandy ground. *Fuentes 1978*.
- \**Haplocladium microphyllum*. On tree bases in the outskirts of seasonally inundated forests. *Fuentes 1997A, 2495*.
- \**Hyophila involuta*. On sandy soils. *Fuentes 2561*.
- \*\**Lorentziella imbricata*. On sandy ground on bank trail. *Fuentes 2523*.
- \**Schlotheimia rugifolia*. On trunk and forks of *Sideroxylon obtusifolium* (Roem. & Schult.) T.D.Penn. *Fuentes 1996*.
- Stereophyllum radiculosum*. On trunks. *Fuentes 1972, 1995*.
- \**Tortella humilis*. On tree forks. *Fuentes 1973, 1997A*.

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