

Bryophytes of the Tucuman-Bolivian Montane Forest, Bolivia

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Abstract: An inventory of the bryophytes from Tucuman-Bolivian montane forest of Bolivia resulted in 374 species distributed among 184 genera and 70 families; liverworts are represented by 97 species, 42 genera, 20 families; hornworts by a single species, genus and family; and mosses by 276 species, 141 genera, 49 families. Twenty-seven percent of the known Bolivian bryophytes are present in the Tucuman-Bolivian montane forest. Comparing the bryophyte composition of the two recognized montane forest ecoregions, the Yungas and the Tucuman-Bolivian, the former is 2.8 times more diverse than the latter.

Keywords: Bryophytes, Tucuman-Bolivian montane forest, catalogue, Bolivia.

Introduction

The montane forest in Bolivia is restricted to the eastern Andean ranges and estimated to cover only eight percent of the land surface. Two types of montane forest are recognized. The Yungas montane forest is the largest, with five percent of land surface; geographically this forest extends from the border of Peru at 14°S diagonally NW-SE along the eastern cordillera flank to 18°S. The Tucuman-Bolivian montane forest is much smaller, covering only two percent of the land surface; geographically this forest extends as parallel N-S ranges from 18°S to 23°S, forming an ecotone with the Yungas in central Bolivia. Virtually all historical and even recent knowledge of the Bolivian montane forest bryophytes, both in terms of collections and literature, relates to the Yungas. This present study represents the first attempt at a systematic bryophyte inventory of the Tucuman-Bolivian montane forest.

Geographical Setting

The Tucumano-Boliviano montane forest extends almost 1000 kms, in the north near Comarapa and Mairana, in the department of Santa Cruz, central Bolivia, to just southwest of the city of Tucumán, in the department of Tucumán, northwest Argentina. The general region is large, from a maximum of 18°00'–27°00'S, and 65°25'–40'W. The Tucuman-Bolivian montane forests are a naturally fragmented vegetation, existing geographically as isolated island-like patches of forest either on slopes of narrow north-south parallel mountain ranges or in isolated valleys. These forested islands are generally surrounded by

vegetational extremes with dry inter-Andean valleys of cactus and thorn forest at lower elevations, and prepuna or puna with shrubby grasslands at higher elevations.

There are no paleo-ecological studies at present to suggest the origin or development of the Tucuman-Bolivian montane forest. The present distribution of forest probably occurred in the mid Holocene. Given the composition of families and genera, both for bryophytes and vascular plants, it seems likely that the Yungas extended far south, essentially to the present day range of Tucuman-Bolivian montane forest in northwest Argentina, during a Pleistocene glacial event (Sherilyn Fritz, pers. comm.). Furthermore this probably occurred on more than one occasion, so at glacial maximum the Yungas expanded, and at each interglacial event the main range fragmented and contracted northward.

Botanically the Tucuman-Bolivian montane forest is among the least known ecoregions in Bolivia. Equally important, the Tucuman-Bolivian forest is the most endangered forested ecoregion in the country (Ibisch & Mérida 2003). Degradation of the Tucuman-Bolivian landscape is due to unrestricted logging, grazing and land clearing for crops. At present there are few designated protected areas. The largest park, Reserva Nacional de Flora y Fauna Tariquia, in the department of Tarija, includes representative Tucuman-Bolivian montane forest. The Reserva Natural Alarachi represents a smaller area adjoining Tariquia. Other protected areas include Área Natural de Manejo Integrado de la Serranía de Iñaño and Área

Natural de Manejo Integrado de El Palmar in the department of Chuquisaca, Área Natural de Manejo Integrado de Amboró in the department of Santa Cruz. All the managed buffer zones are of questionable value in conservation.

Tucuman-Bolivian forest in Bolivia is less diverse than the Yungas forest due to geographical setting and climatic conditions. In general the mountain ranges are narrower, with elevations ranging mostly from 1000–2500 m (rarely to 3200 m or more). The present climate is drier, with a pronounced seasonal dry-cold period, as compared to the Yungas. The floristic composition and vegetation of these forests are, in part, composed of elements of Yungas montane forest, northern Argentinean-southeast Brazilian forest, and an undetermined number of endemic and subendemic plants. Vascular plant diversity has recently been estimated at just over 2000 species (M. Serrano, pers. comm.). In Bolivia the Tucuman-Bolivian montane forest occurs, from north to south, in the departments of Santa Cruz, Chuquisaca and Tarija.

History

The first to collect bryophytes from the Tucuman-Bolivian montane forest was Alcides Charles Dessaline d'Orbigny between 1830–1833 (Montagne 1839). Only a few collections were made by d'Orbigny in the vicinity of Vallegrande, department of Santa Cruz. The first substantial collections were made by Theodor Herzog during his second trip to Bolivia. In January–February of 1911 Herzog made a series of collections from Tres Cruces, department of Santa Cruz. Approximately 94 bryophytes, 36 liverworts and 58 mosses, were recorded (Herzog 1916: 316–317). Present day vegetation of Tres Cruces is highly degraded, consisting of pastures and scrub-thorn forest with small patches of relic secondary montane forest. The original vegetation, however, was likely predominately Tucuman-Bolivian submontane forest. The majority of the bryophytes, particularly the mosses, are typical elements of Tucuman-Bolivian montane forest.

Relatively recent collections, compiled from the Herbario Nacional (LPB), include several collectors; among these are J. Solomon in 1983, E. Bastión in 1986, and S.R. Gradstein in 1989, all from the department of Tarija. Marko Lewis was the single most important collector. Lewis collected bryophytes in Tarija in 1979 and 1984, and in Chuquisaca in 1983 and 1984. Nearly half of these collections were made from Tucuman-Bolivian montane forest, however only a small portion of these have been identified to species. Some of the Lewis collections have been incorporated in the following checklist. Lozano (2005) conducted a thesis study at Nuevo Mundo in the department of Chuquisaca, examining moss

diversity and composition. A few of the collections and species presented here have been published previously as new country or departmental records (Churchill & Fuentes 2005, Churchill et al. 2008). A checklist of the bryophytes of Alarachi Natural Reserve, department of Tarija, was published (Churchill 2009a) enumerating 35 liverworts and 119 mosses.

Inventory

The objective of this study was to sample bryophytes throughout the range of Tucuman-Bolivian montane forest found in the Bolivian departments of Chuquisaca, Santa Cruz and Tarija (Fig. 1). An attempt was made to sample all possible habitats at each locality for bryophytes. Approximately 196 localities were sampled over the course of five years, from 2004–2008, resulting in ca. 3000 collections. A few of the sites were visited more than one time and by more than one collector, e.g., Nuevo Mundo. The first set of collections is deposited at HSB or USZ unless noted otherwise; the first duplicate set is deposited at MO, and a portion of the duplicates at LPB. All collections cited have been databased in Tropicos (2009) and are available to the scientific community. There are now more than 18,000 bryophyte collections databased for Bolivia in Tropicos.

Diversity

A total of 374 bryophyte species distributed among 184 genera and 70 families are recorded for the Tucuman-Bolivian montane forest (Table 1). Liverworts are represented by 97 species, 42 genera, and 20 families; hornworts by 1 species, genus and family; and mosses by 276 species, 141 genera, and 49 families. This represents 27% of the known Bolivian bryophyte flora; separately liverworts represent 20% and mosses 30%. The Tucuman-Bolivian montane forest is generically rich, with 184 genera, but with few species-rich genera (slightly less than 2:1). The maximum species number for a genus is 9 for liverworts and 12 for mosses (Table 2).

The most diverse liverwort families are the Lejeuneaceae, Frullaniaceae, Plagiochilaceae, Metzgeriaceae and Lophocoleaceae accounting for 60% of the total liverwort species (Table 2). All these families are among the ten most diverse families for the tropical Andes (cf. Churchill et al. 2010, León-Yáñez et al. 2006). Seven of the 20 families are represented by a single species. The Lejeuneaceae are not only the most diverse family for species but also for genera (15). The five most diverse genera (Table 2), representing 43% of the liverworts, include *Plagiochila*, *Frullania*, *Metzgeria*, *Porella* and *Radula*. All genera, with the exception of *Porella*, are also among the most diverse for the tropical Andes

Table 1. Bryophyte families and the number of genera/species for the Tucuman-Bolivian Montane forest.

Family	Genera/Species	Family	Genera/Species
LIVERWORTS		Dicranaceae	8/21
20 families, 42 genera, 97 species		Ditrichaceae	1/1
Acrobolbaceae	1/1	Entodontaceae	2/6
Aneuraceae	1/1	Fabroniaceae	1/2
Aytoniaceae	2/2	Fissidentaceae	1/12
Balantiopsidaceae	1/1	Funariaceae	2/5
Cephaloziaceae	2/2	Grimmiaceae	3/5
Frullaniaceae	1/9	Hedwigiaceae	3/7
Herbertaceae	1/1	Hookeriaceae	1/1
Jungermanniaceae	2/4	Hylocomiaceae	1/1
Lejeuneaceae	15/23	Hypnaceae	8/12
Lepidoziaceae	2/2	Hypopterygiaceae	1/1
Lophocoleaceae	3/7	Lembophyllaceae	2/3
Lunulariaceae	1/1	Leptodontaceae	1/3
Marchantiaceae	2/3	Leskeaceae	3/4
Metzgeriaceae	1/9	Leucobryaceae	2/4
Monocleaceae	1/1	Leucodontaceae	1/1
Pallaviciniaceae	2/6	Macromitriaceae	4/8
Pelliaceae	1/1	Meteoriaceae	1/3
Plagiochilaceae	1/9	Mniaceae	1/1
Porellaceae	1/7	Myriniaceae	1/1
Radulaceae	1/7	Neckeraceae	5/10
HORNWORTS		Octoblepharaceae	1/2
1 family, 1 genus, 1 species		Orthotrichaceae	2/5
Anthocerotaceae	1/1	Phyllogoniaceae	1/1
MOSESSES		Pilotrichaceae	6/7
49 families, 141 genera, 276 species		Plagiotheciaceae	1/2
Amblystegiaceae	4/6	Polytrichaceae	6/7
Andreaeaceae	1/1	Pottiaceae	18/34
Bartramiaceae	4/10	Prionodontaceae	1/2
Brachytheciaceae	10/16	Pterobryaceae	4/4
Bruchiaceae	1/1	Racopilaceae	1/2
Bryaceae	9/27	Regmatodontaceae	1/1
Calymperaceae	1/5	Rhizogoniaceae	1/1
Catagoniaceae	1/2	Rigodiaceae	1/1
Cryphaeaceae	2/6	Sematophyllaceae	3/8
Daltoniaceae	1/1	Sphagnaceae	1/1
		Stereophyllaceae	3/3
		Thuidiaceae	3/9

Table 2. The five most diverse liverwort and moss families and genera for the Tucuman-Bolivian montane forest. Lophocoleaceae coequal with Radulaceae, Fissidentaceae coequal with Hypnaceae, *Brachymenium* and *Leptodontium* coequal with *Syntrichia*.

<u>Liverworts</u>		<u>Mosses</u>	
Family	Genus	Family	Genus
Lejeuneaceae 23	<i>Plagiochila</i> 9	Pottiaceae 34	<i>Fissidens</i> 12
Frullaniaceae 9	<i>Frullania</i> 9	Bryaceae 27	<i>Bryum</i> 10
Metzgeriaceae 9	<i>Metzgeria</i> 9	Dicranaceae 21	<i>Campylopus</i> 10
Plagiochilaceae 9	<i>Porella</i> 7	Brachytheciaceae 16	<i>Brachymenium</i> 6
Lophocoleaceae 7	<i>Radula</i> 7	Fissidentaceae 12	<i>Leptodontium</i> 6
Total 57 (59%)	41 (42%)	110 (40%)	44 (16%)

(cf. Churchill et al. 2010, León-Yáñez et al. 2006).

The five most diverse moss families, accounting for 40% of the diversity, are the Pottiaceae, Bryaceae, Dicranaceae, Brachytheciaceae and Hypnaceae (Table 2). Only the latter two families, Brachytheciaceae and Hypnaceae, are not ranked among the ten most diverse families in the tropical Andes (Churchill 2009b). Seventeen families are represented by a single species. The Pottiaceae are not only the most diverse family for species but also for genera (18). The most diverse genera (Table 2), representing 16% of the total are *Fissidens*, *Bryum*, *Campylopus*, *Brachymerium* and *Leptodontium* (coequal with *Syntrichia*). All these genera are among the most diverse genera for the tropical Andes with the exception of *Leptodontium* (Churchill 2009b).

Elevation

Elevational distribution was estimated for the Tucuman-Bolivian montane forest bryophytes recording species present in six 500 meter intervals (Table 3). The most diverse range was from 2000–2500 m, but this and the lower two intervals are close in the number of recorded bryophytes. The discrepancy for mosses at the 1500–2000 m interval may be due to fewer forests sampled at this elevational range; this may also explain the fewer bryophytes for the lowest and highest ranges, coupled with the marginality of forest at those ranges.

Ecology

The Tucuman-Bolivian montane forest differs ecologically in several respects from the Yungas montane forest. In general the Tucuman-Bolivian montane forest is characterized by climatic differences including a more pronounced and prolonged dry season and less annual precipitation and humidity. The effect of a dryer forest includes less accumulation of leaf litter and humic soil layer. In general there is relative less buildup of organic matter in these forests as compared to the Yungas. Another poorly represented substrate is logs; the dryer climatic conditions likely protract the time of decomposition of fallen tree trunks. A further consequence of a more arid environment, coupled with fragmented forest, is the absence or near absence of ponds, lakes, bogs and marshes, and thus few aquatic or semi-aquatic taxa. The few representatives include for example species of the Amblystegiaceae and so far only a single collection of *Sphagnum*; all confined to streams or springs, both often seasonally intermittent.

One aspect of the ecology of Tucuman-Bolivian montane forest bryophytes is reflected in the general substrate they grow on. Based on label data, bryophyte substrates were recorded for five categories: soil, leaf litter, rocks, logs and epiphytes

(living lianas, shrubs, treelets or trees). This data can only be viewed as a relative, suggesting a pattern or trend. While some species only occur on a specific substrate, many others are found on two or more, and a few species appear to grow on nearly all, e.g., *Racomitrium tomentosum*.

Epiphytes are the most diverse category for the Tucuman-Bolivian montane forest, both for liverworts and mosses (Table 4) comprising about 50% of the species. The remaining four categories are ranked similarly for both liverworts and mosses—those found on rocks (loosely interpreted), soil, logs, and last, leaf litter.

Comparison of the Tucuman-Bolivian and Yungas montane forests

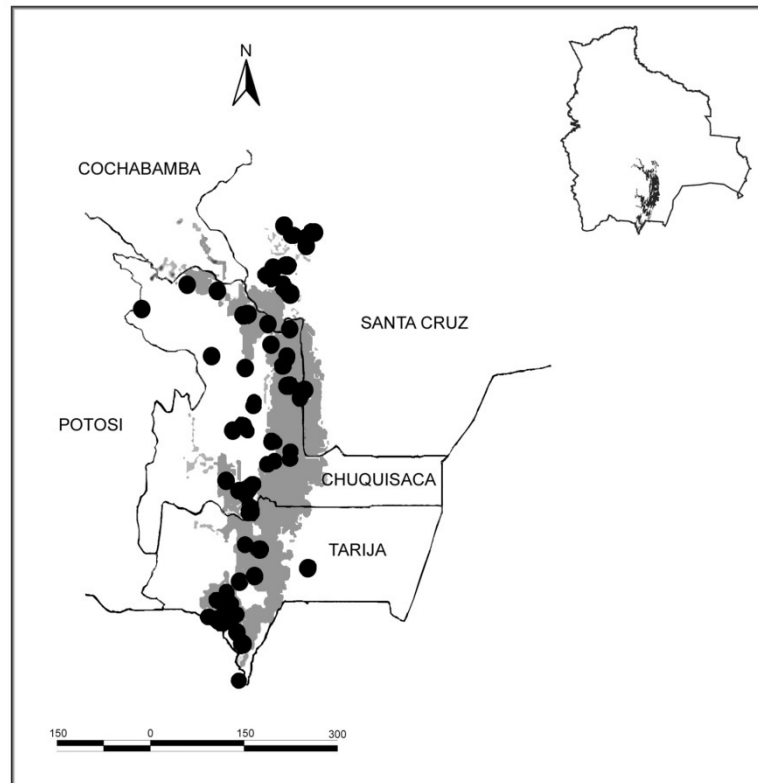
Disproportionate to the land surface occupied by montane forest in Bolivia (8%), bryophyte diversity is impressive; of the total bryophytes recorded for the country 80% of the species are contained within the combined two montane forest ecoregions. The two montane forests, however, differ significantly in their composition. A major transformation in diversity occurs from the humid Yungas forest to the semi-humid Tucuman-Bolivian forest. For liverworts the Yungas is 4.2 times more diversity than Tucuman-Bolivian; 78 species are shared between the two, and only 13 species are restricted to the Tucuman-Bolivian. Sixty-two liverwort genera in the Yungas are not present in the Tucuman-Bolivian forest; 25 of those genera are in the Lejeuneaceae. For mosses the Yungas is 2.3 times more diverse than the Tucuman-Bolivian, with 43 species restricted to the Tucuman-Bolivian. About 87 moss genera recorded for the Yungas are not present in the Tucuman-Bolivian.

Tucuman-Bolivian moss genera not present in the Yungas include: *Cardotiella*, *Flabellidium*, *Forsstroemia*, *Helicodontium*, *Platygyriella*, *Pterogoniadelphus*, *Rhexophyllum* and *Wijkia*. *Calyptothecium* and *Pterobryopsis*, both typical components of the Tucuman-Bolivian forest, are only found in one locality each in the department of La Paz, possibly in somewhat drier Yungas forest.

Many of the bryophyte genera are widely distributed, from the montane forest of Colombia and Venezuela southward to central Bolivian. Examples of typical montane forest (Yungas) bryophyte genera, often of mid to high elevations, but absent from the Tucuman-Bolivian, include for the liverworts *Calypogeia*, *Cheilolejeunea*, *Cryptochila*, *Dicranolejeunea*, *Lepicolea*, *Mnioloma*, *Nowellia*, *Pleurozia*, *Scapania*, *Symbiezidium*, *Syzygiella* and *Trichocolea*; and for the mosses include *Acroporium*, *Aptychella*, *Atractylocarpus*, *Barbellopsis*, *Brachymitrium*, *Chorisodontium*, *Dicranum*, *Eustichia*, *Floribundaria*, *Leiomelea*, *Lepidopilum*, *Leptotheca*, *Lindigia*,

Table 3. Number of bryophyte species for six elevation intervals for Tucuman-Bolivian montane forest.

Elevation	500– 1000	1000– 1500	1500– 2000	2000– 2500	2500– 3000	3000– 3500
Taxon						
Liverwort	6	48	52	51	17	1
Hornwort		1				
Mosses	36	163	140	170	73	5
Total	42	212	192	221	90	6

**Figure 1.** Map of Tucuman-Bolivian montane forest and general localities sampled. Distribution dots outside the shaded area represent outlayers of forest.**Table 4.** Number of liverwort, hornwort and moss species recorded for five substrates for Tucuman-Bolivian montane forest.

TAXON	SUBSTRATE				
	Soil	Leaf litter	Rocks	Logs	Epiphyte
Liverworts	21	10	43	11	56
Hornworts	1	0	1	0	0
Mosses	89	16	119	73	132
Total	111	26	163	84	188

Porotrichopsis, *Rhizogonium*, *Rhynchostegiopsis*, *Symblypharis*, *Tayloria* and *Toloxis*.

Format

The sequence of bryophytes is ordered first with liverworts followed by hornworts and mosses. Within each of the three major groups all are in alphabetical order first for families, and then genera and species. Synonyms if pertinent are in brackets. Substrate is given after the species, species frequently encountered are denoted by "common," followed by the elevational range. Citation of specimens is alphabetical by department with 1–2 collections per department that include collector, collector number and herbaria where the specimens are deposited.

Catalog

LIVERWORTS (Marchantiophyta)

ACROBOLBACEAE

Lethocolea glossophylla (Spruce) Grolle – On rocks along stream. 2380 m. Santa Cruz: *Churchill 22308* (MO, USZ).

ANEURACEAE

Riccardia sp. – On logs, sandstone rocks and soil along streams. 1040–2538 m. Chuquisaca: *Lozano et al. 2533* (HSB, MO, RB, USZ); Santa Cruz: *Carreño & Inturias 47* (MO, USZ). Four collections made, only two cited here, most probably represent the same taxon.

AYTONIACEAE

Asterella macropoda (Spruce) A. Evans – On sandstone rocks. 1230–2240 m. Chuquisaca: *Churchill et al. 22954* (HSB, MO, USZ), *Lewis 84-0990* (LPB); Santa Cruz: *Churchill et al. 23904* (MO, USZ).

Plagiochasma rupestre (G. Forst.) Steph. – On rocky soil and vertical rocks. Common. 1140–1700 m. Chuquisaca: *Lozano et al. 1803-A* (HSB, MO); Santa Cruz: *Churchill et al. 23909* (MO, USZ); Tarija: *Churchill et al. 23337* (HSB, MO, USZ).

BALANTIOPSISIDACEAE

Isotachis serrulata (Sw.) Gottsche – On soil, in shade. 2000–2216 m. Chuquisaca: *Lozano et al. 2868* (HSB, LPB, MO, USZ).

CEPHALOZIACEAE

Cephalozia crossii Spruce – On soil. 2627 m. Chuquisaca: *Lozano et al. 2519* (HSB, MO).

Odontoschisma denudatum (Nees) Dumort. – On rocky bank. 2001–2250 m. Chuquisaca: *Lozano et al. 2852* (HSB, LPB, MO, USZ).

FRULLANIACEAE

Frullania arecae (Spreng.) Gottsche var. *arecae* – On leaf litter, trunk of trees, and fallen branches. Common. 1350–2500 m. Chuquisaca: *Villalobos et al. 321* (HSB, MO); Santa Cruz: *Churchill et al. 21360* (MO, USZ); Tarija: *Churchill et al. 23301* (HSB, MO).

Frullania brasiliensis Raddi – On trunk and branches of treelets and trees. Common. 1350–2529 m. Chuquisaca: *Lozano et al. 1670* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Arroyo P. 21219* (MO, USZ); Tarija: *Churchill et al. 23315-A* (USZ), *Gradstein 7617* (LPB, MO).

Frullania convoluta Lindenb. & Hampe – On tree trunk. 2150 m. Santa Cruz: *Churchill et al. 21219* (MO, USZ).

Frullania cuencensis Taylor – On branches of *Schinus*, with *Cryphaea* and *Fabronia*. 2700–2900 m. Tarija: *Churchill et al. 23538-A* (MO, USZ; verif. Y. Yuzawa).

Frullania ericoides (Nees ex Mart.) Mont. – On rocks and logs. 800–1300 m. Santa Cruz: *Churchill 23874* (LPB, MO, USZ), *Linneo et al. 521* (MO, USZ); Tarija: *Churchill et al. 23290* (HSB, MO).

Frullania kunzei Lehm. & Lindenb. [*F. neesi* Lindenb.] – On trunk of tree. 1300 m. Tarija: *Churchill et al. 23264* (HSB, MO, USZ).

Frullania riojaneirensis (Raddi) Spruce – On rocks, in shade. 2200 m. Santa Cruz: *Churchill & Arroyo P. 21103* (BOLV, GOET, LPB, MO, USZ).

Frullania setigera Steph. – On tree trunk. 1100–1900 m. Santa Cruz: *Linneo & Roth 543* (GOET, HSB, LPB, MO, USZ).

Frullania tetraptera Nees & Mont. – Epiphyte. 2000 m. Tarija: *Gradstein 7719* (GOET).

HERBERTACEAE

Herbertus juniperoideus (Sw.) Grolle subsp. *acanthelium* (Spruce) Feldberg & J. Heinrichs [*H. serratus* Spruce] – On trunk of trees (including *Ilex argentina*), rare on rocks. 1550–2700 m. Santa Cruz: *Churchill 22266* (MO, USZ; det. K. Feldberg); Tarija: *Churchill et al. 23413* (HSB, MO, USZ; det. K. Feldberg).

JUNGERMANNIACEAE

Anastrophyllum leucocephalum (Taylor ex Lehm.) Steph. – On tree trunk (*Ilex argentina*). 1550–1700 m. Tarija: Churchill et al. 23683 (HSB, MO, PRC, USZ; det. J. Váňa)

Anastrophyllum piligerum (Reinw., Blume & Nees) Steph. – On moist sandy soil. 2240 m. Chuquisaca: Churchill et al. 22953 (HSB, MO, USZ).

Anastrophyllum tubulosum (Nees) Grolle – On soil and rocks. 1700–2700 m. Chuquisaca: Churchill et al. 22953 (HSB, MO, PRC, USZ; det. J. Váňa); Santa Cruz: Churchill 22253 (HSB, MO, PRC, USZ; verif. J. Váňa); Tarija: Churchill et al. 23698 (HSB, MO, PRC, USZ; det. J. Váňa)

Jamesoniella rubricaulis (Nees) Grolle – On rocks. 2100–2300 m. Chuquisaca: Lozano et al. 2862 (HSB, LPB, MO, USZ); Tarija: Churchill et al. 23571 (HSB, MO, USZ).

LEJEUNEACEAE

Acanthocoleus aberrans (Lindenb. & Gottsche) Kruijt – On trunk of trees. 1013 m. Tarija: Apaza et al. 130 (HSB, MO, USZ).

Acanthocoleus trigonus (Nees & Mont.) Gradst. – On rocks, along stream. 1600–1950 m. Tarija: Gradstein 7648, 7687 (LPB).

Brachiolejeunea laxifolia (Taylor) Schiffn. – Substrate unknown. 1950 m. Tarija: Gradstein 7645, 7649 (LPB, U).

Bryopteris diffusa (Sw.) Nees – On trunk of tree. 1350–1500 m. Santa Cruz: Churchill et al. 23846 (LPB, MO, USZ).

Bryopteris filicina (Sw.) Nees – On trunk of treelets and trees, rarely on rocks and logs. Common. 1220–2100 m. Chuquisaca: Lozano 1136 (HSB, MO); Santa Cruz: Linneo et al. 576 (LPB, MO, USZ); Tarija: Churchill et al. 23345 (BOLV, HSB, LPB, MO, USZ).

Cheilolejeunea acutangula (Nees) Grolle – Substrate unknown. 1400–1500 m. Santa Cruz: Herzog 3913 (Stephani 1916: 258 [not in Lit. Cit.]).

Cheilolejeunea insecta Grolle & Gradst. – On trunk of *Podocarpus*. 2000 m. Tarija: Gradstein 7624, 7633 (GOET, LPB, U; Gradstein & Costa 2003: 127).

Cheilolejeunea rigidula (Nees ex Mont) R.M. Schust. – Epiphyte? 1050 m. Chuquisaca: Lewis 84-0907 (LPB).

Dicranolejeunea axillaris (Nees & Mont.) Schiffn. – On rocks. 1360 m. Tarija: Lewis 84-2189 (LPB).

Frullanoides densifolia Raddi – On sandstone rocks, fallen branches, and tree trunk. 800–2190 m. Santa Cruz: Churchill et al. 22099 (GOET, MO, USZ); Tarija: Apaza et al. 79 (HSB, LPB, MO, USZ), Gradstein 7692 (LPB).

Harpalejeunea sp. – On trunk of tree. 1803 m. Chuquisaca: Lozano et al. 2918 (GOET, HSB, MO; det. M.E. Reiner-Drehwald).

Lejeunea flava (Sw.) Nees – On rocks and trunk of trees. 2000–2370 m. Chuquisaca: Lewis 84-1932 (LPB; det. S.R. Gradstein); Tarija: Gradstein 7642 (LPB), Lewis 84-2052 (LPB), 84-2152 (LPB; det. S.R. Gradstein).

Lejeunea laetevirens Nees & Mont. – On rocks and trunk of trees. 800–1191 m. Chuquisaca: Lozano & Flores A. 2771 (GOET, HSB, MO, USZ; det. M.E. Reiner-Drehwald); Santa Cruz: Linneo et al. 533 (GOET, LPB, MO, USZ).

Lejeunea ptosimophylla C. Massal. – On trunk of trees. 1165 m. Tarija: Apaza et al. 92 (hb?; det. M.E. Reiner-Drehwald).

Lepidolejeunea eluta (Nees) R.M. Schust. – On leaf litter and trunk of trees. 1320–1550 m. Santa Cruz: Churchill et al. 23732 (HSB, LPB, MO, USZ).

Lepidolejeunea involuta (Gottsche) Grolle – Epiphyte. 1400 m. Santa Cruz: Tres Cruces, Herzog 3890 (MANCH; Reiner-Drehwald 2006: 481).

Leucolejeunea unciloba (Lindenb.) A. Evans – On trunk. 1800 m. Tarija: Gradstein 7685 (LPB).

Marchesinia brachiata (Sw.) Schiffn. – On trunk of trees. 2180 m. Santa Cruz: Churchill et al. 23775 (HSB, MO, USZ).

Microlejeunea bullata (Taylor) Steph. – On bark. 1600–2100 m. Tarija: Gradstein 7638, 7669 (GOET, LPB; det. R. Grolle).

Omphalanthus filiformis (Sw.) Nees – On trunk and branches of treelets, rocks, and leaf litter. 1220–2450 m. Santa Cruz: Churchill & Arroyo P. 21201 (LPB, MO, USZ); Tarija: Churchill et al. 23653 (HSB, LPB, MO, USZ).

Prionolejeunea sp. – On rocks. 1340–1500 m. Chuquisaca: Churchill 20706 (MO, USZ).

Taxilejeunea cf. obtusangula (Spruce) A. Evans – On rocks. 2484 m. Chuquisaca: Lozano et al. 2575 (GOET, HSB, MO; det. M.E. Reiner-Drehwald).

Taxilejeunea pterigonia (Lehm. & Lindenb.) Schifffn. – On leaf litter and rocks. 1220–1380 m. Santa Cruz: Churchill et al. 21851 (LPB, MO, USZ); Tarija: Churchill et al. 23467 (HSB, MO, USZ).

LEPIDOZIACEAE

Bazzania hookeri (Lindenb.) Trevis. – On base and trunk of trees, log of tree fern (*Alsophila*). 1050–2180 m. Santa Cruz: Churchill et al. 23791 (HSB, MO, USZ). Tarija: Churchill et al. 23354 (HSB, MO, USZ), Serrano et al. 6001 (HSB, MO).

Telaranea nematodes (Austin) M. Howe – On soil and exposed tree roots. 2180–2240 m. Santa Cruz: Churchill et al. 23821 (HSB, MO, USZ).

LOPHOCOLEACEAE

Chiloscyphus latifolius (Nees) J.J. Engel & R.M. Schust. [*Lophocolea bidentata* (L.) Dumort. non *Chiloscyphus bidentata* Steph.] – On soil, rocks (often sandstone), logs, leaf litter and exposed tree roots (*Alnus acuminata*). Common. 1200–2627 m. Chuquisaca: Churchill et al. 22895 (HSB, MO); Santa Cruz: Churchill & Arroyo P. 21152 (BOLV, GOET, MO, USZ; det. J. Hentschel); Tarija: Churchill et al. 23681 (HSB, MO, USZ).

Chiloscyphus mandonii (Steph.) J.J. Engel & R.M. Schust. [*Lophocolea mandonii* Steph.] – On rocky soil. 1300 m. Tarija: Churchill et al. 23255 (HSB, MO).

Chiloscyphus martianus (Nees) J.J. Engel & R.M. Schust. [*Lophocolea martianus* Nees] – Leaf litter over log. 1920 m. Santa Cruz: Carreño & Inturias 23 (MO, USZ).

Chiloscyphus muricatus (Lehm.) J.J. Engel & R.M. Schust. [*Lophocolea muricata* (Lehm.) Nees] – On logs, in shade. 2180–2500 m. Chuquisaca: Churchill et al. 22927-A (HSB, MO, USZ); Santa Cruz: Churchill et al. 23776 (MO, USZ).

Chiloscyphus platensis J.J. Engel & R.M. Schust. [*Lophocolea platensis* Steph., non *L. platensis* C. Mass.] – On soil and rocks. 1240–2250 m. Chuquisaca: Lozano et al. 2888 (HSB, LPB, MO, USZ; det. cf.); Santa Cruz: Churchill et al. 22090 (BOLV, GOET, LPB, MO, USZ; det. J. Hentschel).

Clasmatocolea vermicularis (Lehm.) Grolle – On moist or wet soil and sandstone rocks, often along streams and waterfall. 2190–2400 m. Chuquisaca: Lewis 84-0716 (LPB); Santa Cruz: Churchill et al. 23838 (HSB, MO, USZ).

Leptoscyphus expansus (Lehm.) Grolle [*L. difficilis* (Steph.) Fulford] – On trunk of trees. 1950–2100 m.

Tarija: Churchill et al. 23416 (BOLV, HSB, LPB, MO, USZ).

LUNULARIACEAE

Lunularia cruciata (L.) Dumort. ex Lindb. – On soil and rocks, in shade. 1500–2600 m. Chuquisaca: Churchill et al. 22903 (HSB, MO); Tarija: Churchill et al. 23561 (HSB, MO, USZ), Gradstein 7620, 7662 (LPB).

MARCHANTIACEAE

Dumortiera hirsuta (Sw.) Nees – On rocks and soil, in shaded sites, associated with seeps and streams. Common. 1120–2538 m. Chuquisaca: Churchill et al. 23078 (HSB, MO); Santa Cruz: Churchill et al. 23711 (HSB, MO, USZ); Tarija: Churchill et al. 23222 (HSB, MO, USZ), Gradstein 7640 (LPB).

Marchantia chenopoda L.

On rocks, along streams. 1420–1550 m. Chuquisaca: Lozano et al. 1761 (HSB, MO, USZ); Santa Cruz: Churchill et al. 23720 (MO, USZ).

Marchantia plicata Nees & Mont. – On soil over rocks. 1300 m. Tarija: Churchill et al. 23279 (HSB, MO, USZ).

METZGERIACEAE

Metzgeria albinea Spruce – On soil with leaf litter. 2000–2250 m. Chuquisaca: Lozano et al. 2860 (HSB, MO, USZ; det. D.P. Costa).

Metzgeria ciliata Raddi – Substrate unknown. 1900–1950 m. Tarija: Lewis 79-517 (F; Costa 2008: 63).

Metzgeria filicina Mitt. – On bark. 1900 m. Tarija: Gradstein 7673 (LPB, U)

Metzgeria hegewaldii Kuwah. – On trunk of tree. 1184 m. Chuquisaca: Lozano et al. 2958 (HSB, MO, USZ; det. D.P. Costa).

Metzgeria lechleri Steph. – On trunk of treelet. 1350–1500 m. Santa Cruz: Churchill et al. 23841 (MO, USZ).

Metzgeria myriopoda Lindb. – On base of shrubs and trees (including *Podocarpus*), trunk of trees (including *Alnus acuminata*), leaf litter, logs, and sandstone rocks. Common. 1240–2500 m. Chuquisaca: Churchill et al. 23053 (HSB, MO, RB, USZ; verif. D.P. Costa); Santa Cruz: Churchill et al. 20377 (LPB, MO, RB, USZ; verif. D.P. Costa); Tarija: Churchill et al. 23353 (HSB, MO, RB, USZ; verif. D.P. Costa).

Metzgeria parviinvolutrata Kuwah. – On twigs of shrubs. 2450–2500 m. Chuquisaca: *Churchill et al.* 22917 (HSB, MO, RB, USZ; verif. D.P. Costa); Tarija: *Churchill et al.* 23368 (HSB, MO, RB, USZ; det. D.P. Costa).

Metzgeria pulvinata Steph. – On rocks and branches. 2960–3220 m. Chuquisaca: *Lewis* 86-315, 86-445 (F, LPB; Costa 2008: 146).

Metzgeria rufula Spruce – On trunk of trees. 1350–1500 m. Santa Cruz: *Churchill et al.* 23857 (MO, RB, USZ; det. D.P. Costa).

MONOCLEACEAE

Monoclea gottschei Lindb. subsp. *elongata* Gradst. & R. Mues – On soil and rocks, often along streams. 1220–2240 m. Santa Cruz: *Churchill et al.* 23816 (HSB, MO, USZ); Tarija: *Churchill et al.* 23466 (HSB, MO), *Gradstein* 7670 (LPB).

PALLAVICINIACEAE

Jensenia cf. *spinosa* (Lindenb. & Gottsche) Grolle – On rocks along stream. 2647 m. Chuquisaca: *Lozano et al.* 2606 (HSB, MO, USZ).

Symphyogyna apiculispina Steph. – On wet rocky soil, along stream. 2180–2240 m. Santa Cruz: *Churchill et al.* 23823 (MO, USZ).

Symphyogyna brasiliensis Nees – On soil. 1600–2100 m. Tarija: *Gradstein* 7622, 7658 (LPB).

Symphyogyna brongniartii Mont. – On logs, in shade. 1800 m. Tarija: *Churchill et al.* 23357 (HSB, MO).

Symphyogyna circinata Nees & Mont. – On wet soil and sandstone rock. 2000–2364 m. Santa Cruz: *Carreño & Inturias* 45 (JE, MO, USZ), *Inturias et al.* 67 (MO, USZ).

Symphyogyna podophylla (Thunb.) Mont. & Nees – On soil, rocks and rocky soil of stream banks. 2000–2250 m. Chuquisaca: *Lozano et al.* 2854 (HSB, LPB, MO, USZ); Tarija: *Churchill et al.* 23389 (HSB, MO).

PELLIACEAE

Noteroclada confluens Taylor ex Hook. f. & Wilson – On wet soil and rocks, often along streams. 2100–2538 m. Chuquisaca: *Lozano et al.* 2872 (HSB, LPB, MO, USZ); Santa Cruz: *Inturias et al.* 74 (JE, LPB, MO, QCA, USM, USZ, VEN); Tarija: *Churchill* 20802 (LPB, MO, USZ).

PLAGIOCHILACEAE

Plagiochila aerea Taylor – On trunk of trees (including *Ilex argentinum*) and rocks. 1036–1546 m. Chuquisaca: *Lozano et al.* 2847 (GOET, HSB, LPB, MO, USZ); Tarija: *Serrano et al.* 6002 (HSB, MO).

Plagiochila bifaria (Sw.) Lindenb. – Over leaf litter, on rocks, logs and trunk of trees. Common. 1220–2500 m. Chuquisaca: *Churchill et al.* 22910 (GOET, HSB, MO; verif. J. Heinrichs); Santa Cruz: *Churchill & Arroyo P.* 21184 (BOLV, LPB, MO, USZ); Tarija: *Churchill et al.* 23572-A (GOET, HSB, MO, USZ; det. J. Heinrichs).

Plagiochila corrugata (Nees) Nees & Mont. – On branches of treelet, trunk and branches of trees, and lianas. 1036–2000 m. Chuquisaca: *Lozano & Villalobos* 2255 (HSB, MO); Tarija: *Churchill* 20757 (GOET, MO, USZ; det. J. Heinrichs).

Plagiochila diversifolia Lindenb. & Gottsche – On rocks and base of trees. 1450–2180 m. Santa Cruz: *Churchill et al.* 23819 (GOET, HSB, MO, USZ; det. J. Heinrichs).

Plagiochila heterophylla Lehm. var. *heterophylla* – On rocks. 2900–3000 m. Tarija: *Churchill et al.* 23576 (GOET, HSB, MO, USZ; det. J. Heinrichs).

Plagiochila macrostachya Lindenb. – On rocks. 1450–1700 m. Tarija: *Churchill* 23663-A (GOET, HSB, MO; det. J. Heinrichs).

Plagiochila patentissima Lindenb. Epiphyte. 1400–1500 m. Santa Cruz: *Herzog* 4246 (Stephani in *Herzog* 1916: 207).

Plagiochila patula (Sw.) Lindenb. – On rocks, logs, base and trunk of trees (including Lauraceae). 890–2529 m. Chuquisaca: *Lozano et al.* 2231 (HSB, MO, USZ); Santa Cruz: *Inturias et al.* 73 (JE, LPB, MO, USZ, VEN); Tarija: *Churchill et al.* 23231 (GOET, HSB, MO, USZ; det. J. Heinrichs).

Plagiochila rutilans Lindenb. – On trunk of treelet. 890 m. Tarija: *Churchill et al.* 23210 (GOET, HSB, MO, USZ).

PORELLACEAE

Porella brachiata (Taylor) Spruce – On rocks and tree trunk. 2529 m. Chuquisaca: *Apaza et al.* 203, 215 (HSB, MO, USZ).

Porella brasiliensis (Raddi) Schiffn. – On rocks, fallen branches and trunk of trees. 1160–1620 m. Chuquisaca: *Lozano & Ortiz* 2735 (HSB, MO); Tarija: *Lewis* 84-2270 (LPB).

Porella crispata (Hook.) Trevis. – Over leaf litter, on rocks, trunk and branches of trees. Common. 1300–2647 m. Chuquisaca: *Lozano et al. 1743* (HSB, MO, USZ); Santa Cruz: *Linneo et al. 572* (LPB, MO, USZ); Tarija: *Churchill et al. 23603* (HSB, MO, USZ).

Porella leiboldii (Lehm. & Lindenb.) Trevis. – Epiphyte? 1400–1500 m. Santa Cruz: *Herzog 3550* (Stephani in Herzog 1916: 234).

Porella reflexa (Lehm. & Lindenb.) Trevis. – On trunk of treelets and trees. 890–1900 m. Chuquisaca: *Lozano et al. 2239* (HSB, LPB, MO, USZ); Santa Cruz: *Linneo & Roth 537-A* (MO, USZ); Tarija: *Churchill et al. 23232* (HSB, MO, USZ).

Porella squamulifera (Taylor) Trevis. – On rocks. 2200 m. Santa Cruz: *Churchill & Arroyo P. 21118* (BOLV, LPB, MO, USZ).

Porella swartziana (F. Weber) Trevis. – On rocks, base and trunk of treelets and trees (including *Podocarpus*). Common. 1070–2240 m. Chuquisaca: *Lozano et al. 1572* (HSB, LPB, MO, USZ); Santa Cruz: *Linneo & Roth 537-B* (MO, USZ); Tarija: *Serrano et al. 5575* (HSB, MO).

RADULACEAE

Radula cubensis K. Yamada – On trunk of trees. 2420 m. Chuquisaca: *Churchill et al. 23086* (MO, USZ; det. K. Yamada).

Radula episcia Spruce – On moist or wet rocks. 1220–2200 m. Santa Cruz: *Churchill et al. 23708* (HSB, MO, USZ; det. K. Yamada); Tarija: *Churchill et al. 23450* (HSB, MO, USZ; det. K. Yamada).

Radula jamesonii Taylor – On bark. Ca. 2000 m. Tarija: *Lewis 84-2044* (F, LPB; det. K. Yamada).

Radula pocsii K. Yamada – On sandstone rocks. 1120–1500 m. Tarija: *Churchill et al. 23340* (HSB, MO; det. K. Yamada), *23444* (HSB, MO, USZ; det. K. Yamada).

Radula quadrata Gottsche – On tree trunks (including *Podocarpus*). 1090–2580 m. Santa Cruz: *Lewis 85-681* (LPB; det. K. Yamada).

Radula tectiloba Steph. – On rocks, trunk of treelet (*Salix*) and trees. 1140–2500 m. Chuquisaca: *Churchill et al. 23051* (HSB, MO); Santa Cruz: *Churchill & Arroyo P. 21223* (MO, USZ); Tarija: *Churchill et al. 23295* (HSB, MO), *Lewis 84-2084, 84-2092* (LPB; det. K. Yamada).

Radula voluta Taylor – On rocks and trunk of trees. 1220–2300 m. Chuquisaca: *Lozano et al. 1727* (HSB,

LPB, MO, USZ); Tarija: *Churchill et al. 23569* (HSB, MO, USZ).

ANTHOCEROTES (Anthocerotophyta)

ANTHOCEROTACEAE

Phaeoceros laevis (L.) Prosk. – On soil covered rocks. 1040–1298 m. Santa Cruz: *Carreño & Inturias 80B* (MO, USZ), *Inturias & Carreño 90* (MO, USZ).

MOSESSES (Bryophyta)

AMBLYSTEGIACEAE

Amblystegium serpens (Hedw.) Schimp. – Over leaf litter in marsh. 2240 m. Chuquisaca: *Churchill et al. 22939* (MO, USZ).

Amblystegium tenax (Hedw.) C. E. O. Jensen – On wet soil. 2050 m. Santa Cruz: *Fuentes & Vargas 197* (BOLV, MO, USZ).

Amblystegium varium (Hedw.) Lindb. – On soil and rocks, along streams. 1013–1240 m. Santa Cruz: *Churchill et al. 22088* (MO, USZ); Tarija: *Apaza et al. 134* (HSB, MO, USZ).

Anacamptodon cubensis (Sull.) Mitt. – On tree trunk. 1500 m. Santa Cruz: *Herzog 3551* (S). Collection made along the northern limit of Tucuman-Bolivian forest, in the vicinity of Tres Cruces (Herzog 1916: 128).

Campylophyllum sommerfeltii (Myrin) Hedenäs [*Campyllum praegracile* (Mitt.) Broth., *C. trichocladum* (Taylor) Broth.] – On soil, sandstone rocks, logs and trunk of trees (including *Podocarpus*). 1500–2500 m. Chuquisaca: *Churchill et al. 22904* (BOLV, HSB, LPB, MO, USZ); Santa Cruz: *Churchill et al. 20379* (BOLV, HSB, LPB, MO, USZ); Tarija: *Churchill et al. 23634* (HSB, MO, USZ).

Vittia pachyloma (Mont.) Ochyra – On rocks in streams. 2320 m. Chuquisaca: *Lewis 84-1922* (LPB, MO).

ANDREAEACEAE

Andreaea sp. – On rocks. 2700 m. Tarija: *Churchill et al. 23562* (HSB, MO, USZ).

BARTRAMIACEAE

Anacolia laevisphaera (Taylor) Flowers – On soil and rocky soil. 2647 m. Chuquisaca: *Lozano et al. 2604* (HSB, LPB, MO, USZ).

Bartramia potosica Mont. – On soil and rocks. 2150–3031 m. Chuquisaca: *Lozano 991* (HSB, MO), *Lozano et al. 2630* (HSB, MO).

Breutelia austro-arcuata (Müll. Hal.) Paris – On humic soil and rocks. 1450–2700 m. Chuquisaca: *Lozano et al. 1732* (HSB, LPB, MO, USZ); Tarija: *Churchill et al. 23551* (HSB, MO, USZ).

Breutelia chrysea (Müll. Hal.) A. Jaeger – Over leaf litter. 2001–2250 m. Chuquisaca: *Lozano et al. 2906* (HSB, LPB, MO, USZ);

Breutelia inclinata (Hampe & Lorentz) A. Jaeger – On humic soil and sandstone rocks. 1800–2260 m. Santa Cruz: *Carreño & Inturias 23* (JE, LPB, MO, USZ, VEN); Tarija: *Huaylla et al. 1894* (HSB, MO, USZ).

Breutelia polygastrica (Müll. Hal.) Broth. – On wet sandstone rocks. 1429 m. Chuquisaca: *Llully et al. 423* (HSB, LPB, MO, USZ).

Philonotis elongata (Dism.) H.A. Crum & Steere – On wet soil. 1040–2260 m. Santa Cruz: *Churchill et al. 20397* (BOLV, LPB, MO, USZ).

Philonotis hastata (Duby) Wijk & Margad. – On wet soil and rocks, in seeps and along streams. Common. 1200–2700 m. Chuquisaca: *Lozano & Villalobos 2253* (HSB, MO, USZ); Santa Cruz: *Churchill et al. 23839* (HSB, MO, USZ); Tarija: *Huaylla et al. 1892* (HSB, MO, USZ).

Philonotis sphaerocarpa (Hedw.) Brid. – On soil. 1042 m. Chuquisaca: *Lozano et al. 2218* (HSB, MO).

Philonotis uncinata (Schwägr.) Brid. – On soil and rocks, in seeps and along streams. Common. 1228–2552 m. Chuquisaca: *Lozano et al. 1715* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill et al. 23737* (MO, USZ); Tarija: *Churchill & Churchill 20783* (MO, USZ).

BRACHYTHECIACEAE

Aerolindigia capillacea (Hornsch.) M. Menzel – On twigs of shrubs, trunk and branches of treelets. 1054–2500 m. Chuquisaca: *Lozano et al. 1587* (HSB, LPB, MO, USZ); Tarija: *Churchill et al. 23432* (BOLV, HSB, LPB, MO, USZ), *Serrano et al. 5691* (HSB, MO).

Brachythecium plumosum (Hedw.) Schimp. – On rocks and logs, mostly along streams and in seeps. 1100–2700 m. Chuquisaca: *Lozano et al. 2531* (HSB, MO, USZ); Santa Cruz: *Churchill & Arroyo P. 21137* (BOLV, LPB, MO, USZ); Tarija: *Churchill et al. 23396* (HSB, MO, USZ).

Brachythecium stereopoma (Spruce ex Mitt.) A. Jaeger – On soil, rocks, logs, leaf litter and base of trees. Common. 1020–2300 m. Chuquisaca: *Lozano et al. 1570* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Linneo 24558* (LPB, MO, USZ); Tarija: *Churchill et al. 23281* (HSB, MO, USZ).

Eurhynchium aff. *semiscabrum* E.B. Bartram – Over leaf litter, on logs, soil, rocks, trunk of trees, and branches of shrubs. 1120–2420 m. Common. Chuquisaca: *Churchill 20688* (HSB, MO, USZ), *Lozano 1006* (HSB, MO, USZ); Santa Cruz: *Churchill et al. 23849* (MO, USZ); Tarija: *Churchill 20752* (HSB, MO, USZ). The identity of this taxon is unknown; stem leaves distant, ovate-long acuminate, branch leaves ± crowded and complanate, ovate-acute, seta smooth, operculum beak moderately long.

Flabellidium spinosum Herzog – On base of tree. 1400 m. Santa Cruz: *Herzog 3883-a* (JE). This species is only known from the type collection made in January 1911 by Theodor Herzog from Tres Cruces. *Flabellidium* is an endemic, monospecific genus (Herzog 1916); inappropriately ranked as extinct (Hallingbäck & Hodgetts 2000). Further field investigations in the northern range of Tucuman-Bolivian montane forest should be made before assigning conservation ranking.

Meteoridium remotifolium (Müll. Hal.) Manuel – On shrubs, trunk and branches of treelets and trees, also on rocks. 1120–2300 m. Chuquisaca: *Lozano et al. 1733* (HSB, LPB, MO, USZ); Santa Cruz: *Linneo et al. 568* (MO, USZ); Tarija: *Churchill et al. 23695* (HSB, MO, USZ).

Palamocladium leskeoides (Hook.) E. Britton – On logs, base and trunk of trees (including *Podocarpus*). 1228–2837 m. Chuquisaca: *Lozano et al. 1741* (HSB, MO, USZ); Santa Cruz: *Churchill et al. 23836* (HSB, MO, USZ); Tarija: *Churchill et al. 23406-A* (HSB).

Platyhypnidium aquaticum (A. Jaeger) M. Fleisch. – On rocks in streams and rivers. 1240–2450 m. Common. Chuquisaca: *Churchill et al. 22966* (HSB, MO); Santa Cruz: *Churchill & Arroyo P. 21238* (MO, USZ); Tarija: *Churchill et al. 23544* (HSB, LPB, MO, USZ).

Rhynchostegium scariosum (Taylor) A. Jaeger – Over leaf litter and trunk of trees. 1078–2538 m. Chuquisaca: *Lozano et al. 2556* (HSB, MO); Tarija: *Churchill et al. 23544* (HSB, LPB, MO, USZ).

Rhynchostegium serrulatum (Hedw.) A. Jaeger – On soil, rocks, leaf litter, logs and base of trees. 1042–2380 m. Chuquisaca: *Lozano et al. 2215* (HSB, MO, USZ); Santa Cruz: *Churchill et al. 23733* (HSB, MO, USZ); Tarija: *Churchill et al. 23242* (MO, USZ).

Squamidium brasiliense (Hornsch.) Broth. – On rocks, fallen branches, trunk and branches of treelets and trees. Common. 1120–2837 m. Chuquisaca: *Lozano & Cardoso 1586* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Linneo 24542* (LPB, MO, USZ); Tarija: *Churchill et al. 23701* (HSB, MO, USZ).

Squamidium diversicomma (Hampe) Broth. – On fallen tree branches and branches of *Erythroxyllum*. 1350–1552 m. Chuquisaca: *Lozano et al. 199* (HSB, MO, USZ); Santa Cruz: *Churchill et al. 23865* (MO, USZ).

Squamidium macrocarpum (Spruce ex Mitt.) Broth. – On trunk and branches of treelets and trees, also on shrubs. 1450–2200 m. Chuquisaca: *Lozano et al. 1679-A* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Linneo 24563* (LPB, MO, USZ); Tarija: *Churchill et al. 23661* (HSB, MO).

Squamidium nigricans (Hook.) Broth. – On trunk of tree. 1900 m. Santa Cruz: *Linneo et al. 566* (LPB, MO, USZ).

Zelometeorium ambiguum (Hornsch.) Manuel – On trunk and branches of lianas, shrubs, treelets and trees, infrequent on logs and rocks. Common. 890–2500 m. Chuquisaca: *Churchill & Churchill 20714* (BOLV, LPB, MO, USZ); Santa Cruz: *Churchill & Linneo 24555* (LPB, MO, USZ); Tarija: *Churchill et al. 23614* (BOLV, HSB, LPB, MO, USZ).

Zelometeorium patens (Hook.) Manuel – On trunk of tree. 1716 m. Chuquisaca: *Lozano & Mogro 163* (HSB, MO).

BRUCHIACEAE

Trematodon vaginatus Müll. Hal. – On rocky soil. 1128–2150 m. Chuquisaca: *Lozano & Villalobos 2243* (HSB, LPB, MO, USZ), *Lozano et al. 954* (HSB, MO).

BRYACEAE

Acidodontium lonchotrachylon (Müll. Hal.) Broth. – On erect dead tree trunk. 1450–1700 m. Tarija: *Churchill et al. 23648* (HSB, MO).

Anomobryum cf. humillimum (Müll. Hal. ex E. Britton) Broth. – On sandy soil. 1340–1500 m. Chuquisaca: *Churchill 20704* (MO, USZ).

Anomobryum julaceum (Schrader ex P. Gaertn., B. Mey. & Scherb.) Schimp. – On rocky soil and sandstone rocks. 2200–2647 m. Chuquisaca: *Lozano et al. 2598* (HSB, MO); Santa Cruz: *Churchill & Arroyo P. 21134* (MO, USZ).

Anomobryum prostratum (Müll. Hal.) Besch. – On soil and rocks. 1415–2400 m. Chuquisaca: *Lozano et al. 1756* (HSB, MO, USZ).

Brachymenium exile (Dozy & Molk.) Bosch & Sande Lac. – On soil and sandy soil. 1140–1900 m. Chuquisaca: *Lozano & Ortiz 2690* (HSB, MO, USZ); Tarija: *Churchill et al. 23294* (HSB, MO, USZ).

Brachymenium fabronioides (Müll. Hal.) Paris – On rocks. 2200 m. Santa Cruz: *Fuentes & Vargas 272* (LPB, MO, USZ).

Brachymenium klotzschii (Schwägr.) Paris – On trunk and branches of trees. 1000–1400 m. Chuquisaca: *Lozano & Cardoso 1648* (HSB, LPB, MO, USZ); Tarija: *Churchill 20766* (BOLV, LPB, MO, USZ), *Mendoza & Marquardt 1365* (MO, USZ).

Brachymenium radiculosum (Schwägr.) Hampe – On trunk and branches of treelets, rarely on fallen branches and rocks. 1120–1700 m. Tarija: *Churchill et al. 23617* (HSB, MO).

Brachymenium speciosum (Hook. & Wilson) Steere – On fallen tree trunk. 2150 m. Santa Cruz: *Churchill et al. 21457* (MO, USZ).

Brachymenium systylium (Müll. Hal.) A. Jaeger – On soil and logs. 1100–1376 m. Chuquisaca: *Lozano & Cardoso 1652* (HSB, LPB, MO, USZ); Tarija: *Apaza et al. 124* (HSB, MO, USZ).

Bryum andicola Hook. – On trunk of trees and logs. 1408–2990 m. Chuquisaca: *Lozano et al. 1588* (HSB, LPB, MO, USZ), Santa Cruz: *Churchill & Linneo 24557* (LPB, MO, USZ); Tarija: *Churchill et al. 23638* (HSB, MO).

Bryum apiculatum Schwägr. – On soil, along streams. 1128–2552 m. Chuquisaca: *Lozano & Villalobos 2240* (HSB, MO, USZ); Tarija: *Apaza et al. 128* (HSB, LPB, MO, USZ).

Bryum argenteum Hedw. – On soil and rocks. 1300–2627 m. Chuquisaca: *Lozano et al. 1142* (HSB, MO); Santa Cruz: *Churchill et al. 23872-A* (USZ); Tarija: *Churchill et al. 23664* (HSB, MO).

Bryum cf. canariense Brid. – On humic soil and trunk of trees. 1074–2240 m. Chuquisaca: *Churchill et al. 22943* (HSB, MO); Tarija: *Huaylla et al. 1814* (HSB, MO, USZ).

Bryum cf. capillare Hedw. – On soil and humus covered tree roots. 1640–2300 m. Chuquisaca: *Lozano & Ortiz 2700* (HSB, MO, USZ); Santa Cruz: *Churchill & Arroyo P. 21161* (MO, USZ).

Bryum coronatum Schwägr. – On soil. 1013–1300 m. Tarija: *Apaza et al.* 145 (HSB, MO, USZ).

Bryum densifolium Brid. – On soil, humus, leaf litter and rocks. 1150–2450 m. Chuquisaca: *Lozano & Villalobos* 2286 (HSB, MO, USZ); Santa Cruz: *Churchill & Arroyo P.* 21187 (BOLV, LPB, MO, USZ); Tarija: *Churchill* 20768 (MO, USZ).

Bryum limbatum Müll. Hal. – On sandstone rocks, along streams. 890–1400 m. Tarija: *Churchill* 20761-A (MO, USZ), *Huaylla et al.* 1723 (HSB, MO).

Bryum pseudotriquetrum (Hedw.) P. Gaertn., B. Mey. & Scherb. – On soil, along stream. 2647 m. Chuquisaca: *Lozano et al.* 2608 (HSB, MO).

Bryum richardsii Sharp – On logs and standing dead tree trunk. 2000–2450 m. Santa Cruz: *Churchill & Arroyo P.* 21180 (LPB, MO, USZ; det. cf.); Tarija: *Churchill et al.* 23378 (HSB, MO, USZ).

Epipterygium immarginatum Mitt. – On soil, along streams; often associated with thalloid liverworts. 1193–2450 m. Chuquisaca: *Churchill et al.* 22960 (HSB, MO, USZ); Santa Cruz: *Churchill & Arroyo P.* 21192-A (MO, USZ); Tarija: *Huaylla et al.* 1744 (HSB, MO).

Orthodontium gracile (Wilson) Schwägr. ex Bruch & Schimp. – On trunk of trees and logs. 2000–2200 m. Chuquisaca: *Lozano et al.* 951 (HSB, MO); Santa Cruz: *Churchill & Arroyo P.* 21141 (BOLV, MO, USZ).

Pohlia papillosa (Müll. Hal. ex A. Jaeger) Broth. – On soil and rocky soil. 2260–3120 m. Chuquisaca: *Lozano et al.* 2627 (HSB, MO, USZ); Santa Cruz: *Churchill et al.* 20384 (MO, USZ).

Rhodobryum beyrichianum (Hornsch.) Müll. Hal. – On soil, humus, leaf litter, inclined trunk of trees and rocks. Common. 1100–2627 m. Chuquisaca: *Lozano et al.* 1575 (HSB, LPB, MO, USZ); Santa Cruz: *Linneo et al.* 575 (MO, USZ); Tarija: *Huaylla et al.* 1813 (HSB, MO, USZ).

Rhodobryum procerum (Schimp.) Paris – On humic soil. 2100–2300 m. Tarija: *Churchill et al.* 23540 (BOLV, HSB, LPB, MO, USZ).

Rhodobryum roseum (Hedw.) Limpr. – On soil, leaf litter and logs. 2260–2647 m. Chuquisaca: *Lozano et al.* 2603 (HSB, MO, USZ); Santa Cruz: *Churchill & Arroyo P.* 21216 (MO, USZ); Tarija: *Churchill* 20801 (HSB, MO, USZ).

Schizymerium lindigii (Hampe) A.J. Shaw – On soil covered rocks. 2150–2700 m. Chuquisaca: *Lozano* 988 (HSB, MO).

CALYMPERACEAE

Syrrhopodon gaudichaudii Mont. – On base and trunk of trees (including *Crinodendron*), log of tree fern (*Alsophila*), and rocks. Common. 1228–2457 m. Chuquisaca: *Lozano et al.* 1684 (HSB, LPB, MO, USZ); Santa Cruz: *Churchill et al.* 23843 (HSB, LPB, MO, USZ); Tarija: *Serrano et al.* 6322 (HSB, MO).

Syrrhopodon incompletus Schwägr. var. *incompletus* – On base and trunk of trees, and dead standing tree. 1020–1220 m. Tarija: *Churchill et al.* 23480 (HSB, MO, USZ).

Syrrhopodon ligulatus Mont. – On trunk of trees. 1550–1700 m. Tarija: *Churchill et al.* 23685 (HSB, MO, USZ).

Syrrhopodon parasiticus (Sw. ex Brid.) Paris – On logs. 920 m. Tarija: *Churchill et al.* 23495 (HSB, MO).

Syrrhopodon prolifer Schwägr. var. *prolifer* – On sandstone rocks. 1750 m. Tarija: *Lewis* 79-480 (MO; det. W. Reese).

CATAGONIACEAE

Catagonium brevicaudatum Müll. Hal. ex Broth. – On base and trunk of trees, also on trunk of tree fern (*Alsophila*). 1220–2200 m. Santa Cruz: *Churchill et al.* 23749 (HSB, MO, USZ); Tarija: *Churchill et al.* 23452 (HSB, LPB, MO, USZ).

Catagonium emarginatum S.H. Lin – On rocks and shaded rocky bank of stream. 2250–2538 m. Chuquisaca: *Lozano et al.* 2526 (HSB, LPB, MO, QCA, USZ), 2850 (HSB, LPB, MO, USZ).

CRYPHAEACEAE

Cryphaea apiculata Schimp. – On trunk and branches of treelets. 1300–2260 m. Santa Cruz: *Churchill et al.* 20383-A (USZ); Tarija: *Churchill et al.* 23269 (HSB, MO, USZ).

Cryphaea brevipila Mitt. – On shrubs. 2240 m. Chuquisaca: *Churchill et al.* 22944 (HSB, MO).

Cryphaea patens Hornsch. ex Müll. Hal. – On shrubs, trunk and branches of trees. Common. 1013–2647 m. Chuquisaca: *Lozano et al.* 1638 (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Linneo* 24550 (LPB, MO, USZ); Tarija: *Apaza et al.* 129 (HSB, LPB, MO, RB, USZ).

Cryphaea pilifera Mitt. – On on fallen tree branches and on shrubs (including *Baccharis*). 2450–2600 m. Chuquisaca: *Churchill et al.* 22897 (HSB, MO), *Lozano et al.* 865 (HSB, MO).

Cryphaea rhacomitrioides Müll. Hal. – On shrubs, trunk and branches of treelets and trees (including *Acacia*, *Schinus*). Common. 1300–2700 m. Chuquisaca: *Lozano et al. 1811* (HSB, LPB, MO, USZ); Santa Cruz: *Fuentes & Vargas 265-B* (HSB, MO, USZ); Tarija: *Churchill et al. 23314* (HSB, MO, USZ).

Schoenobryum concavifolium (Griff.) Gangulee – On trunk and branches of treelets and trees (including *Acacia*). 1040–1800 m. Chuquisaca: *Lozano & Flores 2791* (HSB, MO); Santa Cruz: *Churchill 23873* (MO, USZ); Tarija: *Mendoza & Alzerraga 1670* (MO, USZ).

DALTONIACEAE

Daltonia trachydonta Mitt. – On shrubs and nodes of bamboo (*Chusquea*). 1950–2200 m. Tarija: *Churchill et al. 23395* (HSB, MO), *23402* (MO, USZ).

DICRANACEAE

Amphidium tortuosum (Hornsch.) Cufod. – On rocks. 3031 m. Chuquisaca: *Lozano et al. 2631* (HSB, MO).

Bryohumbertia filifolia (Hornsch.) J.-P. Frahm – On soil and sandstone rocks. 1420–2529 m. Chuquisaca: *Lozano et al. 1685* (HSB, LPB, MO, USZ); Santa Cruz: *Carreño & Inturias 46* (JE, LPB, MO, USZ, VEN); Tarija: *Churchill et al. 23398* (HSB, MO, USZ).

Campylopus anderssonii (Müll. Hal.) A. Jaeger – On sandstone rock. 1750 m. Tarija: *Lewis 79-478* (LPB; det. J.-P. Frahm).

Campylopus arctocarpus (Hornsch.) Mitt. – On rocks. 2000–2250 m. Chuquisaca: *Lozano et al. 2849* (HSB, LPB, MO, RB, USZ).

Campylopus cuspidatus (Hornsch.) Mitt. – On rocks. 2000–2250 m. Chuquisaca: *Lozano et al. 2891* (HSB, MO, USZ).

Campylopus fragilis (Brid.) Bruch & Schimp. – On logs and trunk of trees. Common. 1042–2500 m. Chuquisaca: *Churchill & Churchill 20711* (LPB, MO, USZ); Santa Cruz: *Churchill & Arroyo P. 21230* (MO, USZ); Tarija: *Churchill et al. 23376* (BOLV, HSB, MO, USZ).

Campylopus heterostachys (Hampe) A. Jaeger – On humic and sandy soil, rocks, logs, and inclined trunk of trees. Common. 1200–2837 m. Chuquisaca: *Lozano et al. 1585* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Arroyo P. 21179* (MO, USZ; det. J.-P. Frahm); Tarija: *Serrano et al. 6339* (HSB, MO, USZ).

Campylopus nivalis (Brid.) Brid. – On horizontal trunk of tree. 2450 m. Santa Cruz: *Churchill & Arroyo P. 21185* (MO, USZ; det. J.-P. Frahm).

Campylopus pilifer Brid. var. *pilifer* – On soil and sandstone rocks. Common. 1240–2900 m. Chuquisaca: *Lozano & Villalobos 2287* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill et al. 20418* (MO, USZ); Tarija: *Churchill et al. 23529* (HSB, MO, USZ).

Campylopus pilifer var. *lamellatus* (Mont.) Gradst. & Sipman – On soil and rocks. 1450–2500 m. Chuquisaca: *Gutiérrez et al. 564* (HSB, MO); Santa Cruz: *Churchill & Linneo 24562* (HSB, LPB, MO, USZ); Tarija: *Churchill et al. 23399* (HSB, MO).

Campylopus reflexisetus (Müll. Hal.) Broth. – On logs. 2200 m. Santa Cruz: *Churchill & Arroyo P. 21106* (MO, USZ; det. J.-P. Frahm).

Campylopus richardii Brid. – On rocks. 1970 m. Tarija: *Lewis 79-539* (F).

Campylopus cf. subcuspidatus (Hampe) A. Jaeger – On rocky soil. 1954–2700 m. Tarija: *Churchill et al. 23555* (HSB, MO, USZ), *Serrano et al. 6297* (HSB, MO, USZ).

Dicranella sp. – On wet soil bank. 2300 m. Tarija: *Churchill 20806* (HSB, MO).

Holomitrium antennatum Mitt. – On trunk of trees and rocks. 1450–2200 m. Chuquisaca: *Lozano et al. 200* (HSB, MO, USZ); Santa Cruz: *Churchill et al. 23755* (MO, USZ); Tarija: *Churchill et al. 23659* (HSB, LPB, MO, USZ).

Holomitrium arboreum Mitt. – On trunk of trees (including *Ilex argentina*), logs and rocks. Common. 1000–2450 m. Chuquisaca: *Lozano et al. 1697* (HSB, LPB, MO, USZ); Santa Cruz: *Linneo et al. 599* (MO, USZ); Tarija: *Churchill et al. 23687* (HSB, MO, USZ).

Holomitrium crispulum Mart. – On fallen branch and rocks. 1400–2200 m. Chuquisaca: *Serrano et al. 1324* (MO, NY, USZ; det. M. Price); Santa Cruz: *Herzog 3892* (JE; det. M. Price); Tarija: *Churchill et al. 23375* (HSB, MO, USZ).

Holomitrium cf. flexuosum Mitt. – On tree branch. 2100–2300 m. Tarija: *Churchill et al. 23567* (HSB, MO, USZ).

Microdus lindigianus (Hampe) Besch. – On soil. 1570–2150 m. Chuquisaca: *Lozano & Ortiz 2697* (HSB, MO, USZ).

Oreoweisia laxiretis Broth. ex Herzog – On soil bank. 2400–2700 m. Tarija: Churchill et al. 23541 (HSB, MO, USZ).

Pilopogon guadalupensis (Brid.) J.-P. Frahm – On soil and rocky soil. Common. 2300–2800 m. Chuquisaca: Lozano et al. 953 (HSB, MO); Santa Cruz: Churchill et al. 20429 (USZ); Tarija: Churchill et al. 23521 (HSB, MO, USZ).

Pilopogon laevis (Taylor) Thér. – On soil. 2260 m. Tarija: Huaylla et al. 1893 (HSLB, MO, USZ).

DITRICHACEAE

Ditrichum difficile (Duby) M. Fleisch. – On soil over vertical rock. 2450–2500 m. Chuquisaca: Churchill 22906 (HSB, MO).

ENTODONTACEAE

Entodon beyrichii (Schwägr.) Müll. Hal. – On rocks and logs. 950–1500 m. Chuquisaca: Holst et al. 4888 (HSB, MO, USZ), Lozano 1622 (HSB, LPB, MO, USZ); Tarija: Mendoza & Alzerraga 1657 (MO, USZ).

Entodon cf. *hampeanus* Müll. Hal. – On trunk of trees and logs. 950–1241 m. Chuquisaca: Arroyo et al. 1001 (MO, USZ), Lozano & Villalobos 2265 (HSB, MO, USZ).

Entodon jamesonii (Taylor) Mitt. – On logs, shrubs, trunk and branches of trees. 1013–2200 m. Chuquisaca: Lozano et al. 2236 (HSB, MO, USZ); Santa Cruz: Fuentes & Vargas 264 (USZ); Tarija: Churchill et al. 23408 (HSB, MO, USZ).

Entodon micans Herzog – On rocks, logs, and trunk of trees (Leguminosae). Common. 1042–1500 m. Chuquisaca: Lozano et al. 2204 (HSB, LPB, MO, USZ); Santa Cruz: Churchill et al. 21307 (MO, USZ); Tarija: Churchill et al. 23298 (HSB, MO, USZ).

Erythrodontium longisetum (Hook.) Paris – On rocks, logs and trunk of trees. Common. 1150–1825 m. Chuquisaca: Lozano & Villalobos 2256 (HSB, LPB, MO, USZ); Santa Cruz: Churchill et al. 21356 (MO, USZ); Tarija: Churchill & Churchill 20789 (USZ).

Erythrodontium squarrosum (Hampe) Paris – On logs. 1040–1745 m. Chuquisaca: Lozano 1062 (HSB, MO); Santa Cruz: Churchill 23882 (USZ).

FABRONIACEAE

Fabronia ciliaris (Brid.) Brid. var. *polycarpa* (Hook.) W.R. Buck – On trunk of *Salix humboldtiana*. 1128 m. Chuquisaca: Lozano & Villalobos 2241 (HSB, MO, USZ).

Fabronia ciliaris var. *wrightii* (Sull.) W.R. Buck – On trunk of trees (including *Tecoma stans*). 1128 m. Chuquisaca: Lozano & Villalobos 2247 (HSB, MO, USZ).

Fabronia jamesonii Taylor – On branches of *Schinus*. 2700–2900 m. Tarija: Churchill et al. 23537 (HSB, MO).

FISSIDENTACEAE

Fissidens angustifolius Sull. – On soil. 1736 m. Chuquisaca: Lozano 1084 (HSB, MO).

Fissidens asplenioides Hedw. – On soil and sandstone rocks, often along streams. Common. 890–2552 m. Chuquisaca: Lozano et al. 1576 (HSB, LPB, MO, USZ); Santa Cruz: Churchill & Arroyo P. 21147 (MO, USZ); Tarija: Serrano et al. 5719 (HSB, MO).

Fissidens crispus Mont. [*F. repandus* Wilson] – On rocky soil and sandstone rocks. Common. 1128–2500 m. Chuquisaca: Churchill 20695 (MO, USZ; det. R. Pursell); Santa Cruz: Churchill & Arroyo P. 21117 (MO, USZ; det. R. Pursell); Tarija: Churchill et al. 23606 (HSB, MO, USZ; det. R. Pursell).

Fissidens dissitifolius Sull. – On rocks. 650 m. Tarija: Lewis 84-2430 (F; det. R. Pursell).

Fissidens elegans Brid. – On soil and rocks. 1042–2150 m. Chuquisaca: Lozano et al. 2225 (HSB, LPB, MO, USZ); Tarija: Churchill et al. 23238 (HSB, MO, USZ).

Fissidens intramarginatus (Hampe) A. Jaeger – On soil bank. 890 m. Tarija: Churchill et al. 23229 (HSB, MO; det. R. Pursell).

Fissidens pallidinervis Mitt. [*Fissidens minutus* Thwaites & Mitt.] – On soil and logs. 1000–1500 m. Chuquisaca: Lozano 1031 (HSB, MO, USZ); Santa Cruz: Linneo et al. 523 (MO, USZ); Tarija: Churchill et al. 23299 (HSB).

Fissidens rigidulus Hook. f. & Wilson – On rocks, mostly associated with streams. 1140–2320 m. Chuquisaca: Lozano et al. 2536 (HSB, LPB, MO, QCA, USZ); Santa Cruz: Churchill et al. 23862-A (USZ); Tarija: Churchill et al. 23326 (HSB, MO, USZ).

Fissidens serratus Müll. Hal. var. *serratus* – On logs. 1000 m. Tarija: Mendoza & Marquardt 1363-A (USZ).

Fissidens wallisii Müll. Hal. – On soil and rocks. 690–2250 m. Chuquisaca: Lozano et al. 1691 (HSB, LPB, MO, USZ; det. R. Pursell); Tarija: Lewis 84-2411 (F, PAC; det. R. Pursell).

Fissidens weirii Mitt. var. *weirii* – On rocky soil and base of tree (including *Tabebuia*). 1020–2364 m. Chuquisaca: *Churchill 20699* (MO, USZ; det. R. Pursell); Santa Cruz: *Carreño & Inturias 32* (JE, LPB, MO, QCA, USM, USZ, VEN); Tarija: *Churchill et al. 23485* (HSB, MO, USZ).

Fissidens weirii var. *hemicraspedophyllus* (Cardot) Pursell – On rocky soil and rocks. 890–1450 m. Chuquisaca: *Lozano et al. 1677-A* (HSB, MO; det. R. Pursell); Tarija: *Churchill et al. 23205* (HSB, MO, USZ).

Fissidens zollingeri Mont. – On rocks. 1150–1241 m. Chuquisaca: *Lozano & Villalobos 2251-A* (HSB, MO).

FUNARIACEAE

Entosthodon lindigii (Hampe) Mitt. – On soil. 2150–2700 m. Chuquisaca: *Lozano 979* (HSB, MO).

Entosthodon mathewsii Hook. f. – On soil. 1191 m. Chuquisaca: *Lozano & Flores 2778* (HSB, MO, USZ).

Entosthodon obtusifolius Hook. f. in Hook. – On soil. 2630 m. Chuquisaca: *Churchill et al. 23070* (HSB, MO, USZ).

Entosthodon radians (Hedw.) Müll. Hal. – On soil. 2000–2250 m. Chuquisaca: *Lozano et al. 2885* (HSB, MO, USZ).

Funaria calvescens Schwägr. – On soil and rocks. 1300–2290 m. Chuquisaca: *Lozano et al. 1673* (HSB, LPB, MO, USZ); Santa Cruz: *Fuentes & Vargas 280* (USZ); Tarija: *Churchill et al. 23293-A* (HSB, MO). GRIMMIACEAE

Grimmia longirostris Hook. – On rocks. 2700–2900 m. Chuquisaca: *Apaza & Lozano 224* (HSB, MA, MO, USZ); Tarija: *Churchill et al. 23530* (HSB, MA, MO, USZ; verif. J. Muñoz).

Ptychomitrium angusticarpum Schiavone & Biasuso – On rocks, along shaded stream. 2200 m. Santa Cruz: *Churchill & Arroyo P. 21109* (BOLV, LPB, MO, USZ).

Ptychomitrium lindmanii (Broth.) Paris – On rocks. 1140–1200 m. Tarija: *Churchill et al. 23325* (BOLV, HSB, LPB, MO, USZ).

Ptychomitrium sellowianum (Müll. Hal.) A. Jaeger – On rocks. 1000–2538 m. Chuquisaca: *Lozano et al. 2537* (HSB, MO); Santa Cruz: *Churchill et al. 21365* (BOLV, LPB, MO, USZ); Tarija: *Mendoza & Marquardt 1367* (MO, USZ).

Racomitrium subsecundum (Hook. & Grev.) Mitt. – On rocks in stream. 2400–2700 m. Tarija: *Churchill et al. 23559* (HSB, LPB, MA, MO, USZ; verif. J. Muñoz).

HEDWIGIACEAE

Braunia argentinica Müll. Hal. – On exposed rocks. 2647 m. Chuquisaca: *Lozano et al. 2614* (HSB, MO, USZ).

Braunia exserta Müll. Hal. – On trunk and branches of trees (including *Podocarpus parlatoresi*), and fallen branches, rarely on rocks. 1500–2627 m. Chuquisaca: *Lozano et al. 1736* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Arroyo P. 21210* (MO, USZ); Tarija: *Churchill 20792* (BOLV, HSB, LPB, MO, USZ).

Braunia plicata (Mitt.) A. Jaeger [as *B. secunda* (Hook.) Bruch & Schimp. in Bolivia] – On rocks, logs and trunk of trees. 1100–2837 m. Chuquisaca: *Villalobos et al. 325* (HSB, MO, USZ); Tarija: *Apaza et al. 10* (HSB, MO).

Braunia reflexifolia (Müll. Hal.) E.B. Bartram – On branches of tree. 2000–2200 m. Tarija: *Churchill et al. 23367* (HSB, MO, USZ).

Braunia subincana Broth. – On logs, trunk of trees. 1200–2837 m. Chuquisaca: *Apaza et al. 206* (HSB, MO, USZ); Tarija: *Apaza et al. 7* (HSB, MO)

Hedwigia ciliata (Hedw.) P. Beauv. – On rocks. 1970–2410 m. Chuquisaca: *Lewis 84-1941* (LPB); Tarija: *Lewis 84-2086, 84-2135* (LPB).

Hedwigidium integrifolium (P. Beauv.) Dixon – On rocks. 2050–2250 m. Chuquisaca: *Lozano et al. 2866* (HSB, LPB, MO, USZ); Santa Cruz: *Inturias et al. 64* (JE, LPB, MO, USZ, VEN); Tarija: *Lewis 84-2059* (LPB).

HOOKERIAACEAE

Hookeria acutifolia Hook. & Grev. – On wet humic soil. 2000–2250 m. Chuquisaca: *Lozano et al. 2902* (HSB, MO).

HYLOCOMIACEAE

Pleurozium quitense (Mitt.) B.H. Allen & Magill – On rocks and trunk of trees. 2450–2900 m. Tarija: *Churchill et al. 23565* (HSB, MO, USZ).

HYPNACEAE

Chryso-hypnum diminutivum (Hampe) W.R. Buck – On rocks and logs. Common. 1000–2265 m. Chuquisaca: *Lozano & Villalobos 2248* (HSB, MO);

Santa Cruz: *Churchill et al. 22072-A* (MO, USZ); Tarija: *Serrano et al. 5655* (HSB, MO).

Chryso-hypnum elegantulum (Hook.) Hampe – On soil and logs. Common. 890–1500 m. Chuquisaca: *Lozano et al. 1723* (HSB, LPB, MO, USZ); Santa Cruz: *Linneo & Roth 536* (LPB, MO, USZ); Tarija: *Churchill et al. 23199* (BOLV, HSB, MO, USZ).

Ctenidium malacodes Mitt. – Over leaf litter and logs. 2100–2250 m. Chuquisaca: *Lozano et al. 2846* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill et al. 23795* (HSB, MO, USZ).

Ectropothecium leptochaeton (Schwägr.) W.R. Buck – On soil and sandstone rocks. 1200–2240 m. Santa Cruz: *Churchill et al. 23739* (BOLV, HSB, LPB, MO, USZ); Tarija: *Apaza et al. 40* (HSB, MO, USZ).

Isopterygium byssobolax (Müll. Hal.) Paris – On logs and base of trees. Common. 922–2450 m. Chuquisaca: *Lozano et al. 1730* (HSB, MO, USZ); Santa Cruz: *Churchill & Linneo 24552-A* (LPB, MO, USZ); Tarija: *Lewis 84-2269* (LPB; det. R. Ireland), *Serrano et al. 5859* (HSB, MO).

Isopterygium tenerum (Sw.) Mitt. – On logs and lianas. 1836–2500 m. Chuquisaca: *Lozano & Mogro 176* (HSB, MO); Santa Cruz: *Churchill et al. 21321* (MO, USZ); Tarija: *Churchill et al. 23335* (HSB, MO, USZ).

Mittenothamnium reduncum (Schimp. ex Mitt.) Ochyra [*Hygrohypnum*] – On rocks and base of trees, mostly associated with streams or seeps. 2000–2500 m. Chuquisaca: *Churchill et al. 22961* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Arroyo P. 21132* (MO, USZ); Tarija: *Churchill et al. 23394* (HSB, MO).

Mittenothamnium reptans (Hedw.) Cardot – On soil, leaf litter, rocks, logs, trunk and branches of trees. 890–2552 m. Chuquisaca: *Gutiérrez et al. 556* (HSB, MO, USZ); Santa Cruz: *Churchill & Linneo 24537* (LPB, MO, USZ); Tarija: *Huaylla et al. 1815* (HSB, MO, USZ).

Mittenothamnium substriatum (Mitt.) Cardot – On soil, rocks and logs. 1240–1550 m. Santa Cruz: *Churchill et al. 21308, 21853, 22076* (MO, USZ).

Platygyriella densa (Hook.) W.R. Buck – On rocks and base of trees (including *Ilex argentina*). 1275–1700 m. Chuquisaca: *Lozano et al. 2991* (HSB, LPB, MO, USZ); Tarija: *Churchill et al. 23699* (HSB, LPB, MO, USZ).

Pylaisia falcata Schimp. – On on logs and tree trunk (*Podocarpus*). 2837 m. Chuquisaca: *Apaza & Lozano 229* (HSB, MO, USZ).

Vesicularia vesicularis (Schwägr.) Broth. – On rocks and logs. 1150–1241 m. Chuquisaca: *Lozano & Villalobos 2273* (HSB, MO, USZ); Santa Cruz: *Linneo & Roth 547* (USZ).

HYPOPTERYGIACEAE

Hypopterygium tamarisci (Sw.) Brid. ex Müll. Hal. – On rocks, logs, exposed roots and base of trees. Common. 639–2500 m. Chuquisaca: *Lozano et al. 1712* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill et al. 23807* (HSB, MO, USZ); Tarija: *Serrano et al. 5850* (HSB, MO).

LEMBOPHYLLACEAE

Orthostichella pachygastrella (Müll. Hal. ex Ångstr.) B.H. Allen & Magill – On rocks, logs, trunk and branches of treelets and trees. Common. 890–2552 m. Chuquisaca: *Lozano et al. 236* (HSB, MO, USZ); Santa Cruz: *Churchill et al. 23736* (HSB, MO, USZ); Tarija: *Churchill et al. 23595* (HSB, LPB, MO, USZ).

Orthostichella versicolor (Müll. Hal.) B.H. Allen & W.R. Buck – On shrubs. 1450–1550 m. Santa Cruz: *Churchill et al. 23728* (HSB, MO, USZ).

Pilotrichella flexilis (Hedw.) Ångstr. – On base, trunk and branches of trees, rarely on rocks. 1350–2450 m. Chuquisaca: *Lozano et al. 1695* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Arroyo P. 21190* (BOLV, LPB, MO, USZ); Tarija: *Churchill et al. 23362* (BOLV, HSB, LPB, MO, USZ).

LEPTODONTACEAE

Forsstroemia coronata (Mont.) Paris – On trunk of trees. 1330–1480 m. Chuquisaca: *Lozano et al. 1568* (HSB, MO, USZ); Tarija: *Churchill 20743* (LPB, MO, USZ).

Forsstroemia producta (Hornsch.) Paris – On trunk and branches of trees. Common. 1013–1900 m. Chuquisaca: *Churchill 20679* (BOLV, LPB, MO, USZ), *Lozano et al. 2205* (HSB, MO); Tarija: *Churchill et al. 23237* (HSB, MO, USZ).

Forsstroemia trichomitria (Hedw.) Lindb. – On branches of trees and fallen branches. 1013–1400 m. Chuquisaca: *Lozano et al. 2207* (HSB, MO, USZ); Tarija: *Churchill 20776* (MO, USZ).

LESKEACEAE

Haplocladium microphyllum (Hedw.) Broth. – On branches (Solanaceae). 2529 m. Chuquisaca: *Apaza et al. 195* (HSB, MO).

Leptopterigynandrum austro-alpinum Müll. Hal. – On trunk of trees. 2700–2900 m. Tarija: Churchill *et al.* 23532 (HSB, MO, USZ; verif. S. He).

Leptopterigynandrum subintegrum (Mitt.) Broth. – On trunk of trees (including *Alnus acuminata*). 2430–2970 m. Chuquisaca: Lewis 84-1878, 84-1945 (LPB; det. H. Si).

Pseudoleskea andina Schimp. ex E. Britton – On logs and shrubs. 2000–2500 m. Chuquisaca: Lozano 972 (HSB, MO); Santa Cruz: Churchill & Arroyo P. 21146 (MO, USZ); Tarija: Churchill *et al.* 23381 (HSB, MO).

LEUCOBRYACEAE

Leucobryum antillarum Schimp. ex Besch. – On rocks, logs and base of trees. 1050–2100 m. Chuquisaca: Lozano *et al.* 202 (HSB, MO, USZ); Santa Cruz: Churchill *et al.* 23784 (HSB, MO, USZ); Tarija: Serrano *et al.* 5720 (HSB, MO, USZ).

Leucobryum crispum Müll. Hal. – On logs and base of trees. 1220–2000 m. Chuquisaca: Holst 4844 (HSB, MO, USZ); Santa Cruz: Linneo & Roth 544 (LPB, MO, USZ); Tarija: Churchill *et al.* 23453 (BOLV, HSB, LPB, MO, USZ).

Leucobryum polakowskyi (Müll. Hal. ex Besch.) Cardot – On logs. 1900 m. Santa Cruz: Linneo *et al.* 552 (HSB, LPB, MO, USZ).

Ochrobryum gardneri (Müll. Hal.) Mitt. – On logs. 1215–1800 m. Chuquisaca: Lozano *et al.* 2926 (HSB, LPB, MO, USZ).

LEUCODONTACEAE

Pterogoniadelphus assimilis (Müll. Hal.) Ochyra & Zijlstra [*Felipponea montevidensis* (Müll. Hal.) Broth.] – On rocks, logs, fallen branches and trunk of trees. 1200–1825 m. Chuquisaca: Lozano *et al.* 2933 (HSB, LPB, MO, USZ); Santa Cruz: Linneo & Roth 538 (LPB, MO, USZ); Tarija: Churchill *et al.* 23274 (HSB, MO, USZ).

MACROMITRIACEAE

Cardotiella quinquefaria (Hornsch.) Vitt – On base of trees (including *Juglans*) and sandstone rocks. 1300–2240 m. Chuquisaca: Lozano *et al.* 218 (HSB, MO, USZ); Santa Cruz: Churchill *et al.* 23892 (BOLV, HSB, LPB, MO, USZ); Tarija: Churchill *et al.* 23585 (HSB, MO, USZ).

Macrocoma orthotrichoides (Raddi) Wijk & Margad. – On trunk of tree. 1200 m. Tarija: Apaza *et al.* 17 (HSB, MO).

Macrocoma tenuis (Hook. & Grev.) Vitt subsp. *sullivantii* (Müll. Hal.) Vitt – On base, trunk and branches of treelets and trees (including *Berberis*, *Podocarpus*), rarely on logs. Common. 1100–2552 m. Chuquisaca: Lozano 1636 (HSB, LPB, MO, USZ); Santa Cruz: Churchill & Arroyo P. 21193 (BOLV, LPB, MO, USZ); Tarija: Churchill *et al.* 23566 (HSB, MO, USZ).

Macromitrium punctatum (Hook. & Grev.) Brid. – On trunk of trees (including *Podocarpus*), rarely on logs. Common. 1376–2500 m. Chuquisaca: Lozano *et al.* 1694 (HSB, MO, USZ); Santa Cruz: Churchill *et al.* 23858 (LPB, MO, USZ); Tarija: Churchill *et al.* 23370 (HSB, MO, USZ).

Macromitrium stellulatum (Hornsch.) Brid. – On trunk of trees. 1350–1500 m. Santa Cruz: Churchill *et al.* 23852 (LPB, MO, USZ).

Schlotheimia cf. rugifolia (Hook.) Schwägr. – On rocks and base, trunk and branches of trees. 1300–1716 m. Chuquisaca: Lozano & Mogro 149 (HSB, MO); Santa Cruz: Churchill *et al.* 23869 (MO, USZ); Tarija: Churchill 20771 (BOLV, LPB, MO, USZ).

Schlotheimia jamesonii (Arn.) Brid. – On logs and trunk of trees. 1540–2200 m. Chuquisaca: Lozano 1046 (HSB, MO); Santa Cruz: Churchill & Arroyo P. 21142 (MO, USZ); Tarija: Churchill *et al.* 23306 (HSB, MO, USZ).

Schlotheimia torquata (Hedw.) Brid. – On logs. 1100–1900 m. Santa Cruz: Linneo *et al.* 565 (MO, USZ).

METEORACEAE

Meteorium deppei (Hornsch. ex Müll. Hal.) Mitt. [*Meteorium illecebrum* Sull.] – On rocks, fallen branches, shrubs, trunk and branches of treelets and trees (including *Brunfelsia*). Common. 1200–2450 m. Chuquisaca: Lozano *et al.* 214 (HSB, MO, USZ); Santa Cruz: Churchill & Arroyo P. 21166 (LPB, MO, USZ). Tarija: Churchill *et al.* 23339 (HSB, MO, USZ).

Meteorium laevifolium Mitt. [*Cryptopapillaria*; *Papillaria penicillata* (Dozy & Molk.) Broth. of reports] – On fallen branches, shrubs and branches of treelets and trees (including *Myrcia multiflora*). 890–2240 m. Chuquisaca: Churchill *et al.* 22888 (HSB, MO, USZ). Santa Cruz: Churchill & Arroyo P. 21225 (BOLV, LPB, MO, USZ). Tarija: Churchill *et al.* 23461 (HSB, MO, USZ).

Meteorium nigrescens (Sw. ex Hedw.) Dozy & Molk. [*Papillaria*] – On rocks, logs, shrubs, and trunk of trees. 1320–1500 m. Chuquisaca: Lozano 1134 (HSB,

MO); Santa Cruz: *Churchill et al.* 23886 (MO, USZ); Tarija: *Lewis* 84-2199 (LPB).

MNIACEAE

Plagiomnium rhynchophorum (Hook.) T.J. Kop. – On rocks, soil, leaf litter, logs, exposed roots and base of trees. Common. 850–2538 m. Chuquisaca: *Gutiérrez et al.* 554 (HSB, MO); Santa Cruz: *Churchill & Arroyo P.* 21158 (BOLV, LPB, MO, USZ); Tarija: *Huaylla et al.* 1643 (HSB, MO, USZ).

MYRINIACEAE

Helicodontium capillare (Hedw.) A. Jaeger – On trunk and branches of treelets and trees. 920–1240 m. Chuquisaca: *Lozano & Villalobos* 2269 (HSB, MO); Tarija: *Churchill et al.* 23501 (HSB, MO).

NECKERACEAE

Neckera andina Mitt. – On trunk of trees. 1013–2552 m. Chuquisaca: *Lozano et al.* 238 (HSB, MO); Tarija: *Apaza et al.* 156 (HSB, MO, RB, USZ).

Neckera chilensis Schimp. ex Mont. – On trunk of trees (including *Schinus andinus*). 1120–2837 m. Chuquisaca: *Lozano et al.* 2553 (HSB, MO); Tarija: *Churchill* 20805-A (BOLV, HSB, LPB, MO, USZ).

Neckera scabridens Müll. Hal. – On logs, shrubs, lianas, trunk of treelets and trees. Common. 1042–2837 m. Chuquisaca: *Lozano* 1015 (HSB, MO, USZ); Santa Cruz: *Churchill & Linneo* (LPB, MO, USZ); Tarija: *Churchill et al.* 23380 (HSB, MO, USZ).

Neckeropsis undulata (Hedw.) Reichardt – On trunk of treelets and trees, rarely on rocks. Common. 890–1736 m. Chuquisaca: *Lozano et al.* 1573 (HSB, LPB, MO, USZ); Santa Cruz: *Churchill et al.* 23722 (HSB, MO, USZ); Tarija: *Churchill et al.* 23283 (HSB, MO, USZ).

Porotrichodendron bertrandii (Renauld & Cardot) Broth. – On base of tree (*Podocarpus*). 1950–2200 m. Tarija: *Churchill et al.* 23369 (HSB, MO, USZ).

Porotrichodendron superbum (Taylor) Broth. – On trunk of trees. 1416–1450 m. Chuquisaca: *Lozano et al.* 1680 (HSB, MO, USZ).

Porotrichum filiferum Mitt. – On rocks, humic soil and trunk of trees. 890–2460 m. Chuquisaca: *Lozano et al.* 1809 (HSB, LPB, MO, USZ); Santa Cruz: *Churchill et al.* 23811 (MO, USZ); Tarija: *Churchill et al.* 23226 (HSB, MO, USZ).

Porotrichum mutabile Hampe – On trunk of treelets and trees. 890–1220 m. Tarija: *Churchill et al.* 23476 (HSB, MO, USZ).

Porotrichum thieleanum (Müll. Hal.) Mitt. – On logs and trunk of treelets and trees (including Myrtaceae). 1228–2538 m. Chuquisaca: *Lozano et al.* 1726 (HSB, MO, USZ), 2561 (HSB, MO, USZ); Tarija: *Churchill et al.* 23654 (HSB, MO, USZ).

Thamnobryum fasciculatum (Sw. ex Hedw.) I. Sastre – On rocks along and in streams. 1120–2450 m. Chuquisaca: *Churchill et al.* 22962 (HSB, MO); Santa Cruz: *Churchill & Arroyo P.* 21212 (BOLV, LPB, MO, USZ); Tarija: *Churchill et al.* 23437 (BOLV, HSB, LPB, MO, USZ).

OCTOBLEPHARACEAE

Octoblepharum albidum Hedw. – On rocks and trunk of trees. 920–1500 m. Santa Cruz: *Churchill et al.* 23887 (LPB, MO, USZ); Tarija: *Churchill et al.* 23496 (HSB, MO).

Octoblepharum pulvinatum (Dozy & Molke.) Mitt. – On tree trunk. 1165 m. Tarija: *Apaza et al.* 88 (HSB, MO, USZ).

ORTHOTRICHACEAE

Orthotrichum cf. *pycnophyllum* Schimp. in Müll. Hal. – On shrubs. 2380 m. Santa Cruz: *Churchill* 22303 (MO, USZ).

Zygodon obtusifolius Hook. – On trunk of trees (*Podocarpus parlatorei*). 2538 m. Chuquisaca: *Lozano et al.* 2552 (HSB, MA, MO, USZ).

Zygodon oeneus Herzog – On logs and trunk of trees (including *Podocarpus*). 1240–2400 m. Chuquisaca: *Lozano et al.* 1752 (HSB, MO, USZ); Tarija: *Churchill et al.* 23358 (HSB, MA, MO, USZ; det. G. Calabrese), 23641 (HSB, MA, MO; det. G. Calabrese).

Zygodon reinwardtii (Hornsch.) A. Braun – On branches. 2450 m. Santa Cruz: *Churchill & Arroyo P.* 21197-A (USZ).

Zygodon subrecurvifolius Broth. – On logs. 2265 m. Santa Cruz: *Churchill et al.* 20412 (LPB, MA, MO, USZ; det. G. Calabrese).

PHYLLOGONIACEAE

Phyllogonium viride Brid. – On trunk of treelet. 2180–2240 m. Santa Cruz: *Churchill et al.* 23788, 23813 (MO, USZ).

PILOTTRICHACEAE

Callicostella merkelii (Hornsch.) A. Jaeger – On rocks in streams. 1150–1320 m. Chuquisaca: *Lozano*

& *Villalobos 2250* (HSB, MO, USZ); Santa Cruz: *Churchill et al. 21842* (BOLV, LPB, MO, USZ).

Cyclodictyon aeruginosum (Mitt.) Kuntze – On sandstone rocks, along streams. 1320–1500 m. Santa Cruz: *Churchill et al. 21839* (BOLV, LPB, MO, USZ).

Cyclodictyon albicans (Hedw.) Kuntze – On wet rocky soil and logs. 890–2538 m. Chuquisaca: *Churchill et al. 23059* (HSB, MO); Tarija: *Churchill et al. 23447* (HSB, MO, USZ), *Serrano et al. 5909* (HSB, MO).

Hypnella pilifera (Hook. f. & Wilson) A. Jaeger – On decaying log. 2364 m. Santa Cruz: *Carreño & Inturias 36* (JE, LPB, MO, USZ, VEN).

Lepidopilidium cf. divaricatum (Dozy & Molk.) Broth. – On rocks, logs and trunk of trees (including *Cedrela lilloni*). 639–2150 m. Chuquisaca: *Lozano et al. 1799* (HSB, LPB, MO, USZ); Tarija: *Serrano et al. 5852* (HSB, MO).

Thamniopsis cf. langsdorffii (Hook.) W.R. Buck – On sandstone rock. 1150–1220 m. Santa Cruz: *Churchill et al. 20900* (LPB, MO, RB, USZ); Tarija: *Churchill et al. 23465* (HSB, MO).

Trachyxiphium guadalupense (Spreng.) W.R. Buck – On moist sandstone rock. 2200 m. Santa Cruz: *Carreño & Inturias 36* (JE, MO, RB, USZ, VEN).

PLAGIOTHECIACEAE

Plagiothecium conostegium Herzog – On soil. 2450–2500 m. Chuquisaca: *Churchill et al. 22916* (BOLV, HSB, MO, USZ).

Plagiothecium lucidum (Hook. f. & Wilson) Paris – Over leaf litter at margin of small lake. 2240 m. Chuquisaca: *Churchill et al. 22940* (HSB, MO).

POLYTRICHACEAE

Atrichum polycarpum (Müll. Hal.) Mitt. – On humic soil. 1250–2450 m. Chuquisaca: *Lozano et al. 1738* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Arroyo P. 21191* (MO, USZ); Tarija: *Churchill et al. 23360* (HSB, MO, USZ).

Pogonatum campylocarpon (Müll. Hal.) Mitt. – On soil and rocky soil. Common. 1236–2627 m. Chuquisaca: *Villalobos et al. 507* (HSB, MO, USZ); Santa Cruz: *Churchill & Arroyo P. 21227* (BOLV, LPB, MO, USZ), Tarija: *Huaylla et al. 1891* (HSB, MO, USZ).

Pogonatum perichaetiale (Mont.) A. Jaeger subsp. *oligodus* (Kunze ex Müll. Hal.) Hyvönen – On soil.

3031 m. Chuquisaca: *Lozano et al. 2629* (HSB, MO, QCA, USZ).

Polytrichadelphus aff. longisetus (Brid.) Mitt. – On rocky soil. 2200 m. Santa Cruz: *Carreño & Inturias 60A* (JE, LPB, MO, USZ, VEN)

Polytrichastrum tenellum (Müll. Hal.) G.L. Sm. – On rocks. 1400–2900 m. Tarija: *Churchill et al. 23573* (HSB, MO), *Serrano et al. 5771* (HSB, MO, USZ).

Polytrichum juniperinum Hedw. – On soil and rocks (including sandstone). Common. 1071–2627 m. Chuquisaca: *Churchill & Churchill 20718* (MO, USZ); Santa Cruz: *Linneo et al. 573* (LPB, MO, USZ); Tarija: *Huaylla et al. 1772* (HSB, MO, USZ).

Psilopilum gymnostomulum (Müll. Hal.) Paris – On soil and rocky soil. 2484–2627 m. Chuquisaca: *Lozano et al. 2506, 2566* (HSB, MO).

POTTIACEAE

Anoetangium aestivum (Hedw.) Mitt. – On rocks, associated with seeps and streams. 890–2900 m. Chuquisaca: *Lozano & Villalobos 2246* (HSB, MO, MUB, USZ); Santa Cruz: *Churchill et al. 23897* (LPB, MO, USZ); Tarija: *Serrano et al. 6195* (HSB, MO, USZ).

Barbula arcuata Griff. – On rocks, along streams. 1042–1400 m. Chuquisaca: *Lozano et al. 2201* (HSB, MO, USZ); Tarija: *Churchill 20775* (LPB, MO, USZ).

Barbula indica (Hook.) Spreng. in Steud. – On soil and rocks. 1040–1191 m. Chuquisaca: *Lozano & Flores 2788* (HSB, MO, USZ); Santa Cruz: *Carreño & Inturias 77* (LPB, MO, MUB, USZ).

Barbula orizabensis Müll. Hal. – On soil and sandstone rocks, often along streams. 800–1700 m. Chuquisaca: *Churchill 20698* (BOLV, HSB, LPB, MO, USZ); Santa Cruz: *Linneo et al. 532* (LPB, MO, MUB, USZ); Tarija: *Churchill 20770* (LPB, MO, USZ).

Bryoerythrophyllum campylocarpum (Müll. Hal.) H.A. Crum – On soil covered rocks, often along streams. 2000–2240 m. Chuquisaca: *Churchill et al. 22941* (MUB, USZ; det. M. Cano & J. Jiménez); Santa Cruz: *Churchill & Arroyo P. 21139* (MO, USZ); Tarija: *Churchill et al. 23393* (HSB, MO, USZ).

Didymodon humboldtii (Herzog) E.H. Hegew. & P.D. Hegew. – On soil and rocks. 1400 m. Santa Cruz: *Herzog 3564* (Herzog 1916: 167).

Didymodon rigidulus Hedw. – On sandstone rocks. 1042 m. *Lozano et al. 2202* (HSB, MO, MUB, USZ).

- Hymenostylium recurvirostrum* (Hedw.) Dixon – On rocks, often associated with seeps and streams. 1140–1240 m. Chuquisaca: *Lozano & Villalobos 2252* (HSB, MO, MUB, USZ); Santa Cruz: *Carreño & Inturias 78* (HSB, MO, MUB, USZ); Tarija: *Churchill et al. 23336* (BOLV, HSB, LPB, MO, USZ).
- Hyophila involuta* (Hook.) A. Jaeger – On rocks, including sandstone. 1040–1400 m. Chuquisaca: *Churchill 20703* (LPB, MO, USZ); Santa Cruz: *Churchill 23876* (MO, USZ); Tarija: *Churchill 20762* (LPB, MO, USZ).
- Leptodontium brachyphyllum* Broth. & Thér. – On rocks, associated with *Campylopus*. 2000–2200 m. Tarija: *Churchill et al. 23391* (HSB, MO, USZ).
- Leptodontium capituligerum* Müll. Hal. – On soil and rocks, rarely on trunk of trees (*Schinus andinus*). 2200–2647 m. Chuquisaca: *Lozano et al. 814* (HSB, MO); Santa Cruz: *Churchill & Arroyo P. 21151* (BOLV, MO, USZ).
- Leptodontium filicola* Herzog – On sandy soil and logs. 2200–2240 m. Chuquisaca: *Churchill et al. 22948* (HSB, MO); Santa Cruz: *Churchill & Arroyo P. 21106-A* (MO, USZ).
- Leptodontium longicaule* Mitt. var. *longicaule* – On soil and leaf litter. 1723–2290 m. Chuquisaca: *Lozano et al. 2853* (HSB, LPB, MO, MUB, USZ).
- Leptodontium planifolium* Herzog – On humus and leaf litter. 2000–2250 m. Chuquisaca: *Lozano et al. 2884* (HSB, MO, MUB, USZ).
- Leptodontium viticulosoides* (P. Beauv.) Wijk & Margad. var. *viticulosoides* – On trunk and branches of trees (including *Podocarpus*), infrequent on lianas, logs and rocks. Common. 1250–2837 m. Chuquisaca: *Lozano et al. 1644* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Arroyo P. 21173* (LPB, MO, USZ); Tarija: *Churchill et al. 23342* (HSB, MO, USZ).
- Leptodontium viticulosoides* var. *sulphureum* (Müll. Hal.) R.H. Zander – On rocks, logs, and branches of *Podocarpus*. 1450–2500 m. Chuquisaca: *Lozano et al. 1690* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Arroyo P. 21129* (MO, USZ).
- Plaubelia sprengelii* (Schwägr.) R.H. Zander – On sandy soil. 1013 m. Tarija: *Apaza et al. 159* (HSB, MO, MUB, USZ).
- Pleurochaete luteola* (Besch.) Thér. – On sandy soil. 1200 m. Tarija: *Apaza et al. 20* (HSB, MO, MUB).
- Pseudocrossidium linearifolium* (Müll. Hal.) J.A. Jiménez & M.J. Cano [*P. perrevolutum* var. *linearifolium* (Müll. Hal.) R.H. Zander] – On sandy soil. 1140 m. Tarija: *Churchill et al. 23297* (HSB, MO; det. J. Jiménez).
- Pseudocrossidium replicatum* (Taylor) R.H. Zander – On soil. 1020–2552 m. Chuquisaca: *Lozano et al. 245* (HSB, MO).
- Rhexophyllum subnigrum* (Mitt.) Hilp. – On soil and fallen branches. 1950–3120 m. Chuquisaca: *Lozano et al. 2625* (HSB, MO); Tarija: *Churchill et al. 23384-A* (HSB, MO, USZ).
- Scopelophila ligulata* (Spruce) Spruce – On vertical rock. 1140–1200 m. Tarija: *Churchill et al. 23323-A* (HSB, MO).
- Streptocalypta lorentziana* Müll. Hal. – On rocks, along stream. 1450 m. Tarija: *Lewis 79-555* (F, LPB, MO; det. R.H. Zander).
- Streptopogon calymperes* Müll. Hal. – On branches of shrubs and trees, rarely on base of trees. 1220–2240 m. Santa Cruz: *Churchill et al. 23827* (MO, USZ); Tarija: *Churchill et al. 23613* (HSB, MO).
- Streptopogon erythrodontus* (Taylor) Wilson – On shrubs and branches of trees. 2000–2700 m. Tarija: *Churchill et al. 23548* (HSB, MO).
- Syntrichia ammonsiana* (H.A. Crum & L.E. Anderson) Ochyra – On fallen branches and rocks. 2450–2647 m. Chuquisaca: *Lozano et al. 2613* (HSB, MO), *Churchill et al. 22938* (LPB, MO, USZ).
- Syntrichia amphidiacea* (Müll. Hal.) R.H. Zander – On logs and trunk of trees. 1300–2200 m. Santa Cruz: *Churchill & Arroyo P. 21145* (USZ); Tarija: *Churchill et al. 23243* (HSB, MO).
- Syntrichia bogotensis* (Hampe) Mitt. ex R.H. Zander – On tree trunk. 2837 m. Chuquisaca: *Apaza & Lozano 236* (HSB, MUB).
- Syntrichia fragilis* (Taylor) Ochyra – On soil, rocks and exposed roots of trees. 2400–2700 m. Chuquisaca: *Lozano et al. 254* (HSB, MO); Tarija: *Churchill et al. 23550* (HSB, MO, MUB, USZ; verif. M. Gallego).
- Syntrichia lacerifolia* (R.S. Williams) R.H. Zander – On shrub (Rosaceae), trunk and branches of trees, and rocks. 2200–2837 m. Chuquisaca: *Apaza & Lozano et al. 217* (HSB, MO, MUB, USZ); Santa Cruz: *Churchill & Arroyo P. 21241* (MUB, USZ; det. M. Gallego); Tarija: *Churchill et al. 23533* (HSB, MO, MUB, USZ; det. M.J. Cano, verif. M. Gallego).
- Syntrichia obtusissima* (Müll. Hal.) R.H. Zander – On soil. 2552 m. Chuquisaca: *Lozano et al. 252* (HSB, MO, MUB; det. M. Gallego).

Tortella humilis (Hedw.) Jenn. – On soil covered rocks, logs, exposed roots and base of trees. 1200–1620 m. Chuquisaca: *Villalobos et al. 324* (HSB, MO); Santa Cruz: *Churchill et al. 23871* (MO, USZ); Tarija: *Churchill et al. 23236* (HSB, MO).

Trichostomum brachydontium Bruch – On soil and rocks, rarely on base of trees. Common. 890–2200 m. Chuquisaca: *Lozano 1059* (HSB, MO); Santa Cruz: *Churchill et al. 23848* (BOLV, HSB, LPB, MO, USZ); Tarija: *Churchill et al. 23676* (HSB, MO, USZ).

Trichostomum tenuirostre (Hook. & Taylor) Lindb. – On soil, logs and base of trees. 1220–2400 m. Chuquisaca: *Lozano et al. 1696* (HSB, LPB, MO); Santa Cruz: *Carreño & Inturias 38* (MO, USZ); Tarija: *Churchill et al. 23560* (HSB, MO, USZ).

Weissia controversa Hedw. – On soil. 1100–1550 m. Chuquisaca: *Lozano 1069* (HSB, MO); Santa Cruz: *Churchill et al. 23735* (MO, USZ); Tarija: *Churchill et al. 23257* (HSB, MO, USZ).

Weissia jamaicensis (Mitt.) Grout – On soil and rocks. 1040–1450 m. Chuquisaca: *Lozano et al. 1673-B* (HSB, MO); Santa Cruz: *Carreño & Inturias 76* (MO, USZ); Tarija: *Churchill et al. 23291-A* (MO, MUB, USZ).

PRIONODONTACEAE

Prionodon densus (Sw. ex Hedw.) Müll. Hal. – On trunk and branches of trees, infrequent on logs or rocks. 1236–2500 m. Chuquisaca: *Lozano et al. 1724* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill & Linneo 24548* (LPB, MO, USZ); Tarija: *Huaylla et al. 1749* (HSB, MO, USZ).

Prionodon luteovirens (Taylor) Mitt. [*P. densus* var. *luteovirens* (Taylor) E.B. Bartram] – On trunk of treelet. 2200 m. Santa Cruz: *Churchill & Arroyo P. 21104* (BOLV, LPB, MO, USZ).

PTEROBRYACEAE

Calypothecium duplicatum (Schwägr.) Broth. – On trunk and branches of treelets and trees. 920–1700 m. Chuquisaca: *Lozano et al. 1571* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill et al. 23723* (BOLV, HSB, LPB, MO, USZ); Tarija: *Churchill et al. 23500* (BOLV, HSB, LPB, MO, USZ).

Orthostichopsis tenuis (A. Jaeger) Broth. – On shrubs, trunk and branches of treelets and trees, infrequent on logs. Common. 1228–2230 m. Chuquisaca: *Lozano et al. 1678* (HSB, LPB, MO, USZ); Santa Cruz: *Churchill et al. 23760* (HSB, MO, USZ); Tarija: *Churchill et al. 23660* (HSB, LPB, MO, USZ).

Pterobryon densum Hornsch. – On shrubs and trunk of trees, rarely on logs. Common. 990–2450 m. Chuquisaca: *Lozano et al. 738* (HSB, MO); Santa Cruz: *Churchill & Arroyo P. 21195* (BOLV, LPB, MO, USZ); Tarija: *Huaylla et al. 1729* (HSB, MO, USZ).

Pterobryopsis stolonacea (Müll. Hal.) Broth. – On trunk of trees (including *Myrcianthes*), infrequent on logs and rocks. Common. 1042–2290 m. Chuquisaca: *Lozano & Mogro 186* (HSB, MO, USZ); Santa Cruz: *Churchill et al. 23900* (MO, USZ); Tarija: *Churchill et al. 23256* (BOLV, HSB, LPB, MO, USZ).

RACOPILACEAE

Racopilum intermedium Hampe – On rocks. 2150–2700 m. Chuquisaca: *Lozano 975* (HSB, MO).

Racopilum tomentosum (Hedw.) Brid. – On soil, rocks, logs, exposed roots and trunk of trees. Common. 890–2290 m. Chuquisaca: *Lozano et al. 2214* (HSB, LPB, MO, USZ); Santa Cruz: *Linneo & Roth 551* (MO, USZ); Tarija: *Huaylla et al. 1679* (HSB, MO, USZ), *Mendoza & Alzerraga 1596* (MO, USZ).

REGMATODONTACEAE

Regmatodon orthostegius Mont. – On trunk of tree (*Myrcianthes*). 1300 m. Santa Cruz: *Churchill et al. 23899* (MO, USZ).

RHIZOGONIACEAE

Pyrrhobryum spiniforme (Hedw.) Mitt. – On logs and base of trees. 1900–2240 m. Santa Cruz: *Churchill et al. 23766* (BOLV, HSB, LPB, MO, USZ), *Linneo et al. 577* (LPB, MO, USZ).

RIGODIACEAE

Rigodium toxarion (Schwägr.) A. Jaeger – On rocks, logs, base of trees and trunk of tree fern (*Alsophila*). 1836–2837 m. Chuquisaca: *Lozano & Mogro 179* (HSB, MO); Santa Cruz: *Churchill et al. 23806* (HSB, MO, USZ); Tarija: *Churchill et al. 23400* (BOLV, HSB, LPB, MO, USZ).

SEMATOPHYLLACEAE

Rhaphidostegium eurycystis Herzog [= *Sematophyllum*] – On logs and sandstone rocks. 1300–1500 m. Santa Cruz: *Churchill et al. 21320* (MO, USZ), *23893* (LPB, MO, USZ), *23903* (MO, USZ).

Sematophyllum cuspidiferum Mitt. – On rocks. 1042–2290 m. Chuquisaca: *Lozano et al. 2198* (HSB, LPB,

MO, USZ); Santa Cruz: *Linneo et al.* 558 (MO, USZ); Tarija: *Apaza et al.* 47 (HSB, LPB, MO, USZ).

Sematophyllum galipense (Müll. Hal.) Mitt. – On humic soil, sandstone rocks, rarely on logs. 890–2700 m. Chuquisaca: *Lozano et al.* 930 (HSB, MO); Santa Cruz: *Churchill et al.* 21832 (BOLV, LPB, MO, USZ); Tarija: *Churchill et al.* 23616 (HSB, LPB, MO, USZ).

Sematophyllum subpinnatum (Brid.) E. Britton – On humus, rocks, and trunk and branches of trees (*Myrcianthes*). 1300–1450 m. Chuquisaca: *Lozano et al.* 1569 (HSB, MO, USZ); Santa Cruz: *Churchill et al.* 23898 (MO, USZ); Tarija: *Churchill et al.* 23248 (HSB, MO).

Sematophyllum swartzii (Schwägr.) W.H. Welch & H.A. Crum – On logs. 1500–2529 m. Chuquisaca: *Lozano et al.* 765 (HSB, MO); Santa Cruz: *Churchill & Linneo* 24552 (LPB, MO, USZ); Tarija: *Churchill et al.* 23347 (HSB, MO, USZ).

Sematophyllum cf. turgidulum (Herzog) S.P. Churchill – On rocks and tree trunk. 1013–1376 m. Tarija: *Apaza et al.* 122, 157 (HSB, MO).

Trichosteleum cf. microcarpum (Mitt.) Broth. – On logs. 1416–2342 m. Chuquisaca: *Apaza et al.* 179 (HSB, MO, USZ), *Lozano et al.* 1750 (HSB, MO, USZ).

Wijkia subnitida (Hampe) H.A. Crum – On logs and trunk of trees (*Ilex argentina*). 1550–2190 m. Santa Cruz: *Churchill et al.* 23768 (HSB, MO, USZ); Tarija: *Churchill et al.* 23703 (BOLV, HSB, LPB, MO, USZ).

SPHAGNACEAE

Sphagnum subsecundum Nees – On wet humic soil. 2000–2250 m. Chuquisaca: *Lozano et al.* 2892 (HSB, LPB, MO, USZ). This collection represents the first *Sphagnum* recorded for southern Bolivia.

STEREOPHYLLACEAE

Entodontopsis leucostega (Brid.) W.R. Buck & Ireland – On fallen liana. 2204 m. Chuquisaca: *Lozano et al.* 766 (HSB, MO).

Eulacophyllum cultelliforme (Sull.) W.R. Buck & Ireland – On rocks. 800–1042 m. Chuquisaca: *Lozano et al.* 2220 (HSB, LPB, MO, USZ); Santa Cruz: *Linneo et al.* 527 (MO, USZ).

Stereophyllum radiculosum (Hook.) Mitt. – On rocks, logs and trunk of trees (Leguminosae). 1040–1300 m. Chuquisaca: *Lozano et al.* 2206 (HSB, MO); Santa Cruz: *Churchill et al.* 23910 (MO, USZ); Tarija: *Churchill et al.* 23280 (HSB, MO, USZ).

THUIDIACEAE

Pelekium leptocladum (Taylor) Touw [*Cyrto-hypnum*, *Thuidium*] – On sandstone rock and base of trees. 890–1320 m. Santa Cruz: *Churchill et al.* 21840 (MO, USZ); Tarija: *Churchill et al.* 23212 (HSB, MO).

Pelekium minutulum (Hedw.) Touw – On rocks. 800 m. Santa Cruz: *Linneo* 524 (MO, USZ).

Pelekium aff. muricatum (Hampe) Touw – On rocks and logs. 800–1900 m. Chuquisaca: *Lozano & Ortiz* 2662 (HSB, MO); Santa Cruz: *Linneo* 530 (LPB, MO, USZ); Tarija: *Apaza et al.* 100 (HSB, MO, USZ).

Rauiella lagoensis (Hampe) W.R. Buck – On rocks, logs, and trunk of trees (including *Citronella apogon*). 639–1200 m. Chuquisaca: *Lozano & Cardoso* 1647 (HSB, LPB, MO, USZ); Santa Cruz: *Linneo et al.* 528 (MO, USZ); Tarija: *Serrano et al.* 5851 (HSB, MO).

Rauiella praelonga (Schimp. ex Besch.) Wijk & Margad. – On rocks, logs, and trunk of trees. 1071–1900 m. Chuquisaca: *Lozano et al.* 1605 (HSB, LPB, MO, USZ); Tarija: *Churchill* 20744 (LPB, MO, USZ), *Serrano et al.* 5594 (HSB, MO).

Thuidium delicatulum (Hedw.) Schimp. – On rocks and logs. 1552–2300 m. Chuquisaca: *Holst et al.* 4882 (HSB, MO, USZ), *Lozano et al.* 193 (HSB, MO);

Thuidium peruvianum Mitt. – On rocks and over leaf litter. 2300–2538 m. Chuquisaca: *Lozano et al.* 2525 (HSB, MO, USZ); Tarija: *Churchill* 20803 (MO, USZ).

Thuidium cf. pseudoprotensum (Müll.Hal.) Mitt. – On rocks and exposed roots of tree. 1700–2240 m. Chuquisaca: *Gutiérrez et al.* 558 (HSB, MO, USZ); Santa Cruz: *Churchill et al.* 23820 (HSB, MO, USZ); Tarija: *Churchill et al.* 23574 (HSB, LPB, MO, USZ).

Thuidium tomentosum Schimp. – On rocky soil, rocks and logs. Common. 890–1836 m. Chuquisaca: *Lozano et al.* 1692 (HSB, LPB, MO, USZ); Santa Cruz: *Linneo et al.* 578 (LPB, MO, USZ); Tarija: *Churchill et al.* 23227 (HSB, MO, USZ).

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References:

- Churchill, S.P. 2009a.** Bryophytes of Alarachi Natural Reserve, Department of Tarija, Bolivia. *Tropical Bryology* 30: 85–91.
- Churchill, S.P. 2009b.** Moss diversity and endemism of the tropical Andes. *Annals of the Missouri Botanical Garden* 96: 000–000.
- Churchill, S. P. & A. Fuentes. 2005.** Additions, combinations, and synonyms for the Bolivian moss flora. *Tropical Bryology* 26: 119–131.
- Churchill, S.P., N.N. Sanjines A., A. Fuentes C. & R. Lozano. 2008.** Additions to the Bolivian bryophyte flora. *Tropical Bryology* 29: 54–59.
- Churchill, S.P. N. Sanjines A. and C. Aldana. 2010.** *Catalogue del Briofitas de Bolivia: La Diversidad, Distribución y Ecología*. Monographs in Systematic Botany from the Missouri Botanical Garden.
- Costa, D.P. 2008.** Metzgeriaceae. *Flora Neotropica Monograph* 102: 1–170.
- Gradstein, S. R. & D. P. Costa. 2003.** The Hepaticae and Anthocerotae of Brazil. *Memoirs of The New York Botanical Garden* 87: i–xviii, 1–316.
- Hallingbäck, T. & N. Hodgetts (eds.). 2000.** *Mosses, Liverworts and Hornworts: A Status Survey and Conservation Action Plan for Bryophytes*. IUCN, Gland.
- Herzog, T. 1916.** Die Bryophyten meiner zweiten Reise durch Bolivia. *Bibliotheca Botanica* 87: 1–347.
- Ibisch, P. L. & G. Mérida (eds.). 2003.** *Biodiversidad: La Riqueza de Bolivia*. Editorial FAN, Santa Cruz. [English version: P. L. Ibisch & G. Mérida (eds.). 2004. *Biodiversity: The Richness of Bolivia*. Editorial FAN, Santa Cruz].
- León-Yáñez, S., S.R. Gradstein & C. Wegner. 2006.** *Hepáticas (Marchantiophyta) y Antoceros (Anthocerotophyta) del Ecuador: Catálogo*. Herbario QCA, Pontificia Universidad Católica del Ecuador, Quito.
- Lozano A., R. 2005.** Aporte al conocimiento de la riqueza y composición de la flora de musgos del bosque Tucuman-Bolivian, comunidad de Nuevo Mundo: Provincia Belisario Boeto, Depto. de Chuquisaca. Universidad Mayor Real y Pontificia de San Francisco Xavier de Chuquisaca, Sucre. Tesis Licenciatura. (viii) 74 p.
- Montagne, C. 1839.** Hepaticae: 49–86; Musci: 86–116; pl. 1–3. *In: A. d'Orbigny, Voyage dans l'Amérique Méridionale*. P. Bertrand, Paris.
- Reiner-Drehwald, M.E. 2006.** Type studies on neotropical Lejeuneaceae (Jungermanniopsida). *Cheilolejeunea* and *Lepidolejeunea*. *Nova Hedwigia* 83: 473–482.
- Tropicos.org. Missouri Botanical Garden. 2009.** <<http://www.tropicos.org>>