

## Additions, Combinations, and Synonyms for the Bolivian Moss Flora

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**Abstract.** Fifty-five mosses are newly recorded for Bolivia. Additional collection data are given for twelve mosses considered little known or rare in the country. Six new synonyms are recognized, five from Bolivia, one from Brazil: *Hookeria scabripes* Müll. Hal. [*Callicostella scabripes* (Müll. Hal.) Broth.] = *Callicostella pallida* (Hornsch.) Ångstr.; *Leucobryum fragile* Herzog = *Leucobryum subobtusifolium* (Broth.) B.H. Allen; *Macromitrium pinnulatum* Herzog = *Macromitrium microstomum* (Hook. & Grev.) Schwägr.; *Schlotheimia vesiculata* Herzog [*Macromitrium vesiculatum* (Herzog) Herzog] = *Macromitrium stellulatum* (Hornsch.) Brid.; *Cyclodictyon breve* Herzog = *Cyclodictyon albicans* (Hedw.) Kuntze; and from Brazil: *Callicostella paludicola* Broth. = *Callicostella merkelii* (Hornsch.) A. Jaeger. Three new combinations are proposed: *Entosthodon subaloma* (Herzog) S.P. Churchill (*Goniobryum subaloma* Herzog), *Syntrichia xerophila* (Herzog) S.P. Churchill (*Tortula xerophila* Herzog), *Thamniopsis lepidopiloides* (Herzog) S.P. Churchill (*Hookeriopsis lepidopiloides* Herzog).

### Introduction

Bolivia has been cited, among the tropical Andean countries, as having the highest moss diversity, with more than 1200 species recorded (Churchill et al., 2000) and an estimated endemism of 30 % (Delgadillo M., 1994). Bolivia is indeed very rich with regard to mosses, but as noted by Lewis (1990) species described by Britton and Müller at the close of the 19th century, and later by Williams, Herzog, and Brotherus in the early part of the 20th century resulted in numerous superfluous names. The

number of species estimated for Bolivia is comparable to that of other tropical Andean countries, ca. 900-1000, and endemism at ca. 8-10% (Churchill, 2003). Gaining a better resolution of the Bolivian moss diversity will require a greater combined efforts of both fieldwork and herbarium studies.

General and specific inventory work related to Bolivian bryophytes over the last four years by the authors, and herbarium studies by the first author, have resulted in additional new moss records and changes in the status of several taxa

originally described from the country. Approximately 6000 bryophytes collections have been made during this time period. General field work has focused primarily on the departments of Chuquisaca, Cochabamba, Santa Cruz and Tarija. Specific field work has involved „all plant inventory“ projects initiated by Bolivian institutions (BOLV, HSB, LPB, USZ) assisted by the Missouri Botanical Garden in four areas: 1) Chapare Region (Department of Cochabamba), with premontane to low montane forest ranging in elevation from 800-2000 m, including the areas of El Palmar and El Limbo; 2) Madidi National Park (Department of La Paz) encompassing more than half of the vegetation types represented in the country, and ranging in elevation from ca. 200-6000 m; 3) Serrania Siberia (departments of Cochabamba and Santa Cruz), the southernmost distribution of true Andean montane forest, ranging in elevation from 1800-3100 m, and 4) Tucumán-Bolivian montane forest (departments of Chuquisaca, Santa Cruz; Tarija), a isolated north-south oriented mountain ranges with a pronounced dry season, including the protected areas of Tariquia National Park and Alarachi Natural Reserve in Tarija.

The recognition of new nomenclatural changes is based on examination of Herzog collections during an extended visit to the herbaria of JE (Jena, Germany) and PC (Paris, France) in 1999. Herbarium studies were also conducted at the Bolivian herbaria of LPB and USZ involving the identification of previous or recent collections.

An excellent overview of the biodiversity and vegetation of Bolivia can be found in Spanish (Ibisch & Mérida, 2003) and English (Ibisch & Mérida, 2004). A summary is available on the internet (<http://www.fan-bo.org/biodiversidad.html>, in Spanish, and <http://www.fan-bo.org/ingles/biodiversidad.html>, in English). A map of the 12 major ecoregions mentioned in this paper is also available and can be downloaded (<http://www.fan-bo.org/ecoregion.html>). Further information related to Bolivian mosses can be found on the following web site: <http://mobot.mobot.org/W3T/Search/andes/andesintro.htm>.

All taxa are listed alphabetically by genus; the family is given parenthetically for the first species of each genus. Collections are deposited with one or more of the four Bolivian institutions: BOLV (Herbario Nacional Forestal Martín Cárdenas, Cochabamba); HSB (Herbario Chuquisaca, Universidad Mayor Real y Pontificia de San Francisco Xavier de Chuquisaca, Sucre), LPB (Herbario Nacional de Bolivia, La Paz), USZ (Herbario del Oriente Boliviano, Museo de Historia Natural Noel Kempff Mercado, Universidad Autónoma Gabriel René Moreno, Santa Cruz); duplicates of most are also deposited at MO. All collections have been databased in W3MOST of TROPICOS (<http://mobot.mobot.org/W3T/Search/most.html>). There are now more than 8350 Bolivian bryophytes entered in MOST (ca. 39,000 total for the tropical Andes) that can be accessed for specimen list and species distribution maps.

#### Additions

***Barbella trichophora*** (Mont.) M. Fleisch. [Meteoriaceae] **La Paz:** Chiriuno, Madidi National Park, 14°30'00"S, 68°13'58"W, 1750-1850 m, *Fuentes et al. 5196* (BOLV, LPB, MO, USZ); **Santa Cruz:** Alto del Ríal, N of Santa Rosa de Lima, 17°50'42.3"S, 64°16'08.2"W, 2030 m, *Fuentes et al. 3196-A* (MO, USZ). On tree trunk and branches, in low montane forest. Alternate name: *Barbellopsis trichophora* (Mont.) W.R. Buck.

***Barbula arcuata*** Griff. [Pottiaceae] **La Paz:** Río Tuichi, Madidi National Park, 14°20'57"S, 67°58'23"W, 367 m, *Fuentes 5470* (BOLV, HSB, LPB, MO, USZ); Río Quendeque, Madidi National Park, 14°58'11"S, 67°47'41"W, 350 m, *Fuentes et al. 3843* (USZ). **Santa Cruz:** Río Bermejo, 6 km W of Bermejo, 18°08'S, 63°41'W, 1000 m, *Churchill 20468* (LPB, MO, USZ). **Tarija:** Río Pilcomayo canyon, 11 km W of Villamontes, 21°16'S, 63°31'W, 500 m, *Churchill 20730* (BOLV, MO, USZ); 7 km NE of Entre Rios, 21°28'S 64°09'W, 1400 m, *Churchill 20775* (LPB, MO, USZ). On soil and

rocks, in various lowlands adjacent to the eastern Andean ranges.

***Barbula indica*** (Hook.) Spreng. var. *indica* **Santa Cruz**: Ca. 20 km W of San José, Espejillos, 17°56'S, 63°26'W, 700 m, *Fuentes 145-A* (MO, USZ). On soil. This species is widespread in the Neotropics, recorded from all Tropical Andean countries.

***Barbula indica*** (Hook.) Spreng. var. *gregaria* (Mitt.) R.H. Zander **Beni**: Collana, Rurrenabaque, 14°43'34"S, 61°14'23"W, 400 m, *Arroyo P. et al. 2582* (MO, USZ). **La Paz**: Río Quendeque, Madidi National Park, 15°01'10"S, 67°44'31"W, 300 m, *Fuentes 3850* (LPB, USZ); Arroyo Negro, 14°39'36"S, 67°48'42"W, 340 m, *Fuentes et al. 4070* (BOLV, LPB, MO, USZ). **Santa Cruz**: city of Santa Cruz de la Sierra, 17°48'S, 63°10'W, 400 m, *Fuentes 307* (HSB, MO, USZ). On soil and rocks.

***Braunia reflexifolia*** (Müll. Hal.) E.B. Bartram [Hedwigiaceae] **Tarija**: Alarachi Natural Reserve, 2000-2200 m, 22°11'13"S, 64°36'27"W, *Churchill et al. 23367* (HSB, MO, USZ). On tree branches, in open, somewhat dry Tucumano-Boliviano forest. This species is known from northwest Argentina (Biasuso, 1992).

***Bryum leptocladon*** Sull. [Bryaceae] **Santa Cruz**: Volcanes, 2 km NW of Bermejo, 18°07'S, 63°38'W, 900 m, *Fuentes 312-A* (BOLV, HSB, LPB, MO, USZ); 20 km NE of San Ramón, 380 m, 16°23'S, 62°30'W, *Churchill et al. 21272* (BOLV, MO, USZ). On soil in semi-deciduous open forest. Common in the Caribbean region, apparently uncommon or overlooked in Central America; record from Colombia (Meta: *Schultes 12142*) needs to be re-examined.

***Bryum renauldii*** Röhl ex Renaud & Cardot **La Paz**: Río Hondo, Madidi National Park, 14°39'36"S, 67°48'42"W, 340 m, *Fuentes 4069* (LPB, MO, USZ). On rocks along stream, in Amazonian forest adjacent to the Andean foothills.

***Callicostella merkelii*** (Hornsch.) A. Jaeger [Pilotrichaceae] **Cochabamba**: El Limbo, Chapare region, 17°08'22"S, 65°39'39"W, 2160-2190 m, *Mogro et al. 342* (BOLV, MO). **Santa Cruz**: 19 km NW of Bella Vista, 18°11'S, 63°42'W, 1320 m, *Churchill et al. 21842* (BOLV, LPB, MO, USZ); Río de la Coca, road to Bella Vista, 18°12'S, 63°40'W, 1240 m, *Churchill et al. 22081* (BOLV, MO, USZ). On rocks, associated with streams and falls in Tucumano-Boliviano and yungas montane forest. An extra-Bolivian synonym is recognized for this species: *Callicostella paludicola* Broth., *Hedwigia* 45: 280. 1906, *syn. nov.* Type: BRAZIL, Estado de Amazonas, Rio Juruá, Cachoeira, *Ule 1974 - Bryoth. brasil n. 260* (PC!).

Features of the type of *C. paludicola* include: leaves oblong, 1.4-1.6 mm long, costae very strong, diverging below, converging (curving inward) slightly or strongly at apex, ending 2-3 cells below apex or extending slightly beyond, upper laminal cells smooth, ca. two times longer than wide, seta smooth, ca. 14 mm long, capsule pendent, urn ca. 1 mm long, operculum conic rostrate.

***Calymperes palisotii*** Schwägr. [Calymperaceae] **Pando**: Prov. Nicolas Suarez, Hacienda Paraiso, on road to Nareuda-Extrema, 11°27'S, 69°14'W, 180 m, *Catari et al. 308-B* (MO, USZ), *Catari et al. 310-A* (BOLV, MO, USZ). On trunk of fallen tree. Widespread in the Neotropics at low elevations. The Department of Pando, almost entirely Amazonian forest located in northern Bolivia, is one of the least documented political subdivisions in the country for bryophytes. The following list of Pando mosses, all new to the department, were collected by J.C. Catari et al. at an elevation of ca. 180 m in Amazonian forest (collection numbers are those of Catari, all are deposited in USZ and MO unless otherwise stated): *Bryum apiculatum* Schwägr. (355), *Callicostella pallida* (Hornsch.) Ångstr. (320, 327, 329), *Calymperes afzelii* Sw. (292-B, 343-C), *Calymperes palisotii* Schwägr. (see above), *Chryso-hypnum diminutivum* (Hampe) W.R. Buck (292-A), *Cyrto-hypnum scabrosulum* (Mitt.) W.R. Buck & H.A. Crum (311, 354), *Dicranella hilariana* (Mont.) Mitt. (297, 299, 301), *Donnellia commutata* (Müll. Hal.) W.R.

Buck (308, 309), *Ectropothecium leptochaeton* (Schwägr.) W.R. Buck (329-A), *Fissidens zollingeri* Mont. (343-A), *Groutiella obtusa* (Mitt.) Florsch. (310), *Groutiella tumidula* (Mitt.) Vitt (308-C, USZ), *Isopterygium tenerum* (Sw.) Mitt. (330, 342), *Lepidopilum affine* Müll. Hal. (see below), *Neckeropsis disticha* (Hedw.) Kindb. (341-A), *Neckeropsis undulata* (Hedw.) Reichardt (343-B, USZ), *Octoblepharum albidum* Hedw. (308-A, 317, 318), *Philonotis uncinata* (Schwägr.) Brid. (296), *Pilosium chlorophyllum* (Hornsch.) Müll. Hal. (328), *Schlotheimia jamesonii* (Arn.) Brid. (308-D, USZ), *Sematophyllum subsimplex* (Hedw.) Mitt. (319, 332), *Syrhodon incompletus* Schwägr. var. *incompletus* (322, 323, 326), *Taxithelium planum* (Brid.) Mitt. (343, 344), *Trichosteleum subdemissum* (Schimp. ex Besch.) A. Jaeger (291, 295, 337, 344-A), *Vesicularia vesicularis* (Schwägr.) Brid. (292, 303), *Zelometeorium patulum* (Hedw.) Manuel (341).

***Calymperes pallidum* Mitt. Santa Cruz:** 78 km NE of San Ramón, 16°12'S, 62°12'W, 510 m, *Churchill et al. 21298* (MO, USZ). On base trunk of palm, semihumid Chiquitano forest. The Bolivian record is the southern most range of the species in South America. The range of this species is from western Amazonia, including western Ecuador, and Surinam.

***Cardotiella quinquefaria* (Hornsch.) Vitt [Macromitriaceae] Chuquisaca:** Entierrillos, Serranía del Iñao, 1836 m, 19°32'19"S, 63°55'01"W, *Lozano & Mogro 184* (HSB, MO, USZ). **Santa Cruz:** 4 km NE of Las Yungas, Mairana, 2180-2240 m, 18°03'57"S, 63°54'25"W, *Churchill et al. 23827-A* (MO, USZ). **Tarija:** Achirales, Tariquia National Park, 1500-1700 m, 22°02'04"S, 64°31'32"W, *Churchill et al. 23585* (HSB, MO, USZ), 1550-1700 m, 22°02'36"S, 64°32'26"W, *Churchill et al. 23704* (HSB, MO). On trunk of trees, in Tucumano-Boliviano montane forest, at elevations from 1500-2180 m. Also known from northwest Argentina: Tucumán, Río Los Soso, *Churchill & Schiavone 20125* (LIL, MO), *Price 1700* (LIL, MO), at elevations from 700-1555 m.

***Cryphaea rhacomitrioides* Müll. Hal. [Cryphaeaceae]** Representative collections (see W3MOST for additional records). **Chuquisaca:** Santa Elena, 20°36'S, 64°45'W, 2430 m, *Lewis 84-1944* (LPB, MO). **Santa Cruz:** Santa Ana, 18°35'S, 64°07'W, 2380 m, *Churchill 22305* (MO, USZ). **Tarija:** Padcaya, 21°51'S, 64°42'W, 2220 m, *Lewis 84-2051* (LPB, MO); Canaletas, 21°27'S, 64°20'W, 2080 m, *Lewis 84-2559* (LPB, MO); Alarachi Natural Reserve, 22°11'09"S, 64°37'32"W, 1350-1500 m, *Churchill et al. 23309* (HSB, MO, USZ). On trunk and branches of trees and shrubs, in drier zone of Tucumano-Boliviano montane forest. Recorded for Brazil (Rio Grande do Sul) and Argentina (Juyuy and Tucumán), see Rao, 2001.

***Cyclodictyon rubrisetum* (Mitt.) Kuntze [Pilotrichaceae] La Paz:** Chiriuno, Madidi National Park, 14°30'00"S, 68°13'58"W, 1850 m, *Fuentes 4782-A* (USZ). On rock along stream, among *Mittenothamnium*, in submontane forest.

***Didymodon rigidulus* Hedw. var. *subulatus* (Thér. & E.B. Bartram ex E.B. Bartram) R.H. Zander [Pottiaceae] Chuquisaca:** Mojtula, 18°21'06"S, 65°10'04"W, 1610 m, *Churchill et al. 23040* (HSB, MO, USZ). **Santa Cruz:** 12 km N of Los Negros, 17°59'53"S, 64°09'54"W, 1420 m, *Churchill 22752* (LPB, MO, USZ). On sandstone rock and soil, in dry interandean valleys. Previously recorded for tropical Andes from Peru.

***Erpodium acrifolium* Pursell [Erpodiaceae] Santa Cruz:** Río Grande, 18°42'S, 64°19'W, 1250 m, *Churchill 22247* (MO, USZ). On tree trunk, in dry interandean valley. This species is also known from Mexico and south-central United States.

***Fissidens allionii* Broth. [Fissidentaceae] Cochabamba:** Sacta Experimental Station, 17°05'S, 64°46'W, 250 m, *Churchill & Arroyo P. 21622* (BOLV, LPB, MO; det. R. Pursell). On soil, associated with *F. inaequalis*, in Amazonian forest.

***Fissidens goyazensis* Broth. La Paz:** Río Beni, Madidi National Park, 14°33'56"S, 67°30'43"W,

219 m, *Fuentes 3897* (USZ). **Santa Cruz:** Río Piray, 12 km E of Bermejo, 18°02'S, 63°41'W, 700 m, *Churchill 20460* (MO, USZ); Río Seco, 18°39'S, 63°15'W, 540 m, *Churchill et al. 21344* (MO, USZ); Algarrobito Station, 19°53'45"S, 62°34'35"W, 400 m, *Fuentes 2884* (MO, USZ). On soil, in Chaco, Chaco Serrano, and subamazonian forest. Known from Central America, Brazil, Colombia and Venezuela.

***Fissidens neglectus*** H.A. Crum **Cochabamba:** Machia Park, near Villa Tunari, 16°58'S, 65°24'W, 600 m, *Churchill et al. 22202* (BOLV, MO). On wet rocks, in subamazonian forest. Widespread, in the tropical Andes mostly below 1000 m.

***Fissidens scariosus*** Mitt. **Cochabamba:** Sacta Experimental Station, 17°05'S, 64°46'W, 250 m, *Churchill & Arroyo P. 21608* (BOLV, MO, USZ). **La Paz:** Río Hondo, Madidi National Park, 14°39'52"S, 67°49'23"W, 400-700 m, *Fuentes et al. 4242* (USZ). **Santa Cruz:** 3.5 km S of Locotal, Serranía de Siberia, 17°47'11"S, 64°43'34"W, 2010 m, *Churchill et al. 22415* (MO, USZ). On soil (including termite mound) and rocks, from Amazonian and montane forest. In the Tropical Andes to ca. 2000 m, but more frequent below 1000 m.

***Fissidens steerei*** Grout **La Paz:** Río Quendeque, Madidi National Park, 15°01'10"S, 67°44'31"W, 400-700 m, *Fuentes et al. 3695, 3852* (LPB, MO, USZ). Distributed in the northern Neotropics, the Bolivian record presently is the southern most record in South America.

***Forsstroemia trichomitria*** (Hedw.) Lindb. [Leptodontaceae] **Tarija:** 7 km NE of Entre Rios, 21°28'S, 64°09'W, 1400 m, *Churchill 20776* (MO, USZ). On tree branch, in Chaco Serrano forest.

***Groutiella tomentosa*** (Hornsch.) Wijk & Margad. [Macromitriaceae] **Cochabamba:** Machia Park, Villa Tunari, 16°58'S, 65°24'W, 240 m, *Churchill et al. 22185* (BOLV, MO). **Santa Cruz:** Río Ibabo, Elías Meneses Experimental Forest, 16°39'56"S, 64°30'26"W, 220 m, *Churchill & Arroyo P. 21527-B* (MO,

USZ). Tree trunk and fallen tree branch in Amazonia forest.

***Isodrepanium lentulum*** (Wilson) E. Britton [Neckeraceae] **Cochabamba:** El Palmar, Chapare region, 17°04'16"S, 65°39'04"W, 572 m, *Mogro et al. 509* (BOLV, MO), 17°06'28"S, 65°34'06"W, 1505 m, *Mogro et al. 696* (BOLV, MO). Epiphyte, in submontane forest.

***Juratzkaea argentinica*** (Thér.) W.R. Buck [Stereophyllaceae] **Santa Cruz:** 4 km SE of Comarapa, 1880 m, 17°55'S, 64°33'W, *Churchill 22518* (MO, USZ). On soil covered tree roots, in dry interandean valley. Recorded previously from Argentina.

***Lepidopilum affine*** Müll. Hal. [Pilotrichaceae] **La Paz:** Río Tuichi, Madidi National Park, 14°20'57"S, 67°58'26"W, 367 m, *Fuentes 5473* (LPB, MO). **Pando:** Puesto Rutina 2, near Nareuda, 11°18'S, 68°46'W, 180 m, *Catari et al. 360* (MO, USZ). On logs, Amazonian forest.

***Lepidopilum polytrichoides*** (Hedw.) Brid. **Cochabamba:** El Palmar, 1000 m, 17°05'29"S, 65°32'34"W, *Mogro et al. 814, 864-A* (BOLV, MO). On tree trunks, in submontane forest. This is the southernmost record for this species and should in time be found along the lower slopes of the eastern cordilleras of Peru.

***Lepidopilum surinamense*** Müll. Hal. **Cochabamba:** Sacta Experimental Station, 250 m, 17°05'S, 64°46'W, *Churchill & Arroyo P. 21645* (BOLV, MO); Machia Park, near Villa Tunari, 240 m, 16°58'S, 65°24'W, *Churchill et al. 22183* (BOLV, MO). **La Paz:** Río Hondo, Madidi National Park, 14°38'51"S, 67°47'40"W, 227 m, *Fuentes 3932* (BOLV, LPB, MO, USZ). On trunk of trees and palms (including *Iriartea deltoidea*), in Amazonian forest. Widespread in the neotropical wet lowlands of South America (and possibly Central America).

***Lepidopilum tortifolium*** Mitt. **Cochabamba:** Above Villa Tunari, between Avispas and Campovia, 17°35'S 65°38'W, 600 m, *Churchill et al. 22218* (BOLV, MO). **La Paz:** Río Hondo, Madidi National Park, 14°39'36"S, 67°48'42"W,



340 m, *Fuentes et al. 4071* (LPB, MO, USZ). On rocks, usually in or along streams, in submontane forest.

***Microcampylopus curvisetus*** (Hampe) Giese & J.-P. Frahm [Dicranaceae] **Cochabamba**: 11 km W of El Churo, Serranía Siberia, 2740 m, 17°45'S, 64°48'W, *Churchill et al. 22588* (BOLV, MO). On soil of exposed roots of fallen tree, in montane forest.

***Mniomalia viridis*** (Mitt.) Müll. Hal. [Phylloprepariaceae] **Santa Cruz**: Noel Kempff Mercado National Park, 14°32'S, 60°48'W, 250 m, *Arbeláez 772-A* (USZ). On tree trunk, with *Cyrtio-hypnum*, in humid Chiquitano forest. The Bolivian record represents the southernmost distribution of this species in South America.

***Octoblepharum erectifolium*** Mitt. ex R.S. Williams [Octoblepharaceae] **La Paz**: Piñalito, Madidi National Park, 14°29'42"S, 68°15'26"W, 2000-2490 m, *Fuentes 5099* (LPB, MO, USZ). On humus. Widespread in the Neotropics, from wet lowlands to lower montane forest.

***Orthotrichum cupulatum*** Brid. var. ***austroamericanum*** Lewinsky [Orthotrichaceae] **La Paz**: Amarka, 15°15'09"S, 69°02'24"W, 4316 m, *Fuentes & Aldana 6606* (LPB, MO, USZ). On rocks, in humid puna. Recorded previously from Colombia, Peru and Chile.

***Orthotrichum pungens*** Mitt. **La Paz**: 4 km south of Mallasa, 16°37'00"S, 68°04'31"W, 3100 m, *Churchill et al. 22838* (LPB, MO). On trunk of *Trichocereus* (Cactaceae), associated with *Fabronia jamesonii* and *Syntrichia fragilis*, in high, dry interandean valley. Previous records from the tropical Andes include Colombia, Ecuador and Peru, at elevations from 2600-4000 m.

***Pilotrichum armatum*** Broth. [Pilotrichaceae] **La Paz**: Río Caripo, 15°19'17"S, 61°05'12"W, 500 m, *Arroyo P. et al. 2591-C* (USZ). On tree trunk, in Amazonian forest. Recorded from Ecuador and Peru.

***Pilotrichum fendleri*** Müll. Hal. **Cochabamba**: El Palmar, Chapare region, 17°05'29"S, 65°32'34"W, 1000 m, *Mogro et al. 830* (BOLV, MO, USZ). On trunk, in submontane forest. Widespread in the northern Neotropics.

***Pirella trichomanoides*** (Mitt.) Cardot [Pterobryaceae] **La Paz**: Río Tuichi, Madidi National Park, 14°20'57"S, 67°58'18"W, 370 m, *Fuentes 5465* (BOLV, HSB, LPB, MO, USZ); Río Hondo, Madidi National Park, 14°39'52"S, 67°49'20"W, 400-700 m, *Fuentes et al. 4444* (BOLV, HSB, LPB, MO, USZ). On trunk of treelet, transitional base montane and Amazonian forest. Apparently rare, only known previously from a few collections from Ecuador and Peru.

***Platygyriella densa*** (Hook.) W.R. Buck [Hypnaceae] **Tarija**: Achirales, Tariquia National Park, 1550-1700 m, 22°02'36"S, 64°32'26"W, *Churchill et al. 23699* (HSB, LPB, MO, USZ). Base of *Ilex argentina*, in Tucumano-Boliviano montane forest. Recorded elsewhere in the tropical Andes from Ecuador and Venezuela.

***Pohlia richardsii*** A.J. Shaw [Bryaceae] **Cochabamba**: 11 km W of El Churo, Serranía Siberia, 2740 m, 17°45'S, 64°48'W, *Churchill et al. 22583* (BOLV, MO). On soil of exposed roots of fallen tree, disturbed open montane forest.

***Potamium lonchophyllum*** (Mont.) Mitt. [Sematophyllaceae] **Cochabamba**: Sacta Experimental Station, 17°04'56"S, 64°30'26"W, 240 m, *Churchill 22686* (BOLV, MO). **La Paz**: Río Hondo, Madidi National Park, 14°38'51"S, 67°47'40"W, 230 m, *Fuentes 3992* (USZ). On tree branches and exposed roots in streams, associated with Amazonian forest. The Bolivian collections represent the southernmost distribution recorded for South America.

***Pseudocrossidium crinitum*** (Schultz) R.H. Zander [Pottiaceae] **Santa Cruz**: 13 km W of El Mataral, 18°06'S, 64°18'W, 1680 m, *Churchill 22356* (MO, USZ); 12 km N of Vallegrande, 18°23'S, 64°08'W, 1850 m, *Churchill 22338* (MO, USZ). On soil, in dry interandean valleys.

Recorded in southern South America from Argentina and Chile.

***Ptychomitrium angusticarpum*** Schiavone & Biasuso [Grimmiaceae] **Santa Cruz**: Palmarito, ca. 16 km S of Vallegrande, 18°35'S, 64°06'W, 2200 m, *Churchill & Arroyo P. 21109* (BOLV, LPB, MO, USZ). On rocks, along a shaded stream, in remnant Tucumano-Boliviano montane forest. Previously recorded from northern Argentina and Brazil (Schiavone & Biasuso, 1997).

***Ptychomitrium lindmanii*** (Broth.) Paris **Tarija**: Alarachi Natural Reserve, 1140-1200 m, 22°13'01"S, 64°36'02"W, *Churchill et al. 23325* (BOLV, HSB, LPB, MO, USZ). On rocks, dry Tucumano-Boliviano forest. This species is distributed in the southern tropical and subtropical South America (Argentina, Paraguay).

***Rhamphidium dicranoides*** (Müll. Hal.) Paris [Ditrichaceae] **La Paz**: Between Puca Suchu and Virgen del Rosario, Madidi National Park, 14°34'40"S, 68°41'24"W, 910 m, *Fuentes et al. 5869* (LPB, MO). On soil over sandstone. Some or all of the four „endemic“ *Rhamphidium* species recorded for the tropical Andes are likely synonyms of *R. dicranoides*, including the Bolivian *R. pygmaeolum* (Müll. Hal.) Broth.

***Sematophyllum lithophilum*** (Hornsch.) Ångstr. [Sematophyllaceae] **La Paz**: Río Hondo, Madidi National Park, 14°38'51"S, 67°47'40"W, 230 m, *Fuentes 4254* (LPB, MO, USZ). On rocks. Recorded from scattered tropical lowland localities in South America. *Sematophyllum cochleatum* (Broth.) Broth. is a synonym, however tentatively *Sematophyllum loxense* (Hook.) Mitt. is not considered here a synonym of *S. lithophilum*.

***Splachnobryum obtusum*** (Brid.) Müll. Hal. [Splachnobryaceae] **La Paz**: Río Tuichi, Madidi National Park, 14°20'57"S, 67°58'19"W, 367 m, *Fuentes 5466* (BOLV, LPB, MO, USZ); Río Quendeque, Madidi National Park, 14°58'36"S, 67°48'53"W, 400 m, *Fuentes 3699* (USZ). **Santa Cruz**: Lomas del Urubó, 17°45'57"S,

63°19'55"W, 450 m, *Fuentes et al. 3051* (BOLV, MO, USZ). On soil and rocks. Widespread in the lowlands of the Neotropics, now known from all the tropical Andean countries at elevations from 50-750 m.

***Splachnum weberbaueri*** Reimers [Splachnaceae] **Santa Cruz**: Small lakes just east of Siberia, Serranía Siberia (ca. 37 km W of Comarapa), 17°50'S, 64°45'W, 2880 m, *Churchill et al. 22047* (BOLV, LPB, MO, USZ), 22388 (HSB, MO, USZ). On dung, in open montane (yuñgas) forest, associated with *Tayloria scabriseta*. Recorded from Central America and the Tropical Andes.

***Syntrichia amphidiacea*** (Müll. Hal.) R.H. Zander [Pottiaceae] **La Paz**: ANMI Apolobamba, 15°14'S, 68°46'W, 1433 m, *Fuentes & Aldana 6602* (LPB, MO, USZ). **Santa Cruz**: 40 km S of Camiri, 20°18'S, 63°27'W, 960 m, *Churchill 20723* (LPB, MO, USZ); La Yunga, ca. 8 km N of Mairana, 18°05'S 63°54'W, 1950 m, *Vargas & Rioja 4590-A* (MO, USZ). **Tarija**: 20 km W of Palos Blancos, 21°25'S, 63°54'W, 1480 m, *Churchill 20742* (MO, USZ), *Churchill 20746-B* (MO, USZ). On trunk and branches of trees, in dry interandean and Chaco Serrano forest, and dry elements of Tucumano-Boliviano montane forest.

***Syntrichia chisosa*** (Magill, Delgadillo M. & Stark) R.H. Zander **Chuquisaca**: between Sucre and Puente Arce, 18°48'S, 65°07'W, 1740 m, *Churchill 20859* (MO, USZ); **Cochabamba**: between Aiquile and Saipina, 18°11'S, 64°54'W, 1860 m, *Churchill & Churchill 20867* (MO, USZ), 20868 (BOLV, LPB, MO, USZ); **Santa Cruz**: city of Santa Cruz de la Sierra, 17°47'S, 63°10'W, 400 m, *Churchill 21100* (MO, USZ), 5 km S of Pampagrande, 18°07'S, 64°06'W, 1334 m, *Fuentes et al. 3280-A* (USZ), Algarrobillo Station, 400 m, 19°53.45'S, 62°34.35'W, *Fuentes 2885* (HSB, MO, USZ); Ipitacuape, 20°07'39"S, 63°03'34"W, 642 m, *Fuentes 3329* (USZ). **Tarija**: between Villamontes and Palos Blancos, 21°20'S, 63°37'W, 540 m, *Churchill 20736* (MO, USZ). On trees (including *Chorisia insignis*, *Prosopis alba*) and shrubs, in Chaco Serrano and dry interandean valleys. This species is recorded

from southwest United States (New Mexico, Oklahoma, Texas) to northern Mexico, and South Africa (Cape).

***Syntrichia pagorum*** (Milde) J.J. Amann **Santa Cruz:** Perforacion Station, 19°55'S, 62°33'W, 400 m, *Fuentes 2891* (MO, USZ). On tree trunks, including *Prosopis nigra*. From the tropical Andes only known from Colombia (*Parra 29*, HUA, MO).

***Syntrichia papillosa*** (Wilson) Jur. **La Paz:** 4 km S of Mallasa, 16°37'00"S, 68°04'31"W, 3100 m, *Churchill et al. 22831* (LPB, MO, USZ). **Santa Cruz:** Huasacañada, 18°31'05"S, 64°05'07"W, 2000 m, *Fuentes & Vargas 198-C* (USZ). On trunk and branches of *Prosopis*, in dry interandean valleys; associated with *Fabronia* and *Lindbergia*.

***Syrrhopodon ligulatus*** Mont. [Calymperaceae] **Santa Cruz:** Los Fierros, Noel Kempff Mercado National Park, 14°32'S, 60°48'W, 250 m, *Churchill & Churchill 20508* (MO, USZ). On decaying log, humid Chiquitano forest. Widespread in tropical America.

***Syrrhopodon africanus*** Mitt. subsp. ***graminicola*** (R.S. Williams) W.D. Reese **Cochabamba:** 10 km N of Villa Tunari on road to Isiboro, 16°52'S, 65°25'W, 280 m, *Churchill & Ortiz-Gentry 21695* (BOLV, MO). **La Paz:** Río Hondo, Madidi National Park, 14°40'20"S, 67°51'10"W, 900-1000 m, *Fuentes et al. 4448* (LPB), Arroyo Negro, Madidi National Park, 14°40'20"S, 67°51'10"W, 700-900 m, *Fuentes et al. 4443* (LPB, USZ). On trunk and branches of treelets and trees, Amazonian to submontane forest.

***Syrrhopodon prolifer*** Schwägr. var. ***scaber*** (Mitt.) W.D. Reese **La Paz:** Río Hondo, Madidi National Park, 14°40'S, 67°51'W, 700-900 m, *Fuentes et al. 4452* (LPB, MO, USZ), Piñalito, 14°29'42"S, 68°15'26"W, 2000-2490 m, *Fuentes 5117* (BOLV, LPB, MO). **Santa Cruz:** 3.5 km S of Locotal, Serranía de Siberia, 17°47'11"S, 64°43'34"W, 2010 m, *Churchill et al. 22422* (MO, USZ). On logs, tree trunks, submontane to montane forest. Widespread in the Neotropics.

***Taxiphyllum taxirameum*** (Mitt.) M. Fleisch. [Hypnaceae] **La Paz:** Río Hondo, Madidi National Park, 14°40'20"S, 67°51'10"W, 900-1000 m, *Fuentes 4457-A* (USZ). **Santa Cruz:** ca. 1 km S of La Negra (Km 86 on Santa Cruz-Cochabamba road) & 6 km E, 18°08'S, 63°40'W, 1100 m, *Churchill et al. 21683* (BOLV, LPB, MO, USZ), Río de la Coca, ca. 14.5 km from Bella Vista, 18°12'S, 63°40'W, 1240 m, *Churchill et al. 22089* (MO, USZ), Espejillos, ca. 20 km W of San José, 17°56'S, 63°26'W, 500-700 m, *Fuentes 140A* (MO, USZ), 500 m, 17°54'S, 63°26'W, *Churchill & Fuentes C. 20450* (MO, USZ). On sandy soil and rocks, in semi-dry lower montane and Tucumano-Boliviano montane canyon forest.

***Thamniopsis killipii*** (R.S. Williams) E.B. Bartram [Pilotrichaceae] **La Paz:** Near Charazani, Area Natural de Manejo Integrado Apolobamba, 15°11'07"S, 68°34'13"W, 832 m, *Fuentes & Aldana 6584* (LPB, MO, USZ). On leaf litter of rocky soil, in submontane forest with *Oenocarpus bataua*. Tropical Andes, probably in Central America.

#### Records of Little Known or Rare Species

***Acroporium esmeraldicum*** (Müll. Hal.) W.R. Buck [Sematophyllaceae] **Cochabamba:** between Km 66-67 on road from Cochabamba to Villa Tunari, 17°12'S, 65°53'W, 3300 m, *Churchill et al. 19890* (LPB, MO). **Santa Cruz:** E of Siberia, Serranía de Siberia, 17°49'S, 64°44'W, 3050 m, *Churchill et al. 20655* (BOLV, MO, USZ); 17°50'S, 64°45'W, 3050 m, *Churchill et al. 22370* (USZ). Shrubby high montane forest; on shrubs and treelets. Apparently known only for Ecuador and Bolivia.

***Didymodon herzogii*** R.H. Zander [Pottiaceae] **La Paz:** Amarka, 15°15'09"S, 69°02'24"W, 4316 m, *Fuentes & Aldana 6608* (LPB, MO, USZ), 6616 (HSB, LPB, MO, USZ). On rock, in puna. Previously known only from the type locality, Chocayatal at 3300 m.



*Entodontopsis angustiretis* (Broth.) W.R. Buck & Ireland [Stereophyllaceae] **Santa Cruz**: SE of Los Fierros, Noel Kempff Mercado National Park, 14°37'S 60°42'W, 300 m, *Fuentes 1083, 1089-A* (MO, USZ); 14°32'S, 60°48'W, 250 m, *Churchill & Churchill 20497* (MO, USZ). On decaying logs, in Chiquitano forest (associated with *Swietenia macrophylla* and *Ampelocera ruizii*). Originally described by Herzog as *Stereophyllum cupreum* from Ybaimini, Department of Santa Cruz.

*Gertrudiella validinervis* (Herzog) Broth. var. **validinervis** [Pottiaceae] Representative collections (see W3MOST for additional records). **Chuquisaca**: 14 km southeast of Sucre, 19°08'S, 65°11'W, 2840 m, *Churchill & Churchill 20839* (MO, USZ). **Santa Cruz**: 12 km S of El Mataral, 18°05'S, 64°07'W, 1500 m, *Churchill et al. 20430* (MO, USZ); 1 km S of Vallegrande, 18°29'S, 64°06'W, 2050 m, *Churchill et al. 20357* (MO, USZ); 7 km E of Comarapa, 17°57'S, 64°29'W, 1800 m, *Churchill et al. 20537* (BOLV, LPB, MO, USZ); between Piedra Santa and Cochabamba, 18°11'S, 64°11'W, 1700 m, *Churchill et al. 20925* (BOLV, LPB, MO, USZ); Rancho Chavez, 18°13'S, 64°03'W, 1439 m, *Fuentes et al. 3102* (MO, USZ); Quebrada Honda, 5.5 km NE of Vallegrande, 18°25'S, 64°07'W, 1940 m, *Churchill & Arroyo P. 21247* (MO, USZ). Very common in the dry interandean valleys of the departments of Santa Cruz and at least northern Chuquisaca. Sporophytes are only known from a single collection in Bolivia (*Churchill et al. 20430*); the capsules were not quite fully mature. The species was recently reported from Argentina, and with sporophytes (Schiafone & Suárez, 2003). The following observations generally confirm the observations from Argentina: *Perichaetia* terminal; innermost leaves sheathing, oblong, abruptly broad acute, oblong portion with cells oblong-rectangular, hyaline, smooth, apical portion with cells isodiametric. *Setae* elongate, 11-15 mm long, weakly twisted clockwise below urn, red. *Capsules* erect, urn narrowly ovoid-cylindrical, 2.2-2.5 mm long, weakly wrinkled; exothecial cells oblong-rectangular, thin-walled; stomata at urn base, superficial, elliptical; annulus adhering

to capsule mouth, cells isodiametric, thick-walled, dark red; opercula long conic, 1.1-1.5 mm long, slightly oblique; peristome with 32 filamentous, twisted, pale yellow-orange segments, to 1.1 mm long, possibly free to base, segments spiculate. *Calyptrae* unknown. *Spores* immature, appearing smooth.

*Gertrudiella validinervis* (Herzog) Broth. var. **serratopungens** (Herzog) R.H. Zander **La Paz**: Inquisivi, 16°53'S, 67°09'W, 2200 m, *Lewis 88-043* (LPB, MO); Valencia, 16°40'02"S, 68°00'34"W, 2950 m, *Churchill et al. 22817, 22820* (LPB, MO, USZ). On soil, exposed or slightly shaded by low shrubs, elevated dry interandean valleys.

*Lorentziella imbricata* (Mitt.) Broth. [Gigaspermaceae] **Santa Cruz**: 4 km SE of Comarapa, 17°55'58"S, 64°33'57"W, 1880 m, *Churchill 22517* (LPB, MO, USZ); 5 km E of Pampagrande, 18°07'S, 64°04'W, 1490 m, *Fuentes et al. 3104* (BOLV, LPB, MO, USZ). On soil covered rock and exposed tree roots, dry interandean valleys. First reported for Bolivia by Fuentes and Muñoz (2002) from the Chaco region at ca. 300 m. The two new localities are significantly higher in elevation than presently recorded for South America. This species is also known from Mexico, Paraguay, Uruguay, and Argentina.

*Porotrichopsis flacca* Herzog [Neckeraceae] **Cochabamba**: old Chapare trail, Cordillera El Ronco, 17°14'S, 65°42'W, 3800 m, *Churchill & Atahuachi B. 20588-A* (BOLV, MO, USZ); 9.4 km W of El Churo, 17°46'S, 64°48'W, 2580 m, *Churchill et al. 21989* (BOLV, MO, QCNE, USM, USZ). **La Paz**: Coscapa, 16°16'S, 67°50'W, 3140-3300 m, *Churchill et al. 19760-A* (MO, fragment mixed with *Daltonia* & *Streptotrichum*). On bamboo (*Chusquea*), shrubs or trees (including *Saracha punctata*); associated with *Plagiochila*, *Porotrichum*, *Rigodium*.

*Pterogoniadelphus assimilis* (Müll. Hal.) Ochyra & Zijlstra [Leucodontaceae] **Santa Cruz**: La Negra, 18°08'S, 63°40'W, 1120 m, *Churchill et al. 21675* (MO, USZ); Laguna Volcán, above Bermejo, 18°07'S, 63°38'W, 1150

m, *Churchill et al. 20903* (LPB, MO, USZ); 11 km NE of Mairana, 18°06'S, 63°56'W, 1825 m, *Churchill et al. 21353* (BOLV, LPB, MO, USZ); Serranía de Chiquitos, 18°19'S, 59°34'W, 550 m, *Fuentes 2944* (USZ), *2945-A* (MO, USZ). **Tarija:** Alarachi Natural Reserve, 22°10'59"S, 64°37'46"W, 1300 m, *Churchill et al. 23274* (HSB, MO, USZ). On shrubs, tree trunk and branches (including canopy), in semideciduous Chiquitano and dryer elements of Tucumano-Boliviano montane forest. The previous record from Bolivia was based on a collection described as *Leucodon squarrosus* by Herzog from Cerro Amboró, Department of Santa Cruz; later placed in synonymy with *Felipponea montevidensis* (Müll. Hal.) Broth., a further synonym of *P. assimilis*. The name *Felipponea* is illegitimate (Ochyra & Zijlstra 2004).

***Streptotrichum ramicola*** Herzog [Pottiaceae] **La Paz:** Coscapa, 16°16'S, 67°50'W, 3140-3300 m, *Churchill et al. 19760* (LPB, MO). High montane cloud forest, partially disturbed; on nodes of bamboo. This endemic, monospecific genus was only known previously from the type locality based on a collection by Herzog from Tables, in the Department of Cochabamba, at 3400 m; also found on the nodes of bamboo.

***Trachyphyllum dusenii*** (Broth.) Broth. [Pterigynandraceae] **Santa Cruz:** Cerro Pelao, 14°32'S, 61°30'W, 350 m, *Garvizu et al. 749* (BOLV, MO, USZ). On trunk of dead tree in semidry Chiquitano forest. Known from the Planalto of Brazil, and reported previously for Bolivia (Churchill et al., 2000).

***Wijkia subnitida*** (Hampe) H.A. Crum [Sematophyllaceae] **Santa Cruz:** Yungas of Mairana, 18°03'42"S, 63°55'05"W, 2180 m, *Churchill et al. 23768* (HSB, MO, USZ), 18°04'07"S, 63°54'40"W, 2190 m, *Churchill et al. 23832* (MO, USZ); **Tarija:** Achirales, Tariquia National Park, 22°02'36"S, 64°32'26"W, 1550-1700 m, *Churchill et al. 23703* (BOLV, HSB, LPB, MO, USZ). On trunk of trees, in Tucumano-Boliviano montane forest. This species was first recorded for Bolivia by Herzog (1916) from Tres Cruces at 1400 m in the Department of Santa Cruz. The locality is

just east of Bermejo, on the same road to Sillar. Tres Cruces has been severely cut over, and the present forest is xeric, mostly secondary thorn forest, with a few relic patches of montane forest. It is apparent from the list of mosses provided by Herzog (1916: 316-317) from Tres Cruces that the forest was in all likelihood Tucumano-Boliviano, not yungas, montane forest. *Flabellidium spinosum* Herzog is among the species listed by Herzog. At present this endemic, monospecific genus is considered threatened. *Flabellidium* may be discovered at other nearby localities with Tucumano-Boliviano forest.

***Wilsoniella flaccida*** (R.S. Williams) Broth. [Ditrichaceae] **La Paz:** San Buenaventura, 14°26'19"S, 67°32'10"W, 190 m, *Fuentes 4493* (USZ). On clay soil, in semideciduous open forest with *Caesalpinia*. First collected by R. S. Williams along the „Lower Cocos River“ 22 March 1902 and described in 1909.

#### Combinations

***Entosthodon subaloma*** (Herzog) S.P. Churchill, comb. nov. *Goniobryum subaloma* Herzog, Hedwigia 74: 106, Fig. 11. 1934. Type: Bolivia. Illampu, Cordillera Real, 4700 m, *Troll 56* (JE!, lectotype).

This species is characterized by lax and rather flaccid elliptic- to oblong-lanceolate leaves that are contorted when dry, weakly serrulate-dentate distal margins, slender subpercurrent costa, large and lax long-hexagonal to rectangular upper cells, and weak border of narrowly oblong cells at basal margin. The leaves are almost identical in areolation to *Entosthodon laxus* (Wilson in Hook.f.) Mitt. and it may in fact be only a semi-aquatic or aquatic form of *E. laxus*. Rather atypical large forms of *E. laxus* do exist, including a synonym of this species, *Physcomitrium benoistii* Thér. (*Benoist 3172*, NY!) and a recent collection from Ecuador at 3300 m (*Lægaard et al. 19267A*, MO). Fugitively and literally this may be a bit of a stretch, for the plants are nearly 6 cm in length. The same, however, can be said for the placement of this taxon in *Goniobryum*. The only species of this genus, *G. subbasilare* (Hook.) Lindb., is typically found on decaying logs in temperate forests at

elevations of 120-300 m in Argentina and Chile (also from Tasmania, Australia and New Zealand). The following description is based on the examined type of *G. subaloma*: *Plants* rather large, glossy green, lower portions yellow. *Stems* to 6 cm long, simple or few branched by innovations; in cross-section outer 2 rows of cells somewhat small, rather thick-walled, inner cells large, thin-walled, central strand weak. *Leaves* contorted when dry, lax and flaccid, remaining somewhat contorted when wet, oblong to somewhat elliptic-lanceolate, 5-6 mm long, 1.0-1.5 mm wide, apex acute; margins plane, weakly serrulate-denticulate, rather bluntly so; costa slender, ending several cells below apex; laminal cells large and lax, upper cells long-hexagonal to rectangular, 85-110  $\mu$ m long, 25-30  $\mu$ m wide, larger and thin-walled toward the costa; basal cells irregularly rectangular, to 200  $\mu$ m long, to 30  $\mu$ m wide; marginal cells at base forming a weak border with 3-4 rows of narrowly oblong cells. *Gemmae* absent. Sex and sporophytes unknown.

***Thamniopsis lepidopiloides*** (Herzog) S.P. Churchill, *comb. nov.* *Hookeriopsis lepidopiloides* Herzog, *Biblioth. Bot.* 87: 133, Fig. 58. 1916. Type: Bolivia. Auf Steinen in der Talschlucht bei Tablas, ca. 1800 m, *Herzog 4580* (JE!).

Low montane; shaded sites, on rocks, humus and leaf litter. Bolivia: 1600-2215 m. This species exhibits a hyalodermis, upper marginal teeth large, rather swollen, marginal cells forming a border of linear cells or cells gradually narrower toward the margin (based on the type and the additional collection cited below). Of the segregate *Hookeriopsis* genera, this taxon is best placed in *Thamniopsis* although the upper and basal cells are not well differentiated (one of the defining characters of *Thamniopsis*). Additional record: **La Paz**: Cutu Sacha, Madidi National Park, 14°31'10"S, 68°16'47"W, 1600-2216 m, *Fuentes 5216* (USZ).

***Syntrichia xerophila*** (Herzog) S.P. Churchill, *comb. nov.* *Tortula xerophila* Herzog, *Biblioth. Bot.* 87: 50, Fig. 15. 1916. Syntypes: Bolivia. In der Dornbuschsteppe des Palo mit Gertrudia validivervis H., ca. 1600 m, *Herzog 4344/a* (JE!);

Argentina. im Trockenwald bei Perico (N.-Argentinien), ca. 400 m, *Herzog 2622*.

Additional representative records. **Chuquisaca**: Chuqui Chuqui, 18°49'09"S, 65°07'09"W, 1820 m, *Churchill et al. 22978* (HSB, MO); Villa Tomina, 19°10'46"S, 64°27'32"W, 2100 m, *Churchill et al. 22976* (HSB, MO). **Cochabamba**: Saipina, 18°49'09"S, 65°07'09"W, 1820 m, *Churchill et al. 23033* (BOLV, MO). **Santa Cruz**: 7 km E of Comarapa, 17°57'S, 64°29'W, 1800 m, *Churchill et al. 20535* (BOLV, LPB, MO, USZ); 9 km N of Los Negros, 17°59'S, 64°09'W, 1440 m, *Churchill et al. 20930* (MO, USZ); El Trigal, 18°20'S, 64°10'W, 1600 m, *Nee & Solomon 36554* (MO). Dry interandean valleys and Chaqueno Serrano forest; on soil and soil covered rocks. Commonly associated with *Gertrudiella* and *Pseudocrossidium*.

### Synonyms

***Callicostella pallida*** (Hornsch.) Ångstr., *Öfvers. Förh. Kongl. Svenska Vetensk.-Akad.* 33(4): 27. 1876. *Hookeria pallida* Hornsch., *Fl. Bras.* 1(2): 64. 1840.

*Hookeria scabripes* Müll. Hal., *Nuovo Giorn. Bot. Ital.* n. ser. 4: 133. 1897. *Callicostella scabripes* (Müll. Hal.) Broth., *Nat. Pflanzenfam.* 1(3): 937. 1907, *syn. nov.* Type: BOLIVIA. *Germain 1145* (PC!).

The type collection exhibits the following morphological features: leaves ovate to oblong-ovate, 1.2-1.3 mm long, apex broadly acute to rounded, margins above base regularly toothed, teeth bifid, costae moderately strong, diverging below, parallel above, 2/3-3/4 lamina length, distal 1/4-1/3 toothed, laminal cells unipapillose in distal 2/3-3/4 of lamina, setae to 13 mm long, papillose-roughened throughout. These features readily place it within the concept of *Callicostella pallida*.

***Cyclodictyon albicans*** (Hedw.) Kuntze, *Revis. Gen. Pl.* 2: 835. 1891.

*Cyclodictyon breve* Herzog, *Biblioth. Bot.* 87: 132. 1916, *syn. nov.* Type: BOLIVIA, An feuchten Steinen im oberen Tocoranital, ca. 2600 m, *Herzog 4049* (JE!).

The type exhibits the following features, well within the present circumscription of *C. albicans*: Leaves ovate, to 1.8 mm long, leaf margin distally serrate, bordered with 2 rows of elongate cells, costa divergent, weakly and bluntly projecting, upper median cells hexagonal.

***Leucobryum subobtusifolium*** (Broth.) B.H. Allen, Contr. Univ. Michigan Herb. 18: 129. 1992. *Ochrobryum subobtusifolium* Broth., Bih. Kongl. Svenska Vetensk.-Akad. Handl. 26 Afd. 3: 10. 1900.

*Leucobryum fragile* Herzog, Beih. Bot. Centralbl. 26(2): 56. 1909, *syn. nov.* Type: Bolivia. Auf faulem Holz im Bergwald von Santiago de Chiquitos, ca. 700 m, Mai 1907, Herzog (JE!).

The very small size of the plants, in relation to other *Leucobryum* species (leaves 1.8-3 mm long), frequent production of terminal brood leaves (similar to several species of *Campylopus*), and the distinctive rounded-apiculate leaf apices are characteristic features of this species. Recorded for Bolivia (Reese 12908, MO) from Beni. Additional records: **Cochabamba**: Sacta Experimental Station, 17°05'S, 64°46'W, 250 m, Churchill & Arroyo P. 21616 (BOLV, LPB, MO, USZ). **Santa Cruz**: Los Fierros, Noel Kempff Mercado National Park, 14°32'S, 60°48'W, 250 m, Churchill & Churchill 20511 (BOLV, LPB, MO, USZ), Lago Caimán, 13°35'46"S, 60°54'50"W, 400 m, Fuentes 1107-A (MO, USZ); Santiago de Chiquitos, Serranía de Santiago, 18°25'S, 59°25'W, 550 m, Fuentes 2947 (MO, USZ). Humid Chiquitano and Amazonian forest, on decaying logs, possibly rocks. Recorded from the lowland forest of Brazil, Colombia, Venezuela and Surinam.

***Macromitrium microstomum*** (Hook. & Grev.) Schwägr., Sp. Musc. Frond. Suppl. 2, 2(2): 130. 1827. *Orthotrichum microstomum* Hook. & Grev., Edinburgh J. Sci. 1: 114, Fig. 4. 1824.

*Macromitrium pinnulatum* Herzog, Biblioth. Bot. 87: 65, Fig. 23. 1916, *syn. nov.* Type: Bolivia. Im Nebelwald über Comarapa, ca. 2600 m, Herzog 3945 (JE!); Quebrada de Pocona, ca. 2800 m, Herzog 5146 (JE!).

The type of *M. pinnulatum* exhibits leaves oblong-lanceolate, 1.4-1.7 mm long, apices commonly acuminate, few acute, margins entire, upper laminal cells quadrate-rounded to slightly short-oblong and oblate along margin, basal elongate cells nearly half the leaf length, smooth, seta smooth, capsule distinctly puckered at the mouth. *Macromitrium microstomum* is found in montane forest of the tropical Andes at elevations from 2250-2800 m. Additional record. **Santa Cruz**: Cerro Bravo, 17°49'41"S 64°33'01"W, 2400 m, Fuentes et al. 1228 (MO, USZ).

***Macromitrium stellulatum*** (Hornsch.) Brid., Bryol. Univ. 1: 314. 1826. *Schlotheimia stellulatum* Hornsch., Horae Phys. Berol. 61. 1820. *Macromitrium vesiculatum* (Herzog) Herzog, Hedwigia 57: 246. 1916. *Schlotheimia vesiculata* Herzog, Beih. Bot. Centralbl. 26(2): 68, Fig. 12. 1909, *syn. nov.* Type: Bolivia. An Bäumen im Urwald des Rio Blanco (Prov. Velasco), ca. 160 m, August 1907, Herzog s.n. (JE!).

The type of *Schlotheimia vesiculata* exhibits the follow features: leaves ligulate, 1.6-2.0 mm long, often with a longitudinal fold, apex obtuse to rounded, cuspidate, margins often broadly recurved, costa strong, short excurrent, upper laminal cells bulging, 8-10 µm, basal cells narrowly rectangular, papillose, thick-walled, marginal cells at base toothed and projecting downward, teeth blunt and swollen, seta 6.5 mm long, twisted, capsule urn 1.6 mm long. This species is recorded for all five tropical Andean countries, also French Guiana, Surinam, Brazil. *Macromitrium stellulatum* is found in lowland to premontane forest; on dead trees, trunk and branches of trees. Recorded from the tropical Andes at elevations from 100-1820 m. Additional records: **Beni**: Beni Biological Station, near Porvenir, 14°30'S, 66°30'W, 200-250 m, Lewis 89-040 (MO). **Cochabamba**: Shinaota, 16°59'S, 65°14'W, 450 m, Fuentes 112-A (USZ). **Santa Cruz**: between Florida and San Martín, 14°36'S, 61°29'W, 300 m, Churchill et al. 20533 (MO, USZ), 20 km NE of San Ramón, 16°23'S, 62°30'W, 380 m, Churchill et al. 21267 (BOLV, MO, USZ); Río Ibabo, Elías Meneses Experimental Forest, 16°39'56"S, 64°30'26"W, 220 m, Churchill & Arroyo P. 21527 (LPB, MO, USZ); 20 km W of San José,



Espejillos, 17°56'S 63°26'W, 700 m, *Fuentes 174* (MO, USZ); Volcanes, 2 km NW of Bermejo, 18°07'S, 63°38'W, 900 m, *Fuentes 338* (BOLV, HSB, LPB, MO, USZ). On trees, treelets and decaying logs, in Chiquitano and Amazonian forest.

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