

CONTRIBUTION TO THE KNOWLEDGE OF THE LICHEN BIOTA OF BOLIVIA. 4

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Abstract. This paper presents new records of 144 lichen species from Bolivia, of which 38 are new to the country, namely *Aspidothelium fugiens* (Müll. Arg.) R. Sant., *Astrothelium galbineum* Kremp., *Baeomyces rufus* (Huds.) Rebent., *Bulbothrix apophysata* (Hale & Kurok.) Hale, *Canoparmelia caroliniana* (Nyl.) Elix & Hale, *Cladonia caespiticia* (Pers.) Flörke, *C. corymbosula* Nyl., *C. farinophylla* Ahti, *C. isabellina* Vain., *C. leprocephala* Ahti & S. Stenroos, *C. macilenta* Hoffm., *C. pityrophylla* Nyl., *Flakea papillata* O. E. Erikss., *Flavopunctelia soledica* (Nyl.) Hale, *Gomphillus ophiosporus* Kalb & Vězda, *Haematomma fenizianum* A. Massal., *Herpothallon aurantiocoflavum* (B. de Lesd.) Aptroot, Lücking & G. Thor, *Heterodermia corallophora* (Tayl.) Scorepa, *H. cubensis* (Kurok.) Trass, *H. flabellata* (Fée) D. D. Awasthi, *H. galactophylla* (Tuck.) W. L. Culb., *H. magellanica* (Zahlbr.) Swinscow. & Krog, *H. palpebrata* (Tayl.) Vain., *H. parva* Moberg, *Hypotrachyna damaziana* (Zahlbr.) Krog & Swinscow, *Micarea peliocarpa* (Anzi) Coppins, *Parmotrema betaniae* Hale, *P. ultralucens* Hale, *Phyllobaeis erythrella* (Mont.) Kalb, *Physconia muscigena* (Ach.) Poelt, *Pseudoparmelia cubensis* (Nyl.) Elix & T. H. Nash, *Punctelia constantimontium* Sérus., *Pyrenula dermatodes* (Borrer) Schaer., *Stereocaulon myriocarpum* Th. Fr., *Trapelia coarctata* (Turner ex Sm.) M. Choisy, *Trypethelium aeneum* (Eschw.) Zahlbr., *T. pupula* (Ach.) R. C. Harris and *Tylophoron protrudens* Nyl. Four infraspecies, *Dictyonema sericeum* (Sw.) Berk. f. *membranaceum* Metzner, *D. sericeum* f. *phyllophilum* Parmasto, *Heterodermia japonica* (Sato) Swinscow & Krog var. *reagens* (Kurok.) J. N. Wu & Z. G. Qian. and *H. leucomela* (L.) Poelt subsp. *boryi* (Fée) Swinscow & Krog are also recorded for the first time for the country. A second locality for the lichenicolous fungus *Phaeosporobolus trypethelii* Flakus & Kukwa was also found. Some taxa, especially those belonging to the taxonomically critical groups, are commented upon.

Key words: biogeography, lichenized fungi, Neotropics, South America

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INTRODUCTION

During ongoing studies of lichenized and lichenicolous fungi of Bolivia several new records have been recently published since our last paper in the series dealing with the biota of this region (Flakus *et al.* 2011a; Flakus & Kukwa 2012a, b; Flakus *et al.* 2012; Knudsen *et al.* 2012; Kukwa *et al.* 2012a, b). In this paper, the fourth of a series, we report new records of 144 lichen species and one lichenicolous fungus from Bolivia.

MATERIAL AND METHODS

The specimens studied for this paper are housed at B, GMUF, H, KRAM, LPB, UGDA (acronyms after Thiers 2011) and the private herbaria of J. Etayo, A. Flakus, U. Schiefelbein and M. Seaward. Lichen substances necessary for the identification of some groups of lichens were identified with thin layer chromatography (TLC) according to the methods summarized by Culberson and Kristinsson (1970) and Orange *et al.* (2001). Annotations

on detected secondary metabolites are provided, as the chemistry of Bolivian lichens is still very poorly known. The symbol (\pm) indicates that a particular substance was absent from some specimens. In some cases the colour reaction with a water solution of potassium hydroxide (K) was made, as well as the colour of the thallus checked in the ultraviolet light (UV).

The general distribution is presented only for those species noted for the first time from Bolivia; for those previously known from the country only references to their Bolivian distribution are reported.

The following abbreviations are used: *AF* – A. Flakus, *JE* – J. Etayo, *JQ* – J. Quisbert, *KB* – K. Bach, *MK* – M. Kukwa, *OP* – O. Plata, *PR* – P. Rodriguez Flakus, *US* – U. Schiefelbein; PNA – Parque Nacional Amboró; PNC – Parque Nacional Carrasco; PNANMIC – Parque Nacional y Área Natural de Manejo Integrado Cotapata.

RESULTS

144 species of lichens are treated in this work, 38 of which are new for Bolivia. The genera *Astrothelium* Eschw., *Baeomyces* Pers., *Flakea* O. E. Erikss., *Gomphillus* Nyl., *Micarea* Fr. and *Trapelia* M. Choisy are reported for the first time from the country, as are four intraspecific taxa.

Alectoria ochroleuca (Hoffm.) A. Massal.

This species has only occasionally been reported from Bolivia (Nylander 1861; Herzog 1922; Feuerer *et al.* 1998).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, below Potosí, 16°17'43"S, 68°07'42"W, 4550 m, high Andean vegetation, on rock, 28 May 2011, *JE 26828* (LPB, herb. Etayo); Prov. Camacho, near Villa Cala, 15°25'53"S, 69°05'07"W, 4250 m, high Andean vegetation, on soil 19 May 2011, *JE 27266* (LPB, herb. Etayo).

Aspidothelium fugiens (Müll. Arg.) R. Sant.

This species is new to Bolivia. It is a Pan-tropical species reported from Africa, Asia, Australia, Neotropics and Oceania (Aptroot *et al.* 2008; Sipman *et al.* 2008; Feuerer 2012; McCarthy 2012).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, km 69 on the road Coroico-La Paz,

16°13'33"S, 67°49'20"W, 2600 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *AF 21481* & *OP* (KRAM, LPB)

Astrothelium galbineum Kremp.

This species is new for Bolivia. It has also been reported from Australia, the Neotropics (Brazil, Costa Rica, Colombia, French Guiana, Guyana) and Papua New Guinea (Aptroot *et al.* 1997, 2008; Sipman *et al.* 2008; Feuerer 2012; McCarthy 2012).

CHEMISTRY. Not tested with TLC, but thallus UV+ yellow, pigment around ostioles K+ violet and UV+ purple.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Achiquiri, 15°13'31"S, 68°13'49"W, 1070 m, Yungas inferior secondary forest, on bark, 16 May 2011, *MK 8680* (LPB, UGDA).

Baeomyces rufus (Huds.) Rebert.

This widely distributed and common species (Feuerer 2012) is new to Bolivia.

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Valle del Zongo, 16°10'15"S, 68°08'02"W, 3375 m, Páramo Yungueño, on soil, 29 May 2011, *JE 26772* (LPB, herb. Etayo).

Bulbothrix apophysata (Hale & Kurok.) Hale

This species is new to Bolivia. It has also been reported from Brazil, Costa Rica and Venezuela (Hale 1976a; López-Figueiras 1986; Fleig & Grüniger 2000; Tenorio *et al.* 2002).

CHEMISTRY. Atranorin and lobaric acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. BANI. Prov. Ballivan, 12 km por carretera maderera al SW del km 12 Yucumo – Rurrenabaque, 15°05'S, 67°07'W, 600 m, bosque siempreverde virgen, epífita, 31 June 1997, *KB 363a, 364 et al.* (B).

Canoparmelia caroliniana (Nyl.) Elix & Hale

The species is new to Bolivia. It has also been reported from the Neotropics (e.g., Brazil, Colombia, Costa Rica, Venezuela), USA, the Azores and Oceania (Osorio & Fleig 1982; Elix

& McCarthy 1998; Tenorio *et al.* 2002; Aptroot & Rodrigues 2005; Sipman *et al.* 2008; Feuerer 2012).

CHEMISTRY. Atranorin, perlatolic acid, additional substances in traces.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, 20 km de Copapata hacia Cotacajes, 16°46'S, 66°44'W, 2000 m, bosque semisecundo disturbado, epífita, 15 May 1997, *KB 110 et al.* (B); Prov. Carrasco, PNC, 156 km del camino antiguo de Cochabamba a Villa Tunari, 17°05'S, 65°32'W, 850 m, epífita, 12 Oct. 1997, *KB 844 et al.* (B).

Cetraria ericetorum Opiz

The species was previously known from only one locality in Bolivia (Bjerke & Elvebakk 2004).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Valle del Zongo, Laguna Viscachani, 16°11'54"S, 68°07'33"W, 3860 m, Páramo Yungueño, on rock, 30 May 2011, *JE 26631* (LPB, herb. Etayo).

Cladia aggregata (Sw.) Nyl.

The species is rather common in Bolivia in cloud forests and Páramo Yungueño (Rodríguez Flakus *et al.* 2012).

CHEMISTRY. Tested specimens contained barbatic and 4-O-demethylbarbatic (\pm) acids (chemotype I) or barbatic and 4-O-demethylbarbatic acids with stictic acid complex (chemotype IV).

SPECIMENS EXAMINED. CHEMOTYPE I. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, Titilaya, 15°39'55"S, 68°42'51"W, 2775 m, transition Yungas forest – Valles Secos vegetation, on soil, 14 May 2011, *MK 8435* (LPB, UGDA); Prov. Murillo, Valle del Zongo, 16°07'41"S, 68°05'55"W, 2450 m, Yungas cloud forest, on ground, 29 May 2011, *MK 9589* (LPB, UGDA); Prov. Nor Yungas, near Pongo, near the road between Coroico and La Paz, 16°19'28"S, 67°57'21"W, 3820 m, Páramo Yungueño, on ground, 25 May 2011, *MK 9380*, *US* (LPB, UGDA, herb. Schiefelbein 2915); DEPT. SANTA CRUZ. Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla, old road between Cochabamba and Comarapa, 17°49'10"S, 64°38'45"W, 2950 m, Páramo Yungueño, on rock, 9 June 2011, *MK 10043* (LPB, UGDA). CHEMOTYPE IV. BOLIVIA, DEPT. LA PAZ. Prov. Larecaja, near Incachaca, 15°17'48"S, 68°26'32"W, 1100 m, Yungas montano inferior forest, on

soil, 29 May 2011, *MK 9609* (LPB, UGDA); Prov. Nor Yungas, near Chuspipata, on the road between Coroico and La Paz, 16°17'09"S, 67°51'00"W, 3228 m, Yungas cloud forest, on ground, 24 May 2011, *MK 9307*, *US* (LPB, UGDA, herb. Schiefelbein 2932); DEPT. SANTA CRUZ. Prov. Florida, PNA, above La Yunga, senda Los Helechos, 18°03'30"S, 63°54'36"W, 2330 m, Yungas cloud forest, on ground, 8 June 2011, *MK 9812a*, *9838* (H, LPB, UGDA). SPECIMENS NOT TESTED WITH TLC. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Cruz Charazani-Pelechuco, 15°15'00"S, 69°02'51"W, 4545 m, high Andean vegetation, 19 May 2011, *JE 27564* (LPB, herb. Etayo); near Charazani, 15°10'39"S, 68°56'36"W, 2237 m, Yungas montane forest, on soil, 18 May 2011, *JE 27604*, *US* (LPB); Prov. Larecaja, near Palyllunga, 15°28'29"S, 68°36'43"W, 1693 m, Valle Seco open vegetation, on rock wall, 14 May 2011, *JE 27221* (LPB, herb. Etayo); Titilaya, 15°39'55"S, on soil, 14 May 2011, 15°39'55"S, 68°42'51"W, transition Yungas forest – Valles Secos vegetation, 2775 m, 14 May 2011, *US* (herb. Schiefelbein 2920, LPB); Prov. Murillo, Valle del Zongo, Laguna Viscachani, 16°11'54"S, 68°07'33"W, 3860 m, Páramo Yungueño, on soil, 30 May 2011, *JE 26626*, *26633* (LPB, herb. Etayo); below Potosí, 16°17'43"S, 68°07'42"W, 4550 m, high Andean vegetation, on rock, 28 May 2011, *JE 26828* (LPB, herb. Etayo); Prov. Nor Yungas, PNANMIC, by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, 3520 m, transition Páramo Yungueño – Yungas montane cloud forest, on humus, 25 May 2011, *JE 28039* (LPB, herb. Etayo).

Cladonia aleuropoda Vain.

This species was previously known from only one locality in Bolivia (Flakus 2008), but as noted below, it is rather common in the high Andes of the country.

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, 28 km from Charazani, on the road between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, open area with boulders, on soil, 18 May 2011, *MK 8890*, *8912* (H, LPB, UGDA); Prov. Larecaja, Jocollone, Páramo Yungueño vegetation, open antropogenic area, 15°37'35"S, 68°41'21"W, 3545 m, 14 May 2011, *AF 20463* & *OP* (H, KRAM, LPB); Prov. Murillo, La Cumbre, camino a los Yungas, vegetación altoandina, con varios bofedales y área muy húmeda, terrestre, 16°19'06"S 68°2'00"W,

4397 m, 18 March 2009, *PR 1101* & *AF* (H, KRAM, LPB); Valle del Zongo, Yungas cloud forest, 16°08'38"S, 68°06'59"W, 2900 m, 29 May 2011, *AF 21998* & *OP* (H, KRAM, LPB); Prov. Nor Yungas, carretera Cotapata – Santa Barbara, cerca de la gasolinera, Páramo yungueño, terrestre, 16°19'23"S, 67°56'36"W, 3573 m, 18 Nov. 2007, *PR 1136* (H, LPB); PNANMIC, by Sillu Tincara pre-Columbian route, Yungas montane cloud forest, 16°16'33"S 67°52'60"W, 3429 m, 27 June 2010, *AF 16985* & *PR* (H, LPB); near Pongo, 16°19'28"S, 67°57'21"W, 3820 m, Páramo Yungueño, on soil, 25 May 2011, *MK 9375*, *US* (H, LPB, UGDA, herb. Schiefelbein 2905); near Unduavi, 16°17'29"S, 67°51'43"W, 3200 m, Yungas cloud forest, on rock, 25 May 2011, *MK 9361* (LPB, UGDA).

Cladonia arbuscula (Wallr.) Flot. subsp. ***boliviana*** (Ahti) Ahti & DePriest

This subspecies has previously been reported from Bolivia on several occasions (Ahti 1961, 2000; Feuerer *et al.* 1998).

CHEMISTRY. Fumarprotocetraric (with related substances) and usnic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, Jocollone, Páramo Yungueño vegetation, open antropogenic area, 15°37'35"S, 68°41'21"W, 3545 m, 14 May 2011, *AF 20421* & *OP* (H, KRAM, LPB); Prov. Nor Yungas, near Pongo, Páramo Yungueño, 16°19'28"S, 67°57'21"W, 3822 m, on rock, 25 May 2011, *AF 21765*, *21728*, *21741*, *OP*, *US* (H, KRAM, LPB, herb. Schiefelbein 2896); DEPT. SANTA CRUZ. Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla, 17°49'10"S, 64°38'45"W, 2950 m, Páramo Yungueño, on ground, 9 June 2011, *MK 10034* (H, LPB, UGDA).

Cladonia arcuata Ahti

This species was previous known from only two records in Bolivia (Ahti 2000; Flakus *et al.* 2008).

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Florida, PNA, above La Yunga, senda Los Helechos, 18°03'30"S, 63°54'36"W, 2330 m, Yungas cloud forest, on soil, 7 June 2011, *MK 9733* (LPB, UGDA).

Cladonia borbonica Nyl.

This is the second locality for this species in Bolivia (Flakus *et al.* 2008).

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, near Chuspipata, on the road between Coroico and La Paz, 16°17'09"S, 67°51'00"W, 3228 m, Yungas cloud forest, on soil, 24 May 2011, *MK 9330* (LPB, UGDA).

Cladonia caespiticia (Pers.) Flörke

This species, new to Bolivia, is widespread in Europe and North America, but in South America it has only been reported from one locality in Brazil (Ahti 2000).

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Puente Vagante, 15°18'18"S, 68°21'53"W, Preandean Amazon secondary forest, open area with boulders, 690 m, 15 May 2011, *US* (LPB).

Cladonia calycantha Delise *ex* Nyl.

This species has been reported several times from Bolivia (Rodriguez Flakus *et al.* 2012).

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PNC, carretera Schuencas – Monte Punku, corticolous, 17°32'15"S 65°16'13,6"W, 2500 m, 20 Nov. 2007, *PR 1209* (H, KRAM, LPB); DEPT. LA PAZ. Prov. Bautista Saavedra, km 196 on the road from Apolo to Charazani, 15 km from Charazani, 15°11'02"S, 68°53'43"W, 2560 m, transition Yungas montane forest-cloud forest, on ground, 18 May 2011, *MK 8943* (H, LPB, UGDA); between Charazani and Apolo, 15°11'02"S, 68°53'43"W, 2560 m, transition Yungas montane forest-cloud forest, on ground, 18 May 2011, *MK 8943* (H, LPB, UGDA); between Charazani and Apolo, 15°12'35"S, 68°51'30"W, transition Yungas montane forest-cloud forest, 2260 m, 18 May 2011, *US* (LPB, herb. Schiefelbein 2951, 2952); near Charazani, 15°10'39"S, 68°56'36"W, Yungas montane forest, 2235 m, 18 May 2011, *US* (LPB); Prov. Lare-

caja, Titilaya, 15°39'55"S, 68°42'51"W, 2773 m, transition Yungas forest – Valles Secos vegetation, 14 May 2011, *AF 20358* & *OP* (H, KRAM, LPB); Jocollone, Páramo Yungueño vegetation, open antropogenic area, 15°37'35"S, 68°41'21"W, 3545 m, 14 May 2011, *AF 20399* & *OP* (H, KRAM, LPB); near Pongo, 16°19'28"S, 67°57'21"W, Páramo Yungueño, 3820 m, 25 May 2011, *US* (LPB, herb. Schiefelbein 2887).

Cladonia ceratophylla (Sw.) Spreng.

This species has been reported several times from Bolivia (Rodríguez Flakus *et al.* 2012), being particularly common in the Yungas montane forests.

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, 28 km from Charazani town, on the road between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, open area with boulders, on soil, 18 May 2011, *AF 21007* & *OP*, *MK 8858*, *US* (H, KRAM, LPB, UGDA, herb. Schiefelbein 3359); Prov. Nor Yungas, PNANMIC, Chairó, 16°12'07"S, 67°50'05"W, 1300 m, Yungas montano inferior forest, on ground, 21 May 2011, *MK 9008* (LPB, UGDA); DEPT. SANTA CRUZ. Prov. Florida, PNA, above La Yunga, senda Los Helechos, 18°03'30"S, 63°54'36"W, 2330 m, Yungas cloud forest, on soil, 7 June 2011, *MK 9732* (LPB, UGDA).

Cladonia chlorophaea (Sommerf. ex Flörke) Spreng.

This species was previously known from only four localities in Bolivia (Feuerer *et al.* 1998; Ahti 2000; Flakus 2008; Flakus *et al.* 2008).

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, carretera Cotapata-Santa Bárbara, cerca de la gasolinera, 16°19'23"S 67°56'36,8"W, 3573 m, Páramo Yungueño, on soil, 18 Nov. 2007, *PR 1135* (H, KRAM, LPB).

Cladonia coccifera (L.) Willd.

Only reported once from Bolivia (Flakus *et al.* 2008).

CHEMISTRY. Usnic acid and zeorin.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, Páramo Yungueño vegetation, 3545 m, 14 May 2011, *US* (LPB, herb. Schiefelbein 2922).

Cladonia confusa R. Sant.

This species has been reported from numerous localities in Bolivia. It comprises two forms, the commoner *C. confusa* s.str. and the rarer *C. confusa* f. *bicolor* (Müll.Arg.) Ahti & DePriest (Feuerer *et al.* 1998; Ahti 2000; Flakus 2008; Flakus *et al.* 2008).

CHEMISTRY. Perlatolic acid (*C. confusa* f. *bicolor*) or perlatolic and usnic acids (*C. confusa* f. *confusa*).

SPECIMENS OF *C. CONFUSA* F. *BICOLOR* EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, near Charazani, 15°10'39"S, 68°56'36"W, Yungas montane forest, 2240 m, 18 May 2011, *US* (LPB, herb. Schiefelbein 2957); Prov. Nor Yungas, PNANMIC, Santa Catalina, 16°11'12"S, 67°52'07"W, Yungas montane forest, 22 May 2011, *US* (LPB, herb. Schiefelbein 2943); DEPT. SANTA CRUZ, Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla, carretera antigua Cochabamba-Comarapa, Páramo Yungueño, 17°49'10"S, 64°38'45"W, 2946 m, 9 June 2011, *AF 22689* & *OP* (H, KRAM, LPB).

SPECIMENS OF *C. CONFUSA* F. *CONFUSA*. EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Área Natural de Manejo Integrado Nacional Apolobamba, near Villa Amarca, 15°16'47"S, 69°01'47"W, 4643 m, Puna Húmeda vegetation, 3 July 2010, *AF 17409* & *PR* (H, KRAM, LPB); Prov. Nor Yungas, near Pongo, 16°19'28"S, 67°57'21"W, 3820 m, Páramo Yungueño, on ground, 21 & 25 May 2011, *AF 21720* & *OP*, *MK 8991*, *9372*, *US* (H, KRAM, LPB, UGDA, herb. Schiefelbein 2881, 2892, 2907); PNANMIC, between Tunkini and Chairó, above Tunkini, 16°11'S, 67°52'W, 2400 m, Yungas montane forest, on ground, 22 May 2011, *MK 9068* (H, LPB, UGDA); by Unduavi, 16°17'22"S, 67°53'29"W, transition Páramo Yungueño – Yungas montane cloud forest, 3520 m, 25 May 2011, *US* (LPB, herb. Schiefelbein 2914); DEPT. SANTA CRUZ. Prov. Florida, PNA, above La Yunga, senda Los Helechos, 18°03'30"S, 63°54'36"W, 2330 m, Yungas cloud forest, on soil, 7 June 2011, *AF 22488* & *OP*, *MK 9812* (H, KRAM, LPB, UGDA); on the road to San Mateo de

Toresilla, 17°49'10"S, 64°38'45"W, 2946 m, Páramo Yungueño, 9 June 2011, *AF 22694, 22915, 22919 & OP* (H, KRAM, LPB).

Cladonia corniculata Ahti & Kashiw.

This species was known only from three localities in Bolivia (Ahti 2000; Flakus *et al.* 2008).

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, open antropogenic area, on soil, 14 May 2011, *MK 8470, US* (LPB, UGDA); Prov. Nor Yungas, on the road Coroico-La Paz, 16°14'30"S, 67°49'58"W, 2848 m, Yungas secondary cloud forest, 23 May 2011, *AF 21520 & OP* (H, KRAM, LPB); near Pongo, 16°19'28"S, 67°57'21"W, Páramo Yungueño, 3820 m, on wood, 25 May 2011, *US* (LPB, herb. Schiefelbein 2897); estacion de servicio near Chuspipata, on the road Coroico-La Paz, 16°17'09"S, 67°51'00"W, 3228 m, Yungas cloud forest, 24 May 2011, *AF 21569 & OP* (H, KRAM, LPB); Coroico, 16°11'10"S, 67°43'16"W, 1550 m, Yungas montane forest, 6 June 2010, *AF 16401 & PR* (H, KRAM, LPB, in the specimen of *Cladonia subradiata*); PNANMIC, between Tunkini and Chairo 16°11'S, 67°52'W, 2400 m, Yungas montane forest, on ground, 22 May 2011, *MK 9106* (H, LPB, UGDA); Chairo, 16°12'07"S, 67°50'05"W, 1300 m, Yungas montano inferior forest, on ground, 21 May 2011, *MK 9008a* (H, LPB, UGDA); by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, 3520 m, transition Páramo Yungueño-Yungas montane cloud forest, on soil, 25 May 2011, *MK 9427* (H, LPB, UGDA).

Cladonia corymbosula Nyl.

This species is new Bolivia. Previously it has been reported from Colombia, Costa Rica, Cuba, Dominican Republic, Honduras, Jamaica, Mexico and Puerto Rico (Ahti 2000; Sipman *et al.* 2008).

Homosekikaic acid is reported for the first time from the species.

CHEMISTRY. Fumarprotocetraric acid (with related substances) or homosekikaic acid.

SPECIMENS EXAMINED. CHEMOTYPE WITH FUMARPROTOCETRARIC ACID. BOLIVIA. DEPT. LA PAZ. Prov.

Bautista Saavedra, Calzada, 15°09'06"S, 68°30'24"W, 835 m, Preandean Amazon secondary forest, on soil, 17 May 2011, *MK 8801, 8802* (H, LPB, UGDA); Prov. Franz Tamayo, near Correo, 14°59'06"S, 68°26'09"W, 1630 m, Yungas montane forest, roadside, on soil, 17 May 2011, *MK 8775* (H, LPB, UGDA); DEPT. SANTA CRUZ. Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla, 17°48'11"S, 64°39'28"W, 2250 m, Yungas cloud forest, on soil, 9 June 2011, *MK 9998, 10023* (H, LPB, UGDA). CHEMOTYPE WITH HOMOSEKIKAIAC ACID. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior secondary forest, 15 May 2011, *MK 8564, 8590, 8591* (H, LPB, UGDA);

Cladonia crispata (Ach.) Flot.

This widespread species, known from the the Northern Hemisphere, Australasia, East Africa and the Neotropics (Ahti 2000), is new to Bolivia.

CHEMISTRY. Thamnic acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, near Incachaca, 17°14'13"S 65°49'02"W, 2295 m, 10 June 2006, Yungas montane cloud forest, *AF 8180* (H, KRAM, LPB).

Cladonia dactyloata Tuck.

This species has only been reported twice from Bolivia (Flakus 2008; Flakus *et al.* 2008).

CHEMISTRY. Psoromic acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, km 62 on the road between Coroico and La Paz, 16°14'30"S, 67°49'58"W, 2850 m, Yungas secondary cloud forest, on ground, 23 May 2011, *MK 9216* (LPB, UGDA); between La Paz and Chulumani, 16°14'10"S, 67°44'20"W, Yungas secondary cloud forest, on ground, 24 May 2011, *MK 9344* (LPB, UGDA); near Unduavi, 16°17'29"S, 67°51'43"W, 3200 m, Yungas cloud forest, 25 May 2011, on soil, *JE 28099, US* (LPB, herb. Etayo, herb. Schiefelbein 2925); near Chuspipata, 16°17'09"S, 67°51'00"W, Yungas cloud forest, 3230 m, 24 May 2011, *US* (LPB); PNANMIC, by Sillu Tincara pre-Columbian route, 16°16'33"S, 67°52'60"W, 3429 m, Yungas montane cloud forest, 27 June 2010, *AF 16847 & P. Rodriguez* (H, KRAM, LPB); DEPT. SANTA CRUZ. Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla, 17°48'11"S, 64°39'28"W, 2250 m, Yungas cloud forest, on soil, 09 June 2011, *MK 10011, 10016* (LPB, UGDA).

Cladonia didyma (Fée) Vain.

This species has only been reported from a few localities in Bolivia (Feuerer *et al.* 1998; Ahti 2000; Flakus 2008; Flakus *et al.* 2008), but is apparently common in the country. It is variable in terms of its secondary metabolite composition: in the studied material, three chemotypes were determined.

CHEMISTRY. Didymic or barbaritic acids together with thamnolic acid, or only thamnolic acid.

SPECIMENS EXAMINED. CHEMOTYPE WITH DIDYMIC AND THAMNOLIC ACIDS. BOLIVIA. DEPT. LA PAZ. Prov. Franz Tamayo, near Yuyo, 15°07'05"S, 68°20'22"W, 1150 m, Preandean Amazon forest, on wood, 16 May 2011, *MK 8713* (LPB, UGDA); near Correo, 14°59'06"S, 68°26'09"W, Yungas montane forest, 1630 m, 17 May 2011, *US* (herb. Schiefelbein 2964, LPB); Prov. Larecaja, near Achiquiri, 15°13'31"S, 68°13'49"W, 1070m, Yungas inferior secondary forest, on rock, 16 May 2011, *MK 8650* (LPB, UGDA); Prov. Murillo, Valle del Zongo, 16°07'41"S, 68°05'55"W, 2450 m, Yungas cloud forest, on rock, 29 May 2011, *MK 9597* (LPB, UGDA); Prov. Nor Yungas, near Unduavi, 16°17'29"S, 67°51'43"W, 3200 m, Yungas cloud forest, on soil, 25 May 2011, *MK 9359 & US* (LPB, UGDA, herb. Schiefelbein 2929, 2930); Km 62 on the road Coroico-La Paz, 16°14'30"S, 67°49'58"W, 2848 m, Yungas secondary cloud forest, 23 May 2011, *AF 21525, 21531 & OP* (H, KRAM, LPB); PNANMIC, by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, transition Páramo Yungueño – Yungas montane cloud forest, on turf, 3520 m, 25 May 2011, *US* (herb. Schiefelbein 2912, 3362, LPB); near Chuspipata, 16°17'09"S, 67°51'00"W, Yungas cloud forest, 3230 m, 24 May 2011, *US* (LPB, herb. Schiefelbein 2937). CHEMOTYPE WITH BARBATIC AND THAMNOLIC ACIDS. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior secondary forest, on soil, 15 May 2011, *MK 8588* (LPB, UGDA). CHEMOTYPE WITH THAMNOLIC ACID. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, km 69 on the road between Coroico and La Paz, 16°13'33"S, 67°49'20"W, 2600 m, Yungas secondary cloud forest, on ground, 23 May 2011, *MK 9183* (LPB, UGDA); km 62 on the road between Coroico and La Paz, 16°14'30"S, 67°49'58"W, 2850 m, Yungas secondary cloud forest, on ground, 23 May 2011, *MK 9215* (LPB); PNANMIC, by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W,

3520 m, transition Páramo Yungueño-Yungas montane cloud forest, on ground, 25 May 2011, *MK 9473* (H, LPB, UGDA).

Cladonia farinophylla Ahti

Previously this species was known only from Brazil and Paraguay (Ahti 2000). These new Bolivian records extend its distribution range northwards.

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Calzada, 15°09'06"S, 68°30'24"W, 835 m, Preandean Amazon secondary forest, on soil, 17 May 2011, *MK 8804* (H, LPB, UGDA); Prov. Nor Yungas, PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, 2400 m, Yungas montane forest, on soil, 22 May 2011, *MK 9103* (H, LPB, UGDA).

Cladonia furcata (Huds.) Schrad.

This is the second locality of the species in Bolivia (Ahti 2000).

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla, 17°49'10"S, 64°38'45"W, 2950 m, Páramo Yungueño, on soil, 9 June 2011, *MK 10032* (LPB, UGDA).

Cladonia granulosa (Vain.) Ahti

Previously this was known only from one locality in Bolivia (Flakus *et al.* 2008).

CHEMISTRY. Thamnolic acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Franz Tamayo, near Correo, 14°59'06"S, 68°26'09"W, Yungas montane forest, 1630 m, 17 May 2011, *US* (LPB); Prov. Nor Yungas, near Chuspipata, 16°17'09"S, 67°51'00"W, 3228 m, Yungas cloud forest, on rock, 24 May 2011, *AF 21586, 21680 & OP, MK 9262, 9316, US* (H, KRAM, LPB, UGDA, herb. Schiefelbein 2935, 2938); PNANMIC, Santa Catalina, 16°11'12"S, 67°52'07"W, 2700 m, Yungas montane forest, 22 May 2011, *MK 9020* (LPB, UGDA); by Sillu Tincara pre-Columbian route, 16°16'33"S, 67°52'60"W, Yungas montane cloud forest, 3430 m, 27 June 2010, *AF 16862*,

16873, 16913 & PR (H, KRAM, LPB); by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, transition Páramo Yungueño – Yungas montane cloud forest, 3520 m, 25 May 2011, US (LPB, herb. Schiefelbein 2910, 2911); DEPT. SANTA CRUZ. Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla, 17°49'10"S, 64°38'45"W, 2950 m, Páramo Yungueño, on soil, 9 June 2011, MK 10028 (H, LPB, UGDA); Prov. Florida, PNA, above La Yunga, senda Los Helechos, 18°03'30"S, 63°54'36"W, 2330 m, Yungas cloud forest, on ground, 7 June 2011, MK 9816 (LPB, UGDA).

Cladonia isabellina Vain.

This species is new to Bolivia. Previously it was known from Costa Rica, Colombia, Dominican Republic, Ecuador, Panama, Peru and Venezuela (Ahti 2000; Sipman *et al.* 2008).

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PNC, between Sehuencas and Monte Punku, 17°32'15"S, 65°16'13"W, 2500 m, on bark, 20 Nov. 2007, PR 1210 (H, LPB); DEPT. LA PAZ. Prov. Murillo, La Cumbre, camino a los Yungas, 16°19'63"S, 68°02'00"W, 4400 m, vegetación altoandina, área muy húmeda, con varios bofedales, on soil, PR 1103 & AF (H, LPB); Prov. Nor Yungas, near Pongo, 16°19'28"S, 67°57'21"W, 3820 m, Páramo Yungueño, on ground, 25 May 2011, AF 21705 & OP, MK 9378, 8379, 9385, US (LPB, UGDA, herb. Schiefelbein 2883, 2893, 2902); PNANMIC, by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, 3520 m, transition Páramo Yungueño-Yungas montane cloud forest, on rock, 25 May 2011, MK 9469 (H, LPB, UGDA).

Cladonia kriegeri (Ahti & S. Stenroos) Ahti & De-Priest

This is the second Bolivian locality of this very rare species (Flakus *et al.* 2008).

CHEMISTRY. Fumarprotocetraric (with related substances) and usnic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla, 17°49'10"S, 64°38'45"W, 2946 m, Páramo Yungueño, 9 June 2011, AF 22921 & OP (H, KRAM, LPB).

Cladonia lepidophora Ahti & Kashiw.

This chemically variable species was previously known from only one locality in Bolivia (Flakus *et al.* 2008).

CHEMISTRY. Usnic, squamatic and thamnolic acids (chemotype 1 sensu Stenroos 1989) or usnic and squamatic acids (chemotype 4 sensu Stenroos 1989).

SPECIMENS EXAMINED. CHEMOTYPE 1. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, below Potosí, 16°17'43"S, 68°07'42"W, 4720 m, high Andean vegetation, on soil, 28 May 2011, MK 9489 (H, LPB, UGDA). CHEMOTYPE 4. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Valle del Zongo, Laguna Viscachani, 16°11'54"S, 68°07'33"W, 3860 m, Páramo Yungueño, on soil, 30 May 2011, MK 9657 (H, LPB, UGDA); Prov. Nor Yungas, near Pongo, 16°19'28"S, 67°57'21"W, Páramo Yungueño, 3820 m, 25 May 2011, US (LPB, herb. Schiefelbein 2882).

Cladonia leprocephala Ahti & S. Stenroos

This species is new to Bolivia. Previously it has been reported from Colombia, Ecuador, Peru and Venezuela (Ahti & Stenroos 1986; Stenroos 1989; Ahti 2000; Sipman *et al.* 2008).

CHEMISTRY. Barbatic (±) and thamnolic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Camacho, Pacoamba near Wila Kala, 15°24'40"S, 69°04'24"W, 4283 m, Puna Húmeda vegetation, on soil, 6 July 2010, AF 17725 & PR (H, KRAM, LPB); Prov. Nor Yungas, near Pongo, 16°19'28"S, 67°57'21"W, Páramo Yungueño, 3820 m, 25 May 2011, US (LPB, herb. Schiefelbein 2882); near Chuspipata, 16°17'09"S, 67°51'00"W, Yungas cloud forest, 3230 m, 24 May 2011, US (LPB, herb. Schiefelbein 2940; specimen with thamnolic acid only); PNANMIC, by Sillu Tincara pre-Columbian route, 16°16'33"S, 67°52'60"W, 3429 m, Yungas montane cloud forest, 27 June 2010, AF 16966 & PR (H, KRAM, LPB).

Cladonia macilenta Hoffm.

Although this species is new to Bolivia, it is found throughout the world and widespread in South America (Ahti 2000).

CHEMISTRY. Barbatic acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, Coroico, 16°11'10"S, 67°43'16"W, 1550 m, Yungas montane forest, 6 June 2010, *AF 16400* & *PR* (H, KRAM, LPB); PNANMIC, by Sillu Tincara pre-Columbian route, 16°16'33"S, 67°52'60"W, 3429 m, Yungas montane cloud forest, 27 June 2010, *AF 16987* & *PR* (H, KRAM, LPB).

Cladonia macilentoides Ahti & Fleig

The species was previously reported from only one locality in Bolivia (Flakus 2008).

CHEMISTRY. Thamnic acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Franz Tamayo, near Correo, 14°59'06"S, 68°26'09"W, Yungas montane forest, 1630 m, on ground, 17 May 2011, *US* (LPB, herb. Schiefelbein 2961); Prov. Nor Yungas, near Unduavi, 16°17'29"S, 67°51'43"W, Yungas cloud forest, 3200 m, on ground, 25 May 2011, *US* (LPB, herb. Schiefelbein 2931); km 62 on the road between Coroico and La Paz, 16°14'30"S, 67°49'58"W, 2850 m, Yungas secondary cloud forest, on ground, 23 May 2011, *MK 9214* (LPB, UGDA); PNANMIC, near Urpuma colony, 16°13'20"S, 67°52'34"W, 1990 m, Yungas montane forest, 30 June 2010, *AF 17256* & *PR* (H, KRAM, LPB).

Cladonia melanopoda Ahti

Previously known only from a few localities in Bolivia (Feurerer *et al.* 1998; Ahti 2000; Flakus *et al.* 2008).

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, on the road between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, open area with boulders, on soil, 18 May 2011, *MK 8911* (H, LPB, UGDA); between Charazani and Apolo, 15°11'02"S, 68°53'43"W, transition Yungas montane forest-cloud forest, 2560 m, 18 May 2011, *US* (LPB, herb. Schiefelbein 2950); near Charazani, 15°10'39"S, 68°56'36"W, 2235 m, Yungas montane forest, on soil, 18 May 2011, *MK 8810*, *US* (LPB, UGDA, herb. Schiefelbein 2958); Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, open antropogenic area, on soil, 14 May 2011, *MK 8472* (LPB); near Consata, 15°20'46"S, 68°29'16"W, Yungas montano inferior secondary forest, on plant debris, 1240 m, 15 May 2011, *US* (LPB, herb. Schiefelbein 2968); Prov.

Murillo, Valle del Zongo, 16°10'15"S, 68°08'02"W, 3375 m, Páramo Yungueño, on soil, 29 May 2011, *MK 9540* (LPB, UGDA); Prov. Nor Yungas, near Pongo, 16°19'28"S, 67°57'21"W, 3820 m, Páramo Yungueño, on soil, 21 & 25 May 2011, *AF 21788* & *OP*, *MK 8992*, *9370*, *9403*, *US* (H, KRAM, LPB, UGDA, herb. Schiefelbein 2885, 2895, 2917, 3361); near Chuspipata, 16°17'09"S, 67°51'00"W, Yungas cloud forest, 3230 m, on ground, 24 May 2011, *US* (LPB, herb. Schiefelbein 2933); PNANMIC, by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, transition Páramo Yungueño – Yungas montane cloud forest, 3520 m, 25 May 2011, *US* (LPB, herb. Schiefelbein 2909); DEPT. SANTA CRUZ. Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla, 17°49'10"S, 64°38'45"W, 2950 m, Páramo Yungueño, on rock, 9 June 2011, *AF 22705* & *OP*, *MK 10029* (H, KRAM, LPB, UGDA).

Cladonia meridensis Ahti & S. Stenroos

Known only from a few localities in Bolivia (Ahti 2000; Rodriguez Flakus *et al.* 2012).

CHEMISTRY. Barbatic and thamnic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas. PNANMIC, by Sillu Tincara pre-Columbian route, 16°16'33"S, 67°52'60"W, 3429 m, Yungas montane cloud forest, 27 June 2010, *AF 16920* & *PR* (H, KRAM, LPB); DEPT. SANTA CRUZ. Prov. Andrés Ibáñez. PNA, on the road to San Mateo de Toresilla, 17°49'10"S, 64°38'45"W, 2946 m, Páramo Yungueño, 9 June 2011 *AF 22691* & *OP* (H, KRAM, LPB).

Cladonia pityrophylla Nyl.

This species is new to Bolivia. It was previously known from Argentina, Brazil, Guyana, Paraguay and Venezuela (Ahti 2000).

Cladonia pityrophylla comprises two chemotypes, one with fumarprotocetraric acid with related substances and the other one with stictic acid complex (Ahti 2000); the Bolivian material contains fumarprotocetraric acid with satellites.

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior secondary forest, on soil, 15 May 2011, *MK 8598* (H, LPB, UGDA).

***Cladonia pocillum* (Ach.) Grognot**

Previously known only from three localities in Bolivia (Feurerer *et al.* 1998; Ahti 2000).

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Cruz Charazani-Pelechuco, on the road from Apolo to Charazani, 15°15'00"S, 69°02'51"W, 4545 m, high Andean vegetation, on soil, 19 May 2011, *AF 21181* & *OP, US* (H, KRAM, LPB, herb. Schiefelbein 2947); Prov. Camacho, near Villa Cala, 15°25'53"S, 69°05'07"W, 4250 m, high Andean vegetation, on soil, 19 May 2011, *MK 8965* (H, LPB, UGDA); Prov. Murillo, below Potosi, 16°17'43"S, 68°07'42"W, 4720 m, high Andean vegetation, on soil, 29 May 2011, *MK 9507* (LPB, UGDA).

***Cladonia rappii* A. Evans**

Previously known from only four localities in Bolivia (Feurerer *et al.* 1998; Ahti 2000).

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, 15 km from Charazani, 15°11'02"S, 68°53'43"W, 2561 m, transition Yungas montane forest-cloud forest, 18 May 2011, *AF 21104* & *OP* (H, KRAM, LPB); Prov. Nor Yungas, near Nogalani, 16°12'57"S, 67°49'15"W, 2168 m, Yungas secondary cloud forest, on ground, 23 May 2011, *MK 9138* (LPB, UGDA); near Siniari colony, km 74 on the road between Coroico and La Paz, 16°13'20"S, 67°50'37"W, 2186 m, Yungas secondary cloud forest, 24 May 2011, *AF 21564* & *OP* (H, KRAM, LPB); PNANMIC, between Tunkini and Chairo, 16°11'S, 67°52'W, 2400 m, Yungas montane forest, on soil, 22 May 2011, *MK 9079* (LPB, UGDA); DEPT. SANTA CRUZ. Prov. Florida, PNA, above La Yunga, 18°03'30"S, 63°54'36"W, 2330 m, Yungas cloud forest, on soil, 7 June 2011, *AF 22441* & *OP, MK 9813* (H, KRAM, LPB, UGDA).

***Cladonia signata* (Eschw.) Vain.**

Previously known in Bolivia from a 19th century record (Ahti 2000).

CHEMISTRY. Fumarprotocetraric (with related substances) and homosekikaic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, PNANMIC, between Tunkini and Chairo, 16°11'S, 67°52'W, 2400 m, Yungas montane forest, on mosses, 22 May 2011, *MK 9102, US* (H, LPB, UGDA, herb. Schiefelbein 3360); near Urpuma colony, 16°13'20"S, 67°52'34"W, Yungas montane forest, 1989 m, 30 June 2010, *AF 17133* & *PR* (H, KRAM, LPB); Santa Catalina, above Tunkini, 16°11'12"S, 67°52'07"W, 2700 m, Yungas montane forest, on ground, 22 May 2011, *AF 21292, 21347, 21350* & *OP, MK 9029, US* (H, KRAM, LPB, UGDA, herb. Schiefelbein 2944).

***Cladonia squamosa* Hoffm.**

Although this species is widespread in temperate and colder regions in Northern and Southern Hemispheres (Ahti 2000), these are the first records from Bolivia.

CHEMISTRY. Squamatic or thamnolic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, near Pongo, 16°19'28"S, 67°57'21"W, Páramo Yungueño, 3820 m, 25 May 2011, *AF 21759* & *OP, US* (H, KRAM, LPB, herb. Schiefelbein 2891, 2923); PNANMIC, by Sillu Tincara pre-Columbian route, 16°16'33"S, 67°52'60"W, Yungas montane cloud forest, 3430 m, 27 June 2010, *AF 16995* & *PR* (H, KRAM, LPB).

***Cladonia subradiata* (Vain.) Sandst.**

Previously, this species has been reported from three localities in Bolivia (Ahti 2000).

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Franz Tamayo, near Correo, 14°59'06"S, 68°26'09"W, 1630 m, Yungas montane forest, open area near a way, on ground, 17 May 2011, *MK 8787* (H, LPB, UGDA); near Yuyo, 15°07'05"S, 68°20'22"W, 1150 m, Preandean Amazon forest, on soil, 16 May 2011, *MK 8715* (H, LPB, UGDA); Prov. Larecaja, near Achiquiri, 15°13'31"S, 68°13'49"W, 1070 m, Yungas inferior secondary forest, on tree, 16 May 2011, *MK 8657* (LPB, UGDA); Prov. Nor Yungas, Coroico, 16°11'10"S, 67°43'16"W, Yungas montane forest, 1550 m, 6 June 2010, *AF 16401* & *PR* (H, KRAM, LPB); near Chuspipata, 16°17'09"S, 67°51'00"W, Yungas cloud forest with Ericaceae, 3228 m, 24 May 2011, *US* (LPB, herb.

Schiefelbein 2939); PNANMIC, Chairó, 16°12'07"S, 67°50'05"W, 1300 m, Yungas montano inferior forest, on ground, 21 May 2011, *MK 9008a* (H, LPB, UGDA).

Cladonia subsquamosa Kremp.

Previously known only from four localities in Bolivia (Ahti 2000; Flakus 2008; Flakus *et al.* 2008), but it is apparently much commoner.

CHEMISTRY. Fumarprotocetraric acid with related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°11'02"S, 68°53'43"W, 2560 m, transition Yungas montane forest-cloud forest, on wood, 18 May 2011, *MK 8947*, *US* (LPB, UGDA, herb. Schiefelbein 2953); between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, open area with boulders, 18 May 2011, *AF 20964*, *21008* & *OP*, *US* (H, KRAM, LPB, herb. Schiefelbein 2954); near Charazani, Yungas montane forest, 15°10'39"S, 68°56'36"W, 2237 m, 18 May 2011, *AF 20894* & *OP* (H, KRAM, LPB); Prov. Franz Tamayo, near Correo, 14°59'06"S, 68°26'09"W, Yungas montane forest, 1630 m, 17 May 2011, *US* (LPB, herb. Schiefelbein 2963, 2966); Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, on soil, 14 May 2011, *MK 8471* (LPB, UGDA); near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior secondary forest, on soil, 15 May 2011, *MK 8569*, *US* (LPB, UGDA, herb. Schiefelbein 2973); Titilaya, 15°39'55"S, 68°42'51"W, 2773 m, transition Yungas forest – Valles Secos vegetation, on soil, 14 May 2011, *MK 8430* (LPB, UGDA); Prov. Murillo, Valle del Zongo, 16°07'41"S, 68°05'55"W, Yungas cloud forest, 2446 m, 29 May 2011, *AF 22045* & *OP* (H, KRAM, LPB); Prov. Nor Yungas, near Siniari colony, 16°13'20"S, 67°50'37"W, 2190 m, Yungas secondary cloud forest, on humus, 24 May 2011, *MK 9236*, *US* (LPB, UGDA, herb. Schiefelbein 2941); near Unduavi, 16°17'29"S, 67°51'43"W, Yungas cloud forest, 3200 m, 25 May 2011, *US* (LPB); PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, 2400 m, Yungas montane forest, on soil, 22 May 2011, *MK 9090* (LPB, UGDA); Coroico, Yungas montane forest, 16°11'10"S, 67°43'16"W, 1550 m, 6 June 2010, *AF 16416* & *PR* (H, KRAM, LPB); by Sillu Tincara pre-Columbian route, 16°16'33"S, 67°52'60"W, 3429 m, Yungas montane cloud forest, 27 June 2010, *AF 16961* & *PR* (H, KRAM, LPB); DEPT. SANTA CRUZ, Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla,

17°48'11"S, 64°39'28"W, 2250 m, Yungas cloud forest, on soil, 9 June 2011, *MK 10012* (LPB, UGDA).

Coccocarpia erythroxyli (Spreng.) Swinscow & Krog

Previously known only from two localities in Bolivia (Feurerer & Sipman 2005; Flakus 2008).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, open area with boulders, on trunk, 18 May 2011, *JE 27324* (LPB, herb. Etayo); near Charazani, 15°10'39"S, 68°56'36"W, 2237 m, Yungas montane forest, on rock, 18 May 2011, *JE 27569* (LPB, herb. Etayo); Prov. Franz Tamayo, near Yuyo, 15°07'05"S, 68°20'22"W, 1150 m, Preandean Amazon forest, 16 May 2011, branches, *JE 27123* (LPB, herb. Etayo); near Apolo, 14°50'15"S, 68°26'58"W, 1430 m, Preandean Amazon forest, on trunk, 17 May 2011, *JE 27631* (LPB, herb. Etayo); Prov. Larecaja, Titilaya between Sorata and Consata, 15°39'55"S, 68°42'51"W, 2770 m, transition Yungas forest – Valles Secos vegetation, 14 May 2011, *JE 27079* (LPB); Prov. Nor Yungas, near Nogalani, 16°12'57"S, 67°49'15"W, 2168 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *JE 27978*, *27994* (LPB, herb. Etayo).

Coccocarpia palmicola (Spreng.) Arv. & D. J. Galloway

Previously known only from two localities in Bolivia (Feurerer & Sipman 2005; Flakus 2008).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, open area with boulders, on trunk, 18 May 2011, *JE 27323* (LPB, herb. Etayo); Prov. Murillo, Valle del Zongo, 16°10'15"S, 68°08'02"W, 3375 m, Páramo Yungueño, on rocks, 29 May 2011, *JE 26785* (LPB, herb. Etayo); Prov. Larecaja, Titilaya, 15°39'55"S, 68°42'51"W, 2773 m, transition Yungas forest – Valles Secos vegetation, 14 May 2011, *JE 27079* (LPB); Prov. Nor Yungas, PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, Yungas montane forest, corticolous, 22 May 2011, *JE 27721* (LPB).

Coccocarpia pellita (Ach.) Müll. Arg.

Previously known only from two localities in Bolivia (Ferraro 2002; Lücking 2008).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, near Pongo, 16°19'28"S, 67°57'21"W, 3700 m, Páramo Yungueño, on rock, 25 May 2011, *JE 26865* (LPB, herb. Etayo); Prov. Nor Yungas, PNANMIC, Chairo, 16°12'07"S, 67°50'05"W, 1300 m, Yungas montano inferior forest, 21 May 2011, trunks, *JE 27530* (LPB, herb. Etayo); between Tunkini and Chairo, 16°11'S, 67°52'W, Yungas montane forest, corticolous, 22 May 2011, *JE 27719* (LPB, herb. Etayo).

Coccocarpia stellata Tuck.

Although previously reported from Bolivia by Lynge (1925), these are the first contemporary records.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Achiquiri, 15°13'31"S, 68°13'49"W, 1071 m, Yungas inferior secondary forest, on tree, 16 May 2011, *JE 27230* (LPB, herb. Etayo); Prov. Nor Yungas, near Nogalani, 16°12'57"S, 67°49'15"W, 2168 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *JE 27977* (LPB, herb. Etayo).

Crocynia pyxinoides Nyl.

Although widespread in the Neotropics (Brazil, Colombia, French Guiana, Guyana, Surinam), Australia, USA, Thailand and Papua New Guinea (Aptroot & Sipman 1991; Sipman 1991; Brodo *et al.* 2001; Wolseley *et al.* 2002; Cáceres 2007; Sipman *et al.* 2008), this is new to Bolivia.

Crocynia pyxinoides is characterized by the lobate thallus and black prothallus (Cáceres 2007) and according to Brodo *et al.* (2001) it contains atranorin, fatty acids, terpenoids and stictic acid. However, in the holotype (Cuba, *C. Wright*, H-Nyl 22059!) stictic acid is lacking, as in all the cited specimens below. The identity of specimens containing this substance needs to be clarified.

CHEMISTRY. Atranorin and terpenoids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. BENI. Prov. Vaca Díez, Cachuela Esperanza, lowland Amazon forest, 130 m, 10°32'09"S, 65°34'55"W, on rock, 5 June 2006, *AF 7493, 7495* (KRAM, LPB); Prov. Itenez, Cotoca by Río San Martín, 13°17'11"S, 63°22'20"W, 150 m, lowland Amazon forest, on bark, 20 Aug. 2008, *AF 12871 & PR* (LPB); DEPT. LA PAZ. Prov. Franz Tamayo, near Yuyo, 15°07'05"S, 68°20'22"W, 1150 m, Preandean Amazon forest, on branches, 16 May 2011,

JE 27117 (LPB, herb. Etayo); Prov. Nor Yungas, near Pacallo, 16°12'10"S, 67°50'39"W, 1360 m, montane forest, on bark of tree, 3 Aug. 2008, *MK 7153b* (LPB, UGDA); DEPT. SANTA CRUZ. Prov. Guarayos, Virgen de Pilar near Chonta, Reserva Vida Silvestre Ríos Blanco y Negro, 15°38'54"S, 62°57'37"W, 230 m, lowland Amazon forest, on bark, 22 July 2009, *AF 13234, 13275 & PR* (KRAM, LPB); Prov. J. M. de Velasco, Camino los Fierros near Florida, Parque Nacional Noel Kempff Mercado, 14°32'25"S, 61°03'13"W, 215 m, lowland Amazon forest, on bark, 14 Dec. 2009, *AF 15582 & PR* (KRAM, LPB); near Florida, 14°37'48"S, 61°12'02"W, 170 m, lowland Amazon secondary forest, on bark, 16 Dec. 2009, *AF 16061 & PR* (KRAM, LPB); Hacienda Chirapa near Florida, 14°33'22"S, 61°16'03"W, 200 m, lowland Amazon forest, 16 Dec. 2009, *AF 16267.1 & PR* (KRAM, LPB).

Dibaeis absoluta (Tuck.) Kalb & Gierl

This species has only been reported from Bolivia by Flakus & Wilk (2006).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior secondary forest, 15 May 2011, *JE 27522* (LPB, herb. Etayo).

Dibaeis columbiana (Vain.) Kalb & Gierl

This species is known only in Bolivia from a few records (Gierl & Kalb 1993; Flakus & Wilk 2006).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, near Unduavi, 16°17'29"S, 67°51'43"W, 3200 m, Yungas cloud forest, on soil, 25 May 2011, *JE 28098* (LPB, herb. Etayo).

Dictyonema glabratum (Spreng.) D. Hawksw.

This is a very common species in the Neotropics (e.g., Feuerer 2012), but in Bolivia it is only known from scattered localities (see Rodríguez Flakus *et al.* 2012).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, Corani, 17°13'36"S, 65°53'25"W, 3260 m, open montane area by lake, 7 July 2009, *AF 12927* (KRAM, LPB); DEPT. LA PAZ. Prov. Bautista Saavedra, near Charazani, 15°12'35"S, 68°51'30"W, 2260 m, transition Yungas montane forest-cloud forest, on rock, 18 May 2011, *JE 27409* (LPB, herb. Etayo); Cruz

Charazani-Pelechuco, 15°15'00"S, 69°02'51"W, 4545 m, high Andean vegetation, on schrub, 19 May 2011, *JE 27564* (LPB, herb. Etayo); Prov. Franz Tamayo, near Correo, 14°59'06"S, 68°26'09"W, 1630 m, Yungas montane forest, open area near a way, on soil, 17 May 2011, *MK 8782* (LPB, UGDA); Prov. Larecaja, la Cumbre de Sorata, 15°53'06"S, 68°38'55"W, 4787 m, high Andean open vegetation, on mosses over stone, 13 May 2011, *MK 8418* (LPB, UGDA); Titilaya, 15°39'55"S, 68°42'51"W, 2773 m, transition Yungas forest – Valles Secos vegetation, on bryophytes, 14 May 2011, *JE 27070, 27076, MK 8442* (LPB, UGDA, herb. Etayo); Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, open antropogenic area, on soil, 14 May 2011, *JE 27209* (LPB, herb. Etayo); near Achiquiri, 15°13'31"S, 68°13'49"W, 1070 m, Yungas inferior secondary forest, on tree, 16 May 2011, *JE 27229* (LPB, herb. Etayo); near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior secondary forest, 15 May 2011, on tree, *JE 27521, 27525* (LPB, herb. Etayo); Prov. Murillo, Valle del Zongo, 16°08'38"S, 68°06'59"W, 2910 m, Yungas cloud forest, on bryophytes, 29 May 2011, *MK 9564* (LPB, UGDA); Prov. Nor Yungas, below Unduavi, 16°18'27"S, 67°53'48"W, 3210 m, Yungas cloud forest, 31 May 2011, humus, *JE 26953* (LPB, herb. Etayo); near Chuspipata, 16°17'09"S, 67°51'00"W, ca 3230 m, Yungas cloud forest, on ground, 24 May 2011, *JE 27686, 26723, 26724* (LPB, herb. Etayo); km 69 on the road between Coroico and La Paz, 16°13'33"S, 67°49'20"W, 2600 m, Yungas secondary cloud forest, on soil, 23 May 2011, *JE 27667* (LPB, herb. Etayo); km 62 on the road between Coroico and La Paz, 16°14'30"S, 67°49'58"W, 2850 m, Yungas secondary cloud forest, on ground, 23 May 2011, *JE 27649, 27652, MK 9206* (GMUF, LPB, UGDA, herb. Etayo); PNaNMIC, by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, 3520 m, transition Páramo Yungueño – Yungas montane cloud forest, on ground, 25 May 2011, *JE 28014, 28022, 28056, 28077, MK 9457* (GMUF, LPB, UGDA, herb. Etayo); Santa Catalina, 16°11'12"S, 67°52'07"W, Yungas montane forest, 22 May 2011, soil, *JE 27373, 27660* (LPB, herb. Etayo); DEPT. SANTA CRUZ. Prov. Florida, PNA, above La Yunga, 18°03'30"S, 63°54'36"W, 2330 m, Yungas cloud forest, on soil, 7 June 2011, *MK 9732* (UGDA, in specimen of *Cladonia ceratophylla*).

Dictyonema melvinii Chaves, Lücking & Umaña

Previously known only from one locality in Bolivia (Chaves *et al.* 2004).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Valle del Zongo, 16°10'15"S, 68°08'02"W, 3375 m, Páramo Yungueño, on bryophytes, 29 May 2011, *MK 9544* (LPB, UGDA). Prov. Nor Yungas, near Pongo, 16°19'28"S, 67°57'21"W, 3700 m, Páramo Yungueño, on soil, 25 May 2011, *JE 26867* (LPB, herb. Etayo).

Dictyonema minus Lücking, Navarro & Sipman

This species has only been reported from Bolivia by Flakus & Wilk (2006) and Lawrey *et al.* (2009), but it appears to be common in the high Andes.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Camacho, near Villa Cala, 15°25'53"S, 69°05'07"W, 4250 m, high Andean vegetation, on soil, 19 May 2011, *JE 27284, MK 8966* (GMUF, LPB, UGDA, herb. Etayo); Prov. Larecaja, la Cumbre de Sorata, 15°53'06"S, 68°38'55"W, 4787 m, high Andean open vegetation, on soil, 13 May 2011, *JE 27241, 27248, 27250, MK 8416, 8427* (LPB, UGDA, herb. Etayo); Prov. Murillo, below Potosí, 16°17'43"S, 68°07'42"W, 4720 m, high Andean vegetation, on soil, 28 May 2011, *MK 9498* (LPB, UGDA). Valle del Zongo, Laguna Viscachani, 16°11'54"S, 68°07'33"W, 3860 m, Páramo Yungueño, on soil, 30 May 2011, *JE 26623, 26624* (LPB, herb. Etayo); Paso Cumbre near La Paz city, 16°19'06"S, 68°02'09"W, 4405 m, high Andean vegetation, 31 May 2011, *JE 26888* (LPB, herb. Etayo).

Dictyonema sericeum (Sw.) Berk.

This species was reported from Bolivia by Parmasto (1978) and Flakus (2008). It is divided into four forms, which might even represent different species (Chaves *et al.* 2004). *Dictyonema sericeum* f. *sericeum* and *D. sericeum* f. *schenkianum* (Müll. Arg.) Parmasto were previously reported from Bolivia, and in this paper *D. sericeum* f. *membranaceum* Metzner and *D. sericeum* f. *phyllophilum* Parm. are new to Bolivia.

SPECIMENS EXAMINED. *Dictyonema sericeum* f. *membranaceum*. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Calzada, 15°09'06"S, 68°30'24"W, 835 m, Preandean Amazon secondary forest, on plant remains, 17 May 2011, *MK 8798* (LPB, UGDA); DEPT. SANTA CRUZ. Prov. Florida, PNA, above La Yunga,

18°02'50"S, 63°54'50"W, 2330 m, Yungas cloud forest with abundant tree ferns, on bark, 8 June 2011, *MK 9879* (LPB, UGDA). *Dictyonema sericeum* f. *phyllophilum*. BOLIVIA. DEPT. LA PAZ. Prov. Franz Tamayo, near Apolo, 14°50'15"S, 68°26'58"W, 1430 m, Preandean Amazon forest, on bark, 17 May 2011, *MK 8736* (GMUF, LPB, UGDA); Prov. Larecaja, near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior secondary forest, on bark, 15 May 2011, *MK 8563a* (LPB, UGDA); Prov. Nor Yungas, PNANMIC, Santa Catalina, 16°11'12"S, 67°52'07"W, 2700 m, Yungas montane forest, on tree bark, 22 May 2011, *MK 9023* (LPB, UGDA). *Dictyonema sericeum* f. *schenkianum*. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior secondary forest, on bark, 15 May 2011, *MK 8563* (LPB, UGDA); Prov. Nor Yungas, near Unduavi, 16°17'29"S, 67°51'43"W, 3200 m, Yungas cloud forest, on bryophytes, 25 May 2011, *MK 9357* (LPB, UGDA).

***Diploschistes cinereocaesius* (Sw. ex Ach.) Vain.**

Previously reported from a few localities in Bolivia by Feuerer *et al.* (1998).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, la Cumbre de Sorata, 15°53'06"S, 68°38'55"W, 4790 m, high Andean open vegetation, 13 May 2011, soil, *JE 27245, 27253* (LPB, herb. Etayo); Valle del Zongo, 16°07'41"S, 68°05'55"W, 2446 m, Yungas cloud forest, on rock, 29 May 2011, *JE 27780* (LPB, herb. Etayo); Prov. Murillo, Valle del Zongo, Laguna Viscachani, 16°11'54"S, 68°07'33"W, 3860 m, Páramo Yungueño, on rocks, 30 May 2011, *JE 26639, 26640* (LPB, herb. Etayo); Paso Cumbre near La Paz city, 16°19'06"S, 68°02'09"W, 4405 m, high Andean vegetation, 31 May 2011, *JE 26904* (LPB, herb. Etayo); Prov. Nor Yungas, near Unduavi, 16°17'29"S, 67°51'43"W, 3200 m, Yungas cloud forest, 25 May 2011, *JE 26877* (LPB, herb. Etayo).

***Diploschistes scruposus* (Schreb.) Norman**

Previously known only from two localities in Bolivia (Nylander 1861; Feuerer & Sipman 2005).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Calzada, 15°09'06"S, 68°30'24"W, 834 m, Preandean Amazon secondary forest, on rock, 17 May 2011, *JE 27109* (LPB, herb. Etayo); Cruz Charazani-Pelechuco, 15°15'00"S,

69°02'51"W, 4545 m, high Andean vegetation, on soil in rock fissures, 19 May 2011, *JE 27558* (LPB, herb. Etayo).

***Dyplolabia afzelii* (Ach.) A. Massal.**

This common tropical species was previously reported from Bolivia by Kalb *et al.* (2000), Staiger (2002), Flakus & Wilk (2006) and Flakus (2008).

CHEMISTRY. Lecanoric acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Calzada, 15°09'06"S, 68°30'24"W, Preandean Amazon secondary forest, 830 m, 17 May 2011, *US* (LPB, herb. Schiefelbein 3016); Prov. Franz Tamayo, near Apolo, 14°50'15"S, 68°26'58"W, Preandean Amazon forest, 1430 m, 17 May 2011, *US* (LPB, herb. Schiefelbein 2992); near Yuyo, 15°07'05"S, 68°20'22"W, 1150 m, Preandean Amazon forest, on tree branches, 16 May 2011, *JE 27124* (LPB, herb. Etayo); Prov. Larecaja, near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior secondary forest, on tree, 15 May 2011, *MK 8561* (LPB, UGDA); near Achiquiri, 15°13'31"S, 68°13'49"W, Yungas inferior secondary forest, 1070 m, 16 May 2011, *US* (LPB, herb. Schiefelbein 2990); DEPT. SANTA CRUZ. Prov. Ichilo, PNA, Macuñucu, 17°43'38"S, 63°35'37"W, 460 m, Amazon forest, on bark, 6 June 2011, *MK 9705* (LPB, UGDA).

***Everniastrum vexans* (W. L. Culb. & C. F. Culb.) Sipman**

This species has been reported several times from Bolivia by Sipman (1992) and Flakus *et al.* (2011a, b); it appears to be very common in the studied areas.

CHEMISTRY. Atranorin, salazinic and consalazinic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. DEPT. LA PAZ. Prov. Bautista Saavedra, near Charazani, 15°12'35"S, 68°51'30"W, 2260 m, transition Yungas montane forest-cloud forest, on rock, 18 May 2011, *JE 27422* (LPB, herb. Etayo); Prov. Murillo, Valle del Zongo, Laguna Viscachani, 16°11'54"S, 68°07'33"W, 3860 m, Páramo Yungueño, on rock, 30 May 2011, *JE 26642* (LPB, herb. Etayo); Prov. Nor Yungas, PNANMIC, by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, 3520 m, transition Páramo

Yungueño – Yungas montane cloud forest, on branches, 25 May 2011, *MK 9434, 9463* (LPB, UGDA).

Flakea papillata O. E. Erikss.

This species is new to Bolivia. It has also been reported from the Neotropics (Argentina, Brazil, Cuba, Galapagos Islands, Paraguay, Peru), Africa (Kenya, St. Helena Island), Asia (Japan, Korea, Taiwan), Australia, Macaronesia (the Azores), North America (USA) and Oceania (Eriksson 1992; Kashiwadani *et al.* 2002, Aptroot & Rodrigues 2005; Perlmutter 2006; Aptroot 2008; Muggia *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Cordillera, 350 km on the road from Tucavaca to Roboré, 18°37'56"S, 59°36'50"W, 370 m, transition Chiquitano-Chaqueño forest, 4 Dec. 2011, corticolous, *AF 23397, 23406.1* (KRAM, LPB).

Flavocetraria cucullata (Bellardi) Kärnefelt & Tell

The species occurs in the Southern Hemisphere only in Bolivia and Peru (Bjerke & Elvebakk 2004). It was previously recorded only from the high Andes in Bolivia (Herzog 1922; Hasselroth 1953; Menhofer 1992; Feuerer *et al.* 1998; Bjerke & Elvebakk 2004).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Cruz Charazani-Pelechuco, 15°15'00"S, 69°02'51"W, 4545 m, high Andean vegetation, on soil, 19 May 2011, *JE 27543* (LPB, herb. Etayo); near Villa Cala villane, 15°25'53"S, 69°05'07"W, high Andean vegetation, 4250 m, 19 May 2011, *US* (LPB).

Flavopunctelia soledica (Nyl.) Hale

This species is new to Bolivia. It has previously been reported from Asia (e.g., China, India, Japan, Russia), South America (Argentina, Chile), Italy, USA and Oceania (Wei 1991; Elix & McCarthy 1998; Galloway & Quillhot 1998; Calvelo & Liberatore 2002; Egan 2004; Divakar & Upreti 2005; Feuerer 2012).

CHEMISTRY. Usnic and lecanoric acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Omasuyos, El Dragon hill near Chahualla,

15°51'17"S, 69°00'40"W, 3850 m, on rock, 6 July 2010, *AF 17833, 17834 & PR* (KRAM, LPB, UGDA).

Gomphillus ophiosporus Kalb & Vězda

Previously known from Brazil, Costa Rica, Ecuador and Papua New Guinea (Kalb & Vězda 1988; Aptroot *et al.* 1997; Tenorio *et al.* 2002), this is the first record from Bolivia.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, Yungas montane forest, on humus, 22 May 2011, *JE 27767* (LPB, herb. Etayo).

Haematomma fenizianum A. Massal.

Although this species is new to Bolivia, it has been reported from Brazil, Chile, Spain, St. Helena and Oceania (Osorio & Fleig 1986; Staiger & Kalb 1995; Elix & McCarthy 1998; Galloway & Quillhot 1998; Llimona & Hladun 2001; Aptroot 2008).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, near Charazani, 15°10'39"S, 68°56'36"W, 2237 m, Yungas montane forest, on rock, 18 May 2011, *JE 27581* (LPB, herb. Etayo).

Herpothallon aurantiacoflavum (B. de Lesd.)

Aptroot, Lücking & G. Thor

This species is new to Bolivia, but it has previously been reported from Brazil, Cuba, Costa Rica, Ecuador, French Guiana, Guyana, Lesser Antilles, Peru and Venezuela (Aptroot *et al.* 2009).

CHEMISTRY. Confluent, 2'-O-methylmicrophyllinic and chiodectonic acids, rugulosin, additional substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Franz Tamayo, near Yuyo, 15°07'05"S, 68°20'22"W, 1150 m, Preandean Amazon forest, on tree bark, 16 May 2011, *MK 8731* (LPB, UGDA).

Heterodermia casarettiana (A. Massal.) Trevis.

This species has previously been reported from Bolivia by Kurokawa (1962) and Trass (1992).

Heterodermia casarettiana is a member of the *H. obscurata* group and is perhaps a synonym of

H. japonica (Moberg 2011), but this needs further study as the results of phylogenetic molecular analyses appear to be ambiguous (Lücking *et al.* 2008).

CHEMISTRY. Atranorin, zeorin, norstictic and salazinic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PNC, near Sehuencas, 17°30'12"S, 65°16'30"W, 2220 m, Yungas montane cloud forest, on bark, 21 July 2008, *AF 10470 & PR* (KRAM, LPB); Prov. Chapare, PNC, near Incachaca, 17°15'10"S, 65°48'51"W, 2330 m, Yungas montane cloud forest, on bark, 23 July 2008, *AF 10784 & PR* (KRAM, LPB); DEPT. LA PAZ. Prov. Nor Yungas, PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, Yungas montane forest, 22 May 2011, corticolous, *JE 27720* (LPB, herb. Etayo).

***Heterodermia comosa* (Esch.) Follmann & Redon**

This widespread species in South America (Moberg 2011), has been reported several times from Bolivia (Nylander 1859, 1860, 1861; Herzog 1922; Lyngé 1924; Kurokawa 1962; Trass 1992; Moberg 2011).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, on tree, 18 May 2011, *JE 27325, 27350* (LPB, herb. Etayo); near Charazani, 15°12'35"S, 68°51'30"W, 2260 m, transition Yungas montane forest-cloud forest, on bushes, 18 May 2011, *JE 27421* (LPB); Prov. Nor Yungas, near Siniari colony, 16°13'20"S, 67°50'37"W, 2190 m, Yungas secondary cloud forest, on tree, 24 May 2011, *JE 27643* (LPB, herb. Etayo).

***Heterodermia corallophora* (Tayl.) Scorepa**

This species is new to Bolivia. It is also known from the Neotropics (Brazil, Colombia, Costa Rica, Ecuador, Mexico, Paraguay, Peru and Venezuela) and China, Malaysia, Oceania, Papua New Guinea and Taiwan (Kurokawa 1962; Osorio 1977; López-Figueiras 1986; Wei 1991; Aptroot 1997; Elix & McCarthy 1998; Sipman *et al.* 2008; Moberg 2011; Feuerer 2012).

CHEMISTRY. Atranorin, zeorin, unknown terpenoid (\pm), pigments.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, NPC, near Sehuencas, 17°30'12"S, 65°16'30"W, 2220 m, montane cloud forest, on tree, 21 July 2008, *AF 10392, 10476, MK 6570* (KRAM, LPB, UGDA); DEPT. LA PAZ. Prov. Nor Yungas, near Pacallo, 16°12'10"S, 67°50'39"W, 1360 m, Yungas montane forest, on tree, 3 August 2008, *AF 11809* (KRAM, LPB); PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, Yungas montane forest, corticolous, 22 May 2011, *JE 27722, 27723* (LPB, herb. Etayo).

***Heterodermia cubensis* (Kurok.) Trass**

This species is new to Bolivia, but it is also reported from Brazil, Costa Rica, Cuba, Guatemala and Peru (Kurokawa 1962; Tenorio *et al.* 2002).

CHEMISTRY. Atranorin, zeorin, norstictic acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PNC, near Sehuencas, 17°30'12"S, 65°16'30"W, 2220 m, Yungas montane cloud forest, on tree, 21 July 2008, *AF 10487 & PR* (LPB).

***Heterodermia fertilis* Moberg**

This recently described Neotropical species has previously only been reported from one Bolivian locality (Moberg 2011).

CHEMISTRY. Atranorin, zeorin (only selected specimens examined by TLC).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PNC, near Sehuencas, 17°30'12"S, 65°16'30"W, 2220 m, Yungas montane cloud forest, on bark, 21 July 2008, *AF 10549.1 & PR* (KRAM, LPB); Prov. Chapare, PNC, near Incachaca, 17°15'10"S, 65°48'51"W, 2330 m, Yungas montane cloud forest, on bark, 23 July 2008, *AF 10784.1 & PR* (KRAM, LPB); DEPT. LA PAZ. Prov. Murillo, Valle del Zongo, 16°07'41"S, 68°05'55"W, 2450 m, Yungas cloud forest, on tree, 29 May 2011, *JE 27777, 26752* (LPB, herb. Etayo); Valle del Zongo, 16°08'38"S, 68°06'59"W, 2900 m, Yungas cloud forest, 29 May 2011, on tree, *JE 26812* (LPB); Prov. Nor Yungas, km 69 on the road Coroico-La Paz, 16°13'33"S, 67°49'20"W, 2600 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *JE 27668* (LPB, herb. Etayo); PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, Yungas montane

forest, corticolous, 22 May 2011, *JE 27733* (LPB); near Nogalani, 16°12'57"S, 67°49'15"W, 2168 m, Yungas secondary cloud forest, corticolous, 23 May 2011, corticolous, *JE 27964* (LPB, herb. Etayo); DEPT. SANTA CRUZ. Prov. Caballero, East Cordillera, Siberia region near La Palma, 17°49'12"S, 64°40'28"W, 2580 m, Yungas montane cloud forest, on bark, 13 Dec. 2004, *AF 4639* (LPB).

***Heterodermia flabellata* (Fée) D. D. Awasthi**

Although new to Bolivia, this species has been found in Argentina, Brazil, Colombia, Ecuador, Peru, Uruguay and Venezuela, as well as in Africa, Asia (e.g., China, Taiwan, India), Macaronesia (the Azores), North and Central America and Oceania (e.g., Swinscow & Krog 1988; Osorio 1992; Elix & McCarthy 1998; Büdel *et al.* 2000; Sipman *et al.* 2008; Moberg 2011; Feuerer 2012).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, open area with boulders, on young tree, 18 May 2011, *JE 27326* (LPB, herb. Etayo); DEPT. TARUJA. Prov. Aniceto Arce, Serranía de Propiedad Arnold, 22°13'19"S, 64°33'41"W, 1310 m, Tucumano-Boliviano montane forest, on bark, 24 Nov. 2010, *AF 18742.1* (KRAM, LPB).

***Heterodermia galactophylla* (Tuck.) W. L. Culb.**

This species is new to Bolivia; it has been previously reported from North and South America (e.g., Brazil, Chile, Colombia, Costa Rica, Cuba, USA and Venezuela), St. Helena, Bhutan, Malaysia and Papua New Guinea (Kurokawa 1962; López-Figueiras 1986; Aptroot 1997; Sipman *et al.* 2008; Tenorio *et al.* 2002; Moberg 2011; Feuerer 2012).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Franz Tamayo, near Yuyo, 15°07'05"S, 68°20'22"W, 1150 m, Preandean Amazon forest, on branches, 16 May 2011, *JE 27112* (LPB, herb. Etayo); Prov. Franz Tamayo, between Apolo and Mapiri, 15°01'50"S, 68°18'33"W, 1120 m, Preandean Amazon forest, on tree 23 Nov. 2011, *MK 10321* (LPB, UGDA); Prov. Larecaja, near Incachaca, 15°17'48"S, 68°26'32"W, 1100 m, Yungas montano inferior forest, on tree, 15 May 2011, *JE 27088* (LPB, herb. Etayo); near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior sec-

ondary forest, on branches, 15 May 2011, *JE 27526* (LPB, herb. Etayo); Prov. Nor Yungas, km 62 on the road Coroico-La Paz, 16°14'30"S, 67°49'58"W, 2850 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *JE 27654* (LPB, herb. Etayo); PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, Yungas montane forest, corticolous, 22 May 2011, *JE 27759* (LPB).

***Heterodermia japonica* (Sato) Swinscow & Krog**

This pantropical to subtropical species with localities in warm temperate regions of Europe (Kurokawa 1962; Moberg 2011), occurs also in Bolivia (see Feuerer 2012).

One specimen contains norstictic and salazinic acids; according to Kurokawa (1962), it represents *Heterodermia japonica* var. *reagens* (Kurok.) J. N. Wu & Z. G. Qian., which is reported here for the first time from Bolivia.

CHEMISTRY. Atranorin, zeorin, norstictic (±) and salazinic (±) acids.

SPECIMENS OF *HETERODERMIA JAPONICA* S.STR. EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, PNC, near Incachaca, 17°15'10"S, 65°48'51"W, 2330 m, Yungas montane cloud forest, on bark, 23 July 2008, *AF 10801* & *PR* (KRAM, LPB); DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, on fallen trunk, 18 May 2011, *JE 27340* (LPB, herb. Etayo); near Charazani, 15°12'35"S, 68°51'30"W, 2260 m, transition Yungas montane forest-cloud forest, on rock, 18 May 2011, *JE 27408*, *27414* (LPB, herb. Etayo); Prov. Franz Tamayo, between Apolo and Mapiri, 15°01'50"S, 68°18'33"W, 1120 m, Preandean Amazon forest, on tree, 23 Nov. 2011, *MK 10322* (LPB, UGDA); Prov. Nor Yungas, near Pongo, 16°19'28"S, 67°57'21"W, 3700 m, Páramo Yungueño, on bushes, 25 May 2011, *JE 26857* (LPB, herb. Etayo); near Nogalani, 16°12'57"S, 67°49'15"W, 2168 m, Yungas secondary cloud forest, 23 May 2011, corticolous, *JE 27995* (LPB, herb. Etayo); PNANMIC, Santa Catalina, 16°11'12"S, 67°52'07"W, Yungas montane forest, on tree, 22 May 2011, *JE 27373*, *27394* (LPB, herb. Etayo).

SPECIMEN OF *HETERODERMIA JAPONICA* VAR. *REAGENS* EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PNC, Ch'i qta rumi, 17°28'44"S, 65°17'06"W, 2120 m, Yungas montane cloud forest, 21 July 2008, *AF 10264*, *MK* & *PR* (LPB).

Heterodermia leucomela (L.) Poelt

This species is widespread in the world and also in Bolivia, where it is known from numerous records (Nylander 1859, 1861; Rusby 1896; Herzog 1922; Lynge 1924; Feuerer *et al.* 1998; Moberg 2011).

The species is morphologically variable and some authors distinguish *H. leucomela* subsp. *boryi* (Fée) Swinscow & Krog [Syn. *H. boryi* (Fée) Hale] and *H. leucomela* s.str. (Swinscow & Krog 1988), but according to Moberg (2011), *H. leucomela* subsp. *boryi* does not deserve separation due to intermediate forms with *H. leucomela* s.str. In our collections no intermediate specimens were found and thus we distinguish both as separate taxa; however, more studies with the aid of molecular tools are necessary to solve the relationship between the morphological forms within *H. leucomela* s.l.

CHEMISTRY. Atranorin, zeorin and salazinic acid (\pm) (only selected specimens examined by TLC).

SPECIMENS OF *HETERODERMIA LEUCOMELA* S.STR. EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, NPC, near Sehucenas, 17°30'12"S, 65°16'30"W, 2220 m, montane cloud forest, on tree, 21 July 2008, *AF 10424 & PR, MK 6349b* (KRAM, LPB); near Phaqcha, 20 km of Monte Punku, 17°27'13"S, 65°16'44"W, 2850 m, Yungas montane cloud forest, 20 July 2008, on bark, *AF 10198, MK & PR* (KRAM, LPB); Prov. Chapare, near Incachaca, 17°14'09"S, 65°48'51"W, 2200 m, Yungas montane cloud forest, on bark, 10 June 2006, *AF 7851.1* (KRAM, LPB); near Incachaca, 17°15'10"S, 65°48'51"W, 2330 m, Yungas montane cloud forest, on bark, 23 July 2008, *AF 10801* (KRAM, LPB); DEPT. LA PAZ. Prov. Bautista Saavedra, near Charazani, 15°10'39"S, 68°56'36"W, 2237 m, Yungas montane forest, on rock, 18 May 2011, *JE 27571* (LPB, herb. Etayo); Prov. Larecaja, Titilaya, 15°39'55"S, 68°42'51"W, 2773 m, transition Yungas forest – Valles Secos vegetation, 14 May 2011, *JE 27074, 27077* (LPB, herb. Etayo); Prov. Murillo, Valle del Zongo, 16°07'41"S, 68°05'55"W, 2450 m, Yungas cloud forest, near metal bridge, on trees, 29 May 2011, *JE 26740* (LPB, herb. Etayo); Prov. Nor Yungas, near Siniari colony, 16°13'20"S, 67°50'37"W, 2190 m, Yungas secondary cloud forest, on trunk, 24 May 2011, *JE 27647* (LPB); near Nogalani, 16°12'57"S, 67°49'15"W, 2170 m,

Yungas secondary cloud forest, on bark, 23 May 2011, *JE 27979* (LPB, herb. Etayo); PNANMIC, Santa Catalina, 16°11'12"S, 67°52'07"W, Yungas montane forest, on trunk, 22 May 2011, *JE 27390* (herb. Etayo); Chairó, 16°12'07"S, 67°50'05"W, 1300 m, Yungas montano inferior forest, on rock, 21 May 2011, *JE 27533* (LPB, herb. Etayo); DEPT. TARIJA. Prov. Aniceto Arce, Seranía de Propiedad Arnold, 22°13'19"S, 64°33'41"W, 1310 m, Tucumano-Boliviano montane forest, on bark, on bark, 24 Nov. 2010, *AF 18740* (KRAM, LPB); La Hierba, Reserva Nacional de Flora y Fauna Tariquía, 22°08'46"S, 64°31'36"W, 1070 m, Tucumano-Boliviano submontane forest, on bark, 25 Nov. 2010, *AF 19738, 19756.1* (KRAM, LPB); Filo de Sidras, 22°14'50"S, 64°33'28"W, 1065 m, Tucumano-Boliviano submontane forest, on bryophytes, 22 Nov. 2010, *AF 18539* (KRAM, LPB).

SPECIMENS OF *HETERODERMIA LEUCOMELA* SUBSP. *BORYI* EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, on branches, 14 May 2011, *JE 27197, 27292, 27294* (LPB, herb. Etayo); la Cumbre de Sorata, 15°53'06"S, 68°38'55"W, 4790 m, high Andean open vegetation, on soil, 13 May 2011, *JE 27252* (LPB); Prov. Murillo, Valle del Zongo, 16°10'15"S, 68°08'02"W, 3375 m, Páramo Yungueño, on bushes, 29 May 2011, *JE 26787* (LPB). Valle del Zongo, 16°08'38"S, 68°06'59"W, 2900 m, Yungas cloud forest, on tree, 29 May 2011, *JE 26810* (LPB, herb. Etayo); Prov. Nor Yungas, below Unduavi, 16°18'27"–16°18'50"S, 67°53'48"–67°54'35"W, 3210–3135 m, Yungas cloud forest, on branches, 31 May 2011, *JE 26924, 26970* (LPB, herb. Etayo); near Nogalani, 16°12'57"S, 67°49'15"W, 2168 m, Yungas secondary cloud forest, 23 May 2011, corticolous, *JE 27964* (LPB, herb. Etayo); PNANMIC, by Sillu Tincara pre-Columbian route, 16°16'33"S, 67°52'60"W, 3430 m, Yungas montane cloud forest, on bark, 27 June 2010, *AF 16938* (KRAM, LPB); DEPT. SANTA CRUZ. Prov. Caballero, East Cordillera, Siberia, 17°49'38"S, 64°45'14"W, 3480 m, open area, on mosses, 11 Dec. 2004, *AF 4488* (LPB).

Heterodermia lutescens (Kurok.) Follman

Previously this species has only been reported from Bolivia by Moberg (2011).

CHEMISTRY. Atranorin and zeorin (only selected specimens examined by TLC).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PNC, Ch'i'qta rumi, 17°28'44"S, 65°17'06"W, 2120 m, Yungas montane cloud forest,

on tree, 21 July 2008, *AF 10272, MK & PR* (KRAM, LPB); near Sehuencas, 17°30'12"S, 65°16'30"W, 2220 m, Yungas montane cloud forest, 21 July 2008, *AF 10549, MK & PR* (KRAM, LPB); Prov. Chapare, near Incachaca, 17°14'13"S, 65°49'02"W, 2295 m, Yungas montane cloud forest, 10 June 2006, *AF 8201.1* (KRAM, LPB); NPC, near Incachaca, S17°15'10", W65°48'51", 2330 m, disturbed montane cloud forest, on tree, 23 July 2008 *MK 6695* (LPB, UGDA); DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, bushes, 18 May 2011, *JE 27351* (LPB, herb. Etayo); Prov. Nor Yungas, PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, Yungas montane forest, corticolous, 22 May 2011, *JE 27733* (LPB).

Heterodermia magellanica (Zahlbr.) Swinscow & Krog s.l.

This species is new to Bolivia. Its distribution is incompletely known, and according to Moberg (2011), it belongs to a species complex which needs further studies.

CHEMISTRY. Atranorin, zeorin, norstictic, conorstictic (minor) and salazinic (minor) acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PNC, Ch'iqtá rumi, 17°28'44"S, 65°17'06"W, 2120 m, Yungas montane cloud forest, on tree, 21 July 2008, *AF 10271, MK & PR* (KRAM, LPB).

Heterodermia palpebrata (Tayl.) Vain.

New to Bolivia, but previously reported from only Brazil, Peru and USA (Moberg 2011; Feuerer 2012).

CHEMISTRY. Atranorin and zeorin (only selected specimens examined).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, bushes, 14 May 2011, *JE 27300* (LPB, herb. Etayo); Prov. Nor Yungas, near Pongo, 16°19'28"S, 67°57'21"W, 3820 m, Páramo Yungueño, on bushes, 25 May 2011, *JE 26856* (LPB, herb. Etayo); DEPT. SANTA CRUZ. Prov. Caballero, East Cordillera, Siberia region near La Palma, 17°49'12"S, 64°40'28"W, 2580 m, Yungas montane cloud forest, on tree, 13 Dec. 2004, *AF 4667.1* (KRAM, LPB).

Heterodermia parva Moberg

This species was recently described from Peru (Moberg 2011). Here it is reported for the first time from Bolivia.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, open area with boulders, on bushes, 18 May 2011, *JE 27350* (LPB, herb. Etayo).

Heterodermia podocarpa (Bél.) D. D. Awasthi

This species has only been reported a few times from Bolivia (Herzog 1922; Lynge 1924; Moberg 2011).

CHEMISTRY. Atranorin, leucotylin, zeorin and norstictic acid (±) (only selected specimens examined).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, 28 km from Charazani, on the road Charazani-Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, open area with boulders, on young trunk, 18 May 2011, *JE 27318, 27327* (LPB, herb. Etayo); Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, open antropogenic area, on bushes, 14 May 2011, *JE 27299* (LPB, herb. Etayo); Prov. Nor Yungas, below Unduavi, 16°18'50"S, 67°54'35"W, 3135 m, Yungas cloud forest, on stones in the stream, 31 May 2011, *JE 26912* (LPB, herb. Etayo); km 62 on the road Coroico-La Paz, 16°14'30"S, 67°49'58"W, 2850 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *JE 27654* (LPB, herb. Etayo); near Nogalani, 16°12'57"S, 67°49'15"W, 2168 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *JE 28005* (LPB); DEPT. SANTA CRUZ. Prov. Caballero, Siberia region near La Palma, 17°49'12"S, 64°40'28"W, 2580 m, Yungas montane cloud forest, 12–13 Dec. 2004, *AF 44572, 4803, 4667* (KRAM, LPB).

Heterodermia vulgaris (Vain.) Follmann & Redón

There are only a few earlier records of this species from (Herzog 1922; Kurokawa 1962; Trass 1992; Moberg 2011).

In our material, most of the specimens were sorediate (as reported by Moberg 2011) and sterile; however, a few were richly fertile and lacked

soredia (as reported by Kurokawa 1962), but otherwise very similar to sorediate samples. We include all into the concept of *H. vulgaris* as we believe they represent the same species, differing in the reproduction mode only.

CHEMISTRY. Atranorin and zeorin (only selected specimens examined by TLC).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, near Incachaca, 17°14'11"S, 65°49'02"W, 2320 m, *Pinus* plantation near Yungas montane cloud forest, on trees, 12 June 2006, *AF 8303* (fertile), *8324* (fertile), *8345* (KRAM, LPB); *ibidem*, 17°14'13"S, 65°49'02"W, 2295 m, Yungas montane cloud forest, on trees, on tree, 10 June 2006, *AF 8196* (fertile) (KRAM, LPB); DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, open area with boulders, on fallen trunk, 18 May 2011, *JE 27340* (LPB, herb. Etayo); Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, open antropogenic area, on bushes, 14 May 2011, *JE 27357* (LPB, herb. Etayo); Prov. Nor Yungas, PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, Yungas montane forest, corticolous, 22 May 2011, *JE 27706* (LPB); DEPT. TARIJA. Prov. Aniceto Arce, La Hierba, Reserva Nacional de Flora y Fauna Tariquia, 22°08'46"S, 64°31'36"W, 1070 m, Tucumano-Boliviano submontane forest near river, on tree, 25 Nov. 2010, *AF 197567* & *JQ* (KRAM, LPB).

Hypogymnia subphysodes (Kremp.) Filson

Previously known only from two localities in Bolivia (Flakus *et al.* 2011a).

CHEMISTRY. Atranorin, physodic and oxyphysodic acids, additional unknown substance in traces.

SPECIMENS EXAMINED. Bolivia. DEPT. LA PAZ. Prov. Bautista Saavedra, Área Natural de Manejo Integrado Nacional Apolobamba, near Villa Amarca, 15°16'47"S, 69°01'47"W, 4643 m, Puna Húmeda vegetation, on plant reimans, 3 July 2010, *AF 17395* & *PR* (LPB, KRAM, LPB).

Hypotrachyna damaziana (Zahlbr.) Krog & Swinscow

Parmelinopsis damaziana (Zahlbr.) Elix & Hale

New to Bolivia, but previously reported from Brazil and Kenya (Hale 1976b; Swinscow & Krog

1988). The records from Australia belong to a different species, *Parmelinopsis neodamaziana* (Elix & J. Johnst.) Elix & Hale (Elix 1994: 135).

CHEMISTRY. Gyrophoric and lecanoric acids with related substances.

SPECIMENS EXAMINED. BOLIVIA. Dept. Tarija. Prov. Aniceto Arce, Filo de Sidras near Tarija, 22°14'50"S, 64°33'28"W, 1060 m, Tucumano-Boliviano submontane forest, on branch, 22 Nov. 2010, *AF 18579* (LPB).

Hypotrachyna horrescens (Taylor) Krog & Swinscow

Parmelinopsis horrescens (Taylor) Elix & Hale

New to Bolivia. The species is widespread, being reported from Africa, Australia, Europe North and South America, Papua New Guinea and New Zealand (e.g., Swinscow & Krog 1988; Elix 1994; Sipman *et al.* 2008; Hawksworth *et al.* 2011).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, PNANMIC, Santa Catalina, 16°11'12"S, 67°52'07"W, Yungas montane forest, on trunk, 22 May 2011, *JE 27384* (LPB, herb. Etayo).

Hypotrachyna longiloba (H. Magn.) Hale

Previously known only from four localities in Bolivia (Hale 1975; Sipman *et al.* 2009; Flakus *et al.* 2011a).

CHEMISTRY. Atranorin, alectotonic and α -collatolic acids with related substances in minor to trace amounts.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, PNANMIC, by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, 3520 m, transition Páramo Yungueño – Yungas montane cloud forest, on branches, 25 May 2011, *MK 9462* (LPB, UGDA, herb. Seaward).

Hypotrachyna minarum (Vain.) Krog & Swinscow

Parmelinopsis minarum (Vain.) Elix & Hale

Previously reported from Bolivia by Feuerer & Sipman (2005) and Flakus *et al.* (2011a).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, 20 km from Charazani,

15°12'35"S, 68°51'30"W, 2260 m, transition Yungas montane forest-cloud forest, on rock, 18 May 2011, *JE 27426* (LPB, herb. Etayo); Prov. Nor Yungas, km 69 on the road Coroico-La Paz, 16°13'33"S, 67°49'20"W, 2600 m, Yungas secondary cloud forest, on siliceous wall, 23 May 2011, *JE 27674* (LPB, herb. Etayo).

***Hypotrachyna prolongata* (Kurok.) Hale**

Previously reported from seven localities in Bolivia (Sipman *et al.* 2009; Flakus *et al.* 2011a).

CHEMISTRY. Atranorin and anziaic acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, PNANMIC, by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, 3520 m, transition Páramo Yungueño – Yungas montane cloud forest, on branches, 25 May 2011, *MK 9433* (LPB, UGDA, herb. Seaward).

***Lepraria lobificans* Nyl.**

This species appears as the commonest member of the genus in Bolivia, but still only a few localities are reported from there (Flakus & Kukwa 2007; Flakus *et al.* 2011a, b).

CHEMISTRY. Atranorin, stictic acid complex and zeorin.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Valle del Zongo, 16°07'41"S, 68°05'55"W, 2450 m, Yungas cloud forest, on mosses, 29 May 2011, *MK 9612* (LPB, UGDA).

***Lepraria yunnaniana* (Hue) Zahlbr.**

This species has recently been reported from only two localities in Bolivia (Kukwa & Flakus 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, PNANMIC, by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, 3518 m, transition Páramo Yungueño – Yungas montane cloud forest, on shaded bryophytes, 25 May 2011, *JE 28062* (LPB, herb. Etayo).

***Leprocaulon gracilescens* (Nyl.) Lamb & Ward**

This species has only been recorded by Flakus & Wilk (2006) and Flakus (2008), but perhaps it is common in the high Andean vegetation.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, la Cumbre de Sorata, 15°53'06"S, 68°38'55"W, 4790 m, high Andean open vegetation, on soil, 13 May 2011, *JE 27254* (LPB, herb. Etayo); Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, open antropogenic area, on soil, 14 May 2011, *JE 27287* (LPB); Prov. Murillo, Valle del Zongo, Laguna Viscachani, 16°11'54"S, 68°07'33"W, 3675–3860 m, Páramo Yungueño, on rocks, 30 May 2011, *JE 26633* (LPB, herb. Etayo); below Potosí, 16°17'43"S, 68°07'42"W, 4550 m, high Andean vegetation, on rock, 28 May 2011, *JE 26827, 26839* (LPB, herb. Etayo); Paso Cumbre near La Paz, 16°19'06"S, 68°02'09"W, 4405 m, high Andean vegetation, 31 May 2011, *JE 26903* (LPB, herb. Etayo).

***Lopezaria versicolor* (Flot.) Kalb & Hafellner**

Previously found in only one locality in Bolivia (Flakus 2008).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, near Incachaca, 17°12'54"S, 65°49'30"W, 2030 m, Yungas montane cloud forest, on bark, 7 July 2009, *AF 12974, 13022* (KRAM, LPB); DEPT. LA PAZ. Prov. Franz Tamayo, near Yuyo, 15°07'05"S, 68°20'22"W, 1150 m, Preandean Amazon forest, on branches, 16 May 2011, *JE 27121* (LPB, herb. Etayo); Prov. Larecaja, near Incachaca, 15°17'48"S, 68°26'32"W, 1100 m, Yungas montano inferior forest, on tree, 15 May 2011, *JE 27089* (LPB, herb. Etayo); Prov. Murillo, Valle del Zongo, 16°07'41"S, 68°05'55"W, 2450 m, Yungas cloud forest, on trees, 29 May 2011, *JE 26747* (LPB, herb. Etayo); near Chuspipata, 16°17'09"S, 67°51'00"W, 3230 m, Yungas cloud forest, on corticolous, 24 May 2011, *JE 27701, 28097* (LPB, herb. Etayo); Prov. Nor Yungas, PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, Yungas montane forest, corticolous, 22 May 2011, *JE 27744* (LPB); by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, 3520 m, transition Páramo Yungueño – Yungas montane cloud forest, corticolous, 25 May 2011, *JE 28036* (LPB, herb. Etayo).

***Megalospora tubercuosa* (Fée) Sipman**

Known only from a few localities in Bolivia (Sipman 1983; Feuerer *et al.* 1998; Flakus 2008).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Incachaca, 15°17'48"S, 68°26'32"W, 1100 m, Yungas montano inferior forest, on tree, 15 May 2011, *JE 27093* (LPB, herb. Etayo).

Micarea peliocarpa (Anzi) Coppins

This is the first record of the species from Bolivia. It is a widespread lichen, known from many countries (e.g., Coppins 1983; Santesson *et al.* 2004; Czarnota 2007), but in South America it has only been reported from Argentina (Calvelo & Liberatore 2002).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, Corani, 17°13'36" S, 65°53'25" W, 3260 m, open montane area with shrubs by the lake, on bryophytes, 7 July 2009, *AF 12922* (KRAM, LPB).

Normandina pulchella (Borrer) Nyl.

The species was previously known only from a few records in Bolivia (Feurerer *et al.* 1998; Flakus & Wilk 2006; Flakus 2008; Flakus *et al.* 2011a).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, on bushes, 18 May 2011, *JE 27349* (LPB, herb. Etayo); Prov. Franz Tamayo, between Apolo and Mapi, 14°50'51"S, 68°21'38"W, 1490 m, savannah with scattered trees, shrubs, along the streams, corticolous, 23 Nov. 2011, *AF 23051* (KRAM, LPB); Prov. Murillo, Valle del Zongo, 16°08'38"S, 68°06'59"W, 2900 m, Yungas cloud forest, 29 May 2011, *JE 26810* (LPB, herb. Etayo); Valle del Zongo, Laguna Viscachani, 16°11'54"S, 68°07'33"W, 3675–3860 m, Páramo Yungueño, on bushes, 30 May 2011, *JE 26637* (LPB, herb. Etayo); Prov. Nor Yungas, estacion de servicios near Chuspipata, 16°17'09"S, 67°51'00"W, 3230 m, Yungas cloud forest, 24 May 2011, *JE 26717* (LPB); near Pongo, 16°19'28"S, 67°57'21"W, 3700 m, Páramo Yungueño, 25 May 2011, *JE 26880* (LPB, herb. Etayo); PNANMIC, by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, 3518 m, transition Páramo Yungueño – Yungas montane cloud forest, corticolous, 25 May 2011, *JE 28070* (LPB, herb. Etayo); DEPT. SANTA CRUZ. Prov. Florida, PNA, above La Yunga, 18°02'50"S, 63°54'50"W, 2330 m, Yungas cloud forest, on bark, 8 June 2011, *MK 9879* (UGDA, in specimen of *Dictyonema sericeum* f. *membranaceum*).

Pannaria rubiginosa (Thunb. ex Ach.) Delise

This species was previously known only from two localities in Bolivia (Nylander 1861; Feuerer *et al.* 1998).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, open antropogenic area, branches, 14 May 2011, *JE 27213* (LPB, herb. Etayo).

Parmotrema betaniae Hale

The species is new to Bolivia, being previously known only from the type locality in Venezuela (Hale 1986).

Our specimen agrees in general with the description, except for the slightly different dimensions of ascospores (20–25 × 10–12 μm) and hymenium (90 μm) than reported by Hale (1986) (ascospores 22–24 × 11–12 μm, hymenium 75–80 μm tall).

CHEMISTRY. Atranorin and protocetraric acids, secalononic acid A (in thallus and apothecia) and fatty acids (in apothecia only).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Iturrealde, 46 km por camino de Ixiamas hacia Alto Madidi, 13°38'S, 68°26'W, 300 m, bosque siempreverde de 30 m de altura, epífita, 13 Aug. 1997, *KB 392a et al.* (B).

Parmotrema cetratum (Ach.) Hale s.l.

Only a few localities of the species were previously known from Bolivia (Rusby 1895; Herzog 1922; Feuerer *et al.* 1998; Flakus *et al.* 2011a), but old records may belong to other species.

Parmotrema cetratum is not monophyletic and represents several cryptic species (Divakar *et al.* 2005).

CHEMISTRY. Atranorin, salazinic and consalazinic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, 10 km de Charazani hacia Apolo, 15°11'S, 68°52'W, 2550 m, terrestre, 22 Aug. 1997, *KB 134 et al.* (B); near Charazani, 2700 m, on rock, 22 June 1999, *P. Gutte, B. Herzog s.n.* (B); Prov. Murillo, Florida above Yanacachi, Yungas forest, on mosses, 20 Sept. 1997, *S. Stab LB98* (B).

Parmotrema crinitum (Ach.) M. Choisy

In Bolivia it has only been recorded by Feuerer *et al.* (1998) and Flakus *et al.* (2011a).

CHEMISTRY. Atranorin, stictic acid complex with hypostictic (trace), norstictic (trace) and menegazziac acids.

SPECIMEN EXAMINED. BOLIVIA. DEPT. COCHABAMBA, Prov. Ayopaya, 5 km al sur de Saila Pata, 16°55'S, 66°56'W, 3050 m, epífita, 14 Nov. 1997, *KB858*, *I. Jimenez* [B; note: specimen in LPB, belongs to *P. bangii* (Vain.) Hale].

Parmotrema merrillii (Vain.) Hale

Only a few records of this species are known from Bolivia (Hale 1965; Flakus *et al.* 2011a).

CHEMISTRY. Atranorin and protocetraric acid.

SPECIMEN EXAMINED BOLIVIA. DEPT. LA PAZ., Prov. Bautista Saavedra, 15 km de Charazani hacia Apolo, 15°11'S, 68°52'W, 2400 m, bosque húmedo secundario, epífita, 3 July 1997, *KB 336 et al.* (B).

Parmotrema mesotropum (Müll. Arg.) Hale

Previously reported by Hale (1965) from only one locality in Bolivia.

The secondary chemistry of this species was very mysterious for us. According to Hale (1965), who analysed the duplicate of one of the specimens cited below (*Wedermann 2389*; preserved in S), the species contains atranorin, caperatic acid and probably protolichetinic acid (reported with question mark); however, Boom *et al.* (2007) reported dehydroconstipatic (major), protodehydroconstipatic (minor) and constipatic (minor) acids. Re-examination of the chemistry of specimens collected by Wedermann from Bolivia revealed the presence of constipatic acid complex (compared with the extraction from *Remototrachyna costaricensis*). Apparently, Hale (1965) confused caperatic and protolichetinic acid with the constipatic acid complex, which also occurred in the case of *Remototrachyna costaricensis* (Hale 1975: 29; Sipman *et al.* 2009: 49).

Surprisingly, we found one specimen morphologically very similar to *P. mesotropum*, but containing caperatic acid [the identity of substance confirmed with an extract from *Platismatia glauca* (L.) W. L. Culb. & C. F. Culb.]; that sample may represent a new species or a chemotype of *P. me-*

sotropum, but it needs to be studied with the aid of molecular analyses.

CHEMISTRY OF *PARMOTREMA MESOTROPUM*. Atranorin, three substances of constipatic acid complex, trace of unidentified pigment (\pm). CHEMISTRY OF *PARMOTREMA* CF. *MESOTROPUM*. Atranorin, caperatic acid, secalonin acid A (minor, only apothecial margin medulla).

SPECIMENS OF *PARMOTREMA MESOTROPUM* EXAMINED. BOLIVIA. DEPT. BENI. Trinidad, Misiones Guarayos, ca 250 m, on bark, Sept. 1926, *E. Wedermann 2305b, 2389* (B).

SPECIMENS OF *PARMOTREMA* CF. *MESOTROPUM* EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Iturralde, Tumupasa, 14°03'S, 67°49'W, 400 m, on bark, 18 March 1987, *S. Stab LB47* (B).

Parmotrema rampoddense (Nyl.) Hale

The record below is only the fourth one from Bolivia (Hale 1965; Flakus *et al.* 2011a).

CHEMISTRY. Alecoronic and α -collatolic acids, atranorin.

SPECIMEN EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, 20 km de Cocapata to Cotacajes, 16°46'S, 66°44'W, 2000 m, on bark 15 May 1997, *KB 112a et al.* (B).

Parmotrema reticulatum (Taylor) M. Choisy s.l.

In Bolivia it has been reported several times (see Flakus *et al.* 2011a), but some older records may belong to other morphologically and chemically similar taxa. The species is represented by several cryptic lineages, but no characters have been found as yet for their separation (Del-Prado *et al.* 2011).

CHEMISTRY. Atranorin, salazinic and consalazinic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, 5 km S of Saila Pata, 16°55'S, 66°56'W, 3050 m, forest with *Podocarpus*, on tree, 10 Nov. 1997, *KB 853*, *I. Jimenez* (B); DEPT. LA PAZ. Prov. Bautista Saavedra, near Charazani, 15°10'39"S, 68°56'36"W, 2237 m, Yungas montane forest, on rocks, 18 May 2011, *JE 27570, 27579, 27606* (LPB, herb. Etayo); DEPT. LA PAZ. Prov. Bautista Saavedra, between

Charazani and Apolo, 15°11'S, 68°52'W, 2400 m, by Río Camata, on rock, 1 July 1997, *KB 261b, 272, 273b et al.* (B); Prov. Larecaja, Titilaya, 15°39'55"S, 68°42'51"W, 2773 m, transition Yungas forest – Valles Secos vegetation, 14 May 2011, *JE 27068* (LPB, herb. Etayo); DEPT. SANTA CRUZ. Prov. Florida, refugio 'Los Volcanes', 18°06'S, 63°36'W, 1000 m, bosque semi-deciduous, epífita, 20 Oct. 1997, *KB 611 et al.* [B; note: specimen in LPB, belongs to *P. perlatum* (Huds.) M. Choisy].

***Parmotrema ultralucens* (Krog) Hale**

This very widespread species is known from Asia (China, Japan, Java, Philippines, Sri Lanka, Taiwan), Australia, East Africa (Tanzania), North and Central America (USA, Dominican Republic, Jamaica, Martinique), South America (Brazil, Colombia, Ecuador, Venezuela), the Azores, Papua New Guinea and Pacific Islands (e.g., Hale 1965, sub *Parmelia subcrinita* Nyl.; Krog 1974; López-Figueiras 1986; Swinscow & Krog 1988; Wei 1991; Elix & McCarthy 1998; Brodo *et al.* 2001; Kurokawa & Lai 2001; Elix *et al.* 2002; Sipman *et al.* 2008; Benatti & Marcelli 2010) is reported here as new to Bolivia.

CHEMISTRY. Salazinic and consalazinic acids, atranorin, lichexanthone.

SPECIMEN EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, between Cocapata and Cotacajes, 16°46'S, 66°44'W, 2000 m, corticolous, 15 May 1997, *KB 97a et al.* (LPB).

***Phaeophyscia endococcinoides* (Poelt) Essl.**

The species has been recorded only twice from Bolivia (Feuerer *et al.* 1998). Its separation from *P. endococcina* (Körb.) Moberg is not always clear (Moberg 1993) and needs to be studied by phylogenetic analyses.

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, 20 km from Charazani, 15°12'35"S, 68°51'30"W, 2260 m, transition Yungas montane forest-cloud forest, on rock, 18 May 2011, *JE 27419* (LPB).

***Phyllobaeis erythrella* (Mont.) Kalb**

This species, reported here as new to Bolivia, is also found in Brazil, Costa Rica and Ecuador

(Tenorio *et al.* 2002; Nöske & Sipman 2004; Feuerer 2012).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Franz Tamayo, near Correo, 14°59'06"S, 68°26'09"W, 1630 m, Yungas montane forest, open area near a way, 17 May 2011, *JE 27100* (LPB, herb. Etayo); Prov. Murillo, Valle del Zongo, 16°07'41"S, 68°05'55"W, 2446 m, Yungas cloud forest, 29 May 2011, *JE 27779* (LPB, herb. Etayo); Prov. Nor Yungas, PNaNMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, Yungas montane forest, on soil, 22 May 2011, *JE 27749* (herb. Etayo).

***Phyllobaeis imbricata* (Hook.) Kalb & Gierl**

This species has been reported from Bolivia several times (Nylander 1861; Rusby 1895; Herzog 1922; Flakus & Wilk 2006; Flakus 2008), but it is still under-recorded.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, km 69 on the road between Coroico and La Paz, 16°13'33"S, 67°49'20"W, 2600 m, Yungas secondary cloud forest, on soil, 23 May 2011, *MK 9182* (LPB, UGDA); DEPT. SANTA CRUZ. Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla, old road between Cochabamba and Comarapa, 17°49'10"S, 64°38'45"W, 2950 m, Páramo Yungueño, 9 June 2011, *MK 10039* (LPB, UGDA).

***Physconia muscigena* (Ach.) Poelt**

This species is new to Bolivia. It is a bipolar lichen (Elvebakk & Moberg 2002; Feuerer 2012), but in South America it has only been found in Argentina and Chile (Elvebakk & Moberg 2002).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Cruz Charazani-Pelechuco, 15°15'00"S, 69°02'51"W, 4545 m, high Andean vegetation, soil in fissures, 19 May 2011, *JE 27557* (LPB, herb. Etayo).

***Piccolia conspersa* (Fée) Hafellner**

Previously there were only three records of this species from Bolivia (Nylander 1859; Wilk 2010).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Franz Tamayo, near Apolo, 14°50'15"S, 68°26'58"W, 1430 m, Preandean Amazon forest, 17 May 2011, branches, *JE 27627* (LPB, herb. Etayo).

***Placopsis gelida* (L.) Linds.**

Previously there was only one historical record of this species from Bolivia (Nylander 1861).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Palyllunga, 15°28'29"S, 68°36'43"W, 1695 m, Valle Seco open vegetation, 14 May 2011, on stones, *JE 27208* (LPB, herb. Etayo); la Cumbre de Sorata, 15°53'06"S, 68°38'55"W, 4790 m, high Andean open vegetation, 13 May 2011, on rock, *JE 27256* (LPB, herb. Etayo); Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, open antropogenic area, 14 May 2011, soil, *JE 27310* (LPB, herb. Etayo).

***Placopsis rhodocarpa* (Nyl.) Nyl.**

Only a few records of this species are known from Bolivia (Nylander 1861; Lamb 1947; Galoway 2002, 2005, 2010).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Paso Cumbre near La Paz city, 16°19'06"S, 68°02'09"W, 4405 m, high Andean vegetation, 31 May 2011, *JE 26899* (LPB, herb. Etayo).

***Pseudocyphellaria aurata* (Ach.) Vain.**

This species has been reported from Bolivia a few times, but only one contemporary record existed to date (Nylander 1859, 1861; Herzog 1922; Feuerer *et al.* 1998).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, on tree, 18 May 2011, *JE 27321, 27341* (LPB, herb. Etayo); near Charazani, 15°10'39"S, 68°56'36"W, 2235 m, Yungas montane forest, 18 May 2011, on branches, *JE 27584* (LPB); Prov. Franz Tamayo, near Apolo, 14°50'15"S, 68°26'58"W, 1430 m, Preandean Amazon forest, on trunk, 17 May 2011, *JE 27626* (LPB); Prov. Nor Yungas, near Nogalani, 16°12'57"S, 67°49'15"W, 2170 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *JE 27984, 27985, 27986* (LPB, herb. Etayo).

***Pseudocyphellaria clathrata* (De Not.) Malme**

This species was previously known only from one locality in Bolivia (Feuerer *et al.* 1998).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Valle del Zongo, 16°05'56"S,

68°03'26"W, 1700 m, Yungas montane forest, 29 May 2011, *JE 26754, 26755, 26756* (LPB, herb. Etayo); Prov. Nor Yungas, PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, Yungas montane forest, corticolous, 22 May 2011, *JE 27731, 27771* (LPB, herb. Etayo).

***Pseudoparmelia cubensis* (Nyl.) Elix & T. H. Nash**

This species is new for Bolivia. It was previously known from Brazil, Costa Rica, Cuba, Ecuador, Haiti, Mexico, Trinidad, Venezuela and USA (Elix & Nash 1998).

CHEMISTRY. Secalonic acid A, stictic and norstictic acids, traces of additional substances.

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Cerro Asunta Pata, 15°05'S, 68°29'W, 1500 m, bosque siempreverde, epífita, 21 June 1997, *KB196 et al.* (B).

***Punctelia constantimontium* Sérus.**

This species is new to Bolivia. It was previously reported from Argentina, Colombia, Brazil, and Uruguay in South America (Sérusiaux 1983; Osorio 1992; Calvelo & Liberatore 2002; Sipman *et al.* 2008) and Africa (Sérusiaux 1983, Swinscow & Krog 1988).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, 28 km from Charazani, on the road Charazani-Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, open area with boulders, on rocks, 18 May 2011, *JE 27333* (LPB, herb. Etayo).

***Punctelia hypoleucites* (Nyl.) Krog**

This is the second record of the species from Bolivia (Flakus *et al.* 2011a).

CHEMISTRY. Atranorin and lecanoric acid

SPECIMENS EXAMINED. BOLIVIA. DEPT. TARIJA. Prov. Aniceto Arce, Papachacra, 21°41'36"S, 64°29'33"W, 2190 m, Tucumano-Boliviano montane forest, on saxicolous bryophytes, 26 Nov. 2010, *AF 19816, JQ* (LPB, KRAM, LPB);

***Punctelia reddenda* (Stirt.) Krog**

Previously found only once in Bolivia (Flakus *et al.* 2011a).

CHEMISTRY. Atranorin and 2–4 unknown fatty acids.

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, 15 km de Charazani hacia Apolo, 15°11'S, 68°52'W, 2400 m, pastos con arbustos al lado del Río Camata, saxícola, 1 July 1997, *KB 271 et al.* (B; in specimen of *Parmotrema perlatum*);

Punctelia stictica (Delise ex Duby) Krog

This is the commonest member of the genus in Bolivia (Feurerer *et al.* 1998; Flakus *et al.* 2011a), being especially frequent on rocks in high Andean communities.

CHEMISTRY. Atranorin, gyrophoric acid and other related substances.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, on rock, 18 May 2011, *JE 27329* (LPB, herb. Etayo); near Charazani, 15°10'39"S, 68°56'36"W, 2240 m, Yungas montane forest, on rock, 18 May 2011, *JE 27578* (LPB, herb. Etayo); Prov. Camacho, near Villa Cala, 15°25'53"S, 69°05'07"W, 4250 m, high Andean vegetation, on rock, 19 May 2011, *JE 27283* (LPB, herb. Etayo); Prov. Larecaja, la Cumbre de Sorata, 15°53'06"S, 68°38'55"W, 4790 m, high Andean open vegetation, on rock, 13 May 2011, *JE 27264, MK 8418* (LPB, UGDA; specimen in UGDA as admixture to *Dictyonema glabratum*); Prov. Murillo, Florida above Yanacachi, Yungas forest, on mosses, 5 May 1993, *S. Stab LB98* (B, in specimen of *Parmotrema cetratum* s.l.); Paso Cumbre near La Paz city, 16°19'06"S, 68°02'09"W, 4405 m, high Andean vegetation, on ground, 31 May 2011, *JE 26891* (LPB, herb. Etayo); Valle del Zongo, 16°10'15"S, 68°08'02"W, 3375 m, Páramo Yungueño, on rock, 29 May 2011, *JE 26774* (herb. Etayo); Valle del Zongo, Laguna Viscachani, 16°11'54"S, 68°07'33"W, 3675–3860 m, Páramo Yungueño, on rock, 30 May 2011, *JE 26634* (LPB, herb. Etayo); Prov. Nor Yungas, near Pongo, 16°19'28"S, 67°57'21"W, 3700 m, Páramo Yungueño, on rock, 25 May 2011, *JE 26855* (LPB, herb. Etayo).

Pyrenula dermatodes (Borrer) Schaer.

This species is new to Bolivia. Previously it was known from Bhutan, Colombia, Costa Rica, Ecuador, Great Britain, Ireland, Macaronesia and Papua New Guinea (Aptroot *et al.* 1997; Aptroot

& Feijen 2002; Coppins 2002; Tenorio *et al.* 2002; Nöske & Sipman 2004; Aptroot & Rodrigues 2005; Aptroot *et al.* 2008; Sipman *et al.* 2008; Seaward 2010).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Valle del Zongo, 16°07'41"S, 68°05'55"W, 2450 m, Yungas cloud forest, on bark, 29 May 2011, *MK 9596* (LPB, UGDA).

Ramalina celastri (Spreng.) Krog & Swinscow

This species has been reported several times from Bolivia (e.g., Nylander 1859, 1861; Herzog 1922; Feuerer & Sipman 2005; Flakus 2008), but it is still under-recorded.

CHEMISTRY. No substances detected by TLC.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PNC, near Sehuencas by Río López Mendoza, 17°30'26" S, 65°16'55" W, 2230 m, montane cloud forest, on bark of tree, 22 July 2008, *MK 6636* (LPB, UGDA); near Sehuencas, 17°30'12"S, 65°16'30"W, 2220 m, montane cloud forest, with some rocks in open place, on bark of tree, 21 July 2008, *MK 6434, 6525* (LPB, UGDA).

Ramboldia russula (Ach.) Kalb, Lumbsch & Elix

This species was only reported from Bolivia by Nylander (1859) and Kalb *et al.* (2008).

CHEMISTRY. Lichexanthone and fumarprotocetraric acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Achiquiri, 15°13'31"S, 68°13'49"W, 1070 m, Yungas inferior secondary forest, on bark, 16 May 2011, *MK 8670* (LPB, UGDA).

Relicina abstrusa (Vain.) Hale

This is only the second record from Bolivia (Flakus *et al.* 2011a).

CHEMISTRY. Usnic, norstictic and connorstictic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Cerro Asunta Pata, 15°05'S, 68°29'W, 1500 m, bosque siempreverde, epifita, 21 June 1997, *KB 207a et al.* (B).

***Remototrachyna costaricensis* (Nyl.) Divakar & A. Crespo**

This species has been reported from several localities in Bolivia (see Flakus *et al.* 2011a), but it is still under-recorded.

CHEMISTRY. Atranorin, constipatic acid complex.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, PNC, near Incachaca, 17°15'10"S, 65°48'51"W, 2330 m, disturbed montane cloud forest, on tree, 23 July 2008, *MK 6688a* (LPB, UGDA); DEPT. LA PAZ. Prov. Murillo, Valle del Zongo, 16°07'41"S, 68°05'55"W, 2450 m, Yungas cloud forest, on trees, 29 May 2011, *JE 26750* (LPB, herb. Etayo).

***Rhizocarpon geographicum* (L.) DC.**

This species was reported from Bolivia by Nylander (1861) and from several records by Feuerer *et al.* (1998).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Paso Cumbre near La Paz city, 16°19'06"S, 68°02'09"W, 4405 m, high Andean vegetation, on rock, 31 May 2011, *JE 26893* (LPB, herb. Etayo).

***Rinodina conradii* Körb.**

Only one Bolivian record previously existed (Mayrhofer *et al.* 2001).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Paso Cumbre near La Paz city, 16°19'06"S, 68°02'09"W, 4405 m, high Andean vegetation, 31 May 2011, *JE 26900* (LPB, herb. Etayo).

***Stereocaulon meyeri* Stein**

This species was reported from Bolivia by Lamb (1977), Feuerer *et al.* (1998) and Oset & Kukwa (2012).

CHEMISTRY. Atranorin and perlatolic acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Camacho, cerca Villa Cala, 15°25'53"S, 69°05'07"W, 4250 m, high Andean vegetation, on rock, 19 May 2011, *MK 8967* (LPB, UGDA).

***Stereocaulon microcarpum* Müll. Arg.**

This species is known only in Bolivia from a few records (Lamb 1977; Flakus *et al.* 2011a).

CHEMISTRY. Atranorin, stictic (\pm) and norstictic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior secondary forest, on rock, 15 May 2011, *MK 8578* (LPB, UGDA); Titilaya, 15°39'55"S, 68°42'51"W, 2775 m, transition Yungas forest – Valles Secos vegetation, on rock, 14 May 2011, *MK 8456* (LPB, UGDA).

***Stereocaulon myriocarpum* Th. Fr.**

This species is new to Bolivia. It was previously reported from Asia (Bhutan, India, Pakistan, Taiwan, Nepal, Mongolia, Russia), North and South America (Canada, USA, Costa Rica, Mexico, Panama, Argentina, Venezuela) and Papua New Guinea (Lamb 1977; Calvelo & Liberatore 2002). According to Sipman (2002), *S. myriocarpum* is a synonym of *S. tomentosum* Fr., but this needs to be clarified by molecular studies.

CHEMISTRY. Atranorin, stictic and norstictic (trace) acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, on soil, 14 May 2011, *MK 8475* (LPB, UGDA); Prov. Murillo, Valle del Zongo, Laguna Viscachani, 16°11'54"S, 68°07'33"W, 3860 m, Páramo Yungueño, on soil, 30 May 2011, *MK 9654* (H, LPB, UGDA).

***Stereocaulon pachycephalum* Vain.**

This species was reported recently from Bolivia from three localities (Oset & Kukwa 2012). It is chemically variable (Lamb 1977; Oset & Kukwa 2012), but the chemotypes mentioned below have not as yet been determined.

CHEMISTRY. Atranorin with perlatolic and protocetraric acids (*MK 9400*), fumarprotocetraric acid (*MK 9645*) or protocetraric acid (*MK 9383*).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Valle del Zongo, 16°05'56"S, 68°03'26"W, ca 1800 m, Yungas montane forest, on rock, 29 May 2011, *MK 9645* (LPB, UGDA); Prov. Nor Yungas, near Pongo, 16°19'28"S, 67°57'21"W, 3820 m, Páramo Yungueño, on rock, 25 May 2011, *MK 9383, 9400* (LPB, UGDA).

***Stereocaulon pityrizans* Nyl.**

This species was reported from Bolivia for the first time by Sipman (2002), and detailed distribution data are provided by Flakus *et al.* (2011a).

CHEMISTRY. Atranorin, stictic and norstictic acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior secondary forest, on rock, 15 May 2011, *MK 8570, 8575* (LPB); DEPT. SANTA CRUZ. Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla, old road between Cochabamba and Comarapa, 17°49'10"S, 64°38'45"W, 2950 m, Páramo Yungueño, on rock, 9 June 2011, *MK 10040* (LPB, UGDA).

***Stereocaulon pomiferum* P. A. Duvign.**

This species was recently reported from three Bolivian localities by Oset & Kukwa (2012).

CHEMISTRY. Atranorin, stictic and norstictic (trace) acids.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Valle del Zongo, 16°08'38"S, 68°06'59"W, 2910 m, Yungas cloud forest, on rock, 29 May 2011, *MK 9567* (LPB, UGDA).

***Stereocaulon ramulosum* Raesch.**

This is the most widespread and common *Stereocaulon* species in Bolivia (e.g., Nylander 1859; Herzog 1922; Lamb 1977; Sipman 1992; Feuerer *et al.* 1998; Flakus *et al.* 2011a). It is especially frequent in anthropogenic habitats along roadsides, where it can cover large areas of rock surfaces.

CHEMISTRY. Atranorin and perlatolic acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, on rock, 14 May 2011, *MK 8539* (LPB, UGDA); Titilaya, 15°39'55"S, 68°42'51"W, 2773 m, transition Yungas forest – Valles Secos vegetation, on rock, 14 May 2011, *MK 8451* (LPB, UGDA); Prov. Murillo, Valle del Zongo, 16°05'56"S, 68°03'26"W, ca 1800 m, Yungas montane forest, on rock, 29 May 2011, *MK 9646* (LPB, UGDA); Prov. Nor Yungas, near Nogalani, 16°12'57"S, 67°49'15"W,

2168 m, Yungas secondary cloud forest, on rock, 23 May 2011, *MK 9137* (LPB, UGDA); on the road between La Paz and Chulumani, ca 16°14'10"S, 67°44'20"W, Yungas secondary cloud forest, on rock, 24 May 2011, *MK 9347* (LPB, UGDA); PNANMIC, between Tunkini and Chairó, 16°11'S, 67°52'W, 2400 m, Yungas montane forest, on rock, 22 May 2011, *MK 9111, 9112* (LPB, UGDA); DEPT. SANTA CRUZ. Prov. Andrés Ibáñez, PNA, on the road to San Mateo de Toresilla, 17°48'11"S, 64°39'28"W, 2250 m, Yungas cloud forest, on rock, 9 June 2011, *MK 9996* (LPB, UGDA); above La Yunga, 18°03'30"S, 63°54'36"W, 2330 m, Yungas cloud forest, on rock, 7 June 2011, *MK 9820* (LPB, UGDA).

***Stereocaulon strictum* Th. Fr.**

This species was reported from Bolivia by Lamb (1977), Sipman (1992), Feuerer *et al.* (1998) and Flakus *et al.* (2011a), but detailed distribution data are only provided in the two latter works.

For taxonomic comments on the infraspecific variation see Flakus *et al.* (2011a).

CHEMISTRY. Atranorin and porphyritic acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, between Charazani and Apolo, 15°11'02"S, 68°53'43"W, 2560m, transition Yungas montane forest-cloud forest, on soil, 18 May 2011, *MK 8932* (LPB, UGDA); Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, on soil, 14 May 2011, *MK 8540* (LPB, UGDA); Prov. Nor Yungas, km 69 on the road between Coroico and La Paz, 16°13'33"S, 67°49'20"W, 2600 m, Yungas secondary cloud forest, on rock, 23–24 May 2011, *MK 9181*, (LPB, UGDA); near Chuspipata, 16°17'09"S, 67°51'00"W, 3230 m, Yungas cloud forest, among mosses, 24 May 2011, *MK 9284, 9319* (LPB, UGDA, herb. Seaward).

***Stereocaulon vesuvianum* Pers.**

This species was reported from Bolivia by Feuerer & Sipman (2005) and Flakus *et al.* (2011a). Comparing its general distribution and frequency in other regions (e.g., Lamb 1977), it appears to be rare in Bolivia.

For taxonomic comments on the infraspecific variation, see Flakus *et al.* (2011a).

CHEMISTRY. Atranorin and stictic acid.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, near Chuspipata, 16°17'09"S,

67°51'00"W, 3230 m, Yungas cloud forest, on rock, 24 May 2011, *MK 9315* (LPB, UGDA).

Teloschistes exilis (Michx.) Vain.

This species was known from Bolivia only from historical data (Lyngé 1925; Malme 1926).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, near Charazani, 15°12'35"S, 68°51'30"W, 2260 m, transition Yungas montane forest-cloud forest, on bushes, 18 May 2011, *JE 27417* (LPB); Prov. Murillo, Valle del Zongo, 16°07'41"S, 68°05'55"W, 2450 m, Yungas cloud forest, 29 May 2011, *MK 9627* (LPB, UGDA).

Teloschistes flavicans (Sw.) Norman

This species was reported from Bolivia by Nylander (1859, 1861), Rusby (1896), Lyngé (1925), Feuerer *et al.* (1998) and Söchting & Fröden (2002).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, 28 km from Charazani, on the road Charazani-Apolo, 15°12'43"S, 68°47'25"W, 1650 m, Yungas montane forest, open area with boulders, on trunk, 18 May 2011, *JE 27348* (LPB, herb. Etayo); near Charazani, 15°10'39"S, 68°56'36"W, 2237 m, Yungas montane forest, on rock and branches, 18 May 2011, *JE 27583, 27597* (LPB, herb. Etayo); Prov. Larecaja, Jocollone, 15°37'35"S, 68°41'21"W, 3545 m, Páramo Yungueño vegetation, open antropogenic area, 14 May 2011, bushes, *JE 27287, 27305, 27360* (LPB, herb. Etayo); Prov. Murillo, Valle del Zongo, 16°10'15"S, 68°08'02"W, 3375 m, Páramo Yungueño, on bushes, 29 May 2011, *JE 26768* (LPB, herb. Etayo); Prov. Nor Yungas, near Nogalani, 16°12'57"S, 67°49'15"W, 2168 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *JE 27971* (LPB, herb. Etayo).

Tephromela atra (Huds.) Hafellner

There were previously only three records of this species from Bolivia (Nylander 1861; Flakus 2008).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Cruz Charazani-Pelechuco, 15°15'00"S, 69°02'51"W, 4545 m, high Andean vegetation, on rock, 19 May 2011, *JE 27560* (LPB, herb. Etayo); Prov. Prov. Camacho, cerca Villa Cala, 15°25'53"S, 69°05'07"W, 4250 m, high Andean vegetation, 19 May 2011, rock, *JE 27271* (LPB, herb. Etayo).

Thamnotia papelillo R. Sant.

This species was reported from Bolivia by Santesson (2004) and Flakus (2008).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, la Cumbre de Sorata, 15°53'06"S, 68°38'55"W, 4790 m, high Andean open vegetation, on soil, 13 May 2011, *JE 27242* (LPB, herb. Etayo); Prov. Prov. Camacho, cerca Villa Cala, 15°25'53"S, 69°05'07"W, 4250 m, high Andean vegetation, on rock, 19 May 2011, *JE 27279* (LPB, herb. Etayo).

Thamnotia vermicularis (Sw.) Schaer.

This species has been reported from only a few localities in Bolivia (Nylander 1861; Herzog 1923; Menhofer 1992; Feuerer *et al.* 1998).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Cruz Charazani-Pelechuco, 15°15'00"S, 69°02'51"W, 4545 m, high Andean vegetation, 19 May 2011, soil, *JE 27548* (LPB, herb. Etayo); Prov. Larecaja, la Cumbre de Sorata, 15°53'06"S, 68°38'55"W, 4790 m, high Andean open vegetation, 13 May 2011, soil, *JE 27236, 27237, 27242* (LPB, herb. Etayo); Prov. Murillo, near Potosí, 16°17'43"S, 68°07'42"W, 4550 m, high Andean vegetation, on soil, 4550 m, 28 May 2011, *JE 26830* (LPB, herb. Etayo); Paso Cumbre near La Paz city, 16°19'06"S, 68°02'09"W, 4400 m, high Andean vegetation, 31 May 2011, *JE 26895* (LPB, herb. Etayo).

Toninia hosseusiana Gyeln.

Previously reported from Bolivia only by Flakus & Wilk (2006).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Cruz Charazani-Pelechuco, 15°15'00"S, 69°02'51"W, 4545 m, high Andean vegetation, on rock, 19 May 2011, *JE 27562* (LPB, herb. Etayo).

Trapelia coarctata (Turner *ex* Sm.) M. Choisy

This species is new to Bolivia, but it is widespread and common through the world, and in South America it has been reported from Argentina, Brazil, Chile, Colombia, Ecuador and Venezuela (Hertel 1971; Calvelo & Liberatore 2002; Nöske & Sipman 2004; Sipman *et al.* 2008; Feuerer 2012).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Consata, 15°20'46"S, 68°29'16"W, 1240 m, Yungas montano inferior secondary forest, on rock, 15 May 2011, *JE 27426* (LPB, herb. Etayo).

Trypethelium aeneum (Eschw.) Zahlbr.

This species is new to Bolivia, but it is known from the Neotropics (Bahamas, Brazil, Colombia, French Guiana, Guyana, Mexico, Peru, Surinam, Venezuela), Malaysia, Oceania, Papua New Guinea and USA (e.g., López-Figueiras 1986; Aptroot & Sipman 1991; Sipman 1993; Elix & McCarthy 1998; Nöske & Sipman 2004; Aptroot *et al.* 2008; Sipman *et al.* 2008; Feuerer 2012).

CHEMISTRY. Unidentified K⁺ purple anthraquinone in the thallus.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, near Incachaca, 17°12'54"S, 65°49'30"W, 2030 m, Yungas montane cloud forest, on tree, 7 July 2009, *AF 12961* (KRAM, LPB); DEPT. LA PAZ. Prov. Larecaja, near Achiquiri, on the road from Mapiro to Apolo, 15°13'31"S, 68°13'49"W, 1070 m, Yungas inferior secondary forest, on bark, 16 May 2011, *MK 8660* (LPB, UGDA); near Charapampa, 15°15'22"S, 68°13'02"W, 770 m, Amazon secondary forest, 16 May 2011, on tree, *JE 27094* (LPB, herb. Etayo).

Trypethelium ochroleucum (Eschw.) Nyl.

This is the second record of the species from Bolivia (Flakus & Kukwa 2012b).

The specimen was infected with the lichenicolous fungus *Phaeosporobolus trypethelii* Flakus & Kukwa; this is the second locality for this fungus recently described from Bolivia (Flakus & Kukwa 2012b).

CHEMISTRY. Thallus and pseudostroma UV+ yellow due the presence of lichexanthone.

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Calzada, 15°09'06"S, 68°30'24"W, 835 m, Preandean Amazon secondary forest, on bark, 17 May 2011, *MK 8790* (LPB).

Trypethelium pupula (Ach.) R. C. Harris

This Neotropical species, known from Costa Rica and Colombia (Aptroot *et al.* 2008; Sipman *et al.* 2008), is reported here as new to Bolivia.

CHEMISTRY. Thallus and pseudostroma UV+ yellow due the presence of lichexanthone.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Larecaja, near Achiquiri, 15°13'31"S, 68°13'49"W, 1070 m, Yungas inferior secondary forest, on bark, 16 May 2011, *MK 8678* (LPB, UGDA).

Tylophoron protrudens Nyl.

This species is new to Bolivia. Previously it was reported from Brazil, Costa Rica, Colombia, Guyana, Oceania, Panama, Papua New Guinea, USA (Hawaii) and Venezuela (López-Figueiras 1986; Sipman 1991; Tibell 1996; Aptroot *et al.* 1997; Elix & McCarthy 1998; Tenorio *et al.* 2002; Aptroot *et al.* 2008; Sipman *et al.* 2008).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, PNANMIC, Chairo, 16°12'07"S, 67°50'05"W, 1300 m, Yungas montano inferior forest, on rock, 21 May 2011, *JE 27532* (LPB, herb. Etayo).

Umbilicaria cinereorufescens (Schaer.) Frey

This species was only recently recorded from a few localities in Bolivia by Hestmark (2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, below Potosí, 16°17'43"S, 68°07'42"W, 4550 m, high Andean vegetation, on rock, 28 May 2011, *JE 26836, 26837* (LPB, herb. Etayo).

Xanthomendoza mendozae (Räsänen) S. Y. Kondr. & Kärnefelt

This species was reported from Bolivia by Kondratyuk & Kärnefelt (1997) and Canseco *et al.* (2006).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Cruz Charazani-Pelechuco, 15°15'00"S, 69°02'51"W, 4545 m, high Andean vegetation, 19 May 2011, on rock, *JE 27552* (LPB, herb. Etayo).

Xanthoparmelia mougeotii (Schaer.) Hale

Two records (only one contemporary) were previously known from Bolivia (Nylander 1861; Nash *et al.* 1995).

CHEMISTRY. Usnic acid and stictic acid complex.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, near Charazani, 15°10'39"S, 68°56'36"W, 2237 m, Yungas montane forest, on rock, 18 May 2011, *JE 27588* (LPB, herb. Etayo); Prov. Murillo, near Cumbre pass, 16°19'18"S, 68°04'42"W, 4550 m, high Andean vegetation, 17 June 2006, on siliceous rock, *AF 8557* (KRAM, LPB).

Xanthoria elegans (Link) Th. Fr.

The species has been very rarely reported from Bolivia (Nylander 1861; Hasselroth 1953; Feuerer *et al.* 1998).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, below Potosí, 16°17'43"S, 68°07'42"W, 4550 m, high Andean vegetation, on rock, 28 May 2011, *JE 26848* (LPB, herb. Etayo).

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