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CONTRIBUTION TO THE KNOWLEDGE OF THE LICHEN BIOTA OF BOLIVIA. 3

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Abstract. New or otherwise interesting records of 80 lichenized fungi from Bolivia are presented. *Everniastrum subplanum* and *E. subvexans* are reported for the first time from the Southern Hemisphere and *E. nepalense* from South America. Sixteen species are recorded as new for Bolivia: *Anzia parasitica*, *Bulbothrix coronata*, *B. goebelii*, *Canoparmelia texana*, *Cetrelia olivetorum*, *Everniastrum columbiense*, *E. fragile*, *E. nigrociliatum*, *Flavopunctelia praesignis*, *Hypogymnia subphysodes*, *Parmelinopsis afrorevoluta*, *Parmotremopsis antillensis*, *Pseudoparmelia hypomilta*, *Punctelia hypoleucites*, *P. reddena* and *Relicina abstrusa*. Notes on the distribution and chemistry of all species are provided. Taxonomic remarks are given for some taxa.

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

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INTRODUCTION

Bolivia is among the countries considered to have the greatest biodiversity in South America, but despite recent intensification of lichenological investigations (e.g., Flakus & Kukwa 2007; Flakus & Lücking 2008; Flakus 2009; Knudsen & Flakus 2009; Krzewicka & Flakus 2010; Kukwa & Pérez-Ortega 2010; Flakus *et al.* 2011) its lichen biota remains poorly studied. All published Bolivian records were summarized by Rodriguez *et al*. (2010), and *ca* 700 species of lichenized and lichenicolous fungi have been encountered up to now, but there is still much to be done to approach the expected number of *ca* 3000–4000 species (Flakus 2010). Also, the ranges of lichen species in the country are not known with any precision.

This paper, the latest of a series (see, e.g., Flakus 2008), aims to improve our knowledge of the diversity and distribution of lichenized fungi in Bolivia.

MATERIAL AND METHODS

The data are based mainly on our recent collections. The specimens are housed at B, KRAM, LPB, UGDA and herb. Flakus (duplicates also donated to other herbaria), with some specimens studied for comparison from BM, H-ACH, H-NYL and LOD (acronyms after Thiers 2011).

Identification of some groups of lichens was supported by TLC analysis according to 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 (±) indicates that a particular substance was absent from some specimens.

The following abbreviations of Bolivian protected areas are used: ANMIN – Área Natural de Manejo Integrado Nacional; PNANMI – Parque Nacional y Área Natural de Manejo Integrado; PN – Parque Nacional; RNFF – Reserva Nacional de Flora y Fauna.

Results

Eighty species are treated in this work. Two are new for the Southern Hemisphere, one is new for South America, and 16 are new for Bolivia. Genera *Anzia* Stizenb., *Bulbothrix* Hale, *Cetrelia* W. L. Culb. & C. F. Culb., *Hypogymnia* (Nyl.) Nyl., *Parmotremopsis* Elix & Hale, *Pseudoparmelia* Lynge and *Relicina* (Hale & Kurok.) Hale are reported for the first time from the country.

Anzia parasitica (Fée) Zahlbr.

The species is new for Bolivia; this is also the first member of the genus known from the country. It has been reported from Costa Rica, Colombia, Ecuador and Venezuela (Yoshimura 1995).

Chemistry. Atranorin and divaricatic acid (see also Yoshimura 1995).

Specimen examined. BOLIVIA. Dept. La Paz. Prov. Nor Yungas, PNANMI Cotapata, 16°16′33″S, 67°52′60″W, 3429 m, Yungas montane cloud forest, on bark, 2010, *Flakus 16998 & Rodriguez* (KRAM, LPB).

Botryolepraria neotropica Kukwa & Pérez-Ortega

The species was recently described from the Neotropics (Bolivia, Cuba and Peru) (Kukwa & Pérez-Ortega 2010) and later reported also from the Paleotropics (Zimbabwe) (Kukwa 2011). In Bolivia it was known from one locality only (Kukwa & Pérez-Ortega 2010); here we report a second record.

Chemistry. Zeorin and unidentified terpenoids (see also Kukwa & Pérez-Ortega 2010).

Specimens examined. BOLIVIA. Dept. Tarija. Prov. Aniceto Arce, Serranía de Propiedad Arnold, 22°13′19″S, 64°33′41″W, 1309 m, Tucumano-Boliviano montane forest, on bark of trees, 2010, *Flakus 18717, 18707, 18731* (KRAM, LPB, UGDA).

Bulbothrix coronata (Fée) Hale

Here it is reported for the first time from Bolivia. Elsewhere it it has been found in the U.S.A., Costa Rica, Mexico, Argentina, Brazil, Paraguay, Venezuela and South Africa (Hale 1976a; Calvelo & Liberatore 2002; Tenorio *et al.* 2002; Neuwirth 2008).

Chemistry. Atranorin, gyrophoric and lecanoric acids (see also Hale 1976a).

Specimen examined. BOLIVIA. Dept. La Paz. Prov. Iturralde, forest above Tumupasa village, 14°08′51″S, 67°53′34″W, 350 m, preandean Amazon forest, on bark of tree, 2008, *Kukwa 7002a* (LPB).

Bulbothrix goebelii (Zenker) Hale

It is a Pantropical species known from the U.S.A., the Neotropics (e.g., Costa Rica, Ecuador), Asia (e.g., China, Malaysia, Thailand) and South Africa (Hale 1976a; Feuerer 2011 and literature cited therein). Here it is reported as new for Bolivia.

Chemistry. Atranorin, gyrophoric and lecanoric acids (see also Hale 1976a).

Specimen examined. BOLIVIA. Dept. Cochabamba. Prov. Chapare, near Bulo Bulo village, near Río Chimoré, 16°58′19″S, 65°21′11″W, 283 m, lowland Amazon forest, on bark, 2010, *Flakus 19500 & Quisbert* (KRAM, LPB).

Canoparmelia amazonica (Nyl.) Elix & Hale

The species was reported from Bolivia by Hale (1976b); it is also known from Brazil, China, Colombia, Cuba, Guyana, Honduras, Mexico, Puerto Rico, Taiwan, Trinidad and the U.S.A. (Hale 1976b; Feuerer 2011).

Chemistry. Atranorin and protocetraric acid (see also Hale 1976b).

Specimen examined. BOLIVIA. Dept. La Paz. Prov. Iturralde, near San Pedro village, 13°43′59″S, 68°00′38″W, 250 m, savanna, on bark of tree, 2008, *Kukwa 6889* (LPB, UGDA).

Canoparmelia texana (Tuck.) Elix & Hale

The species is known from Africa (e.g., Angola, Kenya, Uganda), Asia (e.g., India, Japan, Thailand), Australia, North America (e.g., U.S.A., Mexico, Panama) and South America (Brazil, Chile, Venezuela) (Hale 1976b; Feuerer 2011). Here it is reported as new for Bolivia.

CHEMISTRY. Atranorin, divaricatic acid, trace of nordivaricatic acid, traces of unidentified substances (±) (see also Hale 1976b).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, Coroico, abajo de la plaza, 1500 m, piedra, 1988, *Stab LB189* (B, LPB).

Cetrelia olivetorum (Nyl.) W. L. Culb. & C. F. Culb.

This species is new for Bolivia. It is a very widely distributed species; a summary of its worldwide records is presented by Kukwa *et al.* (2012).

CHEMISTRY. Atranorin and olivetoric acid (see also Culberson & Culberson 1968).

SPECIMEN EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, 5 km al Sur de Saila Pata, 16°55′S, 66°56′W, 3050 m, bosque siempreverde con *Podocarpus*, expositión S, epífita, 1997, *Bach 853 & Jimenez* (LPB).

Dictyonema glabratum (Spreng.) D. Hawksw.

It is a very common lichen in the Neotropics (e.g., Feuerer 2011), but in Bolivia it is still known from scattered localites (see Rodriguez *et al.* 2010).

CHEMISTRY. Not tested.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, between Coroico and La Paz towns, 16°13′09″S, 67°49′32″W, 2600 m, open place by the road in montane cloud forest, on ground, 2008, *Kukwa 7181, 7201b* (BILAS, GPN, LPB, UGDA, herb. Schiefelbein).

Everniastrum cirrhatum (Fr.) Sipman

It is a common lichen in the Neotropics, known from Mexico to Chile and Argentina, Asia (southern China, India, Japan, Mongolia, Nepal, Papua New Guinea, Sri Lanka, Thailand, Taiwan) and Reunion (e.g., Culberson & Culberson 1981; Feuerer 2011). In Bolivia the species was reported rarely (Herzog 1922; Sipman 1986; Feuerer *et al.* 1998) but it appears to be common there.

The genus *Everniastrum* Sipman is paraphyletic and its taxonomic status, especially separation from *Cetrariastrum* Sipman, needs to be studied (Crespo *et al.* 2010).

CHEMISTRY. Atranorin, salazinic, galbinic (±, trace only) and fatty (±) acids (see also Culberson & Culberson 1981; Sipman 1986).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, 10 km de Cotapata hacia Cotacajes. 16°38′S, 66°41′W, 2750–2850 m, bosque humedo, terrestre y epifita, 1997, *Bach 13, 50 et al.* (B, LPB); Prov. Carrasco: PN Carrasco, between Sehuencas and Monte Punku villages, *ca* 2650 m, montane cloud forest, on humus or rocks, 2008, *Kukwa 6575a, 6579a* (LPB, UGDA); near Sehuencas village by Río Lopez Mendoza, 17°30′26″S, 65°16′55″W, 2226 m, montane cloud forest, on bark of tree, 2008, *Kukwa 6628* (LPB, UGDA); narrow canyon of Río Monte Puncu, 5 km NE of Monte Puncu, 17°33′S, 65°16′W, 2700–2750 m, cloud forest with short trees, some cleared for pastures, on rocky bank, 1988, *Nee & Solomon 36610-a* (B); along road from Comarapa to Cochabamba, 6 km (by road) SE of Siberia, 17°50′S, 64°44′W, 2900 m, brushy cloud forest with *Weinmannia* near tree line, 1989, *Saldias 36470 et al.* (B); Prov. Chapare: PN Carrasco, 130 km del camino antiguo de Cochabamba a Villa Tunari, 17°07′S, 65°36′W, 2200 m, bosque humedo con paredes rocosas, epifita y saxicola, 1997, *Bach 705 et al.* (B, LPB); near Incachaca village, *Pinus* plantation near Yungas montane cloud forest, 2317 m, 17°14′11″S, 65°49′02″W, 2006, *Flakus 8305* (KRAM, LPB); near Incachaca village, Yungas montane cloud forest, 2198 m, 17°14′09″S, 65°48′51″W, 2006, *Flakus 7856, 7859* (KRAM, LPB). DEPT. LA PAZ. Prov. Bautista Saavedra: 15 km de Charazani hacia Apolo, 15°11′S, 68°52′W, 3500 m, bosque humedo, epífita, 1997, *Bach 341, 351 et al.* (B, LPB); Charazani-Tal, linke Talseite oberhalb Playa, an den Serpentien des Weges nach Chulliana, 2960 m, 1985, *Feuerer 15678a* (B); Charazani-Tal, bei der Brücke am oberen Ortsende von Chari, 3540 m, 1982, *Feuerer 15780b* (B); Charazani-Tal, linke Talseite, Seitental oberhalb Lonlaya, 3700 m, 1982, *Feuerer 15826b* (B); Prov. Camacho, Pacoamba cerca Wila Kala, Puna Húmeda, 4284 m, 15°24′40″S, 69°04′24″W, 2010, *Flakus 17718 & Rodriguez* (KRAM, LPB); Prov. Franz Tamayo: laguna Tolca Cocha, al NE de Keara Nuevo, 3900 m, 14°41′13″S, 69°5′18″W, 2006, *Fuentes et al. 9956* (KRAM, LPB); ANMIN Apolobamba, near Puyo Puyo village, high Andean open vegetation, 4888 m, 15°56′55″S, 69°07′58″W, 2010, *Flakus 17594, 17656, 17685 & Rodriguez* (KRAM, LPB); Prov. Larecaja, 20 km from Sorata on road to Achacachi, steep roadbank, 3450 m, 1980, *Balslev 1094*

(LPB); Prov. Murillo: auf erde und Gestein Nebelwald, unterhalb Aldea Taquesi, 3800 m, 1987, *Stab LB61* (B); Laguna Viscachani, 3840 m, Valle del Zongo, auf Fels, zwischen Moosen, 1988, *Anze 4* (B, LPB); Zongo valley, along the road near Laguna Viscachani, 3750 m, 1982, *Meenks & Yert 307* (B); Valle de Zongo, arriba Santa Rosa, Ceja de monte, 3000 m, 1988, *Hensen 47* (LPB); Prov. Nor Yungas: al borde del camino, de Unduavi, Terreno con tierra suelta y muchas rocas, 2000, *López & Sanjines 1* (LPB); 2 km del camino principal de Chuspipata hacia Coroico, 16°22′S, 67°49′W, 2900 m, bosque siempreverde, terrestre, 1997, *Bach et al. 525* (B, LPB); Coscapa, senda al Oueste del camino principal *ca* 4 km de Cotapata hacia La Paz, 16°23′S, 67°53′W, 3500 m, bosque siempreverde, epífita, 1997, *Bach et al. 444* (B); Hacienda Sacramento, *ca* 8 km del camino principal de Chuspipata hacia Coroico, 16°24′S, 67°47′W, 2500 m, bosque siempreverde, epífita, 1997, *Bach 563, 564 et al.* (B, LPB); PNANMI Cotapata, 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, Yungas montane cloud forest, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16892, 16918, 17001, & Rodriguez* (KRAM, LPB); Prov. Sud Yungas, Calacoto 69 km hacia el este, pasando el Nevado Illimani, estación generadora Iki-ko, precipicio rocoso con musgos al lado del río, 3100 m, 1980, *Beck 3911* (LPB). Dept. Santa Cruz. Prov. Caballero, Siberia region near La Palma, Yungas montane cloud forest, 2582 m, 17°49′12″S, 64°40′28″W, 2004, *Flakus 4578, 4582 & 4769* (KRAM, LPB). Dept. Tarija. Prov. Aniceto Arce: Filo de Sidras, near park guard camp, 2-hour drive from Tarija, Tucumano-Boliviano submontane forest, 1064 m, 22°14′50″S, 64°33′28″W, 2010, *Flakus 18410, 18557, 18608* (KRAM, LPB); Papachacra, Tucumano-Boliviano montane forest, 2056 m, 21°41′54″S, 64°29′28″W, 2010, *Flakus 20030, 20039 & Quisbert* (KRAM, LPB); Serranía de Propiedad Arnold, Tucumano-Boliviano montane forest, 1309 m, 22°13′19″S, 64°33′41″W, 2010, *Flakus 18709, 18769* (KRAM, LPB).

Everniastrum columbiense (Zahlbr.) Sipman

This is an exclusively Neotropical species known from Colombia, Ecuador, Peru and Venezuela (e.g., Sipman 1980; Culberson & Culberson 1981; Feuerer 2011). In this paper it is reported as new for Bolivia.

Chemistry. Atranorin, salazinic acid and trace of unknown (±) (see also Sipman 1980, 1986; Culberson & Culberson 1981).

Specimens examined. BOLIVIA. Dept. La Paz. Prov. Murillo, near Cumbre pass, high Andean Puna, 4672 m, 16°20′14″S, 68°02′20″W, terricolous, 2006, *Flakus 5697* (KRAM, LPB).

Everniastrum fragile Sipman

The species is new for Bolivia. It has been recorded from Colombia, Ecuador, Peru and Venezuela (Sipman 1980, 1986).

Chemistry. Atranorin, salazinic, consalazic and fatty acids (see also Sipman 1980, 1986).

Specimens examined. BOLIVIA. Dept. La Paz. Prov. Bautista Saavedra, 15 km de Charazani hacia Apolo, 3500 m, 15°11′S, 68°52′W, bosque humedo, epífita, 1997, *Bach 342A et al.* (B); Prov. Nor Yungas: PNANMI Cotapata 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, 3429 m, 16°16′33″S, 67°52′60″W, Yungas montane cloud forest, epiphyte, 2010, *Flakus 16832, 16856, 16869, 16978 & Rodriguez* (KRAM, LPB); Coscapa, senda al oeste del camino principal *ca* 4 km de Cotapata hacia La Paz, bosque siempreverde, 3500 m, 16°23′S, 67°53′W, 1997, *Bach 451 et al.* (B, LPB).

Everniastrum nepalense (B. de Lesd.) Sipman

New for South America. The species was previously known only from Asia (Culberson & Culberson 1981; Sipman 1986; Feuerer 2011); our specimen matches well the description; however, in view of the long distance from its known occurrence area, we report this taxon with some hesitation.

Chemistry. Atranorin, protolichesterinic and salazinic acids (see also Culberson & Culberson 1981; Sipman 1986).

Specimen examined. BOLIVIA. Dept. Cochabamba. Prov. Carrasco, PN Carrasco, Monte Punku village, 17°35′01″S, 65°18′03″W, 2800 m, open place, on schrubs, 2008, *Kukwa 6144* (LPB, UGDA).

Everniastrum nigrociliatum (B. de Lesd.) Sipman

This Neotropical lichen species is reported here for the first time from Bolivia. Previously it has been reported from Costa Rica, Guatemala,

Ecuador, Mexico and Venezuela (see Sipman 1980; Culberson & Culberson 1981).

CHEMISTRY. Atranorin, protolichesterinic and gyrophoric acids (see also Culberson & Culberson 1981; Sipman 1986).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Camacho, Pacoamba cerca Wila Kala, 4284 m, 15°24′40″S, 69°04′24″W, Puna Húmeda, saxicolous, 2010, *Flakus 17752 & Rodriguez* (KRAM, LPB).

Everniastrum sorocheilum (Vain.) Sipman

It is a widespread species, known from the Neotropics (Bolivia, Chile, Colombia, Costa Rica, Ecuador, Panama, Venezuela), Africa (Canary Islands, Madagascar, Kenya, Tanzania), and Asia (Buthan, China, Java, Paupa New-Guinea, Philippines, Thailand, Taiwan) (see Sipman 1980; Culberson & Culberson 1981; Feuerer 2011). In Bolivia only one locality was known previously (Feuerer *et al.* 1998).

CHEMISTRY. Atranorin, lichesterinic and gyrophoric acids (see also Culberson & Culberson 1981; Sipman 1986).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Camacho, Pacoamba cerca Wila Kala, 4284 m, 15°24′40″S, 69°04′24″W, Puna Húmeda, saxicolous, 2010, *Flakus 17752 & Rodriguez* (KRAM, LPB).

Everniastrum subplanum Sipman

It is new for the Southern Hemisphere; previously it has been known only from Mexico and Taiwan (Sipman 1986; Feuerer 2011).

CHEMISTRY. Atranorin, salazinic and fatty acids (see also Sipman 1986).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Valle de Zongo, laguna Viscachani, Ventoso, 3840 m, 1989, *Coello 5* (LPB).

Everniastrum subvexans Sipman

So far the species has been reported only from Guatemala (Sipman 1986); the record below is the first one for the Southern Hemisphere.

CHEMISTRY. Atranorin and protolichesterinic acid (see also Sipman 1986).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, PNANMI Cotapata, 5-hour drive of Unduavi by Sillu Tincara pre-Columbian route, 16°16′33″S, 67°52′60″W, 3429 m, Yungas montane cloud forest, on plant reimans, 2010, *Flakus 16846 & Rodriguez* (KRAM, LPB).

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

The species is very common in the Neotropics (e.g., Argentina, Brazil, Colombia, Mexico, Panama, Venezuela). It has been also reported from Asia (e.g., China, India, Taiwan, Thailand) and Oceania (Sipman 1980, 1986, 1992; Culberson & Culberson 1981; Calvelo & Liberatore 2002; Feuerer 2011). From Bolivia reported only by Sipman (1992), but it appears as very common in the studied area.

CHEMISTRY. Atranorin, salazinic, consalazinic (±), protolichesterinic (±) and unidentified fatty (±) acids (see also Culberson & Culberson 1981; Sipman 1986).

SPECIMEN EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, 5 km al. Sur de Saila Pata, 16°55′S, 66°56′W, 3050 m, bosque siempreverde con *Podocarpus*, epífita, 1997, *Bach 851 & Jimenez* (B, LPB); Prov. Carrasco: PN Carrasco, 18 km N of Monte Punku village, between Ch'iqta rumi and Phaqcha settlements, 17°27′22″S, 65°16′24″W, 2700 m, montane cloud forest, close to the river, on bark of tree, 2008, *Kukwa 6257* (LPB, UGDA); *ibid*. near Sehuencas village, Yungas montane cloud forest, 2220 m, 17°30′12″S, 65°16′30″W, 2008, *Flakus 10463, 10546, Kukwa 6324, 6448 & Rodriguez* (KRAM, LPB, UGDA); Sehuencas, zona de rocas grandes al lado de la carretera, medio sombreado, 2600 m, 1988, *Stab 216, 217* (LPB); Prov. Chapare: Auf Fels an der Str. Cochabamba-Chapare, Nahe represe Corani, 3250 m, 1988, *Hensen 70* (B); Corani, open montane area with shrubs and a little bit of *Pinus* sp. near lake, 3261 m, 17°13′36″S, 65°53′25″W, 2009, *Flakus 12931* (KRAM, LPB). 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, saxicola, 1997, *Bach 273c, 258 et al.* (B); Prov. Murillo: Valle de Zongo, arriba Santa Rosa, Ceja de monte, 3000 m, 1988, *Hensen 52* (LPB); Valle de Zongo, entre laguna de Viscachani y planta Cuticucho, orilla oeste del Río Zongo con vegetacion arborea y herbacea mayormente, 2007, *Rodriguez 344* (LPB); Prov. Nor

Yungas: Limites del Igenio San Luis, a 34.2 km camino a Yungas, 3740 m, 1995, *Capra 270* (B); PNANMI Cotapata, 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, Yungas montane cloud forest, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16881, 16999 & Rodriguez* (KRAM, LPB). DEPT. TARIJA. Prov. Aniceto Arce: Papachacra, Tucumano-Boliviano montane forest, 2195 m, 21°41′36″S, 64°29′33″W, 2010, *Flakus 19805, 19860, 19931 & Quisbert* (KRAM, LPB); Papachacra, Tucumano-Boliviano montane forest, 2056 m, 21°41′54″S, 64°29′28″W, 2010, *Flakus 20045 & Quisbert* (KRAM, LPB).

Flavoparmelia rutidota (Hook.f. & Taylor) Hale

The species is known from the Neotropics (Argentina, Bolivia, Brazil, Chile, Mexico, Venezuela), Asia (China, India), Australia, South Africa and the U.S.A. (Doidge 1950; Hale 1976b; Calvelo & Liberatore 2002; Feuerer 2011). For Bolivia only one old record is known (Hale 1976b).

CHEMISTRY. Usnic and protocetraric acids, probably also a trace of xanthone (see also Hale 1976b).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Río abajo La Paz, Jupapina, *ca* 3400 m, on *Opuntia* sp., 1987, *Stab LB06* (LPB).

Flavopunctelia flaventior (Stirt.) Hale

This is a widely distributed taxon, recorded from all over the world except Antarctica (e.g., Egan 2004; Feuerer 2011). For Bolivia there were few records (Feuerer *et al.* 1998; Canseco *et al.* 2006) but probably it is fairly common there.

CHEMISTRY. Usnic and lecanoric acids, trace of atranorin (±) (see also Egan 2004).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, 5 km al sur de Saila Pata, 16°55′S, 66°56′W, 3050 m, bosque siempreverde, epífita, 1997, *Bach 881a & Jimenez* (B, LPB); Prov. Capinota, carretera a Capinota, 2470 m, 1988, *Hensen 88* (LPB); Prov. Mizque. Questrada, *ca* 6 km de puerto Campasillo, *ca* 220 m, 1988, *Cadina 25* (LPB); Prov. Sipe-Sipe, Jukavaquai, *ca* 3500 m, 1988, *Hensen 78* (LPB). DEPT. LA PAZ. La Paz, Cota Cota Calle 27, University Campus, by Herbario Nacional de Bolivia, 16°32′16″S, 68°04′08″W, 3650 m, botanical garden, on *Accacia* sp. and unidentified tree, 2008, *Kukwa 5993, 7207* (LPB, UGDA); Prov. Murillo: Valle de la Luna near Mallasa district, 16°34′03″S, 68°05′38″W, 3350 m, open semi-desert high Andean area, terricolous, 2009, *Flakus 14653 & Rodriguez* (KRAM, LPB); Laguna Cota Cota (calle 31), sector frente a la puerta principal, 16°32′25″S, 68°04′02″W, 3750 m, Puna y vegetación altoandina, on *Populus balsamifera*, 2002, *Caneco A-120* (LPB); Mecapaca, rio abajo La Paz, jardin cerca del Río Choqueyapu, 2800 m, epífita, 1988, *Stab LB111* (LPB). DEPT. SANTA CRUZ. Prov. Caballero, East Cordillera, Siberia village, 17°49′38″S, 64°45′14″W, 3480 m, open area near Yungas montane cloud forest, 2004, corticolous, *Flakus 4829* (KRAM, LPB).

Flavopunctelia praesignis (Nyl.) Hale

The species is new for Bolivia. It is also known from the U.S.A., Argentina, Mexico, Peru, Venezuela and East Africa (Kenya) (Calvelo & Liberatore 2002; Egan 2004; Feuerer 2011).

CHEMISTRY. Usnic and lecanoric acids, trace of atranorin (±) (see also Egan 2004).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Quillacollo, East Cordillera, area of Incarraya-Sipesipe, 17°28′39″S, 64°21′43″W, 2846 m, semi-desert open area, corticolous, 2004, *Flakus 4928.1* (KRAM, LPB). DEPT. SANTA CRUZ. Prov. Caballero, East Cordillera, Siberia region near La Palma village, 17°49′12″S, 64°40′28″W, 2582 m, Yungas montane cloud forest, 2004, corticolous, *Flakus 4791* (KRAM, LPB).

Hypogymnia subphysodes (Kremp.) Filson

The species is known from southern and southeastern Australia, New Zealand, Thailand, a single locality in the U.S.A., and several records from South America (Argentina, Chile) (Calvelo & Liberatore 2002; Wolseley *et al.* 2002; Elvebakk 2011). Here it is recorded for the first time from Bolivia.

CHEMISTRY. Physodic and oxyphysodic acids, minor amounts of atranorin (see also Elvebakk 2011).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Franz Tamayo, ANMIN Apolobamba, near Puyo Puyo village, 15°56′55″S, 69°07′58″W, 4888 m, high Andean open vegetation, on plant remains, 2010, *Flakus 17633, 17649, 17661 & Rodriguez* (KRAM, LPB).

DEPT. ORURO. Prov. Sajama, PN Sajama, near Sajama village, 18°07′49″S, 68°56′54″W, 4437 m, Puna Sureña, Tholares vegetation, on plant remains, 2010, *Flakus 16505* (KRAM, LPB).

Hypotrachyna aguirrei Sipman, Elix & T. H. Nash

This species was recently described from Bolivia, Costa Rica, Colombia and Peru; in Bolivia it was known previously from only one locality (Sipman *et al.* 2009) but it seems to be widespread in this country at 350–1900 m a.s.l.

CHEMISTRY. Atranorin, protocetraric acid and traces of additional substances (±) (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. BENI. Prov. Ballivian, 12 km por carretera maderera al SW del kilómetro 12 Yucumo - Rurrenabaque, 600 m, 15°6′S, 67°7′W, 1997, *Bach et al. 363, 363E* (LPB). DEPT. LA PAZ. Prov. Iturralde, above Tumupasa village, 14°08′51″S, 67°53′34″W, 350 m, 2008, *Kukwa 7023* (LPB, UGDA); PROV. MURILLO, Valle de Zongo, Chururaci, 1900 m, 1988, *Hensen 44* (LPB). DEPT. TARIJA. Prov. Aniceto Arce: Filo de Sidras, 2-hour drive from Tarija, 22°14′50″S, 64°33′28″W, 1064 m, 2010, *Flakus 18393*, *18442, 18592* (KRAM, LPB, herb. Flakus); Serranía de Propiedad Arnold, 1309 m, 22°13′19″S, 64°33′41″W, 2010, *Flakus 18723* (KRAM, LPB).

Hypotrachyna andensis Hale

In Bolivia the species was known from only a single locality (Sipman *et al*. 2009). It is also known from Brazil, Costa Rica, Ecuador, Haiti and Peru (Hale 1975; Sipman *et al*. 2009).

CHEMISTRY. Usnic, norstictic, salazinic and consalazinic acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Cerro Asunta Pata, 1500 m, 15°5′S, 68°29′W, 1997, *Bach et al. 207* (LPB); Prov. Camacho, Pacoamba cerca Wila Kala, 4283 m, 15°24′40″S, 69°04′24″W, 2010, *Flakus 17701, 17718, 17719, 17765 & Rodriguez* (KRAM, LPB, herb. Flakus); Prov. Murillo, Valle de Zongo, laguna Viscachani, 3840 m, 1988, *Arrazola 31* (LPB); Prov. Nor Yungas, PNANMI Cotapata, 5-hour drive from Unduavi, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16901, 16907 & Rodriguez* (KRAM, LPB).

Hypotrachyna bogotensis (Vain.) Hale

This species is widely distributed in the Neotropics. In Bolivia it was reported from three localities (Sipman *et al.* 2009); the species appears to be rather widespread at altitudes above 2200 m.

CHEMISTRY. Atranorin, evernic and lecanoric acids with traces of related unknowns (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco: PN Carrasco, near Sehuencas village, 17°30′12″S, 65°16′30″W, 2220 m, 2008, *Kukwa 6503* (LPB, UGDA); by Río Lopez Mendoza, 17°30′26″S, 65°16′55″W, 2226 m, 2008, *Kukwa 6639* (LPB, UGDA). DEPT. LA PAZ. Prov. Camacho, Pacoamba cerca Wila Kala, 4283 m, 15°24′40″S, 69°04′24″W, 2010, *Flakus 17762 & Rodriguez* (KRAM, LPB); Prov. Nor Yungas: Carretera Cotapata-Santa Barbara, 3573 m, 16°19′23″S, 67°56′37″W, 2007, *Rodriguez 410* (LPB); Unduavi (Coscapa), senda al lado de la carretera, aprox. a 1 km despues de Unduavi viniendo de La Paz, 3400 m, 2000, *de la Rocha & Gómez s.n.* (LPB).

Hypotrachyna caraccensis (Taylor) Hale

This Neotropical taxon is known from several countries in Latin America (Hale 1975; Sipman *et al*. 2009). In Bolivia it has been reported from three localities (Sipman *et al*. 2009).

CHEMISTRY. Usnic, galbinic, norstictic and salazinic acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, Corani, 3261 m, 17°13′36″S, 65°53′25″W, 2009, *Flakus 12930* (KRAM, LPB). DEPT. LA PAZ. Prov. Franz Tamayo, senda Keara-Mojos, abajo de Chunkani, 2870 m, 14°38′S, 68°57′W, 2001, *Jimenez 5355* (LPB); Prov. Nor Yungas: PNANMI Cotapata, 5-hour drive from Unduavi, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16878, 16934, 16998 & Rodriguez* (KRAM, LPB, herb. Flakus); near Urpuma colony, 1989 m, 16°13′20″S, 67°52′34″W, 2010, *Flakus 17192 & Rodriguez* (KRAM, LPB); Unduavi, 2000, *Janiro 17 et al*. (LPB).

Hypotrachyna chicitae (Hale) Hale

The species is widely distributed in the Neotropics (Hale 1975; Sipman *et al*. 2009), but in Bolivia was previously recorded in only four stands

(Sipman *et al*. 2009). Interestingly, one individual of this normally saxicolous species has been found on tree bark.

CHEMISTRY. Atranorin, barbatic, obtusatic, evernic, norobtusatic and lecanoric acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Inquisivi, between Pongo and Sayaquita, 1 km E of Sayaquita, 3800 m, 17°0′S, 67°16′W, 1986, *Lewis 86–196* (LPB); Prov. Murillo, near Cumbre pass, 4450 m, 16°19′18″S, 68°04′42″W, 2006, *Flakus 8554* (KRAM, LPB).

Hypotrachyna chlorina (Müll. Arg.) Hale

This species has been reported from many countries in the Neotropics (Hale 1975; Sipman *et al*. 2009), but from Bolivia only a single locality was known previously (Sipman *et al.* 2009). The new records suggest that the species is more common in the submontane and montane forests of Bolivia.

CHEMISTRY. Atranorin, barbatic and obtusatic acids, secalonic acid A (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco: PN Carrasco, Ch'iqta rumi, 17°28′44″S, 65°17′06″W, 2120 m, 2008, *Kukwa 6300* (LPB, UGDA); near Sehuencas village, 2220 m, 17°30′12″S, 65°16′30″W, 2008, *Flakus et al. 10545* (KRAM, LPB); Prov. Chapare: near Incachaca village, 2198 m, 17°14′09″S, 65°48′51″W, 2006, *Flakus 7861 & 7864* (KRAM, LPB); PN Carrasco, 137 km del camino antiguo de Cochabamba a Villa Tunari, 1600 m, 17°6′S, 66°35′W, 1997, *Bach et al. 773* (LPB). DEPT. LA PAZ. Prov. Nor Yungas, PNANMI Cotapata, near Urpuma colony, 1989 m, 16°13′20″S, 67°52′34″W, 2010, *Flakus 17120, 17145, 17153, 17212 & Rodriguez* (KRAM, LPB, herb. Flakus); Serranía Bellavista, 36 km por camino de Caranavi hacia Sapecho, 1500 m, 15°41′S, 67°30′W, 1997, *Bach et al. 409* (LPB). DEPT. TARIJA. Prov. Aniceto Arce, Filo de Sidras, 1064 m, 22°14′50″S, 64°33′28″W, 2010, *Flakus 18399, 18433, 18466, 18474* (KRAM, LPB, herb. Flakus).

Hypotrachyna dactylifera (Vain.) Hale

This is a Neotropical taxon widespread in mountains in Latin America, but from Bolivia only a single record was published previously (Hale 1975; Sipman *et al.* 2009).

CHEMISTRY. Atranorin, colensoic, 4-O-methylphysodic, lividic, physodic and oxyphysodic acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Florida, Refugio 'Los Volcanes', 1000 m, 18°6′S, 63°36′W, 1997, *Bach et al. 646* (LPB). DEPT. TARIJA. Prov. Aniceto Arce, Filo de Sidras, 2-hour drive from Tarija, 1064 m, 22°14′50″S, 64°33′28″W, 2010, *Flakus 18463, 18528, 18584, 18673* (KRAM, LPB, UGDA, herb. Flakus).

Hypotrachyna degelii (Hale) Hale

The species is widespread but rather uncommon in the Neotropics; it is also known from Angola (Hale 1975; Sipman *et al*. 2009). For Bolivia there were only three records previously (Sipman *et al*. 2009).

CHEMISTRY. Atranorin, α-collatolic and alectoronic acids with traces of related substances (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare: near Incachaca village, 2198 m, 17°14′09″S, 65°48′51″W, 2006, *Flakus 7857, 7859* (KRAM, LPB); near Incachaca village, 2294 m, 17°14′13″S, 65°49′02″W, 2006, *Flakus 8223* (KRAM, LPB); near Incachaca village, 2317 m, 17°14′11″S, 65°49′02″W, 2006, *Flakus 8346* (KRAM, LPB). DEPT. LA PAZ. Prov. Franz Tamayo: Cutu Sacha, 2216–1600 m, 14°31′10″S, 68°16′47″W, 2005, *Fuentes 5220* (LPB); senda Keara-Mojos, abajo de Chunkani, 2870 m, 14°38′S, 68°57′W, 2001, *Jimenez 5359* (LPB); Prov. Nor Yungas: Hacienda Sacramento, *ca* 8 km del camino principal de Chuspipata hacia Coroico, 2500 m, 16°24′S, 67°47′W, 1997, *Bach et al. 567* (LPB); PNANMI Cotapata, near Urpuma colony, 1989 m, 16°13′20″S, 67°52′34″W, 2010, *Flakus 17241, 17261, 17304 & Rodriguez* (KRAM, LPB, herb. Flakus); Serranía Bellavista, 36 km por camino de Caranavi hacia Sapecho, 1500 m, 15°41′S, 67°30′W, 1997, *Bach et al. 407* (LPB). DEPT. TARIJA. Prov. Aniceto Arce, Papachacra, 2195 m, 21°41′36″S, 64°29′33″W, 2010, *Flakus & Quisbert 19849* (KRAM, LPB).

Hypotrachyna densirhizinata (Kurok.) Hale

The species is common in the Neotropics from Guatemala to Argentina; it has also been found

in the U.S.A. and Africa (Hale 1975; Sipman *et al.* 2009 and literature cited therein). In Bolivia it has been reported from eight localities (Sipman *et al.* 2009).

CHEMISTRY. Atranorin, α-collatolic and alectoronic acids with traces of related substances (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Camacho, Pacoamba cerca Wila Kala, 4283 m, 15°24′40″S, 69°04′24″W, 2010, *Flakus 17716, 17763 & Rodriguez* (KRAM, LPB, UGDA); Prov. Inquisivi, cliffs north of the road between Pongo and Sayaquita, 1 km E of Sayaquita, 3800 m, 17°00′S, 67°16′W, 1986, *Lewis 86-197M* (LPB); Prov. Nor Yungas: Coscapa, senda al oeste del camino principal *ca* 4 km de Cotapata hacia La Paz, 3200–3350 m, 16°23′S, 67°54′W, 1997, *Bach et al. 501* (LPB); PNANMI Cotapata, 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16977, 17003 & Rodriguez* (KRAM, LPB, herb. Flakus).

Hypotrachyna enderythraea (Zahlbr.) Hale

The species is a widespread Neotropical taxon and common in some countries. From Bolivia it has been reported from three localities (Hale 1975; Sipman *et al.* 2009).

CHEMISTRY. Usnic, galbinic and norstictic acids, probably also a trace of salazinic acid (±) (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, Sehuencas, 2220 m, 17°3012″S, 65°1630″W, 2008, *Rodriguez 830, Flakus & Kukwa* (LPB). DEPT. LA PAZ. Prov. Nor Yungas, PNANMI Cotapata, near Urpuma colony, 1989 m, 16°13′20″S, 67°52′34″W, 2010, *Flakus 17186, 17264 & Rodriguez* (KRAM, LPB, UGDA, herb. Flakus).

Hypotrachyna endochlora (Leigh.) Hale

The species is common in the Neotropics (with four records from Bolivia), being known also from Africa, Asia, Europe, the Pacific and Papua New Guinea (Hale 1975; Sipman *et al.* 2009). Thirteen new Bolivian records are added in this paper. This makes it one of the commonest species of the genus in Bolivia.

CHEMISTRY. Atranorin, secalonic acid A, barbatic, obtusatic and norobtusatic (±) acids, unknown with obtusatic acid, echinocapric acid (±) (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PN Carrasco, near Phaqcha, 17°27′13″S, 65°16′44″W, 2850 m, 2008, *Kukwa 6187, 6213* (LPB, UGDA); Sehuencas, 2600 m, *Anze 28* (LPB); Prov. Chapare: Corani, 3263 m, 17°13′36″S, 65°53′25″W, 2009, *Flakus 12915* (KRAM, LPB); near Incachaca village, 2199 m, 17°14′09″S, 65°48′51″W, 2006, *Flakus 7851* (KRAM, LPB); PN Carrasco, near Incachaca, 17°15′10″S, 65°48′51″W, 2330 m, 2008, *Kukwa 6688* (LPB, UGDA). DEPT. LA PAZ. Prov. Bautista Saavedra, 15 km de Charazani hacia Apolo, 2400 m, 15°11′S, 68°52′W, 1997, *Bach et al. 262* (LPB); Prov. Nor Yungas: between Coroico and La Paz towns, 16°13′09″S, 67°49′32″W, 2600 m, 2008, *Kukwa 7193* (LPB, UGDA); Hacienda Sacramento, *ca* 8 km del camino principal de Chuspipata hacia Coroico, 2500 m, 16°24′S, 67°47′W, 1997, *Bach et al. 568* (LPB); PNANMI Cotapata, 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16957 & Rodriguez* (KRAM, LPB); near Urpuma colony, 1989 m, 16°13′20″S, 67°52′34″W, 2010, *Flakus 17305 & Rodriguez* (KRAM, LPB). DEPT. SANTA CRUZ. Prov. Caballero, Siberia region near La Palma, 2583 m, 17°49′12″S, 64°40′28″W, 2004, *Flakus 4725* (KRAM, LPB). DEPT. TARIJA. Prov. Aniceto Arce: Filo de Sidras, 2-hour drive from Tarija, 1064 m, 22°14′50″S, 64°33′28″W, 2010, *Flakus 18577* (KRAM, LPB); Papachacra, 2195 m, 21°41′36″S, 64°29′33″W, 2010, *Flakus 19837, 19979, 20020 & Quisbert* (KRAM, LPB, herb. Flakus).

Hypotrachyna ensifolia (Kurok.) Hale

This species, common in the Neotropics, is also known from New Zealand (Hale 1975; Sipman *et al*. 2009). In Bolivia only one locality of this taxon was known previously (Sipman *et al*. 2009).

CHEMISTRY. Atranorin, α-collatolic and alectoronic acids with traces of related substances (see also Sipman *et al.* 2009).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, Carretera Cotapata – Santa Barbara, 3573 m, 16°19′23″S, 67°56′37″W, 2007, *Rodriguez 419* (LPB, herb. Flakus).

Hypotrachyna gondylophora (Hale) Hale

This species is not common in the Neotropics, though known from many regions. It is also known from the southeastern U.S.A. (Hale 1975; Sipman *et al*. 2009). In Bolivia it was reported from four localities (Sipman *et al*. 2009).

CHEMISTRY. Atranorin and fumarprotocetraric acid with traces of related substances (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo: Valle de Zongo, laguna Viscachani, 3840 m, 1988, *Coello 1* (LPB); Valle de Zongo, arriba laguna Viscachani, 3600 m, 1988, *Stab 198* (LPB).

Hypotrachyna imbricatula (Zahlbr.) Hale

This taxon is common and widespread in the Neotropics, and is also known from Asia, Australia, the Azores, Papua New Guinea and the southeastern U.S.A. (Hale 1975; Sipman *et al*. 2009 and literature cited therein). Sipman *et al*. (2009) published three records from Bolivia.

CHEMISTRY. Atranorin, barbatic, obtusatic and norobtusatic (±) acids, traces of unidentified substances related to obtusatic acid (±) (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco: PN Carrasco, near Sehuencas village, 17°30′12″S, 65°16′30″W, 2220 m, 2008, *Flakus 10403, Kukwa 6568 & Rodriguez 778* (KRAM, LPB, UGDA); Ch'iqta rumi, 2120 m, 17°28′44″S, 65°17′06″W, 2008, *Flakus et al. 10247, 10259* (KRAM, LPB). DEPT. LA PAZ. Prov. Nor Yungas: near Pacallo village, 16°12′10″S, 67°50′39″W, 1360 m, 2008, *Kukwa 7153a* (LPB, UGDA); PNANMI Cotapata, near Urpuma colony, 1989 m, 16°13′20″S, 67°52′34″W, 2010, *Flakus 17119, 17146, 17293 & Rodriguez* (KRAM, LPB, herb. Flakus).

Hypotrachyna laevigata (Sm.) Hale

This taxon is widespread from temperate to tropical regions (Hale 1975; Sipman *et al*. 2009 and literature cited therein). Sipman *et al*. (2009) reported three localities from Bolivia.

CHEMISTRY. Atranorin, barbatic, obtusatic and norobtusatic (±) acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, Monte Punku, a 20 km hacia Phaqcha, 2850 m, 17°27′13″S, 65°16′44″W, 2008, *Rodriguez et al. 891* (LPB); Prov. Nor Yungas, Coscapa, senda al oeste del camino principal *ca* 4 km de Cotapata hacia La Paz, 3500 m, 16°23′S, 67°53′W, 1997, *Bach et al. 446, 488* (LPB). DEPT. LA PAZ. Prov. Nor Yungas, PNANMI Cotapata, 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16839, 16841, 16981, 17004 & Rodriguez* (KRAM, LPB, UGDA, herb. Flakus).

Hypotrachyna livida (Taylor) Hale

This species occurs throughout tropical South America but is rare outside southeastern Brazil and Uruguay. It is also known from the southern U.S.A. (Hale 1975; Sipman *et al*. 2009). From Bolivia only a single record was known previously (Sipman *et al*. 2009).

CHEMISTRY. Atranorin, colensoic, 4-O-methylphysodic and lividic acids, trace of unidentified substance (±) (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. TARIJA. Prov. Aniceto Arce: Filo de Sidras, 2-hour drive from Tarija, 1065 m, 22°14′50″S, 64°33′28″W, 2010, *Flakus 18674* (KRAM, LPB); Papachacra, 2195 m, 21°41′36″S, 64°29′33″W, 2010, *Flakus 19779, 19780, 19781, 19901 & Quisbert* (KRAM, LPB, UGDA, herb. Flakus); Papachacra, 2056 m, 21°41′54″S, 64°29′28″W, 2010, *Flakus 19961, 20032 & Quisbert* (KRAM, LPB); Serranía de Propiedad Arnold, 1309 m, 22°13′19″S, 64°33′41″W, 2010, *Flakus 18756, 18762* (KRAM, LPB).

Hypotrachyna longiloba (H. Magn.) Hale

This very conspicuous lichen species is widespread in the Neotropics and common in some countries. In Bolivia only three localities were known previously (Hale 1975; Sipman *et al.* 2009).

CHEMISTRY. Atranorin, α-collatolic and alectoronic acids with traces of related substances (see also Sipman *et al.* 2009).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, PNANMI Cotapata, 30-minute drive from Unduavi by Sillu Tincara pre-Columbian route, 16°17′38″S, 67°53′33″W, 3437 m, 2009, *Flakus 16333 & Rodriguez* (KRAM, LPB, herb. Flakus).

Hypotrachyna microblasta (Vain.) Hale

The species is common in the Neotropics; it is also known from the Azores, Africa, Mauritius, Southeast Asia, Papua New Guinea and Hawaii (Hale 1975; Sipman *et al.* 2009 and literature cited therein). Sipman *et al*. (2009) reported only three localities from Bolivia.

CHEMISTRY. Usnic, galbinic, norstictic, salazinic and consalazinic (±) acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco: PN Carrasco, Ch'iqta rumi, 17°28′44″S, 65°17′06″W, 2120 m, 2008, *Kukwa 6279, 6297* (LPB, UGDA); near Sehuencas village, 17°30′12″S, 65°16′30″W, 2220 m, 2008, *Kukwa 6551 & Flakus 10497* (KRAM, LPB, UGDA); Prov. Murillo, Valle de Zongo, arriba Santa Rosa, 3000 m, 1988, *Birgt 25* (LPB); Prov. Nor Yungas: near Pacallo village, 16°12′10″S, 67°50′39″W, 1360 m, 2008, *Kukwa 7153* (LPB, UGDA); PNANMI Cotapata, 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16970, 16982 & Rodriguez* (KRAM, LPB, herb. Flakus). DEPT. SANTA CRUZ. Prov. Caballero, Siberia region near La Palma, 2583 m, 17°49′12″S, 64°40′28″W, 2004, *Flakus 4572* (KRAM, LPB).

Hypotrachyna peruviana (Nyl.) Hale

This is a rare species in the Neotropics, with two known localities in Bolivia (Hale 1975; Sipman *et al*. 2009).

CHEMISTRY. Atranorin, barbatic and obtusatic acids, secalonic acid A, traces of additional substances, probably echinocarpic (±) and conechinocarpic (±) acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PN Carrasco, near Phaqcha, 20 km from Monte Punku village, 17°27′13″S, 65°16′44″W, 2850 m, 2008, *Kukwa 6159, 6163* (LPB, UGDA); Prov. Chapare, near Incachaca village, 2198 m, 17°14′09″S, 65°48′51″W, 2006, *Flakus 7850, 7852* (KRAM, LPB, herb. Flakus).

Hypotrachyna physcioides (Nyl.) Hale

The species is rather common in the Neotropics, known also from Asia (China, India, the Philipines, Thailand) (Hale 1975; Sipman *et al*. 2009 and literature cited therein). From Bolivia it was reported previously from only five localities (Hale 1975; Sipman *et al*. 2009).

CHEMISTRY. Atranorin, barbatic, obtusatic, 4-O-demethylbarbatic, and norobtusatic (±) acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Arani, Cordillera de Tiraque, headwaters of Rio Macho Cueva 14 km S of Tiraque, 3770 m, 17°23′S, 65°36′W, 1985, *Lewis 85-67, 85-170* (LPB); Prov. Carrasco, headwaters of Río Monte Punku and slope of cerro Chojo Rumi, 1 km SW of the mouth of Río Meruvia, 3220 m, 17°34′S, 65°17′W, 1985, *Lewis 85-336* (LPB); Prov. Chapare: by the boundaries of PN Carrasco, near Incachaca, 17°15′10″S, 65°48′51″W, 2330 m, 2008, *Kukwa 6746a* (LPB, UGDA); Corani, 3261 m, 17°13′36″S, 65°53′25″W, 2009, *Flakus 12924* (KRAM, LPB). DEPT. LA PAZ. Prov. Nor Yungas: PNANMI Cotapata, near Unduavi by Sillu Tincara pre-Columbian route, 3437 m, 16°17′38″S, 67°53′33″W, 2009, *Flakus 16342 & Rodriguez* (KRAM, LPB); 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16860 & Rodriguez* (KRAM, LPB); Prov. Franz Tamayo, laguna Tolca Cocha, al NE de Keara Nuevo, 3900 m, 14°41′13″S, 69°5′18″W, 2006, *Fuentes 9934 et al.* (LPB, UGDA). DEPT. SANTA CRUZ. Prov. Caballero, Siberia region near La Palma, 2582 m, 17°49′12″S, 64°40′28″N, 2004, *Flakus 4553* (KRAM, LPB). DEPT. TARIJA. Prov. Aniceto Arce, Filo de Sidras, 2-hour drive from Tarija, 1064 m, 22°14′50″S, 64°33′28″W, 2010, *Flakus 18432* (KRAM, LPB).

Hypotrachyna pluriformis (Nyl.) Hale

It is widespread in the Neotropics but common only in Brazil (Hale 1975; Sipman *et al*. 2009 and literature cited therein). Outside the Neotropics it is known also from India (Divakar & Upreti 2005). Only one Bolivian locality was reported previously (Sipman *et al.* 2009).

CHEMISTRY. Atranorin, gyrophoric and lecanoric acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, Carretera Cotapata – Santa Barbara, 3573 m, 16°19′23″S, 67°56′37″W, 2007, *Rodriguez 400* (LPB). DEPT. TARIJA. Prov. Aniceto Arce, Papachacra, 2195 m, 21°41′36″S, 64°29′33″W, 2010,

Flakus 19784, 19899, 19920 & Quisbert (KRAM, LPB, herb. Flakus).

Hypotrachyna producta Hale

This taxon is uncommon in the Neotropics, and is also known from the southeastern U.S.A., Africa and New Zealand (Hale 1975; Sipman *et al.* 2009 and literature cited therein). Sipman *et al*. (2009) reported two localities from Bolivia.

CHEMISTRY. Atranorin, anziac acid and trace of unknown (±) (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare: by the boundaries of PN Carrasco, near Incachaca, 17°15′10″S, 65°48′51″W, 2330 m, managed pine forest, 2008, *Kukwa 6746* (LPB, UGDA); near Sehuencas village by Rio Lopez Mendoza, 17°30′26″S, 65°16′55″W, 2226 m, montane cloud forest, 2008, *Kukwa 6654* (LPB, UGDA).

Hypotrachyna prolongata (Kurok.) Hale

This is a widespread taxon in the Neotropics, also known from the southeastern U.S.A. (Hale 1975; Sipman *et al.* 2009). The species was reported previously from three localities in Bolivia (Sipman *et al*. 2009).

CHEMISTRY. Atranorin and anziac acid (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, Corani, 3261 m, 17°13′36″S, 65°53′25″W, 2009, *Flakus 12913* (KRAM, LPB). DEPT. LA PAZ. Prov. Franz Tamayo, bajando de Puina río abajo, sendero abandonado, 3150 m, 14°34′S, 69°5′W, 2005, *Jimenez 2873* (LPB); Prov. Inquisivi, along the ridge of cerro Lulini about midway between Jankho Khalani and Aguilani, 3250 m, 1989, *Lewis 89-989* (LPB); Prov. Nor Yungas, PNANMI Cotapata, 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16836, 16842, 16915, 17011 & Rodriguez* (KRAM, LPB, UGDA, herb. Flakus). DEPT. SANTA CRUZ. Prov. Caballero, Siberia region near La Palma, 2582 m, 17°49′12″S, 64°40′28″W, 2004, *Flakus 4571, 4585* (KRAM, LPB).

Hypotrachyna protenta Hale

This is a widespread but rather uncommon Neotropical species (Hale 1975; Sipman *et al.* 2009). In Bolivia it was proviously known from a single locality only.

CHEMISTRY. Atranorin, α-collatolic and alectoronic acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, near Incachaca village, 2294 m, 17°14′13″S, 65°49′02″W, 2006, *Flakus 8188* (KRAM, LPB, herb. Flakus). DEPT. LA PAZ. Prov. Murillo, Valle de Zongo, 1900 m, 1988, *Stab 195* (LPB).

Hypotrachyna pulvinata (Fée) Hale

This species is widespread in the Neotropics but mostly confined to mountains. It is also known from the Azores (Sipman *et al.* 2009 and literature cited therein). The species has been reported from four localities in Bolivia (Sipman *et al.* 2009).

CHEMISTRY. Atranorin, evernic and lecanoric acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, Corani, 3262 m, 17°13′36″S, 65°53′25″W, 2009, *Flakus 12913.1* (KRAM, LPB, herb. Flakus). DEPT. LA PAZ. Prov. Inquisivi, on E side of the Rio Miguillas, near Carabuco, 2900 m, 16°49′S, 67°28′W, 1986, *Lewis 86-245* (LPB).

Hypotrachyna revoluta (Flörke) Hale

The species was reported from Bolivia by Hale (1975). It is a Pantropical taxon known also from temperate regions (Sipman *et al.* 2009).

CHEMISTRY. Atranorin, gyrophoric and lecanoric acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Chapare, near Incachaca village, 2198 m, 17°14′09″S, 65°48′51″W, 2006, *Flakus 7860* (KRAM, LPB, herb. Flakus). DEPT. SANTA CRUZ. Prov. Caballero, Siberia, 3480 m, 17°49′38″S, 64°45′14″W, 2004, *Flakus 4468* (KRAM, LPB, herb. Flakus). DEPT. TARIJA. Prov. Aniceto Arce, Papachacra, 2195 m, 21°41′36″S, 64°29′33″W, 2010, *Flakus 19856 & Quisbert* (KRAM, LPB).

Hypotrachyna rockii (Zahlbr.) Hale

This species is known from many regions in the Neotropics, Asia, Europe, Macaronesia, North America and Papua New Guinea (Hale 1975;

Sipman *et al*. 2009 and literature cited therein). It seems to be common in Bolivia; Sipman *et al.* (2009) reported five localities, and five are added here.

CHEMISTRY. Atranorin, lecanoric and evernic acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, 6 km al sur de Saila Pata, 3050 m, 16°55′S, 66°56′W, 1997, *Bach 884 & Jimenez* (LPB); Prov. Carrasco: PN Carrasco, near Sehuencas village, 17°30′12″S, 65°16′30″W, 2220 m, 2008, *Flakus 10527, Rodriguez & Kukwa 6431b* (KRAM, LPB, UGDA); near Sehuencas village by Río Lopez Mendoza, 17°30′26″S, 65°16′55″W, 2226 m, 2008, *Kukwa 6619* (LPB, UGDA); Prov. Chapare, near Incachaca, 2028 m, 17°12′54″S, 65°49′30″W, 2009, *Flakus 12940* (KRAM, LPB, herb. Flakus). DEPT. LA PAZ. Prov. Nor Yungas: Coroico, 1554 m, 16°11′10″S, 67°43′16″W, 2010, *Flakus 16450 & Rodriguez* (KRAM, LPB); PNANMI Cotapata, near Urpuma colony, 1989 m, 16°13′20″S, 67°52′34″W, 2010, *Flakus 17187, 17276 & Rodriguez* (KRAM, LPB).

Hypotrachyna sinuosa (Sm.) Hale

This species is widespread in the tropics, extending to temperate regions of all continents except Antarctica (Hale 1975; Sipman *et al*. 2009). From Bolivia only two localities were reported previously (Sipman *et al*. 2009).

CHEMISTRY. Usnic, salazinic, consalazinic (±) and norstictic (±, trace) acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Arani, Coordillera de Tiraque, headwaters of Río Macho Cueva near forks of streams flowing from laguna Cajitilla Khocha and Yana Khocha, 14 km south of Tiraque, 3570 m, 17°23′S, 65°36′W, 1985, *Lewis 85-172* (LPB); Prov. Carrasco, Monte Punku, a 20 km hacia Phaqcha, 2850 m, 17°27′13″S, 65°16′44″W, 2008, *Rodriguez et al. 894* (LPB); Prov. Chapare, Corani, 3261 m, 17°13′36″S, 65°53′25″W, 2009, *Flakus 12911* (KRAM, LPB). DEPT. LA PAZ. Prov. Bautista Saavedra, ANMIN Apolobamba, near Villa Amarca village, 4643 m, 15°16′47″S, 69°01′47″W, 2010, *Flakus 17362, 17413, 17419, 17428 & Rodriguez* (KRAM, LPB, herb. Flakus); Prov. Camacho, Pacoamba cerca Wila Kala, 4283 m, 15°24′40″S, 69°04′24″W, 2010, *Flakus 17703, 17731 & Rodriguez* (KRAM, LPB); Prov. Franz Tamayo, ANMIN Apolobamba, near Puyo Puyo village, 4888 m, 15°56′55″S, 69°07′58″W, 2010, *Flakus 17578, 17582, 17658 & Rodriguez* (KRAM, LPB, herb. Flakus); Prov. Nor Yungas: 2 km del camino principal de Chuspipata hacia Coroico, 2900 m, 16°22′S, 67°49′W, 1997, *Bach et al. 538* (LPB); San Vincente, *ca* 1 km al Este de Chuspipata, 3000 m, 16°21′S, 67°49′W, 1997, *Bach et al. 586* (LPB); Unduavi, al borde del camino, 2000, *Janiro, Flavia & Carlos 8, 15* (LPB); PNANMI Cotapata, 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16840, 16849, 16929, 16937 & Rodriguez* (KRAM, LPB, herb. Flakus).

Hypotrachyna steyermarkii (Hale) Hale

This is a rare Neotropical species, previously reported in Bolivia from only one locality (Hale 1975; Sipman *et al*. 2009). Here we report four new localities.

CHEMISTRY. Atranorin, barbatic, obtusatic, 4-O-demethylbarbatic and norobtusatic (±) acids (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. PROV. FRANZ TAMAYO, sendero Keara-Mojos, a media hora de caminata aprox. desde Tokuaqe por la senda al inciensal, 2420 m, 14°36′S, 68°56′W, 2001, *Jimenez 5310* (LPB); Prov. Nor Yungas, Hacienda Sacramento, *ca* 8 km del camino principal de Chuspipata hacia Coroico, 2500 m, 16°24′S, 67°47′W, 1997, *Bach et al. 569* (LPB); PNANMI Cotapata, 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16864 & Rodriguez* (KRAM, LPB, herb. Flakus). DEPT. TARIJA. Prov. Aniceto Arce, RNFF Tariquía, La Hierba, 1070 m, 22°08′46″S, 64°31′36″W, 2010, *Flakus 19701 & Quisbert* (KRAM, LPB).

Lepraria incana (L.) Ach.

This species is common worldwide but rare in South America, where it has been reported from Bolivia, Chile and Colombia (Flakus *et al.* 2011). The record below is the third one for Bolivia (Flakus & Kukwa 2007; Flakus *et al.* 2011).

CHEMISTRY. Divaricatic acid and zeorin (see also Laundon 1992; Tønsberg 1992; Flakus & Kukwa 2007).

SPECIMEN EXAMINED. BOLIVIA. DEPT. TARIJA. Prov. Aniceto Arce, Filo de Sidras, near park guard

camp, 22°14′50″S, 64°33′28″W, 1064 m, Tucumano-Boliviano submontane forest, 2010, on bark, *Flakus 18440,1* (KRAM, LPB).

Lepraria lobificans Nyl.

It is a widespread lichen species (e.g., Laundon 1992; Tønsberg 1992; Kukwa 2006; Flakus & Kukwa 2007; Feuerer 2011). It is the commonest representative of the genus *Lepraria* Ach. in both the Neotropics and Bolivia (see Flakus *et al.* 2011).

CHEMISTRY. Atranorin, stictic acid complex and zeorin (see also Laundon 1992; Tønsberg 1992; Flakus & Kukwa 2007).

SPECIMENS EXAMINED. BOLIVIA. DEPT. TARIJA. Prov. Aniceto Arce: Filo de Sidras, near park guard camp, 22°14′50″S, 64°33′28″W, 1064 m, Tucumano-Boliviano submontane forest, on bark, 2010, *Flakus 18434, 18481, 18676* (KRAM, LPB); near park guard camp, 22°14′56″S, 64°32′55″W, 883 m, Tucumano-Boliviano secondary submontane forest, on bark, 2010, *Flakus 18353, 18361, 18375* (KRAM, LPB); La Hierba, RNFF Tariquía, 22°08′46″S, 64°31′36″W, 1070 m, Tucumano-Boliviano submontane forest near river, on bark, 2010, *Flakus 19708, 19710, 19758 & Quisbert* (KRAM, LPB); Papachacra, 21°41′54″S, 64°29′28″W, 2056 m, Tucumano-Boliviano montane forest, on bark, 2010, *Flakus 19955, 20040 & Quisbert* (KRAM, LPB); Serranía de Propiedad Arnold, 22°13′19″S, 64°33′41″W, 1309 m, on bark, 2010, *Flakus 18738, 18806, 18817, 18830* (KRAM, LPB).

Lepraria vouauxii (Hue) R. C. Harris

This is a very widespread species (e.g., Laundon 1992; Tønsberg 1992; Kukwa 2006), but in South America reported only from Bolivia, Chile, Ecuador and Peru (Flakus & Kukwa 2007; Flakus *et al.* 2011). In Bolivia the species was reported from several localities by Flakus and Kukwa (2007) and Flakus *et al.* (2011).

CHEMISTRY. Pannaric acid 6-methylester and related substances (see also Laundon 1992; Tønsberg 1992; Flakus & Kukwa 2007).

SPECIMEN EXAMINED. BOLIVIA. DEPT. TARIJA. Prov. Aniceto Arce, Filo de Sidras, near park guard camp, 22°14′50″S, 64°33′28″W, 1064 m, Tucumano-Boliviano submontane forest, on bark, 2010, *Flakus 18440* (KRAM, LPB).

Normandina pulchella (Borrer) Nyl.

This is a widespread species known from all continents except Antarctica (see Feuerer 2011). In Bolivia it is known from several localities (Flakus 2008).

CHEMISTRY. Not tested.

SPECIMEN EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, 20 km de Cocapata hacia Cotacajes, 16°46′S, 66°44′W, 2000 m, bosque semisecundo disturbado de 5 m de altura en una quebrada, saxícola, 1997, *Bach 100 et al.* (LPB, as admixture in specimen of *Parmotrema reticulatum*). DEPT. TARIJA, Prov. Aniceto Arce, Papachacra, 21°41′54″S, 64°29′28″W, 2056 m, Tucumano-Boliviano montane forest, on trees, 2010, *Flakus 20050 & Quisbert* (KRAM, as admixture in specimen of *Parmelinopsis miniarum*).

Parmelinopsis afrorevoluta (Krog & Swinscow) Elix & Hale

Hypotrachyna afrorevoluta (Krog & Swinscow) Krog & Swinscow

The species is new for Bolivia. It is very widely distributed, being known from Africa, Asia, Europe, North and South America (see Flakus & Kukwa 2009 and literature cited therein). In South America it was previously reported only from Argentina (Adler & Elix 1992).

The material referred to this taxon here agrees well with the characteristics of the species (pustulate soralia, sparsely branched rhizines), however, it is very variable in the color of the thallus, which is ash grey to greenish grey (but no usnic acid was detected), and in lobe width (very narrow up to 5 mm wide); the most deviating specimen has very delicate lobes *ca* 1 mm wide. The specimens cited below may represent more than one taxon.

According to phylogenetic studies the genus *Parmelinopsis* Elix & Hale is paraphyletic and nested within *Hypotrachyna* (Vain.) Hale. It needs more studies to determine whether it can be kept separate from the latter or can be synonymized with *Hypotrachyna* (Crespo *et al.* 2010).

CHEMISTRY. Atranorin, gyrophoric acid, traces of related substances (see also Swinscow & Krog 1988).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, Coroico village, 16°11′10″S, 67°43′16″W, 1550 m, Yungas montane forest, on bark, 2010, *Flakus 16427 & Rodriguez* (KRAM, LPB). DEPT. TARIJA. Prov. Aniceto Arce: Papachacra, 21°41′36″S, 64°29′33″W, 2195 m, Tucumano-Boliviano montane forest, 2010, *Flakus 19882* (as admixture in specimen of *Parmelinopsis miniarum*), *19810, 19846 & Quisbert* (KRAM, LPB); Papachacra, 21°41′54″S, 64°29′28″W, 2056 m, Tucumano-Boliviano montane forest, on bark, 2010, *Flakus 20001, 20004* (KRAM, LPB).

Parmelinopsis minarum (Vain.) Elix & Hale

Hypotrachyna minarum (Vain.) Krog & Swinscow

This is a widespread species, reported for all continents except Antarctica (see Louwhoff 2009a; Feuerer 2011). In Bolivia only one locality of the species was known previously (Feuerer & Sipman 2005).

CHEMISTRY. Atranorin, gyrophoric acid with related substances, and traces of pigments (accompanying gyrophoric acid) (see also Swinscow & Krog 1988; Louwhoff 2009a).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PN Carrasco, near Sehuencas village, 17°30′12″S, 65°16′30″W, 2220 m, Yungas cloud forest, with some rocks in open place, on bark of tree, 2008, *Rodriguez 739 et al.* (LPB); Prov. Ayopaya, 20 km de Cocapata hacia Cotacajes, 16°46′S, 66°44′W, 2000 m, bosque semisecundo, saxícola, 1997, *Bach 98 et al.* (B, LPB); Prov. Chapare, near Incachaca village, 17°14′13″S, 65°49′02″W, 2294 m, Yungas montane cloud forest, 2006, on wood, *Flakus 8186* (KRAM, LPB). DEPT. SANTA CRUZ. Prov. Caballero, Siberia village, 17°49′38″S, 64°45′14″W, 3480 m, open area near Yungas montane cloud forest, on stone, 2004, *Flakus 4860* (KRAM, LPB). DEPT. TARIJA. Prov. Aniceto Arce: Papachacra, 21°41′36″S, 64°29′33″W, 2195 m, Tucumano-Boliviano montane forest, 26 Nov. 2010, on mosses and rocks, *Flakus 19815, 19822, 19823, 19926 & Quisbert* (KRAM); Papachacra, 21°41′54″S, 64°29′28″W, 2056 m, Tucumano-Boliviano montane forest, on trees, 2010, *Flakus 20050 & Quisbert* (KRAM).

Parmotrema bangii (Vain.) Hale

The species has been reported from Africa (Canary Islands, Kenya, Rwanda, Zaire) and South America (Bolivia, Colombia) (Hale 1965; Feuerer *et al.* 1998; Lendemer & Hewitt 2002). In Bolivia it is known from few localities, including the type locality (Hale 1965; Feuerer *et al.* 1998; Lendemer & Hewitt 2002).

The thalli of *Parmotrema bangii* are sparsely ciliate, and sometimes only a single cilium is present at the thallus margin. In such cases, using the key by Hale (1965) the species can easily be misidentified as *P. dilatatum* (Vain.) Hale; however, the two taxa differ in ascospore length (26–36 µm in *P. bangii* and 18–22 µm in *P. dilatatum*) and development of soralia (laminal and pustulate in *P. bangii*, mostly linear or developing on short laciniae in *P. dilatatum*) (Hale 1965).

CHEMISTRY. Atranorin and stictic acid complex, including menegazziaic acid and a trace of hypostictic acid (±) (see also Hale 1965).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, 5 km al. Sur de Saila Pata, 16°55′S, 66°56′W, 3050 m, epífita, 1997, *Bach 858, 858a & Jimenez* (B, LPB); Prov. Carrasco, PN Carrasco, near Sehuencas village by Río Lopez Mendoza, S17°30′26″, W65°16′55″, 2226 m, Yungas cloud forest, on bark of tree, 2008, *Kukwa 6623* (LPB, UGDA). 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, 1997, *Bach 273, 284, 335 et al.* (B, LPB).

Parmotrema cetratum (Ach.) Hale

Rimelia cetrata (Ach.) Hale & A. Fletcher

It is known from Australia, Asia (China, India, Thailand), North America (U.S.A.), Oceania (Hawaii), Africa (Kenya, Tanzania, South Africa) and South America (Bolivia, Brazil, Colombia, Uruguay) (Swinscow & Krog 1988; Marcelli 1991; Feuerer *et al.* 1998; Divakar & Upreti 2005; Divakar *et al.* 2005; Feuerer 2011). In Bolivia it was known previously from a few localities (Rusby 1895; Herzog 1922; Feuerer *et al.* 1998), but some of the old records may belong to other similar species.

The species is variable in development of maculae; in some specimens they are very distinctly reticulate, but in some only some lobes possess reticulae. According to Divakar *et al*. (2005), *P. cetratum* is not monophyletic and may consist of several species unrecognized up to now. The taxonomy of *Parmotrema* species with a maculate upper cortex and containing salazinic acid requires more comprehensive study, as the circumscription of taxa is not clear in several cases.

CHEMISTRY. Atranorin, salazinic and consalazinic acids (see also Divakar & Upreti 2005).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Arani, Cordillera de Tiraque, around shores of Laguna Cajtilla Khocha 17°23′S, 65°36′W, *ca* 3900 m, humid Andean grassy pampas, on rock, 1985, *Lewis 85-28* (LPB); Prov. Ayopaya: 5 km al sur de Saila Pata, 16°55′S, 66°56′W, 3050 m, bosque siempreverde, epífita, 1997, *Bach 857, 870 & Jimenez* (LPB); comunidad de de Saila Pata, 16°54′S, 66°56′W, 3000 m, bosque siempreverdem epífita, 1997, *Bach 899, 904* (as admixture in specimen of *Parmotrema crinitum*) *& Jimenez* (B, LPB). DEPT. TARIJA. Prov. Aniceto Arce, Serranía de Propiedad Arnold, 22°13′19″S, 64°33′41″W, 1309 m, on bark, 2010, *Flakus 18814* (KRAM, LPB).

Parmotrema crinitum (Ach.) M. Choisy

It is a widely distributed species known from all continents except Antarctica; for detailed distribution see Hale (1965) and Jabłońska *et al.* (2009). In Bolivia it was recorded only by Feuerer *et al.* (1998).

CHEMISTRY. Atranorin, stictic acid complex with menegazziac and hypostictic (trace) acids, unidentified terpenoid (±) (see also Hale 1965).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, comunidad de de Saila Pata, 16°54′S, 66°56′W, 3150 m, bosque siempreverde, epífita,1997, *Bach 904 & Jimenez* (B, LPB); Prov. Carrasco: PN Carrasco, between Sehuencas and Monte Punku villages, *ca* 2650 m, Yungas cloud forest, on humus or rocks, 2008, *Kukwa 6579* (LPB, UGDA); Sehuencas, 2600 m, Este del Camino, on twigs, 1988, *Ram 29* (LPB). DEPT. LA PAZ. Prov. Bautista Saavedra, 15 km de Charazani hacia Apolo, 15°11′S, 68°52′W, 2450 m, bosque humedo secundario, base de troncos, 1997, *Bach 261a, 321, 335a et al.* (B, LPB). DEPT. TARIJA. Prov. Aniceto Arce, Papachacra, 21°41′54″S, 64°29′28″W, 2056 m, Tucumano-Boliviano montane forest, on trees, 2010, *Flakus 19992 & Quisbert* (KRAM, LPB).

Parmotrema merrillii (Vain.) Hale

This is a rare species known from Argentina, Bolivia, Indonesia, Malaysia, Papua New Guinea, Philipines, and Taiwan (Hale 1965; Sipman 1993; Louwhoff & Elix 1999; Adler & Calvelo 2007). In Bolivia it was known previously from only a single locality (Hale 1965).

CHEMISTRY. Atranorin and protocetraric acid (see also Hale 1965).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco: PN Carrasco, Ch'iqta rumi, 17°28′44″S, 65°17′06″W, 2120 m, Yungas cloud forest, close to the river, on bark of tree, 2008, *Kukwa 6285* (LPB, UGDA); near Sehuencas village, 17°30′12″S, 65°16′30″W, 2220 m, Yungas cloud forest, along the road and close to the settlement, on bark of tree, 2008, *Flakus 10521, 10529, Kukwa 6323, 6436 & Rodriguez 754, 838* (KRAM, LPB, UGDA). DEPT. LA PAZ. Prov. Nor Youngas, arriba Coroico, cerca del campamento militario, *ca* 1600 m, on *Juniperus* sp., 1988, *Stab LB172* (LPB). DEPT. TARIJA. Prov. Aniceto Arce, Serranía de Propiedad Arnold, 22°13′19″S, 64°33′41″W, 1309 m, Tucumano-Boliviano forest, on bark, 2010, *Flakus 18720, 18736, 18741* (KRAM, LPB).

Parmotrema perlatum (Huds.) M. Choisy

Parmotrema chinense auct.

This widely distributed lichen species is known from all continents except Antarctica; for detailed distribution see Hale (1965) and Jabłońska *et al.* (2009). In Bolivia it was previously known only from historical records (Nylander 1859; Schmidt 1909; Herzog 1922); here the first contemporary localities of the species are reported.

CHEMISTRY. Atranorin, stictic acid complex and unidentified pigment in Rf class C3 (±) (see also Hale 1965).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PN Carrasco, near Sehuencas village, 17°30′12″S, 65°16′30″W, 2220 m, montane cloud forest, with some rocks in open place, on bark of

tree, 2008, *Kukwa 6435, 6501* (LPB, UGDA). DEPT. LA PAZ. Prov. Bautista Saavedra, 15 km de Charazani hacia Apolo, 15°11′S, 68°52′W, 2450 m, bosque seco, base de troncos, 1997, *Bach 271, 306 et al.* (B, LPB). DEPT. SANTA CRUZ. Prov. Florida, Refugio 'Los Volcanes' 18°06′S, 63°36′W, 1000 m, epífita, 1998, *Bach 611 et al.* (LPB). DEPT. LA PAZ. Prov. Bautista Saavedra, Yungas, on rock, 1988, *Stab 182C* (LPB). DEPT. TARIJA. Prov. Aniceto Arce, Papachacra, 21°41′36″S, 64°29′33″W, 2195 m, Tucumano-Boliviano montane forest, on bark, 2010, *Flakus 19868 & Quisbert* (KRAM, LPB).

Parmotrema rampoddense (Nyl.) Hale

It is very widely distributed, known from Africa (e.g., Cameroon, Madagascar, Mozambique), Asia (e.g., India, Taiwan), Australia, North America (e.g., Costa Rica, U.S.A., Mexico) and South America (e.g., Argentina, Bolivia, Brazil, Colombia) (Hale 1965; Calvelo & Liberatore 2002; Tenorio *et al.* 2002; Feuerer 2011 and literature cited therein). Previously only one locality was known from Bolivia (Hale 1965).

CHEMISTRY. Atranorin, α-collatolic and alectoronic acids and trace of unidentified pigment (±) (see also Hale 1965).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, PNANMI Cotapata, near Urpuma colony, 16°13′20″S, 67°52′34″W, 1989 m, Yungas montane forest, on bark, 2010, *Flakus 17239.1 & Rodriguez* (KRAM, LPB). DEPT. TARIJA. Prov. Aniceto Arce, Papachacra, 21°41′36″S, 64°29′33″W, 2195 m, Tucumano-Boliviano montane forest, on bark, 2010, *Flakus 19832, 19928 & Quisbert* (KRAM, LPB).

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

The species is commonly reported from all continents except Antarctica (López-Figueiras 1986; Swinscow & Krog 1988; Marcelli 1991; Sipman 1992; Feuerer *et al.* 1998; Louwhoff & Elix 2002; Tenorio *et al.* 2002; Divakar *et al.* 2005; Louwhoff 2009b; Del-Prado *et al.* 2011; Feuerer 2011). In Bolivia it was previously known from few records (Nylander 1859, 1861; Herzog 1922; Feuerer *et al.* 1998), of which the old ones may represent misidentifications of other taxa.

Similarly to *P. cetratum*, the species is variable in development of maculae; some specimens are distinctly reticulate-maculate, some have only sparse maculae, and there seem to be forms intermediate between those. Also, rhizine density and lobe shape show variation. According to Del-Prado *et al.* (2011), *P. reticulatum* s.l. is represented by several cryptic species, but neither morphology nor geography was conclusive for separation of those genetic lineages.

CHEMISTRY. Atranorin, salazinic and consalazinic acids (see also, e.g., Louwhoff & Elix 2002; Divakar & Upreti 2005; Louwhoff 2009b).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya: 10 km de Cocapata hacia Cotacajes, 16°38′S, 66°41′W, 2900 m, saxícola, 1997, *Bach 29a et al.* (LPB); 20 km de Cocapata hacia Cotacajes, 16°46′S, 66°44′W, 2000 m, bosque semisecundo disturbado, saxícola, 1997, *Bach 100 et al.* (LPB); Prov. Carrasco, PN Carrasco, near Sehuencas village, 17°30′12″S, 65°16′30″W, 2220 m, Yungas cloud forest, along the road and close to the settlement, on bark of tree, 2008, *Kukwa 6311, 6380, 6442, 6552* (LPB, UGDA). DEPT. LA PAZ. Prov. Nor Yungas: arriba de Coroico, cerca del campamento militar, 1600 m, on *Juniperus* sp., 1988, *Stab LB182, LB182b* (B, LPB); Hacienda Sacramento, ca. 8 km del camino principal de Chuspipata hacia Coroico, 16°24′S, 67°47′W, 2500 m, saxícola, 1997, *Bach 572 et al.* (B, LPB); Prov. Omasuyos, El Dragon hill near Chahualla, 15°51′17″S, 69°00′40″W, 3850 m, Puna Húmeda, on rock, 2010, *Flakus 17819 & Rodriguez* (KRAM, LPB). DEPT. TARIJA. Prov. Aniceto Arce, Papachacra, 21°41′54″S, 64°29′28″W, 2056 m, Tucumano-Boliviano montane forest, 2010, on bark, *Flakus 20036 & Quisbert* (KRAM, LPB).

Parmotremopsis antillensis (Vain.) Hale

The species is new for Bolivia. Elsewhere it is known from Costa Rica, Saint Lucia, Venezuela and the U.S.A. (Hale 1971; López-Figueiras 1986; Osorio *et al.* 1997; Tenorio *et al.* 2002).

CHEMISTRY. Atranorin, norstictic and connorstictic acids (see also Hale 1971).

SPECIMEN EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PN Carrasco, 130 km del camino antiguo de Cochabamba a Villa Tunari, 17°07′S, 65°36′W, 2200 m, bosque humedo, terrestre, 1997, *Bach 711 et al.* (LPB).

Pseudephebe pubescens (L.) M. Choisy

It is a bipolar species known from numerous records from all continents; for detailed information on its distribution see Feueruer (2011). It has been reported from Bolivia only recently (Feuerer & Sipman 2005; Flakus & Wilk 2006).

CHEMISTRY. Not tested.

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Franz Tamayo, ANMIN Apolobamba, near Puyo Puyo village, 15°56′55″S, 69°07′58″W, 4888 m, high Andean open vegetation, on rock, 2010, *Flakus 17596 & Rodriguez* (KRAM, LPB).

Pseudoparmelia hypomilta (L.) M. Choisy

The species is new for Bolivia; previously it was known only from Brazil and Peru (Hale 1976b; Honda *et al.* 1995; Elix & Nash 1998).

CHEMISTRY. Atranorin (±) and secalonic acid A; also traces of some unidentified compounds have been found (see also Hale 1976b; Honda *et al.* 1995; Elix & Nash 1998). Note: The specimen was analyzed twice from two different parts of the thallus; in one case no atranorin was detected, in accord with results given by Honda *et al.* (1995).

SPECIMEN EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Guarayos, Virgen de Pilar near Chonta village, Reserva Vida Silvestre Rios Blanco y Negro, 15°38′54″S, 62°57′37″W, 229 m, lowland Amazon forest, corticolous, 2009, *Flakus 13171 & Rodriguez* (KRAM, LPB).

Punctelia borreri (Sm.) Krog

The species is commonly reported from all continents except Antarctica; for more details see Feuerer (2011 and literature cited therein). In Bolivia the species was previously reported only by Nylander (1861).

CHEMISTRY. Gyrophoric acid and trace of atranorin (see also Swinscow & Krog 1988; Egan & Aptroot 2004; Louwhoff 2009c).

SPECIMEN EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PN Carrasco, near Sehuencas village, 17°30′12″S, 65°16′30″W, 2220 m, Yungas cloud forest, with some rocks in open place, on bark of tree, 2008, *Kukwa 6506* (LPB, UGDA).

Punctelia hypoleucites (Nyl.) Krog

The species is known only from rather scattered records in North America (Mexico, U.S.A.) (e.g., Nylander 1858; Culberson & Culberson 1980; Fryday *et al.* 2001; Thomson 2003; Egan & Aptroot 2004) and South America (Argentina, Brazil, Uruguay) (e.g., Osorio 1992a, b; Calvelo & Liberatore 2002). In this paper it is reported for the first time from Bolivia.

CHEMISTRY. Lecanoric acid and atranorin (see also Culberson & Culberson 1980; Egan & Aptroot 2004).

SPECIMEN EXAMINED. BOLIVIA. DEPT. TARIJA, Prov. Aniceto Arce, Filo de Sidras, near park guard camp, 2-hour drive from Tarija, 22°14′50″S, 64°33′28″W, 1064 m, Tucumano-Boliviano submontane forest, 2010, *Flakus 18412* (KRAM, LPB).

Punctelia reddenda (Stirt.) Krog

The species is new for Bolivia. Previously it was reported only from Africa (Madeira), Europe (France, Great Britain, Sweden) and South America (Brazil, Chile, Venezuela) (López-Figueiras 1986; Fleig & Riquelme 1991; Hafellner 1995; Galloway & Quillhot 1998; Santesson *et al.* 2004; Louwhoff 2009c; Feuerer 2011).

CHEMISTRY. Atranorin and two fatty acids (see also Swinscow & Krog 1988; Egan & Aptroot 2004; Louwhoff 2009c).

SPECIMEN EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PN Carrasco, near Sehuencas village by Rio Lopez Mendoza, 17°30′26″S, 65°16′55″W, 2226 m, montane cloud forest, on bark of tree, 2008, *Kukwa 6645* (LPB, UGDA).

Punctelia stictica (Duby) Krog

The species occurs in Africa (Madeira, South Africa), Europe (France, Italy, Norway), North America (Canada, Costa Rica, U.S.A.) and South America (Argentina, Bolivia, Colombia, Venezuela) (Doidge 1950; López-Figueiras 1986; Sipman 1992; Hafellner 1995; Fryday *et al.* 2001;

Calvelo & Liberatore 2002; Tenorio *et al.* 2002; Egan & Aptroot 2004; Santesson *et al.* 2004; Louwhoff 2009c; Feuerer 2011); from Bolivia reported previously only by Feuerer *et al.* (1998).

CHEMISTRY. Atranorin (±), gyrophoric and 4-O-methylgyrophoric (= congyrophoric acid) (±) acids, and orcinyl lecanorate (±) (see also Swinscow & Krog 1988; Egan & Aptroot 2004).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Arani, Cordillera de Tiraque, around headwater streams of Rio Macho Cueva near forks of streams flowing from Laguna Cajitilla Khocha and Laguna Yana Khocha, 17°23′S, 65°36′W, *ca* 3570 m, on sunny rock along the creek, 1985, *Lewis 85-171* (LPB); Prov. Quillacollo, East Cordillera, area of Incarraya-Sipesipe, 17°28′39″S, 64°21′43″W, 2846 m, semi-desert open area, saxicolous, 2004, *Flakus 4946* (KRAM, LPB). DEPT. LA PAZ. Prov. Bautista Saavedra: ANMIN Apolobamba, near Villa Amarca village, 15°16′47″S, 69°01′47″W, 4643 m, Puna Húmeda, on rock, 2010, *Flakus 17435 & Rodriguez* (KRAM, LPB); near Taypi Cañuma village, 15°03′20″S, 69°09′07″W, 4506 m, high Andean open vegetation, on soil, 2010, *Flakus 17521.1 & Rodriguez* (KRAM, LPB); Prov. Camacho, Pacoamba cerca Wila Kala, 15°24′40″S, 69°04′24″W, 4283 m, Puna Húmeda, 2010, *Flakus 17771.2 & Rodriguez* (KRAM, LPB); Prov. Murillo: near Cumbre pass, 16°20′14″S, 68°02′20″W, 4672 m, high Andean Puna, terricolous, 2006, *Flakus 5708, 5781* (KRAM, LPB); near Cumbre pass, 16°21′59″S, 68°02′37″W, 4604 m, high Andean Puna, saxicolous, 2009, *Flakus 16273, 16279, 16283 & Rodriguez* (KRAM, LPB); Yanacachi, arriba de La Mina Chojlla, 3000 m, piedra, 1987, *Stab LB660* (LPB); Prov. Nor Yungas, Valle Unduavi, arriba de Huallara, 4100 m, roca, 1988, *Stab LB121* (LPB); Prov. Franz Tamayo, ANMIN Apolobamba, near Puyo Puyo village, 15°56′55″S, 69°07′58″W, 4795 m, high Andean open vegetation, on soil, 2010, *Flakus 17651.1 & Rodriguez* (KRAM, LPB). DEPT. ORURO. Prov. Sajama, PN Sajama, Jecha K′ala 25 km of Sajama village, 18°09′52″S, 68°49′08″W, 4184 m, Puna Sureña, Pajonales vegetation, on soil, 2010, *Flakus 16675 & Rodriguez* (KRAM, LPB).

Relicina abstrusa (Vain.) Hale

This is a pantropical species known from Africa (Kenya), Asia (e.g., Japan, Malaysia, Papua New Guinea, Philipines), Australia, southeastern U.S.A. and the Neotropics (e.g., Brazil, Costa Rica, Cuba, Guatemala, Honduras, Venezuela) (Elix 1996). Here the species is reported for the first time from Bolivia.

CHEMISTRY. Usnic, norstictic and connorstictic acids, trace of atranorin (±), unidentified substance similar to xanthone (±) (see also Elix 1996).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Ayopaya, 20 km de Cocapata hacia Cotacajes, 16°46′S, 66°44′W, 2000 m, epífita, 1997, *Bach 79, 109, 115 et al.* (B, LPB).

Remototrachyna costaricensis (Nyl.) Divakar & A. Crespo

Hypotrachyna costaricensis (Nyl.) Hale

The species is widespread and common in the Neotropics and has also been reported from Asia, Australia, Papua New Guinea, India and the Azores (Hale 1975; Sipman *et al*. 2009 and literature cited therein). In Bolivia only four localities were known previously (Sipman *et al*. 2009). The new records suggest that the species is common in this country, but only in humid Yungas forests.

Hale (1975) and Divakar and Upreti (2005) reported protolichesterinic and possibly caperatic acids as fatty acids occurring in *R. costaricensis*; however, Sipman *et al*. (2009) concluded that the species contains constipatic acid with related substances. Most of the samples we examined produced the same substances as they reported (compared with specimens from B), but in a very few of them only atranorin was detected (each such sample was examined at least twice). That chemotype was reported by Marcelli and Ribeiro (2002) for *Parmelinella inexplicabilis* Ribeiro & Marcelli, which Sipman *et al.* (2009) consider a synonym of *R. costaricensis*.

CHEMISTRY. Atranorin, constipatic acid complex (±, only very rarely absent), unidentified pigment (±, in one specimen only) (see also Sipman *et al.* 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Valle de Zongo, bajando la cumbre a 23 km, 3050 m, 1986, *Beck 13119* (LPB); Prov. Nor Yungas: between Coroico and La Paz towns, 16°13′09″S, 67°49′32″W, 2600 m, 2008, *Kukwa 7192* (LPB, UGDA);

Coscapa, 3200–3350 m, 16°23′S, 67°54′W, 1997, *Bach et al. 499* (LPB); PNANMI Cotapata, by Sillu Tincara pre-Columbian route, 3429 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16843, 16844, 16900 & Rodriguez* (KRAM, LPB, herb. Flakus); by Sillu Tincara pre-Columbian route, 3430 m, 16°16′33″S, 67°52′60″W, 2010, *Flakus 16903 & Rodriguez* (KRAM, LPB); near Urpuma colony, 1989 m, 16°13′20″S, 67°52′34″W, 2010, *Flakus 17122, 17189, 17328 & Rodriguez* (KRAM, LPB, herb. Flakus). Dept. Santa Cruz. Prov. Caballero, Siberia region near La Palma, 2583 m, 17°49′12″S, 64°40′28″W, 2004, *Flakus 4756* (KRAM, LPB).

Stereocaulon glareosum (Savicz) H. Magn.

Stereocaulon glareosum is a boreal-arctic, alpine-subalpine, circumpolar species of the Northern Hemisphere (Thomson 1984), extending to the northern part of South America, where it has been listed from Bolivia, Colombia, Ecuador and Peru (Lamb 1977; Feuerer *et al.* 1998).

Chemistry. Atranorin and lobaric acid (see also Lamb 1977).

Specimens examined. BOLIVIA. Dept. La Paz. Prov. Murilo: La Paz, *ca* 15 km Hacia el N, Pie del cerro Huajna Potosi, 4800 m, entre rocas de granito, 1981, *Beck 4766* (LPB); auf erde und Gestein Nebelwald, unterhalb Aldea Taquesi, in Nischen ob. Aldea Taquesi am Gmino d. Inca, *ca* 4500 m, Steinen, 1987, *Stab s.n.* (LPB).

Stereocaulon microcarpum Müll. Arg.

Up to now *S. microcarpum* has been found in Latin America in Bolivia, Brazil, Colombia, Ecuador, Peru, Venezuela, Costa Rica, El Salvador, Mexico and the Galapagos Islands. This species is mostly restricted to the Neotropics but was also reported from Tahiti (Lamb 1977).

Chemistry. Atranorin, stictic and norstictic acids, also traces of other related substances (±); the species is chemically variable and, accordingly to Lamb (1977), the studied material belongs to so-called ‘deficient phase IV’.

Specimens examined. BOLIVIA. Dept. La Paz. Prov. Murillo, Valle de Zongo, Laguna Viscachani, 3900 m, Cardillera Real, tajo rocado, rocas, suelo, 1988, *Stab 128* (LPB); Prov. Franz Tamayo, ANMIN Apolobamba, near Puyo Puyo village, 15°56′55″S, 69°07′58″W, 4888 m, high Andean open vegetation, 2010, *Flakus 17584* & *Rodriguez* (KRAM, LPB).

Stereocaulon pityrizans Nyl.

The species has been noted in South and Central America from Bolivia, Colombia, Costa Rica, Peru and Venezuela (Lamb 1977; Sipman 1992).

Chemistry. Atranorin, stictic and norstictic acids, also traces of other related substances (±) (see also Lamb 1977).

Specimens examined. BOLIVIA. Dept. La Paz. Prov. Nor Yungas: 5 km del camino principal de Chuspipata hacia Corocio, 16°23′S, 67°48′W, 2700 m, pared rocosa en el borde de camino, 1997, *Bach 550 et al.* (LPB); PN Cotapata, 16°17′ S, 67°51′W, 3050 m, bosque alto monto, alterado, 1998, *Franken, Meneses & Villavicencio 12*, *14* (LPB).

Type material examined. PERUVIA. Carabaya, *Weddell* (H-NYL 40143 – lectotype).

Stereocaulon ramulosum (Sw.) Raeusch.

Stereocaulon ramulosum is widespread in the tropics. In the Neotropics it has been found in Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Costa Rica, Mexico, Cuba, Dominican Republic and Puerto Rico (Lamb 1977; Galloway 1980; Feuerer *et al*. 1998). In Bolivia it is the commonest member of the genus (see also Feuerer *et al.* 1998).

Eight varieties and five forms have been described within *S. ramulosum* (Lamb 1977, 1978); in Bolivia, *S. ramulosum* var. *exalbidium* (Nyl.) I.M. Lamb, *S. ramulosum* var. *macrocarpum* (A. Rich.) C. Bab. and *S. ramulosum* f. *tomentosulum* I.M. Lamb were reported (Lamb 1977, 1978). However, due to the presence of transitional forms between those taxa, all samples have been classified as *S. ramulosum*.

Chemistry. Atranorin and perlatolic acid (see also Lamb 1977; Boekhout 1982).

Specimens examined. BOLIVIA. Dept. Cochabamba. Prov. Ayopaya, comunidad de Saila Pata, 16°55′S, 66°55′W, 3500 m, sendero con rocas en bosque siempreverde con *Podocarpus* y *Polylepis*, saxicola,

1997, *Bach 908 & Jimenez* (LPB); Prov. Carrasco, PN Carrasco, near Phaqcha, 17°27′13″S, 65°16′44″W, 2850 m, montane cloud forest, on stone, 2008, *Kukwa 6198* (LPB, UGDA); Prov. Chapare, near Incachaca village, 17°14′09″S, 65°48′51″W, 2198 m, 2006, *Flakus 7809, 7839, 7841* (KRAM, LPB). DEPT. LA PAZ. Prov. Murillo, Valle de Zongo, Laguna Viscachani, 3840 m, zona rocosa con pocas macrófitas, roca, 1988, *Stab s.n.* (LPB); Prov. Nor Yungas: Coscapa, senda al oueste del camino principial *ca* 4 km de Cotapata hacia La Paz, 16°23′S, 67°53′W, 3300–3450 m, pastizal con rocas de 1 m de diametro, saxicola, 1997, *Bach 473, 480 et al.* (LPB); near Pacallo village, 16°12′10″S, 67°50′39″W, 1360 m, 2008, *Flakus 11829* (KRAM, LPB); PNANMI Cotapata, 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, 16°16′33″S, 67°52′60″W, 3429 m, Yungas montane cloud forest, 2010, *Flakus 16926 & Rodriguez* (KRAM, LPB); near Urpuma colony, 16°13′20″S, 67°52′34″W, 1989 m, Yungas montane forest, 2010, *Flakus 17253 & Rodriguez* (KRAM, LPB); between Coroico and La Paz towns, 16°13′09″S, 67°49′32″W, 2600 m, open place in mountain cloud forest, on ground, 2008, *Kukwa 7199, 7200, 7202* (LPB, UGDA). DEPT. PANDO. Prov. Manuripi, Puerto Madre de Dios village, Reserva Natural de Vida Silvestre Amazónica Manuripi, 11°27′38″S, 67°15′56″W, 166 m, lowland Amazon forest, 2006, *Flakus s.n*. (KRAM, LPB). DEPT. SANTA CRUZ. Prov. Caballero, Siberia village, 17°49′38″S, 64°45′14″W, 3480 m, 2004, *Flakus 4480, 4490* (KRAM, LPB). DEPT. TARIJA. Prov. Aniceto Acre, Papachacra, 21°41′36″S, 64°29′33″W, 2195 m, 2010, *Flakus 19817 & Quisbert* (KRAM, LPB).

EXSICCATES EXAMINED. Mattsson, *Lich. Austroamer. Regnelliano* 530, 531 (BM); Vězda, *Lich. Sel. Exs*. 1964 (LOD).

Stereocaulon strictum Th. Fr.

Stereocaulon strictum is restricted to the Neotropics, where it has been reported from Bolivia, Costa Rica, Ecuador, Colombia, Mexico, Peru and Venezuela (Lamb 1977; Feuerer *et al.* 1998).

The species is characterized by the presence of porphyrillic acid and the frequent presence of soredia produced on spathulate structures at the apices of the pseudopodetia or simply at the tips of pseudopodetia and/or phyllocladia, but in fertile specimens soredia may be almost or entirely absent (Lamb 1977, 1978). According to Lamb (1977) and Feuerer *et al*. (1998), two varieties of *S. strictum*, var. *strictum* and var. *compressum* (Nyl.) I. M. Lamb, occur in Bolivia. They differ in the development of soredia, which in *S. strictum* var. *strictum* are absent or sparse, and then they are effuse and occur on the ends of the pseudopodetia or phyllocladia; in var. *compressum* the soredia are well developed, occurring on one side of flattened-spathulate apices of pseudopodetia (see Lamb 1977, 1978). In many tested specimens these features were not sharply developed, however, and therefore all samples have been classified as *S. strictum* s.l. The distinction between the two varieties needs further confirmation by molecular analyses.

CHEMISTRY. Atranorin and porphyrilic acid (see also Lamb 1977).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PN Carrasco, near Phaqcha, 17°2713″S, 65°16′44″W, 2850 m, montane cloud forest, 2008, *Flakus 10201 & Kukwa 6248* (KRAM, LPB, UGDA); Prov. Chapare: Cerca de la carretera Cochab-Villa tunari, 3250 m, suelo, 1988, *Arrâzol 752 & Hensen 63* (LPB); Pongo, cerca de la cumbre *ca* 35 km sobre la carretera La Paz - Yungas, *ca* 4200 m, 1989, *Stab s.n.* (LPB). DEPT. LA PAZ. Prov. Nor Yungas: PNANMI Cotapata, 5-hour drive from Unduavi by Sillu Tincara pre-Columbian route, 16°16′33″S, 67°52′60″W, 3429 m, Yungas montane cloud forest, 2010, *Flakus 16888 & Rodriguez* (KRAM, LPB); *ca* 10 km from Unduavi, 3225 m, 1982, *Meenkes & Ybert 419* (LPB); bajando amino a los Yungas, 4500 m, pendiente de tierra movida al lado del camino, suelo, pequeñas piedras, 1989, *Stab 85-169* (LPB); Valle de los Yungas, 1997, *s.coll*. (LPB); 2 km del camino principal de Chuspipata hacia Coroico, 16°22′S, 67°49′W, 2900 m, saxicola, 1997, *Bach 540 et al.* (LPB); between Coroico and La Paz towns, 16°13′09″S, 67°49′32″W, 2600 m, 2008, *Kukwa 7198, 7201* (LPB, UGDA). DEPT. SANTA CRUZ. Prov. Caballero, Siberia region near La Palma village, 17°49′12″S, 64°40′28″W, 2582 m, Yungas montane cloud forest, 2004, *Flakus 4570* (KRAM, LPB, UGDA).

Stereocaulon tomentosum Th. Fr.

It is a circumpolar, boreal-montane species of the Northern Hemisphere, extending to South America, where it has been reported from Bolivia, Colombia, Ecuador, Peru and Venezuela (Lamb 1977; Feuerer *et al*. 1998).

CHEMISTRY. Atranorin, stictic and norstictic acids, also traces of other related substances (±) (see also Lamb 1977).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Murillo, Zongo valley, along the road near Laguna Viscachani, 3750 m, 1982, *Meenks & Ybert s.n.* (LPB).

Stereocaulon vesuvianum Pers.

Stereocaulon vesuvianum occurs in the Northern and Southern Hemispheres, and is practically cosmopolitan and circumpolar. In South America it was recorded only in Bolivia, Peru and Venezuela (López-Figueiras 1986; Sipman 1992; Feuerer & Sipman 2005).

It is a very variable species, with several infraspecific taxa distinguished (two of them reported from Bolivia; see Lamb 1977, 1978). Many of those represent forms which are only the result of adaptation to different environmental conditions and should not be distinguished (see Boekhout 1982). In the studied Bolivian material there were no definitive characters to distinguish any of the infrageneric taxa recognized so far, confirming Boekhout's position.

CHEMISTRY. Atranorin, stictic and norstictic acids, also traces of other related substances (±) (see also Lamb 1977).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Manco Kapac, near Copacabana village, Mt. Horca del Inca, 16°10′15″S, 69°05′05″W, 3974 m, high Andean Puna vegetation, 2006, *Flakus 8647* (KRAM, LPB).

TYPE MATERIAL EXAMINED. ITALY. Vesuvi crater, *s. coll*. (H-ACH 1761 – isolectotype).

Xanthoparmelia taractica (Kremp.) Hale

This terricolous lichen has been reported from Bolivia by Hale (1990), Nash *et al.* (1995) and Feuerer *et al.* (1998). In the Neotropics it is also known from Argentina, Chile, Colombia, Mexico, Uruguay and Venezuela; elsewhere it has been recorded in Canada and the U.S.A., China, South Korea, New Zealand and Australia (Thomson 1984; López-Figueiras 1986; Hale 1990; Nash *et al.* 1995, Feuerer 2011).

CHEMISTRY. Usnic acid, salazinic and consalazinic acids (see also Hale 1990; Nash *et al.* 1995).

SPECIMEN EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, PN Carrasco, Monte Punku village, 17°35′01″S, 65°18′03″W, 2800 m, open place, on soil, 2008, *Kukwa 6151* (LPB, UGDA).

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REFERENCES

ADLER M. T. & CALVELO S. 2007. Ampliación de las distribuciones de especies de Parmeliaceae (Ascomycota liquenizados) en la República Argentina. *Bol. Soc. Argent. Bot.* **42**(1–2): 1–11.

ADLER M. T. & ELIX J. A. 1992. New records of *Hypotrachyna* and *Parmelinopsis* lichens (Ascomycotina, Parmeliaceae) from northwest and central Argentina. *Mycotaxon* **43**: 283–288.

BOEKHOUT T. 1982. Studies on Colombian cryptogams XVIII. The genus *Stereocaulon* (Schreber) Hoffmann (Lichenes). *J. Hattori Bot. Lab.* **53**: 483–511.

CALVELO S. & LIBERATORE S. 2002. Catálogo de los líquenes de la Argentina. *Kurtziana* **29**(2): 7–170.

CANSECO A., ANZE R. & FRANKEN M. 2006. Comunidades de liquenes: indicadores de la calidad del aire en la ciudad de La Paz, Bolivia. *Acta Nova* **3**(2): 286–307.

CRESPO A., KAUFF F., DIVAKAR P. K., DEL PRADO R., PÉREZ-ORTEGA S., AMO DE PAZ G., FERENCOVA Z., BLANCO O., ROCA-VALIENTE B., NÚÑEZ-ZAPATA J., CUBAS P., ARGÜELLO A., ELIX J. A., ESSLINGER T. L., HAWKSWORTH D. L., MILLANES A., MOLINA M. C., WEDIN M., AHTI T., APTROOT A., BARRENO E., BUNGARTZ F., CALVELO S., CANDAN M., COLE M., ERTZ D., GOFFINET B., LINDBLOM L., LÜCKING R., LUTZONI F., MATTSSON J.-E., MESSUTI M. I.,

MIADLIKOWSKA J., PIERCEY-NORMORE M., RICO V. J., SIPMAN H. J. M., SCHMITT I., SPRIBILLE T., THELL A., THOR G., UPRETI D. K. & LUMBSCH H. T. 2010. Phylogenetic generic classification of parmelioid lichens (Parmeliaceae, Ascomycota) based on molecular, morphological and chemical evidence. *Taxon* **59**(6): 1735–1753.

CULBERSON C. F. & KRISTINSSON H. 1970. A standardized method for the identification of lichen products. *J. Chromatogr.* **46**: 85–93.

CULBERSON W. L. & CULBERSON C. F. 1968. The lichen genera *Cetrelia* and *Platismatia* (Parmeliaceae). *Contr. U.S. Natl. Herb.* **34**: 449–558.

CULBERSON W. L. & CULBERSON C. F. 1980. Microconidial dimorphism in the lichen genus *Parmelia*. *Mycologia* **72**(1): 127–135.

CULBERSON W. L. & CULBERSON C. F. 1981. The genera *Cetrariastrum* and *Concamerella* (Parmeliaceae): a chemosynthetic synopsis. *Bryologist* **84**: 273–314.

DEL-PRADO R., DIVAKAR P. K. & CRESPO A. 2011. Using genetic distances in addition to ITS molecular phylogeny to identify potential species in the *Parmotrema reticulatum* complex: a case study. *Lichenologist* **43**(6): 569–583.

DIVAKAR P. K. & UPRETI D. K. 2005, Parmelioid lichens in India (a revisionary study). National Botanical Research Institute, Lucknow.

DIVAKAR P. K., BLANCO O., HAWKSWORTH D. L. & CRESPO A. 2005. Molecular phylogenetic studies on the *Parmotrema reticulatum* (syn. *Rimelia reticulata*) complex, including the confirmation of *P. pseudoreticulatum*. *Lichenologist* **37**(1): 55–65.

DOIDGE E. M. 1950. The South African fungi and lichens to the end of 1945. *Bothalia* **5**: 1–1094.

EGAN R. S. 2004. *Flavopunctelia*. In: T. H. NASH III, B. D. RYAN, P. DIEDERICH, C. GRIES & F. BUNGARTZ (eds), *Lichen flora of the Greater Sonoran Desert Region.* **2**: 111–114. Lichens Unlimited, Arizona State University, Tempe.

EGAN R. S. & APTROT A. 2004. *Punctelia*. In: T. H. NASH III, B. D. RYAN, P. DIEDERICH, C. GRIES & F. BUNGARTZ (eds), *Lichen Flora of the Greater Sonoran Desert Region.* **2**: 431–436. Lichens Unlimited, Arizona State University, Tempe.

ELIX J. A. 1996. A revision of the lichen genus *Relicina*. *Biblioth. Lichenol.* **62**: 1–150.

ELIX J. A. & NASH T. H. III 1998. A monograph of the lichen genus *Pseudoparmelia* (Ascomycotina, Parmeliaceae). *Bryologist* **100**(4/1997): 482–498.

ELVEBAKK A. 2011. A review of the genus *Hypogymnia* (Parmeliaceae) in Chile. *Bryologist* **114**(2): 379–388.

FEUERER T. (ed.) 2011. Checklists of lichens and lichenicolous fungi. Version 1 January 2011. http://www.checklists.de.

FEUERER T. & SIPMAN H. J. M. 2005. Additions to the lichenized and lichenicolous fungi of Bolivia. *Herzogia* **18**: 139–144.

FEUERER T., AHTI T. & VITIKAINEN O. 1998. Lichenological investigations in Bolivia. In: M. P MARCELLI & M. R. D. SEAWARD (eds), *Lichenology in Latin America: history, current knowledge and applications*, pp. 71–86. CETESB, São Paulo.

FLAKUS A. 2008. Contributions to the knowledge of the lichen biota of Bolivia. 2. *Polish Bot. J.* **53**(2): 145–153.

FLAKUS A. 2009. *Aspidothelium lueckingii*: a new lichenized fungus from Bolivia. *Nova Hedwigia* **88**(1–2): 139–143.

FLAKUS A. 2010. The biological diversity of tropical South America: Bolivian lichens – a case study. http://botan.botany.pl/lichens-bolivia/en,strona,home,1.html.

FLAKUS A. & KUKWA M. 2007. New species and records of *Lepraria* (Stereocaulaceae, lichenized Ascomycota) from South America. *Lichenologist* **39**(5): 463–474.

FLAKUS A. & KUKWA M. 2009. Additions to the biota of lichenized fungi of Poland. *Acta Mycol.* **44**(2): 249–257.

FLAKUS A. & LÜCKING R. 2008. New species and additional records of foliicolous lichenized fungi from Bolivia. *Lichenologist* **40**(5): 423–436.

FLAKUS A. & WILK K. 2006. Contribution to the knowledge of the lichen biota of Bolivia. *J. Hattori Bot. Lab.* **99**: 307–318.

FLAKUS A., ELIX J. A., RODRIGUEZ P. & KUKWA M. 2011. New species and records of *Lepraria* (Stereocaulaceae, lichenized Ascomycota) from South America. *Lichenologist* **43**(1): 57–66.

FLEIG M. & RIQUELME I. 1991. Líquens de Piraputanga, Mato Grosso do Sul, Brasil. *Acta Bot. Bras.* **5**(1): 3–12.

FRYDAY A. M., FAIR J. B., GOOGE M. S., JOHNSON A. J., BUNTING E. A. & PRATHER L. A. 2001. Checklist of lichens and allied fungi of Michigan. *Contr. Univ. Michigan Herb.* **23**: 145–223.

GALLOWAY D. J. 1980. The lichen genera *Argopsis* and *Stereocaulon* in New Zeland. *Bot. Not.* **133**: 261–279.

GALLOWAY D. J. & QUILHOT W. 1998. Checklist of Chilean lichen-forming and lichenicolous fungi. *Gayana Botanica* **55**(2): 111–185.

HAFELLNER J. 1995. A new checklist of lichens and lichenicolous fungi of insular Laurimacaronesia including a lichenological bibliography for the area. *Fritschiana* **5**: 1–132.

HALE M. E. 1965. A monograph of *Parmelia* subgenus *Amphigymnia*. *Contr. U. S. Natl. Herb.* **36**(5): 193–358.

HALE M. E. 1971. Two species of *Parmelia* new to North America. *Bryologist* **74**: 44–47.

HALE M. E. 1975. A revision of the lichen genus *Hypotrachyna* (Parmeliaceae) in tropical America. *Smithsonian Contr. Bot*. **25**: 1–73.

HALE M. E. 1976a. A monograph of the lichen genus *Bulbothrix* Hale (Parmeliaceae). *Smithsonian Contr. Bot*. **32**: 1–29.

HALE M. E. 1976b. A monograph of the lichen genus *Pseudoparmelia* Lynge (Parmeliaceae). *Smithsonian Contr. Bot*. **31**: 1–62.

HALE M. E. 1990. A synopsis of the lichen genus *Xanthoparmelia* (Vainio) Hale (Ascomycotina, Parmeliaceae). *Smithsonian Contr. Bot*. **74**: 1–250.

HERZOG T. 1922. Beitrag zur Flechtenflora von Bolivia. *Hedwigia* **63**: 263–268.

HONDA N. K., DEVINCENZI I. A. A. & FILHO L. X. 1995. Secalonic acid A from *Pseudoparmelia sphaerospora* (Nyl.) Hale and *P. hypomilta* (Fée) Hale (Parmeliaceae). *Trop. Bryol.* **10**: 201–204.

JABŁOŃSKA A., OSET M. & KUKWA M. 2009. The lichen family Parmeliaceae in Poland I. The genus *Parmotrema*. *Acta Mycol.* **44**(2): 211–222.

KNUDSEN K. & FLAKUS A. 2009. *Acarospora ramosa* (Acarosporaceae), a new effigurate yellow species from South America. *Nova Hedwigia* **89**(3–4): 349–352.

KRZEWICKA B. & FLAKUS A. 2010. New records of the genus *Umbilicaria* (Umbilicariaceae, lichenized Ascomycota) from Bolivia. *Cryptog. Mycol.* **31**(4): 441–451.

KUKWA M. 2006. The lichen genus *Lepraria* in Poland. *Lichenologist* **38**(4): 293–305.

KUKWA M. 2011. *Botryolepraria neotropica* found in the Paleotropics. *Graphis Scripta* **23**: 8–9.

KUKWA M. & PÉREZ-ORTEGA S. 2010. A second species of *Botryolepraria* from the Neotropics and the phylogenetic placement of the genus within Ascomycota. *Mycol. Progr.* **9**(3): 345–351.

KUKWA M., PIETNOCZKO M. & CZYŻEWSKA K. 2012. The lichen family Parmeliaceae in Poland II. The genus *Cetrelia*. *Acta Soc. Bot. Poloniae* (accepted for publication).

LAMB I. M. 1977. A conspectus of the lichen genus *Stereocaulon* (Schreb.) Hoffm. *J. Hattori Bot. Lab.* **43**: 191–355.

LAMB I. M. 1978. Keys to the species of the lichen genus *Stereocaulon* (Schreb.) Hoffm. *J. Hattori Bot. Lab.* **44**: 209–250.

LAUNDON J. R. 1992. *Lepraria* in the British Isles. *Lichenologist* **24**(4): 315–350.

LENDEMER J. C. & HEWITT D. A. 2002. A catalogue of the type specimens of lichens in the Herbarium of the Academy of Natural Sciences of Philadelphia. *Proc. Acad. Nat. Sci. Philadelphia* **152**: 173–204.

LÓPEZ-FIGUEIRAS M. 1986. Censo de macrolíquenes venezolanos de los estados Falcon, Lara, Merida, Tachira y Trujillo. Facultad de Farmacia, Universidad de Los Andes, Merida.

LOUWHOFF S. H. J. J. 2009a. *Parmelinopsis* Elix & Hale (1987). In: C. W. SMITH, A. APTROOT, B. J. COPPINS, A. FLETCHER, O. L. GILBERT, P. W. JAMES & P. A. WOLSELEY (eds), *The lichens of Great Britain and Ireland*, pp. 658–659. British Lichen Society, London.

LOUWHOFF S. H. J. J. 2009b. *Parmotrema* A. Massal. (1860). In: C. W. SMITH, A. APTROOT, B. J. COPPINS, A. FLETCHER, O. L. GILBERT, P. W. JAMES & P. A. WOLSELEY (eds), *The lichens of Great Britain and Ireland*, pp. 661–663. British Lichen Society, London.

LOUWHOFF S. H. J. J. 2009c. *Punctelia* Krog (1982). In: C. W. SMITH, A. APTROOT, B. J. COPPINS, A. FLETCHER, O. L. GILBERT, P. W. JAMES & P. A. WOLSELEY (eds), *The lichens of Great Britain and Ireland*, pp. 769–771. British Lichen Society, London.

LOUWHOFF S. H. J. J. & ELIX J. A. 1999. *Parmotrema* and allied lichen genera in Papua New Guinea. *Biblioth. Lichenol.* **73**: 1–152.

LOUWHOFF S. H. J. J. & ELIX J. A. 2002 The Parmeliaceae (lichenized Ascomycota) of New Caledonia. *Lichenologist* **34**(5): 373–394.

MARCELLI M. P. 1991. Aspects of the foliose lichen flora of the southern-central coast of Sao Paulo State, Brazil. In: D. J. GALLOWAY (ed.), *Tropical lichens: their systematics, conservation, and ecology. The systematics association special volume*, pp. 150–170. Clarendon Press, Oxford.

MARCELLI M. P. & RIBEIRO C. H. 2002. Twenty-one new species of Parmeliaceae (lichenized fungi) from southeastern Brazil. *Mitt. Inst. Allg. Bot. Hamburg* **30–32**: 125–155.

NASH III T. H., GRIES C. & ELIX J. A. 1995. A revision of the lichen genus *Xanthoparmelia* in South America. *Biblioth. Lichenol*. **56**: 1–158.

NEUWIRTH G. 2008. Further studies on lichens from Venezuela with new and interesting records. *Herzogia* **21**: 147–156.

NYLANDER W. 1858. Lichenes collecti in Mexico a Fr. Müller. *Flora* **41**: 377–381.

NYLANDER W. 1859. Lichenes in regionibus exoticis quibusdam vigentes exponit synopticis enumerationibus. *Ann. Sci. Nat., Bot.* **11**: 205–264.

NYLANDER W. 1861. Additamentum ad lichenographiam Andium Boliviensium. *Ann. Sci. Nat., Bot.* **15**: 365–382.

ORANGE A., JAMES P. W. & WHITE F. J. 2001. Microchemical methods for the identification of lichens. British Lichen Society, London.

OSORIO H. S. 1992a. Contribucion a la flora liquénica del Uruguay. XXV. Lichenes publicados entre 1972 a 1991. *Anales Mus. Hist. Nat. Montevideo* **8**: 43–70.

OSORIO H. S. 1992b. Contribution to the lichen flora of Brazil. XXIX. Lichens from Ponta Porá, Mato Grosso do Sul. *Comun. Bot. Mus. Hist. Nat. Montevideo* **98**(5): 1–6.

OSORIO H. S., AGUIAR L.W. & MARTAU L. 1997. Contribuição à flora liquênica do Brasil XXXIII. Liquens do Estado do

Rio Grande do Sul: Depressão Central. *Iheringia, Bot.* **49**: 11–20.

RODRIGUEZ P., FLAKUS A., KUKWA M., LÜCKING R., ISELA MENESES R., RIVAS PLATA E., STANTON D., TRUONG C. & VARGAS R. 2010. Preliminary catalogue of lichens and lichenicolous fungi from Bolivia. W. Szafer Institute of Botany PAS, Krakow. [Version 1.1, September 2010]. http://botan.botany.pl/lichens-bolivia.

RUSBY H. H. 1895. An enumeration of the plant collected in Bolivia by Miguel Bang, with description of new genera and species. Part II. *Mem. Torrey Bot. Club* **4**(3): 203–274.

SANTESSON R., MOBERG R., NORDIN A., TØNSBERG T. & VITIKAINEN O. 2004. Lichen-forming and lichenicolous fungi of Fennoscandia. Museum of Evolution, Uppsala University, Uppsala.

SCHMIDT J. 1909. Flora of Koh Chang. Contribution to the knowledge of the vegetation in the Gulf of Siam. Part IX. *Bot. Tidsskr.* **29**: 1–152.

SIPMAN H. J. M. 1980. Studies on Colombian Cryptogams. X. The genus *Everniastrum* Hale and related genera (Lichenes). *Proc. Kon. Ned. Akad. Wetensch., Ser. C, Biol. Med. Sci.* **83**: 333–354.

SIPMAN H. J. M. 1986. Notes on the lichen genus *Everniastrum* (Parmeliaceae). *Mycotaxon* **26**: 235–251.

SIPMAN H. J. M. 1992. The origin of the lichen flora of the Colombian páramos. In: H. BALSLEV & J. L. LUTEYN (eds), *Páramo, Andean ecosystem under human influence*, pp. 95–109. Academic Press, London.

SIPMAN H. J. M. 1993. Lichens from Mount Kinabalu. *Trop. Bryol.* **8**: 281–314.

SIPMAN H. J. M., ELIX J. A. & NASH III T. H. 2009. *Hypotrachyna* (Parmeliaceae, lichenized *Fungi*). *Fl. Neotrop. Monogr*. **104**: 1–173.

SWINSCOW T. D. V. & KROG H. 1988. Macrolichens of East africa. British Museum (Natural History), London.

TENORIO L. U., SIPMAN H. J. M. & LÜCKING R. 2002. Preliminary checklist of lichens from Costa Rica. Version 1.2 (June 2002). http://archive.fieldmuseum.org/ticolichen/checklist.html.

THIERS B. 2011. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/ih.

THOMSON J. W. 1984. American Arctic Lichens 1. The Macrolichens. Columbia University Press, New York.

THOMSON J. W. 2003. Lichens of Wisconsin. Wisconsin State Herbarium, Dept. of Botany, Univ. of Wisconsin, Madison.

TØNSBERG T. 1992. The sorediate and isidiate, corticolous, crustose lichens in Norway. *Sommerfeltia* **14**: 1–331.

WOLSELEY P. A., AGUIRRE-HUDSON B. & MCCARTHY P. 2002. Catalogue of the lichens of Thailand. *Bull. Nat. Hist. Mus. London, Bot.* **32**(1): 13–59.

YOSHIMURA I. 1995. The lichen genus *Anzia* (Parmeliaceae, Lecanorales) in Central and South America. In: F. J. A. DANIELS, M. SCHULZ & J. PEINE (eds), *Flechten Follmann. Contributions to lichenology in honour of Gerhard Follmann*, pp. 377–387. Geobotanical and Phytotaxonomical Study Group, Botanical Institute, University of Cologne, Cologne.

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