

A CONTRIBUTION TO THE LICHEN FAMILY GRAPHIDACEAE (OSTROPALES, ASCOMYCOTA) OF BOLIVIA. 2

ULF SCHIEFELBEIN, ADAM FLAKUS, HARRIE J. M. SIPMAN,
MAGDALENA OSET & MARTIN KUKWA¹

Abstract. Microlichens of the family Graphidaceae are important components of the lowland and montane tropical forests in Bolivia. In this paper we present new records for 51 taxa of the family in Bolivia. *Leiorreuma lyellii* (Sm.) Staiger is reported as new for the Southern Hemisphere, while *Diploschistes caesioplumbeus* (Nyl.) Vain., *Graphis daintreensis* (A. W. Archer) A. W. Archer, *G. duplicatoinspersa* Lücking, *G. emersa* Müll. Arg., *G. hossei* Vain., *G. immersella* Müll. Arg. and *G. subchrysocharpa* Lücking are new for South America. Thirty taxa are reported for the first time from Bolivia. Notes on distribution are provided for most species.

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

Ulf Schiefelbein, Blücherstr. 71, D-18055 Rostock, Germany

Adam Flakus, Laboratory of Lichenology, W. Szafer Institute of Botany, Polish Academy of Sciences, Lubicz 46, 31-512 Kraków, Poland

Harrie J. M. Sipman, Botanischer Garten & Botanisches Museum Berlin Dahlem, Königin-Luise-Strasse 6–8, D-14195 Berlin, Germany

Martin Kukwa & Magdalena Oset, Department of Plant Taxonomy and Nature Conservation, University of Gdańsk, Wita Stwosza 59, 80-308 Gdańsk, Poland; e-mail: dokmak@ug.edu.pl

INTRODUCTION

Bolivia has the highest ecosystem diversity in South America and the forest communities form a mosaic of vegetation which offers a variety of potential habitats for numerous microlichens (Navarro & Maldonado 2002; Josse *et al.* 2003; Ibisch & Mérida 2004; Navarro & Ferreira 2007). Thus a large number of such species should be expected to occur in Bolivia; however, current knowledge of this group in Bolivia is very incomplete, and the family Graphidaceae is no exception in this regard. On the basis of material we collected recently during lichenological exploration in Bolivia, here we document some of this hidden diversity.

This paper is the second contribution dealing with the family Graphidaceae in Bolivia (Kukwa *et al.* 2013).

MATERIAL AND METHODS

Specimens are deposited at B, GOET, KRAM, LPB, UGDA (acronyms after Thiers 2012) and the private herbaria of A. Flakus and U. Schiefelbein. Secondary lichen metabolites were identified by thin layer chromatography (TLC) according to Orange *et al.* (2001).

Data on general distribution are presented only for species reported for the first time from Bolivia. New national records are asterisked (*), those new for South America have two asterisks (**), and those new for the Southern Hemisphere have three (***)

The following abbreviations are used in the “Specimens examined” sections: *AF* – A. Flakus; *MK* – M. Kukwa; *OP* – O. Plata; *PR* – P. Rodriguez Flakus; *RIM* – R. I. Meneses; *US* – U. Schiefelbein; *RN* – Reserva Nacional; *AMBORÓ* – Parque Nacional y Área Natural de Manejo Integrado Amboró; *APOLOBAMBA* – Área Natural de Manejo Integrado Nacional Apolobamba; *CARRASCO* – Parque Nacional Carrasco; *COTAPATA* – Parque Nacional y Área Natural de Manejo Integrado Cotapata; *KAA-IYA* – Parque Nacional y Área Natural

¹ Corresponding author

de Manejo Integrado Kaa-Iya del Gran Chaco; SAJAMA – Parque Nacional Sajama; TARIQUÍA – Reserva Nacional de Flora y Fauna Tariquía (abbreviations of protected areas according to SERNAP Bolivia; <http://www.sernap.gob.bo>).

RESULTS

**Diorygma antillarum* (Vain.) Nelsen, Lücking & Rivas Plata

A Neotropical species previously reported from Brazil, Costa Rica, El Salvador, the Lesser Antilles, Panama, Peru, Venezuela and the USA (Florida) (Aptroot *et al.* 2009; Nelsen *et al.* 2012).

SPECIMENS EXAMINED. BOLIVIA. DEPT. TARIJA. PROV. Aniceto Arce, Filo de Sidras, 22°14'50"S, 64°33'28"W, 1064 m, Tucumano-Boliviano submontane forest, on bark, 22 Nov. 2010. *AF 18421 & 18672* (KRAM, LPB); Serranía de Propiedad Arnold, 22°13'19"S, 64°33'41"W, 1309 m, Tucumano-Boliviano montane forest, on bark, 24 Nov. 2010, *AF 18708* (KRAM, LPB); Prov. Burnet O'Connor, Lomas de la Soledad, road between Entre Ríos and Chiquiacá, 21°39'38"S, 64°07'31"W, 1670 m, Tucumano-Boliviano altimontane forest, corticolous, 10 Aug. 2012, *MK 11264* (LPB, UGDA); TARIQUÍA, near Salinas, 21°49'15"S, 64°12'44"W, 1400 m, Tucumano-Boliviano montane forest, corticolous, 10 Aug. 2012, *MK 11246* (LPB, UGDA).

Diorygma confluens (Fée) Kalb, Staiger & Elix

This species was only recently reported from Bolivia from six localities (Kukwa *et al.* 2013).

Diorygma confluens is chemically variable (Kalb *et al.* 2004). The material reported so far from Bolivia contained lichexanthone, stictic and constictic acids (major), and sometimes traces of hypoconstictic, hypostictic, norstictic and cryptostictic acids (Kukwa *et al.* 2013). In one of the specimens cited below (*MK 7111*), lichexanthone, hypoconstictic (major), constictic (submajor) and stictic (trace) acids were detected.

SPECIMENS EXAMINED. BOLIVIA. DEPT. BENI. PROV. Ballivian, Palmar, 14°58'56"S, 67°05'16"W, 250 m, by road, corticolous, 2 Aug. 2008, *MK 7111* (LPB, UGDA); DEPT. LA PAZ. Prov. Iturralde, between Tumapasa and Mamuque, 300 m, garden, corticolous, 5 Mar. 1987, *S. Stab LB-33* (B).

Diorygma epiglaucum (Müll. Arg.) Kalb, Staiger & Elix

Previously known from three records in Bolivia (Kalb *et al.* 2004; Flakus 2008).

SPECIMENS EXAMINED. BOLIVIA. DEPT. BENI. Prov. Marbán, near road from Camiaco to San Lorenzo, 15°14'49"S, 64°49'11"W, 160 m, lowland Amazon forest surrounded by los Llanos de Moxos savanna, corticolous, 30 Aug. 2012, *MK 11951* (LPB, UGDA); DEPT. SANTA CRUZ. Prov. Guarayos, RN de Vida Silvestre Ríos Blanco y Negro, Virgen de Pilar near Chonta, 15°38'54"S, 62°57'37"W, 229 m, lowland Amazon forest, corticolous, 22 July 2009, *AF & PR 13143* (KRAM, LPB).

Diorygma intermedium Kalb, Staiger & Elix

Kukwa *et al.* (2013) reported this species from four localities in Bolivia.

SPECIMENS EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Guarayos, RN de Vida Silvestre Ríos Blanco y Negro, Plan de Manejo AISU, 15°01'49"S, 62°46'36"W, 236 m, lowland Amazon forest, corticolous, 25 July 2009, *AF 14200 & PR* (KRAM, LPB).

Diorygma poitaei (Fée) Kalb, Staiger & Elix

This Neotropical lichen was recently reported from two localities in Bolivia (Kukwa *et al.* 2013).

SPECIMENS EXAMINED. BOLIVIA. DEPT. BENI. PROV. Cercado, Casa del Tigre near Chuchini, 14°43'17"S, 64°56'53"W, 160 m, lowland Amazon forest, corticolous, 31 Aug. 2012, *MK 11997* (LPB, UGDA).

**Diorygma reniforme* (Fée) Kalb, Staiger & Elix

This species has been reported from the Neotropics in Brazil, Colombia, Cuba, British Guiana, Peru and Venezuela, and elsewhere from Cameroon and Tanzania (Kalb *et al.* 2004).

SPECIMEN EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Guarayos, RN de Vida Silvestre Ríos Blanco y Negro, Plan de Manejo AISU, 15°01'58"S, 62°46'36"W, 242 m, lowland Amazon forest, corticolous, 24 July 2009, *AF 13899 & PR* (LPB).

**Diorygma sipmanii* Kalb, Staiger & Elix

This Neotropical species was known previ-

ously from Brazil, Costa Rica, Guatemala and El Salvador (Kalb *et al.* 2004, Cáceres 2007).

SPECIMEN EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Guarayos, RN de Vida Silvestre Ríos Blanco y Negro, Virgen de Pilar near Chonta, 15°38'54"S, 62°57'37"W, 229 m, lowland Amazon forest, corticolous, 22 July 2009, *AF 13273* & *PR* (LPB).

Diploschistes actinostomus (Ach.) Zahlbr.

This species was reported in Bolivia from only one locality (Feurerer & Sipman 2005)

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Camacho, Pacoamba cerca Wila Kala, 15°24'40"S, 69°04'24"W, 4283 m, Puna Húmeda, on sandstone, 6 July 2010, *AF 17740* & *PR* (KRAM); Prov. Manco Kapac, near Copacabana Mt. Horca del Inca, 16°10'15"S, 69°05'05"W, 3974 m, high Andean Puna, on volcanic rock, 18 June 2006, *AF 8637* (LPB).

*****Diploschistes caesioplumbeus*** (Nyl.) Vain.

This species was known previously from Africa (e.g., Algeria, Canary Islands, Madeira, Morocco, St. Helena and Ascension Island), Asia (e.g., India, Israel, Turkey), Europe (the Azores, France, Greece, Great Britain, Ireland, Italy, Spain) and western North America (Breuss 1988; Lumbsch 1989, 2002; Follmann 1990; Pant & Upreti 1993; Hafellner 1995; Llimona & Hladun 2001; Yazici & Aslan 2003; Aptroot 2008; Seaward 2010; Roux 2012; Esslinger 2014).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, APOLOBAMBA, near Villa Amarca, 15°16'47"S, 69°01'47"W, 4643 m, Puna Húmeda, on sandstone, 3 July 2010, *AF 17349*, *17355* & *PR* (KRAM, LPB); Prov. Camacho, Pacoamba cerca Wila Kala, 15°24'40"S, 69°04'24"W, 4283 m, Puna Húmeda, on sandstone, 6 July 2010, *AF 17708*, *17727*, *17757*, *17769*, *17788* & *PR* (KRAM, LPB, herb. Flakus); Prov. Franz Tamayo, APOLOBAMBA, near Puyo Puyo, 14°56'55"S, 69°07'58"W, 4888 m, high Andean open vegetation, on siliceous schist, 5 July 2010, *AF 17564* & *PR* (KRAM, LPB); Prov. Murillo, below Potosí, on road between La Paz and Valle del Zongo, 16°17'43"S, 68°07'42"W, 4716 m, high Andean vegetation, on granite rock, 28 May 2011, *AF 21840*, *21860* & *OP* (KRAM, LPB); near Cumbre pass, 16°19'06"S, 68°02'09"W, 4405 m, high Andean vegetation, on sili-

ceous schist, 31 May 2011, *AF* & *OP 22123* (KRAM, LPB); near Cumbre pass, 16°19'18"S, 68°04'42"W, 4550 m, high Andean Puna, on siliceous rock, 17 June 2006, *AF 8530* (herb. Flakus).

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

This species was reported from Bolivia by Feuerer *et al.* (1998) and Flakus *et al.* (2012). It appears to be a common lichen at high elevations in the Andes.

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Quillacollo, area of Incarraya-Sipesipe, 17°29'25"S, 66°22'09"W, 3146 m, semi-desert open area, on soil, 17 Dec. 2004, *AF 4977* (LPB); DEPT. LA PAZ. Prov. Camacho, cerca de la comunidad de Ulla Ulla, en el cerro Wilamuku, 15°02'04"S, 69°11'53"W, 4739 m, vegetación altoandina, terrestre, 4 Dec. 2007, *PR 272* (B, LPB); near Villa Cala, 15°25'53"S, 69°05'07"W, 4250 m, high Andean vegetation, on soil, 19 May 2011, *AF 21236* & *OP* (KRAM, LPB); Prov. Franz Tamayo, APOLOBAMBA, Socondori Chico near Ulla Ulla, 15°00'38"S, 69°13'48"W, 4479 m, high Andean open vegetation, on soil, 4 July 2010, *AF 17473* & *PR* (KRAM, LPB); Prov. Murillo, near Cumbre pass, 16°19'18"S, 68°04'42"W, 4550 m, high Andean Puna, on soil and terricolous bryophytes, 17 June 2006, *AF 8533* (KRAM, LPB, herb. Flakus); Valle del Zongo, Laguna Viscachani, 16°11'54"S, 68°07'33"W, 3862 m, Páramo Yungueño, on soil, 30 May 2011, *AF 22085*, *22103* & *OP* (KRAM, LPB); Prov. Sud Yungas, Mururata, bajo la Mina Bolsa Negra, 16°35'S, 67°45'W, 4000 m, saxicolous, 1995, *J. González 106* (B, LPB); *ibidem*, pasando por el pueblo de Tres Ríos, 16°35'S, 67°45'W, 3851 m, saxicolous, 6 Apr. 1995, *J. González 380* (B, LPB); DEPT. SANTA CRUZ. Prov. Manuel María Caballero, Siberia, 17°49'38"S, 64°45'14"W, 3000 m, open area near Yungas cloud forest, on soil, 11 Dec. 2004, *AF 4474* & *4478* (LPB, herb. Flakus); DEPT. TARIJA. Prov. Méndez, Cuesta de Sama, near Las Antenas, 21°29'59"S, 64°54'46"W, 3800 m, high Andean vegetation, 6 Aug. 2012, *MK 10958* (LPB, UGDA).

****Diploschistes diacapsis*** (Ach.) Lumbsch

This is a widely distributed species known from Africa (e.g., Algeria, Canary Islands, Morocco, Tunisia), Asia (e.g., China, Cyprus, India, Iran, Mongolia, Saudi Arabia, Syria), Australia, Europe (e.g., Albania, Azores, Bosnia and Herzegovina, France, Germany, Greece, Spain), North America (Mexico,

USA) and South America (Chile, Colombia, Peru) (Schubert & Klement 1971; Lumbsch 1989; Pant & Upreti 1993; Hafellner 1995, 2007; Galloway & Quilhot 1998; Litterski & Mayrhofer 1998; Llimona & Hladun 2001; Scholz 2001; John *et al.* 2004; Seaward *et al.* 2008; Sipman *et al.* 2008; Bilovitz & Mayrhofer 2011; Roux 2012; McCarthy 2013; Esslinger 2014).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Omasuyos, El Dragon hill near Chahualla, 15°51'17"S, 69°00'40"W, 3850 m, Puna Húmeda, on siliceous rock, 6 July 2010, *AF 17836* & *PR* (KRAM, LPB, herb. Flakus).

****Diploschistes diploschistoides* (Vain.) G. Salisb.**

This species was reported previously from South Africa, Zimbabwe, Australia, and in South America from Brazil and Colombia (Guderley & Lumbsch 1996; McCarthy 2013).

SPECIMENS EXAMINED. BOLIVIA. DEPT. TARIJA. Prov. Aniceto Arce, Papachacra, near Papachacra valley, 21°41'14"S, 64°30'19"W, 2050 m, open vegetation with shrubs, on sandstone, 7 Aug. 2012, *AF 23911* (LPB, herb. Flakus).

****Diploschistes euganeus* (A. Massal.) Zahlbr.**

Reported in South America only from Brazil and Chile, and elsewhere from Africa (Algeria, Cape Verde, Republic of South Africa, St. Helena), Asia (Taiwan), Australia (mainland Australia, New Zealand) and Europe (France, Greece, Italy, Poland, Spain) (Lumbsch 1989; Mies & Lumbsch 1990; Guderley & Lumbsch 1996; Galloway & Quilhot 1998; Llimona & Hladun 2001; Fałtynowicz 2003; Aptroot 2008; Roux 2012; McCarthy 2013).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Quillacollo, area of Incarraya-Sipesipe, 17°28'39"S, 66°21'43"W, 2846 m, semi-desert open area, on sandstone, 17 Dec. 2004, *AF 4922* (LPB, herb. Flakus).

****Diploschistes hypoleucus* Zahlbr.**

This rarely reported species is known from Brazil, Peru and Venezuela in South America,

and elsewhere in Oceania (Hawaii), continental North America, the Caribbean (Puerto Rico) and the Republic of South Africa (Lumbsch 1989; Guderley & Lumbsch 1996; Marcano *et al.* 1996; Elix & McCarthy 1998; Esslinger 2014).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, CARRASCO, La Cumbre, El Camino de las Nubes, 17°17'46"S, 65°43'56"W, 4100 m, Páramo Yungueño, on soil, 19 Aug. 2012, *MK 11806* (LPB, UGDA); Prov. Quillacollo, area of Incarraya-Sipesipe, 17°29'25"S, 66°22'09"W, 3146 m, semi-desert open area, on soil, 17 Dec. 2004, *AF 4964* (KRAM, LPB, herb. Flakus); DEPT. LA PAZ. Prov. Larecaja, la Cumbre de Sorata, 15°53'06"S, 68°38'55"W, 4210 m, high Andean open vegetation, on soil, 13 May 2011, *AF 20256* & *OP* (KRAM, LPB).

****Diploschistes muscorum* (Scop.) R. Sant. subsp. *bartlettii* Lumbsch**

This taxon is less common than *D. muscorum* subsp. *muscorum* and has a remarkable Gondwanaland distribution. It was known previously from Australia, India, Lesotho, the Republic of South Africa, and in South America from Argentina, Brazil, Chile, Colombia and Ecuador (Galapagos Islands) (Pant & Upreti 1993; Guderley & Lumbsch 1996; Elix & McCarthy 1998; Galloway & Quilhot 1998; Aptroot 2002; Calvelo & Liberatore 2002; Sipman *et al.* 2008; McCarthy 2013).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Omasuyos, El Dragon hill near Chahualla, 15°51'17"S, 69°00'40"W, 3850 m, Puna Húmeda, on soil, 6 July 2010, *AF 17837.1* & *PR* (KRAM, LPB); DEPT. LA PAZ. Prov. Nor Yungas, near Pongo, near the Coroico-La Paz road, 16°19'28"S, 67°57'21"W, 3822 m, Páramo Yungueño, on soil, 25 May 2011, *AF 21736* & *OP* (LPB).

****Diploschistes muscorum* (Scop.) R. Sant. subsp. *muscorum***

This widely distributed taxon is known from Africa (Cape Verde), Asia (India, Iran), Europe (e.g., Bosnia and Herzegovina, Finland, France, Norway, Poland, Sweden), North America and South America (Argentina, Chile, Colombia, Ecuador) (Mies & Lumbsch 1990; Pant & Upreti 1993; Elix & McCarthy 1998; Calvelo & Lib-

eratore 2002; Fałtynowicz 2003; Santesson *et al.* 2004; Nöske *et al.* 2007; Seaward *et al.* 2008; Sipman *et al.* 2008; Bilovitz & Mayrhofer 2011; Roux 2012; Esslinger 2014).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, km 162 on road from Apolo to Charazani, la Cruz Charazani-Pelechuco, 15°15'00"S, 69°02'51"W, 4545 m, high Andean vegetation, on soil, 19 May 2011, *AF 21160 & OP* (LPB); DEPT. ORURO. SAJAMA, Ladera de la Quebrada Kohniri. 18°07'07"S, 68°56'06"W, 4309 m, *Polylepis tarapacana* forest, on rock, 21 Nov. 2007, *RIM et al. 4380, 4385* (B, LPB); *ibidem*, 18°07'08"S, 68°56'05"W, 4406 m, on rock, 21 Nov. 2007, *RIM et al. 4391* (B, LPB); Prov. Sajama, SAJAMA, Jecha K'ala 18°09'52"S, 68°49'08"W, 4184 m, Puna Sureña, on soil, 20 June 2010, *AF 16679.1, 16684 & PR* (KRAM, LPB).

Dyplolabia afzeli (Ach.) A. Massal.

This easily recognizable species is perhaps the commonest member of the Graphidaceae in Bolivia. It was previously reported from there by Kalb & Staiger (2000), Staiger (2002), Flakus & Wilk (2006), Flakus (2008) and Flakus *et al.* (2012).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Iturralde, near San Pedro, 13°43'59"S, 68°00'38"W, 250 m, savannah, corticolous, 28 July 2008, *MK 6897* (LPB, UGDA); Tumupasa, 14°08'51"S, 67°53'34"W, 350 m, garden, on mango tree, 31 Aug. 2008, *MK 6996* (LPB, UGDA).

**Fissurina triticea* (Nyl.) Staiger

This species was previously reported from Australia, Madeira, New Zealand, Reunion, the Azores, and in the Neotropics from Colombia, Costa Rica, Dominica, Jamaica and Mexico (Wirth & Hale 1978; Hafellner 1995; Staiger 2002; Sipman 2006; Sipman *et al.* 2008).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, near Nogalani, 16°12'57"S, 67°49'15"W, 2168 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *US* (LPB, herb. Schiefelbein 3069, 3070); DEPT. SANTA CRUZ. Prov. Manuel María Caballero, El Camino de Orquideas, 17°49'20"S, 64°42'31"W, 2340 m, Yungas cloud forest, corticolous, 17 Aug. 2012, *MK 11564* (LPB, UGDA).

**Graphis caesiella* Vain.

This is a pantropical species reported in the Neotropics from Brazil, Peru and the USA (Louisiana, Florida) (Staiger 2002; Cáceres 2007; Lücking *et al.* 2009; Seavey & Seavey 2011; Rivas Plata & Lücking 2013), and also from the Philippines (Linsangan-Tabaquero *et al.* 2013) and Australia (Archer 2009).

SPECIMEN EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Ichilo, AMBORÓ, Macuñucu, 17°43'38"S, 63°35'37"W, 460 m, Amazon forest, on twigs, 6 June 2011, *MK 9696a* (LPB).

**Graphis cincta* (Pers.) Aptroot

This species was previously reported in the Neotropics from Costa Rica, the Dominican Republic, Paraguay, the USA (Florida), and elsewhere from the Philippines and Taiwan (Lücking *et al.* 2008, 2009; Seavey & Seavey 2011) and from Australia and Japan (Archer 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Sud Yungas, Alto Beni, San Antonio. 15°38'13"S, 67°12'09"W, 405 m, on *Theobroma cacao*, 29 June 1999, *N. Derakshani 12* (B, GOET).

***Graphis daintreensis* (A. W. Archer) A. W. Archer

Previously known only from Australia and the Solomon Islands (Archer 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. BENI. Prov. Vaca Díez, Cachuela Esperanza, 10°32'09"S, 65°34'55"W, 128 m, lowland Amazon forest, corticolous, 4 June 2006, *AF 7525* (KRAM, LPB).

**Graphis dracaenae* Vain.

Previously known from Africa, Australia and Brazil (Archer 2009; Lücking *et al.* 2009).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, COTAPATA, Santa Catalina, above Tunkini, 16°11'12"S, 67°52'07"W, Yungas montane forest, corticolous, 22 May 2011, *US* (LPB).

Graphis duplicata Ach.

Reported only recently from three localities in Bolivia by Flakus *et al.* (2013) and Kukwa *et al.* (2103).

SPECIMEN EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Manuel María Caballero, Siberia region near La Palma, 17°49'12"S, 64°40'28"W, 2582 m, Yungas cloud forest, corticolous, 13 Dec. 2004, *AF 4642* (KRAM, LPB).

*****Graphis duplicatoinspersa* Lücking**

The species has been reported from Costa Rica and Australia (Lücking *et al.* 2008, 2009).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, COTAPATA, near Urpuma colony, 16°13'20"S, 67°52'34"W, 1989 m, Yungas montane forest, corticolous, 30 June 2010, *AF 17118 & PR* (KRAM, LPB, herb. Flakus).

*****Graphis emersa* Müll. Arg.**

Previously reported from Australia, Costa Rica and Japan (Lücking *et al.* 2008, 2009).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, between Coroico and La Paz, 16°13'33"S, 67°49'20"W, 2600 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *US* (LBP).

***Graphis* aff. *evirescens* (Redinger) Lücking**

To our knowledge this species was previously reported only from the type locality in Brazil (Lücking *et al.* 2009).

With Lücking *et al.* (2009), our material keys out as *G. evirescens*, characterized by a green thallus, stellately branched lirellae with an apically thin, complete thalline margin, 8-spored asci and small muriform ascospores, 12–18 × 7–14 µm (Redinger 1935; Lücking *et al.* 2009). In our specimen the lirellae are unbranched, the asci 2-spored and the ascospores larger (30–44 × 13–17 µm). It is not clear to us if this should be considered an instance of infraspecific variation, such as known in other *Graphis* species (Lücking *et al.* 2009), so the present report should be considered tentative.

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, COTAPATA, between Tunkini and Chairó villages, above Tunkini, 16°11'S, 67°52'W, 2400 m, Yungas montane forest, corticolous, 22 May 2011, *MK 9101* (LPB, UGDA).

****Graphis handelii* Zahlbr.**

Previously reported from Brazil, China, Costa Rica, India and Paraguay (Lücking *et al.* 2008, 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, between Coroico and La Paz, 16°13'33"S, 67°49'20"W, 2600 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *US* (LBP); DEPT. SANTA CRUZ. Prov. Guarayos, RN de Vida Silvestre Ríos Blanco y Negro, Plan de Manejo AISU, 15°01'49"S, 62°46'36"W, 236 m, lowland Amazon forest, corticolous, 25 July 2009, *AF 14254 & PR* (LPB).

*****Graphis hossei* Vain.**

Previously this species was known only from Asia (China, Indonesia, Philippines and Thailand) (Lücking *et al.* 2009).

SPECIMEN EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, COTAPATA, Chairó, 16°12'07"S, 67°50'05"W, 1300 m, Yungas lower montane forest, corticolous, 21 May 2011, *US* (LBP).

***Graphis illinata* Eschw.**

Reported from Bolivia by Flakus & Wilk (2006).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, near Nogalani, between Coroico and La Paz, 16°12'57"S, 67°49'15"W, 2168 m, Yungas secondary cloud forest, corticolous, 23 May 2011, *US* (LPB, herb. Schiefelbein 3453); Prov. Nor Yungas, COTAPATA, Santa Catalina, above Tunkini, 16°11'12"S, 67°52'07"W, Yungas montane forest, corticolous, 22 May 2011, *US* (LPB, herb. Schiefelbein 3057).

*****Graphis immersella* Müll. Arg.**

Known previously from Australia, China, the Philippines, New Caledonia, the Solomon Islands and Vanuatu (Archer 2009; Lücking *et al.* 2009; Linsangan-Tabaquero *et al.* 2013).

SPECIMENS EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Guarayos, RN de Vida Silvestre Ríos Blanco y Negro, Virgen de Pilar near Chonta, 15°38'54"S, 62°57'37"W, 229 m, lowland Amazon forest, corticolous, 22 July 2009, *AF 13217 & PR* (KRAM, LPB).

****Graphis librata* Vain.**

In the Neotropics this species was found in Brazil, Costa Rica, Panama and Venezuela, and elsewhere in Australia, New Zealand, the Philippines, South Africa and the USA (Archer 2001; Staiger 2002; Lücking *et al.* 2008, 2009; Neuwirth 2008; Seavey & Seavey 2011; Boom & Sipman 2013; Linsangan-Tabaquero *et al.* 2013).

SPECIMENS EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Cordillera, KAA-IYA, near Peto Blanco, 18°56'26"S, 60°22'39"W, 340 m, Chiquitano forest, on twig, 5 Dec. 2011, *MK 10644* (LPB, UGDA).

***Graphis lumbricina* Vain.**

Previously reported from four localities in Bolivia (Flakus *et al.* 2103; Kukwa *et al.* 2013).

SPECIMENS EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Manuel María Caballero, near Siberia, 17°49'38"S, 64°44'45"W, 3950 m, open Yungas cloud forest, corticolous, 16 Aug. 2012, *MK 11477* (LPB, UGDA).

****Graphis paralleloides* Cáceres & Lücking**

Reported from Brazil and India (Cáceres 2007; Lücking *et al.* 2009).

According to Cáceres (2007) and Lücking *et al.* (2009) this species produces transversely septate ascospores measuring 30–40 × 7–8 μm. In one collection cited below (*MK 11565*) the ascospores were 38–50 × 13–14 μm, and in the other (*MK 9792a*) 25–40 × 7–12 μm, but otherwise both collection had the same morphology of ascomata (*striatula*-morph) as presented by Cáceres (2007) and Lücking *et al.* (2009). Considerable variation of ascospore dimensions is known in other *Graphis* species as well (e.g., in *Graphis conferta* Zenker or *G. ovata* (Fée) A. Massal.; Lücking *et al.* 2009), so here we widen the circumscription of *G. paralleloides* instead of distinguishing a new species.

SPECIMENS EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Florida, AMBORÓ, above la Yunga village, senda Los Helechos, 18°03'30"S, 63°54'36"W, 2330 m, Yungas cloud forest, on dead twig, 7 June 2011, *MK 9792a* (LPB); Prov. Manuel María Caballero, El Camino de Orquideas, 17°49'20"S, 64°42'31"W,

2340 m, Yungas cloud forest, corticolous, 17 Aug. 2012, *MK 11565* (LPB, UGDA).

****Graphis paraserpens* Lizano & Lücking**

So far reported from Brazil and Costa Rica (Cáceres 2007; Lücking *et al.* 2008, 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Guarayos, RN de Vida Silvestre Ríos Blanco y Negro, Plan de Manejo AISU, 15°01'49"S, 62°46'36"W, 236 m, lowland Amazon forest, corticolous, 25 July 2009, *AF 14250* & *PR* (KRAM, LPB).

****Graphis phaeospora* Vain.**

So far known only from Brazil and Ecuador (Staiger 2002; Nöske *et al.* 2007).

SPECIMENS EXAMINED. BOLIVIA. DEPT. COCHABAMBA. Prov. Carrasco, CARRASCO, near Sehuenas, 17°30'12"S, 65°16'30"W, 2220 m, montane cloud forest, along road, corticolous, 21 July 2008, *MK 6395* (LPB, UGDA); DEPT. SANTA CRUZ. Prov. Manuel María Caballero, Siberia region near La Palma, 17°49'12"S, 64°40'28"W, 2582 m, Yungas cloud forest, on sandstone, 13 Dec. 2004, *AF 4641* (LPB).

****Graphis pitmanii* Rivas Plata & Lücking**

This species was only recently described from Peru (Rivas Plata & Lücking 2013).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Bautista Saavedra, Calzada, 15°09'06"S, 68°30'24"W, 834 m, Preandean Amazon secondary forest, corticolous, 17 May 2011, *US* (LPB, herb. Schiefelbein 2012); Prov. Larecaja, near Achiquiri, 15°13'31"S, 68°13'49"W, 1071 m, Yungas secondary forest, corticolous, 16 May 2011, *US* (LPB, herb. Schiefelbein 2988).

****Graphis puiggarii* (Müll. Arg.) Lücking**

Known before from Brazil, Costa Rica and Paraguay (Lücking *et al.* 2008, 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Franz Tamayo, near Correo, 14°59'06"S, 68°26'09"W, 1632 m, Yungas montane forest, open area, corticolous, 17 May 2011, *US* (LPB, herb. Schiefelbein 3002); Prov. Larecaja, near Incachaca, 15°17'48"S, 68°26'32"W, 1100 m, Yungas lower montane forest, corticolous, 15 May 2011, *US* (LPB, herb. Schiefelbein 2980); Prov. Nor Yungas, COTAPATA, Santa Catalina,

above Tunkini, 16°11'12"S, 67°52'07"W, Yungas montane forest, 22 May 2011, corticolous, *US* (LPB, herb. Schiefelbein 3029); Chairo, 16°12'07"S, 67°50'05"W, Yungas lower montane forest, corticolous, 1300 m, 21 May 2011, *US* (LPB).

****Graphis rhizocola* (Fée) Lücking & Chaves**

This Neotropical species was reported previously from Brazil, Costa Rica, Peru, St. Vincent and Trinidad (Lücking *et al.* 2008, 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, COTAPATA, Santa Catalina, above Tunkini, 16°11'12"S, 67°52'07"W, Yungas montane forest, 17 May 2011, *US* (LPB, herb. Schiefelbein 3056); by Sillu Tincara pre-Columbian route, 16°17'22"S, 67°53'29"W, 3518 m, transition Páramo Yungeño–Yungas montane cloud forest, 25 May 2011, *US* (LPB, herb. Schiefelbein 3456).

****Graphis sitiana* Vain.**

A Neotropical species known previously from Brazil, Costa Rica, Panama and Peru (Lücking *et al.* 2008, 2009; Boom & Sipman 2013; Rivas Plata & Lücking 2013).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Sud Yungas, Alto Beni Sapecho. Cooperativa Sapecho. 15°32'S, 67°20'W, 500 m, on branches, 2 Aug. 1999, *A. Acebey & T. Krömer 997* (B, LPB).

*****Graphis subchrysocharpa* Lücking**

This species is known from Central America (Costa Rica) and Africa (Lücking *et al.* 2008, 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. SANTA CRUZ. Prov. Guarayos, RN de Vida Silvestre Ríos Blanco y Negro, Plan de Manejo AISU, 15°01'49"S, 62°46'36"W, 236 m, lowland Amazon forest, corticolous, 25 July 2009, *AF 14272 & PR* (KRAM, LPB, herb. Flakus).

****Graphis subradiata* (Nyl.) Lücking**

Known only from the Neotropics and previously reported from Brazil, Colombia and Costa Rica (Lücking *et al.* 2008, 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ.

Prov. Nor Yungas, COTAPATA, between Tunkini and Chairo, 16°11'00"S, 67°52'00"W, corticolous, 22 May 2011, *US* (LPB).

****Graphis supracola* A. W. Archer**

A Pantropical species known from Australia, Cambodia, Japan and Thailand, and in the Neotropics from Brazil, Colombia and the USA (Florida) (Archer 2001, 2012; Lücking *et al.* 2009; Nakanishi *et al.* 2010; Seavey & Seavey 2011).

SPECIMENS EXAMINED. BOLIVIA. DEPT. BENI. Prov. Marbán, near San Lorenzo, 15°12'59"S, 64°47'08"W, 160 m, lowland Amazon forest surrounded by los Llanos de Moxos savanna, on twigs, 28 Aug. 2012, *MK 11897* (LPB, UGDA).

****Hemithecium laubertianum* (Fée) Staiger**

This rare species is known from Dominica, Peru and Australia (Staiger 2002; Archer 2009).

SPECIMENS EXAMINED. BOLIVIA. DEPT. BENI. Prov. Cercado, Casa del Tigre near Chuchini, 14°43'17"S, 64°56'53"W, 160 m, lowland Amazon forest, corticolous, 31 Aug. 2012, *MK 11984* (LPB, UGDA, herb. Flakus).

******Leiorreuma lyellii* (Sm.) Staiger**

Phaeographis lyellii (Sm.) Zahlbr.

Previously reported from Great Britain, France, Ireland, Spain and Macaronesia (Madeira), and in the Neotropics only from Costa Rica (Llimona & Hladun 2001, Staiger 2002; Breuss & Neuwirth 2007; Benfield *et al.* 2009; Seaward 2010; Roux 2012).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. Prov. Nor Yungas, near Chuspipata, 16°17'09"S, 67°51'00"W, 3228 m, Yungas cloud forest with Ericaceae, corticolous, 24 May 2011, *US* (LPB, herb. Schiefelbein 3111).

****Pallidogramme chrysenderon* (Mont.) Staiger, Kalb & Lücking**

This species was reported in the Neotropics from Brazil, Colombia, Costa Rica, Guyana and Panama, and elsewhere from Australia, the Philippines and Thailand (Staiger 2002; Wolseley *et al.*

2002; Sipman *et al.* 2008; Boom & Sipman 2013; Linsangan-Tabaquero *et al.* 2013).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. PROV. Bautista Saavedra, Calzada, 15°09'06"S, 68°30'24"W, 835 m, Preandean Amazon secondary forest, corticolous, 17 May 2011, *MK 8806* (LPB, UGDA).

Phaeographis lepriurii (Mont.) Staiger

Previously known from only a single locality in Bolivia (Kukwa *et al.* 2013).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. PROV. Abel Iturralde, Tumupasa village, 14°08'51"S, 67°53'34"W, 350 m, garden in the village, on mango tree, 31 Aug. 2008, *MK 6998* (LPB, UGDA).

Phaeographis scalpturata (Ach.) Staiger

This species was reported from Bolivia before by Nylander (1859) and Flakus *et al.* (2013).

SPECIMENS EXAMINED. BOLIVIA. DEPT. BENI. PROV. Ballivian, Palmar village, 14°58'56"S, 67°05'16"W, 250 m, by road, corticolous, 2 Aug. 2008, *MK 7109*, *7112* (LPB, UGDA); DEPT. LA PAZ. PROV. Nor Yungas, Coroico, 16°11'10"S, 67°43'16"W, 1550 m, Yungas montane forest, corticolous, 6 June 2010, *AF 16430.2* & *PR* (KRAM, LPB); near Pacallo village, 16°12'10"S, 67°50'39"W, 1360 m, montane forest, corticolous, 3 Aug. 2008, *MK 7170* (LPB, UGDA); DEPT. SANTA CRUZ. PROV. Guarayos, RN de Vida Silvestre Rios Blanco y Negro, Plan de Manejo AISU, 15°01'49"S, 62°46'36"W, 236 m, lowland Amazon forest, corticolous, 25 July 2009, *AF 14238*, *14242* & *PR* (KRAM, LPB); *ibidem*, 15°01'58"S, 62°46'36"W, 242 m, 24 July 2009, *AF 13886* & *PR* (LPB); Virgen de Pilar near Chonta, 15°38'54"S, 62°57'37"W, 229 m, lowland Amazon forest, corticolous, 22 July 2009, *AF 13257* & *PR* (LPB).

****Phaeographis tortuosa*** (Ach.) Müll. Arg.

Reported so far from the Caribbean, Brazil and Panama (Staiger 2002; Cáceres 2007; Boom & Sipman 2013).

Our material agrees anatomically and chemically with the description given by Staiger (2002) but the thallus is rather smooth (as also pictured by Cáceres 2007) than granular. Taking under consideration the variability of thallus morphology in other *Phaeographis* species [e.g., *P. intricans*

(Leight.) Kalb and *P. scalpturata*; pictures in, e.g., Lücking *et al.* 2011; Aptroot & Sparrius 2014), we refer our sample to *P. tortuosa*.

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. near Pacallo village, 16°12'10"S, 67°50'39"W, 1360 m, montane forest, corticolous, 3 Aug. 2008, *MK 7115* (LPB, UGDA).

****Platygramme pachyspora*** (Redinger) Staiger

So far known only from Brazil (Staiger 2002).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. PROV. Larecaja, near Achiquiri, 15°13'31"S, 68°13'49"W, 1071 m, Yungas secondary forest, 16 May 2011, *US* (LPB, herb. Schiefelbein 2988).

****Platythecium serpentinellum*** (Nyl.) Staiger

To our knowledge this species was reported only from Colombia (Staiger 2002; Sipman *et al.* 2008).

SPECIMENS EXAMINED. BOLIVIA. DEPT. LA PAZ. PROV. Nor Yungas, COTAPATA, Chairó, 16°12'07"S, 67°50'05"W, Yungas lower montane forest, 1300 m, corticolous, 21 May 2011, *US* (LPB).

****Reimnitzia santensis*** (Tuck.) Kalb

A Pantropical species known in the Neotropics from Brazil, Costa Rica and Paraguay, and elsewhere from Australia, Mozambique and the USA (South Carolina) (Frisch 2006; Sipman *et al.* 2012; Esslinger 2014).

SPECIMENS EXAMINED. BOLIVIA. DEPT. BENI. PROV. Cercado, Casa del Tigre near Chuchini, 14°43'17"S, 64°56'53"W, 160 m, lowland Amazon forest, corticolous, 31 Aug. 2012, *MK 11991* (LPB, UGDA).

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