

New records and range extension of Bryophytes for Paraguay

Bernardo D. CAÑIZA^{a*}, Denilson F. PERALTA^b & Guillermo M. SUÁREZ^c

^aLaboratorio de Análisis de Recursos Vegetales,
Facultad de Ciencias Exactas y Naturales,
Universidad Nacional de Asunción (UNA), Dirección Postal 1039,
San Lorenzo, Paraguay

^bInstituto de Botânica, Av. Miguel Stéfano, 3687 – CEP 04301902 –
São Paulo, Brazil

^cUnidad Ejecutora Lillo, CONICET – Fundación Miguel Lillo, Miguel Lillo 251,
San Miguel de Tucumán, Tucumán, Argentina.
Facultad de Ciencias Naturales e I.M.L., Universidad Nacional de Tucumán

Abstract – We present the first records for Paraguay for 24 species of bryophytes (one hornwort, eight liverworts and 15 mosses). Another 47 new regional records enhance the list of bryodiversity for the departments of Alto Paraguay, Alto Paraná, Amambay, Caaguazú, Canindeyú, Central, Concepción, Cordillera, Paraguari, Presidente Hayes and one new record for the capital district, Asunción.

Diversity / Cryptogams / Taxa / Bryophytes / New records / Paraguay

Paraguay is one of the South American countries with very few bryological surveys (Söderström *et al.*, 2013; Flores *et al.*, 2015). These were primarily conducted by foreign botanists, and few collections were deposited in national herbaria. Hence a campaign is initiated to sample and document the bryological diversity of Paraguay.

Regarding the earliest records of liverworts from Paraguay, several leafy and thalloid liverworts were cited for the country by Spruce (1889) and Stephani (1900, 1906, 1909, 1912). The Lejeuneaceae are the family with the most records from Paraguay (Alvarenga *et al.*, 2008; Arnell, 1961; Bastos, 2012; Bischler, 1966; Dauphin *et al.*, 2006; Gradstein, 1994; Reiner-Drehwald, 1993, 1994a, 1994c, 1995a, 1995b, 1998, 2000). *Radula* species with occurrence in Paraguay are also cited by Castle (1964) and Reiner-Drehwald (1994b), in their systematic and regional treatments. Collections of thalloid liverworts (Marchantiales) from the country are mentioned by Hässel de Menéndez (1962) and Jovet-Ast (1991). The checklist of hornworts and liverworts of Paraguay were compiled by Söderström *et al.* (2013), who reported 2 hornworts and 71 liverworts. Later, Flores *et al.* (2015) reported *Chonecolea doellingeri* for the first time in Paraguay, bringing the current diversity of liverworts to 72 species.

* Corresponding author: bernardo.caniza.1990@gmail.com

The main historical collections were made by Balansa, Lindman and Morong between 1873 and 1894. They collected mostly in central and south-western Paraguay. The Balansa collections were distributed to, amongst other institutions, B, BM, G, H-BR, L, NY and PC. The French bryologist Emile Bescherelle worked on the majority of the Balansa moss collections from Paraguay. Morong's collections are located at NY, BM, G, MO, US and were studied by Britton. Lindman's bryophyte collections are located at B, H and S and were described by Brotherus (Morong & Britton, 1893; Brotherus, 1900; O'Shea & Price, 2008; Price, 2012).

The moss flora of Paraguay was first circumscribed by Buck (1985) who listed 137 taxa. Kuc (1998) reported twelve moss species collected in different microhabitats of the "Caacupé" hill (Department Cordillera). Crum & Buck (1988) cited other collecting places like the "National Park Ybycu'í" (Department Paraguari) and the biological reserve Itabó (Department Alto Paraná), where *Sphagnum* species were found. O'Shea & Price (2008) updated the list to 240 species, and contributions by Câmara & Magill (2009) and Jimenez & Suárez (2017) bring the current diversity of mosses to 242 species. These studies represent the few published studies dealing with the Paraguayan bryoflora.

We are providing a list of the new records and range extension of bryophytes based on the study of, often unidentified, herbarium (FACEN and SP) samples collected between 1979 and 2005, as well as recent collections of the authors and C. Vogt. Specimens were identified using floristic and taxonomic treatments. Most of the recent original collections are deposited in the herbarium FACEN (Paraguay), but some of them are also in the herbaria FCQ (Paraguay), SP (Brazil) and one is in LIL (Argentina). Duplicates are deposited in the herbaria FACEN, FCQ, SP and LIL. The map (Fig. 1) represents the locations prospected by the authors, and from which new records are reported of the recorded species. The distribution of species within Paraguay remains poorly known due to uneven sampling across the country.

The list is arranged alphabetically by division, genus and species, with new departmental records indicated with asterisk (*), and new records for Paraguay with two asterisks (**). Overall distribution of each taxon is based on Söderström *et al.* (2013) for hornworts and liverworts, and O'Shea & Price (2008) for mosses.

We here report one species of hornwort, eight species of liverworts and 15 species of mosses as new records to Paraguay, and new departmental records of 18 liverworts and 29 mosses. The number of hornwort species from Paraguay has now increased by 50% to three, the number of liverwort species by 11% to 80, and the number of moss species by 6.2% to 257.

ANTHOCEROTOPHYTA

***Phaeoceros laevis* (L.) Prosk.

Dept. Central. San Lorenzo, wooded area of the Facultad de Ciencias Agrarias, Universidad Nacional de Asunción: on moist soil in a stream bank (25°20'20.03"S, 57°30'55.93"W), 19 May 2014, B. Cañiza 81 (FACEN, FCQ).

General distribution: subcosmopolitan; South America: Bolivia, Brazil, Argentina (Hassel de Menéndez, 1962; Churchill *et al.*, 2009; Carmo & Peralta, 2016), Paraguay.

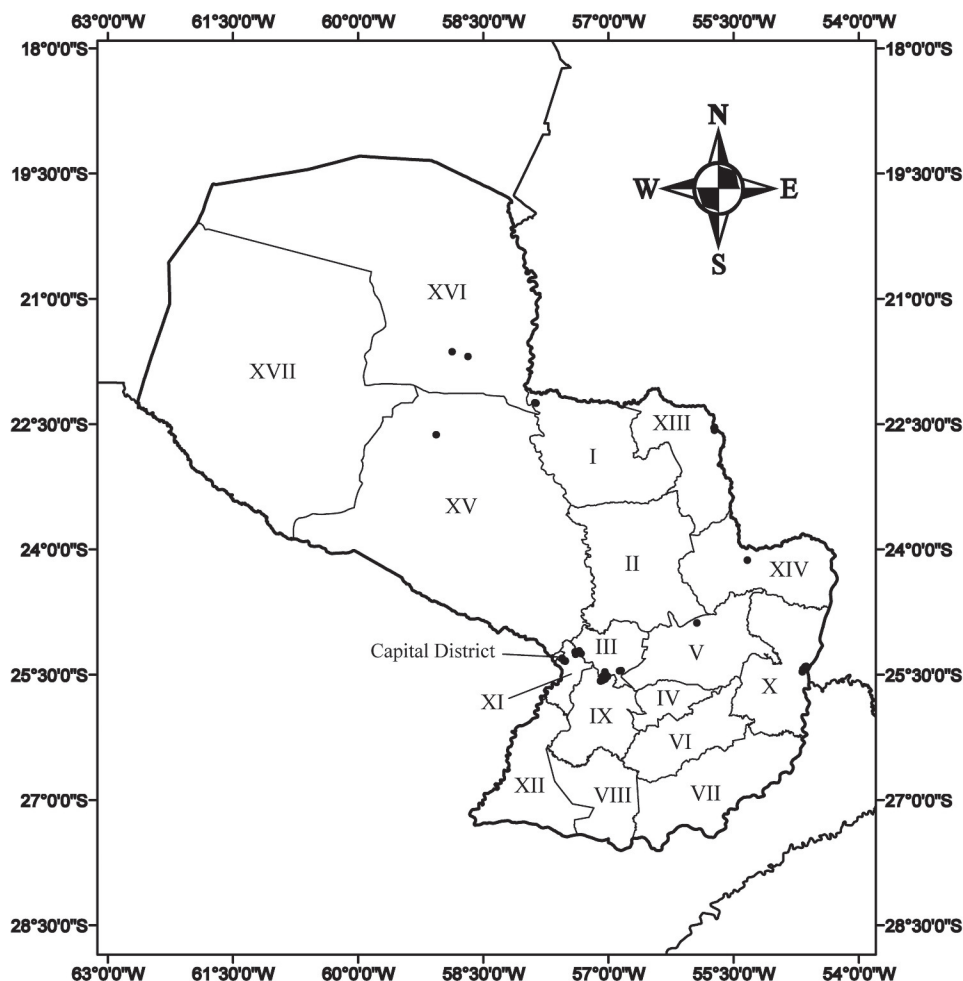


Fig. 1. Locations of the recorded species (as black dots). Capital District, Asunción – I, Concepción – II, San Pedro – III, Cordillera – IV, Guairá – V, Caaguazú – VI, Caazapá – VII, Itapúa – VIII, Misiones – IX, Paraguari – X, Alto Paraná – XI, Central – XII, Ñeembucú – XIII, Amambay – XIV, Canindeyú – XV, Presidente Hayes – XVI, Alto Paraguay – XVII, Boquerón.

MARCHANTIOPHYTA

**Cheilolejeunea clausa* (Nees & Mont.) R. M. Schust.

Dept. Cordillera. Cerro Naranjo, Compañía Naranjo: 236 m, on submerged rock (25°31'06" S, 57°03'48" W), 15 Aug 2000, *L. Fretes & E. Rempel LF004* (FACEN 1156). **Other localities:** Alto Paraná, Caaguazú, Paraguari.

General distribution: widespread Neotropical; America: from southeastern United States to Bolivia, Paraguay, Argentina (Misiones) (Reiner-Drehwald, 1998; Reiner-Drehwald, 2006).

**Chonecolea doellingeri* (Nees) Grolle

Dept. Central. Luque, Arroyo Yukyry: scrubland, very altered wetland, on trunk of *Inga uraguensis* (Fabaceae) (25°15'24.6''S, 57°23'30.3''W), 3 Apr 2015, *B. Cañiza & C. Vogt 147* (FACEN 1362). **Dept. Cordillera.** Piribeby, Arroyo Piribeby: on rotting log (25°28'0.44''S, 57°2'29.76''W), 7 Sep 2014, *B. Cañiza, A. Guerrero, V. Irazusta & G. Pereira 87* (FACEN 2388, SP, FCQ). **Other localities:** Paraguari (Flores *et al.*, 2015).

General distribution: America: United States (Florida), Brazil, Paraguay, Argentina; Africa; Oceania: Australia (Gradstein & Costa, 2003; Flores *et al.*, 2015).

**Cololejeunea jamesii* (Austin) M. E. Reiner & Pócs

Dept. Central. Luque, Arroyo Yukyry: scrubland, very altered wetland, on trunk of *Inga uraguensis* (Fabaceae) (25°15'24.6''S, 57°23'30.3''W), 3 Apr 2015, *B. Cañiza & C. Vogt 147* (FACEN 1362). **Other localities:** Alto Paraná.

Note: This species is a synonym of *Cololejeunea clavatopapillata* (Steph.) (Pócs *et al.*, 2015) illustrated and described as *Aphanolejeunea clavatopapillata* (Steph.) in Reiner-Drehwald (1995b).

General distribution: widespread; America: United States (Florida) and Mexico (as *C. tuberculata* Evans), Costa Rica, Panama, West Indies, Brazil, Paraguay, Argentina; Africa: Kenya, Uganda, Rwanda, Tanzania; Asia: India (Fulford & Sharp 1990; Reiner-Drehwald, 1995b; Lüth & Schäfer-Verwimp, 2004; Schäfer-Verwimp & Pócs, 2009; Asthana & Alam, 2013; Schäfer-Verwimp, 2014).

**Fossombronia porphyrorrhiza* (Nees) Prosk.

Dept. Cordillera. Piribeby, Arroyo Piribeby: on base of trunk on the bank of the Piribeby stream (25°28'0.44''S, 57°2'29.76''W), 7 Sep 2014, *B. Cañiza, A. Guerrero, V. Irazusta & G. Pereira 104* (FACEN 2391, SP, FCQ). **Dept. Paraguari.** Ultima Altura: on moist rock. 29 Oct 2000. *L. Fretes & E. Rempel LF070* (FACEN 3075). **Other localities:** Itapúa.

General distribution: widespread; America: United States (Arkansas and Pennsylvania), West Indies (Cuba, Haiti, Dominican Republic, Puerto Rico, Trinidad, Guadeloupe, Dominica), Brazil, Paraguay; possibly occurring also in Asia (India) (Schäfer-Verwimp & Pócs, 2009; Söderström *et al.*, 2013).

**Frullania ericoides* Nees (Mont.)

Dept. Alto Paraguay. Estancia Yaguareté Porá: low forest with predominance of *Ziziphus mistol*, *Ximenea americana* and *Trithrinax schizophylla*, on bark of *Ziziphus mistol* (21°38'09.0''S, 58°52'13.1''W), 10 Dec 2011, *C. Vogt & B. Cañiza 1287* (FACEN 2614).

Dept. Alto Paraná. Hernandarias. On bark at a garden center, 23 Mar 1982, *O. Yano 4110* (SP 174239). **Dept. Central.** San Lorenzo, wooded area of the Facultad de Ciencias Agrarias, Universidad Nacional de Asunción: on bark, 5m to a watercourse (25°20'20.03''S, 57°30'55.93''W), 7 Sep 2012, *B. Cañiza & M. Ortiz 41* (FACEN 2623, FCQ). **Dept.**

Cordillera. Piribeby, Arroyo Piribeby: on bark of *Salix sp.* about 20m to the Piribeby stream (25°28'0.44''S, 57°2'29.76''W), 7 Sep 2014, *B. Cañiza, A. Guerrero, V. Irazusta, M. Gutiérrez & A. Villagra 107* (FACEN 2564); Piribeby, Cerro Miranda: forming mats on rock (25°31'18.67''S, 57°1'4.43''W), 14 May 2015, *B. Cañiza & R. Caballero 160* (FACEN 1434). **Dept. Paraguari.** Ultima Altura: on very moist rock (attacked by fungi) (25°34'25''S, 57°5'33''W, 359 m), 29 Oct 2000, *L. Fretes & E. Rempel LF091* (FACEN 2984). **Other localities:** Caaguazú.

General distribution: pantropical (Gradstein & Costa, 2003).

***Frullania platycalyx* Herzog

Dept. Amambay. Pedro Juan Caballero: on bark in front of the Ministerio de Hacienda, 31 Mar 1979, *María Tereza de Paiva Azevedo s.n.* (SP 147531).

General distribution: South America: southern Brazil, northern Argentina (Gradstein & Costa, 2003), Paraguay.

***Frullania riojaneirensis* (Raddi) Ångstr.

Dept. Alto Paraná. Campos de Hernandarias, near the Acaraí river: on tree branches, gallery forest, 23 March 1982, *O. Yano 4139* (SP 171937).

General distribution: pantropical; America: from United States (Florida), Mexico, West Indies (Cuba, Puerto Rico, Hispaniola) to south Brazil, northern Chile, (Schäfer-Verwimp & Pócs, 2009) and Paraguay.

**Lejeunea adpressa* Nees

Dept. Alto Paraná. Campos de Hernandarias, near the Acaraí river: on a living trunk base, gallery forest, 23 Mar 1982, *O. Yano 4115* (SP 174242). **Dept. Central.** San Lorenzo, wooded area of the Facultad de Ciencias Agrarias, Universidad Nacional de Asunción: on bark (25°20'20.03"S, 57°30'55.93"W), 7 Sep 2012, *B. Cañiza & M. Ortiz 43* (FACEN 2395, FCQ).

Note: According to the references cited in Söderström *et al.* (2013) there is no information about the exact location of the species.

General distribution: widely distributed in tropical America from United States (Florida), Mexico, West Indies, Paraguay to northern Argentina; Africa (Reiner-Drehwald, 2009; Söderström *et al.*, 2013; Carmo & Peralta, 2016).

***Lejeunea flava* (Sw.) Nees

Dept. Cordillera. Piribebuy, Cerro Miranda: on rocky wall located at the entrance to the hill (25°31'18.67"S, 57°1'4.43"W), 14 May 2015, *B. Cañiza & R. Caballero 169* (FACEN 1435, SP).

General distribution: pantropical; widely distributed in tropical America: from southern United States to northern Argentina (Reiner-Drehwald, 2000) and Brazil; southeastern Asia; Africa (Bastos & Yano, 2009); Paraguay.

***Lejeunea laeta* (Lehm. & Lindenb.) Lehm. & Lindenb.

Dept. Central. San Lorenzo, wooded area of the Facultad de Ciencias Agrarias, Universidad Nacional de Asunción: on bark (25°20'20.03"S, 57°30'55.93"W), 24 Apr 2014, *B. Cañiza & M. Segovia 76* (FCQ, SP).

General distribution: America: Mexico, West Indies, Colombia, Suriname, French Guiana, Ecuador, Brazil, northern Argentina (Misiones) (Gradstein & Costa, 2003; Schäfer-Verwimp & Pócs, 2009), Paraguay.

**Lejeunea laetevirens* Nees & Mont.

Dept. Cordillera. Piribebuy, Cerro Miranda: on rocky wall located at the entrance to the hill (25°31'18.67"S, 57°1'4.43"W), 14 May 2015, *B. Cañiza & R. Caballero 159* (FACEN 1452, SP); on bark, 14 May 2015, *B. Cañiza & R. Caballero 171* (FACEN, SP). **Other localities:** Alto Paraná, Caaguazú, Paraguari.

General distribution: widely distributed in tropical America, from southeastern United States to Paraguay and northeastern Argentina (Formosa, Misiones) (Reiner-Drehwald, 2000).

***Lejeunea setiloba* Spruce

Dept. Cordillera. San Bernardino, Reserva Lago Ypacaraí, Playa Kandu: on trunk (25°14'48"S, 57°19'44"W), 1 Apr 2015, *B. Cañiza & C. Vogt 131* (FACEN 1386, SP).

General distribution: tropical America (Gradstein & Costa, 2003): Costa Rica, West Indies, Brazil, Argentina (Misiones, Corrientes, Buenos Aires) (Reiner-Drehwald, 2000; Dauphin, 2005; Lavocat Bernard & Schäfer-Verwimp, 2011), Paraguay.

**Lejeunea trinitensis* Lindenb.

Dept. Cordillera. San Bernardino, Reserva Lago Ypacaraí, Playa Kandu: on trunk (25°14'48"S, 57°19'44"W), 1 Apr 2015, *B. Cañiza & C. Vogt 132* (FACEN 1391). **Other localities:** Alto Paraná.

General distribution: tropical America: from United States (Florida) to Brazil, Paraguay and Argentina (Salta, Misiones); Africa (Comoros) (Reiner-Drehwald, 2000; Gradstein & Costa, 2003).

***Lophocolea bidentata* (L.) Dumort.

Dept. Cordillera. Piribebuy, Arroyo Piribebuy: on rocky wall near the Piribebuy stream (25°28'0.44"S, 57°2'29.76"W), 7 Sep 2014, *B. Cañiza & A. Guerrero, V. Irazusta, M. Gutiérrez & A. Villagra 100* (FACEN 2394, SP, FCQ).

General distribution: subcosmopolitan (Gradstein & Costa, 2003).

**Marchantia chenopoda* L.

Dept. Paraguari. Parador turístico Choló: On rock with black soil near the Choló stream, 29 Oct 2000, *G. Marín & M. Zárate GM 1089* (FACEN 1154). **Other localities:** Amambay.

General distribution: tropical America: from Mexico to Argentina, Brazil (Hässel de Menéndez, 1962) and Paraguay (Söderström *et al.*, 2013).

***Metzgeria albinea* Spruce

Dept. Alto Paraná. Campos de Hernandarias, near the Acaraí river: on trunk of Tiliaceae, 23 Mar 1982, *O. Yano 4119* (SP 171928).

General distribution: widespread; America: from Mexico southwards to Chile (Schäfer-Verwimp & Pócs, 2009) and Paraguay.

**Microlejeunea globosa* (Spruce) Steph.

Dept. Cordillera. Piribebuy, Cerro Miranda: on corky bark of a fallen tree (25°31'18.67"S, 57°1'4.43"W), 14 May 2015, *B. Cañiza & R. Caballero 162* (FACEN 1456). **Other localities:** Paraguari.

General distribution: America: southeastern United States, Mexico, Ecuador, Brazil, Paraguay, central and northeastern Argentina (Reiner-Drehwald, 1994c).

**Myriocoleopsis minutissima* (Sm.) R. L. Zhu, Y. Yu et Pócs

Dept. Cordillera. San Bernardino, Reserva Lago Ypacaraí, Playa Kandu: very well preserved humid riparian forest, on corky bark of *Chloroleucon tenuiflorum* (Fabaceae) (25°14'47.2"S, 57°19'41.1"W), 1 Apr 2015, *B. Cañiza & C. Vogt 129* (FACEN 1384). **Other localities:** Alto Paraná, Guairá (Reiner-Drehwald, 1994a).

General distribution: pantropical (Carmo & Peralta, 2016).

**Oxymitra paleacea* Bisch.

Dept. Presidente Hayes. Laguna Tte. Rojas Silva: 4,5 m high xerophytic scrubland with predominance of *Ruprechtia triflora*, *Maytenus vitis-idaea* and *Acacia praecox*, growing on soil under *Ruprechtia triflora* (22°37'40.8"S, 59°03'45.0"W), 6 Jan 2011, *C. Vogt & M. Vera 1051* (FACEN 2407). **Other localities:** Asunción, Paraguari.

General distribution: North America, South America: Brazil, Paraguay, Argentina; Europe; northern Africa (Hässel de Menéndez, 1964).

**Plagiochila corrugata* (Nees) Nees & Mont.

Dept. Alto Paraná. Campos de Hernandarias, near the Acaraí river: on the base of the trunk of a living tree, gallery forest, 23 Mar 1982, *O. Yano 4114* (SP 174241). **Dept. Central.** Luque, Cuenca del Salado, Compañía Nueva Asunción: altered semihumid riparian forest, very clean stream, on trunk associated with *Porella swartziana* (25°13'01.9"S, 57°20'51.9"W),

2 Apr 2015, *B. Cañiza* & *C. Vogt* 139 (FACEN 1411, SP). **Dept. Cordillera.** Cerro Naranjo, Compañía Naranjo: on submerged rock (25°31'06"S, 57°03'48"W, 236 m), 15 Aug 2000, *L. Fretes* & *E. Rempel LF004* (FACEN 1156). **Other localities:** Caaguazú.

General distribution: widespread; America: West Indies (Dominican Republic), Bolivia, southeast Brazil, Paraguay, northern Argentina; Africa: Madagascar, the Comores, Tanzania (Schäfer-Verwimp & Pócs, 2009).

**Porella swartziana* (F. Weber) Trevis.

Dept. Central. Luque, Cuenca del Salado, Compañía Nueva Asunción: altered semihumid riparian forest, very clean stream, on trunk associated with *Plagiochila corrugata* (25°13'01.9"S, 57°20'51.9"W), 2 Apr 2015, *B. Cañiza* & *C. Vogt* 139 (FACEN 1411, SP).

Other localities: Alto Paraná.

General distribution: common throughout tropical America (Gradstein & Costa, 2003).

**Radula tectiloba* Steph.

Dept. Central. San Lorenzo, Facultad de Ciencias Veterinarias, Universidad Nacional de Asunción: on trunk (25°20'15.36"S, 57°31'23.35"W), 2015, *B. Cañiza*, *A. Rivarola*, *C. Vogt*, *R. Caballero* 156 (FACEN 2560). **Other localities:** Alto Paraná, Asunción, Caaguazú, Cordillera, Guairá.

General distribution: widespread Neotropical species; America: Mexico, Costa Rica, West Indies, Colombia, Bolivia, Brazil, Paraguay, Chile, Argentina (Schäfer-Verwimp & Pócs, 2009).

**Riccia lindmanii* Steph.

Dept. Central. San Lorenzo, Ruta Mcal. Estigarribia, Km 10: on moist soil alongside the sidewalk (25°20'5.67"S, 57°32'1.27"W), 4 Jun 2014, *B. Cañiza* 173 (FACEN 1494, SP).

Other localities: Asunción.

General distribution: subtropical South America: Peru, Brazil, Paraguay, Argentina, Uruguay (Hässel de Menéndez, 1964; Gradstein & Costa, 2003).

**Riccia plano-biconvexa* Steph.

Asunción. Barrio Santa María: on moist soil alongside the Madame Lynch bikepath, near the Madame Lynch - Mcal. López viaduct (25°18'13.90"S, 57°33'09.34"W), 25 Sep 2014, *B. Cañiza* 122 (FACEN 2469, SP, FCQ). **Other localities:** Caaguazú.

General distribution: tropical and subtropical South America: Brazil, Paraguay, Argentina (Gradstein & Costa, 2003).

**Riccia stenophylla* Spruce

Dept. Central. San Lorenzo, wooded area of the Facultad de Ciencias Agrarias, Universidad Nacional de Asunción: on moist soil, near a stream (25°20'20.03"S, 57°30'55.93"W), 17 October 2013, *B. Cañiza* & *S. Insfrán* 52 (FCQ). **Dept. Cordillera.** Piribebuy, Arroyo Piribebuy: on mud near the base of a trunk on the bank of the Piribebuy stream (25°28'0.44"S, 57°2'29.76"W), 7 Sep 2014, *B. Cañiza* & *A. Guerrero*, *V. Irazusta*, *M. Gutiérrez* & *A. Villagra* 105 (FACEN 2472, SP, FCQ). **Other localities:** Asunción, Presidente Hayes.

General distribution: widespread in tropical and subtropical America: Brazil, Paraguay, Argentina, Uruguay (Hässel de Menéndez, 1964; Gradstein & Costa, 2003).

***Telaranea nematodes* (Gott. ex Austin) Howe

Dept. Central. San Lorenzo, wooded area of the Facultad de Ciencias Agrarias, Universidad Nacional de Asunción: on rotting log, between fallen leaves, to about 25m to the main watercourse in a very humid place (25°20'20.03"S, 57°30'55.93"W), 7 Sep 2012, *B. Cañiza*

& *M. Ortiz* 46 (FACEN 2400, FCQ); San Lorenzo, wooded area of the Facultad de Ciencias Agrarias, Universidad Nacional de Asunción: on muddy soil between roots and fallen leaves, associated with *Isopterygium tenerum* (25°20'20.03"S, 57°30'55.93"W), 7 Sep 2012, *B. Cañiza* & *M. Ortiz* 48 (FACEN 1886).

Note: these are the first records of the genus *Telaranea* from Paraguay.

General distribution: tropical America: West Indies, Mexico, Guatemala, Honduras, Colombia, Brazil; western Europe; tropical Africa (Gradstein & Costa, 2003; Schäfer-Verwimp & Pócs, 2009).

BRYOPHYTA

** *Amblystegium serpens* (Hedw.) Schimp.

Dept. Cordillera. Piribebuy. Arroyo Piribebuy: on rocky wall near the Piribebuy stream (25°28'0.44"S, 57°2'29.76"W), 7 Sep 2014, *B. Cañiza*, *A. Guerrero*, *V. Irazusta*, *M. Gutiérrez* & *A. Villagra* 99 (FACEN 264, SP, FCQ). **Dept. Paraguari.** Mbatovi: on rock emerging from water, 2 Dec 2000, *L. Fretes* & *E. Rempel* LF140 (FACEN 1123).

General distribution: widespread; America: Mexico, West Indies (Bermuda), Colombia, Ecuador, Peru, Bolivia and southern South America; Eurasia; Africa; Australia (Hedenäs, 2003); Paraguay.

* *Aulacopilum tumidulum* Thwaites & Mitt. ex Mitt.

Dept. Alto Paraná. Hernandarias, garden center: on trunk of *Citrus* sp., 23 Mar 1972, *O. Yano* 4111 (SP 171925). **Other localities:** Asunción, Central, Paraguari (Crum, 1972).

General distribution: America: northeastern Mexico, Paraguay; Asia: Sri Lanka, India; Oceania: Australia, New Zealand (Sharp *et al.*, 1994b; Daniels *et al.*, 2012).

** *Bryum micro-nitidum* Ochi

Dept. Central. San Lorenzo, parking lot of the Facultad de Arquitectura, Diseño y Arte, Universidad Nacional de Asunción: on cement (25°20'5.28"S, 57°30'58.57"W), 9 Aug 2013, *B. Cañiza* & *S. Insfrán* 51 (FCQ, LIL).

General distribution: America: Peru, Bolivia (Ochi, 1980), Paraguay.

* *Callicostella pallida* (Hornsch.) Ångstr.

Dept. Central. San Lorenzo, wooded area of the Facultad de Ciencias Agrarias, Universidad Nacional de Asunción: growing on rotting wood on muddy soil and humus (25°20'20.03"S, 57°30'55.93"W), 24 Apr 2014, *B. Cañiza* & *M. Segovia* 78 (FACEN 1958, FCQ). **Other localities:** Cordillera, Paraguari.

General distribution: neotropical; South America: Brazil (Vaz & Costa, 2006), Paraguay (O'Shea & Price, 2008).

* *Campylopus heterostachys* (Hampe) A. Jaeger

Dept. Cordillera. Piribebuy, Cerro Miranda: on wet rock (25°31'18.67"S, 57°1'4.43"W), 14 May 2015, *B. Cañiza* & *R. Caballero* 157 (FACEN 1439). **Other localities:** Paraguari.

Note: This species was also mentioned for Paraguay in Frahm (1991) but without exact information about the location.

General distribution: America: Mexico, Guatemala, Honduras, Nicaragua, Costa Rica, Venezuela, Colombia, Ecuador, Peru, Bolivia, southeastern Brazil, Paraguay, northern Argentina (Frahm, 1991; Carmo & Peralta, 2016).

* *Campylopus pilifer* Brid.

Dept. Cordillera. Piribebuy, Cerro Miranda: on soil in an open rocky area (25°31'18.67"S, 57°1'4.43"W), 7 Sep 2014, *B. Cañiza, S. Páez & G. Marín 119* (FACEN 2317, FCQ). **Other localities:** Caaguazú.

General distribution: America: United States (Arizona), West Indies (Cuba, Jamaica, Puerto Rico) to South America; Europe; Africa; Asia (Sharp *et al.*, 1994a).

** *Chenia leptophylla* (Müll. Hal.) R. H. Zander

Dept. Amambay. Pedro Juan Caballero, service station: on base of a palm tree, 13 Dec 2013, *G. Suárez, A. Vega & H. Sánchez 1769* (LIL). **Dept. Central.** San Lorenzo, parking lot of the Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Asunción: on moist soil alongside the sidewalk, associated with *Fissidens zollingeri* (25°20'8.95"S, 57°31'8.43"W), 21 Apr 2015, *B. Cañiza, C. Vogt, R. Caballero & A. Rivarola 152* (FACEN 1431, SP).

Note: These are the first records of the genus *Chenia* from Paraguay.

General distribution: North and South America; Europe; eastern Asia; Oceania: Australia (Zander, 1993).

* *Chryso-hypnum diminutivum* (Hampe) W.R. Buck

Dept. Cordillera. Itacurubí de la Cordillera, Balneario Ita Koty: riparian forest on rocky hills, growing on rotten log (25°27'25"S, 56°51'56"W), 25 Mar 2001, *G. Marín 971* (FACEN 2038). **Other localities:** Caazapá, Canindeyú, Paraguari.

General distribution: America: United States (Florida and Alabama), Mexico, Central America, northern and central South America (Buck, 1998).

* *Dimerodontium balansae* Müll. Hal.

Dept. Cordillera. Piribebuy, Arroyo Piribebuy: on bark of *Salix sp.* to about 20 m to the Piribebuy stream (25°28'0.44"S, 57°2'29.76"W), 7 Sep 2014, *B. Cañiza, A. Guerrero, V. Irazusta, M. Gutiérrez & A. Villagra 107* (FACEN 2564, SP, FCQ). Piribebuy, Cerro Miranda: on bark of a tree (25°31'18.67"S, 57°1'4.43"W), 14 May 2015, *B. Cañiza & R. Caballero 171* (FACEN, SP). **Other localities:** Amambay, Asunción, Central, Guairá, Ñembucú, Paraguari (Cámara & Magill, 2009).

General distribution: America: Brazil, Paraguay, Argentina, Uruguay; South Africa (Cámara & Magill, 2009).

* *Erpodium beccarii* Müll. Hal. *ex* Vent.

Dept. Alto Paraguay. Estancia Yaguareté Porá: 9 m high xeromorph forest with predominance of *Bulnesia sarmientoi*, *Phyllostylon rhamnoides* and *Cynophalla retusa*, growing on bark of *Bulnesia sarmientoi* (21°41'30.8"S, 58°40'53.1"W) 8 Dec 2011, *C. Vogt & B. Cañiza 1217* (FACEN 2671). **Dept. Alto Paraná.** Hernandarias, garden center: on trunk of *Citrus sp.*, 22 Mar 1982, *O. Yano 4108* (SP 171923). **Dept. Concepción.** Vallemi, Santa Caverna: growing on cactus associated with lichens along a trail about 25 m to the cave entrance (22°14.74'S, 57°52.811'W, 137 m), 29 Jul 2011, *B. Cañiza, S. Insfrán, B. Olmedo & S. Páez 25* (FACEN 2655). **Other localities:** Asunción, Central, Paraguari.

General distribution: America: Mexico, Bolivia, Paraguay, Argentina; Africa: Transvaal, Tanzania, Kenya, Ethiopia; Oceania: Australia (Queensland); Asia: India (Sharp *et al.*, 1994b; Daniels *et al.*, 2012).

* *Erpodium glaziovii* Hampe

Dept. Alto Paraná. Hernandarias, Garden Center: on trunk of *Citrus sp.*, 23 Mar 1982, *O. Yano 4109* (SP 171924). **Dept. Amambay.** Pedro Juan Caballero, Av. Dr. Gaspar: on bark next to house number 894, 31 Jan 1979, *Maria Tereza de Paiva Azevedo s.n.* (SP 147533). **Dept. Cordillera.** San Bernardino, Reserva Lago Ypacaraí, Playa Kandu, deteriorated

semihumid riparian forest: on lower branch of *Handroanthus* (Bignoniaceae) (25°14'52.4''S, 57°19'36.6''W, 76 m), 1 Apr 2015, *B. Cañiza & C. Vogt 124* (FACEN 1360, SP). **Other localities:** Alto Paraguay, Asunción, Central, Concepción, Paraguari.

General distribution: America: Mexico, West Indies (Dominican Republic), Brazil, Paraguay; Asia: Yemen, India (Judd, 1980; Sharp *et al.*, 1994b; Daniels *et al.*, 2012).

** *Erpodium pringlei* E. Britton

Dept. Alto Paraguay. Estancia Yaguareté Porá: low forest with predominance of *Ziziphus mistol*, *Salta triflora*, *Acacia curvifructa* and *Trithrinax schizophylla*, on trunk of *Cynophalla retusa* associated with *Frullania ericoides* (21°38'08.1''S, 58°52'13.7''W), 10 Dec 2011, *C. Vogt & B. Cañiza 1293* (FACEN 2608).

General distribution: America: Mexico, Guatemala, El Salvador, West Indies (Cuba, Dominican Republic), Brazil (Delgadillo *et al.*, 1995), Paraguay.

* *Erythrodontium longisetum* (Hook.) Paris

Dept. Caaguazú. Mbutuy-Capiibary road, hygrophilous forest at the edge of a ravine, on fallen trunk of *Inga uraguensis*, 4 Jun 2005, *G. Marín 1151* (FACEN 2047). **Dept. Canindeyú.** Lagunita Aguará-Nú: epiphytic on orchid (24°07'49''S, 055°20'00''W), 30 Aug 2000, *E. Zardini & I. Franco 55026a* (FACEN 2654). **Other localities:** Paraguari.

General distribution: America: Mexico, Central America, Venezuela, Colombia, Bolivia, Brazil, Paraguay (Buck, 1998; Carmo & Peralta, 2016).

* *Eulacophyllum cultelliforme* (Sull.) W. R. Buck & Ireland

Dept. Cordillera. Cerro Naranja, Compañía Naranjo: growing on sand, forming cushions in the hillside (25°31'04''S, 57°03'46''W, 250 m), 15 Aug 2000, *L. Fretes & E. Rempel LF013a* (FACEN 1118). **Other localities:** Alto Paraguay, Alto Paraná, Amambay, Guairá, Itapúa, Paraguari.

General distribution: America: Mexico, Central America, northern South America, Brazil, Paraguay (Buck, 1998).

* *Fabronia ciliaris* var. *polycarpa* (Hook.) W. R. Buck

Dept. Alto Paraná. Hernandarias, garden center: on branch of *Citrus sp.*, 23 Mar 1982, *O. Yano 4111* (SP 171925). **Dept. Cordillera.** Piribebuy, Arroyo Piribebuy: on rocky wall alongside the Piribebuy stream (25°28'0.44''S, 57°2'29.76''W), 7 Sep 2014, *B. Cañiza, A. Guerrero, V. Irazusta, M. Gutiérrez & A. Villagra 99* (FACEN 2641, SP). Piribebuy, Arroyo Piribebuy: on base of *Eucalyptus* moist trunk (25°28'0.44''S, 57°2'29.76''W), 7 Sep 2014, *B. Cañiza, A. Guerrero & V. Irazusta 89* (FACEN 2645, FCQ). **Other localities:** Alto Paraguay, Asunción, Paraguari.

General distribution: America: southeastern United States, Mexico to central South America (Buck, 1998).

* *Fissidens elegans* Brid.

Dept. Cordillera. Piribebuy, Cerro Miranda: on rock in a humid dark place (25°31'18.67''S, 57°1'4.43''W), 14 May 2015, *B. Cañiza & R. Caballero 161* (FACEN 1454). **Other localities:** Alto Paraná, Asunción, Guairá, Paraguari.

General distribution: America: North America, Central America, Colombia, Venezuela, Trinidad, Guayana, Suriname, French Giana, Ecuador, Peru, Brazil, Paraguay, Argentina (Bordin, 2011).

* *Fissidens minutipes* (Müll.Hal.) Broth.

Dept. Paraguari. Parador Turístico Chololó: on bark of *Myrciaria baporetti*, alongside the Chololó stream, 29 Oct 2000, *G. Marín & M. Zárate GM1085* (FACEN 2972). **Other localities:** Alto Paraguay.

General distribution: neotropical. America: Bolivia, Brazil, Paraguay (Bordin, 2011; Carmo & Peralta, 2016).

* *Fissidens semicompletus* Hedw.

Dept. Paraguari. Mbatoví: on rock in a stream, 2 Dec 2000, *L. Fretes & E. Rempel LF163* (FACEN). **Other localities:** Alto Paraná, Cordillera.

General distribution: America: Bolivia, Brazil, Chile, Paraguay, Argentina, Uruguay (Bordin, 2011).

* *Haplocladium microphyllum* (Hedw.) Broth.

Dept. Paraguari. Última Altura: on cement under shade, 29 Oct 2000, *L. Fretes & E. Rempel LF053* (FACEN 444). **Other localities:** Alto Paraguay, Asunción, Boquerón, Central, Guairá, Presidente Hayes.

General distribution: very widespread; America: southern Canada, United States, Mexico to Argentina; eastern Asia (Buck, 1998).

* *Helicodontium capillare* (Hedw.) A. Jaeger

Dept. Alto Paraná. Hernandarias, Garden Center: on trunk of *Citrus sp.*, 23 Mar 1982, *O. Yano 4109* (SP 171924). **Other localities:** Asunción, Caazapá, Central, Itapúa, Paraguari.

General distribution: America: Mexico to northern Argentina (Buck, 1998).

** *Hypnella pallescens* (Hook.) A. Jaeger

Dept. Paraguari. Mbatoví: on rock, forming cushions, associated with *Cyclodictyon albicans* and *Lepidopilum pallidonitens*, 2 Dec 2000, *L. Fretes & E. Rempel LF177* (FACEN 2980).

Note: This is the first record of the genus *Hypnella* from Paraguay.

General distribution: America: West Indies (Cuba, Jamaica, Puerto Rico, Guadeloupe, Dominica, Martinique, St. Lucia, Trinidad) Panama, Colombia, Venezuela, Guyana, Ecuador, Peru, Brazil (Vilas Bôas-Bastos & Bastos, 2004), Paraguay.

** *Lepidopilum pallidonitens* (Müll. Hal.) Paris

Dept. Paraguari. Mbatoví: on rock, forming cushions, associated with *Cyclodictyon albicans* and *Hypnella pallescens*, 2 Dec 2000, *L. Fretes & E. Rempel LF 177* (FACEN 2980).

Note: This is the first record of the genus *Lepidopilum* from Paraguay.

General distribution: America: Costa Rica, Ecuador, Bolivia (Churchill & Linares, 1995), Paraguay.

* *Macrocoma tenuis* subsp. *sullivantii* (Müll. Hal.) Vitt

Dept. Central. Luque, Compañía Nueva Asunción, Cuenca del Río Salado, slightly deteriorated humid scrubland: on bark (25°13'04.7"S, 57°20'56.8"W), 2 Apr 2015, *B. Cañiza & C. Vogt 141* (FACEN 1397). **Dept. Cordillera.** Piribebuy, Cerro Miranda, rocky scrubland: on bark (25°31'18.67"S, 57°1'4.43"W), 7 Sep 2014, *B. Cañiza, A. Guerrero, V. Irazusta, M. Gutiérrez & A. Villagra 118* (FACEN, SP, FCQ). **Other localities:** Paraguari.

General distribution: America: United States (Georgia, North Carolina, Hawaii), Mexico, Central America to Argentina and Chile; eastern Asia: Japan (Sharp *et al.*, 1994b).

* *Neckeropsis disticha* (Hedw.) Kindb.

Dept. Alto Paraná. Hernandarias, rural area, near the Acaraí river: on trunk of Tiliaceae, 23 Mar 1982, *O. Yano 4119* (SP 171928). **Other localities:** Caaguazú, Chaco, Guairá, Paraguari.

General distribution: America: United States (southern Florida), central Mexico to Panama, West Indies (Trinidad), northern South America to Bolivia, southeastern Brazil, Paraguay and northern Argentina; Africa: São Tomé and Príncipe (Buck, 1998; Enroth & Shevock, 2011).

* *Octoblepharum albidum* Hedw.

Dept. Central. Luque, Arroyo Yukyry, very deteriorated wetland: on trunk of *Inga uraguensis* (Fabaceae) (25°15'24.6"S, 57°23'30.3"W), 3 Apr 2015, B. Cañiza & C. Vogt 148 (FACEN 1424). **Other localities:** Alto Paraná, Chaco (no exact locality was mentioned), Cordillera, Paraguari.

General distribution: pantropical; America: United States (Florida and Louisiana), Paraguay (Sharp *et al.*, 1994a; O'Shea & Price, 2008; Carmo & Peralta, 2016).

** *Oxystegus tenuirostris* (Hook. & Taylor) A. J. E. Sm.

Dept. Central. San Lorenzo, parking lot of the Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Asunción: on moist soil alongside the sidewalk associated with *Fissidens zollingeri* (25°20'8.95"S, 57°31'8.43"W), 21 Apr 2015, B. Cañiza, C. Vogt, R. Caballero & A. Rivarola 152 (FACEN 1431, SP).

Note: This is the first record of the genus *Oxystegus* from Paraguay.

General distribution: America: North and Central America, West Indies, South America; Europe; Africa; Asia: Arabian Peninsula, India, Russia, China; Oceania: New Zealand (Costa, 2016).

* *Physcomitrium subsphaericum* Schimp.

Dept. Central. San Lorenzo, wooded area of the Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Asunción: on humid soil nearby a watercourse (25°20'20.03"S, 57°30'55.93"W), Oct 2013, B. Cañiza & S. Insfrán 53 (FACEN 2716, LIL, FCQ). **Dept. Cordillera.** Piribebuy, Arroyo Piribebuy: on rocky wall alongside the Piribebuy stream (25°28'0.44"S, 57°2'29.76"W), 7 Sep 2014, B. Cañiza, A. Guerrero, V. Irazusta, M. Gutiérrez & A. Villagra 102 (FACEN 2877, SP, FCQ). **Other localities:** Chaco (no exact locality mentioned).

General distribution: America: Mexico, Guatemala (Sharp *et al.*, 1994a), Brazil (Yano, 2011), Paraguay (O'Shea & Price, 2008).

** *Plaubelia spengelii* (Schwägr.) R. H. Zander

Dept. Concepción. Vallemí, Santa Caverna: in a small cleft of calcareous rock approximately 2 m to the entrance in the cave (22°14.778'S, 57°52.797'W, 137 m), 29 Jul 2011, B. Cañiza, S. Insfrán, B. Olmedo & S. Páez 18 (FACEN 1459). Vallemí, Tres Cerros cave: on calcareous rock, approximately 1 m to the entrance in the cave (22°15'01.1"S, 57°52'07.6"W, 128 m), 29 July 2011, B. Cañiza, S. Insfrán, B. Olmedo & S. Páez 32 (FACEN, SP).

Note: these are the first records of the genus *Plaubelia* from Paraguay.

General distribution: America: southwestern United States, Mexico, Central America, West Indies, Brazil (Costa, 2016), Paraguay.

** *Pseudocrossidium exiguum* M. J. Cano & J. A. Jiménez

Dept. Cordillera. Piribebuy, Arroyo Piribebuy: forming carpets on rocky wall approximately 35 m to the Piribebuy stream (25°28'0.44"S, 57°2'29.76"W), 7 Sep 2014, B. Cañiza, A. Guerrero, V. Irazusta, M. Gutiérrez & A. Villagra 110 (FACEN, SP, FCQ).

Note: this is the first record of the genus *Pseudocrossidium* in Paraguay.

General distribution: America: Peru, Brazil, Argentina (Cano *et al.*, 2015), Paraguay.

* *Racopilum tomentosum* (Hedw.) Brid.

Dept. Cordillera. Piribebuy, Arroyo Piribebuy: on rock near the base of a trunk alongside the stream (25°28'0.44"S, 57°2'29.76"W), 7 Sep 2014, *B. Cañiza, A. Guerrero, V. Irazusta, M. Gutiérrez & A. Villagra 106* (FACEN, FCQ). **Other localities:** Alto Paraná, Amambay, Asunción, Caazapá, Canindeyú, Central, Guairá, Itapúa, Misiones, Paraguari.

General distribution: America: United States (Florida), West Indies, Mexico to northern South America; Africa: Guinea, Fernando Po, Cameroon (Sharp *et al.*, 1994b; Carmo & Peralta, 2016).

** *Rhodobryum subverticillatum* Broth.

Dept. Cordillera. Itacurubí de la Cordillera: on soil, 15 Dec 2013, *B. Cañiza & S. Insfrán 55* (FCQ, LIL).

General distribution: America: Brazil, Uruguay (Ochi, 1981), Paraguay.

* *Schlotheimia jamesonii* (Arn.) Brid.

Dept. Alto Paraná. Hernandarias, rural area, near the Acaraí river: on rotten trunk in a gallery forest, 23 Mar 1982, *O. Yano 4129* (SP 171931). **Other localities:** Paraguari.

General distribution: America: Mexico, West Indies (Cuba, Jamaica, Dominican Republic) northern South America and southern Brazil (Sharp *et al.*, 1994b; Carmo & Peralta, 2016), Paraguay.

* *Schlotheimia rugifolia* (Hook.) Schwägr.

Dept. Central. Luque, Compañía Nueva Asunción, Cuenca del Río Salado: on bark in a semihumid high forest (25°13'41.9"S, 57°23'47.4"W, 74 m), 2 Apr 2015, *B. Cañiza & C. Vogt 143* (FACEN 1420). **Dept. Cordillera.** Piribebuy, Cerro Miranda: on bark (25°31'18.67"S, 57°1'4.43"W), 14 May 2015, *B. Cañiza & R. Caballero 163* (FACEN 1474).

Other localities: Alto Paraguay.

General distribution: America: southeastern United States, Mexico, Guatemala, West Indies (Cuba, Haiti, Jamaica) southward to Brazil and Paraguay; Asia: India (Sharp *et al.*, 1994b; O'Shea & Price, 2008; Carmo & Peralta, 2016).

* *Schoenobryum concavifolium* (Griff.) Gangulee

Dept. Central. Luque, Compañía Nueva Asunción, Cuenca del Río Salado: on bark nearby a very clean stream, in a deteriorated semihumid riparian forest (25°13'01.9"S, 57°20'51.9"W), 2 Apr 2015, *B. Cañiza & C. Vogt 139* (FACEN 1411, SP). **Other localities:** Alto Paraná.

Note: We consider that *Schoenobryum concavifolium* and *S. julaceum* Dozy & Molk. may be conspecific since Alvarez & Vargas (2013) did not analyze taxonomy and nomenclature of *S. concavifolium*.

General distribution: America: United States (Florida), Mexico to Panama, West Indies (Jamaica, Puerto Rico, Dominican Republic), Colombia, Venezuela Peru, Bolivia, Paraguay, northern Argentina; Africa: Angola, Madagascar; Asia: India, Sri Lanka, Java, Philippines (Buck, 1998).

* *Sematophyllum adnatum* (Michx.) E. Britton

Dept. Central. San Lorenzo, wooded area of the Facultad de Ciencias Agrarias, Universidad Nacional de Asunción: 24 Apr 2014, *B. Cañiza & M. Segovia 76* (FCQ, SP). **Dept. Cordillera.** Piribebuy, Arroyo Piribebuy: on base of *Eucalyptus* humid trunk (25°28'0.44"S, 57°2'29.76"W), 7 Sep 2014, *B. Cañiza, A. Guerrero & V. Irazusta 90* (FACEN, SP, FCQ). Piribebuy, Cerro Miranda: (25°31'18.67"S, 57°1'4.43"W), 14 May 2015, *B. Cañiza & R. Caballero 159* (FACEN, SP). **Other localities:** Paraguari.

General distribution: America: United States (New York, Ohio, Florida, Texas), Mexico, Central America, South America; Europe: Italy, Switzerland; Africa; Asia: India (Buck, 1998; Blockeel *et al.*, 2000; Frahm, 2014; Schnyder, 2015).

***Sematophyllum beyrichii* (Hornsch.) Broth.

Dept. Paraguari. Mbatoví: on rock towards the top of the hill, 2 Dec 2000, *L. Fretes & E. Rempel LF180* (FACEN 118).

General distribution: neotropical; America: Brazil (Yano, 2011; Carmo & Peralta, 2016), Paraguay.

* *Sematophyllum subpinnatum* (Brid.) E. Britton

Dept. Alto Paraná. Hernandarias, rural area, near the Acaraí river: on tree branches in a gallery forest, 23 Mar 1982, *O. Yano 4137* (SP 171935). **Dept. Amambay.** Pedro Juan Caballero: on trunk in front of the Ministerio de Hacienda, 31 Jan 1979, *María Tereza de Paiva Azevedo s.n.* (SP 147531). **Dept. Caaguazú.** Mbutuy-Capiibary road, hygrophilous forest at the edge of a ravine, on fallen trunk of *Inga uraguensis*, (24°52.988'S, 55°56.794'W), 4 Jun 2005, *G. Marin 1150* (FACEN 3239). **Other localities:** Asunción, Central, Cordillera, Guairá, Paraguari.

General distribution: pantropical; America: United States (Florida and Louisiana), Mexico, Central America, South America; sub-Saharan Africa; Asia; Oceania: Australia (Readfearn, 1990; Buck, 1998; Ramsay *et al.*, 2002; Carmo & Peralta, 2016).

* *Stereophyllum radiculosum* (Hook.) Mitt.

Dept. Concepción. Vallemí, Santa Caverna: on calcareous rock close to the cave (22°14.778'S, 57°52.797'W, 137 m), 29 Jul 2011, *B. Cañiza, S. Insfrán, B. Olmedo & S. Páez 16* (FACEN). **Other localities:** Alto Paraguay, Alto Paraná, Amambay, Asunción, Boquerón, Caaguazú, Central, Cordillera, Guairá, Paraguari.

General distribution: pantropical; America: United States (Florida, Texas), Mexico, Central America, Venezuela, Colombia, Guyana, Ecuador, Peru, Bolivia, southern Brazil, Paraguay, northern Argentina; Africa; Asia: India; Oceania: Australia (Queensland) (Buck, 1998; Carmo & Peralta, 2016).

***Syntrichia amphidiacea* (Müll. Hal.) R. H. Zander

Dept. Central. San Lorenzo, Facultad de Ciencias Agrarias, Universidad Nacional de Asunción: on bark of *Tipuana tipu* (Fabaceae) (25°20'12.35"S, 57°30'53.02"W), 29 Dec 2015, *B. Cañiza, A. Rivarola, C. Vogt & R. Caballero 181* (FACEN).

Note: This is the first record of the genus *Syntrichia* from Paraguay.

General distribution: America: southeastern United States, Mexico, Central America, Ecuador, Peru, Colombia, Brazil, Argentina; Malesia (Schäfer-Verwimp, 1996; Yano, 2011; Costa, 2016).

** *Thamniopsis cruegeriana* (Müll. Hal.) W. R. Buck

Dept. Paraguari. Mbatoví: on rock, 2 Dec 2000, *L. Fretes & E. Rempel LF166* (FACEN 689).

General distribution: America: West Indies (Barbados), Venezuela, Trinidad (Buck, 1998), Brazil (Yano, 2011), Paraguay.

** *Thamnomalia glabella* (Hedw.) S. Olsson *et al.*

Dept. Alto Paraná. Hernandarias, rural area, near the Acaraí river, gallery forest: on branches and trunks, 23 Mar 1982, *O. Yano 4117* (SP 171927).

Note: This is the first record of the genus *Thamnomalia* from Paraguay.

General distribution: America: Central America, West Indies, south-eastern Brazil (Olsson *et al.*, 2011), Paraguay.

* *Tortella humilis* (Hedw.) Jenn.

Dept. Alto Paraguay. Estancia Yaguareté Porá: growing on trunk in a low xerophytic forest with predominance of *Salta triflora*, *Caesalpinia paraguariensis* and *Trithrinax schizophylla* (21°34'35.0"S, 58°53'48.3"W), 9 Dec 2011, C. Vogt & B. Cañiza 1240 (FACEN 1493). Estancia Yaguareté Porá: growing on soil in a low forest with predominance of *Ziziphus mistol*, *Salta triflora*, *Acacia curvifructa* and *Trithrinax schizophylla* (21°38'08.1"S, 58°52'13.7"W), 10 Dec 2011, C. Vogt & B. Cañiza 1291 (FACEN 1669). **Dept. Caaguazú.** Mbutuy-Capiibary road, hygrophilous forest at the edge of a ravine, on fallen trunk of *Inga uraguensis*, (24°52.988'S, 55°56.794'W), 4 Jun 2005, G. Marín 1149 (FACEN 2046). **Dept. Presidente Hayes.** Laguna Tte. Rojas Silva: on branches of *Ruprechtia triflora* in a 4.5 m high xerophytic scrubland with predominance of *Ruprechtia triflora*, *Maytenus vitis-idaea* and *Acacia praecox* (22°37'40.8"S, 59°03'45.0"W), 6 Jan 2011, C. Vogt & M. Vera 1045 (FACEN 1774). **Other localities:** Asunción, Central, Cordillera, Guairá, Paraguari.

General distribution: America: eastern North America, Mexico, Guatemala, West Indies (Cuba, Jamaica, Haiti), northern South America, Brazil, Paraguay; Europe; North Africa (Sharp *et al.*, 1994a; O'Shea and Price, 2008; Yano, 2011).

***Trachyxiophium guadalupense* (Brid.) W. R. Buck

Dept. Paraguari. Última Altura: on humid rock in the shadow, 29 October 2000, L. Fretes & E. Rempel LF075 (FACEN 685).

General distribution: America: Mexico to Panama, West Indies (Trinidad), Venezuela to Bolivia, (Buck, 1998), Brazil (Yano, 2011) and Paraguay.

* *Zelometeorium patulum* (Hedw.) Manuel

Dept. Alto Paraná. Hernandarias, rural area near the Acaraí river: on trunk of a living tree, 23 Mar 1982, O. Yano 4126 (SP 171930). **Dept. Caaguazú.** Mbutuy-Capiibary road, hygrophilous forest at the edge of a ravine, on fallen trunk of *Inga uruguensis*, (24°52.988'S, 55°56.794'W), 4 Jun 2005, G. Marín 1149 (FACEN 2046). **Dept. Cordillera.** Cerro Naranjo, Compañía Naranjo: on submerged rock (25°31'06"S, 57°03'48"W, 236 m), 15 Aug 2000, L. Fretes & E. Rempel LF004 (FACEN 1156). **Other localities:** Paraguari.

General distribution: neotropical; United States (Florida), Mexico, Central America, northern South America, Bolivia, Brazil, Chile (Buck, 1998; Carmo & Peralta, 2016), Paraguay (O'Shea & Price, 2008).

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REFERENCES

- ALVARENGA L.D.P., OLIVEIRA J.R.M.P., SILVA M.P., COSTA S.O. & PÔRTO K.C., 2008 — Liverworts of Alagoas State, Brazil. *Acta botânica Brasilica* 22: 878-890.
- ÁLVAREZ C. & VARGAS Y.L., 2013 — Revision of the neotropical *Schoenobryum* Dozy & Molk. *Tropical bryology* 35: 26-38.
- ARNELL S., 1961 — A new species of *Bazzania* from Chile. *Svensk botanisk tidskrift* 55: 394.
- ASTHANA G. & ALAM A., 2013 — *Cololejeunea clavatopapillata* Steph. — new to Asia. *Tropical bryology* 35: 39-42.
- BASTOS C.J.P. & YANO O., 2009 — O gênero *Lejeunea* Libert (Lejeuneaceae) no estado da Bahia, Brasil. *Hoehnea* 36(2): 303-320.

- BASTOS C.J.P., 2012 — New combinations and synonyms in *Cheilolejeunea* (Spruce) Schiffn. (Lejeuneaceae, Marchantiophyta). *Journal of bryology* 34: 312-315.
- BISCHLER H., 1966 — Recherche sur l'anatomie de la tigechez les Lejeuneaceae III. Les sous-familles Lejeuneoideae, tribu Lejeuneae, et Tuyamaelloideae. *Revue bryologique et lichénologique* 34(3-4): 601-675.
- BLOCKEEL T. L., BERGAMINI A., BRUSA G., ERTZ D., SÉRGIO C., GARCIA C., HEDENÅS L., MÜLLER F., NIEUWKOOP J. A. W. & SABOVLJEVIĆ M. S., 2000 — New national and regional bryophyte records, 3. *Journal of bryology* 22: 303-306.
- BORDIN J., 2011 — *Fissidentaceae (Bryophyta) do Brasil. Tese (Doutorado)*, São Paulo, Instituto de Botânica da Secretaria do Estado do Meio Ambiente, 350 p.
- BROTHERUS V. F., 1990 — Die Laubmoose der ersten Regnellschen Expedition. *Bihang till kongliga Svenska vetenskaps-akademiens handlingar* 26: 1-65.
- BUCK W.R., 1985 — A preliminary list of the mosses of Paraguay. *Candollea* 40: 201-209.
- BUCK W.R., 1998 — Pleurocarpus Mosses of the West Indies. *Memoirs of the New York botanical garden* 82: 1-400.
- CÂMARA P. & MAGILL R., 2009 — A review of *Dimerodontium* (Fabroniaceae). *The bryologist* 112: 301-307.
- CANO M.J., JIMÉNEZ J.A., ALONSO M. & GUERRA J., 2015 — *Pseudocrossidium exiguum* M.J. Cano & J.A. Jiménez (Pottiaceae), a new species from South America. *Journal of bryology* 37: 56-61.
- CARMO D.M. & PERALTA D.F., 2016 — A Survey of bryophytes in Serra da Canastra National Park, Minas Gerais, Brazil. *Acta botanica Brasílica*: 1-12.
- CASTLE H., 1964 — A revision of the genus *Radula*. Part II. Subgenus *Acoradula*. Section 8. *Acutilobulae*. *Revue bryologique et Lichénologique* 33(1-2): 185-210.
- CHURCHILL S. P. & LINARES E. L., 1995. Prodrómus Bryologiae Novo-Granatensis. Introducción a la flora de musgos de Colombia. *Biblioteca José Jerónimo Triana* 12: 1-924.
- CHURCHILL S.P., 2009 — Bryophytes of Alarachi Natural Reserve, Department of Tarija, Bolivia. *Tropical bryology* 30: 85-91.
- COSTA D.P., 2016 — A synopsis of the family Pottiaceae in Brazil. *Phytotaxa* 251(1): 1-69.
- CRUM H. & BUCK W.R., 1988 — A contribution to the *Sphagnum* (Sphagnaceae) flora of Paraguay. *Brittonia* 40(2): 188-194.
- CRUM H., 1972 — A taxonomic account of the Erpodiaceae. *Nova Hedwigia* 23: 201-224.
- DANIELS A.E.D., MABEL J.L. & DANIEL P., 2012 — The Erpodiaceae (Bryophyta: Isobryales) of India. *Taiwania* 57(2): 168-182.
- DAUPHIN G., 2005 — Catalogue of Costa Rican Hepaticae and Anthocerotae. *Tropical bryology* 26: 141-218.
- DAUPHIN G., PÓCS T., VILLARREAL J.C. & SALAZAR ALLEN N., 2006 — Nuevos registros de hepáticas y anthocerotófitas para Panamá. *Tropical bryology* 27: 73-85.
- DELGADILLO C.M., BELLO B. & CÁRDENAS A.S., 1995 — LATMOSS, A Catalogue of Neotropical Mosses. *Monographs in systematic botany from the Missouri botanical garden* 56: 1-191.
- ENROTH J. & SHEVOCK J.R., 2011 — *Porotrichum saotomense* sp. nov. (Neckeraceae) and other additions to the moss flora of São Tomé & Príncipe, Gulf of Guinea, West Africa. *Tropical bryology* 33: 6-11.
- FLORES J.R., SUÁREZ G.M. & REINER-DREHWALD M.E. 2015 — About the first record of the genus *Chonecolea* (Chonecoleaceae, Marchantiophyta) in Paraguay and its differences to related species. *Cryptogamie, Bryologie* 36: 399-402.
- FRAHM J.P., 1991 — Dicranaceae: Campylopodioideae, Paraleucobryoideae. *Flora Neotropica* 54: 1-238.
- FRAHM J.P., 2014 — Tropische Moosarten in Europa. *Archive for Bryology* 197: 1-8.
- FULFORD M.H. & SHARP A.J., 1990 — The leafy Hepaticae of Mexico one hundred and twenty-seven years after C. M. Gottsche. *Memoirs of the New York botanical garden* 63: 1-86.
- GRADSTEIN S.R., 1994 — Lejeuneaceae: Ptychantheae, Brachiolejeuneae. *Flora Neotropica* 62: 1-217.
- GRADSTEIN S.R. & COSTA D.P., 2003 — The Hepaticae and Anthocerotae of Brazil. *Memoirs of the New York botanical Garden* 87: 1-318.
- HÄSSEL DE MENÉNDEZ G., 1962 — Estudio de las Anthocerotales y Marchantiales de la Argentina. *Opera Lilloana* 7: 1-298.
- HEDENÅS L., 2003 — Amblystegiaceae (Musci). *Flora Neotropica* 89: 1-107.
- JIMENEZ S. & SUÁREZ G.M., 2017 — The genus *Gertrudiella* Broth. (Pottiaceae, Bryophyta) in Paraguay. *Check List* 13(1): 2039.

- JOVET-AST S., 1991 — *Riccia* (Hépatiques, Marchantiales) d'Amérique latine. Taxons du sous-genre *Riccia*. *Cryptogamie, Bryologie et Lichénologie* 12: 189-370.
- JUDD W.S., 1980 — Notes on the moss flora of Hispaniola. *The bryologist* 83: 555-558.
- KUC M., 1998 — A supplement the moss flora of Paraguay. *Tropical bryology* 15: 161-165.
- LAVOCAT BERNARD E. & SCHÄFER-VERWIMP A., 2011 — Checklist of the bryophytes of the Guadeloupe archipelago and Martinique (French West Indies). *Cryptogamie, Bryologie* 32(3): 233-272.
- LÜTH M. & SCHÄFER-VERWIMP A., 2004 — Additions to the Bryophyte Flora of the Neotropics. *Tropical bryology* 25: 7-17.
- MORONG T. & BRITTON N. L., 1893. — An enumeration of the plants collected by Dr. Thomas Morong in Paraguay, 1888-1890. *Annals of the New York academy of science* 7: 279-280.
- O'SHEA B.J. & PRICE M.J., 2008 — An updated checklist of the mosses of Paraguay. *Tropical bryology* 29: 6-37.
- OCHI H., 1980 — A revision of the Neotropical Bryoideae, Musci (First Part). *The Journal of the faculty of education Tottori university, Natural science* 29(2): 49-154.
- OCHI H., 1981 — A revision of the Neotropical Bryoideae, Musci (Second Part). *The Journal of the faculty of education Tottori university, Natural science* 30: 21-55.
- OLSSON S., ENROTH J., BUCHBENDER V., HEDEÅS L., HUTTUNEN S. & QUANDT D., 2011 — *Neckera* and *Thamnobryum* (Neckeraceae, Bryopsida): Paraphyletic assemblages. *Taxon* 60: 36-50.
- PÓCS T., ZHU R., REINER-DREHWALD M. E., SÖDERSTRÖM L., HAGBORG A., VON KONRAT M., 2015 — Notes on early land plants today. 71. New synonyms, new names and new combinations in Lejeuneaceae (Marchantiophyta). *Phytotaxa* 208(1): 97-102.
- PRICE M. J., 2012. — Catalogue of the Benjamin Balansa moss collections from Paraguay in Herbarium Genavense (G). *Candollea* 67(1): 153-179.
- RAMSAY H.P., SCHOFIELD W.B. & TAN B.C., 2002 — The family Sematophyllaceae (Bryopsida) in Australia. Part 1: Introduction, family data, key to genera and the genera *Wikia*, *Acanthorrhynchium*, *Trismegistia* and *Sematophyllum*. *Journal of the Hattori botanical laboratory* 92: 1-50.
- REDFEARN P.L.J., 1990 — Tropical component of the moss flora of China. *Tropical bryology* 2: 201-222.
- REINER-DREHWALD M.E., 1993 — Las Lejeuneaceae (Hepaticae) de Misiones, Argentina I. Las especies holostipas. *Tropical bryology* 7: 13-45.
- REINER-DREHWALD M.E., 1994a — Las Lejeuneaceae (Hepaticae) de Misiones, Argentina II. *Cololejeunea*. *Tropical bryology* 9: 79-88.
- REINER-DREHWALD M.E., 1994b — El género *Radula* (Radulaceae, Hepaticae) en el noreste de Argentina. *Tropical bryology* 9: 5-22.
- REINER-DREHWALD M.E., 1994c — Sobre *Microlejeunea globosa* (Spruce) Steph. y la fragmentación del tallo, un tipo de reproducción asexual poco conocido en hepáticas. *Candollea* 49: 225-232.
- REINER-DREHWALD M.E., 1995a — Las Lejeuneaceae (Hepaticae) de Misiones, Argentina. III. *Drepanolejeunea* y *Leptolejeunea*. *Tropical bryology* 10: 21-27.
- REINER-DREHWALD M.E., 1995b — Las Lejeuneaceae (Hepaticae) de Misiones, Argentina. IV. *Aphanolejeunea*. *Tropical bryology* 10: 29-40.
- REINER-DREHWALD M.E., 1998 — Las Lejeuneaceae (Hepaticae) de Misiones, Argentina. V. *Cheilolejeunea* y *Lepidolejeunea*. *Tropical bryology* 14: 53-68.
- REINER-DREHWALD M.E., 2000 — Las Lejeuneaceae (Hepaticae) de Misiones, Argentina. VI. *Lejeunea* y *Taxilejeunea*. *Tropical bryology* 19: 81-131.
- REINER-DREHWALD M.E., 2006 — Type studies on Neotropical Lejeuneaceae (Jungermanniopsida). *Cheilolejeunea* and *Lepidolejeunea*. *Nova Hedwigia* 83: 473-482.
- REINER-DREHWALD M.E., 2009 — *Lejeunea adpressa* Nees (Lejeuneaceae), a widely distributed species of tropical America. *Cryptogamie, Bryologie* 30: 329-336.
- SHARP A.J., CRUM H. & ECKEL P.M., 1994a — The moss flora of Mexico. Part one: Sphagnales to Bryales. *Memoirs of the New York botanical garden* 69: 1-580.
- SHARP A.J., CRUM H. & ECKEL P.M., 1994b — The moss flora of Mexico. Part two: Orthotrichales to Polytrichales. *Memoirs of the New York botanical garden* 69: 581-1113.
- SCHÄFER-VERWIMP A., 1996 — New or interesting records of Brazilian bryophytes, V. *Candollea* 51: 283-302.
- SCHÄFER-VERWIMP A. & PÓCS T., 2009 — Contributions to the hepatic flora of the Dominican Republic, West Indies. *Acta botanica Hungarica* 51 (3-4): 367-425.

- SCHÄFER-VERWIMP A., 2014 — Towards a more complete knowledge of the liverwort flora of Panama. *Phytotaxa* 172(3): 201-234.
- SCHNYDER N., 2015 — New national and regional bryophyte records, 42. 32. *Sematophyllum adnatum* (Switzerland). *Journal of bryology* 37(1): 78-79.
- SÖDERSTRÖM L., HAGBORG A., VON KONRAT M. & SÉNECA A., 2013 — The Guaraní Land. Checklist of hornworts (Anthocerotophyta) and liverworts (Marchantiophyta) of Paraguay. *Polish botanical journal* 58: 267-277.
- SPRUCE R., 1889 — Hepaticae novae Americanae tropicae et aliae. *Bulletin de la société botanique de France* 36: CLXXXIX-CCVII.
- STEPHANI F., 1900 — Species Hepaticarum vol. I. Acrogynae. Genève et Bale, Georg & Cie., 413 p.
- STEPHANI F., 1906 — Species Hepaticarum vol. III. Acrogynae (Pars secunda). Genève et Bale, Georg & Cie., 693 p.
- STEPHANI F., 1909 — Species Hepaticarum vol. IV. Acrogynae (Pars tertia). Genève et Bale, Georg & Cie., 824 p.
- STEPHANI F., 1912 — Species Hepaticarum vol. V. Acrogynae (Pars quarta). Genève et Bale, Georg & Cie., 1044 p.
- VAZ T.F. & COSTA D.P., 2006 — Os gêneros *Brymela*, *Callicostella*, *Crossomitrium*, *Cyclodictyon*, *Hookeriopsis*, *Hypnella* e *Trachyxiphium* (Pilotrichaceae, Bryophyta) no estado do Rio de Janeiro, Brasil. *Acta botânica Brasílica* 20(4): 955-973.
- VILAS BÓAS-BASTOS S.B. & BASTOS C.J.P., 2004 — Notes on the occurrence of *Hypnella pallescens* (Hook.) A. Jaeger (Bryophyta, Pilotrichaceae) in Bahia, Brazil. *Acta botânica Malacitana* 29: 260-263.
- YANO O., 2011 — *Catálogo de musgos brasileiros: literatura original, basiônimo, localidade-tipo e distribuição geográfica*. São Paulo, SP, Brasil, Instituto de Botânica, Secretaria do Meio Ambiente, 180 p.
- ZANDER R. H., 1993. — Genera of the Pottiaceae: Mosses of harsh environments. *Bulletin of the Buffalo society of natural sciences* 32: 1-378.