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Original Paper

Macrolichens from Chaco National Park (Chaco Province, Argentina)

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Abstract

A study of the macrolichens diversity from Chaco National Park was conducted. Thirty-six species were identified, three of which are recorded for the first time from Argentina (*Dirinaria melanocapa*, *Pyxine petricola* var. *convexula,* and *P. pungens*). Moreover, the distribution of 27 species in the country is extended, including new records for Chaco province and, additionally, for other provinces of the region. An identification key for species is here provided and the geographic distribution of each one in Argentina was revised.

Key words: diversity, lichenized ascomycetes, protected area.

Resumen

Se realizó un estudio sobre la diversidad de macrolíquenes presentes en el Parque Nacional Chaco. Fueron identificadas 36 especies, de las cuales tres se registran por primera vez para Argentina (*Dirinaria melanocarpa*, *Pyxine petricola* var. *convexula* y *P. pungens*). Por otra parte, se amplía la distribución de 27 especies en el país, incluyendo nuevos registros para la provincia de Chaco y, adicionalmente, para otras provincias de la región. Se proporciona una clave para la identificación de especies y se actualizó la distribución geográfica actual en Argentina de cada una de ellas.

Palabras clave: diversidad, ascomycetes liquenizados, área protegida.

Introduction

Chaquenian region, together with Paranaense and Yungas forests, constitutes the three ecoregions with the highest biological diversity in the Argentinean territory (Guinzburg *et al.* 2005). It is divided further into four districts: Eastern Chacoan, Western Chacoan, Montane Chacoan, and Savannahs (Cabrera 1971). Chaco National Park (CNP hereafter), located within Eastern Chacoan district (or Humid Chaco), was created in 1954 considering its flora and fauna representative of this phytogeographical region (Caruso 2015). Vegetational types in this area are conditioned by flood gradient (Guinzburg & Adámoli 2006), encompassing a wide variety of natural landscapes: xerophytic forests, palm groves, savannahs, and marginal forests, which alternate with wetlands and swamps; all of them having different ecological conditions where diverse lichen groups could develop. In spite of this, there are still no articles that document the lichen biota from the CNP. Considering this, and that the lichen diversity is still poorly known in Chaco Province, with only ca. 50 species recorded so far (Calvelo & Liberatore 2002; Adler & Calvelo 2010; Rodríguez *et al.* 2012; Michlig 2014; Michlig *et al.* 2017). So, a considerable variety of macrolichens is expected.

The aim of this article is to document the lichen biota from CNP and increase the knowledge of these organisms for the region. Thereby, a list of the species of macrolichens from this protected area and a key to their identification are presented.

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Material and Methods

CNP is located in the center-eastern region of Chaco province, in Sargento Cabral and Presidencia de la Plaza departments (26º40'S, 59º48'W). It covers 14,981 ha that phytogeographically belongs to Eastern Chacoan district of Chaquenian province (Cabrera 1971). It is situated within Negro river watershed, which is fed by precipitations produced in the region, being the maximum rainfalls concentrated in summer and the annual average temperature is 22 ºC (Soria 2001; Guinzburg & Adamoli 2006; Teta *et al.* 2009). In CNP, there are riparian forests along river margins, *Schinopsis balansae* Engl. forests, wetlands, and streams, which are characteristic of this region.

A total of 90 specimens from CNP, collected by the authors in 2008, 2013, and 2015, deposited at CTES herbarium were studied. In addition, some specimens from other Provinces of northern Argentina were included. Morphological analysis was carried out using standard stereoscopic (Leica MZ6) and compound light microscopes (Leica CME). Lichen substances were identified with spot tests with 10% potassium hydroxide (K), sodium hypochlorite (C), and K followed by C (KC), UV fluorescence, and thin layer chromatography (TLC) with solvent C following standard methods (White & James 1985; Hüneck & Yoshimura 1996; Orange *et al.* 2010). Specimens were identified consulting specific literature according to each taxonomic group (Grassi 1953; Hale 1965, 1976; Swinscow & Krog 1975, 1976, 1978; Rogers 1986; Almborn 1989; Moberg 1983, 1990, 2011; Scutari 1992, 1995a,b; Verdón 1992; Elix 1994, 2009; Galloway & Jørgensen 1995; Estrabou *et al*. 2006; Cunha 2007; Canêz 2009; Spielmann & Marcelli 2009; Canêz & Marcelli 2010; Jungbluth 2010; Jungbluth & Marcelli 2011; Rodríguez 2011; Michlig & Ferraro 2012a,b). Apothecia and ascospores types in Caliciaceae and Physciaceae were defined following Kalb (1987) and Aptroot (1987). A key to the identification of studied species and descriptions of those which constitutes new records for the country were made. Each species geographic distribution is presented for Argentina.

Results

In this article, 36 macrolichens from CNP were identified, which belong to the following families and genera: Parmeliaceae (*Canoparmelia*, *Parmotrema*, *Punctelia,* and *Usnea*), Physciaceae (*Heterodermia*, *Physcia,* and *Polyblastidium*), Caliciaceae (*Dirinaria* and *Pyxine*), Collemataceae (*Leptogium*), Teloschistaceae (*Teloschistes*), and Verrucariaceae (*Flakea*).

Key of macrolichens from Chaco National Park

1. Thallus squamulose or fruticose 2
   2. Thallus squamulose ..... 12.1. *Flakea papillata*
   2'. Thallus fruticose 3
      3. Thallus orange to grayish, with scarce fibrils 4
         4. Thallus surface distinctly maculate, not pubescent ..... 11.1. *Teloschistes exilis*
         4'. Thallus surface emaculate, pubescent ..... 11.2. *Teloschistes flavicans*
      3'. Thallus greenish, shrubby, with abundant fibrils 5
         5. Isidiomorphs and soralia present; apothecia absent ..... 7.2. *Usnea dasaea*
         5'. Isidiomorphs and soralia absent; apothecia present 6
            6. Thallus axis with a pink pigment ..... 7.1. *Usnea cristatula*
            6'. Thallus axis without pigment ..... 7.3. *Usnea steineri*
1'. Thallus foliose 7
   7. Thallus gelatinous when wet, dark gray to black; photobiont cyanobacteria (cyanobiont) 8
      8. Apothecia absent; isidia present, cylindrical, marginal and laminal ..... 3.1. *Leptogium austroamericanum*
      8'. Apothecia present; isidia absent or squamiform when present 9
         9. Apothecia marginal, small (0.1–0.5 mm); amphithecium with squamiform isidia ..... 3.2. *Leptogium marginellum*
         9'. Apothecia submarginal, large (1.0–4.8 mm); amphithecium wrinkled; isidia absent ..... 3.3. *Leptogium phyllocarpum*

7’. Thallus not gelatinous when wet, mineral to greenish gray; photobiont a green algae (phycobiont) 10
10. Lower cortex always present, usually rhizinate; apothecia always lecanorine; ascospores hyaline, simple 11
11. Upper surface with pseudocyphellae .... 6.1. *Punctelia punctilla*
11’. Upper surface without pseudocyphellae 12
12. Thallus closely attached to substrate; lobes usually up to 8 mm wide 13
13. Upper surface rugose; apothecia present; soralia absent .... 4.1. *Canoparmelia austroamericana*
13’. Upper surface smooth; apothecia absent; soralia laminal .... 4.2. *Canoparmelia texana*
12’. Thallus moderate to loosely attached to substrate; lobes usually more than 10 mm wide 14
14. Thallus yellowish green, cortex K- .... 5.5. *Parmotrema masonii*
14’. Thallus mineral to greenish gray, cortex K+ yellow 15
15. Isidia or soralia present; apothecia absent 16
16. Isidia laminal to marginal, simple to variously branched; soralia absent .... 5.8. *Parmotrema tinctorum*
16’. Isidia absent; soralia marginal, with farinose soredia 17
17. Cilia absent at lobe margins; medulla C+ red, KC+ red .... 5.2. *Parmotrema austrosinense*
17’. Cilia present, mostly in lobe axils; medulla C-, KC+ rose .... 5.4. *Parmotrema hababianum*
15’. Isidia and soralia absent; apothecia present 18
18. Marginal cilia absent .... 5.6. *Parmotrema mesotropum*
18’. Marginal cilia present 19
19. Lower surface with a wide bared marginal zone; apothecia imperforate, ciliate .... 5.1. *Parmotrema argentinum*
19’. Lower surface rhizinate to the margin; apothecia perforate, eciliate 20
20. Upper surface irregularly maculate; lower surface brown; medulla K-, KC+ rose .... 5.7. *Parmotrema recipiendum*
20’. Upper surface reticulately maculate; lower surface black with a brown margin; medulla K+ yellow turning red, KC+ red .... 5.3. *Parmotrema cetratum*
10’. Lower cortex absent or present, with or without rhizines; apothecia lecanorine, lecideine or with a gradually carbonized margin; ascospores brown, 1-septate 21
21. Upper cortex prosoplectenchymatic 22
22. Upper surface with cilia .... 8.3. *Heterodermia neocomosa*
22’. Upper surface without cilia 23
23. Apothecia laminal; soralia or squamules absent .... 8.2. *Heterodermia diademata*
23’. Apothecia absent; soralia or squamules present 24
24. Squamules marginal, sorediate; soralia absent .... 10.2. *Polyblastidium squamulosum*
24’. Squamules absent; soralia marginal to submarginal 25
25. Soralia continuous to linear .... 8.1. *Heterodermia albicans*
25’. Soralia labriform to capitate 26
26. Lower cortex present .... 8.5. *Heterodermia speciosa*
26’. Lower cortex absent 27
27. Lower surface with a brown to purple pigment, K- .... 10.1. *Polyblastidium japonicum*

27’. Lower surface with a yellowish-orange pigment, K+ purple.....8.4. *Heterodermia obscurata*
21’. Upper cortex paraplectenchymatic.....28
28. Rhizines absent 29
29. Soralia present laminal, orbicular; apothecia absent.....30
30. Upper surface without pruina, with weak, irregular maculae .....1.4. *Dirinaria picta*
30’. Upper surface with pruina, without maculae .....1.1. *Dirinaria applanata*
29’. Soralia absent; apothecia present 31
31. Lower surface black; picnidia laminal .....1.2. *Dirinaria confluens*
31’. Lower surface pale brown; picnidia absent.....1.3. *Dirinaria melanocarpa*
28’. Rhizines present 32
32. Upper surface usually pruinose; lower cortex always prosoplectenchymatic; ascospores *dirinaria*-type 33
33. Upper cortex K+ yellow, UV-; medulla orange to ochre with a lower layer white.....
.....2.3. *Pyxine pungens*
33’. Upper cortex K-, UV+ yellow; medulla white or yellow.....34
34. Medulla yellow; apothecia with carbonized margin (*obscurascens*-type), soralia marginal and laminal .....2.4. *Pyxine subcinerea*
34’. Medulla white; apothecia with a persistent thalline margin (*physciaeformis*-type) or with a gradually carbonized margin (*cocoes*-type).....35
35. Apothecia of *physciaeformis*-type, laminal.....2.1. *Pyxine astridiana*
35’. Apothecia of *cocoes*-type, laminal to submarginal .....
.....2.2. *Pyxine petricola* var. *convexula*
32’. Lower cortex paraplectenchymatic; ascospores *pachysporaria*- type .....
.....9.1. *Physcia integrata*

Caliciaceae Chevall.

1. *Dirinaria* (Tuck.) Clem.

1.1. *Dirinaria applanata* (Fée) D. D. Awasthi, J. Indian Bot. Soc. 49: 135. 1970.

Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, in quebrachal, 24.XI.2008, *A. Michlig & N. Niveiro 1110* (CTES); 26°50’30’’S, 59°36’49’’W, 24.IV.2013, *A. Michlig et al. 3068* (CTES), *3069* (CTES).

This species is cited for Buenos Aires, Entre Ríos, Misiones (Calvelo & Liberatore 2002), and Corrientes Provinces (Michlig & Ferraro 2012b). Its distribution is extended to Chaco Province.

1.2. *Dirinaria confluens* (Fr.) D. D. Awasthi, Biblioth. Lichenol. 2: 28. 1975.

Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, on *Prosopis sp*., 24.XI.2008, *A. Michlig & N. Niveiro 1105* (CTES); in quebrachal, 26°50’30’’S, 59°36’49’’W, 24.IV.2013, *A. Michlig et al. 3062 A* (CTES), *3071* (CTES), *3072 B* (CTES).

This species is cited for Buenos Aires (Calvelo & Liberatore 2002) and Corrientes Provinces (Michlig & Ferraro 2012b). Its distribution is extended to Chaco Province.

1.3. *Dirinaria melanocarpa* (Müll. Arg.) Dodge. Beih. Nova Hedwigia. 38:1-255. 1971. Fig. 1a-c

Thallus foliose, mineral gray, corticolous, up to 2 cm in diam. Lobes subirregular, 0.4–1.5 mm wide, parcially imbricate, apices rounded to subtruncate. Upper surface with pruina. Vegetative propagules absent. Medulla white. Lower surface pale brown, without rhizinae; lower cortex present. Apothecia abundant, *physciaeformis*-type, plane to concave, up to 0.5 mm in diam., adnate, laminal, with black disc, epruinose, margin entire, amphithecia smooth, whit pruina. Ascospores ellipsoid, *dirinaria*-type, 15–18 µm × 5–8 µm. Pycnidia not observed.

Chemistry: Cortex K+ yellow, UV-. Medulla K-, C-, KC-, UV+ white.

Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, in quebrachal, 26°50’30’’S, 59°36’49’’W, 24.IV.2013, *A. Michlig et al. 3062 B* (CTES).

This species is cited for Brazil, Colombia and Paraguay (Awasthi 1975), and Bolivia (Flakus *et al.* 2015). This is the first record for Argentina, its from Chaco Province.

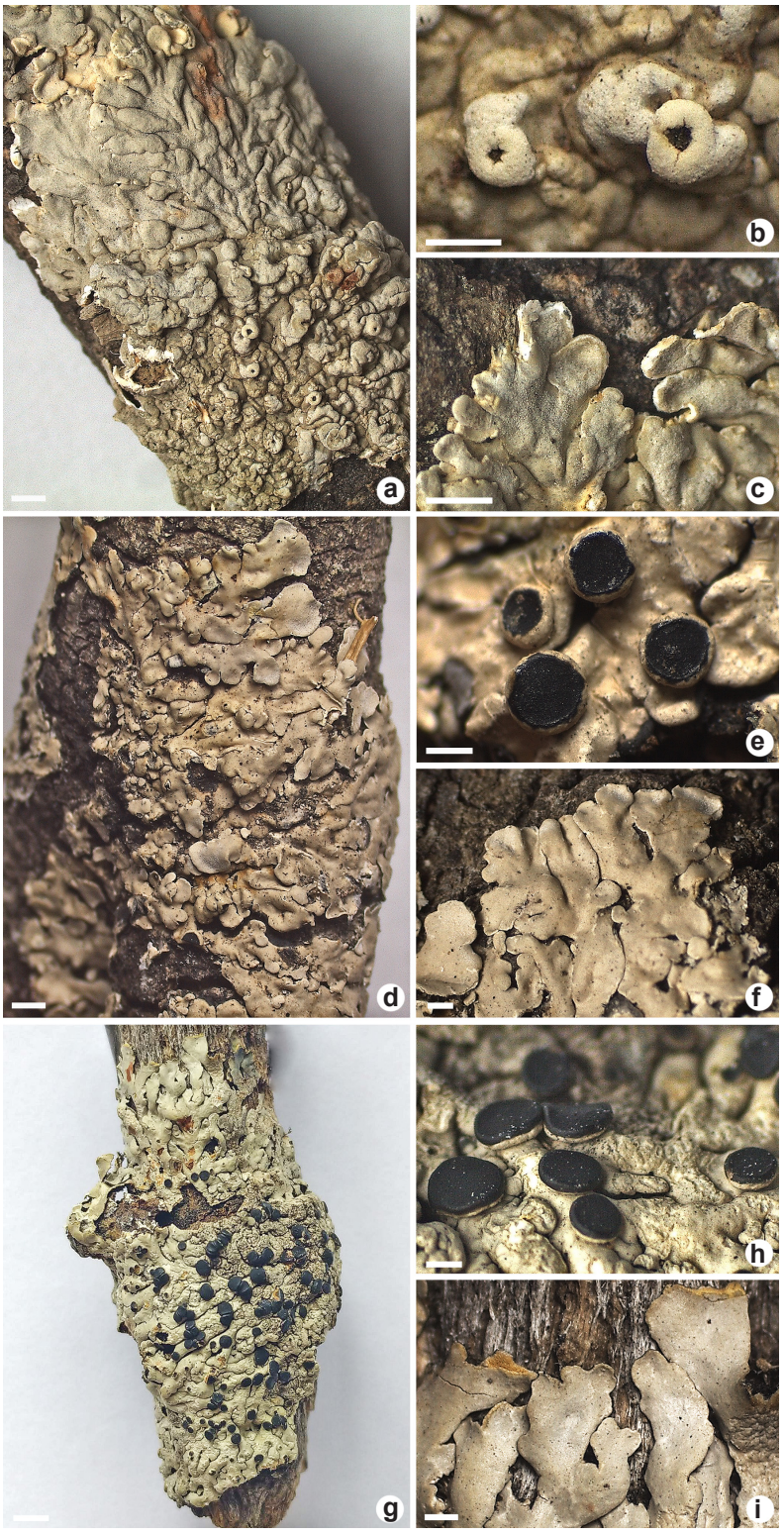

Figure 1 – a-c. *Dirinaria melanocarpa* – a. complete thallus; b. apothecia *physciaeformis*-type whit pruina; c. pruina at the lobe tips. d-f. *Pyxine petricola* var. *convexula* – d. complete thallus – e. apothecia *cocoes*-type; f. pruina at the lobe tips. g-i. *Pyxine pungens* – g. complete thallus; h. apothecia *cocoes*-type; i. lobe tips and medulla. Scale bar: g = 2.5 mm; a,c,d = 1 mm; b,e,f,h,i = 0.5 mm.

1.4. *Dirinaria picta* (Sw.) Clem., Gen. Fung. Edn. 2: 323. 1931.
Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, 23.XI.2008, *A. Michlig & N. Niveiro 1075* (CTES).

This species is cited for Buenos Aires (Scutari 1995a; Rosato 2006), Córdoba (Estrabou *et al.* 2006), Entre Ríos, Jujuy, Misiones, and Salta Provinces (Calvelo & Liberatore 2002). Its distribution is extended to Chaco Province.

2. *Pyxine* Fr.
2.1. *Pyxine astridiana* Kalb, Biblioth. Lichenol. 24: 33. 1987.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, in quebrachal, 26°50'30''S, 59°36'49''W, 24.IV.2013, *A. Michlig et al. 3072 A* (CTES).

This species is cited for Catamarca Province (Rodríguez *et al.* 2016). Its distribution is extended to Chaco Province, this is the first record for northeastern Argentina.

2.2. *Pyxine petricola* var. ***convexula*** (Malme) Kalb, Biblioth. Lichenol. 24: 60. 1987. Fig. 1d-f

Thallus foliose, corticolous, mineral gray, up to 2 cm in diam. Lobes subirregular, 0.3–1.2 mm wide, with eciliate margin. Upper surface emaculate, irregular, with farinose pruina in lobe tips. Vegetative propagules absent. Medulla white. Lower surface black and pale to the margin, abundantly rhizinate; rhizinae simple to irregulary branched, black. Apothecia abundant, laminal to submarginal, *cocoes*-type, plane to convex, sessil, black disc, epruinose, up to 1 mm in diam., internal stipe white. Ascospores ellipsoid, *dirinaria*-type, brown, (12–)15–17(–20) µm × 5–7 µm. Pycnidia absent.

Chemistry: Cortex K-, UV + yellow. Medulla K-, C-, KC-, UV-. Internal stipe K-.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, 24.XI.2008, *A. Michlig & N. Niveiro 1085 C* (CTES).

This species is cited for Uruguay (Osorio 1996), Brazil (Malme 1897; Kalb 1987), Paraguay, and Kenia (Kalb 1987). This is the first record for Argentina, its distributed in Chaco Province.

2.3. *Pyxine pungens* Zahlbr., Ann. Cryptog. Exot. 1(2): 210. 1928. Fig. 1g-i

Thallus foliose, corticolous, mineral gray, up to 3.1 cm in diam. Lobes sublinear to subirregular, 0.6–1.1 mm wide, with eciliate margin. Upper surface with distinct maculae, irregular, with farinose pruina. Vegetative propagules absent. Medulla orange, with a lower layer thinand white. Lower surface black, abundantly rhizinate; rhizinae simple to irregularly branched, black. Apothecia abundant, laminal, *cocoes*-type, plane to convex, adnate, black disc, epruinose, up to 1.2 mm in diam., internal stipe orange. Ascospores ellipsoid, *dirinaria*-type, brown, (12–)15–18(–21) µm × 5–7 µm. Pycnidia apical; conidia sublageniform, 3–5 µm.

Chemistry: Cortex K+ yellow, UV-. Medulla K+ purple, C-, KC-, UV-. Internal stipe K+ yellow.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, in quebrachal, 26°50'30''S, 59°36'49''W, 24.IV.2013, *A. Michlig et al. 3070* (CTES).

This species is cited for Australia, Indonesia, Brazil, Costa Rica, Guyana, Paraguay, Venezuela (Jungbluth & Marcelli 2011). This is the first record for Argentina, its distribuited in Chaco Province.

2.4. *Pyxine subcinerea* Stirt., Trans. New Zealand Inst. 30: 397. 1898.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, 24.XI.2008, *A. Michlig & N. Niveiro 1085 B* (CTES).

This species is cited for Buenos Aires (Osorio 1977a), Entre Ríos (Calvelo & Liberatore 2002), Corrientes (Michlig & Ferraro 2012b), and Catamarca Provinces (Rodríguez *et al.* 2016). Its distribution is extended to Chaco Province.

Collemataceae Zenker.
3. *Leptogium* (Ach.) Gray
3.1. *Leptogium austroamericanum* (Malme) C.W. Dodge, Ann. Missouri Bot. Gard. 20: 419. 1933.
Material studied: Presidencia de la Plaza, CNP, in quebrachal, 26°50'30''S, 59°36'49''W, 24.IV.2013, *A. Michlig et al. 3082* (CTES); trail to Panza de Cabra pond, in forest, 26°51'35''S, 59°36'46''W, 24.IV.2013, *ipse 3122* (CTES); 17.VII.2015, *M.P. Rodríguez et al. 54* (CTES).

This species is cited for Entre Ríos (Osorio 1975, 1982), Misiones (Osorio 1969b, 1981), Salta (Osorio 1990), Corrientes (Ferraro 1995), Buenos Aires, and Santa Fe Provinces (Calvelo & Liberatore 2002). Its distribution is extended to Chaco Province.

3.2. *Leptogium marginellum* (Sw.) Gray, Nat. Arr. Brit. Pl. 1: 401. 1821.
Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, 23.XI.2008, *A. Michlig & N. Niveiro 1056* (CTES), *1064* (CTES); in riverside, 26°48'20''S,

59°36'33''W, 24.IV.2013, *A. Michlig et al. 3050* (CTES); 17.VII.2015, *M.P. Rodríguez et al. 53* (CTES).

This species is cited for Misiones (Osorio 1969a, 1981) and Corrientes Provinces (Ferraro 1995; Michlig & Ferraro 2012b), and Patagonia (Calvelo & Liberatore 2002). Its distribution is extended to Chaco Province.

3.3. *Leptogium phyllocarpum* (Pers.) Mont., Ann. Sci. Nat., Bot. sér. 3 10: 134. 1848.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, in forest, 26°51'35''S, 59°36'46''W, 24.IV.2013, *A. Michlig et al. 3114* (CTES).

This species is cited for Tierra del Fuego (Grassi 1950), Buenos Aires (Osorio 1976), Corrientes (Ferraro 1978; Michlig & Ferraro 2012b), Misiones (Osorio 1981), and Santiago del Estero Provinces (Calvelo & Liberatore 2002). Its distribution is extended to Chaco Province.

Parmeliaceae Zenker.
4. *Canoparmelia* Elix & Hale
4.1. *Canoparmelia austroamericana* Adler, Mycotaxon 28(1): 251. 1987.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, on *Prosopis* sp., 26°51'35''S, 59°36'46''W, 24.XI.2008, *A. Michlig & N. Niveiro 1102* (CTES).

This species is cited for Buenos Aires, Santiago del Estero (Calvelo & Liberatore 2002), and Chaco Provinces (Michlig 2014).

4.2. *Canoparmelia texana* (Tuck.) Elix & Hale, Mycotaxon 27: 279. 1986.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, 24.XI.2008, *A. Michlig & N. Niveiro 1103* (CTES), *1112* (CTES); in quebrachal, 26°50'30''S, 59°36'49''W, 24.IV.2013, *A. Michlig et al. 3061* (CTES), *3074* (CTES).

This species is cited for Buenos Aires, Córdoba, Corrientes, Entre Ríos (Calvelo & Liberatore 2002), Santiago del Estero (Adler 2013), Chaco, Formosa, and Misiones Provinces (Michlig 2014).

5. *Parmotrema* A. Massal.
5.1. *Parmotrema argentinum* (Kremp.) Hale, Phytologia 28(4): 334. 1974.
Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, 23.XI.2008, *A. Michlig & N. Niveiro 1046* (CTES), *1079* (CTES); on river's bank, 26°48'20''S, 59°36'33''W, 24.IV.2013, *A. Michlig et al. 3046* (CTES); 17.VII.2015, *M.P. Rodríguez et al. 32* (CTES), *47* (CTES); trail to Panza de Cabra pond, 24.XI.2008, *A. Michlig & N. Niveiro 1088* (CTES).
Additional material studied: ARGENTINA. CHACO: 1º de Mayo, Colonia Benitez, INTA reserve, inside forest, 21.V.1979, *L. Ferraro et al. 1830* (CTES). FORMOSA: Bermejo, provincial route Nº 9, between Sumayén and El Aibal, 24º22'0.5''S, 61º38'19.7''W, 169 msm, in an *Aspidosperma quebracho-blanco* forest, 18.IV.2009, *A. Michlig et al. 1131* (CTES).

This species is cited for Salta (Hale 1965), Misiones (Calvelo & Liberatore 2002), Corrientes (Popoff & Ferraro 2002) and Santiago del Estero Provinces (Adler 2013). Its distribution is extended to Chaco and Formosa Provinces.

5.2. *Parmotrema austrosinense* (Zahlb.) Hale, Phytologia 28(4): 335. 1974.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, 24.XI.2008, *A. Michlig & N. Niveiro 1096* (CTES).
Additional material studied: ARGENTINA. FORMOSA: Bermejo, Nat. Route Nº 81, Los Chiriguanos, 24º07'1.3''S, 61º26'18.7''W, 171 msm, in an *Aspidosperma quebracho-blanco* forest, 25.IV.2009, *A. Michlig et al. 1616* (CTES).

This species is cited for Tucumán (Osorio 1990), Jujuy (Osorio & Ferraro 2001), Buenos Aires, Chaco, Córdoba, Corrientes, Santiago del Estero, Santa Fe (Calvelo & Liberatore 2002), San Luis (Estrabou *et al.* 2006), La Rioja, Salta (Adler & Calvelo 2010), and Catamarca Provinces (Rodríguez *et al.* 2016). Its distribution is extended to Formosa Province.

5.3. *Parmotrema cetratum* (Ach.) Hale, Phytologia 28(4): 335. 1974.
Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, 23.XI.2008, *A. Michlig & N. Niveiro 1070* (CTES), *1074* (CTES), *1084* (CTES); 17.VII.2015, *M.P. Rodríguez et al. 66* (CTES); trail to Panza de Cabra pond, 24.XI.2008, *A. Michlig & N. Niveiro 1092* (CTES).
Additional material studied: ARGENTINA. CHACO: Comandante Fernández, Nat. Route Nº 95, between Presidencia Roque Sáenz Peña and Tres Isletas, kilometers before crossing with Prov. Route Nº 44, 26º33'44.4''S, 60º18'26.6''W, 108 msm, in a *Schinopsis balansae* forest, 11.II.2010, *A. Michlig & N. Niveiro 2187* (CTES).

This species is cited for Buenos Aires (Adler 1988), Catamarca (Adler & Calvelo 2010), Córdoba (Estrabou 1999; Estrabou *et al.* 2006), Corrientes (Ferraro 1995; Popoff & Ferraro 2002), Entre Ríos (Calvelo & Liberatore 2002), Jujuy (Grassi 1950; Osorio 1990), Misiones (Osorio 1981), Salta, Santiago del Estero (Adler 2013), and Tucumán Provinces (Osorio 1990). Its distribution is extended to Chaco Province.

5.4. ***Parmotrema hababianum*** (Gyeln.) Hale, Phytologia 28(4): 336. 1974.
Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, on river´s bank, 26°48'20''S, 59°36'33''W, 24.IV.2013, *A. Michlig et al. 3047* (CTES); 17.VII.2015, *M.P. Rodríguez et al. 39* (CTES).
Additional material studied: ARGENTINA. CHACO: General Güemes, Prov. Route Nº 9, between Miraflores and Las Hacheras, 25º34'18.3''S, 60º58'39.9''W, 122 msm, 11.II.2010, *A. Michlig & N. Niveiro 2224* (CTES). CORRIENTES: San Martín, Arrocera Drews, 8 km, N of Carlos Pellegrini, in edge of forest, on *Prosopis algarrobilla*, 24.II.1976, *L. Ferraro 770* (CTES). FORMOSA: Bermejo, Nat. Route 81, Los Chiriguanos, in an *Aspidosperma quebracho-blanco* forest, 24º07'01,3''S, 61º20'18,7''W, 171 msm., 25.IV.2009, *A. Michlig et al. 1615* (CTES). MISIONES: San Pedro, Yaboty Biosphere Reserve, Esmeralda Provincial Park, trail to pine forest, 15.V.2005, *A. Michlig et al. 771* (CTES).

This species is cited for Córdoba and Santiago del Estero Provinces (Calvelo & Liberatore 2002). Its distribution is extended to Chaco, Corrientes, Formosa, and Misiones Provinces.

5.5. ***Parmotrema masonii*** L. I. Ferraro, Hickenia: 191. 1979.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, in quebrachal, 24.XI.2008, *A. Michlig & N. Niveiro 1109* (CTES).
Additional material studied: ARGENTINA. FORMOSA: Formosa, Ea. Guaycolec, 22 km N of Formosa, route 11, on fence posts at edge of internal trail, 15.II.1995, *L. Ferraro et al. 4641* (CTES). MISIONES: San Ignacio, in marginal forest of Paraná river, 18.XII.1981, *L. Ferraro et al. 2281* (CTES).

This species is cited for Corrientes Province (Ferraro 1979; Michlig & Ferraro 2012b). Its distribution is extended to Chaco, Formosa, and Misiones Provinces.

5.6. ***Parmotrema mesotropum*** (Müll. Arg.) Hale, Phytologia 28(4): 337. 1974.
Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, 23.XI.2008, *A. Michlig & N. Niveiro 1051* (CTES), *1053* (CTES), *1071* (CTES), *1076* (CTES); on river's bank, 26°48'20''S, 59°36'33''W, 24.IV.2013, *A. Michlig et al. 3045* (CTES), *3060* (CTES); 17.VII.2015, *M.P. Rodríguez et al. 36* (CTES); trail to Panza de Cabra pond, 24.XI.2008, *A. Michlig & N. Niveiro 1094* (CTES).
Additional material studied: ARGENTINA. FORMOSA: Bermejo, Laguna Yema, 26º30'2.7''S, 61º13'19.3''W, 163 msm, on *Schinopsis lorentzii*, 25.IV.2009, *A. Michlig et al. 1656* (CTES).

This species is cited for Corrientes (Popoff & Ferraro 2002; Michlig & Ferraro 2012b), Jujuy, Misiones (Calvelo & Liberatore 2002), and Santiago del Estero Provinces (Adler 2013). Its distribution is extended to Chaco and Formosa Provinces.

5.7. ***Parmotrema recipiendum*** (Nyl.) Hale, Phytologia 28(4): 338. 1974.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, 24.XI.2008, *A. Michlig & N. Niveiro 1099* (CTES).
Additional material studied: ARGENTINA. FORMOSA: Bermejo, Nat. Route Nº 81, Los Chiriguanos, 24º07'1.3''S, 61º26'18.7''W, 171 msm, in an *Aspidosperma quebracho-blanco* forest, 25.IV.2009, *A. Michlig et al. 1621* (CTES). MISIONES: San Pedro, Yaboty Biosphere Reserve, Esmeralda Provincial Park, trail to pine forest, 26º53'40''S, 53º52'42''W, 318 msm, 15.V.2008, *A. Michlig et al. 764* (CTES).

This species is cited for Chaco, Formosa, Misiones, Corrientes (Popoff & Ferraro 2002; Michlig & Ferraro 2012b), La Pampa (Grassi 1950), and Santiago del Estero Provinces (Adler 2013). Its distribution is extended to Chaco, Formosa, and Misiones Provinces.

5.8. ***Parmotrema tinctorum*** (Despr. *ex* Nyl.) Hale, Phytologia 28(4): 339. 1974.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, in quebrachal, 24.XI.2008, *A. Michlig & N. Niveiro 1108* (CTES); 26°50'30''S, 59°36'49''W, 24.IV.2013, *A. Michlig et al. 3081* (CTES).
Additional material studied: ARGENTINA. FORMOSA: Pirané, Provincial Route Nº 1, between Mayor Villafañe and San Francisco de Laishi, 26º12'16.8''S, 58º59'47.3''W, 73 msm, on stump in forest, 12.II.2010, *A. Michlig & N. Niveiro 2351* (CTES).

This species is cited for Córdoba, Jujuy, Misiones, Salta (Calvelo & Liberatore 2002), and Corrientes Provinces (Popoff & Ferraro 2002). Its distribution is extended to Chaco and Formosa Provinces.

6. ***Punctelia*** Krog
6.1. ***Punctelia punctilla*** (Hale) Krog, Nordic J. Bot. 2(3): 291. 1982.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, in forest, 26°51'35''S, 59°36'46''W, 24.IV.2013, *A. Michlig et al. 3119* (CTES), trail of suspension bridge, 17.VII.2015, *M.P. Rodríguez et al. 29* (CTES), *51* (CTES).
Additional material studied: ARGENTINA. CHACO: 1º de Mayo, road to Colonia Benitez, Tragadero river,

on railings of Madera del Puente, 16.V.1979, *L. Ferraro et al. 1805* (BG, CTES, KASSEL, US, VALPL). MISIONES: San Pedro, Yaboty Biosphere Reserve, Moconá Provincial Park, near camping, 27º9'13.1''S, 53º54'5.2''W, 333 msm, 26.V.2009, *A. Michlig & N. Niveiro 1921* (CTES).

This species is cited for Buenos Aires, Córdoba, Corrientes, Mendoza, Río Negro, Santiago del Estero (Calvelo & Liberatore 2002), Catamarca (Rodríguez *et al.* 2016), and Tucumán Provinces (Adler & Calvelo 2010). Its distribution is extended to Chaco and Misiones Provinces.

7. ***Usnea*** Dill. *ex* Adans.

7.1. ***Usnea cristatula*** Motyka, Lich. Gen. Usnea Monogr., Pars Syst. 3: 641. 1936-1938.

Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, 23.XI.2008, *A. Michlig & N. Niveiro 1044 B* (CTES).

This species is cited for Chaco, Corrientes, Entre Ríos, Jujuy, Misiones, Salta, Santa Fe (Rodríguez 2011), and Córdoba Provinces (Rodríguez *et al.* 2016).

7.2. ***Usnea dasaea*** Stirt., Scott. Natural. 6: 104. 1881.

Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, 23.XI.2008, *A. Michlig & N. Niveiro 1044 E* (CTES), *1054 B* (CTES).

This species is cited for Buenos Aires, Chaco, Córdoba, Corrientes, Entre Ríos, Formosa, Jujuy, Misiones, Salta (Rodríguez 2011), Catamarca, Santiago del Estero, and Tucumán Provinces (Rodríguez *et al.* 2016).

7.3. ***Usnea steineri*** Zahlbr., Cat. Lich. Univ. 6: 592. 1930.

Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, 23.XI.2008, *A. Michlig & N. Niveiro 1043 C* (CTES), *1044 A* (CTES), *1054 A* (CTES).

This species is cited for Chaco, Córdoba, Entre Ríos, Misiones (Calvelo & Liberatore 2002), Corrientes, Formosa, Jujuy, Salta, Santa Fe, (Rodríguez 2011), Catamarca, Santiago del Estero, and Tucumán Provinces (Rodríguez *et al.* 2016).

Physciaceae Zahlbr.

8. ***Heterodermia*** Trevis.

8.1. ***Heterodermia albicans*** (Pers.) Swinscow & Krog, Lichenologist 8(2): 113. 1976.

Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, in forest, 26°51'35''S, 59°36'46''W, 24.IV.2013, *A. Michlig et al. 3116 B* (CTES).

This species is cited for Misiones (Osorio 1981), Entre Ríos (Osorio 1982), Buenos Aires, Córdoba, Jujuy, Santiago del Estero (Scutari 1995a), Catamarca (Rodríguez *et al.* 2012), and Corrientes Provinces (Michlig & Ferraro 2012b). Its distribution is extended to Chaco Province.

8.2. ***Heterodermia diademata*** (Taylor) D. D. Awasthi, Geophytology 3(1): 113. 1973.

Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, 23.XI.2008, *A. Michlig & N. Niveiro 1073* (CTES), *1077* (CTES); 17.VII.2015, *M.P. Rodríguez et al. 27* (CTES), *67* (CTES), *73* (CTES), *74* (CTES); trail to Panza de Cabra pond, 24.XI.2008, *ipse 1085 E* (CTES); in quebrachal, 26°50'30''S, 59°36'49''W, 24.IV.2013, *A. Michlig et al. 3078 B* (CTES).

This species is cited for Corrientes (Ferraro 1978), Entre Ríos (Osorio 1982), Buenos Aires, Córdoba, Santiago del Estero (Scutari 1995a), Salta (Calvelo & Liberatore 2002), Catamarca, Chaco, Formosa, Santa Fe (Rodríguez *et al.* 2012), and Tucumán Provinces (Rodríguez *et al.* 2016).

8.3. ***Heterodermia neocomosa*** M.P. Rodríguez, L.I. Ferraro & Aptroot, Cryptog. Mycol. 38(2): 160. 2017.

Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, around the end of the bridge, 26°48'20''S, 59°36'33''W, 24.IV.2013, *A. Michlig et al. 3058* (CTES); trail to Panza de Cabra pond, in quebrachal, 26°50'30''S, 59°36'49''W, 24.IV.2013, *A. Michlig et al. 3080* (CTES).

This species is cited for Chaco, Corrientes, Formosa, and Salta Provinces (Michlig *et al.* 2017).

8.4. ***Heterodermia obscurata*** (Nyl.) Trevis., Nuovo Giorn. Bot. Ital. 1: 114. 1869.

Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, in forest, on fallen branch, 26°51'35''S, 59°36'46''W, 24.IV.2013, *A. Michlig et al. 3103* (CTES).

This species is cited for Buenos Aires, Córdoba (Estrabou *et al.* 2006), Catamarca, Misiones (Rodríguez *et al.* 2012), and Corrientes Provinces (Michlig & Ferraro 2012b). Its distribution is extended to Chaco Province.

8.5. ***Heterodermia speciosa*** (Wulfen) Trevis., Atti Soc. Ital. Sci. Nat. 11: 614. 1868.

Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, 24.XI.2008, *A. Michlig & N. Niveiro 1085 A* (CTES), *1089* (CTES).

This species is cited for Buenos Aires (Rosato 2006), Córdoba, Jujuy (Estrabou *et al.* 2006),

and Misiones Provinces (Sarlej *et al.* 2018). Its distribution is extended to Chaco Province.

9. *Physcia* (Schreb.) Michx.
9.1. *Physcia integrata* Nyl., Syn. Meth. Lich. 1(2): 424. 1860.
Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, 23.XI.2008, *A. Michlig & N. Niveiro 1052* (CTES), *1078* (CTES).

This species is cited for Buenos Aires, Jujuy, and Salta Provinces (Calvelo & Liberatore 2002). Its distribution is extended to Chaco Province, this is its first record for northeastern Argentina.

10. *Polyblastidium* Kalb
10.1. *Polyblastidium japonicum* (M. Satô) Kalb, Phytotaxa 235(1): 43. 2015.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, in forest, 26°51'35''S, 59°36'46''W, 24.IV.2013, *A. Michlig et al. 3115* (CTES), *3117* (CTES).

This species is cited for Catamarca, Córdoba, Tucumán (Rodríguez *et al.* 2012), and Misiones Provinces (Sarlej *et al.* 2018). Its distribution is extended to Chaco Province.

10.2. *Polyblastidium squamulosum* (Degel.) Kalb, Phytotaxa 235(1): 49. 2015.
Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, in riverside, 26°48'20''S, 59°36'33''W, 24.IV.2013, *A. Michlig et al. 3049* (CTES).

This species is cited for Córdoba (Estrabou *et al.* 2006) and Misiones Provinces (Sarlej *et al.* 2018). Its distribution is extended to Chaco Province.

Teloschistaceae Zahlbr.
11. *Teloschistes* Norman
11.1. *Teloschistes exilis* (Michx.) Vain., Acta Soc. Fauna Fl. Fenn. 7(1): 115. 1890.
Material studied: Presidencia de la Plaza, CNP, trail of suspension bridge, 23.XI.2008, *A. Michlig & N. Niveiro 1047* (CTES); 17.VII.2015, *M.P. Rodríguez et al. 44* (CTES), *45* (CTES); trail to Panza de Cabra pond, in quebrachal, 26°50'30''S, 59°36'49''W, 24.IV.2013, *A. Michlig et al. 3065* (CTES), *3066* (CTES), *3079* (CTES).

This species is cited for Córdoba, Jujuy, Tucumán, Salta (Grassi 1950; Osorio 1990), Santa Fe (Osorio & Ferraro 1976), Buenos Aires (Osorio 1980), Misiones (Osorio 1981), Entre Ríos (Osorio 1982), Corrientes (Ferraro 1995), and Santiago del Estero Provinces (Calvelo & Liberatore 2002). Its distribution is extended to Chaco Province.

11.2. *Teloschistes flavicans* (Sw.) Norman, Nytt Mag. Naturvidensk. 7: 229. 1853.
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, in quebrachal, 26°50'30''S, 59°36'49''W, 24.IV.2013, *A. Michlig et al. 3077* (CTES); trail of suspension bridge, 17.VII.2015, *M.P. Rodríguez et al. 28* (CTES), *35* (CTES).

This species is cited for Jujuy, Salta (Herre 1944), Chubut, Córdoba, Islas Malvinas (Grassi 1950), Tucumán (Grassi 1953), Buenos Aires (Osorio 1977b), Santa Fe (Osorio & Ferraro 1976), Misiones (Osorio 1981), and Corrientes Provinces (Michlig & Ferraro 2012b). Its distribution is extended to Chaco Province.

Verrucariaceae Eschw.
12. *Flakea* O.E. Erikss.
12.1. *Flakea papillata* O.E. Erikss. Syst. Ascomycetum 11: 14 (1992).
Material studied: Presidencia de la Plaza, CNP, trail to Panza de Cabra pond, 24.XI.2008, *A. Michlig & N. Niveiro 1087* (CTES).

This species is cited for Jujuy Province (Eriksson 1992). Its distribution is extended to Chaco Province, this is its first record for northeastern Argentina.

A wide species diversity of macrolichens were identified in CNP, increasing thus the knowledge of these organisms in the region. Caliciaceae, Physciaceae and Parmeliaceae were the most diverse families, with 8, 8, and 14 species respectively, followed by Collemataceae (3), Teloschistaceae (2), and Verrucariaceae (1).

All studied species are corticolous with various types of habit, being mostly foliose and fruticose, and only one squamulose (*Flakea papillata*) and one subfruticose (*Heterodermia neocomosa*). Among the most abundant foliose species are *Parmotrema mesotropum*, *P. argentinum*, *P. cetratum*, and *Heterodermia diademata*, while *Teloschistes exilis* is the most abundant species with fruticose habit.

Three of the thirty-six studied species are recorded for the first time from Argentina: *Dirinaria melanocarpa*, *Pyxine petricola* var. *convexula*, and *P. pungens*; and twenty five of the identified species constitutes new records for Chaco Province: *Dirinaria applanata*, *D. confluens*, *D. picta*, *Flakea papillata*, *Heterodermia albicans*, *H. obscurata*, *H. speciosa*, *Leptogium austroamericanum*, *L. marginellum*, *L. phyllocarpum*, *Parmotrema argentinum*,

P. cetratum, *P. hababianum P. masonii*, *P. mesotropum*, *P. recipiendum*, *P. tinctorum*, *Physcia integrata*, *Polyblastidium japonicum*, *P. squamulosum*, *Punctelia punctilla*, *Pyxine astridiana*, *P. subcinerea*, *Teloschistes exilis*, and *T. flavicans*. In addition, we include new records for Formosa (7), Misiones (4), and Corrientes (1) Provinces.

These results have considerably increased the lichen diversity of Chaco Province, considering that 25 of the studied macrolichens species had not been cited yet for that Province. In addition, we can affirm that CNP harbors a high macrolichens diversity, thus constituting an important area for lichens conservation.

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References

Adler MT (1988) La familia Parmeliaceae (líquenes, Ascomycotina) en la provincia de Buenos Aires: estudio taxonómico-florístico. Tesis Doctoral. Universidad de Buenos Aires, Buenos Aires. 236p.

Adler MT (2013) Líquenes Parmelioides (Parmeliaceae, Ascomycota) del Parque Nacional Copo (Provincia de Santiago del Estero, Argentina). Boletín de la Sociedad Argentina de Botánica 48: 387-406.

Adler MT & Calvelo S (2010) *Flavoparmelia baltimorensis*, *Parmotrema yodae* y *Xanthoparmelia braziliensis*, primeras citas para Argentina y ampliación de distribuciones de otras Parmeliaceae (Ascomycota liquenizados). Boletín de la Sociedad Argentina de Botánica 45: 5-16.

Almborn O (1989) Revision of the lichen genus *Teloschistes* in central and southern Africa. Nordic Journal of Botany 8: 521-537.

Aptroot A (1987) Pyxinaceae (Lichens). *In*: Görts-Van Rijn ARA (ed.) Flora of the Guianas. Serie E: Fungi and Lichens (Fascicle 1). D-6240. Koeltz Scientific Books, Koenigstein. 59p.

Awasthi DD (1975) A monograph of the lichen genus *Dirinaria*. Bibliotheca Lichenologica 2: 1-108.

Cabrera AL (1971) Fitogeografía de la República Argentina. Boletín de la Sociedad Argentina de Botánica 1-2: 1-50.

Calvelo S & Liberatore S (2002) Catálogo de los líquenes de la Argentina. Kurtziana 29: 7-170.

Canêz LS (2009) Estudos taxonômicos em *Punctelia* (Parmeliaceae, Ascomycetes liquenizados). Tese de Doutorado. Instituto de Botânica da Secretaria de Estado do Meio Ambiente, São Paulo. 274p.

Canêz LS & Marcelli MP (2010) The *Punctelia microsticta*-group. The Bryologist 113: 728-738.

Caruso SA (2015) Análisis del proceso de creación de los Parques Nacionales en Argentina. Geograficando 11: 1-17.

Cunha IPR (2007) Fungos liquenizados do gênero *Leptogium* (Ascomycetes) no litoral sul do estado de São Paulo. Universidade Estadual Paulista Câmpus de Botucatu, Instituto de Biociências, Botucatu. 114p.

Elix JA (1994) Parmotrema. *In*: Orchard AE (ed.) Lichens - Lecanorales 2, Parmeliaceae, Flora of Australia 55. Australia Government Publishing Service, Canberra. Pp. 140-162.

Elix JA (2009) Physciaceae. *In*: McCarthy PM (ed.) Lichens 5, Flora of Australia 57. Australia Government Publishing Service, Canberra. Pp. 494-533.

Eriksson OE (1992) *Psoroglaena cubensis* and *Flakea papillata* gen. et sp. nov., two corticolous lichens with a pantropical distribution. Systema Ascomycetum 11: 11-24.

Estrabou C (1999) La familia Parmeliaceae (Ascomycetes liquenizados) sensu stricto de la provincia de Córdoba: estudio sistemático-biogeográfico. Tesis Doctoral. Facultad de Ciencias Exactas, Físicas y Naturales. Universidad Nacional de Córdoba, Córdoba. 158p.

Estrabou C, Rodríguez JM, Prieri B & Lijteroff R (2006) Contribución al conocimiento de los macrolíquenes del extremo Sur del Gran Chaco (Argentina). Kurtziana 32: 25-43.

Ferraro L (1978) Contribución a la Flora liquenológica de Corrientes (República Argentina). Facena: 167-244.

Ferraro LI (1979) Una nueva especie de Parmeliaceae para el NE. Argentino. Hickenia 1: 191-193.

Ferraro LI (1995) Comentarios sobre la distribución de los líquenes en las diferentes regiones fitogeográficas de la provincia de Corrientes, Nordeste de Argentina, América del Sur. *In*: Daniels FJA, Schulz M & Peine J (eds.) Contributions to lichenology in honour of Gerhard Follman. Geobotanical and Phytotaxonomical study group. Botanical Institute, University of Cologne, Cologne. Pp. 403-413.

Flakus A, Sipman HJM, Rodriguez Flakus P, Jabłońska A, Oset M, Meneses QRI & Kukwa M (2015) Contribution to the knowledge of the lichen biota of Bolivia. Polish Botanical Journal 60: 1-18.

Galloway DJ & Jørgensen PM (1995) The lichen genus *Leptogium* (Collemataceae) in southern Chile, South America. *In*: Daniels FJA, Schulz M & Peine J (eds.) Contributions to Lichenology in honour of G. Follmann. University of Cologne, Cologne. Pp. 227-247.

Grassi MM (1950) Contribución al catálogo de líquenes argentinos. Lilloa 24: 5-294.

Grassi MM (1953) Teloschistaceae de Tucumán. Lilloa 26: 439-452.

Guinzburg R & Adamoli J (2006) Ecorregión Chaco Húmedo. *In*: Brown A, Martinez Ortiz U, Acerbi M & Corcuera J (eds.) La situación ambiental Argentina 2005. Fundación Vida Silvestre Argentina, Buenos Aires. Pp. 102-129.

Guinzburg R, Adámoli J, Herrera P & Torrella S (2005) Los Humedales del Chaco: clasificación, inventario y mapeo a escala regional. Miscelánea 14: 121-138.

Hale ME (1965) A Monograph of the *Parmelia* subgenus *Amphigymnia.* Contributions from the United States National Herbarium 36: 193-358.

Hale ME (1976) A monograph of the lichen genus *Pseudoparmelia* Lynge (Parmeliaceae). Smithsonian Contributions to Botany 31: 1-62.

Herre AWCT (1944) The South American Lichens. Collected by the second University of California Botanical Garden expedition to the Andes. Revista Universitaria, Cuzco 33: 47-64.

Hüneck S & Yoshimura I (1996) Identification of lichen substances. Springer, Berlin. 493p.

Jungbluth P (2010) Estudos taxonômicos em *Physcia* (Schreb.) Michx. e *Pyxine* Fr. (Physciaceae, Ascomycota). Tese de Doutorado. Instituto de Botânica da Secretaria de Estado do Meio Ambiente, São Paulo. 228p.

Jungbluth P & Marcelli M (2011) The *Pyxine pungens* complex in São Paulo state, Brazil. The Bryologist 114: 166-177.

Kalb K (1987) Brasilianische Flechten. 1. Die Gattung *Pyxine*. Bibliotheca Lichenologica 24: 1-89.

Malme G (1897) Die Fletchen der estern Regnell'schen Expedition. I. Die Gatung *Pyxine*. Bihang Till K. Svenska Vetenskapsakad Handlingar. Band 23, 3: 32-52.

Michlig A (2014) *Canoparmelia* y *Crespoa* (Parmeliaceae, Ascomycota) en el Nordeste de Argentina; *Canoparmelia caroliniana* y *C. cryptochlorophaea* nuevas citas para Argentina. Boletín de la Sociedad Argentina de Botánica 49: 161-172.

Michlig A & Ferraro LI (2012a) Nuevos registros de especies sorediadas de *Parmotrema* con ácido protocetrárico (Ascomycota, Parmeliaceae) en el sur de Sudamérica. Darwiniana 50: 323-331.

Michlig A & Ferraro LI (2012b) Diversidad de macrolíquenes del Parque Nacional Mburucuyá (Corrientes, Argentina). Boletín de la Sociedad Argentina de Botánica 47: 287-302.

Michlig A, Rodríguez MP, Aptroot A, Niveiro N & Ferraro LI (2017) New species of the *Heterodermia comosa*-group (Physciaceae, lichenized Ascomycota) from southern South America. Cryptogamie, Mycologie 38: 155-167.

Moberg R (1983) Studies on Physciaceae (Lichens) II*. The genus *Pyxine* in Europe. The Lichenologist 15: 161-167.

Moberg R (1990) The lichen genus *Physcia* in Central and South America. Nordic Journal of Botany 10: 319-342.

Moberg R (2011) The lichen genus *Heterodermia* (Physciaceae) in South America - a contribution including five new species. Nordic Journal of Botany 29: 129-147.

Orange A, James PW & White FJ (2010) Microchemical methods for the identification of lichens. 2nd Edition. British Lichen Society, London. 101p.

Osorio HS (1969a) Contribution to the Lichen Flora of Argentina II. Lichens from the Province of Misiones. Comunicaciones Botánicas del Museo de Historia Natural de Montevideo 4: 1-5.

Osorio HS (1969b) Contribution to the Lichen Flora of Argentina III. Additions. The Bryologist 72: 409-410.

Osorio HS (1975) Contribution to the Lichen Flora of Argentina VI. Lichens from Concordia, Entre Ríos Province. Revue Bryologique et Lichénologique 41: 83-85.

Osorio HS (1976) Contribution to the Lichen Flora of Argentina. VIII. Lichens from Punta Lara, Buenos Aires Province. The Bryologist 79: 358-360.

Osorio HS (1977a) Contribution to the Lichen Flora of Argentina X. Lichens from Santa Catalina, Buenos Aires Province. The Bryologist 80: 363-364

Osorio HS (1977b) Apuntes de liquenología y clave para los géneros de líquenes de los alrededores de Buenos Aires. Notas Botánicas, Sociedad Argentina de Botánica 1: 1-36

Osorio HS (1980) Contribution to the Lichen Flora of Argentina XII. New or Additional Records from Buenos Aires Province. The Bryologist 83: 219-220.

Osorio HS (1981) Contribution to the lichen flora of Argentina. XIII. Lichens from Misiones Province. Comunicaciones Botánicas del Museo de Historia Natural de Montevideo 4: 1-18.

Osorio HS (1982) Contribution to the lichen flora of Argentina. XIV. Lichens from Entre Ríos Province. Comunicaciones Botánicas del Museo de Historia Natural de Montevideo 4: 1-8.

Osorio HS (1990) Contribution to the lichen flora of Argentina. XVII. Lichens from Northwest Argentina. Comunicaciones Botánicas del Museo de Historia Natural de Montevideo 5: 1-5.

Osorio HS (1996) Contribution to the lichen flora of Uruguay XXIX. Lichens from Rivera department. Comunicaciones Botánicas del Museo de Historia Natural de Montevideo 5: 1-5.

Osorio HS & Ferraro LI (1976) Contribution to the lichen flora of Argentina IX. Some lichens from the Provinces of Santa Fe and Santiago del Estero. Mycotaxon 4: 331-334.

Osorio HS & Ferraro LI (2001) Contribution to the lichen flora of Argentina XX. Lichens from the Province Jujuy. Comunicaciones Botánicas de Museos Nacionales de Historia Natural y Antropología 118: 1-8

Popoff O & Ferraro LI (2002) Hongos y Líquenes. *In*: Arbo MM & Tressens SG (eds.) Flora del Iberá. Capítulo 7. EUDENE. Impr. Estudio Sigma SRL, Buenos Aires. Pp. 381-415.

Rodríguez JM (2011) El género *Usnea* (Ascomycetes liquenizados) en Argentina: estudio sistemático y biogeográfico. Tesis de doctorado en ciencias biológicas. Universidad Nacional de Córdoba, Facultad de Ciencias Exactas, Físicas y Naturales, Córdoba. 217p.

Rodríguez JM, Estrabou C & Quiroga G (2012) El género *Heterodermia* (Lecanorales - Physciaceae) en el centro norte de Argentina. Acta Botánica Brasilica 26: 1000-1005.

Rodríguez JM, Hernández JM, Filippini E, Cañas M & Estrabou C (2016) Nuevas citas de macrolíquenes para Argentina y ampliaciones de distribución en el centro del país. Boletín de la Sociedad Argentina de Botánica 51: 405-417.

Rogers RW (1986) The genus *Pyxine* (Physciaceae, lichenized ascomycetes) in Australia. Australian Journal of Botany 34: 131-154.

Rosato VG (2006) Diversity and distribution of lichens on mortar and concrete in Buenos Aires Province, Argentina. Darwiniana 44: 89-97.

Sarlej MI, Michlig A & Ferraro LI (2018) El género *Heterodermia* (Physciaceae, Lecanorales) en la reserva de biosfera Yaboty (Misiones, Argentina). Boletín de la Sociedad Argentina de Botánica 53: 9-16.

Scutari NC (1992) Estudios sobre Pyxinaceae foliosas (Lecanorales, Ascomycotina) de la Argentina, IV: Claves de los géneros y las especies de lo provincia de Buenos Aires. Boletín de la Sociedad Argentina de Botánica 28: 169-173.

Scutari NC (1995a) Los macrolíquenes de Buenos Aires, I: *Dirinaria*, *Heterodermia* e *Hyperphyscia* (Physciaceae, Ascomycotina). Darwiniana 33: 149-176.

Scutari NC (1995b) Los macrolíquenes de Buenos Aires, II: *Phaeophyscia*, *Physcia* y *Pyxine* (Physciaceae, Ascomycotina). Darwiniana 33: 211-231.

Soria A (2001) Plan general de manejo del Parque Nacional Chaco. Administración de Parques Nacionales, Delegación Regional Nordeste Argentino, Resistencia. 178p.

Spielmann AA & Marcelli MP (2009) *Parmotrema s.l.* (Parmeliaceae, lichenized Ascomycota) from Serra Geral slopes in central Rio Grande do Sul state, Brazil. Hoehnea 36: 551-595.

Swinscow TDV & Krog H (1975) The genus *Pyxine* in East Africa. Norwegian Journal of Botany 22: 43-68.

Swinscow TDV & Krog H (1976) The genera *Anaptychia* and *Heterodermia* in East Africa. The Lichenologist 8: 103-138.

Swinscow TDV & Krog H (1978) The genus *Dirinaria* in East Africa. Norwegian Journal of Botany 25: 157-168.

Teta P, Pereira JA, Muschetto E & Fracassi N (2009) Mammalia, Didelphimorphia, Chiroptera, and Rodentia, Parque Nacional Chaco and Capitán Solari, Chaco Province, Argentina. Check List 5: 144-150.

Verdón D (1992) Leptogium. *In*: George AS (ed.) Lichens - Introduction, Lecanorales 1, Flora of Australia 54. Australia Government Publishing Service, Canberra. Pp. 173-192.

White FJ & James PW (1985) A new guide to microchemical techniques for the identification of the lichen substances. Bulletin, British Lichen Society 57: 1-41.

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