High lichen species richness in *Polylepis australis* forest: new records from South America and Argentina

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**Abstract.** The *Polylepis australis* forests in Central Argentina support a great biodiversity in a relative small area. As a result of this study focusing on the diversity and ecology of the lichen communities of these forests, we present five new species for South America: *Rinodina ficta*, *R. malcolmii*, *R. obscura*, *Usnea glabrata*, *Tetramelas triphragmioides* and eight taxa new for Argentina: *Caliciaceae*, *Erioderma leylandii* subsp. *leylandii*, *Leptogium microstictum*, *Phaeophyscia endococcinodes*, *Rinodina dolichospora*, *R. intermedia*, *Usnea cirrosa* and *U. flavocardia*. Unidentified *Usnea* species, similar to *U. silesiaca*, were also characterized and discussed.

**Key words:** *Caliciaceae*, *Collemataceae*, Córdoba, *Pannariaceae*, *Parmeliaceae*, *Physciaceae*, taxonomy.

**Introduction**

Forest and shrubland patches with canopies dominated by ~28 species of the genus *Polylepis* occupy the uppermost forested slopes of the high mountains of tropical and subtropical South America (Fjeldså & Kessler 2004; Renison et al. 2018; Segovia et al. 2018). These *Polylepis* forests exhibit huge environmental differences with a latitudinal distribution of 4500 km from Venezuela to Central Argentina, elevation ranges from 900 to 5000 m above sea level and includes the world record for the highest elevation displaying tree growth, and a large range of precipitations from 100 to 3000 mm (Harden et al. 2013; Cuyckens et al. 2016; Renison et al. 2018). As a result of their isolation and a relatively stable climate throughout the Pleistocene, many *Polylepis* forests are inhabited by species of birds, rodents, plants and fungi with high levels of endemisms (Tarifa & Yensen 2001; Calvelo & Libratoré 2002; Fjeldså 2002; Bellis et al. 2009; Robledo & Renison 2010; Sylvester et al. 2017; Ames-Martinez et al. 2019; Quispe-Melgar et al. 2020). The ecology and biodiversity of the heterogeneous forest types classified as ‘*Polylepis* forests’ are still poorly represented in the scientific literature with a recent review reporting 139 published studies, of which only 25 studies centered on *Polylepis* forest biodiversity (Renison et al. 2018).

Studies that report lichen diversity in *Polylepis* forests are particularly scarce. To the best of our knowledge, only two have been published. One in the context of edge effects in two *Polylepis* forest patches in the Andes of Colombia (Pulido Herrera & Ramos Montaño 2016) and a second regarding the effects of fires in the mountains of Central Argentina (Perazzo & Rodriguez 2019). Given the island nature of mountain highlands and the diversity of habitat types for *Polylepis* forests from arid regions to wet cloud forests, the lichen communities of the high mountain *Polylepis* forests of South America are largely unexplored and probably hide a wealth of new species to science.

According to the IUCN, 15 of the approximately 30 described *Polylepis* tree species are considered threatened. Hence, the forests they dominate including their endemic biota are also considered threatened (IUCN 2020). The reasons for their threatened status involve the limited distribution range of many of the *Polylepis* species in combination with an important human pressure on the forests. These forests are subjected to small scale, continuous logging, burning to produce pastures for domestic livestock or land for agriculture, invasion by
exotic species and are vulnerable to quick climate change (Fjeldså 2002; Fjeldså & Kessler 2004; Cingolani et al. 2008; Renison et al. 2013; Cuyckens et al. 2016). The description of the Polylepis forests vanishing biodiversity has the potential to promote awareness from conservation agencies and local people about their rich endemic biota. In particular, to date no Polylepis forest endemic species for the most studied taxa such as birds, mammals and vascular plants have been described in the southernmost forest. However, new species to science and a host of possible endemics are emerging for wood decaying fungi and lichens in this location (Robledo et al. 2003; Rodríguez et al. 2011, 2017).

The southernmost Polylepis forests are dominated by P. australis and are located in the Higher Cordoba Mountain range of central Argentina. These forest patches represent less than 10% of the vegetation cover in this location (Cingolani et al. 2008; Renison et al. 2013). Within the wooded patches, in addition to P. australis, as a secondary tree species Maytenus boaria may be found, as well as the shrub species Escallonia cordobensis and Berberis buxifolia and a large number herbaceous plants, ferns and grasses. The plant diversity along with climate gradient provide a wide variety of habitats ideal for the development of very diverse lichen communities. Recently, a review of the lichen genus Parmelia in Argentina included two new records in the P. australis forests (Passo et al. 2020) and the presence of one Oropogon species was rediscovered here (Rodríguez & Filippini 2020). However, the lichen composition in P. australis forests is far from complete. The objective of this work is to describe noteworthy lichen species in Polylepis australis forests including new records for South America and Argentina.

Material and methods

Between the years 2015 and 2020 more than 1000 lichen collections were made in Polylepis australis forests from the mountains of Central Argentina (31°34’S, 64°50’W). The elevation range is 1200–2800 m above sea level (Renison et al. 2002). Mean temperatures of the coldest and warmest months are 5.0°C and 11.4°C, respectively, with no frost-free period. Mean annual precipitation is 920 mm, with 83% of the rainfall being concentrated in the warmest months (Renison et al. 2002). The vegetation in the mountains of Central Argentina consists of a mosaic of tussock grasslands, grazing lawns, degraded grazing lawns, eroded areas with exposed rock surfaces, granite outcrops, closed and open Polylepis australis forests or shrublands (Fig. 1). The lichen collection sites were in the Condorito National Park under permit DRC 321 (Argentinian National Parks Administration) issued to the first author.

The specimens were studied morphologically under stereomicroscope using standard techniques in lichenology. The anatomical characters were studied through handmade sections mounted in water or KOH. The spore measurements are reported with their range. The percentage of cortex, medulla and axis in Usnea (%CMA) is reported as min−X−max where ‘min’ and ‘max’ are the extreme observed values and X the arithmetic mean. The lichen substances were identified by TLC (Orange et al. 2001) using A, B, C and/or G solvents. Also K (5% KOH), C (commercial bleach), KC (K followed by C), PD and UV (fluorescence at 366 nm) were used when necessary (not needed for all species). For the specific morphological characters studied in each genus see the literature in the descriptions. All specimens are preserved in the CORD herbarium.

Results and discussion

Twenty-six lichenized fungi are presented in this work. Five species are new records for South America: Rinodina ficta, R. malcolmii, R. obscura, Usnea glabrata, and Tetramelas triphragmioides. Eight taxa are new records for Argentina: Calicium abietinum, Erioderma leylanidi subsp. leylandii, Leptogium microstictum, Phaeophyscia endococcinodes, Rinodina dolichospora, R. intermedia, Usnea cirrus and U. flavocardia. Twelve species are new records from central Argentina, all of them from Córdoba province: Amandinea punctata, Cratia lauricassiae, Hypotrachyna sinausa, H. vexans, Leptogium brebissonii, L. cyanescens, L. laceroides, L. phyllocarpum, Parmelinopsis swinscovicii, Sticta fuliginosa, Usnea igniaria, U. subelegans. One species remains unidentified Usnea aff. silesiaca.

New records for South America and Argentina

Calicium abietinum Pers., Tentamen dispositionis methodicae Fungorum. Suppl. 59. 1798. (Fig. 2A–C)

For a detailed description see Tibell (1996).

Diagnostic characters. Thallus immersed (Fig. 2A), brown-black stalked ascomata (0.2–0.45 mm long.) without pruina (Fig. 2B); ascospores 1-septate, brown and ellipsoid (Fig. 2A), ornamented when mature, (10–12 × 4.5–6.6 μm).

Chemistry. K−, C−; there are no substances detected by TLC.

Notes. Calicium is a genus underestimated in Argentina: only C. glauccellum, C. hyperelloides, C. subcurtum and C. viride have been cited from Patagonia or to northeast of the country (Calvelo & Liberator 2002). In comparison with these species, C. abietinum is the only with the combination of an immersed thallus, brown to black stipitate and not pruinose apothecia.

Distribution and ecology. Calicium abietinum is a very common species in temperate regions (high mountains in tropical area). In South America, it is known from Paraguay and Venezuela (Tibell 1996). In P. australis forests, this species grows in well illuminated stands on deadwood.

Specimens examined. ARGENTINA. Córdoba. Los Gigantes, 2088 m, 31°24’17.0″S, 64°48’29.4″W, on dead wood, 22 Sep.
Figure 1. A. Location of the collection sites. B. Typical lichen communities in *Polylepis australis* forests.
2018, Rodriguez 4674 (CORD). Parque Nacional Quebrada del Condorito, 2132 m, 31°44′26.5″S, 64°48′24.3″W, on dead wood, 26 Dec. 2018, Rodriguez 4679 (CORD); ibid., 1827 m, 31°45′52.4″S, 64°45′38″W, on dead wood, 29 Jan. 2019, Rodriguez 4690 (CORD).

Erioderma leylandii subsp. leylandii (Taylor) Müll. Arg., Flora 71: 24. 1888.  (Fig. 2D–E)

For a detailed description see Jørgensen & Arvidsson (2002).

Diagnostic characters. Thallus foliose, more or less orbicular, grey to buff, shallowly incised (Fig. 2D); upper surface smooth to scabrid, glabrous centrally, otherwise covered with a soft arachnoid tomentum (Fig. 2E), with aggregated stiff hairs near the involute margins; lower surface whitish, mostly naked, with bundles of blackish rhizohyphae; apothecia marginal, disc brown, flat to convex, margin thin, finely hairy (Fig. 2E).

Chemistry. Medulla PD+ orange, C−, K−; TLC: panthrin.

Notes. This subspecies is similar to E. leylandii subsp. velligerum (Tuck) Jørg., cited for Patagonia in cold temperate Nothofagus spp. forests, which is characterized by the presence of argopsin instead of pannarin, and a more conspicuously hirsute upper surface (Jørgensen 2001).

Distribution and ecology. In South America, Erioderma leylandii subsp. leylandii is a fairly common taxon in the central Andes, from Venezuela to Peru, and costal SE Brazil (Jørgensen & Arvidsson 2002). It has been found growing on stone under the canopy.

Specimens examined. ARGENTINA. Córdoba. El Hueco, 1887 m, 31°58′17.1″S, 64°56′48.1″W, on stone, 19 Oct. 2018, Rodríguez & Díaz Domínguez 4691 (CORD).

Phaeophyscia endococcinodes (Poelt) Essl. Mycotaxon 7(2): 301. 1978.  (Fig. 2I–L)

For a detailed description see Moberg (1995).

Diagnostic characters. Thallus foliose, gray, without pruina (Fig. 2I); medulla orange-red (Fig. 2J); lower surface black, rhizines simple and black; apothecia frequent, 2–3 mm diam., sessile (Fig. 2K), margin concolorous with upper surface; ascospores ellipsoid, 20.3–27 × 8.5–2 μm, of Pachysporaria-type (Fig. 2L).

Chemistry. Cortex K−, medulla K+ purple, TLC: skyrin.

Notes. This species is easily recognizable by the presence of orange-red pigment in the medulla.

Distribution and ecology. In South America the species is known from Brazil, Chile, Colombia, Peru and Venezuela (Moberg 1993; Sipman et al. 2008). Here, it has been found growing over bryophytes on stone.

Specimens examined. ARGENTINA. Córdoba. Parque Nacional Quebrada del Condorito, seccional Condorito, 1995 m, 31°42′55.8″S, 64°45′14.9″W, on bryophytes, 15 Dec. 2016, Rodriguez & Perazzo 4646 (CORD).

Rinodina dolichospora Malme, Bihang till Kungliga svenska Vetenskaps-Akademiens Handlingar 28(1): 30. 1902.  (Fig. 3A–D)

For a detailed description see Mayrhofer et al. (1999).

Diagnostic characters. Thallus variable: crustose, thin and effuse, granulose (Fig. 3A) to thicker and areolate and size of spores separate (Fig. 3B); apothecia lecanorine, sessile and ± frequent, thalline margin prominent, concolorous with the thallus, disc brown, epruinose, 0.75 × 1.51 mm (Fig. 3C); ascospores Pachysporaria-type, 1-septate, brown, 22–31 × 13–14.0 μm, frequently with minute granular or globular inclusions (Fig. 3D). There are no substances detected by TLC.

Notes. The type (Pachysporaria with granular inclusions) and size of spores separate Rinodina dolichospora from the other species of Rinodina from Polyplepis forests studied in this contribution.

Distribution and ecology. The species has been described from Brazil (Malme 1902). It is also known from Australia (Mayrhofer et al. 1999), North America (Sheard 2010) and southern Europe (Giralt et al. 2009). In the forest stands of P. australis, this species is very common growing on trunks and twigs.

Selected specimens examined. ARGENTINA. Córdoba. Parque Nacional Quebrada del Condorito, 1894 m, 31°37′07.9″S, 64°56′48.1″W, on stone, 19 Oct. 2018, Rodriguez & Díaz Domínguez 4691 (CORD). El Hueco, 1865 m, 31°58′12.8″S, 64°56′54.6″W, on Polyplepis australis, 19 Oct. 2018, Rodriguez 4676 (CORD).
Figure 2. New records for Argentina. A–C. Calicium abietinum (Rodríguez 4674). A – thallus; B – stalked apothecia; C – 1-septate, brown and ellipsoid ascospores; D–E. Erioderma leylandii subsp. leylandii (Rodríguez & Díaz Dominguez 4678); D – thallus; E – apothecia; F–H. Leptogium microstictum (Rodríguez & Díaz Dominguez 4691); F – thallus; G – foveolae; H – 5-septated, fusiform ascospore with 1 transverse septum; I–L. Phaeophyscia endococcinodes (Rodríguez 4646); I – thallus; J – orange pigment in the medulla (letter a); K – apothecia; L – ascospores of Pachysporaria type. Scales: A = 3 mm; B = 0.1 mm; C = 11 µm; D = 1.5 cm, E = 2 mm; F = 0.5 cm; G = 2 mm; H = 10 µm; I = 2.4 cm; J = 0.2; K = 48 µm; L = 10 µm.
Rinodina ficta (Stizenb.) Zahlbr., Catalogus Lichenum Universalis 7: 518. 1931. (Fig. 3E–G)

For a detailed description see Giralt & Mayrhofer (1991) as R. boleana Giralt & H. Mayrhofer.

Diagnostic characters. Thallus thin, crustose, inconspicuous, white to pale gray (Fig. 3E); apothecia lecanorine, sessile, 0.25 – 0.38 mm wide, thalline margin developed; disc plane, black, without pruina; ascospores Pachysporaria-type, ontogeny of type B (apical thickenings visible before the insertion of the septum), 11.2–14.7 × 6.1–7.2 μm (Fig. 3F–G). There are no substances detected by TLC.

Notes. This species is separated from the other Rinodina species studied here based on the very thin thallus, the smaller Pachysporaria-type spores and their ontogeny of type B.

Distribution and ecology. Rinodina ficta is new for South America. It is described from South Africa (Stizenberger 1890; Mayrhofer et al. 2014). It occurs also in New Zealand (Mayrhofer et al. 2007, as R. boleana) and Mediterranean Europe (Mayrhofer et al. 2014). It has been found on dead wood in well conserved Polypleis forest stands.

Specimen studied. ARGENTINA. Córdoba, Parque Nacional Quebrada del Condorito, 2132 m, 31°44′26.5″S, 64°48′24.3″W, on dead wood, 26 Dec. 2018, Rodriguez 4677 (CORD).

Rinodina intermedia Bagl., Commentario della Società Crittogamologica Italiana 1(4): 315. 1863. (Fig. 3H–J)

For a detailed description see Mayrhofer et al. (2001)

Diagnostic characters. Thallus light-gray-green or ochraceous to light brown (Fig. 3H), frequently with marginal lobes; apothecia sessile, broadly attached, frequent, often contiguous with dark brown to black disc (Fig. 3I); ascospores large, 20–31 × 12–15 μm, submuform with typically more than four locules at maturity (Fig. 3J).

Chemistry. K–, C–; TLC: deoxylichesterinic acid.

Distribution and ecology. Rinodina intermedia is widely distributed in dry regions at low altitudes; known from Colombia and Ecuador in South America, the Caribbean, western North America, Macaronesia, southern Europe, and north to the Channel Islands, U.K., eastwards to the Himalaya and as far south as Kenya and the Cape Verde Islands in Africa (Mayrhofer et al. 2001, Sheard 2010). It grows on soil or terricolous bryophytes, often in crevices between rocks, rarely on horizontal stems of dead shrubs (Mayrhofer et al. 2001, Sheard 2010). In Polypleis forests, it grows on soil under the canopy.

Selected specimen examined. ARGENTINA. Córdoba. Los Gigantes, 31°24′17.0″S, 64°48′29.4″W, 2088 m, on soil, 22 Sep. 2018, Rodriguez 4665 (CORD).

Rinodina malcolmii Elix, Ch.Edler & H.Mayrhofer, Australasian Lichenology 86: 96. 2020. (Fig. 3K–M)

For a detailed description see Elix et al. (2020).

Diagnostic characters. Thallus thin, continuous, crustose to verruculose, pale grey (Fig. 3K); apothecia frequent, lecanorine, adnate to sessile, 0.32 – 0.58 mm wide, thalline margin developed; disc plane to concave, brown to black, plane when mature; ascospores Pachysporaria-type when immature (14–17.5 × 7–9.2 μm) to Mischoblastia-type (Fig. 3M) when mature (17–21.6 × 8–9.5 μm). There are no substances detected by TLC.

Distribution and ecology. Rinodina malcolmii is new from South America. This species has been recently discovered (Elix et al. 2020) in New Zealand. Here it grows on P. australis bark and on twigs of Maytenus boaria or Berberis bushifolia mixed with many other crustose species (Lecanora spp., Caloplaca spp.) and small fruticose Ramalina and Usnea species.

Selected specimens studied. ARGENTINA. Córdoba, Los Gigantes, 31°23′45.1″S, 64°48′24.3″W, on dead wood, 26 Dec. 2018, Rodriguez 4677 (CORD).

Rinodina obscura Müll. Arg., Bulletin de l’Herbier Boissier 1: 40. 1893. (Fig. 3N–Q)

For a detailed description see Mayrhofer et al. (1999).

Diagnostic characters. Thallus crustose thin, continuous, ± rimose, pale grey to olive-grey (Fig. 3N); apothecia sessile, frequent, lecanorine at least when young, thalline margins poorly developed (Fig. 3O), thin or absent when mature; disc 0.3–0.7 mm, brown to black, convex with age, epruinose; ascospores Physcia-type, 1-septate, brown, 12–15 × 5.5–9 μm (Fig. 3P–Q). There are no substances detected by TLC.

Distribution and ecology. Rinodina obscura is new from South America. It has been described in Australia (Müller 1893) and is widely distributed in southeastern mainland Australia and Tasmania (Mayrhofer et al. 1999). It is a rare species in P. australis forests.

Specimens examined. ARGENTINA. Córdoba, Los Gigantes, 1882 m, 31°24′01.9″S, 64°47′56.1″W, on Polypleis australis, 21 Sep. 2018, Rodriguez 4666 (CORD).
Usnea cirrosa Motyka, Lichenum Generis Usnea Studium Monographicum. Pars Systematica 2: 514. 1937.

For a detailed description and taxonomical notes see Clerc (2007) and Gerlach et al. (2017).

Diagnostic characters. Thallus shrubby, erect, up to 7 cm long, yellowish-grey (Fig. 4A); branches tapering, secondary branches constricted at ramification point (Fig. 4C), segments cylindrical to inflate, terete; papillae verrucose irregularly distributed, fibrils scarce to numerous; apothecia terminal and subterminal some-

Distribution and ecology. Usnea flavocardia is known from North America, Europe, Macaronesia and North Africa (Clerc 2007) and South America (Truong et al. 2011). Usnea flavocardia grows on Maytenus boaria, Berberis buxifolia and P. australis mixed with U. cornuta, U. parvula thalli.

Selected specimens examined. ARGENTINA. Córdoba. Parque Nacional Quebrada del Condorito, seccional Condorito, 31°44′21.6°S, 64°48′03.4°W, on Polylepis australis, 26 Dec. 2018, Rodriguez & Perazzo 4664 (CORD). Ibid., 31°44′21.6°S, 64°48′03.4°W, 2127 m, on Polylepis australis, 26 Dec. 2018, Rodriguez 4664 (CORD).

Usnea glabrata (Ach.) Vain., Annales Academiae Scientiarum Fennicae 6(7): 7. 1915.

For a detailed description see Clerc (2011).

Diagnostic characters: Thallus shrubby, erect to tufted, up to 3.5 cm, greyish-green (Fig. 4H); branches tapering to fusiform, secondary branches constricted at ramifica-

Notes. The recently published U. subaranea and U. subglabrata (Truong & Clerc 2016) are similar to U. glabrata. The former developed circular soralia that remain isolated, the cortex is rigid and the medullary hyphae arranged in bundles. The second species presents more conspicuous papillae and stictic acid in medulla. The characteristics observed fit well with the variation of U. glabrata described in Halonen et al. (1998), Herrera Campos et al. (2001) and Clerc (2007).

Distribution and ecology. Usnea glabrata is known from North America and Europe. This is the first record in South America. It grows on twigs of all of the woody plants present in the Polylepis forest. It is common to observe twigs fully covered with thalli of U. parvula, U. cornuta and U. glabrata together with Ramalina and Teloschistes species.

Selected specimen examined. ARGENTINA. Córdoba. Parque Nacional Quebrada del Condorito, seccional Condorito, 31°44′40.8°S, 64°46′41.8°W, on Polylepis australis, Oct. 2016, Rodriguez & Perazzo 4692 (CORD).

Figure 4. New Usnea species for Argentina. A–D – Usnea cirrosa (Rodriguez 4653); A – thallus; B – reddish apothecia; C – secondary branches constricted at ramification point (letter a, arrow); D – longitudinal section; E–G – Usnea flavocardia (Rodriguez 4647); E – thallus; F – red dots on secondary branches; G – longitudinal section and slightly yellowish medulla; H–J – Usnea glabrata (Rodriguez & Perazzo 4692); H – thallus; I – detail of soralia on terminal branches; J – longitudinal section; K–N – Usnea aff. silesiaca (Rodriguez 4683); K – thallus; L – black and annulated base; M – detail of soralia on terminal branches; N – longitudinal section. Scales: A = 2.5 cm; B = 1 mm; C = 1 mm; D = 0.3 mm; E = 5 cm; F = 1 mm; G = 1.7 mm; H = 3 cm; I = 0.5 mm; J = 0.1 mm; K = 2.5 cm; L = 1 cm; M = 2 mm; N = 3 mm.
Usnea aff. silesiaca  (Fig. 4K–N)

Diagnostic characters. Thallus subpendulous to shrubby, up to 10 cm long, yellowish – green, sometimes slightly pruinose (Fig. 4K); ramifications anisotomous dichotomous; trunk and basal part of main branches jet black sometimes with reddish pigment, with numerous and conspicuous annular cracks extending upwards (Fig. 4L); branches cylindrical or tapering; secondary branches not narrowed at attachment points; segments cylindrical and terete in transverse section; papillae present, verrucous, mainly on main branches; fibrils slender, frequently in a fish-bone pattern, up to 5 mm; soralia variable: initially punctiform then rounded to irregular, planar to concave, larger than half of the diameter of the branch, remaining discrete, sometimes confluent (Fig. 4M); isidiomorphs rare, generally absent on mature soralia; cortex matte to ± glossy, thick 10.7–12.9–15.2%; medulla white, compact to dense, very thin 4.4–12.3–16.2%; axis thick 39.8–49.1–61.7% (Fig. 4N).

Chemistry. K−, TLC: usnic acid.

Ecology. This species has been found growing on P. australis and rarely on M. boaria or fences.

Notes. Usnea aff. silesiaca is very similar to Usnea silesiaca (Clerc 1991, 2006, 2007) sharing the extended black pigment and anastate base, the CMA value and the morphology of branches and segments. Also the variation of soralia characteristics is in the range of Usnea silesiaca. However, the chemistry of Usnea aff. silesiaca without medullary compounds has not been observed previously in Usnea silesiaca and the medulla is compact to dense. Also there are specimens with a red tinge when the black pigmentation finishes in the first mm of main branches. For all these reasons, up to the moment, Usnea silesiaca cannot be confirmed in South America and more studies are needed to confirm the identity of Usnea aff. silesiaca. This species is similar to U. columbiana, a common subpendulous (to pendulous) species with an extended jet black thallus crustose, rimose, continuous, pale gray (Fig. 5D); apothecia frequent, lecideine, abundant, 0.2–0.4 mm in diam., sessile; disc black, flat to convex, margin soon excluded; ascospores brown, 1-septate, ellipsoid to slightly curved (Fig. 5E–F), 10.4–12.9 × 3.9–6.2 μm.

Chemistry. K−, C+ orange, UV+ orange; TLC: arthothelin.

Diagnostic characters. Thallus crustose, rimose, continuous, pale gray (Fig. 5D); apothecia frequent, lecideine, abundant, 0.2–0.4 mm in diam., sessile; disc black, flat to convex, margin soon excluded; ascospores brown, 1-septate, ellipsoid to slightly curved (Fig. 5E–F), 10.4–12.9 × 3.9–6.2 μm.

Chemistry. K−, C−; there are no substances detected by TLC.

Distribution and ecology. Amandinea punctata is a very common and widespread species (Bungartz et al. 2007). It has been cited for Argentina in Patagonia (Calvelo & Liberatore 2002). In Polylepis forest, it is corticolous growing on trees, shrubs, fences or wood.

Selected specimens examined. ARGENTINA. Córdoba, Parque Nacional Quebrada del Condorito, seccional Condorito, 2090 m, 31°45′03.3″S, 64°45′07.4″W, 29 Jan. 2019, Rodriguez 4673 (CORD).

Cratiria lauricassiae (Fée) Marbach, Bibliotheca Lichenologica 74: 160. 2000. (Fig. 5G–I).

For a detailed description see Nordin (2001) as Buellia lauricassiae (Fée) Müll. Arg.

Diagnostic characters. Thallus crustose, verruculose, continuous, greenish gray (Fig. 5G); apothecia frequent, lecideine, crowded in central part of the thallus, 0.2–0.4 mm in diam., sessile; disc black, flat, margin persistent; ascospores brown, 3–septate, ellipsoid to curved (Fig. 5H–I), 17.7–20.6 × 5.8–8.9 μm.

Chemistry. K+ yellow – red, C−; TLC: atranorin and norstictic acid (Nordin 2001). For differences with Tetramelas triphragmioides see under this species.

Distribution and ecology. Cratiria lauricassiae is a pantropical species occurring in Asia, Australia, North
and South America (Nordin 1999; Cáceres 2007; Elix 2011). It has been cited for the Northeast of Argentina as *Buellia lauricassiae* by Osorio & Ferraro (1975). To the best of our knowledge, this is the southernmost record for South America. This species has been collected on shrubs and trees of *Polylepis* and other woody plants.

**Selected specimen examined.** ARGENTINA. Córdoba, Parque Nacional Quebrada del Condorito, 2020 m, 31°42′45.78″S, 64°46′36.87″W, on shrubs, 15 Jan. 2017, Rodriguez 4090, 4094 (CORD).

*Hypotrachyna sinuosa* (Sm.) Hale, Smithsonian Contributions to Botany 25: 63. 1975.

For a detailed description see Adler & Calvelo (2007).

**Diagnostic characters.** Thallus foliose, green yellowish, lobes eciliate (Fig. 6A); lower surface black, rhizines dense, dicotomous, black; soralia subterminal, capitulate to orbicular (Fig. 6B); apothecia not seen.

**Chemistry.** Cortex K–, medulla K+ yellow to red; TLC: usnic, norstictic and salazinic acids.

**Distribution and ecology.** This species is widely distributed in the world mainly in temperate areas (Adler & Calvelo 2007). In Argentina, it is common for Patagonia (Adler & Calvelo 2007). *Hypotrachyna sinuosa* has been found growing on *Polylepis* and twigs of other shrubs.

**Selected specimen examined.** ARGENTINA. Córdoba, Parque Nacional Quebrada del Condorito, 1827 m, 31°45′52.4″S, 64°45′38″W, on *Polylepis australis*, 29 Jan. 2019, Rodriguez 4689 (CORD).
**Hypotrachyna vexans** (Zahlbr. ex W.L. Culb. & C.F. Culb.) Divakar, A. Crespo, Sipman, Elix & Lumbsch, in Divakar, Crespo, Núñez-Zapata, Flakus, Sipman, Elix & Lumbsch, Phytotaxa 132(1): 33. 2013. (Fig. 6C–D)

For a detailed description see Calvelo & Estrabou (1997) as *Everniastrum vexans*.

**Diagnostic characters.** Thallus foliose, lobes linear, up to 4 cm long., subdichotomously branched, up to 3 mm wide (Fig. 6C); underside black, brown to beige through the lobes apices (Fig. 6D); rhizines black, simple or branched, up to 2 mm isidia laminal, frequently branched, with an apical black cilia.

**Chemistry.** Cortex K+ yellow, medula K+ yellow – red, C–; TLC: atranorin and salazinic acid.

**Notes.** The presence of isidia and the type of rhizines separate *Hypotrachyna vexans* from *H. americana*, a very common species in *Polylepis* forests that possesses coarctate rhizines and no isidia or soredia (Calvelo & Liberatore 1997).

**Distribution and ecology.** *Hypotrachyna vexans* has been recorded from Asia, North America and South America: Argentina, Brazil, Ecuador and Venezuela (Calvelo & Estrabou 1997; Spielmann 2006). Previously, it has been recorded from northwest Argentina as *Everniastrum vexans* (Calvelo & Estrabou 1997). It is rare in the *Polylepis* forest.

**Specimen examined.** ARGENTINA. Córdoba, Los Cajones, en parches de bosque, on *Polylepis australis*, 05 Jan. 2017, Rodriguez 4694 (CORD).

**Leptogium brebissonii** Mont., Histoire naturelle des Iles Canaries 3: 130. 1840. (Fig. 7A–B)

For a detailed description see Galloway & Jørgensen (1995).

**Diagnostic characters.** Thallus dark laden-green, lobate, thin and papery when dry (Fig. 7A), conspicuously swelling when wet; lobes poorly developed, irregularly branched, complexly ridged-plicate, isidiate; isidia marginal or laminal on ridges, granular and small (Fig. 7B); apothecia not seen.

**Distribution and ecology.** A widespread species, found in western Europe, North America and New Zealand (Galloway & Jørgensen 1995). In Argentina, previously cited from northeast provinces (Calvelo & Liberatore 2002). It occurs in shaded places, growing among mosses.

**Selected specimen examined.** ARGENTINA. Córdoba, El Hueco, 1865 m, 31°58′12.8″S, 64°56′54.6″W, 19 Oct. 2018, Rodriguez 4695 (CORD).

**Leptogium cyanescens** (Ach.) Körb., *Systema lichenum Germaniae*: 420. 1855. (Fig. 7C)

For a detailed description see Galloway & Jørgensen (1995).

**Diagnostic characters.** Thallus lobate, flat, loosely attached to substrate, pale to dark gray; lobes orbicular, irregularly folded, wavy, more or less ascending; upper surface slightly roughened, isidiate; isidia laminal or marginal, granular to cylindrical; lower surface glabrous; apothecia rare, circular, disc orange, margin thin.

**Distribution and ecology.** The species is widespread globally, especially in temperate and subtropical regions. In Argentina, it has been cited for Buenos Aires and Patagonia (Calvelo & Liberatore 2002). *Leptogium cyanescens* grows on bark, rarely on stone and it is very common in *Polylepis* forests.

**Selected specimen examined.** ARGENTINA. Córdoba, El Hueco, 1865 m, 31°58′12.8″S, 64°56′54.6″W, 19 Oct. 2018, Rodriguez 4697 (CORD).

**Leptogium laceraoides** B. de Lesd., *Annales de Cryptogamie Exotique* 6: 112. 1933. (Fig. 7D)

For a detailed description see Galloway & Jørgensen (1995).

**Diagnostic characters.** Thallus involute to flat, greyish-blue to brownish, loosely attached; lobes irregular, rather fragile, elongate-lobate; margins usually ragged, crisped, and profusely isidiate; upper surface smooth, sometimes with whitish patches of short hairs; isidia terete, stiltiform, simple to coralloid, then lobulate-phyllidiate; lower surface minutely white pubescent; apothecia not seen.

**Distribution and ecology.** The species has been previously recorded for Patagonia (Calvelo & Liberatore, 2002). It has been found on the bark of *Polylepis*.

**Specimen examined.** ARGENTINA. Córdoba, Parque Nacional Quebrada del Condorito, 2123 m, 31°39′56.8″S, 64°42′0.6″W, 14 Nov. 2018, Rodriguez 4698 (CORD).

**Leptogium phyllocarpum** (Pers.) Mont., *Annales des Sciences Naturelles Botanique* 10: 134. 1848. (Fig. 7E)

For a detailed description see Galloway & Jørgensen (1995)

**Diagnostic characters.** Thallus subpulvinated, swelling with wet, loosely adnate, pale to dark gray; lobes oblong, anastomosing, with undulating margins; upper surface with numerous prominent wrinkles or outgrowths; lower surface paler, also wrinkled, without hairs; apothecia submarginal to laminal, short pedicelate to sessile, with thick swelling margins.

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**Figure 6.** New Parmeliaceae for Central Argentina. A–B – *Hypotrachyna sinuosa* (Rodriguez 4689); A – thallus; B – marginal soralia; C–D – *Hypotrachyna vexans* (Rodriguez 4694); C – thallus; D – rhizines and lower surface and isidia on upper side; E–F – *Parmelinopsis swinscowii* (Rodriguez 4688); E – thallus; F – soralia subterminal; G–I – *Usnea igniaria* (Rodriguez & Perazzo 4701); G – thallus; H – soralia; I – longitudinal section; J–K – *Usnea subelegans* (Rodriguez & Perazzo 4700); J – thallus; K – longitudinal section. Scales: A = 2.5 cm; B = 0.5 mm; C = 2 cm; D = 6 mm; E = 2 cm; F = 3 mm; G = 3 cm; H, I = 0.5 mm; J = 5 cm; K = 1 mm.
Distribution and ecology. It has been recorded in different regions of Argentina, probably a widely distributed species (Calvelo & Liberatore 2002). This species is very common on Polylepis forest and it grows on bark and stone under the canopy.

Selected specimen examined. ARGENTINA. Córdoba, El Hueco, 1900 m, 31°58′16.6″S, 64°56′44.7″W, Rodriguez 4696 (CORD).

Parmelinopsis swinscowii (Hale) Elix & Hale, Mycotaxon 29: 243. 1987. (Fig. 6E–F)

For a detailed description see Adler & Calvelo (1993).

Diagnostic characters. Thallus foliose, grey, lobes subdichotomously branched, up to 3 mm wide (Fig. 6E); marginal cilia present up to 0.3 mm long; soralia subterminal to terminal, enlarging through the lamina (Fig. 6F); lower side black, rhizines simple, apothecia not seen.

Chemistry. Cortex K–, medulla K+ yellow to red, TLC: usnic, salazinic and lobaric (trace) acids.

Distribution and ecology. It is known from Africa, New Zealand and southern Argentina (Benatti 2012; Elvebakk et al. 2014). Parmelinopsis swinscowii has been described growing on stone or soil (Adler & Calvelo 1993). However, it has been found on the bark in Polylepis forests.

Specimen examined. ARGENTINA. Córdoba. Los Gigantes, 2088 m, 31°24′17.0″S, 64°48′29.4″W, on Polylepis australis, 22 Sep. 2018, Rodriguez 4688 (CORD).
Sticta fuliginosa (Dicks.) Ach., Methodus Lichenum: 280. 1803.  
(Fig. 7F)

For a detailed description see Galloway (1994).

Diagnostic characters. Thallus foliose, submonophilous, more or less orbicular, centrally attached to substratum, dark brown to ochraceous; lobes wide, upper surface irregular, covered by small globose to coralloid isidia; lower surface cream-whitish, covered by fine tomentum, with broad white cyphellae; apothecia very rare, not seen.

Distribution and ecology. The species is a cosmopolitan species. In Argentina, it is widely distributed (Rodriguez et al. 2016). It is usually found growing on bark or covered stones, in more or less exposed places.

Selected specimens examined. ARGENTINA. Córdoba. Parque Nacional Quebrada del Condorito, 2127 m, 31°44′21.6″S, 64°48′03.4″W, on stone, 26 Dec. 2018, Rodriguez 4699 (CORD).  
Usnea igniaria Motyka, Lichenenum Generis Usnea Studium Monographicum. Pars Systematica 1: 108. 1936.  
(Fig. 6G–I).

Diagnostic characters. Thallus shrubby, caespitose, up to 5 cm (Fig. 6G), yellowish-green; branches irregular; secondary branches not constricted at ramiﬁcation point, terminal branches long and sinuous, segments cylindrical to slightly inﬂated and irregular to terete; ﬁbrils scarce; papillae scarce to numerous, foveolae present, sometimes numerous; sororia originate from the cortex ad initio, irregular, plane to slightly excava posteriorly to partially conﬂuent (Fig. 6H); isidiomorphs rare; cortex moderately thick 4.6–7.1–10.3%; medulla moderately thin 18.4–23.9–27.7%; medulla moderately thin 18.4–23.9–27.7%; central axis moderately thick 31.3–38.0–48.1%, (Fig. 6I).

Chemistry. K–, C–, KC–; TLC: usnic, norstictic, galbinic and salazinic acids.

Distribution and ecology. Usnea subelegans is widespread from Mexico to Argentina (Gerlach et al. 2017). It is a very common apotheciate species widely distributed in Central and North Argentina (unpubl. data). It grows on Polylepis, several shrubs and fences.

Selected specimen examined. ARGENTINA. Córdoba. Parque Nacional Quebrada del Condorito, seccional Condorito, 31°44′42.6″S, 64°46′49.7″W, 2052 m, on shrubs, Oct. 2016, Rodriguez & Perazzo 4700 (CORD).

Acknowledgments

This work was supported by FONCyT – PICT 2016 projects for young researchers and SECyT – Universidad Nacional de Córdoba. We are grateful to the staff of Parque Nacional Quebrada del Condorito, especially to Fernanda Fabio and Fernando Morosini for the logistical support during several days of ﬁeld work. We also thank Jackelyn M. Kembro for her review of the English. Finally, we thank the reviewers for useful comments. We dedicated this work to Philippe Clerc, the world-wide specialist on Usnea, who helped to understand this diﬃcult genus allowing the discovery of its enormous diversity, especially in the Neotropics.

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