

## ***Parmelia araucana* sp. nov. and new reports in the Parmeliaceae sensu stricto (lichenized Ascomycotina) from Patagonia and Tierra del Fuego (Argentina)**

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*Parmelia araucana* Adler & Calvelo is described as a new species in the genus *Parmelia* Ach. sensu stricto (lichenized Ascomycetes). The distribution area of six species of Parmeliaceae sensu stricto is extended as follows: *Parmelinopsis subfatiszens*, new to South America; *Bulbothrix imshaugii* and *Hypotrachyna bogotensis*, new to Argentina; *Flavoparmelia gerlachei*, new to Tierra del Fuego province; *Punctelia stictica*, new to Río Negro province; the presence of *Flavocetraria nivalis* subsp. *nivalis* in Argentina is confirmed. All species are described.

Keywords: lichens, taxonomy, biogeography

Hale (1987) reports *Parmelia* Ach. s. str. as a genus distributed worldwide, which includes 38 species. At present the genus includes ca. 45 species. Only four of them, *P. cunninghamii* Crombie, *P. protosulcata* Hale, *P. saxatilis* (L.) Ach. and *P. sulcata* Taylor, had been formerly reported from South America, exclusively in *Nothofagus* forests in Argentina and Chile. This paper describes a new species, *Parmelia araucana* Adler & Calvelo which is the first epiphytic *Parmelia* reported on *Araucaria araucana*. New information is given on the distribution of *Bulbothrix imshaugii* (Hale) Hale, *Flavocetraria nivalis* (L.) Kärnefelt & Thell subsp. *nivalis*, *Flavoparmelia gerlachei* (Zahlbr.) Hale, *Hypotrachyna bogotensis* (Vain.) Hale, *Parmelinopsis subfatiszens* (Kurok.) Elix & Hale and *Punctelia stictica* (Del. ex Duby) Krog.

The present paper is a further contribution to the knowledge of Argentina's Parmeliaceae s. l. (lichenized Ascomycetes), following an extensive, long-term lichenological survey of the *Nothofagus* forests

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in Patagonia and Tierra del Fuego. Some of the results of these studies have been previously published and deal with both Parmeliaceae s. str. (Adler & Calvelo, 1993) and Parmeliaceae s. l. (Adler & Calvelo, 1996; Calvelo, 1996; 1998; Calvelo & Adler, 1992; 1994; Calvelo & Estrabou, 1997).

### Material and methods

Material was collected over an area extending from ca. 39° to 55° S, where the vegetation is composed mainly of *Nothofagus* spp., including the evergreen *N. dombeyi* (Mirb.) Oerst. and *N. betuloides* (Mirb.) Oerst., and the deciduous *N. pumilio* (Poepp. et Endl.) Krasner and *N. antarctica* (Foster) Oerst. To the North there is a small area covered by *Araucaria araucana* (Mol.) Koch. forest.

The study is based on the analysis of collections made by the authors and kept at BAFC, BCRU, Calvelo's private herbarium (marked with #) and specimens from H and SI.

The morphology and anatomy of the lichens were studied using the methods routinely employed for these organisms (Adler & Calvelo, 1993). Lichen substances were identified by thin layer chromatography (Culberson & Ammann, 1979; Elix & al., 1987) and by comparison with authentic samples. Habit photographs were taken with a SR-Zeiss dissecting microscope, using a MC80 camera.

Herbarium names are abbreviated according to the Index Herbariorum (Holmgren & al., 1990).

### Results

#### ***Parmelia araucana*** Adler & Calvelo sp. nov. – Fig. 1.

Species thallo simili *Parmelia saxatilis* sed ab hac specie lobis linearibus, angustis, subdichotomis et minutis isidiis marginalibus differt.

Typus. – Argentina, Neuquén province, Parque Nacional Lanín, Sec. Tromen, 39° 20' S, 69° 35' W, near the international limit with Chile, on *Araucaria araucana*, 12-II-1994, leg. M. I. Messuti, (BCRU 03152-holotypus; BAFC 39067-isotypus).

**Etymology.** – The specific epithet refers to the phorophyte on which the species grows.

Thallus foliose, corticolous, pale gray, up to 7 cm across. – Lobes linear-elongate, subdichotomously branched, (0.3–)0.5–1 (–1.5) mm broad; distance, on main lobes, between points where branches arise, 0.7–1.5 mm; commonly with black margin and obtuse to slightly truncate apices (Fig. 1A, 1B). – Upper surface smooth, plane, maculate-pseudocyphellate. – Laminal pseudocyphellae

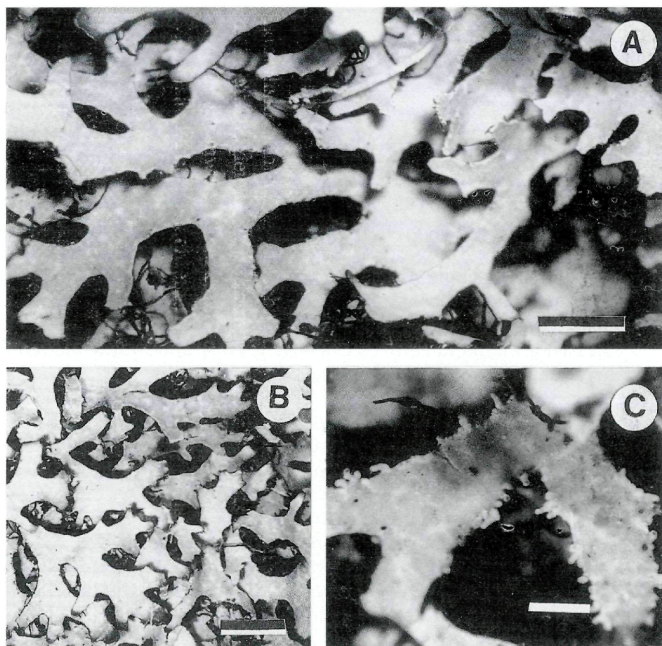


Fig. 1. - *Parmelia araucana* (BAFC 39067-isotype). - A. Detail of linear-elongate, subdichotomously divided lobes. Scale bar: 1 mm. - B. Lobe branching pattern, 8 $\times$ . Scale bar: 1 mm. - C. Detail of lobes with marginal simple or branched cylindrical isidia. Scale bar: 1 mm.

effigurate, small, 0.2–0.5 mm long, mostly covered by a persistent roof (*sensu* Hale, 1981), rarely disintegrating to expose medullary tissue; marginal pseudocyphellae generally cracked open, mostly with minute simple globose isidia, to 0.05 mm high, rarely becoming larger, cylindrical or branched, up to 0.2 mm high (Fig. 1C). - Medulla white. - Lower surface black, brown at the lobe tips, moderate to densely rhizinate; rhizines black, simple or bifurcate, rarely trifurcate 1–3 mm long. - Apothecia and pycnidia unknown.

Chemistry. - Cortex K<sup>+</sup> yellow (atranorin, submajor), medulla K<sup>+</sup> yellow turning red (salazinic acid, major).

*Parmelia araucana* is related to the isidiate *Parmelia saxatilis* (L.) Ach. from which it is distinguished by the narrower, sub-dichotomously branched lobes and the very small marginally restricted isidia. The lobes of *P. saxatilis* are sublinear (Hale, 1987) or shortly elongated, 1.5–4 mm broad (Adler & Calvelo, 1993) whereas those of *P. araucana* are linear, subdichotomous, (0.3)0.5–1.0(–1.5) mm wide. In addition the isidia of *P. saxatilis* are marginal and laminal, mainly cylindrical or sparsely branched, up to 0.7 mm high (Hale, 1987; Adler & Calvelo, 1993); whereas those of *P. araucana* are restricted to the margins and are mostly globose, tiny, up to 0.05 mm high (only rarely cylindrical or branched, up to 0.2 mm high). A further difference is rhizine length, which is usually over 1 mm and often 2–3 mm in *P. araucana*, but mostly under 1 mm in the narrower lobes of *P. saxatilis*.

The major taxonomically characteristic substance of the medulla is salazinic acid in both *P. araucana* and *P. saxatilis*. In *P. saxatilis* some accessory compounds have also been demonstrated: lobaric and aliphatic acids (Hale, 1987) or lobaric and norstictic acids (Purvis & al., 1992). Nevertheless, accessory substances have been only rarely demonstrated in Southamerican specimens (Hale, 1987; Stenroos, 1991), or not demonstrated at all (Adler & Calvelo, 1993). Accessory substances have not been detected in *P. araucana*.

*P. saxatilis* was described as a mainly saxicolous species, rarely growing on bark (Hale, 1987) and was never collected on trees (only on rocks) in Tierra del Fuego (Stenroos, 1991) and in Río Negro Province, Argentina (Adler & Calvelo, 1993). *P. araucana* has been so far only collected on *Araucaria araucana*.

*P. araucana* is also related to *Parmelia hygrophylla* Goward & Ahti (Goward & Ahti, 1983), another corticolous, isidiate species, with mostly simple or furcate rhizines, with medullary salazinic acid and linear-elongate, somewhat dichotomously branched lobes. The lobes of *P. hygrophylla*, however, are wider (1–5 mm broad) and the isidia become soredioid and are not restricted to the margins.

*Parmelia angustifolia* (Asah.) Kurokawa (Kurokawa, 1994), another narrow-lobed, salazinic acid containing species with mostly simple to furcate rhizines, differs from *P. araucana* in its shorter, wider lobes (1–2 mm broad), somewhat divaricate, but not sub-dichotomously branched, and the absence of vegetative propagules.

The corticolous, salazinic acid containing species, *Parmelia marmorata* Nyl. (Kurokawa, 1994), with linear-elongate, sub-dichotomously divided lobes, obtuse or subtruncate apices and long rhizines (up to 2 mm), differs from *P. araucana* in its wider lobes, 1.5–3(–4) mm broad, and the absence of vegetative propagules.

*Parmelia araucana* is so far only known from the type locality (Parque Nacional Lanín) in Neuquén province.

### New reports

1. *Bulbothrix imshaugii* (Hale) Hale. – Phytologia 28: 480. 1974.

= *Parmelia imshaugii* Hale, Phytologia 22: 32.1971.

Thallus foliose, corticolous, pale gray to greenish-gray, moderately attached to the substrate, 10 cm across. – Lobes subirregular, with rounded apices, 2–6 mm wide, ciliate, with bulbate cilia, 0.1–1.5 mm long. – Medulla white. – Upper surface plane to undulate, sorediate; soralia laminal, submarginal or subapical, sometimes with pustular origin. – Lower surface black, with a brown to beige narrow marginal zone; rhizines concolorous with the lower surface, but often dark brown in the pale marginal zone, with or without distinct bulbose base. – Apothecia not seen, but stipitate, ecoronate, ascospores ellipsoid,  $9 \times 4 \mu\text{m}$ , according to Hale (1976a). – Pycnidia unknown.

Chemistry. – Cortex K+ yellow (atranorin, major); medulla K+ yellow turning red (salazinic acid, major).

Specimen examined. – ARGENTINA. Río Negro province, El Bolsón, Río Villegas margins, on *Maytenus boaria*, 4 -IV-1985, leg. Perti Ranta (H).

*Bulbothrix imshaugii* has so far only been found in Chile, in its type locality and surroundings (Hale, 1976a). Its distribution is here extended to Argentina and we report the southernmost locality for the genus *Bulbothrix*.

2. *Flavocetraria nivalis* (L.) Kärnefelt & Thell, subsp. *nivalis*. – Acta Bot. Fenn. 150: 84. 1994.

= *Lichen nivalis* L., Spec. Pl. : 1145. 1803.

Thallus subfruticose, erect, caespitose, growing on soil. – Lobes more or less flat, up to 4 cm high, 1 cm broad, with few irregular branches, truncate apices and marginally incised. – Upper surface straw-yellow to greenish-yellow, bright yellow at the base, reticulately veined to channeled, with marginal pseudocyphellae. – Medulla white. – Lower surface similar to upper surface. – Apothecia not found; according to Kärnefelt & al. (1994) rare, marginal, at the lobe apices, 3–8 mm diam., with chestnut disc, and ascospores ellipsoid,  $5-7 \times 3-4 \mu\text{m}$ . – Pycnidia not found, according to Kärnefelt & al. (1994) black, marginal, conidia slightly fusiform,  $5-6 \times 1.2-1.5 \mu\text{m}$ .

Chemistry. – Cortex K- (usnic acid, major); medulla K-, C-, P- (protolichesterinic acid, major to minor).



Specimens examined. – ARGENTINA. Santa Cruz province, Lago Argentino, Puerto Ferraris, Hotel Esperanza, on soil under *Berberis* sp., at the “altiplano”, 16-III-1914, leg. Hicken, 28187, 28190 (SI).

As established by Kärnefelt & al. (1994) *Flavocetraria nivalis* subsp. *nivalis* is widely distributed in arctic-boreal areas, mainly in the Northern Hemisphere, occurring also in scattered areas in cold temperate regions in the Andes, with a few reports from southern South America. Nevertheless, these reports do not mention any precise locality in southern South America. Lago Argentino (Santa Cruz) can be considered the first precise report for the area.

3. *Flavoparmelia gerlachei* (Zahlbr.) Hale. – Mycotaxon 25: 604. 1986.

= *Parmelia gerlachei* Zahlbr., Cat. Lich. Univ. 6: 137. 1929.

Thallus foliose, saxicolous, tightly attached to the substrate, up to 10 cm diam., greenish-yellow. – Lobes subirregular, eciliate, apically rounded, partially inflated, 2–3 mm wide. – Upper surface plane to undulate at the apices, wrinkled to faveolate at the center, sorediate. – Soralia laminal, sometimes capitate, often originating from small pustules. – Medulla white, with hollow, not continuous central cavities. – Lower surface black, mostly with short, simple and black rhizines, with a dark brown, nude marginal zone at the lobe apices. – Apothecia unknown. – Pycnidia black, immerse, laminal, mostly in submarginal areas; conidia cylindrical to slightly fusiform, 7–11.5 × 1–2 µm.

Chemistry. – Cortex K- to slightly K+ yellow (usnic acid, major, atranorin, minor to trace); medulla slightly K+ orange to wine-red (protocetraric acid, major; physodalic acid, major).

Selected specimens examined. – ARGENTINA. Santa Cruz province, Perito Moreno, Estancia los Manantiales, 46° 36' S 71° 12' W, huge andesitic stone. Roivainen 2455 (H). Tierra del Fuego province, Depto. Ushuaia, Glaciar Martial, on rock, 600 m, XI-1993, leg. Calvelo & Adler, 342, 343 (BCRU). Monte Martial, above ski lift, 54° 47' S 68° 21' W, 700–1100 m alt., 17-I-1989, Ahti 47946a (H). Parque Nacional Tierra del Fuego, Cerro Guanaco, 12-XII-1984, P. Ranta (H).

*F. gerlachei* is distributed in areas of the South American Andes (from Venezuela to the Antarctica). In Argentina it has been cited for Santa Cruz province and Tierra de Graham (Hale, 1976b; Kurokawa, 1967) and for Chubut province (Köfaragó-Gyelnik, in Lamb, 1958). It is reported here for the first time from Tierra del Fuego province.

4. *Hypotrachyna bogotensis* (Vain.) Hale. – Smithsonian Contr. Bot. 25: 26.1975.

= *Parmelia bogotensis* Vain., Hedwigia 38: 122. 1899.

Thallus foliose, whitish-gray to greenish-gray, tight to loosely attached to the substrate, corticolous, saxicolous or lignicolous, up to 13 cm across. – Lobes linear to sublinear, dichotomously branched, 1–3 mm wide. – Upper surface plane, partially maculate; phyllidiate; phyllidia (dorsiventral isidia) laminal and marginal. – Medulla white. – Lower surface black, densely rhizinate; rhizines black, richly dichotomously branched. – Apothecia not found, according to Hale (1975) very rare, adnate, up to 5 mm diam., ascospores  $12 \times 6 \mu\text{m}$ . – Pycnidia unknown.

Chemistry. – Cortex K<sup>+</sup> yellow (atranorin); medulla K<sup>-</sup>, C<sup>+</sup> pink, KC<sup>+</sup> pink turning orange (evernic acid, major, lecanoric acid, major).

Specimens examined. – ARGENTINA. Chubut province, Parque Nacional Lago Puelo, Río Aguja, 300 m above sea level, on rock, 7-XI-1992, leg. Calvelo (#624), on cortex of *Nothofagus dombeyi* covered with mosses; 7-XI-1992, leg. Calvelo (#646).

*Hypotrachyna bogotensis* has been cited for Mexico, Central America and South America, including Chile, Valdivia and Chiloe (Hale, 1975). It is here reported for the first time from Argentina.

5. ***Parmelinopsis subfaticens*** (Kurok.) Elix & Hale. – Mycotaxon 29: 243. 1987.

= *Parmelia subfaticens* Kurok., in Hale & Kurokawa, Contr. US. Natl. Herb 36: 134. 1964.

Thallus foliose, fragile, whitish-gray, corticolous or saxicolous, loosely attached to the substrate. – Lobes sublinear, irregular to subdichotomously branched, 0.5–1.5 mm wide; margins ciliate, particularly at the axils; cilia black, simple, 0.5–1 mm long. – Upper surface emaculate, with esorediate subapical and laminal pustules. – Medulla white. – Lower surface black, densely rhizinate; rhizines black, simple, up to 0.8 mm long. – Apothecia not found, but described as rare, up to 4 mm diam.; ascospores ellipsoid  $12\text{--}14 \times 8\text{--}9 \mu\text{m}$  (Hale, 1976c; Hale & Kurokawa, 1964; Krog & Swinscow, 1979).

Chemistry. – Cortex K<sup>+</sup> yellow (atranorin, major); medulla K- (gyrophoric acid, major, 5-O-methylhiassic, major, 3-methoxy-2,4-di-O-methylgyrophoric acid, major).

Specimens examined. – ARGENTINA. Chubut province, Parque Nacional Lago Puelo, Río Aguja, on rock covered with mosses, 7-XI-1992, leg. Calvelo (#600, #617).

*Parmelinopsis subfaticens*, mostly a corticolous species (Krog & Swinscow, 1979) is rarely collected on rocks, but the specimens stu-

died here are saxicolous. It has been recorded for Africa in Kenya, South Africa, Tanzania and Uganda, for Central America in Panamá and the Caribbean region (Hale, 1973; Hale, 1976c, Hale & Kurokawa, 1964; Krog & Swinscow, 1979), for New Zealand (Galloway, 1985) and Australia (Elix, 1994). It is here reported from South America for the first time.

6. *Punctelia stictica* (Del. ex Duby) Krog. – Nord. J. Bot. 2: 291. 1982.

= *Parmelia borrieri*  $\beta$  *stictica* Del. ex Duby, J. Bot. Gall. 2: 601. 1830.

Thallus foliose, mostly saxicolous, sometimes corticolous, brownish gray to mineral gray, up to 10 cm across, tightly attached to the substrate. – Lobes subirregular with rounded apices, crenate, partially imbricate, 3–6 mm wide, eciliate. – Upper surface pseudocyphellate-sorediate; pseudocyphellae punctiform, orbicular to elongate, laminal and marginal; soredia mostly granular, sometimes mixed with isidioid structures, growing out from the pseudocyphellae (secondary soralia) laminal and marginal. – Medulla white. – Lower surface black, with a nude chestnut marginal zone at the apices; rhizinate, rhizines mostly simple, black. – Apothecia substipitate, circular, up to 4 mm diam., margin smooth, disc brown; ascospores ellipsoid, 14–16  $\times$  10–11  $\mu$ m. – Pycnidia black, laminal mostly in submarginal areas, immersed; conidia filiform 10–11  $\times$  0.5  $\mu$ m.

Chemistry. – Cortex K+ yellow (atranorin, major); medulla K-, C+ pink, KC+ pink to red (gyrophoric acid, major).

Specimens examined. – ARGENTINA. Buenos Aires province, Sierra de la Ventana, on stone wall, route 76, at the base of Cerro Bahía Blanca, 16-X-1992, leg. Adler & Bertoni, 37304 (BAFC). Río Negro province, Bariloche, Llao Llao, on rock, 29-XI-1991, leg. Adler (#764); Villa Tacul, on exposed rock, Lago Nahuel Huapi margin, 6-X-1993, leg. Calvelo (#947); on stone, in forest, 6-X-1993, leg. Calvelo (#948). Cerro Leones, North Valley, on rock, leg. G. Vobis, 18-VI-1986, 345(BCRU). Lower Río Manso, at confluence with Río Villegas, on exposed rock, 15-I-1994, leg. Calvelo (#946).

*Punctelia stictica* is widely distributed over Europe, Africa and America (Hale & Cole, 1988; Krog & Swinscow, 1977; Swinscow & Krog, 1988). It was recorded for Tierra del Fuego and Mendoza provinces in Argentina by Stenroos (1991). It was reported by Adler (1996) from Colombia, Ecuador, Venezuela, Chile and in Argentina from Salta, Tucumán, Córdoba and Buenos Aires provinces. This species is highly tolerant to environmental stress and generally grows at exposed sites on rocks but it has also been collected on tress and bushes (Adler, 1996).

It is here reported from Río Negro province for the first time.



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