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New distributional records for Chilean bryophyte and lichen flora

Nuevos registros de distribución geográfica para la flora briofítica y liquénica de Chile

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ABSTRACT

Ten new distributional records to the Chilean bryo-lichenic flora are reported. Three species and a subspecies are new to the flora of the province of Chiloé, five species are new from the Los Lagos Region and one species is new to mainland Chile. The specimens were collected in peatlands (*Sphagnum* bogs) and swamp forests of *Tepualia stipularis* in Isla Grande de Chiloé (Chile) (41°- 43° S; 74°-73° W). Diagnostic characters, chemistry (only lichens), habitats preferences and distribution are provided. The national ranges of two species are expanded.

Keywords: New records, southern South America, mosses, liverworts, lichens.

RESUMEN

Se reportan 10 nuevos registros de distribución geográfica para la flora brio-liquénica de Chile. Tres especies y una subespecie son nuevas para la provincia de Chiloé, cinco especies son nuevas para la Región de Los Lagos y una es nueva para Chile continental. Los especímenes fueron recolectados en turberas esfagnosas y bosques anegados de *Tepualia stipularis* de la Isla Grande de Chiloé (Chile) (41°- 43° S 74°-73° W). Se proveen caracteres diagnósticos de las especies, química (sólo para líquenes), preferencias de hábitat y distribución. Se extiende el rango de distribución de dos especies.

Palabras clave: Nuevos reportes, sur de Sudamérica, musgos, hepáticas, líquenes.

INTRODUCTION

Bryological and lichenological knowledge of Chile is still scarce, mainly because large areas have not been visited by botanists yet and there are very few specialists in the country. Normally, cryptogamic plants are not considered in studies of flora and vegetation. Thus, bryophytes and lichens are not included in the Red Book on Chilean Terrestrial Flora (Benoit 1989).

Nonetheless, cryptogamic plants of southern Chile have an interesting floristic value (Rozzi *et al*. 2008). In Chile, 890 moss taxa (Müller 2009), 553 liverwort taxa (Hässel de Menéndez & Rubies 2009) and 1415 lichen taxa (Galloway & Quilhot 1998) are currently accepted and over 50% of liverwort and moss species are endemic to the temperate rainforests of southern South America (Rozzi *et al*. 2008). Despite the latest checklists for mosses (Müller 2009), liverworts (Hässel de Menéndez & Rubies 2009) and lichens (Feuerer 2012, Galloway & Quilhot 1998), and the recent floristic works (Burgaz & Raggio 2007, Cuvertino *et al*. 2012, Frahm 2005, Frey & Schaumann 2002, Ireland *et al*. 2010, Ireland *et al*. 2006, Larraín 2007, Larraín *et al*. 2010, Larraín & Vargas 2009, Müller 2009, Villagra *et al*. 2009), the bryo-lichenic flora of Chile doubtlessly requires more detailed research.

During the fieldwork of floristic and ecological studies in *Sphagnum* bogs in Isla Grande de Chiloé (Chile) (León 2012), bryophyte and lichen collections were collected to extend the knowledge of cryptogamic vegetation in these ecosystems. Consequently, national, regional and provincial new records are provided, the distributional ranges of two species are expanded, and distinctive characters, chemistry (only lichens), and some notes about similar species are provided. In addition, global and national distributions and habitat preferences are presented.

MATERIALS AND METHODS

This study is based on 18 specimens collected in 2009, 2010 and 2011, during field expeditions by the authors.

The study area is situated in the Isla Grande de Chiloé, X Region-Chile (42°-43° S and 73°-75° W). The Chiloé climate is wet temperate with strong oceanic influence (Di Castri & Hajek 1976) and an annual rainfall between 1,900 and 2,300 mm (CONAF 2009), that reaches 5,000 – 6,000 mm in some areas (Pérez *et al*. 2003). The mean summer temperature is 10.2º C and the mean winter temperature is 6.2º C (Pérez *et al*. 2003). The material was collected in Ancud, Dalcahue and Chonchi Communes.

Voucher specimens are deposited in MACB and CONC herbaria.

Specimens were carefully determined from morphological characters (macroscopic and microscopic) and their characteristics were compared with descriptions in the literature, type specimens or other herbarium specimens.

For lichens, chemical characters were also studied. The secondary metabolites were identified by thin layer chromatography (TLC) following the protocol of White & James (1985), using the solvents A, B and C.

RESULTS

One species (*Chiloscyphus breutelii* (Gott.) Engel & Schust.) is new to mainland Chile. Five species are reported for the first time from Los Lagos Region, *Pohlia nutans* (Hedw.) Lindb., *Leptobryum pyriforme* (Hedw.) Wilson, *Lepidozia fuegiensis* Stephani, *Cladonia cenotea* (Ach.) Schaer. and *Cladonia bellidiflora* (Ach.) Schaer. Furthermore, three species, *Conostomum pentastichum* (Brid.) Lindb., *Riccardia alcicornis* (Hook. f. & Tayl.) Trev. and *Cladonia mitis* Sandst. and a subspecies, *Cladonia gracilis* subsp. *elongata* (Wulfen) Vain are new to the flora of Chiloé Province.

One asterisk (*) represents species reported as new to the province of Chiloé; two (**), species new to Los Lagos Region; and three (***) species new to Chile.

Mosses

Bartramiaceae

***Conostomum pentastichum** (Brid.) Lindb., Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 20: 392. 1863.

CHILE, Región de Los Lagos, Chiloé, Ancud, sector Pumanzano, turbera antropogénica (pomponal), 41º58’15.1’’S; 73º37’58.1’’W, 92 m, 02-II-2009, C. León & A. Benítez 102972 (MACB).

This circumsubantarctic species has been reported in West & South Patagonia, Tierra del Fuego, Falkland Islands, South Georgia Island, Kerguelen, Tasmania, Auckland Islands, Campbell Islands and New Zealand (Seki 1974). In Chile, it is known from Araucanía Region to Magallanes Region (Müller 2009). In Los Lagos Region it was only known from Antillanca locality, Province of Osorno (Deguchi 1991). This is a new record from Chiloé Province.

This species was collected on peatland soil, mixed with *Isotachis madida* (Hook. f. & Taylor) Mitt., at the edge of a bog.

C. pentastichum can be easily recognized by leaves clearly 5-ranked; costa excurrent; apical leaf cells thickened and with thick mamillae in the distal angles; capsule subglobose.

Description and illustration: Matteri (1985).

Bryaceae

****Leptobryum pyriforme** (Hedw.) Wilson, Bryol. Brit. 219. 1855.

CHILE, Región de Los Lagos, Chiloé, Dalcahue, Laguna Los Caulles, turbera de origen glaciar, 42º 13’25.2’’S 73º32’52.9’’W, 153 m, 12-IV-2011, C. León, G. Oliván & A. Benítez 102973 (MACB).

L. pyriforme has a cosmopolitan distribution and it is known from the Coquimbo Region to the Magallanes Region, in 12 localities according to Müller (2009). However, it had not been registered in Los Lagos Region until now, being this the first record.

Specimens were found growing in peatland soil, on peat and remains of campfires.

This species is distinguished by its capsule being clearly pyriform, light brown; setae 0.8 to 3.5 cm long, reddish; leaves long and narrow, yellow-green and costa percurrent.

Description and illustration: Smith (2004), Ochyra *et al*. (2008) and Porley (2008).

****Pohlia nutans** (Hedw.) Lindb., Musci Scand. 18. 1879.

CHILE, Región de Los Lagos, Chiloé, Ancud, Estación Biológica Senda Darwin, turbera antropogénica (pomponal), 41º52’47,0’’S 73º40’07,9’’W, 24 m, 30-I-2009, C. León & A. Benítez 101577 (MACB). sector Lecam, turbera antropogénica, 41°56’22.80’’S 73°34’31.75’’W, 60 m, 31-I-2009, C. León & A. Benítez 101578 (MACB).

P. nutans is considered a bipolar species (Seki 1974). In Chile, it has been recorded from the Biobío Region to the Magallanes Region (Müller 2009). However, it had not been registered in Los Lagos Region, being this its first record for the region.

The plants were found growing on peatland soil, mixed with *Sphagnum magellanicum*.

According to Shaw (1983) and Suárez (2008), this species is highly variable in size and morphology. Nevertheless, the collected material is distinguished by oval-lanceolate leaves with serrate margin near to the apex, costa percurrent; capsule red-orange with distinct neck; endostome segments broadly perforate along the keels; cilia long; axillary gemmae lacking.

Description and illustration: Shaw (1983) and Suárez (2008).

Liverworts

Lophocoleaceae

******Chiloscyphus breutelii*** (Gott.) Engel & Schust., Nova Hedwigia 39: 412. 1984[1985].

CHILE, Región de Los Lagos Chiloé, Chonchi, Parque Nacional Chiloé, bosque de *Tepualia stipularis*, 42º37'02.9''S 74º06'07.3''W, 153 m, 04-IV-2010, C. León, G. Oliván & A. Benítez 102970 (MACB).

This species is widely distributed in tropical and subtropical areas of South America (Gradstein & Pinheiro da Costa 2003). In Chile, it was only cited by Fulford (1976) as *Lophocolea trapezoides* Mont. from the north of the country, although without naming the exact locality. The occurrence in Chile could now be confirmed.

The plants were found growing on forest soil, among other bryophytes.

Distinctive characters include: leaves rectangular or orbicular; scarcely decurrent, margin with 4 to 6 long slender cilia; underleaves connate with both row of leaves, wing narrow or scarcely developed.

Chiloscyphus quadridentata is very similar to *C. breutelii* but has leaves with only 3(-4) cilia (Gradstein & Pinheiro da Costa 2003).

Description and illustration: Fulford (1976) and Gradstein & Pinheiro da Costa (2003).

Lepidoziaceae

*****Lepidozia fuegiensis*** Stephani, Kongl. Svenska Vetensk. Acad. Handl., n.s. 46(9): 63. f. 24: f-g. 1911.

CHILE, Región de Los Lagos, Chiloé, Ancud, Estación Biológica Senda Darwin, bosque de *Tepualia stipularis*, 41º52'47.0''S 73º40'07.9''W, 24 m, 27-III-2010, C. León, G. Oliván & A. Benítez 102969 (MACB).

Lepidozia fuegiensis is endemic to southern South America. Up to now this species was reported from relict temperate forest of Fray Jorge, located in Coquimbo Region (Villagrán *et al*. 2004). Also, it was reported from Aysén to Magallanes Region (Hässel de Menéndez & Rubies 2009). Thus, an extensive distributional gap between the Mediterranean and Valdivian ecoregion was observed. This is the first record for Los Lagos Region and the occurrence in the Valdivian rainforest ecoregion can now be confirmed.

The specimen was collected on forest soil, among other bryophytes.

The most important diagnostic characters are: small plants, 0.5-1.5 cm wide, bipinnate; leaves subquadrate to rectangular, segments in conspicuous pairs, incurved, triangular from 2 to 6 cells.

Description and illustration: Fulford (1966) and Engel (1978).

Aneuraceae

****Riccardia alcicornis*** (Hook. f. & Tayl.) Trev., Mem. Reale Ist. Lombardo Sci., Ser. 3, Cl. Sci. Mat. 4: 431. 1877.

CHILE, Región de Los Lagos, Chiloé, Ancud, desembocadura Río Chepu, turbera antropogénica (pomponal); 42º03'10.8''S 73º59'56.8''W, 5 m, 29-III-2010, C. León, G. Oliván & A. Benítez 102971 (MACB).

R. alcicornis is endemic to southern South America. In Chile, it has been registered in Valdivian, Nordpatagonic and Subantarctic ecoregions (Villagrán *et al*. 2005), from 10 Provinces. In Los Lagos Region is only known from two Provinces, Osorno and Llanquihue (Hässel de Menéndez & Rubies 2009). This is the first report from Province of Chiloé.

Specimens were found growing on peatland soil, mixed together with *Sphagnum magellanicum*

This species is distinguished by its filamentous thallus, pinnate or bipinnate, wide 1 to 2.5 times the thickness; small cells with thickened walls and dorsal papillae.

Description and illustration: Hässel de Menéndez (1972)

Lichens

Cladoniaceae

*****Cladonia bellidiflora*** (Ach.) Schaer., Lich. Helv. Spicil. 1(1): 21. 1823.

CHILE, Región de Los Lagos, Chiloé, Ancud, Estación Biológica Senda Darwin, turbera antropogénica (pomponal), 41º52'47.0''S 73º40'07.9'' W, 27-III-2010, G. Oliván, C. León, & A. Benítez 102965 (MACB). Dalcahue, Laguna Los Caulles, turbera de origen glaciar, 42º13'25.2''S 73º32'52.9''W, 153 m, 12-IV-2011, G. Oliván, C. León & A. Benítez 102966 (MACB).

This species has a bipolar distribution (Burgaz & Raggio

2007). In Chile, the species has been registered only in Aysén and Magallanes Regions, in four Provinces (Stenroos 1995). This is the first report from Los Lagos. Thus, this record extends the northern distributional range of the species in Chile.

The specimens were found growing on rotting wood and peat, at the edge of a bog.

This species is very variable, but it can be distinguished from others species by the red hymenial discs; simple to slightly branched podetia; surface of podetia discontinuously corticate and densely squamulose.

Description and illustration: Stenroos & Ahti (1990), Stenroos *et al*. (1992) and Stenroos (1995).

Chemistry: P + yellow or red, K- o K + yellow, C-; thamnolic acid. Four chemotypes were reported from Magallanes Region: I) fumarprotocetraric acid complex; II) fumarprotocetraric acid complex and usnic acid; III) usnic, thamnolic and fumarprotocetraric acid complex; IV) thamnolic acid (Burgaz & Raggio 2007). The Chiloé collections contain the chemotype IV.

Cladonia cenotea (Ach.) Schaer., Lich. Helv. Spicil. 1(1): 35. 1823.

CHILE, Región de Los Lagos, Chiloé, Dalcahue, Laguna Los Caulles, turbera de origen glaciar; 42º13'25.2''S 73º32'52.9''W, 153 m, 12-IV-2011, G. Oliván, C. León, & A. Benítez 102968 (MACB).

C. cenotea has a bipolar distribution (Stenroos & Ahti 1990). It has been recorded in Chile only in Magallanes, Tierra del Fuego and Antártica Chilena Provinces (Stenroos 1995).This is the first record for Los Lagos region and Chiloé. This record extends its northern distribution range in Chile. The distributional gap that occurs between Chiloé and Magallanes could be explained by the few bryological collections made in Aysén Region.

Specimens were found growing in peatland soil, on oxidized peat.

It is distinguished by its simple or sparsely branched podetia, apices always open forming scyphoid structures and podetial surface with farinose soredia.

Description and illustration: Stenroos & Ahti (1990), Stenroos *et al*. (1992) and Stenroos (1995).

Chemistry: P- o P + yellow, K- or K + yellow, C-; thamnolic acid. There is other chemotype containing squamatic acid that is the commonest in northern hemisphere, in Europe and North America (Burgaz & Ahti 2009, Hammer 1995, James 2009, Piercey-Normore 2006). Nevertheless, thamnolic acid is more common in South America (Stenroos *et al*. 1992). The material of Chiloé contains thamnolic acid, as in Tierra del Fuego.

Cladonia gracilis subsp. ***elongata*** (Wulfen) Vain, Acta Soc. Fauna Flora Fenn. 53(1): 92. 1922.

CHILE, Región de Los Lagos, Chiloé, Ancud, Estación Biológica Senda Darwin, turbera antropogénica (pomponal), 41º52'47.0''S 73º40'07.9''W, 24 m, 30-I-2009, C. León & A. Benítez 102961 (MACB). Desembocadura Río Chepu, turbera antropogénica (pomponal), 42º03'10.8''S 73º59'56.8''W, 5 m, 29-III-2010, C. León, G. Oliván & A. Benítez 102958 (MACB). Sector Pumanzano, turbera antropogénica (pomponal), 41º58'15.1''S 73º37'58.1''W, 92 m, 02-II-2009, C. León & A. Benítez 102963 (MACB). Dalcahue, Predio Municipal Teguel, turbera antropogénica (pomponal), 42º20'43.8''S 73º38'17.5''W, 167 m, 01-IV-2010, C. León, G. Oliván & A. Benítez 102959 (MACB). Chonchi, Sector Púlpito, turbera de origen glaciar, 42º45'24.6''S 73º47'06.6''W, 110 m, 03-II-2009, C. León & A. Benítez 102960 (MACB), 03-IV-2010, C. León, G. Oliván & A. Benítez 102962 (MACB).

Cladonia gracilis subsp. *elongata* is a taxon with bipolar distribution (Stenroos *et al*. 1992). In Chile, it has been recorded from Los Lagos Region to Magallanes. In addition, it has been found in the Juan Fernández Archipelago (Stenroos 1995). In Los Lagos Region, it is only known from Osorno Province. This is the first record for Chiloé Province.

Specimens were found growing in peatland soil, on oxidized peat.

It is distinguished by podetia simple to slightly branched, subulate or with narrow scyphi, with marginal proliferations.

Description and illustration: Stenroos & Ahti (1990), Stenroos *et al*. (1992) and Stenroos (1995).

Chemistry: P + red, K- o K + yellow, C-; fumarprotocetraric acid complex and atranorin. The magellanic material contains fumarprotocetraric acid complex, quaesitic acid and atranorin (rare) (Burgaz & Raggio 2007). While in Chiloé material quaesitic acid is lacking.

Cladonia mitis Sandst., Sandstede: Clad. Exs. 55. 1918.

CHILE, Región de Los Lagos, Chiloé, Dalcahue, Predio Municipal Teguel, turbera antropogénica (pomponal), 42º20'43.8'' S 73º38'17.5'' W, 167 m, 01-IV-2010, C. León, G. Oliván & A. Benítez 102964 (MACB). Ancud, sector Cogomó junto al Río Negro, turbera de origen glaciar, 41º58'31.5''S 73º43'58.5''W, 15 m, 01-II-2009, C. León & A. Benítez 102967 (MACB).

C. mitis is considered a bipolar species. In Chile, this

species has been recorded from Biobío to Magallanes Region. In Los Lagos Region it is known only from two Provinces, Osorno and Llanquihue (Stenroos 1995). This is the first record from the Province of Chiloé.

The specimen was found growing in peatland soil, on *Sphagnum magellanicum*.

Distinctive characters of the species include: podetia whitish, richly branched, branching anisotomic, mainly trichotomous and tetrachotomous.

Description and illustration: Stenroos *et al*. (1992) and Stenroos (1995).

Chemistry: P-, K-, C-; usnic acid. The Fuegian material (Stenroos *et al*. 1992) and specimens from Isla Navarino (Burgaz & Raggio 2007) contain usnic, rangiformic, norrangiformic and isousnic acids. Nevertheless, a chemotype containing only the usnic acid was found in Chiloé. *C. mitis* is very similar to *C. arbuscula*, but fumarprotocetraric acid complex is lacking (Stenroos *et al*. 1992) and chemical tests are necessary for an accurate determination.

CONCLUSION

The biodiversity of peatlands has erroneously been considered uniform and uninteresting. Our floristic and ecological studies in *Sphagnum* bogs in Chiloé have provided ten new records for Chilean bryolichenic flora. Most species reported in this research are bipolar or cosmopolitan. Nevertheless, two of the species studied are endemic of temperate rainforest of southern South America and two of the species reported extend their known distribution range northwards.

Our contribution highlights the importance of peatlands for flora conservation, and the need to improve the knowledge of bryolichenic flora of these ecosystems in Chile in order to create conservation policies.

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