Studies on the moss flora of the Bío-Bío region of Chile

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Abstract: An extensive study was made on the moss flora of the Bío-Bío Region (VIII Región) in south-central Chile in 2001-2003. Collections were made in all four provinces of the region: Arauco, Bío-Bío, Concepción and Ñuble. Approximately 265 localities in the region were explored with over 6,000 mosses collected in the four provinces. The mosses of this region had not previously been studied to any great extent and with part of the region's environment being destroyed by the construction of several dams on one of the major rivers, the Bío-Bío, the study of this area seemed of utmost importance. Thus far, a total of 20 taxa were found which are new to Chile, making a total of 877 known for the country, with four new taxa known for South America. An additional 87 taxa are reported new only to the Bío-Bío Region. That number, together with some new records from the recent literature, increases the total for the Region from 190 to 300. It was determined from the 87 new taxa for the Bío-Bío Region that the majority (41) represent northern extensions of taxa, while a much smaller number (10) represent southern extensions. The remainder (36) fill in a gap in the distribution of the taxa between the northern and southern parts of the country. Many difficult species still remain to be identified and the number of species new to science, to Chile and to the Bío-Bío Region, is certain to increase when the remaining specimens are identified.

Introduction

A survey was made of the mosses that occur in the Bío-Bío Region (VIII Región) of Chile (Fig. 1), located in the south-central part of the country, during the years 2001–2003. Two to three months of each of the three years were spent collecting mosses in about 265 localities from numerous habitats throughout the region's four provinces: Arauco, Bío-Bío, Concepción and Ñuble. He (1998) published a checklist of the mosses of Chile based on literature reports and herbarium specimens in which he accepted 778 species and 88 subspecific taxa in 203 genera and 63 families. Recently, several other bryologists have published reports of taxa that are new to He's checklist of Chile (e.g., Frey & Schaumann 2002, Cano 2003, Müller & Pursell 2003, Frahm 2005, Calabrese *et al.* 2006), considered synonyms of taxa reported in the flora (e.g., Ochyra & Matteri 2001, Frahm 2005, Jiménez *et al.* 2005, Jiménez & Cano 2006) or deleted from the flora (e.g., Frahm 2005). He (1998) pointed out the need for further studies in Chile since the moss number is low compared to some of the other South American countries with recent checklists, e.g., Brazil with 1964 moss taxa, Bolivia with 1222, Argentina with 1002, Colombia with 900, Peru with 889 and Ecuador with 874. He stressed the need for further studies stating the country "holds great promise of new bryological discoveries in South America because of its extensive south temperate regions." The Bío-Bío Region was reported by He to have 190 taxa with the more northern regions (i.e., Regions I–VII) reported with less, while the more southern regions (i.e., Regions IX–XII) were reported to possess more, with two of them having over double that number (i.e., Region X (Los Lagos) with 412 taxa and Region XII (Magallanes) with 450 taxa). Much of the disparity between the two regions is due to the lack of collecting, especially in the north, however, recent collecting in the northern regions (e.g., Cano 2003, Müller & Pereira 2006) have helped to fill in some of the gaps in Regions I, II and VII. But the southern part of Chile has been collected to a larger extent because of its more interesting rugged terrain, with a greater variety of habitats as well as more precipitation in the region, undoubtedly making it richer in bryophytes and with recent collecting (e.g., Frey & Schaumann 2002, Calabrese *et al.* 2006) there is an increasing number of species in some of the Regions. The main reasons that the Bío-Bío Region was chosen was because of the lack of collecting in the region and more importantly because of the environmental disturbance that is being caused by a series of dams which are presently being built on the upper part of the Bío-Bío River.

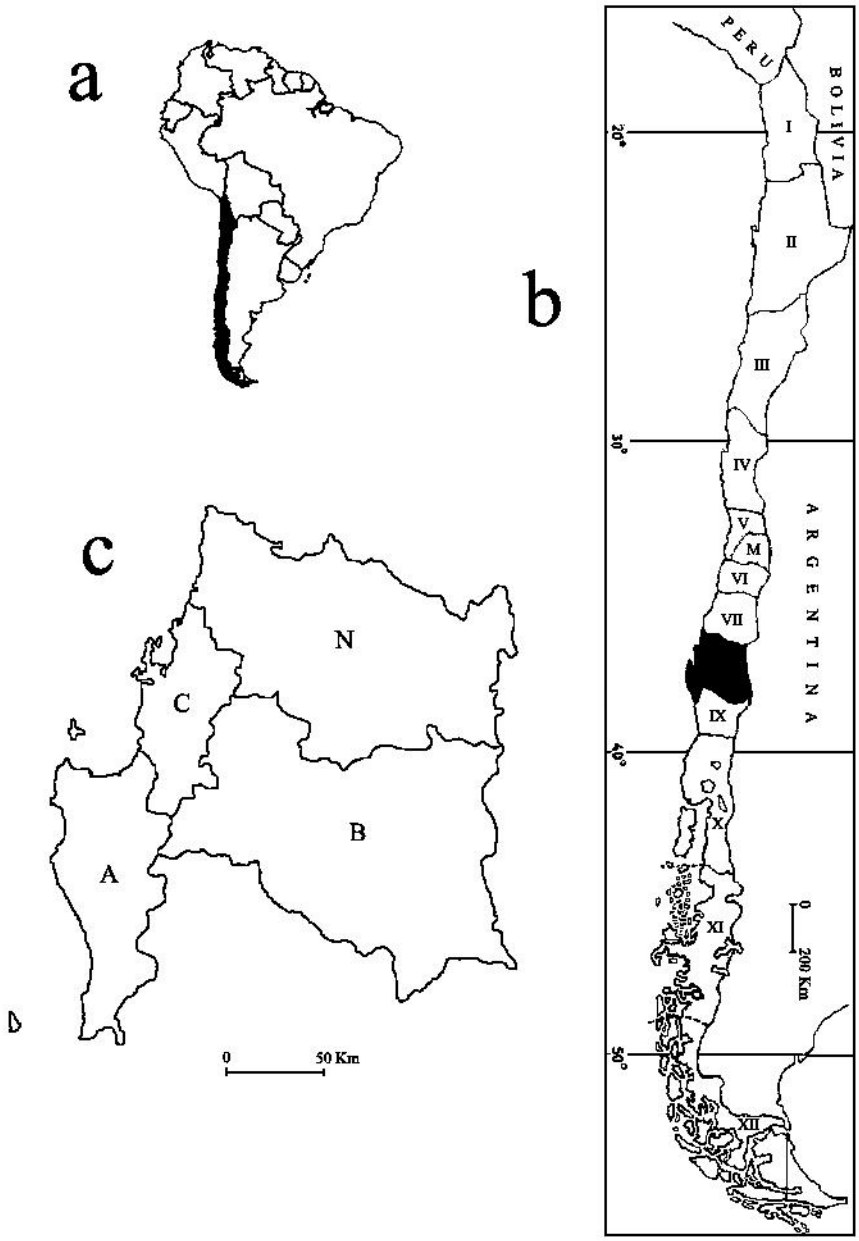

Figure 1: a) Map of South America showing the location of Chile in black. b) Map of Chile showing the location of the 13 Regions in the country (M represents the Metropolitan Santiago Region), with the Bío-Bío Region (VIII) in black. c) The Bío-Bío Region showing the location of the four provinces: A= Arauco, B= Bío-Bío, C= Concepción, N= Ñuble.

The destruction of the environment in this area will undoubtedly have a detrimental impact on the bryoflora, especially since bryophytes are extremely sensitive to disturbances. Therefore, we believe a study of this region is extremely important for this reason alone.

Phytogeographic Description of the Bío-Bío Region (VIII Región) of Chile

The Bío-Bío Region is a transition zone between the central and south part of Chile, being either the northern or southern distribution limit of several vascular plant species (Reiche 1907). The climate of this region permits a great variety and richness of plants, for example, from a total of 125 native trees, 66 of them (53%) occur here (Rodríguez *et al*. 1983). Also, there are an important number of native shrubs,

vines and herbaceous plants occupying diverse habitats offered by the diverse geography.

Geographically, the Bío-Bío Region is bounded on the east by the Andes Mountain Range (Cordillera de los Andes), on the west by a chain of minor importance, the Coastal Mountain Range (Cordillera de la Costa), that runs parallel with the coast, and between the mountain ranges there is a deep intermediate depression or Central Valley. The Coastal Mountains and Central Valley of this region have been intensely exploited for agriculture, suffering the effect of erosion by man. From the Andes towards the Pacific Ocean there are a variety of plants with a predominant number of species in each sector. In all the provinces, below 700 m, occur sporadically a number of common native trees among the predominate trees in the forests, namely *Persea lingue* (Ruiz & Pav.) Nees, *Peumus boldus* Molina, *Laurelia sempervirens* (Ruiz & Pav.) Tul., *Quillaja saponaria* Molina and occasionally *Cryptocarya alba* (Molina) Looser.

There are several rivers in the Bío-Bío Region, with the largest and most important one being the Bío-Bío River, which flows in a northwestern direction through the region into the Pacific Ocean just south of the city of Concepción. A series of seven dams is presently being built on the river which will eventually flood much of the higher parts of the river banks when the dams are completed, thus destroying parts of this environmentally important region. Therefore, much of our collecting was done along the river to collect any mosses that may eventually be destroyed when the dams are completed. Two other smaller rivers of importance that occur in the Central Valley area are the Itata and Laja.

l. Andes Mountains

The Andes Mountains reach a height of 3500 m, with some transverse ranges like the "Nevados de Chillán" reaching 3200 m high, the "Sierra Velluda" with the Antuco Volcano, reaching 2985 m high, and the Copahue volcanic system, with the Mayamaya Mountain Range, with heights of ca. 1800 m. The limit of the vascular plants at the highest points is marked by plains and wetlands formed by snow melts. Growing in these areas are cushion plants like *Azorella trifurcata* (Gaertn.) Pers., plains of grasses, such as *Jarava* sp., *Festuca* sp., and wetland gardens with predominant *Caltha appendiculata* Pers., *Pozoa volcanica* Mathias & Constance, *Aster vahlii* (Gaudich.) Hook. & Arn. and *Sisyrinchium arenarium* Poepp. There are also a variety of shrubs, such as *Orites myrtoidea* (Poepp. & Endl.) Benth. & Hook.f. *ex* Sleumer, *Ephedra chilensis* Miers and *Maytenus disticha* (Hook. f.) Urb. that are predominant.

2. Pre-Andes Mountains

The pre-Andes range is the transition between the Andes Mountains and the Central Valley, with heights of 300–850 m. The predominant vegetation is the *Nothofagus* forest with *N. alpina* (Poepp. & Endl.) Oerst., *N. antarctica* (G. Forst.) Oerst., *N. dombeyi* (Mirb.) Oerst., *N. obliqua* (Mirb.) Oerst., *N. pumilio* (Poepp. & Endl.) Reiche, and the conifers *Austrocedrus chilensis* (D. Don) Pic. Serm. & Bizzarri, *Podocarpus saligna* D. Don and *Prumnopitys andina* (Poepp. *ex* Endl.) de Laub. The sottowood (i.e., the understory and herbaceous plants) is mainly formed by *Chusquea* spp., *Gaultheria mucronata* (L.f.) Hook. & Arn., *Sophora macrocarpa* Sm., several species of *Berberis*, and numerous species of Asteraceae, Fabaceae and Poaceae.

2. Central Valley

The soil in the intermediate depression varies according to the proportion of the sediments of rivers, glaciers and volcanoes. The main river systems that cross the Central Valley are the Itata-Ñuble, that flows into the Pacific Ocean at latitude 36°23'S and the Laja-Bío-Bío with its mouth at latitude 36º49'S. The Itata and Laja rivers carry dark volcanic sands from the Antuco area in the Andes, forming some dunes near Yumbel. Most of the intermediate depression is predominately agricultural land. To the north of the Bío-Bío Region, *Acacia caven* (Molina) Molina and *Quillaja saponaria* Molina dominate, together with thickets of *Colliguaja odorifera* Molina, *Schinus polygamus* (Cav.) Cabrera and several introduced species that are aggressive weeds, such as *Rosa rubiginosa* L. and *Rubus ulmifolius* Schott.

4. Coastal Mountains

The Coastal Mountain Range is primarily comprised of weathered and eroded cliffs. In addition, there are many beaches and sand banks at the mouth of the rivers. In Ñuble Province, south of Quirihue and towards the mouth of the Itata River, the coastal range is eventually reduced to some very complex but geographically insignificant hills and basin regions where grapevines are grown. The highest altitudes are Coiquén Hill, near the town of Quirihue, which is 908 m high and Cayumanqui Hill, near the town of Quillón, which reaches 764 m in height. From these hills the elevation becomes lower towards the coast and Central Valley. South of the Itata River the elevation of the coastal mountains surrounding the Andalién River reaches ca. 650 m. In Arauco Province, the Nahuelbuta Mountain Range reaches a height of ca.1500 m. Most of the coastal hills are planted with *Pinus radiata* D. Don and *Eucalyptus globulus* Labill. The predominant native species are the evergreens *Peumus boldus* Molina, *Aextoxicon punctatum* Ruiz & Pav., *Lithrea caustica* (Molina) Hook. & Arn., and *Cryptocarya alba* (Molina) Looser. In gorges and in other humid areas there occurs *Myrceugenia exsucca* (DC.) O. Berg, *Drimys winteri* J. R. Forst. & G. Forst., *Gomortega keule* (Molina) Baill., *Pitavia punctata* Molina, *Azara integrifolia* Ruiz & Pav. and the lianas *Cissus striata*

Ruiz & Pav., *Lardizabala biternata* Ruiz & Pav. and *Lapageria rosea* Ruiz & Pav. In the high parts of the coastal mountains of Nabuelbuta grows *Araucaria araucana* (Molina) C. Koch, *Nothofagus obliqua* (Mirb.) Oerst., *N. dombeyi* (Mirb.) Oerst., *Luma apiculata* (DC.) Burret and the shrubs *Desfontainia spinosa* Ruiz & Pav., *Chusquea quila* Kunth, together with various species of *Berberis*, *Baccharis*, *Gaultheria mucronata* (L.f.) Hook. & Arn. and *Griselinia jodinifolia* (Griseb.) Taub.

Climate

The Bío-Bío Region has a transitional climate between the semiarid Mediterranean climate of central Chile and the rainy temperate climate of the south (Luebert & Pliscoff 2005). In the entire region the precipitation is more frequent in the winter, with an annual mean of 900–1500 mm and a relative humidity of 70–85% (Hajek & di Castri 1975), reaching 2500 mm in the highlands of the Coastal Mountain Range and in the Andes (Mardones 1999). In the Andes the precipitation is mostly in the form of snow. There is a brief drought season in the summer, which defines the climate as very humid-Mediterranean (di Castri & Hajek 1976). The mean annual temperatures in the Region vary between 12.3–14°C (Hajek & di Castri 1975, Teneb 2003). The climate is strongly influenced by the geography of the region and the latitude: i.e., being drier in the central valley of Bío-Bío and Ñuble provinces and rainier in the coastal regions of Arauco and Concepción provinces, as well as in the upper Bío-Bío province.

Geomorphology

The region can be divided into four main geomorphological types that are determined by the origin and nature of the landscape (Börgel 1983, Veit & Garleff 1995): (1) the coastal plains, formed mostly over clastic sediments together with marine, fluvial and eolic sediments (Mardones 1999); (2) the Coastal Mountain Range, with maximum heights between 400–1300 m, formed mostly by metamorphic rocks from the Paleozoic; (3) the central valley, with a fluvio-glacio-volcanic sediment origin from the Quaternary and Tertiary, and (4) the Andes Mountain Range, originated by tectonic movements in the Quaternary and Tertiary and formed mostly by volcanic and intrusive rocks (Veit & Garleff 1995). The latter is characterized by strong, continuous volcanic and tectonic activity, which reveals its young geologic age. It is worth noting that the Coastal Mountain Range is by far the oldest geological region (Mardones 2005).

Mosses New to Chile

Abbreviations used for the four provinces in the Bío-Bío Region are A=Arauco, B=Bío-Bío, C=Concepción and N=Ñuble. Collection numbers are those of Ireland & Bellolio with voucher specimens at CONC, MO and many at US and NY. Specimens have been identified by R. R. Ireland, unless indicated otherwise. Some records of unpublished species in the MO Tropicos computer data base are also noted. The nomenclature mainly follows that of Crosby *et al*. 2000.

Acaulon uleanum Müll. Hal.: (C 31903), on soil among grass in clearing, Caracol Hill, 36°49'S, 73°02'W, alt. ca. 250 m, 25 Sep 2001, det. B. H. Allen.

Previously reported in South America only from Brazil (Yano 1981).

Barbula convoluta Hedw.: (C 31669), on base of rock bluff, Quebrada Honda, 36°41'S, 72°58'W, alt. ca. 104 m, 17 Sep 2001, det. R. H. Zander.

First report for South America. An apparently unpublished specimen was collected in Brazil in Minas Gerais (cited in Tropicos by MO). It is known elsewhere from the United States, Mexico, Africa, Europe and New Zealand (Delgadillo *et al*. 1995).

Bartramia potosica Mont.: (N 36213, 36216, 36222), on soil bank and on soil among grass beside rivulet, Las Truchas region, Maranto Rivulet in valley, 36°41'S, 71°09'W, alt. ca. 2100 m, 12 Mar 2003.

The San Gavan report for this species, which was the only previous record, is a locality in Peru (Si He pers. comm.) instead of Chile. Several other South America reports for this species are from Argentina (Churchill & Linares 1995, Fransén 1995), Bolivia (Hermann 1976, Churchill *et al*. 2000, Fransén 1995), Colombia (Florschütz & Florschütz 1979, Churchill & Linares 1995, Churchill *et al*. 2000, Fransén 1995), Ecuador (Steere 1948, Churchill *et al*. 2000, Fransén 1995), Peru (Hegewald & Hegewald 1975, Griffin & Hegewald 1986, Menzel 1992, Churchill *et al*. 2000, Fransén 1995) and Venezuela (Pursell 1973, Churchill *et al*. 2000, Fransén 1995).

Breutelia tomentosa (Sw. *ex* Brid.) A. Jaeger: (C 31897), on soil bank, Caracol Hill, 36°49'S, 73°02'W, alt. ca. 250 m, 25 Sep 2001.

South American reports are also from Bolivia (Hermann 1976; Churchill *et al*. 2000), Brazil (Yano 1981), Colombia (Robinson 1967, Florschütz & Florschütz 1979; Churchill 1989, Churchill *et al*. 2000), Ecuador (Steere 1948, Robinson *et al*. 1971, Churchill *et al*. 2000), Guyana (Delgadillo *et al*. 1995), Peru (Hegewald & Hegewald 1975) and Venezuela (Pursell 1973, Churchill *et al*. 2000).

Bryum densifolium Brid.: (N 30831), on muddy soil bank beside river, Renegado River at Aserradero bridge, 36°54'S, 71°28'W, alt. ca. 1000 m, 9 Dec 2002, det. J. R. Spence.

Other South American reports are from Argentina (Ochi 1982, Matteri 2003), Bolivia (Hermann 1976, Churchill *et al*. 2000), Brazil (Yano 1981), Colombia (Churchill 1989, Churchill *et al*. 2000), Ecuador

(Steere 1948, Churchill *et al*. 2000), Paraguay (Ochi 1981), Peru (Hegewald & Hegewald 1975, Ochi 1990, Churchill *et al*. 2000), Uruguay (Delgadillo *et al*. 1995) and Venezuela (Churchill *et al*. 2000).

Bryum revolutum Müll. Hal.: (C 31687), on soil in seepy rock bluff, Quebrada Honda, 36°41'S, 72°58'W, alt. ca. 104 m, 17 Sep 2001, det. J. R. Spence.

Previously known to be endemic to Argentina (Ochi 1982; Matteri 2003).

Campylopus fragilis (Brid.) Bruch & Schimp. *in* B. S. G.: (A 33269), on soil over cliff near ocean, bluffs along ocean with native shrubs, 2 km N of Casa de Piedra Beach, 38°28'S, 73°31'W, at sea level, 6 Nov 2001, det. B. H. Allen.

Reported elsewhere in South America from Bolivia (Churchill *et al*. 2000), Brazil (Delgadillo *et al*. 1995), Colombia (Robinson 1967, Florschütz & Florschütz 1979, Churchill & Linares 1995, Churchill *et al*. 2000), Ecuador (Steere 1948 as *C. fimbriatus* Mitt., Churchill *et al*. 2000), Peru (Hegewald & Hegewald 1975, Churchill *et al*. 2000) and Venezuela (Frahm 1991, Churchill *et al*. 2000).

Campylostelium saxicola (F. Weber & D. Mohr) Bruch & Schimp. *in* B. S. G.: (A 33110), on boulder in shade in bog-meadow surrounded by mixed forest of *Araucaria-Nothofagus-Persea*, road from Curanilahue to Trongol, 19 km SE of Curanilahue, 37°34'S, 73°12'W, alt. ca. 990 m, 30 Oct 2001; (C 32250), on limy sandstone, road from Dichato to Burca, 3 km N of Dichato, 36°31'S, 72°54'W, alt. ca. 89 m, 7 Oct 2001; (C 32837), on rock, road from Santa Juana to La Laja, 1 km E of Santa Juana, 37°10'S, 72°55'W, alt. ca. 50 m, 22 Oct 2001; (N 31035), on boulder in woods, waterfall in Las Trancas, 8 km SW of Termas de Chillán, 36°54'S, 71°29'W, alt. ca. 1200 m, 10 Dec 2002; (N 32669), on limestone rock, farm El Guanaco (Forestal Millalemu), 13 km W of Quirihue, 36°12'S, 72°38'W, alt. ca. 570 m, 16 Oct 2001; (N 35931a), on soil bank by river among scattered young *Nothofagus dombeyi*, Renegado River, 36°54'S, 71°32'W, alt. ca. 1200 m, 14 Dec 2002.

This species is very distinctive but rare in the Bío-Bío Region. It has not been reported for any other South American country. One other species of *Campylostelium*, *C. venezuelanum* Dozy & Molk., was reported for Venezuela (Pursell 1973) but Buck (1979) transferred it to the genus *Dicranella*. Churchill *et al*. (2000) reported it for Venezuela (as *Dicranella venezuelana* (Dozy & Molk.) W. R. Buck). Buck made the transfer to *Dicranella* because of the nearly straight seta compared to the strongly curved one in *Campylostelium* which is always characteristic of *C. saxicola*.

Cryptopapillaria penicillata (Dozy & Molk.) M. Menzel: (A 33129), on limbs of *Peumus boldus* in mature forest of *Luma apiculata* and *Aextoxicon punctatum* Mocha I., trail in National Park, 38°20'S, 73°53'W, alt. ca. 15–350 m, 4 Nov 2001; (A 33468), on limbs of small shrub, near waterfalls surrounded by native forest with dominant *Aextoxicon punctatum* and *Persea lingue*, Lincuyin, W of Lanalhue Lake, 37°57'S, 73°19'W, alt. ca. 250 m, 9 Nov 2001, det. B. H. Allen; (C 32784), on trunk of *Citronella mucronata*, Park "Jorge Allessandri" (Compañia Manufacturera de Papeles y Cartones), 36°56'S, 73°09'W, alt. ca. 200–490 m, 19 Oct 2001, det. B. H. Allen.

Known in South America from Brazil (Yano 1989 as *Papillaria squamatula* Müll. Hal.), Bolivia (Hermann 1976 as *Papillaria squamatula*, Churchill *et al*. 2000 as *Papillaria penicillata* (Dozy & Molk.) Broth.), Colombia (Churchill & Linares 1995 as *Papillaria penicillata*, Churchill *et al*. 2000 as *Papillaria penicillata*, Ecuador (Churchill *et al*. 2000 as *Papillaria penicillata*), Peru (Buck 1998), Surinam (Buck 1998, Churchill *et al*. 2000 as *Papillaria penicillata*) and Venezuela (Pursell 1973 as *Papillaria penicillata*, Churchill *et al*. 2000 as *Papillaria penicillata*).

Leptodontium proliferum Herzog: (A 33170), on trunk of *Peumus boldus* in woods predominately with *Peumus boldus* adjacent to open field, Mocha I., 38°21'S, 73°56'W, alt. ca. 25 m, 5 Nov 2001, det. B. H. Allen.

Also reported in South America from Bolivia (Hermann 1976, Churchill *et al*. 2000), Colombia (Churchill & Linares 1995, Churchill *et al*. 2000) and Peru (Churchill *et al*. 2000).

Orthotrichum aequatoreum Mitt.: (N 30686, 30657), on base of *Nothofagus* in *Nothofagus* forest with boulders and granitic cliffs, Termas de Chillán and environs, 36°55'S, 71°42'W, alt. ca. 1660 m, 5–7 Dec 2002.

Other South American countries from where this species is reported are Argentina (Lewinsky 1984, Matteri 2003), Colombia (Churchill & Linares 1995, Churchill *et al*. 2000), Ecuador (Steere 1948), Peru (Hegewald & Hegewald 1975, Churchill *et al*. 2000) and Venezuela (Churchill *et al*. 2000).

Orthotrichum latimarginatum Lewinsky: (N 30657), on trunk of *Nothofagus* in *Nothofagus* forest with boulders and granitic cliffs, Termas de Chillán and environs, 36°55'S, 71°42'W, alt. ca. 1660 m, 5–7 Dec 2002.

Lewinsky (1987) and Churchill *et al*. (2000) reported this species is known from only two other South American countries, Ecuador and Peru.

Orthotrichum laxifolium Wilson *in* Mitt.: (N 30750), on trunk of *Nothofagus*, río Diguillín, los Mañíos, ca. 10 km SE of Recinto, 37°53'S, 71°38'W, alt. ca. 500 m, 11 Dec 2002.

Known elsewhere in South America from Bolivia (Hermann 1976 as *O. epilosum* R. S. Williams, Lewinsky 1987, Churchill *et al*. 2000), Ecuador (Steere 1948, Lewinsky 1987) and Venezuela (Churchill *et al*. 2000).

Philonotis elongata (Dism.) H. A. Crum & Steere: (C 32124), on wet soil near creek, road from Quilacoya to Talcamávida, 10 km S of Quilacoya, 37°10'S, 72°50'W, alt. ca. 211 m, 2 Oct 2001.

Reports from other South American countries are from Bolivia (cited in Tropicos from specimens in MO), Brazil (Delgadillo *et al*. 1995), Colombia (Churchill & Linares 1995, Churchill *et al*. 2000), Ecuador (Steere 1948 as *P. tenella* var. *elongata* Dism., Churchill *et al*. 2000), Peru (Churchill *et. al*. 2000) and Venezuela (Delgadillo *et al*. 1995).

Platyneuron praealtum (Mitt.) Ochyra & Bednarek-Ochyra: (N 30853, 30867), on sandy bank in clearing, Shangrila, road to ruins of old German hotel, 36°52'S, 71°30'W, alt. ca. 1500 m, 9 Dec 2002.

Otherwise known in South America only from Argentina (Matteri 2003) and from two unreported specimens from the Magallanes Region (XII) of Chile (cited in Tropicos from specimens in MO).

Pseudotaxiphyllum elegans (Brid.) Z. Iwats.: (A 33252), on ledge of limestone cliff among bluffs along ocean with native shrubs, 2 km N of Casa de Piedra Beach, 38°28'S, 73°31'W, at sea level, 6 Nov 2001.

Only known from one other locality in South America where it was collected in Argentina on the Falkland Islands in 1907 (Ireland, unpublished manuscript).

Ptychomitrium sellowianum (Müll. Hal.) A. Jaeger: (A 33682), on base of limy cliff in native forest with falls and rock cliffs, Huillinco Falls, 37°45'S, 73°22'W, alt. ca. 130 m, 12 Nov 2001; (C 31469, 31475), on side of granitic boulder, Coyanmahuida Park, 36°49'S, 72°43'W, alt. ca. 260 m, 9 Sep 2001; (C 31511), on large boulder, el Rosario, 36°48'S, 72°38'W, alt. 269 m, 11 Sep 2001; (C 31914), on cliff, S side of mouth of río Lenga, 36°46'S, 73°09'W, alt. ca. 10 m, 28 Sep 2001; (C 32144), on boulder, road from Quilacoya to Talcamávida, 10 km S of Quilacoya, 37°10'S, 72°50'W, alt. ca. 211 m, 2 Oct. 2001; (C 32248), on boulder in open field, road from Dichato to Burca, 3 km N of Dichato, 36°31'S, 72°54'W, alt. ca. 89 m, 7 Oct 2001; (N 32315), on boulder beside creek, road from Cobquecura to Quirihue, 24 km SE of Cobquecura, Mengel Creek, 36°13'S, 72°36'W, alt. ca. 360 m, 8 Oct 2001; (N 32480), on rock beside river, road from Copiulemo to Los Cóndores, 36°05'S, 72°34'W, alt. ca. 408 m, 9 Oct 2001; (N 34666), on rock cliffs and boulders near river, 32 km E from San Fabián de Alico, El Inglés on El Sauce River, 36°39'S, 71°16'W, alt. ca. 790 m, 16 Oct 2002; (N 34738, 34755, 34767), on rocks and cliff near soil bank by road, 7 km W of San Fabián de Alico, Estero Grande, 36°30'S, 71°37'W, alt. ca. 520 m, 17 Oct 2002.

Reported in South America for five other countries, namely Argentina (Schiavone & Biasuso 1997, Matteri 2003), Bolivia (Hermann 1976, Churchill *et al*. 2000), Brazil (Yano 1989, Schiavone & Biasuso 1997), Paraguay (Schiavone & Biasuso 1997), Peru (Cao *et al.* 2006) and Uruguay (Schiavone & Biasuso 1997).

Rhabdoweisia fugax (Hedw.) Bruch & Schimp. *in* B. S. G.: (A 33253, 33256), on ledge and in crevices of limestone cliff with bluffs along ocean with native shrubs, 2 km N of Casa de Piedra Beach, 38°28'S, 73°31'W, at sea level, 6 Nov 2001; (C 30961), on rock outcrop, Desembocadura Norte del río Bío-Bío, 38°28'S, 73°31'W, alt. ca. 5 m, 8 Sep 2001.

The other South American reports for this species are from Bolivia (Hermann 1976, Churchill *et al*. 2000), Colombia (Florschütz & Florschütz 1979, Churchill & Linares 1995, Churchill *et al*. 2000), Ecuador (Churchill *et al*. 2000), Peru (Hegewald & Hegewald 1975, Churchill *et al*. 2000) and Venezuela (Churchill *et al*. 2000).

Sphagnum recurvum var. ***brevifolium*** (Lindb. *ex* Braithw) Warnst.: (A 33090, 33091, 33093), in water and hummocks in boggy meadow surrounded by mixed forest of *Araucaria-Nothofagus-Persea*, road from Curanilahue to Trongol, 19 km SE of Curanilahue, 37°34'S, 73°12'W, alt. ca. 990 m, 30 Oct 2001.

Sphagnum is rare in the Bío-Bío Region and *S. recurvum* var. *recurvum* P. Beauv. is the only other taxon, until now, to be reported from there. The var. *brevifolium* has narrow stem leaves, more or less triangular, and they are not or slightly erose at the apex. The var. *recurvum*, in comparison, has broad stem leaves, lingulate to somewhat oblong-triangular, and they are moderately to distinctly erose across their broad, truncate to rounded apex (Crum & Anderson 1981). This is the first report of the var. *brevifolium* for South America.

Tortula truncata (Hedw.) Mitt. *in* Godm.: (C 30377), on bare soil in clearing, Mitrinhue, 36°58'S, 72°57'W, alt. ca. 25 m, 14 Sep 2001, det. R. H. Zander; (C 32254a) on soil among grass in field, road from Dichato to Burca, 3 km N of Dichato, 36°31'S, 72°54'W, alt. ca. 89 m, 7 Oct 2001.

This is the first known report of this species for South America.

Mosses New to the Bío-Bío Region (VIII Región)

All the following mosses are new to the Bío-Bío Region according to the list by He (1998) or the list of *Fissidens* by Müller & Pursell (2003). He's paper should be referred to for the regions and their provinces, with Region I being the most northern that includes the Atacama Desert and Region XII the most southern that includes Tierra del Fuego. Some new reports for Region VII by Müller & Pereira (2006) are also included. The Juan Fernández Is., although in front of Region V, are not considered in the northward or southward range extensions given below, for being located more than 600 km offshore from mainland Chile. The province abbreviations are the same as those used for the Mosses New to Chile with the collection numbers of Ireland and Bellolio usually listed without specific locality information.

Acrocladium auriculatum (Mont.) Mitt.: A (31266, 31269, 33096), B (34220, 34249, 35287a, 35591, 35667), N (34534, 34574, 34585, 35906), all det. by J. Larraín.

This species is common in many localities, where it occurs in often dry, noncalcareous habitats on tree bases, rotten logs, or sometimes in more wet habitats on moist road and river banks, moist boulders and logs beside rivulets, on cliffs beside falls, and on rocks in streams. It can be confused with *Calliergonella cuspidata* (Hedw.) Loeske, which is rare in Chile. However, that species is often subpinnately branched and has smooth, longer leaves (2–3:1), compared to *A. auriculatum* which has mostly simple stems with plicate to undulate leaves that are much shorter (often ca. 1:1). In Chile this is a northward extension for this species from Regions IX–XII. Also recorded for the Juan Fernández Is.

Ancistrodes genuflexa (Müll. Hal.) Crosby: A (31176, 31250, 32955, 33068, 33340, 33738), B (34271), C (32102, 33887), N (31590, 32662).

Previously known from Regions VII (Müller & Pereira 2006) and IX–XI.

Andreaea alpina Hedw.: N (30516, 30532, 36163).

Previously known only from the southern Regions X–XII and the Juan Fernández Is.

Andreaea rupestris Hedw.: A (33020), B (35657), N (30571, 30576, 34439, 36115, 36152).

Known previously in the southern Regions IX, X and XII.

Andreaea subulata Harv. *in* Hook.: B (35172), N (36152a, 36175, 36233).

A northward extension from Region IX but also known from Regions XI–XII.

Barbula santiagensis Broth. *in* Dusén: C (30995, 31420).

A southern extension from the nearest known record from the Metropolitan Region (Santiago). Also known from Regions IV–V.

Brachymenium acuminatum Harv. *in* Hook.: A (31864, 31867, 33694), B (34807, 34981, 35051, 35073), C (31344, 31482, 31921, 31938, 32276, 32798, 33872), N (32391, 32473, 32769, 35887a).

A southern extension from RegionVII, which is the nearest region. It has also been reported for the Metropolitan Region (Santiago) and Regions IV–VI.

Brachymenium exile (Dozy & Molk.) Bosch & Sande Lac.: C (30332).

This species is evidently rare in Chile. It is a northern extension from the only other region where it is known, Region IX.

Brachythecium conostomum (Taylor) A. Jaeger: A (33618, 33624,), N (30865).

A northern extension for previous reports from Regions IX and X.

Bryomaltaea obtusifolia (Hook.) Goffinet *in* Goffinet & Vitt: A (33563).

An apparently rare species previously known only from Region X as *Zygodon obtusifolius* Hook. The species was transferred from *Zygodon* to the new genus *Bryomaltaea* by Goffinet & Vitt (1998). Although Calabrese in her revision of the Andean-patagonian species of *Zygodon* (2003) treat the species inside that genus, we agree with Goffinet & Vitt in placing it in a separate one.

Bryum argenteum Hedw.: A (33206, 33525), B (32039, 34119, 34243, 34957, 35079, 35295, 35740), C (30280, 30314, 30425, 31422, 31431, 31640, 31943), N (32342, 32654, 34590, 34628, 34659, 34678, 34685).

A cosmopolitan species surprisingly overlooked in the Bío-Bío Region but known in Chile from Region V and Regions IX–XII, in addition to the Juan Fernández Is.

Bryum gilliesii Hook.: B (34158, 35378), N (34499, 34561).

A distinct species with obtuse leaves recorded elsewhere in Chile from Regions V and X.

Bryum valparaisense Thér.: C (31686 det. J. Spence).

Previously reported from the Metropolitan Region (Santiago) and from Regions V and X.

Camptodontium cryptodon (Mont.) Reimers: A (33032, 33045a, 33099, 33103, 33291, 33727, 33739), B (35285, 35632), N (34443, 34547,

34567, 34577, 34692, 35837, 35909, 35923, 36080, 36141, 36147, 36250).

Known in the Metropolitan (Cordillera) Region, but otherwise known only south of the Bío-Bío Region, in Regions IX–XII.

Campylopodium medium (Duby *in* Moritzi) Giese & Frahm: A (33061).

This species occurred on clay soil in an open field. It is apparently rare in Chile and this collection represents a northward extension from Regions IX and XI.

Campylopus aureonitens (Müll. Hal.) A. Jaeger subsp. **recurvifolius** (Dusén) Frahm: B (35726, 35736).

This taxon occurs on rock bluffs beside rivers and on rock outcrops in clearings. It is also known from Regions VII, IX and X.

Campylopus clavatus (R. Br. *in* Schwägr.) Wilson *in* Hook.f.: C (30937).

Occurring on a cliff in the Bío-Bío Region. Widely known elsewhere in Chile from other regions to the north and south, as well as the Juan Fernández Is.

Campylopus vesticaulis Mitt. *in* Melliss: A (31160, 31165), C (30166).

Occurring on sandy roadside banks. Previously known only south of the Bío-Bío Region from Regions X and XII, as well as in the Juan Fernández Is.

Catagonium nitidum (Hook.f. & Wilson) Broth.: N (30514, 30517, 30598).

Known from Region VII and from some regions and islands south of the Bío-Bío Region.

Ceratodon stenocarpus Bruch & Schimp. *ex* Müll. Hal.: Collected several times in all four provinces of the Bío-Bío Region.

Only reported from Region X prior to these reports undoubtedly because of the confusion with the cosmopolitan species *C. purpureus* (Hedw.) Brid. (Burley & Pritchard 1990), which is often recognized as a subspecies by many bryologists (e.g., Allen 1994, He 1998, Delgadillo *et al*. 1995, Burley & Pritchard 1990). This taxon differs from *C. purpureus* by its capsules that are longer, 1.7–2.3 mm long, erect to sub-erect with struma ± lacking, smooth to slightly sulcate when dry. This compares with *C. purpureus* which has capsules shorter, 1.3–1.8 mm long, inclined to horizontal, strumose, deeply sulcate when dry. Also, the peristome teeth in *C. stenocarpus* have weakly thickened trabeculae and they are split nearly to the base which differs from *C. purpureus* which has peristome teeth with strongly thickened trabeculae and the teeth are split only 1/4–1/3 their length.

Cryphaea consimilis Mont.: Several collections made in each of the Bío-Bío Region provinces always growing on tree limbs or tree trunks.

Previously known only from four regions and one province in each region, namely VII (Cauquenes Prov., Müller & Pereira 2006)), IX (Cautín Prov.), X (Valdivia Prov.) and XI (Aisen Prov.).

Cryphaeophilum molle (Dusén) M. Fleisch.: Several collections were made in each of the four provinces.

Known prior to these collections from Regions VII (Müller & Pereira 2006) and IX–XI.

Daltonia gracilis Mitt.: A (33520, 33611, 33344a).

This is a corticolous species growing on both trunks and limbs of deciduous and coniferous trees in the Bío-Bío Region. It is a northward extension from Regions X–XII.. Also recorded for the Juan Fernández Is.

Dendrocryphaea cuspidata (Sull.) Broth. *in* Skottsb.: Collected several times in all four provinces usually on boulders and rocks beside and in streams, near waterfalls, rarely on rotten logs and dead tree limbs and trunks.

Previously recorded from Regions V, VI, X and the Juan Fernández Is.

Dendrocryphaea lechleri Thér.: A (33075), C (30457, 31325, 31327).

On rocks in rivulets or rarely on fallen decayed tree trunks beside rivulets. Previously known from Regions VII (Müller & Pereira 2006), IX and X.

Dicranoloma billardieri Thér.: C (31333).

Occurring on humus in wooded clearing. Known only from Region V to the north and Regions IX–XII to the south of the Bío-Bío Region. Also in the Juan Fernández Is.

Diphyscium pilmaiquen (Crosby) Magombo: A (33250), on wet cliff near ocean, 2 km N of Casa de Piedra Beach, 38°28'S, 73°31'W, at sea level, 2 Nov 2001; A (33386), on limestone cliff beside river, Matraquín R., 10 km E of Tirúa R., on N side of Tirúa R., 38°20'S, 73°24'W, ca. 195 m, 6 Nov 2001.

These two collections of this recently described endemic Chilean species, represent the only two made after the species was first described by Crosby (1977) as *Florschuetzia pilmaiquen* from Region X (provinces Valdivia/Osorno). The genus name was later changed by Crosby (1978) to *Muscoflorschuetzia* when it was discovered that *Florschuetzia* had been preoccupied in 1968 by a genus of fossil pollen. However, Magombo (2003), who did a DNA study on several species of *Diphyscium*, as well as *Muscoflorschuetzia pilmaiquen* (Crosby) Crosby, placed it in the genus *Diphyscium* (2002). One of the

Bío-Bío collections, A (33250) had one or two old sporophytes but the other collection A (33386) was sterile. The gametophytes of both collections had the general appearance and the color of the type, as well as the consistently unistratose leaf laminae.

Ditrichum cylindricarpum (Müll. Hal.) F. Müll.: Collected three or four times in different localities in A, B and N provinces.
This is a northward extension of this species from Regions IX–XII.

Entosthodon apophysatus (Taylor) Mitt.: (B 32031), on soil among grass in open field, road from Hualqui to Yumbel (Hwy. 0-54), 29 km E from Hualqui, 37°02'S, 72°41'W, alt. ca. 278 m, 1 Oct 2001, det. A. Fife; (C 31661a), on bare soil in road, Tumbes Peninsula, 36°38'S, 73°05'W, alt. at sea level to 58 m, 16 Sep 2001; (C 31919), on loamy soil among grass in open field, S side of mouth of río Lenga, 36°46'S, 73°09'W, alt. ca. 10 m, 28 Sep 2001, det. A. Fife.
Reported for South America from Chile by A. Fife (pers. comm.) only from Constitución in Region VII, somewhat farther north than our collections, and from Uruguay (Fife & Seppelt 2001).

Entosthodon balansae Besch.: N (30551, 30578).
This is a northward extension for this species which was only known from Llanquihue Province in Region X.

Entosthodon laevis (Mitt.) Fife: C (31968).
Mainly a southern distributed species where it was previously known from three regions to the north of the Bío-Bío Region, Metropolitan, IV, V, and to the south only from Region X.

Eucamptodon perichaetialis (Mont.) Mont.: A (33354, 33356, 33751).
A northward extension from Regions IX–XII. Also in the Juan Fernández Is.

Fissidens bryoides Hedw. var. ***pusillus*** (Wilson) Pursell *in* B. H. Allen: A (31838), C (31807, 31818, 31912, 31977).
This variety is a southern extension from only one province (San Antonio) in Region V (He 1998, Müller & Pursell 2003).

Fissidens bryoides var. ***viridulus*** (Sw.) Broth.: A (31863), C (31752, 31922, 31944, 31947, 31996).
Another variety, like the var. *pusillus*, that is a southern extension but it was know earlier from two regions to the north, Metropolitan and VII (Müller & Pursell 2003).

Fissidens serratus Müll. Hal.: C (31352 det. R. A. Pursell, 31421, 31423).
These collections fill in a gap in the distribution of this species since it was reported earlier from Regions V and IX.

Gymnostomum calcareum Nees & Hornsch.: B (34190, 35005).
Previously known from Regions V, X, XI and the Juan Fernández Is.

Hennediella kunzeana (Müll. Hal.) R. H. Zander ?: A (31257).
There is some question about the identity of this collection; however, the morphology and distribution of the plants seem to best fit this species of *Hennediella*. Other collections of this species have been reported from Regions IV, V and X, while all the other species in the genus are only known from regions much farther south.

Hypnodendron microstictum Mitt. *ex* A. Jaeger & Sauerb.: A, C, N.
Reported north of the Bío-Bío Region in the Regions Metropolitan, VI and VII (Müller & Pereira 2006), whereas south of it in Regions IX–XI. Also in the Juan Fernández Is.

Hypnum cupressiforme Hedw.: Collected in several localities in all four provinces.
Commonly on *Nothofagus* tree trunks, fallen rotten tree trunks, exposed tree roots, humus, boulders and rock outcrops in woodlands. Earlier recorded from Regions IV and IX–XII.

Hypnum cupressiforme var. ***filiforme*** Brid.: Not as common as the typical var. *cupressiforme* but collected in a few localities in A, B, and N provinces.
This variety also occurred on the same substrates as the typical variety. This is a northward extension for this variety from Regions IX and X.

Hypopterygium didictyon Müll. Hal.: C (32780, 32781), B (34327).
A species that is uncommon in the Bío-Bío Region where it occurred in only two localities on tree trunks (C) and on a soil bank beside a rivulet (B). Other collections have been recorded from the Metropolitan Region to the north of the Bío-Bío and Regions IX–XI to the south.

Isopterygiopsis pulchella (Hedw.) Z. Iwats. A rare but distinctive pleurocarpous species found with sporophytes only from the following locality: (B 34124), in crevice of rock cliff, National Park Lake Laja, Los Barros Military Base, 37°27'S, 71°19'W, alt. ca. 1500 m, 9 Nov 2002.
Previously recorded (as *Isopterygium pulchellum* (Hedw.) A. Jaeger) only from the extreme southern part of Chile in Region XII (Clarence I., Magallanes).

Leptobryum pyriforme (Hedw.) Warnst.: (N 30634), on and in crevices of logs on bridge, Termas de Chillán & environs, 36°55'S, 71°42'W, alt. ca. 1660 m, 5–7 Dec 2002.

Surprisingly rare in Chile and previously reported only from Regions Metropolitan (Santiago), XI (Prov. Aisen) and XII (Prov. Magallanes).

Leptodictyum riparium (Hedw.) Warnst.: (B 34808), on boulder beside pool of water, Laja Falls at S side of Laja R., 37°12'S, 72°22'W, alt. ca. 170 m, 23 Oct. 2002; (N 30497 ?), on boulder in waterfalls in *Nothofagus* forest with boulders and granitic cliffs, Termas de Chillán & environs, 36°55'S, 71°42'W, alt. ca. 1660 m, 5–7 Dec 2002.

This species is reported as var. *jaffueli* (Thér.) Thér. and var. *looseri* Thér. in He (1998) but we consider both varieties synonyms of *L. riparium*. The reports of the two varieties are from Regions Metropolitan, V and X.

Leptostomum splachnoideum Hook. & Arn.: Collected only a few times in A, C and N provinces.

This is a northward extension of this species range from Regions IX–XI.

Macromitrium crassiusculum Lorentz: (C 30253), on trunk of small deciduous tree, Parque Ecuador, 36°49'S, 73°02'W, alt. 10–250 m, 4 Sep 2001.

This is yet another northward extension for a species in Chile. It was previously known from only two regions and three provinces in the south, namely Region IX (Cautín Prov.) and Region X (Osorno and Valdivia Provinces).

Macromitrium krausei Lorentz ?: (N 31540), on trunk of *Nothofagus* sp., Cayumanque Hill, 36°42'S, 72°31'W, alt. ca. 483–792 m, 15 Sep 2001.

The identification of this species is somewhat doubtful but morphologically it is closer to this species than the other 13 taxa in the genus that are reported for Chile. It has been reported before only in the south from Region X (Guaitecas Is., Llanquihue and Valdivia Provinces).

Macromitrium microcarpum Müll. Hal.: Known from one locality in A Province and from several in C and N provinces.

Earlier reports are from Regions VII and X.

Meteorium flexicaule Wilson in Hook.f.: (B 34817), on limbs of shrub beside falls, Laja Falls at S side of Laja R., 37°12'S, 72°22'N, alt. ca. 170 m, 23 Oct 2002; (C 33899), on tree trunk in habitat with stream and adjacent native forest of predominately *Nothofagus* spp., *Aextoxicon punctatum* & *Peumus boldus*, Bellavista Creek, San José Farm, 36°41'S, 72°56'W, alt. ca. 90 m, 23 Nov 2001.

This species, reported as *Papillaria flexicaulis* (Wilson) A. Jaeger by He (1998), is a northern extension from Regions IX and X. Also in the Juan Fernández Is.

Oncophorus luteovirens E. B. Bartram *in* Roivainen: (A 33764), on sandy soil by stream flowing through native forest with *Araucaria araucana*, San Alfonso, 25 km E of Antiguala, 37°42'S, 73°10'W, alt. ca. 770 m, 13 Nov 2001.

Known from the extreme south only from Region XII (reported as *Symblepharis luteovirens* (E. B. Bartram) Ochyra & Matteri by He 1998).

Orthodontium gracile (Wilson) Schwägr.: Collected in B, C and N provinces where it occurred on its usual substrate of rotten trees, stumps (sometimes burned) and bases of trees, both deciduous and coniferous.

Previously known only from Region V and the Juan Fernández Is.

Orthodontium pellucens (Hook.) B.S.G. *in* Müll. Hal.: Collected two or three times in each of the four provinces where it grew mainly on both living and dead tree trunks or rarely vines.

Previous reports are for Regions IV and X.

Orthotrichum anaglyptodon Cardot & Broth.: (N 30653), on trunk of *Nothofagus*, Termas de Chillán & environs, 36°55'S, 71°42'W, alt. ca. 1660 m, 5–7 Dec 2002.

Known elsewhere in Chile from Regions Metropolitan, VII, IX and XII.

Philonotis nigroflava Müll. Hal.: Collected only a few times in A and N provinces.

These collections fill in a gap in the distribution of this species which has been reported for Regions Metropolitan, V–VII and IX–XII.

Physcomitrium badium Broth. ? : (C 31638), on bare soil along road, Tumbes Peninsula, 36°38'S, 73°05'W, alt. ca. 0–58 m, 16 Sep 2001.

This specimen seems closest to this species but the identification must remain doubtful until it can be compared with the type. It represents a northern extension from Region X where it has been reported only from Llanquihue Province.

Physcomitrium lorentzii Müll. Hal.: (A 33122), in open drainage ditch along road, in town on Mocha I., 38°20'S, 73°53'W, alt. ca. 15 m, 3 Nov 2001.

A southern extension in distribution from Regions Metropolitan (Santiago) and V (Aconagua Prov.).

Plagiothecium ovalifolium Cardot: (B 34132), on base of boulder, Lake Laja National Park, Chacay, trail to Laja River, 37°23'S, 71°24'W, alt. ca. 1120 m, 9 Nov 2002.

A northward extension in distribution for this species from Regions IX, XI and XII. It is also known from the extreme southern part of Argentina (Buck & Ireland 1989).

Pogonatum oligodus (Kunze *ex* Müll. Hal.) Mitt.: Collected in provinces B, C and N.

Earlier reports are from Regions Metropolitan, V and X (all reported as *P. perichaetiale* (Mont.) A. Jaeger subsp. *oligodus* (Kunze *ex* Müll. Hal.) Hyvönen).

Pohlia chilensis (Mont.) A. J. Shaw: Collections were made from numerous localities in all four provinces.

Considering how common this species is in the Bío-Bío Region it has only been previously recorded from Regions Metropolitan and V.

Pohlia nutans (Hedw.) Lindb.: Collected only a few times in A and N provinces.

Otherwise reported from Regions Metropolitan and X–XII.

Polytrichastrum alpinum (Hedw.) G. L. Sm.: (N 31124, 31139), on soil bank and soil over rock outcrop, rivulet by steam baths on Termas de Chillán, 36°54'S, 71°25'W, alt. ca. 1750 m, 11 Dec 2002.

Both collections of this species were sterile and this is may be the reason it has gone undetected this far north from the only two other regions where it has been reported, Regions X and XII.

Polytrichum strictum Menzies *ex* Brid.: (N 30508), on soil bank along road near *Nothofagus* forest with boulders and granitic cliffs, Termas de Chillán & environs, 36°55'S, 71°42'W, alt. ca. 1660 m, 5–7 Dec. 2002; (N 36172), on soil over rock outcrop, small end of Las Truchas Lake, 36°41'S, 71°11'W, alt. ca. 1300 m, 11 Mar 2003.

Reported previously only from the extreme southern part of Chile in Region XII.

Porotrichum lancifrons (Hampe) Mitt.: Collected in all four provinces but it was collected more often in C Province where it appears to be the most common.

Previously reported only in the southern Regions IX–XI.

Racopilum cuspidigerum (Schwägr. *in* Gaudich. *in* Freyc.) Ångstr.:(A 33131), on exposed root of *Peumus boldus*, in forest, Mocha I., trail in National Park, 38°20'S, 75°53'W, alt. ca. 15–350 m, 4 Nov 2001; (A 33795), on rotten tree stump along sandy river bank with few shrubs, Cupaño bridge, 37°36'S, 73°29'W, alt. ca. 39 m, 14 Nov 2001; (C 33923), on soil near river with adjacent native forest, Bellavista Creek, San José Farm, 36°41'S, 72°56'W, alt. ca. 90 m, 23 Nov 2001.

Known previously only south of the Bío-Bío Region in Regions IX–X.

Rhaphidorrhynchium amoenum (Hedw.) M. Fleisch.: Collected in A and C provinces.

Recorded elsewhere only in the extreme south in Region XII.

Sanionia symmetrica (Renauld & Cardot) Wheldon: (N 30648), on base of *Nothofagus*, in forest with boulders and cliffs, Termas de Chillán & environs, 36°55'S, 71°42'W, alt. ca. 1660 m, 5–7 Dec 2002; (N 30813), on base of *Nothofagus*, Renegado R. at Aserradero bridge, 36°54'S, 71°28'W, alt. ca. 1000 m, 9 Dec 2002; (N 36083), on base of *Nothofagus* in forest with rivulet and falls, Las Trancas, Velo de la Novia Falls, 36°54'S, 71°27'W, alt. ca. 1600 m, 12 Feb 2003.

Prior to these three collections this species was reported only from Region XI (as *Drepanocladus uncinatus* var. *symmetricus* (Renauld & Cardot) Grout by He 1998).

Sanionia uncinata (Hedw.) Loeske: Collected in several localities in B and N provinces.

Reported only south of the Bío-Bío Region from Regions IX–XII (as *Drepanocladus uncinatus* (Hedw.) Warnst. by He 1998).

Schistidium falcatum (Hook.f. & Wilson) B. Bremer: (B 34179), on cliff with waterfall beside river, along Bío-Bío River close to Hosteria Doña Pola, 37°46'S, 71°43'W, alt. ca. 350 m, 11 Nov 2002; (N 35817), on boulder by river, Diguillín River at Los Cipreses Farm, 36°57'S, 71°32'W, alt. ca. 970 m, 12 Dec 2002.

Previously known from only two regions: Region VII (Müller & Pereira 2006) to the north and in the south, Region X.

Sematophyllum scorpiurus (Mont.) Mitt.: (A 31190), on exposed tree root, 11 km S of Contulmo, 38°01'S, 73°15'W, alt. ca. 100 m, 19 Sep 2001.

A northward range extension in the distribution of this species from Regions X–XII (as *Rhaphidorrhynchium scorpiurus* (Mont.) Broth. by He 1998).

Sphagnum fimbriatum Wilson *in* Hook.: (A 33011), in water in bog, Tres Pinos, 37°41'S, 73°07'W, alt. ca. 1240 m, 29 Oct 2001; (A 33049), on wet soil under shrubs in meadow surrounded by *Nothofagus* forest, road from Curanilahue to Trongol, 29 km SE of Curanilahue, 37°36'S, 73°09'W, alt. ca. 750 m, 30 Oct. 2001.

Previous collections were reported only from the south in Regions X–XII.

Sphagnum magellanicum Brid.: Collected in three localities in A Province.
An extension northward for this species from Regions IX–XII where it is much more common.

Symblepharis krausei (Lorentz) Ochyra & Matteri: (A 32930, 32936), on boulder in water, Las Corrientes, 9 km E of Hwy. P-60-R, alt. ca. 90 m, 28 Oct 2001; (A 32972), on rock in river, San Alfonso Farm, 37°42'S, 73°09'W, alt. ca. 770 m, 29 Oct 2001.
Previously known in Region VII (Müller & Pereira 2006) and in the south from Regions X–XI (reported as *Anisothecium krausei* Lorentz by He 1998).

Syntrichia epilosa (Broth. *ex* Dusén) R. H. Zander: Collected in A, C. and N provinces.
An extension southward for this species from Regions Metropolitan and V.

Syntrichia papillosa (Wilson *in* Spruce) Jur.: Collected in A and C provinces and often mixed with *S. laevipila* Brid.
Otherwise recorded only from Regions V and XII.

Syntrichia scabrella (Dusén) R. H. Zander: Collected in C and N provinces.
Known from only one other region to the north of the Bío-Bío, Region VI.

Thamnobryum fasciculatum (Sw. *ex* Hedw.) I. Sastre *in* I. Sastre & W. R. Buck: Collected in all four provinces where it was found several times except in N where it was found in only one locality.
An extension northward from Region X (reported as *Porotrichum fasciculatum* (Sw. *ex* Hedw.) Mitt. by He 1998). Also reported for the Juan Fernández Is.

Thuidiopsis furfurosa (Hook. & Wilson) M. Fleisch.: (A 31233, 31235), on humus on ground and base of dead tree, Reserva Forestal Contulmo, 38°01'S, 73°12'W, alt. ca. 400 m, 22 Sep 2001.
A range extension northward where it was known from Regions IX–XII (reported as *Thuidium furfurosum* (Hook. f. & Wilson) A. Jaeger by He 1998). Also in the Juan Fernández Is.

Tortella tortuosa (Hedw.) Limpr.: (B 35064), on rock outcrop near river with *Quillaja saponaria* trees nearby, Valley of Rucué R., 37°23'S, 71°40'W, alt. 640 m, 6 Nov 2002; (B 35241), on soil bank along road with adjacent native forest, Ecological Reserve Coligual, 37°23'S, 71°40'W, alt. 630 m, 21 Nov 2002.
Otherwise known from Regions Metropolitan and X–XII.

Tortula platyphylla Mitt.: (C 30362), on clay bank, Río Lía, Santa Juana, 37°11'S, 73°00'W, alt. ca. 220 m, 14 Sep 2001.
Known elsewhere in Regions Metropolitan, VI and X.

Tortula polycarpa Dusén: Collected several times in Province C and once in N.
A northward extension in range from Regions XI and XII.

Triquetrella patagonica Müll. Hal.: Collected in numerous localities in all four provinces.
Reported for Regions V and IX.

Ulota macrodontia Dusén *ex* Malta: (A 33040), on trunk of *Nothofagus* sp. in *Nothofagus* spp. forest, road from Curanilahue to Trongol, 29 km SE of Curanilahue, 37°36'S, 73°09'W, alt. ca. 750 m, 30 Oct 2001; (N 30649, 30658, 30673), on trunk and at base of *Nothofagus*, also on fallen tree trunk in *Nothofagus* forest with boulders and granitic cliffs, Termas de Chillán & environs, 36°55'S, 71°42'W, alt. 1660 m, 5–7 Dec 2002; (N 30862), on trunk of small *Nothofagus*, Shangrila, road to ruins of old German hotel, 36°52'S, 71°30'W, alt. 1500 m, 9 Dec 2002.
A northern extension of this species from Regions IX–XI.

Ulota rufula (Mitt.) A. Jaeger: Collected several times in A and N provinces.
The northern extension of this species is similar to the previous species since it was known from Regions IX–XI, but it is also known from the Juan Fernández Is.

Warnstorfia exannulata (Schimp. *in* B.S.G.) Loeske: (A 32992, 32994, 33003), in water and among grass in bog, Tres Pinos, 37°41'S, 73°07'W, alt. 1240 m, 29 Oct 2001.
Known from Regions Metropolitan and X–XII (reported as *Drepanocladus exannulatus* (Schimp. *in* B.S.G.) Warnst. by He 1998).

Weissia controversa Hedw.: A common species collected several times in all four provinces.
Known previously from Region XII and the Juan Fernández Is.

Weymouthia cochlearifolia (Schwägr.) Dixon: Collected only in four localities in A Province.
Reported from Regions X and XI (as *W. cochlearifolia* var. *billardieri* (Hampe) Dixon by He (1998), which we consider a synonym of var. *cochlearifolia*).

Weymouthia mollis (Hedw.) Broth.: Collected in five localities in A Province.

Prior to these collections the species was known both north and south of the Bío-Bío Region in Regions IV, IX–XII and the Juan Fernández Is.

Discussion

As a result of collecting by R. R. Ireland and G. Bellolio in the Bío-Bío Region (107 taxa), and the reports of two new *Fissidens* for the region (*F. maschalanthus* Mont. and *F. oblongifolius* Hook.f. & Wilson) by Müller & Pursell (2003), two *Lepyrodon* species new for the region (*L patagonicus* (Card. & Broth.) Allen and *L. parvulus* Mitt.) reported by Allen (1999), *Zygodon hookeri* Hampe var. *leptobolax* (Müll. Hal.) Calabrese reported for the region by Calabrese (2003), the reduction of two species (*Hygroamblystegium fuegianum* (Besch.) Reim. and *Pseudoleskea chilensis* (Lor.) Ochyra), and one variety (*Hygroamblystegium fuegianum* var. *skottsbergii* (Card.) Bartr. in Roiv.), after the creation of the very variable taxon *Orthotheciella varia* (Hedw.) Ochyra by Ochyra & Matteri 2001 (for *Amblystegium varium* (Hedw.) Lindb.), and the description of the new species, *Racomitrium patagonicum* by Bednarek-Ochyra & Ochyra (2003), the number of moss taxa in the region thus far has been increased from 190 taxa listed by He (1998) to 300. This number is certain to increase even more when the remainder of the collections have been identified. As He (1998) stated the "moss flora of Chile is characteristically south temperate and differs notably from that of nearby neotropical countries where tropical and subtropical elements predominate." The south temperate moss flora is particularly prevalent in the Bío-Bío Region, named for the Bío-Bío River that flows into the Pacific Ocean just south of the city of Concepción at approximately 36°S, 73°W.

A total of 20 taxa were found in our study which are new for Chile. Recent additions to the bryological flora of Chile are as follows: Frey & Schaumann (2002) reported *Brachythecium cavifolium* Herzog; several new species were reported by Cano from northern Chile (2003), including *Aloinella andina* Delgad., *Coscinodontella bryanii* R.S. Williams, *Didymodon acutus* (Brid.) K. Saito, *Erythrophyllopsis fuscula* (Müll. Hal.) Hilp., *Fissidens excurrentinervis* R.S. Williams, *Grimmia molesta* J. Muñoz, *Grimmia pseudoanodon* Deguchi, *Jaffueliobryum williamsii* (Deguchi) Delgad., *Leptopterigynandrum austro-alpinum* Müll. Hal., *Pseudocrossidium elatum* (R.S. Williams) Delgad., *Rhexophyllum subnigrum* (Mitt.) Hilp., *Saitobryum lorentzii* (Müll. Hal.) Ochyra and *Syntrichia fragilis* (Taylor) Ochyra); *Fissidens pascuanus* Broth., and *F. pellucidus* Hornsch. were reported by Müller & Pursell (2003); *Racomitrium patagonicum* Bednarek.-Ochyra & Ochyra was newly described by Bednarek-Ochyra & Ochyra (2003); *Zygodon chilensis* Calabrese & F. Lara was described by Calabrese *et al.* (2006); *Campylopus acuminatus* Mitt. var. *kirkii* (Mitt.) Frahm was reported by Frahm (2005); and the most recent addition to the flora is *Ptychomitrium chimborazense* (Spruce ex Mitt.) A. Jaeger by Cao *et al.* (2006). Besides these additions, there are a number of recent deletions, synonymizations and new combinations of several taxa by the following bryologists: Ochyra (1999a) synonymized *Dicranella patagonica* (Müll. Hal.) Broth. with *Anisothecium hookeri* (Müll. Hal.) Broth., *Ditrichum austrogeorgicum* (Card.) Seppelt with *D. hyalinum* (1999b), *D. conicum* var. *glaciale* Card. & Broth. with *D. conicum* (Mont.) Mitt. and *D. homomallum* (Hedw.) Hampe var. *leptocladum* Card. & Broth. with *D. heteromallum* (Hedw.) E.G. Britton (1999c); Ochyra and Matteri (2001) reported a new combination previously mentioned for the Bío-Bío Region, *Orthotheciella varia* (Hedw.) Ochyra for *Amblystegium varium* (Hedw.) Lindb., and included within it *Hygroamblystegium filum* (Müll. Hal.) Reim. and its var. *compactum* Bartr., *H. fuegianum* (Besch.) Reim., including its varieties *skottsbergii* (Card.) Bartr. in Roiv., *excurrens* (Card. & Broth.) Bartr., *gracilis* (Card. & Broth.) Gartr., *secundum* Bartr., *H. luridum* (Card.) Reim., *H. tenellum* (Card. & Broth.) Reim. and *Pseudoleskea chilensis* (Lor.) Ochyra; *Fissidens osmundioides* Hedw. was deleted by Müller and Pursell (2003); Calabrese (2003) deleted several Zygodon taxa, namely *Z. corralensis* Lor., *Z. inermis* Malta, *Z. gracillimus* Broth. ex Fleisch., *Z. porteri* Thér. and its var. *crispatus* Thér., *Z. theriotii* Herz. in Herz. & Hosseus and *Z. reinwardtii* (Hornsch.) Braun var. *hyadesii* (Besch.) Malta; Frahm (2005) deleted six species of *Campylopus* , *C. aerodictyon* (Müll. Hal.) Mitt., *C. asperifolius* Mitt., *C. flavissimus* (Müll. Hal.) Besch., *C. hamatus* Bartr. in Roiv., *C. morenoi* Müll. Hal. and *C. richardii* Brid.; Jiménez *et al.* (2005) synonomized *Tortula geniculata* Mont. (as *Barbula geniculata* (Mont.) Müll. Hal.) with *Didymodon australasiae* (Hook. & Grev.) R. H. Zander; and lastly Jiménez & Cano (2006) made one new synonym and one new combination, namely *Didymodon fuscus* (Müll. Hal.) Jiménez & Cano (for *Barbula fuscoviridis* Broth. ex Thér.) and *Didymodon santessonii* (E. B. Bartram) Jiménez & Cano (for *Barbula santessonii* E.B. Bartram). With all the recent reports and deletions the total number of moss taxa for the country is now 877. Among the 20 new Chilean taxa by Ireland and Bellolio are four that are new to South America: *Barbula convoluta* Hedw., *Campylostelium saxicola* (F. Weber & D. Mohr) Bruch & Schimp. *in* B.S.G., *Sphagnum recurvum* var. *brevifolium* (Lindb. *ex* Braithw.) Warnst. and *Tortula truncata* (Hedw.) Mitt. Most of the others were known from several other South American countries, with the exception of three that were known only from Argentina, namely *Bryum revolutum* Müll. Hal., *Platyneuron praelatum* (Mitt.) Ochyra & Bednarek-Ochyra and *Pseudotaxiphyllum elegans* (Brid.) Z.

Iwats. There were 87 taxa new to the Bío-Bío Region, with 41 of these taxa representing northern range extensions from the regions farther to the south. A much smaller number of 10 were previously known only from northern regions, thereby making the Bío-Bío Region the farthest south that the taxa are known. The remainder of the taxa new to the Bío-Bío Region, i.e. 36, fill in the gap in distribution between the northern and southern parts of Chile (after the contributions to VII Region moss flora by Pereira *et al*. (2006) and Müller & Pereira (2006)).

With many problematic specimens remaining to be identified, some of which may represent new species, the number of taxa in Chile will likely increase to equal many of the other South American countries.

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