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The biodiversity of myxomycetes in central Chile

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Abstract The results obtained from two expeditions to survey the biodiversity of myxomycetes in Central Chile are reported in this paper. The surveys were carried out as part of Global Biodiversity of Eumycetozoans project funded by the National Science Foundation (USA) and the Myxotropic project funded by the Spanish Government. The expeditions were made to the temperate zone of the central part of the country between 23° and 39° South latitudes, which is characterized by Mediterranean vegetation, as well as to the transition areas between the arid and semi-arid regions of northern Chile, and the humid, cold Valdivian and Andean-Patagonian forests of the far South. Eight of the fifteen regions of the country, from Antofagasta to Araucanía, in selected areas where the native vegetation is well preserved, were included in these surveys. Over 600 collections were obtained, and a total of 110 species of myxomycetes representing 29 genera have been identified. Two of these (*Dianema succulenticola, Didymium chilense*) are species new to science and are described in this paper, 12 species (*Collaria nigricapillitia, Comatricha alta, Cribraria oregana, Dianema depressum, Didymium eximium, D. nivicolum, Enerthenema melanospermum, Lepidoderma chailletii, Macbrideola ovoidea, Physarum clavisporum, Ph. newtonii* and *Trichia alpina*) were previously unknown for either the Neotropics or South America, and 49 additional species are new records for Chile. Comments are provided on the morphology, distribution and ecology of selected species and light and SEM micrographs of the most significant species are included. An evaluation of the biodiversity of myxomycetes in Chile, with special emphasis on the endemic plants that provided the substrates with which they were associated, and a comparative analysis of our results with those from other countries of South America is presented.

Keywords Amoebozoa · Distribution · Endemic plants · Mediterranean vegetation · Myxogastria · Plasmodial slime moulds

Introduction

The myxomycetes, also sometimes referred to as myxogastrids or plasmodial slime moulds, are a group of eukaryotic microorganisms, with an important ecological role in terrestrial ecosystems (Stephenson et al. 2007; Foissner and Hawksworth 2009). Myxomycetes feed on bacteria along with yeasts and other fungi associated with decomposing plant tissues, and they exert a major control on populations of these other organisms. Chile is a country characterized by a rich and varied biodiversity with respect to the different vegetation types present, which range from the desert of Atacama in the North to the subantarctic forests in the South, but many ecosystems are understudied for myxomycetes and large areas of the country are unexplored. To address this lack of information, the National Science Foundation (NSF), through the

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program Planetary Biodiversity Inventories (http://slimemold.uark.edu), and the Spanish Government through the Myxotropic Project (www.myxotropic.org), have supported several expeditions to this rich and varied biogeographical region, with the objective of obtaining a body of information on the distribution and ecology of the myxomycetes from this part of the world. The results of the first expedition, to the Atacama Desert in the North of Chile, were published by Lado et al. (2007). In the project described in this paper, the area between the Atacama Desert and the Valdivian forest was studied. The interesting features of Chile, as noted in Lado et al. (2007), are that the country represents a linear series of different vegetation types that extend for more than 5,000 km along the Pacific coast, from 18° south latitude, crossing the Tropic of Capricorn, to 56° south latitude, with an elevational gradient from sea level to 6,000 m. The vegetation in this part of the world changes from the tropical desert zones of the northern part of Chile, on the border with Peru, through the Mediterranean type of woodlands of the central part of the country, to the Valdivian and subantarctic forests (*Nothofagus* spp.) in southern Chile. This zonation provides an opportunity to sample the myxobiota of many of the vegetation types found throughout South America within a single country.

The limited amount of information previously available on the myxomycetes of Chile, was discussed by Lado et al. (2007) and Lado and Wrigley de Basanta (2008). Lazo (1966) published the first catalogue of myxomycetes, with 77 species from the country, but this figure has been increased to the 102 species known prior to the present contribution (Lado and Wrigley de Basanta 2008), and in addition includes three newly described species from this region of South America (Wrigley de Basanta et al. 2009, 2010a, 2011).

Study area

The area considered in the survey described here was the central part of Chile, between latitudes 23° S and 39° S (Fig. 1), including the regions of Antofagasta, Atacama, Coquimbo, Valparaiso, Libertador General Bernardo O'Higgins, Maule, Biobío, Araucanía and the Santiago Metropolitan region. This area is a transitional zone included in the Mediterranean woodlands ecoregion of Chile (Olson et al. 2001) and has a large number of endemic plants (nearly 1,500 species), both in the forests and shrublands (Chilean Chaparral), and some of these are similar to plants found in other Mediterranean regions of the world.

According to Luebert and Pliscoff (2006), this transitional zone is dominated by sclerophyll forest, with *Cryptocarya alba*, *Peumus boldus, Quillaja saponaria, Lithrea caustica, Dasyphyllum* sp., *Schinus latifolius*, *Maytenus boaria* or *Drymis winteri*, but the endemic palm (*Jubaea chilensis*) and some thorny scrubs with cacti (*Eulychnia* sp. or *Echinopsis chiloensis)* and xerophytic spiny scrubland dominated by *Puya* spp. are also present in the most arid areas. In the South, contact is made with austral forests dominated by *Nothofagus* spp. and *Araucaria araucana* (Figs. 2–10). From West to East, the vegetation is distributed over a narrow strip of land between the Pacific Ocean and the Andean Mountains that, as noted earlier, rises from sea level to an elevation of more than 6,000 m over a distance of less than 200 km This considerable gradient results in an elevational zonation of vegetation, from the arid and Mediterranean coastal scrub to the Andean puna. This mosaic of different plant communities provides numerous microhabitats for myxomycetes.

A Mediterranean climate dominates the study area, with dry summers and rainy winters, but climatic conditions change with latitude and elevation. The mean temperature is normally between 12 and 17°C (see Table 1) except for areas in the Andes, where the elevation causes negative values in areas such as Cristo Redentor (mean temperature is −1.4°C at 3,850 m), which is located at the same latitude as Valparaiso (mean temperature 14.4°C at 351 m) on the coast. Mean annual precipitation is from 78 to 115 mm in the North and increases toward the South where it can reach 2,000 mm. In the Andes, the precipitation amounts are higher when compared to other places located at lower elevations but at the same latitude, (see Cristo Redentor, Table 1), but practically all of it occurs in the form of snow due to the elevation, making water unavailable to organisms for much of the year (Luebert and Pliscoff 2006)

Since the central part of Chile is the most densely populated, in order to avoid possible anthropogenic effects on the substrates available for myxomycetes, our research was concentrated in the National Parks (NP) and National Reserves (NR) of the region, where the native vegetation is well preserved. We sampled in Las Chinchillas NR, Lago Peñuelas NR, La Campana NP, Yerba Loca Sanctuary, Los Cipreses NR, Nahuelbuta NP, Malleco NR, Tolhuaca NP, Nalcas RN, Malalcahuello NR, Conguillio Los Paraguas NP, Alto Biobío NR, Lago Galletue NR, Villarrica NR and Villarrica NP and adjacent areas.

Material and methods

Field work was carried out over two years in the 108 localities listed in Table 2. This included a period of three weeks in March and April of 2006 and one week in February of 2008. Both visits took place during a relatively humid period that corresponds with the end of summer and the autumn in boreal latitudes. Geographical data, geo-references, as well as vegetation type are given in Table 2. For the geo-references a GPS model Magellan 600 (datum

Fig 1 Map of the general study area and localities actually sampled

WGS84) and a Garmin eTrex Vista HCX (datum WGS84) were used. All potential substrates for myxomycetes were examined in the field, and samples of plant litter or bark were removed, placed in small paper bags and returned to the laboratory for preparation of moist chamber cultures for laboratory isolation of myxomycetes. The substrates examined can be classified as endemic trees, such as the palm *Jubaea chilensis* (Fig. 5) and the sclerophyll trees *Quillaja saponaria, Maytenus boaria* or *Drymis winteri* (Fig. 6). Also, samples were collected from some endemic cacti, including such examples as *Copiapoa cinerascens, C. solaris*, *Miqueliopuntia miquelii, Cumulopuntia* sp. and *Eulychnia acida* (Figs. 2–3). In addition, samples of the rosette-leaved plant *Puya* spp. (Fig. 4), an Andean scrub (Compositae, Rosaceae) (Fig. 9), and various Andean grassland plants (Fig. 10), were collected.

Descriptions of the sampling methods and the technique used in the preparation of moist chamber (mc) cultures of myxomycetes can be found in Wrigley de Basanta et al. (2009). The observation period for cultures extended up to three months. The type of substrate and the pH of each moist chamber culture (determined at 24 h) were recorded in each instance and these data are provided in the annotated species list that follows.

A species recorded from one moist chamber culture was regarded as a single collection, irrespective of the number of sporophores appearing or the days separating their appearance, as described by Lado et al. (2003). All numbers cited herein (for field or moist chamber collections) refer to specimens deposited in the herbarium MA-Fungi (sub Lado), the mycological herbarium of the University of Arkansas (UARKM sub sls), or the private collection of Diana Wrigley de Basanta (dwb), with some duplicates in TLXM (sub aet). All microscopic measurements and observations were made with material mounted directly in Hoyer's medium and polyvinyl alcohol. Differential interference contrast (DIC) microscopy was used to obtain descriptive data. The light photomicrographs were obtained using a Nikon AZ100 microscope. Some specimens were examined at 10–15 kV, with a Hitachi S-3000 N scanning electron microscope (SEM), in the Real Jardín Botánico, CSIC. For all SEM-photographs the critical point dried material technique was employed. Colour notations in parenthesis are from the ISCC-NBS Color Name Charts Illustrated with Centroid Colors (Anonymous 1976).

Taxonomic diversity was calculated as the mean number of species per genus (S/G), which has been used in other studies of myxomycetes (Stephenson et al. 1993).

To measure the complementarity of the assemblages of myxomycetes among the regions of Chile sampled and other regions of America, the formula proposed by Colwell and Coddington (1994) was used: $C_{jk} = U_{jk}/S_{jk}$ where $U_{jk} = S_j + S_k - 2V_{jk}$ and $S_{jk} = S_j + S_k - V_{jk}$ where U_{jk} is the number of species unique to one area, S_{jk} is the total species richness for both areas, S_j is the number of species from the first site, S_k is that of the second and V_{jk} is the number of species shared by both sites.

The completeness of the sampling effort was evaluated using the ACE and CHAO1 abundance indices (Colwell and Coddington 1994; Colwell et al. 2004) and the accumulation curve adjusted according to Clench where $S_n=(a*n)/[1+(b*n)]$ where S_n is the number of species accumulated for a unit of collecting effort (n) (Jiménez-Valverde and Hortal 2003). Each collecting site was considered as the unit of collecting effort, using the total number of species found with the programme EstimateS v 7.5.2 (http://viceroy.eeb.uconn.edu/estimates). The adjustment according to Clench was carried out with the programme Statistica v 10, using the Simplex and Quasi-Newton method of adjustment (Jiménez-Valverde and Hortal 2003).

Results

As a result of this survey, 633 collections of myxomycetes that had developed in the field under natural conditions or appeared in moist chamber cultures were obtained. In total, 110 taxa representing 29 genera of myxomycetes were identified.

Fig. 2–10 Xerophytic scrubland with *Copiapoa* sp. in Paposo. **3** Spiny scrublands with *Eulychnia* sp. in the Elqui Valley area. **4** Xerophytic spiny scrubland with *Puya* spp. **5** The palm *Jubaea chilensis* in La Campana National Park. **6** Sclerophyll forest. **7** *Nothofagus* sp. forest in Villarrica National Park. **8** *Araucaria araucana* forest in the Villarrica National Park. **9** Andean scrubland (*Acaena* sp.). **10** Andean grassland ▶

Annotated list of species

In the list that follows, the myxomycetes are arranged alphabetically by genus and then species. Information is provided on the source of each record (either a field collection or a collection obtained from a moist chamber [mc] culture), the pH of the culture in which the specimen appeared, the substrate upon which it was collected or cultured and the locality from which the specimen itself or the sample of dead plant material used to prepare the moist chamber culture was collected. Additional comments are included for records of particular interest or species that are new to Chile. Nomenclature follows Lado (2005–2011). The abbreviation 'cf.' in the name of a taxon indicates that the specimen representing the source of the record could not be identified with certainty. This usually indicates scanty or aberrant material. Unless otherwise stated, comments on distribution of the species in South America are based on Lado and Wrigley de Basanta (2008). The species marked with an asterisk (*) are new records for Chile.

Arcyria affinis Rostaf.

CHI-06-56: *Puya chilensis* leaf, MA-Fungi 80731.

In South America, this species has been previously reported only from Ecuador.

Arcyria afroalpina Rammeloo Figs. 11–14.

CHI-06-55: inflorescence of *Puya chilensis,* (mc, pH 6.3), dwb 2892; (mc, pH 6.6), dwb 2890.

This species, described originally from the Karisimbi volcano (Rwanda), at 3,400 m on decayed leaves of *Dendrosenecio* (Rammeloo 1981), has been found near to the Pacific ocean at 33 m in a moist chamber culture of inflorescences of *Puya chilensis*. The species was also collected in cultures and in the field on plants of the same genus *Puya* in the North of Argentina (Lado et al. 2011). The most significant features of this rare species are its scattered habit, the evanescent peridium remaining at the base as a flat calyculus (Fig. 11), the yellowish colour of the sporotheca, and the internal surface of the calyculus, that is almost smooth by LM but with a thin reticulum by SEM (Fig. 12). The slender capillitial threads are up to 3 µm diam (Fig. 13), and the large spores, 10–12 µm diam have the typical ornamentation of the genus (Fig. 14). Apart from Argentina, in South America the species also has been reported previously from Ecuador.


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Table 1 Climatic parameters of some localities in Central Chile (North to South). [source [1]http://www.atmosfera.cl/HTML/climatologia/DATOS/CHILENORTE.HTM [2]Luebert and Pliscoff (2006)]

Locality	Latitude S	Longitude W	Elevation	Mean t°	Precipitation
[1]Antofagasta (Cerro Moreno)	23°26′	70°26′	135 m	16.4°C	2 mm
[1]Copiapo (Chamonate)	27°18′	70°25′	291 m	15.2°C	12 mm
[1]Vallenar (aerodromo)	28°35′	70°46′	469 m	14.9°C	32 mm
[2]La Serena	29°54′	71°15′	169 m	14.9°C	78 mm
[2]Embalse La Paloma	30°41′	71°02′	430 m	17.0°C	115 mm
[2]Illapel	31°38′	71°11′	290 m	16.0°C	170 mm
[2]La Ligua	32°27′	71°16′	58 m	14.4°C	342 mm
[2]Cristo Redentor	32°50′	70°37′	3,850 m	−1.4°C	902 mm
[2]Valparaiso	33°02′	71°38′	41 m	14.4°C	351 mm
[2]Rengo	34°24′	70°52′	319 m	13.7°C	582 mm
[2]Talca	35°26′	71°40′	400 m	14.7°C	737 mm
[2]Chillán	36°26′	72°06′	144 m	14.1°C	1,025 mm
[2]Angol	37°47′	72°42′	77 m	13.3°C	1,055 mm
[2]Lonquimay	38°26′	71°15′	900 m	8.4°C	1,851 mm
[2]Lancoche	39°33′	72°38′	115 m	12.5°C	2,139 mm

Arcyria cinerea (Bull.) Pers.

CHI-06-48: *Eucalyptus* sp. bark, (mc, pH 6.6), dwb 2881. CHI-06-52: mixed ground litter, (mc, pH 5.3), sls 22809. CHI-06-54: Ground litter, (mc, pH 5.8), sls 22795. CHI-08-31: Dead leaf bases of *Puya* sp. (mc, pH 5.8), dwb 3218.

Arcyria denudata (L.) Wettst.

CHI-06-52: *Puya chilensis* leaf, MA-Fungi 80670. CHI-06-53: *Jubaea chilensis* leaf base, MA-Fungi 80677, 80705, 80709.

Arcyria incarnata (Pers. ex J.F.Gmel.) Pers.

CHI-06-04: wood, MA-Fungi 80455. CHI-06-43: *Nothofagus* sp. wood, MA-Fungi 80619.

Arcyria obvelata (Oeder) Onsberg

CHI-06-18: *Nothofagus* sp. wood, MA-Fungi 80518. CHI-06-24: *Nothofagus dombeyi* wood, MA-Fungi 80547. CHI-06-51: wood, MA-Fungi 80654. CHI-06-53: wood, MA-Fungi 80688.

Arcyria pomiformis (Leers) Rostaf.

CHI-06-53: wood, MA-Fungi 80691.

Badhamia* cf. *capsulifera (Bull.) Berk.

CHI-06-11: stem of a Compositae, MA-Fungi 88234.

Only one collection was obtained. It that was not well developed, which did not allow the identity of the species to be confirmed. The material has an apparently double peridium due to a fragmented calcareous layer, the capillitium is strongly calcified in some sporocarps but limeless and hyaline in others, the spores are turbinate, 12–14×11–13 µm with a cap of dense warts or spines on the outside, and adhered in large clusters of up to 40 spores per cluster.

Badhamia* cf. *macrocarpa (Ces.) Rostaf.

CHI-08-31: decayed *Eulychnia* sp., MA-Fungi 80835. CHI-08-34: *Miqueliopuntia miquelii* epidermis, (mc, pH 6.9), dwb 3115; (mc, pH 7.1), dwb 3104; (mc, pH 7.3), dwb 3117. CHI-08-35: decayed *Copiapoa coquimbana*, MA-Fungi 80861. CHI-08-39: decayed *Eulychnia acida*, MA-Fungi 80859.

We have included several collections found on different succulent plants in this taxon. The specimens have polygonal spores, like those of *B. melanospora,* but differ in that the spores are paler and somewhat smaller (up to 13 µm diam.), and thus conform to the description of the remains of the type of *B. macrocarpa* by Farr (1976:186).

Badhamia melanospora Speg.

CHI-06-01 decayed *Echinopsis* sp., MA-Fungi 80411. CHI-06-02: decayed *Echinopsis* sp. internal tissue and epidermis, MA-Fungi 88213, 88272, 88214, 88215, 80420, 80421, 80422, 80423. CHI-06-03: decayed *Echinopsis* sp. internal tissue and epidermis, MA-Fungi 88216, 88217, 88218. CHI-06-04: decayed *Echinopsis* sp., MA-Fungi 80444; mixed aerial litter, (mc, pH 5.5), sls 22806. CHI-06-05: decayed *Echinopsis* sp., MA-Fungi 80457, 80458. CHI-06-06: decayed *Echinopsis* sp., MA-Fungi 80467. CHI-06-54: decayed *Echinopsis chiloensis*, MA-Fungi 80716, 80717. CHI-06-55: decayed *Echinopsis chiloensis*, MA-Fungi 80724. CHI-06-57: decayed *Eulychnia* sp., MA-Fungi 80734, 80736, 80741. CHI-06-58: decayed *Eulychnia* sp., MA-Fungi 80746, 80747, 80748, 80749, 80750, 80751, 80752. CHI-06-59: decayed *Eulychnia* sp., MA-Fungi 80755, 80756, 80759, 80760. CHI-06-61: decayed *Eulychnia* sp. MA-Fungi 80768. CHI-06-62: decayed *Eulychnia* sp., MA-Fungi 80772, 80773. CHI-06-63: decayed *Eulychnia* sp., MA-Fungi 80775; epidermis and spines of *Eulychnia* sp., MA-Fungi 80776; decayed *Eulychnia* sp., MA-Fungi 80777, 80778. CHI-06-66: decayed *Eulychnia* sp., MA-Fungi 80780, 80782, 80783. CHI-06-67: decayed *Eulychnia* sp., MA-Fungi 80785, 80786, 80787, 80788. CHI-06-68: decayed *Echinopsis* sp., MA-Fungi 80789,

Table 2 Summary data on collecting localities in Central Chile

CHI-06-01: Libertador General Bernado O´Higgins Region (VI), Cachapoal, Machalí, Coya, termas de Cauquenes, 34°16′01″S 70°34′19″W, 780±8 m, degraded Mediterranean woodland with cacti and sclerophyllous trees, 18-III-2006. **CHI-06-02:** Libertador General Bernado O´Higgins Region (VI), Cachapoal, Machalí, Coya, Los Cipreses NR, entrance to the Reserve, 34°15′16″S 70°28′25″W, 932±7 m, spiny scrubland with *Echinopsis* sp. and *Acacia caven,* 19-III-2006. **CHI-06-03:** Libertador General Bernado O´Higgins Region (VI), Cachapoal, Machalí, Puente Chacayes, 34°14′10″S 70°28′54″W, 860±4 m, spiny scrubland with *Echinopsis* sp. and *Acacia caven*,19-III-2006. **CHI-06-04:** Libertador General Bernado O´Higgins Region (VI), Cachapoal, Machalí, Coya, 2 km from Club de Campo Coya, 34°12′18″S 70°32′59″W, 940±6 m, sclerophyllous forest with *Echinopsis* sp. and *Acacia caven*,19-III-2006. **CHI-06-05:** Santiago Metropolitan Region (RM), Cordillera, San José de Maipo, El Alfalfal, route G-25, Km 22, 33°30′48″S 70°12′18″W, 1317±4 m, degraded sclerophyllous forest with *Quillaja saponaria, Maytenus boaria* and *Echinopsis* sp., 20-III-2006. **CHI-06-06:** Santiago Metropolitan Region (RM), Cordillera, San José de Maipo, El Alfalfal, route G-25, Km 21, 33°30′57″S 70°12′50″W, 1305±15 m, sclerophyllous forest with *Quillaja saponaria*, *Maytenus boaria, Echinopsis* and *Puya* sp., 20-III-2006. **CHI-06-07:** Santiago Metropolitan Region (RM), Cordillera, San José de Maipo, cuesta Maiten, route G-25, Km 18, Cuesta Maiten, 33°31′33″S 70°14′03″W, 1304±20 m, sclerophyllous forest with *Quillaja saponaria*, *Maytenus boaria, Echinopsis* sp. and *Puya* sp., 20-III-2006. **CHI-06-08:** Santiago Metropolitan Region (RM), Santiago, Lo Barnechea, El Colorado, 33°20′39″S 70°17′25″W, 2769±7 m, Andean scrubland, 21-III-2006. **CHI-06-09:** Santiago Metropolitan Region (RM), Santiago, Lo Barnechea, La Parva, 33°19′51″S 70°17′31″W, 2733±8 m, Andean scrubland, 21-III-2006. **CHI-06-10:** Santiago Metropolitan Region (RM), Santiago, Lo Barnechea, Valle Nevado, 33°21′28″S 70°15′02″W, 2959±9 m, Andean scrubland, 21-III-2006. **CHI-06-11:** Santiago Metropolitan Region (RM), Santiago, Lo Barnechea, Valle Nevado, 33°21′40″S 70°15′24″W, 2717±6 m, Andean scrubland, 21-III-2006. **CHI-06-12:** Santiago Metropolitan Region (RM), Santiago, Lo Barnechea, road to Valle Nevado Km 3, 33°21′35″S 70°17′43″W, 2352±11 m, Andean scrubland, 21-III-2006. **CHI-06-13:** Santiago Metropolitan Region (RM), Santiago, Lo Barnechea, Santuario de la Naturaleza Yerba Loca, Los Pinos, 33°18′34″S 70°19′22″W, 1972±9 m, open woodland with *Cajenetia angustifolia*, 21-III-2006. **CHI-06-14:** Araucanía Region (IX), Cautín, Curarrehue, Villarrica NP, sector Puesco, Paso Mamuil Malal, km 144, 39°34′51″S 71°28′38″W, 1200±11 m, *Nothofagus antarctica* forest with *Araucaria araucana*, 23-III-2006. **CHI-06-15:** Araucanía Region (IX), Cautín, Curarrehue, Villarrica NP, sector Puesco, Paso Mamuil Malal, km 143, 39°34′33″S 71°29′35″W, 1160±9 m, *Nothofagus antarctica* forest with *Araucaria araucana*, 23-III-2006. **CHI-06-16:** Araucanía Region (IX), Cautín, Curarrehue, Villarrica NP, sector Puesco, lake Quilleihue, 39°33′15″S 71°32′13″W, 1120±16 m, *Nothofagus pumilio* forest with *Chusquea culeou*, 23-III-2006. **CHI-06-17:** Araucanía Region (IX), Cautín, Curarrehue, Villarrica NP, sector Puesco, route Ch-199, km 134, 39°32′33″S 71°33′43″W, 993±30 m, *Nothofagus pumilio* forest with *Chusquea culeou*, 23-III-2006. **CHI-06-18:** Araucanía Region (IX), Cautín, Curarrehue, track to Reigolil, Remeco bridge, 39°17′12″S 71°25′42″W, 559±15 m, disturbed *Nothofagus pumilio* forest with *Salix* sp., *Chusquea culeou*, 23-III-2006. **CHI-06-19:** Araucanía Region (IX), Cautín, Pucón, Caburgua, lake Tinquilco, entrance to Huerquehue NP, 39°10′11″S 71°43′37″W, 780±9 m, *Nothofagus dombeyii* forest with *Luma* sp., 24-III-2006. **CHI-06-20:** Araucanía Region (IX), Cautín, Pucón, Caburgua, Playa Blanca, 39°11′26″S 71°49′01″W, 540±6 m, *Nothofagus dombeyii* forest with *Luma sp*, 24-III-2006. **CHI-06-21:** Araucanía Region (IX), Cautín, Pucón, Villarica NP, Villarrica volcano, above ski station, 39°23′29″S 71°57′36″W, 1421±7 m, Andean scrubland with *Nothofagus antarctica*, 24-III-2006. **CHI-06-22:** Araucanía Region (IX), Cautín, Pucón, Villarica NP, Villarrica volcano, ski station, 39°22′27″S 71°58′14″W, 1169±10 m, Andean scrubland with *Nothofagus antarctica,* 24-III-2006. **CHI-06-23:** Araucanía Region (IX), Malleco, Curacautín, Tolhuaca NP, road to Victoria, km 41.5, 38°14′23″S 71°53′13″W, 918±11 m, mixed forest with *Nothofagus dombeyii, Nothofagus pumilio*, lianas and *Chusquea culeou,* 25-III-2006. **CHI-06-24:** Araucanía Region (IX), Malleco, Curacautín, Tolhuaca NP, road to Victoria, km 46.6, 38°13′23″S 71°50′43″W, 1015±17 m, mixed forest with *Nothofagus dombeyii, Nothofagus pumilio* and *Chusquea culeou*, 25-III-2006. **CHI-06-25:** Araucanía Region (IX), Malleco, Curacautín, Tolhuaca NP, road to Victoria and lake Malleco, km 53.3, 38°13′21″S 71°46′13″W, 939±13 m, mixed forest with *Nothofagus dombeyii, Nothofagus pumilio* and *Chusquea culeou,* 25-III-2006. **CHI-06-26:** Araucanía Region (IX), Malleco, Curacautín, Conguillio NP, sector Los Paraguas, Llaima volcano, above ski station, 38°41′08″S 71°48’01″W, 1550±10 m, Andean grassland, 26-III-2006. **CHI-06-27:** Araucanía Region (IX), Malleco, Curacautín, Conguillio NP, sector Los Paraguas, Llaima volcano, below ski station, 38°40′55″S 71°40′12″W, 1425±8 m, mixed forest with *Araucaria araucana, Nothofagus pumilio* and *Chusquea culeou,* 26-III-2006. **CHI-06-28:** Araucanía Region (IX), Malleco, Curacautín, Conguillio NP, sector Los Paraguas, Llaima volcano, track to ski station, 38°40′47″S 71°48′56″W, 1264±15 m, mixed forest with *Araucaria araucana, Nothofagus pumilio* and *Chusquea culeou*, 26-III-2006. **CHI-06-29:** Araucanía Region (IX), Malleco, Curacautín, Conguillio NP, sector Los Paraguas, Llaima volcano, track from Melipeuco to Cuaracautin, km 94, 38°39′40″S 71°49′04″W, 1167±17 m, *Araucaria araucana* forest with *Nothofagus* sp., 26-III-2006. **CHI-06-30:** Araucanía Region (IX), Malleco, Curacautín, Conguillio NP, sector Captren, lake Conguillio, 38°39′00″S 71°39′22″W, 1234±30 m, *Araucaria araucana* forest with *Nothofagus dombeyii*, 26-III-2006. **CHI-06-31:** Araucanía Region (IX), Malleco, Curacautín, Conguillio NP, Llaima volcano, sector Captren, Laguna Captren, 38°38′31″S 71°42′11″W, 1231±18 m, *Araucaria araucana* forest with *Nothofagus dombeyii*, 26-III-2006. **CHI-06-32:** Araucanía Region (IX), Malleco, Lonquimay, Alto Biobío NR, Paso Pino Hachado, km 175, 38°38′37″S 71°57′14″W, 1609±8 m, *Araucaria araucana* forest with *Nothofagus pumilio,* 27-III-2006. **CHI-06-33:** Araucanía Region (IX), Malleco, Lonquimay, Laguna de Galletue NR, Laguna Galletue, 38°41′40″S 71°16′52″W, 1158±11 m, degraded *Araucaria araucana* forest with *Nothofagus dombeyii,* 27-III-2006. **CHI-06-34:** Araucanía Region (IX), Malleco, Lonquimay, Laguna de Galletue NR, Laguna Galletue, 38°41′29″S 71°19′06″W, 1167±12 m, Grassland, 27-III-2006. **CHI-06-35:** Araucanía Region (IX), Malleco, Lonquimay, Laguna de Galletue NR, Quinquen, 38°40′16″S 71°22′51″W, 1178±12 m, *Araucaria araucana* forest, 27-III-2006. **CHI-06-36:** Araucanía Region (IX), Malleco, Lonquimay, route to Los Arenales ski centre Km 19, 38°25′50″S 71°24′37″W, 1315±8 m, mixed forest with *Araucaria araucana, Nothofagus* sp., 28-III-2006. **CHI-06-37:** Araucanía Region (IX), Malleco, Lonquimay, route to Los Arenales ski centre Km 16.3, 38°25′37″S 71°26′13″W, 1536±7 m, mixed forest with *Araucaria araucana, Nothofagus* sp., 28-III-2006. **CHI-06-38:** Araucanía Region (IX), Malleco, Lonquimay, Malalcahuello-Nalca NR, sector Cayunco, Los Arenales ski centre, 38°25′33″S 71°27′26″W, 1663±7 m, Mixed forest with *Araucaria araucana, Nothofagus* sp., 28-III-2006. **CHI-06-39:** Araucanía Region (IX), Malleco, Lonquimay, Malalcahuello-Nalca NR, Corralco, Los Arenales ski centre, 38°25′00″S 71°32′36″W, 1477±7 m, Andean scrubland, 28-III-2006. **CHI-06-40:** Araucanía Region (IX), Malleco, Lonquimay, Malalcahuello-Nalca NR, Corralco, Lonquimay volcano, 38°25′49″S 71°32′16″W, 1368±9 m, mixed forest with *Araucaria araucana* and *Nothofagus* sp., 28-III-2006. **CHI-06-41:** Araucanía Region (IX), Malleco, Angol, road to Nahuelbuta NP, km 16, 37°47′41″S 72°51′08″W, 623±10 m, mixed forest with *Luma* sp., *Nothofagus* sp., *Chusquea culeou*, 29-III-2006. **CHI-06-42:** Araucanía Region (IX), Malleco, Angol, Nahuelbuta NP, Km 2 from entrance, 37°49′33″S 72°58′00″W, 1133±17 m, *Nothofagus obliqua* forest, 29-III-2006. **CHI-06-43:** Araucanía Region (IX), Malleco, Angol, Nahuelbuta NP, track to Piedra del Águila, km 3.2, 37°49′31″S 72°58′55″W, 1192±18 m, mixed forest of *Nothofafus* sp., 29-III-2006. **CHI-06-44:** Araucanía Region (IX), Malleco, Angol, Nahuelbuta NP, Piedra del Águila, 37°49′21″S 73°02′07″W, 1415±13 m, *Araucaria araucana* forest with *Nothofagus obliqua, Chusquea culeou,* 29-III-2006. **CHI-06-45:** Biobío Region (VIII), Arauco, Cañete, road to Nahuelbuta NP, km 43, 37°48′10″S 73°02′49″W, 1343±16 m, *Nothofagus* sp. forest, 29-III-2006. **CHI-06-46:** Biobío Region (VIII), Arauco, Cañete, road to Nahuelbuta NP, km 34, 37°49′39″S 73°06′45″W, 802±7 m, plantation of pine and Eucalyptus with Puya sp., 29-III-2006. **CHI-06-47:** Valparaiso Region (V), Valparaiso, Peñuelas, Lago Peñuelas NR, sector Patos, 33°09′21″S 71°32′05″W, 341±16 m, plantation of *Mimosa* sp. on edge of artificial lake, 30-III-2006. **CHI-06-48:** Valparaiso Region (V), Valparaiso, Peñuelas, Lago Peñuelas NR, sector Patos, 33°09′19″S 71°32′16″W, 350±10 m, *Eucalyptus-Pinus* plantation on edge of artificial lake, 30-III-2006. **CHI-06-49:** Valparaiso Region (V), Valparaiso, Peñuelas, Lago Peñuelas NR, sector Patos, 33°10′17″S 71°31′01″W, 342±6 m, Grassland on edge of artificial lake, 30-III-2006. **CHI-06-50:** Valparaiso Region (V), Marga Marga, Olmué, La Campana NP, sector Granizo, La Represa trail, 32°58′57″S 71°07′42″W, 407±35 m, sclerophyllous forest, 31-III-2006. **CHI-06-51:** Valparaiso Region (V), Marga Marga, Olmué, La Campana NP, sector Granizo, La Canasta trail, 32°58′48″S 71°07′56″W, 480±8 m, sclerophyllous forest with *Cryptocarya alba*, *Quillaja saponaria, Dasyphyllum* sp. and *Schinus latifolius,* 31-III-2006. **CHI-06-52:** Valparaiso Region (V), Marga Marga, Olmué, La Campana NP, sector Granizo, Mina Nueva trail, 32°58′58″S 71°07′47″W, 508±14 m, xerophyllous scrubland with *Puya chilensis*, 31-III-2006. **CHI-06-53:** Valparaiso Region (V), Quillota, Hijuelas, La Campana NP, sector Palmar de Ocoa, Quillay trail, 32°56′03″S 71°04′35″W, 508±18 m, area dominated by *Jubaea chilensis* and sclerophyllous forest with *Acacia caven,* 2-IV-2006. **CHI-06-54:** Valparaiso Region (V), Quillota, Hijuelas, La Campana NP, sector Palmar de Ocoa, El Peral, 32°56′18″S 71°05′10″W, 508±11 m, area dominated by *Jubaea chilensis* with *Acacia caven, Puya chilensis, Drymis winteri,* 2-IV-2006. **CHI-06-55:** Valparaiso Region (V), Petorca, La Ligua, Los Molles, La Ballena, route Ch-5, km 182.5, 32°15′39″S 71°28′25″W, 22±14 m, coastal scrubland with *Echinopsis chiloensis, Puya chilensis* and *Eryngium paniculatum*, 3-IV-2006. **CHI-06-56:** Coquimbo Region (IV), Choapa, Los Vilos, Totoralillo, route Ch-5, km 210.4, 32°01′50″S 71°30′34″W, 33±12 m, coastal scrubland with *Echinopsis chiloensis, Puya chilensis* and *Eryngium paniculatum*, 3-IV-2006. **CHI-06-57:** Coquimbo Region (IV), Choapa, Illapel, route ChD-85, km 42, 31°40′46″S 71°17′06″W, 230±6 m, spiny scrubland with *Echinopsis chiloensis, Puya chilensis,* 3-IV-2006. **CHI-06-58:** Coquimbo Region (IV), Choapa, Illapel, Las Chinchillas NR, road to Los Pozos, km 2.8, 31°29′55″S 71°06′49″W, 583±8 m, spiny scrubland with *Eulychnia* sp. and *Echinopsis chiloensis*, 4-IV-2006. **CHI-06-59:** Coquimbo Region (IV), Choapa, Illapel, road to Combarbalá, km 3.2, 31°29′17″S 71°05′53″W, 567±8 m, spiny scrubland with *Eulychnia* sp. and *Echinopsis chiloensis*, 4-IV-2006. **CHI-06-60:** Coquimbo Region (IV), Choapa, Salamanca, Cucumén, Los Portones, route ChD-81, km 36.8, 31°53′22″S 70°38′52″W, 1119±10 m, degraded sclerophyllous scrubland with *Quillaja saponaria*, *Acacia caven* and *Populus* sp., 4-IV-2006. **CHI-06-61:** Coquimbo Region (IV), Choapa, Salamanca, Cucumén, route ChD-81, km 34, 31°53′31″S 70°40′24″W, 1003±8 m, spiny scrubland with *Eulychnia* sp., *Puya chilensis* and *Echinopsis chiloensis*, 4-IV-2006. **CHI-06-62:** Coquimbo Region (IV), Elqui, Vicuña, Cerro Mamalluca observatory, 29°59′44″S 70°41′05″W, 1005±5 m, spiny scrubland with *Eulychnia* sp., 5-IV-2006. **CHI-06-63:** Coquimbo Region (IV), Elqui, Vicuña, road to Cerro Mamalluca observatory, 30°00′35″S 70°41′18″W, 870±5 m, spiny scrubland with *Eulychnia* sp., 5-IV-2006. **CHI-06-64:** Coquimbo Region (IV), Elqui, Vicuña, Balada, Puente del Toro, route Ch-41, km 130,2 9°59′114″S 70°14′06″W, 1692±20 m, river bank vegetation surrounded by desert, 6-IV-2006. **CHI-06-65:** Coquimbo Region (IV), Elqui, Vicuña, Balada, Puente del Toro, route Ch-41, km 115, 29°59′114″S 70°14′06″W, 1692±20 m, desert with very dispersed *Acacias,* 6-IV-2006. **CHI-06-66:** Coquimbo Region (IV), Elqui, Vicuña, Totoralillo, Fundo El Algarrobo, route Ch-41, km 88, 29°54′19″S 70°31′32″W, 950±6 m, spiny scrubland with *Eulychnia* sp., 6-IV-2006. **CHI-06-67:** Coquimbo Region (IV), Elqui, Vicuña, Varillar, Las Mercedes, Fundo La Plata, route Ch-41, km 86,29°55′34″S 70°32′06″W, 970±7 m, spiny scrubland with *Eulychnia* sp., 6-IV-2006. **CHI-06-68:** Coquimbo Region (IV), Limarí, Punitaqui, caleta El Teniente, route Ch-5, km 328, 31°03′04″S 71°36′00″W, 450±6 m, spiny scrubland with *Echinopsis chiloensis* and *Puya chilensis,* 7-IV-2006. **CHI-06-69:** Valparaiso Region (V), San Felipe de Aconcagua, Llaillay, Colorado Chico hill, route Ch-5, km 75, 32°52′11″S 70°50′55″W, 628±7 m, disturbed sclerophyllous scrubland with *Echinopsis chiloensis*, *Cryptocarya alba* and *Acacia* sp., 7-IV-2006. **CHI-08-01:** Coquimbo Region (IV), Elqui, La Serena, Cuesta Porotitos, route RN-5, km 477, 29°47′39″S 71°17′38″W, 122±9 m, xerophyllous scrubland with *Puya* sp., *Echinopsis* sp. and *Copiapoa* sp., 14-II-2008. **CHI-08-02:** Atacama Region (III), Huasco, track to La Campana observatory, km 7.5, 29°06′32″S 70°46′28″W, 1335±8 m, xerophyllous scrubland with *Atriplex* sp., 14-II-2008. **CHI-08-03:** Atacama Region (III), Huasco, Vallenar, route RN-5, km 678, 28°27′23″S 70°43′24″W, 641±6 m, xerophyllous scrubland with *Eulychnia* sp. and *Cumulopuntia spherica*, 14-II-2008. **CHI-08-04:** Atacama Region (III), Copiapó, route RN-5, km 770, 27°39′49″S 70°28′24″W, 640±6 m, xerophyllous scrubland with *Eulychnia* sp., 14-II-2008. **CHI-08-05:** Atacama Region (III), Copiapó, RN-31 to Paso de San Francisco, km 73, 27°07′04″S 69°45′17″W, 1529±9 m, isolated *Prosopis* sp. trees, 15-II-2008. **CHI-08-06:** Atacama Region (III), Copiapó, RN-31 to Paso de San Francisco, km 84, 27°03′10″S 69°41′17″W, 2043±16 m, grasses in xerophyllous scrubland, 15-II-2008. **CHI-08-07:** Atacama Region (III), Copiapó, RN-31 to Paso de San Francisco, km 94, 26°59′43″S 69°37′04″W, 2404±7 m, *Cortaderia* sp. in wetlands, 15-II-2008. **CHI-08-08:** Atacama Region (III), Copiapó, RN-31 to Paso de San Francisco, Puerto Codocedo, km 155, 26°49′07″S 69°12′04″W, 4211±8 m, Andean puna with *Stipa* sp., 15-II-2008. **CHI-08-09:** Atacama Region (III), Chañaral, Diego de Almagro, route RN-173, km 80, 26°37′56″S 69°03′55″W, 3707±7 m, Andean puna with *Stipa* sp., 15-II-2008. **CHI-08-10:** Atacama Region (III), Chañaral, Diego de Almagro, route RN-173, near Salar de Pedernales, 26°24′25″S 69°17′01″W, 3547±5 m, xerophyllous scrubland with *Eulychnia* sp. and *Copiapoa* sp., 15-II-2008. **CHI-08-11:** Atacama Region (III), Chañaral, route Pan de Azúcar NP, km 5, 26°17′48″S 70°37′53″W, 79±6 m, xerophyllous scrubland with *Eulychnia* sp. and *Copiapoa* sp., 16-II-2008. **CHI-08-12:** Atacama Region (III), Chañaral, route Pan de Azúcar NP, km 12, 26°17′48″S 70°37′53″W, 20±6 m, xerophyllous scrubland with *Copiapoa* sp., 16-II-2008. **CHI-08-13:** Atacama Region (III), Chañaral, Pan de Azúcar NP, Caleta Pan de Azúcar, 26°08′26″S 70°37′51″W, 87±7 m, xerophyllous scrubland with *Eulychnia* sp. and *Copiapoa* sp., 16-II-2008. **CHI-08-14:** Atacama Region (III), Chañaral, Pan de Azúcar NP, mirador Pan de Azúcar, 26°06′40″S 70°38′54″W, 313±9 m, xerophyllous scrubland with *Eulychnia* sp. and *Copiapoa* sp., 16-II-2008. **CHI-08-15:** Atacama Region (III), Chañaral, Pan de Azúcar NP, behind the mirador Pan de Azúcar, 26°06′33″S 70°38′34″W, 306±7 m, xerophyllous scrubland with *Eulychnia* sp. and *Copiapoa* sp., 16-II-2008. **CHI-08-16:** Atacama Region (III), Chañaral, Pan de Azúcar NP, road to Las Bombas, 26°04′10″S 70°31′41″W, 330±7 m, grassland by a dry stream, 16-II-2008. **CHI-08-17:** Antofagasta Region (II), Antofagasta, Salar Imilac, road to Paso Socompa, km 8, 24°11′54″S 68°46′31″W, 2963±8 m, grassland, 17-II-2008. **CHI-08-18:** Antofagasta Region (II), Antofagasta, Salar Imilac, road to Paso Socompa, km 10, 24°10′36″S 68°46′32″W, 2973±10 m, grasses in a salt flat, 17-II-2008. **CHI-08-19:** Antofagasta Region (II), Antofagasta, Salar Imilac, road to Salar de San Pedro de Atacama, 23°51′32″S 68°36′01″W, 2457±7 m, small herbaceous plants in a dip in the desert, 17-II-2008. **CHI-08-20:** Antofagasta Region (II), Antofagasta, road to Peine de Baquedano, near the lithium mine, 23°40′15″S 68°19′46″W, 2321±3 m, small shrubs on a hill by a salt flat, 17-II-2008. **CHI-08-21:** Antofagasta Region (II), Antofagasta, route RN-1, to Caleta El Cobre, 24°13′19″S 70°21′26″W, 1524±7 m, xerophyllous scrubland with bushes of a Compositae, 18-II-2008. **CHI-08-22:** Antofagasta Region (II), Antofagasta, route RN-1, to Caleta El Cobre, 24°18′49″S 70°27′14″W, 1039±9 m, xerophyllous scrubland with bushes of a Compositae,18-II-2008. **CHI-08-23:** Antofagasta

Region (II), Antofagasta, route RN-1, El Cobre, Mina Lilian, 24°17′50″S 70°29′25″W, 804±8 m, xerophyllous scrubland with *Copiapoa solaris*, 18-II-2008. **CHI-08-24:** Antofagasta Region (II), Antofagasta, route RN-1, El Cobre, 24°17′15″S 70°31′00″W, 505±12 m, dunes with deteriorated cacti of *Eulychnia* sp. 18-II-2008. **CHI-08-25:** Antofagasta Region (II), Antofagasta, route RN-1, Blanco Encalada, 24°25′57″S 70° 31′59″W, 137±7 m, xerophyllous scrubland with *Copiapoa* sp., 18-II-2008. **CHI-08-26:** Antofagasta Region (II), Antofagasta, route RN-1, Caleta Botija, 24°35′22″S 70°32′57″W, 2±7 m, xerophyllous scrubland with grasses and small succulent shrubs, 18-II-2008. **CHI-08-27:** Antofagasta Region (II), Antofagasta, route RN-1, Caleta Colorada, 49 kms North of Paposo, 24°41′53″S 70°33′43″W, 36±7 m, xerophyllous scrubland with *Copiapoa*,sp., *Puya* sp. *Euphorbia* sp. and *Eulychnia* sp., 18-II-2008. **CHI-08-28:** Antofagasta Region (II), Antofagasta, route B-900, from Cifuncho to Taltal, km 9, 25°32′45″S 70°28′21″W, 536±6 m, xerophyllous scrubland with *Copiapoa* sp., 19-II-2008. **CHI-08-29:** Antofagasta Region (II), Antofagasta, route RN-1, from Taltal to Paposo, km 41, 25°16′08″S 70°26′16″W, 45±9 m, xerophyllous scrubland with *Copiapoa* sp., 19-II-2008. **CHI-08-30:** Antofagasta Region (II), Antofagasta, route RN-1, from Taltal to Paposo, km 65, 25°05′00″S 70°29′32″W, 19±5 m, xerophyllous scrubland with *Copiapoa* sp., 19-II-2008. **CHI-08-31:** Antofagasta Region (II), Antofagasta, route RN-1, from Paposo to Caleta Rincón, 24°57′44″S 70°28′35″W, 36±7 m, xerophyllous scrubland with *Copiapoa* sp. *Eulychnia* sp. and *Euphorbia* sp., 19-II-2008. **CHI-08-32:** Atacama Region (III), Copiapó, route RN-5, km 795, 27°27′41″S 70°22′38″W, 857±9 m, xerophyllous scrubland with *Eriosyce confinis* and *Cumulopuntia spherica*, 20-II-2008. **CHI-08-33:** Atacama Region (III), Copiapó, route RN-5, km 721, La Bandera, 28°05′01″S 70°35′56″W, 485±7 m, xerophyllous scrubland with *Miqueliopuntia miquelii,* 20-II-2008. **CHI-08-34:** Atacama Region (III), Copiapó, route RN-5, km 713, Canto del Agua, 28°08′42″S 70°38′06″W, 446±5 m, xerophyllous scrubland with *Miqueliopuntia miquelii* and *Cumulopuntia* sp., 20-II-2008. **CHI-08-35:** Coquimbo Region (IV), Elqui, La Higuera, Trapiche, route RN-5, km 552, 29°22′47″S 71°05′26″W, 322±5 m, xerophyllous scrubland with *Cumulopuntia spherica*, *Eulychnia breviflora* and *Copiapoa coquimbana*, 20-II-2008. **CHI-08-36:** Coquimbo Region (IV), Elqui, La Higuera, Cuesta Buenos Aires, La Huerta, route RN-5, km 520, 29°34′53″S 71°14′24″W, 409±9 m, xerophyllous scrubland with *Puya* sp., 20-II-2008. **CHI-08-37:** Coquimbo Region (IV), Elqui, La Serena, route RN-5, km 486, 29°47′41″S 71°17′32″W, 116±8 m, xerophyllous scrubland with *Puya* sp., 20-II-2008. **CHI-08-38:** Coquimbo Region (IV), Elqui, Vicuña, Villa de Puclaro, 30°01′10″S 70°49′43″W, 521±7 m, xerophyllous scrubland with *Eulychnia acida*, 21-II-2008. **CHI-08-39:** Coquimbo Region (IV), Elqui, Vicuña, track to Tololo, Fundio San Carlos, 30°02′40″S 70°48′59″W, 569±9 m, xerophyllous scrubland with *Eulychnia acida*, 21-II-2008.

80790, 80793, 80794. CHI-06-69: decayed *Echinopsis* sp., MA-Fungi 80795, 80796; mixed litter, (mc, pH 6.5), sls 22793. CHI-08-03: decayed *Eulychnia* sp., MA-Fungi 80802, 80803, 80804, 80806, 80808. CHI-08-04: decayed *Eulychnia* sp., MA-Fungi 80809. CHI-08-11: decayed *Eulychnia* sp., MA-Fungi 80811, 80812, 80813, 80814, 80815, 80816. CHI-08-14: Dead leaf bases of *Puya* sp. (mc, pH 6.7), dwb 3061; (mc, pH 6.5) dwb 3084; (mc, pH 7.1), dwb 3095. CHI-08-23: decayed *Copiapoa solaris*, (mc, pH 8.0), aet-12155; (mc, pH 8.1), aet-12158. CHI-08-27: decayed *Copiapoa* sp., MA-Fungi 80819; (mc, pH 8.8), aet-12161. CHI-08-29: decayed *Copiapoa* sp., MA-Fungi 80821, 80822. CHI-08-30: decayed *Copiapoa* sp., MA-Fungi 80823, 80824, 80825, 80826, 80827, 80828, 80829, 80830. CHI-08-31: decayed *Copiapoa* sp., MA-Fungi 80831, 80832, 80833. CHI-08-32: decayed *Eulychnia* sp., MA-Fungi 80836, 80837, 80838, 80839, 80840; *Eulychnia* sp. epidermis, (mc, pH 8.0), dwb 3220. CHI-08-34: decayed *Miqueliopuntia* sp., MA-Fungi 80842. CHI-08-35: decayed *Copiapoa coquimbana*, MA-Fungi 80843, 80844; decayed *Eulychnia breviflora*, MA-Fungi 80847, 80848, 80849, 80850; decayed *Miqueliopuntia miquelii*, MA-Fungi 80852. CHI-08-38: decayed *Eulychnia acida*, MA-Fungi 80858. CHI-08-39: decayed *Eulychnia acida*, MA-Fungi 80860.

Badhamia nitens Berk.

CHI-06-07: wood, MA-Fungi 80470.

The yellow colour of the sporocarps and the spores that adhered in clusters of usually 4–12 are the distinctive characters of this species, reported previously in South America from Bolivia and Brazil.

Badhamia utricularis (Bull.) Berk.

CHI-06-04: bark of woody shrub, (mc, pH 4.0), dwb 2962. CHI-06-53: *Acacia caven* bark, (mc, pH 4.9), dwb 2913.

In the Neotropics, reported previously from Bolivia and Mexico.

Ceratiomyxa fruticulosa (O.F. Müll.) T. Macbr.

CHI-06-17: *Nothofagus* sp. wood, MA-Fungi 80515. CHI-06-19: *Nothofagus dombeyi* wood, MA-Fungi 80521. CHI-06-20: *Nothofagus dombeyi* wood, MA-Fungi 80531. CHI-06-22: *Nothofagus* sp. wood, MA-Fungi 80537. CHI-06-23: *Nothofagus* sp. wood, MA-Fungi 80538. CHI-06-24: *Nothofagus dombeyi* wood, MA-Fungi 80545.

Collaria lurida (Lister) Nann.-Bremek.

CHI-06-53: *Jubaea chilensis* leaves, MA-Fungi 80862.

Only one collection was found on the leaves of this endemic palm. In South America, this species has been reported previously only from Colombia, with a doubtful record from Ecuador.

Collaria nigricapillitia (Nann.-Bremek. & Bozonnet) Lado

CHI-06-37: *Nothofagus pumilio wood*, MA-Fungi 80590.

This is the first record of this nivicolous species for the Americas. Described originally as *Lamproderma nigricapillitium* Nann.-Bremek. & Bozonnet from the French Alps on the wood of *Fagus sylvatica* (Nannenga-Bremekamp 1989), it is reported here from the Chilean Andes on *Nothofagus pumilio*, expanding the distribution of the species to the American continent and the Southern hemisphere. The characters of the Andean specimen are the same as the original European collections.

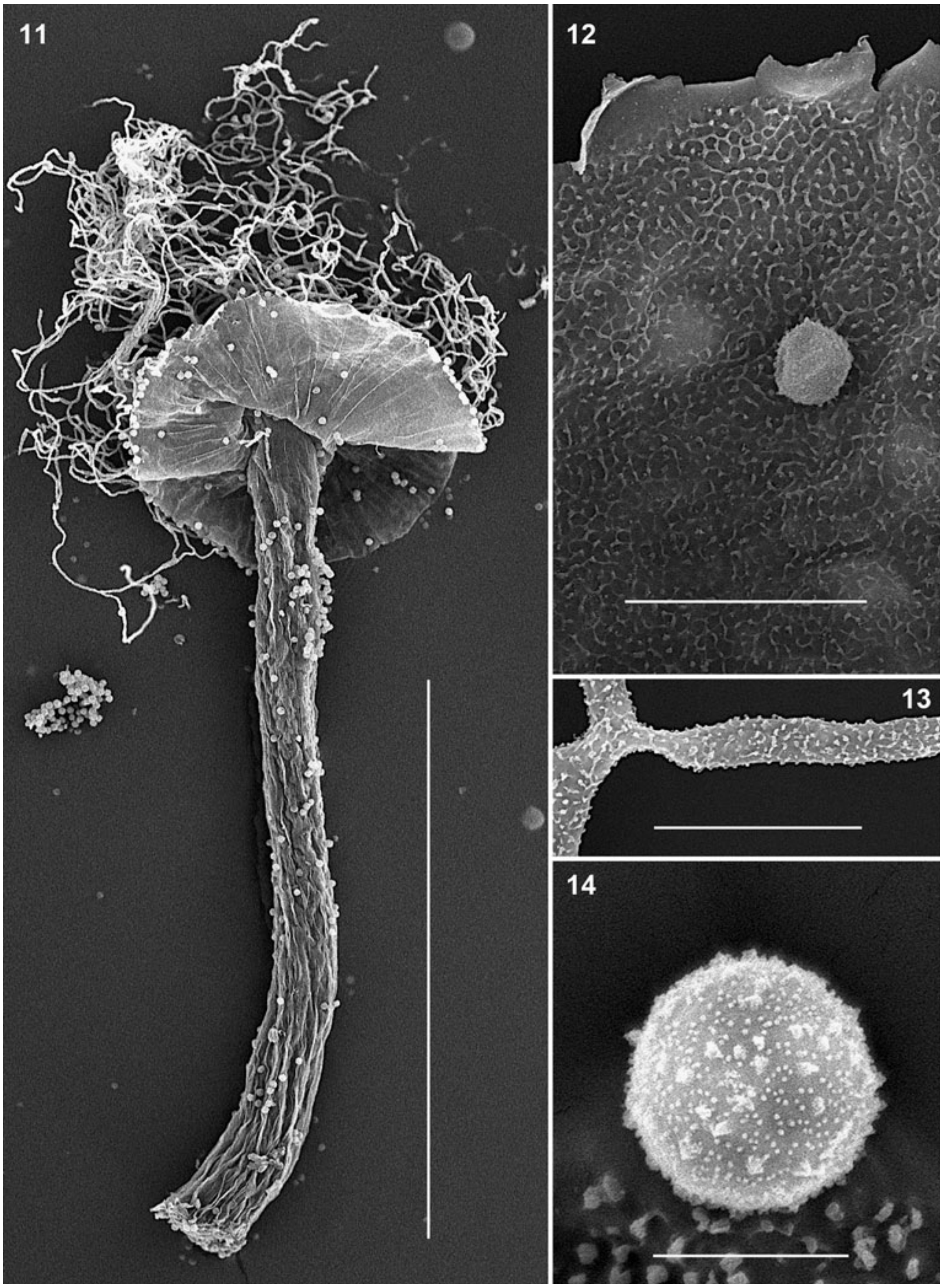
Collaria rubens (Lister) Nann.-Bremek.

CHI-06-50: leaves, MA-Fungi 88251.

In South America, this species has been reported previously only from Argentina and Ecuador.

Comatricha alta Preuss

CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 80593. CHI-06-53: *Jubaea chilensis* leaves, MA-Fungi 80676.



Figs. 11–14 *Arcyria afroalpina* (dwb 2892) by SEM. **11.** Sporocarp. **12.** Detail of the lightly ornamented inner surface of the calyculus. **13.** Capillitial thread. **14.** Spore. Bar: 11=500 μm; 12–13= 20 μm; 14=5 μm

This is the first record for the Neotropics. Our collections consist of large sporocarps up to 6 mm tall and have the elastic expanding capillitium, which falls away from the upper part of the columella, that characterizes this species. In our collections the spores, of 8.5–10 μm diam, are covered with dispersed warts, and in the sporotheca of Lado 17749, there is a collar around the base. This last feature is not mentioned in the few descriptions that exist (Preuss 1851; Lister 1911; Nannenga-Bremekamp 1991). In all of the Chilean collections the capillitium is attached to the upper part of the columella and does not leave a spike-like apex exposed as mentioned by Lister (1911:153).

Comatricha laxa Rostaf.

CHI-06-32: *Nothofagus* sp. wood, MA-Fungi 80577. CHI-06-35: *Araucaria araucana* wood, MA-Fungi 80579. CHI-06-36: *Nothofagus* sp. wood, MA-Fungi 80585. CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 80595. CHI-06-40: *Araucaria araucana* wood, MA-Fungi 80604. CHI-06-60: *Quillaja saponaria* leaves, MA-Fungi 80765.

Comatricha nigra (Pers. ex J.F. Gmel.) J. Schröt.

CHI-06-04: wood, MA-Fungi 80456. CHI-06-14: mixed aerial litter, (mc, pH 4.7), sls 22817. CHI-06-15: *Araucaria araucana* wood, MA-Fungi 80502, 80504. CHI-06-19: *Nothofagus dombeyi* wood, MA-Fungi 80527. CHI-06-30: *Araucaria* *araucana* wood, MA-Fungi 80565. CHI-06-33: *Nothofagus* sp. wood, MA-Fungi 80578. CHI-06-44: *Araucaria araucana* bark, (mc, pH 4.2), dwb 3066; (mc, pH 4.2), dwb 3033.

******Comatricha tenerrima*** (M.A. Curtis) G. Lister

CHI-06-01: decayed *Echinopsis* sp., MA-Fungi 80410. CHI-06-52: *Puya chilensis* leaf, MA-Fungi 80667.

******Craterium leucocephalum*** (Pers. ex J.F. Gmel.) Ditmar

CHI-06-03: leaves of a sclerophyll tree, MA-Fungi 80440. CHI-06-06: wood, MA-Fungi 80463; leaves, MA-Fungi 80465, 80466. CHI-06-50: leaves, MA-Fungi 80641, 80644; wood, MA-Fungi 80646. CHI-06-51: leaves, MA-Fungi 80656. CHI-06-53: leaves of a sclerophyll tree, MA-Fungi 80672, 80686; *Jubaea chilensis leaves*, MA-Fungi 80700. CHI-06-54: leaves of a sclerophyll tree, MA-Fungi 80712; *Puya chilensis* leaf, MA-Fungi 80713; *Jubaea chilensis* leaves, MA-Fungi 80719. CHI-06-55: *Eryngium paniculatum* leaves, MA-Fungi 80721; wood, MA-Fungi 80726; leaf litter, MA-Fungi 80728. CHI-06-60: *Quillaja saponaria* leaves, MA-Fungi 80762.

****Cribraria argillacea*** (Pers. ex J.F. Gmel.) Pers.

CHI-06-30: *Araucaria araucana* wood, MA-Fungi 88237.

In South America, this species has been reported previously only from Argentina and Brazil.

Cribraria cancellata (Batsch) Nann.-Bremek.

CHI-06-15: *Araucaria araucana* wood, MA-Fungi 80503.

This one collection has a small, shining cup at the base of the sporotheca and thus would be referred to the var. *fusca* (Lister) Nann.-Bremek., recognized by several authors.

****Cribraria microcarpa*** (Schrad.) Pers.

CHI-06-47: remains of *Eulychnia* sp. in mc, aet-12168; aet-12171.

In South America, this species has been reported previously from Argentina (Wrigley de Basanta et al. 2010b), Brazil, Colombia, French Guiana and Venezuela.

Cribraria mirabilis (Rostaf.) Massee

CHI-06-29: *Araucaria araucana* wood, MA-Fungi 80564. CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 80599.

***Cribraria oregana** H.C. Gilbert

CHI-06-36: *Nothofagus* sp. wood, MA-Fungi 80584.

This is the first record of this species for South America, described originally from the United States on decaying coniferous wood, especially that of *Pseudotsuga menziesii* (Peck and Gilbert 1932). Our record considerably expands the distribution of this species.

***Cribraria rufa** (Roth) Rostaf.

CHI-06-47: remains of *Eulychnia* sp. in mc, aet-12172.

In South America, this species has been reported previously from Argentina (Wrigley de Basanta et al. 2010b).

***Cribraria violacea** Rex

CHI-06-01: decayed *Echinopsis* sp., MA-Fungi 80409.

Dianema succulenticola Lado, Estrada & D. Wrigley, **sp. nov.** Figs. 15–25.

Chile: (CHI-06-62) Coquimbo Region (IV), Elqui, Vicuña, Cerro Mamalluca observatory, 29°59′44″S 70°41′05″W, 1005±5 m, spiny scrubland with *Eulychnia* sp., 5-IV-2006, on decayed *Eulychnia* sp., MA-Fungi 80774 (Lado 17960). *Holotype.*

Mycobank: MB 564324

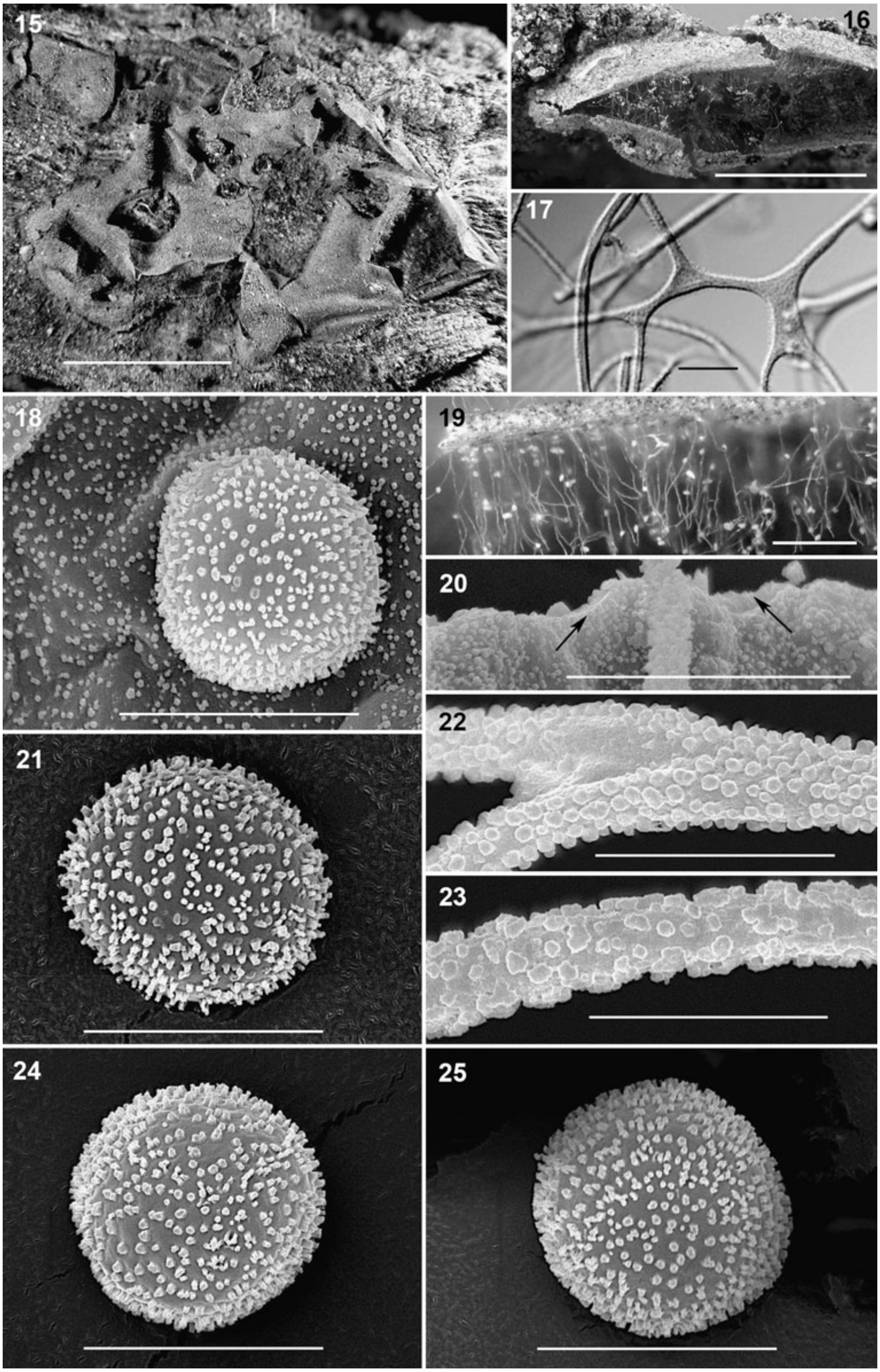
Sporophores sporocarpic to plasmodiocarpic, sessile. Sporocarps dispersed or in small groups, pulvinate, 0.5–1.2×0.1–0.4 mm. Plasmodiocarps simple or ramified, reticulate to effuse with convex edges (Figs. 15, 16), 0.6–16.5 mm long, 0.3–3.7 mm wide, 0.2–0.6 mm in height. Sporothecae yellow brown to olive brown (77. m. y Br – 85. deep Y – 95. m. Ol Br), opaque, on a broad membranous base attached to the substrate. Hypothallus inconspicuous, appearing as a concolorous margin to the sporothecae. Stalk absent. Peridium double (Fig. 20), partially evanescent, revolute, opaque, the outer layer formed from granular refuse matter, yellow brown to greyish yellow (77. m. y Br – 80. gy. y Br – 91. d. gy. Y) in reflected light, the inner layer membranous, colourless to pale yellow (89. p. Y) in transmitted light and densely warted on the inner surface by SEM (Fig. 18, 20); dehiscence irregular. Columella absent. Capillitium filiform, yellow (89. p. Y – 84. s. Y), attached to the inner layer of the peridium, the surface densely and finely warted (Figs. 17), warts flattened by SEM (Figs. 22, 23), threads 1.5–3 μm diam, straight or slightly undulated (Fig. 19), branched and with some H-shaped connections, and flat expansions at the junctions, and occasional darker swellings of up to 5 μm wide, occasionally with blunt free ends. Spores free, yellow (84. s. Y – 88. d. Y – 74. s. y Br) in mass, colourless to pale yellow (89. p. Y) by LM, subglobose, (9.5-) 10–12.5 (−13) μm diam., to ellipsoid or ovoid (10.5-) 11.5–13.5 (−14)×(9-) 9.5–12 (−12.5) μm, spinulose by LM, with evenly distributed short spinules and bacula by SEM (Figs. 18, 21, 24, 25).

Etymology: The epithet *succulenticola* refers to the type of substrate on which the species was found.

Habitat: Decayed *Eulychnia* sp. and *Echinopsis chiloensis.*

Known distribution: Coquimbo region in North Chile.

Other specimens examined: Chile: **(**CHI-06-58) Coquimbo Region (IV), Choapa, Illapel, Las Chinchillas NR, road to Los Pozos, km 2.8, 31°29′55″S 71°06′49″W, 583±8 m, spiny scrubland with *Eulychnia* sp. and *Echinopsis chiloensis*, 4-IV-2006, on decayed *Eulychnia* sp., MA-Fungi 81387. **(**CHI-06-59) Coquimbo Region (IV), Choapa, Illapel, road to Combarbalá, km 3.2, 31°29′17″S 71°05′53″ W, 567±8 m, spiny scrubland with *Eulychnia* sp. and *Echinopsis chiloensis*, 4-IV-2006, on decayed *Eulychnia* sp., MA-Fungi 81388. (CHI-06-62) Coquimbo Region (IV), Elqui, Vicuña, Cerro Mamalluca observatory, 29°59′44″S



Figs. 15–25 *Dianema succulenticola*. **15.** Large plasmodiocarps (MA-Fungi 80774). **16.** Detail of an open plasmodiocarp showing the capillitium (MA-Fungi 80774). **17.** Fragment of capillitium (MA-Fungi 81394). **18.** Spore by SEM (MA-Fungi 81391). **19.** Edge of peridium with attached capillitial threads (MA-Fungi 80774). **20.** Edge of peridial fragment showing two layers (arrows) (MA-Fungi 81389). **21.** Spore by SEM (MA-Fungi 81391). **22.** Detail of the ornamentation of capillitial threads by SEM (MA-Fungi 81391). **23.** Detail of the ornamentation of a capillitial thread by SEM (MA-Fungi 81391). **24.** Spore by SEM (MA-Fungi 80774). **25.** Spore by SEM (MA-Fungi 81389). Bar: 15=5 mm; 16=1 mm; 17–18, 21, 23–25=10 µm; 19=100 µm; 20, 22=5 µm

70°41′05″W, 1005±5 m, spiny scrubland with *Eulychnia* sp., 5-IV-2006, on decayed *Eulychnia* sp., MA-Fungi 81389. Coquimbo Region (IV), Elqui, Vicuña, road to Quebrada Chumi, 30°45′51″S 70°36′43″W, 1,305 m, 28-I-2004, on decayed *Echinopsis chiloensis*, MA-Fungi 81390, 81391, 81392, 81393, 81394.

The major distinguishing features of the new species are the scattered habit, the sessile, flat to slightly pulvinate large and effuse plasmodiocarps, up to 16.5 mm long (Figs. 15, 16), and the revolute (Fig. 15), dull, double peridium (Fig. 20) that is closely warted on the inner surface of the inner layer (Figs. 18, 20). The abundant capillitium, joined to the peridium (Fig. 19), has branched and anastomosed threads (Figs. 17, 22), with flat expansions and fusiform nodes. The ornamentation of the capillitium appears warted by LM, but by SEM a dense distribution of coarse and somewhat flattened warts can be seen (Figs. 17, 20,22, 23), and the free spinulose spores by LM, are baculate by SEM (Figs. 18, 21, 24, 25).

The other species in the genus most similar to *D. succulenticola* is *D. depressum* (Lister) Lister, which also has large, flat plasmodiocarps, abundant capillitium and free spores, but it can be differentiated by the reticulate spores, not warted like in the new species. *Dianema depressum* also has penicillate capillitial threads, in groups of 2–6, interconnected at the apex. The capillitium is neither penicillate, nor in groups interconnected at the apex in *D. succulenticola.*

The sporocarpic forms, dispersed or in small groups could be confused with *D. subretisporum* Kowalski, *D. harveyi* Rex, *D. corticatum* Lister, or *D. nivale* (Meyl.) G. Lister, but *D. subretisporum* is nivicolous and has an incomplete reticulum on the spores, *D. harveyi* is differentiated by the iridescent and translucent peridium, with capillitium fragments attached as sharp appendices, and it has capillitial threads that are rigid, simple or bifurcate without anastomoses. *Dianema corticatum* has clustered spores, with spinules only on the outside of the cluster and a smooth surface elsewhere. *Dianema nivale* is a nivicolous species differentiated by the iridescent peridium and the capillitium arising from the thickened base, and it usually has stalked sporocarps, not sessile to plasmodiocarpic as in D. *succulenticola*.

The new species somewhat resembles *D. aggregatum* Kowalski, *D. inconspicuum* Poulain, Mar. Mey. & Bozonnet, *D. leptotrichum* A. Sánchez, G. Moreno & A. Castillo and *D. mongolicum* Novozh., in that the capillitium is attached to the peridium, but *D. aggregatum* has reticulate spores, and *D. inconspicum* is a nivicolous species that has a shiny, more or less plicate peridium, and forms flat sporocarps only about 0.3 mm thick (Poulain et al. 2000). *Dianema leptotrichum* is also a nivicolous species with capillitial threads that are only occasionally branched, sometimes forked but not anastomosed, with slightly larger spores, 12–14 µm diam. that are dark olive brown in mass (Moreno et al. 2011). *Dianema mongolicum* is corticolous and only forms sporocarps up to 3 mm long and 0.1–0.2 mm thick (Novozhilov and Golubeva 1986). It has a single peridium, not double as in *D. succulenticola*. It also has a moniliform capillitium ornamented with spines and short crests as observed under SEM (Novozhilov et al. 2010), not flattened warts like those found in *D. succulenticola*.

Attempts were made to culture the new species on agar, but these were not successful. The taxonomic characters are constant in the nine collections of *D. succulenticola*, obtained in two separate years collecting and from four different localities. Therefore, we describe it here as a new species.

***Dianema depressum** (Lister) Lister

CHI-06-53: *Jubaea chilensis* leaves, MA-Fungi 80673.

This species is reported for the first time for the Neotropics. In America it is previously known from the United States (Colorado, Washington, Oregon and California) (Martin and Alexopoulos 1969). This is the first time that the species has been found on palms.

Dictydiaethalium plumbeum (Schumach.) Rostaf.

CHI-06-52: wood, MA-Fungi 80668.

***Diderma asteroides** (Lister & G. Lister) G. Lister

CHI-06-06: *Puya* sp. leaf, MA-Fungi 80460.

In South America, this species has been reported previously from Argentina.

***Diderma deplanatum** Fr.

CHI-06-40: *Nothofagus* sp. wood, MA-Fungi 80606.

In South America, this species has been reported previously from Brazil and there is a weathered collection known from Argentina.

***Diderma niveum** (Rostaf.) T. Macbr.

CHI-06-08: stem of a Compositae, MA-Fungi 88231, 80474, 80863, 80475, 80487. CHI-06-09: stem of a Compositae, MA-Fungi 80490.

The subspecies *lyallii* (Massee) G. Lister, now considered to be a synonym of *D. fallax* (Rostaf.) Lado, was reported from Chile by Sturgis (1916).

Didymium anellus Morgan

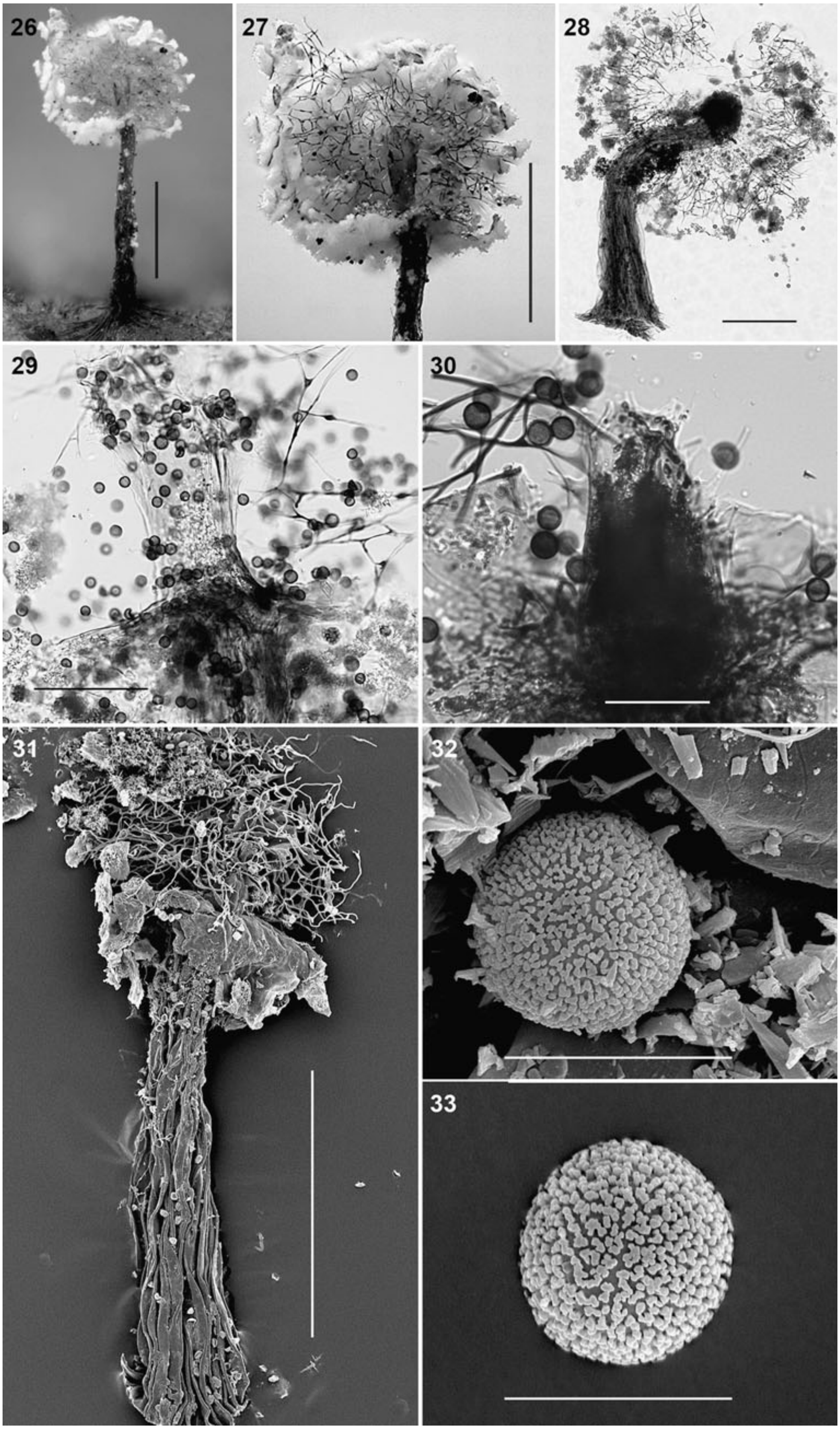
CHI-06-34: mixed aerial litter, (mc, pH 5.8) sls 22816. CHI-06-53: *Jubaea chilensis* leaves, MA-Fungi 80706. CHI-06-60: *Populus deltoides* wood, MA-Fungi 88255.

Didymium chilense Estrada, Lado & D. Wrigley, **sp. nov.** Figs. 26–33.

CHILE: (CHI-06-01) Libertador General Bernado O´ Higgins Region (VI), Cachapoal, Machalí, Coya, termas de Cauquenes, 34°16′01″S 70°34′19″W, 780±8 m, degraded Mediterranean woodland with cacti and sclerophyllous trees, 18-III-2006, on leaves of a sclerophyll tree, MA-Fungi 80549 (Lado 17514). Holotype.

Mycobank: MB 564325

Sporophores sporocarpic, grouped to dispersed. Sporocarps, stipitate (Figs. 26–28, 31), erect, 0.9–1.5 mm total height. Sporotheca subglobose to oblate (Figs. 26, 27), occasionally slightly umbilicate below, 0.4–1.0×0.2–0.6 mm, covered with calcium carbonate crystals, white (263. White), frequently with a limeless reddish base that leaves behind a disc 0.2–0.35 mm diam after dehiscence. Hypothallus discoid to irregular, membranous, individual, concolorous with the stalk to hyaline. Stalk cylindrical to subcylindrical, then wider at the base, from 1/2 to 4/5 of the total height of the sporocarp, (0.55-) 0.8–1.2 mm high, 55–195 µm wide at the apex and 100–290 µm at the base, not



Figs. 26–33 *Didymium chilense* (MA-Fungi 80549). **26.** Sporocarp. **27.** Open sporotheca showing the columella and capillitium. **28.** Sporocarp showing the stalk, columella and capillitium. **29.** Detail of the columella with calcareous deposits at the lower part (MA-Fungi 80661). **30.** Capillitial threads arising from the columella packed with calcareous deposits. **31.** Sporocarp by SEM (MA-Fungi 80642). 32–33. Spores by SEM. Bar: 26–27=500 μm; 28=200 μm; 29, 32–33=10 μm; 30=50 μm; 31=300 μm

calcareous, longitudinally striate, translucent, with granular material at the base, dark brown (59. d. Br) or dark yellowish brown (78. d. y Br) to blackish in reflected light, brown (55. s. Br) to orange brown (54. br O) or orange yellow (69. deep OY) in transmitted light. Peridium single, membranous, colourless, but with yellowish brown to violet brown areolae by transmitted light, covered with abundant, white, stellate lime crystals, the same size or slightly larger than the spores; dehiscence following the shape of the areolae, these peridial fragments frequently remaining attached to the capillitial threads after dehiscence. Columella cylindrical to conical (Figs. 27–30), up to 225 μm tall, exceptionally dome-shaped, the upper half ending in spikes (Fig. 30) which give rise to the capillitium, usually filled with calcium carbonate except at the apex in some cylindrical or conical forms (Figs. 29, 30), covered with a hyaline to yellowish brown (79. l. gy. Y Br) membrane. Capillitium filiform, limeless, appearing hoary by reflected light, dark brown (59. d. Br) to greyish brown (60. l. gy. Br – 81. d. gy. y Br) in transmitted light, with hyaline tips; capillitial threads straight to somewhat undulating (Fig. 31), smooth, 1–3 μm diam, sometimes with swellings up to 6 μm, branched and anastomosing (Figs. 29–31) with cross connections forming a network, with membranous expansions and pointed free ends, or attached to the peridial fragments. Spores free, black (267. Black) in mass, greyish to yellowish brown (60. l. gy. Br – 64. br Gray – 80. gy. y Br) by LM, with a lighter equatorial band, subglobose, (8.5-) 9.0-11 (−12.5) μm diam., densely and uniformly warted by LM, the warts or pila flattened and fused in small groups by SEM (Figs. 32–33).

Etymology: The epithet *chilense* refers to the geographical area where the species was found.

Habitat: Leaves of sclerophyll trees

Known distribution: Central Chile.

Other specimens examined

CHILE: (CHI-06-01) Libertador General Bernado O´Higgins Region (VI), Cachapoal, Machalí, Coya, termas de Cauquenes, 34°16′01″S 70°34′19″W, 780±8 m, degraded Mediterranean woodland with cacti and sclerophyllous trees, 18-III-2006, on leaves of a sclerophyll tree, MA-Fungi 80587, 80622, 80477, 80650, 80600, 88211, 88212. (CHI-06-03) Libertador General Bernado O´Higgins Region (VI), Cachapoal, Machalí, Puente Chacayes, 34°14′10″S 70°28′54″W, 860±4 m, spiny scrubland with *Echinopsis* sp. and *Acacia caven*,19-III-2006, leaves of a sclerophyll tree, MA-Fungi 88226. (CHI-06-50) Valparaiso Region (V), Marga Marga, Olmué, La Campana NP, sector Granizo, La Represa trail, 32°58′57″S 71°07′42″W, 407±35 m, sclerophyllous forest, 31-III-2006, on leaves, MA-Fungi 80642, 80647. (CHI-06-51) Valparaiso Region (V), Marga Marga, Olmué, La Campana NP, sector Granizo, La Canasta trail, 32°58′48″S 71°07′56″W, 480±8 m, sclerophyllous forest with *Cryptocarya alba*, *Quillaja saponaria, Dasyphyllum* sp. and *Schinus latifolius,* 31-III-2006 on leaves, MA-Fungi 80651, 80659, 80661, 80662; on leaves and wood, MA-Fungi 80663. (CHI-06-53) Valparaiso Region (V), Quillota, Hijuelas, La Campana NP, sector Palmar de Ocoa, Quillay trail, 32°56′03″S 71°04′35″W, 508±18 m, area dominated by *Jubaea chilensis* and sclerophyllous forest with *Acacia caven,* 2-IV-2006, on leaves of a sclerophyll tree, MA-Fungi 80681, 88253, 88254. (CHI-06-60) Coquimbo Region (IV), Choapa, Salamanca, Cucumén, Los Portones, route ChD-81, km 36.8, 31°53′22″S 70°38′52″W, 1119±10 m, degraded sclerophyllous scrubland with *Quillaja saponaria*, *Acacia caven* and *Populus* sp.*,* 4-IV-2006, on *Quillaja saponaria* leaves, MA-Fungi 80764, 80766, 80767).

The most distinctive feature of *D. chilense* is the true columella, which is usually cylindrical, with the upper half ending in spikes (Fig. 30) that give rise to the capillitium, and filled with calcium carbonate. The capillitium forms a net with expanded nodes, hoary by reflected light but greyish brown in transmitted light, with hyaline tips. The spores are densely and uniformly warted with a pale ecuatorial band.

This species resembles *D. rubeopus* G. Moreno, A. Castillo & Illana and *D. laxifilum* G. Lister & J. Ross in the colour of the sporocarps, the shape and colour of the stalks and the netted capillitium. We examined the holotype of *D. rubeopus* (AH 16458) and *D. rubeopus* var. *albocapillitium* G. Moreno, A. Castillo, Illana & Lizárraga (AH 16379). *Didymium chilense* differs from these two species, both of which have a subglobose to dome-shaped white columella, whereas the latter is normally cylindrical and brownish in *D. chilense*. Also different are the spiny spores with a pale area, that are uniformly coloured, except for a lighter equatorial band, and densely warted in *D. chilense.* They also differ in that they have sessile and stalked sporocarps (always stalked in the new species), with the short stalks, up to 1/2 of the total height, but from 1/2 to 3/4 in *D. chilense*. In addition, the netted capillitial threads of uniform diameter in *D. rubeopus* (Moreno et al. 1997) are different from the capillitium with membranous expansions at the nodes of the net in the new species. The sole difference that Moreno et al. (1997) established for the var. *albocapillitium* is that "the filaments of the capillitium, …. are from hyaline to whitish," which is not clearly visible in the type material. The filaments of the holotype examined by us are a little paler than in *D. rubeopus* var. *rubeopus*, but grayish brown not hyaline nor whitish. In our opinion, recognition of this variety should be questioned.

Didymium laxifilum differs in having sporothecae that are deeply umbilicate below, short stalks, a hemisphaeric columella, a rigid and strong capillitium with threads of 5–8 μm diam (only 1–3 μm diam in the new species), and the very dark warted spores with a pale area (Moreno et al. 1997), uniformly coloured except for a lighter equatorial band and densely warted in *D. chilense*.

Didymium columellacavum Hochg., Gottsb. & Nann.-Bremek. also has stalked sporocarps and a cylindrical to conical columella, but the latter is hollow, filled with air, although with some lime crystals, whereas in *D. chilense* the columella is packed with calcium carbonate. *Didymium columellacavum* also differs in the deep umbilicate base of the sporotheca, in the profuse capillitium with flexuose, partially undulate threads radiating from the columella, not forming a dense internal mesh as in the new species, and in the smaller spores (7.5–9 μm diam.), that are minutely warted and with small groups of dark wartlets (Hochgesand et al. 1989).

A total of 22 collections of this myxomycete were obtained from 6 localities in 3 different Regions of Chile. The characters are constant in all collections and thus we describe it herein as a new species. In the Neotropics, this species has been reported previously from Costa Rica (Rojas et al. 2010) and the Windward Islands.

***Didymium clavus** (Alb. & Schwein.) Rabenh.

CHI-06-07: *Puya* sp. leaf, MA-Fungi 80468. CHI-06-54: *Jubaea chilensis* leaves, MA-Fungi 80718; *Puya chilensis* stem, MA-Fungi 80711.

***Didymium comatum** (Lister) Nann.-Bremek.

CHI-06-08: stem of a Compositae, MA-Fungi 80482. CHI-06-11: stem of a Compositae, MA-Fungi 80492, 80494, 80496.

The sporocarps in these collections have the typical capillitium but it ranges from hyaline to very dark. Spores (11-) 12-14(−15) μm diam.

Didymium difforme (Pers.) Gray

CHI-06-03: leaves of a sclerophyll tree, MA-Fungi 80433. CHI-06-04: mixed litter, (mc, pH 6.1), sls 22797, mixed aerial litter; (mc, pH 5.5), sls 22800. CHI-06-08: mixed aerial litter, (mc, pH 5.2), sls 22798. CHI-06-11: mixed litter, (mc, pH 5.4), sls 22803. CHI-06-36: mixed aerial litter, mc, pH 5.7), sls 22807. CHI-06-49: mixed litter, (mc, pH 6.8), sls 22792; (mc, pH 6.2), sls 22805. CHI-06-52: mixed aerial litter, (mc, pH 8.0), sls 22794. CHI-06-53: mixed aerial litter, (mc, pH 5.8), sls 22804. CHI-06-54: mixed aerial litter, (mc, pH 5.2), sls 22801. CHI-06-69: *Cryptocarya alba* leaves, MA-Fungi 80800, mixed aerial litter, (mc, pH 5.0), sls 22802.

***Didymium dubium** Rostaf.

CHI-06-02: mixed litter, (mc, pH 5.5), sls 22796. CHI-06-55: bark of woody Compositae, (mc, pH 6.3), dwb 2946. CHI-06-58: mixed litter, (mc, pH 6.0), sls 22791; (mc, pH 5.7), sls 22790. CHI-08-30: decayed *Copiapoa* sp., MA-Fungi 88270.

In South America, this species has been reported previously from Argentina, Colombia and Venezuela.

***Didymium eximium** Peck

CHI-06-03: leaves of a sclerophyll tree, MA-Fungi 88224.

This is a new record for the Neotropics for this species, recognized as a synonym of *D. megalosporum* Berk. & M. A. Curtis by Martin and Alexopoulos (1969). As Nannenga-Bremekamp (1972, 1991) stated, *D. eximium* differs by having a tapered stalk, which is orange-ochraceous in transmitted light when fresh, filled with a large amount of particulate matter and stellate peridial lime crystals, smaller than the diameter of the spores. These differences are present in the Chilean collection.

Didymium infundibuliforme D. Wrigley, Lado & Estrada

CHI-08-13: on decayed *Copiapoa* sp. (mc, pH 8.2), dwb 3103. CHI-08-14: on dead leaf bases of *Puya* sp. (mc, pH 6.5), dwb 3057. CHI-08-23: decayed *Copiapoa solaris*, (mc, pH 8.0), aet-12156; (mc, pH 8.1), aet-12149; (mc, pH 8.1), aet-12159; (mc, pH 7.4), dwb 3464; (mc, pH 7.4), dwb 3465. CHI-08-27: on dead leaf bases of *Puya* sp. (mc, pH 6.3), dwb 3044; (mc, pH 6.8), dwb 3056; (mc, pH 6.7), dwb 3060.

This recently described species has been isolated again in moist chamber cultures prepared with material from *Copiapoa* spp. (aet-12156, aet-12149, aet-12159 and dwb 3103, dwb 3464, dwb 3465), confirming the association of the species with this substrate. Two field collections from Chile on *Copiapoa* as well as all the other collections above were listed in the original description of the species (Wrigley de Basanta et al. 2009). The pH of the substrates producing this species was described as 6.3–7.2, This range is extended to pH 8.1 with these collections.

***Didymium laxifilum** G. Lister & J. Ross

CHI-06-04: leaves of a sclerophyll tree, MA-Fungi 80441, 80442, 80443, 80445, 80446, 80447, 80449, 80450, 80451, 80452, 80453, 80454.

This species is usually found on sclerophyll leaves, which are typical in Mediterranean vegetation. See the discussion provided above on differences between this species and *D. chilense*. It has been reported from similar vegetation in Baja California in the Neotropics, and also from Costa Rica (Rojas et al. 2010).

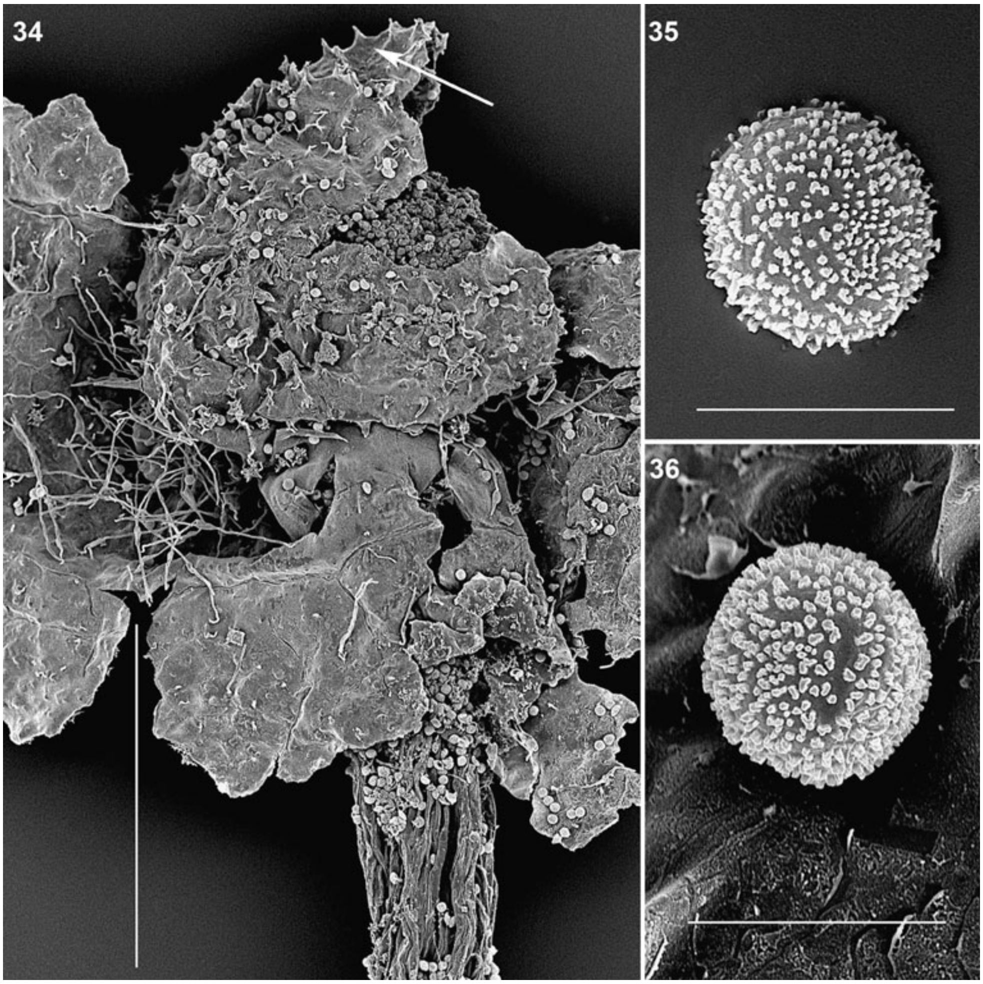
***Didymium megalosporum** Berk & M.A. Curtis Figs. 34–36.

CHI-06-48: bark and leaves of *Eucalyptus* sp., MA-Fungi 80548; *Eucalyptus* sp. bark, MA-Fungi 80634, 80635, 80637. CHI-06-53: *Jubaea chilensis* leaves, MA-Fungi 80697, 80699.

The presence of membranous pointed projections on the pseudocolumella (Martin and Alexopoulos 1969), which give rise to the capillitium, is a constant feature in our collections (Fig. 34) and the most distinctive feature of this species. In addition, a pseudocolumella full of crystals, an orange stalk, a sporotheca that is deeply umbilicate below, and baculate spores by SEM (Figs. 35, 36) are characters that can help in the identification of the species. In South America, this species has been reported previously from Brazil.

Didymium minus (Lister) Morgan

CHI-06-19: wood and leaves of *Nothofagus dombeyi*, MA-Fungi 80526. CHI-06-41: *Nothofagus* sp. wood, MA-Fungi 80617.



Figs. 34–36 *Didymium megalosporum* (MA-Fungi 80634) by SEM. **34.** Detail of the pseudocolumella showing the connections of the capillitium (arrow). **35**–**36.** Spores. Bar: 34=300 μm; 35–36=10 μm

***Didymium nivicolum** Meyl.

CHI-06-08: stem of a Compositae, MA-Fungi 80472, 80473, 80476, 80478, 80479, 80480, 80483, 80484, 80485. CHI-06-09: stem of a Compositae, MA-Fungi 80488, 80489, 80491. CHI-06-11: stem of a Compositae, MA-Fungi 80493, 80495, 80497. CHI-06-12: stem of a Compositae, MA-Fungi 80498, 80499, 80500.

This nivicolous myxomycete, usually found near melting snow, appeared abundantly in the Chilean Andes, on the stems of shrubs (Compositae) between 2,300 and 3,000 m. However, it was found at the end of the austral summer when no snow remained, which was months since the last snowfall. This species is frequently found in the mountains of Europe, North America and Asia, but this is the first time that it has been recorded for the Neotropics.

Didymium operculatum D. Wrigley, Lado & Estrada

CHI-08-12: on decayed *Copiapoa cinerascens,* (mc, pH 9.1), aet-12142; (mc, pH 9.3), aet-12147; (mc, pH 9.3), aet-12143; (mc, pH 9.0), aet-12162. CHI-08-23: on decayed *Copiapoa cinerascens*, (mc, pH 8.0), aet-12157; (mc, pH 8.1), aet-12160. CHI-08-25: *Copiapoa* sp. epidermis, (mc, pH 7.1), dwb 3142; (mc, pH 7.1), dwb 3155; (mc, pH 6.3), dwb 3157, on decayed *Copiapoa* sp. (mc, pH 8.8), aet-12153; (mc, pH 8.8), aet-12148; (mc, pH 8.9), aet-12152. CHI-08-27: decayed *Copiapoa* sp., MA-Fungi 88257, 88258, 88259, 80820, 88260.

All the collections noted above were listed in the original description of the species from the Atacama desert Chile (Wrigley de Basanta et al. 2011).

***Didymium quitense** (Pat.) Torrend Figs. 37, 38.

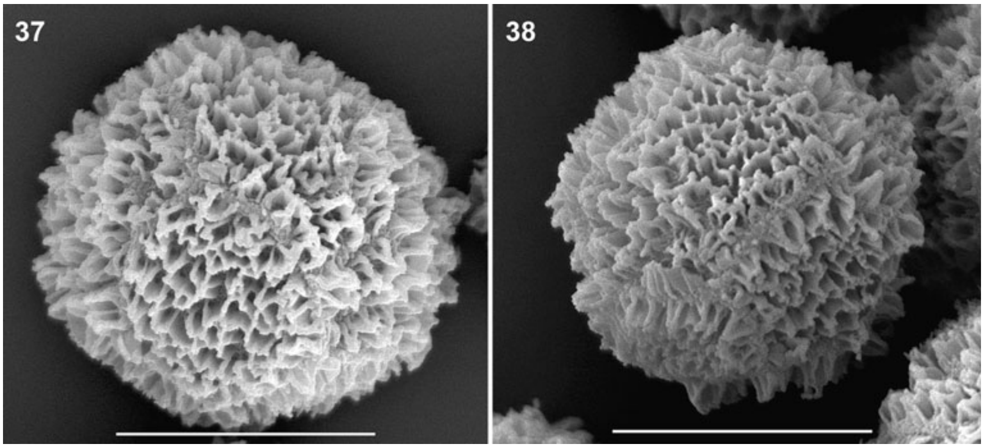
CHI-06-13: *Cajenetia angustifolia*, (mc, pH 5.5), dwb 2728; (mc, pH 4.6), dwb 2737; (mc, pH 5.3), dwb 2752.

These collections consist of white sporocarps to short plasmodiocarps, with a double peridium, the outer layer like an egg-shell, formed of tiny closely packed crystals. The ornamentation of the spores by SEM consists of a very dense mesh of irregular cristate muri (Figs. 37, 38). Described originally from Ecuador by Patouillard and de Lagerheim (1895), it was reported recently from Argentina by Lado et al. (2011).

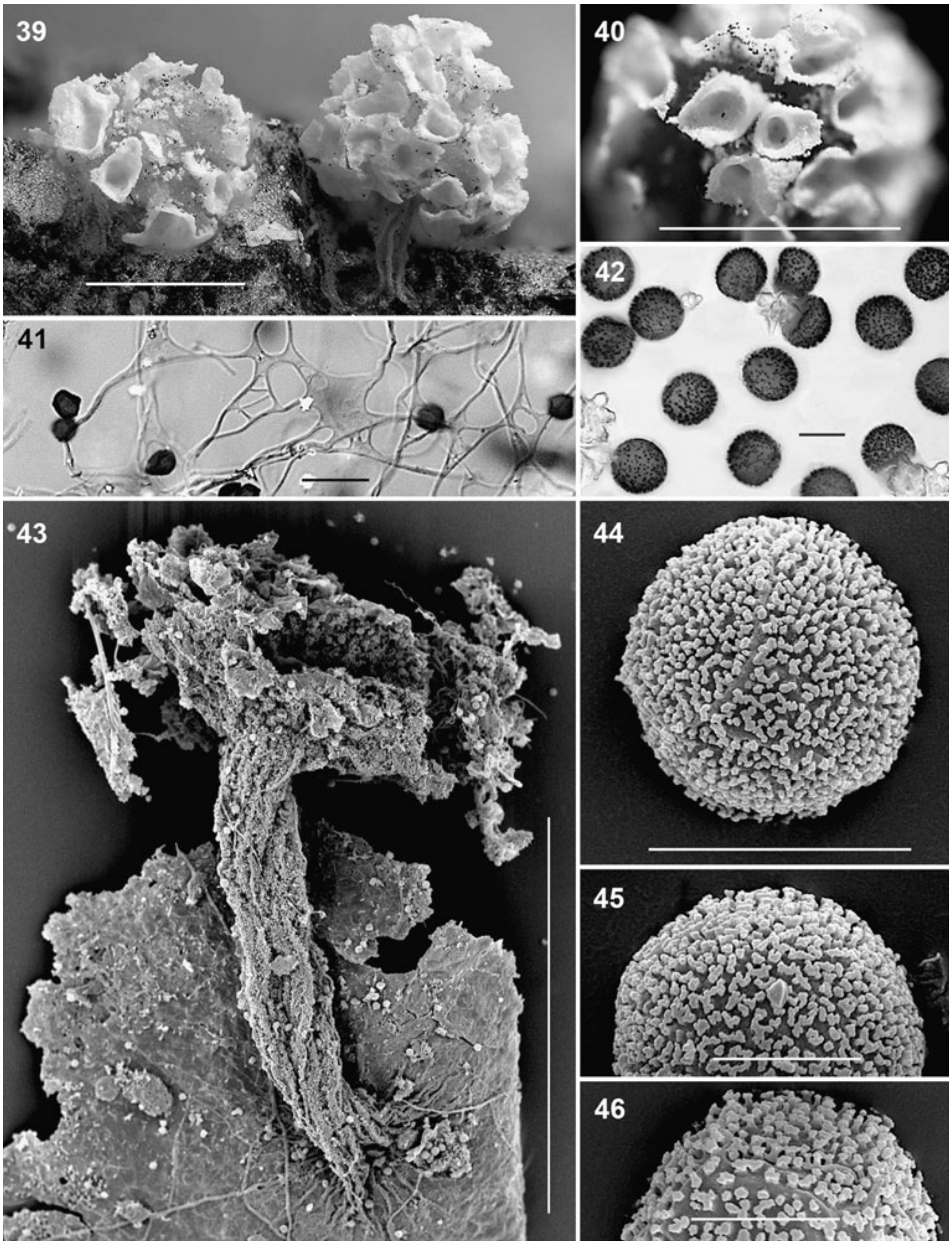
Didymium squamulosum (Alb. & Schwein.) Fr. (Figs. 39–46).

CHI-06-01: leaves of a sclerophyll tree, MA-Fungi 81386, 88210, 80418. CHI-06-03: leaves of a sclerophyll

Figs. 37–38 *Didymium quitense* (dwb 2728) by SEM. **37–38.** Spores with a dense network of irregular muri. Bar: 37–38=10 μm



Figs. 39–46 *Didymium squamulosum* (ecotype). **39.** Sporocarps showing the carbonate present on the peridium in the form of funnel-shaped flakes (MA-Fungi 80471). **40.** Detail of the flakes of the peridium (MA-Fungi 80471). **41.** Reticulate capillitial threads (MA-Fungi 88250). **42.** Spores by LM (MA-Fungi 80471). **43.** Hypothallus and calcareous stalk by SEM (MA-Fungi 80643). **44.** Spore by SEM (MA-Fungi 80643). **45–46.** Detail of the spore ornamentation by SEM (MA-Fungi 70307). Bar: 39=1 mm; 40=0.5 mm; 41–42, 44=10 μm; 43=500 μm; 45–46=5 μm



tree, MA-Fungi 80431, 80434, 88222, 88223, 80437. CHI-06-05: *Maytenus boaria* leaves, MA-Fungi 80459. CHI-06-07: *Maytenus boaria* leaves, MA-Fungi 80471, 88230. CHI-06-48: *Eucalyptus* sp. bark, MA-Fungi 80631, 80633. CHI-06-50: leaves, MA-Fungi 88250, 80643, 80648. CHI-06-51: leaves, MA-Fungi 80652, 80653, 80655. CHI-06-53: leaves of a sclerophyll tree, MA-Fungi 80680, 80682, 80689; *Jubaea chilensis* leaves, MA-Fungi 80693, 80694, 80695; *Jubaea chilensis* leaves, MA-Fungi 80678, 80679, 80703; mixed litter, (mc, pH 5.8), sls 22811. CHI-06-55: leaves and twigs of an unidentified bush, MA-Fungi 80722; wood, MA-Fungi 80725. CHI-06-60: *Populus deltoides* wood, MA-Fungi 80763.

Under this taxon we have included a series of collections associated with Mediterranean vegetation (leaves of sclerophyll trees and the palm *Jubaea chilensis*) (MA-Fungi 80471, 88230, 88250, 80643, 80652, 80653, 80655, 80703), with very constant features. The peridium with large conical scales, like a *Morchella*, the colourless and netted capillitium with flat expansions, and the non-calcareous hypothallus are the major distinguishing characters of these collections. The rest of features agree with those of the rather variable *D. squamulosum*, including the whitish sporocarps, the calcareous and white stalk, the dark, warted spores, the reticulate, almost hyaline capillitium, abundant granules, and the whitish hemispherical columella. These collections may represent an ecotype of *D. squamulosum* and we add a full description and illustrate them below.

Sporophores sporocarpic, grouped to dispersed. Sporocarps stipitate to almost sessile (Figs. 39, 43), 0.6–1.5 mm in total height. Sporothecae from subglobose to hemisphaerical or oblate, 0.25–0.55 mm in height, 0.5–1.35 mm diam, covered with a dense layer of calcium carbonate crystals, white (263. White – 264. l. Gray), with a flat discoid base, radially striate from the stalk. Stalk cylindrical, 0.4–1 mm in height, up to 100 μm wide, calcareous, opaque, longitudinally striate (Fig. 43), yellowish grey (93. y Gray) by reflected light, colourless to pale yellow (92. y White – 89. p. Y) by LM, occasionally with a darker base and then filled with granular refuse material mixed with the calcium carbonate crystals. Hypothallus non-calcareous, membranous, inconspicuous, discoid, individual, occasionally with a few scattered lime crystals. Peridium double, outer layer a white to grey (263. White – 264. l. Gray), calcareous crust of stellate lime crystals smaller than the spores, the crust consisting of large conical scales, giving the appearance of a honeycomb in closed sporocarps (Figs. 39–40), the inner layer membranous, hyaline, iridescent when lime is absent; dehiscence irregular into funnel-shaped flakes, adhered to the capillitium on the inner surface. Columella white to grey (263. White – 264. l. Gray), calcareous, dome-shaped to subglobose, sometimes with irregular projections. Capillitium filiform, delicate, undulating, limeless, white by reflected light, yellowish brown (79. l. gy. y Br) with paler apices, to colourless by LM, capillitial threads smooth, 1–2 μm diam, branched and anastomosing forming a network (Fig. 41) with membranous expansions and pointed free ends, the ends attached to the inner peridial fragments. Spores free, blackish in mass, greyish brown (58. m. Br – 62. d. gy. Br) by LM, globose to angular when not fully turgid, (10-) 11–12 μm diam, warted (Fig. 42), baculate to pilate and fused in small groups by SEM (Figs. 44–46).

Didymium vaccinum (Durieu & Mont.) Rostaf.

CHI-06-02: decayed *Echinopsis* sp. internal tissue and epidermis, MA-Fungi 80419, 80427, 80428, 80429, 80430. CHI-06-06: hoja de *Puya* sp., MA-Fungi 80461. CHI-06-07: *Puya* sp. leaf, MA-Fungi 80469. CHI-06-54: *Puya chilensis* leaf, MA-Fungi 80710, 80714, 80715. CHI-06-57: tallo de *Puya chilensis*, MA-Fungi 80733, 80735, 80738. CHI-06-59: decayed *Eulychnia* sp., MA-Fungi 80757. CHI-06-64: grasses, MA-Fungi 80779. CHI-08-01: *Puya* sp. leaf, MA-Fungi 80801. CHI-08-09: *Stipa* sp. in, (mc, pH 6.5), dwb 3096. CHI-08-12: decayed *Copiapoa cinerascens*, (mc, pH 9.3), aet-12154; (mc, pH 9.0), aet-12166. CHI-08-15: *Eulychnia* sp. epidermis, (mc, pH 7.6), dwb 3178. CHI-08-23: decayed *Copiapoa solaris*, (mc, pH 8.1), aet-12163; (mc, pH 8.9), aet-12165. CHI-08-25: *Copiapoa* epidermis, (mc, pH 7.1), dwb 3156; (mc, pH 6.3), dwb 3158; (mc, pH 7.1), dwb 3159; (mc, pH 7.1), dwb 3175. CHI-08-27: decayed *Copiapoa* sp., MA-Fungi 80818; *Copiapoa* sp. epidermis, (mc, pH 7.4), dwb 3131; (mc, pH 6.9), dwb 3122. CHI-08-32: decayed *Eulychnia* sp., MA-Fungi 80841; *Eulychnia* sp. epidermis, (mc, pH 8.0), dwb 3222. CHI-08-34: *Miqueliopuntia miquelii* epidermis, (mc, pH 6.9), dwb 3114; (mc, pH 7.1), dwb 3134. CHI-08-35: decayed *Copiapoa coquimbana*, MA-Fungi 80846. CHI-08-36: *Puya* sp. leaf, MA-Fungi 80853, 80854; dead leaf bases of *Puya* sp. (mc, pH 5.4), dwb 3109. CHI-08-37: *Puya* sp. leaf, MA-Fungi 80856; dead leaf bases of *Puya* sp. (mc, pH 6.9), dwb 3111.

***Didymium wildpretii** Mosquera, Estrada, Beltrán-Tej., D. Wrigley & Lado

CHI-06-69: *Cryptocarya alba* wood, MA-Fungi 80798. CHI-08-23: decayed *Copiapoa solaris*, (mc, pH 8.9), aet-12167.

In South America, this species has been reported previously from Argentina (Lado et al. 2011), Brazil and Ecuador.

***Echinostelium colliculosum** K.D. Whitney & H.W. Keller

CHI-08-34: *Miqueliopuntia miquelii* epidermis, (mc, pH 6.9), dwb 3098; *Eulychnia* sp. bark, (mc, pH 6.6), dwb 2876.

In South America, this species has been reported previously from Argentina (Wrigley de Basanta et al. 2010b) and Brazil.

***Echinostelium minutum** de Bary

CHI-06-53: *Jubaea chilensis* bark, (mc, pH 3.3), dwb 2733; (mc, pH 3.4), dwb 2734; (mc, pH 3.1), dwb 2751; *Acacia caven* bark; (mc, pH 5.1), dwb 2877.

This relatively common species has been reported from Argentina (Wrigley de Basanta et al. 2010b; Lado et al. 2011) but is new for Chile.

***Enerthenema melanospermum** T. Macbr. & G.W. Martin

CHI-06-32: *Nothofagus* sp. wood, MA-Fungi 80576.

The blackish colour of the sporocarps and the columella with a large apical disk, up to 0.5 mm diam, are the most important distinguishing features of this species. This nivicolous myxomycete is commonly found near melting snow bank patches at other latitudes, but is not previously known from the Andes. Our collection occurred on very wet *Nothofagus* wood, at an elevation of around 1,600 m. It was found at the end of the austral summer when no snow remained. This is a new record for the Neotropics.

***Fuligo cinerea** (Schwein.) Morgan

CHI-06-06: *Quillaja saponaria* bark, (mc, pH 6.6), dwb 2880.

In South America, this species has been reported previously from Argentina and Brazil.

Fuligo septica (L.) F.H. Wigg.

CHI-06-23: Liana dead, (mc, pH 5.3), dwb 2730. CHI-06-24: *Nothofagus dombeyi* wood, MA-Fungi 80543, 80544. CHI-06-28: *Araucaria araucana* wood, MA-Fungi 80558; *Nothofagus pumilio* wood, MA-Fungi 80559. CHI-06-29: *Araucaria araucana* wood, MA-Fungi 80563. CHI-06-45: *Nothofagus* sp. wood, MA-Fungi 80623. CHI-06-47: *Mimosa* sp. wood, MA-Fungi 80626, 80627 (Lado 17787). CHI-06-50: wood, MA-Fungi 80638. CHI-06-51: wood, MA-Fungi 80660. CHI-06-56: *Puya chilensis* leaf, MA-Fungi 80732.

Hemitrichia calyculata (Speg.) M.L. Farr

CHI-06-48: *Pinus* sp. wood, MA-Fungi 80629.

***Hemitrichia leiocarpa** (Cooke) Lister

CHI-06-24: *Nothofagus dombeyi* wood, MA-Fungi 80548.

In South America, this species has previously been reported from Brazil and Colombia.

***Hemitrichia pardina** (Minakata) Ing

CHI-06-01: epidermis and spines of a cactus, MA-Fungi 80413.

In South America, this species has been reported previously from Brazil and Ecuador.

***Lamproderma maculatum** Kowalski

CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 88239, 88240, 88241, 88245. CHI-06-40: *Nothofagus* sp. wood, MA-Fungi 88243, 80607, 80608; *Berberis* sp. wood, MA-Fungi 80609; wood of an unidentified bush, MA-Fungi 80610; *Nothofagus* sp. wood, MA-Fungi 80611, 80612, 80613.

In South America, this nivicolous species has been reported previously from the Andes of Argentina, where it was found on *Nothofagus pumilio* wood. Like these collections from Chile, it was collected during the mid-austral summer and in the absence of snow (Wrigley de Basanta et al. 2010b).

***Lamproderma scintillans** (Berk. & Broome) Morgan

CHI-06-11: mixed ground litter, (mc, pH 5.4), sls 22814.

Leocarpus fragilis (Dicks.) Rostaf.

CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 80592, 80597.

***Lepidoderma chailletii** Rostaf.

CHI-06-15: *Araucaria araucana* bark, MA-Fungi 80509.

This is a new record for the Neotropics. Only a single collection of this nivicolous species was found in the Villarrica National Park, without any trace of snow in the general area. The specimen is a little damaged but the sporocarpic habit and the characteristic crystalline lime scales of the peridium permitted a positive identification.

***Lepidoderma granuliferum** (W. Phillips) R.E. Fr.

CHI-06-08: stem of a Compositae, MA-Fungi 80481.

In South America, this species has been reported previously from Argentina. The plasmodiocarpic habit, and the netted capillitium, containing large crystalline lime inclusions in the stellate expanded nodes, are the most relevant features of this nivicolous species (Poulain et al. 2011).

***Licea belmontiana** Nann.-Bremek.

CHI-08-36: Dead leaf bases of *Puya* sp. (mc, pH 6.6), dwb 3110. CHI-08-37: Dead leaf bases of *Puya* sp. (mc, pH 7.2), dwb 3112.

In South America, this species has been reported previously from Argentina (Lado et al. 2011).

Licea biforis Morgan

CHI-06-01: epidermis and spines of a cactus, MA-Fungi 80414. CHI-06-50: mixed litter, (mc, pH 5.9), sls 22810. CHI-06-53: wood, MA-Fungi 80684.

Licea eremophila D. Wrigley, Lado & Estrada

CHI-08-14: Dead leaf bases of *Puya* sp. (mc, pH 7.1), dwb 3092. CHI-08-34: *Miqueliopuntia miquelii* epidermis, (mc, pH 6.9), dwb 3113.

These collections were included in the recent description of this species as new to science (Wrigley de Basanta et al. 2010a)

***Licea kleistobolus** G.W. Martin

CHI-06-53: *Jubaea chilensis* bark, (mc, pH 3.4), dwb 2734b.

In South America, this species has been reported previously from Brazil.

***Licea minima** Fr.

CHI-06-53: *Jubaea chilensis* bark, (mc, pH 3.3), dwb 2735.

Licea succulenticola Mosquera, Lado, Estrada & Beltrán-Tej.

CHI-08-14: Dead leaf bases of *Puya* sp. (mc, pH 6.7), dwb 3062. CHI-08-27: *Copiapoa* sp. epidermis, (mc, pH 7.3), dwb 3127; (mc, pH 6.9), dwb 3124.

This species has been reported from other areas of the Atacama Desert (Lado et al. 2007).

Licea variabilis Schrad.

CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 80591.

Lycogala epidendrum (L.) Fr.

CHI-06-35: *Araucaria araucana* wood, MA-Fungi 80582. CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 80589. CHI-06-48: *Pinus* sp. wood, MA-Fungi 80628.

***Macbrideola ovoidea** Nann.-Bremek. & Y. Yamam.

CHI-08-27: *Copiapoa* sp. epidermis, (mc, pH 6.9), dwb 3100.

This is a new record for the Neotropics. This species was described from Japan (Nannenga-Bremekamp and Yamamoto 1983) on inflorescences of *Quercus serrata*. Poulain et al. (2011) also illustrated another collection from Japan but on inflorescences of *Castanea crenata*. It is the first time that the species has been collected from a succulent plant. Our collection displays the distinguishing characters of the species such as the translucent base of the stalk, the flexuose capillitial threads that do not anastomose, and spores 7–8.5 μm diam., with rather widely spaced, delicate spinules.

Metatrichia floriformis (Schwein.) Nann.-Bremek.

CHI-06-16, *Nothofagus* sp. wood, MA-Fungi 80513. CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 80588. CHI-06-43: *Nothofagus* sp. wood, MA-Fungi 80620. CHI-06-53: *Jubaea chilensis* leaves, MA-Fungi 80674; wood, MA-Fungi 80683.

***Paradiacheopsis fimbriata** (G. Lister & Cran) Hertel ex Nann.-Bremek.

CHI-06-04: Bark of woody shrub,(mc, pH 4.0), dwb 2943.

In South America, this species has been reported previously from Ecuador.

Perichaena depressa Lib.

CHI-06-50: mixed litter,(mc, pH 5.9), sls 22822. CHI-06-53: mixed litter,(mc, pH 6.3), sls 22812.

***Perichaena quadrata** T. Macbr. (Figs. 47–54).

CHI-06-05: *Quillaja saponaria*, (mc, pH 6.4), dwb 2727. CHI-06-53: *Jubaea chilensis* leaves, MA-Fungi 80675, 80692. CHI-06-55: *Ochagavia* sp. leaves, MA-Fungi 80727. CHI-06-57: *Puya chilensis* stem, MA-Fungi 80739. CHI-06-59: *Eulychnia* sp. epidermis, (mc, pH 4.9), dwb 2731. CHI-06-62: *Eulychnia* sp. epidermis, (mc, pH 6.3), dwb 2912. CHI-08-04: *Eulychnia* sp. epidermis, (mc, pH 6.6), dwb 3223. CHI-08-14: Dead leaf bases of *Puya* sp. (mc, pH 6.7), dwb 3067. CH)-08-27: Dead leaf bases of *Puya* sp. (mc, pH 6.7), dwb 3097; *Copiapoa* sp. epidermis, (mc, pH 6.9), dwb 3123; (mc, pH 7.4), dwb 3133.

In South America, this species has been reported previously from Argentina (Lado et al. 2011). All the collections we studied showed more or less pulvinate sporocarps, with a double peridium (Fig. 47), with the inner surface of the inner peridial layer showing marks of the impression of the spores (Fig. 48). The capillitial threads have a variable ornamentation that ranges from almost smooth to markedly reticulate by SEM and an irregular shape (Figs. 51–54), and the spores are ornamented with warts by LM, from pila to bacula by SEM (Figs. 49, 50). All these features agree with the description provided by Keller and Eliasson (1992).

Perichaena vermicularis (Schwein.) Rostaf.

CHI-06-01: bark and spines of a cactus, MA-Fungi 80416. CHI-06-02: decayed *Echinopsis* sp. internal tissue and epidermis, MA-Fungi 80426. CHI-06-57: decayed *Eulychnia* sp., MA-Fungi 80744. CHI-06-59: decayed *Eulychnia* sp., MA-Fungi 80754. CHI-06-62: decayed *Eulychnia* sp., MA-Fungi 80770, 80771. CHI-06-66: decayed *Eulychnia* sp., MA-Fungi 80784. CHI-08-11: decayed Eulychnia sp., MA-Fungi 80810, 80817. CHI-08-14: Dead leaf bases of *Puya* sp. (mc, pH 7.1), dwb 3054. CHI-08-15: *Eulychnia* sp. epidermis, (mc, pH 7.6), dwb 3165. CHI-08-35: decayed *Eulychnia breviflora*, MA-Fungi 80851.

Physarum bivalve Pers.

CHI-06-48: *Eucalyptus* sp. bark, MA-Fungi 80630, 80632, 88244, 88246. CHI-06-50: hojas, MA-Fungi 88249.

***Physarum bogoriense** Racib.

CHI-06-51: wood, MA-Fungi 80658. CHI-06-57: *Puya chilensis* stem, MA-Fungi 80743.

Physarum brunneolum (W. Phillips) Massee

CHI-06-03: leaves of a sclerophyll tree, MA-Fungi 80439. CHI-06-50: leaves, MA-Fungi 80639. CHI-06-53: leaves of a sclerophyll tree, MA-Fungi 80690; *Jubaea chilensis* leaves, MA-Fungi 80698, 80704.

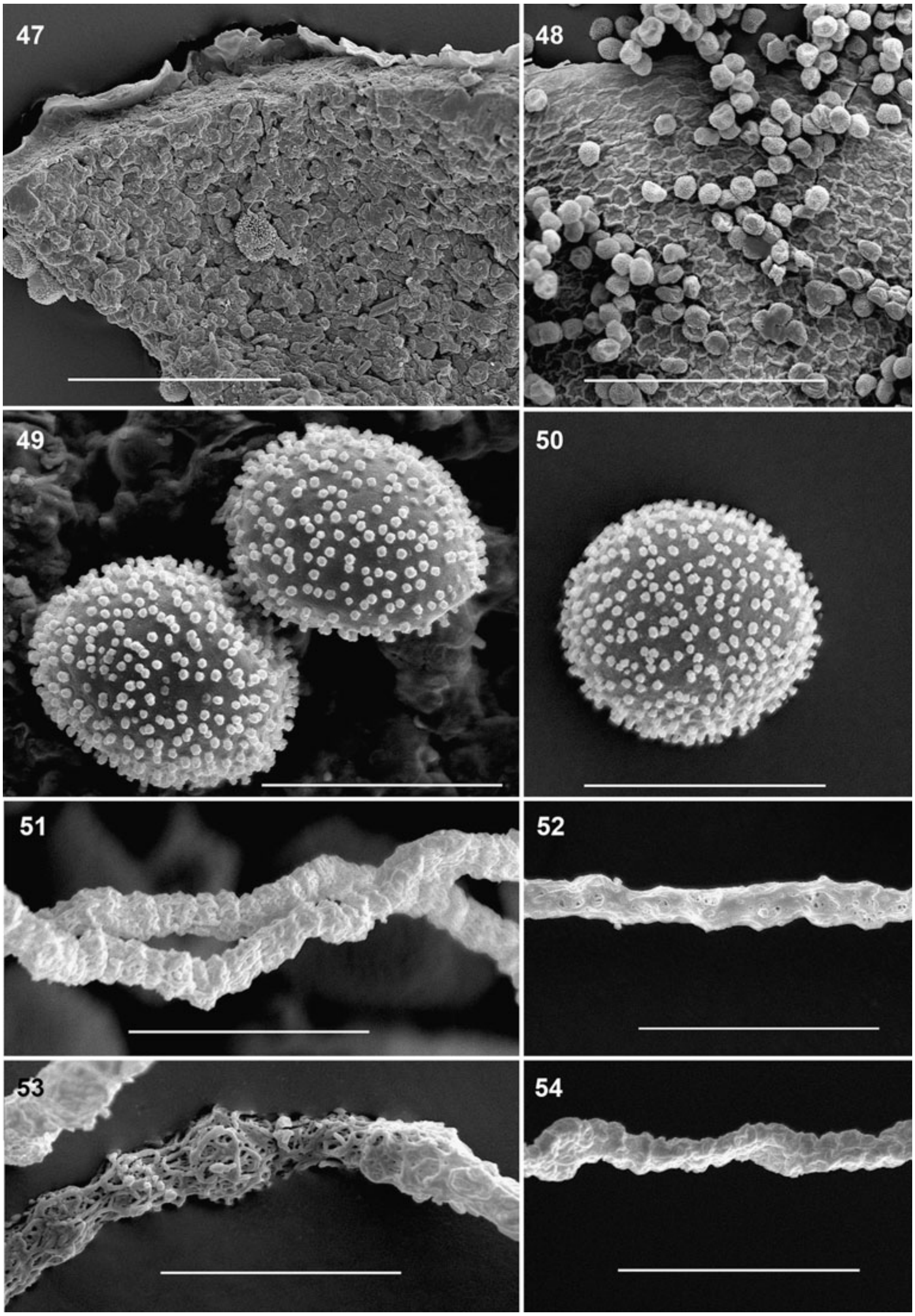
Physarum cinereum (Batsch) Pers.

CHI-08-36: Dead leaf bases of *Puya* sp. (mc, pH 5.4), dwb 3108.

*** Physarum clavisporum** G. Moreno, A. Sánchez, A. Castillo & Illana (Figs. 55–57).

CHI-06-03: leaves of a sclerophyll tree, MA-Fungi 88219, 88220, 88221, 88271, 88225, 80438. CHI-06-07: *Maytenus boaria* leaves and twigs, MA-Fungi 88227; *Puya* sp. leaf, MA-Fungi 88228. CHI-06-13: *Cajenetia angustifolia*, (mc, pH 5.9), dwb 2736. CHI-06-50: leaves, MA-Fungi 88248. CHI-06-57: *Puya chilensis* stem and leaves, MA-Fungi 80745.

This is a new record for the Neotropics. The species, described recently by Moreno et al. (2009) from the leaves of sclerophyll, semideciduous and deciduous trees and shrubs, seems to occur throughout the European and American areas of Mediterranean vegetation. Here it is recorded from Mediterranean vegetation in Chile, also from sclerophyll trees. Macroscopically, *Ph. clavisporum* can be confused with *Ph. bivalve* and *Ph. bitectum* G.



Figs. 47–54 *Perichaena quadrata* by SEM. **47.** Peridium (MA-Fungi 80739). **48.** Inner surface of the inner peridial layer marked with the impression of the spores (dwb 2727). **49.** Spores (MA-Fungi 80739). **50.** Spore (dwb 3123). **51.** Capillitial threads (dwb 2727). **52.** Detail of a capillitial thread with the typical pores of the genus and less obvious ornamentation (dwb 3123). **53.** Detail of an ornamented capillitial thread (MA-Fungi 80739). **54.** Capillitial thread (dwb 2727). Bar: 47=50 μm; 48=100 μm; 49–54=10 μm

Lister, two other species common on this type of substrate, but *Ph. clavisporum* has darker spores with a paler area. The spores also have an ornamentation consisting of irregularly distributed spines up to 1 μm high, described as bacula, that are sometimes fused and form short crests as observed by SEM (Moreno et al. 2009), and are minutely punctate between the bacula (Figs. 56, 57). The nodes of the capillitium are packed with granules of calcium carbonate (Fig. 55).

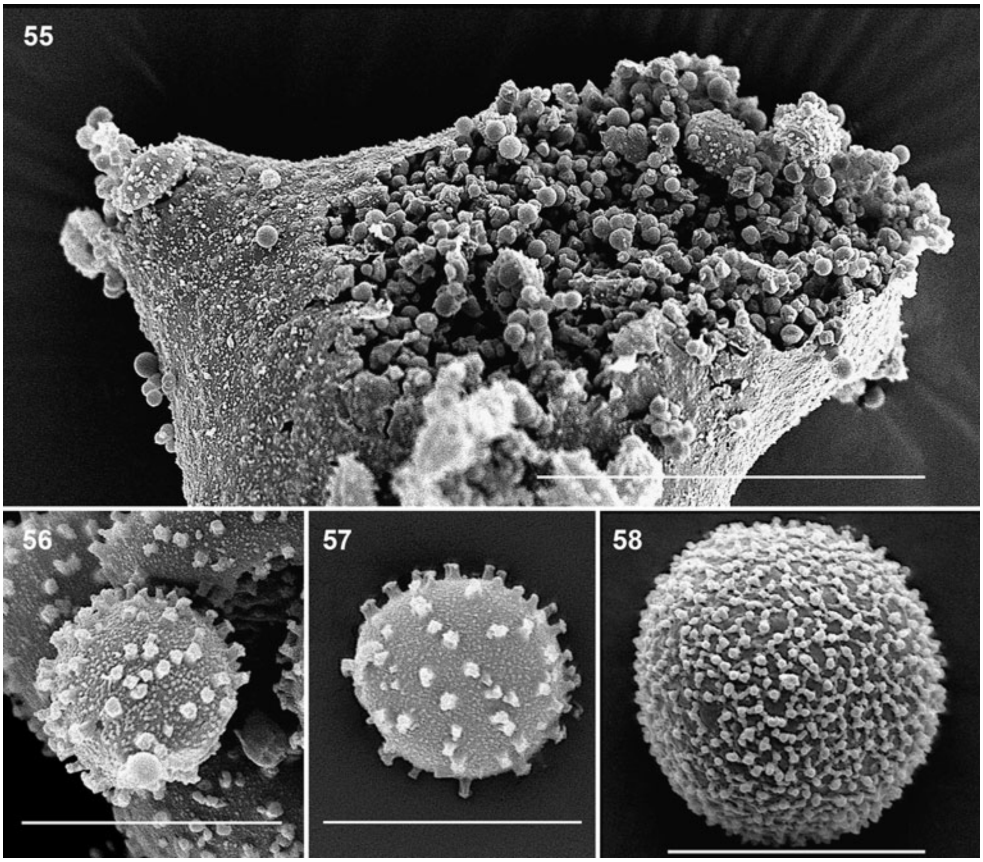
Physarum compressum Alb. & Schwein.

CHI-06-49: mixed aerial litter, (mc, pH 6.4), sls 22813. CHI-06-57: *Puya chilensis* stem, MA-Fungi 80737.

***Physarum contextum** (Pers.) Pers.

CHI-06-53: *Jubaea chilensis* leaves, MA-Fungi 80696, 80702; leaves of a sclerophyll tree, MA-Fungi 88252. CHI-06-54: *Jubaea chilensis* leaves, MA-Fungi 80720.

In South America, this species has been reported previously from Argentina.



Figs. 55–58 *Physarum clavisporum* (MA-Fungi 80438) by SEM. **55.** Detail of a node of the capillitium filled with calcium carbonate granules. **56.** Spore. **57.** Spore (MA-Fungi 88219). **58.** *Physarum nicaraguense* (dwb 2724) by SEM. Spore. Bar: 55=50 μm; 56–58=10 μm

*__Physarum decipiens__ M.A. Curtis

CHI-06-59: decayed *Eulychnia* sp., MA-Fungi 80761.

In South America, this species has been reported previously from Argentina (Lado et al. 2011), Bolivia, Brazil and Peru.

Physarum leucophaeum Fr.

CHI-06-06, leaves, MA-Fungi 80464. CHI-06-15: *Araucaria araucana* wood, MA-Fungi 88235. CHI-06-48: *Eucalyptus* sp., bark MA-Fungi 88247. CHI-06-55: wood, MA-Fungi 80723.

*__Physarum licheniforme__ (Schwein.) Lado

CHI-08-03: decayed *Eulychnia* sp., MA-Fungi 88256.

In South America, this species has been reported previously from Argentina (Lado et al. 2011).

*__Physarum newtonii__ T. Macbr.

CHI-06-01: leaves of a sclerophyll tree, MA-Fungi 80701, 80417. CHI-06-03: leaves of a sclerophyll tree, MA-Fungi 80432. CHI-06-52: *Puya chilensis* leaf, MA-Fungi 80669.

This is a new record for South America. The collections from Chile have the subglobose sporotheca with typical purple colour, short stalks, and dark spores characteristic of this species. Lister (1925) commented on the differences between this species and *Craterium paraguayense* (Speg.) G. Lister, another species with a purple colour that is widely distributed in the Neotropics (Lado and Wrigley de Basanta 2008). The shape of the sporotheca (deep cup-shape) and the paler spores seem to be the only characters that distinguish *C. paraguayense* from *Ph. newtonii*.

*__Physarum__ cf. **nicaraguense** T. Macbr. (Fig. 58)

CHI-06-05: *Quillaja saponaria*, (mc, pH 6.4), dwb 2724.

We have included a large, well-developed collection consisting of 30 groups of multilobate and compound-contorted sporocarps, obtained in moist chamber culture, of this taxon. However, the stalks are very short to absent, giving the clusters an almost sessile appearance, whereas *Physarum nicaraguense* is described as having short fluted stalks. The capillitium is densely calcareous, with large angular nodes massed in the centre as a pseudocolumella, and the spores are 10–12.5 μm diam, closely warted, with the warts joined by a reticulum by SEM (Fig. 58). This species was described originally from Nicaragua and has been reported previously from Mexico, Central America and in South America from Brazil.

*__Physarum notabile__ T. Macbr.

CHI-06-15: *Araucaria araucana* wood, MA-Fungi 80512. CHI-06-58: mixed ground litter, (mc, pH 6.0), sls 22799.

In South America, this species has been reported previously from Argentina, Bolivia and Brazil.

*__Physarum__ cf. **nucleatum** Rex

CHI-06-53: *Jubaea chilensis* inflorescence, MA-Fungi 81385.

The sporocarps in this collection have no pseudocolumella but the rest of the characters fit this species.

Physarum pusillum (Berk. & M.A. Curtis) G. Lister

CHI-06-15: *Araucaria araucana* wood, MA-Fungi 80508.

Physarum spectabile Nann.-Bremek., Lado & G. Moreno

CHI-06-01: epidermis and spines of a cactus, MA-Fungi 80412, 80415. CHI-06-02: decayed *Echinopsis* sp. internal tissue and epidermis, MA-Fungi 80424, 80425; on decayed *Eulychnia* sp. in mc, aet-12170. CHI-06-54: on *Puya* sp. in mc, aet-12169. CHI-06-55: inflorescence of *Puya chilensis*, (mc, pH 6.6), dwb 2891; (mc, pH 6.3), dwb 2893. CHI-06-57: *Puya chilensis* stem, MA-Fungi 80740. CHI-06-58: decayed *Eulychnia* sp., MA-Fungi 80753. CHI-06-59: decayed *Eulychnia* sp., MA-Fungi 80758. CHI-06-62: decayed *Eulychnia* sp., MA-Fungi 80769. CHI-06-66: leaves, MA-Fungi 80781. CHI-06-68: decayed *Echinopsis* sp., MA-Fungi 80791, 80792. CHI-08-03: decayed *Eulychnia* sp., MA-Fungi 80805, 80807. CHI-08-04: *Eulychnia* sp. epidermis, (mc, pH 6.6), dwb 3221. CHI-08-23: decayed *Copiapoa solaris*, (mc, pH 8.9), aet-12164. CHI-08-31: decayed *Eulychnia* sp., MA-Fungi 80834. CHI-08-35: decayed *Copiapoa coquimbana*, MA-Fungi 80845. CHI-08-36: *Puya* sp. leaf, MA-Fungi 80855. CHI-08-38: decayed *Eulychnia acida*, MA-Fungi 80857.

This species has been reported from other areas of the Atacama Desert (Lado et al. 2007) in Chile and the Monte Desert in Argentina (Lado et al. 2011).

Physarum viride (Bull.) Pers.

CHI-06-19: *Nothofagus dombeyi* wood, MA-Fungi 80519, 80520. CHI-06-23: *Nothofagus* sp. wood, MA-Fungi 80539, 80541. CHI-06-52: *Puya chilensis* leaf, MA-Fungi 80664.

***Reticularia intermedia** Nann.-Bremek.

CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 88242.

This species has been reported previously from Argentina.

Stemonitis axifera (Bull.) T. Macbr.

CHI-06-18: *Nothofagus* sp. wood, MA-Fungi 80517. CHI-06-19: *Nothofagus dombeyi* wood, MA-Fungi 80522. CHI-06-23: *Nothofagus* sp. wood, MA-Fungi 80542. CHI-06-47: *Mimosa* sp. wood, MA-Fungi 80625.

Stemonitis fusca Roth

CHI-06-11: mixed aerial litter, (mc, pH 5.1), sls 22824. CHI-06-19: mixed litter, (mc, pH 5.2), sls 22098. CHI-06-23: mixed litter, (mc, pH 5.2), sls 22821. CHI-06-39: mixed aerial litter, (mc, pH 4.7), sls 22820. CHI-06-42: mixed litter, (mc, pH 5.1), sls 22815. CHI-06-49: mixed aerial litter, (mc, pH 6.4), sls 22819; mixed ground litter, (mc, pH 6.2), sls 22823.

All of these collections belong to the var. *nigrescens* (Rex) Torrend.

Stemonitis splendens Rostaf.

CHI-06-41: *Nothofagus* sp. wood, MA-Fungi 80614. CHI-06-51: wood, MA-Fungi 80649. CHI-06-53: wood, MA-Fungi 80687.

This material is characterized by a smaller mesh on the surface capillitial net than that described by Nannenga-Bremekamp (1991) for *S. lignicola* Nann.-Bremek., but according to Moreno et al. (2004), these taxa are conspecific.

Trichia affinis de Bary

CHI-06-20: *Nothofagus dombeyi* wood, MA-Fungi 80530. CHI-06-32: *Nothofagus* sp. wood, MA-Fungi 80567, 80568, 80572, 80573, 80574. CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 80866, 80601. CHI-06-38: *Nothofagus* sp. wood, MA-Fungi 80602, 80603. CHI-06-43: *Nothofagus* sp. wood, MA-Fungi 80618, 80621.

***Trichia alpina** (R.E. Fr.) Meyl.

CHI-06-21: twig of a living Compositae, MA-Fungi 80534. CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 80594; *Nothofagus pumilio* wood, MA-Fungi 80598.

This is a new record for the Neotropics. It is another nivicolous myxomycete, not reported previously from the Andes, but easy to identified by virtue of the blackish sporophores that, when dehisced, show in contrast the yellow mass of spores and capillitium. Also, the thick capillitial threads, up to 8 μm diam, and the large spores, 14–18 μm diam, distinguish this species.

Trichia contorta (Ditmar) Rostaf.

CHI-06-15: *Araucaria araucana* wood, MA-Fungi 80505. CHI-06-26: stem of a Compositae, MA-Fungi 80552, 80557. CHI-06-32: *Nothofagus* sp. wood, MA-Fungi 80570, 80571; *Nothofagus* sp. wood and *Araucaria araucana* leaves, MA-Fungi 80575. CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 88238. CHI-06-40: *Nothofagus* sp. wood, MA-Fungi 80605. CHI-06-48: *Eucalyptus* sp. bark, MA-Fungi 80636. CHI-06-53: *Jubaea chilensis* leaves, MA-Fungi 80708.

Trichia decipiens (Pers.) T. Macbr.

CHI-06-29: *Araucaria araucana* wood, MA-Fungi 80560, 80561, 80562. CHI-06-37: *Nothofagus pumilio* wood, MA-Fungi 80596.

***Trichia lutescens** (Lister) Lister

CHI-06-18: *Nothofagus* sp. wood, MA-Fungi 80516. CHI-06-21: *Nothofagus antarctica* wood, MA-Fungi 80535, 80536. CHI-06-26: *Nothofagus* sp. wood, MA-Fungi 80553, 80554, 80556. CHI-06-32: *Nothofagus* sp. wood, MA-Fungi 80569. CHI-06-35: *Araucaria araucana* wood, MA-Fungi 80580.

This species has been reported previously from Brazil and Argentina (Wrigley de Basanta et al. 2010b) in South America.

Trichia persimilis P. Karst.

CHI-06-19: *Nothofagus dombeyi* wood, MA-Fungi 80523, 80528. CHI-06-41: *Nothofagus* sp. wood, MA-Fungi 80615. CHI-06-46: *Puya* sp. leaf, MA-Fungi 80624.

***Trichia scabra** Rostaf.

CHI-06-24: *Nothofagus dombeyi* wood, MA-Fungi 80546. CHI-06-52: *Puya chilensis* leaf, MA-Fungi 80666. CHI-06-53: wood, MA-Fungi 80685. CHI-06-57: *Puya chilensis* stem, MA-Fungi 80742.

Trichia varia (Pers. ex J.F. Gmel.) Pers.

CHI-06-14: *Araucaria araucana* wood, MA-Fungi 80501. CHI-06-15: *Araucaria araucana* wood, MA-Fungi 80506, 80507, 80510, 80511. CHI-06-30: *Araucaria araucana* wood, MA-Fungi 80566. CHI-06-35: *Araucaria araucana* wood, MA-Fungi 80581, 80583. CHI-06-41: *Nothofagus* sp. wood, MA-Fungi 80616.

Trichia verrucosa Berk.

CHI-06-16: *Nothofagus* sp. wood, MA-Fungi 80514. CHI-06-24: *Nothofagus dombeyi* wood, MA-Fungi 80550. CHI-06-25: *Nothofagus dombeyi* wood, MA-Fungi 80551.

***Willkommlangea reticulata** (Alb. & Schwein.) Kuntze

CHI-06-19: *Nothofagus dombeyi* wood, MA-Fungi 80524, 80525, 80529.

Discussion

The 633 collections obtained in the present study represent a total of 110 species in 29 genera. Two species (*Dianema succulenticola* and *Didymium chilense*) are described as new to science, and 10 species (*Collaria nigricapillitia, Comatricha alta, Dianema depressum, Didymium eximium, D. nivicolum, Enerthenema melanospermum, Lepidoderma chailletii, Macbrideola ovoidea, Physarum clavisporum* and *Trichia alpina*) are new records for the entire Neotropical region. Two others were not known from South America (*Cribraria oregana* and *Physarum newtonii*) prior to this study. Lado and Wrigley de Basanta (2008) listed 102 species for Chile, and three additional species (*D. infundibuliforme, L. eremophila, D. operculatum*) new to science and based on material collected during the 2008 survey have been described since then (Wrigley de Basanta et al. 2009, 2010a, 2011). The new records reported herein increase the total number of species now known from Chile to 163. This number represents almost 40% of the total of all species of myxomycetes reported for the Neotropics (Lado and Wrigley de Basanta 2008), which indicates the richness of the myxomycete biota of Chile.

This survey of Chile described herein covered 2,300 km from North to South in the country, along a primary transect with several transverse ocean to mountain secondary transects (Fig. 1), and a wide variety of different vegetation types were sampled, which had a positive effect upon the diversity of myxomycetes collected. The type of vegetation is, in turn, influenced by geographical and climatic factors such as differences in latitude, the presence of two high and long mountain chains (the Andes and Coastal mountains), the marine Humboldt cold stream current, the presence of a high pressure area over the Pacific and the Polar barrier. In the northern portion of the area sampled, extremely xeric climatic conditions predominate, with areas such as the Atacama Desert going without any rain the entire year. The vegetation in the Atacama Desert was very scanty or absent, and endemic cacti and spiny shrubs dominated, frequently restricted to the western side of the mountains where there was condensation from the coastal fog. Myxomycetes such as *Badhamia melanospora, Didymium vaccinum*, *Perichaena vermicularis* and the newly described *Didymium infundibuliforme* and *D. operculatum* were the most common species, appearing on succulent substrates such as the decaying tissue of the cacti present, including species of *Echinopsis, Eulychnia* or *Copiapoa*. One of the new species described here (*Dianema succulenticola*) appeared toward the southern end of these xeric ecosystems on two species of endemic cacti. *Badhamia melanospora, Didymium vaccinum*, *Perichaena vermicularis* and others species such as *Licea succulenticola* and *Physarum spectabile*, have been found previously in the far northern part of Chile (Lado et al. 2007) on succulent plants. Altogether, 58% of the species found in that earlier survey were found again in the present survey. On the other side of the Andes, in the Monte desert of Argentina (Lado et al. 2011), these species appeared also, as did *Craterium leucocephalum, D. wildpretii, Echinostelium arboreum, E. colliculosum, Licea belmontiana* and *Licea eremophila.* More than half of the species from the Monte Desert (56%) were recorded again in this xeric area of Chile.

The central portion of Chile, located between 31° and 37° south latitude, is dominated by warm temperate ecosystems. The region is a transitional zone or ecotone between the arid areas of the north and more humid areas to the south. The precipitation increases gradually (Table 1), and the vegetation is dominated by Mediterranean-type sclerophyll forests and scrub (chaparral). These forests are made up of trees with leaves specially adapted to avoid the lost of moisture by transpiration. These include such examples as *Peumos boldo, Quillaja saponaria, Cryptocaria alba*, or the palm *Jubaea chilensis* (Fig. 5), with the bromeliad *Puya* spp. and certain cacti mixed among them. In this highly diverse vegetation, there were a large number of different species of myxomycetes, ranging from many foliicolous to some succulenticolous forms. Once again, *Badhamia melanospora* appeared on the cacti, but *Craterium leucocephalum*, *Didymium squamulosum*, and the new *Didymium chilense* also were common, and 11 species of the genus *Physarum* were collected.

With an increase in the precipitation gradient between 37° and 43° south latitude (Table 1), with rainfall occurring throughout the year, trees with perennial leaves (e.g., *Araucaria araucana* and *Nothofagus* spp.) prevail. In this type of forest, we found a different myxobiota characterized by a predominance of lignicolous species. There were four species of *Cribraria* collected and three species of *Comatricha*, along with *Fuligo septica* and *Metatrichia floriformis*. A particularly interesting result was the appearance of large numbers of representatives from the genus *Trichia*, otherwise rare in this survey. This was noted for a similar type of vegetation, the subantarctic forests of Argentina (Wrigley de Basanta et al. 2010b), found at similar latitudes but on the other side of the Andes, where the same species in this genus were found. *Trichia verrucosa* was often exceedingly abundant in both regions, although this species is infrequently collected in forests at other latitudes.

Up in the Andean mountains, which extend along the length of Chile, at over 1,000–3,000 m elevation, depending on the latitude, the environment of the areas where collecting was carried out, had little precipitation, much of it occurring as snow, low temperatures and high solar radiation. In general, the vegetation was typical of such high mountain ("Andean") areas, being composed of grasses along with cushion-shaped and trailing small shrubs (Figs. 9, 10), adapted for survival in these extreme environments. In these areas, nivicolous species of myxomycetes, those that usually complete their life cycles near melting snow, appeared. Species such as *Lamproderma maculatum, Lepidoderma chailletii, L. granuliferum, Diderma niveum, Didymium nivicolum* and *Trichia alpina* were common. In most cases, large, well developed fruitings were found, without even a trace of snow, since the collecting time was at the end of the austral summer. It is possible that these nivicolous species are more montane-related than purely arctic-alpine elements (Ronikier and Ronikier 2009). Some normally nivicolous species were also reported from some montane sites in the study of Argentinian subantarctic forests by Wrigley de Basanta et al. (2010b), and Stephenson et al. (2007) recorded several species from subantarctic Macquarie Island, again with no snow present. A possible reason for finding these species, otherwise considered nivicolous, during the summer, is that they occur at high elevations where the environment remained cold throughout the summer and there was fairly constant moisture available. A similar explanation would apply to the situation on Macquarie Island. In some instances in the present study, the elevation at which nivicolous species were collected was over 2,700 m (at 31° S) and in others instances, a higher latitude (38°–39° S) would have produced conditions that allowed them to be found at a lower elevation (1,100–1,300 m).

An analysis of the results in relation to latitude indicates that a greater number of collections (53%) were made between 31-34° S latitude, and when the results are corrected for the amount of time spent in study areas at each latitude, 34° S yielded the greatest number of myxomycetes. In terms of elevation, the majority of collections (79%) were made at elevations below 2,000 m, and the greatest number of collections (56%) was made between 500 and 1,000 m, with 23% obtained at elevations from sea level to 500 m. These results are consistent with those obtained for comparable latitudes in Argentina, where study areas located at latitude 28° S in the northern part of the country were the most productive within the range of latitude (23° to 33° S), while in the southern part study areas at latitude 42° S were the most productive within the range (39°–54° S) sampled. The greatest number of collections in the northern part of Argentina were recorded between 1000 and 1,500 m, whereas in the subantarctic forests of Patagonia numbers were higher at lower elevations (200–400 m) (Wrigley de Basanta et al. 2010b; Lado et al. 2011). These data suggest that distinct patterns of distribution exist for myxomycetes in this part of South America, with the succulenticolous, foliicolous, lignicolous and nivicolous species distributed according to the prevailing environmental conditions and the availability of substrates in each habitat.

The complementarity of the assemblages of myxomycetes associated with the three regions of Chile, the Monte Desert in Northern Argentina (Lado et al. 2011) and the subantarctic forests of Patagonia in Southern Argentina (Wrigley de Basanta et al. 2010b), was calculated using the formula proposed by Colwell and Coddington (1994). Data from the northernmost part of Chile, published previously by Lado et al. (2007), were included in the analysis under Chile N. The results are presented in Table 3.

Complementarity is a measure of the biotic distinctness or dissimilarity of the species composition when two areas are compared (Colwell and Coddington 1994). It allows patterns of diversity under different conditions to be observed, and varies from a value of zero to 1, with zero indicating an identical species composition and 1 a situation in which the species compositions are totally different. These moderately high (0.667) to high values (0.905) of complementarity indicate a considerable difference in the assemblages of species of myxomycetes, in spite of the geographic proximity of the regions being considered. For the three regions of Chile, there is a difference of 79.6% (0.796) between the Mediterranean vegetation of the central region and the arid northern region, and an 82.1% difference between the former and the temperate colder southern region. Only four species of myxomycetes (*Arcyria cinerea, Didymium anellus, Trichia contorta* and *T. scabra*) were recorded from all three regions. In an analysis of the

Table 3 Matrix of community similarity values calculated for the myxobiotas of different regions of South America, a complementarity index

	Monte	Chile N	Chile C	Chile S	Patagonia
Monte	0				
Chile N	0.667	0			
Chile C	0.786	0.796	0		
Chile S	0.882	0.889	0.821	0	
Patagonia	0.897	0.905	0.809	0.687	0

N=North, C=Centre, S=South

distribution of fungi, plants and insects, Crisci et al. (1991) indicated that the South America biota has a hybrid origin, and that organisms in the northern (tropical) areas and the southern (patagonian) areas have an independent history. The authors concluded that the latter are more closely related to the biota of Australia, New Caledonia, New Guinea, New Zealand and Tasmania, while the former areas have elements more closely related to the Neotropics. This fact could account for the low percentage of species of myxomycetes shared in common between the northern and southern Chile.

On the other hand, the lowest values of complementarity (i.e., greatest similarity) exist between the assemblage of species found in northern Chile and the assemblage associated with the Monte Desert on the other side of the Andes. However, there is still a difference of 66.7% between the assemblages of species from each region. Both regions are in the South American Transition Zone (Morrone 2004) and share succulenticolous species of myxomycetes, most notably the recently described *Didymium infundibuliforme* (Wrigley de Basanta et al. 2009) and *Licea eremophila* (Wrigley de Basanta et al. 2010a), both associated with species of cacti and succulents common to both sides of the Andes. A similar situation exists between southern Chile and Argentinian Patagonia, where the calculated value of 68.7% indicates a clear difference in species composition. The natural barrier formed by the Andes during the Pleistocene which favoured the isolation of other groups of organisms (e.g., insects) east and west of the main mountain chain (Roig-Juñent et al. 2006), could explain why only about 30% of the species of myxomycetes on each side of the Andes are the same.

The most productive region of Chile in terms of collections of myxomycetes, corrected for the collecting effort in each area in relation to the number of positive collecting localities sampled, appears to be Region VI, where Mediterranean woodland was mixed with the spiny xerophyllous scrubland "chaparral" (Table 4), and this was followed by Region V, which had considerable overlap in the type of vegetation present. Region V had the greatest number of species (51), but when corrected for positive localities, Region VI was more diverse. Considering the S/G ratios, a measure of taxonomic diversity used in many previous studies (Stephenson et al. 1993), a surprising result was the diversity of myxomycetes found in the hyper-arid Region II (Antofagasta), which had the lowest S/G ratio of the survey, since the lower the number, the more diverse the area. The S/G ratio for the whole survey was 3.79, which indicates a slightly higher taxonomic diversity than the results (3.9) obtained for the dryland ecosystem in Mexico (Estrada-Torres et al. 2009) but is within the range of values (2.2-4.6) reported for tropical and temperate forests (Stephenson et al. 1993). A comparison of the value (2.9) obained for Argentinian Patagonia (Wrigley de Basanta et al. 2010b), which is similar to Region IX described in this paper when combined with that calculated for the Monte Desert Argentina (3.27), which is similar to Regions II-IV (Lado et al. 2011), the resulting ratio is 4.35, or much less diverse than the 3.8 of present survey. The Mediterranean type of vegetation, which is missing from the surveys carried out in Argentina, possibly accounts for the higher diversity in Chile.

All the results provided thus far consider both field collections and those from moist chamber cultures. The 110 species reported include 86 species found in the field, 41 species appearing in moist chamber cultures and 17 species recorded as both field collections and from moist chamber cultures. According to the estimators ACE and CHAO1, if the sampling effort was exhaustive, the number of species to be expected is calculated as 145 and 147,

Table 4 Summary data on the different regions of Chile (*species or collections/positive localities)

Region	Collecting localities (positive)	Total Collections	Spp	Spp./ locality*	Collections/ locality*	S/G ratio	Vegetation
II	15 (6)	64	13	2.17	10.67	1.63	Xerophyllous scrubland, grassland in desert, salt flats
III	18 (10)	53	12	1.2	5.30	2.00	Xerophyllous scrubland and Andean pre-puna
IV	19 (18)	99	23	1.28	5.50	1.92	Coastal and spiny scrub with cacti
V	10 (10)	146	51	5.1	14.60	2.68	Coastal scrub, sclerophyll forest, xerophyllous scrub
RM	9 (8)	57	23	2.88	7.10	2.30	Andean scrubland and sclerophyll forest with some cacti
VI	4 (4)	79	21	5.25	19.75	1.91	Spiny xerophyllous scrub, sclerophyll forest, mediterranean woodland
IX	31 (29)	133	42	1.45	4.59	2.00	*Araucaria* and *Nothofagus* forest and Andean scrubland

respectively (Fig. 59), and the estímate based on the Clench function is 166 species (Fig. 60). This indicates that the sampling effort of the present survey was 75-76% complete according to ACE and CHAO1, or 66% according to Clench, for a total of just four weeks of collecting. This suggests that the survey recovered a large proportion of the assemblage of myxomycetes to be expected in the areas studied, and the overall results are comparable to those obtained in the Monte Desert in Argentina (Lado et al. 2011). The results are even more surprising if the huge area studied and the variable nature of the vegetation are taken into consideration. In addition, the fact that in the four weeks involved in the two surveys, some myxomycetes were not recovered does not mean they were not present, but it may simply mean that the optimum conditions for those species did not exist at the time the surveys were carried out. The almost 20% of the collecting sites that did not yield any collections were almost all located in the Atacama desert, where there was virtually no vegetation to serve as a substrate for the development of myxomycetes, and this makes the diversity found there even more surprising.

The number of positive moist chamber cultures is often used as a measure of productivity in studies of myxomycetes. Only 65% of the 228 moist chamber cultures were positive, that is showed some evidence of the presence of myxomycete plasmodia or fruiting bodies. If collections recovered from moist chamber cultures are assessed separately using the ACE and CHAO1 estimators, only 65-73% of the expected number of species were recovered. As noted in other studies (e.g. Estrada-Torres et al. 2009; Wrigley de Basanta et al. 2010b) some plasmodia produced only poor or malformed specimens, which are not included in the results, and in some cases formed only sclerotia that never fruited in the time span (three months) that the cultures were maintained. A possible reason for the lower productivity of the moist chamber cultures was the pH of some of the substrates, since this parameter has been shown to influence the distribution of myxomycetes (e.g., Wrigley de Basanta 2000, 2004). There was a wide range of pH from 3.1 to 9.3. This is due to the different types of substrates used, which ranged from the bark of shrubs and trees (acidic) to the inner tissue of decaying cacti (basic). The productivity was higher for moist chambers prepared with plants from dryland areas such as the Monte desert (82%), which were characterized by a pH range of 4.4 to 9.2, but most collections recorded there were made from substrates with a pH of 6.0 to 7.9 (Lado et al. 2011). In another dryland area that has been studied, 77% of 250 cultures of cacti from the Tehuacán-Cuicatlán Valley of Mexico were positive, where the internal tissue of cacti had a pH of 7.5 to 10.0 (Estrada-Torres et al. 2009). However, the range of pH for substrates from the subantarctic forests of Patagonia in Argentina was low (3.3 to 6.8) and the productivity was only 37%. The two studies are comparable as they were carried out in the same manner by the same people. The substrates in this area of Chile also could have become progressively more acidic over time as a result of their exposure to emissions from the numerous volcanoes in the area, something that could have negatively affected the field results, too. However, the effect in the closed system of the moist chamber would most likely be greater.

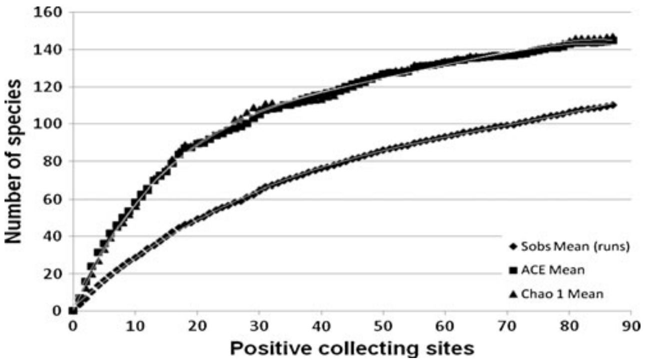


Fig. 59 Curves of abundance (ACE and CHAO1 estimators) compared to the species observed curves (Sobs) of this survey. White lines indicate the polinomial best-fit curve

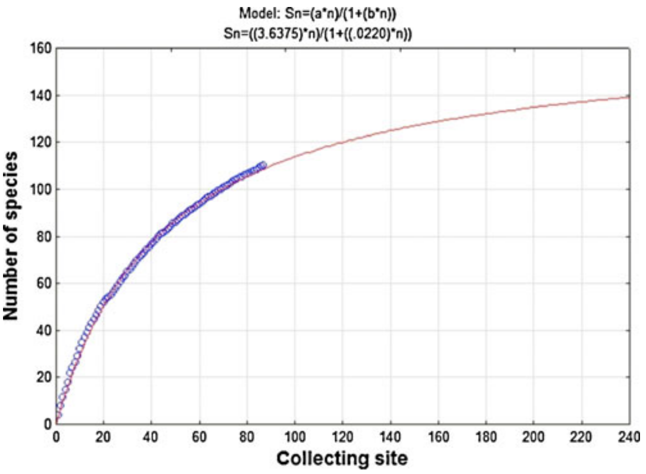


Fig. 60 Species accumulation curve using the adjustment by Clench

Although there are similarities in the assemblages of myxomycetes in similar environments, as discussed above, there are also obvious restrictions in the distribution of some species. The surveys discussed in this paper have produced to date five species new to science and not recorded from other well-studied similar environments. These results support the moderate endemicity model of microorganism dispersal proposed by Foissner (2006, 2008), which is similar to that known for higher animals and plants, as indicated by Stephenson et al. (2008) and Wrigley de Basanta et al. (2011). The restricted distribution can not be explained alone by macroenvironmental factors such as precipitation, temperature, latitude and elevation, although these affect the distribution and growth of the plants that provide substrates for myxomycetes. As suggested by Lado et al. (2011), specific microenvironmental factors associated with the plants themselves must determine the presence or absence of certain species, such as *Badhamia melanospora* (found primarily on cacti) or *Didymium operculatum* (recorded so far on a single genus of cacti, *Copiapoa*, endemic to Chile), and restrict their occurrence to these substrates. The results presented herein also underline the fact that Chile is an enormously diverse country, for myxomycetes as well as for other better known organisms, since the country has almost 40% (Lado and Wrigley de Basanta 2008) of the myxomycetes reported for the entire Neotropics.

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