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Biodiversity of myxomycetes in subantarctic forests of Patagonia and Tierra del Fuego, Argentina

by

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With 34 figures and 3 tables

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Abstract: A biodiversity survey for myxomycetes was carried out in Patagonia and Tierra del Fuego (Argentina) in late January and early February 2005. Specimens were collected from six National Parks, located in five different provinces between 39° and 55°S latitude. *Nothofagus* forests represented the primary vegetation type investigated, but Valdivian temperate rainforests also were included in the survey, as were coniferous forests dominated by species of *Araucaria*, *Astrocedrus* and *Fitzroya*. More than four hundred (442) specimens of myxomycetes representing 67 different species in 23 genera were collected either in the field, or from moist chamber cultures prepared with samples of bark and litter obtained from the same collecting sites. The total species list generated from both the field and laboratory components of the survey includes six new records for South America and 13 new records for Argentina. Two species of the genus *Diderma*, *D. gracile* and *D. robustum*, described originally from Tierra del Fuego 35 years ago and not reported since, were among the more interesting collections. A third species of the genus, *D. antarcticum*, found only once since its description in 1887, was found for the third time in the world during the survey. These collections were compared to the type material deposited in La Plata, Argentina (LPS) and the first photographs of these species by LM and SEM are included. Ecological comments are made on how macroenvironmental factors as well as microhabitats, influence patterns of myxomycete distribution.

Keywords: *Diderma,* geographical distribution, National Parks, *Nothofagus*, SEM.

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Introduction

Argentina, one of the largest countries in the world, extends in the Southern Hemisphere from just above the Tropic of Capricorn to the archipelago of Tierra del Fuego and Antarctica and encompasses a great diversity of vegetation types that range from subtropical "yungas" to subantarctic and Magellanic forests. Patagonia was selected by the Centres of Plant Diversity project (WWF/IUCN) as a priority conservation site for vascular plants, since it is an area characterized by a rich and diverse flora that is threatened with desertification and by human activities such as overgrazing (Davis et al. 1997). The Patagonian Andean forests are dominated by trees of the genus *Nothofagus* (southern beech), of which there are ten species in South America between latitudes 56° to 33°S. Among the species found in Argentina are the evergreen *Nothofagus betuloides* and the deciduous *N. pumilio* at the southern wetter end of the west to east precipitation gradient, along with the evergreen *N. dombeyi* and the larger-leaf deciduous species *N. obliqua* in the more northerly warmer areas and *N. antarctica* towards the drier eastern areas (Gut 2008).

The diversity of myxomycetes in many areas of Argentina is unknown, since most of the existing records are from the central and north portion of the country. Results from previous work done in these southern provinces was published by Spegazzini (1887), Digilio (1946), Arambarri (1972, 1973, 1975), and Deschamps (1976). However, the catalogue of myxomycetes in the four provinces other than Tierra del Fuego, amounted to only nine species in total (Crespo & Lugo 2003).

During late January and early February 2005, a biodiversity survey for myxomycetes was carried out in Patagonia and Tierra del Fuego by a team of investigators from six different countries (Wrigley de Basanta & Stephenson 2005). The primary objective of this survey, which encompassed areas of the Patagonian Andes on the borders of Chile and Argentina along with the Argentinian portion of Tierra del Fuego, was to obtain data on myxomycete diversity. A secondary objective was to assess the biodiversity of protostelids and dictyostelids, two other groups of eumycetozoans. The majority of the collecting effort was directed towards relatively undisturbed forests in six National Parks. The purpose of this paper is to report the results obtained for myxomycetes from this survey.

Materials and methods

All localities visited were located within or in the immediate vicinity of six Southern National Parks (NP) in Patagonia and Tierra del Fuego (Fig. 1), where autochthonous subantarctic or andino-patagonian vegetation is best preserved. Sampling was carried out in January and February to coincide with the austral summer and thus the time of the year when fruiting bodies of myxomycetes might be expected to be most abundant. The six parks mentioned above are located along a south to north summer temperature gradient (Table 1) that extends from 39° and 55°S latitude and from 67° to 73°W longitude. The parks vary considerably with respect to both annual precipitation and overall area. In total, 50 different localities (Table 2) were subjected to at least some sampling. At each locality, the microhabitats in which myxomycetes are known or suspected to occur were examined carefully. All localities were referenced to geographic location through the use of the NAVSTAR Global Positioning System (GPS), with latitude and longitude determined by means of a portable GPS unit (model Garmin 12, Datum: SAM 69). Methods used for collecting myxomycetes in the

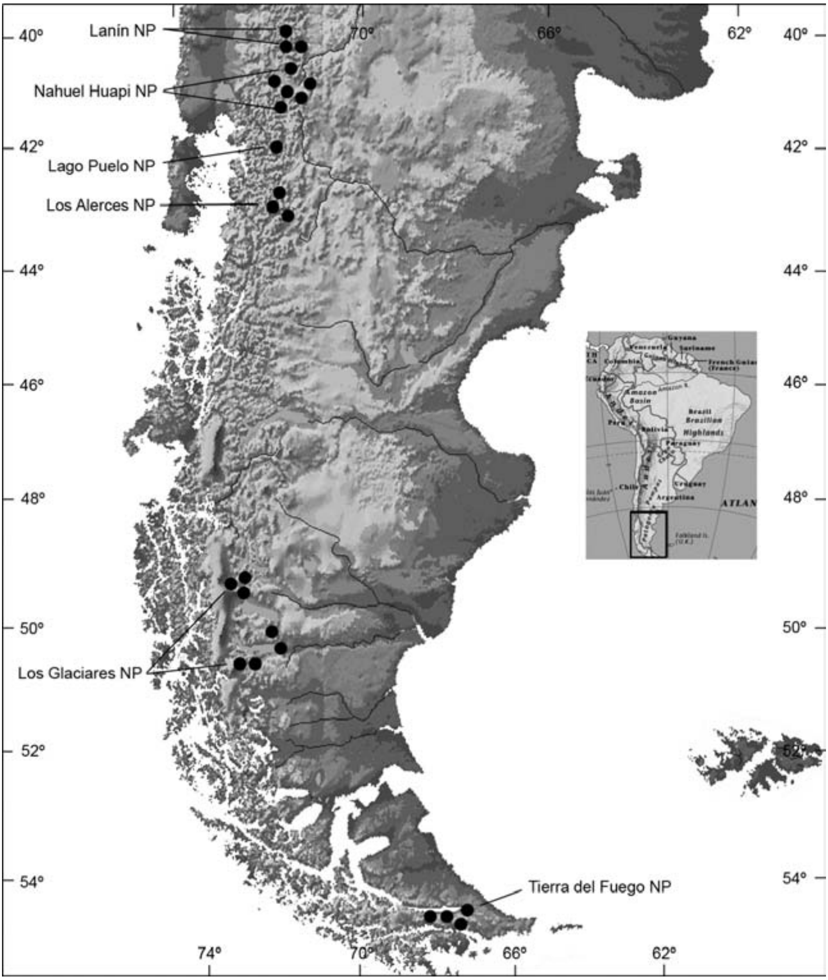


Fig. 1. Map showing location of sampling areas in Argentinian Patagonia and Tierra del Fuego.

field and obtaining samples of dead plant material for subsequent laboratory culture were those described by Stephenson (1989), Rossman et al. (1998) and Schnittler et al. (2002).

Moist chamber cultures were prepared in the manner described by Stephenson & Stempen (1994), using disposable plastic Petri dishes (10 cm diameter) lined with filter paper. After a period of approximately 24 hours, the pH of each culture was determined with a portable pH meter, and then excess water in each dish was poured off. Cultures were maintained at room temperature (21–25°C) in diffuse daylight and examined at regular intervals with a dissecting microscope for a period of up to three months in order to detect plasmodia and/or fruiting bodies of myxomycetes. The latter were noted and recorded each time a culture was checked. All fruiting bodies of a given species that developed in the same culture, were considered to represent a single record, whether they developed over a period of time or all at once. As soon as the fruiting bodies were judged to be mature, the portion of the substrate upon which the fruiting occurred was removed from the moist chamber culture, allowed to dry and then glued in a small paper box suitable for long-term storage. Differential

Table 1. National Parks sampled in Patagonia and Tierra del Fuego. [Sources: Administración de Parques Nacionales (2009), Chebez (2005a, 2005b)].

National Park	Province	Size (ha)	Elevation (m) sampling areas	Mean summer temperature (°C)	Mean annual rainfall (mm)
Lanín	Neuquén	412,000	660–1125	18	2000–3000
Nahuel Huapi	Río Negro and Neuquén	710,000	780–1578	18	500–3000
Lago Puelo	Chubut	27,675	228–231	17	1200
Los Alerces	Chubut	263,000	520–525	15	4000
Los Glaciares	Santa Cruz	724,000	195–786	13	100–2000
Tierra del Fuego	Tierra del Fuego	63,000	12–162	9	700

interference microscopy was used to obtain descriptive data. Specimens were examined at 10–15 kV, with a Hitachi S-3000N 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).

Results

The entire survey produced a total of 442 collections of myxomycetes. This included both material that had developed under natural conditions in the field as well as material obtained from 158 moist chamber cultures. These cultures were 37% positive for myxomycete fruiting bodies or plasmodia. The collections included 67 species and one variety representing 23 different genera.

Annotated list of species

In the list that follows, all the myxomycetes observed are arranged alphabetically by genus and species. Information is provided on the source of each record (either a field collection [fc] 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 Argentina. Nomenclature follows Lado (2001) and Hernández-Crespo & Lado (2005), with the conserved names of several genera (Lado et al. 2005), approved by the Committee for Fungi (Gams 2005) of the IAPT. 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 indicated, collections reported herein are those of Carlos Lado (Lado), Steven L.Stephenson (SLS) or Diana Wrigley de Basanta (dwb). Vouchers have been deposited in several places, with those of Stephenson in the mycological herbarium of the University of Arkansas (UARKM), those of Lado in

Table 2. Summary data on collecting localities.

	Locality	Coordinates, elevation	Vegetation	Date
Loc. 1	Tierra del Fuego, Ushuaia, Tierra del Fuego NP, Bahia Lapataia	54°50'04"S 68°33'45"W, 12 ± 9 m	*Nothofagus pumilio* forest	22 Jan 2005
Loc. 2	Tierra del Fuego, Ushuaia, Tierra del Fuego NP, camping Lago Roca	54°49'49"S 68°33'47"W, 4 m	*Nothofagus pumilio* forest	22 Jan 2005
Loc. 3	Tierra del Fuego, Ushuaia, Tierra del Fuego NP, Lago Roca	54°49'29"S 68°33'52"W, 8 ± 12 m	*Nothofagus pumilio* forest	22 Jan 2005
Loc. 4	Tierra del Fuego, Ushuaia, Tierra del Fuego NP, Bahia Ensenada	54°50'30"S 68°29'07"W, 60 m	*Nothofagus betu-loides* forest	22 Jan 2005
Loc. 5	Tierra del Fuego, Ushuaia, Lago Fagnano	54°35'57"S 67°37'40"W, 57 ± 14 m	*Nothofagus betu-loides* forest	23 Jan 2005
Loc. 6	Tierra del Fuego, Ushuaia, Lago Escondido	54°39'04"S 67°47'07"W, 162 m	*Nothofagus antartica* forest	23 Jan 2005
Loc. 7	Tierra del Fuego, Ushuaia, crossroads of RN-3 and RP-J to the Estancia Harberton	54°44'33"S 67°49'30"W, 130 ± 10 m	*Sphagnum* spp. marsh with *Nothofagus* sp.	23 Jan 2005
Loc. 8	Tierra del Fuego, Ushuaia, road RP-J to the Estancia Harberton, km 30	54°50'09"S 67°29'20"W 10 ± 10 m	*Nothofagus* sp. woodland	23 Jan 2005
Loc. 9	Santa Cruz, Lago Argentino, El Calafate, Los Glaciares NP, Perito Moreno glacier	50°29'12"S 73°02'26"W, 200 ± 10 m	*Nothofagus betu-loides* forest	25 Jan 2005
Loc. 10	Santa Cruz, Lago Argentino, El Calafate, Los Glaciares NP, Península Magallanes	50°29'20"S 72°56'41"W, 230 ± 9 m	*Nothofagus* spp. forest	25 Jan 2005
Loc. 11	Santa Cruz, Lago Argentino, El Calafate, Los Glaciares NP, bridge over Centinela river	50°21'13"S 72°30'09"W, 195 m	Steppe with *Berberis buxifolia*	25 Jan 2005
Loc.12	Santa Cruz, Lago Argentino, El Chaltén, Los Glaciares NP, Mount Fitz Roy, Chorrillo del Salto	49°17'52"S 72°54'18"W, 420 ± 10 m	*Nothofagus pumilio* and *N. antarctica* forest	26 Jan 2005
Loc.13	Santa Cruz, Lago Argentino, El Chaltén, Los Glaciares NP, Mount Fitz Roy, Las Vueltas river	49°18'31"S 72°53'56"W, 418 ± 6 m	*Nothofagus ant-arctica* forest	26 Jan 2005
Loc. 14	Santa Cruz, Lago Argentino, El Chaltén, Los Glaciares NP, Mount Fitz Roy, Lago Capri	49°18'17"S 72°55'77"W, 760 m	*Nothofagus pumilio* forest	27 Jan 2005
Loc. 15	Santa Cruz, Lago Argentino, El Chaltén, Los Glaciares NP, Mount Fitz Roy, Lago Capri	49°18'08"S 72°55'45"W, 786 ± 8 m	*Nothofagus pumilio* forest	27 Jan 2005
Loc. 16	Santa Cruz, Lago Argentino, El Chaltén, Los Glaciares NP, Mount Fitz Roy, Lago Capri	49°18'24"S 72°55'11"W, 761 m	*Nothofagus pumilio* forest with *Escalonia virgata*	27 Jan 2005
Loc. 17	Santa Cruz, Lago Argentino, El Chaltén, Los Glaciares NP, Mount Fitz Roy, path to Lago Capri	49°18'10"S 72°55'28"W, 770 ± 13 m	*Nothofagus pumilio* forest with *Escalonia virgata*	27 Jan 2005

Table 2 continued.

	Locality	Coordinates, elevation	Vegetation	Date
Loc. 18	Santa Cruz, Lago Argentino, El Chaltén, Los Glaciares NP, Mount Fitz Roy, Lago Capri	49°18'64"S 72°54'62"W, 644 m	*Nothofagus pumilio* forest with *Escalonia virgata*	27 Jan 2005
Loc. 19	Santa Cruz, Lago Argentino, El Chaltén, Los Glaciares NP, Mount Fitz Roy, path to Fitz Roy glacier	49°17'49"S 72°56'14"W, 730 ± 4 m	*Nothofagus pumilio* forest with *Escalonia virgata*	27 Jan 2005
Loc. 20	Santa Cruz, Lago Argentino, El Chaltén, Los Glaciares NP, Mount Fitz Roy, Laguna Madre	49°17'22"S 72°56'44"W, 730 m	*Nothofagus* spp. forest	27 Jan 2005
Loc. 21	Santa Cruz, Lago Argentino, El Chaltén, Los Glaciares NP, Mount Fitz Roy, crossroads at Laguna Madre	49°17'11"S 72°57'08"W, 738 ± 8 m	*Nothofagus* spp. forest	27 Jan 2005
Loc. 22	Santa Cruz, Lago Argentino, El Chaltén, crossroads RP-23 with RN-40	49°42'32"S 71°56'53"W, 275 m	Steppe with *Berberis buxifolia*	27 Jan 2005
Loc. 23	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, path to Cumbre Challhuaco	41°15'49"S 71°18'00"W, 1560 ± 10 m	*Nothofagus pumilio* forest	29 Jan 2005
Loc. 24	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, path to Cumbre Challhuaco	41°15'54"S 71°18'00"W, 1578 ± 10 m	*Nothofagus pumilio* forest	29 Jan 2005
Loc. 25	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, path to Cumbre Challhuaco	41°15'05"S 71°17'35"W, 1520 ± 10 m	*Nothofagus pumilio* forest	29 Jan 2005
Loc. 26	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, path to Cumbre Challhuaco	41°15'43"S 71°17'54"W, 1532 ± 10 m	*Nothofagus pumilio* forest	29 Jan 2005
Loc. 27	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, path to Cumbre Challhuaco	41°15'36"S 71°17'30"W, 1435 ± 10 m	*Nothofagus pumilio* forest	29 Jan 2005
Loc. 28	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, path to Cumbre Challhuaco	41°15'40"S 71°17'40"W, 1464 ± 10 m	*Nothofagus pumilio* forest	29 Jan 2005
Loc. 29	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, Puerto Blest, path to Los Cantaros falls	41°01'24"S 71°49'20"W, 850 m	Valdivian forest with *N. dombeyi*, *Saxegothea conspicua* and *Chusquea culeou*	30 Jan 2005
Loc. 30	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, Puerto Blest, path to Los Cantaros falls	41°01'02"S 71°49'22"W, 780 ± 7 m	Valdivian forest with *N. dombeyi*, *Saxegothea conspicua* and *Chusquea culeou*	30 Jan 2005
Loc.31	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, Llao Llao Peninsula	41°03'17"S 71°32'40"W 820 ± 10 m	*Nothofagus dombeyi* forest	31 Jan 2005

Table 2 continued.

	Locality	Coordinates, elevation	Vegetation	Date
Loc. 32	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, Llao Llao Peninsula	41°03'22"S 71°32'43"W 820 ± 10 m	*Nothofagus dombeyi* forest	31 Jan 2005
Loc. 33	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, Llao Llao Peninsula	41°03'13"S 71°32'43"W, 802 m	*Nothofagus dombeyi* forest	31 Jan 2005
Loc. 34	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, Cerro Tronador, Ventisquero Negro	41°12'13"S 71°49'22"W, 985 ± 10 m	*Nothofagus dombeyi* forest	1 Feb 2005
Loc. 35	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, Cerro Tronador, Ventisquero Negro	41°12'27"S 71°46'40"W, 1534 m	*Nothofagus dombeyi* forest	1 Feb 2005
Loc. 36	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, Cerro Tronador, Pampa Linda	41°13'27"S 71°46'25"W, 865 m	*Nothofagus dombeyi* forest	1 Feb 2005
Loc. 37	Río Negro, Bariloche, San Carlos de Bariloche, Nahuel Huapi NP, Cerro Tronador, Pampa Linda, path to Paso de las Nubes, Castaño Overa river	41°12'27"S 71°46'40"W, 900 ± 8 m	*Nothofagus dombeyi* forest	1 Feb 2005
Loc. 38	Neuquen, Los Lagos, La Angostura, Nahuel Huapi NP, Pichi Traful	40°29'53"S 71°35'11"W, 845 ± 7 m	*Nothofagus dombeyi* forest	2 Feb 2005
Loc. 39	Neuquen, Huiliches, Junín de los Andes, Lanín NP, Lago Curruhué Grande	39°53'10"S 71°25'13"W, 1125 ± 9 m	*Araucaria araucana* forest	3 Feb 2005
Loc. 40	Neuquen, Huiliche, Junín de los Andes, Lanín NP, Termas de Lahuen-Có, Epulafquen	39°49'18"S 71°38'26"W, 1015 m	Valdivian forest with *Saxegothea conspicua* and *Nothofagus* sp.	3 Feb 2005
Loc. 41	Neuquen, Huiliche, Junín de los Andes, Lanín NP, Termas de Lahuen-Có, Epulafquen	39°55'00"S 71°17'52"W, 1015 m	*Astrocedrus chilensis* woodland	3 Feb 2005
Loc. 42	Neuquen, Huiliches, Junín de los Andes, Lanín NP,Termas de Lahuen -Có	40°08'35"S 71°17'52"W, 1015 ± 8 m	*Astrocedrus chilensis* woodland	3 Feb 2005
Loc. 43	Neuquen, Lacar, San Martín de los Andes, Lanín NP, Puerto Hua Hum	40°07'09"S 71°39'43"W, 660 m	Cleared area by river with *Sambucus nigra*	4 Feb 2005
Loc. 44	Neuquen, Lacar, San Martín de los Andes, Lanín NP, Lago Nonthué	40°08'35"S 71°37'21"W, 685 ± 4 m	*Nothofagus alpina* and *N. dombeyi* forest	4 Feb 2005
Loc. 45	Río Negro, Bariloche, San Carlos de Bariloche Nahuel-Huapi NP, border of Lago Nahuel Huapi	41°03'04"S 71°08'58"W, 800 m	Steppe with *Senecio* sp.	5 Feb 2005

Table 2 continued.

	Locality	Coordinates, elevation	Vegetation	Date
Loc. 46	Chubut, Cushamen, Lago Puelo NP, Los Hitos	42°06'16"S 71°43'31"W, 231 ± 19 m	*Nothofagus dombeyi* forest	6 Feb 2005
Loc. 47	Chubut, Cushamen, Lago Puelo NP, Los Hitos	42°06'02"S 71°43'18"W, 228 ± 9 m	*Nothofagus dombeyi* forest	6 Feb 2005
Loc. 48	Chubut, Futaleufú, Trevelin, Los Alerces NP, Lago Menéndez, Puerto Café	42°42'18"S 71°55'48"W, 520 ± 7 m	*Fitzroya cupressoides* forest with *N. dombeyi*	8 Feb 2005
Loc. 49	Chubut, Futaleufú, Trevelin, Los Alerces NP, Lago Menéndez, El Alerzal	42°36'40"S 71°53'26"W 520 ± 9 m	*Fitzroya cupressoides* forest with *N. dombeyi*	8 Feb. 2005
Loc. 50	Chubut, Futaleufú, Trevelin, Los Alerces NP, Lago Menéndez, Puerto Chucao	42°43'48"S 71°45'32"W, 525 ± 6 m	*Nothofagus dombeyi* forest	8 Feb 2005

the herbarium of the Real Jardín Botánico of Madrid (MA-Fungi), and those of Wrigley de Basanta in the personal collection of this author. Duplicate material has been deposited in the herbaria of the University of Comahue, Argentina (BCRU), and the University of Tlaxcala (TLXM sub AET). Unless otherwise stated, comments on distribution of the species in South American are based on Lado & Wrigley de Basanta (2008). The species marked with an asterisk (*) are new records for Argentina.

Arcyria cinerea (Bull.) Pers.

Loc. 10: On *Nothofagus* sp. wood (fc), Lado 16349 (MA-Fungi 78716). Loc. 13: On *Nothofagus antarctica* wood (fc), Lado 16362 (MA-Fungi 78717). Loc. 22: On mixed aerial litter (mc, pH 4.3), SLS 20535. Loc. 30: On liana (mc, pH 6.4) dwb 2606. Loc. 41: On *Astrocedrus chilensis* (mc, pH 6.0), dwb 2726. Loc. 42: On *Nothofagus* sp. wood (fc), SLS 19643.

Comments: *Arcyria cinerea*, which is usually rather common in temperate forests of the Northern Hemisphere, was recorded only three times as field collections in the present study.

Arcyria denudata (L.) Wettst.

Loc. 27: On *Nothofagus pumilio* wood (fc), Lado 16412 (MA-Fungi 78718). Loc. 31: On *N. dombeyi* wood (fc), Lado 16448. Loc. 32: On *N. dombeyi* wood (fc), Lado 16480. Loc. 35: On *N. dombeyi* wood (fc), Lado 16507.

Comments: This is another species that is usually rather common in temperate forests of the Northern Hemisphere but did not appear to display a comparable level of abundance in the subantarctic forests examined.

Arcyria ferruginea Saut.

Loc. 49: On *Nothofagus dombeyi* wood (fc), Lado 16644 (MA-Fungi 78719).

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

Loc. 5: On *Nothofagus* sp. wood (fc), Lado 16319 (MA-Fungi 78720). Loc. 7: On *Nothofagus* sp. wood (fc), Lado 16322 (MA-Fungi 78721). Loc. 12: On decaying wood SLS 19592 (fc), on mixed litter SLS 20757 (mc), on *Nothofagus* sp. wood (fc), Lado 16352 (MA-Fungi 78722). Loc. 13: On *Nothofagus antarctica* wood (fc), Lado 16356 (MA-Fungi 78723), Lado 16358 (MA-Fungi 78724), Lado 16360 (MA-Fungi 78725), Lado 16363 (MA-Fungi 78726). Loc. 22: On aerial litter SLS 22776 (mc). Loc. 34: On *N. dombeyi* wood (fc), Lado 16493 (MA-Fungi 78727). Loc. 49: On *N. dombeyi* wood (fc), Lado 16627 (MA-Fungi 78728); On *Nothofagus* sp. wood (fc), SLS 19674.

Sporocarps gregarious, with short stalks to sessile, 0.6–1.2 mm total height, 1.2–3.5 mm when expanded. Sporotheca sub-globose to sub-cylindrical, 0.5–1.1 mm tall and 0.3–0.6 mm in diameter, and from 1–3.2 mm tall by 0.5–0.7 mm in diameter when expanded, from rosy yellow to orange yellow and brownish when faded. Hypothallus is common to a cluster, membranous and inconspicuous. Stalk cylindrical short, erect, 0.1–0.4 mm tall, longitudinally striate, brownish to pale orange or hyaline by transmitted light, filled at the base with spore-like cells (6–)8–19(–22) µm diam., subglobose, and hyaline. Peridium single, membranous, partially evanescent, remaining as a basal calyculus, almost flat, saucer-shaped, translucent, pale yellow to colourless by transmitted light, the inner surface ornamented with small spines sometimes interconnected in an incomplete reticulum, with bordered pits from 2–3.4 µm diam. towards the edge; dehiscence irregular, with fragments of the peridium sometimes remaining attached to the apex of the sporotheca, the edge of the calyculus or the expanded capillitium. Columella absent. Capillitium tubular, elastic, lax, from yellowish to colourless by transmitted light, tubes from 4.4–8.5 µm diam., flexuous, branched and anastomosing, entangled, with few attachments to the calyculus, and with swellings and bulbous free ends, 8.6–25.2 × 4–9.8 µm, ornamented with spines, cogs, half-rings and rings. Spores free from orange to yellow orange in mass, very pale yellow to colourless by transmitted light, subglobose, 6.3–8.4 µm diam., faintly warted (visible with oil immersion lens) with scattered groups of more prominent warts.

COMMENTS: The description given above is based on the abundant material found by us in Argentina, over a range of localities that extend from Neuquen (40°S) to Tierra del Fuego (54°S). The most relevant characters are that the fruiting bodies have very short stalks or are almost sessile. The peridium is partially evanescent, remaining sometimes as fragments attached to the expanded capillitium, and at the base of the sporotheca as a shallow, flat calyculus. The calyculus is ornamented on its inner surface with spines and some bordered pits near the edge. The capillitium is lax and, on expansion, breaks free from the calyculus. The capillitial tubes, ornamented with spines, cogs, half-rings and rings, sometimes have swellings and bulbous free ends ornamented only with spines. This last character was noted and illustrated by Lister (1925) for *A. incarnata*, although it is not included in comments on the species by authors such as Martin & Alexopoulos (1969) and Nannenga-Bremekamp (1991). All of these characters are consistent with those given by Arambarri (1972) and Nannenga-Bremekamp & Schinner (1986) for *A. fuegiana* Aramb., a species described from Tierra del Fuego (Argentina). Arambarri (1972) considered her species to be very close to *A. incarnata* because of the size and ornamentation of the spores and the structure of the capillitium, but she separated *A. fuegiana* on the basis of the globose shape of the sporotheca before the capillitium expands, and the persistent peridium. In our Argentinian material of *A. incarnata*, younger sporocarps have sub-globose shapes mixed with sub-cylindrical ones, and in some mature sporocarps peridium fragments were observed adhering to the calyculus. This suggests that the characters purported to define *A. fuegiana* as a distinct species, fall within the range of morphological variability expressed by *A. incarnata*, a widely distributed species. Unfortunately, the type material of *A. fuegiana* was not available for examination, so it was not possible to confirm whether it is conspecific with *A. incarnata*.

Arcyria cf. ***insignis*** Kalchbr. & Cooke

Loc. 18: On mixed litter (mc, pH 4.3), SLS 20528.

Arcyria obvelata (Oeder) Onsberg

Loc. 44: On *Nothofagus alpina* wood (fc), Lado 16537 (MA-Fungi 78729), Lado 16544 (MA-Fungi 78730); on *Nothofagus* sp. wood (fc), SLS 19648. Loc. 46: On wood (fc), Lado 16556 (MA-Fungi 78731), Lado 16563 (MA-Fungi 78732); on *Nothofagus* sp. wood (fc), SLS 19657, SLS 19663, SLS 19666.

Arcyria pomiformis (Leers) Rostaf.

Loc. 32: On *Nothofagus dombeyi* wood (fc), Lado 16477 (MA-Fungi 78733).

****Badhamia dubia*** Nann.-Bremek.

Loc. 10: On *Nothofagus* sp. wood (fc), Lado 16348 (MA-Fungi 78734), Lado 16350 (MA-Fungi 78735). Loc. 13: On *Nothofagus antarctica* wood (fc), Lado 16359 (MA-Fungi 78736).

Comments: The sessile, spherical, sporocarps are about 1 mm diam. and have spores in clusters with a cap of denser warts on the outside of each spore. Described from the Netherlands on bark, it was recently cited in South America, from the Atacama desert of Chile, by Lado et al. (2007) where it occurred on *Opuntia* sp. remains.

Badhamia versicolor Lister

Loc. 46: On wood (fc), Lado 16592 (MA-Fungi 78737).

Calomyxa metallica (Berk.) Nieuwl.

Loc. 31: On *Nothofagus dombeyi* wood (fc), Lado 16463 (MA-Fungi 78738).

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

Loc. 1: On *Nothofagus betuloides* wood (fc), Lado 16286 (MA-Fungi 78739). Loc. 32: On *N. dombeyi* wood (fc), Lado 16472 (MA-Fungi 78740). Loc. 46: On wood (fc), Lado 16549 (MA-Fungi 78741). Loc. 47: On wood (fc), Lado 16604 (MA-Fungi 78742).

Comments: Evidence from various studies (Olive 1975, Rojas et al. 2008) suggests that the genus *Ceratiomyxa* is more closely related to the protostelids and thus is not a true myxomycete. However, species of *Ceratiomyxa* are usually recorded in field surveys for myxomycetes. We use the conserved name for this species as proposed by Lado et al. (2005) and accepted by the IAPT (Gams 2005).

Comatricha laxa Rostaf.

Loc. 30: On wood (fc), Lado 16443(MA-Fungi 78743).

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

Loc. 1: On *Nothofagus* sp. wood (fc), Lado 16326 (MA-Fungi 78744). Loc. 2: On *Nothofagus* sp. twigs (mc), SLS 19826. Loc. 5: On *Nothofagus* sp. wood (fc), Lado 16320 (MA-Fungi 78745). Loc. 9: On *Drimys winteri* wood (fc), Lado 16337 (MA-Fungi 78746). Loc. 10: On *Nothofagus* sp. wood (fc), Lado 16346 (MA-Fungi 78747). Loc. 13: On *N. antarctica* wood (fc), Lado 16361 (MA-Fungi 78748). Loc. 26: On *N. pumilio* wood (fc), Lado 16384 (MA-Fungi 78749). Loc. 27: On *N. pumilio* wood (fc), Lado 16409 (MA-Fungi 78750). Loc. 30: On decaying wood (fc), Lado 16444 (MA-Fungi 78751). Loc. 31: On *Luma apiculata* (fc), Lado 16465 (MA-Fungi 78752). Loc. 36: On *Nothofagus dombeyi* wood (fc), SLS 19637. Loc. 38: On *Nothofagus dombeyi* wood (fc), SLS 19642. Loc. 39: On *Araucaria araucana* wood (fc), Lado 16521 (MA-Fungi 78753), 16522 (MA-Fungi 78754). Loc. 46: On wood (fc), Lado 16581 (MA-Fungi 78755). Loc. 49: On *N. dombeyi* (fc), Lado 16629 (MA-Fungi 78756), on *Fitzroya cupressoides* (fc), Lado 16646 (MA-Fungi 78757).

Cribraria aurantiaca Schrad.

Loc. 47: On wood (fc), Lado 16597 (MA-Fungi 78758), Lado 16603 (MA-Fungi 78759).

Cribraria cancellata (Batsch) Nann.-Bremek.

Loc. 5: On *Nothofagus* sp. wood (fc), SLS 19590, SLS 19591. Loc. 32: On *Nothofagus dombeyi* wood (fc), Lado 16471 (MA-Fungi 78760). Loc. 46: On wood (fc), Lado 16583 (MA-Fungi 78761).

****Cribraria microcarpa*** Schrad.

Loc. 5: *Nothofagus* sp. wood (fc), SLS 19589.

Comments: This species is known from several other South American countries and the Caribbean and widely distributed in Europe and North America (Martin & Alexopoulos 1969).

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

Loc. 46: On wood (fc), Lado 16582 (MA-Fungi 78762). Loc. 47: On wood (fc), Lado 16598 (MA-Fungi 78763), Lado 16605 (MA-Fungi 78764).

Comments: This is the first record of *Cribraria rufa* for South America. The species was reported from Mexico by Rodríguez-Palma (1998), and is widely distributed throughout the United States and Europe (Martin & Alexopoulos 1969: 89).

Diderma antarcticum (Speg.) Sturgis Figs 2–3, 7–10

Loc. 27: On *Nothofagus pumilio* bark and leaves (fc), Lado16397 (MA-Fungi 78765); on *N. pumilio* wood (fc), Lado 16406 (MA-Fungi 78766).

Comments: This species was described originally from Chile by Spegazzini in 1887, and the only other record appears to be from Tierra del Fuego (Arambarri 1973). Our material was compared to the type material (LPS 31371, leg. *Spegazzini*) from Punta Arenas, Chile. The prominent rugose columella (Figs 2–3), double peridium, with the tough cartilaginous outer layer that is patchy brown on the outside, packed with lime ganules inside (Fig. 8), the membranous inner layer (Fig. 7) and circumcissile dehiscence (Fig. 2), along with the characteristic spore ornamentation, leave no doubt as to the identity of our specimens. The capillitium is ornamented

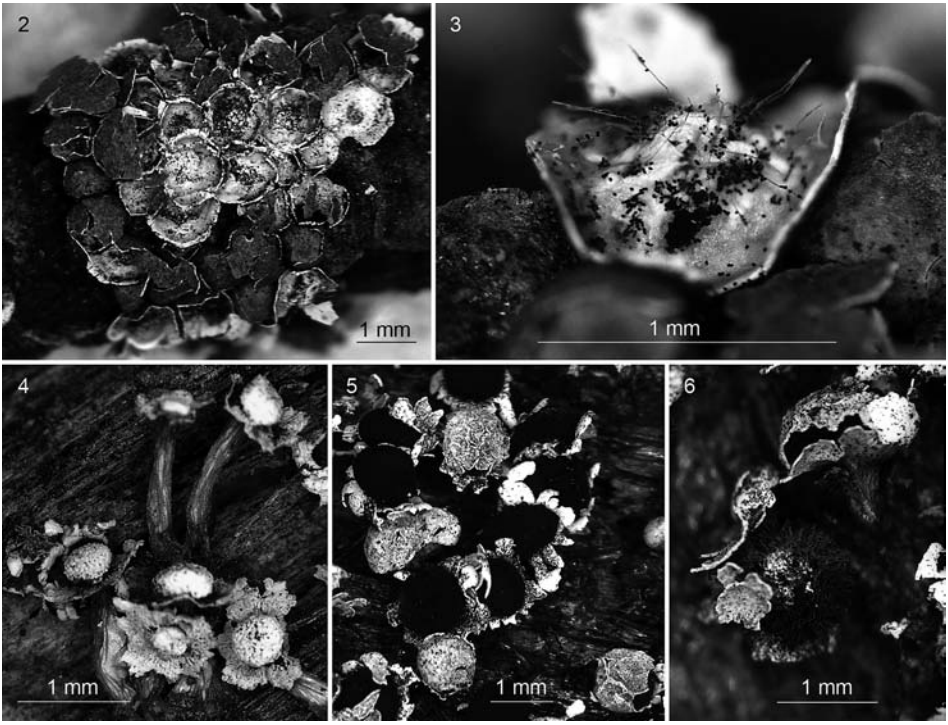


Fig. 2. *Diderma antarcticum* (MA-Fungi 78766) group of sporocarps. Fig. 3. *Diderma antarcticum* (MA-Fungi 78766) detail of dehisced sporocarp showing rugose columella. Fig. 4. *Diderma gracile* (holotype, LPS 37124) showing petaloid dehiscence. Figs 5–6. *Diderma gracile* (MA-Fungi 78767) whole dehiscing sporocarps.

with small spines, and the spores are minutely spinulose (Figs 9–10). These records extend the known distribution in Argentina of *Diderma antarcticum,* from latitude 54°S, further north to 41°S, to the Neuquén province.

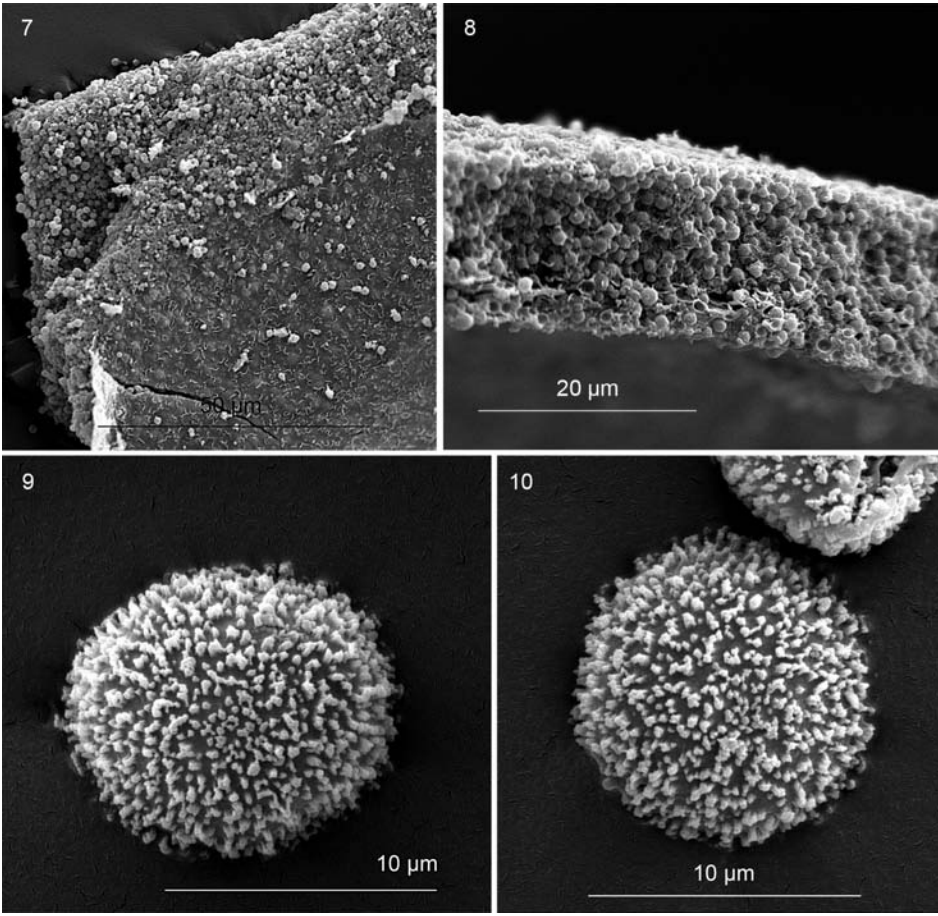
Diderma effusum (Schwein.) Morgan

Loc. 2: On *Nothofagus* sp. twigs (mc, pH 5.2), SLS 19825, SLS 20666.

Diderma gracile Aramb. Figs 4–6, 11–16

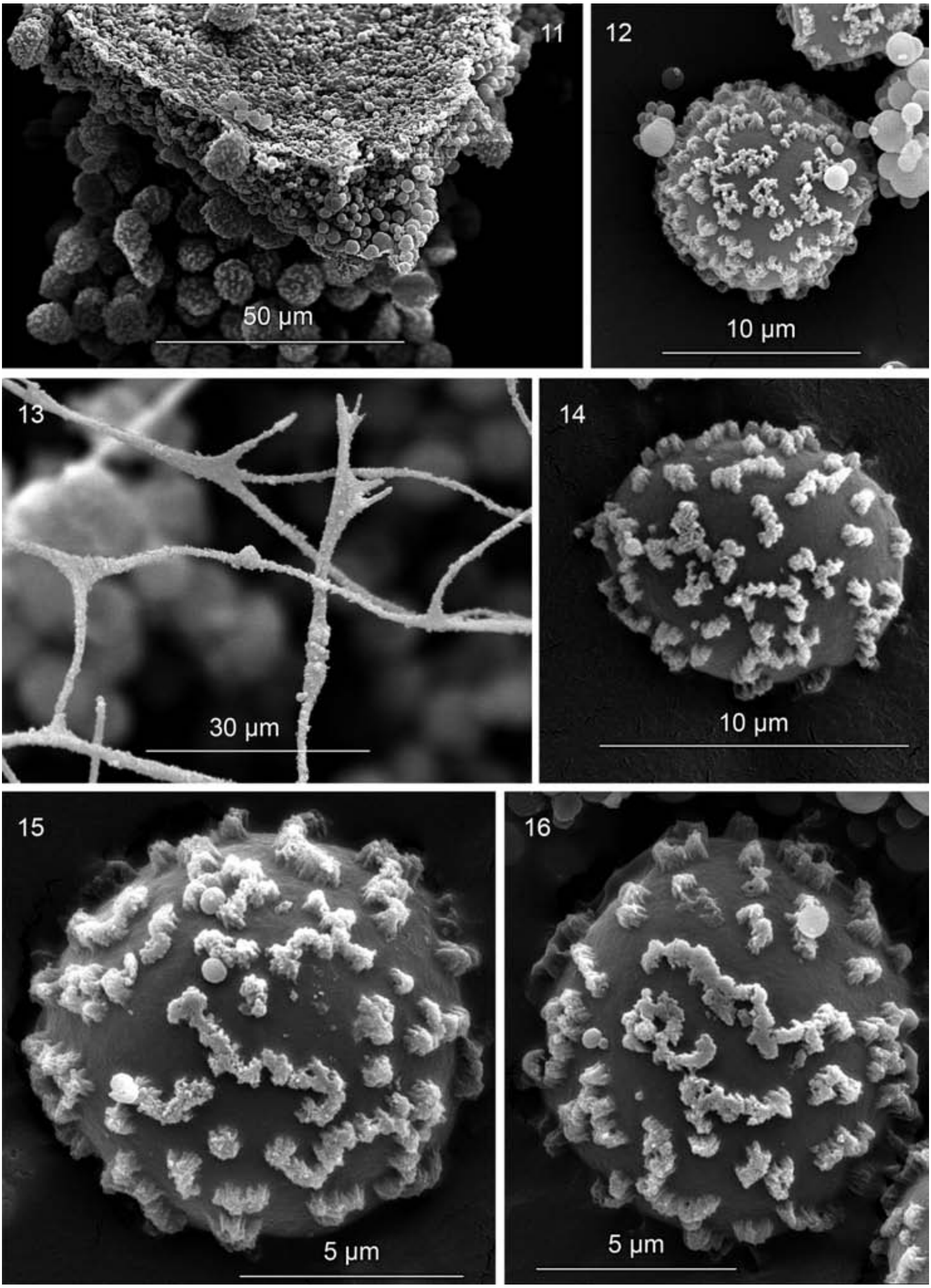
Loc. 2: On decaying wood (fc) SLS 19584. Loc. 9: On wood of *Nothofagus* sp. (fc), Lado 16343 (MA-Fungi 78767). Loc. 31: On *Nothofagus dombeyi* wood (fc), Lado 16451 (MA-Fungi 78768), Lado 16453 (MA-Fungi 78769), Lado 16454 (MA-Fungi 78770), Lado 16455 (MA-Fungi 78771). Loc. 32: On *N. dombeyi* wood (fc), Lado 16482 (MA-Fungi 78772). Loc. 46: On wood (fc), Lado 16549 (MA-Fungi 78773), Lado 16551 (MA-Fungi 78774), Lado 16554 (MA-Fungi 78775), Lado 16560 (MA-Fungi 78776), Lado 16570 (MA-Fungi 78777).

Sporophores sporocarpic, gregarious, stalked, 1.3–2.3 mm high. Sporotheca from sub-globose to oblate, on a flattened base, dark red-brown, 0.6–0.8 mm high,



Figs 7–8. *Diderma antarcticum* (MA-Fungi 78765) cross-section of the peridium packed with lime granules by SEM. Figs 9–10. *Diderma antarcticum* (MA-Fungi 78766) detail of spore ornamentation.

0.9–1.1 mm diam., marked with red-brown bands which arise from the base and break up into spots or flecks at the apex. Hypothallus membranous, yellowish, under individual sporocarps, or sometimes common to a group, with radial vein-like folds. Stalk cylindrical or with an expanded base, erect or curved, non-calcareous, translucent yellowish to reddish brown, by transmitted light, 0.9–1.5 mm in height, 0.2–0.25 mm wide at the apex, to 0.6 mm at the expanded base, deeply furrowed longitudinally. Peridium with three layers, outer layer cartilaginous, 8–13 µm thick, with dark red-brown bands of granular material on the outer surface intercalated with narrow areas appearing membranous and yellowish, the bands 15–30 µm wide arising from the base towards the apex, parallel sometimes merging or ramifying, breaking up into round or ellipsoid spots at the apex; middle layer white, calcareous, 20–25 µm wide, attached to the external layer; inner layer membranous hyaline except for the base



Figs 11–16. *Diderma gracile* (MA-Fungi 78767) by SEM. Fig. 11. Cross-section of peridium. Fig. 12. Spore. Fig. 13. Capillitium of thin tubules. Figs 14 –16. Detail of spore ornamentation formed by short crests in a sub-reticulum.

where it is yellowish, separate from the middle and outer layers, rarely adhering to part of the calcareous layer; dehiscence petaloid to irregular, the middle and outer layers remaining attached and forming 8 to 13 lobes (Fig. 4), the bands of the outer layer separating and showing the lighter zones between them; the inner layer separating and disintegrating quickly and so difficult to see, except at the base where it remains as a collar around the columella, whitened by the granular calcareous material from the middle layer. Columella pulvinate (Fig. 4), full of calcareous material, yellowish, 0.3–0.65 mm diam., 0.12–0.33 mm high, up to one third the height of the sporotheca, rough on the surface. Capillitium abundant, tubular, with very thin tubes 1–2 µm diam. (Fig. 13) violet-brown to hyaline at the tips straight, branching and anastomosed to form a lax net, with membranous expansions arising radially from the columella and attached to the outer peridial layer by conical expansions, which penetrate the calcareous layer, and ornamented with rounded granules. Spores dark brown in mass, sub-globose, free, violet brown by transmitted light, one pole slightly more pallid, (11.5–)13–14 µm diam., with short crests (Figs 12, 14–16) which sometimes branch to form a sub-reticulum.

Comments: This species is somewhat similar to *Diderma rufostriatum* Nann.-Bremek. & Lado but that species has sessile to short-stalked sporocarps and not clearly stipitate sporocarps as in *D. gracile.* In addition *D. rufostriatum* is paler in colour, with less distinct bands on the peridium, has a calcareous hypothallus, a capillitium without membranous expansions and uniformly warted, smaller spores (9–11 µm vs. 12–14 µm diam.). The comparison of this material with *Diderma rufostriatum* was based on the isotype (Lado 4758). The long stalks of *Diderma gracile* (Fig. 4) also differentiate it from *D. asteroides* (Lister & G.Lister), another sessile to short-stalked species. In addition, *D. asteroides* G.Lister has a uniform peridium without marked bands, a hyaline capillitium without membranous expansions and uniformly warted spores that measure 10.5–11 µm. The comparison of this material with *D. asteroides* was based on Lado 7137.

These represent the first known collections of this species since it was described by Arambarri (1973) from Tierra del Fuego, Argentina. Our material was compared to the type material (LPS 37124). An extended description and the first photographs by LM and SEM of this species are included herein. The collections cited above are from four states (Chubut, Río Negro, Santa Cruz, and Tierra del Fuego).

Diderma niveum (Rostaf.) T.Macbr.

Loc. 24: On *Nothofagus pumilio* wood (fc), Lado 16379 (MA-Fungi 78778). Loc. 27: On *N. pumilio* wood (fc), Lado 16401 (MA-Fungi 78779), Lado 16410 (MA-Fungi 78780).

Comment: Our collections of this species, which is considered a nivicolous species in other areas, were found in the woodlands at about 1500 m elevation, but during the austral summer and in the absence of snow.

***Diderma peyerimhoffii** (Maire & Pinoy) H.Neubert, Nowotny & K.Baumann
Figs 19–20

= *Diderma trevelyanii* var. *nivale*

Loc. 9: On *Nothofagus* sp. wood (fc), Lado 16345 (MA-Fungi 78781).

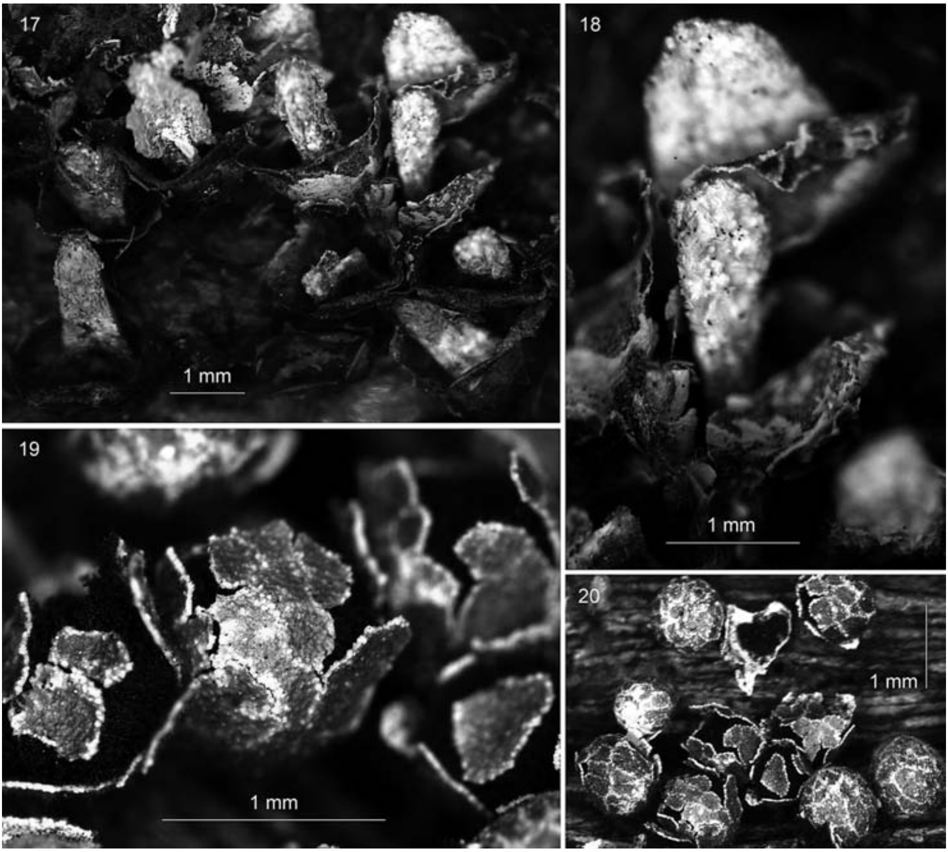


Fig. 17. *Diderma robustum* (MA-Fungi 78782) group of sporocarps. Fig. 18. *Diderma robustum* (MA-Fungi 78782) detail of large columella with a flattened spatula shape. Fig. 19. *Diderma peyerimhoffi* (MA-Fungi 78781) detail of rugose outer peridium. Fig. 20. *Diderma peyerimhoffi* (MA-Fungi 78781) group of dehiscing sporocarps.

Comments: This is the first record of *Diderma peyerimhoffii* for South America. Described originally as *Diderma trevelyanii* var. *nivale* this species was renamed by Neubert et al. (2000) and its taxonomic status remains questionable. It was found among the nivicolous myxomycetes of Europe and its taxonomic position discussed in detail by Lado & Ronikier (2008). The clustered, spherical, sessile sporocarps have a very rugose outer peridium with a thick layer of lime attached to the inner surface. At dehiscence the two layers remain attached as the fragments separate (Figs 19–20).

Diderma radiatum (L.) Morgan

Loc. 50: On *Nothofagus* sp. wood (fc), SLS 19669.

Diderma robustum Aramb. Figs 17–18, 21–26

Loc. 27: On *Nothofagus pumilio* bark (fc), Lado 16403 (MA-Fungi 78782); on *N. pumilio* wood (fc), Lado 16411 (MA-Fungi 78783). Loc. 46: On wood (fc), Lado 16567 (MA-Fungi 78784), Lado 16572 (MA-Fungi 78785).

Comments: These represent the first collections of this species since it was described by Arambarri (1973) from Tierra del Fuego, Argentina. Our collections are from two different states (Río Negro and Chubut) and extend the known distribution of *Diderma robustum* a considerable distance northward, from 54° to 41° South latitude. The most obvious distinguishing character of these stipitate, obovate, whitish sporocarps, is the large flattened columella (Figs 17–18), shaped like a spatula, which reaches the apex of the sporotheca. The spores are warted and 12–13 µm diam., with the warts forming an incomplete crested reticulum (Figs 23–26). The fragile double peridium has transverse folds and dehisces irregularly. The outer peridium is totally calcareous and the inner layer membranous (Fig. 21) and translucid.

Didymium difforme (Pers.) Gray

Loc. 45: Mixed aerial litter (mc, pH 5.5), SLS 19852.

Didymium minus (Lister) Morgan

Loc. 31: On *Chusquea culeou* leaves (fc), Lado 16461 (MA-Fungi 78786); on *Nothofagus dombeyi* wood (fc), Lado 16462 (MA-Fungi 78787). Loc. 46: On wood (fc), Lado 16576 (MA-Fungi 78788).

Didymium nigripes (Link) Fr.

Loc. 44: On *Nothogafus alpina* wood (fc), Lado 16534 (MA-Fungi 78789), Lado 16536 (MA-Fungi 78790).

Echinostelium brooksii K.D.Whitney

Loc. 39: On *Araucaria araucana* bark (mc, pH 5.1), dwb 2702.

Comments: This is the first record of the species for South America. Typical specimens possess the characteristic pigmented lenticular columella, which is 4–5 µm diam. and have a small peridial collar. This tiny species was cited from Mexico by Rodríguez-Palma et al. (2002). Its appearance on acidic bark is consistent with its appearance on acidified bark in Europe (Wrigley de Basanta 2004).

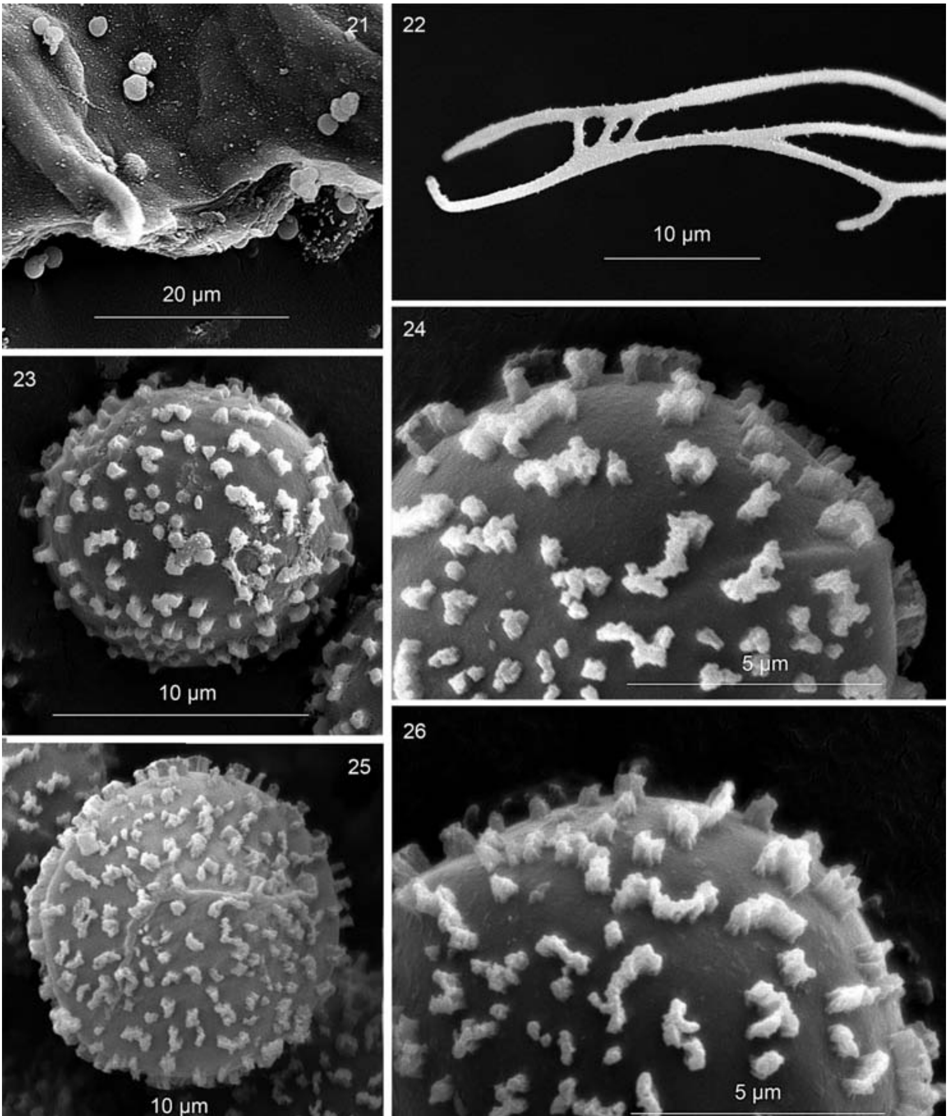
Echinostelium colliculosum K.D.Whitney & H.W.Keller

Loc. 22: On *Berberis buxifolia* bark (mc, pH 5.8), dwb 2691.

Comments: In South America it has otherwise been reported only from Brazil.

Echinostelium minutum de Bary

Loc. 2: On forest floor litter (mc, pH 4.6, 4.8), SLS 19801, SLS 19853. Loc. 5: On *Nothofagus betuloides* bark (mc, pH 5.0), dwb 2670. Loc. 30: On liana (mc, pH 6.2-6.3), dwb 2588, dwb 2600, dwb 2604; on *Saxegothea conspicua* (mc pH 5.1), dwb 2701.



Figs 21–23. *Diderma robustum* (MA-Fungi 78782) by SEM. Fig. 21. Inner surface of peridium. Fig. 22. Detail of capillitium. Fig. 23. Warted spore. Fig. 24. *Diderma robustum* (MA-Fungi 78784) detail of spore ornamentation by SEM. Fig. 25. *Diderma robustum* (MA-Fungi 78785) detail of spore ornamentation by SEM. Fig. 26. *Diderma robustum* (MA-Fungi 78784) detail of spore ornamentation by SEM.

COMMENTS: *Echinostelium minutum* has been reported from Brazil, Colombia, Ecuador and Peru in South America. It was reported from the South Polar Region by Stephenson et al. (2007).

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

Loc. 1: On *Nothofagus betuloides* wood (fc), Lado 16294 (MA-Fungi 78791). Loc. 3: On *N. betuloides* wood (fc), Lado 16311 (MA-Fungi 78792), Lado 16312 (MA-Fungi 78793), Lado 16313 (MA-Fungi 78794); on bryophytes (fc), Lado 16315 (MA-Fungi 78795); on lichens (fc), Lado 16316 (MA-Fungi 78796). Loc. 9: On *Drimys winteri* wood (fc), Lado 16338 (MA-Fungi 78797), Lado 16344 (MA-Fungi 78798). Loc. 12: On *Nothofagus* sp. wood (fc), Lado 16355 (MA-Fungi 78799). Loc. 32: On *N. dombeyi* wood (fc), Lado 16468 (MA-Fungi 78800). Loc. 42: On *N. alpina* wood (fc), Lado 16523 (MA-Fungi 78801). Loc. 48: On *N. dombeyi* wood (fc), Lado 16611 (MA-Fungi 78802). Loc. 49: On *N. dombeyi* (fc), Lado 16641 (MA-Fungi 78803), Lado 16643 (MA-Fungi 78804). Loc. 50: On herbaceous plant debris (fc), Lado 16648 (MA-Fungi 78805).

Lamproderma arcyrioides (Sommerf.) Rostaf.

Loc. 27: On *Nothofagus pumilio* wood (fc), Lado 16405 (MA-Fungi 78806).

****Lamproderma echinosporum*** Meyl.

Loc. 27: On *Nothofagus pumilio* wood (fc), Lado 16395 (MA-Fungi 78807).

Comments: This is the first time this species has been recorded from South America. The ovoid sporothecae are on a rigid flattened stalk of about 1 mm in length. The persistent peridium is thin, dehiscing irregularly. The black columella reaches half to two thirds the diameter of the sporotheca, and at the apex gives rise to the capillitium, which forms a dense net with abundant free ends, that are hyaline at the tips. The capillitial threads are covered with many nodules. The spores are 13–16 µm diam. uniformly dusky brown and covered with irregularly distributed long spines (up to 1 µm long).

****Lamproderma maculatum*** Kowalski

Loc. 27: On *Nothofagus pumilio* wood and bark (fc), Lado 16392 (MA-Fungi 78808), Lado 16393 (MA-Fungi 78809).

Comments: This is the first record of this species from South America. It is known from California and Washington in North America (Kowalski 1970). The globose to ovoid sporocarps are on a rigid cylindrical stalk less than 1 mm in length. The persistent peridium is thin, silvery-blackish, iridescent with colourful reflections, mottled with black depressed areas, especially at the base, the basal part of the peridium brown in transmitted light, the upper part hyaline with big brown dots. The purple-brown spores 12–15 µm diam. are uniformly spinulose with spines of less than 0.5 µm in length.

Leocarpus fragilis (Dicks.) Rostaf.

Loc. 3: On *Nothofagus betuloides* wood (fc), Lado 16310 (MA-Fungi 78810); on wood (fc), Lado 16317 (MA-Fungi 78811). Loc. 9: On *N. betuloides* wood (fc), Lado 16331 (MA-Fungi 78812). Loc. 27: On *N. pumilio* wood (fc), Lado 16407 (MA-Fungi 78813), Lado 16414 (MA-Fungi 78814). Loc. 44: On *N. alpina* wood (fc), Lado 16538 (MA-Fungi 78815).

****Licea minima*** Fr.

Loc. 29: On stem of *Chusquea culeou* (fc), Lado 16432a (MA-Fungi 78816). Loc. 32: On aerial litter of *Chusquea culeou* (mc, pH 5.3) dwb2699. Loc. 46: On wood (fc), Lado 16566 (MA-Fungi 78817), Lado 16594 (MA-Fungi 78818).

COMMENTS: This species is known in South America from Paraguay and Uruguay, and also widely distributed in North America and Europe (Martin & Alexopoulos 1969: 45).

Lycogala epidendrum (L.) Fr.

LOC. 3: On *Nothofagus betuloides* wood (fc), Lado 16297 (MA-Fungi 78819), Lado 16308 (MA-Fungi 78820), SLS 19587. LOC. 27: On *N. pumilio* wood (fc), Lado 16413 (MA-Fungi 78821). LOC. 29: On *Nothofagus* sp. wood (fc), Lado 16422 (MA-Fungi 78822), Lado 16424 (MA-Fungi 78823). LOC. 32: On *N. dombeyi* wood (fc), Lado 16489 (MA-Fungi 78824), SLS 19629. LOC. 38: On *N. dombeyi* wood (fc), Lado 16517 (MA-Fungi 78825). LOC. 44: On *N. alpina* wood (fc), Lado 16546 (MA-Fungi 78826); on *Nothofagus* sp. wood (fc), SLS 19649. LOC. 46: On wood (fc), Lado 16569 (MA-Fungi 78827); on decaying wood (fc), SLS 19665.

Metatrichia floriformis (Schwein.) Nann.-Bremek.

LOC. 2: On *Nothofagus pumilio* wood (fc), SLS 19576, SLS 19578. LOC. 3: On *Nothofagus betuloides* wood (fc), Lado 16300 (MA-Fungi 78828), Lado 16301 (MA-Fungi 78829). LOC. 9: On *N. betuloides* wood (fc), Lado 16332 (MA-Fungi 78830). LOC. 29: On *Nothofagus* sp. wood (fc), Lado 16418 (MA-Fungi 78831), Lado 16435 (MA-Fungi 78832), Lado 16439 (MA-Fungi 78833), Lado 16425 (MA-Fungi 78834), SLS 19616, SLS 19620, SLS 19621. LOC. 31: On *N. dombeyi* wood (fc), Lado 16449 (MA-Fungi 78835), Lado 16456 (MA-Fungi 78836), Lado 16457 (MA-Fungi 78837), Lado 16467 (MA-Fungi 78838), SLS 19630, SLS 19633. LOC. 32: On *N. dombeyi* wood (fc), Lado 16479 (MA-Fungi 78839), Lado 16480 (MA-Fungi 78840), Lado 16481 (MA-Fungi 78841). LOC. 35: On *N. dombeyi* wood (fc), Lado 16502 (MA-Fungi 78842), Lado 16509 (MA-Fungi 78843). LOC. 38: On *N. dombeyi* wood (fc), Lado 16513 (MA-Fungi 78844), Lado 16515 (MA-Fungi 78845). LOC. 46: On wood (fc), Lado 16554 (MA-Fungi 78846), Lado 16555 (MA-Fungi 78847), Lado 16589 (MA-Fungi 78848), SLS 19654, SLS 19662; on dead bark (fc), SLS659, SLS 19664. LOC. 47: On wood (fc), Lado 16600 (MA-Fungi 78849). LOC. 48: On *N. dombeyi* wood (fc), Lado 16608 (MA-Fungi 78850), Lado 16612 (MA-Fungi 78851), Lado 16616 (MA-Fungi 78852), Lado 16618 (MA-Fungi 78853), Lado 16622 (MA-Fungi 78854), SLS 19668, SLS 19679, SLS 19682; on dead bark (fc), SLS 19673, SLS 19676. LOC. 49: On *N. dombeyi* wood (fc), Lado 16636 (MA-Fungi 78855).

COMMENTS: This was one of the most abundant myxomycetes collected during the entire survey. It often occurred in large fruitings. Interestingly, *Metatrichia floriformis* also tends to be very abundant in the *Nothofagus* forests of New Zealand and Tasmania (Stephenson, personal observation).

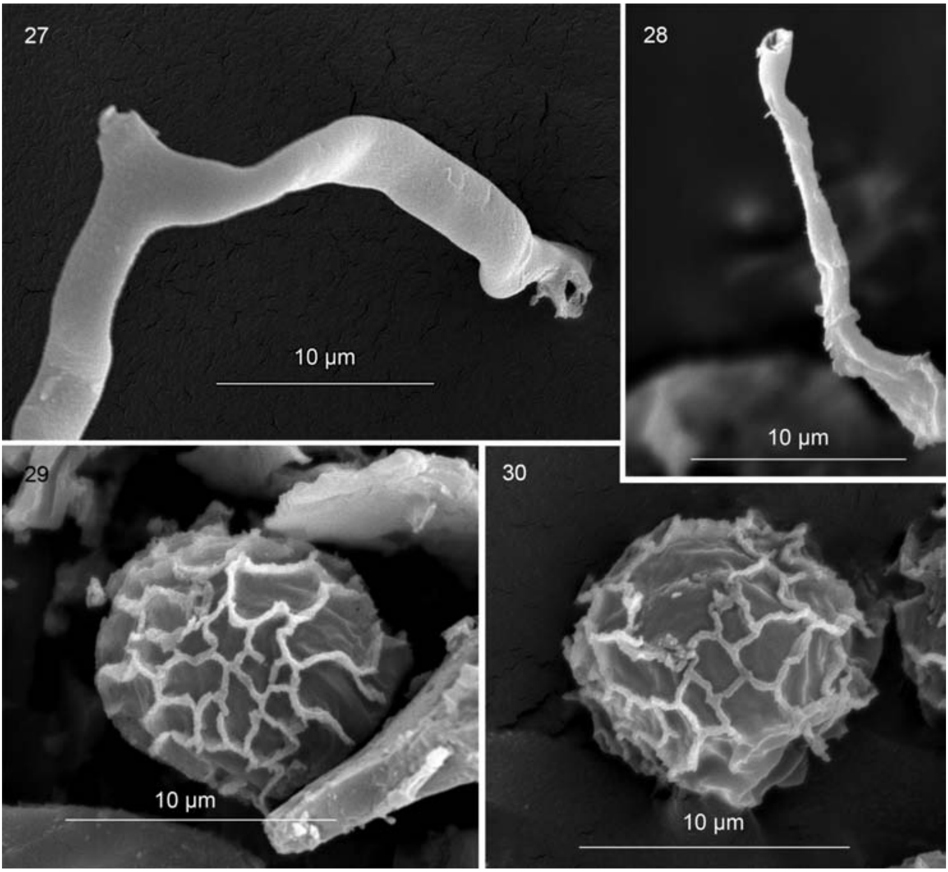
****Oligonema flavidum*** (Peck) Peck — Figs 27–30

LOC. 15: On *Nothofagus pumilio* wood (fc), Lado 16366 (MA-Fungi 78856), Lado 16367 (MA-Fungi 78857).

COMMENTS: This is the first record of this species from South America. The densely clustered bright yellow sporocarps sometimes form a layer thus approaching a pseudoaethalium. The scant, simple, tubular, capillitial threads have free blunt ends and no ornamentation (Figs 27–28). The free yellow spores are 12–16 µm in diam., and markedly reticulate (Figs 29–30).

Perichaena chrysosperma (Curr.) Lister

LOC. 22: On grass aerial litter (mc, pH 21), SLS 20480.



Figs 27–30. *Oligonema flavidum* (MA-Fungi 78856) by SEM. Figs 27–28. Simple tubular capillitial threads with no ornamentation. Figs 29–30. Reticulate spores.

Perichaena depressa Lib.

Loc. 45: On mixed aerial litter (mc, pH 4.7), SLS 20612.

****Perichaena pedata*** (Lister & G.Lister) G.Lister

Loc. 46: On forest floor litter (mc, pH 4.9), SLS 19813.

Comments: In South America, this species has only been found before in Ecuador.

Physarum album (Bull.) Chevall.

= *Physarum nutans* Pers.

Loc. 29: On *Nothofagus* sp. wood (fc), Lado 16426 (MA-Fungi 78858), Lado 16427 (MA-Fungi 78859), Lado 16428 (MA-Fungi 78860), Lado 16431 (MA-Fungi 78861); on dead bark (fc), SLS 19619, SLS 19622. Loc. 31: On *Luma appiculata* wood (fc), Lado 16464 (MA-Fungi 78862), Lado

16465 (MA-Fungi 78863), Lado 16466 (MA-Fungi 78864). Loc. 32: On *N. dombeyi* wood (fc), Lado 16475 (MA-Fungi 78865), Lado 16476 (MA-Fungi 78866), Lado 16491 (MA-Fungi 78867). Loc. 48: On *N. dombeyi* wood (fc), Lado 16613 (MA-Fungi 78868). Loc. 49: On *N. dombeyi* wood (fc), Lado 16640 (MA-Fungi 78869).

Physarum cinereum (Batsch) Pers.

Loc. 33: On mixed aerial litter (mc, pH 4.7), SLS 20527.

Physarum leucophaeum Fr.

Loc. 9: On *Nothofagus betuloides* wood (fc), Lado 16330 (MA-Fungi 78870). Loc. 35: On *N. dombeyi* wood (fc), Lado 16499 (MA-Fungi 78871), Lado 16501 (MA-Fungi 78872).

****Physarum psittacinum*** Ditmar

Loc. 30: on wood of *Chusquea culeou* (fc), Lado 16442 (MA-Fungi 78873).

Comments: This species is known in South America from Colombia, Venezuela and Chile.

Physarum vernum Sommerf.

Loc. 27: On bark of *Nothofagus pumilio* (fc), Lado 16402 (MA-Fungi 78874).

Physarum viride (Bull.) Pers.

Loc. 18: On dead bark (fc), SLS 19603. Loc. 29: On *Nothofagus* sp. wood (fc), SLS 19612. Loc. 31: On *N. dombeyi* wood (fc), Lado 16460 (MA-Fungi 78875). Loc. 35: On *N. dombeyi* wood (fc), Lado 16505 (MA-Fungi 78876). Loc. 42: On *N. alpina* wood (fc), Lado 16525 (MA-Fungi 78877). Loc. 46: wood (fc), Lado 16593 (MA-Fungi 78878).

****Reticularia jurana*** Meyl.

Loc. 5: On *Nothofagus* sp. wood (fc), Lado 16318 (MA-Fungi 78879). Loc. 7: On *Nothofagus* sp. wood (fc), Lado 16321 (MA-Fungi 78880). Loc. 8: On *Nothofagus* sp. wood (fc), Lado 16324 (MA-Fungi 78881). Loc. 12: On *Nothofagus* sp. wood (fc), Lado 16353 (MA-Fungi 78882). Loc. 28: On *N. pumilio* wood (fc), Lado 16376 (MA-Fungi 78883).

Comments: The species has been previously reported in South America from Brazil.

Stemonitis axifera (Bull.) T.Macbride

Loc. 1: On *Nothofagus betuloides* wood (fc), Lado 16287 (MA-Fungi 78884). Loc. 3: On *N. betuloides* wood (fc), Lado 16302 (MA-Fungi 78885). Loc. 29: On *Nothofagus* sp. wood (fc), Lado 16437 (MA-Fungi 78886). Loc. 32: On *N. dombeyi* wood (fc), Lado 16488 (MA-Fungi 78887); on *Nothofagus* sp. wood (fc), SLS 19628. Loc. 35: On *N. dombeyi* wood (fc), Lado 16495 (MA-Fungi 78888), Lado 16498 (MA-Fungi 78889). Loc. 38: On *N. dombeyi* wood (fc), Lado 16514 (MA-Fungi 78890). Loc. 44: On decaying wood (fc) SLS 19651. Loc. 46: On wood (fc), Lado 16585 (MA-Fungi 78891), Lado 16590 (MA-Fungi 78892). Loc. 49: On *N. dombeyi* wood (fc), Lado 16642 (MA-Fungi 78893).

Stemonitis flavogenita E.Jahn

Loc. 2: On bark of *Nothofagus pumilio* (mc, pH 4.5), dwb 2669. Loc. 29: On *Nothofagus* sp. wood (fc), Lado 16421 (MA-Fungi 78894).

Stemonitis fusca Roth

Loc. 2: On *Nothofagus betuloides* wood (fc), SLS 19588. Loc. 3: On *Nothofagus betuloides* wood (fc), Lado 16307 (MA-Fungi 78895). Loc. 7: On decaying wood (fc), SLS 20533. Loc. 9: On *N. betuloides* wood (fc), Lado 16333 (MA-Fungi 78896). On *Drimys winteri* wood (fc), Lado 16339 (MA-Fungi 78897). Loc. 40: On decaying wood (fc), SLS 19644. Loc. 45: On decaying wood (fc), SLS 20534. Loc. 46: On wood (fc), Lado 16558 (MA-Fungi 78898), Lado 16559 (MA-Fungi 78899), Lado 16588 (MA-Fungi 78900).

Stemonitis fusca var. ***nigrescens*** Rex.

Loc. 2: On *Nothofagus* sp. twigs (mc, pH 5.0–5.2), SLS 20479, SLS 19406, SLS 19824, SLS 19827, SLS 20487, SLS 20632. Loc. 7: On mixed litter (mc, pH 5.9), SLS 20530. Loc. 39: On forest floor litter (mc, 5.5), SLS 20529. Loc. 45: On mixed aerial litter (mc, pH 5.7), SLS 20761.

Comments: This variety of the species is sometimes considered to represent a distinct species, *Stemonitis nigrescens*. However, Castillo et al. (1997) considered it to be synonymous with *S. fusca*.

Stemonitis lignicola Nann.-Bremek.

Loc. 49: On *Nothofagus dombeyi* wood (fc), Lado 16637 (MA-Fungi 78901).

Stemonitis splendens Rostaf.

Loc. 46: On wood (fc), Lado 16591 (MA-Fungi 78902), SLS 19656, SLS 19658.

Stemonitopsis typhina (F.H.Wigg.) Nann.-Bremek.

Loc. 31: On *Nothofagus dombeyi* wood (fc), Lado 16452 (MA-Fungi 78903), Lado 16453 (MA-Fungi 78904), Lado 16454 (MA-Fungi 78905), Lado 16467 (MA-Fungi 78906).

****Trichia affinis*** de Bary

Loc. 1: On *Nothofagus betuloides* wood (fc), Lado 16284 (MA-Fungi 78907), Lado 16285 (MA-Fungi 78908), Lado 16289 (MA-Fungi 78909). Loc. 3: On *N. betuloides* wood (fc), Lado 16296 (MA-Fungi 78910), 16309 (MA-Fungi 78911). Loc. 9: On *N. betuloides* wood (fc), Lado 16335 (MA-Fungi 78912); on *Drimys winteri* wood (fc), Lado 16342 (MA-Fungi 78913). Loc. 10: On *Nothofagus* sp. (fc), Lado 16351 (MA-Fungi 78914). Loc. 15: On *N. pumilio* wood (fc), Lado 16364 (MA-Fungi 78915), Lado 16368 (MA-Fungi 78916). Loc. 17: On *N. pumilio* wood (fc), Lado 16369 (MA-Fungi 78917). Loc. 19: On *N. antarctica* wood (fc), Lado 16372 (MA-Fungi 78918). Loc. 21: On *Nothofagus* sp. wood (fc), Lado 16373 (MA-Fungi 78919). Loc. 26: On *N. pumilio* wood (fc), Lado 16380 (MA-Fungi 78920). Loc. 27: On *N. pumilio* wood (fc), Lado 16396 (MA-Fungi 78921). Loc. 29: On *Nothofagus* sp. wood (fc), Lado 16415 (MA-Fungi 78922), Lado 16434 (MA-Fungi 78923). Loc. 31: On *N. dombeyi* wood (fc), Lado 16450 (MA-Fungi 78924). Loc. 32: On *N. dombeyi* wood (fc), Lado 16479 (MA-Fungi 78925), Lado 16485 (MA-Fungi 78926), Lado 16500 (MA-Fungi 78927). Loc. 42: On *N. alpina* wood (fc), Lado 16524 (MA-Fungi 78928). Loc. 44: On *N. alpina* wood (fc), Lado 16541 (MA-Fungi 78929), 16542 (MA-Fungi 78930). Loc. 46: On wood (fc), Lado 16557 (MA-Fungi 78931). Loc. 47: On wood (fc), Lado 16596 (MA-Fungi 78932), 16602 (MA-Fungi 78933). Loc. 48: On *N. dombeyi* wood (fc), Lado 16614 (MA-Fungi 78934). Loc. 49: On *N. dombeyi* wood (fc), Lado 16635 (MA-Fungi 78935); on *Fitzroya cupressoides* (fc), Lado 16645 (MA-Fungi 78936).

Comments: In South America this species has been reported previously from Chile and Ecuador. It was one of the most common species collected during the survey. The intense orange-yellow, globose to subglobose sporothecae and fragmented-reticulate spores characterise this species (Lado & Pando 1997).

Trichia botrytis (J.F.Gmel.) Pers.

Loc. 2: On *Nothofagus* sp. wood (fc), SLS 19577. Loc. 46: On wood (fc), Lado 16548 (MA-Fungi 78937), Lado 16553 (MA-Fungi 78938). Loc. 48: On *N. dombeyi* wood (fc), Lado 16609 (MA-Fungi 78939).

****Trichia contorta*** (Ditmar) Rostaf.

Loc. 12: on dead bark (fc), SLS 19595, SLS 19596, SLS 19597, SLS 19598, SLS 19599, SLS 19600, SLS 19601. Loc. 23: On *Nothofagus pumilio* wood (fc), Lado 16389 (MA-Fungi 78940), Lado 16390 (MA-Fungi 78941). Loc. 26: On *N. pumilio* wood (fc), Lado 16383 (MA-Fungi 78942); on dead bark (fc), SLS 19606, SLS 19608, SLS 19609, SLS 19610. Loc. 27: On *N. pumilio* wood (fc), Lado 16391 (MA-Fungi 78943). Loc. 35: On *N. dombeyi* wood (fc), Lado 16508 (MA-Fungi 78944).

Comments: *Trichia contorta* is known from Brazil and Chile in South America.

Trichia decipiens (Pers.) T.Macbr.

Loc. 2: On *Nothofagus betuloides* wood (fc), SLS 19579, SLS 19583. Loc. 3: On *Nothofagus betuloides* wood (fc), Lado 16298 (MA-Fungi 78945), Lado 16299 (MA-Fungi 78946), Lado 16303 (MA-Fungi 78947). Loc. 9: On *N. betuloides* wood (fc), Lado 16334 (MA-Fungi 78948); on *Drimys winteri* wood (fc), Lado 16341 (MA-Fungi 78949). Loc. 17: On *N. pumilio* wood (fc), Lado 16371 (MA-Fungi 78950). Loc. 23: On *N. pumilio* wood (fc), Lado 16377 (MA-Fungi 78951). Loc. 28: On *N. pumilio* wood (fc), Lado 16375 (MA-Fungi 78952). Loc. 29: On *Nothofagus* sp. wood (fc), Lado 16432 (MA-Fungi 78953). Loc. 31: On *N. dombeyi* wood (fc), Lado 16454 (MA-Fungi 78954), Lado 16455 (MA-Fungi 78955), Lado 16458 (MA-Fungi 78956), SLS 19625, SLS 19635. Loc. 32: On *N. dombeyi* wood (fc), Lado 16470 (MA-Fungi 78957), Lado 16481 (MA-Fungi 78958), Lado 16483 (MA-Fungi 78959), Lado 16484 (MA-Fungi 78960), Lado 16487 (MA-Fungi 78961), Lado 16490 (MA-Fungi 78962). Loc. 34: On *N. dombeyi* wood (fc), Lado 16492 (MA-Fungi 78963), Lado 16494 (MA-Fungi 78964). Loc. 35: On *N. dombeyi* wood (fc), Lado 16504 (MA-Fungi 78965). Loc. 38: On *N. dombeyi* wood (fc), Lado 16516 (MA-Fungi 78966). Loc. 42: On *N. alpina* wood (fc), Lado 16530 (MA-Fungi 78967). Loc. 48: On *N. dombeyi* wood (fc), Lado 16609 (MA-Fungi 78968), Lado 16621 (MA-Fungi 78969), Lado 16626 (MA-Fungi 78970). Loc. 49: On *N. dombeyi* wood (fc), Lado 16631 (MA-Fungi 78971), Lado 16634 (MA-Fungi 78972), SLS 19670.

Trichia favoginea (Batsch) Pers.

Loc. 2: On *Nothofagus betuloides* wood (fc), SLS 19582. Loc. 19: On dead bark (fc), SLS 19604, SLS 19605. Loc. 25: On *Nothofagus pumilio* wood (fc), Lado 16387 (MA-Fungi 78973), Lado 16388 (MA-Fungi 78974). Loc. 29: On dead bark (fc), SLS 19617. Loc. 32: On *Nothofagus* sp. wood (fc), SLS 19626; on dead bark (fc), SLS 19627, SLS 19631. Loc. 35: On *N. dombeyi* wood (fc), Lado 16503 (MA-Fungi 78975). Loc. 38: On *N. dombeyi* wood (fc), Lado 16510 (MA-Fungi 78976), Lado 16511 (MA-Fungi 78977). Loc. 44: On *N. alpina* wood (fc), Lado 16539 (MA-Fungi 78978). Loc. 46: On *Nothofagus* sp. wood (fc), SLS 19653, SLS 19660, SLS 19661. Loc. 48: On *N. dombeyi* wood (fc), Lado 16615 (MA-Fungi 78979), Lado 16617 (MA-Fungi 78980), Lado 16620 (MA-Fungi 78981), Lado 16623 (MA-Fungi 78982), Lado 16624 (MA-Fungi 78983). Loc. 49: On *N. dombeyi* wood (fc), Lado 16629 (MA-Fungi 78984), SLS 19675.

****Trichia flavicoma*** (Lister) Ing

Loc. 29: On *Nothofagus* sp. wood (fc), Lado 16438 (MA-Fungi 78985). Loc. 30: On wood (fc), Lado 16445 (MA-Fungi 78986). Loc. 31: On *N. dombeyi* wood (fc), Lado 16459 (MA-Fungi 78987).

Comments: These collections represent the first records of this species for South America. In Europe *T. flavicoma* is usually found on dead leaves of angiosperms or pine needles (Lado & Pando 1997, Ing 1999).

***Trichia lutescens** (Lister) Lister

Loc. 26: On *Nothofagus pumilio* wood (fc), Lado 16385 (MA-Fungi 78988), Lado 16386 (MA-Fungi 78989). Loc. 32: On *N. dombeyi* wood (fc), Lado 16478 (MA-Fungi 78990). Loc. 47: On wood (fc), Lado 16601(MA-Fungi 78991).

Comments: In South America it has been reported from Brazil and is relatively common in Europe and North America.

***Trichia persimilis** P.Karst.

Loc. 26: On *Nothofagus pumilio* wood (fc), Lado 16382 (MA-Fungi 78992). Loc. 44: On *N. alpina* wood (fc), Lado 16540 (MA-Fungi 78993). Loc. 46: On wood (fc), Lado 16573 (MA-Fungi 78994), Lado 16574 (MA-Fungi 78995), Lado 16575 (MA-Fungi 78996). Loc. 48: On *N. dombeyi* wood (fc), Lado 16625 (MA-Fungi 78997).

Comments: This species has been reported from Peru and Chile.

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

Loc. 3: On *Nothofagus betuloides* wood (fc), Lado 16305 (MA-Fungi 78998). Loc. 10: On *Nothofagus* sp. wood (fc), Lado 16347 (MA-Fungi 78999). Loc. 15: On *N. pumilio* wood (fc), Lado 16365 (MA-Fungi 79000). Loc. 30: On wood (fc), Lado 16441 (MA-Fungi 79001). Loc. 46: On wood (fc), Lado 16568 (MA-Fungi 79002).

Trichia verrucosa Berk.

Loc. 1: On *Nothofagus betuloides* wood (fc), Lado 16288 (MA-Fungi 79003); on *Nothofagus* sp. (fc), Lado 16327 (MA-Fungi 79004). Loc. 2: On *Nothofagus* sp. wood (fc), SLS 19581. Loc. 9: On *N. betuloides* wood (fc), Lado 16328 (MA-Fungi 79005). Loc. 29: On *Nothofagus* sp. wood (fc), Lado 16417 (MA-Fungi 79006), Lado16429 (MA-Fungi 79007), Lado 16436 (MA-Fungi 79008), SLS 19613, SLS 19614. Loc. 31: On *N. dombeyi* wood (fc), Lado 16446 (MA-Fungi 79009), Lado 16447 (MA-Fungi 79010). Loc. 34: On *Nothofagus* sp. wood (fc), SLS 19640. Loc. 39: On *Araucaria araucana* (fc), Lado 16519 (MA-Fungi 79011), Lado 16520 (MA-Fungi 79012). Loc. 42: On *N. alpina* wood (fc), Lado 16528 (MA-Fungi 79013), Lado 16529 (MA-Fungi 79014). Loc. 44: On *Nothofagus* sp. wood (fc), SLS 19647. Loc. 46: On wood (fc), Lado 16550 (MA-Fungi 79015), Lado 16552 (MA-Fungi 79016), Lado 16561 (MA-Fungi 79017), Lado 16564 (MA-Fungi 79018), Lado 16566 (MA-Fungi 79019), Lado 16571 (MA-Fungi 79020), Lado 16579 (MA-Fungi 79021), Lado 16584 (MA-Fungi 79022), Lado 16587 (MA-Fungi 79023), Lado 16594 (MA-Fungi 79024), SLS 19652, SLS 19653, SLS 19655. Loc. 48: On *N. dombeyi* wood (fc), Lado 16606 (MA-Fungi 79025), Lado 16607 (MA-Fungi 79026). Loc. 49: On *N. dombeyi* wood (fc), Lado 16630 (MA-Fungi 79027).

Tubifera ferruginosa (Batsch) J.F.Gmel.

Loc. 1: On *Nothofagus betuloides* wood (fc), Lado 16290 (MA-Fungi 79028), SLS 19586. Loc. 27: On *N. pumilio* wood (fc), Lado 16374 (MA-Fungi 79029).

Willkommlangea reticulata (Alb. & Schwein.) Kuntze

Loc. 2: On decaying wood (fc), SLS 19580. Loc. 9: On *Nothofagus betuloides* wood (fc), Lado 16329 (MA-Fungi 79030); on *Drimys winteri* wood (fc), Lado 16336 (MA-Fungi 79031). Loc. 12: On *Nothofagus* sp. wood (fc), Lado 16354 (MA-Fungi 79032). Loc. 32: On dead bark (fc), SLS 19632. Loc. 46: On wood (fc), Lado 16562 (MA-Fungi 79033). Loc. 49: On dead bark (fc), SLS 19677.

Discussion

The survey yielded in total 442 collections of myxomycetes, including 404 specimens that had fruited in the field under natural conditions and 38 obtained from moist chamber cultures. These collections included 67 species and one variety in 23 different genera. The moist chamber cultures prepared with samples of dead plant material produced 16 of these species. Among the myxomycetes obtained are six species (*Cribraria rufa, Diderma peyerimhoffii, Echinostelium brooksii, Lamproderma echinosporum, L. maculatum* and *Oligonema flavidum*) that are new for all of South America and 13 species that are new records for Argentina. Two species of the genus *Diderma*, *D. gracile* and *D. robustum*, which were described from Tierra del Fuego and not found since their original description, were among the more noteworthy collections from the survey. In addition, *D. antarcticum,* a third rare species of *Diderma*, found only once since its original description in 1887, was collected.

The most productive collecting locality visited during the survey was in Lago Puelo National Park (Table 3), where 26 different species of 15 genera were recorded in one day of fieldwork. This was probably due to the mild temperatures, abundant annual precipitation and the wide range of substrates potentially available to myxomycetes (Table 1). Lago Puelo is the smallest National Park in terms of total area, and is located at a lower elevation than the other National Parks sampled (200 m at the lake). This results in a relatively benign microclimate with more different tree species than the other parks and the presence of several elements of Valdivian forest. Among the trees present were wild hazel, a false walnut belonging to the Proteaceae, *Lomatia hirsuta,* elm, the mountain cypress *Austrocedrus chilensis* and other trans-Andean species that have distributions that extend eastwards from Chile. This increase in the diversity of substrates leading to an increase in myxomycete diversity was also noted in studies of litter and twigs by Stephenson (1989) and Stephenson et al. (2008), and also observed in our own recent fieldwork in Central Chile (Wrigley de Basanta et al. 2008a). *Trichia* was the most commonly collected genus, and seven different species in the genus were recorded in this National Park. Species in several other genera produced very large fruitings and prominent examples of this were *Stemonitis fusca* and *Metatrichia floriformis*. Of particular interest were the second known record in the world of *Diderma robustum,* not collected again since its original description in 1973 from Tierra del Fuego (Arambarri 1973), and now reported from Río Negro and Chubut considerably increasing its distribution. In addition, five collections of *D. gracile* were made here. This species was also described originally from Tierra del Fuego (Arambarri 1973) and found for the first time since then in this survey. Its distribution is extended by the collections, from Tierra del Fuego to Chubut Río Negro and Santa Cruz (54°–41° South latitude). *Willkommlangea reticulata,* a species distributed widely in tropical areas, particularly in the Neotropics (Farr 1976), was collected in Lago Puelo and in four of the other National Parks visited, and even in Tierra del Fuego at 54°S latitude, where subantarctic climatic conditions prevail. In addition, five of the species that are new records for Argentina were found in Lago Puelo National Park.

Los Alerces National Park, named after the endangered Patagonian cypress *Fitzroya cupressoides* that grows there, provided 47 collections and 16 species. There are few

Table 3. Summary of results by National Park and areas close to each National Park.

National Park	Collecting sites	Days	Time (hrs)	Collections	Collections per site	Spp.	Genera	S/G ratio
Lanín	6	2	12	31	5.2	18	10	1.8
Nahuel Huapi	17	5	30	167	9.8	46	21	2.2
Lago Puelo	2	1	6	72	36	26	15	1.7
Los Alerces	3	1	6	47	15.7	16	9	1.8
Los Glaciares	14	2	12	60	4.3	24	15	1.6
Tierra del Fuego	8	2	12	65	8.1	24	15	1.6

trees of this species left in Argentina, and they occur in discontinuous patches of forest in this province and to the south of the neighboring province. Some of the trees in this monospecific genus are more than 2000 years old and up to 70 m tall. We obtained *Trichia affinis* on substrates provided by *F. cupressoides*, but most of our collections were associated with *Nothofagus dombeyi* and resulted from the intensive sampling effort carried out on one day in this park. The most common genus was *Trichia*, and the most common species was *Metatrichia floriformis*. The species *Arcyria ferruginea, Diderma radiatum* and *Stemonitis lignicola* were collected only from Alerces National Park. There was only a single previous record of a myxomycete from the Province of Chubut (*T. botrytis*, as reported by Crespo and Lugo [2003]), so all the 33 different species represented among the 119 collections from Lago Puelo and Los Alerces National Parks are new provincial records.

Substrate diversity was also high in parts of Nahuel Huapi National Park. Over a distance of only 60 km within this park, the vegetation changes from arid steppe land in the east through southern beech (*Nothofagus*) forest, with dwarf forms on hill-tops, to lush Valdivian temperate rainforest where annual rainfall is above 3000 mm. There are thickets of a bamboo-like grass (*Chusquea culeou*) upon which we found myxomycetes on the cane, leaves and aerial litter. The canes are mixed with *Podocarpus* spp., *Saxegothea* spp. and *Nothofagus dombeyi* and on the slopes to the mountain lakes, even lianas and epiphytes provided substrates for moist chamber culture. The myrtle *Luma apiculata*, with pretty, white flowers and an edible fruit used for medicinal purposes (Bisheimer 2003), formed patches of woodland in lowland places near the water. On the slopes, *Nothofagus* forest predominated, with *N. dombeyi* and *N. pumilio* particularly abundant. Both of these species provided field collections of myxomycetes. The longest period of time (5 days) was spent visiting different parts of this National Park as it is one of the largest parks and 17 collecting sites were visited. As a result, the total number of myxomycetes collected (167) was the highest, and 46 species were recorded, including representatives from 21 of the 23 genera represented in the whole survey. Seven species of *Trichia* were also found in this park. The most common species encountered as field collections were *Metatrichia floriformis* and *Trichia decipiens,* but four species of *Diderma,* including two more collections of *D. robustum,* were found. In addition, two collections of *D. antarcticum*, which was described originally from southern Chile by Spegazzini in 1887, and found only once since then in Tierra del Fuego (Arambarri 1973), and five more of the collections of *D. gracile,* another species described from Tierra del Fuego (Arambarri 1973), were reported. Collections of two normally nivicolous species of *Lamproderma*, and *Diderma niveum*, were found in the woodlands at about 1,500 m elevation, close to the limit of the timber line, in spite of the fact that there had been no snow anywhere nearby for months. It is still not clear how many of the nivicolous species, found normally near melting snow, are obligate nivicoles or facultative nivicoles, with species in the latter group not necessarily requiring months of snow covering the substrate. Our specimens were freshly fruiting at the time of collection, which was mid austral summer, although they did develop where temperatures were low, and the substrates were very humid.

The northernmost of the National Parks visited was Lanín in Neuquén Province, where the deciduous species of southern beech, *Nothofagus nervosa* and *N. obliqua*, were the main substrates in these mixed forests, which yielded 18 species. The dioecious conifer *Araucaria araucana* was also sampled in one of the few patches of this species remaining on the Argentinian side of the Andes, and the first collection in South America of *Echinostelium brooksii* developed on the bark of this substrate. In two days collecting, ten genera were represented in the collections from Lanín, with *Trichia verrucosa* as the most common species.

The largest National Park visited was Los Glaciares. The park is characterized by high annual precipitation on mountain crags of the Andes but as little as 100 mm on parts of the dry steppe. The highest peak in the area is Mount Fitz Roy, with an elevation of 3375 m. *Nothofagus* forests with *N. antarctica*, *N. betuloides* and *N. pumilio* dominate the sub-antarctic vegetation on the slopes of the mountains. The mountains are bordered by arid Patagonian steppe where low precipitation and fierce winds permit only small low-growing shrubs and hardy grasses to survive. Sub-antarctic forests line the shore of Lake Argentino right up to the edge of the Perito Moreno Glacier, and these forests yielded many collections of myxomycetes even at less than 100 m from the face of the glacier. The cold temperatures limit decomposition, but fallen wood of *Nothofagus*, and understory woody shrubs such as *Fuchsia magellanica* and *Drimys winteri* provided good substrates. In two days, 57 myxomycete collections representing 17 genera were obtained. Again, the most common genus was *Trichia* (with three species) and the most common species found was *Trichia affinis*. Another collection of *Diderma gracile,* was recorded from the park, located in the province of Santa Cruz, as were the first South American records of *Diderma peyerimhoffii* (Figs 19–20) and *Oligonema flavidum* (Figs 27–30). *Leocarpus fragilis,* a widespread species, had been cited previously only once from Argentina, in Tierra del Fuego (Crespo & Lugo 2003), before our collections, which extend its distribution to Santa Cruz, Río Negro and Neuquén.

The cold temperatures and fierce winds in Tierra del Fuego National Park mean that even in an apparently lush woodland, with plenty of fallen wood and moisture, decomposition is very slow and the wood in these forests remains intact for long periods. The sphagnum bogs found here are also characterized by slow decomposition with low oxygen and acidic conditions and were tinted red with the carnivorous plant *Drosera* sp. Under these conditions, it was surprising to find as many myxomycetes as we did. In two days collecting we obtained 65 collections

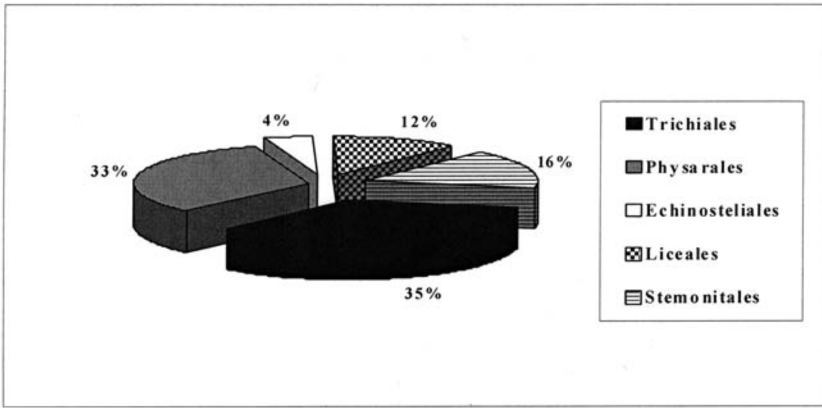


Fig. 31. Summary of results to show the relative proportion of myxomycete orders.

representing 15 different genera. The most common genus was once again *Trichia*, and the most common species was *Stemonitis fusca*. However, one collection of *Diderma gracile* was also made here, which is in the same province as the type locality of Lago Yehuin (Arambarri 1973).

Altogether, *Metatrichia floriformis* (44 collections) *Trichia decipiens* and *Trichia verrucosa* (33 collections each) were the most common species. The former was also very common in New Zealand (Stephenson 2003), where *Nothofagus* forests are also present, and the latter was the most common species in the results reported from Macquarie Island (Stephenson et al. 2007), another subantarctic territory, suggesting a pattern in their distribution. In general, the genus *Trichia* was very well represented. *Arcyria cinerea*, normally one of the most cosmopolitan of all myxomycetes, and common in forests at comparable latitudes in the Northern Hemisphere, was collected only six times during the present study. Twenty-one of the 67 species we collected were represented by only a single collection, and just four species were recorded in all the parks surveyed. The predominant order was the Trichiales, as can be seen in the graph providing data on the relative proportion of the taxonomic orders (Fig. 31). This contrasts with the results obtained in most other regions of the world where comparable studies have been carried out. For example a review of the myxomycetes reported from the entire Neotropics, which includes all South America, Lado & Wrigley de Basanta (2008) indicated that this order is represented far less than the Physarales. When the number of known species in each order is taken into account (16% for the Trichiales versus 38% for the Physarales), the predominance of the former order in these results from Patagonia is particularly noteworthy. These results also contrast with those from arid areas of Chile or Mexico, where almost half of the species (Lado et al. 2007, Estrada-Torres et al. 2009) recorded were members of the Physarales. A predominance of the Physarales in high-latitude, cold-dominated ecosystems has been noted previously. For example, Stephenson et al. (2007) reported that 48% of the species of myxomycetes recorded from subantarctic Macquarie Island (54°30' South latitude, the same as Tierra del Fuego) belonged to

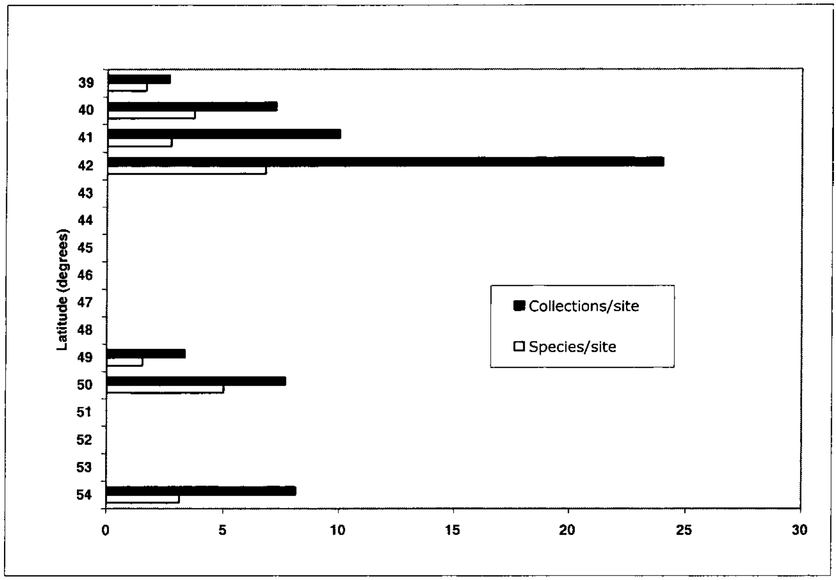


Fig. 32. Summary of the results by latitude (degrees South) of collecting site.

the Physarales. However, members of the Trichiales were next in abundance, making up 28% of all species. In high-elevation areas of the state of Alaska, members of the Trichiales were the most abundant, representing 40% of all species. In a recent study carried out in *Nothofagus* forests of Tasmania (41°09' to 42°49'S), 58% of all collections of myxomycetes were those of species belonging to the Trichiales (Stephenson, unpublished data). Based on the data obtained for pH in the moist chamber culture component of the present study, most of the substrates available for myxomycetes in southern South America are relatively acidic, and it is possible that this represents a limiting factor for at least some members of the Physarales. In a study of dryland ecosystems in Mexico, the abundant presence of the order Physarales was linked to substrates with a basic pH (Estrada-Torres et al. 2009).

The mean number of species per genus (S/G) has been used to estimate taxonomic diversity (Stephenson et al. 1993), and was calculated for the assemblage of myxomycetes recorded in the present study. As has been pointed out, an assemblage in which the species are divided among many genera is intuitively more 'diverse' than one in which most species belong to only a few genera. Consequently, a low value for S/G implies a higher overall diversity than does a high value. The value 2.9 (67/23) we calculated for the whole survey was well within the range of values (generally 2.2 to 4.6) that have been reported for temperate and tropical forests (Stephenson et al. 1993). Many of the individual National Parks (Table 3) had lower values, usually below 2. As such, they fall within the range of values (1.4–2.1) that have been reported for both northern and southern high-latitude regions (Stephenson et al. 2007).

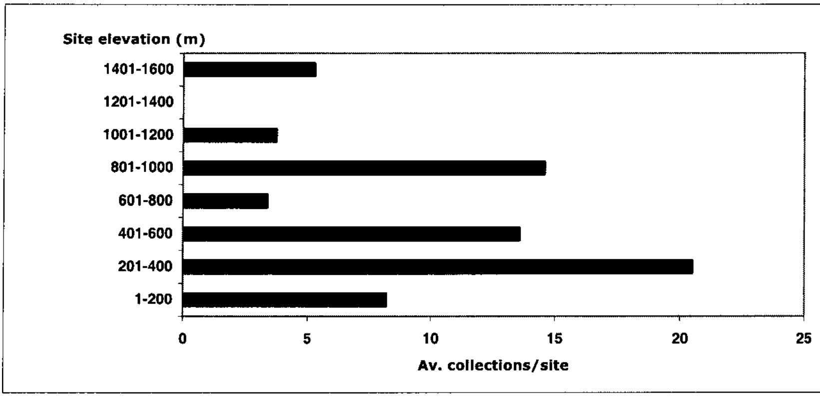


Fig. 33. Summary of results by elevation of collecting site (m).

Eleven species (16% of the total) were recorded exclusively from moist chamber cultures, thus providing further evidence of the importance of including this method in biodiversity surveys. However, moist chamber cultures were much less productive than in most other surveys of which we are aware, and only 37% of 158 cultures were positive for myxomycete fruiting bodies or plasmodia. There was a marked tendency for plasmodia to form sclerotia, some of which never fruited in spite of several months of observation. The pH of the substrates may have been a contributing factor as the range of all cultures was 3.3 to 6.8, with a mean value of 5.3. This is somewhat more acidic than the optimum pH of other relatively more productive cultures (Wrigley de Basanta et al. 2008b). The six species of *Nothofagus* provided the substrate upon which fruiting occurred for a large percentage (more than 90%) of the field collections, but in moist chamber culture, leaf litter and bark from *Nothofagus* were very poor (24 bark cultures produced only two collections and 38 cultures prepared with leaf litter produced only six collections). Apart from the relatively low pH, *Nothofagus* bark and litter decay very slowly and the time frame of the cultures may not have allowed sufficient decomposition to provide ideal conditions for myxomycete development. The results obtained for *Nothofagus* in the present study were consistent with those obtained for other members of the same genus in both New Zealand and Tasmania (Stephenson, unpublished data).

In order to compare the results from the different latitudes and elevations at which collecting was carried out, data were compiled on the mean number of collections per collecting site (Figs 32–33), since the number of sites varied.

These data indicate that the lower latitudes (Fig. 32) and elevations (Fig. 33) were apparently more favourable for myxomycetes in this portion of South America. The greatest number of collections per collecting site was at latitude 42 and from 201–400 m elevation. Almost three quarters of the collections (72%) were made between 39° and 42° South latitude which represented only 56% of the sites visited, and 88% of the collections were at elevations up to 1000 m (78% of the collecting sites). It is also evident, as can be seen from the results of the most common species

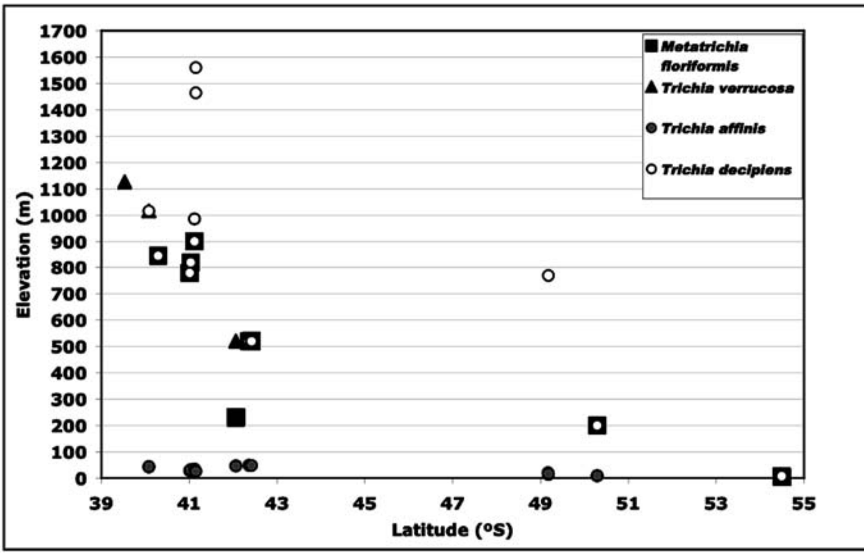


Fig. 34. Latitude (°S) versus elevation (m) of collections of four common species.

(Fig. 34), that as the latitude increases the elevation at which the species is generally found decreases, although *Trichia affinis* was found at all latitudes below 100 m. This is similar to the latitude-elevation relationships that have been noted for many other organisms, including such well-studied examples as the red spruce (*Picea rubens*) in eastern North America (Cogbill & White 1991).

The predominance of the order Trichiales in this survey of Patagonia contrasts with the predominance of the Physarales in South America considered as a whole, and some other high-latitude cold-dominated ecosystems in the Southern Hemisphere. However, our data are similar to those obtained in a more limited study of *Nothofagus* forests in Tasmania and to results from Alaska in the Northern Hemisphere. Other aspects of the data set reported herein are consistent with similar studies in both hemispheres. The low productivity of southern beech in moist chamber cultures versus natural conditions in the field may be due to the slow decomposition of the substrate material. The present survey has increased the known biodiversity of the myxomycete biota of South America and of Argentina, bringing the total number of species recorded from the latter to 173 (Lado & Wrigley de Basanta 2008). In addition, the known distribution of previously recorded species in Argentina has been substantially increased as a result of collections made during this survey. Our data also indicate that an increase in the range of microhabitats available, as observed in Lago Puelo National Park, results in an increase in myxomycete abundance and diversity. The results we obtained also suggest that patterns of myxomycete distribution are affected by macroenvironmental factors such as latitude and elevation, although this may be largely an indirect effect through their influence on available substrates and microhabitat conditions.

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