New records of mitosporic ascomycetes on Nothofagaceae from Patagonia, Argentina

Nuevos registros de ascomycetes mitospóricos en Nothofagaceae de la Patagonia, Argentina

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Citar este artículo
SÁNCHEZ, R. M. & M. V. BIANCHINOTTI. 2023. New records of mitosporic ascomycetes on Nothofagaceae from Patagonia, Argentina. *Bol. Soc. Argent. Bot.* 58: 491-503.

DOI: https://doi.org/10.31055/1851.2372.v58.n4.42019

Summary

Background and aims: The Funga of the Patagonian *Nothofagus* forests is being studied since the late 19th century, but despite many efforts is still far from being completely known. The aim of this paper is to present detailed descriptions and data on geographical distribution of some genera and species of mitosporic ascomycetes that constitute new records for Argentina and for the Neotropical Region.

M&M: Bark and woody debris from native Nothofagaceae were collected and studied. Reproductive structures were hand-sectioned and examined following traditional mycological techniques.

Results: Six species of mitosporic ascomycetes were identified: *Avettaea salvadorae*, *Bactrodesmium atrum*, *Dwiroopa ramya*, *Gilmaniella multiporosa*, *Monodictys paradoxa* and *Pycnopeziza quisquiliaris*. Full descriptions, comments on identification and data on distribution and habitat of each species are provided, along with photographs illustrating diagnostic features.

Conclusions: Two genera, *Dwiroopa* and *Pycnopeziza*, and one species, *M. paradoxa*, are registered for the first time in the Neotropical Region, two other species are first recorded in South America (*B. atrum* and *G. multiporosa*). This constitutes the second record of *A. salvadorae* in the continent, thus expanding its area of distribution.

Key words

Anamorphs, Andean forests, Ascomycota, Fungi, *Lophozonia*, *Nothofagus.*

Resumen

Introducción y objetivos: La Funga de los bosques patagónicos de "*Nothofagus*" viene siendo estudiada desde finales del siglo XIX, pero a pesar de los muchos esfuerzos realizados aún está lejos de ser completamente conocida. El objetivo de este trabajo es presentar descripciones detalladas y datos sobre la distribución geográfica de algunos géneros y especies de ascomicetes mitospóricos, que constituyen nuevos registros para Argentina y para la Región Neotropical.

M&M: Se recolectaron y estudiaron restos de corteza y madera de Nothofagaceae nativas. Las estructuras reproductivas se seccionaron a mano y se examinaron siguiendo las técnicas micológicas tradicionales.

Resultados: Se identificaron seis especies de ascomicetes mitospóricos: *Avettaea salvadorae*, *Bactrodesmium atrum*, *Dwiroopa ramya*, *Gilmaniella multiporosa*, *Monodictys paradoxa* and *Pycnopeziza quisquiliaris*. Se presentan descripciones completas, comentarios sobre la identificación y datos sobre la distribución y el hábitat de cada especie, junto con fotografías que ilustran sus características diagnósticas.

Conclusiones: Se registran dos géneros, *Dwiroopa* y *Pycnopeziza*, y una especie, *M. paradoxa*, por primera vez en la Región Neotropical, otras dos especies se registran por primera vez para Sudamérica (*B. atrum* y *G. multiporosa*). Este constituye el segundo registro de *A. salvadorae* en el continente, ampliando así su área de distribución.

Palabras clave

Anamorfos, Ascomycota, Bosques andinos, Fungi, *Lophozonia*, *Nothofagus*.

Recibido: 31 Jul 2023
Aceptado: 20 Oct 2023
Publicado impreso: 22 Dic 2023
Editora: María Victoria Vignale

ISSN versión impresa 0373-580X
ISSN versión on-line 1851-2372

Introduction

The temperate Andean Patagonian forests of Argentina and Chile constitute the southernmost forests on Earth and one of the most particular bio-geographical formations of South America (Hueck, 1978; Cabrera & Willink, 1980; Donoso Zegers, 1993). Its biota is historically related with that of Australia and New Zealand, and is characterized by great biodiversity and high rates of endemism (Bertonatti & Corcuera, 2000). The dominant plant family is Nothofagaceae (Crisci *et al*., 1991), which was considered monogeneric until Heannan and Smissen (2013) reassessed its classification and rearranged the species in four genera: *Fuscospora* (R. S. Hill & J. Read) Heenan & Smissen*, Lophozonia* Turcz*., Nothofagus* Blume, and *Trisyngyne* Baill. In Argentina, two species of *Lophozonia* (*L. alpina* (Poepp. & Endl.) Heenan & Smissen and *L. obliqua* (Mirb.) Heenan & Smissen) and four of *Nothofagus* (*N. antarctica* (G. Forst.) Oerst., *N. betuloides* (Mirb.) Oerst., *N. dombeyi* (Mirb.) Oerst., and *N. pumilio* (Poepp. & Endl.) Krasser) are present. All of them are also present in Chile along with four more species, endemic from that country.

The fungal biodiversity of Patagonian *Nothofagus* forests have been intensively studied, but despite many efforts, its Funga is still far from being as well-known as the Flora and the Fauna are, in this region. Pioneers like Dusén, Müller, Nylander and Spegazzini, were followed in the middle of the 20th century by Gamundí, Horak, Singer and Wright and, more closely, we could mention the contributions of Rajchenberg, collaborators and disciples. Some groups, like several among the macromycetes, are much better known than others, such as most of the ascomycetes, particularly those with tiny reproductive structures.

With the aim of expanding the knowledge on these fungi, a survey of micromycetes on native plants of the Andean Patagonian forest was initiated in the early 2000s. Since then, several new species and new records of Ascomycota have been published (Bianchinotti *et al*., 2002; Bianchinotti & Rajchenberg, 2004; Sánchez & Bianchinotti, 2007, 2010, 2015; Sánchez *et al*., 2012, 2018, 2019).

Here, new records of some genera and species of mitosporic ascomycetes are presented for Argentina and for the Neotropical Region, along with detailed descriptions, and data on geographical distribution of each one.

Materials and Methods

Small pieces of bark were taken off from living plants of *Lophozonia obliqua*, *L. alpina*, *N. antarctica*, *N. dombeyi* and *N. pumilio*; and also from logs of *N. pumilio* deposited in the sawmill "Aserradero Pelech S.A." Survey was done in protected areas from the Andean Patagonian forests of Argentina: Parque Nacional Lanín, Parque Nacional Los Alerces, Parque Nacional Nahuel Huapi and Parque Provincial Lago Baggilt. A total of 148 samples were examined. Sections of fungal materials were freehand made under a Leica EZ4 stereomicroscope and mounted in water or 5% KOH with phloxine. Microscopic observations and photographs were made with a Leica DM2000 microscope with a Samsung NV10 digital camera. To measure diagnostic structures, material was mounted in tap water and, at least, 10 measurements were taken; M represents the average values. For scanning electron microscopy, reproductive structures were dehydrated (15 minutes in each step) in a graded acetone series (10%-90%, 95%), followed by three changes in absolute acetone. After critical point-drying, the specimens were mounted on aluminum stubs, sputter coated with gold-palladium, and viewed with a LEO EVO 40 Scanning Electron Microscope (SEM). Vouchers were air dried and deposited in BBB Herbarium of the Universidad Nacional del Sur. Isolates were tried in traditional culture media as MA, OA, PDA (Waller *et al.*, 2001) or in *Nothofagus* Agar (NA) or *Nothofagus* Glucose Agar (NGA), which were prepared from a decoction of *Nothofagus dombeyi* bark, by boiling 7 g of bark in small pieces, in 200 ml of distilled water for 15 minutes. Then both media were made as follows: -NA: 170 ml of filtered *N. dombeyi* decoction, 10 g agar and distilled water to reach 500 ml in volume; pH 5 and 20 minutes of sterilization at 1 atmosphere, -NGA: 170 ml of filtered *N. dombeyi* decoction, glucose 5 g, agar 10 g and distilled water to reach 500 ml in volume; pH 6 and 20 minutes of sterilization at 1 atmosphere. The authors of the species are listed following Index Fungorum (www. indexfungorum.org).

Results

Six species of mitosporic ascomycetes were identified: *Avettaea salvadorae* (Petr.) Abbas & B. Sutton, *Bactrodesmium atrum* M.B. Ellis, *Dwiroopa ramya* Subram. & Muthumary, *Gilmaniella multiporosa* Moustafa & Ezz-Eldin, *Monodictys paradoxa* (Corda) S. Hughes and *Pycnopeziza quisquiliaris* (Ellis & Everh.) W.L. White & Whetzel.

1. Avettaea salvadorae (Petr.) Abbas & B. Sutton, *Trans. Br. Mycol. Soc.* 90: 491. 1988. Fig. 1A-F.

Conidiomata pycnidial, spheroidal, subperidermic, dark brown to black, ca. 158 µm diam., 132-138 µm high (M = 134.9); peridium of *textura epidermoidea*, ca. 20 µm thick. Conidiophores absent or represented by a cylindrical to quadrangular subhyaline cell, ca. 5 µm high. Conidiogenous cells ampulliform, enteroblastic, annelidic, with a small collarette, discrete or integrated, percurrent, smooth, hyaline, 9-15 × 2-5 µm (M = 10.9 × 2.9). Conidia slightly obovoid, enclosed by mucilaginous sheath (0.5-2 µm wide), aseptate, smooth, hyaline, 9-16 × 7-12 µm (M = 12.6 × 9.8; n = 20).

Distribution and habitat. Growing on twigs of *Geoffroea decorticans* (Gillies ex Hook. & Arn.) Burkart (Bianchinotti, 1993) and on bark of *Nothofagus pumilio* in Argentina. On *Salvadora oleoides* Decne. and *S. persica* L. in India and Pakistan (Abbas & Sutton, 1988).

Comments. The specimen described here is assigned to *A. salvadorae* because of the presence of enteroblastic conidiogenous cells and the size of conidia, which are the biggest in the genus (8-21.5 × 9-17.5 µm). The species is easily distinguishable from the other two in the genus, *A. alcornii* Sivan. & B. Sutton and *A. philippinensis* Petr. & Syd., because the first has holoblastic conidiogenous cells (4.5-7 µm high) and smaller (9-11 µm diam.), spherical, verrucose conidia, with a very thin, persistent mucilaginous sheath (less than 1 µm). The second, which is the type species, differs because conidia, of less size, are ellipsoidal to ovoid (6-10 × 4.5-5.5 µm) and are devoid of conidial sheath when mature.

Material examined. ARGENTINA. Prov. Chubut: *Parque Nacional Los Alerces*, ca. 12 km on the way to Lago Baggilt (43° 15′ 59.76″ S, 71° 39′ 2.52″ W), 1079 m alt., on bark of *N. pumilio*, 15-V-2007, Bianchinotti & Sánchez 545 (BBB).

2. Bactrodesmium atrum M. B. Ellis, *Mycol. Pap.* 72: 9. 1959. Fig. 1G-J.

Conidiomata sporodochial, scattered, punctiform or irregular, bright black, superficial, sometimes effuse colonies. Mycelium immersed, branched, hyaline to pale brown, formed by cylindrical cells, thin-walled, smooth, 6-21 × 4-5 µm (M = 13.9 × 4.8). Conidiophores cylindrical, unbranched, pale brown, ca. 7-10 × 2 µm. Conidiogenous cells cylindrical, widening towards the apex, monoblastic, integrated, determinate, terminal, smooth, pale brown, ca. 3-7 × 6 µm. Conidial secession rhexolytic. Conidia solitary, obovoid, 2-6 septate, mostly smooth, sometimes punctate, apical cells black, basally pale brown to subhyaline, 32-68 × 20-38 µm (M = 49 × 28.4; n = 52).

Distribution and habitat. Growing on bark of *Lophozonia obliqua* in Nothofagaceae forest in Argentina; on rotten branches of unidentified tree from China (Zhao *et al.*, 2009), on bark of deciduous trees of England including *Betula* sp. and *Fagus sylvatica* L. (Ellis, 1959); on *F. crenata* Blume in Japan (Matsushima, 1975); on stems of *Phragmites australis* (Cav.) Steud., in a brackish tidal marsh of the river Scheldt in the Netherlands (Van Ryckegem & Verbeken, 2005); on *Agathis australis* (D. Don) Lindl., *Beilschmiedia tarairi* Kirk, *Corynocarpus laevigatus* J.R. Forst. & G. Forst., *Elaeocarpus dentatus* (J.R. Forst. & G. Forst.) Vahl, *Laurelia novae-zelandiae* A. Cunn., *Leptospermum scoparium* J.R. Forst. & G. Forst., *Rhopalostylis sapida* H. Wendl. & Drude and *Rhopalostylis* sp. from New Zealand (Hughes, 1978); on unidentified dead wood from Spain (Silvera-Simón *et al*., 2009); on *Elaeis guineensis* Jacq. in Tanzania (Pirozynski, 1972).

Comments. The material is fully consistent in all its features with the originally described growing on *Fagus sylvatica* and *Betula* sp. in England (Ellis, 1959). It only differs in having thicker hyphae than that (1.5-4 µm wide). Three species have been

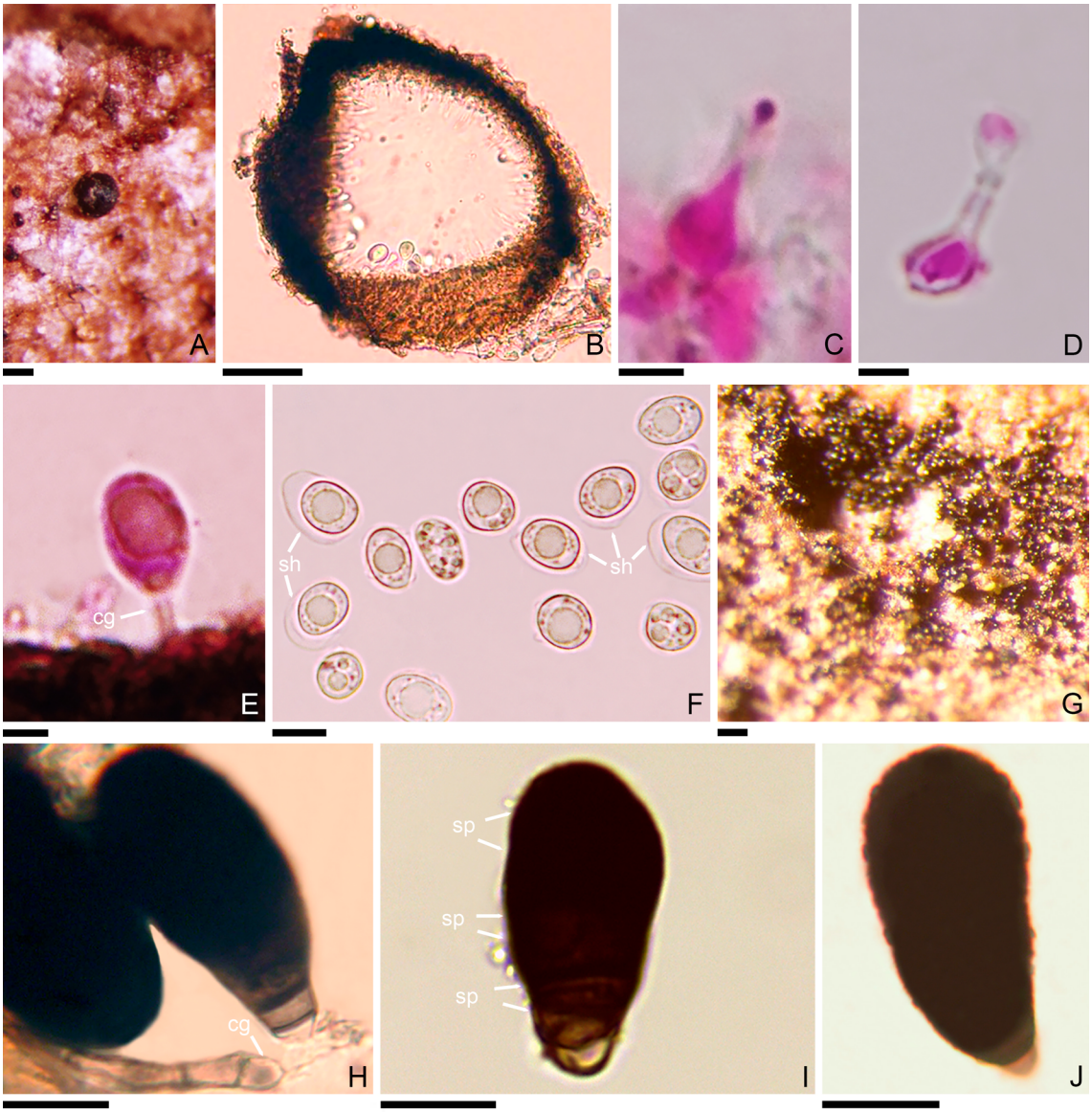

Fig. 1. *Avettaea salvadorae*. **A**: Pycnidial conidioma on substrate. **B**: Vertical section of a pycnidial conidioma. **C**: Conidiogenous cell. **D**: Conidiogenous cell with two annelidic percurrences. **E**: Conidium before liberation from conidiogenous cell. **F**: Conidia. *Bactrodesmium atrum*. **G**: Sporodochial conidioma on substrate. **H**: Conidium detached from conidiogenous cell and view of the conidiophore. **I**: Conidium 6 septate, septa visible by constrictions. **J**: Conidium with ornamented wall. Abbreviations: cg: conidiogenous cell; sh: sheath; sp: septa. Scale bars= A, G: 100 µm; B: 40 µm; C-D: 2 µm; E: 5 µm; F: 10 µm; H-J: 20 µm.

earlier found growing on Nothofagaceae hosts. One of them, *B. biformatum* (Hönh.) S. Hughes found on corticated branches of *Nothofagus* sp. in New Zealand, differs from *B. atrum* in the paler and smaller (18-40 × 7-9.4 µm), ellipsoidal to clavate, 3 to 9 septate conidia (Hughes, 1983). The second one is *B. traversoanum* (Peyronel) M.B. Ellis which differs from *B. atrum* in the length of the conidiophores (up to 35 µm) and in the shape (clavate to ellipsoidal) of the smaller conidia

(20-37 × 8-12 µm) (Ellis, 1959). The third one, *B. nothofagi* J.A. Cooper, has paler and smaller conidia (47-55 × 18-25 µm) with more septa (5-8) (Cooper, 2005).

Material examined. ARGENTINA. Neuquén: *Parque Nacional Lanín*, ascent path to the Cascada Chachín waterfall (40° 8′ 25.29 ″S, 71° 40′ 3.84″ W), 757 m alt., 15-V-2007, on bark of *Lophozonia obliqua*, Bianchinotti & Sánchez 591 (BBB).

3. Dwiroopa ramya Subram. & Muthumary, *Proc. Indian Acad. Sci., Pl. Sci.* 96: 196. 1986. Fig. 2A-D.

Conidiomata stromatic immersed, erumpent through the bark, gelatinous and dark brown when wet, carbonaceous and black when dry, 3-9 × 3-7 mm (M = 6.1 × 4.3); plurilocular, locules oval to pyriform, separated by cells in *textura porrecta*, cylindrical, smooth, hyaline, 5-18 × 2-8 µm (M = 11.2 × 5.6). Conidiogenous cells of two types: a) holoblastic, discrete, cylindrical, smooth, hyaline; those producing macroconidia measure 5-17 × 2-7 µm (M = 10.3 × 3.6), while mesoconidia producing cells are 12-26 × 2-4 µm (M = 16.7 × 2.4); b) enteroblastic phialidic, cylindrical, smooth, hyaline, 4-15 × 1-3 µm (M = 9.7 × 2), these cells are integrated on cylindrical, branched, smooth, hyaline conidiophores, ca. 27-39 × 2 µm. Macroconidia unicellular, ellipsoidal, dark brown, 1-2 longitudinal germ slits, smooth with SEM, 11-29 × 8-12 µm (M = 19.6 × 9.7; n = 51). Macroconidia germinates through the slits to produce a septate, hyaline mycelium. Mesoconidia unicellular, ellipsoidal, smooth, hyaline to pale brown, 6-15 × 2-8 µm (M = 11.2 × 5.1; n = 28). Microconidia unicellular, ellipsoidal, apical end rounded, base truncate, smooth, hyaline, 2-10 × 1-3 µm (M = 6.4 × 2.5; n = 31).

Distribution and habitat. Growing on bark of fallen branches and logs of *N. pumilio* in Argentina and on an indeterminate host in India (Subramanian & Muthumary, 1986).

Comments. The material on *Nothofagus* fully agrees with the original description of the species. Besides the species reported here, the genus contains two other ones: *D. lythri* (D.F. Farr & Rossman) D.F. Farr & Rossman on leaves of *Lythrum salicaria* L. from the USA and *D. punica* K.V. Xavier, A.N. Kc, J.Z. Groenew., Vallad & Crous which is pathogenic to *Punica granatum* L. in the USA. The macroconidia of *D. ramya* are the longest in the genus (up to 30 µm), in *D. lythri* they are subglobose to ellipsoidal (up to 19 µm) and in *D. punica* broadly ellipsoid (up to 20 µm) (Subramanian & Muthumary, 1986).

Material examined: ARGENTINA. Chubut: *Parque Nacional Los Alerces*, Huemules forest (42º 47' 27.7" S, 71º 28' 15.5" W), 1137 m alt., on fallen branches of *N. pumilio*, 20-XI-2003, Rajchenberg 12131 (BBB); *Esquel*, Aserradero Pelech Hnos., 8-V-2006; on logs of *N. pumilio* (from Parque Nacional Los Alerces, Huemules forest), Bianchinotti 67, 68 (BBB).

4. Gilmaniella multiporosa Moustafa & Ezz-Eldin., *Mycol. Res.* 92: 502. 1989. Fig. 2E-I.

Colonies sporodochial, punctiform, irregular, gregarious, sometimes confluent, dark brown, bright. Mycelium immerse, ramified, pale brown, individual cells cylindrical to reniform, smooth, 4-10 × 3-4 µm (M = 6.9 × 3.3). Conidiophores macronematous, cylindrical, septate, pale brown, 33-93 × 2-3 µm (M = 60.4 × 2.9). Conidiogenous cells mono or polyblastic, clavate, discrete, terminal or intercalar, smooth, pale brown, 6-18 × 3-7 µm (M = 9.9 × 4.7). Conidia holoblastic, in chains of up to 8 conidia, subspherical, smooth, pale brown, 6-9 × 4-7 µm (M = 7.7 × 6.3; n = 23), surface with many scars or pores, from which new lateral chains may be produced; terminal conidia globose, smooth, dark brown, 9-17 × 9-14 (M = 13.8 × 12; n = 31).

Distribution and habitat. Growing on bark of *N. antarctica* in Argentina and in saline soil in Egypt (Moustafa & Ezz-Eldin, 1989).

Comments. The specimen found in Patagonia could not be isolated, however diagnostic morphological features such as shape and size of conidiogenous cells and conidia fit well with those materials isolated from the soil of a salt marsh at north of Sinai (Egypt). The patagonian collection differs only in possessing conidiophores and having longer conidial chains (up to 8 conidia) than in Egyptian specimens (2-3 conidia) (Moustafa & Ezz-Eldin, 1989).

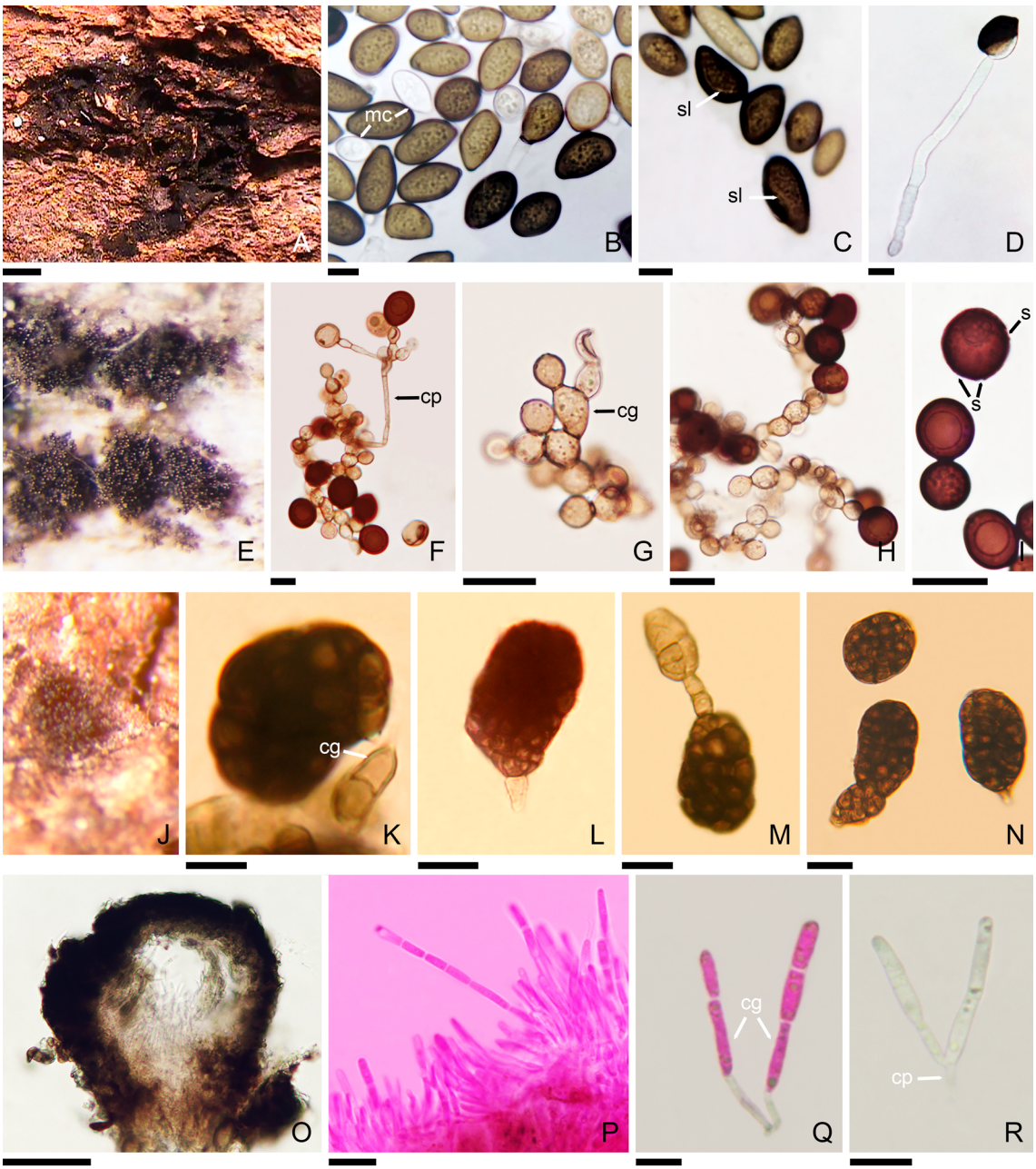

Fig. 2. *Dwiroopa ramya*. **A**: Stromatic conidioma on decorticated wood. **B**: Two microconidia surrounded by macroconidia. **C**: View of the longitudinal germ slits of macroconidia. **D**: Conidium germinating through the longitudinal slit. *Gilmaniella multiporosa*. **E:** Sporodochial conidioma on substrate. **F**: Conidiophore. **G**: Conidiogenous cell. **H**: Conidia in chains. **I:** Terminal conidia showing multiple scars. *Monodictys paradoxa*. **J**: Conidioma on substrate. **K**: Conidium detached from the conidiogenous cell which narrows towards the apex. **L**: Conidium showing the lighter basal cells and a rest of the conidiogenous cell. **M**: Germinating conidium and formation of a new one. **N**: Different shapes and sizes of conidia. *Pycnopeziza quisquiliaris*. **O**: Vertical section of a conidioma. **P**: Chain of two conidia (phloxine stain). **Q**: Conidia attached to conidiogenous cells (phloxine stain). **R**: Conidiophore. Abbreviations= cg: conidiogenous cell; cp: conidiophore; mc: microconidia; s: scars; sl: germ slits. Scale bars= A: 1 mm; B–I, L–N, P: 15 µm; K, Q–R: 10 µm; O: 50 µm.

Material examined. ARGENTINA. Neuquén Prov.: *Parque Nacional Nahuel Huapi*, National Route 40, going from Villa La Angostura to Villa Traful, 1 km before to the provincial access Route 65 (40° 37' 1.358" S, 71° 38' 48.098" W), 16-V-2007, on bark of *N. Antarctica*, Bianchinotti and Sánchez 564 (BBB).

5. Monodictys paradoxa (Corda) S. Hughes, *Canad. J. Bot.* 36: 786. 1958. Fig. 2J-N.

Colonies superficial, discrete, punctate, irregular, dark brown, bright. Mycelium scarce, immerse, hyphae cylindrical, short, flexuous, thick walled, smooth, brown. Conidiophores semi-macronematous, cylindrical, long, smooth, hyaline, ca. 3 µm diam. Conidiogenous cells monoblastic, integrated, terminal, cylindrical, short, sometimes narrowing to the apex, smooth, brown, 5-19 × 4-8 (M = 11.4 × 5.6). Conidia irregular, globose, clavate or pyriform, smooth, dark reddish brown, constricted at the thick septa, 21-49 × 14-36 µm (M = 33.2 × 22.2; n = 47), individual cells globose, guttulate, often 2–4 basal cells lighter. Monosporic isolates were done on NA, NGA and PDA following Goh (1999) and placing groups of conidia over small pieces of sterilized *Nothofagus* wood. Sporulation was observed at 7 days and formation of yellow crystals appeared in some 4 months old cultures.

Distribution and habitat. Growing on the bark of stems of *Lophozonia alpina* and *L. obliqua* in Argentina; on bark of a dead branch of fallen *Sorbus aucuparia* L. tree in Belarus (Yurchenko, 2001); on *Betula papyrifera* Marshall and *Betula* sp. from Canada (Hughes, 1960, 1987); on standing senescent culms of *Bambusa* sp. and *Miscanthus floridulus* (Labill.) Warb. ex K. Schum. & Lauterb. in China (Wong & Hyde, 2001); on *Betula* sp. in Czech Republic (Corda, 1938); on *Nectandra* sp. in Cuba (Mercado Sierra, 1981); on bark of *Eucalyptus tereticornis* Sm. and *Eucalyptus* sp. in India (Prasher & Verma, 2016); *Prunus yedoensis* Matsum. in Japan (Matsushima, 1975); on indeterminate bark, twig and decayed wood from Mexico (Heredia-Abarca, 1998); on dead wood of *Betula pendula* Roth and *Quercus robur* L. in Lithuania (Treigiené & Markovskaja, 2003; Markovskaja & Treigiené 2005); on unidentified wood and bark from Malawi (Sutton, 1993); on different parts of *Rubus gracilis* J. Presl & C. Presl and *Rubus* sp. and bark of *Sizyngium cumini* (L.) Skeels in Pakistan (Abbas & Sobia, 2008); on *B. pendula and Quercus* sp. in Poland (Kieruczenko, 1976); on stems of *Chrysanthemum coreanum* (H. Lév. & Vaniot) Nakai ex T. Mori. and cuttings of *Rhododendron* sp. and branches of *R. dauricum* L. and *R. sichotense* Pojark. from Russia (Melnik & Papushoi, 1992; Melnik 2000; Pavlyuk, 2009); on unidentified twigs in Taiwan (Matsushima, 1980); on *B. pendula* in Scotland, Ukraine and United Kingdom (Hughes, 1951; Hayova, 2011); on wood of *Acer saccharum* Marshall and *Lonicera canadensis* Bartram & W. Bartram ex Marshall in the USA (Barr, 1978; Mack, 2022), and on *Glycyrrhiza glabra* L. in Uzbekistan (Gafforov, 2017).

Comments. The specimen found in Patagonia agrees well with the original, just for a slight difference in the size of conidiogenous cells. Species of *Monodictys* are widely spread around the world. When compared with the only three species previously recorded in South America, *M. paradoxa* is distinct from *M. castaneae* (Wallr.) S. Hughes, found on leaves of *Eucalyptus* spp. in Brazil, because this latter has conidia formed by a few cells, with verrucose walls and truncate base (Wellbaum *et al*., 1999). It differs from *M. glauca* (Cooke & Harkn.) S. Hughes, recorded on bark of *Nothofagus betuloides* in Tierra del Fuego (Argentina), due to its smaller conidia (7-14 × 5-10 µm) (Godeas & Arambarri, 2007). Lastly it could be distinguished from *M. pelagica* (T. Johnson) E.B.G. Jones, recorded on bark of an indeterminate plant in Chile, for having undifferentiated conidiophores and conidiogenous cells, and slightly smaller conidia that when mature they turn completely black so septa are not visible (34-44 × 17-31 µm) (Hughes & Chamut, 1971).

Material examined. ARGENTINA. Neuquén: *Parque Nacional Lanín*, on the way to Lago Hui Hui; 17-V-2007, on bark of *L. alpine*, Bianchinotti and Sánchez 574 (BBB); *ibid*., in the path of ascent to Cascada Chachín (40° 8′ 25.29″ S, 71° 40′ 3.84″ W), 757 m alt., 17-V-2007, on bark of *L. obliqua*, Bianchinotti and Sánchez 592 (BBB).

6. Pycnopeziza quisquiliaris (Ellis & Everh.) W.L. White & Whetzel, *Mycologia* 30: 192. 1938. Fig. 2O-R.

Conidiomata pycnidial, subperidermic, globose to obpiriform, dark brown when wet, black when dried, 180-225 × 100-188 µm (M = 193 × 138); ostiolum star-shaped. Conidiophores cylindrical, subhyaline to pale brown, ca. 5-10 × 3 µm. Conidiogenous hyphae cylindrical, holothallic, discrete, determinate, smooth-walled, subhyaline to pale brown, ca. 10-26 × 3 µm (M = 14.4 × 3). Conidia cylindrical with rounded ends, sometimes curved, centrally 1-septate, constricted, guttulate, hyaline, 11-17 × 2-4 µm (M = 14 × 3; n = 34), forming chains of up to 3 conidia.

Distribution and habitat. Growing on decorticated branches of *Nothofagus antarctica* in Argentina, on buds of *Acer rubrum* L. and on buds, leaves and petioles of an undetermined herbaceous species, both from the USA (White & Whetzel, 1938).

Comments. *Pycnopeziza quisquilaris* is the only species in the genus with conidia deprived of appendages. The patagonian material agrees well with the originally described, which differs for its bigger conidiomata (400-1000 µm diameter) and longer chains of up to 16-20 conidia (White & Whetzel, 1938).

Material examined. ARGENTINA. Chubut: *Parque Nacional Los Alerces*, on the way to Huemules forest, (42° 47' 27.769'' S, 71° 28' 15.466'' W), 1137 m alt., 28-X-2006, on decorticated branches of *N. antarctica*, Bianchinotti and Sánchez 335 (BBB).

Discussion

From the species of ascomycetes presented here, five are recorded for the first time in the country, while three of them are also cited in South America for the first time. All of them are first cited associated to a nothofagaceous host, adding to the ca. 200 species mentioned by Farr *et al.* (2023) in relation to this plant family in South America. From these, 123 species have been recorded in Argentina and 76 in Chile, but just a few number of species (11) are shared by both countries. Number of species are usually considered a good expression of diversity in a particular ecosystem (Bermudez & Lindemann-Matthies, 2020). When the diversity of ascomycetes related to *Nothofagus* forests is compared between our continent and Oceania, the greater specific richness is registered in South America, both regions share a few number of genera (less than 20) (Grandi & Silva, 2006; Iturriaga & Minter, 2006; Minter & Peredo López, 2006; Minter & Silva, 2007; Biota of New Zealand, 2023; Farr *et al*., 2023).

The mitosporic fungi reported here are rare species, mostly of them belong to genera poorly known. The species of the coelomycete genus *Avettaea* Petr. & Syd. are infrequently collected, and no sequence data are available, thus their taxonomic placement remains uncertain (Wijayawardene *et al.*, 2016). This genus was first referred to South America by Bianchinotti (1993) who recorded the same species, *A. salvadorae*, on bark of a native leguminosae shrub, and so far, there has been no other record of any species in the continent (Farr, 1973; Iturriaga & Minter, 2006; Minter & Peredo López, 2006; Minter & Silva, 2007). In the material described here, conidia are hyaline, probably because they are immature. Although the typical paraphyses of *A. salvadorae* were not observed here, these could be absent in some collections (Bianchinotti, 1993). This last feature, along with others such as the much smaller conidiomata, raises the question of whether it is a new species. Unlikely the scarce quantity of conidiomata found and the frustrated cultivation attempts have prevented the possibility to obtain molecular sequences. Additional material needs to be examined to perform a definite assignment. The record of this uncommon species is important because the original host species are endangered because of habitat loss.

Bactrodesmium atrum is first recorded in Argentina, and on a nothofagaceous host. *Bactrodesmium* Cooke constitutes a well-resolved lineage in the Savoryellales (Sordariomycetes) (Réblová *et al*., 2020). Four species have been previously registered in South America considering the old circumscription of the genus: *B. aspidospermatis* Bat., Peres & R. Garnier in Brazil on *Aspidosperma* sp. (Batista *et al*., 1965), *B. microleucurum* (Speg.) M.E. Ellis in Chile on *Chusquea cumingii* (Spegazzini, 1921; Ellis, 1965), *B. peruvianum* B. Sutton in Perú on dead fallen leaves of *Eucalyptus* spp. (Sutton, 1977) and *B. traversoanum* in Argentina on litter of *N.*

dombeyi (Gamundí *et al*., 1979). However, only two of them were included and accepted in the updated circumscription proposed by Réblová *et al.* (2020): *B. peruvianum* and *B. traversoanum* (as *B. traversianum*). On the contrary, *B. aspidospermatis* is not mentioned and *B. microleucurum* is excluded because of its effuse colonies and different septation of conidia.

Dwiroopa Subram. & Muthumary, another coelomycete, is also considered an odd genus. Close to *Harknessia* Cooke, the major morphological differences between both genera lie in conidial features. According to phylogenetic studies (Xavier *et al*., 2019), *Dwiroopa* stands as the only member of the family Dwiroopaceae (Diaporthales). From the three known species in the genus, two are pathogens (*D. lythri* and *D. punicae*), while that reported here, *D. ramya*, is considered a saprophyte (Farr & Rossman, 2003; Xavier *et al*., 2019). Taking into account that as *D. lythri*, *D. ramya* had been previously found only once, this constitutes the second world record of the species. The range of distribution of the genus is thus expanded to South America on a newly recorded host.

Although considered cosmopolite, the hyphomycete *Gilmaniella* G.L. Barron seems to be rare in South America, being known only from Argentina and Brazil. Godeas *et al.* (1977) isolated *G. humicola* G.L. Barron from soil, Mendes *et al.* (1998) reported an indeterminate species of the genus on *Glycine max* L. and *Pseudobombax munguba* (Mart. & Zucc.) Dugand and now, with the finding of *G. multiporosa*, these are the unique published records for the continent (Farr, 1973; Grandi & Silva, 2006; Iturriaga & Minter, 2006; Minter & Peredo López, 2006; Minter & Silva, 2007). Initially monospecific, the genus now comprises eight species: *G. bambuseae* Umali, Goh & K. D. Hyde from bamboo, *G. indica* R.K. Dubey, A.N. Rai, S. Shrivast. & N.K. Verma on living leaves of *Anogeissus acuminata* (Roxb. ex DC.) Wall. ex Guill. & Perr., *G. multiporosa*, *G. nyukfahii* Goh, L.L. Lee & K.C. Teo from dung, *G. subornata* Morinaga, Minoura & Udagawa from soil, *G. thermophila* M. Qureshi & J.H. Mirza from dung, *G. humicola* (type species) on dung and soil and *G. punctiformis* Sivan. & B. Sutton from burned leaves (Barron, 1964; Morinaga *et al*., 1978; Qureshi & Mizra, 1983; Sivanesan & Sutton, 1985; Umali *et al*., 1998; Dubey *et al*., 2011; Goh *et al*., 2013).

This is the first record of *Monodictys paradoxa* in South America. This species was originally described by Corda (1838) as *Sporidesmium paradoxum* Corda and then transferred by Hughes (1958) to *Monodictys* as *M. paradoxa* (Corda) S. Hughes. This species has been registered many times in Asia and Europe, mainly on bark and wood of different trees, and also on submerged wood in salt water from mangroves (Ellis, 1971; Matsushima, 1975; Yurchenko, 2001; Jones & Vrijmoed, 2003; Abbas & Sobia, 2008). Other species of the genus have been previously recorded in the continent in Argentina (Godeas & Arambarri, 2007), in Brazil (Wellbaum *et al.*, 1999) and in Chile (Minter & Peredo López, 2006).

Finally, the finding of a mitosporic *Pycnopeziza* species constitutes another infrequent record, as these have been described and, up to now, just known from the northern hemisphere. No species had been previously recorded in the southern hemisphere nor from a woody substratum (Farr, 1973; Iturriaga & Minter, 2006; Minter & Peredo López, 2006; Minter & Silva, 2007), so far this is the first record of the genus for the Neotropical region and on wood. Most of *Pycnopeziza* species grow on herbaceous substrata (buds, petioles and decaying leaves), just one species was described as parasitic on lichens from Canada (Ihlen, 1998). However, without giving an explanation, Johnston *et al*. (2014) doubt the belonging of this species in the genus. When the principle "one fungus one name" was accepted and sanctioned in the Code of Nomenclature (Turland *et al*., 2018), the separate naming of mitosporic and sexual states ended. Several changes were necessarily introduced and several fungal names changed. The specimen here described represents a good example for this subject. It is a mitosporic state, which in the past was named *Acarosporium* Bubák & Vleugel. That genus comprised four species, all considered to represent the anamorphic state of *Pycnopeziza*. Although the name of the anamorph had priority since it was introduced earlier, Johnston *et al.* (2014) proposed *Pycnopeziza* to be protected against *Acarosporium*, and synonymized *Acarosporium* under *Pycnopeziza* because this last has available sequence data and the name was widely used (Holst-Jensen *et al*., 1997, 2004; Pärtel *et al*., 2017; Wijayawardene *et al*., 2017).

However, lacking molecular sequences for the asexual morph, the relationship of these two genera still remains uncertain. Currently the genus comprises five species: *P. americana* (Nag Raj) W.J. Li & K.D. Hyde, *P. pachyderma* (Rehm) W.L. White & Whetzel, *P. quisquilaris*, *P. sejournei* (Boud.) Whetzel & W.L. White and *P. sympodialis* (Bubák & Vleugel ex Bubák) W.L. White & Whetzel (White & Whetzel, 1938; Whetzel & White, 1940; Li *et al*., 2020).

Numbers of species of the Kingdom Fungi are under constant revision, and figures could vary among authors but there is a general consensus that published species represent just a small fraction of total fungal diversity (Phukhamsakda *et al*., 2022). Even in the most explored regions, the addition of new records goes hand in hand with making new collections. Argentina does not escape this reality, and despite having a long tradition in mycological studies, the immensity of its territory in addition to the small number of specialists in some groups conspires so knowledge of its fungal diversity is far from being complete. It is hoped that all data provided here, besides being useful to help future collectors in the identification of newly collected specimens, will stimulate to continue performing exploratory studies in a vast, rich and still understudied area.

Acknowledgements

To Mario Rajchenberg, Alina Greslebin and María Belén Pildaín for sharing their knowledge about the sampling areas and their time in every collection trip. Consejo Nacional de Investigaciones Científicas y Tecnológicas and Universidad Nacional del Sur for financial support, and the National Parks Administration of Argentina (Administración de Parques Nacionales) for allowing us to collect the samples in protected nature reserves of the Andean Patagonian forests.

Authors' Contributions

The two authors were involved in the collection, conditioning and examination of the samples, both in the field and in the laboratory, and finally in the writing of the manuscript.

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