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***Chondrogaster pachysporus* in a  
*Eucalyptus* plantation of southern Brazil**

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**Abstract** — *Chondrogaster pachysporus* is reported for the first time in Brazil. It is similar to *C. angustisporus*, also known from southern Brazil, but differs in the size and ornamentation of the basidiospores and in the presence of monosporic basidia. The hypogeous sequestrate specimens were collected in a *Eucalyptus saligna* plantation. Descriptions, photographs, and line drawings of the specimens are presented.

**Key words** — ectomycorrhiza, false-truffle, *Hysterangiales*, *Mesophelliaceae*

## Introduction

*Chondrogaster* Maire is a genus of sequestrate fungi characterized by enclosed hypogeous basidiomata that bear a loculate gleba composed of tramal plates where basidia and basidiospores are produced (Castellano et al. 1989). The genus is closely related to *Hysterangium* Vittad., from which it was segregated and differs in the lack of a distinct columella and presence of a mycelial mass covering the whole basidioma (Giachini et al. 2000). Both currently known species are associated with *Eucalyptus* and possibly native to Australia but have spread to many areas where *Eucalyptus* plantations have been established for forestry purposes.

*Chondrogaster angustisporus* Giachini et al., originally described from Australia, Uruguay, and southern Brazil (Giachini et al. 2000), is possibly the only South American record of the genus. *Chondrogaster pachysporus*, the type



species, is so far known from the Mediterranean zone (Europe and Africa), North America, and Australia (Lago & Castro 2004). Recent studies on the biology and taxonomy of sequestrate fungi in Brazil and neighboring countries are scarce and limited to a few local revisions from Brazil (Giachini et al. 2000, Cortez et al. 2008) and Argentina (Nouhra et al. 2005, 2008). In this paper, we report the occurrence of *C. pachysporus* in southern Brazil.

## Materials and methods

Fieldwork was conducted in a *Eucalyptus saligna* Sm. plantation at the Experimental Forestry Station (FEPAGRO), in the municipality of Santa Maria, central region of Rio Grande do Sul State, southern Brazil (29°45' S, 53°43'W). The site comprises 280 ha for cultivation of native trees as *Apuleia leiocarpa* (Caesalpinaceae), *Senna multijuga* (Caesalpinaceae), and *Tabebuia* spp. (Bignoniaceae), and exotics as *Hovenia dulcis* (Rhamnaceae), *Platanus×acerifolia* (Platanaceae), *Pinus* (Pinaceae), and *Eucalyptus* spp. (Myrtaceae). Soil is of the Hapludult type, which is deep, imperfectly drained and with low natural fertility (Abrão et al. 1988, Streck et al. 2008). Climate is subtropical humid (Cfa) according to Köppen's system, with mean temperature values for the warmest month higher than 22°C (Menegat 1998). Annual rainfall is about 1769 mm, with rains well distributed throughout the year (Schumacher et al. 2008).

Fresh basidiomata were collected and photographed in situ, then analyzed macro- and microscopically following Brundrett et al. (1996) and Castellano et al. (2004). Color names and codes follow Kornerup & Wanscher (1978). Microscopic analysis of the basidiomata comprised 30 measurements of each microstructure (basidiospores, basidia, and hyphae), which were drawn under a light camera. Specimens are deposited in the herbaria of Department of Biology, "Universidade Federal de Santa Maria" (SMDB) and the Institute of Biosciences, "Universidade Federal do Rio Grande do Sul" (ICN).

## Taxonomy

*Chondrogaster pachysporus* Maire, Bull. Soc. Mycol. Fr. 40: 312, 1925. FIG. 1–8

BASIDIOMATA hypogaeous, 8–23 mm in width, 7–11 mm high, depressed globose to subglobose, aggregated in clusters within a common mycelium. PERIDIUM <1 mm thick, greyish beige (4C2) when fresh, dull red (9C4) when bruised, glabrous or covered by scattered to numerous rhizomorphs. GLEBA composed by non-gelatinized, radially arranged locules, greyish green (28C3) to dull green (29D3) at younger stages, to finally olive (1F5) or blackish at maturity. RHIZOMORPHS white, numerous, arising from several points of attachment in the basidiomata surface. COLUMELLA absent.

BASIDIOSPORES 12.5–16.5 × 6–9 µm (ornamentation excluded), subfusoid, ellipsoid to broad ellipsoid, apex and base tapered, some with a shortly mucronate apex; sterigmal attachment persistent at maturity; in KOH, they are hyaline when young to finally pale yellowish brown at maturity; wall smooth



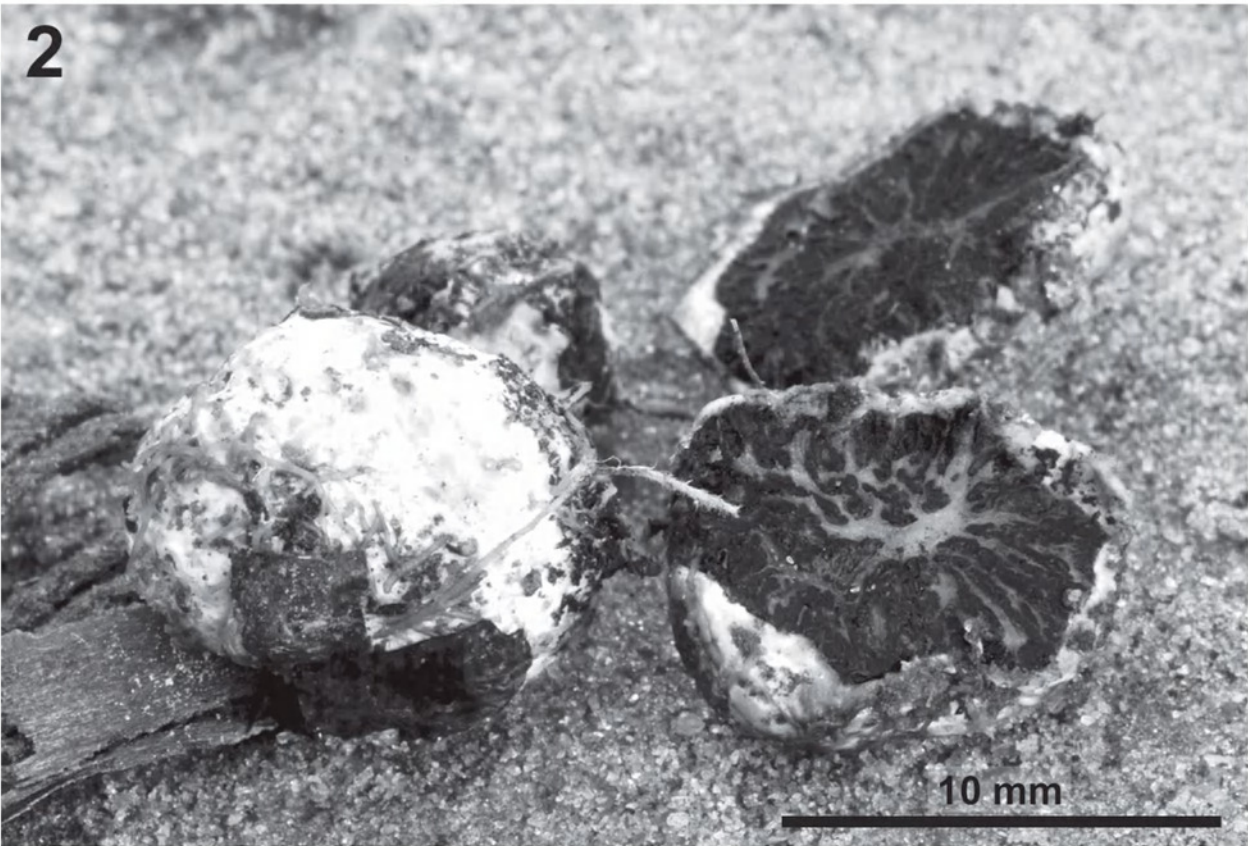
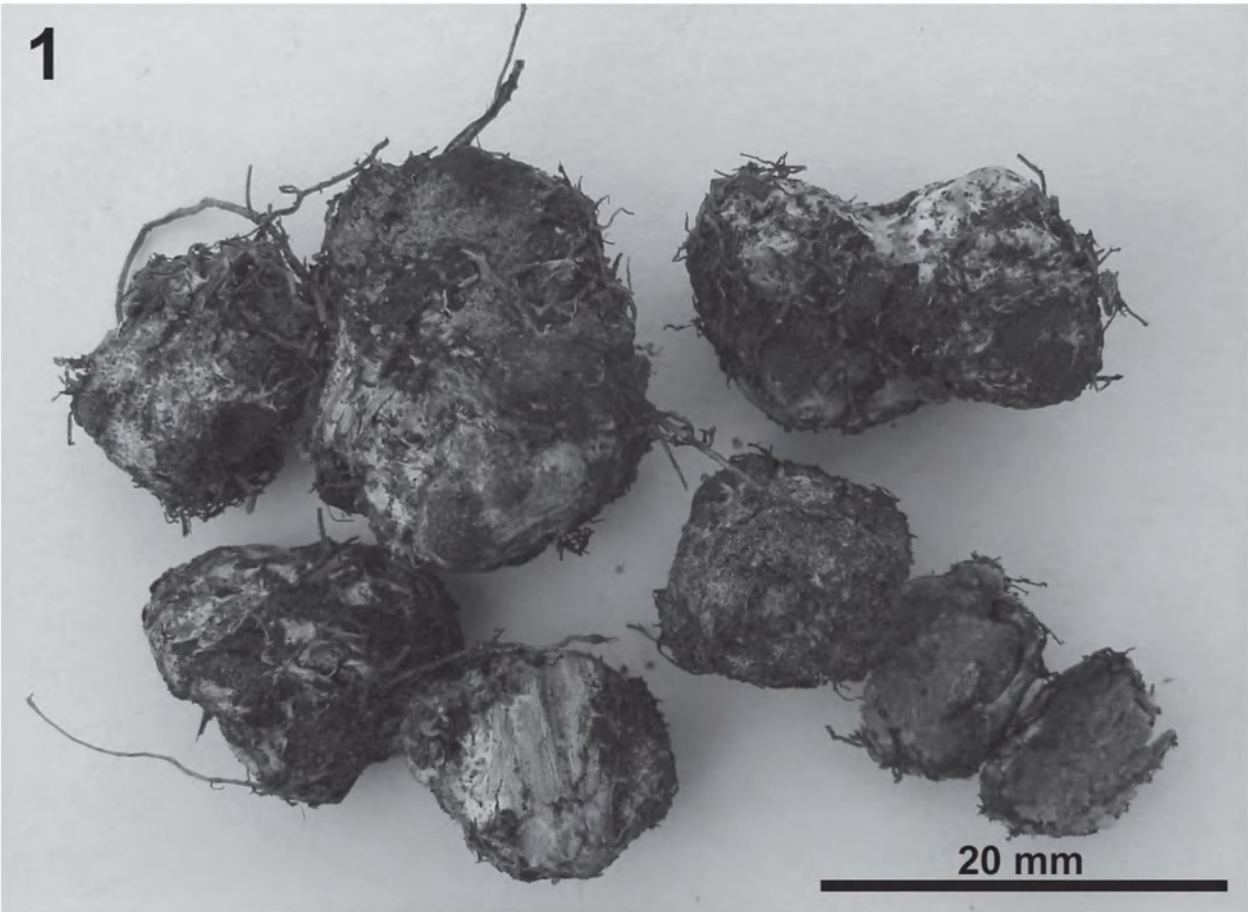


FIG. 1-2. Basidiomata of *Chondrogaster pachysporus*. (1. Sulzbacher-192; 2. Sulzbacher-196)



when young, becoming irregularly reticulate at maturity and of variable diameter ( $<3\ \mu\text{m}$ ).

**BASIDIA** monosporic,  $31\text{--}52 \times 4\text{--}16.5\ \mu\text{m}$ , hyaline, subcylindrical, with constricted base and apex, clamp connections common, collapsed in mature specimens. **PERIDIUM** separable from the gleba, 2-layered: a) external layer formed by yellowish brown, thick-walled, clamped hyphae ( $4.2\text{--}11\ \mu\text{m}$  diam.) mixed with abundant soil particles; b) internal layer composed by hyaline, smooth and thin-walled hyphae, compactly interwoven, filamentous to subglobose  $4\text{--}27.5\ \mu\text{m}$  diam. **TRAMA**  $30\text{--}100\ \mu\text{m}$  thick, not gelatinized in young basidiomata, becoming gelatinized in mature specimens, constituted of hyaline, smooth, thin-walled, and compactly interwoven hyphae,  $3.2\text{--}5.5\ \mu\text{m}$  diam., clamp connections rare.

**DISTRIBUTION:** Australia and United States (Bougher & Lebel 2001), North Africa (Lago & Castro 2004), Spain (Lago & Castro 2004, Moreno-Arroyo et al. 2005), Portugal (Calonge & Vidal 2000), France and Italy (Lago & Castro 2004). Probably widespread with eucalypt trees.

**SPECIMEN EXAMINED:** **BRAZIL.** Rio Grande do Sul: Santa Maria, Boca do Monte District, Estação Experimental de Silvicultura-FEPAGRO, 21 April 2009, leg. M.A. Sulzbacher 191 (SMDB 12.920); *ibid.*, 06 May 2009, leg. M.A. Sulzbacher 192 (SMDB 12.921); *ibid.*, 10 July 2009, leg. M.A. Sulzbacher 196 (SMDB 12.922; ICN 154459).

**COMMENTS** — The genus *Chondrogaster* was considered in the past as a member of the *Melanogastraceae* E. Fisch. (Zeller 1949), *Hysterangiaceae* E. Fisch. (Bougher & Lebel 2001), and *Chondrogastraceae* Locq. (Giachini et al. 2000). However, molecular phylogenetic analysis places the genus is currently placed in the *Mesophelliaceae* Jülich of the *Hysterangiales* K. Hosaka & Castellano (Hosaka et al. 2006).

*Chondrogaster pachysporus*, originally described by Maire from Mauritania (Africa), constitutes the type species of the genus, which until recently was considered monotypic (Giachini et al. 2000). Although it is associated with widely cultivated *Eucalyptus* spp. in the world, this species has been poorly documented, probably due to its underground cryptic habit, as most mycologists pay little attention to hypogeous fungi.

As far as we know, this is the first record in South America. *Chondrogaster angustisporus*, which has been reported from southern Brazil, Australia, and Uruguay (Giachini et al. 2000), differs from *C. pachysporus* in the narrower basidiospores ( $10\text{--}15 \times 4\text{--}5\ \mu\text{m}$ ) covered by a less coarse ornamentation and the presence of mostly bisporic basidia within the glebal locules (Lago & Castro 2004). In contrast to our specimens, which were collected under *E. saligna*, *C. angustisporus* has been found under *E. dunnii* Maiden in southern Brazil as well as several other *Eucalyptus* species in Australia (Giachini et al. 2000).

Lupatini et al. (2008) characterized southern Brazilian strains of *C. angustisporus* through mycorrhizal morphotyping and ITS (rRNA) sequences. Their



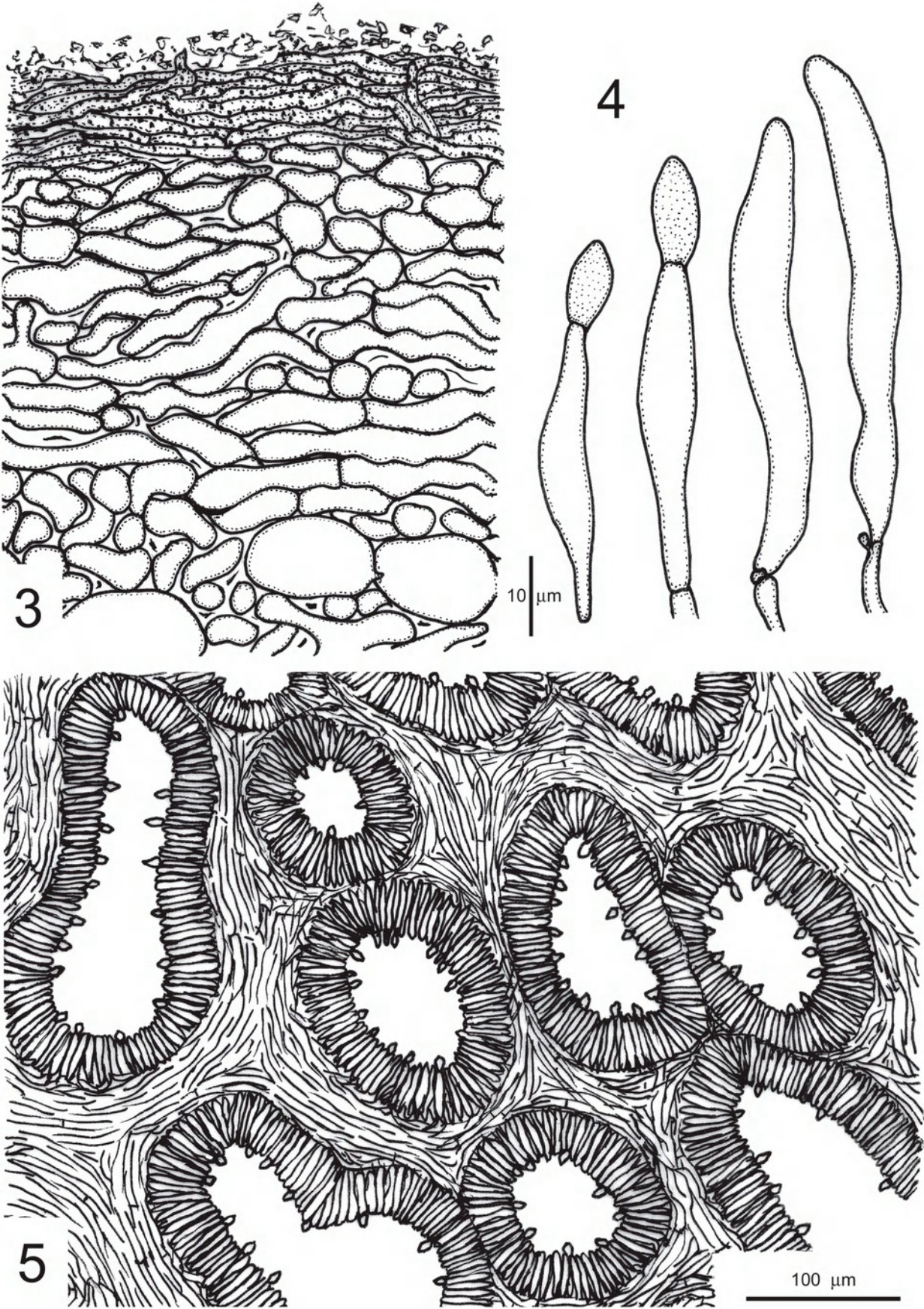


FIG. 3-5. *Chondrogaster pachysporus*. 3. Peridium. 4. Basidia. 5. Gleba structure.



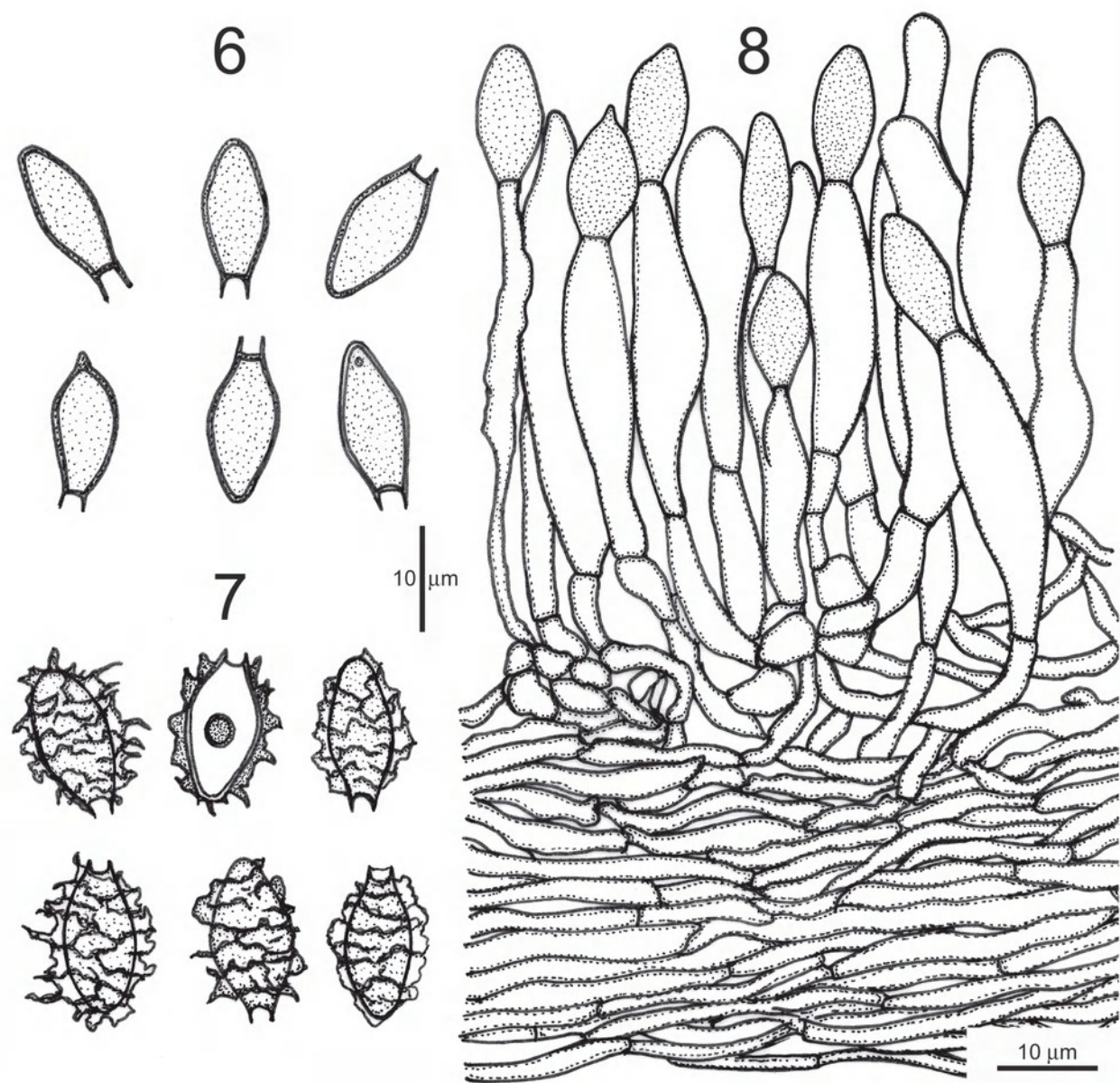


FIG. 6-8. *Chondrogaster pachysporus*.

6. Immature basidiospores. 7. Mature basidiospores. 8 Detail of the hymenium and trama.

results supported strong relationships among other taxa in the gomphoid-phalloid clade (e.g. *Gautieria*, *Gloeocantharellus*, *Gomphus*, *Hysterangium*, *Ramaria*, and *Sphaerobolus*). In two recent molecular phylogeographic studies of *Hysterangiales*, *Andebbia pachythrix* (Cooke & Masee) Trappe et al. clustered with *C. angustisporus* and *C. pachysporus*, suggesting a close relationship between them (Hosaka et al. 2006, 2008).

The present report from southern Brazil considerably extends the known world distribution of *C. pachysporus*. The new record arises from ongoing investigations of hypogeous fungi associated with *Eucalyptus* in the state of Rio Grande do Sul. As this research progresses, we hope to provide additional data on their diversity and biology.



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## Literature cited

- Abrão PUR, Gianluppi D, Azolim MAD. 1988. Levantamento semidetalhado dos solos da Estação Experimental de Silvicultura de Santa Maria. Publ. Inst. Pesq. Rec. Nat. Renov. 21: 1–75.
- Bougher NL, Lebel T. 2001. Sequestrate (truffle-like) fungi of Australia and New Zealand. *Austr. Syst. Bot.* 14: 439–484. [doi:10.1071/SB000002](https://doi.org/10.1071/SB000002)
- Brundrett M, Bougher N, Dell B, Grove T, Malajczuk N. 1996. Working with mycorrhizas in forestry and agriculture. Canberra (Australia): ACIAR.
- Calonge FD, Vidal JM. 2000. Contribución al catálogo de los hongos hipogeos de Portugal. *Bol. Soc. Micol. Madrid* 25: 251–264.
- Castellano MA, Trappe JM, Maser Z, Maser C. 1989. Key to spores of the genera of hypogeous fungi of north temperate forests with special reference to animal mycophagy. Eureka (USA): Mad River Press.
- Castellano MA, Trappe JM, Luoma DL. 2004. Sequestrate fungi. Pp. 197–213. In: Foster MS, Mueller GM, Bills GF (eds.) Biodiversity of Fungi: inventory and monitoring methods. Burlington (USA): Academic Press. [doi:10.1016/B978-012509551-8/50013-1](https://doi.org/10.1016/B978-012509551-8/50013-1)
- Cortez VG, Baseia IG, Guerrero RT, Silveira RMB. 2008. Two sequestrate cortinarioid fungi from Rio Grande do Sul, Brazil. *Hoehnea* 34: 513–518.
- Giachini AJ, Oliveira VL, Castellano MA, Trappe JM. 2000. Ectomycorrhizal fungi in exotic *Eucalyptus* and *Pinus* plantations in southern Brazil. *Mycologia* 92: 1166–1177. [doi:10.2307/3761484](https://doi.org/10.2307/3761484)
- Hosaka K, Bates ST, Beever RE, Castellano MA, Colgan III W, Domínguez LS, Nouhra ER, Geml J, Giachini AJ, Kenney SR, Simpson NB, Spatafora JW, Trappe JM. 2006. Molecular phylogenetics of the gomphoid-phalloid fungi with an establishment of the new subclass *Phallomycetidae* and two new orders. *Mycologia* 98: 949–959. [doi:10.3852/mycologia.98.6.949](https://doi.org/10.3852/mycologia.98.6.949)
- Hosaka K, Castellano MA, Spatafora JW. 2008. Biogeography of *Hysterangiales* (*Phallomycetidae*, *Basidiomycota*). *Mycol. Res.* 112: 448–462. [doi:10.1016/j.mycres.2007.06.004](https://doi.org/10.1016/j.mycres.2007.06.004)
- Kornerup A, Wanscher JH. 1978. Methuen handbook of colour. London (UK): Eyre Methuen.
- Lago M, Castro ML. 2004. Macrobasidiomicetos asociados a *Eucalyptus* en la Península Ibérica. *Fungi Non Delineati* 27: 1–84.
- Lupatini M, Bonnassis PAP, Steffen RB, Oliveira VL, Antonioli ZI. 2008. Mycorrhizal morphotyping and molecular characterization of *Chondrogaster angustisporus* Giachini, Castellano, Trappe & Oliveira, an ectomycorrhizal fungus from *Eucalyptus*. *Mycorrhiza* 18: 437–442. [doi:10.1007/s00572-008-0191-4](https://doi.org/10.1007/s00572-008-0191-4)
- Menegat R. 1998. Environmental atlas of Porto Alegre. Porto Alegre (Brazil): Ed. UFRGS.
- Moreno-Arroyo B, Gómez J, Pulido E. 2005. Tesoros de nuestros montes. Trufas de Andalucía. Córdoba (Spain): Consejería de Medio Ambiente, Junta de Andalucía.
- Nouhra ER, Domínguez LS, Becerra AC, Trappe JM. 2005. Morphological, molecular and ecological aspects of the South American hypogeous fungus *Alpova austroalnicola* sp. nov. *Mycologia* 97: 598–604. [doi:10.3852/mycologia.97.3.598](https://doi.org/10.3852/mycologia.97.3.598)

- Nouhra ER, Dominguez LS, Daniele GG, Longo S, Trappe JM, Claridge AW. 2008. Occurrence of ectomycorrhizal, hypogeous fungi in plantations of exotic tree species in central Argentina. *Mycologia* 100: 752–759. [doi:10.3852/07-182](https://doi.org/10.3852/07-182)
- Schumacher MV, Brun EJ, Illana VB, Dissiuta SI, Agne TL. 2008. Biomassa e nutrientes em um povoamento de *Hovenia dulcis* Thunb., plantado na Fepagro Florestas, Santa Maria, RS. *Ciência Florestal* 18: 27–37.
- Streck EV, Kämpf N, Dalmolin RSD, Klamt E, Nascimento PC, Schneider P, Giasson E, Pinto LFS. 2008. Solos do Rio Grande do Sul. 2<sup>nd</sup> ed. Porto Alegre (Brazil): EMATER.
- Zeller SM. 1949. Keys to the orders, families, and genera of the *Gasteromycetes*. *Mycologia* 41: 36–58. [doi:10.2307/3755271](https://doi.org/10.2307/3755271)





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