ISSN (print) 0093-4666 ISSN (online) 2154-8889

MYCOTAXON

http://dx.doi.org/10.5248/123.113

Volume 123, pp. 113–119 *January–March 2013*

Rediscovery of *Pseudocolus garciae* in southern Brazil

Marcelo A. Sulzbacher[1, 3*], Vagner G. Cortez[2] & Iuri G. Baseia[3]

[1] *Universidade Federal de Pernambuco, Programa de Pós-graduação em Biologia de Fungos, Departamento de Micologia, Recife, PE, Brazil*

[2] *Universidade Federal do Paraná, Campus Palotina, Palotina, PR, Brazil*

[3] *Universidade Federal do Rio Grande do Norte, Departamento de Botânica, Ecologia e Zoologia, Natal, RN, Brazil*

* Correspondence to: *marcelo_sulzbacher@yahoo.com.br*

Abstract —*Pseudocolus garciae* is described and illustrated based on fresh specimens collected in southern Brazil. This is the third known report for the species since its discovery in 1895. This clathraceous fungus is characterized by the white receptacle, which differs from the pinkish to red receptacle of *P. fusiformis*. A detailed description accompanies photographs, SEM images, and line drawings.

Key words — gasteromycetes, *Phallales*, subtropical fungi, taxonomy

Introduction

Pseudocolus Lloyd is characterized by a shortly stipitate receptacle with three to four unbranched columns bearing the slimy gleba in their internal surface, which are connected at the apex or seldom become free (Dring 1980). The genus is a poorly known due to the scarcity of collections and is regarded as one of the most difficult phalloid genera to treat satisfactorily at the species level using morphological features (Dring 1980). *Colus* Cavalier & Séchier is similar but differs in the receptacle, which is composed of columns forming an apical lattice (Dring 1980). *Pseudocolus* (*Clathraceae*, *Phallales;* Hosaka et al. 2006) currently comprises two species: *P. fusiformis* (E. Fisch.) Lloyd, with a pinkish to red receptacle widely distributed in Australasia, Europe, and the Americas (Wright 1960, Burk 1978, Dring 1980, Hemmes & Desjardin 2009, Akata & Doğan 2011), and *P. garciae*, with a white receptacle and a restricted distribution in the subtropical zone of southern Brazil (Möller 1895, Braun 1932, Rick 1961). The present paper reports the occurrence of *P. garciae*, a rare and poorly known clathraceous fungus, almost 120 years after its discovery. It follows recent observations on south Brazilian phalloid fungi (Cortez et al. 2011a, 2011b, 2011c, Trierveiler-Pereira et al. 2009).

Materials & methods

Specimens were gathered in a *Eucalyptus* plantation in Minas do Camaquã, located in the municipality of Caçapava do Sul, southeast region of the state of Rio Grande do Sul, southern Brazil (30°54′S, 53°25′W). The relict native vegetation in the area, typical of the Campos Biome of southern South America, is composed of grasses and shrubs of several families, such as *Asteraceae*, *Cyperaceae*, *Leguminosae*, and *Poaceae* (Overbeck et al. 2007), but some areas contain exotic tree species (mostly *Pinus* and *Eucalyptus*).

Fresh basidiomata were collected and analyzed macro- and microscopically in accordance to Miller & Miller (1988). Color terminology follows Kornerup & Wanscher (1978). Microscopic analysis of basidiomata comprised measurements of 20 basidiospores and hyphae (from the receptacle and rhizomorphs). For scanning electron microscopy (SEM) study, dried material was mounted directly on aluminum stubs and coated with a 5 nm thick layer of gold using a Balzers SCD 050 Sputter. Stubs were examined in a Jeol JSM-6360 LV scanning electron microscope at the Universidade Federal do Paraná (UFPR), Centro de Microscopia Eletrônica (CME). Specimens are deposited in UFRN-Fungi Herbarium (Holmgren & Holmgren 1998).

Taxonomy

Pseudocolus garciae (Möller) Lloyd, Mycol. Notes 28: 358. 1907. Figs 1–9

≡ *Colus garciae* Möller, Brasil. Pilzb.: 146. 1895.

Immature basidiomata (mycoeggs) 5–8 mm diam., white (1A1) to yellowish white (4A2); globose to subglobose, opening by splitting from the apex and forming three slightly irregular lobes. Mature basidiomata 26–35 mm high when expanded. Receptacle 9–13 × 3–4 mm, yellowish white (4A2) to orange white (5A2) throughout; with a long-cylindrical, rugose and hollow pseudostipe, splitting upwards into three tapered columns connected at their tips. Columns with one large tube occupying an entire half of the inner face and a group of about three small tubes, forming the outer portion, which carry a pair of flanges running longitudinally down the arm. Volva membranous, 5–7 mm diam., white (7A1), with numerous white and branched (7A1) rhizomorphs projecting from the base. Gleba olive (1F7), produced over the inner surface of the columns. Odor fetid, resembling decaying fish. Basidiospores 3–4.5 (–5) × 1–1.5 µm, ellipsoid to bacilliform, smooth, thin-walled, hyaline in 3% KOH; surface smooth with SEM. Receptacle composed of pseudoparenchymatous hyphae, 23.5–37 × 13.5–20 µm, globose to subglobose, thin-walled. Clamp connections present. Basidia not observed. Rhizomorphs constituted by hyaline, thin-walled hyphae, 3–12 µm diam., smooth or encrusted by numerous angular crystals 1.5–5 µm diam., slowly dissolving in 3% KOH. Other hyphae present smooth thick walls, up to 1.5 µm diam., with brown contents, 2–3 µm diam.; terminal hyphae rounded.

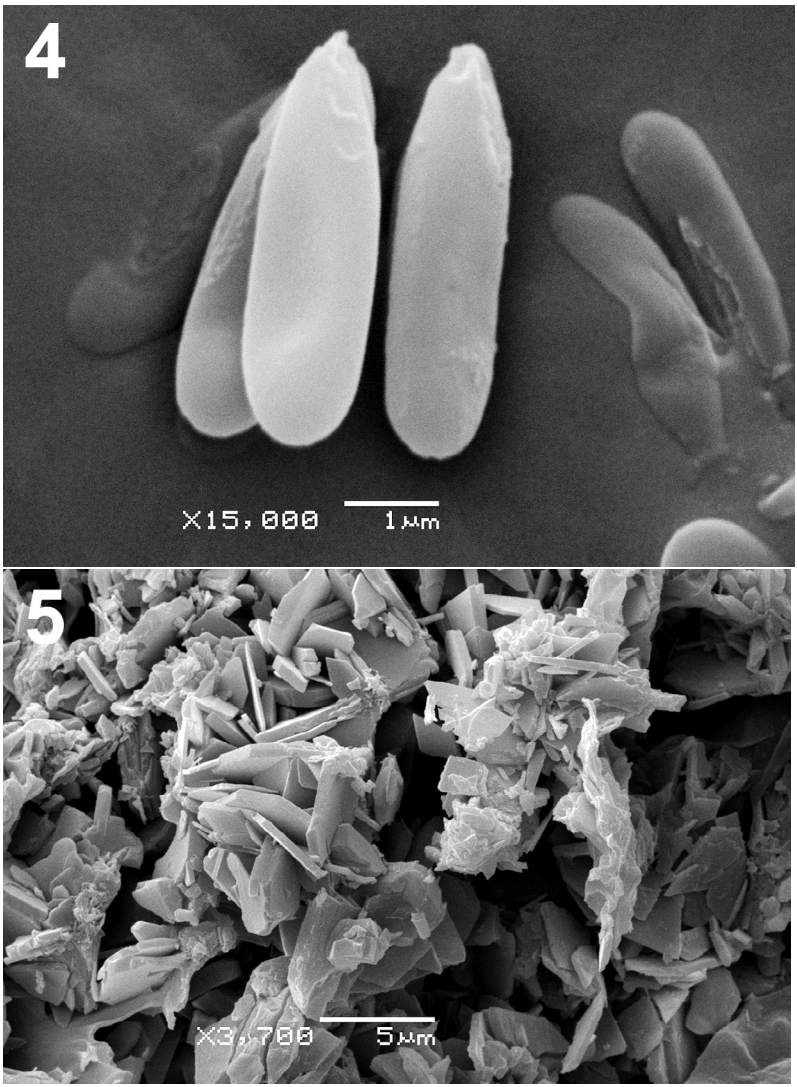
Habitat: Saprophytic on litter and soil, in *Eucalyptus* plantation.

Distribution: only known from southern Brazil, states of Santa Catarina (Möller 1895) and Rio Grande do Sul (Braun 1932, Rick 1961).

Figs 1–3. *Pseudocolus garciae*. 1. Fresh mature basidioma. 2. Mycoegg in cross-section. 3. Immature and mature specimens showing abundant rhizomorphs. Scale bar: 10 mm.

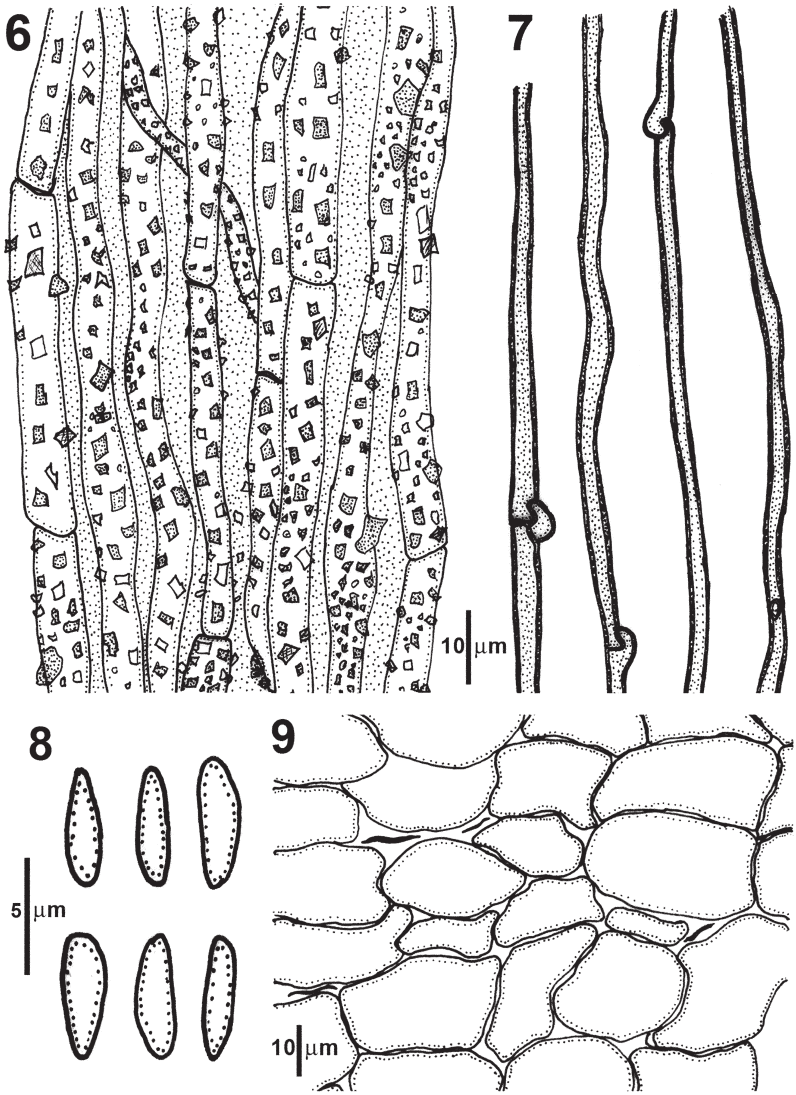
Examined specimens: **BRAZIL. Rio Grande do Sul, Caçapava do Sul,** Minas do Camaquã, 03.XII.2009, leg. M.A. Sulzbacher 209 (UFRN-Fungi 1522).

Comments: Möller (1895) originally described *P. garciae* (as a *Colus* species) from the Atlantic rainforest of Southern Brazil. The holotype was collected near



Figs 4–5. *Pseudocolus garciae* SEM photographs.
4. Basidiospores. 5. Rhizomorph surface covered by crystals.

Blumenau, state of Santa Catarina. Lloyd (1907) later transferred the species to the recently proposed genus *Pseudocolus*, but others have also considered it a *Lysurus* (Hennings 1902) or *Anthurus* (Cunningham 1931). The receptacle tubular structure of *Pseudocolus* is a good character to distinguish the genus within the anthuroid fungi (Dring 1980).



Figs 6–9. *Pseudocolus garciae*. 6. Rhizomorphs: external hyphae bearing crystals. 7. Rhizomorphs: internal hyphae. 8. Basidiospores. 9. Pseudoparenchymatic hyphae of the receptacle.

Since the original description, little information on this species has been available. In fact, the only known specimen except for the type collection was gathered in 1905 by J. Rick, reported later by Braun (1932) and Rick (1961). It is important to note that Dring (1980) translated his description from the

original protologue by Möller (1895), and both Lloyd (1907) and Braun (1932) reproduced the holotype photos. Thus, the present study reports the third collection for the species.

Our specimens fit in all aspects the descriptions provided by Möller (1895) and Braun (1932). There is no doubt the fungus is rare, since it is known only from the region in which the type collection was originally described. The new collection's habitat, however, differs from the original. Examination of new fresh material allowed observation of both immature and mature specimens (Figs 1–3) and provided new morphological data not described elsewhere: long and abundant white rhizomorphs present at the base of the mycoeggs (Fig 3), as well as the hyphal structure forming them (Figs 5–7).

SEM analysis revealed that hyphae in the rhizomorphs are covered by numerous prismatic to irregular shaped crystals (Figs 5–6) and confirmed that the basidiospore surface is, in fact, smooth (Fig 4). *Pseudocolus* comprises two species, both occurring in southern Brazil: *P. fusiformis* and *P. garciae*. In *P. fusiformis*, the receptacle is pinkish to red, the stipe is hollow and divided into 3 or 4 vertical columns tapering upwards, and the basidiospores are elliptical, 3–4 × 1–2 µm (Dring 1980). The preserved material of *P. garciae* (Brazil. Rio Grande do Sul: São Leopoldo, 1905, leg. J. Rick, PACA 12816, as *Colus garciae*) is in poor condition and therefore taxonomically inconclusive. However, judging from the descriptive notes by Braun (1932) and Rick (1961), it fits well with Möller's fungus. The present finding expands the morphological knowledge of *P. garciae* from Brazilian subtropics. Additional phylogenetic studies are needed to clarify the systematics of the Neotropical *Phallales*.

Acknowledgments

We thank Dr. Admir J. Giachini (Universidade Federal de Santa Catarina, Brazil) and Dr. Eduardo R. Nouhra (Universidad Nacional de Córdoba, Argentina) for critical review of the manuscript, Dr. Maria S. Marchioreto (Herbarium PACA), CME/UFPR for facilities during SEM analysis and CNPq (Brazil) for financial support to research.

Literature cited

Akata I, Doğan HH. 2011. *Pseudocolus fusiformis*, an uncommon stinkhorn new to Turkish mycobiota. Mycotaxon 115: 259–262. http://dx.doi.org/10.5248/115.259

Braun B. 1932. Estudo sobre as Phalloideas Riograndenses. Relatório do Ginásio Anchieta (Porto Alegre) 1932: 5–28 + 8 pl.

Burk WR. 1978. *Pseudocolus fusiformis*: synonymy and distributional records. Mycologia 70: 900–905.

Cortez VG, Baseia IG, Silveira RMB. 2011a. Gasteroid mycobiota of Rio Grande do Sul State, Brazil: *Lysuraceae* (*Basidiomycota*). Acta Sci., Biol. Sci. 33: 87–92. http://dx.doi.org/10.4025/actascibiolsci.v33i1.6726

Cortez VG, Baseia IG, Silveira RMB. 2011b. Two noteworthy *Phallus* from southern Brazil. Mycoscience 52: 436–438. http://dx.doi.org/10.1007/s10267-011-0124-5

Cortez VG, Sulzbacher MA, Baseia IG, Antoniolli ZI, Silveira RMB. 2011c. New records of *Hysterangium* (*Basidiomycota*) from a *Eucalyptus* plantation in southern Brazil. R. Bras. Bioci. 9: 220–223.

Cunningham GH. 1931. The Gasteromycetes of Australasia XI. The *Phallales*, Part II. Proc. Linn. Soc. New South Wales 56: 182–200.

Dring DM. 1980. Contributions towards a rational arrangement of the *Clathraceae*. Kew Bull. 35: 1–96.

Hemmes DE, Desjardin DE. 2009. Stinkhorns of the Hawaiian Islands. Fungi 2: 8–10.

Hennings P. 1902. Eine neue norddeutsche Phalloidee (*Anthurus borealis* Burt var. n. *klitzingii* P. Hennings). Hedw. Beibl. 41: 169–174.

Holmgren PK, Holmgren NH. 1998. Index Herbariorum: a global directory of public herbaria and associated staff. Available at: http://sweetgum.nybg.org/ih/. Accessed: 16 May 2011.

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. http://dx.doi.org/10.3852/mycologia.98.6.949

Kornerup A, Wanscher JE. 1978. Methuen handbook of colour. 3rd ed. London: Eyre Methuen.

Lloyd CG. 1907. Concerning the Phalloids. Mycol. Notes 28: 349–364.

Miller Jr. OK, Miller HH. 1988. Gasteromycetes: morphology and developmental features. Mad River Press, Eureka.

Möller A. 1895. Brasilische Pilzblumen. Bot. Mitth. Tropen 7: 1–152.

Overbeck GE, Müller SC, Fidelis A, Pfadenhauer J, Pillar VD, Blanco CC, Boldrini II, Both R, Forneck ED. 2007. Brazil's neglected biome: the South Brazilian Campos. Persp. Pl. Ecol., Evol. Syst. 9: 101–116. http://dx.doi.org/10.1016/j.ppees.2007.07.005

Rick J. 1961. *Basidiomycetes* Eubasidii in Rio Grande do Sul – Brasilia 6. Iheringia, Sér. Bot. 9: 451–479.

Trierveiler-Pereira L, Loguercio-Leite C, Calonge FD, Baseia IG. 2009. An emendation of *Phallus glutinolens*. Mycol. Progr. 8: 377–380. http://dx.doi.org/10.1007/s11557-009-0603-7

Wright JE. 1960. Notas sobre faloideas Sud y Centroamericanas. Lilloa 30: 339–359 + 3 pl.