New records of *Hysterangium* (Basidiomycota) from a *Eucalyptus* plantation in southern Brazil

Vagner Gularte Cortez1*, Marcelo Aloisio Sulzbacher2, Iuri Goulart Baseia3, Zaida Inês Antoniolli2 and Rosa Mara Borges da Silveira4

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**ABSTRACT:** (New records of *Hysterangium* (Basidiomycota) from a *Eucalyptus* plantation in southern Brazil). *Hysterangium affine* and *H. inflatum* are recorded for the first time from Brazil, based on specimens collected in a plantation of exotic *Eucalyptus*. Detailed descriptions and illustrations of the studied collections are presented, including an identification key to the species known from southern Brazil.

**Key words:** ectomycorrhizae, false-truffles, *Hysterangiales*, taxonomy.

**RESUMO:** (Novos registros de *Hysterangium* (Basidiomycota) em plantação de *Eucalyptus* no sul do Brasil). *Hysterangium affine* e *H. inflatum* têm sua ocorrência registrada pela primeira vez no Brasil a partir de espécimes coletados em plantação de *Eucalyptus*. São apresentadas descrições e ilustrações dos espécimes estudados, assim como uma chave de identificação das espécies de *Hysterangium* conhecidas no sul do Brasil.

**Palavras-chave:** ectomicorrizas, falsas-trufas, *Hysterangiales*, taxonomia.

**INTRODUCTION**

*Hysterangium* Vittad. is a genus of sequestrate (false-truffle) fungi, diagnosed by its hypogeous to subhypogeous habit and enclosed basidiomata that have a columella with a slimy gleba (due to the presence of a gelatinized trama) and smooth to rugose basidiospores (which are usually covered by a membranous utricle), and form ectomycorrhiza with species of trees in the *Fagaceae*, *Myrtaceae* and *Pinaceae* (Beaton et al. 1985, Castellano 1999). The genus comprises approximately 40 species (Castellano 1999) and belongs to the *Hysterangiales* E. Fisch., in the order *Hysterangiaceae* (Castellano 1999). The present paper comprises some of the results of a survey of the gasteroid fungi from the state of Rio Grande do Sul (Cortez et al. 2008a, 2008b, 2009, 2010, 2011a, 2011b, Sulzbacher et al. 2010), and discusses *Hysterangium* specimens collected and identified by the authors.

**MATERIALS AND METHODS**

The field trips were carried out in a *Eucalyptus* plantation at the Estação Experimental de Silvicultura (FEPA-GRO) - 29°45’S, 53°43’W, in the municipality of Santa Maria, in the central region of the state of Rio Grande do Sul, in southern Brazil. FEPA-GRO comprises an area of 280 ha and cultivates trees that are native (*Apuleia leiodcarpa* J.F. Macbr., *Senna multijuga* (Rich.) H.S. Irwin & Barneby, and *Tabebuia* spp.) and exotic (*Hovenia dulcis* Thunb., *Platanus×acerifolia* Willd., *Pinus* spp. and *Eucalyptus* spp.). The soil is of the Hapludult type, which is deep and poorly drained, and has low natural fertility (Abrão et al. 1988, Streck et al. 2008). The climate is subtropical humid (Cfa) according to Köppen’s system, with mean temperature values higher than 22°C during the warmest month, an annual rainfall of about 1769 mm, and precipitation well distributed throughout the year (Schumacher et al. 2008).

The collected specimens were photographed and analyzed macro- and microscopically following Brundrett et al. (1996). Color names and codes were based on the *New York Botanical Garden* Herbaceous Color Charts.

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1. Universidade Federal do Paraná. Rua Pioneiro 2153, Jardim Dallas, CEP 85950-000, Palotina, PR, Brazil.
2. Universidade Federal de Santa Maria. Departamento de Solos. CEP 97105-900, Santa Maria, RS, Brazil.

*Author for correspondence. E-mail: cortezvg@yahoo.com.br

on Kornerup & Wanscher (1978). The microscopic analysis of the basidiomata comprised the measurements of at least 30 microstructures (basidiospores, basidia and hyphae). Illustrations were made with the aid of a drawing tube. Specimens were deposited in the SMDB (Department of Biology of Universidade Federal de Santa Maria) and ICN (Institute of Biosciences of Universidade Federal do Rio Grande do Sul) herbaria.

RESULTS AND DISCUSSION

Key to the Hysterangium species associated with Eucalyptus in southern Brazil

1. Basidiospores without utricle .................................................................................................................. 1. H. affine

1'. Basidiospores with a distinct hyaline utricle .......................................................................................... 2

2. Rhizomorphs present only at the base of the basidiomata, basidiospores with a winged utricle ....... 2. H. infaltum

2'. Rhizomorphs present at the base and sides of the basidiomata, basidiospores with an irregular, appressed utricle .................. H. gardneri


Basidiomata 7-12 mm diam., depressed globose to subglobose, with a distinct rhizomorphic base. Peridium <1 mm thick, brownish orange (6C3) to light brown (6D6), smooth and glabrous. Gleba loculate, gelatinized, greenish grey (27C2) to dull green (27D4), with irregular locules radially arranged on a dendroid columella. Rhizomorphs white (6A1) thin, short and very numerous, forming a fasciculate base in the basidiomata. Basidiospores 10-12.6 × 4.5-5.5 µm, ellipsoid to suboblong, apex and base tapered, hyaline in KOH, smooth and little thickened wall, with a sterigmal attachment base, utricle absent. Basidia 22.5-26 × 4.5 6.7 µm, clavate, tetrsporic, hyaline. Peridium about 100-180 µm thick, composed of a cutis of interwoven hyphae 2.5-5 µm diam., with brownish walls, slightly thickened and encrusted by numerous, small crystals, not readily separable from gleba in the examined material. Trama formed by subparallel, smooth and thin-walled, hyaline hyphae, 2.5-7.5 µm diam.


Habitat: subhypogeous, under soil and fallen leaves of Eucalyptus sp., ectomycorrhizal.

Known distribution: Australia (Beaton et al. 1985), North (Zeller & Dodge 1929) and South America. Widespread in areas where species of Eucalyptus are cultivated.

Remarks: Hysterangium affine is diagnosed by the greenish color of the mature gleba, basidiospore size and shape, and the absence of a utricle (Beaton et al. 1985). Although more frequently reported as having an ectomycorrhizal association with species of Eucalyptus (Beaton et al. 1985), an association with Quercus has also been reported from North America (Zeller & Dodge 1929). Hysterangium eucalyptorum Lloyd, from Ecuador, is considered a synonym of this species (Zeller & Dodge 1929, Cunningham 1942, Beaton et al. 1985). Hysterangium gardneri E. Fisch., known from Eucalyptus plantations in Argentina and southern Brazil (Giachini et al. 2000), differs by its smaller basidiospores (8-10.5 × 3.3-4 µm) with wrinkled exosporium (Nouhra et al. 2008). Hysterangium affine is a new record for Brazil.


Basidiomata 5-12 mm diam., subglobose to irregular, with a distinct rhizomorphic base. Peridium 0.2 mm thick, greyish yellow (1B3), to dull red (8B4) when fresh, drying orange brown (4DB), covered by soil and litter particles, smooth. Gleba loculate, olive (1F3), with elongate locules and a cartilaginous, dendroid, translucent columella. Rhizomorphs white (6A1), well developed at the base and sides of basidiomata, abundant within the substrate. Basidiospores 7.5-12.5 × 3-4 µm (ornamentation excluded), ellipsoid with a truncate base, surface smooth but enclosed in an inflated wing-like utricle (absent in immature spores) 0.8-2.5 µm, hyaline in KOH. Basidia 21-31 × 3-9 µm, clavate to cylindrical, 4-6 spored, hyaline, basal clamp connections present. Peridium 2-layered; external layer formed by narrow yellowish to brownish hyphae 1.6-3.3 µm in diam., slightly thickened walls, with clamp connections, and crystals adhered to the surface (1.5-) 2.5-4 µm diam.; internal layer composed by hyaline, smooth and thin-walled hyphae, interwoven to subregular, broader than the external layer, 5-20 µm diam. Trama gelatinized in young and mature basidiomata, formed by hyaline, smooth and thin-walled, 0.8-6 µm diam. hyphae, with clamp connections.


Habitat: subhypogeous, under soil and dead leaves of Eucalyptus, ectomycorrhizal.

Known distribution: Australia (Beaton et al. 1985), New Zealand (Castellano & Beever 1994), United States
(Zeller & Dodge 1929), Spain (Lago & Castro 2004), France, Ecuador (Castellano & Muchovej 1996), and Brazil. Possibly widespread in plantations of species of *Eucalyptus* worldwide.

**Remarks:** *Hysterangium inflatum* is morphologically characterized by its ellipsoid and truncate basidiospores, each with an inflated wing-like utricle (Castellano & Muchovej 1996). The presence of numerous and large calcium oxalate crystals adhered to the surface of the external layer of the peridium is also a diagnostic feature that has been observed on the rhizomorph hyphae (Malajczuk et al. 1987, Castellano 1999). *Hysterangium inflatum* forms within the upper humus layers or occasionally in the litter layer (Castellano 1999), and is reported to have ectomycorrhizal relationships with species of *Eucalyptus*, especially *E. globulus* (Castellano & Muchovej 1996). In Australia the mycelium of *H. inflatum* occupied ca. 10% of the soil surface area in some native

![Figure 1. Basidiomata of Hysterangium affine (A) and H. inflatum (B). Photographs by V. G. Cortez (a) and M. A. Sulzbacher (b).](image1)

**E. diversicolor** F. Muell. forests, indicating its important role as a dominant ectomycorrhiza of those trees (Malajczuk et al. 1987).

The record of two previously unreported species of *Hysterangium* in Brazil is not surprising because these fungi are usually introduced via *Eucalyptus* roots, which are cultivated worldwide. However, these records emphasize the need of further studies in order to identify other mycorrhizal symbionts of these trees in southern Brazil. This is ultimately the first step towards a potential use of these symbionts in agroforestry programs. Members of the genus *Hysterangium* are considered of relevant interest to forestry programs because they form ectomycorrhizal relationships with several *Eucalyptus* species (Malajczuk et al. 1987, Castellano 1999). Unfortunately, little is known about the ectomycorrhizal fungi in southern Brazil where cultivation of *Eucalyptus* is economically important, and their possible use as an ectomycorrhizal inoculum remains unexplored. Isolating these fungi in culture, however, has been reported to be difficult (Castellano 1999), and our attempts to isolate the species of fungi in the present study also failed. Species of *Hysterangium* play decisive roles in the ecology of forests, contributing directly to the structure of soil communities (Castellano 1999), and, for this reason, will be the subject of future investigations.

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**REFERENCES**


