

***Lycoperdon ovoidisporum* sp. nov. from Brazil**

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Lycoperdon ovoidisporum is described as a new taxon based on specimens collected in Southern Brazil. The diagnostic feature of the proposed new species is the shape of the basidiospores, which are ovoid, slightly verrucose-subnodulose under scanning electron microscopy and shortly pedicellate. A morphological description, as well as detailed illustrations and scanning electron micrographs of the basidiospores are presented, with a brief discussion and comparison with other members of the genus.

Keywords: Agaricales, gasteromycetes, Lycoperdaceae, mycobiota, taxonomy.

Distributed worldwide, *Lycoperdon* Pers. is, undoubtedly, one of the most important puffball genera. In spite of more than 700 recorded names in MycoBank databases (www.mycobank.org), only 50 are currently used (Kirk *et al.* 2008). Twenty five of them have been reported from Brazil (Baseia 2005, Trierveiler-Pereira & Baseia 2009). However, most of these names are synonyms, invalid or were transferred to other genera in the family, accounting for the confusing and complex generic circumscription of *Lycoperdon*, which has been the subject of discussion for decades (Kreisel 1963, Demoulin 1970, Krüger & Kreisel 2003). Thus, in spite of advances in DNA sequencing techniques for phylogenetic purposes (Krüger *et al.* 2001, Vellinga 2004, Krüger & Gargas 2008, Larsson & Jeppson 2008, Bates *et al.* 2009), the taxonomic concept of the genus *Lycoperdon* and its relationships with satellite genera as *Morganella* Zeller and *Vascellum* Smarda (sometimes considered at the infrageneric level) have not been elucidated. In this way, there is a clear need of further investigations worldwide.

During a survey of gasteroid fungi in southern Brazil (Cortez *et al.* 2008a, 2008b, 2009, 2010, 2011a, 2011b), the authors collected and examined both fresh and herbarium specimens of a unique member of the genus, which is described and discussed in the present paper as new species.

Materials and Methods

Specimens were collected from March 2006 to May 2009 during mycological trips in Rio Grande do Sul, the southernmost Brazilian State. The basidiomata were gathered in an area of native subtropical vegetation (seasonal semideciduous forest) in the Atlantic Rainforest of Southern Brazil. Additionally, specimens from the following herbaria were reviewed (abbreviations according to Index Herbariorum): BAFC, HURG, ICN, PACA, PEL, SMDB, and SP. Macro- and micro-morphology were analyzed following procedures and terminology described by Miller & Miller (1988). Color names and codes followed Korrnerup & Wanscher (1978). Microscopic examination of 25 elements (basidiospores, capillitia, hyphae) for each collection was performed in 5% KOH. In basidiospore description, Q is the ratio of length/width, Q_m is the average of the Q , and n is the number of measured basidiospores. Line drawings were made with the aid of a light tube attached to a light microscope (LM). Scanning electron microscopy (SEM) was performed as described previously (Cortez *et al.* 2008b). All collected specimens (including holotype) are deposited in the herbarium of the Universidade Federal do Rio Grande do Sul, Instituto de Biociências, Porto Alegre (ICN).

Taxonomy

Lycoperdon ovoidisporum Cortez, Baseia & R.M. Silveira **sp. nov.** – Figs. 1–7.

MycoBank no.: MB561562

Basidiomata pyriformis, terrestres. Exoperidio luteobrunneo vel brunneo, velutino. Gleba olivacea vel olivaceo brunnea. Basidiosporis ovoidis, luteobrunneis, laevibus vel verrucosae, $4.2\text{--}6 \times 3.4\text{--}4.2\text{ }\mu\text{m}$, pedicellum brevis ($0.7\text{ }\mu\text{m}$).

Holotypus. – Brasília, Provincia Rio Grande do Sul, Santa Maria, Cerrito, 28-05-2007, legit V.G. Cortez 109/07, in herbario ICN (154573) conservatur.

Basidiomata 20–35 mm diam., 29–50 mm high, pyriform, with a well-developed sterile base, pseudorrhiza and rhizomorphs attached to substrate. Exoperidium greyish brown (5C2), dark blond to yellowish brown (5F8), dull, formed by small spines ($<0.2\text{ mm}$ high), velvety when fresh, granulose to asperulate when dried; microscopically, it is composed by globose, subglobose, pyriform to subfusoid elements, $11\text{--}27 \times 8\text{--}23\text{ }\mu\text{m}$, with smooth and thickened walls ($<2\text{ }\mu\text{m}$ diam.), color pale brownish in KOH. Endoperidium papery, light brown (6D5), dehiscing by a central and broad ($<5\text{ mm}$ diam.) circular peristome. Gleba olive (3E8) to yellowish brown (5E8) at maturity, cottony. Sterile base 9–22 mm high, spongy, greyish green (1C6) to yellowish brown (5E6), gradually separate from gleba. Rhizomorphs $<1\text{ mm}$ thick, white (2A1), scattered and short. Basidiospores $4.2\text{--}5.5\text{ (–}6) \times 3.4\text{--}4.2\text{ }\mu\text{m}$, $Q = 1.10\text{--}1.44$, $Q_m = 1.28$, $n = 110$ (from four collec-

tions), mostly ovoid or broad ellipsoid in a few cases, with a short pedicel ($<0.7\ \mu\text{m}$ long), yellowish to pale brown under KOH, smooth to subtle punctuate under LM, under SEM the surface is verrucose to subnodulose. *Eucapillitium* $3\text{--}8.5\ \mu\text{m}$ diam., *Lycoperdon*-type, walls smooth, thick and with scattered to frequent pores, septa rare, yellowish brown in KOH. *Paracapillitium* absent.

Etymology. – The epithet refers to the ovoid shape of the basidiospores.

Habitat or Host plant. – On soil and litter in subtropical, semideciduous seasonal forest (Atlantic Rainforest).

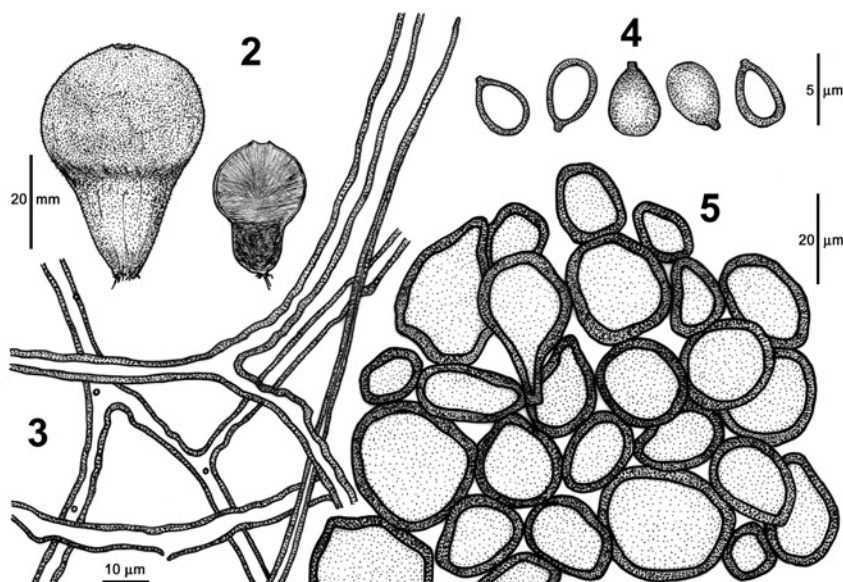
Distribution. – Known only from the type locality, in southern Brazil.

Material examined. – BRAZIL, Rio Grande do Sul State: Santa Maria, Campus UFSM, 22 Aug 2006, leg. V.G. Cortez 066/06 (ICN 154575); Estação Experimental de Silvicultura – FEPAGRO, 25 Feb 2009, leg. G. Coelho (ICN 154577); Morro da Caturrita, 27 Apr 2006, leg. V.G. Cortez 023/06 (ICN 154574); Morro Mariano da Rocha, 23 March 2007, leg. V.G. Cortez 031/07 (ICN 154576). São Leopoldo, leg. J. Rick (PACA 13805, as *L. brasiliense* Speg.), 1931, leg. J. Rick (PACA 13771, as *L. cupricum* Bonord.). Viamão, Parque Saint-Hilaire, 14 March 1975, leg. M.H. Homrich (ICN 6434).

Holotypus. – BRAZIL, Rio Grande do Sul State: Santa Maria, Cerrito, 28 May 2007, leg. V.G. Cortez 109/07 (ICN 154573).



Fig. 1. *Lycoperdon ovoidisporum*: basidiomata in natural habitat. Photo: G. Coelho.

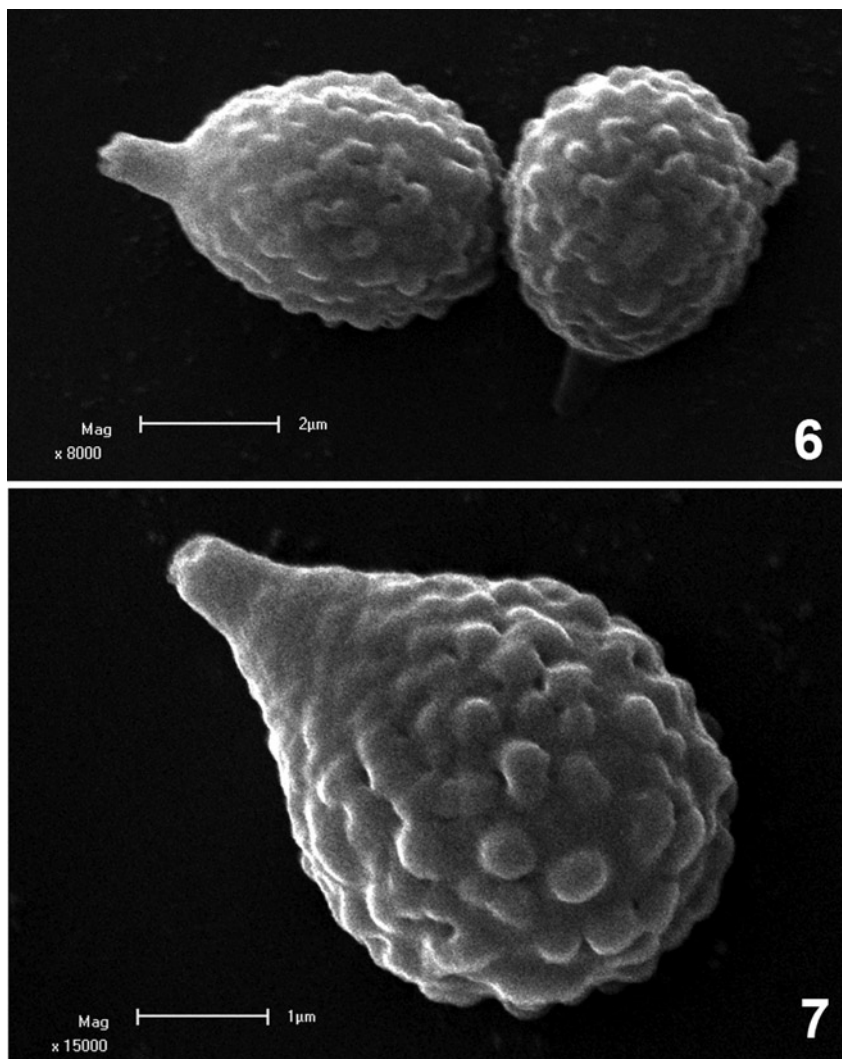


Figs. 2–5. *Lycoperdon ovoidisporum*. 2. Basidioma and vertical section; 3. Eucapillitium; 4. Basidiospores; 5. Cells of the exoperidium.

Discussion

Lycoperdon ovoidisporum is considered a new species based on the combination of the following morphological features: pyriform-shaped basidiomata, velvety to granular exoperidium, olivaceous to olivaceous-brown gleba, remarkable brown and ovoid basidiospores, exhibiting a smooth appearance under LM, but verrucose to subnodulose ornamentation under SEM, and presence of a short, but conspicuous pedicel. Basidiospore shape is considered a diagnostic feature at specific level because only few species of *Lycoperdon* are known to have ovoid basidiospores, while most have globose or subglobose basidiospores (Bowerman 1961, Demoulin 1976, Calderón-Villagómez & Pérez-Silva 1989, Calonge 1998).

Lycoperdon eximium Morgan, an ovoid-spored species, is a widely distributed puffball in North America but not known in the subtropical zone of South America; it differs strongly in the depressed shape of the basidiomata, purplish gleba and larger basidiospores ($5\text{--}6.5 \times 4.3\text{--}5\text{ }\mu\text{m}$) with longer ($<2.5\text{ }\mu\text{m}$ long) pedicels (Coker & Couch 1928). With a number similar features, *L. darjeelingense* B.M. Sharma displays subglobose to ovoid basidiospores, but has much longer pedicels ($<19\text{ }\mu\text{m}$ long – Sharma 1991). *Lycoperdon ovalicaudatum* D. Bisht, J.R. Sharma & Kreisel, also has ovoid spores with long pedicels ($<22\text{ }\mu\text{m}$ long – Bisht *et al.* 2006).



Figs. 6–7. *Lycoperdon ovoidisporum*: SEM pictures of the basidiospores.

Lycoperdon ovoidisporum is comparable macroscopically to the Neotropical puffball *L. juruense* P. Henn. (= *L. atrum* Pat.), with a similar shape of basidiomata as well as similar colors of the exoperidium and the gleba (Demoulin 1976). *Lycoperdon juruense* differs microscopically in the hyphal structure of the exoperidium, which is composed of clavate to subcylindrical setoid elements, and the globose and echinate basidiospores in LM (Demoulin 1976).

Specimens collected in Rio Grande do Sul State as *L. brasiliense* [a synonym of *Calvatia rugosa* (Berk. & M.A. Curtis) D.A. Reid (Reid

1977)] and *L. cupricum* [= *L. molle* (Demoulin 1970)] by Johannes Rick (1961; Fungi Rickiani, PACA herbarium) could be identified as *L. ovoidisporum*.

The diversity of Neotropical macromycetes is only partially known, which could be demonstrated by the discovery of this remarkable taxon. A better knowledge of the mycobiota of this area would complete phylogenetic studies of puffballs and other mushrooms.

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