Gasteroid mycobiota of Rio Grande do Sul, Brazil: *Arachnion* and *Disciseda* (Lycoperdaceae)

Fungos gasteroides no Rio Grande do Sul, Brasil: *Arachnion* e *Disciseda* (Lycoperdaceae)

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Lycoperdaceae Chevall. comprises fungi belonging to the phylum *Basidiomycota*, known as puffballs because of the globose to subglobose shape of their basidiomata and the pulverulent mass of spores that are dispersed passively in the air and by rain. The family contain about 20 genera and approximately 150 species worldwide (Kirk *et al.*, 2001). The diversity of the gasteroid fungi in the mycobiota of Rio Grande do Sul has been recently investigated (Cortez *et al.*, 2008a, 2008b, 2009, 2010), and in this paper the genera *Arachnion* and *Disciseda* are considered.

Arachnion Schwein. is a genus with small basidiomata (< 20 mm diam.), disintegrating endoperidium at maturity, gleba formed by minute peridioles similar to sand grains, and capillitium absent or poorly developed (Long, 1941; Zeller, 1949). There are 15 recorded names in MycoBank databases, seven of which are in current use (Demoulin, 1972; Quadraccia, 1996). Some consider the genus to belong to a distinct family

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Arachniaceae Coker & Couch (MILLER & MILLER, 1988), but currently it is classified as *Lycoperdaceae* (KIRK *et al.*, 2001) or *Agaricaceae* (KIRK *et al.*, 2008). Recent phylogenetic studies on *Lycoperdaceae* (KRÜGER & GARGAS, 2008; LARSSON & JEPPSON, 2008; BATES *et al*., 2009) did not considered members of the genus *Arachnion* and thus their relationships remain unclear. In Brazil, four *Arachnion* taxa were recorded: *A. foetens* Speg., *A. album* Schwein., *A. scleroderma* Lloyd, and *A. iriemae* Rick (SPEGAZZINI, 1889; RICK, 1961).

Disciseda Czern. is another genus occupying a rather isolated position in *Lycoperdaceae* especially because the species exhibit a circumscissile rupture of the exoperidium (MILLER & MILLER, 1988; MORENO *et al.*, 2003). They occur in desert, xerophilous or sandy habitats and are said to be partially hypogeous when immature, with a basal peristoma; when mature, the exoperidium breaks, leaving the lower half in soil, and the basidioma overturns, allowing the peristoma to spread the spores (MITCHELL *et al*., 1975; CALONGE, 1998; MORENO *et al*., 2003). Of the 43 recorded names in Mycobank databases, about 15 species are considered by modern mycologists (KIRK *et al.*, 2008). The name *Disciseda* has not been previously reported in Brazil, but *Catastoma* Morgan, a synonym of that genus, was recorded from Rio Grande do Sul by RICK (1961), who cited *C. circumcissum* (Berk. & M.A. Curtis) Morgan.

The aim of the present paper was to investigate the occurrence of species belonging to *Arachnion* and *Disciseda* in the mycobiota of Rio Grande do Sul State, in southern Brazil.

MATERIALS AND METHODS

Specimens were collected during mycological surveys from March 2006 to May 2009, in several areas of Rio Grande do Sul State, southern Brazil. Collected specimens were analyzed macro- and micromorphologically following standard procedures (MILLER & MILLER, 1988), then dried and preserved at the ICN herbarium ("Instituto de Biociências, Universidade Federal do Rio Grande do Sul"). Additional specimens from the ICN and PACA herbaria were revised. Color terminology followed KORNERUP & WANSCHER (1978).

RESULTS AND DISCUSSION

Arachnion Schwein. 1822

1. ***Arachnion album*** Schwein., *Leipzig, Schr. Nat. Gesell.* 1: 59, 1822. [Figs 1-2]

Basidiomata 5-12 mm diam., 4-7 m high, depressed-subglobose, with scattered basal rhizomorphs. Peridium <0.3 mm thick, smooth, fragile to

papery, white (4A1), grey (4B1) to yellowish grey (4B2), dehiscence irregular. Gleba granulose to pulverulent when mature, composed by numerous minute peridioles reminding sandgrains, color grey (4C1) to greyish beige (4C2) in fresh, brownish grey (5C2) to light grey (1D1). Sterile base lacking. Rhizomorphs scattered, small, thin and white (4A1). Basidiospores 4.2-6 × 3.5-4.5 (-5) µm, ovoid to broad ellipsoid or subglobose, pedicels with length depending on the stage of the development (in mature spores, usually not longer than 1 µm), walls thickened and smooth under LM, guttulate. Basidia 13.5 × 4 µm, tetrasporic, with very long sterigmata (<50 µm long). Peridium two-layered: external layer composed by filamentous, prostrate hyphae, 1.7-3.5 µm diam., yellowish brown, with some parietal incrustation; internal layer pseudoparenchymatic, formed by interwoven, hyaline and thin-walled hyphae, 2.5-5 µm diam. Eucapillitium and paracapillitium absent.

Examined specimens: Brazil, RIO GRANDE DO SUL: Santa Cruz do Sul, Reserva Krödt. 25/IV/2004, *J. Veleda & M. A. Sulzbacher 25* (ICN 154479); Santa Maria, Campus UFSM, 06/III/2007, *V. G. Cortez 020/07* (ICN 154478), Estação Experimental de Silvicultura, FEPAGRO, 01/VI/2009, *V. G. Cortez 016/09* (ICN 154480); Salvador do Sul, 17/II/1943, *J. Rick* (PACA 12160), 21/II/1945, *J. Rick* (PACA 22735); Viamão, Schöenwald, 13/V/1971, *M. H. Homrich* (ICN 6228).

Geographical distribution — Japan (Kasuya *et al.*, 2006), South Africa (Bottomley, 1948), North America (Coker & Couch, 1928), South America (Calonge *et al.*, 2000). Brazil: Pernambuco (APNE, 2009), São Paulo (Spegazzini, 1889) and Rio Grande do Sul (Lloyd, 1906; Rick, 1961, as *A. album* and *A. scleroderma*).

Discussion — *Arachnion album* is the type species of the genus, and is diagnosed by the presence of a fragile peridium, greyish gleba, ovoid basidiospores and lack of eucapillitium (Demoulin, 1972). *Arachnion iulli* Quadr., from Italy (Quadraccia, 1996), seems to differ little from the present species; the basidiospores are described as having long pedicels, a feature observed to our examined specimens that, in our understanding, represents different stages of maturation. The ontogenetic series of basidioma and basidiospores development is described and presented in detail-rich illustrations by Lander (1934). *Arachnion album* is a common grassland species, but poorly documented in Rio Grande do Sul, and probably widespread in South America. Noteworthy is Rick's (1961) placement of *Arachnion* in *Nidulariaceae* Dumort., because of the presence of peridioles. These structures, however, differ completely from the peridioles of *Crucibulum* Tul. & C. Tul., *Cyathus* Haller and

Nidularia Fr., where a more complex and specialized spore dispersal system is observed (MILLER & MILLER, 1988).

Disciseda Czern. 1845

2. *Disciseda bovista* (Klotzsch) Henn., *Hedw. 42*: 128, 1903. [Figs. 3-5]

Basidiomata 20-24 mm diam., 14-15 mm high, subglobose to depressed-globose, basal rhizomorphs absent. Exoperidium <1.5 mm thick, completely covered by soil particles, occupying one half of the size of endoperidial body. Endoperidium leathery, smooth, reddish blond (5C4) to brownish orange (5C5), dehiscing through an apical, fimbriate peristoma. Gleba fairly pulverulent, golden brown (5D7). Sterile base absent. Rhizomorphs absent. Basidiospores 5-6.5 µm diam., globose, strongly echinate, formed by subcylindrical spines <1 µm long, yellowish brown in KOH. Eucapillitium 2.5-4.5 µm diam., walls thickened, yellowish to greenish under KOH, without pores, branches and septa rare.

EXAMINED SPECIMENS — Brazil, RIO GRANDE DO SUL: São Leopoldo, 1944, *J. Rick* (PACA 12699).

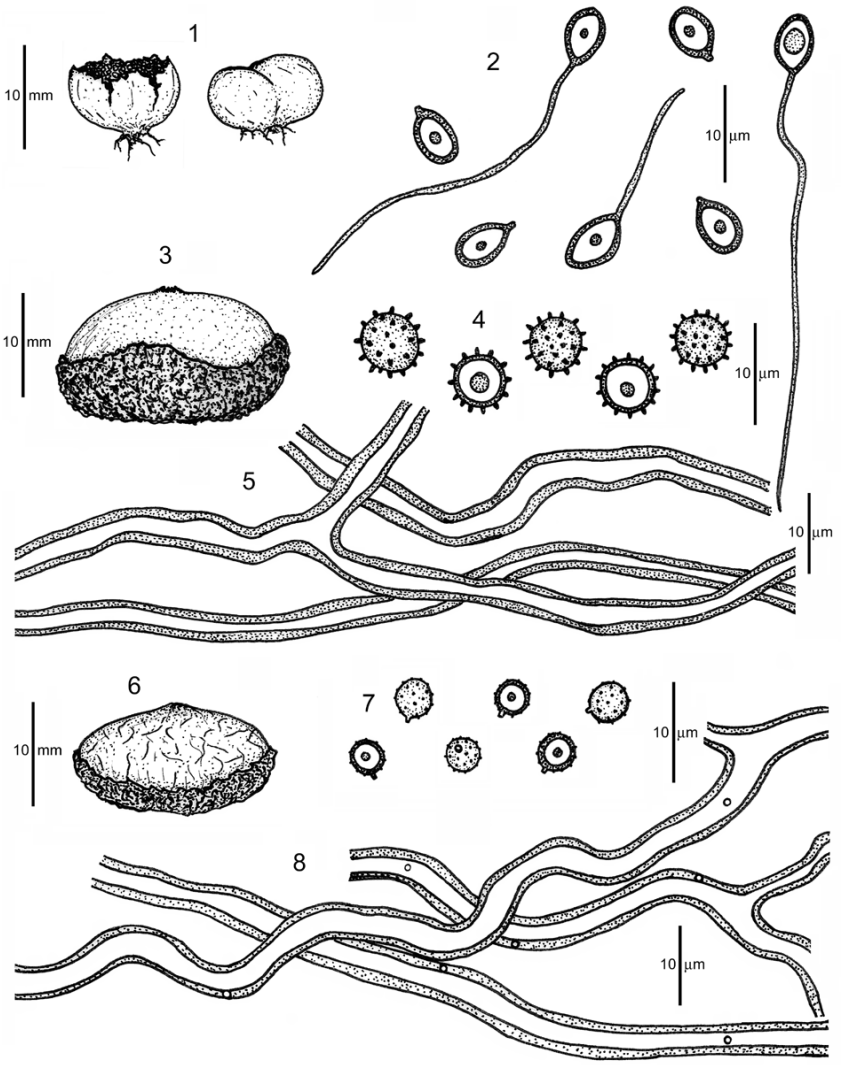
GEOGRAPHICAL DISTRIBUTION — Europe (CALONGE, 1998; SARASINI, 2005), North America (COKER & COUCH, 1928; OCHOA & MORENO, 2006), South America (WRIGHT & ALBERTÓ, 2006). Brazil: only known from Rio Grande do Sul.

DISCUSSION — The material is preserved in the Fungi Rickiani collection as *Catastoma subterraneum* (Peck) Morgan, but it was not included in RICK (1961). This name is considered a synonym of *D. bovista* by several mycologists and the most important features are larger basidiomata and basidiospores, the latter with a conspicuous subcylindrical ornamentation, and a poreless eucapillitium (CALONGE, 1998; OCHOA & MORENO, 2006). Although currently only known from Rio Grande do Sul, *D. bovista* may also occur in xerophilous environments in other parts of Brazil.

3. ***Disciseda candida*** (Schwein) Lloyd, *Mycol. Writ.* 1: 100, 1902. [Figs 6-8]

Basidioma 18 mm diam., 9 mm high, depressed-subglobose, basal rhizomorphs absent. Exoperidium about 1 mm thick, covered by abundant soil particles, occupying about one quarter of the basidioma size. Endoperidium papery to membranous, smooth or cracked, greyish brown (5D4) to light brown (5D5), dehiscence through a small, fimbriate peristoma. Gleba pulverulent, golden brown (5D7). Sterile base absent. Rhizomorphs absent. Basidiospores 3.4-4.2 µm diam., globose, smooth

to punctuate, shortly pedicellate (<0.7 µm long), yellowish under KOH. Eucapillitium 3-5.5 µm diam., commonly wavy, walls more or less thickened, hyaline to yellowish under KOH, with scattered and small pores, branches dichotomous, septa not seen.



Figs 1-2. *Arachnion album*: 1, basidiomata; 2, basidiospores. Figs. 3-5. *Disciseda bovista*: 3, basidioma; 4, basidiospores; 5, eucapillitium. Figs. 6-8. *Disciseda candida*: 6, basidioma; 7, basidiospores; 8, eucapillitium.

EXAMINED SPECIMENS — Brazil, RIO GRANDE DO SUL: Cacequi, 1935, *J. Rick* (PACA 12698).

GEOGRAPHICAL DISTRIBUTION — Australia (GRGURINOVIC, 1997); Europe (CALONGE, 1998; SARASINI, 2005), North America (COKER & COUCH, 1928; OCHOA & MORENO, 2006), South America (WRIGHT & ALBERTÓ, 2006). Brazil: only known in Rio Grande do Sul (RICK, 1961).

DISCUSSION — This species is distinct from the other *Disciseda* spp. by virtue of the weakly ornamented basidiospores, which seems to be smooth under light microscopy, but punctuated structure can be seen in most basidiospores. Such as other members in the genus, it is considered a rare species, and the studied material was collected in a region of intense desertification in Rio Grande do Sul (SUERTEGARAY *et al.*, 2001). It was reported by RICK (1961) as *Catastoma circumscissum*, considered a later synonym (CALONGE, 1998).

DOUBTFUL TAXA

Arachnion iriemae Rick — The species, described by RICK (1961) from Rio Grande do Sul, was not preserved or deposited in any consulted herbarium. Consequently, it should be considered a doubtful species.

Arachnion foetens Speg. - Also reported by RICK (1961), but without preserved specimens.

SUMÁRIO

Os gêneros *Arachnion* e *Disciseda* (*Lycoperdaceae*, *Basidiomycota*) foram estudados durante a revisão dos fungos gasteróides do Rio Grande do Sul, Brasil. Com base no material coletado e estudo de exsicatas de herbários, as seguintes espécies foram identificadas: *Arachnion album, Disciseda bovista* e *D. candida*. Todas espécies são descritas e ilustradas.

PALAVRAS CHAVE: mycobiota; diversidade; descrição; taxonomia

SUMMARY

The genera *Arachnion* and *Disciseda* (*Lycoperdaceae*, *Basidiomycota*) were studied during the revision of the gasteroid fungi from Rio Grande do Sul State, in southern Brazil. Based on the study of fresh and herbarium specimens, the following species were identified: *Arachnion album, Disciseda bovista* and *D. candida*. All taxa are described and illustrated.

KEY-WORDS: mycobiota; diversity; description; taxonomy

RÉSUMÉ

Les genres *Arachnion* et *Disciseda* (*Lycoperdaceae*, *Basidiomycota*) ont été étudiés lors de la révision des gastéromycètes du Rio Grande do Sul, au sud du Brésil. Basé sur l'étude des frais et des spécimens d'herbier, les espèces suivantes ont été identifiées: *Arachnion album, Disciseda bovista* et *D. candida*. Tous les taxons sont décrits et illustrés.

MOTS CLÉS: mycobiota; diversité; description; taxonomie

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BIBLIOGRAPHY

ASSOCIAÇÃO PLANTAS DO NORDESTE [APNE]. 2009. Lista de Fungos do Herbário Pe. Camille Torrend (URM), Departamento de Micologia, Universidade Federal de Pernambuco. Available at: <http://www.plantasdonordeste.org/herbarios/relatorios/URM_html_5.html> Access in 22 September 2009.

BATES, S. T.; R. W. ROBERSON & D. E. DESJARDIN. 2009. Arizona gasteroid fungi I: *Lycoperdaceae* (*Agaricales*, *Basidiomycota*). *Fungal Diversity 37*: 153-207.

BOTTOMLEY, A. M. 1948. Gasteromycetes of South Africa. *Bothalia 4:* 473-810.

CALONGE, F. D. 1998. *Flora Mycologica Ibérica 3*. *Gasteromycetes*. Berlin: J. Cramer.

CALONGE F. D.; B. MORENO-ARROYO & J. GÓMEZ. 2000. Aportación al concocimiento de los Gasteromycetes, *Basidiomycotina*, de Bolivia (América del Sur). *Geastrum ovalisporum* sp. nov. *Boletin de la Sociedad Micológica de Madrid 25*: 271-276.

COKER, W. C. & J. N. COUCH. 1928. *The Gasteromycetes of the Eastern United States and Canada.* Chappel Hill, University of North Carolina.

CORTEZ, V. G.; I. G. BASEIA & R. M. B. SILVEIRA. 2008a. Gasteromicetos (*Basidiomycota*) no Parque Estadual de Itapuã, Viamão, Rio Grande do Sul, Brasil. *Revista Brasileira de Biociências 6*: 291-299.

CORTEZ, V.G.; I.G. BASEIA; R.T. GUERRERO & R.M.B. SILVEIRA. 2008b. Two sequestrate cortinarioid fungi from Rio Grande do Sul, Brasil. *Hoehnea 34:* 513-518.

CORTEZ, V. G.; I. G. BASEIA & R. M. B. SILVEIRA. 2009. Gasteroid mycobiota of Rio Grande do Sul, Brazil: *Tulostomataceae*. *Mycotaxon 108:* 365-384.

CORTEZ, V. G.; I. G. BASEIA & R. M. B. SILVEIRA. 2010. Gasteroid mycobiota of Rio Grande do Sul, Brazil: *Lysuraceae*. *Acta Scientiarum, Biological Sciences*: in press.

DEMOULIN, V. 1972. Observations sur le genre *Arachnion* Schw. (Gasteromycetes). *Nova Hedwigia* 21: 641-655.

GRGURINOVIC, C. 1997. *Larger fungi of South Australia*. Adelaide, The Botanic Gardens of Adelaide and State Herbarium.

KASUYA, T.; T. ORIHARA; T. FUKIHARU & S. YOSHIMI. 2006. A lycoperdaceous fungus, *Arachnion album* (*Agaricales, Arachniaceae*) newly found in Japan. *Mycoscience* 47: 385-387.

KIRK, P. M.; P. F. CANNON; J. C. DAVID & J. A. STALPERS. 2001. *Dictionary of the Fungi*. 9th ed. Wallingford, CABI.

KIRK, P. M.; P. F. CANNON; D. W. MINTER & J. A. STALPERS. 2008. *Dictionary of the Fungi*. 10th ed. Wallingford, CABI.

KORNERUP, A. & J. H. WANSCHER. 1978. *Methuen handbook of colour.* 3rd ed. London, Eyre Methuen.

KRÜGER, D. & A. GARGAS. 2008. Secondary structure of ITS2 ribosomal RNA provides taxonomic characters for systematic studies – a case in *Lycoperdaceae* (*Basidiomycota*). *Mycological Research* 112: 316-330.

LANDER, C. A. 1934. The development of the fruiting body of *Arachnion album*. *Journal of the Elisha Mitchell Scientific Society 50:* 275-282.

LARSSON, E. & M. JEPPSON. 2008. Phylogenetic relationships among species and genera of *Lycoperdaceae* based on ITS and LSU sequence data from north European taxa. *Mycological Research* 112: 4-22.

LLOYD, C. G. 1906. The genus *Arachnion*. *Mycological Notes 21:* 252-254.

LLOYD, C. G. 1917. The genus *Arachnion*. *Mycological Notes 46:* 643-645.

LONG, W. H. 1941. Studies in the Gasteromycetes: III. The family *Arachniaceae*. *Mycologia 33*: 350-355.

MILLER, O. K. & H. H. MILLER. 1988. *Gasteromycetes: morphological and development features.* Eureka, Mad River.

MITCHELL, D. H.; S. H. CHAPMAN & G. GRIMES. 1975. Studies of *Disciseda* (Gasteromycetes) in Colorado. *Mycologia 67:* 586-596.

MORENO, G.; A. ALTÉS & C. OCHOA. 2003. Notes on some type materials of *Disciseda* (*Lycoperdaceae*). *Persoonia 18:* 215-223.

OCHOA, C. & G. MORENO. 2006. Hongos gasteroides y secotioides de Baja California, México. *Boletín de la Sociedad Micológica de Madrid 30:* 121-166.

QUADRACCIA, L. 1996. Studies on Italian gasteromycetes. I. Two new species of *Arachnion* and *Radiigera* (*Basidiomycotina, Lycoperdales*) from Rome and its environs. *Mycotaxon 58:* 331-341.

RICK J. 1961. Basidiomycetes Eubasidii in Rio Grande do Sul, Brasilia. 6. *Iheringia, Série Botânica 9:* 451-480.

SARASINI, M. 2005. *Gasteromiceti epigei.* Trento, Associazione Micologica Bresadola.

SPEGAZZINI, C. 1889. Fungi Puiggariani. Pugillus I. *Boletín de la Academia Nacional de Ciencias de Córdoba 11:* 381-622.

SUERTEGARAY, D.M.A.; L.A. GUASSELLI & R. VERDUM (orgs.). 2001. *Atlas da arenização: sudoeste do Rio Grande do Sul*. Porto Alegre, Secretaria da Coordenação e Planejamento e Secretaria da Ciência e Tecnologia do Rio Grande do Sul.

WRIGHT, J.E. & E. ALBERTÓ. 2006. *Guía de los hongos de la región Pampeana. II. Hongos sin laminillas*. Buenos Aires, L.O.L.A.

ZELLER, S.M. 1949. Keys to the orders, families, and genera of the Gasteromycetes. *Mycologia 41:* 36-58.

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