
Lycoperdon demoulinii
e
d
c
b
a

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Lycoperdon subg. ***Arenicola*** Alfredo, M.P. Martín & Baseia, *subg. nov.*

Etymology. Name refers to the basidiomata growing in sandy soil and the exoperidium encrusted with sand grains.

Classification — *Lycoperdaceae*, *Agaricales*, *Agaricomycetes*.

Basidiomata mature pyriform to turbinate, *exoperidium* incrusted with grains of sand, ornamentation of two types: verrucae in specimens of *L. arenicola* or spines in specimens of *L. demoulinii*; the apical ornamentation falling off with age, leaving a smooth to areolate surface of the endoperidium; *gleba* powdery with age. *Basal exoperidium* composed of chains of globose to subglobose sphaerocysts at the spine base, and arranged in regular chains of cells in the spine apices (like in *L. perlatum*). *Apical endoperidium* composed of mycosclerids with irregular form, apical dehiscence composed of interwoven hyphae with inflated terminations. *Capillitium* aseptate and branched. *Paracapillitium* absent or septate and incrusted with amorphous hyaline glebal membrane (in specimens of *L. arenicola*). *Basidiospores* globose, punctate to slightly verrucose (A–B) (sensu Demoulin (1972), where A–D indicates smooth/punctate basidiospores 'A' to strongly verrucose 'D') under light microscope, and minute verrucae under Scanning Electron Microscope.

Ecology & Distribution — The specimens of *Lycoperdon* subg. *Arenicola* have single to gregarious habitats, growing in Atlantic rainforest on sand dune or in amazon rainforest (*L. arenicola* species). Until now, the distribution of *L.* subg. *Arenicola* is restricted to Brazil.

Type species. *Lycoperdon arenicola* (Alfredo & Baseia) Baseia, Alfredo & M.P. Martín.

MycoBank MB818186.

Lycoperdon demoulinii Baseia, Alfredo & M.P. Martín, *sp. nov.*

Etymology. In honour to Prof. Vincent Demoulin, for his contribution to the study of the genus *Lycoperdon*.

Basidiomata mature epigeous, pyriform to turbinate, 16–20 × 11–21 mm. *Exoperidium* incrusted with grains of sand, ornamentation of black spines (14F4) 0.6–1 mm long at the apical portion, and black verrucae (14F3) at the basal portion; the apical spines falling off with age. *Endoperidium* yellowish white (3A2) to yellowish grey (3A3), surface marked by areoles. *Gleba* powdery brown. *Basal exoperidium* composed of globose to subglobose sphaerocysts, 20–39 × 19–27 µm, disposed in non-regular chain at the base of the spines, which remains on endoperidium surface after the spines have fallen off, walls 1–2.2 µm thick, while the spines are formed by regular chains of sphaerocysts (like in *L. perlatum*), globose to pyriform, 21–28 × 14–18 µm, walls < 1.5 µm thick. *Apical endoperidium* composed of interwoven hyphae with inflated terminations, 8–17 µm diam, walls 1.3–2.2 µm thick, mixed with mycosclerids, irregular shape, 40–75 × 10–34 µm, walls 2–3.7 µm thick, weakly dextrinoid. *Capillitium* 3–5 µm diam, without pores and septa, walls 1–1.8 µm thick. *Paracapillitium* absent or rare. *Basidiospores* globose, 4–4.5 µm diam, punctate (A–B) often A in LM.

Ecology & Distribution — The specimens have a gregarious habitat, growing in the Atlantic rainforest on sand dunes. Until now the distribution of *L. demoulinii* is restricted to Brazil.

Typus. Brazil, Rio Grande do Norte, Natal, Parque Estadual Dunas de Natal, S35°21'40" W06°18'18", in dunes growing on sandy soil, 24 June 2006, leg. *M.M.B. Barbosa & I.G. Baseia* (holotype UFRN-Fungos 655, ITS and LSU sequences GenBank KU958307 and KU958308; isotype S35°21'40" W06°18'18", 11 May 2011, leg. *B.D.B. Silva et al.* UFRN-Fungos 2554, ITS and LSU sequences GenBank KU958309 and KU958310, MycoBank MB816279).

Notes — The molecular analyses, based on ITS and LSU nrDNA sequences, obtained by Alfredo et al. (2017) revealed *Lycoperdon* subg. *Arenicola* proposed here as the sister clade of *L.* subg. *Morganella.* Moreover, the two specimens of *L. demoulinii* grouped in a well-supported clade (bootstrap, bs = 100 %; posterior probability, pp = 1.0) and separate from *L. arenicola* (bs = 84 %, pp = 1.0).

Lycoperdon demoulinii can be clearly distinguished from *L. arenicola* since in *L. demoulinii* the exoperidium ornamentation is formed by big spines (0.6–1 mm long) that fall off leaving an endoperidium surface marked by areoles; while in *L. arenicola* these features are not present (Alfredo et al. 2014, 2017). *Lycoperdon americanum* and *L. echinatum* are species morphologically similar to *L. demoulinii* in that they have the exoperidium ornamentation formed by spines, and the endoperidium surface is areolate; in *L. demoulinii* the spines are smaller than in *L. americanum* (3 mm long) (Demoulin 1972) and *L. echinatum* (3–6 mm long) (Demoulin 1983, Calonge 1998). Also, the basidiospore ornamentation is different among these species: in *L. demoulinii* are mostly punctate (A) (although B can be found), whereas in *L. americanum* and *L. echinatum* they are verrucose (C).

Colour illustrations. Brazil, Rio Grande do Norte, Natal, Parque Estadual Dunas de Natal, field track of locality type where the specimens were collected; a. dry specimen; b. detail of exoperidium ornamentation; c. detail of endoperidium surface areolate; d. mycosclerids from apical endoperidium; e. capillitium and basidiospores punctate in LM. All images from holotype UFRN-Fungos 655. Scale bars: a = 10 mm; b–c = 2 mm; d = 20 µm; e = 5 µm.

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