

LYCOPERDACEAE—GASTEROMYCETES

THE IDENTITY OF *LYCOPERDON COMPLANATUM* DESF. AND ITS NOMENCLATURAL IMPLICATION

INTRODUCTION

Lycoperdon complanatum Desf., nom. illeg. (non Batsch 1786), was established by Desfontaines (1799) to accommodate a fungus growing in arid soil from an unspecified locality in Algeria, North Africa. The taxon still remains known from the original collection only and its taxonomic status has been uncertain ever since it was first described. Desfontaines's original diagnosis is rather cryptic and ambiguous and of no use at all to establish whether *L. complanatum* Desf. actually represented a good species or not: '*Lycoperdon acaule, orbiculatum; superne planum, leave; subtus lacunosum; margine acuto. Orbiculatum, depressum, sessile, planum, superne leave, subtus saepe lacunosum, irregulare; margine acuto, saepe dentate-lacero. Diameter 1–2 decimeter*'. Desfontaines thus merely and, as would later be revealed, quite incorrectly, described it as being a stalkless, flat, round fungus, 100–200 mm diam., with an acute, lacerated margin, flat, smooth upper surface and lacunose lower part. The illustration accompanying the original description (tab. 261, not 161 as cited in the protologue; accessible also through the Missouri Botanical Garden library's rare books web site at <http://ridgwaydb.mobot.org/mobot/rarebooks/>) depicts dorsal (outer surface viewed from above) and lateral views of the specimen, but those are also without any significant diagnostic features.

In view of the illegitimacy of *Lycoperdon complanatum* Desf., Rafinesque's (1814) use of a new epithet was justified—whether intentionally or not—when he treated this fungus as *Omalycus erosus* Raf. Durieu & Léveillé, in Durieu de Maisonneuve (1848), correctly concluded that *L. complanatum* Desf. merely represented the sterile base of a mature puffball of which the peridium had already disintegrated and the gleba was absent. However, as explained in the note at the end of this paragraph, they erred in synonymising it in the protologue with their later (and, in that sense, superfluous and also illegitimate) *L. fontanesii* Durieu & Léveillé. According to Demoulin (1971), as well as our own interpretation of the original material of *L. fontanesii* at the cryptogamic herbarium of the Museum of Natural History in Paris (PC), this latter fungus is the same taxon as *Calvatia utriformis* (Bull.: Pers.) Jaap [or *Handkea utriformis* (Bull.: Pers.) Kreisel, if one prefers to accept the segregate genus *Handkea* Kreisel]. In his classic monograph of the genus *Lycoperdon*, Demoulin (1971) did not provide any further clarity on the identity of *L. complanatum* Desf. and, since he was unaware of the existence of the type material at P while revising *Lycoperdon* Pers.: Pers. at PC (V. Demoulin pers. comm.), he only referred to Desfontaines's original ambiguous illustration. He nevertheless correctly concluded that Desfontaines's fungus could not have been a *Lycoperdon*, but reserved further judgement regarding its true identity. [Explanatory note: *Lycoperdon fontanesii* Durieu & Léveillé is an illegitimate (superfluous) name only because it was synonymised in the protologue with the already existing *L. complanatum* Desf. (the only legitimate name for which, at that stage—and which should have been used in the protologue—was *Omalycus erosus*), not because of the synonymy with

Calvatia utriformis (such synonymy gives only the non priority of *L. fontanesii*.)]

During a visit to the Botanisches Museum Berlin-Dahlem (B) in 1998, the first author had the opportunity to study Desfontaines's herbarium (P-DESF at P) on microfiche, from which the surprising discovery was made that it included also two sheets of fungi, one of which represented the original material used by Desfontaines in drafting the description of his *Lycoperdon complanatum*. This specimen in P-DESF is a probable holotype (ICBN Art. 9.1, Note 1) but, as is the opinion also of V. Demoulin (pers. comm.), it must rather be regarded as a lectotype since no reasonable proof exists that it really was the only material seen by Desfontaines. It is therefore here designated as such, conforming with ICBN Art. 9.9 (Greuter *et al.* 2000). This material seems to have been overlooked by all investigators since Durieu & Léveillé (1848), although enquiry confirmed that it still existed in good condition in the phanerogamic herbarium (P) of the Museum of Natural History in Paris [and not the cryptogamic herbarium (PC) as might have been expected]. Since Desfontaines's material formed part of the 'historical' collection at P, it was unfortunately not available on loan. A full-colour electronic image of the material was obtained but, although it provided more information than Desfontaines's original illustration, it was still inadequate to allow identification. It did, however, indicate the presence of small bits of glebal tissue still adhering to the base of the specimen, a study of which would certainly throw more light on the identity and status of this fungus. To that purpose the first author undertook a brief study visit to P in 2002, the outcome of which is reported below.

EXAMINATION OF THE LECTOTYPE OF *LYCOPERDON COMPLANATUM* DESF.

Methodology: the lectotype was examined macroscopically and microscopically at P-DESF. Macroscopic observations were aided using a 10× magnifying hand lens. Permission was obtained to remove a small tuft of glebal tissue and a tiny piece of endoperidium from the lectotype for microscopic study. The material was mounted in lactic acid with aniline blue and briefly heated over an open flame to determine the cyanophilic reaction as described by Kreisel (1967). Initial microscopic observation at P-DESF was made with a Nikon SE binocular light microscope, but measurements were carried out in the first author's laboratory using a Reichert-Jung Polyvar research microscope. Slides were sealed with clear nail varnish and deposited in the slide collection of the H.G.W.J. Schweickerdt Herbarium (PRU), Department of Botany, University of Pretoria, Pretoria.

Macroscopic observations: the lectotype of *L. complanatum* Desf. consists of a single herbarium sheet on which the two halves of a single, vertically sectioned and pressed fungus are mounted, inside and outside surfaces facing respectively. The specimen, that must have measured ± 90 mm diam. before sectioning, consists only of

the flattened sterile base of a relatively large puffball of which the gleba and surrounding upper section of the peridium had almost completely disintegrated and disappeared. Small amounts of glebal tissue can, however, still be observed in places adhering to the exposed upper surface of the subgleba. Remnants of the basal part of the endoperidium, just above and along the circumference of the subgleba, are also still present. The outer surface of the subgleba is reddish brown with a suede-like texture, but a very thin glossy layer, pale brown in colour and with a metallic sheen, is still present here and there in surface folds. Remnants of what appears to have been part of the exoperidium, now blackish brown, occur near the very base of the specimen. The inner surface of the subgleba is dull greyish brown.

Apart from the name '*Lycoperdon complanatum*', the herbarium label contains no additional information and merely reads: 'Herbier de la FLORE ATLANTIQUE donné au Muséum, par M. DESFONTAINES'. Included also with the lectotype, however, is Desfontaines's (1799) original handwritten description as published in *Flora Atlantica*.

Microscopic observations: *capillitium* septate, branched, 2.0–4.5 µm diam., occasionally slightly swollen at septa, terminating in relatively blunt, rounded tips, ± 2 µm diam., disarticulating at or rupturing between septa; *capillitial walls* ± 0.25–0.75 µm thick, appearing smooth and imperforate at first glance but careful observation reveals segments densely pitted with small wall perforations <1 µm wide, immediate cyanophilic reaction not intense but walls staining bright blue over time. *Spores* globose, apedicellate, brownish, poorly cyanophilic, even over time, distinctly verrucose, ornamentation up to 1 µm high, diameter mostly 5–7 µm without and 6.5–9.0 µm with ornamentation. *Endoperidium* consisting of fragile, positively cyanophilic, branched, septate, often bent and contorted hyphae, breaking up into numerous short fragments when pressure is applied; swollen, short, barrel-, spindle- or irregularly shaped sphaerocyst-like elements present between and continuous with unswollen peridial hyphae.

Taxonomic conclusion: after studying the material in P-DESV, the current authors are quite convinced that *L. complanatum* Desf. is conspecific with the common and cosmopolitan puffball, *Calvatia cyathiformis* (Bosc) Morgan, and not with *C. utriformis* (= *Lycoperdon fontanesii*) as has been suggested by Durieu & Léveillé (1848), De Toni (1888) and Mussat (1901). Macroscopically, Desfontaines's material is reminiscent of both *C. utriformis* and *C. cyathiformis*. Microscopically, however, *C. utriformis* is characterized by spores that are smooth under the light microscope and by essentially aseptate capillitium threads with slit-like wall perforations. The septate capillitium threads with numerous small, not slit-like wall perforations, and the distinctly verrucate spores of *L. complanatum* Desf. therefore convincingly distinguish it from *C. utriformis*.

On the other hand, in terms of spore as well as capillitial morphology, Desfontaines's specimen closely matches *C. cyathiformis*, a fungus that we are well acquainted with and which, from the material/records at PC, also seems to be quite common in Algeria. Although a cursory look at the

capillitium of Desfontaines's fungus may create the impression that the walls are not perforated, careful observation reveals many capillitial segments and fragments that are densely pitted with small perforations, identical to and indistinguishable from the capillitium of *C. cyathiformis*. The spore ornamentation of *L. complanatum* Desf. appears to be somewhat more pronounced than what we have become accustomed to in *C. cyathiformis*, but is still within the range as has been described for the latter fungus (Zeller & Smith 1964). A frequently overlooked diagnostic character of *C. cyathiformis* is the occurrence of swollen, often irregularly shaped sphaerocyst-like elements in its endoperidium. In the course of our comparative studies on South African Lycoperdaceae, and in concurrence with the opinion of V. Demoulin (pers. comm.), we have found these elements, previously described in Calonge & Demoulin (1975) and Moyersoen & Demoulin (1996) and adequately illustrated also in Dominguez de Toledo (1993) and Migliozi & Coccia (1999), to be a very constant, reliable and easily observable diagnostic feature of *C. cyathiformis*. Hence the presence of similar cells in the investigated peridium fragment strengthens our conviction that Desfontaines's *L. complanatum* and *C. cyathiformis* are conspecific.

NOMENCLATURE IMPLICATION

When he established the genus *Omalycus*, Rafinesque (1814) also included *Lycoperdon complanatum* Desf. in his new taxon, renaming it *Omalycus erosus* Raf. No original material of *Omalycus violacinus* Raf., the type species of the genus *Omalycus*, has survived, therefore, it has never been possible to determine the taxonomic status of *Omalycus* with certainty. Note, however, that our acceptance of *O. violacinus* as type species is provisional, and follows the interpretation of Farr *et al.* (1979). There is some doubt as to whether the protologue in Rafinesque (1814) provides enough evidence to justify the selection of *O. violacinus* as the type species. Seeing that *O. violacinus* was not explicitly indicated as type species by Rafinesque, and that the genus *Omalycus* was not monotypic when established, then it may be argued that *O. erosus* could, in the light of ICBN Art. 10.1. Note 1, be regarded, by analogy, as a syntype of the genus *Omalycus*. If the latter interpretation is followed, then Farr *et al.* (1979) unintentionally lectotypified *Omalycus*. In view of the existence of original material of *L. complanatum* Desf., the appointment of *O. erosus* (= *L. complanatum* Desf.) as lectotype might have been more appropriate (ICBN Art. 9.10 and Art 10.2).

Although De Toni (1888), relegated *Omalycus* to synonymy under *Scleroderma* Pers. (1801): Pers., more recent authors listed it as a probable synonym of *Calvatia* Hawksworth *et al.* 1995; Kirk *et al.* 2001). In the absence of any substantial evidence, however, the question remained: was *Omalycus* really a *Calvatia* or might it perhaps have been a *Scleroderma*? In the light of our conclusion that *Lycoperdon complanatum* Desf., and therefore also *Omalycus erosus*, is indeed a good *Calvatia*, and taking also into account the opinion of V. Demoulin (pers. comm.) that *O. violacinus* is the same species, it is our firm conviction that Rafinesque's *Omalycus* must be regarded as a synonym of *Calvatia*, confirming earlier suggestions to that effect and refuting its placement in the genus *Scleroderma*. The nomenclature implication of this, however, is far-reaching.

Omalycus (1814) predates *Calvatia* Fr. (1849) by 35 years, and its adoption to cover species of *Calvatia* would require a considerable number of new combinations, something which is highly undesirable. Since *Calvatia* is already a *nomen conservandum*, it would be logical to add *Omalycus* to the list of rejected names against it, which would not preclude the use of *Omalycus* for a segregate including *C. cyathiformis*. A formal proposal to that effect has been submitted to the journal *Taxon*.

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