

A redistribution of *Ascophanus tityrii* Velen.

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Summary. A small discomycete growing on dung-inhabiting pyrenomycetes is shown to have been first described by Velenovsky under the name *Ascophanus tityrii* Velen. Its generic placement is discussed and a new combination in *Unguiculella* Höhn. is proposed. The species is redescribed based on type and recent material and shown to be widely distributed from Central and Western Europe to Sweden, Greenland and the USA. It shows marked interpopulational variability in hymenial and hair characteristics. Marked variability occurs also between southern material and specimens from Greenland.

INTRODUCTION

In ‘*Monographia Discomycetum Bohemiae*’, Velenovsky (1934) described in the genus *Ascophanus* Boud. a species with setose, protruding paraphyses. The sole collection on which the species was based was made from previous year’s cow dung. The apothecia were observed to grow on pyrenomycetous fruit-bodies. However, this was not the first time this species had caught the eye of a mycologist: an earlier specimen by H. Crouan & P. Crouan from 1870 bears the unpublished name *Peziza parasitica*. They found the species growing on ‘*Sordaria squamulosa*’ (= *Podospora squamulosa* (P. Crouan & H. Crouan) Niessl). More recently this species has been noted by few collectors. However, in the late 1950’s Prof. Nils Lundqvist became familiar with this curiosity and it is thanks to him that the type of Velenovsky’s *Ascophanus* can here be linked to present material. Several further collections of this species have come to light in recent years and the total number of known specimens is now twenty.

At first, Velenovsky’s placement of this tiny, setose species in *Ascophanus* seems odd. However, after repeated difficulties during the present study in interpreting the dehiscence mechanism of the asci, it does not seem quite so strange after all. The fungus exhibits taxonomic characteristics which could support its interpretation as either an inoperculate or an operculate species. For example, the almost totally symmetrical, firm-walled and eguttulate spores are like those of many dung-inhabiting operculates. Also, the lack of a clear apical thickening to the ascus and, especially, the uniformly thin-walled apex in mature asci, are seen in many operculate asci. These features may have led Velenovsky to place his species in *Ascophanus*. On the other hand, the tiny, parasitic, whitish, hairy apothecia are typical of the *Helotiales*. The characters of the hairs, excipulum and paraphyses

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suggest affinities to *Hyaloscyphaceae* Nannf., most notably to the genera *Unguiculella* Höhn. and *Unguiculariopsis* Rehm. The latter was referred by Zhuang (1988) to *Helotiaceae: Encoelioideae* based on excipular structure. Generic placement in *Unguiculella* is suggested here, albeit with some uncertainty.

***Unguiculella tityrii* (Velen.) Huhtinen & Spooner, comb. nov.**

Ascophanus tityrii (sub. *Tityri*) Velen., Monogr. Discom. Bohemiae: 361 (1934).

Holotype (by original designation ("semel")): [Czech Republic: Bohemia] Mnichovice, in fimo vaccino, May 1929, *Velenovsky* (PRM 150366, examined).

Apothecia 0.2 – 1.0 mm diam. when fresh, solitary or a few apothecia occurring together, often growing from pyrenomycete ostioles, or found in close proximity to perithecia, globular to convex, or shallowly cupulate, mostly narrowly sessile, greyish-white when fresh, outside smooth, margin minutely fimbriate, disc minutely scurfy; dry apothecia whitish, cupulate, with or without a short stipe, rarely clearly stipitate or disc prominently convex. *Ectal excipulum* of large-celled *textura prismatica*, cells on middle flanks 11 – 18 × 4 – 8 µm, thin-walled; walls hyaline, basally faintly brownish, CB-, CR- to faintly CR+, MLZ-. *Hairs* present in most populations, most abundant at the margin, similar but more scanty on flanks, in a few populations hairs scarce to totally lacking, narrowly conical to lageniform, undulating-straight to apically curved, smooth, aseptate, in most populations apically slightly firm-walled, refractive in CB, CR, dull in MLZ, wall CB-, CR+, in northern specimens CR-. *Asci* cylindrical-clavate, very variable in size, 22 – 32 × 7.5 – 10.0 µm at the lower end of variability (CR), 54 – 61 × 8.5 – 9.5 µm at the upper end of variability (CR), also showing marked variation within a single disc, eight-spored, apically rounded, lacking a well-developed pore, MLZ-, arising from croziers. *Spores* ellipsoid, with rounded apices, showing very little variability in size, 5.0 – 7.2 × 2.9 – 3.6 µm, $x = 5.9 \times 3.2$ µm, $Q = 1.6 - 2.1$, $Q = 1.8$ in CR and MLZ ($n = 30$, from 7 populations), aseptate, hyaline, smooth, firm-walled, mostly symmetrical, more rarely slightly inequilateral, without guttulae in dry material. *Paraphyses* of two types; those equalling the asci or often shorter than asci are cylindrical, thin-walled, 2.0 – 3.8 µm wide, terminal cell often slightly widened or lageniform, septal intervals typically short, 6 – 9 µm; the protruding paraphyses mostly similar to hairs, with refractive walls. Figs. 1 – 10.

ECOLOGY. All collections originate from dung, the species fruiting in nature in 12 collections and in moist chamber in 8 collections. The substrate is mostly cow dung (8) or rabbit pellets (6), but material has also been collected from dung of vole (1), musk-ox (3) and deer (1). Apothecia are mostly found in connection with perithecia, often growing directly from the ostiole. The perithecia all belong to species of *Podospora* Corda, namely *S. aloides* (Fuckel) J. H. Mirza & Cain, *S. conica* (Fuckel) A. E. Bell & Mahoney, *S. tetraspora* (G. Winter) Cain and *S. squamulosa*. Sometimes, apothecia appear to arise directly from the substrate but, in these cases, a developing, sunken fruit-body may have been undetected. Usually, one apothecium occurs on a single perithecium; more rarely, a perithecium supports several apothecia.

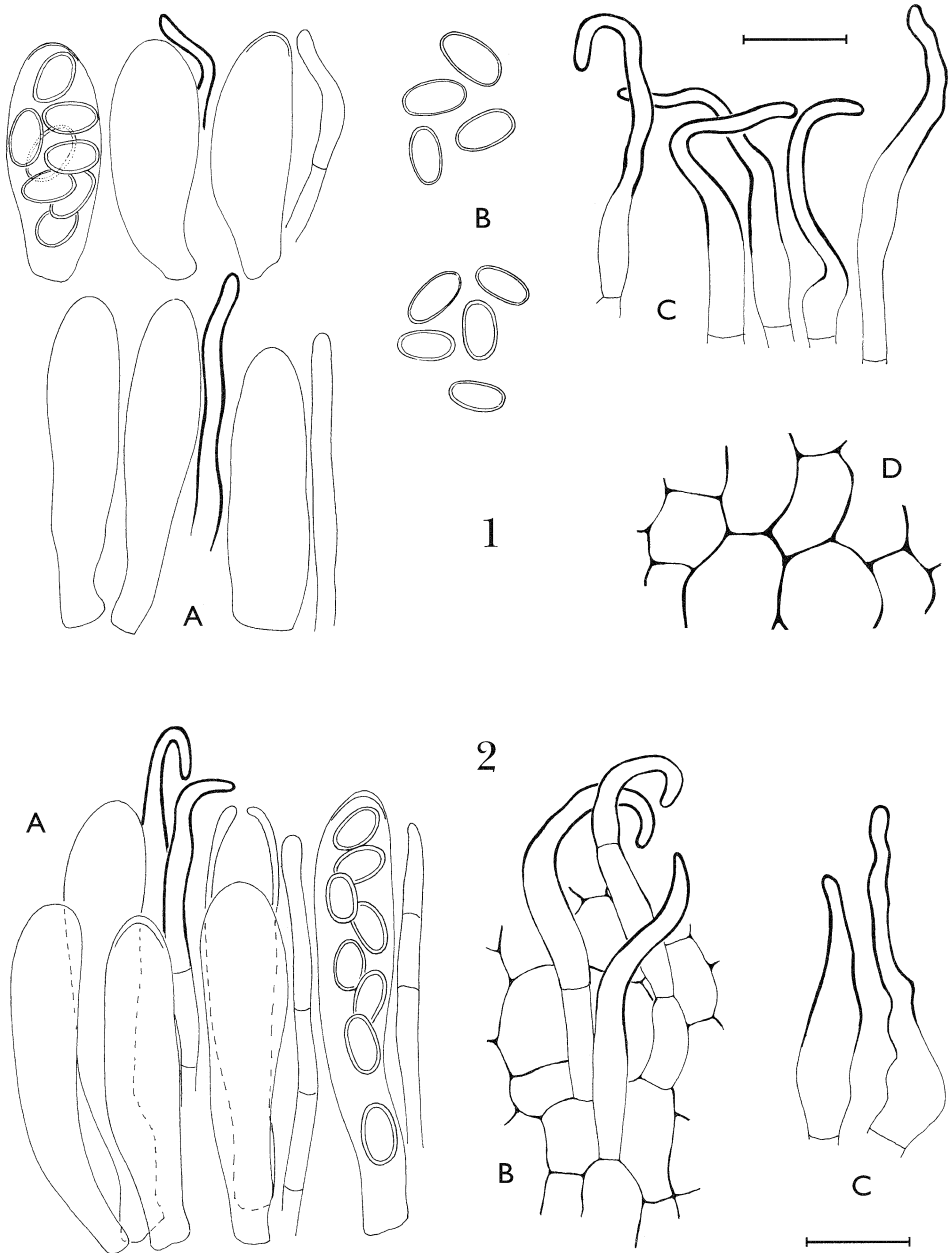
For an ecologically restricted species *U. tityrii* shows marked and surprising variability in many characters, although spores and excipular structure show little variation. Even though the spores are markedly uniform in size, ascus size varies greatly. The type collection shows the smallest and widest asci (Fig. 1). At the other end of the scale are populations with all asci twice or more than twice as long as those of the type (Figs. 5 – 7). Ascus size varies also within a single apothecium (Fig. 7, where two common types of asci are illustrated). In most populations apothecia are sessile to short-stalked, but in one population stipes exceeding the cup diameter were seen and in one the discs were prominently convex (Fig. 4).

However, the most problematic variability is seen in the hairs and paraphyses. Most lowland populations have abundant hairs with slightly thickened, refractive, CR+ walls (Figs. 1 – 2). The walls are typically congophilous throughout the refractive part, more rarely only in their central part. A typical feature is the presence of hair-like paraphyses which protrude from the hymenium. In some populations these are present only close to the margin, but definitely within the disc area. In some they occur throughout the disc. Such paraphyses are accompanied by thin-walled, 'normal' paraphyses, which are very often shorter than the asci. In a few populations these are scanty, but in most populations they are abundant. In one population from Scotland adjacent apothecia were clearly different (Fig. 3). One was without any hairs and showed only thin-walled, cylindrical paraphyses which did not exceed the asci. An adjacent apothecium had normal hairs and hair-like paraphyses concentrated around the marginal areas of the disc.

As this amount of variability is present within and between lowland populations, it is, perhaps, not surprising that material from Greenland shows additional variability in hairs and paraphyses (Figs. 8 – 10). Most arctic specimens are characterized by protruding, apically roughened paraphyses, which show slightly thickened, but CR- walls. Hairs are scanty or almost totally lacking even at the margin. No traces of CR+ refractive walls, so typical of lowland material, can be seen. However, the spores are identical to those of lowland specimens, and the asci are close to the mean.

The variation forms a fairly long continuum but there are, however, no discontinuities which would suggest division into different taxa. The material is best accepted as a single taxon with some stable and some variable characters.

Although Velenovsky (1934) described the hairs of this species as clavate, it is clear from examination of herbarium material that this is a misinterpretation. He did not see the characteristic hooked hairs and those he described seem likely to have belonged to a species of *Podospora* with which the apothecia may be associated. Nevertheless, the generic placement of this species is not without problems as it exhibits characters in common with several genera. It resembles *Hyaloscypha* Boud. in the tapered, mostly non-septate hairs, but the firm-walled, symmetrical spores and firm-walled, protruding paraphyses are both atypical for this genus. The paraphyses would also be anomalous in the genus *Phialina* Höhn., in which the hairs are morphologically similar but contain a yellow pigment (Huhtinen 1990). It resembles *Hamatocanthoscypha* Svrček in hair type and/or ascus and paraphysis characters and in excipular structure. In that genus, apothecia have an excipulum of hyaline, thin-walled, prismatic to angular cells and hairs which are curved or

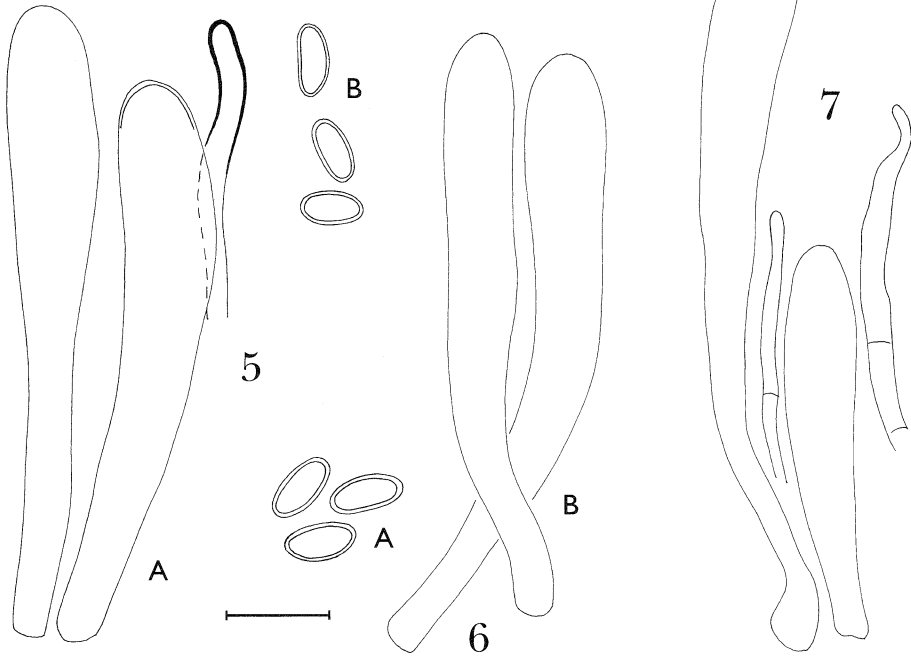
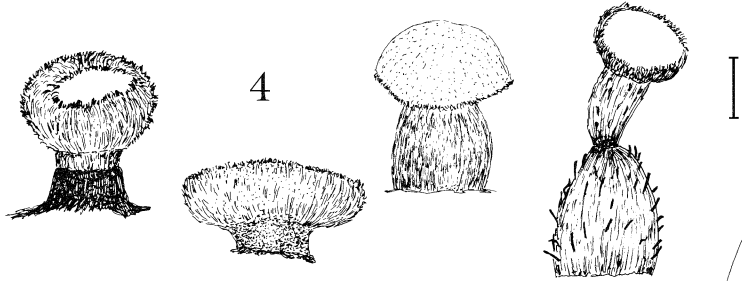
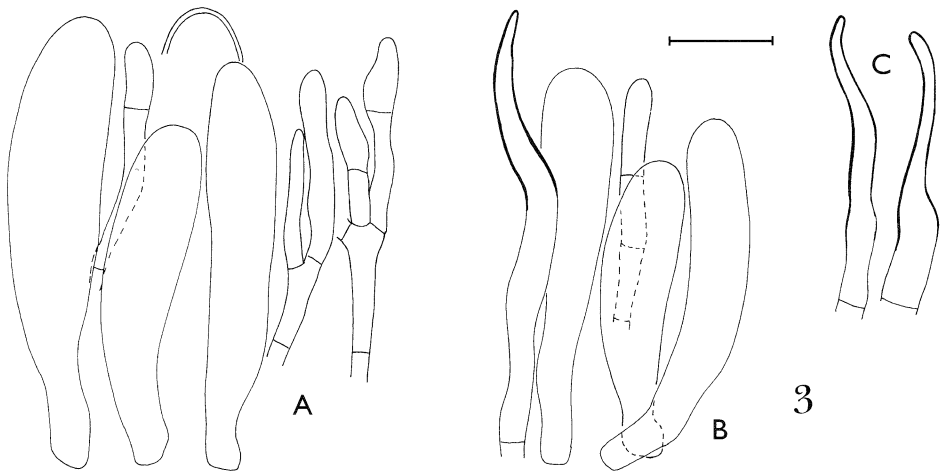


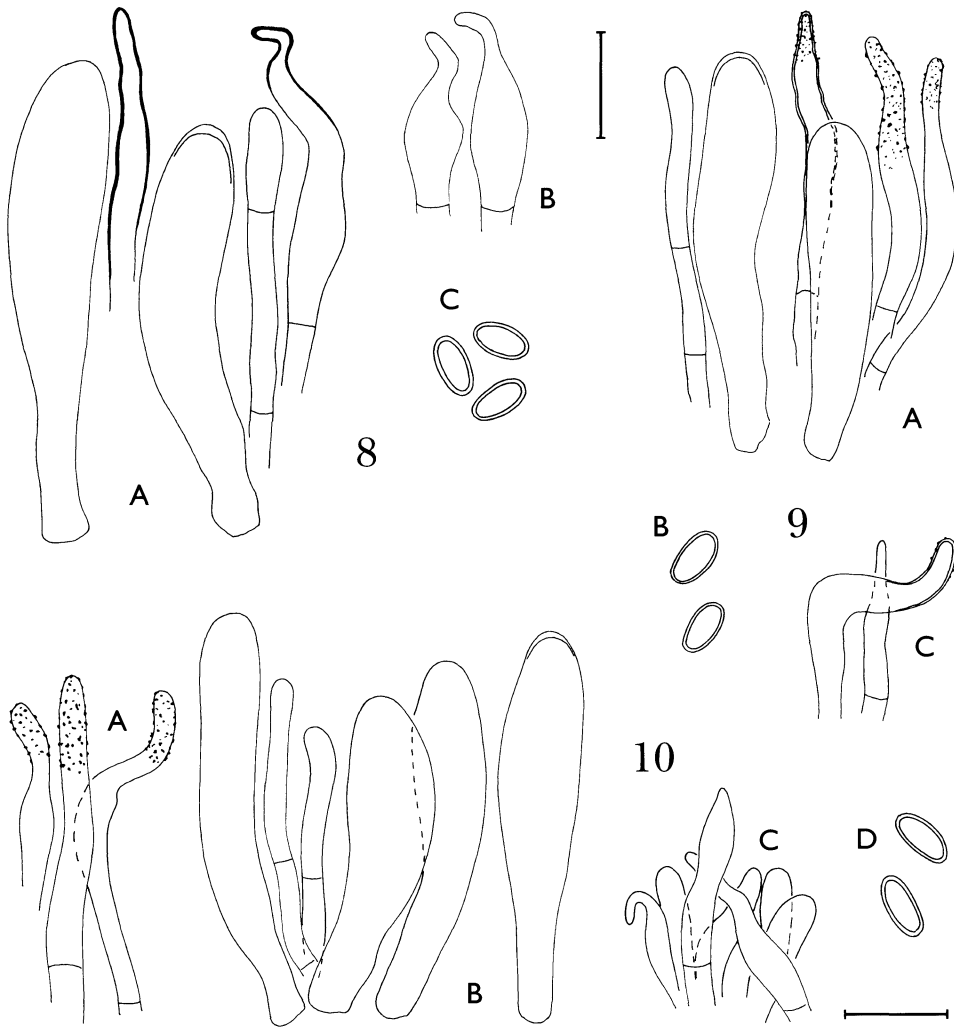
FIGS 1–2. *Unguiculella tityrii*. FIG. 1. **A–D** holotype, in Congo red. **A** asci and two types of paraphyses; **B** spores; **C** marginal hairs; **D** ectal excipulum in surface view. FIG. 2. **A–C** *Richardson* 130/97, in Melzer's reagent. **A** asci and paraphysis; **B** hairs on medial flanks; **C** marginal hairs. Scale bar = 10 μ m.

hooked and hyaline. These hairs may also have somewhat thickened walls or solid apices, although this is due solely to deposition of pigment (Huhtinen 1990). However, they differ significantly from the present species in their asci typically having the apical pore blue in Melzer's reagent, though this is lacking in some species referred there. Furthermore, *Hamatocanthoscypha* species are not fungicolous but usually 'detriticolous', occurring on plant litter, or rarely on more bulky wood.

The present species appears most similar to species of *Unguiculella* and *Unguiculariopsis*, both of which have hooked, tapered hairs. From the monograph of *Unguiculariopsis* by Zhuang (1988) it may be concluded that this genus is fairly homogeneous in its ecology and morphological characteristics. However, later additions to the genus, most of which are lichenicolous (Alstrup & Hawksworth 1990; Kondratyuk *et al.* 1994; Kondratyuk & Galloway 1995a, b; Etayo & Diederich 1996; Diederich & Etayo 2000; Zhuang 2000), differ from typical members of the genus in hair characters and excipular structure and may prove better referred elsewhere. Addition of the present species to *Unguiculariopsis* would still further widen the overall variation within the genus, especially in spore and excipulum features. Furthermore, no other species with thick-walled spores, nor with hyaline excipulum, are so far included in it. Most species have thin-walled, though similarly small and unicellular, spores and brown to dark brown excipular elements. An equally typical feature throughout the genus seems to be the rounded ascus apices which lack any clearly visible pore and colour reactions in MLZ. The fungicolous habit, the hairs, and the asci of *A. tityrii* are typical of this genus, but the pale, thin-walled excipulum is not.

The generic concept of *Unguiculella* has widened since the days of Höhnelt, but the main differences from *Unguiculariopsis* listed by Zhuang (1988), viz. excipular structure, excipular cell colour, hair colour and shape of paraphyses, characterize many species. All have curved to hooked hairs very similar to those of *A. tityrii* and the asci are similarly rounded at the apex and show no reaction in Melzer's reagent. Furthermore, the paraphyses, at least in typical species (Huhtinen 1990), are apically modified. Höhnelt's original definition of the genus includes use of the term "Granne". This referred not only to paraphyses with totally solidified, protruding apices but also to those with protruding, hooked apices with walls merely thickened (Huhtinen 1990), as in *A. tityrii*. However, the excipulum in *Unguiculella* typically comprises *textura prismatica* with brownish walls, though there are several exceptions. Furthermore, the firm-walled, symmetrical spores pose a taxonomic problem in being atypical of *Unguiculella*, although it is not clear how much taxonomic weight one should place on this, a relatively rare character amongst the inoperculates. Finally, the fungicolous habit in the present species is also atypical of *Unguiculella*, but is nevertheless characteristic of several species placed there, viz. *U. aggregata* (Feltgen) Höhnelt. (Höhnelt 1906), *U. meliolicola* Dennis (Dennis 1955), *U. jamaicensis* W. Y. Zhuang & Korf (Zhuang & Korf 1989), *U. nectriiphila* Svrček (Svrček 1992) and *U. oregonensis* (Kanouse) Dennis (Dennis 1963). These resemble the present species in various respects, and in *U. jamaicensis* the apothecia are white, with similar excipular structure and two types of paraphyses. It is to these that the present species seems most closely allied, and the combination in *Unguiculella* is therefore proposed.





FIGS 3–7 (opposite). Variability in *Unguiculella tityrii*. FIG. 3. **A–C** *Wilberforce*, 7 March 1999. **A** asci and paraphyses from a hairless apothecium, in Congo red; **B** asci and paraphyses from an adjacent apothecium, in Cotton blue; **C** marginal hairs from the same apothecium, in Cotton blue. FIG. 4. Range of interpopulational variability of dry apothecia. FIG. 5. **A, B** *Lundquist* 4102c, in Congo red. **A** asci and paraphyses; **B** spores. FIG. 6. **A, B** *Lundquist* 3414c, in Melzer's reagent. **A** spores; **B** asci. FIG. 7. *Richardson* 28/97, types of asci and paraphyses from the same disc, in Congo red. Scale bar = 10 μ m, for apothecia 100 μ m.

FIGS 8–10 (above). Greenland specimens of *Unguiculella tityrii*. FIG. 8. **A–C** *Mogensen* GP 83.04 **A** asci and paraphyses, in Congo red; **B** marginal hairs, in Melzer's reagent; **C** spores. FIG. 9. **A–C** *Mogensen* GP 83.17, in Congo red. **A** asci and paraphyses; **B** spores; **C** marginal hairs. FIG. 10. **A–D** *Mogensen* GP 83.30, in Congo red. **A** apically rough paraphyses; **B** asci and paraphyses; **C** detail from margin; **D** spores. Scale bar = 10 μ m.

Further observations on fresh material would be of great interest and might further clarify the taxonomic position of this taxon.

SPECIMENS EXAMINED. DENMARK: Mon, Ulvshale, 18 March 2000, *Læssøe* (C). FRANCE: Finistère, 6 March 1870, *H. Crouan & P. Crouan* (UPS, slide). GREENLAND: East Greenland, Peary Land, 83°N, 28°W, on musk ox dung, Aug. 1983, *Mogensen* (GP 83.04, GP 83.17, GP 83.30, C). SWEDEN: Småland, Hälleberga parish, Långaskruv, on cow dung, 6 June 1962, *Lundqvist* 3354b (UPS); Östergötland, Skärkind parish, Bäckeby, on cow dung, 5 June 1962, *Lundqvist* 3347c (UPS); Södermanland, Aspö parish, Aspö Island, on cow dung, 30 May 1959, *Lundqvist* 2022e (UPS); Uppland, Nysätra parish, W of Sjövik at Lake Alsta, on cow dung, 24 May 1959, *Lundqvist* 2009b (UPS); Uppland, Dalby parish, Dalkarlskärret, 25 Aug. 1963, *Lundqvist* 4102c (UPS); Jämtland, Hackås parish, Östnår, on cow dung, 16 June 1962, *Lundqvist* 3414c (UPS). ENGLAND: Surrey, nr Esher, The Ledges, on rabbit dung, 2 May 1993, *Spooner* (K(M) 23971). SCOTLAND: Inverness-shire, Cairngorm, on red deer dung, 26 May 1997, *Richardson* 28/97 (E); Argyll, Benderloch, Tralee Bay, on rabbit dung, 7 March 1999, *Wilberforce* (K(M) 60822); Midlothian, N Allermuir, on rabbit dung, 30 Oct. 1997, *Richardson* 125/97 (E); Midlothian, Braid Hills, on rabbit dung, 22 Nov. 1997, *Richardson* 127/97 (E); Midlothian, Arthur's Seat, on rabbit dung, 5 Dec. 1997, *Richardson* 130/97 (E); Midlothian, Aberlady, on rabbit dung, 26 Dec. 1997, *Richardson* 140/97 (E); U.S.A.: Colorado, Castel Canyon, on cow dung, 19 July 1906, *Clements & Clements* (UPS, slide).

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