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STUDIES IN AMANITA—II

Miscellaneous notes

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Two new species are described in *Amanita* sect. *Amanita*, viz. *A. pulverotecta* Bas from southeastern Africa and *A. brunneoconulus* Bas & Gröger from central Europe. Type studies are given of *A. hyperborea* P. Karst. (a species related to *A. friabilis* and not to *A. vaginata*), *A. vaginata* f. *oreina* J. Favre (a synonym of *A. nivalis* Greville), and *A. sternbergii* Velen. (a synonym of *A. friabilis*).

1. AN UNDESCRIBED SPECIES OF AMANITA SECTION AMANITA FROM SOUTHEASTERN AFRICA

A specimen of a rather unusual species of *Amanita* from Malawi was kindly sent to me for identification by Dr. D. Pegler, Kew. It consists of a single large and rather fleshy carpophore with an exannulate clavate stipe and a dry powdery-granular pileal surface. There does not seem to be any type of volva and therefore the specimen does not immediately make one think of the genus *Amanita*. The divergent trama of the lamellae and the acrophysalidic tissue of the stipe nevertheless proof that the species concerned belongs to this genus. The volva is here apparently reduced to a thin powdery-granular layer that owing to a non-gelatinizing pileipellis seem to be part of the pileus itself.

No name being available for this remarkable fungus, the following new species is based upon it.

Amanita pulverotecta Bas, *spec. nov.* — Fig. 1

Pileus c. 150 mm latus, plano-convexus, margine laevis, albidus, fragmentis volvae granuliformibus vel pulveraceis, bubalinis ornatus. Lamellae subliberae, albidae vel pallide luteolo-bubalinae; lamellulae probabiliter truncatae. Stipes c. 175 mm longus, deorsum incrassatus, bulbo c. 25 mm lato, ventricoso, subradicanti praeditus, solidus, griseolo-pulverulentus vel griseolo-subsquamulosus, exannulatus. Volva pulveracea. Caro alba. Sporae 11-13 × 5.5-7.5 μm, ellipsoideae vel elongatae, inamyloideae. Fragmenta volvae cellulis turgidis, brunneo-flavidis, terminalibus vel subcatenulatis hyphisque inconditis composita. Fibulae absentes. Typus: '*B. Morris 186*, 21 III 1980, Malawi, Zomba Plateau' (K).

ETYMOLOGY: pulvis, powder; tectus, covered.

Carpophore large and robust. Pileus 150 mm wide, plano-convex (perhaps with slight central depression)[1], with (slightly inflexed) sulcate-striate (0.15 to 0.25 R) margin, whitish but densely

[1] Macroscopic characters placed between brackets observed in dried material.

sprinkled with pale buff powdery, at centre powdery-granular, remnants of volva, dry. Lamellae just touching apex of stipe, (moderately crowded), up to 16 mm wide, whitish with yellowish buff tinge (with conspicuous, minutely flocculose, white edge; only one lamellula clearly seen and that truncate). Stipe 175 mm long, gradually broadening downwards into a subventricose, 27 mm wide bulbous base with short (± 30 mm long) rooting point, solid (probably whitish), covered with greyish powdery to powdery-subsquamulose remnants (< 1 mm) of partial veil and volva, exannulate. Volva completely pulverulent. Context white, soft and brittle. Sporeprint not available.

Spores [10/1] (10.6-)10.9 × 12.8(-14.8) × 5.7-7.4 μm, ellipsoid or elongate or elongate-ovoid (Q = 1.6-2.0, mean 1.7^5), sometimes with slight suprahilar depression and somewhat tapering towards a rather broad and truncate apiculus, smooth, thin-walled, hyaline, usually with one large oil-drop, somewhat greenish in NH_4OH, inamyloid, not cyanophilous. Basidia 39-52 × 9.5-10.5 μm, 4-spored, clampless. Marginal tissue consisting of abundant small to relatively large, thin-walled, colourless, clavate, ellipsoid and globose cells 15-45 × 10-30 μm, terminal or in short rows, covered by an up to 200 μm thick strip of desintegrating elements. Trama of lamellae divergent (difficult to analyze in dried material). Subhymenium about 30-40 mm wide, almost pseudoparenchymatic, consisting of inflated ramose to (sub)globose cells. Pileipellis merely a dense, non-gelatinized cutis-like layer (in dried material brown probably from necropigment) between volval remnants and trama of pileus, made up of 3-7 μm wide, interwoven to subradial hyphae. Volval remnants on cap consisting of globose, ellipsoid, ovoid and more rarely elongate, yellow-brown inflated cells, 28-46 × 20-35 μm, terminal or sometimes in short rows, with somewhat encrusted walls, on slightly thick-walled, brownish yellow encrusted, 2.5-5.5(-7) μm wide, entangled hyphae. Granular volval remnants on base of stipe resembling those on pileus but without incrustations and inflated cells often with slightly thickened yellowish wall. Trama of stipe with abundant acrophysalides, 50-220 × 20-50 μm, and scanty oleiferous hyphae. Covering of stipe consisting of rather loose acrophysalidic tissue but at apex with crowded sphaeropedunculate, piriform and clavate terminal cells, 35-150 × 28-46 μm. Clamps absent from all tissues.

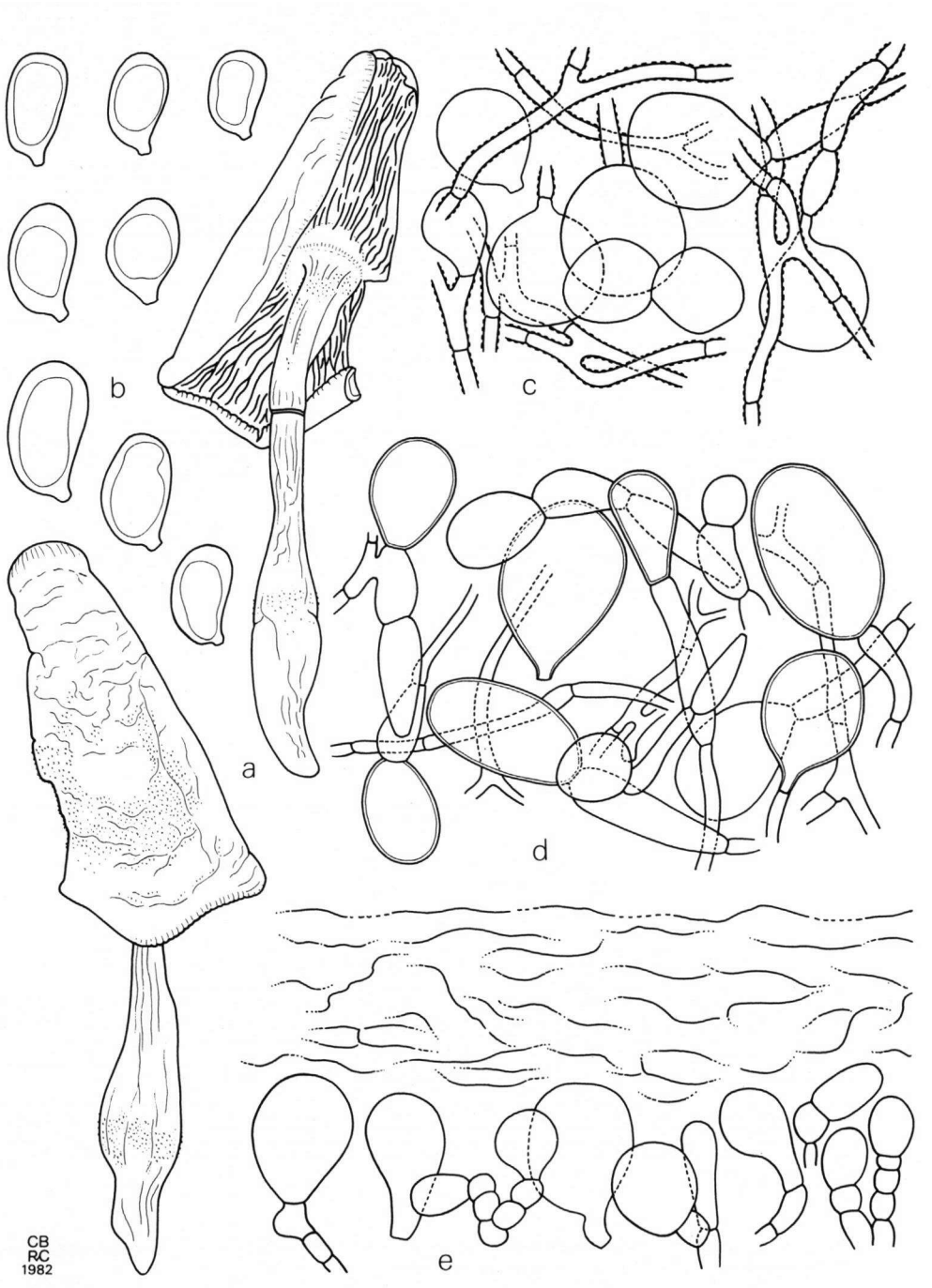
HABITAT & DISTRIBUTION. — Terrestrial at about 1000 m. alt.

COLLECTION EXAMINED.—MALAWI, Malose Mtn., Zomba Plateau, 21 March 1980, *B. Morris 186* (holotype, K).

The non-amyloid spores in combination with the sulcate-striate margin of the pileus and the bulbous base of the stipe render this species a member of section *Amanita*. There are a number of species in this section that have with *A. pulverotecta* a character in common that is somewhat unusual in *Amanita*, viz. a dry powdery or granular pileal surface caused by a pulverulent volval layer over a non-gelatinizing pileipellis. In addition the volval remnants on the base of the stipe are usually also pulverulent or granular and sometimes not or hardly dicernable in mature carpophores.

It was precisely this set of characters that lead Earle (*1909*: 449) to create the genus *Amanitella* for the North American species *Amanita farinosa* Schw. We know now that several other species show these characters also, e.g. *A. obsita* Corner & Bas (Malaya), *A. subvaginata* Clel. & Cheel

Fig. 1. *Amanita pulverotecta*. — a. Dried carpophore × ½. — b. Spores × 1250. — c. Elements of volval remnant on pileus × 500. — e. Strip of amorphous matter and underlying marginal cells at edge of lamella × 500 (all figs. from type).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(Australia), *A. xerocybe* Bas (Brasil). It is tempting to bring these species together in a taxon on subsectional level, but unfortunately among themselves they differ rather strongly in other aspects, such as very small, globose versus large, ellipsoid spores, annulus present or absent, etc. Moreover, some brightly coloured species like *A. bingensis* Beeli (Congo) might have to be placed in the same group and it seems that among these the transition from a dry pileipellis with adnate pulverulent volval remnants to a more or less gelatinized pileipellis with small, friable, wart-like volval remnants is very gradual.

It is not clear yet which characters should prevail in subdividing section *Amanita*.

Among the species in section *Amanita* with a dry pulverulent pileal surface, *A. pulverotecta* is easy to recognize by its large (> 10 μm) ellipsoid spores and its large and robust fruit-body.

2. An undescribed species of Amanita section Amanita from Central Europe

It is surprising that even nowadays in Europe a very characteristic and yet undescribed species of *Amanita* can be found. The species described here, discovered and very well annotated by Mr. F. Gröger, Warza (East Germany) is somewhat intermediate in habit between *A. inaurata* Secr. and *A. friabilis* (P. Karst.) Bas, but because of the presence of a primordial bulb it is, together with *A. friabilis*, to be placed in section *Amanita*, whereas *A. inaurata*, in which a primordial bulb is lacking, belongs to section *Vaginatae*.

Amanita brunneoconulus Bas & Gröger, *spec. nov.*—Fig. 2

Pileus 20–80 mm latus, hemisphaericus vel plano-convexus, exumbonatus, margine sulcatus, (pallide) brunneus, centro verrucis conicis, brunneis, minutis, 0.5–1 mm latis ornatus. Lamellae confertae, liberae, albae. Stipes 50–80 × 8–16 mm, basi subbulbosus, farctus vel cavus, exannulatus, pallide zonatus vel brunneo-zonatus, deorsum costis 1 vel 2 brunneis, angustis, annularibus ornatus. Caro alba. Sporae 10–12 × 9.5–11.5 μm, (sub)globosae, non-amyloideae. Volvae fragmenta conica in pileo deposita cellulis turgidis brunneis clavatis vel sphaeropedunculatis hyphisque ± erectis composita. Fibulae absentes. Typus: '*F. Gröger*, 27 June 1981, East Germany, Haina' (L).

ETYMOLOGY: brunneus, brown; conulus, small cone.

Carpophores subgregarious. Pileus in type 22–44 mm wide, in paratype up to about 80 mm wide[2], from almost hemispherical when young to plano-convex when mature, without umbo, with rather broad sulcate margin (0.25–0.3(–0.4) R), ochraceous brown[3], somewhat darker and slightly more reddish brown to olivaceous brown at centre and darker at sulcate marginal zone (because of darker radial ridges), smooth, not viscid, at centre densely set with small, 0.5–1 mm wide, truncate-conical volval warts towards margin gradually passing into somewhat larger, 2–3 mm wide, usually angular volval patches; volval warts and patches concolorous with pileus, but

[2] There are no field-notes on the paratype available; as the dried carpophores of this collection are considerably larger than those of the type, the measurements of the fresh carpophores as estimated from the dried ones are included in this description.

[3] In the field-notes on the type the following colours are mentioned for the pileus: ochraceous brown, pale brown, pale coffee-with-milk brown, wood brown.

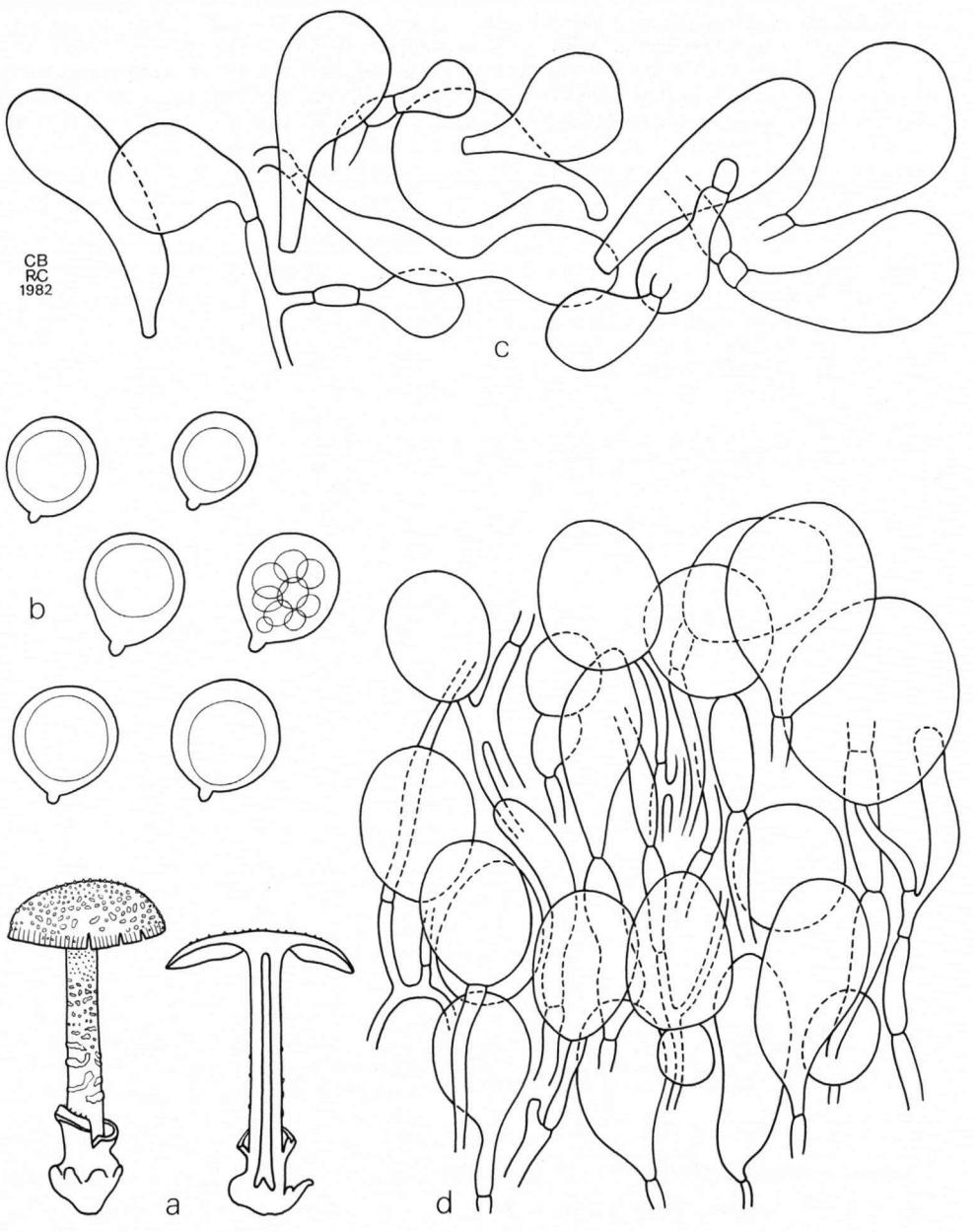

Fig. 2. *Amanita brunneoconulus.* — a. Fruit-bodies $\times \frac{1}{2}$. — b. Spores $\times$ 1250. — c. Elements of marginal tissue of lamella ($\pm$ in situ) $\times$ 500. — d. Slightly dissociated elements of volva in longitudinal section of wart on pileus $\times$ 500 (all figs. from type).

at first at darker centre somewhat paler than background, later with conspicuous dark brown tips, not easily removable but in paratype broad margin of pileus glabrous. Lamellae free, crowded, with 0-1(-3) truncate lamellae between each pair, near margin of pileus sometimes forked, moderately broad (up to 5 mm wide in type), whitish, with minutely fimbriate, whitish, but near margin of pileus often pale brown edge. Stipe 52-83 × 8-12 (at apex) to 9-16 mm (just above base) in type, up to 150 × 20 mm in paratype, subcylindrical to attenuate upwards, with subbulbous base (16-25 wide in type and up to 30 mm in paratype), stuffed, becoming hollow in late stages, exannulate, with whitish (at apex) to pale ochraceous brown subflocculose covering and this on middle part of stipe breaking up into zig-zag zones on white background, at base with one or two (incomplete) circular narrow volval ridges of same colour and substance as volval warts on pileus and these volval ridges often causing a splitting of superficial tissue of stipe thus giving rise to an (incomplete) pseudovolva[4] 15-30 mm above base of stipe and causing lobbed appearance of subbulbous base itself. Context white but somewhat ochraceous in base of stipe, moderately thick in pileus (up to 4.5 mm thick above middle of lamellae in type). Taste and smell practically absent. Spore-print lacking.

Spores [20/2/2] (9.5-)10.2-12.2(-13.6) × (9.1-)9.6-11.6(-13.3) μm, Q = 1.0-1.15, mean Q 1.05, globose to subglobose, with medium-sized abrupt apiculus, thin-walled, smooth, colourless, usually uni-, sometimes multiguttulate, inamyloid. Basidia 52-74 × 13.5-19.5 μm, 4-, rarely 2-spored, clampless. Marginal tissue when young an up to 145 μm broad, somewhat brownish strip of irregularly arranged, narrowly clavate to spheropedunculate cells, 18-47 × 12-27 μm, terminal or rarely in rows of 2 or 3 on rather inconspicuous narrow hyphae, but very soon cells collapsing and their remains forming a narrow strip of amorphous matter with still some scattered inflated cells. Trama of lamellae probably bilateral but difficult to study in dried material; subhymenium 20-30 μm thick, broad-celled ramose, tending to become pseudoparenchymatic. Pileipellis a rather thin, ±25-35 μm thick, colourless ixocutis of 2-3.5 (-5) μm wide straight hyphae running criss-cross over a dense, thick, brown cutis of up to 6 μm wide hyphae with vacuolar pigment. Volval warts near centre of pileus consisting of very abundant more or less erect (sub)globose, ellipsoid and clavate, thin-walled, brown cells, 20-50(-75) × 13-45(-70) μm, terminal or more rarely (particularly small cells) in short terminal rows on abundant but rather inconspicuous, ascending, 2-7.5 μm wide, branching hyphae, intermixed with scattered elongate and somewhat irregular cells and a few oleiferous hyphae, with vacuolar pigment; volval patches near margin of pileus made up of same but irregularly arranged elements. Stipitetrama consisting mainly of up to 250 × 70 μm and 275 × 36 μm large acrophysalides; some scattered oleiferous hyphae present. Covering of upper and middle part of stipe made up of loosely arranged, somewhat irregular, sublongitudinal, 4-9 μm wide hyphae and scattered relatively small ± clavate terminal cells. Brown volval ridges on base of stem of some composition as volval patches on margin of pileus; main body of pseudovolval limb consisting of stipe tissue. Clamps absent.

HABITAT & DISTRIBUTION.—Deciduous forest (*Fagus*, *Tilia cordata*, *Fraxinus*, *Prunus avium*, *Quercus petraea*, *Acer campestre*, *Crataegus*) on calcareous loam over "Muschelkalk", with *Arum maculatum*, *Asarum*, *Campanula trachelium*, *Hedera*, *Lathyrus vernus*, *Phyteuma spicata*, *Stellaria holostea*, *Micromphale foetidum*, etc. Thus far known from four localities in the Bezirk Erfurt in East Germany (Kreise Haina, Mühlhausen, Bad Langensalza, and Heiligenstadt).

COLLECTIONS EXAMINED.—EAST GERMANY, Bezirk Erfurt: Kreis Gotha, 2 km WSW of Haina, 27 June 1981, *F. Gröger* (holotype; L); Kreis Mühlhausen, Stadtwald 6 km WSW of Mühlhausen, 9 July 1977, *F. Gröger* (paratype; L, JE).

[4] This term is used here for a structure resembling a volval limb but for the greater part consisting of the acrophysalidic tissue of the stipe.

NOTE.—Although in the field-notes the pileal surface is described as dry and the volval warts on the pileus as rather difficult to remove, in view of the presence of a thin ixocutis it is to be expected that the pileus becomes subviscid in rainy weather and that the volval warts are sometimes washed away.

Amanita brunneoconulus is fully characterized by the crowded, small, brown, truncate-conical warts on the central part of the brown pileus in combination with the exannulate stipe decorated with rather conspicuous whitish to pale brown zigzag zones of partial veil material and the few narrow strips of brown volval material on the base of the stipe. These volval strips sometimes provoke the formation of a 'pseudovolva' by splitting of the superficial tissue of the stipe.

On account of the subbulbous base *A. brunneoconulus* has to be placed in section *Amanita*, in spite of its exannulate stipe. There it finds its place near the European species *A. friabilis* (P. Karst.) Bas and *A. hyperborea* (P. Karst.) Fayod and several extra-european species. This conclusion, however, is drawn from the morphology of the base of the stipe in just expanded and mature carpophores. The presence of a true primordial bulb in this species still has to be confirmed by observations on very young unexpanded carpophores.

Amanita brunneoconulus differs from *A. friabilis* by more (sub)globose spores (10–12 × 9.5–11.5 with Q 1.0–1.15 in the former and 10–12.5 × 8–10 μm with mean Q = 1.2–1.35 in the latter), the complete lack of grey tinges and the strictly truncate-conical volcal warts at the centre of the pileus. Moreover *A. brunneoconulus* seems to prefer rich deciduous forest without *Alnus* on calcareous loam, whereas *A. friabilis* grows in wetter deciduous forest where it is associated with *Alnus*.

Amanita hyperborea is completely white, has larger, more broadly ellipsoid spores (11.5–13 × 9.3–11 μm, Q = 1.1–1.3) than *A. brunneoconulus*, and is untill now known only from Russian Lapland.

3. TYPIFICATION AND REDESCRIPTION OF AMANITA HYPERBOREA (P. KARST.) FAYOD

In 1876 Karsten published a new species of *Amanita* under the name *Agaricus* (*Amanita*) *hyperboreus* from material collected by him in 1861 in Russian Lapland. The name *Agaricus gemmatus* var. *lapponicus* Karst. ('Enum. Fung. Lapp. p. 197') is given as a synonym, which seems somewhat strange as the date of publication of Karsten's 'Enum. Fung. Lapp. ...' is usually given as 1882. Fortunately Dr. H. Harmaja, Helsinki (in lit.) informed me that this publication of Karsten appeared as a preprint 16 years before it was published again in a journal in 1882 (see synonymy on p. 436 of the present paper), so that the name *A. gemmatus* var. *lapponicus* is 10 years older than the name *A. hyperboreus*.

The only information on this var. *lapponicus* given by Karsten in 1866 is that it had a white cap and was found on a sandy bank of the river Tuloma. The description of the same taxon under the name *A. hyperboreus* in 1876 provides more information. From this we learn that the whole fruit-body is white, that the 6 cm wide pileus has a sulcate margin and is covered with angular warts, and that the 4 cm long stipe has a bulb and is exannulate. The spores are said to be globose and to measure 10–14 μm. Karsten mentions a resemblance with varieties of *A. vaginatus* but stresses

the warts on the pileus and the habit of the fruit-body as differential characters. Later Karsten continues the use of the epithet '*hyperboreus*' (e.g. in 1879: 40, in *Amanitopsis*).

It is somewhat unexpected to find in the Karsten Herbarium in the Botanical Museum in Helsinki one collection (*Karsten 1545*) under the name *Agaricus (Amanita) hyperboreus* and another (*Karsten 1544*) under the name *Amanitopsis gemmata*,[5] both collected on the same day and at the same locality (Russia, peninsula Kola, near Kola, among grasses on sand near the bank of the river Tuloma, 27 VII 1861).

It seems very probable that *Karsten 1545* and *Karsten 1544* originally formed one collection which for unknown reasons has been split into two parts which got different herbarium numbers. This assumption is strengthened by the facts that on the packet of *Karsten 1545* the original specific epithet of the name *Agaricus gemmatus* has been deleted and replaced by the epithet '*hyperboreus*' (in Karsten's handwriting), and that the two collections certainly are conspecific. Therefore I consider *Karsten 1544* to represent an isotype. This is of some importance as the specimen in that collection is in a somewhat better condition than the two in the holotype collection *Karsten 1545*. Particularly characters of the stem can be observed much better in the isotype.

The following description is based on the data published by Karsten and on data obtained by a study of the holotype and isotype collections.

AMANITA HYPERBOREA (P. Karst.) Fayod—Fig. 3

Agaricus gemmatus var. *lapponicus* P. Karst., Enum. Fung. Myxomyc. Lapponia orient. aest. 1861 lect 197. *1866*.[6] (preprint of paper *in* Not. Sällsk. Fauna Fl. fennica Förh. **8** n.s. **5**: 197. *1882*.)

Agaricus hyperboreus P. Karst., Mycol. fennica **3**: 27. *1876*. — *Amanitopsis hyperborea* (P. Karst.) P. Karst. *in* Bidr. Finl. Nat. Folk (Ryssl. Finl. Skand. Hattsv.) **32**: 7. *1879*. — *Amanita hyperborea* (P. Karst.) Fayod *in* Ann. Sc. nat., sér. 7 (Bot.) **9**: 317. *1889*. — *Pseudofarinaceus hyperboreus* (P. Karst.) O. Kuntze, Rev. Gen. Plant. **2**: 868. *1891*. — *Vaginata hyperborea* (P. Karst.) O. Kuntze, Rev. Gen. Plant. **3** (2): 539. *1898*. — *Amanita vaginata* f. *hyperborea* (P. Karst.) Veselý in Annls. mycol. **31**: 280. *1933*.

Pileus up to 60 mm wide, convex to plano-convex, probably somewhat umbonate, thin-fleshed, with rather strongly and densely sulcate margin (dried: sulcation 0.2[5] to 0.5 R long; about 12 groves per 10 mm), white, at least at centre with small (dried: 0.5–1.5 mm wide and 0.5–1 mm high), (sub)conical white volval warts to felted volval patches; pileal surface in dried state mat to somewhat shiny and without distinct fibrillose pattern (even under hand lens). Lamellae free, crowded, probably rather narrow, white, probably with minutely floculose white edge; lamellae present. Stipe relatively short, up to 40 mm long, moderately thick, with narrowly clavate to (sub)bulbous base (dried: stipe 20–30 × 4 mm, at base up to 7 mm wide), white, exannulate, slightly fibrillose, on lower quarter with small, vaque, white, felted-subflocculose volval warts or patches.

Spores [30/2/2] 11.2–13.3(–13.8) × 9.4–10.8(–11.3) µm, Q 1.1–1.35, mean Q in both collections 1.2, subglobose to broadly ellipsoid or broadly obovoid, rarely ellipsoid, colourless, thin-walled,

[5] The epithet '*lapponicus*' does not occur on the labels and packages of the two collections.

[6] The information that Karsten's 'Enum. Fung. Myxomyc. Lapponia...' has been prepublished as a separate paper in 1866 is to be found on the fourth page of the volume of the journal in which it has been published again in 1882.

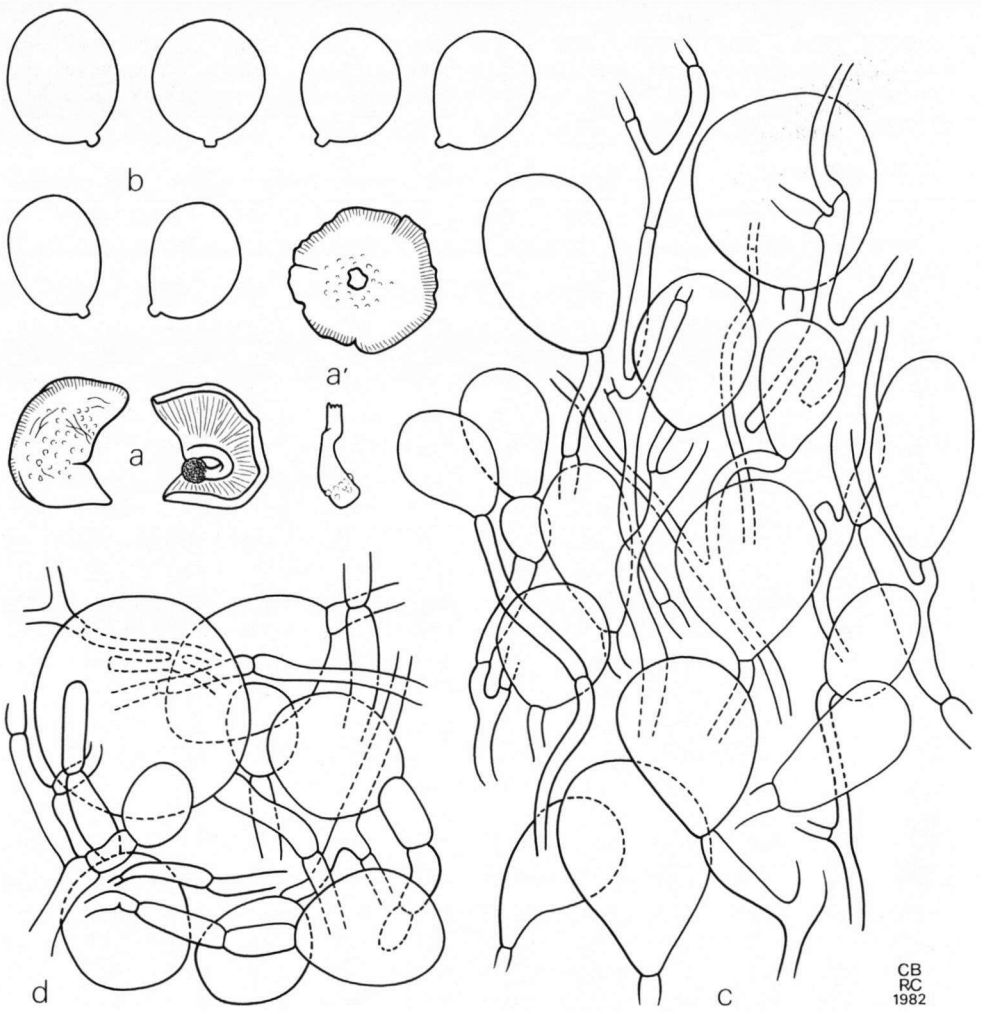

Fig. 3. *Amanita hyperborea.* — a, a'. Dried fruit-bodies × 1. — b. Spores × 1250. — c. Slightly dissociated elements of tissue of volval wart on pileus × 500. — d. Elements of tissue of volval wart on base of stipe × 500. (a, b from type; a', c, d from isotype).

with medium to small abrupt apiculus, sometimes with cloudy and somewhat refractive contents, inamyloid. Basidia 48–65 × 12.5–14.5 μm, 4-spored (very rarely 3- or 2-spored), clampless. Trama of lamellae (impossible to analyse in both collections). Pileipellis (difficult to analyse because of heavy moulding) composed mainly of 2–6 μm wide, interwoven or subradial hyphae; suprapellis a thin ixocutis. Volval remnants on pileus yellowish in NH_4OH 10%, made up of a mixture of abundant 3–8 μm wide hyphae often with somewhat refractive contents, abundant subglobose to ellipsoid or broadly ovoid inflated cells, 20–65 × 15–55 μm, terminal or in short terminal rows, and scattered oleiferous hyphae; at least in base of pileal warts hyphae and more elongate inflated cells showing a preference for the erect position. Volval remnants on

base of stipe breaking up into small, thick, felted, poorly delimited patches without a trace of a (sub)membranous outer layer, consisting of 20–70 μm long globose to ellipsoid or ovoid inflated cells terminally on 3–7 μm wide branching hyphae; all elements thin-walled and colourless except the scarce, sometimes (in NH_4OH 10%) yellowish oleiferous hyphae. Trama of stipe (difficult to analyse) acrophysalidic; inflated cells up to 25 μm wide. Clamps lacking in all tissues studied.

HABITAT & DISTRIBUTION.—Known only from the type locality in Russian Lapland from a grassy sandy bank of a river. Collected in July.

COLLECTIONS EXAMINED.—U.S.S.R., Murmansk, along river Tuloma near Kola, 27 July 1861, *P. A Karsten 1545* (type, H) & *1544* (isotype, H).

Amanita hyperborea has generally been considered a member of *Amanita* section *Vaginatae* and has been confused with *A. nivalis* Greville and other white or whitish taxa near *A. vaginata* (Veselý, *1933*: 280; Kallio & Kankainen, *1964*: 207; Kühner, *1972*: 34; Bas, *1977*: 86, Moser, *1978*: 221). Examination of the type, however, has shown that *A. hyperborea* is to be placed in section *Amanita* near *A. friabilis* (P. Karst.) Bas, and what is more, that the possibility that it is a white variety of that species can not be neglected.

It is the distinctly clavate-subbulbous base of the stipe with indistinct, felted-flocculose, perhaps sometimes slightly wart-like remnants of the volva that excludes *A. hyperborea* from section *Vaginatae* and, as the spores are inamyloid, refers it to section *Amanita*.

In that section the rather small fruit-body with exannulate stipe and wart-like volval remnants together with the more than 10 μm long, subglobose to ellipsoid spores make *A. hyperborea* belong to a group of species of which *A. friabilis* and *A. brunneoconulus* Bas & Gröger (see p. 432) are until now the only European representatives.

Except for the lack of pigment in *A. hyperborea*, there is very little that distinguishes this species from *A. friabilis*. In the latter the spores are on an average about 1 μm smaller, viz. 10–12.5 × 8–10 μm, but the length-width ratio of the spores of *A. hyperborea* falls well within the range of that ratio in *A. friabilis* (1.1–1.5, averages per collection 1.2–1.3[5]). The size of the basidia, the diameter and the arrangement of the hyphae in the pileipellis, and the size of the inflated cells in the volval remnants are about the same in the two taxa.

The structure of the volval warts on the pileus of the type material of *A. hyperborea* is rather difficult to analyse, but a careful comparison with that of the volval warts of *A. friabilis* has given me the impression that in the former the inflated cells form less frequently rows (and then short ones) than in *A. friabilis* where they are frequently found in rows of two to six. Moreover, the refractive contents of the probably somewhat more abundant hyphae in the volval remnants of *A. hyperborea* are practically lacking from the volval hyphae of *A. friabilis* which therefore are considerably less conspicuous. For these reasons I think that for the time being *A. hyperborea* and *A. friabilis* should be maintained as independent but closely related species, pending further information on the first of the two.

4. TYPIFICATION AND TYPE STUDY OF AMANITA VAGINATA FORMA OREINA J. FAVRE

In his study on alpine fungi Favre (*1955*: 158, 205, fig. 144) described a small whitish member of *Amanita* section *Vaginatae*, under the name *A. vaginata* f. *oreina*, found by him several times in

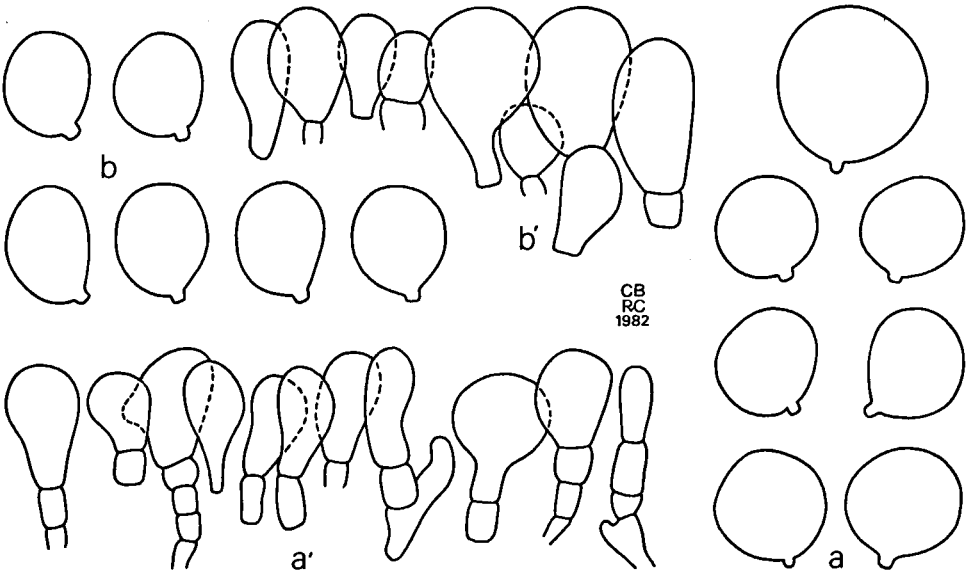

Fig. 4a-a'. *Amanita vaginata* f. *oreina*. — a. Spores × 1250. — a'. Marginal cells × 500 (all figs. from type).

Fig. 4b-b'. *Amanita sternbergii*. — b. Spores × 1250. — b'. Marginal cells × 500 (all figs. from type).

the Swiss Alps, growing with dwarf willows at altitudes between 2400 and 2650 m. Favre's description and illustrations provided the data in the macroscopical description below.

The Director of the Nationalpark-Museum at Chur kindly sent on loan to me the collection from which Favre's illustrations are drawn and which is selected here as lectotype. This collection consists of one sectioned fruit-body. The microscopical characters in the following description are those observed by me in the lectotype.

AMANITA VAGINATA FORMA OREINA J. Favre, Champ. sup. Zone alpine Parc nation. Suisse: 158, 205, fig. 144. *1955*. —Fig. 4a.

Pileus up to 40 mm wide, convex or conico-convex, not completely expanding, sometimes with vague broadly rounded umbo, with rather short marginal striation (0.15–0.2 R in illustration), white to greyish-whitish, glabrous. Lamellae free, rather broad. Stipe relatively short, up to 50 mm long, up to 10 mm wide (at base), without bulb, hollow, exannulate (glabrous in illustration). Volva membranous and rather thick (± 1 mm in illustration), appressed against lower 10 to 15 mm of stipe, with lobbed, flaring limb (without internal limb in the one sectioned fruit-body illustrated).

Spores [20/1] (9.8-)10.5-12.6(-13.5....15) × (9.1-)9.5-11.9(-12.5....15) μm, Q = 1.0-1.1 (-1.1[5]), globose, colourless, thin-walled, often with somewhat refractive granular contents (in Favre's illustration often with one large oildrop), with small to medium-sized abrupt apiculus, inamyloid. Basidia 54-69 × 15-18 μm, 4-spored (in only a few sterigmata sufficiently distinct for counting), clampless. Marginal tissue consisting of subclavate to broadly clavate, thin-walled colourless terminal cells, 20-35 × 7-25 μm, on short chains of small short cells. Subhymenium

(still?) ramose. Trama of lamellae not studied. Pileipellis (at ± 1/3 R from centre) rather thin, made up of a ± 40 μm thick ixocutis downwards gradually passing into a ± 25 μm thick cutis of 1.7–2.8 μm wide, interwoven hyphae, abruptly differing from trama underneath. Volval limb at outer surface made up of abundant, 3.5–11(–14) μm wide, loosely interwoven, curving hyphae and rather scarce 50–80 μm long globose, ellipsoid and ovoid, terminal, inflated cells; at interior of 3.5–7 μm wide strongly interwoven, undulating hyphae and fairly abundant, globose, ellipsoid, ovoid and piriform cells, up to 65 × 55 μm, or when elongate up to 70 × 40 μm; at inner surface of slightly gelatinizing, abundant, 2–6.5 μm wide, strongly interwoven hyphae and only scattered inflated cells similar to those inside tissue. Trama of stipe acrophysalidic; acrophysalides very abundant, relatively short and broad, 70–190 × 23–46 μm; vascular hyphae not found. Clamps absent.

COLLECTION EXAMINED.—SWITZERLAND, Graubünden, Mount Plazer, près de Scarl, 20 Aug. 1952, *J. Favre 186a* (lectotype, CHUR).

This is the same taxon described and pictured earlier under the name *A. nivalis* by Greville (*1822*: pl. 18). Unfortunately I have not yet seen a well-annotated collection from Scotland suited for neotype, although I have studied a few that agree fairly well with Greville's plate and description as well as with *A. vaginata* f. *oreina* Favre as described above.

Amanita nivalis as conceived by me now and earlier (*1977*: 86, fig. 1/6104) is a relatively small whitish to pale greyish buff taxon with a short sulcation at the margin of the pileus, a glabrous to subpubescent, exannulate stem without floccose girdles, a prominent membranous-saccate volva leaving no or hardly any remnants on the pileus, globose to subglobose spores, 10–12.5 × 9.5–12 μm (Q 1.0–1.1), growing with dwarf and shrub willows in alpine and arctic regions.

As demonstrated elsewhere in this paper (p. 435) the name *A. hyperborea* (P. Karst.) Fayod is not a synonym of *A. nivalis* and *A. vaginata* f. *oreina*, as it belongs to a white species in section *Amanita*, which is close to *A. friabilis* (P. Karst.) Bas.

The material from the Alps and from Lapland extensively described by Kühner (*1972*: 34) under the name *A. hyperborea* with the name *A. vaginata* f. *oreina* as a synonym, undoubtedly belongs for the greater part to *A. nivalis*. However, it is possible that a few of these collections represent the same taxon as described by me in *1977* (: 86) and incorrectly named *A. hyperborea*, be it with a question-mark. Particularly the lower right-hand figure on p. 35 of Kühner's paper reminds of that taxon (compare Bas, *1977*: fig. 1/6105), which has not been correctly named yet.

I have no definite opinion on the question whether *A. nivalis* should be ranked on species level or lower. Observations by M. Lange (*1955*: 52) and Kühner (*1972*: 38) seem to indicate that intermediate forms between *A. nivalis* and *A. vaginata* (Bull. ex Fr.) Vitt. do occur.

Pending further information I prefer to treat this taxon as a species in its own right with the following name and synonyms.

AMANITA NIVALIS Grev.

Amanita nivalis Grev., Scott. cryptog. fl. **1** (4): pl. 18. *1822*. — *Agaricus nivalis* (Grev.) Loudon, Encycl. plantes: 986. *1829*. — *Amanitopsis nivalis* (Grev.) Sacc., Syll. fung. **5**: 22. *1887*. — *Pseudofarinaceus nivalis* (Grev.) O.K., Rev. gen. plant. **2**: 808. *1891*. — *Vaginata nivalis* (Grev.) O.K., Rev. gen. plant. **3** (2): 539. *1898*. — *Amanita vaginata* var. *nivalis* (Grev.) Guillaud & *al.* ['*nivea* Grev.'] *in* Ann. Sci. natur. Bordeaux **3** (2): 45. *1884*; Cooke, Illustr. Brit. fungi **7**: pl. 940. *1888*. — *Amanitopsis vaginata* var. *nivalis* (Grev.) Peck *in* Ann. Rep. N. Y St. Mus. **47**: 169. *1894*. — *Amanita vaginata* forma *nivalis* (Peck) Quél., Fl. mycol.: 302. *1888*.

Agaricus vaginatus var. *albidus* Fr., Epicr.: 11. *1838* [new name based on *Amanita nivalis* Grev.]. — *Amanita vaginata* var. *albida* (Fr.) Gill., Hymén. France: 51. *1874*. — *Amanitopsis albida* (Fr.) Imai, Bot. Mag. Tokyo **47**: 429. *1933*.

Amanita vaginata forma *oreina* Favre, Champ. sup. zone alp. parc nation. Suisse: 158, 205. fig. 144. *1955*. — *Amanita oreina* (Favre) Heim, Champ. Europe **2**: 441, 444, fig. 293. *1957*.

5. TYPE-STUDY OF AMANITA STERNBERGII VELEN.

In a paper on *A. friabilis* (P. Karst.) Bas (*1974*: 18), the name *A. sternbergii* was included in the synonymy of that species with a question-mark. This was done because, although Velenovský's description of his new species and its habitat agree fairly well with *A. friabilis*, the spore-shape and -size as given by Velenovský (12–14 μm and globose) are aberrant for this species (10–12,5 × 8–10 μm and subglobose to ellipsoid).

Meanwhile I have kindly been enabled to study the only fruit-body of *A. sternbergii* preserved in the Velenovský collection at Prague. The original label of that specimen is very simple and reads '*Amanita sternber.* Mnich.', the second abbreviation standing for 'Mnichovice', a little town, where Velenovský spent much of his time, at about 6 km distance from 'Pecný prope Ondřejov' which name is mentioned in the protologue of *A. sternbergii*.

Although it is not sure that Velenovský had this collection in hands when he described *A. sternbergii*, it is clear that he kept it as a sample of his new species and therefore I look upon it as the type.

The macroscopical data in the following description are taken from the type (preserved in liquid) with data taken from Pilat's (*1948*: 47) latin translation of Velenovský's description added between brackets. The microscopical data are those observed by me in the type collection.

AMANITA STERNBERGII Velen., České houby 1: 192. 1920.—Fig. 4b.

Pileus 28 mm wide (40–50 mm), plano-convex with broad, slightly depressed centre with low umbo in the middle (flattened), thin-fleshed, with sulcate-striate margin, ±0.25–0.3 R (with deeply striate margin), brown (sad grey-brown, 'cinereo-subfusca'), glabrous now but volval remnants probably washed away (dry, whitish pruinose, densely set with persisting grey warts). Lamellae crowded, just reaching apex of stem and narrowly adnate, *c.* 4 mm wide (narrow), now pale buff (white) with even, concolorous edge. Stipe *c.* 48 × 6 mm (*c.* 10 mm wide, tall), with subclavate, 9 mm wide base (slightly thickened at base), hollow, now pallid with minute brownish squamules in places but surface structure dammaged (entirely minutely grey-squamulose and below broadly squamose), only at one side of subbulbous base with some vague brownish wartlike volval remnants (with narrow, apressed, adnate vaginate volva).

Spores [10/1] 10.1–12.1 × 8.5–9.8(–10.8) μm, Q 1.1–1.3[5] mean Q 1.2, subglobose to broadly ellipsoid, rarely ellipsoid, sometimes obovoid, thin-walled, colourless, with medium-sized, abrupt, subtruncatate apiculus, non-amyloid. Basidia 53–83 × 12.5–15 μm, clampless. Marginal tissue (probably partly washed away) consisting of scattered broadly clavate colourless cells, 25–40 × 15–23 μm, among fertile basidia. Subhymenium (probably still young) made up of short cylindrical to inflated, sometimes subcoralloid cells. Pileipellis a cutis: suprapellis consisting of 3.5–5(–7) μm wide loosely interwoven, distant, slightly brownish hyphae, probably gelatinized; infrapellis of up to 10 μm wide denser subradial hyphae with brown vacuolar pigment. Volval remnants lacking from pileus, at base of stipe made up of 4–10 μm wide interwoven hyphae

carrying mostly single subglobose to obovoid, piriform or ellipsoid, brownish cells, 30–75 × 28–55 μm. Tissue of stipe acrophysalidic; terminal cells up to 260 × 40 μm. Clamps lacking from all tissues studied.

HABITAT.—In shady Alnetum on damp soil (according to protologue).

COLLECTION EXAMINED.—CZECHOSLOVAKIA, Mnichovice (type, Velenovský collection, PRC).

Velenovský's description of the volval remnants at the base of the stipe of *A. sternbergii* is somewhat ambiguous. I gather from it that Velenovský saw the volva as narrow, adnate, and vaginate and so it is also drawn in his sketch published by Sartory & Maire (*1923*: 501). Particularly the term vaginate does not apply to the volva of *A. friabilis*. But as a volva of that type does not go together with crowded volval warts on the pileus as described and depicted in *A. sternbergii*, I assume that Velenovský's description of the volval remnants at the base of the stem of *A. sternbergii* is based more on interpretation than on observation.

The size of the spores of the type of *A. sternbergii* (10–12 × 8.5–10 μm) fits perfectly in the range established for *A. friabilis* (10–12.5 × 8–10 μm), as all the other microscopical characters observed agree very well. Therefore no shade of doubt is left about the conspecificity of the type of *A. sternbergii* with *A. friabilis*.

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