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MYCOTAXON

Volume LIII, pp. 455-466 January-March 1995

AMANITA POPULIPHILA—A NEW SPECIES FROM THE CENTRAL UNITED STATES

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Summary

Amanita populiphila is described as new based on collections from Idaho, Kansas, Michigan, Minnesota, Montana, New Mexico, and Wyoming. All collections for which habitat information was recorded were made in association with *Populus*.

Methods and terminology follow those of Tulloss *et al.* (1992) and Tulloss (1993; 1994). With one exception (RET—Tulloss' personal herbarium), abbreviations of names of herbaria follow Holmgren *et al.* (1990). Collections for which no herbarium is cited are deposited in RET. Color codes of the form "5A2" are taken from Kornerup & Wanscher (1978). Color names in italics with first letters capitalized are from Ridgway (1912); for these colors, translation to Munsell notation is provided according to Hamly (1949).

Amanita populiphila (Fig. 1) is a medium sized mushroom assignable to *Amanita* section *Vaginatae* (Fr.) Quél. It can occur in large quantities under aspen and cottonwood in the central United States from the Mississippi River west into the Rocky Mountains. It is white to pallid at first, tending to take on tan or brown tones with age. Its stipe is exannulate and has an easily lost, cupulate, submembranous, white volva at its base. Rather thick warts may be left on both pileus and stipe. The species is edible.

Amanita populiphila Tulloss & E. Moses *sp. nov.*

Etymology: Populus + *-philo-*, loving; hence, *Populus*-loving because of association with that genus.

Pileus 30 - 120 (-135) *mm latus, initio albus vel subalbidus vel subalutaceus (disco plus minusve brunneore) deinde subflavidus vel alutaceus vel brunneus, convexus umbone lato deinde plano-convexus, carne nivea, margine striata et non appendiculata, velo universali detersili subalbido vel flavo-brunneo (ubi veto) et fragmenta parva vel verrucas formans. Lamellae liberae vel annexae, confertae, albae; lamel-*

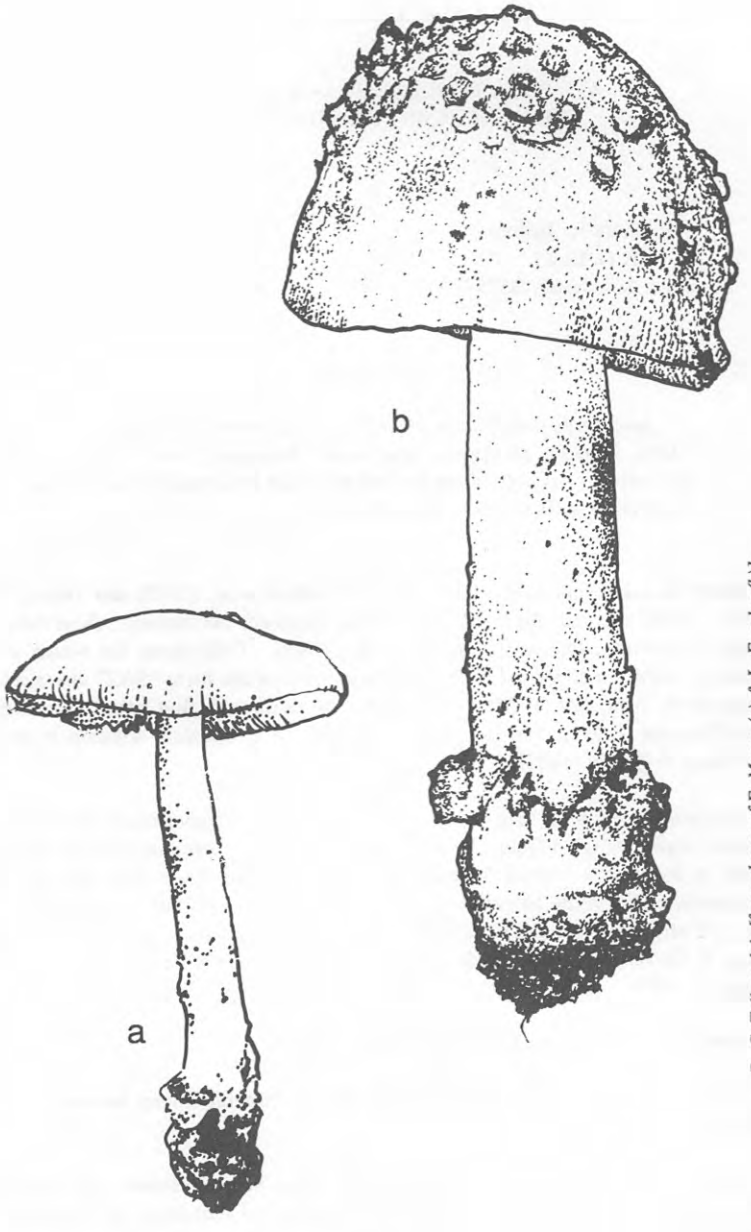


Fig. 1 *Amanita populiphila* habit [**a** (Tulloss 8-11/13-90-EM1) $\times 0.5^{\pm}$; **b** (holotype) $\times 2^{\pm}$].

lulae truncatae. Stipes 63 - 175 (-220) × (5-) 7 - 20 *mm, albus, exannulatus, velo universali albo vel flavo-brunneo (ubi veto) membranaceo vel submembranaceo et fragmenta vel verrucas vel volvam cupulatum vel saccatum et laxe affixam ad basim stipitis maturi formans. Sporae* (7.0-) 9.2 - 12.5 (-21) × (6.0-) 8.2 - 11.2 (-15.8) *µm. Fibulae praesentes. Habitat saepe abundanter Populo in udis vel in sylvis sparsis. Holotypus*: U.S.A., Kansas, Pottawatamie Co., N of Manhattan, Tuttle Creek St. Pk., River Pond Area, W. R. & E. Moses *s.n.* [Tulloss 5-15-92-EM1] (NY).

PILEUS: 30 - 120 (-135) mm wide, white to off-white to *Tilleul Buff* (7.5YR 8.4/2.0), very pale tan (slightly darker over disc) or pale cream (with orange-brown tint over disc), often becoming yellowish (*e.g.*, more cream than 5A2 with margin remaining nearly white) to straw-color to tan to brown with age and handling, tacky to subviscid to viscid (Smith 50210), shiny to dull, broadly campanulate, then convex and broadly umbonate, then plano-convex, in age with margin uplifted; *context* pure white, unchanging when bruised or cut, 5 - 12.5 mm thick at stipe, thinning evenly for up to four-fifths of radius, then a membrane to margin; *margin* rather short striate at least at first (0.15±R), eventually with longer striation (0.2 - 0.4R) particularly in dry weather, frequently becoming rimose, nonappendiculate; *universal veil* absent or in often rather thick warts or small patches or a large areolate patch (Smith 84263), submembranous, fragile, detersile, off-white to avellaneous at first, unchanging or becoming yellowish brown or yellowish buff to pale brown to grayish brown to "very dark" (Trueblood 5472) in age or through drying or handling.

LAMELLAE: free to adnexed, sometimes with long decurrent very pale orangish white lines on upper stipe, close to crowded, off-white to pinkish white to very pale orangish or pinkish cream in mass, cream to pale cream to sordid pale cream to white in side view, unchanging when cut or bruised, pale pinkish or salmon pink (Trueblood 5472) or pale orange to pale yellow-orange when just dried, 3 - 7.5 mm broad, with concolorous to very pale orangish white flocculence on edge; *lamellulae* truncate to excavate-truncate, in several ranks, unevenly distributed, common to plentiful.

STIPE: 63 - 175 (-220) × (5-) 7 - 20 mm, white, sometimes with pale watery streaks, not discoloring or becoming watery pale brown over time or from handling, narrowing upward to subcylindric, flaring slightly or not at all at apex, decorated in upper half with very pale orangish white flocculence, finely striatulate; *context* white to off-white (with watery streaks), usually unchanging when cut or bruised, sometimes sordid in lower stipe or pale tan in universal veil below stipe base, concolorous in larva tunnels, stuffed in whole or part with white cottony fibrils, becoming hollow, with central cylinder 2.5 - 14 mm wide; *exannulate*; *universal veil* as "thimble-like" cupulate volva, submembranous to membranous, thin to 3.5 mm or more thick, white, changing with age and drying as on pileus or taking on orange-red or brown spots in lowest portion, easily detached from stipe in mature specimens, frequently also as warts (separate or confluent) unevenly distributed along stipe or in rings around stipe and having form like that of warts on pileus.

Odor none (Smith 50210) or mild and pleasantly fungoid or pungent (Smith

84263) in older specimen. *Taste* mild and pleasantly fungoid in all parts except universal veil (tasteless). EDIBLE (with caution) and good with exception of unavoidably gritty universal veil.

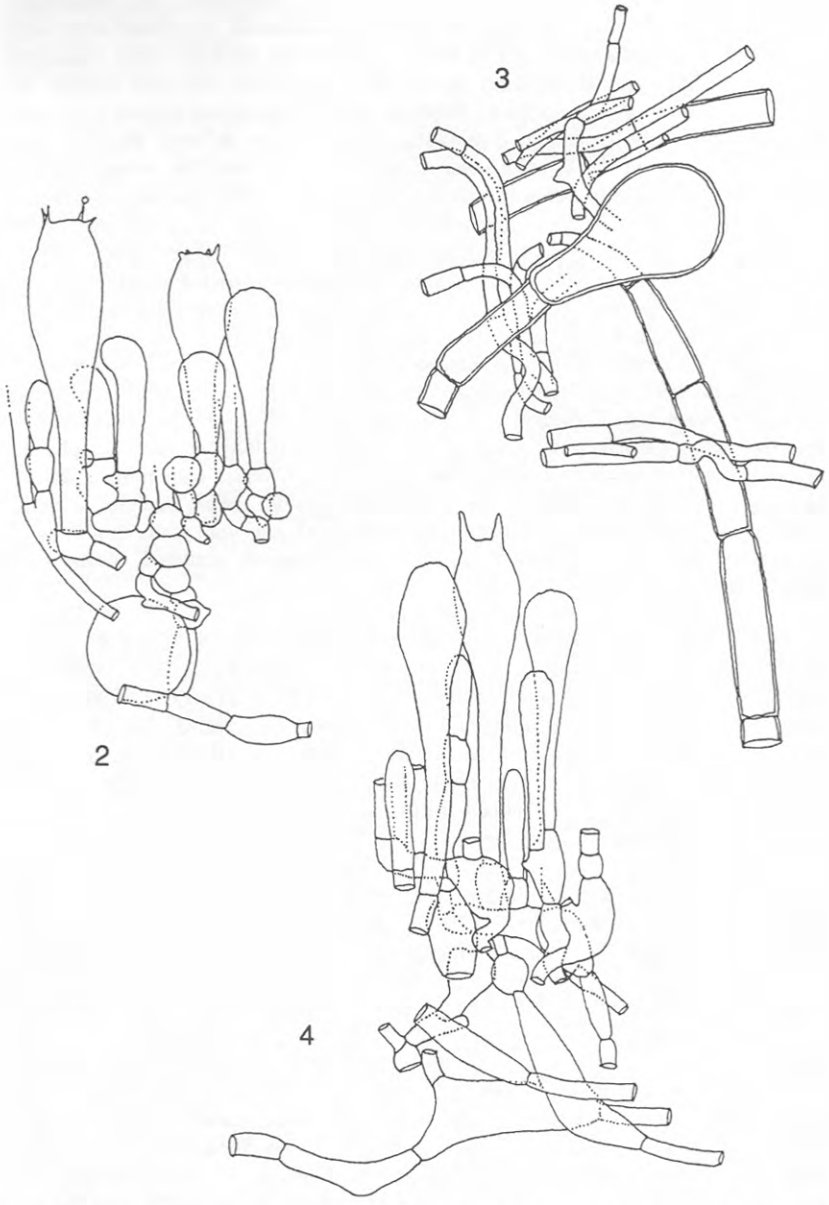
MACROCHEMICAL TESTS: Paracresol spot test for tyrosinase - for freshly collected material, rapidly positive throughout basidiocarp in specimens of all stages of development; in material collected 26 hours before testing, reaction took 5 min. Syringaldazine spot test for laccase - negative throughout basidiocarp with exception of exterior surface of undried portions of universal veil at stipe base and there rather rapidly and strongly positive (reddish lavender instantly or in less than 1 min., deepening to near ruby red). 95% ethanol (control for syringaldazine test) - negative in all parts. KOH - negative on pileus and lamellae. NH_4OH - very pale yellow on context throughout basidiocarp. Chemical tests performed on holotype and Moses 1.

PILEIPELLIS: with rather extensively gelatinized suprapellis colorless and 15 - 45 μm thick, with ungelatinized subpellis yellowish and 135 - 200 μm thick; filamentous, undifferentiated hyphae 1.8 - 6.5 μm wide, branching, densely packed, subradially arranged, sometimes with slightly thickened walls; vascular hyphae 2.2 - 17.0 μm wide, common to plentiful, branching, sometimes tightly coiling in part, best seen in scalp. PILEUS CONTEXT: filamentous, undifferentiated hyphae 2.8 - 14.8 μm wide, plentiful to dominant, frequently branching, loosely interwoven, only infrequently in fascicles, with walls thin or up to 0.8 μm thick, often constricted at septa, with occasional slightly inflated intercalary segments up to 15.0 μm wide; acrophysalides plentiful, elongate to narrowly clavate, up to 121 × 34 μm, with walls thin or up to 0.8 μm thick; vascular hyphae 3.5 - 15.0 μm wide, common, sinuous, occasionally branching; clamps not observed. LAMELLA TRAMA: bilateral, with shallow angle of divergence; w_{cs} = (50-) 60 - 85 μm when rehydrated well; subhymenial base containing numerous intercalary thin-walled inflated cells [clavate or obclavate to ellipsoid (up to 48 × 21 μm) to fusiform or elongate or allantoid (up to 85 × 20 μm) to (rarely) globose (*e.g.*, 23 × 22 μm)]; filamentous, undifferentiated hyphae 1.5 - 11.0 μm wide, branching, with plentiful intercalary partially inflated to subfusiform to fusiform to broadly fusiform to clavate cells in central stratum (up to 52 × 17.5 μm or larger, becoming disoriented rather easily by sectioning); divergent, terminal, inflated cells not observed; vascular hyphae 2.0 - 4.8 μm wide, sinuous, observed in only one mount (Solheim 5259)—rare. SUBHYMENIUM: w_{st}-near = 40 - 75 μm when rehydrated well; w_{st}-far = 70 - 100 μm when rehydrated well; frequently branching and rather tangled structure of short uninflated or partially inflated hyphal segments and small inflated cells, with basidia arising mostly from uninflated to partially inflated hyphal segments or from uninflated to slightly inflated branched elements, with basidia arising occasionally from small inflated cells; clamps infrequent to rare. BASIDIA: 36 - 83 × 7.8 - 17.8 μm, thin-walled, 4- or occasionally 2-sterigmate, with sterigmata up to 8.0 × 5.0 μm; clamps and proliferated clamps scattered (most often found near pileus margin), infrequently locally common. UNIVERSAL VEIL: *On pileus*: as on stipe base except exterior surface layer sometimes missing, often with much of remainder partially gelatinized; filamentous, undifferentiated hyphae in narrower fascicles than at stipe base and with diameter up to 16.2 μm, with tip cells often somewhat inflated; inflated cells up to 150± × 42 μm (almost always less than 65 × 40 μm), common to plentiful, often

badly collapsed. *At base of stipe, exterior surface*: filamentous, undifferentiated hyphae 1.8 - 8.8 μm wide, partially gelatinized to gelatinized, sometimes with walls slightly thickened, almost always in thick criss-crossing fascicles, with occasional slightly inflated terminal segment (up to 10.8 μm wide); vascular hyphae not observed. *At base of stipe, interior*: filamentous, undifferentiated hyphae 1.8 - 14.5 μm wide, frequently branching, dominating, almost always in broad fascicles, with walls up to 1.0 μm thick, with some branches out of fascicles loosely coiling, occasionally having yellowish subrefractive walls; inflated cells unevenly distributed, occasionally in loose clusters (rather commonly in Trueblood 5472), terminal, sometimes dissociated, hyaline, colorless, with walls thin or up to 1.0 μm thick, pyriform to subpyriform to broadly clavate to clavate to elongate-constricted to subfusiform to ellipsoid to ovoid to subglobose, up to 101 × 68 μm (almost always not more than 60 × 40 μm); vascular hyphae not observed; clamps not observed. *At base of stipe, inner surface*: filamentous, undifferentiated hyphae 1.8 - 10.0 μm wide, branching, in densely packed thin layer, longitudinally oriented, partially to extensively gelatinized, fasciculate, often with thickened walls; vascular hyphae 5.0 - 8.5 μm wide, in scattered fragments, partially gelatinized. STIPE CONTEXT: longitudinally acrophysalidic; filamentous, undifferentiated hyphae 2.8 - 9.1 μm wide, with thin or slightly thickened walls, very frequently branching, often in rather robust fascicles, plentiful to dominant; acrophysalides plentiful, up to 264 × 42 μm, with walls thin or up to 0.5 μm thick; vascular hyphae 4.5 - 11.2 μm wide, sinuous, scattered, locally common; clamps not observed.

BASIDIOSPORES: [1140/57/22] (7.0-) 9.2 - 12.5 (-21) × (6.0-) 8.2 - 11.2 (-15.8) μm, (**L** = (10.0-) 10.1 - 11.8 (-12.2) μm; **L'** = 10.9 μm; **W** = (8.9-) 9.1 - 10.6 (-11.1) μm; **W'** = 9.8 μm; **Q** = (1.0-) 1.04 - 1.20 (-1.61); **Q** = (1.06-) 1.08 - 1.15 (-1.19); **Q'** = 1.11), hyaline, colorless, smooth, thin-walled, inamyloid, subglobose, occasionally globose, occasionally broadly ellipsoid, infrequently lachrimiform or langeniform, very rarely ellipsoid, often adaxially flattened, often expanded at one end; apiculus sublateral to lateral, small, truncate-conic to cylindric; contents monoguttulate; white in deposit.

Distribution and habitat: Idaho: Solitary at 1900± m elev. under *Populus tremuloides* Michx. with (Solheim 5259) or without (Trueblood 5472) nearby conifers. Pottawatomie Co., Kansas: August, 1990: occurring in hundreds (possibly with several mycelia each producing 25 - 150 basidiocarps) covering several acres in mowed field (within flood plain) under *P. deltoides* Marsh.; with similar large fruiting in September, 1989 (no voucher); with May, 1991 fruiting producing no more than 50 basidiocarps; with no fruiting in August, 1991. In 1992 (with plentiful rainfall and cool weather) fruitings starting in mid-May, with close to 2000 basidiocarps present simultaneously (probably from twenty or more separate mycelia) by early June; with fruiting reduced to several hundred fresh basidiocarps in third week of month; with fruiting continuing with reduction in number and size of basidiocarps until only twenty found on 27 June. [Between 1 July and 25 July 1992, area had 28.8 cm of rain.] 25 July 1992: 200 basidiocarps counted (most smaller than usual). 29 July, 1992: about 100 fresh basidiocarps in main fruiting area with scattered specimens in two other nearby sites. [Temperatures began to rise in late July, 1992 and became very hot in first week of August.] 2 August, 1992: in continuing rain,



Figs. 2-4. All anatomical drawings are scaled 570:1. Figs. 2-3. *Amanita populiphila* (holotype). 2. Elements of hymenium and subhymenial tree. 3. Elements of universal veil interior (stipe base). Fig. 4. *Amanita nivalis* (Bas 9307) elements of hymenium and subhymenial tree.

about 200 basidiocarps found in several sites. 8 August, 1992: about 150 basidiocarps (most smaller than usual) total for all sites. [During mid-August, weather remained hot and became dry.] 18 August, 1992: 12 basidiocarps in main area of occurrence, with 3 in distant site and these with darker than usual disc. 22 August, 1992: no fruiting bodies seen. [July 1992 rainfall (33.6 cm) was third highest recorded for that month for eastern Kansas region in Twentieth Century.] Michigan: Solitary to scattered on moss at edge of bog (Smith 50210). Minnesota: Subgregarious, in dark soil of old lake bottom, under *P. tremuloides*, in sparsely wooded area containing *P. tremuloides*, *Juniperus*, and plentiful young buckthorn (*Rhamnus*) scrub. New Mexico: Subgregarious to gregarious, in sod of pasture with *P. deltoides* nearby (Barrows 1090) or in dark wet loam of riparian habitat at 2410± m elev. with *P. deltoides*, *Abies*, and *Acer negundo* L. among low cover including "cow parsnips," *Rosa*, and *Spirea* (Tulloss 8-15-92-A). Wyoming: In grassy area, under *P. tremuloides*.

Collections examined: **U.S.A.:** IDAHO—Fremont Co. - Targhee Nat. For., 6.6 km W of Idaho/Wyoming state line, 2.viii.1957 W. G. Solheim 5259 (MICH). Owyhee Co. - Vulcan Crk., 7.vii.1973 Ellen & Ted Trueblood 5472 (MICH). KANSAS—Pottawatomie Co. - N of Manhattan, Tuttle Creek St. Pk., River Pond Area, 11-13.viii.1990 W. R. & E. Moses *s.n.* [Tulloss 8-11/13-90-EM1], 25.viii.1990 W. R. & E. Moses *s.n.* [Tulloss 8-25-90-EM1], 25.v.1991 W. R. & E. Moses *s.n.* [Tulloss 5-25-91-EM1], 15.v.1992 W. R. & E. Moses *s.n.* [Tulloss 5-15-92-EM1] (holotype, NY; isotype, RET), 22.v.1992 W. R. & E. Moses *s.n.* [Tulloss 5-22-92-EM1], 25.v.1992 W. R. & E. Moses *s.n.* [Tulloss 5-25-92-EM1] (L; RET), 30.v.1992 W. R. & E. Moses *s.n.* [Tulloss 5-30-92-EM1], 5.vi.1992 W. R. & E. Moses 1 (NY), 2, 3, & 4. Rooks Co. - Stockton, 1.ix.1908 Elam Bartholomew *s.n.* (FH as "*A. nivalis*"). Co. unknown - locality unknown, 18.vi.1967 Harbaugh 67-6-18-1 (MICH). MICHIGAN—Luce Co. - Tahquamenon St. Pk., 22.viii.1965 Alexander H. Smith 50210 (MICH). Oakland Co. - Highland Recreation Area, 22.vii.1973 A. H. Smith 84263 (MICH). MINNESOTA—Washington Co. - Afton, 11.vii.1993 Anna Gerenday 9307. MONTANA—Gallatin Co. - Bozeman, divide btwn. Bridger & Kelly Cyn., 2.vii.1957 F. B. Cotner 570039 (MICH). NEW MEXICO—Colfax Co. - Colin Nesblett Wildlife Area, Tolby Creek, 15.viii.1992 NAMA '92 foray participant *s.n.* [Tulloss 8-15-92-A]. Rio Arriba Co. - El Rito, viii.1959 Charles Barrows 1090 (MICH). WYOMING—Teton Co. - Grand Teton Nat. Pk., Reid Mtn., 26.viii.1983 Kent H. McKnight & Meinhard Moser [McKnight 83082610] (BPI as "*A. alba*").

DISCUSSION

In 1990, Moses and her husband cooked up a batch of *A. populiphila*, ate it entirely, and noticed no ill effects whatever. They enjoyed the mushroom again in May, 1992 and note that it ranks as a "good" edible and that the stipe is "pleasantly crispy." Particularly since the species is white or pallid, persons collecting it for the table must be very careful not to confuse it with one of the poisonous white species of *Amanita* section *Phalloideae* (Fr.) Quél.

To justify the novelty of *A. populiphila* it is necessary to compare it to taxa with

similar spores and somewhat weakly structured universal veil (but neither friable, nor with a strong tendency to turn gray at maturity)—*A. arctica* Bas *et al. in* Knudsen & Borgen (1987); *A. lividopallescens* (Secr. *ex* Gillet) Seyot (1930); and *A. nivalis* Grev. (1822).

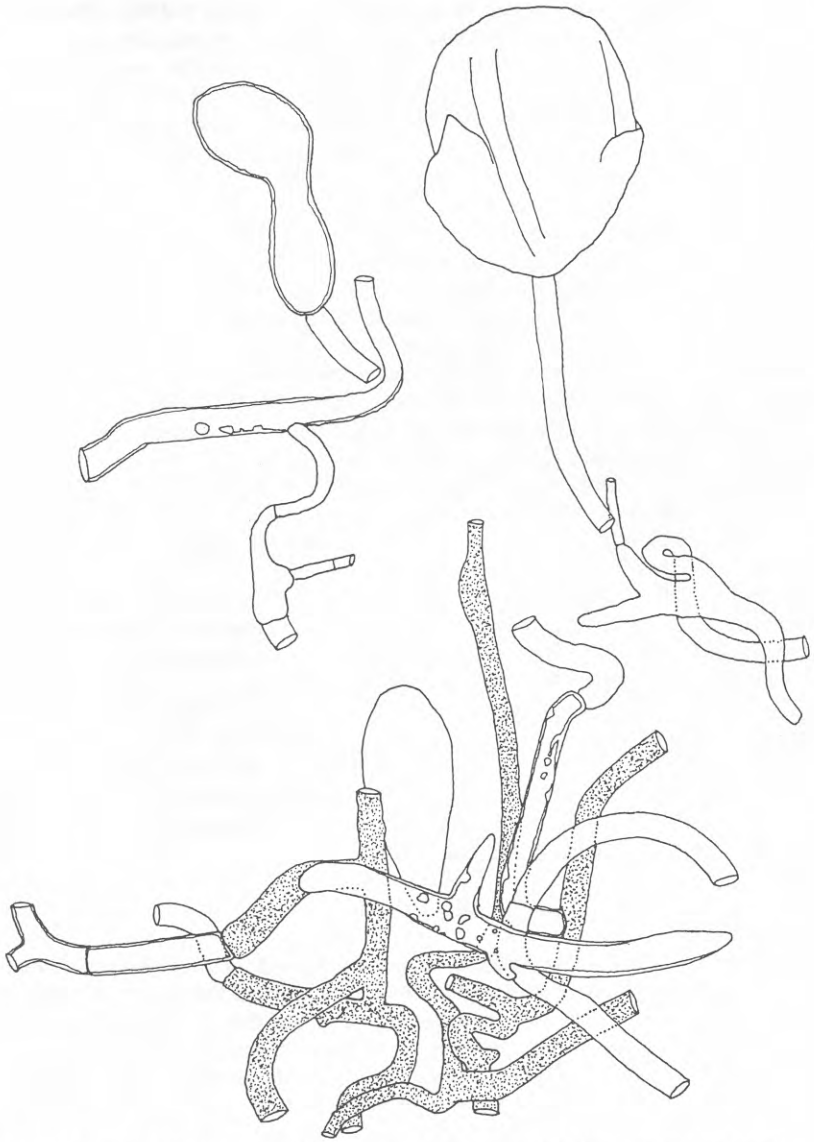


Fig. 5. *Amanita nivalis* (Bas 9307) elements of universal veil interior (stipe base).

Amanita arctica was described from Greenland where it is found associated with *Betula* and *Salix*. According to Tulloss (1994), *A. arctica* has a cellular (pseudoparenchymatous) subhymenium, an universal veil more membranous than in *A. populiphila* (when some is left on the pileus, it is in the form of a single patch), and larger spores (L = 11.0 - 11.9 μm; W = 9.9 - 10.8 μm).

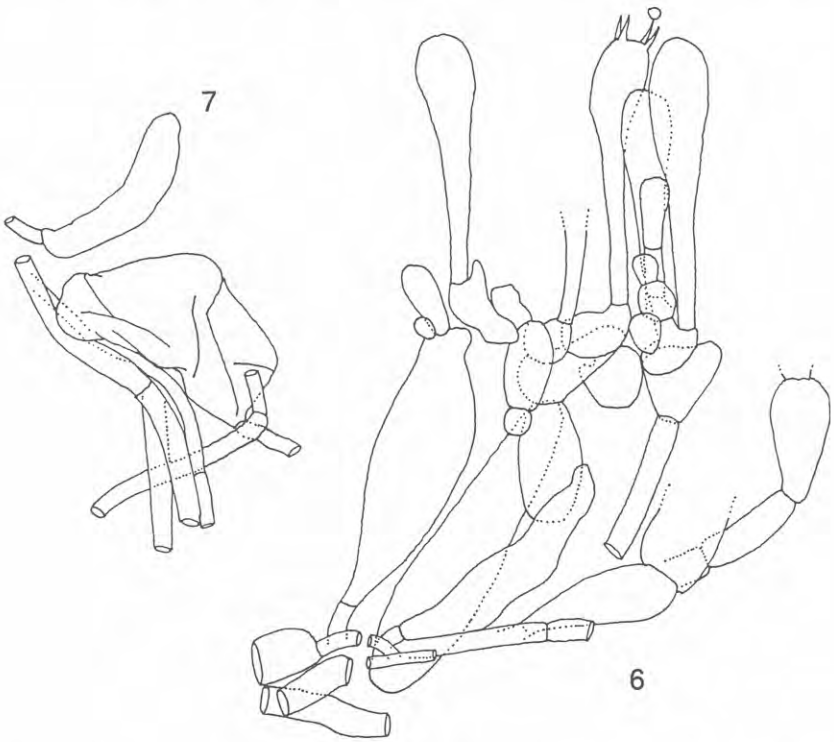
Amanita lividopallescens of Europe is a species often producing very large basidiocarps, the pilei of which are grayish ochraceous at first and become more pallid with age. While its universal veil is somewhat weak, it is often illustrated with a complete, copious, saccate volva. Boudier (1907), whose color plate is considered by many to be the definitive illustration of this species, depicts a large, saccate volva with tears in it. Fraiture (1993) gives the volva of *A. lividopallescens* as the example of his category Ib of volval forms ("voile fragile, très peu membraneux, abandonnant ordinairement des lambeaux sur le chapeau, formant au bas du pied une volve généralement morcelée"). Boudier (1907) described the stipe of *A. lividopallescens* as being up to 250 mm long and its spores as 12 - 16 μm in diameter. Romagnesi (1982) reported a collection of what he determined to be this species having spores 10 - 13.5 μm in diameter. Hence, *A. lividopallescens* differs from *A. populiphila* at least in having a somewhat more coherent universal veil, larger spores, a pileus that is not white at first, and (often) a larger habit.

Amanita nivalis, described from Scotland, is a rather small species that (contrary to some interpretations) is infrequently white at maturity (Watling, 1985; 1987). It is associated with dwarf *Salix* in arctic-alpine environments. Tulloss has examined the neotype (E) and additional material from Norway, Sweden, and Switzerland (BERN, L, and RET) including Bas 9307 (L; RET). In the subhymenial base of *A. nivalis* (Fig. 4) there are fewer inflated cells than in the same structure of *A. populiphila*, except in the portion of a lamella rather close to the pileus context. The pileipellis of *A. nivalis* is only about half as thick as that of *A. populiphila* and the filamentous, undifferentiated hyphae at the surface of the pileipellis in the European species are criss-crossed rather than subradially oriented. Vascular hyphae are lacking in the pileus context of *A. nivalis* except in the region near the stipe apex, and acrophysalides dominate in the stipe context of *A. nivalis*. In the interior of the universal veil of *A. nivalis* (Fig. 5), the filamentous, undifferentiated hyphae are not so commonly fasciculate as in *A. populiphila*; and any fascicles are loosely constructed. Moreover, these hyphae include intercalary segments swollen up to 30 μm wide; and there are common, branching and knotted vascular hyphae throughout the tissue.

Amanita populiphila has been mistaken for *A. vaginata* var. *alba*. According to Dr. C. Bas (pers. comm.), *A. vaginata* var. *alba* is probably not interpreted in the same way by all European mycologists. Heinemann's key (1964) says *A. vaginata* var. *alba* is usually entirely white, but with the cap sometimes slightly ochraceous in the disc and that the universal veil remains entire at the base of the stipe. Fraiture (1993) describes the universal veil as membranous—belonging in his volval form category III. Merlo & Traverso (1983) depict *A. vaginata* var. *alba* as a mushroom with a membranous universal veil of proportions like those seen in *A. fulva* (Schaeff.) Fr. and a pileus that is entirely white with rather long marginal striation (nearly 0.5R). Gilbert (1940-41) describes *A. vaginata* var. *alba* similarly and adds that the

spores are 11.5 - 13.5 μm in diameter. Therefore, based on recent literature, *A. populiphila* differs from apparently commonly held European concepts of *A. vaginata* var. *alba* by having a less membranous universal veil, shorter marginal striation on the pileus, and smaller spores. Also, *A. vaginata* (Bull.:Fr.) Vitt. has a stipe base that is intergrown with the universal veil so that the latter does not separate from the stipe as in *A. populiphila* [*e.g.*, see illustration of Bon (1987: 295)].

Amanita vaginata var. *alba* is described as "a tall, elegant fungus and much the same in stature as *A. fulva*" by Watling (1987) whose concept is based on collections from upland *Betula* woods in northern Scotland. Tulloss examined a specimen from Perthshire [6.ix.1984 R. Watling 17518 (E)]. Spore measurement data from this specimen is as follows: [40/1/1] (9.8-) 11.0 - 13.0 (-13.8) × (9.0-) 10.0 - 12.2 (-13.2) μm, (**L** = 11.9 μm; **W** = 11.0 μm; Q = (1.02-) 1.03 - 1.13 (-1.28); **Q** = 1.08). The subhymenial base in this specimen (Fig. 6) is composed of long, narrow, often curving cells and is thus well-differentiated from a relatively narrow subhymenium (10 - 35 μm from edge adjacent to subhymenial base to nearest base of



Figs. 6-7. *Amanita vaginata* var. *alba sensu* Watling (Watling 17518). 6. Elements of hymenium and subhymenial tree. 7. Elements of universal veil interior (stipe base).

basidium; 35 - 60 μm from edge adjacent to subhymenial base to most distant base of basidium) composed of uninflated or partially inflated hyphal segments and small, irregular, inflated cells (up to 18.0 × 18.0 μm, but usually considerably smaller in at least one dimension) in a branching structure. The central stratum is 40 - 60 μm wide. Parameters of the subhymenial tree (very good rehydration) are w_{st}-near = 60 - 85 (-125) μm; w_{st}-far = 95 - 110 (-145) μm. Clamps were not observed in any tissue. Moreover, in the Scottish collection, inflated cells and hyphae of the universal veil interior were thin-walled (Fig. 7). Hence, *A. vaginata* var. *alba sensu* Watling is easily distinguished from *A. populiphila*.

According to an unpublished manuscript (MICH), A. H. Smith recognized this taxon as a new species assigning it at least one manuscript name. Notes filed in MICH for Trueblood 5472 indicate that E. Trueblood was not successful in an attempt to start a culture from that material.

In the past we have referred to *A. populiphila* as "species KS1" in checklists and correspondence.

ACKNOWLEDGMENTS

We sincerely thank the following persons: Dr. C. Bas, L, for enlightening discussions and correspondence and for his reviewing this paper; Dr. Richard Beeman, Manhattan, Kansas, for providing Moses with macrochemical test reagents; Drs. Jean Boise Cargill and Donald H. Pfister and Mr. Gennaro Cacavio, FH, for their support during visits to their institution; Ms. Lori Fansler, St. George, Kansas, for photographs of Moses' collections of *A. populiphila*; Dr. W. R. Moses for companionship in the field and out and for supportive spade work; Dr. Amy Y. Rossman and Ms. Loretta Alessandrini, BPI, for loan of material and their kindnesses during Tulloss' visit to their institution; Dr. Beatrice Senn-Irlet, BERN, for loan of Swiss collections of *A. nivalis*; Dr. Robert L. Shaffer and Ms. Pat Rogers, MICH, for loans of material and for hosting Tulloss during his visit to their institution; Mr. David C. Tulloss, Berkeley, California, for preparing the habit illustration of *A. populiphila*; Ms. Mary Tulloss, Roosevelt, New Jersey, for her assistance in preparing the paper for publication; and Dr. Roy Watling, E, for loan of material. Tulloss is grateful for support from the Alexander H. and Helen V. Smith Fund (Mycological Society of America) that enabled him to spend fruitful days in MICH.

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