AMANITA BASIANA—A NEW SPECIES FROM PURE PINUS FOREST AND RESEMBLING THE ALNUS-ASSOCIATED SPECIES AMANITA FRIABILIS

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Summary

Amanita basiana (*Amanita* section *Amanita*) is described as new from pure pine forest in Liguria, Italy. It is phenetically similar to *A. friabilis*, which is only known from wet habitat associated with *Alnus*.

Riassunto

Amanita basiana (*Amanita* sezione *Amanita*) viene descritta come una nuova specie rinvenuta in pineta pura in Liguria, Italia. Essa é morfologicamente simile ad *A. friabilis*, conosciuta solamente crescita in habitat umido e in associazione con *Alnus*.

Methods and terminology in the present paper are based on those of Tulloss *et al.* (1992) with amendations from Tulloss (1993, 1994) that have been summarized in (Tulloss, 2000). Abbreviations for names of herbaria are derived from Holmgren *et al.* (1990). Color notations of the form "5E5" are from Kornerup and Wanscher (1978).

AMANITA BASIANA Tulloss & M. Traverso *sp. nov.*

Illus.: Tulloss & M. Traverso. 2000. *Boll. Gruppo Micol. G. Bresadola* 43(2): figs. a-d.

*Pileus (*30-) 40 - 75 (-100) *mm latus, initio pallidocinereus vel brunneogriseus deinde griseobrunneus vel flavobrunneus vel brunneus, saepe disco fusciore, raro omnino fuligineus, initio globosus deinde plano-convexus, haud umbonatus, solito siccus, caelo humido tamen viscidus, nunquam glutinosus, rare nudus etsi imber effusus est assiduus; margine striato* (0.3R - 0.5R) *non appendiculato; carne alba non mutabili; laminis farinosis vel coactis vel subcoactis obtectus, plus minusve latis, atque verrucis exiguis densisque, initio albis dein griseis denique brunneolis, ad pileipellem adnatis veli universalis vestigiis. Lamellae liberae vel uncinatae, albae, subdistantes,* 8 - 9 *mm latae, lamellulis truncatis vulgaribus longitudine varia. Stipes* ($10^{\pm}$-) 35 - 90 (-110) × 10 - 13 (-20) *mm, albus, materia flocossa et cinerea vela universalis decoratus, bulbo basali, annulo evanescente, saepe fragmento subbasali annuliformi vela universalis, saepe zona subbasali strangulata et non decorata. Sporae* (8.5-) 10.0 - 13.6 (-26) × (7.5-) 8.0 - 10.7 (-15.3) *µm, subglobosae vel late ellipsoideae vel ellipsoideae, raro cylindricae. Basidia* 35 - 64 × 12.7 - 17.1 *µm, plurima tetrasporigera, alia bisporigera. Fibulae nullae. Holotypus: in loco Piani di Prá, Janua Ligurum, Italia*, 26.x.1999 M. Traverso & P. Roncallo [Traverso 30.0] (GDOR).

Etymology: In honor of Dr. Cornelis Bas, Rijksherbarium, Leiden, perceptive, meticulous, and innovative monographer of *Amanita*, *Squamanita*, *Pseudobaeospora*, etc.; dedicated and demanding editor of *Persoonia* and *Flora Agaricina Neerlandica*; Pied Piper of mycology in the Netherlands; academic parent of a generation of finely trained agaricologists; generous friend and mentor.

PILEUS: (30-) 40 - 75 (-100) mm wide, pale ash gray to brownish gray at first, becoming darker with age such as brownish gray with bronze tint or yellowish brown or brown (*e.g.*, 5E5 or 6E4), usually darker over disc, rarely entirely fuligineous, globose at first, then hemispheric, finally convex to plano-convex, not umbonate, slightly viscid in humid weather but not sticky; *context* white, unchanging when cut or bruised, 6 - 8 mm thick over stipe; thinning evenly to $75^{\pm}$% of radius then membranous to margin; *margin* striate (0.3R - 0.5R), nonappendiculate; *universal veil* as broad felted patches or confluent warts, whitish in button stage then grayish and finally brownish, friable, difficult to remove entirely even after heavy rains, often eventually detersile in age.

LAMELLAE: usually free, briefly uncinate in some basidiocarps, with short decurrent lines on stipe apex, subdistant, 1.5 - 2 mm apart at pileus margin at maturity, white to cream-white, 8 - 9 mm broad, neither forking nor anastomosing, with finely floccose edge concolorous with or slightly darker than hymenial surface; *lamellulae* truncate, of diverse lengths (from 0.3 – 0.8× length of lamellae), irregularly distributed, common.

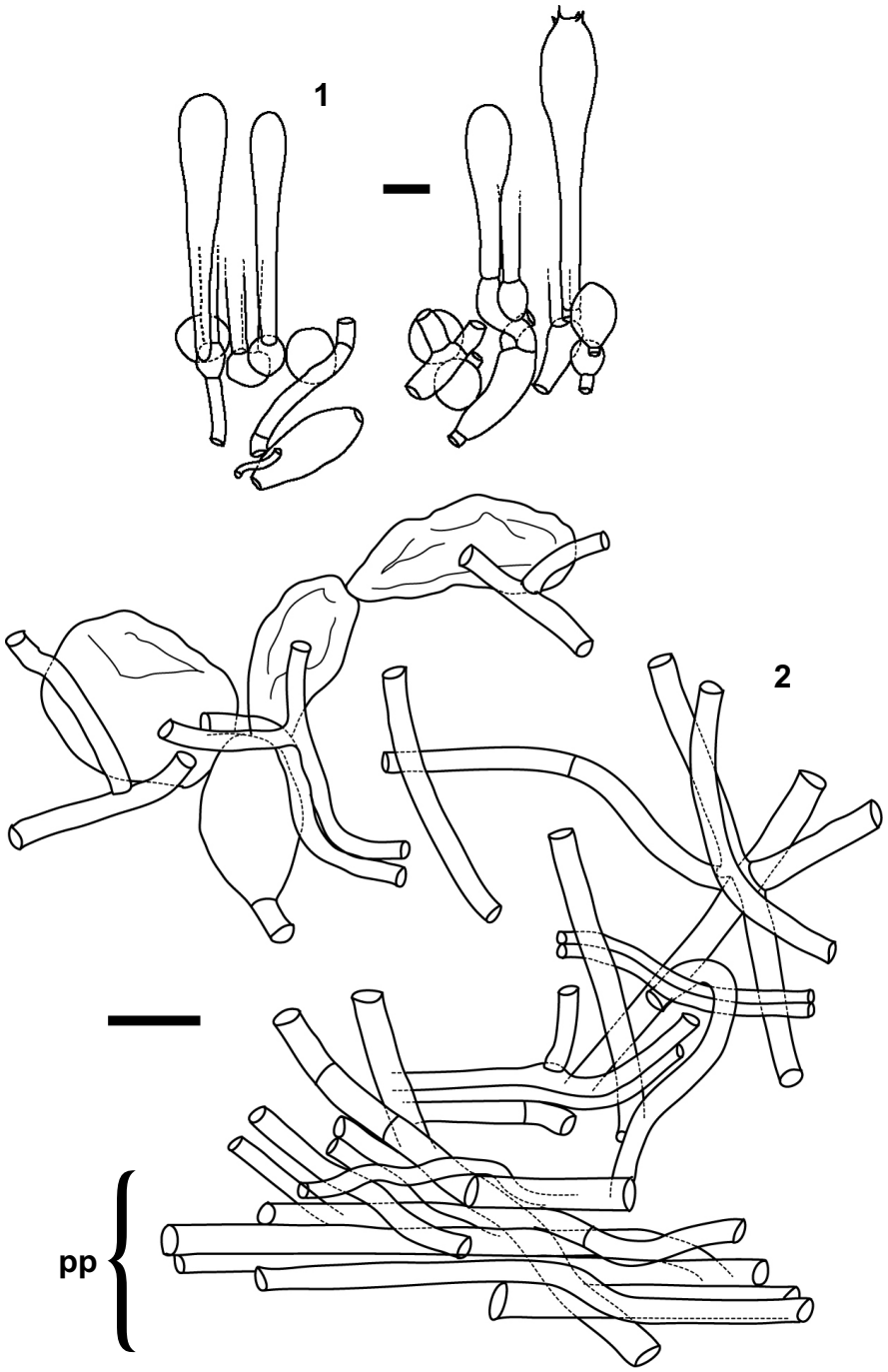
STIPE: ($10^{\pm}$-) 35 - 90 (-110) × 10 - 13 (-20) mm, cylindric or narrowing upward slightly, flaring very slightly at apex, with fine pale brownish gray squamules on upper part, decorated with blackish brown somewhat subtle zebrature becoming denser and coarser toward stipe base or when interrupted in this region forming obliquely oriented rings (see below); *bulb* subovoid, $20^{\pm}$ × 10 - 20 (-25) mm, sometimes very minimal in mature material; *context* white, unchanging when cut or bruised, often with brown-orange or ferruginous spots in base of bulb, stuffed with pithy material at first, then hollow, with central cylinder 3 - 5 mm wide; *partial veil* as very thin membrane clearly visible in partially expanded button specimens, whitish, often evanescent and quickly lost; *universal veil* as friable layer on upper part of bulb, sometimes lost at least in part, concolorous with material on pileus, sometimes with incomplete cottony ring of *limbus internus* on lower stipe suggesting inferior to subbasal annulus.

Odor not distinctive. *Taste* not recorded.

MACROCHEMICAL TESTS: none recorded.

PILEIPELLIS: 60 - 170 µm thick, with colorless upper layer 25 - 55 µm thick and brown-orange lower layer 35 - 120 µm thick, often ungelatinized below warts or patches of universal veil but becoming partially gelatinized in colorless layer in age, with occasional openings allowing view of lower layers of pileipellis hyphae, with broken stubs of filamentous, undifferentiated hyphae (common) and vascular hyphae (infrequent) scattered over surface (apparently remnants of hyphae formerly crossing boundary between pileipellis and universal veil); filamentous, undifferentiated hyphae 2.3 - 7.6 µm wide, branching, in fascicles, dominantly radially arranged except over disc, there less tightly packed and interwoven, minimally gelatinized even in areas lacking universal veil (in Traverso 30.2); vascular hyphae 3.8 - 11.4 µm wide, sinuous, rarely branching, scattered, but locally common and somewhat mutually interwoven. PILEUS CONTEXT: filamen-

tous, undifferentiated hyphae 2.2 - 8.9 µm wide, common, commonly branched, comprising open lattice structure, infrequently with yellowish subrefractive walls, with plentiful intercalary inflated cells up to 159 × 38 µm (sometimes in short chains, subfusiform to fusiform to broadly fusiform, thin-walled); acrophysalides up to 89 × 39 µm, often with inflated subtending hyphal segment, clavate to elongate-ellipsoid, common, thin-walled; vascular hyphae 3.8 - 15.0 µm wide, uncommon, sinuous, infrequently with tight loop or self-entangled. LAMELLA TRAMA: bilateral; w_{cs} = 55 - 60 µm (moderate rehydration); subhymenial base dominated by diverging inflated to partially inflated hyphal segments, usually one or two such segments sufficient to connect central stratum to subhymenium; filamentous, undifferentiated hyphae 2.5 - 3.6 µm wide with frequent slightly inflated intercalary segments up to 13.0 µm wide and in both central stratum and subhymenial base; terminal, inflated cells not observed; vascular hyphae 3.0 - 5.5 µm wide, scattered, tangled locally, sinuous, branching very infrequently. SUBHYMENIUM: w_{st}-near = 70 - 75 µm (moderate rehydration); w_{st}-far = 85 - 90 µm (moderate rehydration); [w_{st}-far - w_{st}-near] = 15 - 40? µm; having frequently branching short-segmented structure with segments variously uninflated, partially inflated or fully inflated, with inflated cells usually having major diameter less than 12.5 µm, with basidia arising from segments of any of these types. BASIDIA: 35 - 69 × 12.7 - 17.1 µm, 4- or infrequently 2-sterigmate, with sterigmata up to 10.0 × 2.8 µm; clamps not observed here or in any other tissue. UNIVERSAL VEIL: *On pileus, away from pileus surface*: filamentous, undifferentiated hyphae 2.1 - 7.1 µm wide, plentiful, branching, with walls thin or up to 0.5 µm thick, colorless or yellowish or brownish, sometimes with subrefractive walls, often slightly constricted at septa, often fasciculate; inflated cells plentiful, up to 74 × 57 µm, with walls thin or up to 0.5 µm (rarely to 0.8 µm) thick, colorless to brownish, globose to subglobose to subpyriform to ovoid to ellipsoid to broadly fusiform to clavate to narrowly clavate-constricted, terminal singly or more often in short chains of 2 - 4 (-6?) cells with distinct vertical orientation; vascular hyphae not observed. *On pileus, near pileipellis*: filamentous, undifferentiated hyphae more plentiful than in upper part, even dominating, many crossing between pileipellis and universal veil (Fig. 2); inflated cells scattered to fairly abundant, sometimes in clusters; vascular hyphae not observed. *From ring above strangulate region of stipe*: very similar to that on pileus, perhaps with inflated cells somewhat more plentiful; filamentous, undifferentiated hyphae 2.9 - 11.2 µm wide, plentiful to dominant, commonly branching, with walls thin or slightly thickened, sometimes with yellowish subrefractive walls, sometimes in fascicles; inflated cells up to 77 × 55 µm, plentiful, globose to subglobose to subpyriform to ovoid to ellipsoid to clavate (sometimes constricted), colorless or faintly brownish to faintly grayish to pale brown to pale yellow-brown, terminal in chains of up to six cells, with walls thin or up to 0.6 µm thick; vascular hyphae not observed. STIPE CONTEXT: longitudinally acrophysalidic; filamentous, undifferentiated hyphae 4.2 - 10.3 µm wide, branching, plentiful, dominating near stipe surface; acrophysalides up to 300 × 40 µm (predominantly less than 230 µm long), sometimes subtended by similarly shaped inflated cell, dominating away from stipe surface; vascular hyphae 4.1 - 7.6 µm wide, sinuous, unbranching, infrequent, sometimes sublongitudinally oriented in narrow elongate coil. PARTIAL VEIL: *On upper stipe surface*: largely gelatinized; where remnants discernible, scattered clavate inflated cells of uniform proportions dominating, with major axes longitudinally oriented, 28 - 65 × 15.0 – 23 µm, singly terminal on filamentous, undifferentiated hyphae. *From fresh material*: see (Tulloss & M. Traverso, 2000: fig. c).



Figs. 1-2. *Amanita basiana* (holotype). 1. Elements of hymenium and subhymenial tree. (Scale bar represents10 µm.) 2. Elements of lower part of universal veil and adjacent portion of pileipellis (pp), simplified by elimination of some hyphae. (Scale bar represents 20 µm.)

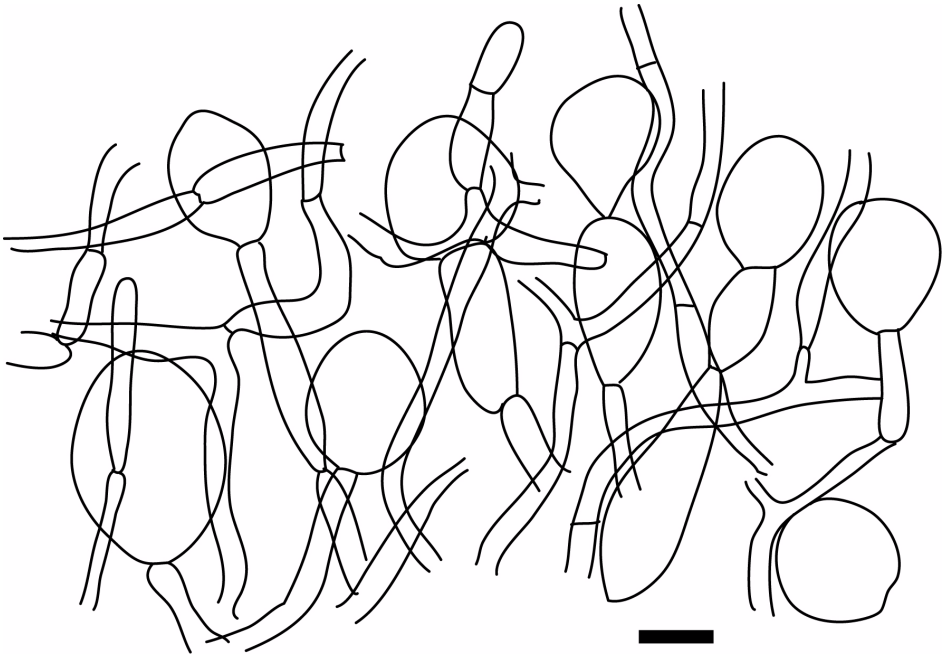


Fig. 3. *Amanita basiana* (2.xii.1997 Traverso *s.n.*) elements of universal veil from pileus in approximate radial section from region above contact with pileipellis, based on pencil drawing by Dr. C. Bas (original in L) annotated by him to indicate simplification by omission of numerous hyphae. (Scale bar represents 20 µm.)

BASIDIOSPORES: [280/14/3] (8.5-) 10.0 - 13.6 (-26) × (7.5-) 8.0 - 10.7 (-15.3) µm, (**L** = (9.7-) 11.2 - 12.1 (-13.2) µm; **L'** = 11.6 µm; **W** = (7.9-) 8.7 - 10.6 µm; **W'** = 9.2 µm; **Q** = (1.08-) 1.13 - 1.44 (-2.34); **Q** = 1.21 - 1.33 (-1.36); **Q'** = 1.27), hyaline, colorless, thin-walled, smooth, inamyloid, subglobose to broadly ellipsoid to (occasionally) ellipsoid, rarely elongate or cylindric (in such cases malformed), rarely constricted, often adaxially flattened, often swollen at one end, in immature material (especially) sometimes elongate-pyriform or peanut-shaped or subclavate or subfusiform or otherwise malformed; apiculus sublateral, cylindric; contents sometimes granular or multiguttulate but predominantly monoguttulate, often with additional small granules; white in deposit.

Habitat and distribution: Subgregarious to gregarious or in troops. Italy: At 230 - 250 m elev. In pure *Pinus pinaster* Ait. forest in dry area exposed to sunlight 50 m to 1 km from coast.

Collections examined: **ITALY**: LIGURIA - Genoa, Piani di Prà, 2.xii.1997 M. Traverso *s.n.* (L; RET; *in herb.* M. Traverso), 28.x.1998 M. Traverso 30.2 (NY; RET; *in herb.* M. Traverso), 26.x.1999 M. Traverso & P. Roncallo [Traverso 30.0] (holotype, GDOR; isotypes, L & RET & *in herb.* M. Traverso).

DISCUSSION

It was not possible to determine from macroscopic examination of exsiccata whether the tissue found on the stipe surface and ascribed to the partial veil was indeed part of a par-

tial veil. However, partial veil tissue from fresh material depicted by Tulloss & M. Traverso (2000: fig. c) is very like the dried tissue we describe. This tissue is quite distinct from that of the universal veil because of the uniform form and orientation of the inflated cells as well as the fact that they do not occur in chains. Cells of this type (interspersed with similarly oriented hyphae and, often with a thin layer of similarly oriented hyphae on at least the upper surface) are typical of those found in partial veils in *Amanita*. Therefore, it seems probable to us that our description of the partial veil tissue based on dried material is correct, although possibly lacking some details.

Amanita basiana (Tulloss & M. Traverso, 2000: figs. a-b, d) seems, at first, strikingly similar to *A. friabilis* (P. Karst.) Bas, also known from Europe; however, there are a number of points distinguishing the two taxa:

- habit—The pileus of *A. friabilis* is (10-) 30 - 55 (-80) mm wide according to Bas (1974: 18).
- universal veil—That of *A. friabilis* has a greater percentage of inflated cells, especially away from the pileus surface (Bas, 1974: 19, fig. 5). This contributes to remnants of the universal veil on the pileus being segregated into distinct powdery warts.
- partial veil—If this structure is ever coherent in *A. friabilis*, it is much more tenuous than in the present species; indeed, Bas (1974: 21) considered *A. friabilis* to be a "ringless species."
- spore size and shape—The ranges of lengths and widths both are shifted upward slightly in the present species compared with the ranges in *A. friabilis* described by Bas (1974: 20 & 1982: 442). Our study of five collections of *A. friabilis* produced similar results (below). The range of **Q** is shifted downward in the present species compared with that range in *A. friabilis*. (The lowest **Q** value was obtained from data on spores of an old specimen that also exhibited the lowest value of **L**.)
- habitat—*A. friabilis* is only known to occur with *Alnus* in areas with wet soils while the present species is, to date, known only to occur with *Pinus* in a mesic region.

BASIDIOSPORES of *A. friabilis*: [100/5/4] (8.4-) 9.6 - 12.7 (-17.8) × (6.6-) 7.5 - 10.0 (-11.5) µm, (**L** = 10.8 - 11.9 µm; **L'** = 11.3 µm; **W** = 8.2 - 9.0 µm; **W'** = 8.5 µm; Q = (1.06-) 1.13 - 1.61 (-1.78); **Q** = 1.23 - 1.42; **Q'** = 1.33), hyaline, colorless, thin-walled, smooth, inamyloid, subglobose to broadly ellipsoid to ellipsoid, infrequently elongate, occasionally constricted, often adaxially flattened, often swollen at one end; apiculus sublateral, cylindric; contents sometimes granular or multiguttulate but predominantly monoguttulate, often with additional small granules; color in deposit not recorded.

Collections of A. friabilis examined: **AUSTRIA**: $5^{\pm}$ km SSE of Klagenfurth, Hauswandel, 7.x.1978 C. Bas 7422 (L; RET). **NORWAY**: HEDMARK - Rinsaker, Putten, Furnesåsen [UTM_{ED60} (PN 10-11,53-54)], 22.ix.1995 G. Gulden 91/95 (O 70889). OPPLAND - Gjövik komm., Svennesvollene naturreservat [NN 8760 (1816 I)], 24.viii.1985 T. E. Brandrud & J. Stordal 24310 (O 58532). ÖSTFOLD - Hvaler, Kirköy, 2.ix.1982 Ö. Weholt 191182 (L; RET).

The poorly known *A. hyperborea* (P. Karst.) Fayod, originally described from "Russian

Lapland," has similarly shaped spores and an incompletely gelatinizing pileipellis. However, this species also has (Bas, 1982: 436-438)

- a basidiocarp that is almost entirely white or whitish
- spores with **Q** of 1.2—so far as is known (less than **Q** in any collection of *A. basiana* we have examined)
- hyphae in the universal veil on the pileus which commonly have refractive content
- an extreme northerly distribution—so far as is known.

Other taxa of *Amanita* section *Amanita* with

(a) pulverulent universal veil including hyphae intimately connected to pileipellis that is not or poorly gelatinizing

(b) partial veil lacking or ephemeral (with one apparent exception)

(c) basidia lacking basal clamps

(d) pileus and universal veil not brightly colored

(e) basidiocarp rather small and gracile with marked marginal striations on the pileus

differ from *A. basiana* as follows:

- *Amanita brunneoconulus* Bas & Gröger *in* Bas (1982) of Europe - stipe exannulate from early development; basidiocarp lacking any gray tones; universal veil on pileus disc disposed in conical warts; spores with **Q** = 1.05
- *Amanita farinosa* Schw. (1822) of eastern North American *Quercus-Fagus* forest (Tulloss, unpub. data; Z. L. Yang, unpub. data) and Central American *Quercus* forest (Tulloss, R. E. Halling & G. M. Mueller, unpub. data) - stipe exannulate from early development; universal veil not leaving coherent pseudoannuli on stipe and only a thin powdery rim on basal bulb; spores smaller with length (6.0-) 6.5 - 8.8 (-10.5) and **Q** = 1.15 - 1.27 (-1.31); apparently associated with Fagaceae
- *Amanita nehuta* Ridley (1991) of New Zealand - pileus buff; stipe exannulate from early development; inflated cells of universal veil distinctly warted—a cell wall decoration that may be unique in the genus (Tulloss, unpub. data); spores smaller with length 6.5 - 9 µm and **Q** = 1.16; associated with *Kunzea*, *Leptospermum*, and *Nothofagus*
- *Amanita obsita* Corner & Bas (1962) of Singapore - pileus pallid, with pale fuscous disc; stipe exannulate from early development; spores smaller with length 5.8 - 6.7 µm (up to 1.5 µm longer when fresh) and **Q** = 1.1; fruiting "in jungle"
- *Amanita xerocybe* Bas (1978) of Amazonian Brazil - pileus white to pale ochraceous and sometimes browner over disc and having broad umbo at maturity; stipe having persistent annulus; spores smaller with length 7.8 - 9.1 (-9.7) µm and **Q** = 1.0 - 1.05; associated with Sapotaceae and/or Leguminosae.

Another poorly known taxon is sufficiently similar in general habit, pigmentation, spore size and shape, and macroscopic form of universal veil that it might also be considered

for comparison—namely *A. umbrinella* E. J. Gilb. & Clel. *in* E. J. Gilb. (1941) of South Australia. The recently proposed name *A. bambra* Grgurinovic (1997) appears to us to be a taxonomic synonym of *A. umbrinella*.

Amanita umbrinella differs from *A. basiana*, additionally, in having

- brief or lacking marginal striations on the pileus
- a median to inferior partial veil that usually persists until maturity and is markedly striate above
- limbate remains of the universal veil more common on the stipe bulb, at least at first
- a pallid stipe that is undecorated or minimally decorated. See illustrations of Gilbert (1941: pl. 23-24).

Amanita bambra was based on collections of Cleland determined by him as *A. grisea* Massee & Rodway. These collections (in AD) are different than those similarly determined collections Cleland sent to Gilbert that served as holotype and paratypes of *A. umbrinella*. However, macroscopic characters in the two protologues are nearly perfectly the same (down to citing, with few exceptions, the same Ridgway color names) and apparently derive from the same pre-1940 publications of Cleland [*e.g.*, (Cleland, 1934)]. Moreover, although little microscopic data are available in the two protologues, the ranges of spore lengths and widths given by Cleland and Gilbert fit within those of Grgurinovic. Approximating **Q'** from the data of Cleland and Gilbert for *A. umbrinella* yields 1.2, which is the value given by Grgurinovic for **Q'** in the case of *A. bambra*. This value is slightly lower than that computed for *A. basiana* and lower than the **Q** value obtained from any single examined specimen of the present species. Treatment of *A. umbrinella* is omitted in Grgurinovic's study.

Singer's concept of *A. umbrinella* based on material so determined from Argentina and Chile is a misapplication of the name. Tulloss (unpub. data) has found South American material of "*A. umbrinella*" determined by Singer (BAFC, F) to include collections of *A. morenoi* Raithelhuber and a species close to, or identical with, *A. diemii* Sing.

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LITERATURE CITED

Bas, C. 1974. A rare but widespread *Amanita* associated with *Alnus*. *Travaux mycologiques dédiés à R. Kühner, numéro spécial de la Bulletin de la Société Lin-*

néenne de Lyon: 17-23.

Bas, C. 1978. Studies in *Amanita*—I. Some species from Amazonia. *Persoonia* 10: 1-22.

Bas, C. 1982. Studies in *Amanita*—II. Miscellaneous notes. *Persoonia* 11: 429-442.

Cleland, J. B. 1934. *Toadstools and mushrooms and other larger fungi of South Australia*. (Brit. Sci. Guild (S. Austral. Branch)). 178 pp.

Corner, E. J. H. and C. Bas. 1962. The genus *Amanita* in Singapore and Malaya. *Persoonia* 2: 241-304.

Gilbert, E. J. 1940-41. Amanitaceae. *Iconogr. Mycol. (Milan)* 27 suppl. 1(1-3). x+427 pp., 73 pl.

Grgurinovic, C. A. 1997. *Larger fungi of South Australia*. (Bot. Gard. Adelaide, State Herbarium, Fl. Fauna S. Austral. Handbooks Comm., Adelaide). vi+725 pp.

Holmgren, P. K., N. H. Holmgren and L. C. Barnett. 1990. *Index herbariorum. Part I. The herbaria of the world*, 8th ed. *Regnum Veg.* 120: 1-693.

Kornerup, A. and J. H. Wanscher. 1978. *Methuen handbook of colour.* (London). 252 pp.

Ridley, G. S. 1991. The New Zealand species of *Amanita* (Fungi: Agaricales). *Austral. Sys. Bot.* 4: 325-354.

Schweinitz, L. D. von. 1822. Synopsis fungorum Carolinae superioris. *Schriften Naturf. Ges. Leipzig* 1: 20-131.

Tulloss, R. E. 1993. *Amanita pachysperma*, *Amanita subvirginiana*, and *Amanita virginiana* (taxonomy and distribution) with notes on description of the lamella trama in *Amanita*. *Mycotaxon* 49: 449-475.

Tulloss, R. E. 1994. Type studies in *Amanita* section *Vaginatae* I: Some taxa described in this century (studies 1-23) with notes on description of spores and refractive hyphae in *Amanita*. *Mycotaxon* 52: 305-396.

Tulloss, R.E. 2000. Note sulla metodologia per lo studio del genere *Amanita* (Agaricales). *Boll. Gruppo Micol. G. Bresadola* 43(2): in press.

Tulloss, R. E., C. L. Ovrebo and R. E. Halling. 1992. Studies on *Amanita* (Amanitaceae) from Andean Colombia. *Mem. New York Bot. Gard.* 66: 1-46.

Tulloss, R. E. and M. Traverso. 2000. Illustrazioni di una nuova specie di *Amanita* dedicata al dr. Cornelis Bas di Leiden. *Boll. Gruppo Micol. G. Bresadola* 43(2): in press.


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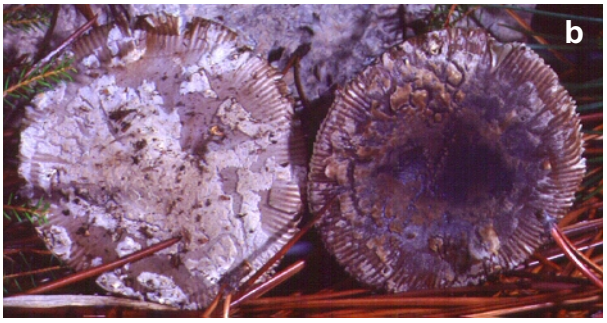
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