

**AMANITA RISTICHI: A NEW SPECIES FROM NEW ENGLAND
WITH BASIDIA DOMINANTLY 2-SPORED**

Rodham E. Tulloss
21 Lake Drive
Roosevelt, NJ 08555

Summary

Amanita risticchi is described as new from southern Maine and New Hampshire. Worldwide, this is the fourth taxon of section *Vaginatae* to be described as having dominantly bisterigmate basidia. Two other species (*A. pachysperma* Atkinson and *A. virginiana* (Murrill) Murrill) were also described from the eastern United States. *Amanita submembranacea* var. *bispora* Reid was described from the United Kingdom.

Amanita risticchi Tulloss sp. nov. Holotypus: Maine, Oxford Co., Oxford, T. Herman 7-15-85-SSR1 (NY).¹

Etymology: Named in honor of Dr. Samuel S. Ristic, Cumberland Center, Maine—entomologist, mycologist, lover of nature, and enthusiastic teacher.

Pileus albus, impolitus, 25 - 64 mm in mensura diametrica; margine striata, nonappendiculata; materies volvica absentes. Lamellae condensae, in massa albae vel roseae; lamellulae abundantes. Stipes 37 - 89 × 3 - 9 mm, albus; annulus superus vel subsuperus, tenuis, albus, interdum evanescens; volva membranacea, alba, 12 - 25 alta, interdum limbis acutis. Dimidium vel duo trientes basidiarum bisterigmaticarum; fibulae praesentes. Sporae: (9.2-) 10.2 - 14.2 (-17.0) × (6.6-) 7.0 - 9.0 (-12.8) μm, subellipsoideae vel ellipsoideae vel elongatae, nonamyloideae.

Belonging to section *Vaginatae*, *Amanita risticchi* (Fig. 1) is a rather small, delicate, white mushroom with a slender stipe exhibiting a superior to subsuperior annulus. The pileus usually has no remnants of the universal veil upon it and has a striate, nonappendiculate margin. The stipe base is contained by a saccate, persistent, membranous universal veil which is separated into several lobes. The lamellae are usually quite notably pinkish or pale orangish, although in one of six specimens

1.

FH - Farlow Library and Herbarium, Harvard University, Cambridge, Massachusetts, U.S.A.
NY - Herbarium of The New York Botanical Garden, Bronx, U.S.A.

All collections with no herbarium location cited are in the author's private herbarium. The author's collection numbers are composed of three numbers (month, day, year) and a string of characters which serve to distinguish fungi collected on a given day.

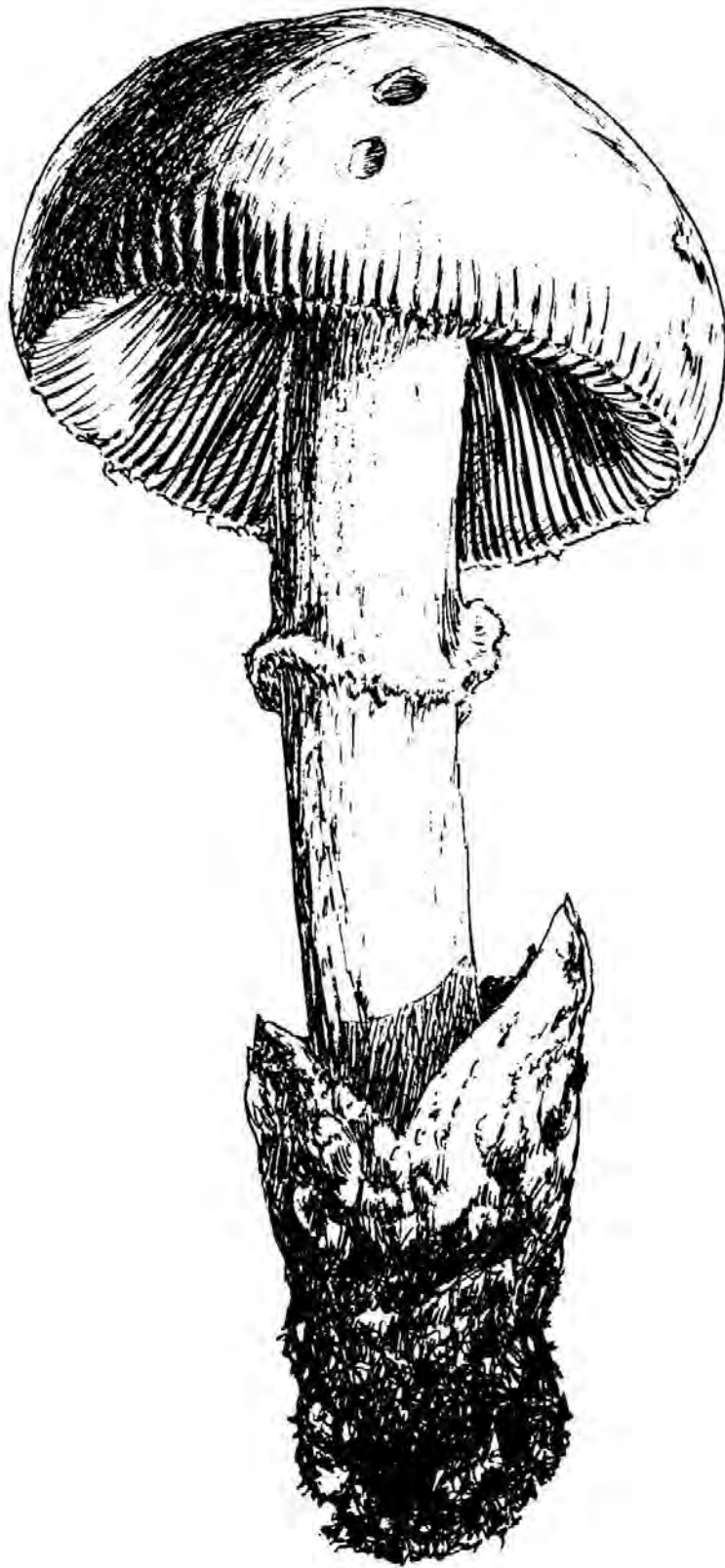


Fig. 1 *Amanita ristichii*. S. S. Ristich 7-11-84-SSR1 [$\times 3$].

examined, they were whitish. The microscopic characters that are particularly notable are the dominantly bisterigmate basidia and the rather large spores. At present, the taxon is known only from the southern parts of the states of Maine and New Hampshire, U.S.A.

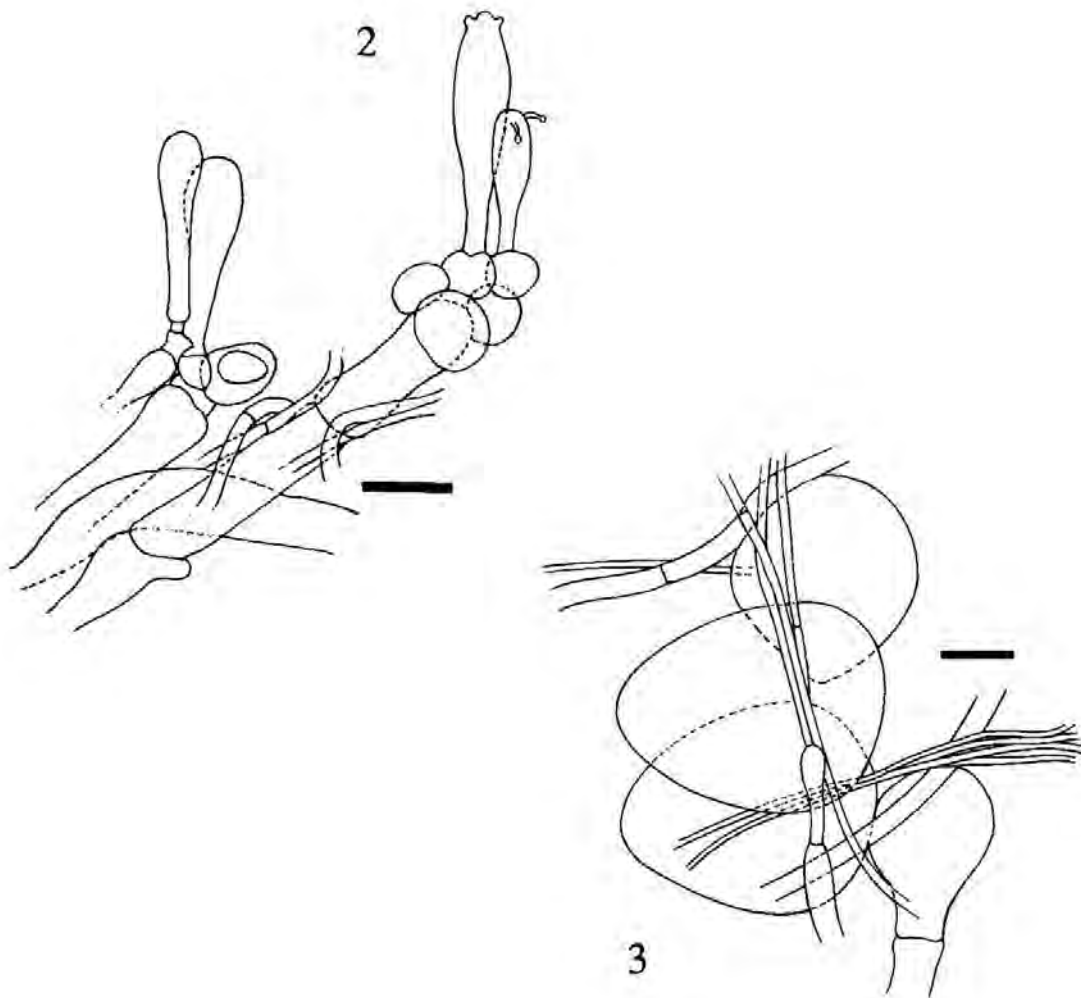
PILEUS: 25 - 64 mm diam, hemispheric at first, becoming convex then planoconvex, sometimes with slight umbo, white, surface dull to slightly shiny, subviscid; margin striate (.2R - .3R), nonappendiculate; context whitish, 3± mm thick at stipe; lacking remnants of universal veil. **LAMELLAE:** close, about 3 mm or more broad, free to narrowly adnate, pinkish or (occasionally) whitish in mass, drying pinkish to pale orange (5A3² or 5YR 8/4³), occasionally anastomosing; lamellulae plentiful, subtruncate. **STIPE:** 37 - 89 × 3 - 9 mm, narrowing upwards, white, browning from handling, longitudinally striate, pulverulent above annulus, somewhat fibrillose below; context whitish, hollow with some cottony stuffing in 1 - 2 mm diam central cylinder; partial veil superior to subsuperior, white, delicate, finely striate above, sometimes disappearing or, if not, becoming appressed to stipe and browning at margin in age; universal veil membranous, persistent, saccate, breaking into several, sometimes pointed limbs about 1 mm thick, white to whitish, flaring in upper one-half to two-thirds or collapsed against the stipe, with tallest limb reaching 12 - 25 mm from stipe base; limbus internus positioned in upper third of interior surface of limb. Odor and taste not recorded.

PILEIPELLIS: 50 - 60 µm thick, composed of undifferentiated, filamentous hyphae and occasional oleiferous hyphae (sometimes in fascicles) randomly to subradially arranged, interweaving, gelatinizing throughout, but especially strongly in upper 10 µm; penetrated in lower portion by upturned tips of hyphae (filamentous or inflated) from pileus trama. **PILEUS CONTEXT:** a tangle of interwoven, branching, undifferentiated, filamentous hyphae <1 - 10.8 µm diam; slightly inflated hyphae to 19.6 µm diam; occasional oleiferous hyphae 1.7 - 4.5 µm diam; inflated cells to 135 × 45.5 µm, elongate clavate to bacilliform, somewhat difficult to reinflate. **LAMELLA TRAMA:** bilateral; branching undifferentiated filamentous hyphae 1.5 - 5.6 µm diam; somewhat inflated hyphae to 14.7 µm diam, with occasional, conspicuous clamps; inflated cells to 115 × 26 µm in chains; branching, oleiferous hyphae present 2.5 - 13.3 µm diam. **SUBHYMENIUM:** small cellular, subglobose to pyriform elements in short chains clustered at the end of the broadest diam hyphae which arise in the central stratum. **BASIDIA:** 42.5 - 60 × 8.5 - 12.5 µm, clavate to narrowly clavate, about half to two-thirds 2-spored, also 1-, 3-, and 4-spored, a number aborted or stunted (measurements of such not included in dimensions cited), thin-walled, apparently rapidly collapsing after release of spores; some basidioles branching; sterigmata to 3.5 µm long; clamps frequent. **UNIVERSAL VEIL:** throughout dominated by sublongitudinally oriented hyphae; outer surface consisting of interwoven to sublongitudinally arranged branching undifferentiated filamentous hyphae 1.7 - 5.6 µm diam, gelatinizing; inner surface composed of longitudinally oriented hyphae to 14 µm

2. This color code is from Komerup & Wanscher (1978).

3. This color code is from Munsell Color (1975).

diam in a rather easily separable layer, less than five hyphal diams thick, somewhat gelatinizing; inflated cells confined to interior, terminal, broadly ellipsoid to cylindrical, up to $77 \times 63 \mu\text{m}$; oleiferous hyphae throughout $4.9 - 7.7 \mu\text{m}$ diam; tissues densest on inner and outer surfaces, else rather uniform in cross-sectional mount; in some specimens, all tissues somewhat difficult to reinflate except oleiferous hyphae. STIPE CONTEXT: acrophysalidic; branching, filamentous, undifferentiated hyphae, $1.0 - 4.2 \mu\text{m}$ diam; acrophysalides narrow elongate to $400 \times 42 \mu\text{m}$; oleiferous hyphae present $3.5 - 8.4 \mu\text{m}$ diam. PARTIAL VEIL: dominated by branching undifferentiated filamentous hyphae $1.4 - 7.7 \mu\text{m}$ diam, partially gelatinizing and difficult to reinflate; branching oleiferous hyphae $2.1 - 5.9 \mu\text{m}$ diam, densely tangled locally; inflated cells difficult to reinflate, apparently subglobose to broadly ellipsoid to ovoid to elongate to clavate, up to $81 \times 49 \mu\text{m}$. All tissues pale yellow in NH_4OH .



Figs. 2-3 *Amanita ristichii*. 2. Portion of hymenium and subhymenium of holotype. 3. Internal layer of universal veil from stipe base of holotype. The bars in Figs. 2 & 3 represent $20 \mu\text{m}$.

BASIDIOSPORES: [165 measured from 6 specimens] (9.2-) 10.2 - 14.2 (-17.0) × (6.6-) 7.0 - 9.0 (-12.8) μm, (average length per specimen = 11.5 - 12.4 μm; average length (overall) = 12.1 μm; average breadth per specimen = 7.8 - 8.5 μm; average breadth (overall) = 8.1 μm; Q = (1.22-) 1.33 - 1.70 (-1.84); average Q per specimen = 1.42 - 1.57; average Q (overall) = 1.50), inamyloid, thin-walled, hyaline, broadly ellipsoid to ellipsoid to elongate, occasionally expanded at or near one end; contents guttulate; apiculus sublateral, cylindrical, 1 μm diam; white in deposit.

Habitat and distribution: Known only from southern Maine and New Hampshire. Found in July in sandy soil, solitary. In Maine, collections were made under *Tsuga canadensis* (L.) Carr. and *Acer rubrum* L. in the flood plain of a river or under *T. canadensis* and *Pinus strobus* L. as dominant trees in mixed woods. The New Hampshire collection was made under *Pinus sp.*

Collections examined: UNITED STATES OF AMERICA, MAINE, Androscoggin County, Sabbathus, S. S. Ristich 7-23-84-SSRA; Cumberland County, Windham, flood plain of Pleasant River, S. S. Ristich 7-11-84-SSR1, 7-13-88-SSRA, 7-13-88-SSRB, 7-30-88-SSR1; Oxford County, Oxford, T. Herman 7-15-85-SSR1 (holotype, NY); NEW HAMPSHIRE, Carroll Co., Chocorua, 28.vii.1906 L. C. C. Krieger Kr. 224 (FH).

DISCUSSION

After examination of the literature regarding 113 taxa belonging to *Amanita* section *Vaginatae*, I have found only one reference to a taxon described from outside of North America having basidia dominantly bisterigmate. Worldwide, I found a total of 56 species described in the literature as having 4-spored basidia; 3 (three) are described as having dominantly 2-spored basidia—*A. pachysperma* Atkinson (1918) and *A. virginiana* (Murrill) Murrill (1914) in North America and *A. submembranacea* var. *bispora* Reid (1987) from the United Kingdom.

C. Bas, Rijksherbarium, Leiden, The Netherlands, has observed (personal communication) that the presence of some bisterigmate basidia is not uncommon in many taxa of *Amanita*. In a number of taxa, it is not uncommon to find such basidia in specimens in which sporulation is just beginning. Dominance of bisterigmate basidia in mature basidiocarps is a character likely to be of taxonomic significance in sorting out section *Vaginatae*. Both of the previously described North American species with bisterigmate basidia are apparently rarely collected (Jenkins, 1986).

Described from sandy ground in woods, Watauga County, North Carolina, *A. pachysperma* is similar to *A. ristichii* in habit and in spore size and shape. Jenkins (1982) studied the type of *A. pachysperma*. Jenkins (1986) reports average Q of *A. pachysperma* = 1.45. It is described as being the color of "*Amanita cinerea* Bres." ("*livido-grigiastro traente al cenerino*" (Bresadola, 1881: 75)); and it differs markedly from *A. ristichii* in microscopic characters. For example, the acrophysalides of the stipe tissue of *A. pachysperma* are half the length of those of *A. ristichii*; also, the former has a ramose subhymenium and smaller basidia which lack clamps (Jenkins, 1986).

A study of the type of *Amanita virginiana* was reported in (Jenkins, 1979). It has a grayish pileus; its spores, basidia, and stipe acrophysalides are all of differing dimensions than those of *A. ristichii*; and its basidia lack clamps.

Amanita submembranacea var. *bispora* is very much larger than *A. ristichii*, has an exannulate stipe, a deeply colored pileus, and mostly globose to subglobose spores (Reid, 1987).

Krieger preserved Kr. 224 as a voucher from which he had painted an excellent watercolor (also in FH) showing Kr. 224 whole and in longitudinal section. The specimen is in poor condition, but large spores and acrophysalidic stipe context are to be seen. The watercolor leaves little doubt as to the identity of the collection; it represents very clearly all major macroscopic characters except the presence of an internal limb in the volva. The specimen is accompanied by three pages of discursive description by Krieger and a note in the handwriting of W. D. Farlow which summarizes some of Krieger's description and adds notes on the spores including the observation that "some spores were monstrous, as large as 6 div. \times 4 1/2 div." Krieger's notes are the source of my information about the anastomosing of lamellae and striation of the upper surface of the annulus. He also mentions previously having collected the entity in 1904 in Chocorua; however, I have not located a 1904 collection. Because the few spores I found in Kr. 224 were on the stipe and, in some cases, were damaged, I have not included their measurements in the data on basidiospores, above. The eight spores measured fell into the following range: 12.0 - 15.0 \times 6.5 - 9.4 μ m.

In the field, *A. ristichii* might be confused with *Amanita alba* ss. auct. amer. (= *A. vaginata* var. *alba* ss. auct. amer.) as described in North American field guides and floristic studies (e.g., see Miller & Farr (1975) and Thiers (1982)). *Amanita ristichii* can be distinguished by many characters including the size and shape of its spores, the more robust universal veil, pale orange or pinkish gills drying a similar color, annulate stipe, and bisterigmate basidia.

In correspondence I have used the designation "species N1" for the taxon here named *Amanita ristichii*.

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