

**BOLETUS AURANTIOSPLENDENS SP. NOV. FROM THE SOUTHERN
APPALACHIAN MOUNTAINS WITH NOTES ON PULVEROBOLETUS AURIFLAMMEUS,
PULVEROBOLETUS MELLEOLUTEUS AND BOLETUS AURIPES**

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Abstract: *Boletus aurantiosplendens*, a brilliant orange-yellow bolete, is described as new and compared to a number of other brightly yellow, golden or orange colored boletes found in the southern United States, eastern Asia and Malaysia. Detailed descriptions, as well as line illustrations, of the microscopic features of *Pulveroboletus auriflammeus*, *P. melleoluteus*, and *Boletus auripes* are presented, because data for these species were not available in the literature for comparison. The new combination *Boletus melleoluteus* is made.

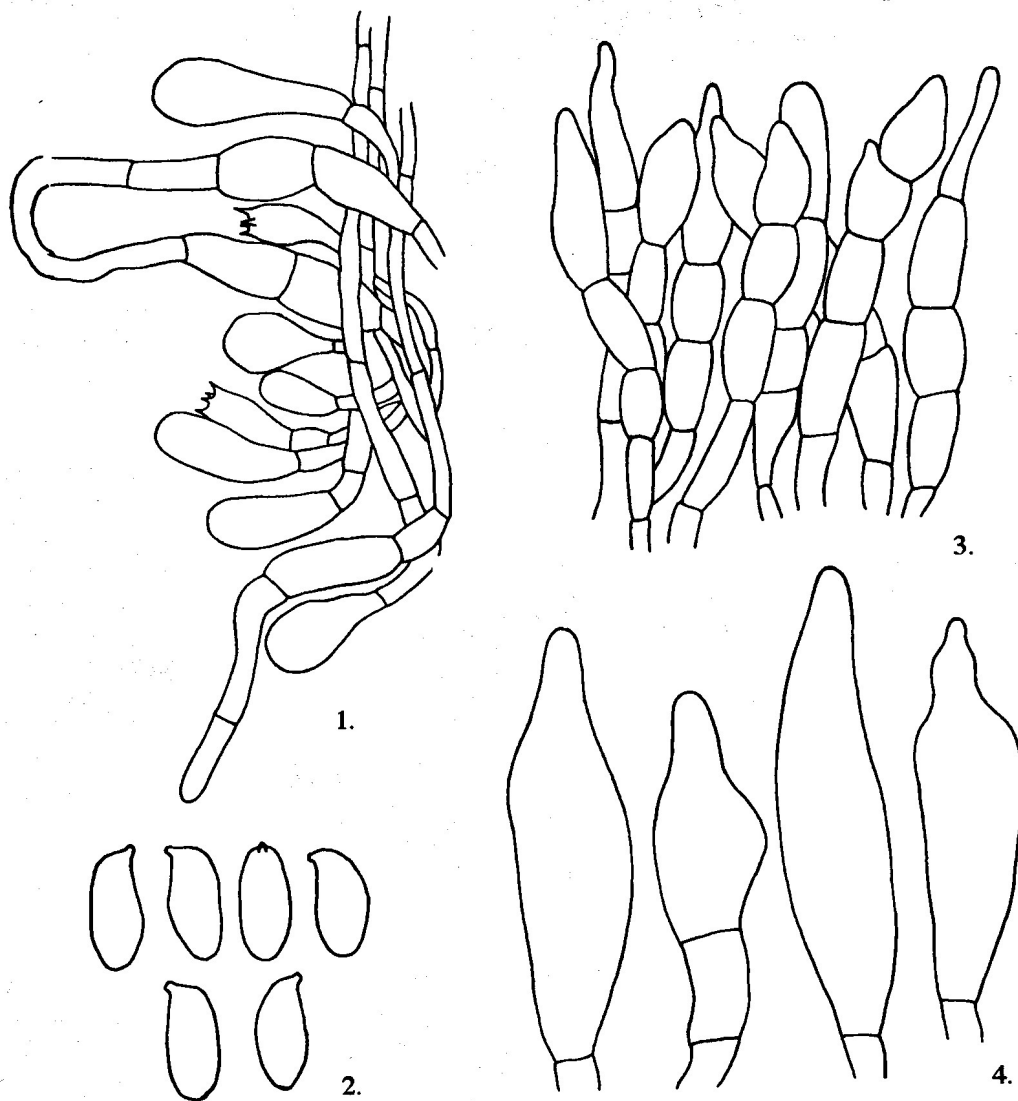
Several authors have described or discussed boletes of the southeastern United States (e. g. Coker and Beers, 1943; Grand, 1970a, b & c; Grand and Smith, 1971a & b; Hesler, 1960; Murrill, 1908; Murrill, 1910; Murrill, 1948; Singer, 1947; Singer and Williams, 1992) because this region has a rich diversity of these organisms. A number of these taxa are brightly colored and not easily overlooked when collecting fungi in this region. *Pulveroboletus auriflammeus* (Berkeley & Curtis) Singer, *Pulveroboletus curtisii* (Berkeley) Singer, *Pulveroboletus ravenellii* (Berkeley & Curtis) Murrill, *Pulveroboletus hemichrysus* (Berkeley & Curtis) Singer, *Boletus aureissimus* (Murrill) Murrill and *Pulveroboletus melleoluteus* Snell, Dick & Hesler are certainly some of the more striking of these species due to their bright yellow and sometimes orange pigments. However, there exists in the southern Appalachian Mountains a brilliant orange and yellow taxon which has either gone unnoticed, or has been confused with an existing species, and has therefore remained undescribed until now. This species is a member of the genus *Boletus* Section *Appendiculati* (Singer, 1986). It is a rather robust bolete with an aspect very similar to the species of the *Boletus edulis* Bulliard complex, except the pileus is orange or brownish orange, the pores and tubes are brilliant yellow, the stipe is yellow, and the context is bright yellow and unchanging. A description and discussion of this new taxon are provided below.

Methods used were those of Baroni and Both (1991) except as noted below. Color designations are from Kernerup and Wanscher (1978) unless otherwise noted. The color names for the hues of Kernerup and Wanscher (1978) are capitalized and either precede or follow the color designation, e.g. Orange (5B8) or (5A8 - Cadmium Orange). Color terms not capitalized and not supplied with a number and letter designation are general approximations, e.g. apricot yellow. All microscopic structures were measured in 10% NH₄OH unless otherwise noted. In the description

of the basidiospores, n/2 indicates the number of spores measured from 2 different collections; L^m = mean length; W^m = mean width; E = length/width of an individual spore and is given as a range; Q = the mean of all E values in a sample; Q^m = the mean of Q values where more than one collection is included in measurements. Basidiospores were measured with an Olympus BHS light microscope under Hoffman interference optics using a semi-automated image analysis system (a GTCO digitizer pad and Metrics5 software written by Dr. David Malloch). Descriptive statistical analysis of the measurements was obtained using EXCEL 5.0.

***Boletus aurantiosplendens* Baroni, sp. nov.** Figs. 1-4
Pileus aurantiacus, brunneo-aurantiacus vel brunneo-aureus ad primum, demum aureo-aurantiacus, 30-110 mm latus, convexus, plano-convexus, siccus, subtomentosus minutissime velutinusve; contextus aureus, immutabilis. Hymenium aureus, immutabilis, 5-10 mm crassus, adnatus. Pori isodiametri, 0.5-1 mm lati. Stipes aureus, cum areis rufis vel brunneo-aurantiacis super medius ad basis, 50-80 mm longus, 15-30 mm latus ad apicem, aequalis vel subclavatus, reticulatus, minutissime velutinus. Odor saporeque nullae. Sporae 9.5-11.8 × 3.8-5.4 μm, subfusiformes, laeves. Pleuro- et cheilocystidia similia, 32-45 × 6.4-12 μm, pigmento luteo impleta. Pileipellis hyphis inflatis, erectis, cellularum brevium compositarum, cellula apicalis aut fusiformis aut ventricosa, 24-44 × 8-15 μm. Fibulae nullae. Ad humus in silvis mixtis, *Fagus*, *Quercus*, *Acer*, *Carya*, *Liriodendron*, *Pinus* praesens. USA. HOLOTYPUS T. J. Baroni 5575 (CORT).

Pileus varying from Orange (5B8) to Mandarin Orange (6B8) to Brownish Yellow (5C8) to Brownish Orange (6C8), some duller and Yellowish Brown (5D-E8), Light Brown (6D8) to Rust Brown (6E8) when young over most of the pileus, but brighter yellowish orange (5A8 - Cadmium Orange) around the margin, becoming more evenly



Figs. 1–4: *Boletus aurantiosplendens* (Holotype). 1. Stipitipellis.—2. Basidiospores.—3. Pileipellis.—4. Pleurocystidia. Standard line = 10 μ m.

yellowish orange (5A8 or 5A-B5-7 - Melon, Light Orange, Golden Yellow, Apricot) overall with expansion, on some with even more yellowish hues (no good match); 30–110 mm broad, convex, becoming plano-convex and then nearly plane; margin inrolled at first, becoming decurved; surface dry, matted subtomentose or more suede-like, short velutinous (at 250x), soft to touch, not tacky; **CONTEXT** Light Yellow (4A4), Butter Yellow (4A5), Maize (4A6), or Buttercup Yellow (4A7), slowly turning darker, to Melon (5A6), upon exposure, solid or slightly translucent-watery, 18–25 mm thick. **ODOR** not distinctive. **TASTE** mild.

Pores at first Butter Yellow (4A5), Maize (4A6) to But-

tercup Yellow (4A7) or Cadmium Yellow (4A8) and stuffed at first, 1–2/mm, round or slightly angular, some compound (smaller pores within larger pores), not changing color when bruised. **Tubes** concolorous with pores at first, becoming duller with maturity, Yolk Yellow (4B8), Banana (4B7) or Amber Yellow (4B6), 5–10 mm deep, adnate or slightly depressed around stipe, not changing color when exposed.

Stipe Butter Yellow (4A7), Cadmium Yellow (4A8), or Apricot (5B6), or more or less concolorous with pileus, with Brick Red (7D7), brownish orange (7C7), Fox (8D7) or reddish brown (9D6–7) discolored streaks over mid-

stipe on most specimens, some with scattered grayish yellow discolored areas (Corn 4B5 or Chamois 4C5) over lower stipe, with distinctly yellow mycelioid covering over base (pale yellow 3A4-5, yellow 3A6, Genet 3A7 to Maize 4A6); 50-80 mm long, 15-30 mm broad at apex, equal or subclavate; dry, glabrous to the unaided eye, but compact velutinous under a lens and \pm erect pubescent over reticulum, obscurely to distinctly reticulate, reticulum running from 5-7 mm down stipe on young specimens to mid stipe on some of the mature specimens, reticulum concolorous with surface and composed of low elongate-elliptical mesh; context concolorous with pileus flesh, on most turning distinctly bright orange when exposed, solid.

Spore deposit olive brown (4D4) to Soot Brown (5F5) when fresh. **Spores** $9.5-11.8 \times 3.8-5.4 \mu\text{m}$ ($n=85/2$, $L^m = 10.7 \pm 0.57$, $W^m = 4.5 \pm 0.36$, $E = 1.95-2.88$, $Q^m = 2.4 \pm 0.20$); **HOLOTYPE** from spore deposit - $9.8-11.8 \times 3.8-5.4 \mu\text{m}$, $n=55$, $L^m = 10.7 \pm 0.59$, $W^m = 4.5 \pm 0.37$, $E = 1.95-2.88$, $Q = 2.39 \pm 0.23$), subfusiform, smooth, pale olivaceous yellow in NH_4OH , not dextrinoid nor amyloid. **BASIDIA** 4-sterigmate, clavate, $24-36 \times 8-10.5 \mu\text{m}$. **PLEURO- AND CHEILOCYSTIDIA** similar, mostly ventricose or ventricose-rostrate, scattered to abundant, thin-walled, pleurocystidia mostly hyaline, cheilocystidia mostly with uniform pale golden-yellow plasmatic pigment in NH_4OH , $32-45 \times 6.4-12 \mu\text{m}$. **TUBE TRAMA** composed of mainly parallel, cylindric, hyaline hyphae, $3.2-10 \mu\text{m}$ in diam., with scattered undulate shiny refractive hyphae (pale golden in NH_4OH), $4-6 \mu\text{m}$ in diam. **PILEAL CONTEXT** hyaline, composed of compactly interwoven, cylindric hyphae, $6-12 \mu\text{m}$ in diam. **PILEPELLIS** ochre to ochre-brownish in NH_4OH , a palisadoderm on young pilei or on the disc of expanded pilei, becoming a trichodermium elsewhere and hyphae becoming procumbent with age, each filament composed of several short, inflated, thin-walled, barrel-shaped cells, penultimate cells $10-18 \mu\text{m}$ in diam., bearing cystidioid terminal cells, these cells broadly fusiform to fusoid-ventricose, some cylindric or tapered from base to apex, $24-44 \times 8-15 \mu\text{m}$. **STIPITPELLIS** at apex a bright golden-yellow layer in NH_4OH , composed of an hymeniform layer of inflated clavate or broadly ventricose cells, $16-58 \times 10-18 \mu\text{m}$, with scattered clusters of caulocystidia, cystidia ventricose-rostrate with elongate, cylindric, septate apices, $106-140 \times 10-18 \mu\text{m}$, all cells hyaline or with yellow plasmatic pigments. **CLAMP CONNECTIONS** none.

Macrochemical Reactions - 5% KOH solution on hymenium dark brown, negative on pileus context and pileus surface; 14% NH_4OH solution no reaction on hymenium, pileus context, and pileus surface.

HABIT/HABITAT: Scattered to gregarious on humus, under mixed hardwoods of beech (*Fagus grandifolia* Ehrh.), oak (*Quercus* red or black), red maple (*Acer rubrum* L.), hickory (*Carya* sp.), tulip poplar (*Liriodendron*

tulipifera L.), and shortleaf pine (*Pinus echinata* Mill.), late July.

MATERIAL EXAMINED: NORTH CAROLINA: Macon Co., near Franklin, Coweeta Hydrologic Research area, Shope Fork Rd., 24 July 1987, T. J. Baroni 5575 (**HOLOTYPE, CORT; ISOTYPE, TENN**); same general area, collected by R. H. Petersen's Mycology Class, 22 July 1987, T. J. Baroni 5559 (**CORT**).

Boletus aurantiosplendens would be a member of the Subsection Calopodes of Section Boletus in the sense of Smith and Thiers (1971). If one follows Singer's (1986) classification scheme, this species would be placed in Section Appendiculati of *Boletus* due to its mild taste, reticulate stipe, and yellow to orange-yellow flesh. This latter taxonomic arrangement seems best, even though there is no bluing reaction of the exposed context. The brilliant colors of these rather large basidiomata make this species hard to overlook when collecting. In fact, it was rather surprising that this taxon had not already been described. The problem may lie in the fact that there are several bright yellow or orange colored species of boletes occurring in the southeastern United States which might superficially resemble *B. aurantiosplendens*, and in fact the collections described here had been misidentified by various researchers.

The two most common names erroneously used for this species were *Tylopilus balloui* and *Pulveroboletus auriflammeus*. *Tylopilus balloui* (Peck) Singer, with its bright reddish-orange pileus, might be confused with *B. aurantiosplendens*, however numerous differences easily separate these two taxa: *T. balloui* has a white to creamy whitish stipe, context, and pores/tubes, the pores/tubes become a flesh color with age and bruise brownish upon handling. Also, the spore deposit of *T. balloui* is not olivaceous, but has decided ochre hues (Coker and Beers, 1943) or is cinnamon buff or light brown (Snell and Dick, 1970), hence *balloui* is placed in *Tylopilus* not in *Boletus*.

Pulveroboletus auriflammeus is also superficially similar to *B. aurantiosplendens* due to its brilliant yellow or golden and occasionally scarlet-golden colors, and its reticulate stipe. However, *P. auriflammeus* is generally a small to medium sized bolete, and the pileus and stipe surfaces of the basidiomata of *P. auriflammeus* are generally covered with a soft flaking pulverulence which often stains the fingers after handling (see also Coker and Beers, 1943). *B. aurantiosplendens* is a large robust bolete which lacks pulverulence and does not leave stains on the hands after being held. Several other features help to distinguish these two taxa as well. *P. auriflammeus* typically develops bright crimson or crimson-orange pores with age. These brightly colored pigments can be evenly distributed or scattered on the pores and the stipe apex as well. *B. aurantiosplendens* does not develop bright crimson pigments on the pores or the stipe apex with age. The struc-

ture of the pileipellis and stipitipellis in *P. auriflammeus* also differs from that of *B. aurantiosplendens* (refer to the description of *P. auriflammeus* below and see Figures 5–11).

Of the several other North American species which have bright yellow or bright orange-yellow colors, the differences between them and *B. aurantiosplendens* are readily apparent. *Pulveroboletus ravenellii*, which is more commonly collected than the other species discussed below, has an obvious powdery, peronate veil which frequently covers the pileus, or at least the pileus margin, and leaves a fragile-fugaceous annulus upon expansion. The stipe of *P. ravenellii* is not reticulate, but covered with the powdery veil material, while the context of the pileus slowly turns bluish when exposed. *B. aurantiosplendens* has a reticulum over the stipe apex, lacks any pulverulent surface coverings, and the context does not turn blue upon exposure. *Pulveroboletus hemichrysus*, a rarely encountered taxon, is a small to medium sized bolete with a short tapered stipe and is usually lignicolous on the stumps of pine (Coker and Beers, 1943). *P. hemichrysus* also has a powdery yellow covering over the pileus and stipe, lacks a reticulum on the stipe, and the tubes are decurrent, yellowish but becoming deep reddish-brown with age. It is not likely that one would confuse *P. hemichrysus* with *B. aurantiosplendens*. The slender, bright yellow *Pulveroboletus curtisii* possesses a distinctly viscid pileus and stipe and should therefore not be confused with *B. aurantiosplendens*. *Pulveroboletus melleoluteus* is another of the brightly colored but rarely reported and illustrated taxa. This species differs from *B. aurantiosplendens* by its intense yellow, not orange-yellow colors, the lack of a reticulum on the stipe and the blue discolorations of the pale yellow pileus context when exposed (see the discussion of *P. melleoluteus* below).

Two species described by Murrill (1938) from Florida, *Boletus aureissimus* and *Boletus flavissimus* (Murrill) Murrill, were also considered during this investigation because of their bright yellow colors and because no recent accounts of these species can be found in the literature. The yellow context of *B. flavissimus* turns blue when exposed and this species also lacks a reticulum on the stipe (Murrill, 1938), therefore immediately distinguishing it from *B.*

aurantiosplendens. *B. aureissimus*, considered a synonym of *B. auripes* Peck by some (Singer, 1947; Grund and Harrison, 1976) but as an autonomous species by others (Murrill, 1948; Both, 1993), is yellow overall and has a reticulate stipe. However, *B. aureissimus* lacks orange hues on the basidiomata (Murrill, 1938). In addition, the spores of *B. aureissimus* are $11\text{--}13 \times 3.5 \mu\text{m}$ (Murrill, 1938), while those of *B. aurantiosplendens* are $9.5\text{--}11.8 \times 3.8\text{--}5.4 \mu\text{m}$. Therefore *B. flavissimus* and *B. aureissimus* are clearly different from *B. aurantiosplendens*.

Boletus auripes is somewhat similar to *B. aurantiosplendens*, but *B. auripes* has a yellowish brown pileus and lacks orange or orange-brown hues in the pileus and stipe. *B. auripes* also produces larger spores [$11\text{--}13 \times 3.7\text{--}4.2 \mu\text{m}$ (Coker & Beers, 1943), $(9.5\text{--})12\text{--}13.7 \times (3\text{--}) 3.7\text{--}4.8 \mu\text{m}$ (Singer, 1947), and $9.5\text{--}15 \times 3.5\text{--}5 \mu\text{m}$, but mostly $12\text{--}13 \times 3.5\text{--}4 \mu\text{m}$ (Snell and Dick, 1970)]. In addition, the pileipellis of *B. auripes* is described as an irregularly interwoven layer of filamentous hyphae (Singer, 1947) and is therefore not similar in construction to that of *B. aurantiosplendens* (also see the illustrations and description of the type study of *B. auripes* below). Curiously, the photograph of *B. auripes* (p. 324) presented in the "Fungi of Japan" (Imazeki, et al., 1988), is most assuredly *B. aurantiosplendens*. In fact, the translation of the macroscopic description of this specimen, kindly supplied by Dr. Kazumasa Yokoyama of Shiga University, fits perfectly the description of *B. aurantiosplendens*.

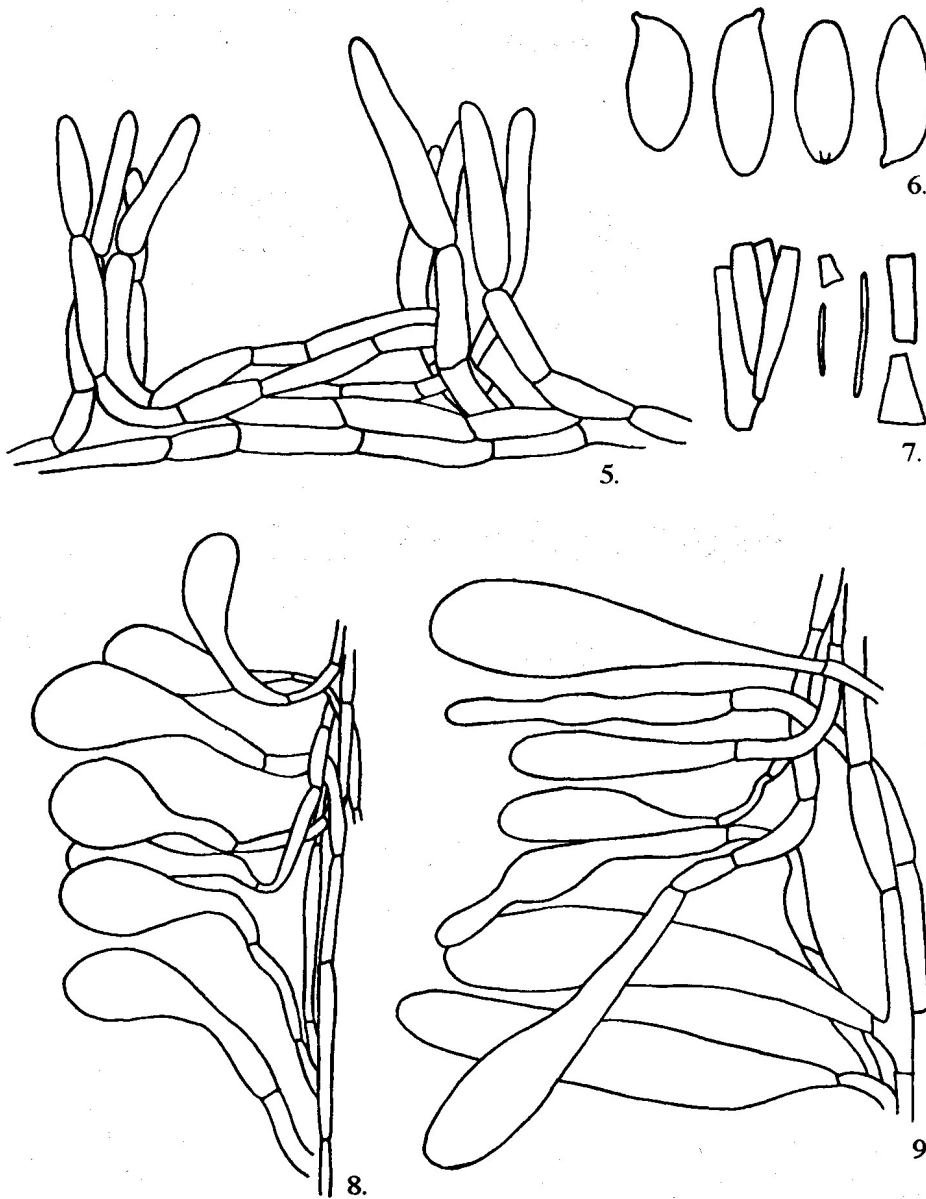
Several other non-North American species were considered also, e.g. *Boletus laetissimus* Hongo from Japan, *Boletus rufoaureus* Masee from Singapore, *Boletus jocosus* Corner from Borneo, and *Boletus formosus* Corner from Borneo. *B. laetissimus* (Hongo, 1968) and *B. rufoaureus* (Corner, 1972) both lack a reticulum on the stipe and their flesh turns either bluish (*B. laetissimus*) or greenish (*B. rufoaureus*) upon bruising or exposure. Several other major differences are found between these two species and *B. aurantiosplendens*. *B. jocosus* and *B. formosus* (Corner, 1972) both possess a reticulum on the stipe, but they have yellowish flesh which turns blue upon exposure, thus ruling out these species as possible matches for our fungus.

Notes on *Pulveroboletus auriflammeus*, *Pulveroboletus melleoluteus* and *Boletus auripes*

***Pulveroboletus auriflammeus* (Berkeley & Curtis) Singer,**
Am. Mid. Nat. 37: 10. 1947. Figs. 5–11
= ***Boletus auriflammeus* Berkeley & Curtis,** Grevillea
1: 36. 1872.

The following is a detailed description and illustration of the microscopic structures of this taxon. Information on macromorphology and colored illustrations of the

basidiomata are to be found in Snell and Dick (1970) or Coker and Beers (1943). Only limited information on the anatomy of this species is available in the literature, mostly the size and shape of the spores (Coker and Beers, 1943; Snell and Dick, 1970). Although Singer (1947) did make a few cursory comments on the arrangement of the hyphae in the tube trama and the pileipellis, his comments on the pileipellis ("the cuticle is a modification of a cutis

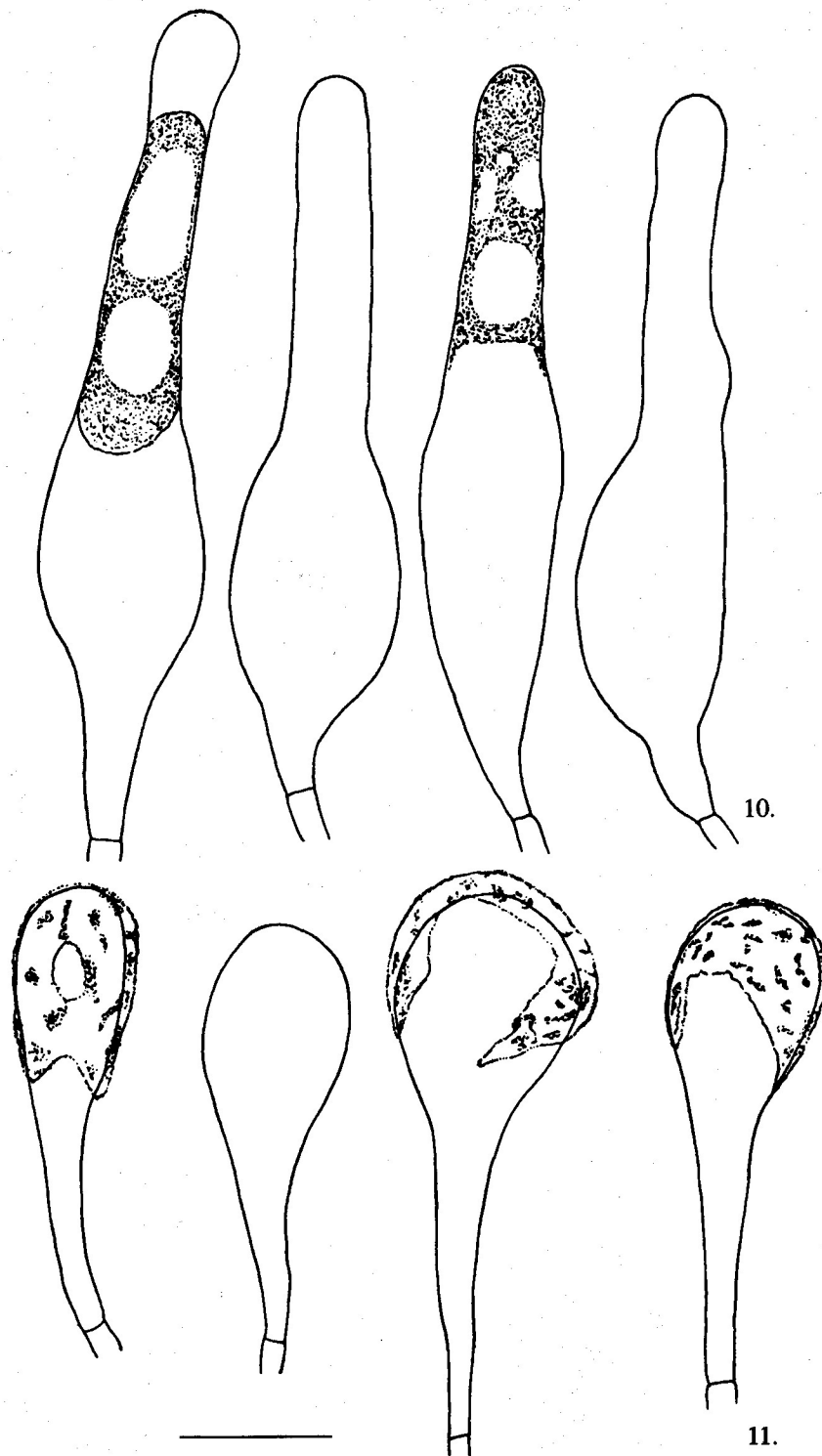


Figs. 5–9. *Boletus auriflammeus*. 5. Pileipellis (A. H. Smith 10324).—6. Basidiospores (A. H. Smith 10132).—7. Crystals from pore surface (A. H. Smith 10324).—8. Stipitipellis (K. A. Harrison 10903).—9. Stipitipellis (A. H. Smith 10324). Standard line = 10 μ m.

consisting of long, filamentous, interwoven hyphae which never from a palisade”), are not a true representation of the structure of this layer. Perhaps Singer examined older specimens in which the surface tomentosity and pulverulence had been removed or had collapsed.

Material examined: New York, Erie Co., Town of Orchard Park, Chestnut Ridge Park, 16 Aug. 1980, E. E.

Both 2246; also from same general location 9 Aug. 1981, E. E. Both 2307; 12 Aug. 1982, E. E. Both 2404; 6 Aug. 1983, E. E. Both 2462; 12 Sept. 1985, E. E. Both 2673; 17 Sept. 1985, E. E. Both 2684; 5 Aug. 1986, E. E. Both 2851; 13 Aug. 1986, E. E. Both 2870; 5 Aug. 1987, E. E. Both 3114 (all collections at BUF); Tennessee, Blount Co., Great Smoky Mts. National Park, Cades Cove, 13



Figs.10–11. *Boletus auriflammeus*.—10. Pleurocystidia (A. H. Smith 10132).—11. Cheilocystidia (K. A. Harrison 10959).
Standard line = 10 μ m.

Aug. 1938, A. H. Smith 10132 and 18 Aug. 1938, A. H. Smith 10324 (both MICH); North Carolina, Swain Co., Great Smoky Mts. National Park, Deep Creek, 27 Aug. 1971, K. A. Harrison 10903 and 1 Sept. 1971, K. A. Harrison 11000; Swain Co. K. A. Harrison 11157 (all MICH); Swain Co., Almond, 30 Aug. 1971, K. A. Harrison 10959 (MICH).

SPORE DEPOSIT: "pale ochraceous-brown to sub-olivaceous" (Snell and Dick, 1970); "(of no. 10444) distinctly olivaceous" (Coker and Beers, 1943). **SPORES** $8-12 \times 4-5.6$ (-6.4) μm ($n = 108$, $L^m = 10.3 \pm 1.0$, $W^m = 4.5 \pm 0.43$, $E = 1.8-2.8$, $Q = 2.3 \pm 0.22$), short ellipsoid to mostly subfusiform in profile view, smooth, pale yellowish in H_2O , KOH and NH_4OH , not amyloid nor dextrinoid. **BASIDIA** 4-sterigmate, clavate, $20-32 \times 8-10 \mu\text{m}$. **CHEILOCYSTIDIA** abundant, producing a sterile layer of thin-walled, most often broadly clavate to sphaeropedunculate cells, some broadly ventricose, $30-60 \times 10-19 \mu\text{m}$, typically with pale yellow to deep golden coagulated plasmatic pigments, also frequently with golden yellow encrusting pigments, granules and also crystals distributed over apex as viewed in H_2O , occasionally with deep reddish styloid crystals scattered or clustered over the apices of these cells as well, all crystals dissolving in KOH. **PLEUROCYSTIDIA** abundant, thin-walled, most broadly ventricose, some clavate, $32-90 \times 8-18 \mu\text{m}$, frequently with yellowish-golden, coagulated, plasmatic pigments or hyaline. **TUBE TRAMA** hyphae cylindrical, hyaline, divergent from a central strand, loosely arranged. **PILEAL CONTEXT** hyphae hyaline, \pm cylindrical, densely interwoven. **PILEPELLIS** hyphae with bright yellow and some reddish-orange encrusted crystals in H_2O , dissolving in KOH and producing a diffuse lemon yellow pigment throughout, composed of an entangled trichodermium of erect cylindrical, septate hyphae, eventually collapsing in places and leaving scattered clusters of erect fascicles which eventually also collapse, terminal cells of erect filaments tending to disarticulate, $18-72 \times 3-16 \mu\text{m}$, some terminal cells with a hyaline outer "membrane" or coating which pulls away from and provides an irregular hyaline coating over the wall of these cells. **STIPITPELLIS** at apex an hymeniform layer of broadly clavate to sphaeropedunculate caulocystidia, $32-52 \times 10-14 \mu\text{m}$, some cells also cylindrical or broadly ventricose-rostrate, typically encrusted with golden yellow crystals which are soluble in KOH (as in the pileipellis).

DISCUSSION: *Pulveroboletus auriflammeus* is a striking bright golden-yellow to orange-yellow bolete which has a distinctly pulverulent pileus surface, lacks a veil, but does possess a wide mesh reticulum on the stipe. The scarlet discolorations on the pores and upper stipe apex are also characters which are frequently present and can aid in confirming the identity of this species. *P. auriflammeus* can be easily characterized by several microscopic features. The

bright yellow encrusting pigments and crystals of the pileipellis, stipitipellis and cheilocystidia, which quickly dissolve in KOH mounts, are distinctive for this taxon. The inflated clavate or sphaeropedunculate cheilocystidia and caulocystidia are also diagnostic. Noting the somewhat trichodermial arrangement of the hyphae of the pileipellis, and the disarticulation of the terminal cells of this layer, can also be helpful in recognizing this species.

Pulveroboletus auriflammeus is apparently rarely collected. No color photographs of this taxon can be found in the many popular handbooks on fleshy fungi of North America. It is such a striking species, photographers would surely not overlook such a find. However, there at least two different renditions of color paintings of this taxon for reference and comparison (Snell and Dick, 1970; Coker and Beers, 1943).

Boletus melleoluteus

(Snell, Dick & Hesler) Baroni & Halling, comb. nov.

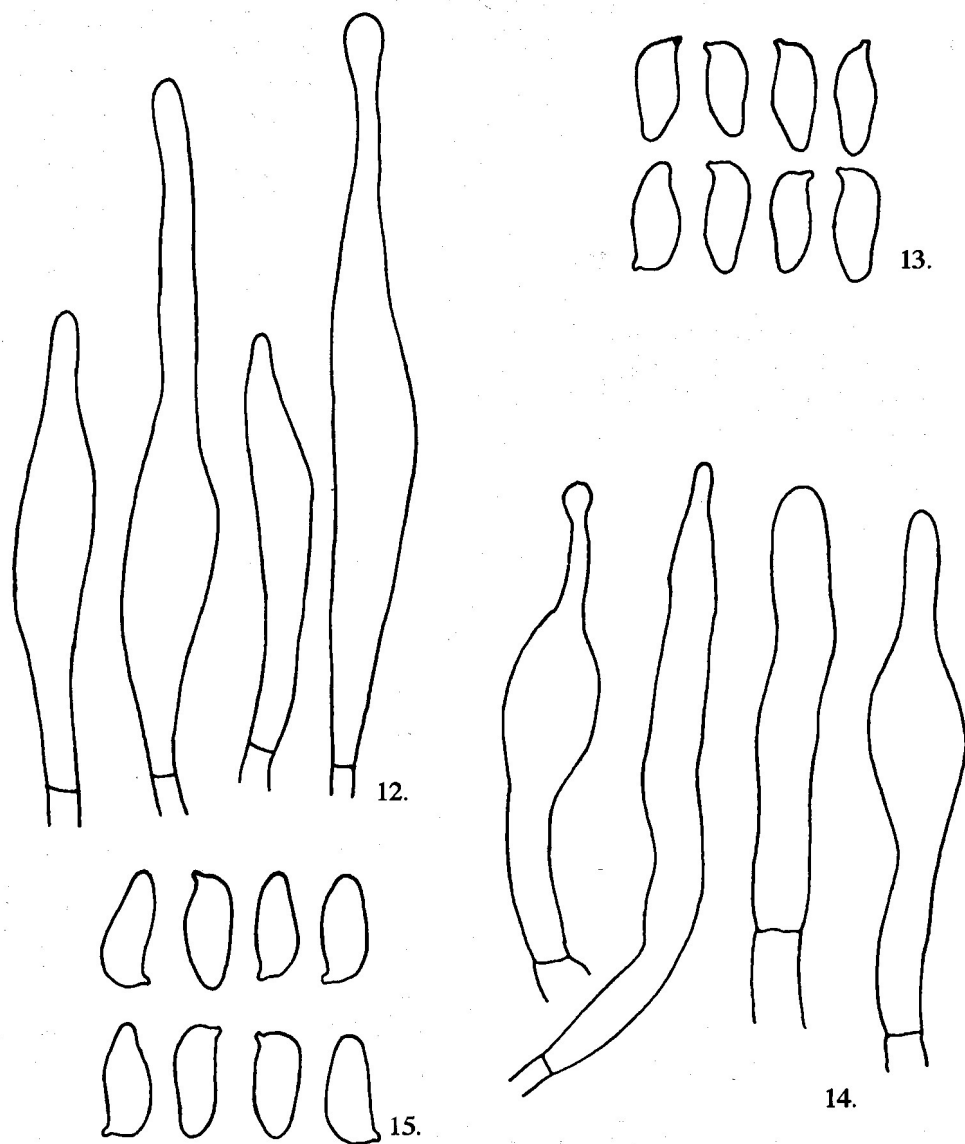
Figs. 12-17

\equiv *Pulveroboletus melleoluteus* Snell, Dick & Hesler, Mycologia 43: 361. 1951.

This species is also rarely collected and not well documented in the literature. A description of the macro- and micromorphological features is provided. In our opinion, this taxon does not belong in *Pulveroboletus*. The many collections we have studied did not have a true pulverulence on the surface of the pileus or stipe, nor is there a true viscid layer on either of these surfaces, thus this species belongs in *Boletus* (Singer, 1986).

PILEUS bright yellow to yellowish olive (Primuline Yellow), more brownish with age (Chamois to Honey Yellow), 20-60 mm broad, convex at first, becoming planoconvex or occasionally becoming very broadly umbonate, smooth, minutely subtomentose at first, glabrous with age (not at all pulverulent!), may be viscid in wet weather (Snell, et al., 1951), margin with a narrow sterile inrolled band; **CONTEXT** pale yellow, slowly turning pale blue when exposed, especially above tube layer, 8-12 mm thick. **PORES** pale yellow, becoming grayish yellow, turning dark olivaceous (Deep Seafoam Green of Ridgway, 1912) when bruised, 2/mm, round. **TUBES** colored as pores, adnate or emarginate, 2-10 mm thick, unchanging or on some of the older basidiomata slowly turning blue-green when exposed. **STIPE** concolorous with pileus or slightly paler at first, apex often white or very pallid, with brownish or reddish brown slowly developing in areas where handled, 25-70 mm long, 5-12 mm wide at apex, equal or some slightly enlarged toward base, surface finely matted fibrillose over apex to mid, glabrescent, not reticulate; context solid, pale yellow. **ODOR & TASTE** mild.

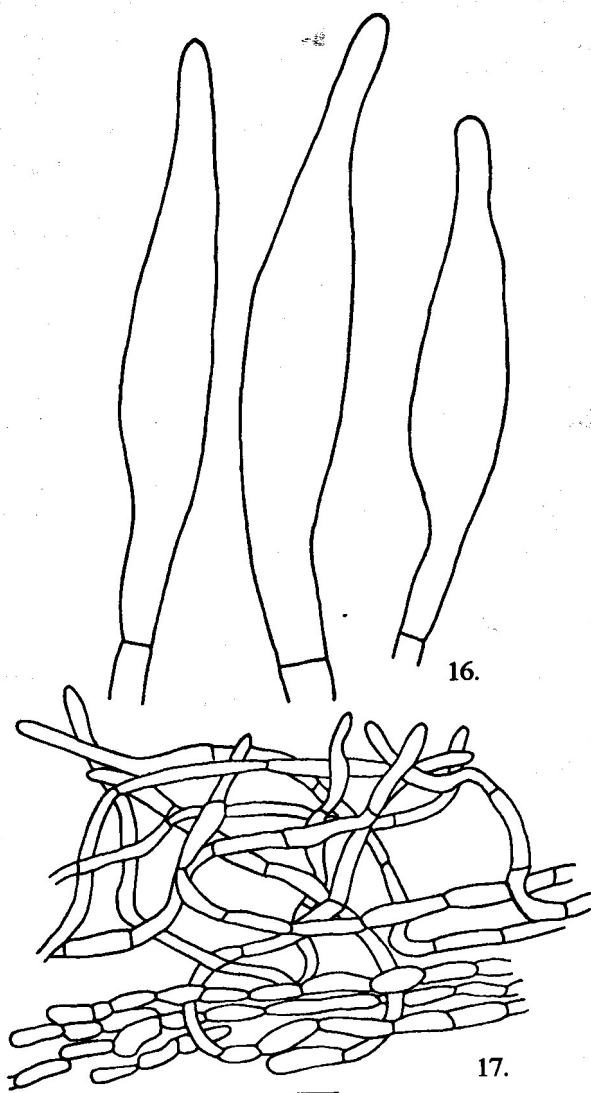
SPORES DEPOSIT Light Brownish Olive (Ridgway, 1912). **SPORES** (8.4-) $8.8-11$ (-11.4) \times $3.5-4.5$ (-4.8) μm



Figs 12–15: *Boletus melleoluteus*.—12. Cheilocystidia (HOLOTYPE).—13. Basidiospores (T. J. Baroni 3383).—14. Caulocystidia (T. J. Baroni 3383).—15. Basidiospores (HOLOTYPE). Standard line = 10 μ m.

($n = 216$, $L^M = 9.8 \pm 0.54$, $w^M = 4.1 \pm 0.24$, $e = 1.97$ – 2.7 , $Q = 2.4 \pm 0.13$), subfusiform and often with a tapered, slightly bent apex in profile view, subfusiform in back view, pale brownish in 3% KOH, smooth, not truncate. **BASIDIA** 4-sterigmate, clavate, 24 – 36×8 – 9.7μ m. **PLEURO-CHEILOCYSTIDIA** similar, ventricose to ventricose-rostrate, thin-walled, often filled with a diffuse pale yellow plasmatic pigment, pleurocystidia abundant, arising from the subhymenium and tramal elements, 44 – 80×6 – 10.5μ m; cheilocystidia forming a dense sterile layer on the

pores, 36 – 61×6.5 – 10μ m. **TUBE TRAMA** a broad parallel layer of cylindrical hyphae, slightly divergent near subhymenium, central 3–5 strands often gelatinized, 4 – 9μ m in diam. **PILEAL CONTEXT** hyaline, composed of interwoven, cylindrical or slightly inflated hyphae, 4 – 12μ m in diam. **PILEIPELLIS** deep golden to golden-brown in H_2O , pale yellow in 3% KOH, composed of an ascendant layer of loosely interwoven, cylindrical hyphae, 4 – 8μ m in diam, on immature or unexpanded basidiomata forming a loosely entangled trichodermium, end cells becoming



Figs 16–17: *Boletus melleoluteus*.—16. Pleurocystidia (HOLOTYPE).—17. Pileipellis (HOLOTYPE). Standard line = 10 μ m.

procumbent with expansion (age), pigments plasmatic, coagulated, deep golden, dissolving in 3% KOH. **STIPITPELLIS** at apex a turf of erect caulocystidia, cystidia mostly ventricose or ventricose-rostrate, others cylindric or cylindric tapered at apex, 34–65 \times 5–9 μ m, collapsing in areas on older stipes, typically with pale golden plasmatic pigments. **CLAMP CONNECTIONS** none.

MACROCHEMICAL REACTIONS: NH₄OH on pileus margin pale blue-green, dark brown on disc.

HABIT/HABITAT: Scattered on soil under oaks and mixed hardwoods, August, also under hemlock, pine and mixed hardwoods (no date given for TYPE collection).

MATERIAL EXAMINED: GEORGIA: Clarke Co.,

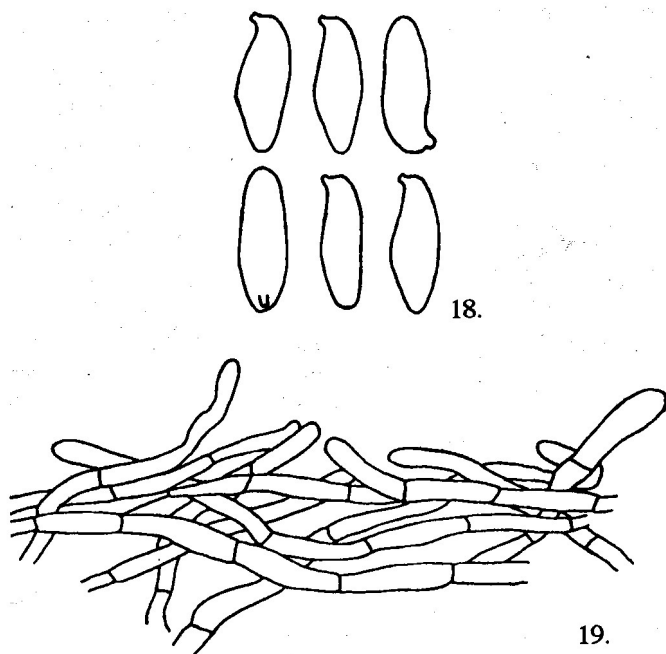
vicinity of Athens, University of Georgia Botanical Gardens: all collections listed below were made on 22 Aug. 1978 - R. E. Halling 2522b, R. E. Halling 2542, T. J. Baroni 3383, T. J. Baroni 3425, T. J. Baroni 3426, T. J. Baroni 3427, T. J. Baroni 3435 (all preceding collections at NY); T. J. Baroni 3423 (CORT). TENNESSEE: Blount Co., Great Smoky Mountains National Park, Cades Cove, no date, W. H. Snell 1970 (HOLOTYPE, BPD).

Hesler (1960) placed this species in *Boletus*, indicating that he believed *Pulveroboletus* was not the proper affiliation for *B. melleoluteus*. Unfortunately, the combination was not validly published since Hesler (1960) did not cite the required information (ICBN, Art. 33.2) for the combination to be attributed to him. This rare species is easily recognized by its intensely bright yellow hues which do not change color when handled, the slight blue color change of the exposed pileus context, and the pores of the hymenium which turn deep olivaceous (not blue) when bruised. *B. melleoluteus* is not truly viscid, it does not have a reticulum on the stipe, and there is no pulverulence associated with the surface layers of the pileus and stipe. The oddly shaped spores with their frequently bent apices, the abundant ventricose or ventricose-rostrate hymenial cystidia, and the loosely entangled, cylindric hyphae of the pileipellis also help to define *B. melleoluteus*.

Boletus auripes Peck, Ann. Rep. N. Y. State Museum 50: 107. 1898. Figs. 18–19

The Holotype consists of three basidiomata, two mature and one immature (i.e. the tubes are stuffed). The specimens are whole and appear very dark brownish overall except for the pale grayish brown pileus of the immature specimen. The stipe apex is obviously reticulate on the immature basidiomata, but more obscurely so on the two mature specimens. Since a modern detailed type study of *B. auripes* was not available in the literature, the following description of the microscopic features taken from the Holotype (Port Jefferson, NY; July; NYS) is provided for comparison. In general the tissues of these specimens were difficult, or in the case of the hymenium impossible, to revive for detailed studies.

SPORES 11–14.9 \times 3.9–5.2 μ m ($n = 45$, $L^m = 12.6 \pm 0.86$, $W^m = 4.5 \pm 0.32$, $E = 2.4–3.5$, $Q = 2.8 \pm 0.22$), subfusiform, smooth, not truncate. **BASIDIA** 4-sterigmate, difficult to measure because mostly collapsed. **PLEURO- AND CHEILOCYSTIDIA** unable to determine. **TUBE TRAMA** composed of divergent hyphae from a central strand of parallel hyphae, cylindric, 4.8–8 μ m in diam. **PILEAL CONTEXT** hyaline or very pale straw colored, composed of interwoven, cylindric hyphae, 4–14 μ m in diam. **PILEPELLIS** a pale brownish layer, composed of an entangled layer of mostly repent, cylindric hyphae, 6–16 μ m in diam, hardly differentiated from the context.



Figs. 18–19: *Boletus auripes* (HOLOTYPE). 18. Basidiospores.—19. Pileipellis. Standard line = 10 μ m.

STIPITIPPELLIS not studied. CLAMP CONNECTIONS none seen in pileipellis and context.

HABIT/HABITAT Under mountain laurel, *Kalmia latifolia*, July.

MATERIAL EXAMINED: NEW YORK: Suffolk Co., Port Jefferson, July, C. H. Peck (HOLOTYPE, NYS). Erie Co., Town of North Collins, Elementary School woods, 17 July 1977, E. E. Both 1920, 30 July 1980, E. E. Both 2199, 8 September 1990, E. E. Both 3218A. Erie Co., Town of North Collins, Town Park, 22 July 1992, E. E. Both 3278, 28 July 1992, E. E. Both 3323A. Erie Co., Town of Orchard Park, Chestnut Ridge Park, 25 July 1986, E. E. Both 2809, 5 July 1987, E. E. Both 2959, 12 July 1994, E. E. Both 3640 (all Both collections in BUF)

Boletus auripes is characterized by its yellowish brown pileus, by its clear yellow tubes and pores which do not turn blue when injured, and by its bright yellow stipe with a fine, concolorous reticulum over the apex. There are no unique microscopic features which can be used to help distinguish this species. *B. auripes* is not a commonly collected bolete, but it can be found widely distributed in eastern North America. Good illustrations can be found in Snell and Dick (1970), Coker and Beers (1943) and Phillips (1991).

ACKNOWLEDGMENTS

Support from an L. R. Hesler Visiting Professorship in Botany from the University of Tennessee and a research grant from the Highlands Biological Station made the discovery of *Boletus aurantiosplendens* possible. Drs. Ronald H. Petersen and Dennis E. Desjardin were instrumental in setting up and leading field excursions to the collecting areas during this study. Their assistance was invaluable and they are kindly thanked for their help. Several loans from herbaria and individuals are gratefully acknowledged: Ernst E. Both (BUF), Drs. John H. Haines (NYS), Roy E. Halling (NY), David F. Farr (BPI), and Tusguo Hongo (personal herbarium), Robert Fogel (MICH). Logistic support for collecting around the Gainesville, Florida area was kindly provided by Drs. James W. Kimbrough and Gerald L. Benny. Numerous insightful discussions about southeastern U. S. boletes with Ernst Both and Roy Halling is sincerely appreciated. Ernst Both suggested the specific epithet *aurantiosplendens* for this eye-catching bolete.

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