

Notes on cantharelloid fungi. X.  
***Cantharellus confluens* and *C. lateritius*,  
*Craterellus odoratus* and *C. aureus*.**

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**Abstract.** Species circumscriptions and nomenclatural notes are furnished for *Cantharellus confluens*, *C. lateritius* and *Craterellus odoratus*. A description of the type specimen of *Craterellus aureus* is given.

PETERSEN (1979) published aquarelle illustrations of cantharelloid fungi, including figures purporting to be *Cantharellus odoratus* and *C. lateritius* "sensu SMITH". Because I felt some doubt over the identity of the latter (not the former) I subsequently examined type material of these from the Royal Botanic Gardens, Kew. In addition, the type specimens of *C. confluens* and *C. wrightii* BERK. & CURTIS were also examined. While I agree with CORNER (1966) that the type specimen of the latter is not a *Cantharellus* but an agaric, the other type specimens overturned completely my identifications of the figures just published, and require, unfortunately, a separate paper to correct these errors and to more completely circumscribe the taxa involved.

1. *Craterellus aureus*

HEINEMANN's (1958, 1959) descriptions of this fungus (and especially BEELI's aquarelle) are reminiscent of the gill-less cantharelles described below, and the following description of the type specimen (only) confirms his conclusions.

*Craterellus aureus* BERKELEY & CURTIS 1860. — Proc. Amer. Acad. Arts & Sci. 4: 123

Holotype: HONG KONG: herb. U. S. North Pacific Exploring Expedition under Commanders RINGOLD & RODGERS, 1853—56. Coll. C. WRIGHT [s. n.], K. [presumably a duplicate in herb. CURTIS, FH].

Single fruitbody, circum 2 cm high, 1 cm broad, trumpet-shaped, perforate (at least, see below). Pileus regularly flared, of thin flesh (less than 1 mm thick), yellow-ocher now (probably orange-yellow when fresh; margin even to minutely crenulate, somewhat paler than





"disc"; pileus surface smooth. Hymenial surface smooth, with no irregularities or wrinkles, now yellow-ocher (probably buffy yellow-orange when fresh). Stipe 1.5 cm long, 2 mm thick, widening above and not distinctly separate from pileus and/or hymenium, tapering gradually downward, very slightly expanded at base, now yellow-ocher with one area dull light rusty orange (probably concolorous with pileus when fresh, and bruising to a soaked, rusty orange color), paler at base (probably off-white when fresh).

Hyphae of pileus surface a loose, repent trichodermium, without clamp connections, disarticulating occasionally, hardly inflated. Hyphae of pileus flesh similar, tightly interwoven. Basidia circum 60—70  $\mu\text{m}$  long, subcylindrical to narrowly clavate, without clamp connections; contents refringent at maturity; sterigmata not observed.

Spores 6.7—9.3  $\times$  5.6—6.7  $\mu\text{m}$  ( $E = 1.13$ —1.46;  $E^m = 1.31$ ;  $L^m = 7.91 \mu\text{m}$ ), broadly ovate, ellipsoid to subglobose, flattened adaxially, smooth, thinwalled; contents homogeneous to granular; apiculus small, papillate.

Observations: There is every reason to believe that the detailed description by HEINEMANN (1958: 429—431) refers to this fungus. Spore dimensions were given as 8.7—9.9  $\times$  7.0—8.3  $\mu\text{m}$ , which is very large for the type specimen, but spores of the type vary considerably, and random selection was measured for the description above. If only larger spores were selected (as might result from a spore print), dimensions would be much closer to those by HEINEMANN.

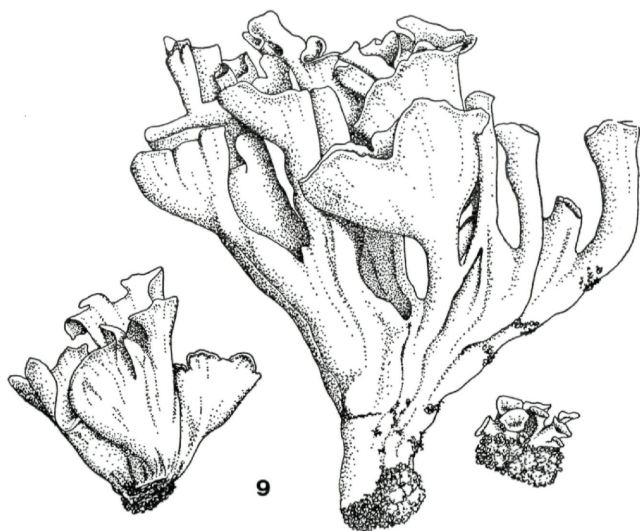
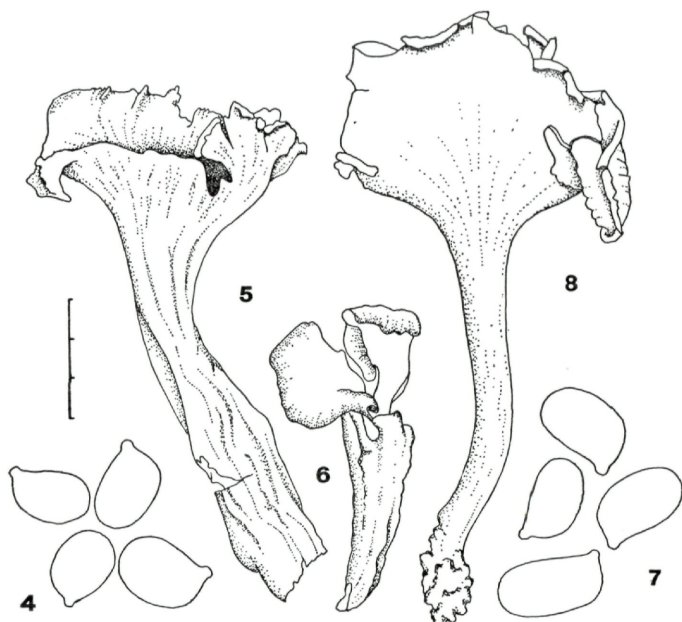
I have examined no other specimens, and cannot attest to the synonymy listed by HEINEMANN. The aquarelle by BEELI (in HEINEMANN, 1959; pl. 28, figs. 4a, 4b) is excellent, although I cannot vouch for the color reproduction.

The type specimen and HEINEMANN's reports confirm that *C. aureus* produces simple, trumpet-shaped fruitbodies, while *C. odoratus* exhibits complexly branched cornucopioid carpophores. This, together with spore morphology and geographic range, can serve to separate the two taxa. BERKELEY & CURTIS rightly drew attention to their similarities.

The pronouncedly flaring pileus of young fruitbodies is reminiscent of a cantharelloid stature, and even more specifically of subg. *Leptocantharellus*. The waxy appearance of fruitbodies in this subgenus may also link them to *Craterellus* more than the fleshy consistency of fruitbodies of subg. *Cantharellus*.

The bright colors of *C. aureus* (and *C. odoratus*) tempt one to perceive them as closer to *Cantharellus* than the somber taxa of *Craterellus*. *Cantharellus cinereus* FRIES shows very dark colors, however, and *Craterellus foetidus* SMITH and *C. caeruleo-fuscus* SMITH exhibits quite cantharelloid hymenial surfaces, so color and stature cannot be examined capriciously for clues to phylogenetic relationships.





## 2. *Cantharellus confluens*

Figs. 1, 4, 5

Having examined the type specimen of this name, it is now clear that the following commentary on the taxon can be given.

*Cantharellus confluens* (BERKELEY & CURTIS) PETERSEN, comb. nov.

Basionym: *Craterellus confluens* BERKELEY & CURTIS in BERKELEY. Jour. Linnaean Soc. 9: 423. 1867.

≡ *Trombetta confluens* (B. & C.) KUNTZE. Rev. Gen. Plant. 1: 873. 1891.

Holotype: MEXICO: vic. Orizaba, Botteri no. 6, K. [isotype presumably in herb. CURTIS, FH].

Fruitbodies up to 13 cm high, up to 8 cm broad, occasionally simple, usually multipileate and/or with united stipes. Pileus surface smooth, bright orange ("cadmium orange", "orange", "capucine yellow"); margin not appreciably paler, irregularly lobed to crenulate, 1 mm thick or thicker, erect to everted early, then recurving downward, finally irregularly everted at maturity. Hymenium buffy orange ("capucine buff", "light ochraceous buff", "orange buff"), staining yellowish where bruised; hymenial surface smooth when very young or rarely in limited areas when mature, most often rugulose in a generally radial pattern, irregularly forking and anastomosing to give a weakly merulioid configuration (see fig. 1, right). Stipe up to 4 cm long, up to 2.5 cm thick, tapering downward, stuffed to almost solid, but not hollow, smooth, more or less clearly delimited from fertile area by texture and color, rounded at base and not involving significant soil, pale yellow to yellow-orange ("antimony yellow", "pale orange yellow", "pale yellow orange", "apricot yellow"), staining where bruised to rusty orange ("raw sienna", "Mars yellow").

Hyphae of pileus surface a repent, irregular trichodermium, uninflated to slightly inflated, thin-walled, clamped; hyphae of pileus flesh similar, tightly interwoven. BASIDIA cylindrical to narrowly clavate, (3)–4–(5)–sterigmate.

Spores 7–10 × 5–6.3 μm, ovate to ellipsoid, somewhat flattened adaxially, smooth, pale yellow in prints ("capucine buff").

Observations: This taxon can be identified only with difficulty even when fresh. The colors of pileus and stipe are brighter than those of *C. lateritius*, and with virtually no pinkish component. Microscopic characters vary little in the two taxa.

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Figs. 4, 5. *Cantharellus confluens*, type specimen. 4. Basidiospores. 5. Dried fruitbody. Figs. 6, 7. *Cantharellus lateritius*, type specimen PH. 6. Dried fruitbody. 7. Basidiospores. Fig. 8. *Cantharellus lateritius*, fruitbody of no. 4539 (K). Fig. 9. *Craterellus odoratus* fruitbodies, TENN 18026. Standard line = 15 μm for spores, = 1 cm for fruitbodies.

PETERSEN's (1979) analysis of this taxon was under the name "*Cantharellus lateritius* sensu SMITH." The comparison of it to the true *Cantharellus lateritius* (treated there under *C. odoratus*) included several differences, and the reader is referred there for further comments on diagnostic characters.

*Cantharellus confluens* is much less common in the flora of the southern Appalachian Mountains than *C. lateritius*. While in herb. TENN there are several score of specimens of the latter, I can identify only four of the former. Perhaps the taxon is more common further south, as suggested by its type locality in Mexico.

The type specimen (figs. 4, 5) is represented by a single fruitbody. All macroscopic characters are typical (thickish margin, irregular hymenium surface, stout tapering stipe). The spores are at the lower end of the range for the taxon ( $6.7-8.9 \times 4.8-5.9 \mu\text{m}$ ;  $E = 1.29-1.54$ ;  $E^m = 1.39$ ;  $L^m = 7.53 \mu\text{m}$ ). In all probability, the fruitbody is very young, and many spores may be immature. The type was probably treated ("poisoned") to inhibit insects, and all hyphae (including basidia) are collapsed, and could not be reinflated.

Specimens examined: MEXICO: vic. Orizaba, s. n. (holotype, K). — UNITED STATES: North Carolina: Macon Co., Coweeta Hydrologic Laboratory, 11. vii. 67, no. 32623 (TENN); Macon Co., vic. Highlands, Horse Cove, 8. viii. 71, no. 36105 (TENN). — Tennessee: Blount Co., GSMNP, Cades Cove, 2. vii. 34, coll. HESLER, no. 3650 (TENN); same location, 15. viii. 63, no. 25783 (TENN).

### 3. *Cantharellus lateritius*

Figs. 2, 3, 6—8

This is the common "gill-less" cantharelle of eastern North America. Based on the type specimen and many others, the following species circumscription is offered.

*Cantharellus lateritius* (BERKELEY) SINGER 1951. — Lilloa 22: 729

= *Craterellus lateritius* BERKELEY apud BERKELEY & CURTIS 1856. — Journ. Philadelphia Acad. Nat. Sci. II 3: 218.

= *Trombetta lateritia* (BERK.) O. KUNTZE 1891. — Rev. Gen. Plant. 1: 873.

= *Thelephora cantharella* SCHWEINITZ 1822. — Schr. Naturf. Gesell. Leipzig 1: 105.

= *Craterellus odoratus* auct. non (SCHWEINITZ) FRIES: Burt. Ann. Missouri Bot. Gard. 1: 331. 1914.

Holotype: PH — herb. SCHWEINITZ, sub *Thelephora cantharella*, Salem [N. C.], no date, s. n.

Fruitbodies up to 12 cm high, up to 9 cm broad, most often simple or with 2—3 stipes joined at base, but only rarely multipileate and then with no more than 3 pilei; pileus plane when very young, soon recurving downward at margin, and becoming crenate and/or

lobed, later evverting somewhat and by maturity deeply infundibuliform or lax trumpet-shaped and then often lacerate-torn by inability to bear its own weight; disc bright orange to slightly pinkish orange ("capucine orange", "capucine yellow", "orange", "orange buff", "mikado orange"); margin somewhat lighter, especially when young ("pale orange yellow", "capucine buff") to nearly concolorous with disc. Pileus surface smooth to very minutely radially fibrillose. Hymenial surface virtually smooth when very young, later developing shallow radial wrinkles or subrugose ridges, and by maturity often with clearly discernable but very irregular radial ridges, irregularities sometimes in the form of pleats, decurrent, buffy orange to slightly pinkish or salmon buff ("light salmon buff", "orange buff", "capucine orange", "capucine buff") often somewhat brighter orange toward margin ("light orange yellow") and lighter when very young ("pale orange yellow"). Stipe up to 4 cm long, up to 6 mm thick, generally equal or sometimes slightly swollen at base, stuffed to almost solid, never perforate, smooth, white or whitish where protected, pale buffy orange above ("pale yellow orange", "pale orange yellow", "light orange yellow") with very common areas of pinkish orange ("mikado orange", "salmon orange", "bittersweet pink"), easily but slowly staining citron yellow where handled ("ochraceous buff", "citron yellow"), then slowly and reluctantly rust color.

Odor moderately to faintly of fruit, like *C. cibarius*; taste slowly moderately to faintly acrid.

Macrochemical reaction: FSW on stipe section instantly vinaceous, then quickly (2—3 secs) grey, and finally (30 secs) returning to white or off-white.

Hyphae of pileus surface and flesh thin-walled, hardly inflated, routinely clamped. Basidia cylindrical to narrowly clavate, (3)—4—5—sterigmate.

Spores  $7.5-9.5 \times 4.8-6.0$   $\mu\text{m}$ , ellipsoid, flattened adaxially, smooth, thin-walled, occasionally with 1-several guttulae, pale pinkish yellow in prints ("orange pink").

Observations: I was obviously but regrettably led astray in a former paper (PETERSEN, 1979) by the report of BURT (1914), who had examined type specimens of "*Craterellus cantharellus* SCHW. ex FR.", "*C. lateritius* BERK." and "*C. odoratus* SCHW. ex FRIES". The reader is referred to my paper (PETERSEN, 1979) for a fuller amplification of diagnostic characters and literature on these taxa.

The following concordance must be offered in order to make correct the concepts in that paper:

- 1) *Cantharellus odoratus sensu* PETERSEN (that paper, figs. 5, 6) is really *Cantharellus lateritius*;
- 2) *Cantharellus lateritius sensu* PETERSEN (that paper, figs. 7, 8) is really *Cantharellus confluentis*;



3) the true *Craterellus odoratus* was not included in that paper under any name.

*Cantharellus lateritius* is by far the most common cantharelloid with suppressed hymenial folds in eastern North America. It may be found as far north as Michigan (cf. SMITH, 1968) and New England (BIGELOW, 1978).

Based on their specimens, *Cantharellus lateritius* and *Craterellus odoratus* are not congeneric, much less conspecific as suggested by CORNER (1966) and BIGELOW (1978). They may well have been misled by BURT's (1914) interpretation, as was I. There is a distinct possibility, however, that *C. lateritius* may represent yet another tropical element in the flora of eastern North America, with a range extending into many Pacific Ocean landmasses. This would parallel almost exactly the situation with the carotene-bearing, clamped taxa of *Clavaria* ( $\equiv$  *Clavulinopsis*, pro parte).

Figures 3 and 4 show the organism. In Figure 3 the mature hymenial surface can be seen as irregular folds, while in Figure 4 this surface is more pleat-like. The fungus shown by SMITH (1968: fig. 11) is probably *C. lateritius*, if the "pinkish tint of the hymenophore in older specimens" can be taken as diagnostic. The fruitbodies shown are complex, and it is difficult to ascertain whether they are branched or merely lobed, crenate and lacerate. The figure by BIGELOW (1978: fig. 10) is surely *C. lateritius*.

Typification of *C. lateritius* is somewhat complex. BURT (1914) accepted two different types, one for *Thelephora cantharella* SCHW. and one for *Craterellus lateritius* BERK. DONK (personal notes) was convinced that the latter represented merely a new name, not a new taxon, and therefore must be based on the SCHWEINITZ type.

BERKELEY's first mention of the organism came in his analysis of SCHWEINITZ specimens (*sub* BERKELEY & CURTIS, 1856). There the full mention reads: "605. *THELEPHORA CANTHARELLA* SCHWEIN.! A *Craterellus*. It was gathered in Ohio by LEA, and is *Craterellus lateritius* BERK. in herb." From this it is obvious that BERKELEY considered the specimens contaxic, but was apparently reluctant to surrender his own name for the organism. That he foresaw a tautonym, and therefore retained his own name, is outside the reference itself, for he believed it belonged in *Craterellus*, a combination under which would not have been tautonymic.

Even stranger, however, was his eventual conversion of names (BERKELEY, 1873: 147). There, omitting only the Latin and English descriptions, the text reads: "215. *Craterellus lateritius*. B. — No. 4539. Alabama, PETERS. . . This is *Thelephora craterellus*, SCHWEIN. Fine specimens were gathered in Ohio by F. G. LEA." First: BERKELEY explicitly names a specimen to represent his name, and that specimen



could surely be interpreted as a type, especially as it did not come from Ohio, as mentioned in both citations. Second: BERKELEY suffered a lapsus calami in his citation of SCHWEINITZ's name. Here (not in his earlier mention of the taxon) he could have foreseen a tautonym in *Craterellus*, but only by misciting the original name. Third: his statement of synonymy is steadfast — the two names represent the same taxon.

If the selection of specimens is taken as an indication of BERKELEY's sentiments, there is room to accept two types. I am persuaded by his unequivocal statement of synonymy, however, and accept his name as only a nomen novum, not a species novum, in which case the type for both names is the SCHWEINITZ specimen.

Where is this specimen? I do not know. Some of SCHWEINITZ's specimens (or portions of specimens) came to Sir William HOOKER from John TORREY, and were available to BERKELEY. Others came to BERKELEY from CURTIS, who was permitted to split many of SCHWEINITZ's collections. BERKELEY returned these specimens to CURTIS, but often kept a bit for his own herbarium. Still other specimens (or portions thereof) remained constantly in herb. SCHWEINITZ at PH (it is this specimen which I have selected as the type). So the whereabouts of the SCHWEINITZ specimen which warranted the "!" in BERKELEY's Commentary (BERKELEY & CURTIS, 1856) is unclear to me.

Selection of specimens examined: UNITED STATES: Alabama: No location, no date, "PETERS", no. 4539 (K, dupl. in herb. Curtis, FH, fide Burt, 1914). — Georgia: vic. Dillard, 28. vii. 34, no. 5113 (TENN). — North Carolina: Macon Co., Horse Cove, 14. vii. 55, coll. L. R. HESLER, no. 21851 (TENN); Transylvania Co., Whitewater Falls, viii. 64, no. 26932 (TENN); Macon Co., Horse Cove, 12. vii. 67 (with notes), nos. 32600, 32607; same location, 8. viii. 71 (with notes & diapositive), no. 36110 (TENN); Jackson Co., Nantahala Nat. Forest, 16. vii. 75, coll. B. J. DYKO, no. 4125 (TENN). — Ohio: Adams Co., 29. vii. 73, coll. W. B. COOKE, no. 47991 (TENN no. 10714); Hocking Co., Ash Cave St. Park, 23. viii. 73, COOKE no. 48540 (TENN no. 12898); Pike Co., Pike Lake St. Park, 22. vii. 73, COOKE no. 47844 (TENN no. 11758). — Pennsylvania: State College, 23. vii. 41, coll. L. O. OVERHOLTS, no. 12996 (TENN). — Tennessee: Blount Co., Rich Mt., GSMNP, 24. vi. 34, HESLER Coll., no. 3648 (TENN); Blount Co., Cades Cove, GSMNP, 6. viii. 59 (with notes & photo), no. 23219 (TENN); Blount Co., Sugar Cove, GSMNP, 27. vii. 67 (with notes), no. 32658 (TENN); Blount Co., Cades Cove, GSMNP, 20. viii. 68 (with notes), nos. 33838, 33839 (TENN); Jefferson Co., vic. Kent, 4. viii. 34, coll. S. L. WALLACE, no. 7370 (TENN); Knox Co., Ball Camp Pike, 17. vii. 34, no. 4248 (TENN); same location, 21. vii. 36, no. 8983 (TENN); Unicoi Co., Rock Creek Rec. Area, 27. vii. 73, no. 37856 (TENN).

#### 4. *Craterellus odoratus*

Fig. 9

*Craterellus odoratus* (SCHWEINITZ) FRIES 1838. — *Epicrasis* p. 532. LT: BURT, 1919.

≡ *Merulius odoratus* SCHWEINITZ 1822. — Syn. Fung. Carol. Super. p. 91.

≡ *Cantharellus odoratus* (SCHW.) FR. 1828. — *Elenchus* Fung. p. 51.

≡ *Trombetta odorata* (SCHW.) O. KUNTZE 1891. — Rev. Gen. Plant. 1: 873.

The type specimen was a complete surprise, for it represented an organism quite different from *Cantharellus lateritius*. Accordingly, the taxon can be circumscribed as follows.

Fruitbodies up to 8 cm high, up to 6 cm broad, complicate cornucopiod to subparasitoid, with several curved, funnel-shaped extensions arising from a single stipe; inside surface of pilei bright orange ("Mikado orange"), smooth and subglabrous to minutely squamulose, soft; hymenial surface smooth, without veins or significant undulation, orange-yellow ("capucine yellow"), without clear demarcation from stipe portion; stipe hollow, irregularly expanded upward, smooth, longitudinally ridged, channelled or lacunose, concolorous with hymenium; all surfaces apparently slowly bruising to a rust color. Taste not reported, probably mild; odor mild, pleasant, reported (teste SCHWEINITZ) to be like violets.

Hyphae of inner (dorsal) surface of pilei undifferentiated, in a loose trichodermium, 3.0—7.5  $\mu$ m diam, hardly inflated, randomly extending from the surface up to 100  $\mu$ m, without clamp connections. Hyphae of pileus trama similar, hyaline, thin- to somewhat thick-walled (wall up to 1  $\mu$ m thick), not noticeably secondarily septate. Hymenium congested, thickened, with effete basidia persistent as semi-collapsed "ghosts"; basidia 60—95  $\times$  7.5—9  $\mu$ m, narrowly clavate, without clamp connections, arising successively as branches just proximal to old basidial septa; contents homogeneous; sterigmata (4)—5—(6), stout divergent-cornute, 4—7  $\mu$ m long.

Spores 8.9—11.8  $\times$  4.4—6.3  $\mu$ m ( $E = 1.59$ —2.21;  $E^m = 1.87$ ;  $L^m = 10.05$   $\mu$ m), ellipsoid to narrowly ovoid, smooth, thin-walled; contents homogeneous; hilar appendix small, papillate, eccentric.

Observations: The clampless hyphae and funnel-shaped fruitbodies immediately remove the taxon from *Cantharellus*, and the lack of secondary septa eliminates *Pseudocraterellus*, if that genus is considered taxonomically valid. Instead, the species is clearly related to other *Craterellus* taxa, although superficially anomalous in color and shape. It would appear that all black or brown pigment, so common and dominant in the genus (viz. *C. fallax* SMITH or *C. cornucopiodes*) has been suppressed so that the macroscopic colors are very close to those in *Cantharellus*. Identification of the major biochemical constituent pigments would reveal to which part of *Cantharellus* (i. e., *Cantharellus*, with betacarotene predominating, or *Leptocantharellus*

with neurosporene as most commonly deposited) it is related and perhaps give interesting clues to intergeneric relationships in general.

Fruitbodies apparently arise from a mass of mycelium 1—2 cm below ground (fig. 9, right), and when young appear as small (circum 0.5 cm diam) cups, not dissimilar from small fruitbodies of *Peziza* or *Otidia*. The margins of the cups continue to expand, however, eventually becoming primarily funnelshaped (fig. 9, left), but usually folding to become more complex and often laterally compressed (fig. 9, center).

Spores in *C. odoratus* are narrower than in any other taxon of the genus. Otherwise, however, they are typical of the genus, as are the basidia, which usually produce five sterigmata. I suspect that spore print color would be pale apricot or pale peach, not white, but no data can be found on this.

COKER (1919) was correct in his interpretation of *C. odoratus*, but BURT (1919) equated the type specimens collected near St. Louis, clearly of a different and much more common and widespread taxon, and with *Cantharellus confluens* BERK. & CURT., assuredly not the same as *C. odoratus*. CORNER (1966) perpetuated the misconception, describing and figuring an organism quite like the incorrect concept of BURT. CORNER apparently examined the type of *Cantharellus confluens*, and likened it to his (CORNER's) idea of *C. odoratus*, reinforcing the notion that *C. confluens* and *C. odoratus* are not synonyms.

Specimens examined: UNITED STATES: North Carolina: Salem, herb. SCHWEINITZ, s. n. (PH). — Florida: Gainesville, l. iv. 46, det. W. A. MURRILL, no. 10186 (TENN); Gainesville, 23. vii. 38, det. W. A. MURRILL, no. 16138 (TENN); Gainesville, vii. 78, coll. H. BARNHART, s. n. (TENN). — Tennessee: Great Smoky Mountains Nat. Park, 10. vii. 34, no. 6554 (TENN); GSMNP, Cades Cove, 18. viii. 40, det. L. R. HESLER, no. 12810 (TENN); GSMNP, Greenbrier, 17. iv. 47, det. L. R. HESLER, no. 18026 (TENN); GSMNP, 12. viii. 68, no. 33813 (TENN).

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