

Studies on North American Cortinariid IV. New and interesting *Cortinarius* species (subgenus *Phlegmacium*) from oak forests in Northern California^{1, 2}

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Oak- and *Lithocarpus* associations in California have not yet been studied with respect to their *Cortinarius* flora and new taxa can therefore be often found. There are also some similarities with European oak forests, particularly from the Mediterranean area. Eight taxa are described in this paper and two of them are known from Europe. The following species are new to science: *Cortinarius albofragrans*, *C. lagentii*, *C. roseobulbus*, *C. griseocoeruleus*, *C. flavobulbus*, *C. viridirubescens*.

Keywords: *Cortinarius*, *Phlegmacium*, *Quercus*, *Lithocarpus*, California.

The *Cortinarius* species in oak forests in northwestern California have hitherto been neglected. In the fall season of 1995 we had the opportunity to collect in pure and mixed oak stands as well as other plant associations where *Quercus* species and often *Lithocarpus densiflora* occurred with other trees and shrubs. To a lesser extent collecting in some of these areas was done by the senior author in 1991 and the junior author in 1990. Primary collecting sites listed below are in Del Norte, Humboldt and Mendocino Counties. Information on California vegetation is taken from Sawyer & al. (1977) and Sawyer & Keeler-Wolf (1995).

In this paper on Oak (*Quercus*) and tanoak (*Lithocarpus*) Cortinariid, a selection of new and interesting species from northwestern California are presented.

¹ Part I Mycotaxon 55: 301–346; Part II Mycotaxon 58: 387–412; Part III *Sydowia* 45: 275–306

² This contribution is dedicated to Prof. Dr. E. Horak on occasion of his 60th anniversary.

Collecting sites

1. Gasquet Flat. – This site is on the north side of the Middle Fork of Smith River at Gasquet, Highway 199, Del Norte County, California. It is a small, nearly pure stand of *Quercus garryana* with the shrubby undergrowth removed, likely due to its use as a farm or pasture land in earlier times. During the summer before we collected there a light fire had gone over the area without damaging the trees; the grass had already recovered by November. This stand appears to be on an old river terrace with basic soil that originated from serpentine and other parent materials in the Middle Fork drainage of the Smith River.

2. Danger Point. – This locality is on the north side of Highway 199, Del Norte County, California about one mile southwest of Grassy Flat Campground. The dominant trees in this site are *Lithocarpus densiflora*, *Quercus vaccinifolia* and *Quercus chrysolepis* with *Pseudotsuga menziesii*, *Arbutus menziesii* and *Pinus* on some sites. The vegetation is composed of dense shrub cover in some areas and the soils are basic with serpentine parent materials in some places.

3. Patrick's Creek Campground. – This location is adjacent to Highway 199 where it crosses Patrick's Creek, Del Norte County, California. The soils are basic and the dominant trees are *Lithocarpus densiflora*, *Quercus chrysolepis* with some *Pseudotsuga menziesii* and *Umbellularia californica* intermixed in places. Some areas are also somewhat shrubby.

4. South Fork of the Smith River. – A Tanoak Forest stand of almost pure *Lithocarpus densiflora* was examined near the intersection of Road 427 and the road down to Buck Creek Campground. Mostly bare soil or covered with leaf litter. Basic soil with serpentine parent materials on some sites.

5. Boise Creek Campground. – Situated on Highway 299 west of Willow Creek, Humboldt County, California. Trees in this locality are *Quercus garryana* and evergreen oaks, for example, *Quercus chrysolepis*, plus *Lithocarpus densiflora*, *Arbutus menziesii* and *Pseudotsuga menziesii*. Often a mixed forest with some open areas in the lower campground area and with leaf litter over basic soil.

6. Mendocino, Jackson State Forest. – This site is about 8 miles east of Mendocino on Road 408 in a stand dominated by *Lithocarpus densiflora* mixed with few *Sequoia sempervirens*. Col-

lections were also made near the intersection of Roads 408 and 409 (Caspar Little Lake Road). This site also was dominated by *Lithocarpus densiflora* mixed with *Sequoia sempervirens* and few *Tsuga heterophylla*. Some areas with *Pseudotsuga menziesii*. Two collections were made in 1991 on a site along Caspar Little Lake Road called Russian Gulch. These sites are on a maritime terrace and in part represent the Redwood/Tanoak association.

7. Stout Grove, Jedediah Smith State Park, Del Norte County, California. – A part of the Redwood Series this stand has *Sequoia sempervirens* and *Tsuga heterophylla* with Tanoak common in some areas. Soils in this area may be mixed and likely less basic on *Sequoia* dominated sites.

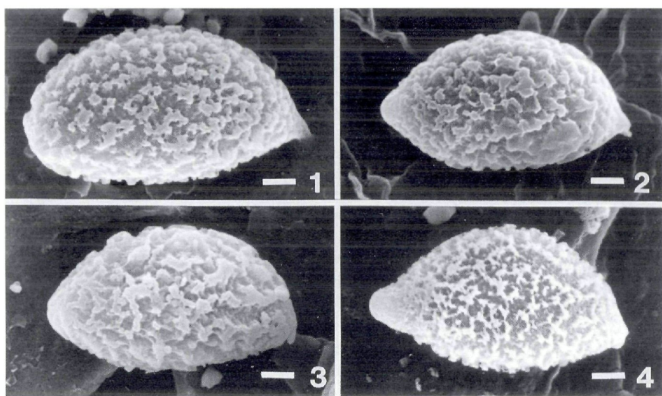
Materials and methods

For Methods see also Parts 1 to 3 of this series. Description of microscopic characters were taken from sections mounted in 3% KOH. Spore measurements were made from spore prints wherever possible. Abbreviations used to describe the basidiospore measurements: S=standard deviation, Q=quotient of spore length to spore width, V=approximate volume. Variations found in collections other than the type are given in parentheses. To describe the density of the lamellae the following measures are given: L=total number of lamellae reaching the stipe; l=number of lamellulae between two lamellae. Comparison of lamella width with the thickness of the pileus context was made at about half the radius of the pileus. Color Codes include Munsell Soil Color Charts (1975; example of notation: Mu 2.5YR2/4), Ridgway, Color Standards and Color Nomenclature [1912; example: Carob Brown (R)], A. Cailleux, Code des Couleurs des Sols (1981; example: Caill 55S) and Methuen Handbook of Color (example: 1D8). Macrochemical color reaction were made with 20% or 30% KOH and/or $\text{NH}(\text{DoB1})_4\text{OH}$. Collections of Meinhard Moser are deposited in the Herbarium of the Institut für Botanik der Universität Innsbruck (IB) and those of J. Ammirati at the University of Washington Herbarium (WTU).

Taxonomic part

Cortinarius (Phlegmacium) albofragrans Ammirati et Moser, sp. nov.
– Fig. 1, 9, 15.

Pileo 3–8 cm in diametro, ex hemispherico convexo, margine subinvoluta, postremo applanato margineque recurvato, non hygrophano, albo, eburneo, estriato, aetate pallide ochraceo, disco flavo-brunneo, lamellis primo roseo-buba-



Figs. 1–4. SEM pictures of basidiopores. – 1. *Cortinarius albofragrans* 95/595. – 2. *C. largentii* 95/672. – 3. *C. roseobulbus* 95/684. – 4. *C. griseocoeruleus* 95/685.

linis, dein pallide argillaceis, griseo-brunneis, emarginatis, acie serrulato, confertis, 4–13 mm latis, stipite 6–10 cm longo, apice 10–15 mm, basi 10–25 mm crasso, aequali subclavato, raro bulbo submarginato praedito, albo, albidulo, parte inferiore e velo pallide brunneo oblecto, interdum cingulato, carne alba vel albida, odore fragrante, similis *Cortinarii* percomis vel florum, sapore miti. Sporis 10–11.8(–12.3) \times 5.6–6.8 μ m, amygdaliformibus, verrucosis, basidiis 34–38 \times 8 μ m, tetrasporigeris, clavatis, absque cheilocystidiis. Fibulis praesentibus.

Habitatio: in Quercetis (*Quercus vaccinifolia*, *Q. chrysolepis*, *Lithocarpus densiflora*), holotypus IB 95/595, Middle Fork Smith River, Highway 199, in localitate dicto Danger Point, 20 Nov. 1996, leg. M. Moser.

Pileus 3–8 cm diam., at first hemispheric, later convex, margin at first inbent and sterile margin inrolled, later appanate and margin finally often upturned, glutinous, white, ivory white, Cream Color (R), Ivory Yellow (R), not innately fibrillose, margin not translucent striate, not hygrophanous, later becoming pale ochraceous, margin Cartridge Buff (R), toward the disc Cream Buff (R) and darker, Warm Buff (R), later disc yellow-brown, Ochraceous Buff (R), Caill 57N. – Lamellae whitish at first, Light Pinkish Buff (R) to Pinkish Buff (R), then pale gray-brown, near Mu 10YR7/6, or slightly darker than Cinnamon (R), with age gray-brown, Sayal Brown (R), finally somewhat darker than Sayal Brown, shallowly, later deeply and sharply emarginate, edges eroded, close, L = 60–80, l = 1–3(–5), 15–18/cm at margin, 4–13 mm wide (equal to 2–4x thickness of pileus context). – Stipe 6–10 cm long, 10–15 mm at apex, 10–25 mm thick at base, equal or slightly clavate, sometimes apex enlarged, in some

specimens with a very indistinct, submarginate bulb, white, whitish, in basal part or up to the middle with a thin pale brown covering from veil which sometimes can form belts or patches, sometimes more dispersed. – Veil pale brown (Mu 10YR 7/8 or darker). – Context white to whitish, in center of pileus and pith with a slight yellowish flush. – Odor fragrant, similar to *Cortinarius percomis* (marjoram) or also of some flours. – Taste mild.

Chemical reactions. – KOH 30% negative both on pileus surface and context, also in the base of the stipe. With Lugol solution the context in the stipe base becomes quickly dark brown. – UV: bluish on pileus, stipe and parts of context, partly yellow on context. Gills dark.

Microscopic characters. – Basidiospores $10\text{--}11.8$ (-12.3) $\times 5.6\text{--}6.8$ μm , mean 10.8 ($S=0.43$) $\times 6.0$ ($S=0.24$) μm , $Q=1.8$, $V=163\text{--}268$ μm^3 , mean 204 μm^3 ($S=21$), slender almond-shaped, verrucose, apex smooth. – Basidia $34\text{--}36 \times 8$ μm , 4-spored, clavate, without cheilocystidia, on gill edge basidia and basidioles. – Subhymenial hyphae $3.5\text{--}4.5$ μm , gill trama hyphae $4\text{--}12$ μm , in mediostratum $15\text{--}20$ μm , colorless, clamp connections present. – Pileipellis with a gelatinous layer of repent, $2.5\text{--}3.5$ μm thick, colorless hyphae with clamp connections, some with yellow content, often strongly curled. – Epicuticular hyphae $4.5\text{--}5.5$ (-6) μm , walls pale ochraceous in KOH, no hypocutis differentiated. In Melzer's reagent the tissue is filled with dark granules.

Habitat. – Under *Quercus*, also evergreen oak (*Quercus vacciniifolia*, *Q. chrysolepis* and *Lithocarpus densiflora*), some *Pseudotsuga menziesii* sometimes not far from the site.

Collections examined. – CALIFORNIA: JFA 8809, Edgewood Park, Redwood City, San Mateo County, leg. F. Weidig, 14 Dec 1982; IB 95/595 (holotype) and JFA 11799, Danger Point, Highway 199, Del Norte Co., California, leg. M. Moser, 20 Nov. 1995; IB 95/633, same area, 29 Nov. 1995, leg. M. Moser, JFA 11828 same area and date.

In collection JFA 8809 the range of spore size ranges from $11.2\text{--}14.6 \times 5.9\text{--}7$ μm . Most spores fall in the normal range. The larger spores seem to be derived from 2-spored basidia. Collection JFA 11799 represents a short-stemmed, somewhat abnormal specimen and has slightly smaller spores ($10\text{--}11.5 \times 5.4\text{--}6.2$ μm).

The taxonomic position is rather difficult to determine. The color and clavate stipe could suggest a relation to *Cortinarius lus-tratus* Fr. but the type of spores is rather different and the presence of a thin, brownish universal veil, which can form either a thin sheath or belts could suggest a position within section *Cliduchi* (Fr.) Sacc. Also a relation to the South American series *Xiphidipus*,

however, might be considered where species like *C. longicaudus* Mos. and *C. effundens* Mos., Horak & Sing. have a slight similarity and and the latter also a fragrant odor.

Cortinarius (Phlegmacium) largentii Ammirati & Moser, sp. nov. – Fig. 2, 10, 16.

Pileo 6.5–14 cm lato, ex hemisphaerico convexo, margine fortiter involuto, aetate applanato, disco subdepresso, margine inflexo, glutinoso, colore laete flavo-brunneo usque rufo-brunneo, aetate obscuriore, numquam innato fibrilloso, e glutine desiccante obscuriore maculato, lamellis primo lilaceis, aetate brunnescentibus, adnatis usque anguste emarginatis, confertis, 4–6 mm latis, stipite 7–10 cm longo, 27–50 mm crasso, bulbo 45–70 mm lato acute marginato, bubalino, incarnato-bubalino, margine bulbi fimbriato e velo pallide bubalino. Carne bubalina, absque odore distincto, sapore miti.

Sporis 8.8–10.9 × 4.7–5.8 µm, amygdali- vel sublimoniformibus, verrucosis, basidiis 30–33 × 7.5–8 µm, tetrasporigeris, clavatis. Fibulis praesentibus.

Habitatio in quercetis (*Quercus garrayana*, *Q. chrysolepis*, *Lithocarpus densiflora*). Holotypus IB 95/672, Boise Creek Camp Ground prope Willow Creek, Humboldt Co., California, 5 Dec. 1995, leg. D. Largent.

Pileus 6.5–14 cm diam., hemispheric, later convex, margin strongly involute, finally applanate and disc somewhat depressed, margin remaining persistently enrolled, glutinous, colors rather bright yellow-brown to red-brown, Ochraceous Tawny (R) in buttons, later darker, Tawny and Ochraceous Tawny (R) mottled, not innately fibrillose, the drying gluten causing somewhat darker spots (older specimens can remind of *Cortinarius ponderosus* seen from above, but it lacks any greenish tinges near the margin), disc somewhat matted or finely granular under lens at first, Colors Caill 60N in buttons, Caill 39B and 60N mottled in older specimens. No veil remnants visible on pileus. – Lamellae at first lilac, Hay's Lilac (R) (slightly paler and more dull), with age becoming Cinnamon Drab (R), finally Mikado Brown (R), near the pileus margin retaining lilac color rather long times, rounded adnate to narrowly emarginate, edges eroded to strongly eroded, crowded, L=120–130, l=3, 15–20/cm at the margin, 4–6 mm wide (about 1/2 of the thickness of pileus context). – Stipe 7–10 cm long, 27–50 mm thick, the very broad and obtusely to sharply marginate bulb 45–70 mm wide, above rim usually flat-depressed, color Pale Pinkish Buff (R) to Cartrige Buff (R), also the margin of the bulb fringed by veil of the same color. On the pileus surface of buttons the veil is dingy whitish. – Context whitish or Cartridge Buff (R) to Pale Pinkish Buff (R), brown where eaten by larvae, watery grayish above the gills. Without particular odor or somewhat pungent.

Chemical characters. – KOH 20% on pileus surface brown, on context brownish. – UV: context yellow, larvae tunnels brown,

pileus surface reddish and yellowish (margin) with some purple, lamellae dull and pale or dark, stipe yellowish to reddish dull including base. Taste mild.

Microscopic characters. – Basidiospores $8.8\text{--}10.9 \times 4.7\text{--}5.8 \mu\text{m}$, mean $9.6 (S=0.38) \times 5.2 (S=0.25) \mu\text{m}$, $Q=1.86$, $V=105\text{--}170 \mu\text{m}^3$, mean $135 (S=15) \mu\text{m}^3$, almond-shaped to sublimoniform, verrucose, apex smooth. – Basidia $30\text{--}33 \times 7.5\text{--}8 \mu\text{m}$, 4-spored, clavate, without cheilocystidia, subhymenial hyphae 3–5 mm thick, colorless, clamp connections present. – Pileipellis with very thick, gelatinous layer of $2.5\text{--}5.5 \mu\text{m}$ thick, subrepent to irregularly ascending hyphae with yellowish walls and deep yellow-brown content, few hyphae colorless. – Epicuticular hyphae $6\text{--}9.5 \mu\text{m}$, somewhat irregularly interwoven, walls yellow to yellow-brown.

Habitat. – Under *Quercus garrayana*, *Q. chrysolepis* and *Lithocarpus densiflora* with scattered *Arbutus menziesii*.

Collections examined. – IB 95/672, (holotype) JFA 11875 (isotype), 5. Dec. 1995 leg. D. Largent, IB 96/695, 10 Dec. 1995, leg. M. Moser, both Boise Creek Camp Ground, near Willow Creek, Humboldt Co., California.

This taxon also remains fairly isolated but temporarily we can place the species in section *Multiformes*, subsection *Callochroi*, series *Pansa*.

***Cortinarius (Phlegmacium) roseobulbus* Moser, sp. nov. – Fig. 3, 11, 17.**

Pileo 4–8 cm lato, convexo, primo margine involuto, dein appanato, coloribus simili *Cortinari* callochroi, primis coloribus luteis, discum versus testaceo-maculato vel variegato, interdum sordide brunneo, numquam innato-fibrilloso, lamellis argillaceis vel subtiliter lilaceis, aetate avellaneis, emarginatis, confertis, 5–7 mm latis, stipite 5.5–8 cm longo, 11–20 mm crasso, bulbo marginato 15–40 mm lato, saepe depresso, apice lilaceo, mox albicante, margine bulbi fimbriato e velo flavo vel flavo-albo, facie externa mycelioque rosea, carne bubalina, incarnato-bubalina, in bulbo rosea, odore nullo, sapore miti.

Sporis $8.2\text{--}10 \times 5\text{--}5.9 \mu\text{m}$, amygdaliformibus, verrucosis, basidiis $30\text{--}33 \times 7.5\text{--}8.5 \mu\text{m}$, tetrasporigeris, clavatis, absque cystidiis, fibulis praesentibus.

Habitatio in quercetis (*Quercus garrayana*, *Lithocarpus densiflora*), holotypus IB 95/684, Mendocino, prope furcam viarum 409/408, Mendocino Co., California, 8 Dec. 1995, leg. M. Moser.

Pileus (4–)5–8 cm diam., convex, margin at first inrolled, the sterile margin remaining so for long time, then applanate, glutinous, colors reminiscent of *C. callochrous*, ground color yellow, Mustard Yellow (R) or a yellow which is a mixture of Naples Yellow, Baryta Yellow and Maize Yellow (R), toward center with brown to dingy red-brown areas, spots and/or streaks (Caill 57N), sometimes also more dingy brown, not innately fibrillose. – Lamellae argillaceous or with a very faint lilac reflex, near Tilleul Buff (R) (more grayish), then gray-

brown, Avellaneous (R), Sayal Brown (R) when mature, emarginate, edges uneven to eroded, close to crowded, $L=95-120$, $l=1-3$, $16-19/\text{cm}$ at margin, $5-7$ mm broad ($1-1.5 \times$ thickness of pileus context). – Stipe $4.5-8$ cm long, $11-20$ mm thick, the marginate, often depressed bulb $15-40$ mm, the apex in some specimens lilac, in most specimens whitish discolored, the margin of the bulb fringed by yellow to yellow-whitish veil, but the outside of the bulb and mycelial rhizomorphs distinctly pink. – Context Pale Pinkish Buff (R) to Pinkish Buff (R), in bulb pink, Salmon Buff (R), in stipe after some time of exposure to air also with slight pinkish flush. Without distinctive odor, taste mild.

Chemical reactions. – KOH 30% on pileipellis more orange-yellow, then brown to red-brown, negative on pileus context, on pinkish context in bulb gray-brown. – NH_4OH negative in and outside of bulb. – Lugol negative (orange to yellow). – UV: Pileus yellowish and red areas, brown areas dark, gills grayish or yellowish, stipe and context yellow to bluish, bulb outside reddish.

Microscopic characters. – Basidiospores $8.2-10 \times 5.0-5.9$ μm , mean 9.1 ($S=0.4$) $\times 5.5$ ($S=0.23$) μm , $Q=1.7$, $V=108-176$ μm^3 , mean 145 ($S=16.7$) μm^3 , in coll. 95/684 : $8.2-10.2 \times 4.8-5.6$, mean 9.4 ($S=0.36$) $\times 5.3$ ($S=0.16$), $Q=1.8$, $V=115-159$ μm^3 , mean 138 μm^3 ($S=11$). – Basidia $30-33 \times 7.5-8.5$ μm , 4-spored, clavate, without cheilocystidia, subhymenial hyphae $3-5$ μm , gill trama hyphae $6-9$ μm , mediostratum hyphae up to $12(-15)$ μm , walls pale ochraceous to colorless, clamp connections present. – Pileipellis with gelatinous pellicle of repent to irregular hyphae, $3-4.5$ μm thick, walls yellow, finely encrusted, clamp connections present; epicuticular hyphae $4.5-6$ μm , walls yellowish, finely encrusted. No hypocutis differentiated, trama hyphae colorless, irregular to pseudoparenchymatic in lower part. – Hyphae from bulb surface $3-4$ μm , the pink pigment dissolving but no reaction with KOH, some in KOH with yellow content.

Habitat. – Under *Quercus garryana* and *Lithocarpus densiflora*.

Collections examined. – IB 956/647, Gasquet flat, Highway 199, but on north side of the Middle Fork of the Smith river, Del Norte Co., California, 2. Dec. 1995, leg. M. Moser. Under *Quercus garryana*; JFA 11838, same area, 30. Nov. 1995, leg. J. F. Ammirati; IB 95/684 (holotype), JFA 11850 (isotype), Mendocino, Caspar Little Lake Road, Mendocino Co., California, under *Lithocarpus densiflora*, *Sequoia*, 8 Dec. 1995, leg. M. Moser.

The most striking character of this species is the pink exterior of the bulb and the basal mycelium. The gills can be at first lilac. This, together with the brown to red-brown KOH reaction on pileipellis could suggest a position within the sect. *Multiformes*, subsect. *Callochroi*.

Cortinarius (Phlegmacium) calyptratus A. H. Smith. Contr. Univ. Michigan Herb. 2: 14. 1939.

A. H. Smith described this species as associated with spruce and redwood "near Crescent City". He apparently overlooked *Lithocarpus* which is present in all conifer forests around Crescent City. We collected this taxon both in oak and tanoak forests and therefore it seems to be mycorrhizal with *Quercus* and *Lithocarpus* but not conifers. Our collections permitted a study of the whole range of variation. A redescription will be included in a forthcoming publication. It is mentioned here because of its common occurrence in some of the study sites.

Cortinarius (Phlegmacium) griseocoeruleus Ammirati & Moser, sp. nov. – Fig. 4, 12, 21, 22.

Pileo 9–16 cm lato, convexo dein plano-convexo, margine primo involuto, colore marginem versus primo griseo-lilacino, disco ochraceo usque pallide brunneo, ad marginem innato fibrilloso, discum versus brunneo maculato, demum totius griseo, lamellis primo lilaceis, dein griseo-brunneis, rotundato-adnatis usque submarginatis, confertis, 8–9 mm latis, stipite 7–8 cm longo, 20–35 mm crasso, violaceo, bulbo e velo albido-ochraceo fimbriato, interdum submembranaceo, carne infra discum et in bulbo albida, supra lamellis pallide coerulea, violacea in cortice stipitis.

Sporis 9.4–11.8 × 5.6–6.9 µm, Q=1.7, limoniformibus, verrucosis, apice glabro, basidiis 35–37 × 8.5–9 µm, tetrasporigeris, saepe acie cum cellulis sterilibus filamentosis, interdum subcapitatis, 25–45 × 4–5 µm. Fibulis praesentibus.

Habitatio: in quercetis vel silvis mixtis sub Lithocarpo, holotypus IB 95/685, prope partem meridianum rivi Smith, Del Norte Co., California, 19 Nov. 1995, leg. M. Moser.

Pileus 9–10(–16) cm diam., convex to plano-convex, margin at first involute, glutinous, at first marginal area with grayish lilac color, between Purplish Gray and Hair Brown or near Pale Vinaceous Drab to Pale Ecru Drab (R), at edge with tints of Deep Heliotrop Gray (R), toward the disc more ochraceous to pale brownish, later gray over the whole surface, near Drab (R), on disc with brownish spots and areas, near the margin innately fibrillose. – Lamellae lilac at first, Grayish Lavender (R), becoming gray-brown, Drab (R), Wood Brown (R) or Fawn Color (R), Cinnamon Drab (R), Benzo Brown (R) or mixtures of these colors at maturity, rounded adnate to slightly emarginate, edges uneven to eroded, close to crowded, L=100–140, l=3, 16–18/cm at margin, 8–9 mm wide (equal to thickness of pileus context). – Stipe 7–8 cm long, 20–35 mm thick, the marginate bulb 35–53 mm wide, violaceous, Grayish Lavender (R), the bulb sheathed by a rather strongly developed whitish-ochraceous veil which can be submembranaceous, bulb under-

neath white and often with rather strong rhizomorphs. Mycelium mostly white, occasionally with lilac tints. – Veil whitish-ochraceous, submembranaceous. – Context whitish under the disc, pale bluish above the lamellae and darker violaceous in the cortex of stipe (Madder Blue (R)) somewhat marbled, in bulb whitish. – Without distinctive odor. – Taste mild.

Chemical characters. – KOH 20% brown on pileipellis and veil, no reaction on context or only grayish yellow. – Lugol in stipe base orange to yellow. – UV: pileus yellowish with some lilac areas or like the gills dark purple, stipe bluish, bulb outside yellowish, context yellow in pileus and bulb, bluish in upper part of stipe.

Microscopic characters. – Basidiospores $9.4\text{--}11.8 \times 5.6\text{--}6.9\text{ }\mu\text{m}$, mean $10.7\text{ (S=0.36)} \times 6.3\text{ (S=0.26)}\text{ }\mu\text{m}$, $Q=1.7$, $V=161\text{--}281\text{ }\mu\text{m}^3$, mean $226\text{ (S=21)}\text{ }\mu\text{m}^3$, lemon-shaped, sometimes perispore visible, verrucose, apex smooth. – Basidia $35\text{--}37 \times 8.5\text{--}9\text{ }\mu\text{m}$, 4-spored, clavate, gill edge often with filamentose, sometimes slightly capitate sterile cells, $25\text{--}45 \times 4\text{--}5\text{ }\mu\text{m}$ which can form dense fascicles. – Subhymenial hyphae $3\text{--}4\text{ }\mu\text{m}$, gill trama hyphae $5\text{--}7\text{ }\mu\text{m}$, in mediostratum $9\text{--}10\text{ }\mu\text{m}$, colorless, clamp connections present. – Pileipellis with gelatinous pellicle of repent to irregular $4.5\text{--}6\text{ }\mu\text{m}$ wide hyphae, walls pale ochraceous in KOH, with numerous refringent vacuoles or otherwise refringent content, clamp connections present. – Epicuticular hyphae $4.5\text{--}8\text{ }\mu\text{m}$ wide, walls in KOH pale ochraceous. In hypocutis hyphae up to $15\text{ }\mu\text{m}$ thick. – Pileipellis generally relatively thin ($120\text{--}180\text{ }\mu\text{m}$ thick).

Habitat. – Under *Lithocarpus densiflora*, sometimes in mixed forstes but growing with *Lithocarpus*.

Collections examined. – IB 95/582 (JFA 11.779) Stout Grove, Jedediah Smith Redwood State Park, Del Norte Co., California, 18 Nov. 1995, leg. J. Ammirati; IB 95/586 South Fork of the Smith River, below road fork 427 and road to Buck Campground, Del Norte Co., California, 19 Nov. 1995, leg. M. Moser; IB 95/685 (holotype) JFA 11892 (isotype), about 8 km east of Mendocino on road 408, Mendocino Co., California, 8 Dec. 1995, leg. M. Moser.

This taxon belongs to Sect. *Coerulescentes* and is one of the largest and most robust species in this section, becoming more robust and larger than most other taxa in this section.

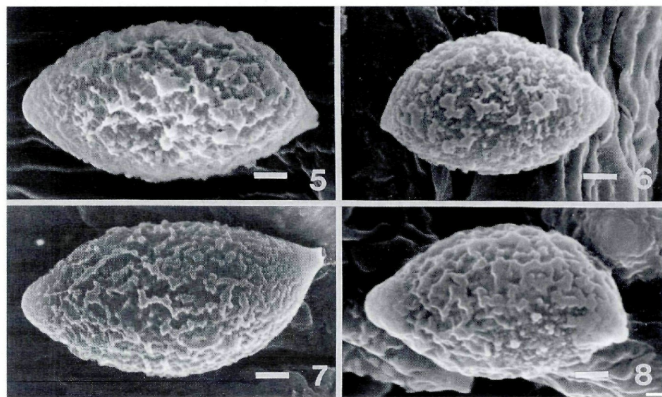
Cortinarius (Phlegmacium) flavobulbus Moser & Ammirati, sp. nov. – Fig. 5, 13, 19.

Pileo 3–7 cm lato, convexo, dein applanato, interdum umbonato, margine primo subinvolutu, glutinoso, primo totius laete lilaceo, dein in fundo piu pallido obscuriore violaceo innato fibrilloso, postremum disco decolorante bubalino vel

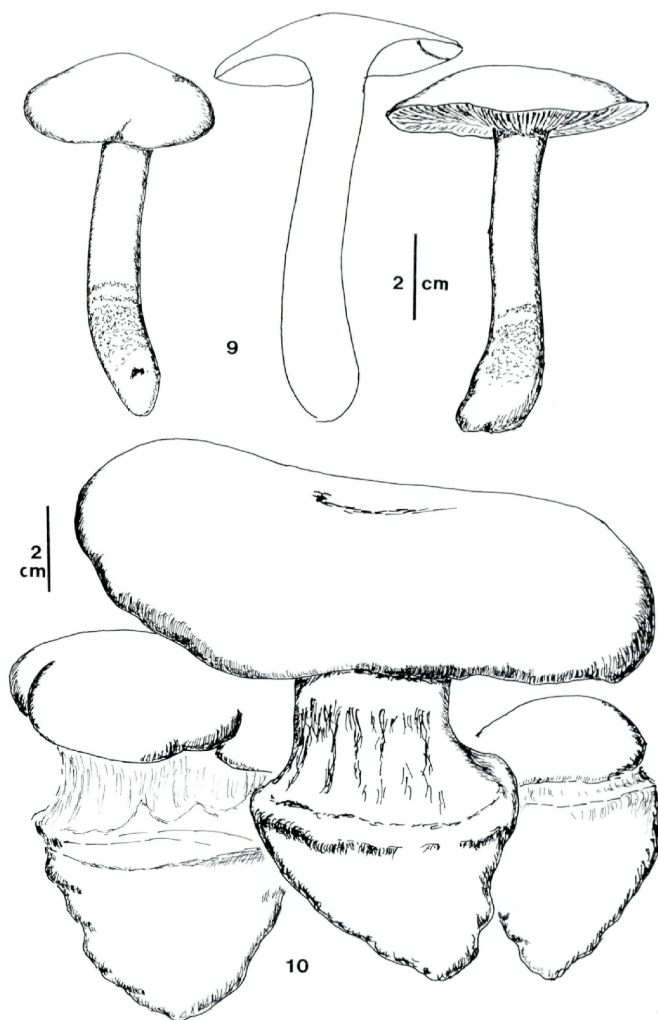
ochraceo. Lamellis laete lilaceis, dein brunneis, emarginatis, confertis, 4–7 mm latis, stipite 4–8 cm longo, 8–13 mm crasso, bulbo 13–30 mm lato, lilaceo, dein pallescente, margine bulbi fimbriato e velo pallide lilaceo, saepe subvolvaceo, bulbo infra pallide sulphureo, aetate albido, carne albida, in cortice stipitis per-pallide lilacea, odore nullo vel leviter fruticoso, sapore miti. KOH ope nullam reactionem praebente, nisi in pileipelli, nisi in carne. Sporis (8.5)–9.4–11.8 × (5)–5.2–6.5 µm, Q=1.8, amygdaliformibus, verrucosis, apicibus glabris, basidiis 34–36 × 8–9 µm, tetrasporigeris, clavatis.

Habitatio: in Quercetis sempervirentibus vel deciduis (*Quercus vaccinifolia*, *Q. garryana*), Holotypus IB. 95/629, prope partem centralem rivi Smith, Highway 199, in localitate dicto Danger Point, Del Norte Co., California, 29 Nov. 1995, leg. M. Moser.

Pileus 3–7(–10.5) cm diam., convex, then applanate and broadly umbonate, margin at first slightly inrolled (with age plano-uplifted), later only sterile margin remaining inrolled, glutinous, at first bright lilac up to the center, Light Mauve (R), later on margin and disc with a paler ground color; Mauvette (R) and with dark violet innate fibrillosity, disc finally discoloring to Pale Pinkish Buff (R) or with ochraceous areas (with age on a few places of outer margin pale lilac or grayish lilac, typically in these specimens the surface is pallid to pale tan or pale brownish with some darker brown shades and streaks centrally, outer edge can become very brownish as well). – Lamellae bright lilac, Light Violaceous Lilac (R), later mixed with brown somewhat brighter than Cinnamon Drab (R), emarginate, edges uneven, close, L=70–80, l=3, 17/cm at margin, 4–7(–9) mm



Figs. 5–8. SEM pictures of basidiospores. – 5. *C. flavobulbus* 95/629. – 6. *C. arcuatum* 95/686. – 7. *C. viridirubescens* 96/688. – 8. *C. fulmineus* 95/637.



Figs. 9–10. Basidiomata. – 9. *C. albofragrans* 95/595. – 10. *C. largentii* 95/672.

wide. – Stipe 4–8 cm long, 8–13 mm thick, the marginate bulb with 13–30 mm diam., lilac, Deep Vinaceous Lavender (R), later fading and paler, base of stipe even becoming whitish, the bulb at first fringed by sometimes nearly volva-like remains of pale lilac veil, outside of bulb yellow, Sulfur Yellow (R), basal mycelium yellowish, with age whitish. – Veil lilac. – Context white, with some brownish spots, only in stipe apex and sometimes under the pileipellis with a very faint lilac flush. – Odor when cut slightly fruity (apples) to not distinctive. – Taste mild.

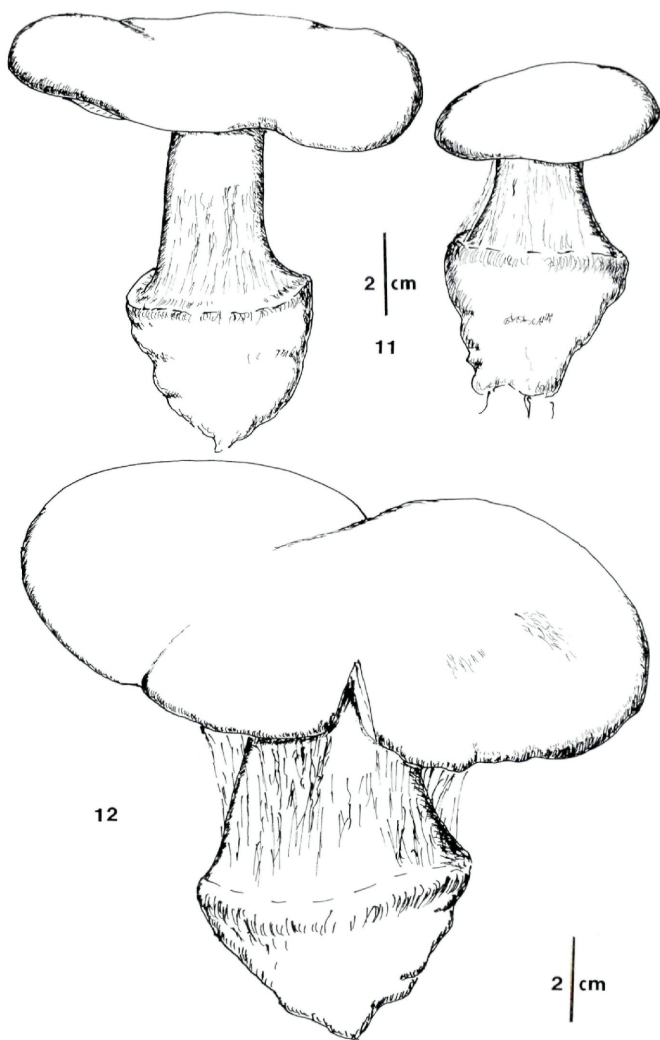
Chemical characters. – KOH 20% negative on pileipellis and context and also on outside of bulb (in one collection somewhat reddish to brown on pileipellis, brownish on context). – UV: bluish on pileus, (with age also yellowish in places), gills dark, stipe and bulb outside bluish, context blue in pileus and bulb, yellow in stipe.

Microscopic characters. – Basidiospores (8.5–)9.4–11.8 × (5.0–) 5.2–6.5 μm , mean 10.5 (S=0.55) × 5.8 (S=0.27) μm , Q=1.8 (S=0.1), vol. 137–232 μm^3 , mean 188 μm^3 (S=21.5), almond-shaped, verrucose, apex smooth. – Basidia 34–36 × 8–9 μm , 4-spored, clavate, without cheilocystidia, subhymenial hyphae 3–4(–5) μm , colorless, clamp connections present, trama hyphae 5–7(–8) μm , in mediostratum around 12 μm . – Pileipellis with a gelatinous pellicle of repent to more or less irregular hyphae, 3–5 μm wide, colorless, but often with a coarse hyaline incrustation, clamp connections present, sometimes granulose, amorphous accumulations between the hyphae. – Epicutis of 7–15 μm wide hyphae, \pm regular, walls pale ochraceous in KOH. – No hypocutis differentiated.

Habitat. – Under *Quercus vaccinifolia* and *Q. garryana* in rather dry habitats on basic soils.

Collections examined. – IB 95/594, JFA 11836, Danger Point, Highway 199, Del Norte Co., California, 20 Nov. 1995, leg. M. Moser; IB 95/629 (holotype), same area, but 29 Nov. 1995; IB 95/640, Gasquet Flat, north side of Middle Fork of Smith River, 30 Nov. 1995, leg. M. Moser.

At a first glance the species seems very close if not identical to *C. luteolilacinus* Chev. & Henry (Chevassut & Henry, 1975) that grows under *Quercus ilex* in the mediterranean area. It has a similar habitat under evergreen oaks (but occurs also with deciduous oak, *Q. garryana*) in dry habitats. It differs, however, in having yellow colors only on the outside of the bulb. A study of type material (coll. Chevassut 2457 from 24/11/1973) gave spore measurements (n=31) of 9.4–12.3 × 5.3–6.75 μm , mean 10.4 (S=0.6) × 6.1 (S=0.3) μm , a further collection (Chevassut 2431, 17–11–1973) 9.4–12.1 × 5.4–6.6 μm , mean 10.6 (S=0.6) × 6.0 (S=0.3), Q=1.7 (1.5–2.1), V=203 μm^3 (138–274 mm^3).



Figs. 11–12. Basidiomata. – 11. *C. roseobulbus* 95/684. – 12. *C. griseoceruleus* 95/685.

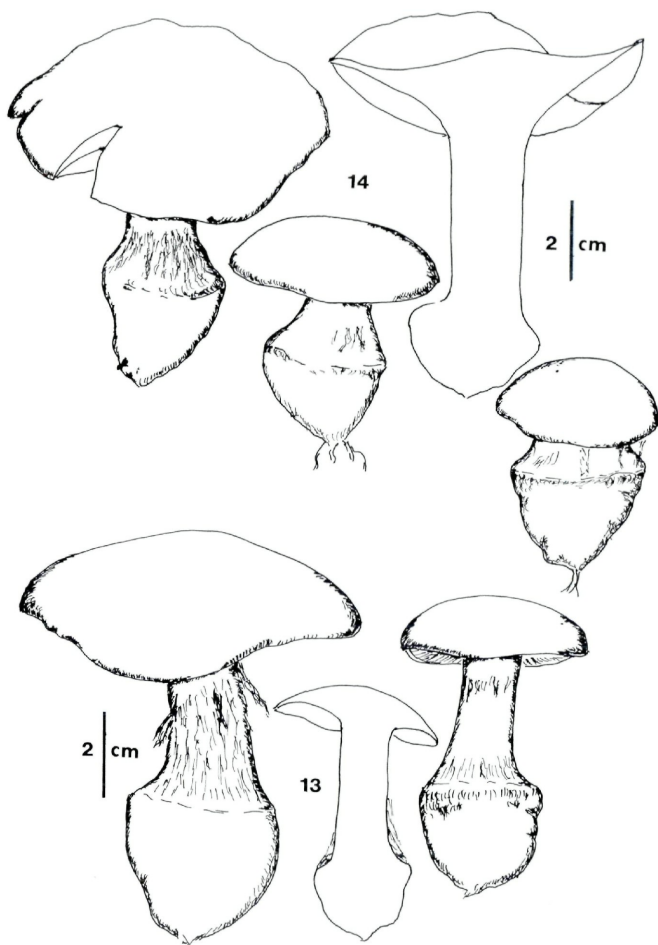
This would agree fairly well with our California records. We observed in the hyphae of the gill trama as well as those of the pileipellis a rather strong red reaction in 2% KOH (the substance also dissolving). The authors mention no KOH reaction in their original description. In our California collections we could not detect such a reaction. This points to differences in the pigment pattern and the two taxa may belong in different series or sections. For this reason we prefer to treat the taxon as a new species.

Cortinarius (Phlegmacium) arcuatorum R. Henry. Bull. Soc. mycol. France 55: 80. 1939. – Fig. 6, 18., tab. 1.

Pileus 3.5–5.5–7 cm diam., convex, margin involute and sometimes pruinose, later applanate, sometimes center becoming slightly depressed, glutinous, color incarnate brownish in young buttons and often also later so, disc Caill 25P or paler, toward the margin Caill 20M, Mu 5YR6/6, 5YR5/8, Pinkish Cinnamon (R), Onion Skin Pink (R), Vinaceous Tawny (R) to near Pecan Brown (R) but with maturity often paler, Caill 49L, 53L, 67L, in rare cases the very margin also slightly lilac, sometimes surface somewhat marbled, in age reddish yellow-orange or more orangeish tones can be common, where context exposed by snails strongly ochraceous. – Lamellae pale lilac, Lavender (R), Pale Mauve (R), Pale Lavender Violet (R), Light Pinkish Lilac (R), with age becoming gray-brown, Cinnamon Drab to Avellaneous (R), rounded adnate to emarginate, edges eroded, close, L=80–90, l=1–3, 17–18/cm at margin, 5–7 mm wide, equaling twice the thickness of pileus context. – Stipe 3–6 cm long, 6–11 mm at apex, the marginate bulb 15–18(–20) mm, lilac at first, Lavender to Grayish Lavender (R), the margin of bulb fringed by mostly lilac veil, occasionally the veil can be whitish, with age fading and becoming Pale Pinkish Buff (R), in lower part of stipe more cream color. Bulb underneath white. – Veil lilac, sometimes white. – Context whitish in pileus and base of stipe, lilac in upper part of stipe.

Chemical reactions. – KOH 20% pinkish to ink-red on context, red-brown in pileipellis. Gills in KOH pink, Lugol dark orange-brown to black on context. Under microscope in 3% KOH gill trama, basidia and epicutis pink (but not the gelatinous pellicle). – UV: pileus with yellowish cast, lamellae bluish, stipe blue with yellow spots, context blue in stipe, yellowish in pileus and base of stipe.

Microscopic characters. – Basidiospores $9.4\text{--}11.5 \times 5.3\text{--}5.9 \mu\text{m}$, mean 10.6 ($S=0.54$) $\times 5.7$ ($S=0.18$) μm , $Q=1.9$, $V=138\text{--}208 \mu\text{m}^3$, mean $182 \mu\text{m}^3$ ($S=15$), almond-shaped, few spores sublimoniiform, verrucose, apex smooth. – Basidia $35\text{--}38 \times 7.5\text{--}8 \mu\text{m}$, 4-spored, clavate, gill edge with basidia and basidioles, subhymenial



Figs. 13–14. Basidiomata. – 13. *C. flavobulbus* 95/629. – 14. *C. viridirubescens* 95/688.

hyphae 3–5 μm , clamp connections present, trama hyphae 5–7 μm , mediostratum hyphae 7–8 μm , colorless, clamp connections present. – Pileipellis with gelatinous pellicle of 3–4 μm thick, colorless hyphae with granulose walls, subrepent, clamp connections present, epicuticular hyphae 4–7(–8) μm , no hypocutis differentiated.

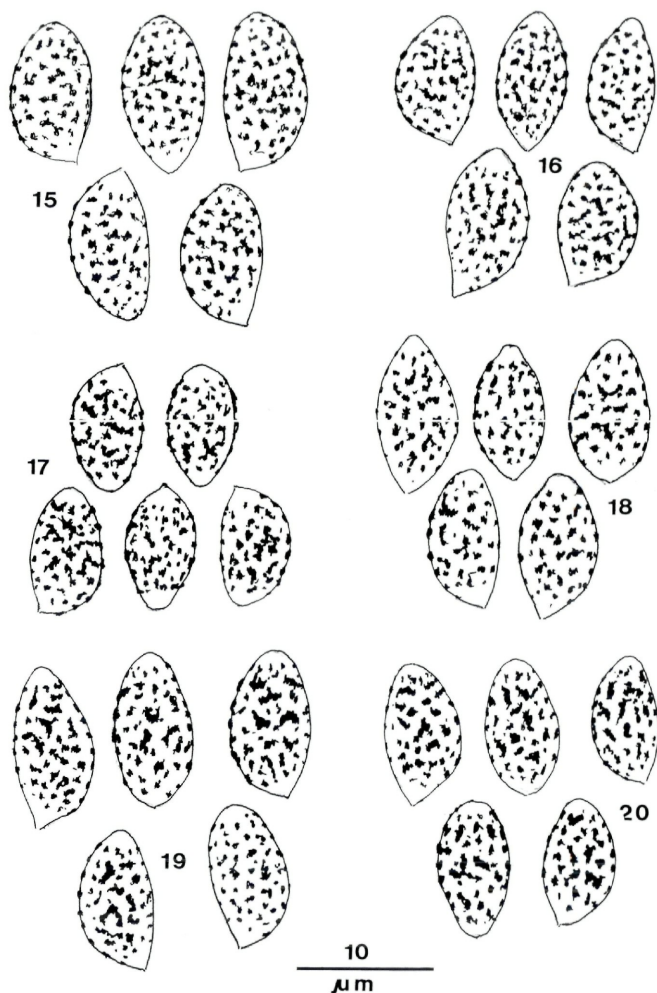
Habitat. – Under hardwoods, *Quercus garryana*, *Q. vaccinifolia*, *Lithocarpus densiflora*.

Collections examined. – USA. – IB 95/564, Patrick's Creek Campground, Middle Fork of Smith River, Highway 199, Del Norte Co., California, 17 Nov. 1995, leg. M. Moser; JFA 11765, same area and date, leg. J. F. Ammirati; JFA 11766 same area and date, leg. J. F. Ammirati; IB 95/596, Danger Point, Highway 199, Del Norte Co., California 20 Nov. 1996, leg. M. Moser, JFA 11803, Big Flat Station, South Fork of Smith River, Del Norte Co., California, 21 Nov. 1995, leg. J. F. Ammirati; IB 95/686, JFA 11893 Mendocino, Caspar Little Lake Rd. near fork Rd. 408 and 409, north slopes, Mendocino Co., California, 8 Dec. 1995, leg. M. Moser.

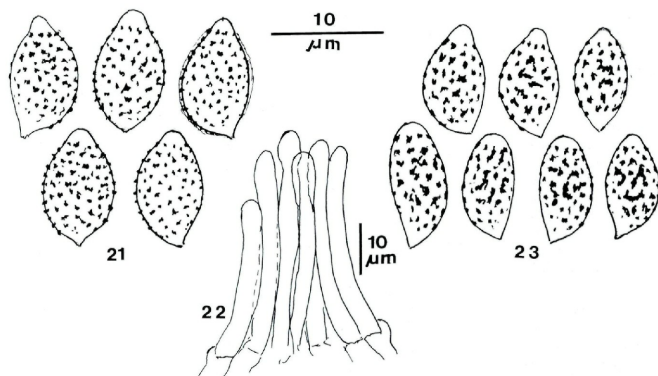
Observed but not collected also in Gasquet Flat.

EUROPE. – GERMANY: 56/63, near Stuttgart, under *Fagus*, 15 Oct. 1956, leg. M. Moser. – SWITZERLAND: 74/526 near Mendrisio–Serpiano, Ticino, 26 Sept. 1974, leg. C. Furrer. – FRANCE: 68/135 Hardtwald near Hombourg, Alsace, 27 Sept. 1968, leg. M. Moser, 82/544 S. Trinit near Sault, Vaucluse, 31 Oct. 1982, leg. M. Moser. – ITALY: 94/322 Val di Sella, Trentino, 6 Oct. 1994, leg. M. Moser, 82/379, near Redipuglia, Prov. Gorizia, 2 Oct. 1982 leg. M. Moser, 82/443 Stabielle above Borgotaro, Prov. Parma, 24 Oct. 1982, 96/193, same area, 5 Oct. 1996, 82/453, Laghetto above Borgotaro, Prov. Parma, 25 Oct. 1982, leg. C. Furrer, 93/247, S. Quirico near Albareto, Prov. Parma, 28 Sept. 1993, leg. M. Moser, 93/257, same area and date, leg. M. Moser, 96/216 C'aBruna, Marzocco above Borgotaro, Prov. Parma, 7 Oct. 1996, leg. E. Steiner, 96/221, Baselica, Val di Taro, Prov. Parma, 8 Oct. 1996, leg. M. Moser, 96/157 Peschiera above Civitella di Rovero, Prov. Abruzzo, 23 Sept. 1996, leg. M. Moser.

Determining the correct name for this taxon was somewhat complicated. We thought at first that it best fits *C. fulvoincarnatus* Joach., but this name is a *nomen invalidum*. Studies of many collections of *C. arcuatorum* Henry, both exsiccata and fresh material, however, convinced us that it falls fully within the range of variability of this taxon. Henry (1939) distinguished the two taxa mainly by size of the basidiomata and spores. He indicates for "*fulvoincarnatus*" pileus dimensions of 4–7 cm and spores of 10.5–11.5 \times 6–6.5 μm , for his *C. arcuatorum* pilei up to 12 cm and spores 12–14.5 \times 6–7 μm . Henry (1958) distinguishes *C. (Phl.) fulvoincarnatus* Joach. f. *joachimii* Hry. and subordinates his *C. arcuatorum* also as forma under *C. fulvoincarnatus*. In 1961 he raises f. *joachimii* (= *fulvoincarnatus* Joach. ss. *strictu*, nec auct. plur.) to the rank of a subspecies and even species in the same article without latin diagnosis. Therefore also this name is not valid. The colors of this taxon should be distinctly paler as in *C. arcuatorum*. He gives now 11–13 \times 6.6 μm for



Figs. 15–20. Basidiospores. – 15. *C. albofragrans* 95/595. – 16. *C. largentii* 95/672. – 17. *C. roseobulbus* 95/684. – 18. *C. arcuatorum* 95/596. – 19. *C. flavobulbus* 95/629. – 20. *C. fulmineus* 95/637.



Figs. 21–23. – 21. Basidiospores of *C. griseocoeruleus* 95/685. – 22. Cheilocystidia of *C. griseocoeruleus* 95/582. – 23. Basidiospores of *C. viridirubescens* 95/688.

the spore size and he cites for his *C. arcuatorum* (here again as species) the plate of Bertaux (1957) in Bull. Soc. Myc. de France, Atlas pl. 112 (under the name of *C. fulvoincarnatus*). Romagnesi (1961) gives the spore size for *C. arcuatorum* to be $9\text{--}11.2 \times 6.6\ \mu\text{m}$. The large dimensions given by Henry may be due to the fact that he measured them in lactic acid.

In studying the literature it becomes difficult if not impossible to distinguish the two taxa, with taxonomic characteristics overlapping in many instances. Also, we have made numerous collections of this species complex from different parts of Europe (Germany, Switzerland, France, Italy), which has further confirmed our opinion that there is a single species with a certain range of variability but not enough to recognize distinct taxa.

Our Californian collections are generally of small size but otherwise agree well with the European material in all other characteristics. When we compare the mean values for the spores they are about $0.3\text{--}0.5\ \text{mm}$ narrower than the values found for European collections. This is particularly striking for the collection from Mendocino, which is otherwise the most typical in macroscopic characters. Single spore sizes overlap, however, as shown in Tab. 1. We cannot determine at this time whether or not this is significant. We could compare only four collections all from northern California. The junior author has observed the same species complex in Costa Rica (Central America), but these collections have not yet been studied in detail.

Tab. 1. – Comparison of spore data from *Cortinarius arcuatorum* collections from California and Europe. (n=31). All measurements are given in μm .

collection	mean n=31	min	max	Q/ mean	V/mean n=31
America					
95/686 Mendocino	9.7×5.6	8.8×5.1	10.8×6.2	1.75	160
95/564 Patrick's Cr.	10.7×5.7	9.4×5.3	11.5×5.9	1.9	182
95/596 Danger Point	10.7×5.9	9.7×5.3	11.2×6.2	1.8	193
JFA 11803 Big Flat	10.6×5.8	10.0×5.5	11.4×6.1	1.8	187
Europe					
82/257 S. Quirico, I	10.1×6.0	9.7×5.9	10.9×6.4	1.7	190
96/193 Stabielle	10.1×6.1	9.0×5.6	11.2×7.1	1.7	198
95/221 Baselica	10.3×6.0	9.4×5.6	11.1×6.5	1.7	197
93/257 Borgotaro, I	10.3×6.1	9.7×5.5	11.5×7.1	1.7	191
82/443 Borgotaro	10.3×6.1	9.7×5.9	10.9×6.5	1.7	202
96/216 Marzocco	10.4×6.0	8.8×5.3	10.9×6.5	1.7	195
94/322 Val di Sella	10.5×6.3	9.7×5.6	11.2×7.1	1.7	216
96/157 Peschiera	10.6×5.9	9.7×5.3	12.3×6.5	1.9	196
74/526 Mendrisio, CH	10.6×6.3	9.7×5.9	11.8×6.8	1.7	218
93/247 S. Quirico, I	10.8×6.2	9.7×5.6	12.1×6.5	1.75	216
82/453 Borgotaro, I	10.8×6.3	10.0×5.9	11.5×7.1	1.7	225
68/135 Hardtwald, F	11.2×6.1	10.0×5.8	12.7×6.8	1.8	222
82/379 Redipuglia, I	11.3×6.2	10.3×5.6	12.3×6.8	1.8	226
82/544 S. Trinit, F	11.5×6.4	10.0×5.5	13.3×7.1	1.8	246
56/63 Stuttgart, D	11.8×6.3	10.0×5.9	13.6×6.8	1.75	243

Cortinarius (Phlegmacium) viridirubescens Moser et Ammirati, sp. nov. – Fig. 7, 14, 23.

Pileo 3–7 cm diam., convexo, primo margine involuto, dein convexo margine stricto, glutinoso, colore laete viride usque flavo-viride, saepe maculato, aetate disco interdum brunneo, lamellis primo argillaceis, dein pallide flavescentibus, aetate flavo-brunneis, adnatis dein emarginatis, tritis leniter rubescentibus, stipite 5–7 cm longo, apice 10–15 mm crasso, bulbo marginato 25–35 mm lato, laete luteo, bulbo fimbriato e velo flavo, mycelio flavo praedito, cortina pallide flavida, carne pilei corticeque stipitis flava, medullae alba, in apice stipitis leniter rubescente, interdum etiam in parte inferiore stipitis bulboque. Sporis (8.8–)9.1–10.8 (–11.5) \times 4.9–5.9 μm , amygdaliformibus usque sublimoniformibus, verrucosis, basidiis 30–32 \times 7.5–8 μm , tetrasporigeris, absque cheilocystidiis, fibulis praesentibus.

Habitatio in Quercetis (*Quercus garrayana*, *Lithocarpus densiflora*) vel silvis mixtis. Holotypus IB 95/688, Mendocino, California, 8 Dec. 1995, leg. M. Moser.

Pileus 3–7 (–7.6) cm diam., convex, later convex, margin involute at first later straight, only the sterile margin remaining in-rolled, glutinous, color from deep green nearest Met 1D8, to moss green, Citrine (R) or yellowish green, Met 2B7, 2B8, finally the yellow colors can dominate, ground color then Met 2A7, 2A6, but on this ground mottled with green spots, margin often paler and slightly punctate-guttate, occasionally also center more brownish in age (disc

R Roman Green, Mignonette Green then Olive Lake to Buffy Citrine, margin Olive Yellow). – Lamellae argillaceous at first, Tilleul Buff (R), Caill 71M, without any trace of olive, greenish or yellowish or lilac, later becoming pale yellowish, straw yellow, with age yellowish brown, reddening where bruised, rounded adnate, later emarginate, close to crowded, L=90, l=1–3, 22/cm at the margin, 5–7 mm wide (equal to thickness of pileus context). – Stipe 5–7 cm long, apex 10–15 mm, the marginate bulb 25–35 mm, bright yellow, Sulphur Yellow (R) to Pale Green Yellow (R), the bulb darker yellow and also fringed by yellow veil, Lemon Chrome (R) (R Citron Yellow), bulb underneath and mycelium Lemon Yellow (or Picric Yellow) (R). Cortina yellowish. – Context underneath the pileipellis pale greenish yellow, in stipe cortex yellow, (Citron Yellow or Pale Greenish Yellow (R)), in bulb dark yellow, toward the base olive-yellow, in the very base olive-brown, in pileus and stipe center whitish or pallid (oxidized apple slices), after some time staining red near apex and sometimes also in lower part of stipe and bulb (R Jasper Pink with spots of Coral Red). – Odor of hot baked (or not distinctive), taste mild.

Chemical characters. – KOH 20% on pileipellis red-brown, on context in pileus only slightly brownish, on yellow cortex and outside of the bulb dingy red-brown. – UV: pileus dark (reddish), gills yellow, stipe orange, bulb reddish, context yellow with blue areas, in bulb red.

Microscopic characters. – Basidiospores (8.8)–9.1–10.8(–11.5) × 4.9–5.9(–6.2) μm , mean 9.7 (S=0.35) × 5.3 (S=0.24) μm , Q=1.8, V=117–195 μm^3 , mean 145 μm^3 (S=16.5), almond-shaped to sublimoniform, verrucose, apex smooth. – Basidia 30–32 × 7.5–8 μm , 4-spored, clavate. – Without cheilocystidia. – Subhymenial hyphae 3–4.5 μm , gill trama hyphae 7–12 μm , mediostrium hyphae 14–16 μm , all pale olivaceous in KOH, clamp connections present. – Pileipellis with a gelatinous pellicle of 2.5–4.5 μm wide hyphae, pale olivaceous, clamp connections present, subrepent to somewhat irregular. – Epicuticular hyphae 4–8 μm thick, pale olivaceous, slightly irregular. – No hypocutis differentiated.

Habitat and distribution. – Under *Lithocarpus densiflora* or deciduous oaks (*Quercus garryana*), also in mixed forests of oak and tanoak with *Pseudotsuga*, *Tsuga* and/or *Sequoia*. Northern California.

Collections examined. – CALIFORNIA: Mendocino Co., Mendocino, Russian Gulch IB 91/524, IB 91/541, 23 Nov. 1991 and 25 Nov. 1991, leg. M. Moser; Mendocino, on Forest Rd. 408 about 8 miles from village, IB 95/622 27 Nov. 1995 leg. M. Moser, 95/688, (holotype) 8 Dec. 1995, leg. M. Moser. Del Norte Co.: Middle Fork of Smith River. Gasquet Flat (north side of river) IB 95/639 30 Nov. 1995, leg.

J. F. Ammirati and M. Moser, IB 95/651 same area, 2 Dec. 1995, leg. M. Moser, JFA 10217, Boise Creek Campground, leg. J. F. Ammirati, 16 Nov. 1990, JFA 10218, Boise Creek Campground Humboldt Co., 16 Nov. 1990, leg. J. F. Ammirati & D. Largent, IB 95/673, Boise Creek Campground, Humboldt Co., leg. D. Largent, 5 Dec. 1995.

At first the species seemed closely related to *C. atrovirens* Kalchbr. It differs, however, by argillaceous gills, white colors in the context and reddening of parts of context and gills. *C. ionochlorus* R. Maire (Maire, 1937) differs by lilac gills and yellow, not reddening context, *C. subionochlorus* R. Henry (Henry, 1961) differs by olive yellow gills with lilac toward the margin of the pileus and with olive green to yellow green context which can even have some lilac tints in the upper part of stipe. There are also differences in the reaction with KOH. In spite of these differences we think that the species is best placed within this group, i. e. section Scauri.

In Washington, Olympic Natl. Park, near Soleduck Falls one young, still closed specimen was collected (IB 95/176) which seemed at first to belong also to this taxon. It was, however, growing under *Pseudotsuga*. In addition, although immature, the few mature spores found were broader than in *C. viridirubescens* and no reddening of the context or gills was observed. This collection, therefore, seems to belong to another species.

Cortinarius (Phlegmacium) fulmineus (Fr.) Fr. Epicrisis p. 267.1838. Hym. Europ. p. 347, 1874. – Fig. 8, 20.

Pileus 4–15 cm diam., convex with involute margin at first, later applanate and finally center depressed and margin undulate, but margin even in old specimens remaining somewhat involute, glutinous, in young specimens with bright yellow color (Pinard Yellow (R), Martius Yellow (R) to near Picric Yellow (R), later only the marginal area remaining so or slightly darker, Chrome Yellow or Lemon Yellow (R), the center becoming fulvous, bright orange-brown, Xanthine Orange, Orange Rufous (R), some areas tinted Sanford's Brown (R), with age over most of the surface so, disc sometimes spotted, toward the margin sometimes with brown streaks but not innately fibrillose. – Lamellae at first yellow, viewed from edges Straw Yellow to Amber Yellow, Deep Colonial Buff (R), Caill 87L, later becoming brownish with an olivaceous tinge, Caill 65N, 60P, gill edge sometimes brownish, rounded adnate to emarginate, edges uneven to serrulate, sometimes with darker brown spots, close, L=120–140, l=1–3, 12–17–19/cm at margin, 4–7–12 mm wide, about half to one times the thickness of pileus context. – Stipe 3.5–11.5 cm long, 13–35 mm thick at apex, the obliquely marginate bulb 30–

45 mm, in many specimens somewhat rooting below the rim, in some specimens only rounded, in young specimens whitish, Cartridge Buff (R), later more yellowish, brownish yellow to brownish orange, the bulb fringed by yellowish veil, in age discoloring reddish or orange brown, bulb underneath whitish to reddish brown. – Veil Sulphur Yellow (R), later discoloring orange brown to reddish brown, in old specimens mostly disappearing. – Context at first whitish in center, yellow underneath the pileipellis, pale yellowish in stipe, later cream colored to very pale yellowish. – Odor weak, slightly of hot baked. – Taste mild.

Chemical reactions. – KOH 20% slowly red-brown to purple brown on yellow areas of the pileus surface, purple brown on orange-brown parts, on context slightly brownish and then becoming pinkish purple. – UV: on pileus red, on yellow areas orange, lamellae yellow to dark brownish, stipe yellowish with blue areas, where veil occurs orange, context yellow with blue areas, bulb underneath bright orange red.

Microscopic characters. – Basidiospores $8.2\text{--}10.6 \times 4.9\text{--}6.0 \mu\text{m}$, mean 9.7 ($S=0.37$) $\times 5.5$ ($S=0.26$) μm , $Q=1.7\text{--}1.8$, $V=115\text{--}192 \mu\text{m}^3$, mean $155 \mu\text{m}^3$ ($S=18$), almond-shaped to sublimoniform, verrucose, apex smooth, content reddish in 3% KOH. – Basidia $32\text{--}34 \times 7.5\text{--}9 \mu\text{m}$, 4-spored, clavate, often with brownish content, subhymenial hyphae $3\text{--}4(5) \mu\text{m}$, trama hyphae $4\text{--}7 \mu\text{m}$, in mediostratum $7\text{--}9(10) \mu\text{m}$, \pm colorless under microscope, clamp connections present. – Without cheilocystidia. – Pileipellis with gelatinous pellicle of $2.5\text{--}4 \text{ mm}$ thick, repent to subrepent hyphae with pale ocher-gray to pale grayish vinaceous content in KOH, clamp connections present. – Epicuticular hyphae $4.5\text{--}8 \mu\text{m}$ thick, somewhat irregular, at first pale vinaceous in KOH, in older specimens grayish brown in upper layer, in deeper layer with pale vinaceous content. – No hypocutis differentiated. – Cortina hyphae $3\text{--}4 \mu\text{m}$ thick, colorless, clamp connections present.

Habitat. – under deciduous oak, (*Quercus garrayana*), Gasquet Flat, north side of the Middle Fork of Smith River middle fork, Del Norte Co., California.

Collections examined. – IB 95/637, JFA 11832, Gasquet Flat, Middle Fork of Smith River, Highway 199, Del Norte Co., California, leg. J. Ammirati & M. Moser, 30 Nov. 1995, IB 95/638, JFA 11834, same area and date, leg. M. Moser & J. Ammirati.

These collections agree well with the interpretation of *C. fulmineus* Fr. as interpreted by Moser (1960), a species also rare in Europe. This seems to be the first record for North America.

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References

- Bertaux, A. (1957). *Cortinarius fulvoincarnatus* Joach. – Bull. Soc. Myc. de France 73: Atlas pl. 112.
- Cailleux, A. (1981). Code des couleurs des sols. – Ed. Boubée, Paris.
- Chevassut, G. & R. Henry (1975). Six Cortinaires méditerranéens nouveaux du chêne vert (*Qu. ilex*) dans le Bas-Languedoc (1). – Doc. Myc. V(20): 23–36.
- Henry, R. (1939). Suite et complément à l'étude des Phlegmacia. – Bull. Soc. Myc. de France 55: 61–94.
- (1958). Suite à l'étude des Cortinaires. – Bull. Soc. Myc. de France 74: 249–361.
- (1961). Cortinaires rares ou nouveaux du Doubs, du Jura et des Vosges. – Bull. Soc. Myc. de France 77: 85–149.
- Kornerup, A. & J. H. Wanscher (1967). Methuen Handbook of Colour. 2nd Ed. – Methuen & Co. Ltd, London.
- Maire, R. (1937). Fungi Catalaunici II. – Publ. Inst. Bot. Barcelona 8(4): 1–128.
- Moser, M. (1960). Die Gattung *Phlegmacium* (Schleimköpfe). – Die Pilze Mitteleuropas Bd. IV. Verlag J. Klinkhardt, Bad Heilbrunn.
- Munsell (1975). Soil Color Charts. – Munsell Color, Baltimore.
- Ridgway, R. (1912). Color Standards and Color Nomenclature. – Washington.
- Romagnesi, H. (1961). Nouvel Atlas des Champignons, vol. III. – Bordas, Paris.
- Sawyer, J. O., D. A. Thornburgh & J. R. Griffin (1977). Mixed evergreen forests. – In: Barbour, M. J. & J. Major (eds.) Terrestrial Vegetation of California. John Wiley & Sons, New York, pp. 359–382.
- Sawyer, J. O. & T. Keeler-Wolf (1995). A Manual of California Vegetation. – California Native Plant Society, Sacramento, CA, 471 pp.
- Smith, A. H. (1939). Studies in the genus *Cortinarius* I. – Contr. Univ. Michigan Herbarium 2: 5–42, XII plates.

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