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Mycologia, Vol. 88, No. 3. (May - Jun., 1996), pp. 497-508.

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New species of *Tricholoma* from California and Oregon

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Abstract: Eight *Tricholoma* species from California and Oregon are described. New taxa, *Tricholoma griseoviolaceum*, *Tricholoma muricatum*, *Tricholoma mutabile*, *Tricholoma nigrum* and *Tricholoma myomyces* var. *cystidiotum* are described. *Tricholoma vernaticum* comb. nov. is proposed.

Key Words: Agaricales, systematics, taxonomy, Tricholomataceae

INTRODUCTION

Species of *Tricholoma* are common in north temperate and subtropical areas worldwide. Most species are considered obligately ectomycorrhizal, and play an important role in forest ecosystems. This paper presents in part the results of a taxonomic survey of *Tricholoma* in California (Shanks, 1994). Previous taxonomic work on *Tricholoma* in California is limited to species described by Murrill (1913) and Baroni and Ovrebo (1983). Below are described three new species and one new variety from California, and a new species from Oregon. Redescriptions of *Tricholoma dryophillum* (Murrill) Murrill and *Tricholoma moseri* Singer are also given.

MATERIALS AND METHODS

The infrageneric classification used is that of Singer (1986). Color notations in parentheses are from Kernerup and Wanscher (1978). All studies of micromorphological features were made from dried material, mounted in 3% KOH. A minimum of 20 spores were measured from each collection, and the following statistical measures were calculated for all the spores measured of a given taxon: \bar{x} = mean length and width; E = the ratio of length/width, expressed as a range of all the spores measured; Q = the mean of E values; n = the total number of spores measured.

Measurements over 12 μm have been rounded to the nearest whole micrometer. Unless otherwise stated, collections cited are deposited at SFSU. The following abbreviations have been used for collectors: DLL: David Largent; KMS: Kris M. Shanks; AHS: Alexander Smith; HDT: Harry D. Thiers.

TAXONOMY

I. *Tricholoma*, subg. *Tricholoma*, sect. *Tricholoma* (Fr.)
Staude, Die Schwamme Mitteldeutsch. 125. 1858.

***Tricholoma griseoviolaceum* Shanks sp. nov.**

FIGS. 1–3

Pileus 40–80 mm latus, viscosus, fibrillas radiantes exhibens, primitus albus, dein maturitate subviolaceo-griseus vel fumosus. Lamellae albus, incarnatescens, nun lutescens. Stipes albus. Basidiosporae $4.8\text{--}7.2 \times 3.4\text{--}4.8 \mu\text{m}$, ellipticae. Cheilocystidia $26\text{--}62 \times 9.6\text{--}14\text{--}(19) \mu\text{m}$, rara, clavata vel saccata, hyalina. Hyphae cuticulares pilei in matrice gelatinosa inclusae. Cum quercibus crescens.

Etymology. *Griseoviolaceum*, violet-gray coloration.

HOLOTYPE. USA. CALIFORNIA: San Mateo Co., Portola State Park, Summit trail, 9 Jan. 1993, K. M. Shanks 352 (SFSU).

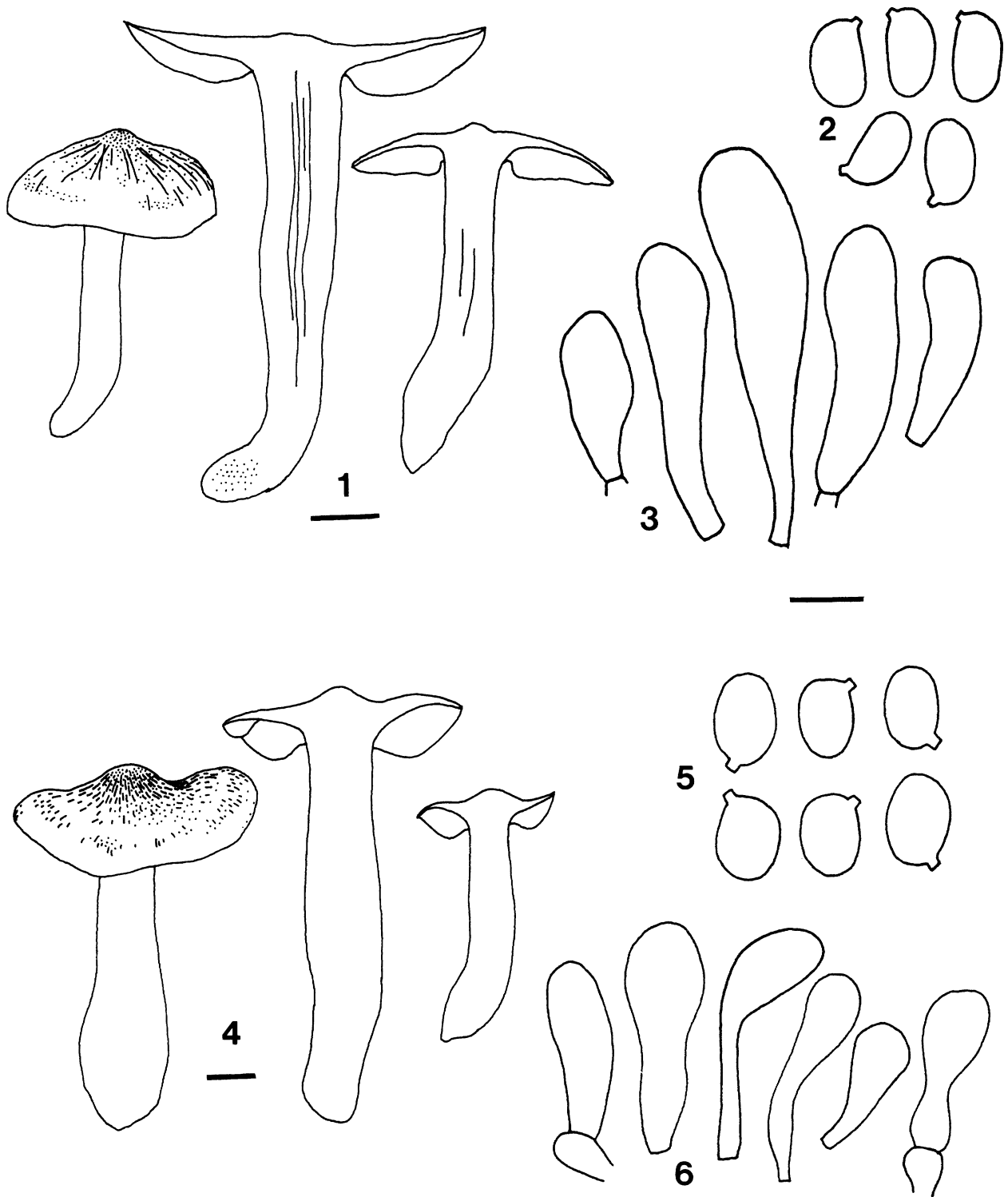
Pileus 40–80 mm broad, campanulate at first, a prominent umbo present in younger specimens, but mature specimens typically lacking an umbo, becoming broadly convex and finally plane with uplifted and wavy margins splitting in age (FIG. 1); surface viscid, innately radiating fibrillose; white at first or when covered in duff, developing a pale violet to violet gray (17A2-3, 17B2) ground color with irregular radiating streaks of dull violet gray, dark gray or nearly black (16E4, 16F3, 17D3-F3), at maturity dark violet gray at the disc, the margins remaining pale violet or white, often with a ring of watery dark pigment 5–8 mm from the margin, in age the disc developing paler grayish brown tones (6E3-4); context thin, white to watery gray above lamellae and near pileus surface; odor faintly farinaceous or cucumery, taste farinaceous or sweet farinaceous.

Lamellae sinuate, thin or somewhat thick and forking near the stipe, 3–15 mm broad, close, white, discolored pinkish brown to grayish orange (5C4, 7-9A2) in patches in age.

Stipe 20–130 \times 10–22 mm; equal or tapering slightly

Accepted for publication January 16, 1996.

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FIGS. 1-6. Features of *Tricholoma* species. 1-3. *T. griseoviolaceum* (KMS 363). 1. Basidiomata. 2. Basidiospores. 3. Cheilocystidia. 4-6. *T. mutabile* (Calhoun 81-2947). 4. Basidiomata. 5. Basidiospores. 6. Cheilocystidia. Lines represent 15 mm for basidiomata, 10 μm for basidiospores, 20 μm for cystidia.

towards the base (FIG. 1); base pointed or abrupt; surface dry, dull, silky-fibrillose, white, occasionally pale orange (5A3) at the base; context solid, hollow or stuffed, white or watery gray in the center.

Basidiospores $4.8-7.2 \times 3.4-4.8 \mu\text{m}$ ($\bar{x} = 5.9 \pm 0.55 \times 4.0 \pm 0.43$; E = 1.2-1.9; Q = 1.5 ± 0.15 ; n = 142/7 collections); elliptic, hyaline, smooth, inamyloid (FIG. 2). Basidia $28-38 \times 5.8-7.2 \mu\text{m}$, clavate, 4-spored, hy-

aline. *Cheilocystidia* 26-62 × 9.6-14(19) μm, rare to scattered, clavate to saccate, thin-walled, often collapsing, hyaline (FIG. 3). *Pileipellis* an ixocutis; *epicutis hyphae* 2.0-4.8 μm diam, cylindrical, loosely interwoven in a gelatinous matrix; hyaline or with granular golden brown contents, rarely smooth, commonly with fine punctate to zebroid or flare-like hyaline or brown incrustations; *subcutis hyphae* 3.0-9.6 μm diam, cylindrical to slightly inflated, parallel; with punctate, zebroid or flare-like hyaline incrustations or punctate, zebroid or plaque-like brown incrustations. *Pileus trama* hyphae 2.4-19.0 μm; cylindrical near the pileipellis, inflated elsewhere, hyaline, smooth, mostly parallel. *Lamellar trama* hyphae 2.8-21.0 μm; cylindrical to inflated, hyaline, smooth, parallel. *Stipe* hyphae 2.4-14.0 μm, cylindrical to somewhat inflated, hyaline, smooth or with irregularly thickened walls, parallel. *Caulocystidia* absent. Clamp connections absent.

Habitat. Solitary to gregarious, associated with *Quercus* or *Lithocarpus*, December to February in coastal forests from Riverside County to Mendocino County, and low elevation Sierra Nevada forests.

Collections examined. USA. CALIFORNIA: Amador Co, Ione, 4 Feb. 1970, *HDT 24748*; Marin Co, Phoenix Lake, 22 Feb. 1960, *HDT 7558*; Audubon Canyon Ranch, Pitcher Canyon, 15 Dec. 1975, *Calhoun 386*; same location, 21 Jan. 1980, *Calhoun 80-1457*; Audubon Canyon Ranch, Bolinas Fairfax Rd., 8 Dec. 1984, *Calhoun 84-3904*; Marin Municipal Watershed District, Bon Tempe Lake, 27 Dec. 1984, *R.E. Halling 4062* (NY); 20 Dec. 1992, *KMS 328*; Marin Municipal Watershed District, Rock Creek Simmonds Trail, 31 Dec. 1992, *KMS 250*; Marin Municipal Watershed District, Bon Tempe Lake, 12 Jan. 1993, *KMS 363*, *KMS 364*, *KMS 365*; Tomales Bay State Park, near Shell Beach, 12 Dec. 1991, *M.T. Seidl 3251*; Mendocino Co, Jackson State Forest, 2 Dec. 1961, *Peters 723*; Riverside Co, LAMS Foray, 7 Feb. 1981, *H.E. Bigelow 15674* (NY); San Mateo Co, San Francisco Watershed, 22 Dec. 1963, *HDT 11191*; 6 Jan. 1967, *HDT 18357*; 31 Dec. 1968, *HDT 23132*; Santa Barbara Co, Los Padres National Forest, Fremont Campground, 28 Jan. 1967, *HDT 18558*; Lake Cachuma, 5 Jan. 1983, *HDT 45670*; Orcut Hill nr Santa Maria, 2 Feb. 1988, *HDT 51476*; Los Padres National Forest, Figueroa Campground, 31 Jan. 1993, *KMS 371*; Santa Clara Co, Hwy 9, Saratoga, Skyline to Sea Trail, 1 Feb. 1987, *HDT 51190*; Santa Cruz Co, Boulder Creek, 9 Dec. 1962, *HDT 9701*; 18 Jan. 1967, *HDT 18541*; 30 Dec. 1970, *HDT 27067*; Tuolumne Co, Hwy 120, Moccasin Creek Recreation Area, 27 Jan. 1979, *HDT 39354*; *HDT 39357*; Yuba Co, Bullard's Bar Recrea-

tion Area, Schoolhouse Campground, 30 Nov. 1984, *HDT 48310*; 28 Nov. 1989, *HDT 53054*.

Discussion.—*Tricholoma griseoviolaceum* is most likely to be confused with *T. portentosum* which also possesses a viscid pileus with radiating gray fibrils, but *T. griseoviolaceum* differs in the absence of yellow coloration of the lamellae and stipe, a violet gray rather than brownish gray pileus, lamellae that stain pinkish brown in age, a more strongly farinaceous to cucumery odor, and an association with oaks rather than pines. Micromorphologically, the two are nearly indistinguishable. *Tricholoma portentosum* has slightly larger spores and lacks cheilocystidia, but the cheilocystidia of *T. griseoviolaceum* are often collapsed and difficult to observe. *Tricholoma griseoviolaceum* may also be confused with *T. mutabile*, which also occurs in California (see description below).

***Tricholoma mutabile* Shanks sp. nov. FIGS. 4-6**

Pileus 30-90 mm latus, viscosus, glaber, interdum rugulosus, subgriseus ad marginem albidus, maturitate cinereus; sapor et odor valde farinaceus. Lamellae et stipes albus, stipes basi subrubescens. Basidiosporae 5.8-7.7 × 4.3-5.8 μm, ellipticae vel subgloboae. Cheilocystidia 26-43 × 8.2-12 μm, cylindrica vel clavata, hyalina. Hyphae cuticulares pilei in matrice gelatinosa inclusae. Hypoderma pseudoparenchymatica.

Etymology. *Mutabile*, changable.

HOLOTYPE. USA. CALIFORNIA: Yuba Co., Bullard's Bar Recreation Area, Schoolhouse Campground, 17 Dec. 1993, *K. M. Shanks 424* (SFSU).

Pileus 30-90 mm broad, broadly convex or plano-convex, with a broad or prominent umbo, center sometimes depressed in age, margins down-turned, often becoming uplifted and wavy or lobed in age (FIG. 4); surface viscid, glabrous, rarely faintly tomentose on the disc, often radially rugulose between the disc and margin, pale warm gray (17B2, 14D2) or pale violet gray (9D3-9C2) on the disk, progressively paler towards the margin with irregular darker gray streaks; margins white; pileus darkening in age to dark gray (9F4) or medium gray (9E3, 7D2) with violet tones, occasionally with yellow brown (4B4) areas, margin remaining silvery gray to white; context white, grayish in age or when waterlogged, very thin, taste and odor strongly sweet farinaceous or reminiscent of grapefruit.

Lamellae sinuate, thin, close, white, discoloring pale golden brown (5D4-7) in age.

Stipe 50-100 × 9-25 mm, equal or slightly clavate, base abrupt; surface dry, silky fibrillose, white, discoloring pale golden brown (5C5) with handling; context solid or hollow, white or watery gray, base of stipe dull pink or pale orange.

Basidiospores 5.8-7.7 × 4.3-5.8 μm (\bar{x} = 6.6 ± 0.52 × 5.1 ± 0.40 μm; E = 1.1-1.6; Q = 1.3 ± 0.10; n = 161/8 collections); globose to broadly elliptic, hyaline, smooth, inamyloid (FIG. 5). *Basidia* 33-40 × 7.2-9.6 μm, 4 spored, clavate. *Cheilocystidia* 26-43 × 8.2-12 μm; cylindrical, clavate, or broadly clavate, hyaline, thin-walled or slightly thick-walled (FIG. 6). *Pileipellis* an ixocutis; *epicutis* hyphae 1.9-5.8 μm diam, cylindrical or collapsed, parallel to loosely interwoven in a gelatinous matrix, hyaline or with granular brown contents, smooth; *pseudoparenchymatous hypodermium* hyphae 9.6-29 μm diam, inflated to nearly isodiametric, hyaline or yellow brown, thin- or thick-walled, smooth, occasional plaques of dark pigment present, particularly near pileus context. *Pileus trama* hyphae 2.4-8.6(-14) μm diam, cylindrical to somewhat inflated, mostly parallel, hyaline or pale yellow brown, thin or slightly thick-walled, smooth. *Lamellar trama* hyphae 2.4-14 μm diam, cylindrical to somewhat inflated, parallel, hyaline or with refractive contents, thin-walled, smooth. *Stipe trama* hyphae 2.4-14 μm diam, cylindrical to inflated, parallel, hyaline, smooth. *Caulocystidia* present as recurved hyphal tips at stipe apex, 29-34 × 4.8-7.2 μm diam, cylindrical to clavate, often flexuous, in clusters or as a turf, hyaline or with hyaline granular contents, thin-walled or slightly thick-walled and refractive, smooth. Clamp connections absent.

Habitat. Scattered to gregarious in mixed evergreen forest, December to January, coastal mountains and foothills of the Sierra Nevada.

Collections examined. USA. CALIFORNIA: Marin Co., Audubon Canyon Ranch, above Volunteer Canyon, 27 Dec. 1981, *Calhoun 81-2947*; Humboldt Co., Tish Tang Campground, 6 Nov. 1971, *DLL 5261* (HSC); Sonoma Co., Salt Point State Park, 5 Jan. 1993, *KMS 351*; 9 Jan. 1993, *KMS 358*; Yuba Co., Bullard's Bar Recreation Area, Schoolhouse Campground, 28 Dec. 1993, *KMS 428*; *KMS 429*. WASHINGTON: Clallam Co., Olympic National Park, Olympic Hot Springs, 8 Oct. 1941, *AHS 17728* (MICH); 11 Oct. 1941, *AHS 17804* (MICH); 15 Oct. 1941, *AHS 17916* (MICH; AHS collections as *Tricholoma portentosum* var. *avellaneifolium*).

Discussion.—*Tricholoma mutabile* is closely related to *T. josserandii* Bon, a European species, and *T. marquetteense* Ovrebo, described from Michigan. The three species cannot be differentiated on the basis of micromorphological characters, but *T. mutabile* has a darker pileus at maturity than either *T. josserandii* or *T. marquetteense*, and has a stipe base that bruises pinkish.

Tricholoma mutabile is most easily confused with *T. griseoviolaceum*, which has very similar coloration when young, but the pileus of *T. griseoviolaceum* is not radially rugulose, and is dark violet gray in age.

Tricholoma griseoviolaceum also lacks a pseudoparenchymatous hypodermium and has narrower spores.

The material collected in California matches Smith's (1944) description of *Tricholoma portentosum* var. *avellaneifolium* (Murrill) A. H. Sm. very well, but he described the spores as smaller than reported here. My measurements of basidiospores from Smith's collections determined as *T. portentosum* var. *avellaneifolium* are the same size and shape as spores from the California collections. Smith's collections can not be considered a variety of *T. portentosum*; the presence of a pseudoparenchymatous hypodermium allies the material collected by Smith with others in stirps *Luteomaculosum* [see Ovrebo (1986) for descriptions of other species in this stirps]. Examination of the holotype of *Tricholoma avellaneifolium* (Murrill) Murrill, upon which *T. portentosum* var. *avellaneifolium* must be based, has shown that the basidia contain carminophilous granules, indicating that the holotype is not a *Tricholoma* species, but is most likely a species of *Lyophyllum* P. Karst. It therefore becomes necessary to propose a new name for the material determined by Smith (1944) as *T. portentosum* var. *avellaneifolium*.

Tricholoma nigrum Shanks et Ovrebo, sp. nov.

FIGS. 7-9

Pileus 35-100 mm latus, humidus, centrum fibrillosus, alibi glaber et saepe rugulosus, primitus schistaceus, dein atoschistaceus; sapor et odor valde farinaceus. Lamellae albae, margine aliquando nigrescentes. Stipes albus, squamulis nigris apice saepe instructis. Basidiosporae 6.7-8.6 × 4.8-5.8 μm, ellipticae. Cheilocystidia 23-45 × 9-13 μm, clavata, hyalina vel fusca. Hyphae cuticulares pilei in matrice gelatinosa inconspicua inclusae. Hypoderma pseudoparenchymatica.

Etymology. *Nigrum*, blackish coloration.

HOLOTYPE. USA. OREGON: Tillamook Co., off of Three Capes Scenic Road, between Sandlake and Cape Lookout, 22 Nov. 1984, *C. L. Ovrebo 1758* (SFSU).

Pileus 35-100 mm broad, rounded-conic when young, expanding to broadly convex to nearly plane, the edge decurved to straight, frequently wavy, occasionally lobed (FIG. 7); surface moist to tacky, densely matted-fibrillose at the center, elsewhere glabrous but with occasional scattered minute squamules, occasionally virgate in places, often rugulose when mature, when young dark slate-gray overall, when mature medium dark gray with edge lighter gray, occasionally with black streaks, when over-mature dingy brownish gray; context 2-12 mm thick, white to very light gray, odor and taste strongly farinaceous.

Lamellae deeply adnexed when young, sinuate



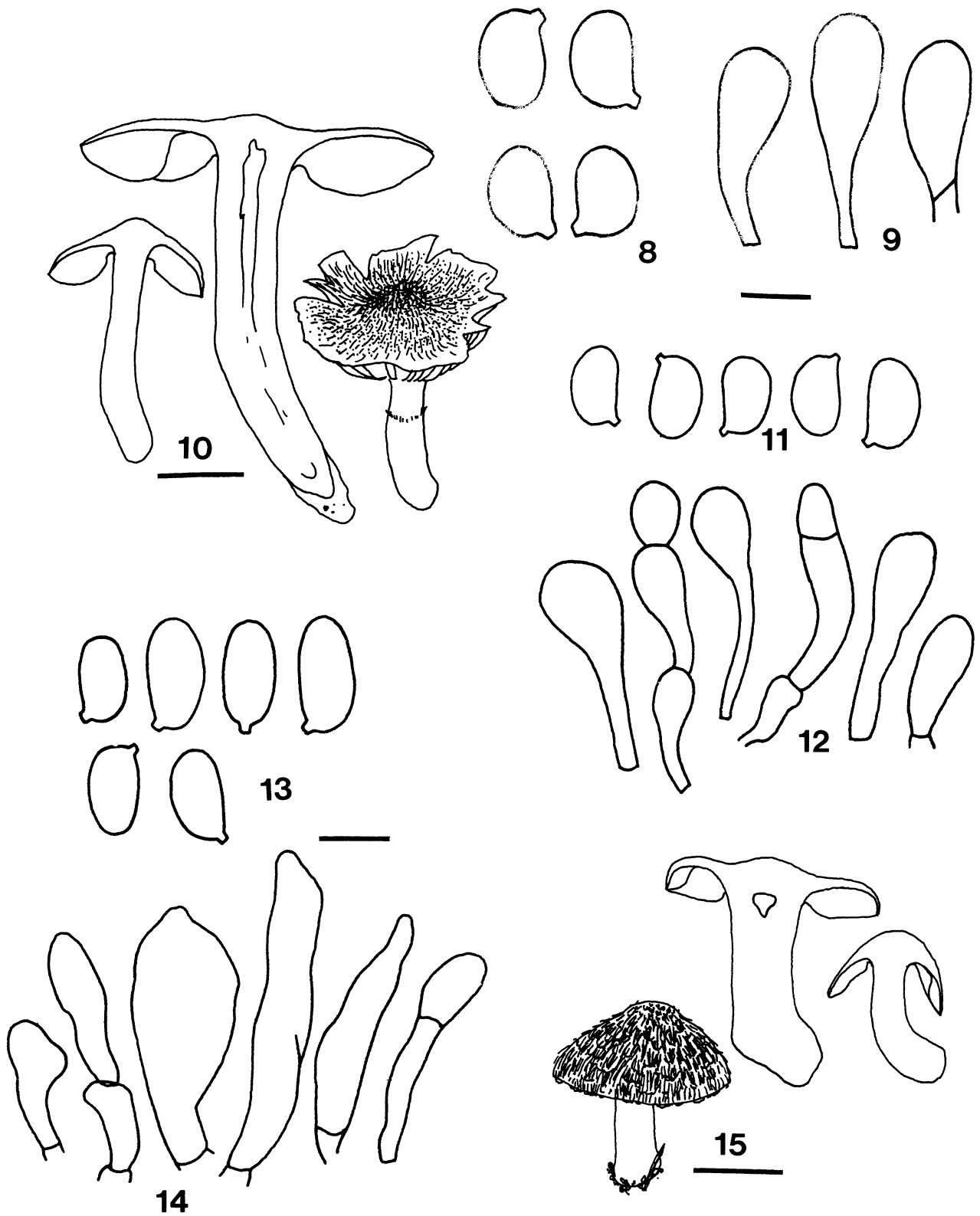
FIG. 7. *T. nigrum* (Ovrebo 1758). Basidiomata, approx. life size.

when mature, entire but often becoming eroded, thin, close to subdistant, white, occasionally light gray at the apex, discoloring blackish on edge or not.

Stipe 75-150 × 10-30 mm, equal to subclavate, often twisted or bent, the base rounded or abruptly tapered; surface silky-fibrillose with loosened surface fibrils, often with blackish squamules over upper half or near the apex, white, not discoloring, dingy buff when older; context fleshy fibrous, solid or hollow, white.

Basidiospores 6.7-8.6 × 4.8-5.8 μm; (\bar{x} = 7.7 ± 0.5 × 5.5 ± 0.3 μm; E = 1.3-1.6; Q = 1.4 ± 0.1; n = 21/ 1 collection); elliptic, hyaline, smooth, inamyloid (FIG. 8). *Basidia* 31-40 × 7-8 μm, clavate, 4-spored, hyaline. *Cheilocystidia* 23-45 × 9-13 μm; conspicuous or inconspicuous, often not projecting much beyond the hymenium, clavate to broadly clavate, hyaline or occasionally opaque- or translucent-blackish, smooth, thin-walled (FIG. 9). *Pileipellis* an ixocutis; hyphae 3-8(-10) μm diam, interwoven in a gelatinous matrix; the matrix best developed on young basidiomes and sometimes scarcely evident on mature specimens;

cells cylindric, smooth and thin-walled or with rough yellowish brown to fuscous incrustations, hyaline or translucent-brown; *pseudoparenchymatous hypodermium* barely distinguishable, of inflated cells 8-20 μm diam, frequently with brownish black plaque-like incrustations giving the layer a gray to grayish brown coloration. *Pileus trama* hyphae 5-25 μm wide, cylindric near pileipellis, cylindric to somewhat inflated elsewhere, mostly parallel, hyaline or somewhat refractive, smooth, thin-walled. *Lamellar trama* hyphae 3-11 μm diam, parallel, cylindric, hyaline, the walls slightly refractive, smooth, thin-walled. *Stipe* hyphae 3-15 μm diam, parallel, cylindric, hyaline, smooth. *Caulocystidia* present at stipe apex as recurved hyphal tips, 15-40 × 5-12 μm, solitary or forming pyramidal clusters, cylindric, cylindro-flexuous or clavate, hyaline to pale brownish gray, smooth, thin-walled; *squamules* elsewhere on stipe formed from hyphal clusters, cells 2-5 μm wide, cylindric, heavily roughened and thickened with blackish incrustations that, when extensive, render the the hyphae black and opaque. Clamp connections absent.



FIGS. 8–15. Features of *Tricholoma* species. 8–9 *T. nigrum* (Ovrebø 1758). 8. Basidiospores. 9. Cheilocystidia. 10–12. *T. myomyces* var. *cystidiotum* (KMS 329). 10. Basidiomata. 11. Basidiospores. 12. Cheilocystidia. 13–15. *T. moseri* (HDT 20127 & HDT 46079). 13. Basidiospores. 14. Cheilocystidia. 15. Basidiomata. Lines represent 15 mm for basidiomata, 10 μ m for basidiospores, 20 μ m for cystidia.

Habitat.—Scattered under *Pinus contorta* Dougl. in coastal Oregon.

Collections examined.—USA. OREGON: Tillamook Co., off of Three Capes Scenic Road, between Sandlake and Cape Lookout, 22 Nov. 1984, *Ovrebø 1759*.

Discussion.—*Tricholoma nigrum* is known only from Oregon. The presence of a pseudoparenchymatous hypodermium indicates this species belongs in stirps *Luteomaculosum*. *Tricholoma nigrum* is distinguished from other species in the stirps by the very dark gray pileus, and very thin gelatinous layer of the pileipellis. *Tricholoma mutabile*, a related species that occurs in the Pacific Northwest, also possesses a pseudoparenchymatous hypodermium, but has a pale gray pileus when young, and discolors pink at the base of the stipe.

Tricholoma myomyces* (Fr.) Lange var. *cystidiotum
Shanks, var. nov. FIGS. 10–12

Differt a *T. myomyces* var. *myomyces* a cheilocystidia clavata.

Etymology. *Cystidiotum*, possessing cystidia.

HOLOTYPE. USA. CALIFORNIA: San Mateo Co., Jasper Ridge Biological Reserve, 26 Dec. 1992, *K. M. Shanks 343* (SFSU).

Pileus 17–60 mm broad, obtusely conic when young, expanding to plane with a low broad umbo, the margins inrolled at first, becoming uplifted and splitting in age (FIG. 10); surface dry, matted fibrillose to recurved fibrillose overall when young, becoming more appressed radiating fibrillose in age, but often retaining recurved fibrils and small squamules over the disc, nearly purple black, dark gray or brownish gray (7-11F3, 7E3-8E2) overall when young, becoming paler in age as the pale gray context is exposed between the surface fibrils; context thin, 1–2 mm, white, pale gray near pileus surface; taste and odor not distinguishable.

Lamellae sinuate, 4–10 mm broad, close to subdistant, thin, pale gray becoming whitish in age, occasionally margins discoloring dark gray.

Stipe 25–60 × 4–12 mm; equal, occasionally with a slightly bulbous base; surface dry, silky fibrillose, whitish, pale gray or silvery gray, discoloring yellow brown in age or where handled; context white or pale gray, solid or hollow; partial veil a fugacious cortina present on young buttons, leaving blackish fibrils at stipe apex.

Basidiospores 5.8–8.6 × 3.4–5.3 μm (\bar{x} = 7.2 ± 0.52 × 4.4 ± 0.40 μm; E = 1.3–2.1; Q = 1.6 ± 0.16; n = 197/12 collections); elliptic to narrowly elliptic, hya-

line, smooth, inamyloid (FIG. 11). *Basidia* 26–33 × 6.2–7.2 μm; clavate, 4-spored, hyaline. *Cheilocystidia* 19–38 × 8.2–12.0 μm; broadly clavate to sphaeropedunculate, often septate, scattered to abundant, hyaline, smooth, slightly thick-walled (FIG. 12). *Pileipellis* a cutis; hyphae 4.8–16 μm diam, cylindrical to somewhat inflated, parallel, forming recurved fascicles, dark brown, rarely hyaline, smooth or with broken plaques of dark brown incrustations, thick-walled; *pseudoparenchymatous hypodermium* hyphae 14–48 μm diam, highly inflated to nearly isodiametric, hyaline or with plaques of dark brown incrustation between the cells, thin- or thick-walled. *Pileus trama* hyphae 3.8–16 μm diam, cylindrical near pileipellis, cylindrical to inflated elsewhere, mostly parallel, hyaline, smooth, thin-walled. *Lamellar trama* hyphae 2.4–19 μm diam, cylindrical to inflated, parallel, hyaline, smooth, thin-walled. *Stipe* hyphae 2.4–14 μm diam, cylindrical to somewhat inflated, parallel, hyaline, smooth; hyphae of partial veil 7.2–14 μm, slightly inflated, appressed or interwoven, dark brown, smooth. *Caulocystidia* absent. Clamp connections absent.

Habitat. Solitary to gregarious with *Pseudotsuga menziesii* Carr. (Douglas Fir) or in mixed woods, November through March, coastal forests from Santa Cruz County northwards, and montane forests.

Collections examined. USA. CALIFORNIA: Del Norte Co., Hwy 199 near Oregon border, 23 Oct. 1972, *HDT 30349*; Humboldt Co., Patrick's Point State Park, 25 Oct. 1992, *KMS 251*; Marin Co., Alpine Lake, 16 Nov. 1975, *HDT 35442*; Audubon Canyon Ranch, above Pitcher Canyon, 23 Jan. 1981, *Calhoun 81-1796*, 29 Nov. 1984, *Calhoun 84-3901*; Audubon Canyon Ranch, Bolinas Ridge Rd., 27 Mar. 1981, *Calhoun 81-2280*; Mt. Tamalpais State Park, Bootjack Trail, 30 Dec. 1991, *KMS 208*; Marin Municipal Watershed District (MMWD), Rock Creek Simmonds Trail, 16 Nov. 1992, *KMS 281*; 9 Dec. 1992, *KMS 323*; MMWD, Bon Tempe Lake, 20 Dec. 1992, *KMS 326*, *KMS 329*, *KMS 340*; MMWD, Bolinas Ridge Road, 31 Dec. 1992, *KMS 346*; Mendocino Co., Jackson State Forest, 8 Jan. 1967, *HDT 18407*; 5 Nov. 1967, *HDT 21439*; 21 Nov. 1992, *KMS 283*; 20 Nov. 1993, *M.G. Wood 363*; Nevada Co., Hwy 20, Skillman Campground, 5 Nov. 1983, *HDT 46873*; San Mateo Co., San Francisco Watershed, 21 Dec. 1964, *HDT 12033*; 6 Jan. 1967, *HDT 18342*; Santa Cruz Co., Boulder Creek, 30 Dec. 1964, *HDT 12049*; 9 Dec. 1966, *HDT 18045*; Siskiyou Co., McCloud, 17 Nov. 1967, *HDT 21646*; Shasta Co., Sweetbriar Creek, 24 Dec. 1966, *HDT 18212*; Sonoma Co., Cleary Reserve, 19 Dec. 1967, *HDT 21806*; Trinity Co., Hwy 299 nr Weaverville, Trinity National Forest, 9 Nov. 1962, *HDT 9396*; Hwy 299 nr Big Bar, Trinity National Forest, 17 Nov. 1965, *HDT 14273*.

Discussion.—*Tricholoma myomyces* var. *myomyces* is recognized by its small stature, fibrillose to squamulose

gray pileus, cortinate veil, pseudoparenchymatous hypodermium, lack of cystidia, and lack of a distinguishable taste or odor. See Ovrebo (1989) and Bon (1984) for a description of *T. myomyces* var. *myomyces* and related species. *Tricholoma myomyces* var. *cystidiotum* differs from var. *myomyces* in the presence of broadly clavate to sphaeropedunculate cheilocystidia, but is otherwise indistinguishable.

Tricholoma myomyces var. *cystidiotum* is the most common small, gray *Tricholoma* in mixed evergreen forests in the fall in California, particularly in association with *Pseudotsuga menziesii* (Douglas Fir). *Tricholoma terreum* (Schaeff.:Fr.) Kummer is the name most commonly applied to collections of *T. myomyces* in California, but to my knowledge *T. terreum* does not occur in California. *Tricholoma moseri* Singer is common in montane regions in the spring, but occurs rarely in coastal forests. *Tricholoma moseri* is distinguished from *T. myomyces* by the lack of a partial veil and lack of a pseudoparenchymatous hypodermium.

Tricholoma moseri Singer, Beih. Sydowia 7: 17. 1973.

FIGS. 13–15

Pileus 20–45 mm broad, campanulate when young, becoming broadly convex to plane, rarely umbonate (FIG. 15); surface dry, woolly tomentose overall when young, remaining so over the disc, appressed radiating fibrillose to minutely squamulose overall, the surface often splitting radially to reveal the whitish context, margin inrolled and heavily bearded when young, a cobweb of white fibrils remaining on the margin in age; grayish brown (8F3-4, 8-7D3), to blackish, the margin often paler; context white to gray, taste and odor not noticeable to farinaceous.

Lamellae sinuate, 2–5 mm broad, close to subdistant, thin or thick, pale gray to gray, spotting dark gray or blackish.

Stipe 20–60 × 5–11 (–18) mm, equal, occasionally with a slightly bulbous base, surface dry, silky fibrillose, pruinose at apex, white to very pale gray, cortina absent; context whitish to pale gray, solid.

Basidiospores 7.2–10.6 × 3.8–5.8 μm (\bar{x} = 8.3 ± 0.75 × 4.6 ± 0.40 μm; E = 1.5–2.4; Q = 1.8 ± 0.18; n = 366/16 collections), elliptic to narrowly elliptic, hyaline, smooth, inamyloid (FIG. 13). *Basidia* 31–43 × 6.7–8.6 μm, clavate, 4-spored, hyaline. *Cheilocystidia* 21–57 × 5.8–19 μm, not present in all collections, clavate to broadly clavate, often with a strangulated apex, hyaline or fuscous, somewhat thick-walled (FIG. 14). *Pileipellis* a cutis; hyphae 2.4–24 μm diam, cylindrical to inflated, parallel, forming recurved fascicles; pale brown to dark brown, rarely hyaline, smooth and somewhat thick-walled, or with rough dark

brown or hyaline incrustations; pseudoparenchymatous hypodermium absent. *Pileus trama* hyphae 2.4–19 μm diam, cylindrical to inflated, mostly parallel, hyaline or pale brown, smooth. *Lamellar trama* hyphae 2.4–19 (24) μm diam, cylindrical to inflated, parallel, hyaline, smooth. *Stipe* hyphae 2.4–19 μm diam, cylindrical near surface to inflated, parallel, hyaline, smooth. *Caulocystidia* 24–62 × 3.3–7.2 μm; cylindrical to broadly clavate, often with strangulated apices, solitary or in pyramidal clusters at stipe apex, hyaline or dark brown, occasionally with hyaline granular contents, smooth. Clamp connections absent.

Habitat. Solitary to caespitose under conifers, particularly *Abies magnifica* A. Murr. (Red Fir) in the Sierra Nevada mountains, or *Pinus hartwegii* Lindl. in Mexico, often in disturbed soil or near melting snow, May to August in montane regions, rarely from October to January in montane and coastal regions.

Collections examined. MEXICO. DISTRICT FEDERALES: Paso de Cortés, 23 July 1969, *Singer M8521* (HOLOTYPE, F). USA. CALIFORNIA: Alpine Co., Alpine lake Campground, 24 May 1966, *HDT 16571*; Blue Lakes, 10 June 1966, *HDT 16931*; Breckon 438; Hwy 108 nr Clark Fork, 27 June 1967, *HDT 19880*; Alpine Lake, 29 Aug. 1982, *HDT 44797*; 20 Aug. 1983, *HDT 46043*; 26 Aug. 1983, *HDT 46146*; Amador Co., Silver Lake, 9 June 1966, *HDT 16905*; Hwy 88 E of Silver Lake, 12 July 1967, *HDT 20127*; Hwy 88, Carson Spur, 20 June 1986, *HDT 49951*; Hwy 88 rest area, 10 mi W of Silver Lake, 14 May 1988, *HDT 51657*; Calaveras Co., Hwy 4 nr Devils Kitchen, Vista Point, 28 May 1966, *HDT 16745*; El Dorado Co., Crystal Basin Recreation Area, 27 May 1978, *HDT 38*; Fresno Co., Huntington Lake, 25 Aug. 1983, *HDT 46079*; Humboldt Co., Six Rivers National Forest, Big Hill Rd, Mill Creek Lakes Trail, 18 May 1973, *DLL 5903* (HSC); 26 May 1973, *DLL 5919* (HSC); 1 June 1973, *T. J. Baroni 1306* (HSC); Lassen Co., Lassen Volcanic National Park, 23 June 1965, *HDT 12717*; 1 July 1965, *HDT 12897*; Madera Co., Yosemite National Park, 21 June 1967, *HDT 19775*; Marin Co., Pt. Reyes National Seashore, Limantour Ridge, 4 Dec. 1993, *KMS 414*; Mariposa Co., Yosemite National Park, Glacier Point Rd, 20 June 1967, *HDT 19714*; Sierra Co., Yuba Pass, 13 June 1967, *HDT 19532*; 19 June 1982, *HDT 44477*; Weber Lake Rd, 4 mi S of Yuba Pass, 26 June 1986, *HDT 50020*; 3 June 1989, *HDT 52095*; SFSU Field Campus, 6 June 1993, *KMS 376*; *KMS 377*; 7 June 1993, *KMS 380*; *KMS 381*; *KMS 382*; Haskell Peak Rd, 9 June 1993, *KMS 383*; Siskiyou Co., Mt. Shasta, 1 June 1969, *HDT 23481*; 3 June 1970, *HDT 25389*; 29 May 1972, *HDT 28879*; 17 June 1980, *HDT 41095*; 5 June 1988, *HDT 51696*; Tehama Co., hwy 89, 20 mi S of Lassen Volcanic National Park, 2 July 1982, *HDT 44611*; Tuolumne Co., Yosemite National Park, Tuolumne Grove, 22 June 1967, *HDT 19810*; Pinecrest Lake, 25 Oct. 1975, *R. E. Halling 996*; Pinecrest, 17 May 1980, *HDT 40810*; Hwy 108, 2 mi E of Long Barn, 16 Oct. 1982, *HDT 45137*. UTAH. Grand Co., La Sul Mtn., Gold Basin nr Moab, 13

Sep. 1969, *HDT* 23914; Summit Co., Uinta Mts., Yellow Pine Campground, 18 June 1970, *HDT* 25478.

Discussion.—*Tricholoma moseri* is extremely common, and can be quite abundant in the montane regions of California in the spring and summer. It is recognized by its small stature, minutely squamulose dark brownish gray pileus, pale gray lamellae, white stipe, and lack of a cortina. Micromorphologically, *T. moseri* lacks a pseudoparenchymatous hypodermium, although the hyphae of the pileipellis are somewhat inflated, and the basidiospores are long and narrow relative to those of other *Tricholoma* species possessing a similar stature. Cheilocystidia were not observed in every collection. They are most common in collections with somewhat contorted lamellae, and may be the result of arrested development of the lamellae.

Tricholoma moseri is most closely related to *T. scalpturatum* (Fr.) Quélet, which also lacks a pseudoparenchymatous hypodermium and has narrowly elliptic spores. *Tricholoma scalpturatum* occurs in the fall, is paler than *T. moseri*, and has a cortina when young. Other species with which *T. moseri* may be confused include *T. myomyces* var. *cystidiotum*, which occurs in the fall in coastal regions, and is distinguished by the presence of a cortina when young, and microscopically by the presence of a pseudoparenchymatous hypodermium.

Tricholoma moseri was first described from the upper limits of *Pinus hartwegii* forest at 4100 m in the mountains of Mexico. To my knowledge, this is the first report of this species from the United States.

II. *Tricholoma* subg. *Tricholoma* sect. *Genuina* (Fr.) Kauffman, *The Agaricaceae of Michigan*. 689. 1918.

Tricholoma dryophilum (Murrill) Murrill, *Mycologia* 5: 223. 1913. FIGS. 16–18

≡ *Melanoleuca dryophila* Murrill, *Mycologia* 5: 221. 1913.

Pileus 40–100 mm broad, obtusely conic at first, becoming convex to broadly convex, a low broad umbo sometimes present, margins inrolled to downturned (FIG. 18); surface viscid, glabrous to innately radiating fibrillose, pale orange white (5-6A2) at first, darkening in irregular streaks and patches to brownish orange (6C5-D6) and finally more uniformly brown (6-7D7, 7E6) overall, margins lighter in coloration and sometimes with watery spots; context white, taste and odor farinaceous.

Lamellae adnate, sinuate or adnexed, 5–10 mm

broad, thin, close, white or pale cream (3A2), spotting brownish orange (6C6) to brown (6D5).

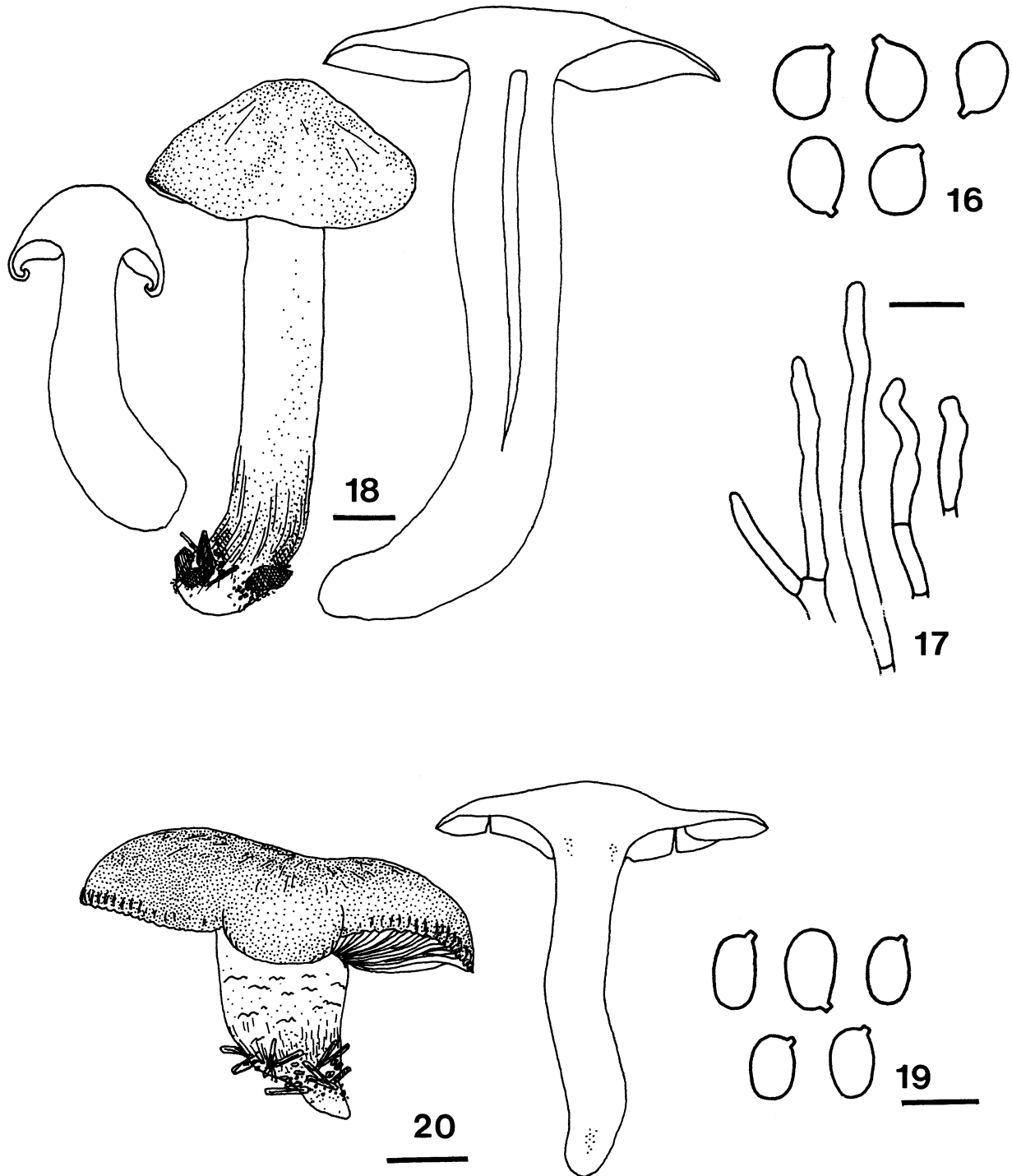
Stipe 70–175 × 9–20 mm, equal or tapered slightly towards the base; surface dry, silky-fibrillose, pruinose at apex; apex white and often remaining so in age, but no clearly defined annular zone present; stipe darkening from the base upwards, brownish orange (6C7) or yellowish brown (5B6), dark brown (6F-7E7) at base when overmature; context white, buff to brownish orange at base at maturity, solid or hollow.

Basidiospores 5.3–7.7 × 3.8–5.8 μm (\bar{x} = 6.3 ± 0.53 × 4.5 ± 0.37 μm; E = 1.2–1.8; Q = 1.4 ± 0.12; n = 101/5 collections), elliptic to narrowly elliptic, smooth, hyaline, inamyloid (FIG. 16). *Basidia* 28–45 × 5.76–7.2 μm, 4-spored, clavate. *Cheilocystidia* 30–62 × 2.4–3.4 μm, filiform, some with strangulated tips, scattered, extending beyond hymenium, hyaline with refractive contents, smooth (FIG. 17). *Pileipellis* an ixocutis; epicutis hyphae 2.4–7.2 μm diam, cylindrical, loosely interwoven in a gelatinous matrix, hyaline, some with hyaline or pale brown refractive contents, pigment dissolving in KOH, smooth; subcutis hyphae 3.4–9.6 μm diam, cylindrical to slightly inflated, mostly parallel, hyaline, smooth or with fine to rough hyaline incrustations. *Pileus trama* hyphae 2.4–14 μm diam, cylindrical to inflated, interwoven, hyaline, smooth. *Lamellar trama* hyphae 2.4–12 μm diam, cylindrical to inflated, parallel, hyaline, smooth. *Stipitipellis* hyphae forming a loose interwoven network, hyaline, some with granular hyaline contents, smooth or with fine granular hyaline incrustations. *Stipe trama* hyphae 2.4–12 μm diam, cylindrical to inflated, parallel, hyaline, smooth. *Caulocystidia* present as recurved hyphal tips at stipe apex, 14–100 × 2.4–4.8 μm, cylindrical, in pyramidal clusters, hyaline, smooth. Clamp connections absent.

Habitat. Scattered to gregarious with *Quercus agrifolia* Née (Coast Live Oak), November to January, Marin County southward.

Collections examined. USA. CALIFORNIA: Marin Co., Point Reyes National Seashore, Limantour Ridge, 1 Nov. 1992, *KMS* 257; Marin Municipal Watershed District, Bon Tempe Lake, 17 Dec. 1992, *KMS* 325; 12 Jan. 1993, *KMS* 360; *KMS* 361; *KMS* 362; San Mateo Co., San Bruno, 31 Dec. 1960, *HDT* 8654; Huddard County Park, 16 Dec. 1982, *HDT* 45605; Wunderlich Park, 6 Feb. 1987, *M. T. Seidel* 2224; Santa Barbara Co., Los Padres National Forest, Figueroa Campground, 31 Jan. 1993, *KMS* 374; Santa Clara Co., Stanford University, 21 Jan. 1903, *James McMurphy* 27 (HOLOTYPE, NY).

Discussion.—*Tricholoma dryophilum* appears to be associated exclusively with *Quercus agrifolia*. The tall stature and color changes of the pileus from pale cream to brownish orange and finally brown in age are distinctive characters in the field. Micromorphol-



FIGS. 16–20. Features of *Tricholoma* species. 16–18. *T. dryophilum* (KMS 325). 16. Basidiospores. 17. Cheilocystidia. 18. Basidiomata. 19–20. *T. muricatum* (KMS 407). 19. Basidiospores. 20. Basidiomata. Lines represent 15 mm for basidiomata, 10 μ m for basidiospores, 20 μ m for cystidia.

ogically, the filiform cheilocystidia and weakly pigmented hyphae of the pileipellis are distinctive.

The basidiomata of *Tricholoma manzanitae* Baroni & Ovrebo also become more darkly pigmented at maturity, but are associated with *Arctostaphylos* spp, and

are typically shorter in stature with a yellow instead of white stipe apex. *Tricholoma ustale* (Fr.) Kummer occurs under oaks, but has a bitter taste and a more fibrillose pileus that is reddish brown from the first. *Tricholoma nictitans* (Fr.) Gillet also has a tall stature

and farinaceous taste and odor, but has a dark reddish brown pileus, and a buff to dark dull brown stipe.

Tricholoma muricatum Shanks, sp. nov. FIGS. 19, 20

Pileus 40–110 mm latus, viscosus, fibrillas radiantes exhibens, obscure badius, margine saepe breve costatus; sapor amarus farinaceus, odor farinaceus. Lamellae aurantiaco-albidae. Stipes apice aurantiaco-albus, alibi brunneus, zona annularis distincta absens. Basidiosporae 4.8-6.7(-7.2) × 2.9-4.3 μm, ellipticae. Hyphae cuticulare pilei incrustatae, in matrice gelatinosa inclusae.

Etymology. *Muricatum*, associated with *Pinus muricata* D. Don (Bishop pine).

HOLOTYPE. USA. CALIFORNIA: San Francisco Co., San Francisco State University, 14 Jan. 1993, K. M. Shanks 368 (SFSU).

Pileus 40–115 mm broad, convex to broadly convex, sometimes with a low broad umbo, margin inrolled at first, becoming down-turned, and finally lobed and wavy in age, often short costate, at maturity pileus plane, the center sometimes slightly depressed (FIG. 20); surface viscid, becoming dry, often shiny, innately radiating fibrillose, streaked from the radiating fibrils, dull reddish brown (7-8E-F5-6) on the disc, pinkish brown (6B3-4, 7D4) towards margin; context white, odor not distinguishable or farinaceous, taste farinaceous or bitter farinaceous.

Lamellae sinuate, 8–13 mm broad, close, thin, buff (near 4A2) at first, rapidly orange white (5-6A2), discoloring brown (6F5), often marginate.

Stipe 30-80 × 10-25 mm, equal or tapered slightly towards the base, stipe base often subradicating; surface dry, silky-fibrillose with irregular belts of recurved fibrils, pruinose and concolorous with lamellae at apex, stipe overall becoming brown to brownish orange (6C-E5), darkening from the base upwards or bruising with handling; context whitish, solid or hollow.

Basidiospores 4.8-6.7(-7.2) × 2.9-4.3 μm (\bar{x} = 5.8 ± 0.50 × 3.6 ± 0.3 μm; E = 1.3–2.3; Q = 1.6 ± 0.18; n = 149/12 collections); elliptic to narrowly elliptic, hyaline, smooth, inamyloid (FIG. 19). *Basidia* 24-36 × 4.8-6.2 μm, 4-spored, clavate. *Hymenial cystidia* absent. *Pileipellis* an ixocutis; *epicutis* hyphae 2.4–7.2 μm diam, cylindric, loosely interwoven or mostly parallel and repent, hyaline or pale brown, or with refractive brown contents, smooth or with hyaline punctate to zebroid incrustations in KOH, incrustations hyaline or dark brown in H₂O; *hypodermium* absent; *subcutis* not always distinctive, hyphae 4.8–7.2 μm diam, cylindric to slightly inflated, mostly parallel, hyaline to

pale brown, some with refractive brown contents, smooth or more commonly with rough irregular or zebroid incrustations. *Pileus trama* hyphae 3.8–14 μm diam, cylindric and nearly parallel near pileipellis, cylindric to inflated and interwoven elsewhere, hyaline, smooth. *Lamellar trama* hyphae 2.4–16 μm diam, cylindric to inflated, parallel, hyaline, smooth. *Stipe hyphae* 3.4–14 μm diam, cylindric near surface, cylindric to inflated elsewhere, parallel, hyaline or surface hyphae yellow brown, smooth. *Caulocystidia* present as recurved hyphal tips arising from a loose network of hyphae on the stipe surface, 21-86 × 2.8-7.2 μm, cylindric to narrowly clavate, in pyramidal clusters or rarely solitary, hyaline, smooth. Clamp connections absent.

Habitat. Solitary to gregarious or caespitose under *Pinus radiata* D. Don (Monterey Pine) and *Pinus muricata* (Bishop Pine), coastal forests San Francisco County northwards.

Collections examined. USA. CALIFORNIA: Humboldt Co., Hwy 101, 4 mi N of Trinidad, 11 Nov. 1990, HDT 53387; Marin Co., Audubon Canyon Ranch, Volunteer Canyon, 10 Dec. 1982, Calhoun 82-3548; Mendocino Co., Jackson State Forest, 18 Nov. 1979, HDT 40409; 24 Nov. 1979, HDT 40474; 13 Nov. 1986, HDT 50855; 22 Nov. 1986, HDT 50916; 13 Nov. 1992, KMS 270; KMS 273; Van Damme State Park, Pygmy Forest Parking Lot, 13 Nov. 1992, KMS 277; San Francisco Co., San Francisco State University Campus, 1 Dec. 1964, HDT 11805; 29 Dec. 1973, HDT 32131; 5 Jan. 1984, HDT 47252; 12 Jan. 1992, KMS 228; 14 Jan. 1993, KMS 368; 14 Oct. 1993, KMS 448; 7 Nov. 1993, KMS 407; San Francisco Presido, 5 Dec. 1974, Fordham s.n.; Parkmerced, 4 Jan. 1978, HDT 38475.

Discussion.—*Tricholoma muricatum* is characterized by orange-white lamellae, a brownish orange stipe and an innately radially fibrillose pileus that becomes lobed and wavy in age. The pileus often has short costa on the margin. Micromorphologically, the pileipellis hyphae are strongly incrustated, and the incrusting pigments tend to dissolve in KOH. The basidiospores, which are small and narrow relative to those of other brown viscid *Tricholoma* species, are also distinctive. The taste and odor are somewhat variable, but are never strongly farinaceous, and the taste often has a slightly bitter component.

Tricholoma muricatum has been confused with *T. pessundatum* (Fr.) Quélet, a European species associated with pines. *Tricholoma pessundatum* has smaller spores (4.5 × 2.5-3 μm), and a hypodermium of inflated hyphae. *Tricholoma stans* (Fr.) Sacc. is a closely related species with pinkish lamellae that occurs with pines in Europe, but it is described as having a more slender stature, and the pileus lacks a costate margin. The pileipellis hyphae of *T. stans* lack the strong incrustations seen in *T. muricatum*, and are only weakly

gelatinized. More complete descriptions of *T. pessundatum* and *T. stans* may be found in Bon (1984).

III. *Tricholoma*, subg. *Contextocutis*, sect. *Contextocutis* Singer, *Annl. Mycol.* 41: 70. 1943.

***Tricholoma vernaticum* Shanks, nom. nov.**

Armillaria olida Thiers & Sundberg, *Madroño* 23: 541. 1976, non *Tricholoma olidum* Velen., 1920.

Etymology. *Vernaticum*, occurring in the spring.

Tricholoma vernaticum is a common species in the spring in the Sierra Nevada. It is characterized by a strong cucumber odor, a moist white to gray pileus and an often inconspicuous membranous annulus. The combination of clamp connections and interwoven pileipellis hyphae place *T. vernaticum* in subgenus *Contextocutis*.

Thiers and Sundberg (1976) maintained a rather broad concept of *Armillaria* when they described *A. olida*, and included species possessing a white spore print, attached lamellae, and partial veil forming an annulus. However, the type species of *Armillaria* is now considered to be *A. mellea* (Vah. ex Fr.) Kummer (Watling et al., 1982), and *Armillaria* is restricted to wood-rotting species that form black rhizomorphs. The mycorrhizal species with inamyloid spores formerly included in *Armillaria* by some authors are now more properly placed in *Tricholoma*. The older name of *Tricholoma olidum* Velen. necessitates the erection of a new name for *A. olida*.

ACKNOWLEDGMENTS

I thank Dennis Desjardin for advice and encouragement, Mark Norton, Nathan Wilson and Harry Thiers for sharing collections, and the following herbaria for the loan of spec-

imens: F, HSC, IB, MICH, NY, NYS, and TRTC. This research was supported in part by an H. D. Thiers scholarship. Thanks to Clark Ovrebo, Gary Samuels, Roy Halling and an anonymous reviewer for helpful comments on the manuscript. Dr. W. Culberson was of invaluable assistance in the writing of the latin diagnoses.

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