A Systematic Study of Tricholoma in California

A thesis submitted to the faculty of
San Francisco State University
in partial fulfillment of the
requirements for the
degree

Master of Arts
in
Biology: Ecology and Systematic Biology

by

Kristen MacKay Shanks

San Francisco, California

July, 1994

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CERTIFICATION OF APPROVAL

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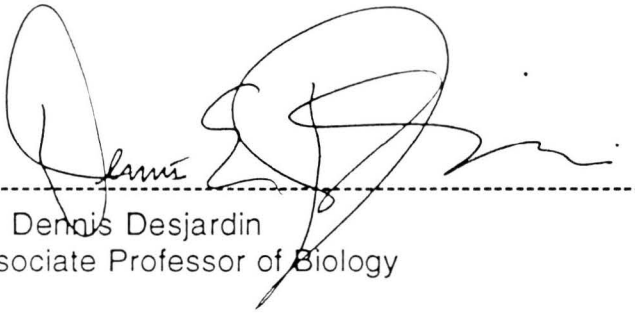

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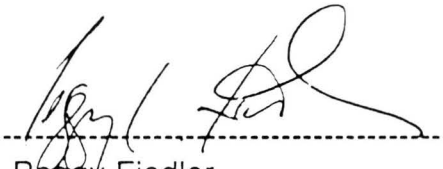

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Members of the largely mycorrhizal genus *Tricholoma* are common in forested north temperate regions worldwide. Although species of *Tricholoma* have been the subject of recent taxonomic study in Europe, species from other areas are not well known, and this study is the first comprehensive systematic study of *Tricholoma* species in California. The goals of the present study are to provide a resource for the identification of *Tricholoma* species in California, and to serve as a basis for further study of systematic relationships within the genus. Complete macro- and micromorphological descriptions of *Tricholoma* species occurring in California are provided based on examination and measurement of characters of herbarium and fresh material. I recognize 34 species as occurring in California, seven of which are first reports, and five of which represent previously undescribed taxa.

I certify that the Abstract is a correct representation of the content of this thesis.

(Chair, Thesis Committee) 13 July 1994 (Date)

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INTRODUCTION

Within the last few years, there has been increasing appreciation, both within the scientific community and the general public, of the importance of biodiversity. The group of organisms termed true fungi is one of the more poorly known in terms of biodiversity. Hawksworth (1991) estimates that 2.5-5% of the fungal diversity worldwide is known to the scientific community. In North America, several genera of agarics have been the subject of taxonomic treatment (*Pholiota, Lactarius, Galerina, Hygrophorus, Clitocybe*, etc.), but most other genera remain relatively poorly known taxonomically.

The genus *Tricholoma* (Fr.) Staude is the type genus of the large family *Tricholomataceae*, and is characterized by a white spore print; sinuate lamellae; smooth, hyaline spores; parallel lamellar trama hyphae; and terrestrial fruiting habit. 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. At least one species, *T. magnivelare*, is collected commercially in North America, and two species, *T. pardinum* and *T. venenatum* are known to be toxic. Although the genus is considered relatively well known in Europe, recent taxonomic literature on *Tricholoma* in North America is limited to species from the Pacific Northwest and Great Lakes regions.

One approach to developing material for a North American monograph of *Tricholoma* is to study smaller geographic regions within North America.

Because of its diversity of forest types, California is well suited to a project of this kind. Murrill (1913) and Baroni and Ovrebo (1983) have described *Tricholoma* species from California, but my research is the first exhaustive taxonomic survey of the genus in California. The main goal of this study is to provide a resource for the identification of *Tricholoma* species in California. For this study, I have compiled complete macro- and micromorphological descriptions for species that occur in California, as well as information on range, phenology and habitat.

The study area emphasizes the forested regions of California. Although I made an effort to collect in all areas of California, I collected primarily in the San Francisco Bay Area, North Coast Ranges, and northern Sierra Nevada. I made collections from 10 counties (Humboldt, Marin, Mendocino, San Francisco, San Mateo, Santa Barbara, Santa Cruz, Sierra, Sonoma, Yuba) and examined material from 20 additional counties (Alpine, Amador, Calaveras, Contra Costa, Del Norte, El Dorado, Fresno, Madera, Mariposa, Mono, Monterey, Placer, Riverside, San Diego, Santa Clara, Shasta, Siskiyou, Tehama, Trinity, Tuolumne), as well as material from elsewhere in North America and Europe.

California has a diversity of forest types, including mixed evergreen, mixed hardwood, closed-cone pine and cypress, and mixed conifer forests dominated by *Pinus ponderosa* Dougl., *Abies concolor* Lindl. & Gord. or *Abies magnifica* Murr. As defined in Barbour & Major (1977), mixed evergreen forest occurs in the Coast Ranges, in the Klamath region, and low elevation montane regions. Mixed evergreen forest is dominated by *Pseudotsuga menziesii* (Mirb.) Franco and *Lithocarpus densiflora* Rehd. Other tree species found in

this association include *Arbutus menziesii* Pursh. and *Pinus ponderosa*. Closed-cone pine and cypress forest occurs in discontinuous patches along the coast from Monterey County north to Humboldt County. The ectomycorrhizal tree species of this forest type are *Pinus muricata* D. Don. and *Pinus radiata* D. Don. At lower elevations and dryer sites in the Coast Ranges and montane regions there are mixed hardwood forests dominated by a mixture of *Lithocarpus*, *Arbutus*, and *Quercus agrifolia* Née in coastal regions, and *Quercus chrysolepsis* Liebm. in montane regions. Vegetation of the southern coast ranges consists of a mosaic of mixed evergreen forest, mixed hardwood forest, and chaparral.

Montane forests of the northern Sierra Nevada are dominated by conifers. *Pinus ponderosa* is the dominate tree species from 300-1800 m elevation, and is associated with *Pseudotsuga menziesii*, *Pinus lambertiana* Dougl., and *Calocedrus decurrens* (Torrey) Florin. From 1250-2200 m elevation*Abies concolor* occurs as an associate or a dominant in montane forests. *Abies magnifica* forms nearly monospecific stands from 1800-2750 m elev., although *A. concolor* and *Pinus contorta* ssp. *murrayana* Engleman may be present also. *Pinus contorta* ssp. *murrayana* occurs in monospecific stands from 1830-2400 m elev. in moist areas near meadows and seepage areas.

Mycorrhizae, the symbiotic association between soil fungi and the roots of vascular plants, was first recognized and named by Frank (1885), although the constant association of many edible mushrooms with particular tree species has been recognized by Europeans for centuries (Trappe, 1962). Mycorrhizae

may influence the development of plant communities through availability of mycorrhizal fungal propagules, and affect competitive interactions through mycorrhizal linkages (Allen, 1991). Crucial to the issue of mycorrhizal impact on plant communities is the question of mycorrhizal specificity. From the perspective of a vascular plant, fidelity to a particular type of mycorrhizae may influence seedling establishment and later competitive interactions.

Information on host specificity of mycorrhizae is, for the most part, limited to records of associations of sporocarp production with particular tree species. Three categories of host specificity have been suggested for ectomycorrhizal fungi (Molina et al. 1992). A fungus is considered to have a narrow host specificity if it is associated with plants from a single genus. Fungi with intermediate host specificity are restricted to a particular family of vascular plants, or to angiosperms or gymnosperms. Fungi associated with a diversity of ectomycorrhizal hosts are considered to have a broad host range.

In California, most species of *Tricholoma* (71%) have an intermediate host specificity, 20% have a narrow host specifity and 9% exhibit a broad host specificity. This is in contrast to the findings of Molina et al. (1992) who estimated 45% of *Tricholoma* species have an intermediate host specificity and 35% have a broad host specificity. Some species of *Tricholoma* seem to exhibit a narrower host specificity in California. When the diversity of tree associates over the entire range of these fungi are compared to the tree species with which they are associated in California, it is clear that many species have a broader host specificity over their entire range. For example, *T. psammopus* occurs

exclusively with *Pseudotsuga* on the west coast of North America, but was reported to be associated with *Larix* and other *Pinaceae* in Europe. *Tricholoma venenatum* is associated with *Pinaceae* in California and Washington, but was described as associated with hardwoods in Michigan.

A possible explanation for this pattern of more narrow specificity in isolated geographic regions is that isolated but morphologically identical populations that are associated with different hosts represent sister species. These populations may be following different evolutionary paths, but have not yet diverged morphologically. An alternate explanation is that the shift in specificity patterns may represent an opportunistic shift of host preference by a fungal species with the ability to form mycorrhizae with a broad range of hosts. Further research is required, both to document patterns of mycorrhizal specificity more rigorously, and increase our understanding of population structure of ectomycorrhizal fungi.

The number of *Tricholoma* species associated with particular families of trees reflects the relative abundance of these tree families in the forests of California. The majority of *Tricholoma* species in California are associated with *Pinaceae* and *Fagaceae*(Table 1).

According to herbarium records and published accounts, 56 species of *Tricholoma* have been reported from California. My examination of type collections has shown that 10 of these species are more properly placed in 6 different genera in the *Tricholomataceae* and *Lepiotaceae* (see type studies below). Over the course of two years, I made over 200 collections, comprising

29 species, of *Tricholoma*. I recognize 34 species of *Tricholoma* in 4 subgenera as occurring in California. My concepts of *Tricholoma* species are based on the available literature, and whenever possible, examination of type collections or authoritatively identified collections. Provisional names have been given to species I consider previously undescribed. Seven species are first reports from California, and five taxa are previously undescribed.

Vascular Plant Families	Number of species	Percentage of species
Ericaceae	1	3%
Fagaceae	6	17%
Pinaceae	26	74%
Salicaceae	2	6%

Table 1. Number of *Tricholoma* species associated with vascular plant families in California. Some *Tricholoma* species occur with more than one family of vascular plants, and are included in the totals for both families. The occurrence of *Tricholoma populinum*, associated with *Salicaceae*, has not been documented in California, but is included in this table.

HISTORY AND NOMENCLATURE

The name *Tricholoma* was first used by Elias Fries in 1821 for a tribe of the genus *Agaricus*. His concept of *Tricholoma* included a large diversity of fungi possessing a common stature. Many of the species he included in *Tricholoma* are currently considered more properly placed in other genera. Fries (1821) initially divided *Tricholoma* into three groups without taxonomic

rank based on pileus features. Fungi with viscid pilei were included in *Tricholomata Limacina*, while fungi with dry pilei were placed in either *Tricholomata Personata* if smooth, or *Tricholomata Genuina* if fibrillose or squamulose. In *Epicrisis Systema Mycologica* (1836) Fries expanded his classification, dividing *Tricholoma* into 7 tribes in two series without giving taxonomic rank to the name *Tricholoma.* The first series consisted of fungi with fibrillose, pubescent or squamulose pilei and contained 4 tribes: *Limacina*, *Genuina*, *Ridgida* and *Sericella*. The second series contained fungi with hygrophanous, glabrous pilei in 3 tribes: *Guttata*, *Spongiosa* and *Hygrophana*.

Many of the species placed in tribus *Tricholoma* by Fries were later included in the genus *Tricholoma* by Kummer (1871) and Quélet (1872). These authors did not significantly change Fries' concept of *Tricholoma*. Quélet maintained unchanged Fries' groupings within *Tricholoma* without giving the groupings formal rank. Quélet (1886) later erected the large genus *Gyrophila* into which he grouped *Tricholoma* and *Armillaria* sensu Fries. *Gyrophila* is not accepted by modern taxonomists.

With few exceptions, workers in North America and in Europe continued to use an essentially Friesian concept of *Tricholoma* until after the turn of the century. Classifications proposed before the widespread use of micromorphological characters were based exclusively on macromorphological characters, and for the most part maintained Friesian groupings. However, some authors did present modifications to the Friesian system of infrageneric classification by segregating elements of *Tricholoma* sensu Fries into other

genera.

Earle (1909), in an attempt to clarify generic classifications of agarics, subdivided *Tricholoma* into three genera on the basis of pileus viscidity. He placed in *Melanoleuca* Pat. species with moist or hygrophanous pilei, corresponding to Fries' sections *Guttata*, *Spongiosa* and *Hygrophana* as defined by Saccardo (1887) in *Sylloge Fungorum*. The sections with dry pilei, *Genuina*, *Ridgida* and *Sericella*, were placed in *Monomyces* Batt. ex Earle, and Earle erected *Glutinaster* to encompass the viscid species lacking a veil from Fries' section *Limacella*. *Monomyces* and *Glutinaster* are no longer in use in modern taxonomy, and *Melanoleuca* is currently defined in part on the basis of spore morphology.

Roze (1876) erected *Cortinellus* and based it on *Tricholoma vaccinum*. Karsten (1879) applied *Cortinellus* to the species of *Tricholomata Genuina* of Fries. Murrill applied the name *Cortinellus* to fungi possessing brightly colored, squamulose pilei. Cortinellus is no longer in use in modern taxonomy. Murrill (1913) considered *Tricholoma* to be a synonym of *Melanoleuca* Pat., but made simultaneous combinations in *Tricholoma* "for those desiring to continue its use".

The first treatment of *Tricholoma* to diverge significantly from Fries was Ricken's classification (1915). Ricken is credited with being the first to include annulate species originally placed in *Armillaria* (such as *T. focale*) in *Tricholoma*. His infrageneric classification, however, follows Friesian groupings. Ricken recognized two subdivisions of *Tricholoma*: *Genuina*, which

contained species from the first series of *Epicrisis Systema Mycologica* (those species with fibrillose, pubescent or squamulose pilei), and *Gymnoloma*, which included species from the second series (those species with glabrous hygrophanous pilei).

Kauffmann (1918), was the first to indicate rank in his infrageneric classification of *Tricholoma*. He recognized three sub-genera: *Limacina*, containing species with viscid pilei; *Cortinellus*, containing species with dry, silky, fibrillose or somewhat scaly pilei; and *Melanoleuca*, containing species with moist or hygrophanous pilei. His classification maintained essentially Friesian groupings at the sectional level, but showed the influence of Earle in the naming of subgenera.

Beginning with Lange (1935), the relationships between *Tricholoma* and macromorphologically similar genera were clarified further by the utilization of micromorphological characters, particularly microchemical color reactions and the arrangement of pileipellis hyphae. Several genera have since been segregated from *Tricholoma* sensu Fries, and many species of *Tricholoma* have been transferred to other genera primarily on the basis of micromorphological characters.

Lange (1935) recognized Section *Dermoloma*, on the basis of the presence of a cellular cuticle, and Singer (1956) later elevated Section *Dermoloma* to generic rank. Based on his experiments with acetocarmine, Kühner (1938) recognized *Calocybe* Kühner ex Donk as a segregate of *Tricholoma* on the basis of the presence of carminophilous granules in the

basidia and the presence of clamp connections. However, *Calocybe* was not validly published until 1962 by Donk.

Singer published a series of type studies of agarics (1942,1943,1955), including many North American type collections, and he emphasized the utility of microscopic features for distinguishing species of *Tricholoma* . He segregated the genus *Tricholomopsis* from *Tricholoma* (1939) on the basis of the presence of cheilocystidia, clamp connections and a lignicolous fruiting habit. Singer (1943, 1951, 1962, 1975, 1986) proposed several infrageneric classifications of *Tricholoma* based on micromorphological and macromorphological characters. In his later publications, Singer emphasized the presence of clamp connections as a subgeneric character, and modified the hierarchical nomenclature of his classification to agree with the botanical code of nomenclature (Art. 22). His final classification, presented in the 4th ed. of Agaricales in Modern Taxonomy (Singer, 1986), contains 9 Sections in four sub-genera (Table 2). Singer's (1986) system of classification, with minor changes in the treatment of various Stirps, and the recognition of *Tricholosporum* Guzman, is the one followed in this treatment.

Species of Tricholoma have been the subject of intensive taxonomic treatment in Europe, but the lack of type collections for many species recognized by Fries has resulted in a multitude of concepts for certain species of *Tricholoma.* Recent works include Moser (1983), Bon (1984), Riva (1982), and Gulden (1992). The works of Moser and Gulden are in the form of an annotated key, and are not as informative as Bon's publication. Moser and

Gulden follow Singer's classification, but in their keys separate Subgenus *Tricholoma* Section *Tricholoma* into yellow and gray species. Ovrebo (1980, 1989), a North American mycologist, presented a similar classification in which the yellow and gray species of Subgenus *Tricholoma* are placed into different Sections (Table 2). Gulden also includes *T. pardinum* (Subgenus *Pardinicutis*) in his key to Subgenus *Tricholoma* without stating its subgeneric affiliations. Bon presents a classification that differs from Singer primarily in the hierarchical rank of his groupings (Table 2). His monograph is the most complete work on *Tricholoma* in Europe, and includes commentary on micromorphological features and nomenclature.

In North America, several mycologists have contributed substantially to the taxonomic understanding of *Tricholoma*. Workers on the east coast include Peck, who described many species of *Tricholoma* from the northeast during his long career as New York state botanist. Peck also described some collections sent to him from the midwest and western United States. More recently, Bigelow (1979) published modern descriptions of east coast *Tricholoma* species related to *T. flavovirens* in Section *Tricholoma*.

Authors who have dealt with *Tricholoma* from western North America include Murrill, Smith and Ovrebo. Murrill made collecting trips to the pacific coast in the early 1900's and also received specimens from collectors in California, Oregon and Washington. He named nine *Tricholoma* species from specimens collected in California (Murrill, 1913), and reported on the occurrence of 30 *Tricholoma* species on the west coast (Murrill, 1914).

A.H. Smith collected on the Olympic peninsula and in Northern California in the mid 1940's. He described species of *Tricholoma* from the Olympic peninsula and the Michigan area in several publications spanning forty years (Smith, 1937, 1941, 1942, 1944, 1979) but made no attempt to provide a comprehensive taxonomic treatment of the genus.

The most recent publications on *Tricholoma* from the Great Lakes region of North America and the Pacific Northwest are those of C. L. Ovrebo (1973, 1975, 1979, 1980, 1986, 1989). Ovrebo's publications are the most complete and comprehensive works on *Tricholoma* in North America to date. He has described several species from the Great Lakes region, and published descriptions and commentary on selected species of Section *Tricholoma* from the Great Lakes region. His system of classification differs from that of Singer primarily in the subdivision of Subgenus *Tricholoma* Section *Tricholoma* into two Sections, Section *Tricholoma* and Section *Albidogrisea* (Table 2).

Bon (1974)	Singer (1986)	Ovrebo (1980)
Sect. Ridgida	Subg. Contextocutis	Subg. Contextocutis
(not treated)	Sect. Leucorigida	Sect. Leucorigida
Subsect. Saponacea	Sect. Contextocutis	Sect. Contextocutis
Subsect. Iorigida	Sect. Iorigida	*Tricholosporum* Guzman
Sect. Inamoena	Subg. Sericeicutis	Subg. Sericeicutis
Subsect. Lascivia Subsect. Sulphurea	Sect. Sericeicutis	Sect. Sericeicutis
(Sect. Equestria, Subsect. Albata)	Sect. Polyphyllina	Sect. Polyphyllina
Sect. Pardinicutis	Subg. Pardinicutis Sect. Pardinicutis	Subg. Pardinicutis Sect. Pardinicutis
	Subg. Tricholoma	Subg. Tricholoma
Section Equestria		
Subsect. Sejuncta	Sect. Tricholoma	Sect. Tricholoma
Stirps Equestre Stirps Fucatum	Stirps Flavovirens	Stirps Flavovirens
Stirps Sejunctum	Stirps Portentosum	Stirps Portentosum
		Sect. Albidogrisea
Sect. Atrosquamosa		
Subsect. Terrea Stirps Scalpturatum Stirps Terreum Stirps Atrosquamosum	Stirps Scalpturatum Stirps Terreum Stirps Atrosquamosum	Stirps Myomyces
Subsect. Virgata	Stirps Virgatum	Stirps Virgatum
(not treated)	(not treated)	Stirps Luteomaculosum
	Sect. Genuina	Sect. Genuina
Sect. Imbricata Subsect. Vaccina	Stirps Imbricatum	Stirps Vaccinum
Subsect. Psammopoda	Stirps Acerbum	(not treated)

Bon (1974)	Singer (1986)	Ovrebo (1980)
Sect. Albobrunnea Subsect. Pessundata Stirps Pessundatum Stirps Flavobrunneum Subsect. Subannulata	Stirps Pessundatum Stirps Transmutans Stirps Aurantium	Stirps Pessundatum
Subsect. Caligata	Stirps Caligatum	Sect. Caligatum
(not treated)	Section Adusta	Sect. Adusta

Table 2. Comparison of infrageneric classifications of Bon (1974), Singer (1986), and Ovrebo (1980). Taxa across from each other contain the same or similar species; where a blank appears, no equivalent taxon exists in the classification.

METHODS AND MATERIALS

Due to the ephemeral nature of most Agarics, and the unpredictability of sporocarp production, collecting trips were undertaken whenever weather conditions seemed favorable for the production of sporocarps. Data collected in the field included associated tree species and the relative abundance and distribution of individual sporocarps. Macromorphological descriptions were compiled from specimens collected in California from October 1992 to February 1994. When fresh material was not available, descriptions were compiled from available literature.

Notes on macromorphological features were made as soon as possible

after return to the lab. Colors were compared with Kornerup and Wanscher (1978), and are cited in the text in parentheses as page, column, row. When a range of color was present, the colors are cited with a hyphen between the colors representing the limits of the color range. For example, (4-5A6-8) refers to the colors on pages 4 and 5, column A, rows 6, 7 and 8. Terminology for macromorphological character states follows Largent (1977) or Snell and Dick (1971). Taste and odor data were obtained from pileus context tissue. Macrochemical color reactions were tested on some collections using PDAB (2 g p-dimethylaminobenzaldehyde, 76 ml 95% ethanol, 24 ml conc. HCl) on surface and trama of the pileus and stipe and on the lamellae. Spore prints were made only if the spore color was not apparent from deposits in the collecting bag, or deposits at the apex of the stipe. Longitudinal sections of collections were drawn to scale, and in some cases drawings of surface features were also made. In addition, color photographic slides of many collections were taken using a Contax 159 35 mm camera with a ring flash. Collections were dried in a plant drier over hot air at approximately 38° C.

Micromorphological features were studied using a Wild M20 microscope. Drawings of micromorphological features were made with the use of a drawing tube. Spores are drawn at 2000x, basidia and cystidia at 1000x. All observations were made from dried material wetted in 95% ethanol, revived in distilled water and mounted in 3% KOH. Unless otherwise noted, descriptions of color are from sections in observed in KOH. Sections were also mounted in Melzer's reagent to test for an amyloid reaction.

Three different sections were made. Tissues of the pileus surface and trama were studied from a radial section of the pileus from approximately midway between the disc and margin. Features of the hymenophore were observed by mounting a portion of a lamella including the margin stained in Congo Red. The margin and lamellae surface was scanned for the presence of cystidia, and the tissue gently squashed to facilitate observation and measurement of individual cystidia, basidia, spores, and lamellar trama hyphae. When the arrangement of the lamellar trama hyphae was in question, cross sections of the lamellae were also made. Features of the stipe surface and trama were observed by making a longitudinal section from the stipe of a sporocarp which had been cut in half longitudinally before drying. In the case of a collection consisting of only entire sporocarps, a scalp section of the stipe was made.

Basidiospores were measured when viewed in profile; spore length does not include the apiculus. A minimum of 20 spores was measured from each collection, and the following statistical measures were calculated for all the spores measured of a given species: $\bar{x}$ = 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. Length of basidia and cystidia was measured from the first septum to the apex of the cell, and sterigmata were not included. Width of basidia, cystidia and all other hyphae was measured at the widest portion of the cell. Measurements over 12µm have been rounded to the nearest whole micrometer.

In addition to my own collections, collections from the following herbaria were examined: Field Museum of Natural History, Chicago (F), Humboldt State University (HSC), Herbarium Universität Innsbruck (IB), University of Michigan (MICH), New York Botanical Garden (NY), New York State Museum (NYS). San Francisco State University (SFSU), and University of Toronto (TRTC). Unless otherwise noted, collections cited are deposited at San Francisco State University. The following is a list of abbreviations of the initials of specimen collectors cited in this study:

HEB - Howard. E. Bigelow

DED - Dennis E. Desjardin

DLL - Dave L. Largent

CLO - Clark L. Ovrebo

KMS - Kris M. Shanks

AHS - Alexander H. Smith

HDT - Harry D. Thiers

MGW - Mike G. Wood

TAXONOMICALLY INFORMATIVE CHARACTERS

Macromorphological characters:

PILEUS:

Shape and size:

Pileus shape in *Tricholoma* is variable, and for most species is not

taxonomically informative. The pileus ranges from convex to broadly convex, rarely obtusely conic at first, usually becoming plane to planoconvex at maturity. The pileus margin is usually inrolled at first and may become lobed and wavy in age. The margin in some species, such as *T. nictitans*, remains inrolled even at maturity. Some species are characterized by the presence of a prominent umbo, such as *T. virgatum*.

Pileus size may be a taxonomically informative character in two respects: as an indication of overall size, and as a component of stature. The pileus diameter often reflects the overall size of the sporocarp. *Tricholoma* species are often a characteristic size, although there is a great deal of overlap in the range of pileus size between species in different size classes. In general, *Tricholoma* species may be considered small, such as *T. psammopus* (pileus 13-40 mm broad), of medium size, such as *T. sejunctum* (pileus 35-75 mm broad) or large, such as *T. pardinum* (pileus 40-115 mm broad). The ratio of pileus diameter to stipe length is an indication of overall stature, and can be a useful character for distinguishing between species in the field. Species of *Tricholoma* often have a characteristic stature, which is most easily seen in the ratio of pileus diameter to stipe length. *Tricholoma nictitans*, for example, typically has a very long stipe (60-150 mm long) relative to pileus diameter (25-110 mm broad).

Pileus surface:

The pileus surface may be viscid or dry, and this is an important

taxonomic distinction. Care must be taken when assessing the nature of the pileus surface. Viscid species usually appear dry in dry weather, although they may still retain a characteristic shininess. Microscopic examination is the only certain method of determining whether the pileus is viscid or dry.

The pileus surface may be glabrous, radiating-fibrillose, squamulose or some combination of these character states. Some species, such as *T. saponaceum*, are always glabrous, although the pileus surface may crack in age, and some fibrils may be visible on the disc. When examined with a hand lens, the pileus of glabrous species is shown to be formed of tightly interwoven fibrils.

Most species of *Tricholoma* with a dry pileus are somewhat woolly-tomentose at first, and as the pileus expands, the fibrils of the pileus separate into more discrete fibrils and/or squamules which may be appressed or recurved or some combination of the two. The degree of scaliness and the amount of separation between the elements of the pileus surface at maturity are both taxonomically important characters. *Tricholoma pardinum*, for example, is characterized by the presence of widely spaced squamules on the pileus surface.

Species of *Tricholoma* with a viscid pileus are never squamulose, but are glabrous to appressed fibrillose. In these species, some appressed fibrils may be present over the disc, and the pileus is glabrous elsewhere, or the pileus may be innately radiating fibrillose overall, the fibrils visible as streaks of color in the otherwise smooth pileus surface.

Pileus color:

Pileus color is a very important character in *Tricholoma*. Generally, the pileus may be whitish, yellow, gray, or brown. Important features to note are changes in coloration with age and the variation of color on the pileus surface. In most species the pileus coloration is due to dark surface fibrils over a pale background coloration, and both the color of the surface fibrils and the underlying color are important.

The color and arrangement of the surface fibrils affects the overall coloration of the pileus, and the pileus is rarely uniformly colored. Species with a viscid pileus typically have a darker disc and very pale margins, with a gradual transition in color between the center and margin of the pileus. For example, *T. griseoviolaceum* has a violet gray disc and nearly white margin. Species with a more or less glabrous pileus may become darker as the sporocarp matures, and this development of color with age is characteristic of *T. dryophilum* and *T. manzanitae*. Both of these species are nearly white at first, or when buried in leaf litter, but rapidly develop brown coloration with exposure to light. In species with a dry fibrillose or squamulose pileus, such as *T. moseri*, young buttons are typically darkly colored, and as the pileus expands and the fibrils are separated the coloration appears paler. Some species such as *T. virgatum* and *T. sejunctum* are characterized by a virgate pileus surface in which the pileus has long radiating fibrils of a darker color than the background fibrils.

Pileus context:

The thickness of the pileus context typically varies with the overall size of the pileus, and is not a taxonomically valuable character for most species, although some species such as *T. sejunctum* are characteristically thin fleshed, and *T. magnivelare* has a thick pileus context relative to its size. Most species of *Tricholoma* have a white or pale gray context, but *T. atroviolaceum* has a sordid gray context that stains dull reddish when cut. In species with yellow coloration, such as *T. flavovirens*, the pileus context near the surface may also be yellow.

The taste and odor of the context is very important in *Tricholoma*, and can be used to distinguish between macromorphologically similar species in the field. Species of *Tricholoma* may have a mild, farinaceous, bitter or acrid taste. Section *Tricholoma* Stirps *Virgatum* is defined as having an acrid or bitter taste in combination with other characters. Taste is particularly important in Section *Genuina*, Stirps *Pessundatum*. Species in this Stirps have few distinctive macromorphological features, and taste is often a valuable distinction between species. For example, *T. ustale* and *T. dryophilum* both occur under oaks in California, and are difficult to distinguish when mature, but *T. ustale* has a strongly bitter taste, and *T. dryophilum* has a farinaceous taste.

Odors in *Tricholoma* are more difficult to characterize, but when present may be farinaceous, cucumbery, spicy or like cinnamon, or like coal tar. *Tricholoma saponaceum* is characterized by an odor traditionally described as

soapy, which is both sharp and rancid.

LAMELLAE:

Tricholoma is defined in part by the possession of sinuate lamellae, but the lamellae may in fact be adnate, particularly as young buttons, or sinuate with a subdecurrent tooth. Most species of *Tricholoma* have thin, close lamellae. A few species, such as *T. atroviolaceum*, have consistently thicker lamellae, but in general the overall aspect of the lamellae does not provide any taxonomically informative characters.

The color of the lamellae, however, is very important. The variation in color parallels the pileus color, and species of *Tricholoma* may have white or whitish, yellow or pale gray lamellae. The color of mature lamellae and any discolorations which occur during development are also useful taxonomic characters. Species in Section *Genuina* typically have whitish to cream or pale yellow lamellae that discolor brown in spots or become marginate in age. Species in Section *Tricholoma* Stirps *Flavovirens* are differentiated in part on the basis of lamellae color. For example, *T. flavovirens* and *T. intermedium* differ only in the lack of yellow coloration in the lamellae and stipe of *T. intermedium*.

STIPE:

Size and shape:

Size of the stipe varies with overall sporocarp size, and thus is by itself

not a taxonomically informative character, but as discussed in the section on pileus size, the ratio of stipe length to pileus width is a taxonomically useful character as it gives some indication of overall stature. Most species of *Tricholoma* have a more or less equal stipe, but the stipe may be slightly clavate or obclavate. Although most species have a rounded stipe base, or slightly bulbous base, a few species, such as *T. saponaceum*, are characterized by the presence of a pointed or subradicating stipe base.

Stipe surface:

The stipe surface of most *Tricholoma* species is dry, even in species with a viscid pileus. The stipe is either silky fibrillose or appressed-fibrillose, but some species are characterized by the presence of recurved belts of fibrils (*T. aurantium*), or possess appressed to slightly recurved squamules on the stipe (*T. caligatum*). The stipe apex is commonly pruinose, and this is often correlated with the presence of caulocystidia.

As is the case with the pileus and lamellae, the color of the stipe is an important taxonomic feature. Species in Section *Genuina* commonly have the stipe concolorous with the lamellae at first, at least at the apex, and the stipe darkens with age and handling from the base upwards. Other species of *Tricholoma* have white to pale gray stipes, or in Section *Tricholoma* Stirps *Flavovirens*, some yellow coloration may be present.

Stipe context:

The stipe context may be solid or hollow, and the presence of a hollow stipe from early in development can be a taxonomically informative character. *Tricholoma nictitans* and *T. vaccinum* commonly have hollow stipes. The color of the stipe context, particularly at the base of the stipe is also useful in identification of *Tricholoma* species. *Tricholoma saponaceum* is most easily recognized by the pink to orange coloration of the stipe base.

PARTIAL VEIL:

Universal veils are absent in *Tricholoma*, but a partial veil may be present. These can be membranous, and leave a persistent membranous annulus (*T. magnivelare*), or the partial veil may be a cortina. Cortinate veils in *Tricholoma* are rapidly evanescent, and while they are a very important taxonomic character, young buttons must be examined to determine the presence of a partial veil. The veil may leave remnants of fibrils on the stipe, and the color of the fibrils is a useful feature. For example, in *T. myomyces* the cortina leaves blackish fibrils on the stipe, but in *T. scalpturatum* the cortina fibrils are white. The fibrils of the veil may also remain on the pileus margin for a brief time, forming a very faint appendiculate margin in young specimens (*T. vaccinum*). However, care must be taken when assessing the presence or absence of a partial veil from mature specimens. *Tricholoma moseri*, which lacks a partial veil, has a cottony network of white fibrils on the pileus margin, that may be mistaken for remnants of a partial veil unless young buttons are examined.

Tricholoma fracticum is a species with a more or less glutinous partial veil, that leaves a distinct annular zone on the stipe. This annular zone can be obscured in age as the stipe apex discolors, but the presence of a distinct annular zone should not be confused with other species in sect *Genuina* which commonly have a pale stipe apex without a clear demarcation of color between the apex and the remainder of the stipe.

MACROCHEMICAL REACTIONS:

Macrochemical tests have some utility in *Tricholoma*. Section *Tricholoma* Stirps *Virgatum* is characterized by a pink PDAB reaction of the lamellae and stipe. $FeSO_4$ and formalin have been used by Smith (1979) and Singer (1986) respectively as taxonomic characters, but a more comprehensive investigation of macrochemical reactions needs to be conducted before their true utility as taxonomic characters in *Tricholoma* can be determined.

Micromorphological characters:

BASIDIOSPORES:

Basidiospores of *Tricholoma* species are uniformly smooth, even under SEM (Pegler et. al., 1971). Spores are hyaline and inamyloid, although occasional spores within a collections of species in Subgenus *Sericeicutis* may be dextrinoid. Spore shape within the genus varies from narrowly elliptic to broadly elliptic or subglobose, but never truly globose, or rarely amygdaliform,

and are typically the same shape in face and profile views. Spore length within *Tricholoma* ranges from approximately 5-12 µm. Spore size and shape is generally consistent within a species, and can be very useful in distinguishing related species. *Tricholoma moseri*, for example, is easily distinguished from macromorphologically similar species on the basis of spore size.

BASIDIA:

Basidia of *Tricholoma* are narrowly clavate to clavate. The size varies consistently with spore size, and is thus not a very useful taxonomic character. Most species have 4-spored basidia, but varieties with consistently 2-spored basidia have been described. *Tricholoma atroviolaceum* seems to show a greater variation in number of sterigmata than is common in *Tricholoma*; although the majority of basidia have 4 sterigmata, basidia with 2 or even one sterigmata are not uncommon. The basidia are typically hyaline, but in species in which the lamellae discolor, basidia and basidioles may be seen with brown refractive contents, or may develop thick dark walls.

HYMENIAL CYSTIDIA:

Cheilocystidia are not uncommon in species of *Tricholoma*, particularly in species with gray or yellow pilei (Section *Tricholoma*). Cheilocystidia are defined as morphologically distinctive sterile cells present in the hymenium at the margin of the lamellae. They are typically hyaline, or more rarely fuscous, smooth, thin- or slightly thick-walled. They are often easily collapsing, and may

be filiform, cylindric, clavate, ventricose, sphaeropedunculate or saccate. Metuloid type cystidia are consistently absent in *Tricholoma*.

There is often a great deal of variation in size and shape within a species and overlap in shape and size of cheilocystidia between species, but the presence or absence of cheilocystidia, and more rarely the size and shape of the cystidia, are very useful taxonomic characters. Unfortunately, the lamellar margin is not always sterile when cheilocystidia are present, and the cystidia may be scattered or collapsed, making identification difficult. There can also be some variation within species as to the distribution of cheilocystidia. *Tricholoma virgatum*, for example, always has abundant and prominent cheilocystidia, while collections of *T. sejunctum* vary from lacking cheilocystidia altogether to possessing abundant cheilocystidia. Variation in the abundance of cheilocystidia is particularly common in species of Section *Tricholoma*, Stirps *Flavovirens*.

Very few species of *Tricholoma* are known to possess pleurocystidia. When they are present, they are usually very similar in size and shape to the cheilocystidia. *Tricholoma luteomaculosum* and *T. tumidum* have scattered saccate pleurocystidia.

PILIEPELLIS:

The size, shape, arrangement and pigmentation of the pileipellis hyphae are important taxonomic features. The arrangement of the pileipellis hyphae often reflects the macromorphological features of the pileus surface. If the

pileus is glabrous, the pileipellis hyphae are interwoven, and do not form a layer distinct from the pileus trama. A radially-fibrillose pileus has the pileipellis hyphae arranged more or less parallel to the pileus surface, and if the pileus is recurved fibrillose or squamulose the pileipellis hyphae form recurved fascicles. Species with a viscid pileus have the pileipellis hyphae arranged in a gelatinous matrix, forming an ixocutis or more rarely an ixotrichodermium. A truly dry pileus lacks any gelatinization of the pileipellis hyphae. This is the best means of distinguishing whether a sporocarp has a viscid or a dry pileus.

Species possessing an ixocutis or ixotrichodermium typically have a pileipellis composed of two discrete layers of tissue. The epicutis is the surface layer in which the hyphae are loosely interwoven in a gelatinous matrix. The subcutis is the tissue immediately beneath the epicutis, and typically consists of more strongly pigmented or encrusted cells which are not as gelatinized and are more parallel in orientation.

Some species have an additional tissue layer beneath the subcutis called the hypodermium. A pseudoparenchymatous hypodermium is a layer of highly inflated to nearly isodiametric cells. This feature is taxonomically very important, and appears to have arisen independently in several unrelated groups. Stirps *Luteomaculosum* and Stirps *Terreum* in Section *Tricholoma* are defined as possessing a pseudoparenchymatous hypodermium.

The location of pigment in the pileipellis is a useful taxonomic character, particularly in Section *Genuina*. The pigment may be intracellular, or extracellular as a pigmented encrustation on the pileipellis hyphae. Some

extracellular pigments dissolve in KOH, but are observable in H_2O. *Tricholoma nictitans* has strongly encrusted hyphae which appear pale brown or hyaline in KOH, but are dark reddish brown in H_2O. The intracellular yellow pigments found in *T. flavovirens* and *T. intermedium* turn violet brown in KOH in herbarium specimens. Both intra and extracellular pigment may be present in a species, but the distribution of the pigments and relative proportions can be taxonomically informative.

Encrustations of the pileipellis hyphae may be pigmented or hyaline. The distribution of the encrustations and the type of encrustation are taxonomically useful characters. Fine encrustations are small and irregular, so that the hypha appears as if it was rolled in granulated sugar (see fig. 44). Rough encrustations are similar, but are typically larger and more irregular. Both types of encrustations may be hyaline or pigmented. Flare-like encrustations are extremely thick (up to 2 µm thick), localized, and hyaline (see fig. 2). Flare-like encrustations are typical of species in Section *Tricholoma* Stirps *Flavovirens*. Plaque-like encrustations are typically pigmented, and appear as thick sheets of encrustations over the surface of the hyphae, giving the hyphae a thick-walled appearance. These encrustations may break up slightly, revealing the thin, hyaline cell wall beneath. Plaque-like encrustations are typically found in the subcutis or on the cells of the pseudoparenchymatous hypodermium. Scalariform or zebroid encrustations are characteristic of some species in Section *Genuina*, notably *T. nictitans* and *T. muricatum* (see fig. 41).

LAMELLAR TRAMA:

Tricholoma is defined as having parallel arrangement of the lamellar trama hyphae. The hyphae are typically hyaline, smooth and are cylindric in the subhymenium, cylindric to inflated elsewhere. Although there is some variation in the width of the hyphae, the morphology of the lamellar trama is not generally taxonomically informative for *Tricholoma.*

STIPE SURFACE AND TRAMA:

Hyphae of the stipe trama are consistently hyaline and smooth, although irregularly thickened walls are often present. The hyphae are tightly parallel, and are cylindric near the surface, cylindric to inflated elsewhere. The hyphae of the stipe surface are often without distinctive features, although they may be more interwoven than the hyphae of the stipe trama. In species with strong pigmentation of the stipe, the hyphae usually have pigmented contents or encrustations. *Tricholoma ustaloides*, known from Europe, has hyphae of the stipitipellis arranged in a gelatinous matrix, but related species in California lack gelatinized stipitipellis hyphae.

CAULOCYSTIDIA:

Caulocystidia are present at the stipe apex in most species of *Tricholoma*, and are correlated with a pruinose stipe. Caulocystidia in *Tricholoma* typically consist of recurved hyphal tips in clusters or solitary, and are rarely strongly differentiated from the hyphae of the stipitipellis. They are

easily lost by careless handling of the stipe during collecting, and are not usually distinguishable on older sporocarps. Caulocystidia can be taxonomically informative in Section *Genuina*, and usually confirm macroscopic features of the stipe apex. For example, *T. psammopus* has caulocystidia with bright orange contents, and *T. manzanitae* has unusually long caulocystidia that correspond to the strongly pruinose stipe apex of that species.

CLAMP CONNECTIONS:

Clamp connections are one of the features used to distinguish between subgenera of *Tricholoma*. Species of Subgenus *Tricholoma* lack clamp connections entirely. In Subgenus *Contextocutis* and Subgenus *Pardinicutis* , clamps are present throughout the sporocarp. Species of Subgenus *Sericeicutis* have clamp connections present only at the base of the basidia.

KEY TO GENERA OF AGARICS WITH A PALE SPORE PRINT AND TRICHOLOMATOID STATURE

1a. Pileipellis cellular or a hymenoderm ..... *Dermoloma*

1b. Pileipellis a cutis or trichoderm 2

2a. Basidia forming carminophilous granules 3

2b. Basidia not forming carminophilous granules 4

3a. Pileus and lamellae generally dull colored (gray, fuscous, umber); pigments encrusting ..... *Lyophyllum*

3b. Pileus and lamellae white or brightly colored (reddish, violaceous brown, orange, pink, etc.); pigments intracellular, not encrusting ..... *Calocybe*

4a. Spores amyloid or with amyloid warts 5

4b. Spores inamyloid or dextrinoid 8

5a. Annulus present ..... *Floccularia*

5b. Annulus absent 6

6a. Clamp connections absent; spores warted ..... *Melanoleuca*

6b. Clamp connections present; spores warted or smooth 7

7a. Pigments intracellular; cheilocystidia absent; spores warted or smooth; pileus smooth ..... *Leucopaxillus*

7b. Pigments encrusting; cheilocystidia usually present; spores smooth; pileus innately fibrillose to squamulose ..... *Porpoloma*

8a. Spores cross-shaped ..... *Tricholosporum*

8b. Spores globose to elliptic 9

9a. Spore print pink to cinnamon 10

9b. Spore print white to cream 13

10a. Spores punctate to echinulate, not dextrinoid 11

10b. Spores smooth, some spores in a collection dextrinoid and cyanophilic .. .. *Collybia* Subgenus *Rhodocollybia*

11a. Spores acyanophilic, lamellae appearing thick and waxy ..... *Laccaria*

11b. Spores or spore ornamentation cyanophilic; lamellae not thick and waxy 12

12a. Spores angular in end view, undulate and pustulate; spore wall evenly cyanophilic ..... *Rhodocybe*

12b. Spores round in end view, punctate to finely warted; spore ornamentation only cyanophilic ..... *Lepista*

13a. Growing caespitose on wood; black rhizomorphs present; annulus .....

typically present ..... *Armillaria*

13b. Not on wood, or if on wood then lacking black rhizomorphs 14

14a. Spores warted 15

14b. Spores smooth 16

15a. Pileus fibrous-squamulose at maturity; lamellae thick and waxy . *Laccaria*

15b. Pileus glabrous, canescent or fibrillose; lamellae not thick and waxy .....

..... *Clitocybe*

16a. Growing on wood; cheilocystidia abundant, saccate; pileus with surface

fibrils or squamules often differently colored than the background .....

..... *Tricholomopsis*

16b. Not growing on wood, or if on wood pileus surface glabrous; cheilocystidia

variable 17

17a. Lamellae decurrent to subdecurrent; pileus often depressed or umbilicate.

..... *Clitocybe*

17b. Lamellae adnate, sinuate or adnexed, pileus convex 18

18a. Hyphae of lamellar trama divergent ..... *Megatricholoma*

18b. Hyphae of lamellar trama parallel 19

19a. Lamellae sinuate at maturity, but may be adnate at first; pileus surface typically appressed-fibrillose to squamulose, never hygrophanous; stipe fleshy, not fibrous, rarely hollow ..... *Tricholoma*

19b. Lamellae adnate to adnexed; pileus surface glabrous, often hygrophanous; stipe tough and fibrous, usually hollow at maturity ..... *Collybia*

KEY TO SUBGENERA OF *TRICHOLOMA*

1a. Clamp connections present throughout sporocarp or only at the base of the basidia; pileus dry 2

1b. Clamp connections absent; pileus viscid or dry .....
..... Subgenus *Tricholoma* (Key B)

2a. Pileus surface radiating-fibrillose to squamulose; pileipellis hyphae not interwoven ..... Subgenus *Pardinicutis*, Section *Pardinicutis* (Key D)

2b. Pileus surface glabrous, rarely with scattered fibrils; pileipellis hyphae interwoven 3

3a. Odor of coal tar; pileus surface sericieus .....
..... Subgenus *Sericeicutis*, Section *Sericeicutis* (Key A)

3b. Odor farinaceous or soapy, not of coal tar; pileus surface glabrous .....

. . . . . Subgenus *Contextocutis*, Section *Contextocutis* (Key C)

KEY A: Subgenus *Sericeicutis* Section *Sericeicutis*

1a. Sporocarp pale yellow; pileus with pinkish tan colors over the disc. . . . . *T. sulphureum*

1b. Sporocarp white, pale buff or tan . . . . . *T. inamoenum*

KEY B: Subgenus *Tricholoma*

1a. Pileus reddish or rusty brown; lamellae usually discoloring brown or developing brown spots . . . . . Section *Genuina* 2

1b. Pileus not reddish or rusty brown, but may be olive brown or brownish gray or brown present as a wash over another color; lamellae not spotting brown . . . . . Section *Tricholoma* 17

Key to Section *Genuina*

2a. Pileus surface dry 3

2a. Pileus surface viscid 8

3a. Membranous annulus present 4

3b. Membranous annulus absent 6

4a. Pileus appressed-fibrillose, brownish orange with olive or yellow tones; odor absent or farinaceous ..... *T. focale*

4b. Pileus with appressed floccules or scales; odor fragrant, like cinnamon .. 5

5a. Pileus pale buff to buff with scattered darker fibrils or scales .... *T. magnivelare*

5b. Pileus with cinnamon brown to dark blackish brown appressed squamulose over a ochraceous background ..... *T. caligatum*

6a. Pileus 1-3.5 cm diam., appressed-fibrillose, the disc of young specimens golden yellow to rusty orange, dulling in age to yellowish brown .... *T. psammopus*

6b. Pileus larger, dark dull brown to rusty red brown 7

7a. Pileus surface mostly squamulose or scaly to rimose-areolate, rusty brown, rusty tan or cinnamon; stipe usually hollow; veil present as a cortina, occasionally leaving remnants on the pileus margin ..... *T. vaccinum*

7b. Pileus appressed-fibrillose to recurved squamulose, dull brown or chestnut brown), lighter when young; stipe solid; veil absent ..... *T. imbricatum*

8a. Pileus white or whitish when young, developing brown coloration in age in irregular spots and patches 9

8b. Pileus uniformly brown, orange or tan 10

9a. Pileus whitish with rusty brown stains; stipe white at apex; taste and odor farinaceous; associated with *Quercus* ..... *T. dryophilum*

9b. Pileus white when young, becoming pale orange to brownish orange to brown in age; stipe pale yellow at apex; taste and odor not distinctive; associated with *Arctostaphylos* ..... *T. manzanitae*

10a. Pileus bright orange brown, stipe with belts of orange fibrils . . *T. aurantium*

10b. Pileus red-brown or nut brown, or if orange brown then stipe smooth . . . 11

11a. Stipe with a fugaceous annulus or clearly defined annular zone; taste bitter; basidia 2 spored or 4 spored ..... *T. fracticum*

11b. Stipe lacking a clearly defined annular zone; taste absent, farinaceous or bitter; basidia 4 spored 12

12a. Pileus pale brown or somewhat rosy; associated with *Populus.* . . . . *T. populinum*

12b. Pileus dark red brown or orange brown; associated with other trees . . . 13

13a. Growing with hardwoods; pileipellis hyphae smooth or with few fine hyaline encrustations 14

13b. Growing with conifers; pileipellis hyphae strongly encrusted or smooth . 15

14a. Taste farinaceous; pileus whitish at first; filiform cheilocystidia present . . . . . *T. dryophilum*

14b. Taste bitter; pileus brown from the first; cheilocystidia absent . . . . *T. ustale*

15a. Pileipellis hyphae mostly hyaline, but apical cells may have refractive contents; encrustations when present not zebroid . . . . . *T. ustale*

15b. Pileipellis hyphae strongly pigmented, with brown refractive contents; pigmented zebroid encrustations visible in H_2O 16

16a. Pileus diameter less than stipe length; lamellae pale yellow or buff; spores 5.8-7.7 x 3.8-5.3 µm . . . . . *T. nictitans*

16b. Pileus diameter usually greater than stipe length; lamellae orange white; spores 4.8-6.7 x 2.9-3.8 µm . . . . . *T. muricatum*

Key to Section *Tricholoma*

17a. Sporocarp with some yellow coloration; pileus surface viscid . . . . . Stirps *Flavovirens* 18

17b. Sporocarp lacking yellow coloration on any part; pileus surface viscid or dry 22

18a. Pileus with gray or fuscous colors; lamellae and stipe whitish with some

yellow coloration ..... *T. portentosum*

18b. Pileus pale yellow to sulfur yellow, or greenish yellow, sometimes with brown or tan colors at center; lamellae and stipe yellow or dry 19

19a. Pileus yellow to yellow green, darker at center, virgate with dark fibrils ... . *T. sejunctum*

19b. Pileus yellow to yellowish brown on the disc, pale yellow elsewhere, not virgate 20

20a. Stipe and lamellae lemon yellow; cheilocystidia absent .... *T. flavovirens*

20b. Stipe and lamellae more or less white; cheilocystidia present or absent 21

21a. Spores 5.3-7.2 x 3.3-4.3 µm ..... *T. intermedium* var. *intermedium*

21b. Spores 6.2-9.6 x 3.3-5.8 µm ..... *T. intermedium* var. *macrosporum*

22a. Stipe with minute appressed blackish fibrils and squamules; pileus blackish ..... *T. atrosquamosum*

22b. Stipe silky-fibrillose; pileus color variable 23

23a. Pileus less than 70 mm broad, dry; cortina like veil present or absent, if present sometimes leaving veil remnants on stipe or pileus margin 24

23b. Pileus typically greater than 70mm, dry or viscid; cortina absent 28

24a. Pseudoparenchymatous hypodermium absent ... Stirps *Scalpturatum* 25

24b. Pseudoparenchymatous hypodermium present ..... Stirps *Myomyces* 27

25a. Partial veil present, forming cottony annulus at maturity, with *Salix* .....
..... *T. cingulatum*

25b. Partial veil present or absent, persistent annulus absent, with conifers . 27

26a. Occurring in the fall; spores 5.2-6.7 x 3.3-3.8 µm; partial veil present; lamellae pale gray when young, white when mature, discoloring yellow .....
..... *T. scalpturatum*

26b. Occurring in the spring; spores 7.2-10.6 x 3.8-5.8 µm; partial veil absent; lamellae pale gray to gray when mature ..... *T. moseri*

27a. Cheilocystidia absent ..... *T. myomyces* var. *myomyces*

27b. Cheilocystidia present ..... *T. myomyces* var. *tephrocystus*

28a. Taste acrid or bitter; PDAB bright pink on stipe; pileus silvery gray, virgate
..... *T. virgatum*

28b. Taste absent or farinaceous; PDAB not pink; pileus not as above 29

29a. Pseudoparenchymatous hypodermium present .....
..... Stirps *Luteomaculosum* 30

29b. Pseudoparenchymatous hypodermium absent 32

30a. Pileus viscid, often radially rugulose; odor strongly cucumbery .. *T. smithii*

30b. Pileus dry; odor absent to farinaceous 31

31a. Pileus squamulose, blackish violet gray; context sordid brownish gray; lamellae drab to grayish cinnamon; hymenial cystidia absent . *T. atroviolaceum*

31b. Pileus fibrillose to squamulose, fuscous, occasionally discoloring yellowish; context and lamellae light buff to light gray; hyaline or fuscous pleuro- and cheilocystidia present ..... *T. luteomaculosum*

32a. Pileus viscid, dark violet gray; associated with hardwoods .....
..... *T. griseoviolaceum*

32b. Pileus dry, blackish to brownish gray; associated with conifers .. *T. moseri*

Key C: Subgenus *Contextocutis,* Section *Contextocutis*

1a. Membranous annulus present, but may be appressed to stipe; context of stipe base whitish; pileus white when young, becoming fuscous to brown, often with gray or olive tones; odor strongly cucumbery ..... *T. olidum*

1b. Membranous annulus absent; context of stipe base pinkish; pileus not white when young, but color variable: copper red, gray green, brownish gray, or waxy yellow gray; odor distinctive, sharp or somewhat rancid ..... *T. saponaceum*

Key D: Subgenus *Pardinicutis*, Section *Pardinicutis*

1a. Pileus appressed-radiating-fibrillose, yellow brown ..... *T. tumidum*

1b. Pileus squamulose, whitish to dark gray 2

2a. Cheilocystidia absent; pileus light buff to tan ..... *T. venenatum*

2b. Cheilocystidia present; pileus light to dark brownish gray ..... *T. pardinum*

SPECIES DESCRIPTIONS

Tricholoma (Fr.) Staude, Die Schwamme Middledeutsch. 125. 1858.

≡*Cortinellus* Roze, Bull. Soc. Bot. Fr. 23: 51. 1876.

≡*Gyrophila* Quélet, Enchir. 9. 1886.

≡*Glutinaster* Earle, Bull. New York Bot. Gard. 5: 433. 1909.

≡*Monomyces* Batt. ex Earle, Bull. New York Bot. Gard. 5: 442. 1909.

≡*Sphaerocephalus* Batt. ex Earle, Bull. New York Bot. Gard. 5: 447. 1909.

Type species: *Agaricus flavovirens* Fries, Syst. Mycol. 1: 41. 1821.

Pileus 20-150 mm broad, obtusely conic, convex or broadly convex, at first, becoming convex, broadly convex, or plano-convex at maturity, the margins down-turned or inrolled at first, often becoming lobed or wavy in age; surface dry, moist or viscid; glabrous, radiating-fibrillose, or squamulose; color uniform, or more commonly darker at the disc and fading towards the margins, but not hygrophanous, occasionally virgate, whitish, yellow, gray, fuscous, orange brown, or reddish brown; context white, buff or pale gray, occasionally discoloring, taste and odor not distinguishable, bitter, acrid, farinaceous, spicy or cucumbery. **Lamellae** sinuate, but may be adnate when young, white, buff, yellow, or gray, often discoloring fuscous, reddish brown, or pinkish. **Stipe** 20-140 x 5-35 mm, equal, clavate, or ventricose, base rounded, tapered, enlarged or subradicating; surface dry or rarely viscid, silky fibrillose or appressed- to

recurved-fibrillose, the apex often pruinose, white, buff, yellow, gray or reddish brown, discoloring like lamellae; context solid or hollow. **Partial veil** present or absent, if present then membranous and leaving a persistent annulus, or cortinate and leaving fibrils on the stipe apex or pileus margin.

Basidiospores 5-12 x 3-7 µm, subglobose, broadly elliptic, elliptic, narrowly elliptic, or rarely amygdaliform, hyaline, smooth, thin-walled, inamyloid, rarely isolated spores dextrinoid. **Basidia** clavate, 4 spored, rarely 2 spored, hyaline or rarely fuscous or with reddish brown contents. **Cheilocystidia** present or absent; filiform, cylindric, clavate, ventricose, sphaeropedunculate or saccate, hyaline or fuscous, smooth, thin-walled. **Pleurocystidia** uncommon, when present similar to cheilocystidia. **Pileipellis** a cutis, ixocutis or rarely an ixotrichodermium; hyphae cylindric to somewhat inflated, interwoven, or parallel and then often forming recurved fascicles, hyaline, yellow brown, reddish brown or fuscous, pigment intra- or extracellular, encrustations present or absent. **Pileus trama** hyphae parallel to interwoven, cylindric to inflated, hyaline, smooth. **Lamellar trama** hyphae cylindric to inflated, parallel, hyaline, smooth. **Stipe trama** hyphae parallel, cylindric to inflated, hyaline, smooth. **Stipe surface** hyphae cylindric to somewhat inflated, parallel to interwoven, hyaline, fuscous or brown, smooth or encrusted. **Caulocystidia** usually present at the stipe apex as recurved hyphal tips, cylindric, clavate or ventricose, solitary, in clusters or as a turf, hyaline, fuscous or brown, smooth or encrusted. **Clamp connections** present or absent.

Subgenus *Tricholoma* Section *Tricholoma*

Type species: *Tricholoma flavovirens* (Fries) Lundell

Pileus viscid or dry, glabrous, appressed-fibrillose, or squamulose; yellow, yellow brown, olive or some shade of gray, but never reddish brown or orange. **Lamellae** white, yellow or pale gray, occasionally discoloring yellow, pale gray or fuscous, but never discoloring brown. **Partial veil** a cortina when present.

Pileipellis a cutis, the hyphae more or less parallel and usually forming recurved fascicle, or pileipellis an ixocutis, the hyphae interwoven in a gelatinous matrix. **Hymenial cystidia** often present. **Clamp connections** absent.

Stirps *Flavovirens*

Pileus viscid, glabrous or radiating-fibrillose, usually with some yellow coloration. **Lamellae** and stipe yellow or white, occasionally discoloring gray or pinkish. **Partial veil** absent. **Pileipellis** an ixocutis, hyphae usually with flare-like encrustations, pseudoparenchymatous hypodermium absent.

Tricholoma flavovirens (Fries) Lundell, in Lundell & Nannfeldt, Fungi exsiccati Suecici, fasc. 23, n. 1102. 1942

≡ *Agaricus flavovirens* Fries, Syst. Mycol. 1: 41. 1821.

= *Agaricus equestre* Fries, Elench. Fung. 1: 6. 1828.

≡*Tricholoma equestre* (Fr.) Staude, Pilze Mittdeutschl. 18: 25.1857.

≡ *Gyrophila equestris* (Fr.) Quélet, Enchir. Fung. p.10. 1886.

≡ *Melanoleuca equestris* (Fr.) Murrill, North Amer. Flora 10: 24. 1914.

= *Melanoleuca yatesii* Murrill, North Amer. Fl. 10: 29. 1914.

≡ *Tricholoma yatesii* (Murr.) Murrill, Mycologia 6: 269. 1914.

Illustrations: Figures 1-2.

Pileus 33-110 mm broad; convex to broadly convex, margin down-turned when young, broadly convex to nearly plane in age, a low broad umbo often present, margin becoming uplifted and wavy in age; surface viscid, appressed radiating fibrillose to minutely squamulose over the disc, glabrous elsewhere; golden yellow (3B4) to pale yellow (2A4) overall, or disc yellowish brown (5E5-D7) when young, becoming yellowish brown to brown overall in age from brown fibrils over a yellow background color; context white, pale yellow near pileus surface; taste and odor not distinctive to mildly farinaceous. **Lamellae** sinuate to strongly notched, 4-10 mm broad, thin, close, pale yellow to yellow (2A4-7). **Stipe** 20-105 x 8-20 mm; equal or with a slightly bulbous base; surface dry, innately fibrillose, white to pale yellow (2A4) at apex, pale yellow to yellow (2A4-7) elsewhere, surface fibrils darkening to pale yellow brown in age; context white, fibrous, solid or hollow in age.

Basidiospores 4.8-8.6 x 3.4-5.8 µm ($\bar{x}$ = 6.8 ± 0.73 x 4.7 ± 0.55 µm; E =

1.1-2.0; Q = 1.5 ± 0.13; n = 194/11 collections); elliptic to broadly elliptic in profile, narrowly elliptic to elliptic in face view; hyaline, smooth, inamyloid. **Basidia** 31.2-43.2 x 7.2-9.6 µm, clavate, 4 spored, rarely 2 spored; hyaline or occasionally with granular brown contents. **Hymenial cystidia** absent; **Pileipellis** an ixocutis; epicutis hyphae 2.0-5.0 µm diam., cylindric or collapsed, interwoven to subparallel in a gelatinous matrix, hyaline, some apical cells with golden brown refractive contents that in herbarium specimens are pinkish brown when mounted in KOH, mostly smooth or with granular or more rarely, flare-like hyaline encrustations; subcutis hyphae 2.4-12.0 µm diam., cylindric to slightly inflated, mostly parallel, intergrading into context hyphae, hyaline to pale yellow en masse, smooth, or more commonly with granular to flare-like hyaline encrustations, or plaque-like yellow brown encrustations. **Pileus trama** hyphae 2.4-19.2 µm diam., cylindric to inflated, loosely interwoven to subparallel, hyaline, smooth. **Lamellar trama** hyphae 2.4-24.0 µm diam., cylindric to inflated, hyaline, smooth. **Stipe trama** hyphae 2.4-19.2 µm diam., cylindric to somewhat inflated, parallel, hyaline or with refractive yellow brown contents near the stipe surface, smooth, or with irregularly thickened walls. **Caulocystidia** 28.8-48.0 x 3.36-4.8 µm, present as recurved hyphal tips, solitary or in pyramidal clusters, cylindric to flexuous or slightly clavate, hyaline or with refractive yellow to yellow brown contents. **Clamp connections** absent.

Scattered to gregarious, occasionally caespitose, associated with conifers, or rarely hardwoods from September to January in coastal forests and

the Sierra Nevada.

Collections examined:

CALIFORNIA. Amador Co: Silver Lake, 3 Oct. 1976, HDT 36579; **Contra Costa Co:** University of California Berkeley campus, Berkeley, H. S. Yates 8 (HOLOTYPE *Melanoleuca yatesii* Murrill, NYS); **El Dorado Co:** near Kyburg, 4 Oct. 1975, Saylor G16; Luther Pass, 3 Oct. 1976, HDT 36556; **Humboldt Co:** Patrick's Point State Park, 2 Nov. 1965, HDT 13978; Lanphore property, Arcata, 22 Oct. 1968, DLL 3715A (HSC); **Marin Co:** Audobon Canyon Ranch, 6 Dec. 1981, Calhoun 81-2800; Marin Municipal Watershed District, Bon Tempe Lake, 27 Dec. 1984, HDT 48477; Marin Municipal Watershed District, Rock Springs Trail, 3 January 1992, KMS 209; **Mariposa Co:** Holtzeil Rd., Greeley Hill, 30 Nov. 1975, Halling 175; **Mendocino Co:** Jackson State Forest, 19 Nov. 1960, HDT 8305; 2 Dec. 1961, Peters 719; 2 Dec. 1961, HDT 9031; 9 Dec. 1961, Jensen 94; 9 Dec 1961 HDT 9081; 3 Nov. 1962, HDT 9365; 1 Dec. 1962, HDT 9638; 30 Jan. 1965, HDT 12099;11 Nov. 1965, HDT 14146; 20 Nov. 1965, Breckon 270;19 Dec. 1965, HDT 14662; 19 Jan. 1966, HDT 14707; 4 Dec. 1966, HDT 17896; 20 Dec. 1966, HDT 18113; 8 Jan. 1967, HDT 18394; 9 Dec. 1967, HDT 21795; Hwy 128, near Navarro, 9 Nov. 1968, HDT 23068; Jackson State Forest,11 Nov. 1969, HDT 24226; 5 Nov. 1972, HDT 30455; 21 Nov. 1981, HDT 44035; 30 Dec. 1984, HDT 48524; Hendy Woods State Park, 8 January 1992, KMS 212; Jackson State Forest, Rd. 409, 13 Nov. 1992, KMS 274; KMS 275; Van Damme State Park, Pygmy Forest parking lot,

13 Nov. 1992, KMS 276; 21 Nov. 1992, KMS 290; **Mono Co:** Inyo National Forest, Mammoth Mountain, 11 Sept. 1967, HDT 20999; **Placer Co:** 3 mi s of Tahoe City, 24 Sept. 1982, Calhoun; **San Francisco Co:** San Francisco Golf Course, 25 Jan 1965, HDT 12090; Parkmerced, 13 Jan. 1974, HDT 32157; San Francisco State University campus, 28 Dec. 1983, HDT 47228; **San Mateo Co:** San Francisco Watershed, 30 Dec. 1968, Keller 265; **Santa Barbara Co:** Lake Cachuma, 5 Jan. 1983, HDT 45671; Los Padres National Forest, Figeroa Campground, 6 Feb. 1988, HDT 51553; 31 Jan. 1993, KMS 370; **Santa Cruz Co:** Felton, 18 Jan. 1967, HDT 18546; Boulder Creek, 30 Dec. 1970, HDT 27060; **Sierra Co:** Hwy. 49, Yuba Pass, 22 Sept.1965, HDT 13241; 29 Sept. 1967, HDT 21133; 17 Sept. 1969, HDT 23973; 9 Aug. 1974, HDT 32910; Hwy 49, Chapman Creek Campground, 21 Sept. 1980, HDT 41537; 23 Sept. 1982, HDT 44981; Sand Pond Picnic Area, 22 Nov. 1988, Dan Kelly 139; **Siskiyou Co:** Mt. Shasta, 4 Sept. 1976, HDT 39292; **Sonoma Co:** Salt Point State Park, 25 Nov. 1972, HDT 30752; **Tehama Co:** Mineral, 29 Sept. 1975, Showers 2902; **Tuolumne Co:** Moccasin Creek Recreation Area, Don Pedro Lake, 27 Jan. 1979, HDT 39355; **Yuba Co:** Bullard's Bar Recreation Area, Schoolhouse Campground, 3 Dec. 1983, HDT 47117; 7 Dec. 1984, HDT48398 14 Dec. 1986, HDT 51090; 17 Dec. 1993, KMS 425.

Discussion:

Tricholoma flavovirens is an extremely common species associated with conifers, particularly *Pinus*, in California. It is recognized by the viscid yellow

pileus that becomes yellow brown to brown in age, and the yellow lamellae and stipe. My concept of *T. flavovirens* follows Bigelow (1979), Ovrebo (1980) and Gulden (1992). Bon (1982) and Moser (1983) recognize two species that correspond to my concept of *T. flavovirens*: *T. auratum* (Fr.) Gillet has a reddish brown to yellowish brown pileus, pale yellow lamellae, and white flesh under a yellow zone near the surface, and is associated with *Pinus*; *Tricholoma flavovirens* sensu Bon has a dry pileus with olive to sepia coloration, and golden yellow lamellae and flesh, and is associated with *Picea* and deciduous trees. Moser's concept of *T. flavovirens* differs in considering the species to have a viscid, or at least moist, pileus. The confusion over the pileus surface of *T. flavovirens* arises from Fries' original placement of *Agaricus flavovirens* in a group with dry pilei (1821). Fries later (1836) placed *Agaricus equestre* Fries with other viscid species, and noted *A. flavovirens* as a synonym. The designation of a neotype for *T. flavovirens*, and more critical study of European material of *T. flavovirens* and *T. auratum* is needed to determine whether the two taxa are distinct, and whether North American collections are indeed *T. flavovirens*.

Species that may be confused with *T. flavovirens* in California include *T. intermedium* and *T. sejunctum*. *Tricholoma intermedium* differs in having white lamellae and stipe. Micromorphologically, the flare-like hyaline encrustations and pigments which become pinkish brown in herbarium collections ally *T. flavovirens* with *T. intermedium*. *Tricholoma sejunctum* also has yellow lamellae and stipe, but has long radiating blackish fibrils on the pileus surface,

and has subglobose rather than elliptic spores.

Tricholoma intermedium var. *intermedium* Peck, Annual Report New York Sate Mus. 41: 61. 1888.

= *Tricholoma leucophyllum* Ovrebo & Tylutki, Mycologia 67(1): 78-79. 1975.

Illustrations: Figure 3.

Pileus 35-100 mm broad, convex, plane or often slightly concave, often with a rounded or subacute umbo; surface viscid, becoming dry, glabrous or minutely areolate-squamulose over the disc, elsewhere glabrous and often with scattered minute squamulose or appressed fibrils, yellowish tan (5C5) to olive tan over the disc, elsewhere light yellow (2A3-4), often fading in age; context white, taste and odor farinaceous. **Lamellae** sinuate to broadly sinuate, 2-8 mm broad, close, white. **Stipe** 35-90 x 7-19 mm, equal or rarely subclavate or obclavate, the base rounded; surface silky fibrillose and with superficial surface fibrils projecting, often lightly pruinose or scabrous at the apex, white overall or occasionally very pale yellow in places; context solid but generally becoming hollow in age, white.

Basidiospores 5.3-6.7 x 3.4-4.3 µm ($\bar{x}$ = 6.0 ± 0.61 x 3.9 ± 0.40 µm; E = 1.3-1.8; Q = 1.6 ± o.10; n = 43/2 collections), elliptic, hyaline, smooth, inamyloid. **Basidia** 26-36 x 5.3-7.2 µm, 4 spored, clavate. **Cheilocystidia** rare to abundant, 19-29 x 6.7-9.5 µm, filiform, cylindric, clavate, saccate, ventricose or sphaeropedunculate, hyaline, smooth, thin-walled. **Pileipellis** an ixocutis;

epicutis hyphae 2.4-4.8 µm diam., cylindric, repent in a gelatinous matrix, hyaline or with pinkish brown refractive contents, smooth or with hyaline, flare-like encrustations; subcutis hyphae 3.4-7.2 µm diam., cylindric to slightly inflated, mostly parallel, like epicutis hyphae in all other respects. **Pileus trama** hyphae 4.8-16 µm diam., cylindric to inflated, interwoven, hyaline, smooth. **Lamellar trama** hyphae 2.4-18 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe trama** hyphae 2.4-12 µm diam., cylindric to inflated, parallel, hyaline or somewhat refractive, smooth, some with irregularly thickened walls. **Caulocystidia** present as recurved hyphal tips, 24-29 x 6.7-9.5 µm, cylindric, clavate or saccate, single or in fascicles, hyaline, smooth. **Clamp connections** absent.

Distribution in California uncertain.

Collections examined:

CALIFORNIA. Sierra Co: Tahoe National Forest, Sand Pond Picnic Area, 5 Oct. 1989, HDT 52089; **NEW YORK.** Catskill Mountains, September, C. H. Peck (HOLOTYPE, NY).

Discussion:

I have not collected *T. intermedium* var. *intermedium*. The description above is compiled from Ovrebo (1980) and my own observations of the collections cited (see also the type study below). *Tricholoma intermedium* var. *intermedium* is apparently uncommon in California. A comparison of var.

intermedium to the more common var. *macrosporum*, and a discussion of the occurrence of *T. intermedium* in California, may be found under var. *macrosporum* below.

Tricholoma intermedium var. *macrosporum* nom prov.

Illustrations: Figures 4-5.

Pileus 30-100 mm broad, convex to plano convex, the margin uplifted and wavy in age; surface viscid, becoming dry, glabrous or appressed radiating fibrillose, pale brown (4C6, 5D7) over the disc, elsewhere pale greenish yellow (3B3-4); context white, taste and odor faintly farinaceous. **Lamellae** sinuate, 3-5 mm broad, close, thin to somewhat thick, white, developing a faint pinkish cast in age. **Stipe** 50-85 x 15-35 mm, subventricose, ventricose or obclavate, base tapered or abrupt; surface dry, silky fibrillose with belts of recurved fibrils, entire stipe white to very pale yellow (2A2); context white, solid.

Basidiospores 6.7-9.6 x 3.8-5.8 µm ($\bar{x}$ = 7.6 ± 0.64 x 4.8 ± 0.34; E = 1.4-2.0; Q = 1.6 ± 0.12; n = 85/4 collections); elliptic side and face views, hyaline, inamyloid; **Basidia** 26-48 x 5.3-8.6 µm, narrowly clavate, 4 spored, occasionally 2 spored. **Cheilocystidia** 21.6-33.6 x 3.4-9.6 µm; absent to abundant; filiform with constricted apices or broadly clavate to sphaeropedunculate, hyaline, thin walled. **Pileipellis** an ixocutis to ixotrichodermium; epicutis hyphae 2.4-5.8 µm diam., cylindric to slightly inflated or collapsed, occasionally branched, parallel to somewhat interwoven in a

gelatinous matrix, hyaline or with pale yellow contents which become pinkish brown in herbarium specimens, smooth, or rarely with hyaline punctate encrustations; subcutis hyphae 2.8-14.4 µm diam., cylindric to somewhat inflated, mostly parallel, hyaline or pale yellow, pinkish brown in herbarium specimens, smooth or rarely with hyaline punctate or flare-like encrustations. **Pileus trama** hyphae 2.9-14.4 µm diam., cylindric to inflated, parallel to somewhat interwoven, hyaline or pale yellow, smooth. **Lamellar trama** hyphae 2.8-16.0 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe trama** hyphae 3.4-16.8 µm diam., cylindric to somewhat inflated, parallel, hyaline, smooth, occasionally with irregularly thickened walls. **Caulocystidia** 36-38 x 3.8-6.2 µm, present as recurved cylindric to slightly inflated hyphal tips, solitary or in large recurved clusters, hyaline or yellow to pale brown, smooth. **Clamp connections** absent.

Solitary to gregarious in association with conifers, October to November in the Sierra Nevada.

Collections examined:

CALIFORNIA: Sierra Co: Yuba Pass, hwy 49, 9 Oct. 1972, HDT 30111; SFSU Sierra Nevada Field Camp, Hwy 49, 25 Oct. 1985, HDT 49230; 8 Oct. 1993, KMS 397; Chapman Creek Campground, Hwy 49, 9 Oct. 1993, KMS 389.

Discussion:

Tricholoma intermedium var. *macrosporum* is distinguished from var.

intermedium on the basis of spore size. The holotype collection of *T. intermedium* has spores that measure 5.3-7.2 x 3.3-4.3 µm ($\bar{x}$ = 5.7 ± 0.62 x 3.6 ± 0.36 µm; E = 1.4 - 1.7; Q = 1.6 ± 0.10; n = 22), and reported spore sizes from Idaho and the Great Lakes regions (Ovrebo, 1980) are consistent with the holotype collection. *Tricholoma intermedium* var *macrosporum* has spores that are significantly longer than the holotype (6.2-9.6 x 3.3-5.76), but basidiomata are identical in all other respects. I have seen collections of var. *macrosporum* from locations several miles apart, suggesting that this taxon represents more than a single aberrant individual.

Tricholoma intermedium is characterized by a viscid greenish yellow pileus and white lamellae and stipe. It is closely related to *T. flavovirens*; both species have yellow pigment in the pileipellis that turns pinkish brown in herbarium specimens after ± 1 year. In the field, *T. intermedium* is distinguished by the white lamellae and stipe. Micromorphologically, *T. flavovirens* lacks cheilocystidia, and pigment of the pileipellis is often concentrated in the hyphal tips of the epicutis. *Tricholoma intermedium* may posses cheilocystidia, and pileipellis pigment is localized near the subcutis.

Tricholoma sejunctum also has a viscid pileus, and may be greenish yellow, but *T. sejunctum* has dark radiating fibrils on the pileus surface, and yellow lamellae and stipe. Micromorphologically it is easily distinguished by the presence of subglobose spores and dark brown encrustations of the pileipellis hyphae.

The presence of cheilocystidia in *T. intermedium* is quite variable within

and between collections, and their absence is not a good diagnostic character. Cheilocystidia were not observed in the type collection of var. *intermedium*, and it is possible the cheilocystidia have collapsed. Ovrebo (1980) reported a wide range of cheilocystidia shapes for *T. intermedium*.

Tricholoma portentosum (Fries) Quélet, Champ. Jura et Vosges, II:338.1873.

≡*Agaricus portentosus* Fries, Syst. Mycol. 1:39. 1821.

≡*Gyrophila portentosa* (Fries) Quélet, Enchir. Fung. 10. 1886.

≡*Melanoleuca portentosa* (Fries) Murrill, North Amer. Flora 10: 23. 1914.

Illustrations: Figure 6.

Pileus 50-120 mm broad, broadly convex, becoming plane in age, umbonate throughout development, margin down-turned when young, becoming wavy, occasionally uplifted and splitting in age; surface viscid, becoming dry, appressed radiating fibrillose; dark gray to dark grayish brown (8F3, 7E-F3), occasionally with lilac or grayish yellow tones, resulting from dark radiating fibrils and streaks of dark gray color over a pale yellow to nearly white background; context whitish, watery gray or with pale yellow coloration, particularly near the pileus surface, thin; taste and odor not distinct to mildly farinaceous. **Lamellae** sinuate to strongly notched, close, 8-11 mm broad, white at first, developing pale yellow tones (2-3A3) in age which may be visible only on the face of the lamellae, occasionally some gray coloration also present. **Stipe** 65-150 x 15-28 mm, equal with an abruptly tapered or

somewhat bulbous base, often twisted and contorted; surface dry, silky fibrillose, white to pale yellow (2A2-3); context solid, white to pale grayish, yellow near surface.

Basidiospores 5.3-8.6 x 3.0-5.8 µm ($\bar{x}$ = 6.2 ± 0.62 x 4.3 ± 0.15 µm; E = 1.1 - 1.9; Q = 1.5 ± 0.08; n = 97/4 collections); elliptic, hyaline, smooth, inamyloid. **Basidia** 28-38 x 6.2-7.2 µm; clavate, 4 spored, occasionally thick-walled. **Hymenial cystidia** absent. **Pileipellis** an ixocutis; epicutis hyphae 2.4-4.8 µm diam., cylindric or collapsed, interwoven in a gelatinous matrix, hyaline, occasionally with refractive, brownish, granular contents, smooth or with fine, punctate, hyaline to dark brown encrustations; subcutis hyphae 2.8-7.2 µm diam., cylindric to slightly inflated, parallel, hyaline, with punctate, flare-like or zebroid hyaline to dark grayish brown encrustations. **Pileus trama** hyphae 2.8-16.0 µm diam., cylindric to somewhat inflated, parallel to somewhat interwoven, hyaline to pale yellow, smooth. **Lamellar trama** hyphae 2.4-14.4 µm diam., cylindric to inflated, hyaline, smooth. **Stipe trama** hyphae 2.4-16.8 µm diam., cylindric at surface, inflated elsewhere, parallel, hyaline or pale yellow, smooth or with hyaline encrustations. **Caulocystidia** absent. **Clamp connections** absent.

Solitary to gregarious in association with conifers, particularly *Pinus*, November to January in coastal and low elevation Sierra Nevada forests.

Collections examined:

CALIFORNIA. Humboldt Co: Patrick's Point State Park, 31 Oct. 1986, DD

251 (HSC); **Marin Co:** Muir Woods, 29 Dec. 1966, Madden 840; 15 Jan. 1967, Madden 873; Volunteer Canyon, Audobon Canyon Ranch, 3 Mar. 1981, Calhoun 81-2250; 10 Dec. 1982, Calhoun 82-3550; **Mendocino Co:** Jackson State Forest, 16 Jan. 1967, HDT 18516; 6 Dec. 1969, DLL 4284 (HSC);18 Nov. 1977, HDT 38420; 7 Dec. 1980, HDT 41691; 28 Nov. 1992, KMS 304; 5 Dec. 1992, KMS 313; KMS 314; **Santa Barbara Co**: Los Padres National Forest, Figeroa Campground, 28 Feb. 1992, KMS 243; **Yuba Co:** Schoolhouse Campground, Bullard's Bar Recreation Area, 19 Nov. 1981, HDT 44008; 27 Nov. 1981, HDT 44128; 7 Dec. 1984, HDT 48396; 14 Dec. 1986, HDT 51097.

Discussion:

Tricholoma portentosum is distinguished by a dark gray, viscid pileus with long, appressed, radiating fibrils, and lamellae and stipe that develop some yellow coloration at maturity. Some yellow coloration is typically present in the pileus as well. Species that may be confused with *T. portentosum* are those gray *Tricholoma* species with a viscid pileus. *Tricholoma smithii* has a paler gray pileus that is often radially rugulose, a strong cucumber odor, and white lamellae and stipe that never develop yellow tones. Micromorphologically, *T. smithii* is distinguished by the presence of a pseudoparenchymatous hypodermium. *Tricholoma griseoviolaceum* is micromorphologically very similar to *T. portentosum*, but has a more violet gray pileus and lamellae that develop pinkish rather than yellow tones in age, and typically has a strong farinaceous to cucumber odor and taste. Both *T. smithii* and *T. griseoviolaceum* are

associated with *Quercus* or *Lithocarpus* in California, rather than *Pinus*.

Tricholoma griseoviolaceum nom. prov.

Illustrations: Figures 7-8.

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; 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 cucumbery, taste farinaceous or sweet farinaceous. **Lamellae** sinuate, thin or somewhat thick and forking near the stipe, 3-15 mm broad, close, white, discoloring pinkish brown to grayish orange (5C4, 7-9A2) in patches in age. **Stipe** 20-130 x 10-22 mm; equal or tapering slightly towards the base, 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; **PDAB** immediately blue-green on stipe surface.

Basidiospores 4.8-7.2 x 3.4-4.8 µm ($\bar{x}$ = 5.9 ± 0.55 x 4.0 ± 0.43; E = 1.2-1.9; Q = 1.5 ± 0.15; n = 142/7 collections); elliptic, hyaline, smooth, inamyloid. **Basidia** 28-38 x 5.8-7.2 µm, clavate, 4 spored, hyaline. **Cheilocystidia** 26-62 x 9.6-14 (19) µm, rare to scattered, clavate to saccate, thin walled, often collapsing, hyaline. **Pileipellis** an ixocutis; epicutis hyphae 2.0-4.8 µm diam., cylindric, 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 encrustations; subcutis hyphae 3.0-9.6 µm diam., cylindric to slightly inflated, parallel; with punctate, zebroid or flare-like hyaline encrustations or punctate, zebroid or plaque-like brown encrustations. **Pileus trama** hyphae 2.4-19.0 µm; cylindric near the pileipellis, inflated elsewhere, hyaline, smooth, mostly parallel. **Lamellar trama** hyphae 2.8-21.0 µm; cylindric to inflated, hyaline, smooth, parallel. **Stipe trama hyphae** 2.4-14.0 µm, cylindric to somewhat inflated, hyaline, smooth or with irregularly thickened walls, parallel. **Caulocystidia** absent. **Clamp connections** absent.

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:

CALIFORNIA. Amador Co: Ione, 4 Feb. 1970, HDT 24748; **Marin Co:** Phoenix Lake, 22 Feb. 1960, HDT 7558; Audobon Canyon Ranch, Pitcher Canyon, 15 Dec. 1975, Calhoun 386; 21 Jan. 1980, Calhoun 80-1457;

Audobon Canyon Ranch, Bolinas Fairfax Rd., 8 Dec 1984, Calhoun 84-3904; Marin Municipal Watershed District, Bon Tempe Lake, 27 Dec 1984, RE 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, MTS 3251; **Mendocino Co:** Jackson State Forest, 2 Dec. 1961, Peters 723; **Riverside Co:** LAMS Foray, 7 Feb 1981, HE Bigelow 15674 (NY); **San Mateo Co:** San Francisco Watershed, 22 Dec. 1963, HDT 11191; 6 Jan. 1967, HDT 18357; 31 Dec. 1968, HDT 23132; Portola State Park, Summit Trail, 9 Jan 1993, KMS 352; **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, Figeroa 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 Recreation Area, Schoolhouse Campground, 30 Nov. 1984, HDT 48310; MTS 314; 28 Nov. 1989, HDT 53054.

Discussion:

Tricholoma griseoviolaceum is commonly associated with oaks along the

coast as far northwards as Mendocino County, and in the low elevation forests of the Sierra Nevada. The possession of flare-like encrustations on the pileipellis hyphae and a viscid pileus place *T. griseoviolaceum* in Stirps *Flavovirens*, even though it lacks any yellow coloration.

Tricholoma griseoviolaceum is most likely to be confused with *T. portentosum* which is also viscid and has radiating gray fibrils, but *T. griseoviolaceum* differs by the absence of yellow coloration, a violet gray rather than brownish gray pileus, lamellae that stain pinkish brown in age, a more strongly farinaceous to cucumbery odor, and a habit under 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 is also likely to be confused with *T. smithii*, which also occurs under *Lithocarpus* in California. *Tricholoma smithii* has very similar coloration, and odor, but has a radially rugulose pileus and is not as dark gray as *T. griseoviolaceum*. Micromorphologically, *T. smithii* possesses a pseudoparenchymatous hypodermium. Collections identified as *T. portentosum* var. *avellaneifolium* (Murr.) Smith from under oaks in California are likely to be *T. griseoviolaceum*. A discussion of *T. portentosum* var. *avellaneifolium* may be found under *T. smithii*.

Other gray species of *Tricholoma* in California with radiating streaks or fibrils on the pileus, such as *T. virgatum*, lack a viscid pileus.

Tricholoma sejunctum (Fries) Quélet, Champ. Jura et Vosges, p. 76. 1872.

≡ *Agaricus sejunctus* Fries, Syst. Mycol. 1: 47. 1821.

≡ *Gyrophila sejunctum* (Fr.) Quél., Enchir. Fung. p.10. 1886.

= *Tricholoma subsejunctum* Peck, Bull. New York State Mus. 157: 53. 1912.

≡ *Melanoleuca subsejunctum* (Peck) Murrill, North Amer. Fl. 10: 24. 1914.

Illustrations: Figures 9-10.

Pileus 35-75 mm broad; convex when young becoming nearly plane in age, with a low to prominent umbo, margin splitting radially in age; surface viscid, becoming dry, appressed radiating fibrillose; virgate with blackish or very dark brown fibrils over a yellow (3B5-C5) background, yellow often visible only at the margin, overall coloration dark greenish yellow; context thin, white to watery gray; taste and odor not distinctive or farinaceous. **Lamellae** adnate to sinuate, 5-15 mm broad, close, thin, splitting in age, pale grayish yellow (2B4), pale yellow (3A3), or pastel yellow (2A4). **Stipe** 40-90 x 10-15 mm; equal or tapering upwards from a slightly bulbous base; surface dry, silky fibrillose; color often uneven, white with yellow areas or pale yellow to yellow (2A2-5, 3A4) overall; context solid or hollow, white, watery gray in age.

Basidiospores 5.3-8.2 x 3.8-6.2 µm ($\bar{x}$ = 6.9 ± 0.62 x 5.2 ± 0.49; E = 1.1-1.8; Q = 1.3 ± 0.13; n = 86/4 collections); broadly elliptic to subglobose in profile and face views, hyaline, smooth, inamyloid. **Basidia** 31-41 x 7.2-9.6 µm, clavate, 4 spored. **Cheilocystidia** absent or rare, 7-14 x 20-35 µm, broadly clavate to sphaeropedunculate, hyaline, thin-walled. **Pileipellis** an ixocutis;

epicutis hyphae 2.4-7.2 µm diam., cylindric or collapsed, parallel to slightly interwoven in a gelatinous matrix, hyaline to pale brown, contents hyaline or granular yellow to yellow brown, smooth or with hyaline or pale brown punctate to zebroid encrustations; subcutis hyphae 3.4-12 µm diam., cylindric to slightly inflated, parallel, hyaline, with thick hyaline to dark brown rough, irregular, punctate or plaque like encrustations. **Pileus trama** hyphae 2.4-14(22) µm diam., narrowly cylindric near cutis, otherwise slightly to highly inflated, interwoven beneath the disk, more parallel near the margin; hyaline to pale yellow, smooth; pale yellow gleophorus hyphae present. **Lamellar trama** hyphae 2.4- 9.2 µm diam., cylindric to highly inflated, hyaline, smooth. **Stipe trama** hyphae 2.4-17 µm diam., cylindric to somewhat inflated, parallel, hyaline, smooth, or walls irregularly thickened. **Caulocystidia** 19-48 x 3.4-5.8 µm, present as recurved hyphal tips in pyramidal clusters, or as a turf, cylindric or occasionally with inflated tips, hyaline, smooth. **Clamp connections** absent.

Scattered to gregarious in mixed woods or with *Picea sitchensis* Carr (sitka spruce) in coastal forests from Mendocino County northwards, October to December.

Collections examined:

CALIFORNIA. Del Norte Co: Jedediah Smith State Park, 27 Oct. 1967, HDT 21347; **Humboldt Co:** Big Lagoon State Park, 16 Oct. 1971, HDT 28365; 15 Oct. 1977, HDT 38296; 10 Nov. 1979, Kevin Mitchell s.n.; 10 Nov. 1979, HDT

40371; 1 Dec. 1979, DLL 8106 (HSC); 31 Oct. 1981, HDT 43851; 12 Oct. 1985, HDT 49146; 8 Nov. 1986, HDT 50812; Redwood National Park, Davidson Rd., 8 Nov. 1992, KMS 261; **Mendocino Co:** Jackson State Forest, 27 Dec. 1962, HDT 9916; 5 Nov. 1967, HDT 21247; 14 Nov. 1967, HDT 21527; 1 Dec. 1967, HDT 21771; 6 Dec. 1969, HDT 24414; 31 Oct. 1972, HDT 30415; 29 Oct. 1977, HDT 38394; 2 Dec. 1979, HDT 40600; 7 Nov. 1981, HDT 43928; 21 Nov. 1992, KMS 285; 28 Nov. 1992, KMS 307.

Discussion:

Tricholoma sejunctum occurs in north coastal forests from Mendocino County northward. It is distinguished by a viscid pileus with long, dark, radiating fibrils over a yellow background. The color of the lamellae and stipe is often mottled with yellow and white, but some yellow coloration is always present. Micromorphologically, broadly elliptic to subglobose spores, and dark brown pileipellis encrustations separate it from other species in Stirps *Flavovirens*. The presence of cheilocystidia should not be considered a diagnostic character as they are uncommon in most collections. In the field, *T. sejunctum* could be most easily confused with *T. flavovirens* or *T. intermedium*. *Tricholoma flavovirens* has more uniformly yellow lamellae and stipe, and does not possess the greenish yellow virgate pileus of *T. sejunctum*. *Tricholoma intermedium* has whitish lamellae and stipe, and the colors of the pileus may be a pale greenish yellow, but the surface is not virgate.

The concept of *T. sejunctum* presented here is that of Ovrebo (1980) and

Bigelow (1979), which agrees with the descriptions of Orton (1987) and Bon (1984). Related European species include *T. coryphaeum* (Fr.) Gillet, *T. arvernense* Bon, and *T. sejunctoides* Orton, all of which have prominent cheilocystidia and smaller spores than *T. sejunctum*, and none have the dark greenish yellow virgate pileus characteristic of *T. sejunctum*. The holotype of *T. subsejunctum* agrees in all respects with my concept of *T. sejunctum*. In his description Peck distinguished *T. subsejunctum* from *T. sejunctum* on the basis of the very dark virgate fibrils, but modern authors recognize variation in the darkness of the fibrils of *T. sejunctum*, and consider *T. subsejunctum* to be a synonym of *T. sejunctum*.

Stirps *Virgatum*

Pileus dry, pale gray to gray, occasionally virgate; taste bitter or acrid; PDAB pink on pileus and stipe. **Basidiospores** usually broadly elliptic. **Cheilocystidia** usually present.

Tricholoma virgatum (Fr.: Fr.) Kummer, Führer Pilzkunde 134. 1871.

≡*Agaricus virgatus* Fries, Obs. Mycol. 113. 1818; Fries, Syst. Mycol. 1: 48. 1821.

≡*Gyrophila virgata* (Fr.) Quélet, Enchir. Fung. 14. 1886.

=*Tricholoma subacutum* Peck, Annu. Rep. N. Y. State Mus. 42: 16-17. 1889.

≡*Melanoleuca subacuta* (Peck) Murrill, N. Am. Flora 10(1): 7. 1914.

Illustrations: Figures 11-12.

Pileus 23-90 mm broad, convex at first, becoming broadly convex to planoconvex, an acute umbo nearly always present; surface dry, glabrous, virgate from innate, radiating dark gray fibrils, overall coloration silvery gray to medium gray, pale gray to nearly white at margin; context pale gray, taste bitter or acrid, odor not distinctive. **Lamellae** sinuate, 6-12 mm broad, close, whitish to pale gray, yellowish gray (4B2) in age, spotting dark gray or occasionally gray marginate. **Stipe** 60-100 x 8-12 mm; equal, base rounded or slightly bulbous; surface silky fibrillose, white, context solid or hollow, white.

Basidiospores 6.2-8.6 x 4.8-6.7 µm ($\bar{x}$ = 7.6 ± 0.54 x 5.6 ± 0.37; E = 1.2-1.6; Q = 1.4 ± 0.09; n = 106/5 collections); broadly elliptic, hyaline, smooth, inamyloid. **Basidia** 31-40 x 7.2-9.6 µm, 4 spored, clavate. **Cheilocystidia** 31-53 x 7.2-13 µm, cylindric or clavate, hyaline, thin-walled or slightly thick-walled. **Pileipellis** a cutis; hyphae 1.9-7.2 µm diam., cylindric, parallel; epicutis hyphae hyaline, some with refractive contents, smooth and thin-walled or with fine hyaline encrustations; subcutis hyphae hyaline, smooth and thin-walled, or with plaque-like, zebroid or rough dark brown encrustations. **Pileus context** hyphae 2.4-19 µm diam., cylindric to inflated, parallel, hyaline, some with refractive contents, smooth and thin-walled. **Lamellar trama** hyphae 2.4-19 µm diam., cylindric to inflated, parallel, hyaline, thin-walled, smooth. **Stipe trama** hyphae 2.9-12 µm diam., cylindric to slightly inflated, densely parallel, hyaline, smooth and thin-walled, some surface hyphae slightly thick-walled. **Caulocystidia** present at stipe apex as clusters of recurved hyphal tips, 33-48

x 7.2-9.6 µm, cylindric or slightly clavate, in clusters, hyaline, thin-walled and smooth. **Clamp connections** absent.

Solitary to gregarious, with conifers or in mixed woods, November to January, coastal forests Sonoma County northwards.

Collections examined:

CALIFORNIA. Humboldt Co: Patrick's Point State Park, 23 Nov. 1969, HDT 24351; 22 Nov. 1969, HDT 24399; Big Lagoon, 1 Dec. 1979, DLL 8114 (HSC); Big Lagoon State Park, 22 Nov. 1984, HDT 48272; 8 Nov. 1986, HDT 50813; **Mendocino Co:** Jackson State Forest, 25 Nov. 1960, HDT 8454; 2 Dec. 1961, HDT 9029; 9 Dec. 1961, HDT 9072; 7 Dec. 1963, HDT 11104; 20 Jan. 1964, HDT 14787; 19 Dec. 1965, HDT 14648; 20 Jan. 1966, HDT 14819; 8 Jan. 1967, HDT 18510; 1 Dec. 1967, HDT 21741; 9 Dec. 1967, DLL 3429 (HSC); 2 Dec. 1972, Wong 333; 29 Dec. 1974, HDT 33293; 9 January 1992, KMS 220; Van Damme State Park, Pygmy Forest Parking Lot, 5 Dec. 1992, KMS 317; **Siskiyou Co:** Duck Lake Trailhead, 29 Oct. 1983, HDT 46806; **Sonoma Co:** Salt Point State Park, Stump Beach Trail, 10 January 1992, KMS 226.

Discussion

Tricholoma virgatum is distinguished by the dry, virgate pileus, conspicuous acute umbo, and acrid or bitter taste. To my knowledge it is the only species in Stirps *Virgatum* that occurs in California. A closely related species described from Michigan is *T. argenteum* Ovrebo, but the latter lacks an

acute umbo and has a lighter gray pileus. A number of *Tricholoma* species with dry, gray pilei and acrid or bitter taste are reported from the Great Lakes region; a more complete discussion of species in Stirps *Virgatum* may be found in Ovrebo (1989). In California, *T. griseoviolaceum* may be confused with *T. virgatum* in the field due to the gray, radially streaked pileus of *T. griseoviolaceum*. However, *T. griseoviolaceum* has a viscid rather than dry pileus, and a farinaceous taste and odor.

Tricholoma subacutum was described by Peck (1889) as having a pileus that is "at first ovate or broadly conical, then convex and subacutely umbonate". However, the fungus pictured in the illustration accompanying the description has an acute umbo. Ovrebo (1989) considered *T. virgatum* and *T. subacutum* to be synonymous on the basis of his examination of the type of *T. subacutum*, Peck's 1889 illustration, and a later (1903) description and illustration of *T. subacutum*.

Stirps *Luteomaculosum*

Pileus viscid or dry; taste and odor strongly farinaceous; partial veil absent; **cheilocystidia** usually present, **pseudoparenchymatous hypodermium** present.

Tricholoma atroviolaceum Smith, Mycologia 36: 256-257. 1944.

Illustrations: Figure 13.

Pileus 40-100 mm broad, broadly convex to plane, the margin often wavy and becoming uplifted in age; surface dry, matted fibrillose over the disc, appressed radiating fibrillose to squamulose elsewhere, nearly black over the disk, grayish violet brown (11F3) to violet gray (17B2) at margin, fading to grayish brown overall (6E3) in age; context thin, whitish at first, rapidly bruising reddish gray and finally sordid grayish brown (5C3, 6D3, 6B2-3), odor strongly rancid farinaceous to mildly farinaceous, taste farinaceous. **Lamellae** sinuate, 8-15mm broad, close, thick, anastomosing in some, very pale gray when young, becoming sordid brownish gray (7C-D1, 6B-C2) at maturity, margins discoloring fuscous at times. **Stipe** 50-100 x 15-40 mm; equal, base abrupt or tapered; surface dry, dull appressed fibrillose with some surface fibrils projecting, pruinose at apex, whitish to pale violet gray (15C2, 17B2), developing yellowish tan colors (4A4-B5, 5C-D5) towards the base or where handled; context solid, tough, staining as pileus context, base often with yellow or tan coloration.

Basidiospores 7.2-10 x 4.8-7.2 µm ($\bar{x}$ = 8.3 ± 0.62 x 6.0 ± 0.46 µm; E = 1.2-1.7; Q = 1.4 ± 0.09; n = 152/6 collections); elliptic to broadly elliptic in profile, elliptic in face view, hyaline, smooth, inamyloid. **Basidia** 43-56 x 8.6-12 µm, clavate, 4-spored, occasionally 2-spored or mucronate, hyaline, some basidioles fuscous near lamellae margin, smooth. **Hymenial cystidia** absent. **Pileipellis** a cutis; hyphae 4.8-14 µm diam., cylindric to slightly inflated, parallel, forming recurved fascicles, brown, thick walled and smooth, or with rough brown encrustations; pseudoparenchymatous hypodermium hyphae 9.6-24(50) µm diam., inflated to nearly isodiametric, hyaline and smooth, or with

plaques of dark brown encrustations, thin to thick walled. **Pileus trama** hyphae 2.4-12 µm diam., cylindric to somewhat inflated, mostly parallel, hyaline, smooth. **Lamellar trama** hyphae 3.4-16 µm diam., cylindric to inflated, parallel, hyaline, smooth, oleiferous hyphae common. **Stipitipellis** hyphae 2.4-5.8 µm diam., cylindric, parallel or loosely interwoven, hyaline, pale gray or with golden brown contents, smooth or with fine punctate to thick and rough dark brown encrustations. **Stipe trama** hyphae 2.4-12 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Caulocystidia** present as recurved hyphal tips 24-43 x 5.8-7.2 µm, cylindric to clavate, solitary, hyaline or fuscous, smooth. **Clamp connections** absent.

Solitary to scattered with conifers, September to December, Santa Cruz County northwards in coastal forests, and in the Sierra Nevada.

Collections examined:

CALIFORNIA. Calaveras Co: Hwy 4, Big Meadow Campground, 14 Oct. 1967, HDT 21263; **Humboldt Co:** Trinity National Forest, Big Hill Rd 13 mi e of Hoopa, 6 Nov. 1971, DLL 5256 (HSC); Willow Creek, 12 Dec. 1981, DLL 8257 (HSC); Trinity National Forest, Hoopa Indian Reservation, Big Hill Rd, 31 Oct. 1985, RW 39 (HSC); **Mendocino Co:** Jackson State Forest, 14 Dec. 1980, HDT 41714; 28 Dec. 1980, HDT 41747; Van Damme State Park, Pygmy Forest Parking Lot, 5 Dec. 1992, KMS 318; **Napa Co:** Saint Helena, 23 June 1966, HDT 14841; **Santa Cruz Co:** Boulder Creek, 30 Dec. 1970, HDT 27083; Felton, 6 Feb. 1979, HDT 39425; Empire Grade Rd nr Bonny Doon, 13 Dec.

1983, HDT 47156; **Sierra Co:** Hwy 49, Yuba Pass, 24 Sep. 1976, HDT 36490; 22 Sept. 1984, HDT 47859; 13 Oct. 1984, HDT 48005; 8 Oct. 1989, HDT 52886; 15 Oct. 1993, KMS 399; KMS 400; KMS 401; 31 Oct. 1993, KMS 404; **Siskiyou Co:** Haypress, 15 Oct. 1982, DLL 8325 (HSC); **Sonoma Co:** Salt Point State Park, 25 Nov. 1972, HDT 30803; **Tuolumne Co:** Pinecrest, 22 Oct. 1967, HDT 21297; 12 Nov. 1983, HDT 46932; **OREGON. Josephine Co:** Kerby, nr California border, 29 Nov. 1937, AHS 8195 (HOLOTYPE, MICH); **WASHINGTON. Clallam Co:** Olympic National Park, Olympic Hot Springs, 8 Oct. 1941, AHS 17701 (PARATYPE, MICH).

Discussion:

Tricholoma atroviolaceum can be quite common with conifers in the Sierra Nevada and coastal forests. *Tricholoma atroviolaceum* is characterized by a dark violet gray, fibrillose or squamulose pileus, sordid gray lamellae and hard texture. To my knowledge, no other species of *Tricholoma* has the unique reddish gray staining reaction of the pileus context. Micromorphologically, the large spores, pseudoparenchymatous hypodermium and lack of cheilocystidia are characteristic. The presence of a pseudoparenchymatous hypodermium and strong farinaceous odor places *T. atroviolaceum* in Stirps *Luteomaculosum*. *Tricholoma luteomaculosum* is a related species occurring in California, but it lacks violet tones on the pileus and is characterized by the presence of cheilo- and pleurocystidia.

Tricholoma luteomaculosum Smith, Pap. Mich. Acad. Sci. 27: 67-69. 1942.

Illustrations: Figures 14-16.

Pileus 45-110mm broad, convex to planoconvex, a broad umbo present or absent, margins down-turned when young, becoming uplifted and wavy in age; surface dry, appressed radiating fibrillose, interwoven over the disk, some fibrils recurved near the pileus margin, dark brownish gray overall (7C-D2, 7E3, 8D2), the disc occasionally dull yellowish brown (5E5); context whitish to pale gray, taste and odor farinaceous, sometimes strongly so. **Lamellae** sinuate, 5-20 mm broad, close to subdistant, somewhat thick, pale gray to drab, the margins often spotting dark brownish gray, occasionally developing yellow tones near the pileus margin in age. **Stipe** 50-120 x 10-25 mm; equal, base tapered; surface dry, silky fibrillose, white to pale gray, occasionally discoloring pale yellowish brown (5C5), context solid or hollow, whitish or pale gray.

Basidiospores 6.2-9.6 x 4.3-6.2 µm ($\bar{x}$ = 7.4 ± 0.67 x 5.2 ± 0.41; E = 1.2-1.8; Q = 1.4 ± 0.13; n = 123/6 collections); elliptic to broadly elliptic, hyaline, smooth, inamyloid. **Basidia** 28-43 x 7.2-9.6 µm, clavate, 4-spored. **Cheilocystidia** 24-52 x 11-24 µm, clavate, sphaeropedunculate, ventricose or saccate, occasionally mucronate, hyaline or dark brown, thin- or slightly thick-walled. **Pleurocystidia** 33-72 x 14-26 µm, broadly clavate, saccate or ventricose, hyaline or dark brown, thin- or slightly thick-walled. **Pileipellis** a cutis; hyphae 3.8-14 µm, cylindric to slightly inflated, parallel, forming occasional recurved fascicles, hyaline or dark brown to gray, contents hyaline

or pale golden brown, smooth or more commonly with hyaline or grayish brown rough or plaque-like encrustations; pseudoparenchymatous hypodermium hyphae 9.6-43 µm diam., highly inflated to nearly isodiametric, hyaline, smooth, or occasionally with plaques of yellow brown encrustations, thin-walled or with irregularly thickened walls. **Pileus trama** hyphae 3.8-20 µm diam., cylindric to somewhat inflated, mostly parallel, hyaline, smooth. **Lamellar trama** hyphae 2.4-21 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipitipellis** hyphae 2.4-6.2 µm diam., cylindric, parallel or somewhat interwoven, hyaline or pale golden brown, smooth or with hyaline to dark brown encrustations. **Stipe trama** hyphae 3.4-12 µm diam., cylindric to slightly inflated, parallel, hyaline, smooth, walls thin or irregularly thickened. **Caulocystidia** 29-62 x 3.8-8.6 µm; cylindric to slightly clavate or ventricose, present at stipe apex as recurved hyphal tips, solitary or in pyramidal clusters, hyaline, faintly roughened or smooth. **Clamp connections** absent.

Solitary to gregarious in mixed woods from November to January, coastal forests from Marin County northwards.

Collections examined:

CALIFORNIA. Del Norte Co: Hwy 199, Patrick's Creek Campground, 1 Nov. 1986, DLL 8743 (HSC); **Humboldt Co:** Hoopa, Hospital Rd, 8 Nov. 1977, DLL 7591 (HSC); Willow Creek, 8 Dec. 1979, DLL 8170 (HSC); 2 mi ne of Salyer, 15 Nov. 1986, RW 98; 21 Jan. 1986, RW 101 (HSC); **Marin Co:** Marin Municipal Watershed District, Rock Creek Simmonds Trail, 31 Dec. 1992, KMS 345;

Mendocino Co: Van Damme State Park, Pygmy Forest Parking Lot, 22 Nov. 1992, KMS 292; location unknown, 28 Nov. 1992, KMS 305; **Sonoma Co:** Salt Point State Park, 25 Nov. 1972, HDT 30794; **MICHIGAN. Washtenaw Co:** Ann Arbor, 27 Sept. 1940, AHS 15477 (HOLOTYPE, MICH).

Discussion:

Tricholoma luteomaculosum is recognized by the dry, fuscous to brownish gray pileus and pale gray or drab lamellae. It occurs in mixed woods, commonly with *Lithocarpus* or *Quercus* spp. Micromorphologically, the combination of a pseudoparenchymatous hypodermium and large saccate cheilocystidia and pleurocystidia is distinctive. The pleurocystidia may be widely scattered, and are best observed by scanning the surface of a lamella mounted whole. To date, *T. luteomaculosum* had been known only from southeastern Michigan; this is the first report from California.

Species that may be confused with *T. luteomaculosum* included *T. atroviolaceum* and *T. atrosquamosum*. *Tricholoma atroviolaceum* has a darker violet gray pileus, sordid gray flesh, and lacks hymenial cystidia. *Tricholoma atrosquamosum* has blackish fibrils on the pileus, rather than brownish gray, has white lamellae, a pale gray stipe with appressed blackish fibrils and also lacks hymenial cystidia.

Tricholoma smithii nom. prov.

= *Tricholoma portentosum* var. *avellaneifolium* (Murrill) Smith, American

Midland Naturalist 32: 686-687. 1944.

≡*Melanoleuca avellaneifolia* Murrill, Mycologia 5: 215. 1913

≡*Tricholoma avellaneifolium* (Murr.) Murrill, Mycologia 5: 223. 1913

Illustrations: Figures 17-18.

Pileus 30-90 mm broad, broadly convex or planoconvex, with a broad or prominent umbo, center sometimes depressed in age, margins down-turned, often becoming uplifted and wavy or lobed in age; surface viscid, glabrous, rarely faintly tomentose on the disc, often radially rugulose between the disc and margin, pale warm gray (17B2, 14 D2) or pale violet gray (9D3-9C2) on the disk, progressively paler towards the margin with irregular darker gray streaks, margins white, entire 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. **Lamellae** sinuate, thin, close, white, discoloring pale golden brown (5D4-7) in age. **Stipe** 50-100 x 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 x 4.3-5.8 µm ($\bar{x}$ = 6.6 ± 0.52 x 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. **Basidia** 33-40 x 7.2-9.6 µm, 4 spored, clavate. **Cheilocystidia** 26-43 x 8.2-12 µm; cylindric, clavate, or broadly clavate,

hyaline, thin-walled or slightly thick-walled. **Pileipellis** an ixocutis; epicutis hyphae 1.9-5.8 µm diam., cylindric 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., cylindric to somewhat inflated, mostly parallel, hyaline or pale yellow brown, thin or slightly thick-walled, smooth. **Lamellar trama** hyphae 2.4-14 µm diam., cylindric to somewhat inflated, parallel, hyaline or with refractive contents, thin-walled, smooth. **Stipe trama** hyphae 2.4-14 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Caulocystidia** present as recurved hyphal tips at stipe apex, 29-34 x 4.8-7.2 µm diam., cylindric 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.

Scattered to gregarious with *Lithocarpus* or in mixed evergreen forest, December to January, coastal mountains and foothills of the Sierra Nevada.

Collections examined:

CALIFORNIA. Marin Co: Audobon Canyon Ranch, above Volunteer Canyon, 27 Dec 1981, Calhoun 81-2947; **Humboldt Co:** Tish Tong Campground, 6 Nov. 1971, DLL 5261 (HSC); **Sonoma Co:** Salt Point State Park, 5 January 1993, KMS 351; 9 January 1993, KMS 358; **Yuba Co:**

Bullard's Bar Recreation Area, Schoolhouse Campground, 17 Dec. 1993, KMS 424; 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 *Tricholoma portentosum* var. *avellaneifolium*).

Discussion:

Tricholoma smithii is recognized by a viscid, pale gray to medium gray pileus with white margins, white pileus and stipe, and strong farinaceous odor. The pileus is generally radially rugulose, but this feature may be obscured in age. Micromorphologically, the presence of a pseudoparenchymatous hypodermium and subglobose spores is distinctive. In our area *T. smithii* is most easily confused with *T. griseoviolaceum*, which has very similar coloration when young, but the pileus is not radially rugulose, and is dark violet gray in age. *T. griseoviolaceum* also lacks a pseudoparenchymatous hypodermium and has more elliptic spores.

The material collected in California matches Smith's (1944) description of *T. portentosum* var. *avellaneifolium* very well, but he describes the spores as smaller than reported here. My measurements of basidiospores from Smith's collections determined as *T. portentosum* var. *avellaniefolium* are the same size and shape as spores from the California collections. Smith's collections are not a variety of *T. portentosum*; the presence of a pseudoparenchymatous hypodermium places this species in Section *Tricholoma*, Stirps

Luteomaculosum, rather than in Stirps *Flavovirens* with *T. portentosum*. The fungus described by Murrill as *T. avellaneifolium* (Murr.) Murrill, is not a *Tricholoma* species because the basidia of the type collection have carminophilous granules (see type study below). It therefore becomes necessary to propose a new name for *T. portentosum* var. *avellaneifolium* sensu Smith.

Tricholoma smithii is closely related to *T. josserandii* Bon, a European species, and *T. marquettense* Ovrebo, described from Michigan. The three species cannot be differentiated on the basis of micromorphological characters, but *T. smithii* has a darker pileus than either *T. josserandii* or *T. marquettense*. *Tricholoma marquettense* and *T. josserandii* differ in that *T. josserandii* has a pointed stipe base that discolors reddish at the base, while *T. marquettense* has a rounded stipe base which lacks any reddish discoloration. *Tricholoma smithii* may represent an intermediate between the two species, in that the stipe base of *T. smithii* is rounded, but does develop some pinkish coloration.

Stirps *Atrosquamosum*

Pileus dry, dark gray to blackish; **lamellae** white, often black marginate; stipe and lamellae tending to stain reddish, and possessing a reddish formalin reaction; **pileipellis** a cutis, hyphae somewhat inflated, but not forming a pseudoparenchymatous hypodermium; **cheilocystidia** usually present.

Tricholoma atrosquamosum (Chev.) Sacc., Syll. Fung. 5: 104. 1887.

≡*Agaricus atrosquamosus* Chev., Grevilia 4: 93. 1837.

Illustrations: Figure 19.

Pileus 43-55 mm broad, broadly convex with a low umbo, margin inrolled when young with a distinctly bearded margin; surface dry, woolly tomentose over the disc, breaking up into radiating fibrils and squamules towards the margin, fibrils black over a very pale gray background, fibrils becoming brownish black (7F3-6F3) in age; context pale gray, odor and taste farinaceous. **Lamellae** strongly notched, 7-9mm broad, close, thin, white to very pale gray. **Stipe** 45-70 x 10 mm, equal or the base slightly enlarged; surface dry, appressed fibrillose, pruinose at apex, elsewhere with minute, appressed blackish squamules or fibrils, medium gray; context solid, white, stipe base usually carmine red when dry.

Basidiospores 5.3-8.6 x 3.8-4.8 µm ($\bar{x}$ = 6.7 ± 0.84 x 4.5 ± 0.36 µm; E = 1.2-1.9; Q = 1.5 ± 0.14; n = 40/2 collections); elliptic to narrowly elliptic, hyaline, smooth inamyloid. **Basidia** 24-38 x 5.8-7.2 µm, clavate, 4-spored, hyaline. **Hymenial cystidia** absent. **Pileipellis** a cutis; hyphae 4.8-12 µm diam., cylindric to somewhat inflated, parallel, forming recurved fascicles, dark brown and smooth or hyaline with rough or plaque like brown encrustations. **Pileus trama** hyphae 5.8-12 µm diam., cylindric to somewhat inflated, parallel beneath pileipellis, parallel to interwoven elsewhere, hyaline to pale gray, smooth. **Lamellar trama** hyphae 2.4-17 µm diam., cylindric to somewhat inflated,

parallel, hyaline, smooth. **Stipitipellis** hyphae 3.4-4.8 µm diam., cylindric, loosely interwoven to parallel, hyaline, smooth or with rough hyaline encrustations. **Stipe trama** hyphae 3.4-12 µm diam., cylindric to slightly inflated, parallel, hyaline, smooth, thin or thick walled. **Caulocystidia** 29-48 x 3.4-5.8 µm, cylindric, often with strangulated tips, in irregular clusters, fuscous, smooth, thick-walled. **Clamp connections** absent.

Distribution in California uncertain.

Collections examined:

CALIFORNIA. Del Norte Co: Smith River, 30 Nov. 1937, AHS 9271 (MICH; as *T. nigromarginatum* Bres); **Santa Cruz Co:** location unknown, 9 Jan. 1994, KMS 435.

Discussion:

Tricholoma atrosquamosum is characterized by a dark, fibrillose to squamulose pileus, white lamellae that may discolor black on the margin, and a pale gray stipe with appressed blackish fibrils. Some collections develop reddish colors on the stipe base when dried. A related species is *T. squarrulosum* Bres., which differs in having recurved blackish squamules on the stipe, a bulbous stipe base and lamellae which discolor orange-pink. Bon (1984) considered *T. squarrulosum* to be a variety of *T. atrosquamosum*, but Moser (1983), and Gulden (1992) maintained the two taxa as separate species. My concept of *T. atrosquamosum* follows Bon and Gulden, but I consider *T.*

atrosquamosum and *T. squarrulosum* to be distinct species. Ovrebo (1989) reported *T. squarrulosum* from the Great Lakes area, but to my knowledge there has been no previous report of *T. atrosquamosum* from North America.

Smith (1944) published a description of *T. nigromarginatum* Bres. based on a collection from California, and his description matches my concept of *T. atrosquamosum*. Smith stated his collection has clamp connections throughout but my examination of his collection failed to reveal clamp connections.

Tricholoma atrosquamosum appears to be an uncommon species in California. It is most easily confused with *T. luteomaculosum*, but the latter has a more appressed-radiating-fibrillose pileus and occasionally develops dingy yellow discolorations on the pileus margin and lamellae. Micromorphologically, *T. luteomaculosum* has a pseudoparenchymatous hypodermium and broadly clavate to saccate cheilo- and pleurocystidia. *Tricholoma atroviolaceum* has darker gray lamellae than *T. atrosquamosum*, and also has a pseudoparenchymatous hypodermium. *Tricholoma myomyces* and related species typically have a smaller stature, and have a pale gray to white, silky-fibrillose stipe.

Stirps *Myomyces*

Pileus small, less than 70 mm, gray, dry; **cortinate veil** present or absent; spores elliptic, **pseudoparenchymatous hypodermium** present.

Tricholoma myomyces var. *tephrocystus* nom. prov.

Illustrations: Figures 20-21.

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; 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 x 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 x 3.4-5.3 µm ($\bar{x}$ = 7.2 ± 0.52 x 4.4 ± 0.40 µm; E = 1.3-2.1; Q = 1.6 ± 0.16; n = 197/12 collections); elliptic to narrowly elliptic, hyaline, smooth, inamyloid; **Basidia** 26-33 x 6.2-7.2 µm; clavate, 4-spored, hyaline. **Cheilocystidia** 19-38 x 8.2-12.0 µm; broadly clavate to sphaeropedunculate, often septate, scattered to abundant, hyaline, smooth, slightly thick-walled. **Pileipellis** a cutis; hyphae 4.8-16 µm diam., cylindric to

somewhat inflated, parallel, forming recurved fascicles, dark brown, rarely hyaline, smooth or with broken plaques of dark brown encrustations, thick-walled; pseudoparenchymatous hypodermium hyphae 14-48 µm diam., highly inflated to nearly isodiametric, hyaline or with plaques of dark brown encrustation between the cells, thin- or thick-walled. **Pileus trama** hyphae 3.8-16 µm diam., cylindric near pileipellis, cylindric to inflated elsewhere, mostly parallel, hyaline, smooth, thin-walled. **Lamellar trama** hyphae 2.4-19 µm diam., cylindric to inflated, parallel, hyaline, smooth, thin-walled. **Stipe context** hyphae 2.4-14 µm diam., cylindric 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.

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

Collections examined:

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; Audobon Canyon Ranch (ACR), above Pitcher Canyon, 23 Jan. 1981, Calhoun 81-1796; ACR, Bolinas Ridge Rd., 27 Mar. 1981, Calhoun 81-2280; ACR, above Pitcher Canyon, 29 Nov. 1984, Calhoun 84-3901; 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; Northern California Coast Preserve, 9 mi w of Branscombe, 1 Dec. 1979, HDT 40565; Jackson State Forest, 21 Nov. 1992, KMS 283; 20 Nov. 1993, MGW 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; Jasper Ridge Biological Reserve, 26 Dec. 1992, KMS 343; **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 (Fr.) Lange is recognized by its small stature, fibrillose to squamulose gray pileus, cortinate veil, pseudoparenchymatous hypodermium and lack of a distinguishable taste or odor. *Tricholoma myomyces* var. *tephrocystus* differs from var. *myomyces* in the presence of broadly clavate to sphaeropedunculate cheilocystidia, but is otherwise

indistinguishable.

Tricholoma myomyces var. *tephrocystus* is the most common small, gray *Tricholoma* in mixed evergreen forests in the fall in California, particularly in association with *Pseudotsuga menziesii* (Douglas Fir). Several closely related species known from Europe have the same general stature as *T. myomyces*. These species include *T. scalpturatum* (Fr.) Quélet, *T. argyraceum* (Bull.:Fr.) Sacc., *T. triste* (Scop.) Quél., and *T. terreum* (Schaeff.) Kummer. Historically, concepts of these species have varied between authors, and the names have not been applied in a consistent fashion. Type collections for the species in this complex are lacking. My concept of *T. myomyces* is based on descriptions by Ovrebo (1989) and Bon (1984).

T. scalpturatum occurs in the same habitat as *T. myomyces* in California, but is distinguished by the farinaceous taste and odor, generally paler pileus with more widely spaced squamules, and micromorphologically by the lack of a pseudoparenchymatous hypodermium, and narrower spores. *Tricholoma argyraceum* is considered a synonym of *T. scalpturatum*. *Tricholoma terreum* differs from *T. myomyces* by the absence of a partial veil, paler pileus coloration and farinaceous taste and odor. Historically, this 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 triste* is considered closely related to *T. myomyces*, but has a darker gray stipe with recurved fibrils rather than the smooth, white stipe of *T. myomyces*.

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 pseudoparenchymatous hypodermium.

Stirps *Scalpturatum*

Pileus small, less than 70 mm, dry, gray; **cortinate veil** present or absent; **basidiospores** narrowly elliptic, **pseudoparenchymatous hypodermium** absent.

Tricholoma scalpturatum (Fries) Quélet, Champ. Jura et Vosges, ser. II, 5. 232. 1872.

≡ *Agaricus scalpturatus* Fries, Epicrisis 31. 1836-1838.

= *Agaricus argyraceum* Fries, Hymen.: 58. 1874.

≡*Tricholoma argyraceum* (Bull.:Fr.) Sacc., Syll. Fung. 5: 104. 1887.

≡*Tricholoma myomyces* var. *argyraceum* (Fr.) Lange, Dansk. bot. Ark. 8(3): 22. 1933.

= *Tricholoma inocybeoides* Pearson, Trans. Brit. Mycol. Soc. 22: 29. 1938.

= *Tricholoma myomyces* var. *alboconicum* Lange, Flora Agaricina Danica, 5: 9. 1940.

Illustrations: Figure 22.

Pileus 45-70 mm broad, convex with low broad umbo, becoming planoconvex with an uplifted and wavy margin in age; surface dry, woolly

overall at first, becoming matted fibrillose over the disc, appressed radiating fibrillose elsewhere, pileus surface with uneven coloration, grayish brown (7E-F2), or pale to medium gray, or black in places from blackish fibrils scattered over a white or pale gray background; context whitish to pale gray; taste and odor farinaceous. **Lamellae** sinuate, 3-8 mm broad, close, thin, pale gray when young, becoming white, discoloring yellow, particularly towards the pileus margin. **Stipe** 43-70 x 13-18 mm; equal, tapered at base; surface dry, silky fibrillose, white, discoloring yellow brown (5C4) or pale brown in places; cortina fugacious, remnants present as whitish fibrils near the stipe apex; context solid or hollow, white.

Basidiospores 4.8-6.7 x 2.9-4.3 µm ($\bar{x} = 5.6 \pm 0.65 \times 3.3 \pm 0.34$; E = 1.4-2.2; Q = 1.7 ± 0.16; n = 103/5 collections); elliptic to narrowly elliptic, hyaline, inamyloid, smooth. **Basidia** 20-28 x 5.8-7.2 µm; clavate, 4-spored, hyaline. **Hymenial cystidia** absent. **Pileipellis** a cutis; hyphae 2.4-14 µm diam., cylindric to somewhat inflated, parallel, forming recurved fascicles of hyphae, hyaline or brown, smooth, thin or thick-walled; pseudoparenchymatous hypodermium absent. **Pileus trama** hyphae 3.4-14 µm diam., cylindric to inflated, mostly parallel, hyaline, smooth. **Lamellar trama** hyphae 2.5-19 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe hyphae** 2.4-14 µm diam., cylindric to inflated, parallel, surface hyphae hyaline or pale golden brown, context hyphae hyaline, smooth. **Caulocystidia** present as clusters of recurved hyphal tips at stipe apex,14-48 x 4.8-9.6 µm; cylindric to clavate, hyaline, smooth. **Clamp connections** absent.

Solitary to gregarious in mixed evergreen forest, December and January, coastal forests from Santa Barbara County northwards.

Collections examined:

Canada. ONTARIO. Peel Co: Toronto Conservation Forest, Pelgrave Tract, 10 Sept. 1977, Ovrebo 485 (TRTC); 1 Oct. 1977, Ovrebo 527 (TRTC); **Switzerland**: Tirol, 28 July 1978, Moser 78/117 (IB); Uagarn, 20 Sept. 1978, Moser 78/354 (IB); **USA. CALIFORNIA. Marin Co:** Audobon Canyon Ranch, Bolinas Ridge Rd., 19 April 1981, Calhoun 81-2325; Marin Municipal Watershed District, Rock Creek Simmonds Trail, 31 Dec. 1992, KMS 344; **Monterey Co:** Monterey, 14 Jan. 1979, HDT 39319; **Santa Barbara Co:** Los Padres National Forest, Figeroa Campground, 31 Jan. 1993, KMS 373; **Trinity Co:** location unknown, 17 Nov. 1977, DLL 7790 (HSC); **Yuba Co:** Bullard's Bar Recreation Area, 19 Nov. 1981, HDT 44039.

Discussion:

European agaricologists recognize a number of species closely related to *T. scalpturatum* which possess a similar overall stature. *Tricholoma scalpturatum* is one of a number of small, gray *Tricholoma* species which have been called *T. terreum* in California. My concept of *Tricholoma scalpturatum* is based on descriptions by Ovrebo (1989) and Bon (1984). *Tricholoma scalpturatum* is uncommon in California, and occurs in mixed evergreen forest, the same habitat as the more common *T. myomyces*. Both *T. scalpturatum* and

T. myomyces have a cortina when young, but *T. scalpturatum* tends to be paler, with scattered dark fibrils over a pale background, and has lamellae that discolor yellow. Not all collections examined showed the yellow coloration, and more collecting is needed to document the variation in this species and related species. Micromorphologically, *T. scalpturatum* lacks a pseudoparenchymatous hypodermium and has smaller and more narrow spores.

Other California species with which *T. scalpturatum* may be confused include *T. atrosquamosum* and *T. moseri*. *Tricholoma atrosquamosum* does not have a cortina when young, and is typically larger than *T. scalpturatum*, and has a dark gray pileus and a stipe with appressed blackish fibrils. *T. moseri* occurs in the spring in montane areas, has larger spores, and lacks a cortina.

Tricholoma triste and *T. terreum* are two related European species; both have a pseudoparenchymatous hypodermium, and are discussed above with *T. myomyces*. *Tricholoma inocybeoides, T. argyraceum* and *T. myomyces* var. *alboconicum* are considered synonymous with *T. scalpturatum* by Bon (1984) and Gulden (1992).

Tricholoma moseri Singer, Fieldiana Botany, New Series 21: 11. 1989.

Illustrations: Figures 23-24.

Pileus 20-45 mm broad, campanulate when young, becoming broadly convex to plane, rarely umbonate; 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, 2-5mm broad, close to subdistant, thin or thick, pale gray to gray, spotting dark gray or blackish. **Stipe** 20-60 x 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 x 3.8-5.8 µm ($\bar{x}$ = 8.3 ± 0.75 x 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. **Basidia** 31-43 x 6.7-8.6 µm, clavate, 4-spored, hyaline. **Cheilocystidia** 21-57 x 5.8-19 µm; not present in all collections, clavate to broadly clavate, often with a strangulated apex, hyaline or fuscous, somewhat thick-walled. **Pileipellis** a cutis; hyphae 2.4-24 µm diam., cylindric 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 encrustations, pseudoparenchymatous hypodermium absent. **Pileus trama** hyphae 2.4-19 µm diam., cylindric to inflated, mostly parallel, hyaline or pale brown, smooth. **Lamellar trama** hyphae 2.4-19(24) µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe trama** hyphae 2.4-19 µm diam., cylindric near surface to inflated, parallel, hyaline, smooth. **Caulocystidia** 24-

62 x 3.3-7.2 µm; cylindric 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.

Solitary to caespitose under conifers, particularly *Abies magnifica* (Red Fir), often in disturbed soil or near melting snow, May to August in montane regions, rarely from October to December in montane and coastal regions.

Collections examined:

MEXICO. Paso de Cortés, July 23 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 38498; **Fresno Co:** Huntington Lake, 25 August 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, 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, 17 Aug. 1965, Sundberg 327; 13 June 1967, HDT 19532; 1 July 1969, HDT 23504; 27 May 1970, HDT 25350; 28 July 1971, HDT 27526; 9 June 1980, HDT 40880; Hwy 49, Chapman Creek Campground, 10 June 1980, HDT 40893; Yuba Pass, 10 June 1982, HDT 44388; 19 June 1982, HDT 44477; SFSU Field Camp, 10 June 1983, HDT 45885; Yuba Pass, 18 May 1984, HDT 47681; 12 June 1984, HDT 47737; 17 May 1986, HDT 49785; 7 June 1986, HDT 49886; Weber Lake Rd, 4 mi s of Yuba Pass, 26 June 1986, HDT 50020; 3 June 1989, HDT 52095; Bassets Station, hwy 49, 5 Oct. 1989, HDT 52806; 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, 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 Sept. 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, and white stipe. Micromorphologically, *T. moseri* lacks a pseudoparenchymatous hypodermium, although the hyphae of the pileipellis are somewhat inflated, and has long and narrow spores relative to related *Tricholoma* species. 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.

Tricholoma moseri is most closely related to *T. scalpturatum*, 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*, 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 atrosquamosum* also has a dark gray squamulose pileus, but occurs in the fall, has dark fibrils on the stipe, and smaller spores.

Tricholoma moseri was first described from the upper limits of *Pinus hartwegii* Lindl. at 4100m in the mountains of Mexico. It is considered by Singer (1989) to be ambiguous in its placement between Stirps *Terreum* and Stirps *Atrosquamosum*, although I consider it to belong in Stirps *Terreum* sensu

Singer. To my knowledge, this is the first report of this species from the United States.

Tricholoma cingulatum (Fries) Jacobsh., Verh. Bot. Ver. Prov. Brandb. 33: 55. 1890.

≡ *Agaricus cingulatus* Fries, Linnea t. 10. 1830.

≡ *Armillaria cingulata* (Fr.) Quélet, Champ Jura et Vosges: 74. 1872.

Illustrations: Figure 26.

The following macromorphological description adapted from Smith (1944):

Pileus 20-35 mm broad, obtuse or soon obtusely campanulate, margin incurved and cottony at first, becoming expanded or umbonate with a spreading margin, in age frequently split radially; surface dry, appressed fibrillose, the fibrils sometimes becoming arranged in patches forming appressed scales, when young dull gray over all or gray with a bluish cast along the margin, changing in age to more or less dark avellaneous; context thick under the disc but abruptly thinner away form the stipe, moderately fragile, watery drab gray when moist, pallid when faded, odor and taste farinaceous. **Lamellae** squarely adnate at first but developing a slight tooth in age, close, tending to stain greenish yellow, edges even. **Stipe** 40-60 x 3-6 mm, slightly enlarged below; surface whitish or near the apex a pale gray, annulate from the submembranous to fibrillose remains of a copious veil, with appressed white fibrils or zones for some distance below the ring, silky at the apex and more or

less glabrous at the base; context solid, pallid to pale gray within.

Basidiospores 4.8-6.7 x 2.9-4.3 µm (5.7 ± 0.46 x 3.5 ± 0.32 µm; E = 1.4-2.2; Q = 1.6 ± 0.14; n = 45/2 collections), elliptic to narrowly elliptic, smooth, hyaline, inamyloid. **Basidia** 22 x 5.8-6.2 µm, clavate, 4 spored. **Hymenial cystidia** absent. **Pileipellis** a cutis; hyphae 3.4-12 µm, cylindric to slightly inflated, parallel, forming recurved fascicles of hyphae, hyaline or yellow brown, pigment either intracellular and somewhat refractive, or extracellular as smooth plaques of pigment appearing as irregularly thickened walls. **Pileus trama** hyphae 3.4-14 µm diam., cylindric to inflated, mostly parallel, hyaline, smooth. **Lamellar trama** hyphae 2.4-21 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe hyphae** 3.4-17 µm diam., cylindric to slightly inflated, parallel, hyaline, smooth, somewhat thick-walled. **Hyphae of annulus** 3.4-7.2 µm diam., cylindric, interwoven, hyaline, smooth. **Caulocystidia** not observed. **Clamp connections** absent.

Gregarious, associated with *Salix* (Willow) in sandy soil, north coastal forests, October to December.

Collections examined:

CALIFORNIA. Humboldt Co: Lamphore property, 18 Nov. 1973, Baroni 1534 (HSC); Samoa, New Navy Base Rd. near Lincoln Ave, 6 Nov. 1986, BLT 570 (HSC).

Discussion:

Tricholoma cingulatum is a rare fungus that occurs with *Salix*. I have not seen fresh material of this species, but the combination of a gray fibrillose pileus, and cottony persistent annulus is quite distinctive. Smith (1944) reported *T. cingulatum* from the Pacific Northwest on the Olympic Peninsula of Washington state, and it is likely that it is a rare but regular part of the mycota anywhere willow occurs. The absence of a pseudoparenchymatous hypodermium and the relatively narrow spores ally *T. cingulatum* with *T. scalpturatum.*

Subgenus *Tricholoma*, Section *Genuina*

Pileus viscid or dry, orange brown, rusty brown or chestnut brown; **lamellae** white, pale yellow or pale orange, spotting or staining brown in age; **partial veil** when present membranous or a cortina; **cheilocystidia** uncommon; **clamp connections** absent.

Stirps *Caligatum*

Pileus viscid or dry; **membranous annulus** present.

Tricholoma focale (Fr.) Ricken, Die Blatterpilze: 332. 1915.

≡ *Agaricus focalis* Fries, Epicrisis: 20. 1836-38.

≡ *Armillaria focalis* (Fries) Saccardo, Syll. Fung. 5:74. 1887.

= *Melanoleuca arenicola* Murrill, Mycologia 5(4): 214. 1913.

≡ *Tricholoma arenicola* (Murrill) Murrill, Mycologia 5(4): 223. 1913.

= *Armillaria zelleri* Stunz & Smith, Mushrooms in Their Natural Habitats: 351. 1949.

≡ *Tricholoma zelleri* (Stunz & Smith) Ovrebo & Tylutki, Mycologia 67(1):80. 1975.

Illustrations: Figures 26-27.

Pileus 50-135 mm broad, convex when young, becoming broadly convex to planoconvex, occasionally broadly umbonate, the margins inrolled at first, becoming uplifted and wavy in age; surface viscid, becoming dry, with innate radiating fibrils, orange brown (5B4-6E4, 6B7) with irregular streaks and patches of olive (3E4, 4D3), yellow (3A4-7) and deep orange (5A5); context white, odor mildly farinaceous, taste bitter to bitter farinaceous. **Lamellae** sinuate, thin, close to crowded, buff, discoloring caramel (6C6) in spots. **Stipe** 45-110 x 15-30 mm, equal, ventricose, or tapered towards the base; surface above annulus silky fibrillose, pruinose, white, discoloring orange brown (5B3); annulus appressed, cottony, persistent, whitish; surface below annulus appressed fibrillose, with clumps of loosened fibrils giving a shaggy appearance, coloration much like pileus, orange (5B8-6B8), orange brown (6C6, 6C8) or brown (6D4) over a white background; context solid, white, discoloring orange brown around worm holes.

Basidiospores 4.8-5.8 x 2.9-3.8 µm ($\bar{x}$ = 5.3 ± 0.38 x 3.4 ± 0.25 µm; E = 1.4-2.0; Q = 1.6 ± 0.11; n = 82/4 collections); elliptic, hyaline, smooth, inamyloid;

Basidia 19-31 x 4.8-5.8 µm, narrowly clavate, 4-spored. **Hymenial cystidia** absent, but occasional cylindric basidioles extending beyond gill margin. **Pileipellis** an ixocutis; hyphae 2.4-7.2 µm diam., cylindric to slightly inflated, repent to interwoven in a gelatinous matrix, hyaline or with golden brown refractive contents, thin-walled, smooth or with fine to flare like hyaline encrustations up to 1.9 µm high. **Pileus trama** hyphae 3.4-14 µm diam., cylindric to inflated, parallel to interwoven, hyaline, smooth, thin-walled. **Lamellar trama** hyphae 2.4-19 µm diam., cylindric to inflated, parallel, hyaline, smooth, thin-walled. **Stipitipellis** hyphae above annulus 3.8-9.6 µm diam., cylindric to somewhat inflated, repent to loosely interwoven, hyaline or pale yellowish, smooth, somewhat thick-walled; hyphae below annulus 3.4-11.5 µm diam., cylindric to somewhat inflated, mostly repent, yellow brown to orange brown, some with refractive yellow brown contents, smooth, thin-walled or with irregularly thickened walls. **Stipe trama** hyphae 3.8-14 µm diam., cylindric to slightly inflated, parallel, hyaline, smooth, thin or irregularly thickened walls. **Caulocystidia** present above annulus, 17-37 x 3.8-9.6 µm, cylindric, clavate or ventricose, in pyramidal clusters or as a turf, hyaline, smooth, thin-walled. **Clamp connections** absent.

Scattered to gregarious with conifers, particularly *Pinus*, September to December, in coastal and montane forests.

Collections examined:

SCOTLAND. Fife Co: Tentsmuir Forest, HDT 31099; **SWEDEN:** Dalarna,

Rättvik Heden, Rättvik, 14 Sept. 1985, Moser 85/210 (IB); **USA. CALIFORNIA. El Dorado Co:** Fallen Leaf Lake, 4 Oct. 1975, Saylor D5; **Marin Co:** Mount Tamalpais State Park, Rock Springs, 22 Dec. 1992, DED 5598; **Mendocino Co:** Jackson State Forest, 19 Nov. 1960, HDT 8390; 4 Nov. 1961, Peters 41; 11 Nov. 1961, Motta 136; 5 Nov. 1965, HDT 14112; 4 Dec. 1966, HDT 17893; 20 Dec. 1966, HDT 18107; 29 Oct. 1967, HDT 21314; 5 Nov. 1967, HDT 21433; 6 Dec. 1969, HDT 24437; 27 Nov. 1970, HDT 26933; 29 Oct. 1977, HDT 38409; 26 Nov. 1977, HDT 38434; 5 Dec. 1992, KMS 312; **Napa Co:** Cleary Reserve, 12 Dec. 1964, HDT 11906; Sundberg 162; **Nevada Co:** Grass Valley, 9 Nov. 1975, HDT 35356; **Sierra Co:** Yuba Pass, 26 Sept. 1981, HDT 43773; Hwy 49, Turner Canyon, 13 Oct. 1984, HDT 47978; SFSU Field Campus, 26 Oct. 1985, HDT 49210; Yuba Pass, 13 Sept. 1989, HDT 52706; Hwy 49, Chapman Creek Campground, 9 Oct. 1993, KMS 390; **Siskiyou Co:** McCloud, 17 Nov. 1967, HDT 21644; Mt. Shasta, Sand Flat, 30 Oct. 1983, HDT 46733; Sugar Lake Trail, 19 Oct. 1985, HDT 49175; **Yuba Co:** Bullard's Bar Recreation Area, Schoolhouse Campground, 24 Nov. 1981, HDT 44129; 3 Dec. 1983, HDT 47146; 9 Nov. 1984, HDT 48158; 30 Nov. 1984, HDT 48327; 14 Dec. 1986, HDT 51087; 15 Jan. 1992, KMS 230; 17 Dec. 1993, KMS 426.

Discussion:

Tricholoma focale is distinguished by an orange brown, viscid pileus often streaked with olive or yellow coloration, and presence of a membranous annulus. Other *Tricholoma* species with brown coloration and a membranous

annulus in California have a dry pileus and spicy odor. A closely related European species is *T. robustum* (Fr.) Ricken which has a duller reddish brown coloration, apparently lacks any greenish tones, and has a larger stature.

In their discussion of *Armillaria zelleri*, Stunz and Smith compared it to *Tricholoma focale* (as *Armillaria*). They interpreted *T. focale* as having a dry pileus and considered *A. zelleri* to be distinct from *T. focale* on the basis of pileus viscidity. Fries (1836) failed to indicate whether the pileus is viscid or not in his description of *Agaricus focalis*, but modern European authors are consistent in considering *T. focale* to have a viscid pileus. Designation of a neotype for *T. focale* with a collection possessing a viscid pileus would further reinforce this interpretation.

Tricholoma magnivelare (Peck) Redhead, Trans mycol. Soc. Japan 25(1): 6. 1984.

≡*Agaricus magnivelaris* Peck, Annu. Rep. NY State Mus. 29: 66. 1878.

≡*Armillaria magnivelaris* (Peck) Murrill, North Amer. Flora 10: 37. 1914.

=*Agaricus ponderosus* Peck, Bull. Buff. Soc. Natur. Sci. 1: 42. 1873. nom. illeg. non *Agaricus ponderosus* Persoon (1828: 116)

≡*Armillaria ponderosa* Sacc., Syll. Fung. 5: 78. 1887.

≡*Tricholoma ponderosum* (Peck) Singer, Lloydia 5: 114. 1942.

=*Armillaria arenicola* Murrill, Mycologia 4: 212. 1912.

≡*Tricholoma murrillianum* Singer, Lloydia 5: 113.1942. nom. nov. for *A. arenicola* Murrill

Illustrations: Figure 28.

Pileus 65-190 mm, convex at first, the margins inrolled, becoming planoconvex in age, the margins down-turned and wavy; surface dry, but may appear slightly viscid when wet, and often with debris sticking to the pileus surface, glabrous or with large appressed cottony squamules, color white or pale buff at first, surface fibrils becoming ochraceous to pale brown (5B4, 6D7) over a yellowish white (4A2) background; context white, firm, taste mild, odor spicy, like cinnamon. **Lamellae** scarcely sinuate, 8-12 mm broad, close to crowded, thin, whitish to pale cream (4A3) when young, spotting and discoloring pale to orange brown in age. **Stipe** 60-150 x 20-40 mm, equal or tapered towards the base; surface dry, above annulus silky fibrillose with belts of small recurved fibrils, white, discoloring as lamellae in extreme age, annulus and stipe surface below annulus much like pileus surface, but becoming darker brown (6F6) in age or with handling, squamules never forming distinct belts; partial veil membranous, leaving remnants on the pileus margin, and a thick, cottony, persistent annulus, prominent and flaring upwards at first, becoming appressed in age; stipe context white, solid, very firm.

Basidiospores 5.8-8.2 x 4.3-5.8 µm ($\bar{x}$ = 7.0 ± 0.50 x 5.0 ± 0.29 µm; E = 1.1-1.6; Q = 1.4 ± 0.10; n = 60/3 collections); broadly elliptic to elliptic, hyaline, smooth, inamyloid. **Basidia** 33-43 x 6.2-7.2 µm, clavate, 4 spored. Hymenial cystidia absent. **Pileipellis** a cutis, hyphae 3.4-9.6 µm diam., cylindric or collapsed, appressed parallel to somewhat interwoven, hyaline to pale yellow,

smooth, thin-walled. **Pileus trama** hyphae 3.4-17 µm diam., cylindric to somewhat inflated, compact, parallel to somewhat interwoven, hyaline, smooth. **Lamellar trama** hyphae 2.4-14 µm diam., cylindric to slightly inflated, parallel, hyaline, smooth. **Stipe surface** hyphae above annulus 2.4-7.2 µm diam., cylindric, parallel, or a loose covering of interwoven hyphae, rarely with recurved hyphal tips, hyaline, smooth; hyphae below annulus cylindric to somewhat inflated or collapsed, parallel or loosely interwoven, hyaline or with yellow brown contents, smooth. **Stipe trama** hyphae 2.4-12 µm diam., cylindric to slightly inflated, tightly parallel, hyaline, smooth, thin- or somewhat thick-walled. **Caulocystidia** not observed. **Clamp connections** absent.

Solitary to gregarious with conifers, particularly in sandy soil, October to January in coastal forests and montane regions.

Collections examined:

CALIFORNIA. Del Norte Co: Jedediah Smith Redwoods State Park, 19 Nov. 1965, HDT 14333; 12 Nov. 1966, HDT 17739; **El Dorado Co:** Lake Tahoe, Pope Beach Park, 6 Oct. 1974, Peterson 25; **Mendocino Co:** Jackson State Forest, 5 Nov. 1960, HDT 8157; 19 Nov. 1960, Peters 83; 4 Nov. 1961, Peters 31; 8 Jan. 1967, HDT 18431; 5 Nov. 1967, HDT 21424; 28 Oct. 1969, HDT 8743; 18 Nov. 1969, HDT 8849; 31 Oct. 1972, HDT 30443; 2 Dec. 1972, HDT 30875; 8 Dec. 1972, Wong 265-a; 12 Nov. 1977, HDT 38413; 24 Nov. 1979, HDT 40494; Van Damme State Park, Pygmy Forest Parking Lot, 22 Nov. 1992, KMS 295; **Santa Cruz Co:** Santa Cruz Mountains, 14 Dec. 1982, HDT

45581; **Sierra Co:** Hwy 49, Yuba Pass, 21 Sept. 1975, B. Thiers 107; Siskiyou Co: 10 Oct. 1984, MTS 88; **Trinity Co:** Six Rivers National Forest, Grey Falls Campground, 27 Nov. 1986, HDT 47135; **Yuba Co:** Bullard's Bar Recreation Area, Schoolhouse Campground, 3 Dec. 1983, HDT 47135; 28 Nov. 1989, HDT 53026; 13 Jan. 1992, KMS 232; 12 Dec. 1993, KMS 415.

Discussion:

This species is commonly referred to in field guides as *Armillaria ponderosa*. The basionym, *Agaricus ponderosus*, was published illegitimately by Peck (1873) as a later homonym of *Agaricus ponderosus* Persoon (1828: 116). The name was not legitimized until Saccardo (1887) published it as *Armillaria ponderosa*, which is properly cited as *A. ponderosa* Saccardo. However, Peck (1878) proposed the new name *Agaricus magnivelare* for *Agaricus ponderosus* when he became aware of the earlier homonym, and thus *Agaricus magnivelare* is the earliest available legitimate name.

Tricholoma magnivelare was first reported from the west coast as *Armillaria arenicola* by Murrill (1912), and has been the subject of study by Zeller and Togashi (1934), and Kinugawa and Goto (1978). It is a prized edible species and is harvested for commercial sale. The only other *Tricholoma* species in California that shares a persistent membranous annulus and distinctive spicy odor with *T. magnivelare* is *T. caligatum*, but the latter has darker fibrils on both the pileus and stipe, and is typically not as robust. A discussion of related European and Asian species may be found below under

T. caligatum.

Tricholoma caligatum (Viv.) Ricken, Die Blatterpilze (Agaricaceae) :331. 1915

≡*Agaricus caligatus* Viv., I Funghi D'Italia :40.

≡*Armillaria caligata* (Viv.) Gillet, Hymen. France. 79. 1874.

Illustrations: Figure29.

Pileus 45-70 mm broad, convex at first with margins inrolled, becoming planoconvex in age with margins down-turned to uplifted, a low umbo present; surface dry, with radiating appressed to slightly recurved dark brown (7E6, 7F4-6) fibrils and soft floccules over a cream to buff background; context white, odor spicy, like cinnamon, taste extremely bitter. **Lamellae** sinuate, 10 mm broad, thin, close, white, developing orange brown (5B7-5C6) spots in age. **Stipe** 80-120 x 10-20 mm, equal or tapering towards the base; surface above the annulus silky fibrillose with faint belts of recurved fibrils; annulus membranous, appressed or flaring upwards, whitish, becoming pale brown in age (5A2); surface below annulus with belts or patches of appressed dark brown (8Ef-7E6) squamules over a cream to pale tan background, much like pileus surface, fading to grayish brown (6C3-7F4) in age; context white, solid, fibrous.

Basidiospores 5.3-7.2 x 4.3-6.2 µm ($\bar{x}$ = 6.4 ± 0.49 x 4.9 ± 0.35 µm; E = 1.1-1.4; Q = 1.3 ± 0.08; n = 68/3 collections); broadly elliptic to subglobose, hyaline, smooth, inamyloid. **Basidia** 28-32 x 6.24-7.2 µm, cylindric to subclavate, 4 spored. **Hymenial cystidia** absent. **Pileipellis** a cutis;

hyphae 3.9-14 µm diam., cylindric to slightly inflated, parallel to somewhat loosely interwoven, hyaline or with refractive golden to yellow brown contents, smooth. **Pileus trama** hyphae 4.8-16 µm diam., cylindric to inflated, interwoven, hyaline, smooth, oliferous hyphae common. **Lamellar trama** hyphae 1.9-17 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipitipellis** hyphae above annulus 2.4-5.8 µm diam., cylindric, parallel, hyaline, smooth; hyphae below annulus 4.8-14 µm diam., cylindric to slightly inflated, forming large recurved bundles of hyphae, hyaline or with yellow brown to golden refractive contents, smooth. **Stipe trama** hyphae 4.8-16 µm diam., cylindric to inflated, parallel, hyaline, smooth, thin to somewhat thick-walled. **Caulocystidia** present at apex as solitary recurved hyphal tips, 26-48 x 3.8-4.8 µm, cylindric, hyaline or with refractive contents, smooth. **Clamp connections** absent.

Solitary to gregarious with conifers, November to December in northern coastal forests and low elevation montane forests of the Sierra Nevada.

Collections examined:

CALIFORNIA. Mendocino Co: Jackson State Forest, 18 Nov. 1989, HDT 53014; **Yuba Co:** Bullard's Bar Recreation Area, Schoolhouse Campground, 28 Nov. 1989, HDT 53048; 12 Dec. 1993, KMS 416; 28 Dec. 1993, KMS 432.

Discussion:

Tricholoma caligatum is a member of a complex of species with members

in North America, Europe and Japan. In Europe, Kytövuori (1989) recognized three species with similar coloration and a characteristic spicy odor. *Tricholoma caligatum* (Viv.) Ricken has a fuscous brown pileus with large appressed scales on the margin and a bitter taste. *Tricholoma nauseosum* (Blytt) Kytövuori, is a somewhat larger species with a slightly paler brown pileus, mild taste and larger spores (6.6-8.4 x 5.0-6.3 µm). Kytövuori (1989) considered *T. matsutake* (Ito & Imai) Singer, a prized edible in Japan, to be a synonym of *T. nauseosum*. *Tricholoma dulciolens* Kytövuori is brown to light brown with a pinkish tint, with thin scales, a bitter taste, and relatively small spores (4.8-6.1 x 4.1-5.0 µm). Bon (1984) maintained that *T. nauseosum* and *T. matsutake* are synonyms of *T. caligatum*.

Smith (1979) described three varieties of *T. caligatum* (as *Armillaria*) from North America. I have not seen the type collections of any of his varieties, but based on his descriptions, Smith's conception of *T. caligatum* var. *caligatum* is closer to *T. nauseosum* as described by Kytövuori. Smith considered *T. caligatum* var. *caligatum* to have a mild or pleasant taste, which agrees with Kytövuori's description of *T. nauseosum*. Kytövuori describes the taste of *T. caligatum* as bitter. *Armillaria caligatum* var. *occidentalis* Smith occurs in the Rocky Mountains and the west coast under conifers, and differs from var. *caligatum* primarily by the bitter taste, and from the other varieties described by Smith by a lack of FeSO4 reaction. It seems likely that *A. caligatum* var. *occidentalis* is synonymous with *T. caligatum* (Viv.) Ricken.

Both *Armillaria caligatum* var. *glaucescens* Smith and *Armillaria*

caligatum var. *nardosmia* Smith are described from under hardwoods east of the Rocky Mountains. *Armillaria caligatum* var. *glaucescens* is distinguished by the context of the pileus staining gray to bluish green when cut, and a gray $FeSO_4$ in the stipe base. The pileus context of *A. caligatum* var. *nardosmia* discolors pale vinaceous tan with FeSO4, and has a pungent rather than a spicy or fruity odor.

Stirps *Vaccinum*

Pileus dry; membranous annulus absent, but a cortina may be present.

Tricholoma imbricatum (Fr.) Kummer, Füher Pilzkunde 133. 1871.

≡ *Agaricus imbricatus* Fries, Syst. Mycol. 1: 42. 1821.

≡ *Cortinellus imbricatus* (Fr.) Karsten, Hattsvamp. 27. 1879.

≡ *Gyrophila imbricata* (Fr.) Quélet, Enchir. Fung. 12. 1886.

Illustrations: Figures 30-31.

Pileus 35-115 mm, convex at first, the margins inrolled, becoming broadly convex to planoconvex in age with the margins down-turned; surface dry, matted fibrillose over the disc, generally appressed radiating fibrillose elsewhere, often the margin with small recurved squamules or cracking in age to reveal the buff interior, surface color dark dull brown (7E-F4-5, 8F4-5), margin often paler (6D6, 6C3); context whitish to buff, often darker near pileus surface; odor not distinguishable, taste bitter or not distinguishable. **Lamellae** barely

sinuate to strongly notched, 3-10 mm broad, close, thin, whitish to buff, discoloring reddish brown (6E5), in spots or overall in age. **Stipe** 60-100 x 7-25 mm, equal, slightly clavate, or ventricose, often with an abruptly pointed stipe base; surface dry, dull appressed to matted fibrillose, nearly canescent in some, concolorous with lamellae at apex, light brown (6C6, 6D4, 6E5) overall at first, darkening in age from the base upwards; context solid, whitish, discoloring light brown (6D5-7) at base.

Basidiospores 5.3-7.2 x 3.8-6.2 µm ($\bar{x}$ = 6.5 ± 0.51 x 4.8 ± 0.38 µm; E = 1.1-1.8; Q = 1.4 ± 0.12; n = 151/7 collections), elliptic, hyaline, smooth, inamyloid. **Basidia** 27-38 x 6.7-7.2 µm, clavate, 4 spored. **Hymenial cystidia** absent. **Pileipellis** a cutis; hyphae 3.8-19 µm diam., cylindric to inflated, mostly parallel, no distinct boundary between cutis and context, pale brown to reddish or orange brown, apical cells often with refractive brown contents, smooth, thin- or somewhat thick-walled. **Pileus trama** hyphae (2.8)9.6-16(19) µm diam., cylindric to inflated, parallel near cutis, elsewhere interwoven, hyaline, smooth. **Lamellar trama** hyphae 2.4-16 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe trama** hyphae 2.9-16 µm diam., cylindric to somewhat inflated, parallel, hyaline or faintly yellow-brown, smooth. **Caulocystidia** present at stipe apex as a turf of recurved hyphae arising from a loosely interwoven network of hyphae, 21-72 x 2.9-5.8 µm, cylindric with slightly inflated or strangulated tips, hyaline or with refractive yellow-brown contents, smooth, thin-walled. **Clamp connections** absent.

Solitary to gregarious, occasionally caespitose, associated with conifers

October to March, coastal forests Mendocino County southward, and rarely montane regions.

Collections examined:

CALIFORNIA. Amador Co: Carson Spur near Silver Lake, 3 Oct. 1976, HDT 36561; **El Dorado Co:** Luther pass, 7 Oct. 1971, HDT 28359; **Marin Co:** Audobon Canyon Ranch, Volunteer Canyon, Calhoun 82-3549; **Mendocino Co**: Jackson State Forest: 19 Nov. 1960, Peters 121; HDT 8296; 2 Dec. 1961, Peters 712; 9 Dec. 1961, HDT 9083; 23 Nov. 1962, HDT 9582; 20 Dec. 1962, HDT 9805; 27 Dec. 1962, HDT 9894; 5 Jan. 1963, HDT 9972; 20 Dec. 1966, HDT 18161; 8 Jan. 1967, HDT 18411; 3 Dec. 1972, HDT 30836; 7 Nov. 1981, HDT 43941; 30 Dec. 1984, HDT 48531; **Monterey Co:** Pacific Grove, 25 Jan. 1974, HDT 32165; Aquahito Rd., 18 Jan. 1975, HDT 33333; Del Monte Forest nr Carmel, 11 Jan. 1983, HDT 45755; **San Francisco Co:** SFSU Campus, 9 Feb. 1960, HDT 7492; Presido, 21 Dec. 1960, HDT 8576; HDT 8590; Lake Merced Golf Course, 24 Dec. 1969, HDT 24532; **Siskiyou Co:** Mt. Shasta, 3 Nov. 1979, HDT 40265; **Sonoma Co:** Salt Point State Park, 25 Nov. 1972, HDT 30745; 1 March 1986, HDT 49432; **Tehama Co:** Hwy 89, Gurnsey Creek Campground, 10 Oct. 1976, HDT 36639.

Discussion:

Tricholoma imbricatum is a common species in California in coastal forests from Mendocino County southward. It is recognized in the field by its

dry, dull brown pileus, lack of a partial veil, and solid stipe. It is closely related to *T. vaccinum*, from which it has been traditionally distinguished by duller and darker brown pileus coloration, and a less squamulose pileus surface. In my experience, both species can be somewhat squamulose, and so this is an unreliable character. In California, the two species are characteristic of different habitats. *Tricholoma imbricatum* is common in coastal forests from Mendocino County southward, while *T. vaccinum* is more common from Mendocino County northward, and in montane areas.

The most reliable character by which to distinguish *T. vaccinum* from *T. imbricatum* is the partial veil. *Tricholoma vaccinum* is characterized by the presence of a partial veil that leaves an appendiculate pileus margin in young sporocarps, and young sporocarps are more conic than *T. imbricatum*. *Tricholoma imbricatum* lacks a partial veil, although very young sporocarps may have a more or less cottony margin. Ovrebo & Smith (1977) mentioned the consistently hollow stipe of *T. vaccinum* as a distinguishing characteristic, although *T. imbricatum* collections may also possess a hollow stipe on occasion. Micromorphologically, the two species are very similar. Although the range in pileipellis hyphae diameter is the same for both species (3.9-19 µm), *T. imbricatum* tends to have predominantly cylindric hyphae with a subcutis of more inflated hyphae, and often has intracellular pigments. The pileipellis hyphae of *T. vaccinum* tend to be more consistently inflated, with few cylindric hyphae, and they rarely possess intracellular pigments (see figures 31 & 33). The difference in the pileipellis structure between the two species observed in

the North American collections examined is confirmed by Bon (1984), who described *T. imbrication* as possessing a more or less distinct hypodermium.

The only other species of *Tricholoma* in California with a dry brown pileus is *T. psammopus*. *Tricholoma psammopus* is much smaller than either *T. imbricatum* or *T. vaccinum*, and has a more yellow brown pileus with a rusty orange disc, and rusty orange fibrils at the apex of the stipe.

Tricholoma vaccinum (Fr.) Staude, Die Schwamme Mitteldeutschl. 128. 1858.

≡ *Agaricus vaccinus* Fries, Syst. Mycol. 1: 42. 1821.

≡ *Cortinellus vaccinus* (Fr.) Roze, Bull. Soc. Bot. France 23: 50. 1876.

≡ *Gyrophila vaccinum* (Fr.) Quélet, Enchir. Fung. 12. 1886.

Illustrations: Figures 32-33.

Pileus 20-70 mm broad, conic to convex at first, becoming broadly convex to planoconvex in age, often with a rounded to subacute umbo, margins inrolled and cottony or with appendiculate fibrils at first, becoming down-turned and without veil remnants in age; surface dry, matted fibrillose overall with occasional recurved squamules near the margin when young, becoming matted fibrillose to rimose-areolate over the disc, the remainder with various combinations of recurved to appressed fibrils, squamules, and scales, occasionally rimose-areolate overall, frequently with radiating cracks at the pileus margin, rusty brown (6C4-7D5), disc often darker (7E-F5); context whitish, taste and odor not distinguishable, somewhat farinaceous, or bitter.

Lamellae adnate to deeply notched, 2-8 mm broad, close to subdistant, cream or pale buff (4A2) at first, spotting brownish orange, and becoming orange buff (5A-B3) overall in age. **Stipe** 30-85 x 4-20 mm, equal, occasionally clavate; surface dry, pruinose at apex, silky fibrillose, lower 2/3 with belts of brown squamules over a buff ground color at first, in age squamules present or absent, context whitish, hollow.

Basidiospores 6.2-7.2 x 4.3-5.3 µm ($\bar{x}$ = 7.0 ± 0.33 x 4.9 ± 0.22 µm; E = 1.3-1.6; Q = 1.4 ± 0.07; n = 63/3 collections), elliptic. **Basidia** 28-36 x 6.2-7.2 µm, clavate, 4-spored, rarely 2-spored. **Hymenial cystidia** absent. **Pileipellis** a cutis; hyphae 2.4-14 (19) µm diam., cylindric to somewhat inflated, mostly repent and parallel, with recurved fascicles of hyphae, reddish to pinkish brown with somewhat refractive walls, smooth or rarely with fine hyaline encrustations. **Pileus trama** hyphae 2.9-19 µm diam., cylindric near pileus surface, cylindric to inflated elsewhere, mostly parallel near pileus surface, interwoven elsewhere, pale yellow near pileus surface, hyaline elsewhere, smooth. **Lamellar trama** hyphae 2.4-16 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipitipellis** hyphae 3.4-14 µm diam., cylindric to somewhat inflated, loosely repent, pale yellow with refractive walls, some with orange-brown contents, smooth or occasionally with irregularly thickened walls. **Stipe trama** hyphae 4.8-17 µm diam., cylindric near surface to inflated, parallel, hyaline, smooth. **Caulocystidia** present at stipe apex, 24-45 x 7.2-9.6 µm, cylindric to clavate, often occurring as chains of cells, in pyramidal clusters, hyaline or reddish brown, smooth and thin-walled. **Clamp**

p 115 missing!

California and appears to be restricted to montane regions and north coastal forests. The only other brown species of *Tricholoma* with a dry pileus are *T. imbricatum* and *T. psammopus*. For a comparison with the latter species, see the discussion under *T. imbricatum* above.

Tricholoma psammopus (Kalch.) Quélet, Champ. Jura et Vosges 3: 5. 1875.

≡ *Agaricus psammopus* Kalchbrenner, Ic. Hym. Hung. 12, pl. 3. 1873.

=*Tricholoma aurantio-olivaceum* Smith, Mycologia 36: 257-259. 1944.

Illustrations: Figures 34-35.

Pileus 13-38 mm broad, obtusely conic when young, margin inrolled, becoming broadly convex to planoconvex in age, margin down-turned, a low to prominent umbo present; surface dry, appressed radiating fibrillose, occasionally minutely squamulose or woolly on the disc when young; disc golden yellow (5B7) with rusty orange (6C7) stains at first, margin pale yellowish tan (near 4A4), color rapidly dulling with age, although the orange coloration on the disc often remains, becoming obscured and darkened, at maturity yellowish brown (5C-D4) to light brown (6D4-5) with brown (6E5) to dark brown (6-7F4-5) spots and stains; context whitish when young, becoming buff (4A2) and finally grayish brown (6D3) in age, odor not distinguishable, taste not distinguishable or slowly acrid. **Lamellae** deeply notched, 4-6 mm broad, close to subdistant, white or buff when young, gradually spotting light brown (6D4) to dark brown (6F5). **Stipe** 40-80 x 4-7 mm, equal, the base tapered and

rooting; surface dry, dull fibrillose with rusty grayish orange (5B5) fibrils or granules over a cream to buff background, fibrils dulling to brown (5D4-6E6) in age; context whitish when young, darkening from the base upwards in age, stuffed or hollow.

Basidiospores 5.3-7.6 x 3.4-5.3 µm ($\bar{x}$ = 6.4 ± 0.54 x 4.4 ± 0.42 µm; E = 1.2-2.2; Q = 1.5; n = 125/6 collections), elliptic. **Basidia** 24-33 x 5.8-7.2 µm, clavate, 4 spored. **Hymenial cystidia** absent. **Pileipellis** a cutis, hyphae 2.9-6.2(9.6) µm diam., cylindric to slightly inflated, the terminal cells often with inflated apices, repent or forming recurved fascicles of hyphae, hyaline or more commonly with golden brown to pale orange refractive contents, smooth or rarely with irregularly thickened walls near the pileus trama. **Pileus trama** hyphae 2.4-16 µm diam., cylindric to inflated, mostly parallel to somewhat interwoven, hyaline, smooth. **Lamellar trama** hyphae 2.4-16 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe hyphae** 2.4-14 µm diam., cylindric to somewhat inflated, loosely interwoven at the surface, parallel elsewhere, hyaline, smooth. **Caulocystidia** 16-62 x 3.8-9.6 µm, cylindric or clavate, solitary or in clusters, hyaline or with refractive yellow to orange contents, smooth, thin-walled. **Clamp connections** absent.

Gregarious with *Pseudotsuga menziesii* (Douglas Fir), January to February, coastal forests from Marin County northward.

Collections examined:

France: Mategena Savoyen, Forêt de Praz, St. Bon le Praz, 4 Sept. 1980,

Moser 80/235 (IB); **USA. CALIFORNIA. Marin Co:** Muir Woods National Monument, 31 Jan. 1967, Madden 920; Alpine Lake, 2 Jan. 1978, HDT 38472; Audobon Canyon Ranch, Volunteer Canyon, 21 Jan. 1980, Calhoun 80-1429; Audobon Canyon Ranch, Bolinas Ridge Rd., 15 Feb. 1981, Calhoun 81-1921; 27 Feb. 1981, Calhoun 81-2002; Pt. Reyes National Seashore, Limantour Rd., 9 Jan. 1993, KMS 357; 12 Jan. 1993, KMS 366; **Mendocino Co:** Jackson State Forest, 23 Jan. 1987, HDT 51186; **WASHINGTON. Clallam Co:** Olympic National Park, Olympic Hot Springs, 8 Oct. 1941, AHS 17666 (HOLOTYPE *T. aurantio-olivaceum*, MICH).

Discussion:

Tricholoma psammopus is associated with various conifers in Europe, but most commonly with *Larix* (Larch). On the west coast, *T. psammopus* occurs with *Pseudotsuga* (Douglas Fir), a close relative of *Larix*. At least two collections have been found in very young Douglas Fir stands. This small, dry *Tricholoma* is unlikely to be confused with any other *Tricholoma* species in California. *Tricholoma vaccinum*, with a rusty brown pileus is typically larger, has a partial veil, and lacks bright rusty orange fibrils at the stipe apex. *Tricholoma imbricatum* is a duller brown, and also lacks orange fibrils at the apex of the stipe. Older specimens of *T. psammopus* are more likely to be confused with *Inocybe* in the field until a spore print is made.

Collections from the west coast agree in all respects with European material, but are typically smaller in stature. European authors (Gulden, 1992;

Bon, 1984) report the pileus to be 2.5-7 cm broad, much larger than material described here (1.3-3.8 cm). Smith felt the lack of staining on the lamellae reported from Kalchbrenner's description and smaller stature of the Washington material warranted the description of *T. aurantio-olivaceum*. Modern European authors (Gulden, 1992; Bon,1984), describe a series of color changes of the lamellae (white to pale yellow and finally discoloring brown), which matches Smith's description and my observations. In my opinion, the difference in stature does not indicate a significant hiatus between the two putative species based on morphology and I accept *T. aurantio-olivaceum* as a synonym of *T. psammopus*.

Stirps *Pessundatum*

Pileus viscid; **stipe** without a partial veil or annular zone.

Tricholoma manzanitae Baroni & Ovrebo, Mycotaxon 18(2): 300-302. 1983.

Illustrations: Figures 36-37.

Pileus 35-90 mm, broadly convex at first, margin inrolled and cottony, becoming planoconvex with a depressed center in age, margin decurved; surface viscid, occasionally minutely tomentose over the disk, otherwise glabrous, often with dirt and leaf litter adhering to the surface, color whitish when young, rapidly developing orange tan (5B3-4) to orange brown (6B3-C4) coloration overall, and at maturity with brown (6E4-5) in places over the disc,

often with scattered rufescent stains, the inrolled margins pale yellow (4A3-4); context white, discoloring pale yellow or brown (6E6) near the pileus surface, odor not distinctive, taste not distinctive or slightly bitter. **Lamellae** sinuate, 5-12 mm broad, close to crowded, thin, white to cream (4A2) at first, spotting dull brown (5D4-6E5) in age or rarely discoloring overall. **Stipe** 30-45 x 12-30 mm, tapered towards the base, equal, or with a somewhat bulbous base; surface dry, strongly pruinose at apex, silky fibrillose below, apex pale yellow (2-4A2-3), whitish below, or developing orange brown stains like pileus; context white, solid.

Basidiospores 5.3-7.2 x 3.4-5.3 µm ($\bar{x}$ = 6.7 ± 0.56 x 4.3 ± 0.53 µm; E = 1.3-1.9; Q = 1.6; n = 60/3 collections), elliptic, hyaline, smooth, inamyloid. **Basidia** 28-38 x 6.2-7.2 µm, clavate, 4-spored. **Hymenial cystidia** absent. **Pileipellis** an ixocutis; epicutis hyphae 2.4-4.3 µm diam., cylindric or collapsed, loosely interwoven in a gelatinous matrix, hyaline, or with granular yellow-brown contents, smooth and thin-walled; subcutis hyphae 2.9-9.6 µm diam., cylindric to slightly inflated, interwoven, pale yellow, smooth, thick-walled. **Pileus trama** hyphae 2.9-14 µm diam., cylindric to somewhat inflated, loosely interwoven, hyaline, smooth, thin or thick-walled. **Lamellar trama** hyphae 2.9-12 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipitipellis** hyphae 2.4-8 µm diam., cylindric, repent or somewhat interwoven, giving rise to caulocystidia, hyaline, smooth. **Stipe trama** hyphae 2.8-12 µm diam., cylindric to slightly inflated, parallel, hyaline or rarely pale yellow, smooth. **Caulocystidia** present on upper 1/3 of stipe, in pyramidal clusters, loosely

entangled or as a turf, 35-170 x 2.8-7.2 µm, cylindric or flexuous with apices strangulated, tapered or swollen, hyaline or with yellow granular contents, smooth. **Clamp connections** absent.

Scattered to gregarious with *Arctostaphylos* (Manzanita), November to January, coastal forests from Marin to Sonoma Counties, and low elevation Sierra Nevada forests.

Collections examined:

CALIFORNIA. Marin Co: Marin Municipal Watershed District, 4 Dec. 1991, KMS 194; Bolinas Ridge Rd., 17 Jan. 1992, HDT 54063; Marin Municipal Watershed District, 17 Nov. 1992, KMS 282; Bolinas Ridge Rd., 17 Dec. 1992, DED 5601; **Mariposa Co:** Greeley Hill, 15 Dec. 1974, Halling 302; **Napa Co:** Cleary Reserve, 12 Dec. 1964, Sundberg 162; **Nevada Co:** Grass Valley, 9 Nov. 1975, HDT 35356; **Sonoma Co:** Healdsburg, Dec. 1980, Baroni 3930; 3 Jan. 1982, Baroni 4084 (ISOTYPE); **Tuolumne Co:** Greeley Hill Rd., 15 Dec. 1974, HDT 33239; **Yuba Co:** Bullard's Bar Recreation Area, Schoolhouse Campground, 4 Jan. 1987, HDT 51143; 28 Nov. 1989, HDT 53022; 7 Dec. 1991, KMS 199; 17 Dec. 1993, KMS 423; 28 Dec. 1993, KMS 430.

Discussion:

Tricholoma manzanitae is commonly encountered under *Arctostaphylos* in coastal and low elevation montane regions. The viscid orange brown pileus that is white when young, and the yellow, pruinose stipe apex are distinctive

features of *T. manzanitae*. The only other species of *Tricholoma* in California with a similar change in pileus color is *T. dryophilum*. *Tricholoma dryophilum* is white when young, but develops more reddish brown coloration, and lacks any yellow coloration on the pileus or stipe. *Tricholoma manzanitae* has been confused with *T. focale* in California. The inrolled pileus margin is continuous with the stipe in *T. manzanitae* in the button stage, and as the pileus expands an annular zone may be visible in very young collections, but there is no true partial veil or membranous annulus as in *T. focale*. *Tricholoma aurantium* (Fr.) Rickenis a species known from Oregon with orange coloration, but the pileus is more bright orange than *T. manzanitae*, and the stipe has belts of bright orange fibrils, rather than a pruinose yellow apex. *Tricholoma aurantium* occurs under conifers.

Tricholoma dryophilum (Murr.) Murrill, Mycologia 5(4): 223. 1913.

≡ *Melanoleuca dryophila* Murrill, Mycologia 5(4): 221. 1913.

Illustrations: Figures 38-39.

Pileus 40-100 mm broad, obtusely conic at first, becoming convex to broadly convex, a low broad umbo sometimes present, margins inrolled to down-turned; 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, spotting brownish orange to brown. **Stipe** 70-175 x 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 x 3.8-5.8 µm ($\bar{x}$ = 6.3 ± 0.53 x 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. **Basidia** 28-45 x 5.76-7.2 µm, 4 spored, clavate. **Cheilocystidia** 30-62 x 2.4-3.4 µm, filiform, some with strangulated tips, scattered, extending beyond hymenium, hyaline with refractive contents, smooth. **Pileipellis** an ixocutis; epicutis hyphae 2.4-7.2 µm diam., cylindric, 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., cylindric to slightly inflated, mostly parallel, hyaline, but pale brown en masse, smooth or with fine to rough hyaline encrustations. **Pileus trama** hyphae 2.4-14 µm diam., cylindric to inflated, interwoven, hyaline, smooth. **Lamellar trama** hyphae 2.4-12 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipitipellis** hyphae forming a loose interwoven network, hyaline, some with granular hyaline contents, smooth or with fine granular hyaline encrustations. **Stipe trama** hyphae 2.4-12 µm diam.,

cylindric to inflated, parallel, hyaline, smooth. **Caulocystidia** present as recurved hyphal tips at stipe apex, 14-100 x 2.4-4.8 µm, cylindric, in pyramidal clusters, hyaline, smooth. **Clamp connections** absent.

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

Collections examined:

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, MTS 2224; **Santa Barbara Co:** Los Padres National Forest, Figeroa Campground, 31 Jan. 1993, KMS 374; **Santa Clara Co:** Stanford University, 21 Jan. 1903, James McMurphy 27 (HOLOTYPE, NYS).

Discussion:

Tricholoma dryophilum appears to be associated exclusively with *Quercus agrifolia* in California. 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. Micromorphologically the filiform cheilocystidia and weakly pigmented hyphae of the pileipellis are distinctive.

Tricholoma manzanitae also becomes more darkly pigmented as it

develops, but is associated with *Arctostaphylos* spp, and is typically shorter in stature with a yellow instead of white stipe apex. *Tricholoma ustale* occurs under oaks, but has a bitter taste and a more fibrillose pileus that is reddish brown from the first. *Tricholoma nictitans* has a tall stature and farinaceous taste and odor, but has a dark reddish brown pileus, a buff to dark dull brown stipe, and occurs with pines.

Tricholoma nictitans (Fr.) Gillet, Champ. Fr. 93. 1878.

≡*Agaricus nictitans* Fries, Syst. Mycol. 1: 38. 1821.

Illustrations: Figures 40-41.

Pileus 25-110 mm, conic with inrolled margin when young, expanding to convex, broadly convex or nearly plane in age, margin inrolled to down-turned, a low broad umbo often present; surface viscid becoming dry, glabrous with occasional agglutinations of appressed fibrils over the disc, liver brown to reddish brown (8E7, 8F3-6), margin brown to light brown (7E6-7, 6C4-D6), often with striations of darker brown; context white to pale yellowish, taste and odor farinaceous. **Lamellae** adnate to sinuate, often with a subdecurrent tooth, 2-8 mm broad, thin, close, yellowish white to cream (4A2-3). **Stipe** 60-150 x 7-20 mm, equal, or slightly clavate, tapering up from base, the base sometimes subradicating; surface dry, dull appressed fibrillose with occasional fibrils projecting, apex pruinose, buff to grayish orange (5B4, 6B3), stipe progressively darker towards base due to dark brown surface fibrils over a buff to grayish

orange background, stipe base dull dark brown (6F7, 7F4-5, 7E5) at maturity; context whitish to pale yellow, discoloring dull dark brown at base in age, firm, hollow.

Basidiospores 5.3-8.2 x 3.4-6.2 µm ($\bar{x}$ = 6.5 ± 0.60 x 4.8 ± 0.48; E = 1.1-1.9; Q = 1.4 ± 0.13; n = 198/10 collections); elliptic to broadly elliptic, hyaline, smooth, inamyloid. **Basidia** 24-33 x 5.8-7.2 µm, 4 spored, clavate, hyaline or with brown contents. **Hymenial cystidia** absent. **Pileipellis** an ixocutis; hyphae 2.4-7.2 µm diam., cylindric, parallel near the pileus trama to interwoven, hyaline, usually with reddish brown contents, generally strongly encrusted with punctate to zebroid encrustations which are hyaline or pale brown in KOH, brown to dark brown in H_2O, the hyphae near the pileus trama typically without refractive contents and more strongly encrusted; subcutis not distinct. **Pileus trama** hyphae 2.4-14(17) µm diam., cylindric to somewhat inflated, interwoven, hyaline or pale yellow, smooth. **Lamellar trama** hyphae 3.4-14 µm diam., cylindric to somewhat inflated, parallel, hyaline, smooth. **Stipe trama** hyphae 2.4-20 µm diam., cylindric to inflated, parallel, hyaline or hyphae at stipe surface with refractive brown contents, smooth, thin- or slightly thick-walled. **Caulocystidia** 14-43 x 3.3-9.6 µm, terminal cells cylindric to clavate, some with strangulated tips, typically as chains of cells in pyramidal clusters or as a turf, hyaline or with refractive brown contents, smooth. **Clamp connections** absent.

Scattered to gregarious with conifers, particularly *Pinus*, November to December, Mendocino County northward.

Collections examined:

AUSTRIA: Tirol, Achenkirch, Schulterbergalm, 2 Sept. 1993, Moser 93/147 (IB); **USA. CALIFORNIA. Mendocino Co:** Jackson State Forest, 20 Dec. 1966, HDT 18162; 25 Nov. 1975, Calhoun 319; 2 Dec. 1979, HDT 40607; 2 Dec. 1989, HDT 53061; Jackson State Forest, Rd 409, 13 Nov. 1992, KMS 267; 13 Nov. 1992, KMS 269; 21 Nov. 1992, KMS 298; KMS 299; 28 Nov. 1992, KMS 311; **Humboldt Co:** Big Lagoon, hwy 101 n of Trinidad, 27 Nov. 1991, HDT 53868; Redwood National Park, Davidson Rd, 8 Nov. 1992, KMS 260; KMS 262; KMS 264.

Discussion:

Tricholoma nictitans is common under pines and other conifers in north coastal forests. In the field it is characterized by a dark brown viscid pileus, farinaceous taste and odor, and distinctive stature. *Tricholoma nictitans* has a very long and hollow stipe relative to the pileus diameter, and the margin is often inrolled even at maturity. Micromorphologically, the strongly encrusted hyphae of the pileipellis and larger spores relative to related species identify *T. nictitans* in the lab. Species which may be confused with *T. nictitans* include *T. muricatum*, *T. ustale* and *T. fulvum* (Bull.:Fr.) Sacc. *T. muricatum* also occurs with pines, but has orange white lamellae, a more innately fibrillose pileus, and smaller spores. *Tricholoma ustale* occurs under oaks, has a bitter taste and lacks strong encrustations on the pileipellis hyphae.

Tricholoma nictitans is closely related to *T. fulvum*, a European species with yellow lamellae and stipe apex. *Tricholoma fulvum* appears to be restricted to hardwood forests (*Betula*, *Quercus*) in Europe, has smaller spores (5-6.5 x 3.5-4.5 μm), and the hyphae of the stipe surface are gelatinized. See Bon (1984) for a more complete description. Collections identified as *T. fulvum* in California are most likely *T. nictitans*.

Tricholoma muricatum nom. prov.

Illustrations: Figure 42.

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; 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 to 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 x 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) x 2.9-4.3 µm ($\bar{x}$ = 5.8 ± 0.50 x 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. **Basidia** 24-36 x 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 encrustations in KOH, encrustations hyaline or dark brown in H2O; 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 encrustations. **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 trama** 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 x 2.8-7.2 µm, cylindric to narrowly clavate, in pyramidal clusters or rarely solitary, hyaline, smooth. **Clamp connections** absent.

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

Collections examined:

CALIFORNIA. Humboldt Co: Hwy 101, 4 mi n of Trinidad, 11 Nov. 1990, HDT 53387; **Marin Co:** Audobon 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; San Francisco Presido, 5 Dec. 1974, Fordham s.n.; Parkmerced, 4 Jan. 1978, HDT 38475; San Francisco State University Campus, 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.

Discussion:

Tricholoma muricatum is common under closed cone pines (*Pinus radiata* or *P. muricata*) in the coastal forests of California, and is named for its association with closed cone pines. *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, and often has short costa on the pileus margin. Micromorphologically, *T. muricatum* has strongly encrusted pileipellis hyphae, and encrusting pigments that tend to dissolve in KOH. The small, narrow spores relative to 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 ustale is a related species occurring in California that occurs with hardwoods and has a strongly bitter taste. The sporocarp of *T. ustale* darkens in age, and pileipellis hyphae lack strong pigmented encrustations. *Tricholoma muricatum* has been confused with *T. pessundatum* (Fr.) Quélet, a European species associated with pines. *Tricholoma pessundatum* has smaller spores (4-5 x 2.5-3 µm), and a hypodermium of inflated, but not isodiametric 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 encrustations seen in *T. muricatum*, and are only weakly gelatinized. More complete descriptions of *T. pessundatum* and *T. stans* may be found in Bon (1984).

Tricholoma ustale (Fr.) Kummer, Führer Pilzekunde 130. 1871.

≡*Agaricus ustalis* Fr., Syst. Mycol. 1: 37.1821.

Illustrations: Figures 43-44.

Pileus 40-150 mm broad, convex to broadly convex, becoming lobed and wavy in age, occasionally broadly umbonate; surface viscid, becoming dry, glabrous with scattered appressed radiating fibrils visible on the disc, grayish orange to brownish orange (6B3, 6C2-6), the disc dark brown (7F5-7, 8F3-4),

and the entire sporocarp darkening in age; context whitish, pinkish buff near pileus surface, taste bitter, odor not distinguishable. **Lamellae** adnate to strongly sinuate, sometimes with a subdecurrent tooth, 3-10 mm broad, close, thin, pale buff or yellowish white (4A2), discoloring reddish brown in spots or sometimes marginate. **Stipe** 38-90 x 15-35 mm, equal or tapered slightly towards the base, appressed fibrillose to finely squamulose in places, pruinose at apex, whitish to pale yellow at apex, progressively darker towards the base, and generally concolorous with the pileus from the orange brown to brown (6D5-7E6) fibrils overlaying a buff background; context whitish to buff, solid or hollow.

Basidiospores 5.3-7.2 x 3.4-4.8 μm ($\bar{x}$ = 6.1 ± 0.64 x 3.4 ± 0.37; E = 1.2-2.0; Q = 1.5 ± 0.18; n = 82/4 collections); elliptic in side and face view, hyaline, inamyloid, smooth. **Basidia** 26-36 x 5.8-7.2 μm, clavate, 4 spored. **Hymenial cystidia** not observed. **Pileipellis** an ixotrichodermium; epicutis hyphae 2.4-5.8 μm diam., cylindric but often slightly inflated at the septa, and sometimes coiled or flexuous, mostly vertical, the apices somewhat interwoven in a gelatinous matrix, hyaline or with pale brown refractive contents, smooth or with fine hyaline encrustations; subcutis hyphae 3.8-9.6 μm diam., mostly cylindric to somewhat inflated, parallel, hyaline or with pinkish brown granular contents, smooth or with yellow brown plaques of encrustation. **Pileus trama** hyphae 3.8-14 μm diam., cylindric to inflated, loosely interwoven, hyaline, smooth. **Lamellar trama** hyphae 3.4-14 μm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe trama** hyphae 2.9-14 μm diam., cylindric to inflated,

parallel and compact, hyaline, smooth. **Stipitipellis** hyphae 3.4-5.8 µm diam., appressed and slightly interwoven, hyaline or with pale golden brown contents, smooth or with fine hyaline encrustations. **Caulocystidia** present at stipe apex as solitary recurved hyphal tips, 30-42 x 3.6-5.3 µm, cylindric, hyaline, smooth. **Clamp connections** absent.

Scattered to gregarious with hardwoods, December to January, Marin County southward.

Collections examined:

CALIFORNIA. Marin Co: Marin Municipal watershed district, Bon Tempe Lake, 17 Dec. 1992, KMS 324; **Santa Barbara Co:** Los Padres National Forest, Figeroa Campground, 31 Jan. 1993, KMS 372; **Santa Cruz Co:** location unknown (Santa Cruz Fungus Federation show), 9 Jan. 1994, KMS 438.

Discussion:

Tricholoma ustale is an uncommon species in California under oaks. It is characterized by the lack of a distinct annular zone, a mostly glabrous pileus that darkens in age, bitter taste and habit with oaks. Micromorphologically *T. ustale* has a thick gelatinous pileipellis, with finely encrusted or smooth hyphae. A related species, *T.dryophilum*, also occurs under oaks, but has a paler pileus coloration and a farinaceous taste and odor. Other viscid brown species in California with a bitter taste include *T. muricatum*, and *T. fracticum*. These

species are compared to *T. ustale* under their respective descriptions.

Tricholoma populinum Lange, Flora Agar. Dan. 1: 48. 1935.

The following description adapted from Bon (1984):

Pileus 80-120 mm broad, convex, margin inrolled; surface viscid, glabrous, occasionally with watery spots near the margin, rosy brown, paler towards the margin; context white, rosy near the surface, taste and odor farinaceous. **Lamellae** sinuate, white, discoloring reddish brown. **Stipe** 50-100 x 10-30 mm, equal, or tapered towards the base, whitish at first, concolorous with the pileus at maturity, sometime yellowish at the base; context solid, white.

Basidiospores 5.5-6.5 x 3.5-4 µm, elliptic, hyaline, inamyloid, smooth. **Basidia** 25-35 x 6-7 µm, clavate, 4 spored. **Hymenial cystidia** absent. **Pileipellis** an ixocutis; epicutis hyphae 3-7 µm diam., cylindric, interwoven?, hyaline, smooth; subcutis hyphae 10-15 µm diam., cylindric to somewhat inflated, more or less parallel, hyaline or with encrusting pigments.

Gregarious to caespitose in sandy soil with *Populus*.

Collections examined:

none

Discussion:

I have not seen any collections of *T. populinum* from California. However, it is likely to occur in California associated with *Populus* based on reports from local amateur collectors. It is considered a good edible, and has been traditionally collected by Interior Salish Indian people in British Columbia (Turner et al., 1987).

Stirps *Subannulatum*

Pileus viscid; **stipe** with an annular zone.

Tricholoma fracticum (Britz.) Kreisel, Feddes repert. 95(9-10): 700. 1984.

≡*Agaricus fracticus* Britz., Hym. Sudbavaria VI: 12, fig 394.

=*Tricholoma batschii* (Batsch) Gulden, Musseronflora Oslo: 60. 1969.

=*Tricholoma subannulatum* (Batsch) Bresadola, Icon. mycol. 2, Tab. 63. 1927. nom. illeg. non *Tricholoma subannulatum* (Peck) Zeller (1922: 187)

≡*Agaricus subannulatus* Batsch, El.: 75. 1786.

Pileus 23-100 mm broad, convex when young, margins inrolled, becoming broadly convex to plane in age, margins decurved; surface viscid becoming dry, with scattered appressed radiating fibrils, color reddish brown (7E-F7, 7D-F8), with occasional darker fibrils over the disc, margin often paler, with watery spots and/or striations; context white, orange-brown near the pileus surface in some, taste strongly bitter, odor not distinguishable or faintly farinaceous. **Lamellae** adnate at first, sinuate with a sub-decurrent tooth at

maturity, 2-5 mm broad, close, thin, orange white (5A2), discoloring brown (6E7) in spots in age. **Stipe** 20-70 x 10-17 mm, equal or tapered slightly towards the base, with a distinct annular zone, surface above the annular zone silky fibrillose and strongly pruinose, white to whitish, staining brown (6E6) in places in age; surface below the annular zone appressed fibrillose with a covering of orange brown (6B3-D5) fibrils which may break up revealing the whitish context below; partial veil a fugacious cortina which leaves a clearly defined superior to central annular zone; context white, solid.

Basidiospores 5.3-7.2 x 3.4-5.3 µm ($\bar{x}$ = 6.5 ± 0.58 x 4.7 ± 0.41 µm; E = 1.2-1.7; Q = 1.4 ± 0.10; n = 66/3 collections), elliptic, hyaline, inamyloid, smooth. **Basidia** 26-38 x 5.3-7.2 µm, clavate, 2 spored, rarely with 3 or 4 sterigmata, some with reddish brown contents. **Hymenial cystidia** absent. **Pileipellis** an ixocutis or ixotrichodermium; hyphae 3.4-7.2 µm diam., cylindric, vertically oriented, but terminal cells repent and parallel to the pileus surface or somewhat interwoven, hyaline with refractive reddish brown contents, smooth or rarely with fine, hyaline encrustations; no distinctive subcutis present. **Pileus trama** hyphae 4.8-12(17) µm diam., cylindric to somewhat inflated, interwoven, hyaline, smooth, somewhat thick-walled. **Lamellar trama** hyphae 2.4-19 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipitipellis** hyphae below annular zone 2.9-9.6 µm diam., cylindric, loosely interwoven but not in a gelatinous matrix, hyaline with reddish brown refractive contents, smooth. **Stipe trama** hyphae 2.4-9.6 µm diam., cylindric to slightly inflated, parallel, hyaline, smooth, thin- or slightly thick-walled. **Caulocystidia** present

at stipe apex above annular zone as recurved hyphal tips, 21-43(75) x 2.9-6.2 µm, cylindric, flexuous, often with strangulated apices, solitary or in pyramidal clusters, hyaline, smooth. **Clamp connections** absent.

Caespitose to gregarious in coastal forests, December to January.

Collections examined:

CALIFORNIA. Santa Cruz Co: location unknown (Mycological Society of San Francisco Fungus Fair), 7 Dec. 1991, KMS 196; location unknown (Santa Cruz Fungus Federation Fair), 9 Jan. 1994, KMS 436; KMS 437.

Discussion:

Tricholoma fracticum is an uncommon species in California that is easily recognized by the combination of a viscid brown pileus and fugacious cortina that leaves a clearly defined annular zone. No other species of *Tricholoma* in California possesses this combination of characters. The annular zone may become obscured in age, and older collections may be confused with other bitter tasting, viscid brown *Tricholoma* species, such as *T. ustale*, and *T. muricatum*. *Tricholoma ustale* occurs under oaks, and the sporocarp darkens in age overall. Micromorphologically the two species are not distinguishable. *Tricholoma muricatum* occurs with closed cone pines, and has orange white lamellae and the pileus margin is often costate. Micromorphologically, the pileipellis hyphae of *T. muricatum* are strongly encrusted, and the encrustations appear pigmented in H_2O.

A related European species is *T. ustaloides* Romagnesi. The pileus of *T. ustaloides* is more orange and viscid than *T. fracticum*, and *T. ustaloides* has a viscid stipe. Bon (1984) reported the spores of *T. fracticum* (as *T. batschii*) as 5-5.5 x 4-4.5 μm, smaller than the spores measured from the collections examined from California. However, all of the California collections examined have 2-spored basidia, instead of the 4-spored basidia described by Bon. Until more collections of this species are made, and the variation in sterigmata number determined, I consider the California material to be representative of *T. fracticum*. Gulden (1992) in his most recent key to Nordic species of *Tricholoma*, considered *T. batschii* to be a synonym of *T. fracticum*, and his nomenclature is followed here. The earlier name of *T. subannulatum* is invalid, as it is a later homonym of *T. subannulatum* (Peck) Zeller (1922).

Subgenus *Pardinicutis*, Section *Pardinicutis*
Type species: *Tricholoma pardinum* (Pers.) Quélet

Pileus dry, radially-fibrillose to squamulose, whitish, tan, gray or yellow brown; **lamellae** whitish; **spores** broadly elliptic; **cheilocystidia** usually present; **clamp connections** present throughout.

Tricholoma pardinum (Pers.) Quélet, Champ. Jura et Vosges 2: 339. 1873.
≡*Agaricus pardinus* Persoon, Syn.: 346. 1801.
= *Gyrophila tigrina* Schaeffer ex Quélet, Enchir. Fung. 12. 1886.

≡ *Tricholoma tigrinum* (Schaeffer ex Quélet) Barla, Champ. Alpes mar. 66. 1890.

= *Tricholoma pardalotum* Herink & Kotlaba, Ceska Mycol. 21: 5. 1967.

Illustrations: Figures 46-47.

Pileus 30-115 mm broad, convex, broadly convex or plane, the margins remaining down-turned in age; surface dry, with uniformly scattered small dark grayish brown to black appressed or recurved squamules and occasional fibrils over a white to pale gray background, the margin occasionally white; context white to pale gray; taste and odor farinaceous. **Lamellae** sinuate to deeply notched, 8-12 mm broad, close to subdistant, somewhat thick, whitish to cream or yellowish white (4A2). **Stipe** 70-110 x 7-25 mm; equal, the base slightly bulbous or tapered; surface dry, silky fibrillose, white or concolorous with lamellae at apex, the surface fibrils of the lower half bruising pale brown to golden tan (5C5); context white, occasionally orange white at the base, solid, very firm.

Basidiospores 6.2-10.6 x 4.3-6.7 µm ($\bar{x}$ = 8.4 ± 0.69 x 5.6 ± 0.43 µm; E = 1.2-1.9; Q = 1.5 ± 0.11; n = 192/9 collections); elliptic to broadly elliptic, hyaline, smooth, inamyloid. **Basidia** 38-48 x 7.2-9.6 µm, nearly cylindric to slightly clavate, 4-spored, hyaline, clamped at base. **Cheilocystidia** 24-58 x 12-19 µm, broadly clavate to sphaeropedunculate, scattered to abundant, hyaline, smooth, thin-walled and easily collapsing. **Pileipellis** a cutis; hyphae 2.2-8.2 µm diam., cylindric to slightly inflated or collapsed, mostly parallel,

forming recurved fascicles, hyaline to dark brown, smooth or with fine hyaline punctate encrustations. **Pileus trama** hyphae 4.8-19.2 µm diam., cylindric to inflated, interwoven, hyaline, smooth, oliferous hyphae common. **Lamellar trama** hyphae 2.4-24 µm diam., cylindric to inflated, parallel, hyaline. **Stipe trama** hyphae 2.4-9.6 µm diam., cylindric, parallel, hyaline, some surface hyphae with golden brown contents. **Caulocystidia** absent. **Clamp connections** scattered throughout.

Scattered to gregarious with conifers or in mixed woods from October to December in coastal forests from Santa Cruz County northward, and in montane regions from September to October.

Collections examined:

ITALY: Near Malgolo, 4 Oct. 1973, HDT 31683; **U.S.A. CALIFORNIA**. **Amador Co:** Silver Lake, 3 Oct. 1976, HDT 36563; **Calaveras Co:** Hwy 4, 1 mi e of Camp Connell, 22 Oct. 1983, HDT 46683; **Del Norte Co:** Jedediah Smith State Park, 19 Nov. 1965, HDT 14342; **El Dorado Co:** Hwy 199 at Oregon border, 29 Oct. 1971, HDT 28538; Crystal Basin Reservoir, 16 Oct. 1976, HDT 36667; **Fresno Co:** Huntington Lake, 27 Sept. 1975, HDT 35001; **Humboldt Co:** Le Perron Peak area, s of Hoopa, Six Rivers National Forest, 5 Nov. 1972, DLL 5451 (HSC); Groves Prairie, 31 Oct. 1976, HDT 36853; 2 mi ne of Salyer, 30 Nov. 1989, DLL 8990 (HSC); **Santa Cruz Co:** Boulder Creek, 30 Dec. 1970, HDT 27084; **Shasta Co:** Castle Crags State Park, 17 Nov. 1967, HDT 21581; **Sierra Co:** SFSU Field Campus, 26 Oct. 1985, HDT 49217; Wild

Plum Campground, Hwy 49 nr Sierra City, 4 Oct. 1989, HDT 52784; **Siskiyou Co:** Haypress Trail, Marble Mountain Wilderness, 30 Oct. 1976, HDT 36880; Carter meadow near Callahan, 1 Oct. 1983, HDT 46494; Duck Lake Trailhead, Klamath National Forest, 2 Oct. 1983, DLL 8423 (HSC); Sand Flat, Mt. Shasta, 28 Sept. 1989, HDT 52750; **Sonoma Co:** Salt Point State Park, 25 Nov. 1972, HDT 30703; 7 Dec. 1991, KMS 197; Stump Beach Trail, Salt Point State Park, 10 January 1992, KMS 224; **Tehama Co:** Intersection of Hwy 36 & 89, s of Lassen Volcanic National Park, 29 Sept. 1989, HDT 52756; **Mendocino Co:** Jackson State Forest, 19 Nov. 1960, Peters 122; 5 Nov. 1960, HDT 8199; 12 Nov. 1960, HDT 8224; 11 Nov. 1960, HDT 8287; 18 Nov. 1961, HDT 8901; 7 Dec. 1963, HDT 11085; 11 Dec. 1965, HDT 14600; 19 Dec. 1965, HDT 14644; 20 Dec. 1966, HDT 18160; 5 Nov. 1967, HDT 21279; 9 Dec. 1967, HDT 21786; 8 Nov. 1969, HDT 24186; 6 Dec. 1969, HDT 24432; 5 Nov. 1972, HDT 30454; 3 Dec. 1972, HDT 30828; 29 Oct. 1977, HDT 38407; 26 Nov. 1977, HDT 38436; 24 Nov. 1979, HDT 40515; Northern California Coast Preserve, 9 mi w of Branscombe, 1 Dec. 1979, HDT 40581; Jackson State Forest,14 Dec. 1980, HDT 41704; 7 Nov. 1981, HDT 43929; 6 Dec. 1991, HDT 53938; Van Damme State Park, Pygmy forest Parking Lot, 13 Nov. 1992, KMS 278; 13 Nov. 1992, KMS 280; Jackson State Forest, 21 Nov. 1992, KMS 284; Van Damme State Park, Pygmy forest Parking Lot, 22 Nov. 1992, KMS 289; Paul Dimmick State Park, 4 Dec. 1992, KMS 319; **Trinity Co:** Gray Falls campground, 18 Nov. 1972, G. Wong 277; 2 mi ne of Salyer, Six Rivers National Forest, 30 Nov. 1989, DLL 8990 (HSC);**Tuolumne Co:** Pinecrest, 28 Oct. 1965, HDT 13881; Hwy

108, 2 mi e of Long Barn, 12 Nov. 1983, HDT 46983.

Discussion:

Tricholoma pardinum is a large, robust species characterized by a dry pileus with regularly spaced dark squamules over a white to pale gray background. The presence of clamp connections and radially oriented piliepellis hyphae place it in Subgenus *Pardinicutis*, and distinguish this species from other gray *Tricholoma* species in Subgenus *Tricholoma*. It is most easily confused with T. *venenatum*, a paler buff to tan species which lacks cheilocystidia and appears to be restricted to montane habitats in California. Both species are known to cause severe gastrointestinal distress. European authors (Bon, 1984; Moser, 1983; Gulden, 1992) do not mention cheilocystidia in their descriptions of *T. pardinum*, but a collection of *T. pardinum* from Italy (HDT 31683) was identical in all respects to collections from California, including the presence of cheilocystidia.

A related species described from Washington state, but not known from California, is *T. huronense* Smith. It is characterized by a smoky gray fibrillose pileus, with drops of pink liquid on the stipe and pileus margin, and has cheilocystidia.

Tricholoma venenatum Atkinson, Botan. Gazette 46: 461. 1908.

≡ *Melanoleuca venenata* (Atkinson) Murrill, North American Flora 10(1): 15. 1914.

Illustrations: Figure 48.

Pileus 75-130 mm broad, broadly convex to plane or uplifted; surface dry, appressed radiating fibrillose with occasional faint brown (6D6) squamules over the disc, otherwise white to pale tan overall; context white, grayish near pileus surface; taste and odor not distinguishable or farinaceous. **Lamellae** strongly sinuate, 8-13 mm broad, thin to thick, close to subdistant, white to pale cream (4A2). **Stipe** 40-100 x 22-25 mm; equal with a slightly bulbous base; surface dry, silky fibrillose, white, discoloring tan (5C5) where handled; context solid, white to grayish buff.

Basidiospores 7.2-10.7 x 4.8-7.2 µm ($\bar{x}$ = 8.8 ± 0.67 x 5.5 ± 0.44 µm; E = 1.4-1.9; Q = 1.6 ± 0.11; n = 84/4 collections), elliptic, hyaline, smooth, inamyloid. **Basidia** 40-48 x 7.2-9.6 µm, clavate, 4-spored, hyaline. **Hymenial cystidia** absent. **Pileipellis** a cutis; hyphae 2.4-9.6 µm diam., cylindric, mostly parallel, forming recurved fascicles, hyaline or pale brown, smooth, or with fine, hyaline, granular encrustations. **Pileus trama** hyphae 3.8-14 µm diam., cylindric near the pileipellis, cylindric to inflated elsewhere, mostly parallel, hyaline, or occasionally with refractive granular contents that are bright orange in melzer's, smooth. **Lamellar trama** hyphae 3.4-19 µm diam., cylindric to somewhat inflated, parallel, hyaline, smooth. **Stipe trama** hyphae 2.4-12 µm diam., cylindric to slightly inflated, parallel, hyaline, smooth. **Caulocystidia** present as recurved hyphal tips, 24-43 x 3.4-3.8 µm, cylindric, in large interwoven clusters, hyaline or pale yellow, smooth. **Clamp**

connections present throughout.

Solitary to scattered with conifers above 1300 m elevation from September to October in the Sierra Nevada.

Collections examined:

CALIFORNIA. Nevada Co: Skillman Campground, Hwy 20, 5 November 1983, HDT 46888; **Placer Co:** 3 mi s of Tahoe City, 24 Sept. 1982, Calhoun s.n.; **Shasta Co:** Hwy 44 nr Viola, 24 Nov. 1967, HDT 21699; **Sierra Co:** Hwy 49, Yuba Pass, 8 Oct. 1983, HDT 46626; Hwy 49, Chapman Creek Campground, 9 Oct. 1993, KMS 393; SFSU Field Camp, 9 Oct. 1993, KMS 396; Hwy 49, Turner Canyon, 9 Oct. 1993, KMS 394; **Tuolumne Co:** Bottlin Ranch Rd nr Hwy 108, 30 Nov. 1974, Halling 233; **WASHINGTON. Clallam Co:** Boulder Creek, Olympic National Park, 21 Nov. 1992, O'Dell 1602 (WTU).

Discussion:

Tricholoma venenatum was described as associated with hardwoods in Michigan (Atkinson, 1908). In California it appears to be restricted to the Sierra Nevada above 1300 m, where it is associated with conifers. I have also seen collections of *T. venenatum* from the Olympic Peninsula of Washington State associated with *Pseudotsuga menziesii* (O'Dell 1602). *Tricholoma venenatum* is most easily confused with *T. pardinum*, which has darker gray squamules on the pileus, and cheilocystidia. Both *T. venenatum* and *T. pardinum* are known to cause severe gastrointestinal distress. *Tricholoma serratifolium* Peck is a

pale species with a dry pileus and occasional squamules known from eastern North America. It lacks clamp connections and has a bitter taste. A more complete description of *T. serratifolium* may be found in Ovrebo (1989).

Tricholoma tumidum (Pers.:Fr.) Ricken, Die Blatterpilze, No. 1022. 1915.

≡ *Agaricus tumidus* Pers.:Fr., Sys. Mycol. 1: 48. 1821.

Illustrations: Figures 49-52.

Pileus 50-100 mm, convex when young, becoming broadly convex or planoconvex with a low, broad umbo; surface dry, appressed radiating fibrillose, often virgate, occasionally matted fibrillose or faintly squamulose over the disc, cracking radially in age and exposing the white context; disc dark brown to yellowish brown (5D7-6D6, 6E-F4, 7F5), elsewhere a mixture of yellow ochre and greenish to grayish yellow (4B-C4), and bright yellow (3A4) from brownish fibrils over a yellow to yellow gray background, often whitish on the margin; context thin, white with yellow or gray tints near the pileus surface; taste and odor faintly farinaceous. **Lamellae** sinuate, 5-11 mm broad, close, thin, whitish, pale cream (4A2) or pale buff, margins discoloring yellow (4A6) in age, particularly near pileus margin. **Stipe** 30-110 x 8-30 mm, ventricose, base tapering to a point; surface silky fibrillose, pruinose at apex, white, pinkish or pale orange (6A3) towards the base, surface fibrils discoloring pale brown (5C7) in age or with handling; context solid, fibrous, white.

Basidiospores 4.3-7.2 x 3.4-5.3 μm ($\bar{x}$ = 5.4 ± 0.52 x 4.19 ± 0.45 μm; E

= 1.0 - 1.5; Q = 1.3 ± 0.11; n = 83/4 collections); subglobose to broadly elliptic in face view and profile, hyaline, smooth, thin-walled and often collapsing, inamyloid. **Basidia** 26-38 x 5.8-6.7 µm, narrowly clavate, 4 spored. **Cheilocystidia** 19-48(72) x 9.6-17 µm; broadly clavate, ampuliform, saccate or sphaeropedunculate, occasionally ventricose or mucronate, abundant, hyaline, smooth, thin-walled, rarely clamped at the base. **Pleurocystidia** 26-34 x 9.6-17 µm, sphaeropedunculate to saccate, uncommon, hyaline, smooth, thin-walled and easily collapsing. **Pileipellis** a cutis; hyphae 2.4-7.2 µm diam., cylindric to slightly inflated, parallel to slightly interwoven, hyaline or pale brown, smooth, or with punctate or rarely zebroid hyaline encrustations. **Pileus trama** hyphae 4.8-19(26) µm diam., cylindric to highly inflated, mostly parallel, hyaline or with hyaline granular contents which are bright orange in melzer's, smooth. **Lamellar trama** hyphae 2.4-12 µm diam., cylindric to inflated, parallel, smooth. **Stipe trama** hyphae 2.4-16 µm diam., cylindric to somewhat inflated, hyaline, smooth, thin or thick-walled. **Caulocystidia** present as tangled clusters of recurved hyphal tips, 17-34 x 5.8-9.6 µm, clavate to broadly clavate, hyaline, smooth. **Clamp connections** scattered throughout.

Gregarious in coastal mixed evergreen forests November to December from Santa Cruz to Mendocino Counties.

Collections examined:

CALIFORNIA. Mendocino Co: Van Damme State Park, Pygmy Forest Parking Lot, 22 Nov. 1992, KMS 291; 28 Nov. 1992, KMS 306; Jackson State

Forest, 5 Dec. 1992, KMS 315; **Santa Cruz Co:** Big Basin State Park, 9 Jan. 1994, KMS 434.

Discussion:

Tricholoma tumidum is easily recognized by the combination of a dry, radially fibrous pileus with a mixture of yellow and brown coloration, and a ventricose stipe. The material described here matches the description of *T. tumidum* by Bon (1984) with the exception of the hymenial cystidia. Bon considered *T. tumidum* to have contorted and slender sterile cells on the gill margin, a far cry from the large inflated cheilocystidia seen in the California collections. However, Bon (1984) failed to mention the inflated cheilocystidia of *T. pardinum*. Until a more thorough examination of North American and European collections of *T. tumidum* indicates a consistent variation in the presence or absence of cheilocystidia, I consider the North American material of *T. tumidum* to be conspecific with the European material.

Species occurring in California with which *T. tumidum* may be confused are species in Stirps *Tricholoma*, which differ by lacking clamp connections and possessing a viscid pileus. *Tricholoma davisae* Peck (1900) [= *T. cheilolaminum* Ovrebo & Tylutki (1975)] is a species known from the Pacific Northwest, that is macromorphologically very similar to *T. tumidum. Tricholoma davisae* has a dry, radially fibrillose pileus that is brown over the center with a yellowish green margin, but has a prominent acute umbo, and rounded stipe base. Micromorphologically, *T. davisae* lacks clamp connections and has

larger spores than *T. tumidum*. See Ovrebo (1989) for a more complete description of *T. davisae*.

Subgenus *Sericeicutis*, Section *Sericeicutis* (Section *Sericella*)

Type species: *Tricholoma sulphureum* (Bull.:Fr.) Kummer

Pileus dry, sericeous; odors strong, usually like coal tar; **partial veil** absent; **cheilocystidia** absent; **pileipellis** hyphae interwoven; **clamp connections** usually present, particularly at the base of the basidia.

Tricholoma inamoenum (Fries) Gillet, Champ. Fr. 112. 1878.

≡*Agaricus inamoenum* Fries, Syst. Mycol. 1: 111. 1821.

≡*Gyrophila sulfurea* var. *inamoena* Quélet, Enchir. Fung. 14. 1886.

=*Melanoleuca platyphylla* Murrill, Mycologia 5: 219. 1913.

≡*Tricholoma playtphyllum* (Murr.) Murrill, Mycologia 5: 223. 1913.

Illustrations: Figure 53.

Pileus 15-30 (45)mm broad, convex to broadly convex; surface dry, glabrous, cream to pale tan, paler at margin; context white; taste like motor oil, odor of coal tar. **Lamellae** adnate when young, sinuate at maturity, 3-5 mm broad, subdistant to distant, thin, cream to very pale tan. **Stipe** 40-80 x 4-5 mm, equal or tapering upwards from a swollen base; surface dry, silky-fibrillose, pallid to cream; context white, solid.

Basidiospores 9.6-14.4 x 5.3-7.7 µm ($\bar{x}$ = 11.1 ± 0.86 x 6.4 ± 0.52 µm; E = 1.5-2.1; Q = 1.7 ± 0.13; n = 141/8 collections) amygdaliform, fusoid-ventricose or broadly elliptic, smooth, inamyloid, occasional spores dextrinoid; **Basidia** 41-53 x 8.2-12 µm, clavate, 4 spored, clamp connections present at base. **Hymenial cystidia** absent, some irregular basidioles present on the margin. **Pileipellis** a cutis; hyphae 2.4-12 µm diam., cylindric to slightly inflated, interwoven, appearing nearly gelatinous, occasional hyphae extending beyond the pileus surface, hyaline or with refractive contents, smooth, rarely with fine hyaline punctate encrustations. **Pileus trama** hyphae 2.9-12 µm diam., cylindric to somewhat inflated, interwoven, hyaline, smooth. **Lamellar trama** hyphae 2.4-16.8 µm diam., cylindric to inflated, parallel, hyaline, smooth or with irregularly thickened walls. **Stipe trama** hyphae 2.4-14.4 µm, cylindric to inflated, mostly parallel, hyaline, surface hyphae occasionally with refractive contents, smooth. **Caulocystidia** 14.4-38.4 x 3.4-4.3 µm, cylindric, often with strangulated apices, present at stipe apex as pyramidal clusters of recurved hyphal tips, hyaline, smooth. **Clamp connections** present at the base of basidia.

Solitary to gregarious with conifers, particularly *Picea*, October to December in coastal forests Mendocino County northward.

Collections examined:

NORWAY: NLH Forest, Akershus, 27 Sept. 1980, HEB 18420 (NYS); **SWITZERLAND:** Biere, 22 Oct. 1973, HDT 32076; **USA. CALIFORNIA. Del**

Norte Co: Alder Camp Rd, Rugg Grove, Redwood National Park, 24 Oct. 1982, HDT 45192; 3 Nov. 1984, HDT 48129; 3 Nov 1984, MTS 208; **Humboldt Co:** Big Lagoon, 6 Nov. 1972, DLL 5443 (HSC); Patrick's Point State Park, 11 Nov. 1979, HDT 40372; Murray Rd near McKinleyville, 28 Nov. 1980, HDT 41664; Patrick's Point State Park, 12 Sep. 1986, DD 41 (HSC); 25 Oct. 1992, KMS 249; **Mendocino Co:** Jackson State Forest, 11 Dec. 1969, HDT 24483; 28 Dec. 1980, HDT 41730; 22 Nov. 1981, HDT 44023; 20 Nov. 1982, HDT 45440; 24 Nov. 1985, HDT 49277; **WASHINGTON**. nr Seattle, October-November 1911, Murrill 419 (HOLOTYPE; NY).

Discussion:

Tricholoma inamoenum is an uncommon species of the northern coastal forests in California. It is readily identified by an overall dull cream or buff coloration, small stature, and coal tar odor. Micromorphologically, the large, amygdaliform spores and clamp connections at the base of the basidia are distinctive. A related species with similar spores and a coal tar odor, *Tricholoma sulphureum*, is bright yellow overall, and has a yellow pileipellis pigment which appears vinaceus in KOH in herbarium specimens.

My concept of *Tricholoma inamoenum* is based on descriptions by Moser (1983) and Bon (1984) and European material identified by Gro Gulden (HEB 18420, NYS). My examination of the type collection of *Melanoleuca platyphyla* Murrill has shown it to be identical in all micromorphological features to material from Europe, and Murrill's description, based on a single sporocarp, differs from

European material only in his description of the lamellae and stipe as white. Assuming he saw a relatively pale collection, it seems prudent to consider *M. platyphyllum* a synonym of *T. inamoenum*. Collections of *T. inamoenum* from California are slightly smaller than European collections. The pileus diameter of California collections ranges from 15-45 mm, while Moser (1983) and Bon (1984) report the pileus of *T. inamoenum* as 30-70 mm broad. However, the limited number of dried European collections I examined were similar in size to dried collections from California.

Tricholoma sulphureum (Fr.) Staude, Die Schwamme Middledeut. 126. 1858.

≡*Agaricus sulphureus* Fr., Syst. Mycol. 1: 110. 1821.

≡*Gyrophila sulfurea* Quél., Enchir. Fung. 14. 1886.

Illustrations: Figure 54.

The following description of macromorphological features is adapted from Ovrebo (1980) and Bon (1984):

Pileus 20-50 mm broad; when young obtuse, expanding to plane; surface dry, glabrous, with occasional scattered, minute squamules, very pale pinkish tan over the disc (near 6C3), pale yellow elsewhere; context pale greenish yellow; odor of coal-tar, taste similar to odor. **Lamellae** adnate, 2-5 mm broad, subdistant, pale yellow (1A2-3), not discoloring,. **Stipe** 40-45 x 7-13 mm, equal or clavate, the base rounded or somewhat bulbous; surface silky-fibrillose with superficial surface fibrils projecting, pale yellow (near 1A3) overall

but the base often with a slight vinaceous tinge; context solid, pale yellow.

Basidiospores 8.6-12.0 x 5.3-7.2 µm ($\bar{x}$ = 10.4 ± 0.87 x 6.0 ± 0.38 µm; E = 1.5-2.1; Q = 1.7 ± 0.15; n = 62/3 collections); amygdaliform or elliptic in profile, elliptic or fusoid-ventricose in face view, hyaline, smooth, inamyloid, occasional spores thick-walled and dextrinoid. **Basidia** 38-52 x 9.6-12 µm; clavate, hyaline, basidioles occasionally with violet contents in KOH, smooth. **Hymenial cystidia** absent. **Pileipellis** a cutis; hyphae 2.4-14 µm diam., cylindric to slightly inflated, loosely interwoven to interwoven, appearing nearly gelatinized, hyaline, or with brownish or violet refractive contents in KOH, smooth or with fine hyaline encrustations. **Lamellar trama** hyphae 2.4-14 µm diam., cylindric to somewhat inflated, parallel, smooth. **Stipe hyphae** 2.4-11 µm diam., cylindric near the surface to somewhat inflated, parallel, surface hyphae with pinkish brown to violet refractive contents, context hyphae slightly yellowish, smooth. **Caulocystidia** absent. **Clamp connections** present at the base of basidia in some collections.

Scattered to gregarious under conifers in October to December, coastal forests, Marin County northward.

Collections examined:

SWITZERLAND: Bierre, 22 Oct. 1973, HDT 32021; **USA. CALIFORNIA. Marin Co:** Point Reyes National Seashore, Skycamp Trail, 2 Dec. 1984, Strong 201; **Mendocino Co:** Jackson State Forest, 2 Dec. 1978, HDT 39251; **Siskiyou Co:** Trailhead to Duck Lake, Klamath National Forest, 2 Oct. 1983,

DLL 8426 (HSC); **OREGON. Klamath Co:** Lake of the Woods, 28 Oct. 1990, HDT 53370.

Discussion:

Tricholoma sulphureum is an extremely uncommon fungus in California. It is distinguished by an overall pale yellow coloration, although the pileus disc may have some yellow-brown coloration, dry and glabrous pileus, and coal tar odor. Micromorphologically, the large, amygdaliform spores and pileipellis hyphae which are violet in KOH are distinctive. A related species in California is *T. inamoenum*, which is a pale cream color overall, and is similar micromorphologically, but the pileipellis hyphae are hyaline in KOH. *Tricholoma bufonium* (Pers.:Fr.) Gillet (1878) is a European species that is micromorphologically very similar to *T. sulphureum* , but the pileus has violet brown fibrils over a yellow background.

I have not collected *Tricholoma sulphureum*. My concept of the species is based on descriptions by Bon (1984), Moser (1983) and Ovrebo (1980). One of the collections from California I examined (DLL 8426) has 2-spored basidia, and slightly larger spores (9.6-12 x 5.28-6.72 µm). Collections from the west coast have either scattered clamps at the base of the basidia, or appear to lack them entirely. Bon described the clamp connections of *T. sulphureum* as being rare, although Ovrebo reported clamp connections to be present at the base of the basidia. In all other respects the material from California is identical to collections from Europe.

Subgenus *Contextocutis*, Section *Contextocutis* (Section *Ridgida*)

Type species: *Tricholoma saponaceum* (Fr.) Staude

Pileus glabrous, moist; **cheilocystidia** absent; pigments exclusively intracellular; **clamp connections** present throughout.

Tricholoma saponaceum (Fr.) Staude, Die Schwamme Mitteldeut. :127.1858.

≡*Agaricus saponaceus* Fr., Epicrisis: 35. 1836-38.

≡*Gyrophila saponacea* (Fr.) Quélet, Enchir. Fung.:13. 1886.

Illustrations: Figure 55.

Pileus 30-170 mm broad, convex to planoconvex, often with a broad umbo, margins inrolled at first, becoming uplifted and wavy in age; surface moist or dry, not viscid, glabrous, rarely with scattered appressed fibrils over the disc, color variable, greenish yellow (3B5), olive (4C-E4-6), or grayish brown (5-6D-F3), occasionally copper-colored (near 6C6) in age; context whitish, taste and odor historically described as like soap, rather sharp and rancid with a sweet overtone. **Lamellae** sinuate, 3-10 mm broad, close to sub-distant, thin or somewhat thick, white to yellowish white (4A2), not staining or discoloring. **Stipe** 30-100(250) x 6-25 mm, equal or slightly ventricose, tapered towards the base, the base pointed or subradicating; surface silky fibrillose or glabrous and somewhat moist, concolorous with lamellae overall or only at apex, remainder

brownish gray (5C3-6D4), stipe base orange white or pinkish; context solid, whitish to pale gray, pinkish at base.

Basidiospores 5.3-7.2 x 3.4-4.8 µm ($\bar{x}$ = 6.0 ± 0.61 x 4.1 ± 0.47; E = 1.2-1.8; Q = 1.5 ± 0.14; n = 100/5 collections); elliptic, hyaline, smooth, inamyloid. **Basidia** 24-33 x 5.8-6.2 µm, clavate, 4 spored. **Hymenial cystidia** absent. **Pileipellis** a cutis; hyphae 1.9-8.6 µm diam., cylindric to somewhat inflated or collapsed, interwoven, hyaline or with granular grayish brown contents, smooth or with fine hyaline encrustations. **Pileus trama** hyphae 2.4-17 µm diam., cylindric to inflated, interwoven, hyaline or with refractive walls, smooth, thin- or thick-walled. **Lamellar trama** hyphae 2.4-17 µm diam., cylindric to inflated, hyaline, smooth. **Stipe hyphae** 2.8-14 µm diam., cylindric to inflated, hyaline, smooth, walls thin or irregularly thickened. **Caulocystidia** present as recurved hyphal tips, 21-48 x 3.3-9.6 µm, cylindric to clavate, in large pyramidal clusters or as a turf, hyaline, smooth, thin-walled and easily collapsing. **Clamp connections** scattered throughout.

Solitary to caespitose with hardwoods or conifers throughout California, September to March in coastal forests, June to November in montane forests.

Collections examined:

CALIFORNIA. Alpine Co: Ebbetts pass, 21 Aug. 1974, HDT 32788; Alpine Lake, 2 Oct. 1975, Halling 846; 13 June 1976, Halling 1413; 29 Aug. 1982, HDT 44760;18 Sept. 1982, HDT 44872; HDT 44907; **Amador Co:** Carson Spur, 4 Oct. 1975, Halling 871; **Del Norte Co:** Jedediah Smith State Park, 11 Nov.

1967, HDT 21556; 3 Oct. 1976, HDT 36558; **El Dorado Co:** Luther Pass, 7 Oct. 1971, HDT 28360; Crystal Basin Recreation Area, 16 Oct. 1976, HDT 36750; **Humboldt Co:** Big Lagoon, 15 Oct. 1977, HDT 38311; 10 Nov. 1979, HDT 40380; 31 Oct. 1981, HDT 43854; Redwood National Park, Davison Rd, 8 Nov. 1992, KMS 265; **Marin Co:** Bolinas Ridge Rd, 16 Dec. 1981, CB 489; Audobon Canyon Ranch, Volunteer Canyon, 22 Dec. 1981, Calhoun 81-2937; Marin Municipal Watershed District, 3 Jan. 1992, KMS 211; 22 Dec. 1992, DED 5596; 26 Jan. 1993, DED 5653; **Mendocino Co:** Jackson State Forest, 19 Nov. 1960, HDT 8342; 9 Dec. 1961, HDT 9059; 24 Dec. 1964, HDT 9917; 30 Jan. 1965, HDT 12098; 8 Jan. 1967, HDT 18415; 1 Dec. 1967, HDT 21747; 26 Nov. 1977, HDT 38428; 24 Nov. 1979, HDT 40415; 3 March, 1984, HDT 47382; 18 Nov. 1984, HDT 48231; 23 Nov. 1986, HDT 50869; HDT 50874; 24 Mar. 1989, HDT 52009; Hendy Woods State Park, 8 Jan. 1992, KMS 213; Jackson State Forest, 9 Jan. 1992, KMS 221; Van Damme State Park, Pygmy Forest Parking Lot, 21 Nov. 1992, KMS 286; Jackson State Forest, 28 Nov. 1992, KMS 303; **Nevada Co:** Donner Summit, 14 Sept. 1965, HDT 13176; Tahoe National Forest, Skillman Flat Campground, 26 Oct. 1975, HDT 35218; **San Diego Co:** Lake Henshaw, 10 Mar. 1970, HDT 25067; **San Mateo Co:** San Francisco Watershed, 17 Jan. 1965, HDT 12079; 12 Dec. 1975, HDT 35610; Huddard Co. Park, 16 Dec. 1982, HDT 45588; Jasper Ridge Biological Reserve, 9 Jan. 1993, KMS 355; **Santa Barbara Co:** Los Padres National Forest, Ridge Rd nr Figeroa Mtn, 28 Feb. 1992, KMS 244; **Santa Cruz Co:** Felton, 18 Jan. 1967, HDT 18527; Big Basin State Park, 26 Dec. 1969, HDT 24561;

Boulder Creek, 30 Dec. 1970, HDT 27073; **Sierra Co:** Hwy 49, Yuba Pass, 20 Sept. 1965, HDT 13205; 26 Oct. 1965, HDT 13861; 29 Sept. 1967, HDT 21138; SFSU Field Campus, 3 Sept. 1983, HDT 46161; Hwy 49, Turner Canyon, 13 Oct. 1984, HDT 47980; Hwy 49 nr Bassetts Station, 5 Oct. 1989, HDT 52819; **Siskiyou Co:** Hwy 89 nr McCloud, 15 June 1967, HDT 19587; Mt. Shasta, 4 Sept. 1976, HDT 36287; **Sonoma Co:** Salt Point State Park, 25 Nov. 1972, HDT 30717; 10 Jan. 1992, KMS 222; 1 Nov. 1992, KMS 254; Tehama Co: Hwy 89, Gurnsey Creek Campground, 10 Oct. 1976, HDT 36590; **Trinity Co:** Six River National Forest, Hwy 299, Grey Falls Campground, 18 Nov. 1972, HDT 30631; 25 Nov. 1983, HDT 47080; 27 Nov. 1986, HDT 50941; **Tuolumne Co:** Pinecrest, 29 Sept. 1965, HDT 13316; Sonora, 13 Dec. 1984, HDT 48436; **Yuba Co:** Bullard's Bar Recreation Area, Schoolhouse Campground, 19 Nov. 1981, HDT 43986; 30 Oct. 1982, HDT 45283; 3 Dec. 1983, HDT 47124; 9 Nov. 1984, HDT 48214; 7 Dec. 1991, KMS 200.

Discussion:

Tricholoma saponaceum is a very common species in California. It occurs in a variety of habitats in both the spring and fall. The pileus coloration is variable, and several varieties of *T. saponaceum* have been described from Europe (Bon, 1984) on the basis of pileus coloration. In my experience, the pileus coloration may vary with age as well as between populations. The distinctive odor and pinkish coloration at the base of the stipe are the characters that are consistent in *T. saponaceum*.

Tricholoma olidum (Thiers & Sundberg) nom. prov.

≡*Armillaria olida* Thiers & Sundberg, Madroño 23(8): 541. 1976.

Illustrations: Figure 56.

Pileus 50-170 mm broad, convex to broadly convex with the margin down-turned at first, becoming planoconvex to plane in age, the margin uplifted, and often lobed and irregular; surface dry to moist, not viscid, glabrous, often with a whitish bloom at first, appearing streaked or appressed fibrillose in age, white at first or when covered with litter, rapidly becoming fuscous to brown (6B3-E4), often with olive or grayish shades, sometimes with pale tan areas; context white, taste and odor strongly cucumbery or farinaceous. **Lamellae** adnate to adnexed when young, deeply notched or appearing nearly free in age, close, thick, white, pale pinkish in age. **Stipe** 40-140 x 13-35 mm, equal or subclavate, the base often enlarged; surface dry, glabrous to silky fibrillose above annulus, appressed fibrillose to fibrillose scaly below, white, staining tan to orange brown below the annulus; annulus median to superior, fibrillose; context solid, white.

Basidiospores 8.2-12 x 4.8-6.2 µm, ($\bar{x}$ = 10.0 ± 0.99 x 5.3 ± 0.40; E = 1.5-2.2; Q = 1.9 ± 0.17; n = 61/3 collections), elliptic to narrowly elliptic, hyaline, smooth, inamyloid. **Basidia** 38-48 x 7.2-9.6 µm, clavate, 4 spored, occasionally 2 spored. **Hymenial cystidia** absent. **Pileipellis** a cutis; hyphae 1.9-4.8 µm diam., cylindric, interwoven to subparallel and appearing

nearly gelatinized, hyaline or with hyaline refractive contents, smooth. **Pileus trama** hyphae 2.4-9.6 µm diam., cylindric to inflated, parallel near the pileus surface, elsewhere interwoven, hyaline, smooth. **Lamellar trama** hyphae 2.4-12 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe hyphae** 2.4-7.2 µm diam., cylindric to slightly inflated, interwoven at the surface, parallel elsewhere, hyaline, some surface hyphae at stipe base with pale brown refractive contents, smooth. **Clamp connections** scattered throughout.

Solitary to gregarious with conifers (*Abies* and *Pinus*) above 1200 m throughout the Sierra Nevada and rarely in coastal forests, April to July.

Collections examined:

CALIFORNIA. Amador Co: Hwy 88, Silver Lake Campground, 18 May 1985, HDT 49039; **Calaveras Co:** Hwy 4 nr Devils Kitchen Vista Point, 28 May 1966, HDT 16756; **El Dorado Co:** El Dorado National Forest, Crystal Basin Recreation Area, 6 May 1972, HDT 28816 (HOLOTYPE, SFSU); 23 May 1973, HDT 30911; 4 May 1974, HDT 32229; 14 June 1975, HDT 34050; 3 May 1980, HDT 40763; 8 May 1985, HDT 49019; **Fresno Co:** Huntington Lake, 2 July 1975, HDT 34318; **Mariposa Co:** Yosemite National Park, Crane Flat, 5 June 1976, Halling 1388; **Mendocino Co:** Monkey Rock, Toren 1266; **Nevada Co:** Tahoe National Forest, Skillman Flat Campground, 6 April 1974, HDT 32199; 1 May 1976, HDT 35720; 13 May 1983, HDT 45861; **Shasta Co:** Hwy 36, 5 mi n of Lassen Volcanic National Park, 2 July 1982, HDT 44614; **Sierra Co:** Hwy 49, Yuba Pass, 27 May 1970, HDT 25360; 12 June 1984, HDT 47743;

Tahoe National Forest, Wild Plum Campground, 28 April 1989, HDT 52080; **Siskiyou Co:** Medicine Lake Rd, 7.5 mi n of Hwy 89, 4 June 1970, HDT 25407; SFSU Field Campus, 6 June 1993, KMS 378; **Trinity Co:** Hwy 3, 4 mi s of Scott Mtn Pass, 6 June 1975, HDT 33895; **Tuolumne Co:** Hwy 108, Pinecrest, 27 May 1970, HDT 25321; 9 June 1973, HDT 30915; 17 May 1980, HDT 40816; 9 May 1984, HDT 47623; 24 April 1986, HDT 49612; 29 April 1992 KMS 246.

Discussion:

Tricholoma olidum 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. olidum* in Subgenus *Contextocutis*. Species that may be confused with *T. olidum* are gray viscid species of *Tricholoma* in Subgenus *Tricholoma* Section *Tricholoma* (such as *T. griseoviolaceum*) that lack clamp connections.

Thiers and Sundberg (1976) had a rather broad concept of *Armillaria*, and included species with white spore prints, attached lamellae, and a partial veil forming an annulus. The type species of *Armillaria* is now considered to be *A. mellea* (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*.

EXCLUDED, EXTRALIMITAL AND DOUBTFUL SPECIES

Tricholoma acre Peck, Bull. Torrey Bot. Club 24: 139. 1897.

≡*Melanoleuca acris* (Peck) Murrill, N. Am. Fl. 10:8. 1914.

Tricholoma acre is known only from eastern North America. A complete description of *T. acre* and related species may be found in Ovrebo (1989).

Tricholoma albobrunneum (Pers.:Fr.) Kummer, Fuhrer in die Pilzkunde 130. 1871.

≡*Agaricus albobrunneus* Fries, Sys. Mycol. 1: 37. 1821.

=*Tricholoma striatum* (Schaeff.:Quél.) Sacc., Fl. it cry., Hym.: 118. 1915.

≡*Gyrophila striata* Quél., Enchir. Fung. 1886

There is some dissent among European authors as to the identity of *T. albobrunneum*. Moser (1983) and Gulden (1992) described *T. albobrunneum* as lacking an annular zone and considered *T. striatum* to be a synonym of *T. albobrunneum*. Bon (1984) claimed *T. albobrunneum* is a *nomen ambiguum,* and considered *T. striatum* the valid name for a fungus possessing an annular zone. No type collection for either name exists, and until a neotype is designated, the status of this species is uncertain. Collections from California determined as *T. albobrunneum* are often *T. dryophilum*, but mature specimens of *T. dryophilum* are difficult to distinguish from *T. albobrunneum* sensu Moser.

More collecting is needed to determine if more than one species of *Tricholoma* with a viscid brown pileus, white lamellae and farinaceus taste and odor occurs in California.

Tricholoma anomolum (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Melanoleuca anomola* Murrill, Mycologia 5: 214. 1913.

The holotype is a *Lepiota*; see the type study below.

Tricholoma aurantium (Fr.) Ricken, Die Blatterpilze: 332. 1915.

≡*Agaricus aurantius* Fries, Syst. Mycol. 1:39. 1821.

≡*Armillaria aurantia* (Fr.) Quél., Champ. Jura et Vosges 1: 23. 1872.

≡*Gyrophila aurantia* (Fr.) Quél., Enchir. Fung.: 9. 1886.

≡*Melanoleuca aurantia* (Fr.) Murrill, North Amer. Flora 10: 23. 1914.

Tricholoma aurantium occurs in Oregon, and may occur in Northern California, but I have not seen any authentic material. See Bon (1984) or Ovrebo (1980) for a description of this species. Collections determined as *T. aurantium* from California associated with *Arctostaphylos* are *T. manzanitae*.

Tricholoma bicolor (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Melanoleuca bicor* Murr., Mycologia 5: 215. 1913.

≡*Leucopaxilus amarus* f. *bicolor* (Murr.) Singer & Smith, 1942. Pap. Mich.

Acad. Sci. 28: 129.

Tricholoma bicolor is a synonym of *Leucopaxillus gentianeus* (Quél.) Kotlaba. See the type study below for a further discussion of this species.

Tricholoma californicum (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Melanoleuca californica* Murrill, Mycologia 5: 216. 1913.

I have not seen any collections with the combination of characters found in the holotype collection. The status of this species is difficult to interpret due to the cursory protologue and ambiguous micromorphological characters. See the type study below for a more complete discussion.

Tricholoma davisiae Peck, Bull. Torrey Bot. Club 27: 611. 1900.

≡*Melanoleuca davisiae* (Peck) Murrill, N. Am. Fl. 10: 14. 1914.

=*Tricholoma cheilolaminum* Ovrebo & Tylutki, Mycologia 67(1): 76-77. 1975.

Tricholoma davisiae has been reported from the Pacific Northwest and Great Lakes regions of North America (Ovrebo, 1989), but does not occur in California. See Ovrebo (1989) for a description of this species.

Tricholoma farinaceum (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Melanoleuca farinacea* Murrill, Mycologia 5: 217. 1913.

This species was described from Washington, but does not occur in California. In California it has been confused with *T. smithii*, which also has a strong farinaceous odor, and can be quite pale at first. See the type study below for a further discussion of *T. farinaceum*.

Tricholoma fulvum (Fr.) Saccardo, Fl. Ital. Crypt. 14: 117. 1915.

≡*Agaricus fulvus* Fries, Syst. Mycol. 1:37. 1821

=*Tricholoma flavobrunneum* (Fr.) Kummer, Fuhrer Pilzekunde 130. 1871.

≡*Agaricus flavobrunneus* Fr., Epicrisis 28. 1836.

Tricholoma fulvum is a brown, viscid species with yellow lamellae. It does not occur in California, but has been confused with a closely related species, *T. nictitans*. See the discussion of *T. nictitans* above for a comparison of the two species.

Tricholoma fumosoluteum (Peck) Saccardo, Syll. Fung. 5: 122. 1887.

≡*Agaricus fumosoluteus* Peck, Ann. Rep. N. Y. State Mus. 27: 92. 1875.

≡*Melanoleuca fumosolutea* (Peck) Murr. N. Am. Fl. 10: 13. 1914.

Tricholoma fumosoluteum has a moist, but not viscid, yellow pileus with grayish fibrils, and occurs under hardwoods in Eastern North America. In California it has been confused with *T. sejunctum*, which has a virgate, viscid

pileus. A description of *T. fumosoluteum* may be found in Bigelow (1979).

Tricholoma fumosellum (Murr.) Murrill, Mycologia 6: 269. 1914.

≡*Melanoleuca fumosella* Murrill, North American Flora10(1): 28. 1914.

Tricholoma fumosellum was described from material collected in Southern California in association with oaks. Based on an examination of the holotype (see type study below) and the protologue, *T. fumosellum* appears to be most closely related to *T. fumosoluteus*. However, the holotype is in poor condition, and more collections from the type locality are needed to confirm the status of this species.

Tricholoma harperi (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Melanoleuca harperi* Murrill, Mycologia 5: 217. 1913.

≡*Lepista harperi* (Murr.) Singer, Lilloa 22: 192. 1949.

This species is considered by Bigelow (1982) to be a synonym of *Clitocybe brunneocephala* Bigelow, and a more complete description of this species may be found there.

Tricholoma irinum (Fr.) Kummer, Der Fuhrer die Pilzkunde 132. 1871.

≡*Agaricus irinus* Fries, Epicrisis 1: 48. 1836-38.

≡*Rhodopaxillus irinus* (Fr.) Métrod, Rev. Mycol. 7, Suppl.: 29. 1942.

≡*Lepista irina* (Fr.) Bigelow, Can. J. Bot. 37: 775. 1959.

≡*Clitocybe irina* (Fr.) Bigelow & Smith, Brittonia 21: 172. 1969.

Collections determined as *T. irinum* from California are *Lepista* species. See Bigelow (1982) for a description of this species and related *Lepista* species (as *Clitocybe*).

Tricholoma lascivium (Fr.) Gillet, Champ. en France: 111. 1878.

≡*Agaricus lascivus* Fr., Syst. Mycol. 1: 110. 1821.

Tricholoma lascivium is related to *T. saponaceum*, and is characterized by a cream or beige pileus and a strong, sweet odor. To my knowledge, this species does not occur in California. See Bon (1984) for a description and discussion of related species.

Tricholoma olesonii (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Melanoleuca olesonii* Murrill, Mycologia 5: 218. 1913.

This species is not a *Tricholoma*; for a discussion of possible affiliations, see the type study below.

Tricholoma onychinum (Fr.) Saccardo, Syll. Fung. 5: 116. 1887.

≡*Agaricus onychinum* Fr., Epicrisis: 41. 1836.

≡*Calocybe onychina* (Fr.) Donk, Beih. Nov. Hedwigia 5: 43. 1962.

This species is properly refered to as *Calocybe* due to the presence of carminophilous granules in the basidia and bright yellow lamellae.

Tricholoma pessundatum (Fr.) Quélet, Jura et Vosges 1: 77. 1872.

≡*Agaricus pessundatus* Fr. Syst. Mycol 1: 38. 1821.

Tricholoma pessundatum is a name that has been applied to several species of *Tricholoma* with brown, viscid pilei in California, including *T. muricatum* and *T. nictitans*. *Tricholoma pessundatum* is characterized by the presence of a hypodermium of inflated cells and very small spores (Bon, 1984); I have not seen any collections from California with this distinctive combination of characters, and it is uncertain whether this species occurs in North America.

Tricholoma portolense (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Melanoleuca portolense* Murrill, Mycologia 5: 219. 1913.

The holotype is not a *Tricholoma* nor a *Melanoleuca* due to the smooth, amyloid spores. For a discussion of possible generic affiliations, see the type study below.

Tricholoma rhizoideum Smith, Mycologia 36: 259. 1944.

This species is considered by Bigelow (1982) to be a synonym of *Clitocybe ramigena* Bigelow.

Tricholoma roseibrunneum (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Melanoleuca roseibrunnea* Murrill, Mycologia 5: 220. 1913.

Singer (1975) cites this species as a synonym of *Leucopaxillus gentianeus* (Quél.) Kotlaba See the type study below.

Tricholoma rudericola (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Melanoleuca rudericola* Murrill, Mycologia 5: 220. 1913.

Bigelow (1982) cites this species as a synonym of *Clitocybe saeva* (Fr.) Bigelow & Smith. See the type study below.

Tricholoma squarrulosum Bres., Fung. Trid. 2: 47. 1893.

≡*Tricholoma atrosquamosum* (Chev.) Sacc. var. squarrulosum (Bres.) Kühner & Romagnesi, Flore Anal. Champ. Sup.: 154. 1953.

=*Tricholoma michiganense* Smith, Pap. Mich. Acad. Sci. 27:69-70. 1942.

Tricholoma squarrulosum has been reported from the Great Lakes region (Ovrebo, 1989), but does not appear to occur in California. A comparison of this

species to the closely related species, *T. atrosquamosum*, may be found in the discussion of the latter species above, and in Ovrebo (1989).

Tricholoma striatellum (Murr.) Murrill, Mycologia 5: 223. 1913.

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

I have not seen any collections that resemble this species. See the type study below.

Tricholoma terreum (Schaeff.:Fr.) Kummer, Fuhrer in die Pilzkunde: 134. 1871.

≡*Agaricus terreus* Schaeff.:Fr., Epicrisis: 34. 1836-38.

Tricholoma terreum, as it is described by Bon (1984), does not appear to occur in North America. In California, *T. moseri*, *T. myomyces*, and *T. scalpturatum* have all been called *T. terreum*. A comparision of these species with *T. terreum* may be found under their respective descriptions above.

Tricholoma transmutans (Peck) Saccardo, Syll. Fung. 5: 91. 1887.

≡*Agaricus transmutans* Peck, Ann. Rep. N.Y. State Mus. 29: 38. 1878.

Based on Peck's description of the lamellae as whitish or pale yellow, and the presence of encrusted pileipellis hyphae, *T. transmutans* is related to *T. fulvum*. Collections from California with similar coloration (pale yellow lamellae

and a brown viscid pileus) have consistently larger spores than either *T. transmutans* or *T. fulvum*, and are *T. nictitans*. Descriptions of the holotype of *T. transmutans* may be found in Singer (1942) and Ammirati & Ovrebo (1979).

Tricholoma tricolor Peck, Ann. Rep. NY St. Mus. 41: 60. 1888.

≡*Melanoleuca tricolor* (Peck) Murrill, N. Am. Fl. 10(1): 17. 1914.

≡*Leucopaxillus tricolor* (Peck) Kühner, Contrib.: 135. 1926.

Singer & Smith (1942) examined the holotype of *T. tricolor*; see their publication for a description and discussion of this species of *Leucopaxillus*. In California this name has been incorrectly applied to species of *Calocybe onychina*.

Tricholoma viscosum Peck, Bull. Torrey Bot. Club 31: 178. 1904.

≡*Melanoleuca viscosa* (Peck) Murrill, N. Am. Fl. 10: 23. 1914.

Peck describes the pileus and stipe of *T. viscosum* as glutinous. I have not seen any reddish brown species of *Tricholoma* with a viscid stipe from California. See the type study below for commentary on this species.

TYPE STUDIES

Melanoleuca anomola Murrill, Mycologia 5: 214. 1913.

≡*Tricholoma anomolum* (Murr.) Murrill, Mycologia 5: 223. 1913.

W. A. Murrill and L. R. Abrams 1198, 25 November 1911, in soil under redwoods near Palo Alto, CA. (NY)

Basidiospores 7.2-10.0 x 3.4-4.8 µm ($\bar{x}$ = 8.6 ± 0.89 x 4.2 ± 0.55 µm; E = 1.5-2.6; Q = 2.1 ± 0.34; n = 12/1 collection), narrowly eliptic, spurred or booted, hyaline, smooth, weakly dextrinoid, thick-walled. **Basidia** clavate, 4-spored. **Cheilocystidia** 22-80 x 4.8-8.0 µm, clavate to broadly clavate, hyaline, smooth, thin-walled. **Pileipellis** consisting of fascicles of pilocystidia, 72-120 x 12-24 µm, cylindric to clavate, the apices often strangulated, hyaline and somewhat refractive. **Clamp connections** present throughout.

The holotype is a *Lepiota*, near *L. castanea* Quélet. The combination of thick-walled, weakly dextrinoid, spurred spores and long fusiform pilocystidia is characteristic for *Lepiota* (Horak, 1980).

Tricholoma atroviolaceum Smith, Mycologia 36: 256. 1944.

A. H. Smith 8195, 29 November 1937, under fir and oaks, near California-Oregon line, near Kerby, Josephine Co., OR. (MICH)

Basidiospores 7.2-9.6 x 5.3-6.7 µm ($\bar{x}$ = 8.1± 0.78 x 6.0 ± 0.41 µm; E =

1.2-1.6; Q = 1.4 ± 0.09; n = 22), broadly eliptic, hyaline, smooth, inamyloid. **Basidia** 40-56 x 8.6-9.6 µm, clavate, 4-spored. **Hymenial cystidia** absent. **Pileipellis** a cutis; cutis hyphae 5.8-14 µm diam., cylindric to somewhat inflated, mostly parallel to appressed, with occasional recurved fascicles of hyphae present, pale brown to dark brown, thick-walled and smooth, or the pigmentation breaking up into rough encrustations; pseudoparenchymatous hypodermium present, hyphae 4.8-26 µm diam., short cylindric to nearly isodiametric, parallel, hyaline to pale brown, thick-walled, occasional plaques of dark pigment present between cells. **Pileus trama** hyphae 2.9-12 µm diam., cylindric near hypodermium, somewhat cylindric elsewhere, pale brown, smooth. **Lamellae trama** hyphae 2.5-12 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe hyphae** not reviving well.

See the description of *T. atroviolaceum* above for a discussion of this species.

Melanoleuca avellaniefolia Murrill, Mycologia 5: 215. 1913.

≡*Tricholoma avellaniefolium* (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Tricholoma portentosum* var. *avellaniefolium* (Murr.) Smith, Am. Mid. Natur. 32: 686. 1944. as a misapplied name.

W. A. Murrill 267, October-November, 1911, Seattle, WA. (NY)

Holotype consists of one sporocarp in poor condition.

Basidiospores 5.8-7.2 x 4.8-5.8 µm, subglobose, hyaline, smooth,

inamyloid. **Basidia** 60-70 x 15 µm, clavate, 4 spored, with carminophilous granules. **Hymenial cystidia** absent. **Pileipellis hyphae** 2.4-5.7 µm diam., cylindric, tightly interwoven, hyaline, smooth or with rough, golden encrustations. **Pileus trama** hyphae 3.8-11.5 m diam., cylindric to inflated,interwoven, hyaline, smooth or with rough hyaline encrustations. **Clamp connections** present throughout.

The presence of basidia with carminophilous granules, clamp connections and encrusted pileipellis hyphae indicate the holotype is a *Lyophyllum*. The holotype of *T. portentosum* var. *avellaniefolium* is a *Tricholoma* in Stirps *Luteomaculosum*, Section *Tricholoma* (see the description of *T. smithii* above, and the type study of *T. portentosum* var. *avellaniefolium* below).

Melanoleuca bicolor Murr., Mycologia 5: 215. 1913.

≡*Tricholoma bicolor* (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Leucopaxilus amarus* f. *bicolor* (Murr.) Singer & Smith, 1942. Pap. Mich. Acad. Sci. 28: 129.

=*Leucopaxillus gentianeus* (Quél.) Kotlaba, Ceska Mycol. 20: 230. 1966.

W. A. Murrill 745, 7 November 1911, Glen Brook, OR. (NY)

Basidiospores amyloid and warted. **Clamp connections** present throughout.

My interpretation of the holotype agrees with Singer & Smith. This

species is a synonym of *Leucopaxillus gentianeus*.

Melanoleuca californica Murrill, Mycologia 5: 216. 1913.

≡*Tricholoma californicum* (Murr.) Murrill, Mycologia 5: 223. 1913.

James McMurphy 125, 11 January 1912, under oaks, Jasper Ridge near Stanford University. (NY)

Holotype collection consists of 4 sporocarps in good condition.

Basidiospores 4.8-6.2 x 3.4-4.3 µm ($\bar{x}$ = 5.3 ± 0.40 x 3.8 ± 0.23 µm; E = 1.2-1.6; Q - 1.4 ± 0.11; n = 22), elliptic to narrowly elliptic, hyaline, smooth, inamyloid. **Basidia** 25-31 x 5.8-7.2 µm, clavate, 4- or 2-spored. **Hymenial cystidia** none observed. **Pileipellis** an ixocutis; hyphae 2.9-5.8 µm diam., cylindric or collapsed, repent to interwoven in a gelatinous matrix, hyaline, smooth. **Pileus trama** hyphae not reviving well. **Lamellar trama** hyphae 2.8-9.6 µm diam., cylindric to somewhat inflated, parallel, hyaline, smooth. **Stipe trama** 2.4-14 µm diam., cylindric to somewhat inflated, parallel, hyaline, smooth. **Caulocystidia** present at stipe apex as recurved hyphal tips, 29 x 4.8 µm, cylindric, often with strangulated apices. **Clamp connections** absent.

Inamyloid spores, absence of clamp connections and parallel lamellar trama hyphae indicate the holotype is a *Tricholoma*. The status of *T. californicum* is difficult to assess. The stature of the preserved specimens is similar to *T. dryophilum*, with very long stipes relative to the pileus diameter, but *T. californicum* has smaller spores, lacks cheilocystidia, and is reported to have

a slightly bitter taste. It is possible that *T. californicum* is a synonym of *T. ustale*, although the spores are slightly smaller than common for *T. ustale*. Murrill (1914) listed *T. californicum* as a synonym of *Armillaria subannulata* Peck. However, the holotype collection of *T. californicum* shows no evidence of a partial veil, and the spores are smaller than those of *A. subannulata*.

Melanoleuca dryophilum Murrill, Mycologia 5: 217. 1913.

≡*Tricholoma dryophilum* (Murr.) Murrill, Mycologia 5: 223. 1913.

James McMurphy 27, 21 January 1903, under oaks, Stanford University, CA. (NY) The holotype consists of one entire flattened sporocarp and a portion of pileus in good condition.

Basidiospores 5.8-7.2 x 3.8-5.8 µm ($\bar{x}$ = 6.6 ± 0.56 x 4.7 ± 0.43 µm; E = 1.2-1.6; Q = 1.4 ± 0.09; n = 20), eliptic, hyaline, inamyloid, smooth. **Basidia** 34 x 4.8 µm, clavate, 4-spored, often collapsed. **Cheilocystidia** 31-53 x 2.4 µm, filiform, occasionally with strangulated apices, scattered, hyaline, smooth. **Pileipellis** an ixocutis; hyphae 2.4-3.8 µm diam., cylindric, interwoven in a gelatinous matrix, hyaline, some with reddish brown contents, smooth. **Lamellar trama** hyphae 4.8-7.2 µm diam., parallel. **Stipe surface** hyphae 3.4-4.3 µm diam., cylindric, interwoven, hyaline. **Caulocystidia** present as recurved hyphal tips, usually > 48 x 4.8 µm, cylindric with strangulated apices. **Clamp connections** absent.

See the discussion of *T. dryophilum* above.

Melanoleuca farinacea Murrill, Mycologia 5: 217. 1913.

≡*Tricholoma farinaceum* (Murr.) Murrill, Mycologia 5: 223. 1913.

Murrill 644, October-November 1911, Seattle, WA. (NY)

The holotype consists of 7 sporocarps in good condition. Pileus buff or tan, lamellae sinuate to decurrent, stipe base bulbous.

Basidiospores 4.3-5.4 x 2.4-3.5 µm ($\bar{x}$ = 4.8 ± 0.32 x 2.9 ± 0.25 µm; E = 1.5-2.0; Q = 1.7 ± 0.15; n = 20), eliptic, hyaline, inamyloid, smooth. **Basidia** 25-30 x 4.8-6.4 µm, clavate, 4-spored, carminophilous granules absent. Hymenial cystidia absent. **Pileipellis** a cutis; hyphae 2.4-7.2 µm diam., cylindric, interwoven, hyaline, smooth. **Pileus trama** hyphae 2.4-9.6 µm diam., cylindric to somewhat inflated, more or less parallel, hyaline, smooth. **Lamellar trama** hyphae 4.8-9.6 µm diam., cylindric to somewhat inflated, parallel, hyaline, smooth. **Clamp connections** present throughout.

Singer (1942) stated this species belongs to the same group as *T. mongolicum* Imai (Subgenus *Contextocutis*). The combination of interwoven pileipellis hyphae and presence of clamp connections is characteristic of species in Subgenus *Contextocutis*. This species is most likely related to *T. album* (Fr.) Kummer.

Melanoleuca fumosella Murrill, North American Flora10(1): 28. 1914.

≡*Tricholoma fumosellum* (Murr.) Murrill, Mycologia 6: 269. 1914.

C. F. Baker 5078, January, under oaks, Claremont, CA. (NY)

Type collection consists of a stipe and pileus fragments, few intact lamellae present.

Basidiospores 4.3-6.2 x 2.9-3.8 µm ($\bar{x}$ = 5.3 ± 0.5 x 3.5 ± 0.25 µm; E = 1.4-1.7; Q = 1.5 ± 0.09; n = 22), elliptic, hyaline, smooth, inamyloid. **Basidia** 22 x 5.8 µm, clavate, hyaline, 4-spored, carminophilous granules absent. **Hymenial cystidia** absent, some filiform basidioles extending beyond gill margin. **Pileipellis** appearing somewhat gelatinized, a great deal of dirt and debris is stuck to the pileus surface; hyphae mostly collapsed, apparently more or less parallel, smooth, hyaline. **Lamellar trama** hyphae 2.4-19 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe hyphae** 2.4-12 µm diam., cylindric to somewhat inflated, parallel, hyaline, smooth. **Caulocystidia** present at stipe apex in pyramidal clusters, 34-40 x 7.2-9.6 µm, cylindric, hyaline, smooth, often collapsed. **Clamp connections** absent.

The holotype is likely a species of *Tricholoma*, most closely related to *T. fumosoluteum*. The nature of the pileus surface is difficult to determine. Murrill described the surface as smooth and dry, but the abundace of dirt and debris stuck to the pileus suggests the surface may have been viscid at first. If a gelatinous layer is present, it is very thin and inconspicuous. More collections from the type locality are needed to establish the identity and relationships of this species.

Agaricus fumosoluteus Peck, Ann. Rep. N. Y. State Mus. 27: 92. 1875.

≡*Tricholoma fumosoluteus* (Peck) Saccardo, Syll. Fung. 5: 122. 1887.

≡*Melanoleuca fumosolutea* (Peck) Murr. N. Am. Fl. 10: 13. 1914.

Holotype consists of 8 entire sporocarps and some fragments, flattened and some with contaminant hyphae, but otherwise in good condition.

Bigelow (1979) presented a thorough type study and redescription of *T. fumosoluteus*. My observations of the holotype agree with his description.

Melanoleuca harperi Murrill, Mycologia 5: 217. 1913.

≡*Tricholoma harperi* (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Lepista harperi* (Murr.) Singer, Lilloa 22: 192. 1949.

R. A. Harper 12, 31 January 1911, Berkeley, CA. (NY)

My examination of the holotype agrees with the interpretations of Singer (1949). The presence of cyanophilic, roughened spores and clamp connections indicates the holotype is a *Lepista*. This species is considered by Bigelow (1982) to be a synonym of *Clitocybe brunneocephala* Bigelow, and a more complete description of this species may be found there.

Tricholoma intermedium Peck, Ann. Rep. N.Y. State Mus. 41:60. 1888

≡*Melanoleuca intermedia* (Peck) Murrill, N. Am. Fl. 10: 22. 1914.

Catskill Mountains, September. (NYS)

The holotype consists of several sporocarps in good condition.

Basidiospores 4.8-7.2 x 2.9-4.3 µm ($\bar{x}$ = 5.7 ± 0.62 x 3.6 ± 0.36 µm; E = 1.4-1.8; Q = 1.6 ± 0.10; n = 22).

My examination of the holotype agrees in all respects with Bigelow (1979).

Tricholoma luteomaculosum Smith, Pap. Mich. Acad. Sci. 27: 67. 1942.

A. H. Smith 15477, 27 September 1940, in an oak woods, Ann Arbor, Washtenaw Co., MI. (MICH)

Basidiospores 6.2-9.6 x 4.3-5.8 µm ($\bar{x}$ = 7.6 ± 0.94 x 5.0 ± 0.41 µm; E = 1.3-1.8; Q = 1.5 ± 0.16; n = 23), eliptic, hyaline, smooth, inamyloid. **Basidia** 28-38 x 7.2-8.1 µm, clavate, 4-spored. **Cheilocystidia** 24-52 x 11-24 µm, broadly clavate, ventricose or saccate, occasionally mucronate, hyaline or rarely dark brown, thin-walled or walls irregularly thickened. **Pleurocystidia** much like cheilocystidia, 36-43 x 17-24 µm, broadly clavate or saccate, occasionally mucronate, scattered, hyaline or fuscous, thin-walled. **Piliepellis** a cutis; hyphae 3.8-7.2 diam., cylindric to slightly inflated, parallel, hyaline or pale golden brown, some with yellow-brown contents, rarely smooth, usually with fine hyaline encrustations; pseudoparenchymatous hypodermium present, hyphae 9.6-29 µm diam., inflated to isodiametric, parallel, hyaline, smooth, or with plaques of yellow-brown pigment between cells. **Pileus trama** hyphae

3.8-29 µm diam., cylindric to inflated, mostly parallel, hyaline, smooth. **Lamellar trama** hyphae 2.4-22 µm diam., cylindric to inflated, parallel, hyaline, smooth or with irregularly thickened walls. **Stipe hyphae** 2.4-12 µm diam., cylindric to slightly inflated, mostly parallel, hyaline, smooth or with irregularly thickened walls. **Clamp connections** absent.

See the discussion of *T. luteomaculosum* above.

Tricholoma marquettense Ovrebo, Mycologia 78(3): 418. 1986.

Ovrebo 710, 9 September 1979, under *Pinus banksiana*, south of Marquette, Marquette Co., MI. (TRTC)

Basidiospores 5.8-7.7 x 4.3-5.3 µm ($\bar{x}$ = 6.6 ± 0.57 x 4.7 ± 0.28 µm; E = 1.3-1.6; Q = 1.4 ± 0.10; n = 20), eliptic to broadly eliptic, hyaline, smooth, inamyloid.

My examination of the holotype agrees in all respects with Ovrebo's (1986) description.

Tricholoma moseri Singer, Fieldiana Botany, New Series 21: 11. 1989.

Singer M-8521, 23 January 1969, Mexico, Paso de Cortés, 4100 m elevation, in thin *Pinus hartwegii* forest. (F)

The holotype consists of one sporocarp in good condition, woolly-squamulose over the disc, appressed fibrillose to squamulose elsewhere, no evidence of a

cortina.

Basidiospores 7.7-9.6 x 3.8-4.8 µm ($\bar{x}$ = 8.5 ± 0.50 x 4.2 ± 0.32 µm; E = 1.7-2.3; Q = 2.0 ± 0.15; n = 24), narrowly eliptic to cylindric, hyaline, smooth, inamyloid. **Basidia** 31-40 x 7.2-8.2 µm, clavate, 4-spored. **Hymenial cystidia** absent. **Pileipellis** a cutis; hyphae 6.2-17 µm diam., cylindric to somewhat inflated, more or less parallel, forming recurved fascicles of hyphae, pale brown, smooth; pseudoparenchymatous hypodermium absent. **Pileus trama** hyphae 3.4-17 µm diam., cylindric to somewhat inflated, hyaline, smooth, thin-walled. **Lamellar trama** hyphae 2.4-14 µm diam., cylindric to inflated, hyaline, smooth. **Clamp connections** absent.

See the discussion of *T. moseri* above.

Melanoleuca olesonii Murrill, Mycologia 5: 218. 1913.

≡*Tricholoma olesonii* (Murr.) Murrill, Mycologia 5: 223. 1913.

Oleson 100, spring 1913, Mission Cañyon near Santa Barbara, CA. (NY)
The holotype consists of several sporocarps in good condition.

Basidiospores 6.7-8.2 x 4.3-4.8 µm, eliptic, smooth or minutely roughened. **Hymenial cystidia** absent. **Pileipellis** hyphae 1-1.9 um diam., cylindric or collapsed, interwoven in a gelatinous matrix. **Clamp connections** present.

The holotype collection is not a *Tricholoma*, but may be a *Lepista* or a *Rhodocybe*. Singer (1942) thought the holotype represented a *Rhodopaxillus*.

Melanoleuca platyphylla Murrill, Mycologia 5: 219. 1913.

≡*Tricholoma platyphyllum* (Murr.) Murrill, Mycologia 5: 223. 1913.

Murrill 419, October-November 1911, Seattle, WA. (NY)

Basidiospores 9.6-12 x 4.8-6.7 µm, eliptic to amygdaliform, hyaline, smooth, inamyloid or weakly dextrinoid. **Basidia** 43-48 x 7.2-9.6 µm, clavate, 4-spored. **Hymenial cystidia** absent. **Pileipellis** a cutis; hyphae 2.4-4.8 µm diam., cylindric, interwoven and appearing almost as if in a gelatinous matrix, hyaline or refractive, smooth.

The holotype of *Melanoleuca platyphylla* agrees in all respects with Bon's (1984) description of *T. inamoenum*, and material I have examined from Europe (HDT 32076). I consider *M. platyphylla* to be a synonym of *T. inamoenum*.

Tricholoma portentosum var. avellaniefolium (Murr.) Smith, American Mid. Natur. 32: 686. 1944.

≡*Melanoleuca avellaniefolia* Murrill, Mycologia 5: 215. 1913.

≡*Tricholoma avellaniefolium* (Murr.) Murrill, Mycologia 5: 223. 1913.

The following is a description of the three speciemens cited by Smith (AHS 17728; 17804; 17916 (MICH)) as representative of *T. portentosum* var. *avellaniefolium*.

Basidiospores 5.8-7.7 x 4.8-5.8 µm ($\bar{x}$ = 6.6 ± 0.47 x 5.2 ± 0.35 µm; E = 1.2-1.5; Q = 1.3 ± 0.07; n = 63/3 collections), eliptic to broadly eliptic, hyaline, smooth, inamyloid. **Basidia** 36-38 x 8.2-9.1 µm, clavate, 4-spored. **Cheilocystidia** 22-31 x 7.2-12 µm, broadly clavate to sphaeropedunculate, hyaline, smooth, thin-walled. **Pileipellis** an ixocutis; epicutis hyphae 2.4-7.2 µm diam., cylindric, interwoven in a gelatinous matrix, hyaline or somewhat refractive, smooth, or with fine hyaline encrustations; pseudoparenchymatous hypodermium present, hyphae 7.2-19(36) µm diam., inflated to nearly isodiametric, parallel, hyaline or pale brown, smooth, some with plaques of pale brown pigment between cells. **Pileus trama** hyphae 2.4-14 µm diam., cylindric to inflated, mostly parallel, hyaline, smooth. **Lamellar trama** hyphae 2.4-16 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe hyphae** 2.4-12 µm diam., cylindric to slightly inflated, parallel, hyaline, smooth. **Caulocystidia** present at stipe apex as recurved hyphal tips, 21-28 x 4.3-9.6 µm, cylindric or clavate, not forming discrete clusters, hyaline, smooth. **Clamp connections** absent.

See the discussion of *T. smithii* above for commentary on this species.

Melanoleuca portolense Murrill, Mycologia 5: 219. 1913.

≡*Tricholoma portolense* (Murr.) Murrill, Mycologia 5: 223. 1913.

James McMurphy 23, 4 January 1903, Portola, CA. (NY)

My observations of the holotype agree with those of Singer (1942). The

holotype collection does not represent either a *Tricholoma* or *Melanoleuca* due to the presence of smooth, amyloid spores. From the macroscopic description provided by the collector, James McMurphy, the holotype may represent a species of *Floccularia*. James McMurphy describes the stipe as having a roughed surface below an annular zone, which is typical for *Flocularia* species. However, the holotype is in such poor condition it is difficult to confirm this interpretation. Singer (1942) suggested the holotype may belong to such diverse genera as *Cantharellula*, *Armillaria*, or *Leucopaxillus*.

Melanoleuca rudericola Murrill, Mycologia 5: 220. 1913.

≡*Tricholoma rudericolum* (Murr.) Murrill, Mycologia 5: 223. 1913.

James McMurphy 18, 21 December 1902, Madera Creek, CA. (NY)

Basidiospores 6.2-8.6 x 4.8 um, smooth or minutely roughened. **Basidia** 26-29 x 5.8-6.7 µm, clavate, 4-spored. **Hymenial cystidia** absent. **Pileipellis** hyphae 2.9-5.3 µm diam., cylindric or collapsed, tightly interwoven, hyaline, smooth. **Clamp connections** present throughout.

Discussion:

Bigelow annotated the holotype collection as *Lepista saeva* (Fr.) Orton, and cited *M. rudericola* as a synonym of *Clitocybe saeva* (Fr.) Bigelow & Smith (Bigelow, 1982). My observations of the holotype are consistent with his interpretation.

Melanoleuca striatella Murrill, Mycologia 5: 221. 1913.

≡*Tricholoma striatellum* (Murr.) Murrill, Mycologia 5: 223. 1913.

James McMurphy 29, January 1903, under live oak, Stanford University, CA. (NY)

The holotype consists of one sporocarp in fair condition, the base of the stipe is missing.

Basidiospores 5.3-8.2 x 3.4-4.8 µm ($\bar{x}$ = 5.7 ± 0.79 x 4.3 ± 0.42 µm; E = 1.3-2.0; Q = 1.6 ± 0.15; n = 23), eliptic, hyaline, inamyloid, smooth. **Basidia** 26-33 x 3.8-4.8 µm, clavate, 4-spored, carminophilous granules absent. **Hymenial cystidia** not observed. **Pileipellis** a cutis, little differenciated from pileus trama; hyphae 4.8-9.6 µm diam., cylindric, nearly parallel to interwoven, hyaline, smooth. **Lamellar trama** hyphae 5.8-12 µm diam., cylindric to inflated, parallel, hyaline, smooth. **Stipe trama** hyphae 4.8-9,6 µm diam., cylindric to slightly inflated, parallel, hyaline, smooth. **Clamp connections** absent.

Singer (1942) reports the presence of cheilocystidia in the holotype collection, and suggests it is a species of *Tricholoma*. I agree that the holotype could be a *Tricholoma*, but the combination of characters is unusual for *Tricholoma*. Most species of *Tricholoma* that lack clamp connections also have a pileipellis that is differentiated from the pileus context. I have not seen any collections that match Murrill's description, and more collections from the type

locality are needed to establish the identity of this species.

Armillaria subannulata Peck, Bull. Torrey Bot. Club 36: 330. 1909.

≡*Melanoleuca subannulata* (Peck) Murrill, N. Am. Fl. 10: 30. 1914.

≡*Tricholoma subannulatum* (Peck) Zeller, Mycologia 14: 187. 1922.

C. F. Baker, January, under oak trees, Claremont, CA. (NYS)

The holotype consists of 4 sporocarps in fair to poor condition, contaminant hyphae present.

Basidiospores 5.3-6.7 x 3.8-4.8 µm ($\bar{x}$ = 6.1 ± 0.42 x 4.3 ± 0.38 µm; E = 1.2-1.8; Q = 1.4 ± 0.12; n = 23), eiliptic, hyaline, smooth, inamyloid. **Basidia** 26-38 x 7.2 µm, clavate, 4-spored. **Hymenial cystidia** absent. **Pileipellis** an ixocutis; hyphae 2.8 µm diam., cylindric or collapsed, interwoven in a thick gelatinous layer. **Lamellar trama** hyphae parallel. **Stipe trama** hyphae 2.9-12 µm diam., cylindric to somewhat inflated, parallel, hyaline, smooth, surface hyphae not differenciated. **Clamp connections** absent.

If the annulus is thick and white as described in the protologue, this species is related to *T. focale*. However, there is no evidence of a veil on the holotype material, and notes included with the holotype by the collector do not describe the annulus in any detail. More collections from the type locality are needed to establish the identity of this species, and its relationships with European taxa.

Melanoleuca subpessundata Murrill, Mycologia 5: 223. 1913.

≡*Tricholoma subpessundatum* (Murr.) Murrill, Mycologia 5: 223. 1913.

≡*Limacella subpessundata* (Murr.) Singer, Lloydia 5(2): 132. 1942.

W. A. Murrill 733, 7 November 1911, Glen Brook, OR. (NY)

The holotype consists of 3 sporocarps in good condition.

Basidiospores 4.8-5.8 x 4.3-4.8 µm ($\bar{x}$ = 5.3 ± 0.40 x 4.8 ± 0.15 µm; E = 1.0-1.2; Q = 1.1 ± 0.08; n = 20), globose to subglobose with a prominent apiculus, hyaline, smooth, inamyloid. **Basidia** 24-31 x 5.8-7.2 µm, clavate, 4-spored. **Hymenial cystidia** not observed. **Pileipellis** a cutis or trichodermium, epicutis hyphae 4.8-7.2 µm diam., cylindric, apex rounded or slightly inflated, nearly vertical or repent, appearing nearly gelatinous in some sections, hyaline, smooth; subcutis hyphae 6.0-48 µm diam., cylindric to inflated, more or less parallel to the pileus surface, hyaline, smooth, somewhat thick-walled. **Clamp connections** present throughout.

Singer (1942) stated the lamellar trama hyphae of the holotype are divergent, and made a new combination in *Limacella*. My examination of the type, and Murrill's description indicated the lamellae are adnate, and not free as they are in *Limacella*. In my opinion, *M. subpessundata* does not belong to *Limacella* as currently circumscribed, but is a *Collybia*, near *C. subdryophila* Atkinson.

Tricholoma viscosum Peck, Bull. Torrey Bot. Club 31: 178. 1904.

≡*Melanoleuca viscosa* (Peck) Murrill, N. Am. Fl. 10: 23. 1914.

The holotype conisists of pileus fragments with very few intact lamellae.

Basidiospores 6.2-7.2 x 3.4-3.8 µm, eliptic to narrowly eliptic, hyaline, smooth, inamyloid. **Basidia** 21-26 x 4.8-5.8 µm, clavate, 4-spored. **Pileipellis** an ixocutis; hyphae 3.4-6.2 µm diam., cylindric, interwoven in a gelatinous matrix, hyaline, with hyaline encrustations. **Lamellar trama** hyphae 4.8-24 µm diam., cylindric to hightly inflated, parallel. **Clamp connections** present throughout.

The presence of clamp connections in combination with a viscid pileus and stipe is not characteristic of *Tricholoma.*

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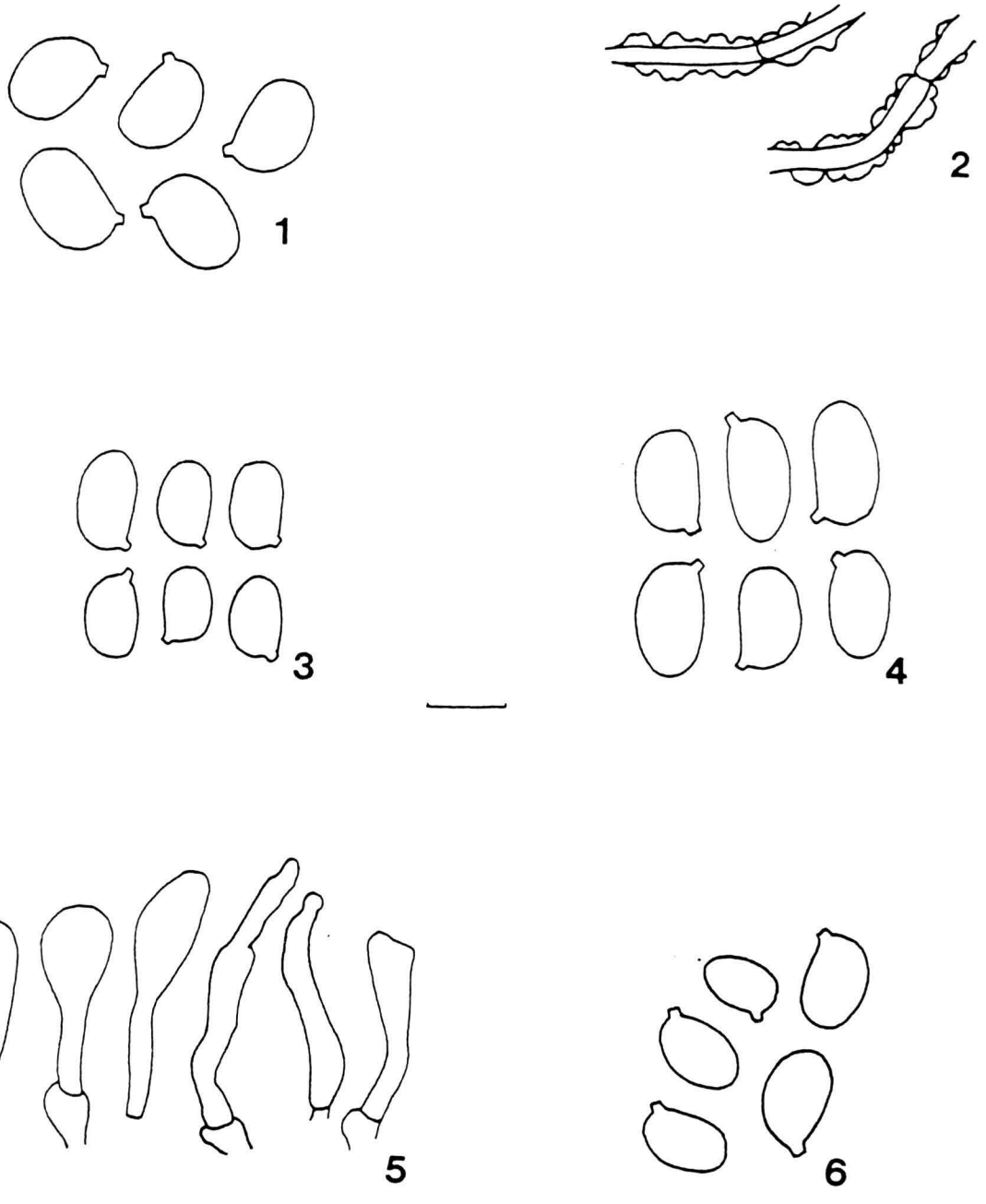
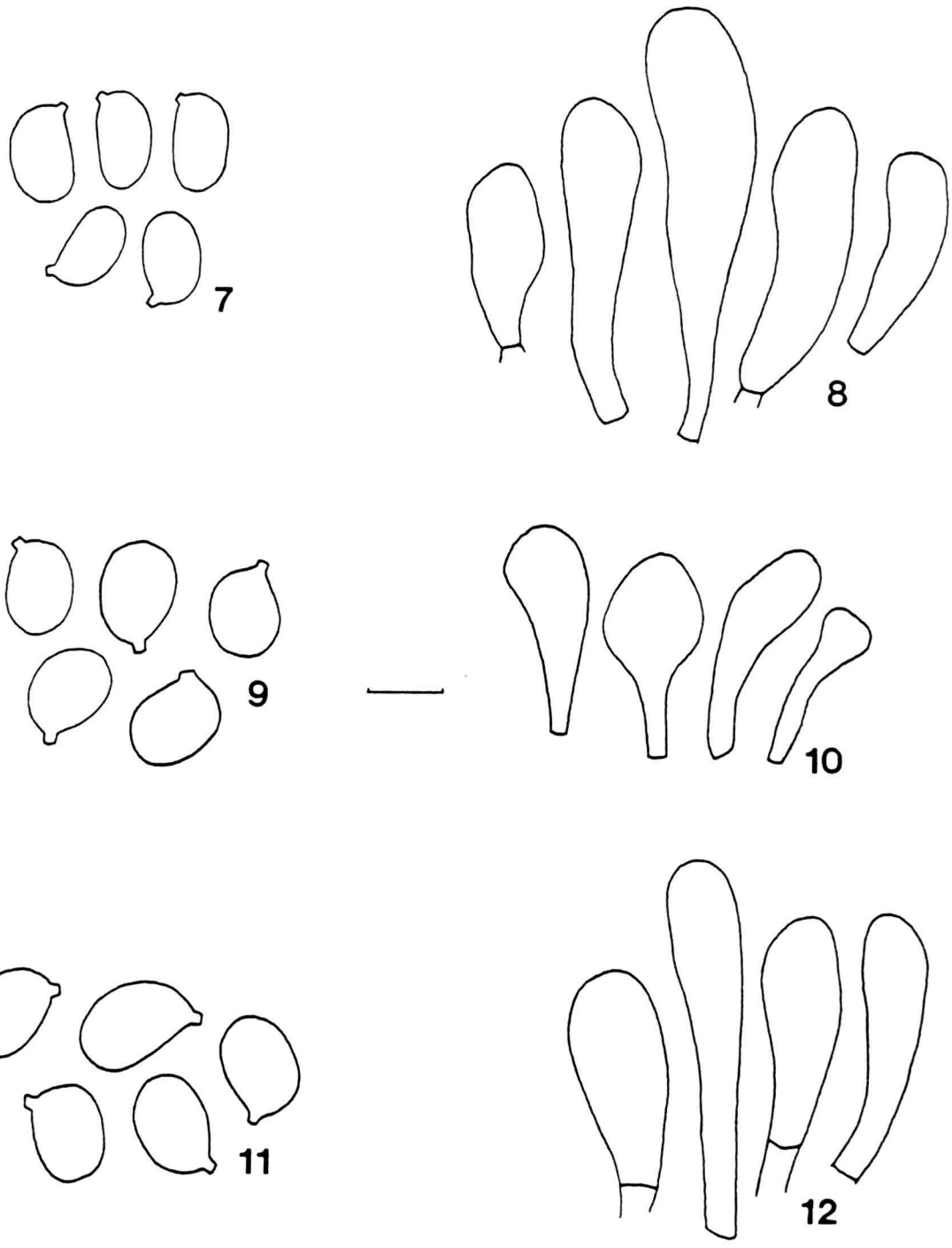


Figures 1-2. *T. flavovirens*. 1. spores. 2. pileipellis hyphae. Figure 3. *T. intermedium* var. *intermedium*. 3. spores. Figures 4-5. T. *intermedium* var. *macrosporum*. 4. spores. 5. cheilocystidia. Figure 6. *T. portentosum* 6. spores. Bar equals 10 µm for spores; 5µm for hyphae and cystidia.



Figures 7-8. *T. griseoviolaceum*. 7. spores. 8. cheilocystidia. Figures 9-10. *T. sejunctum*. 9. spores. 10. cheilocystidia. Figures 11-12. *T. virgatum*. 11. spores. 12. cheilocystidia. Bar equals 10 µm for spores; 5µm for cystidia.

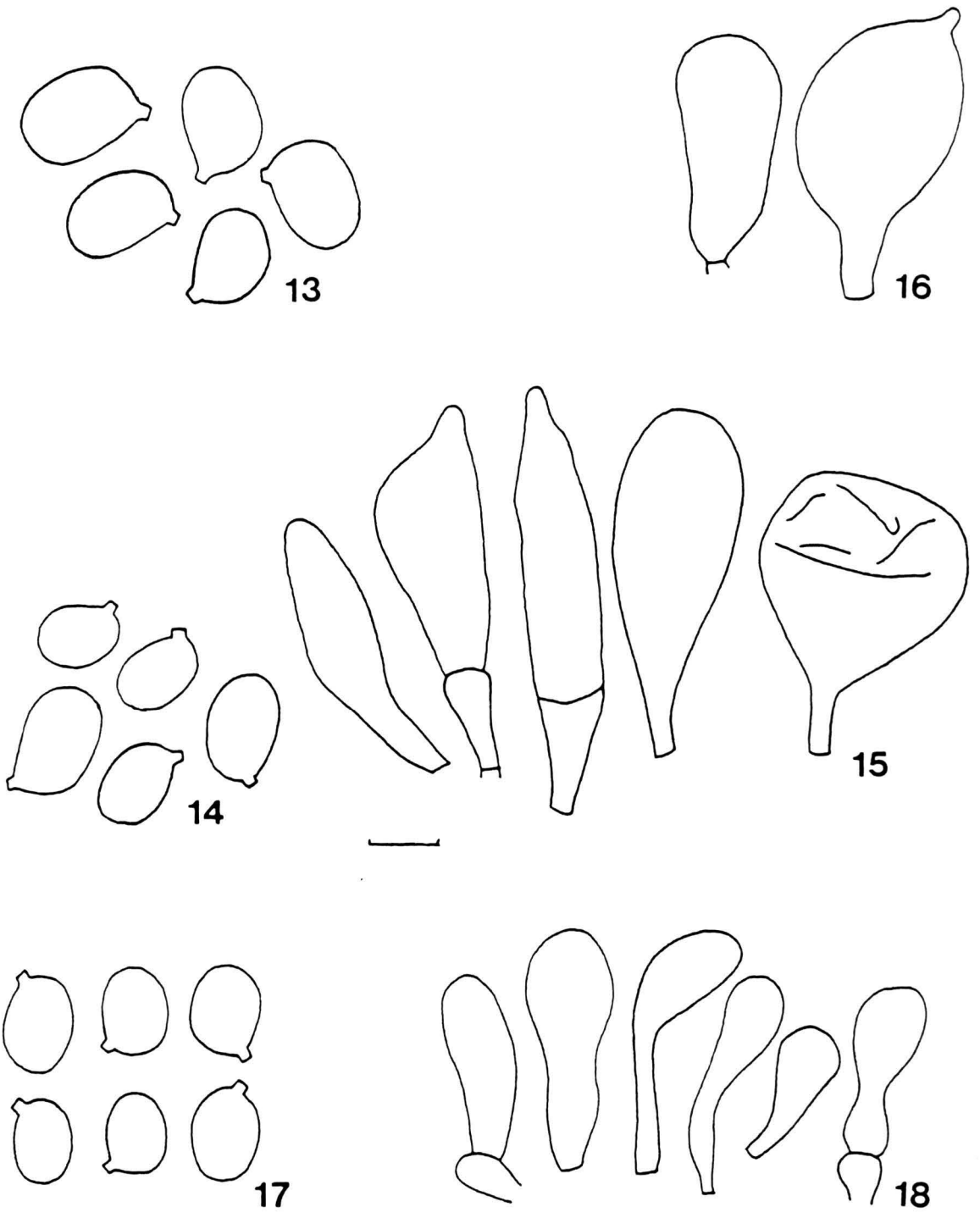


Figure 13. *T. atroviolaceum*. 13. spores. Figures 14-16. *T. luteomaculosum*. 14. spores. 15. cheilocystidia. 16. pleurocystidia. Figures 17-18. *T. smithii*. 17. spores. 18. cheilocystida. Bar equals 10 µm for spores; 5µm for cystidia.

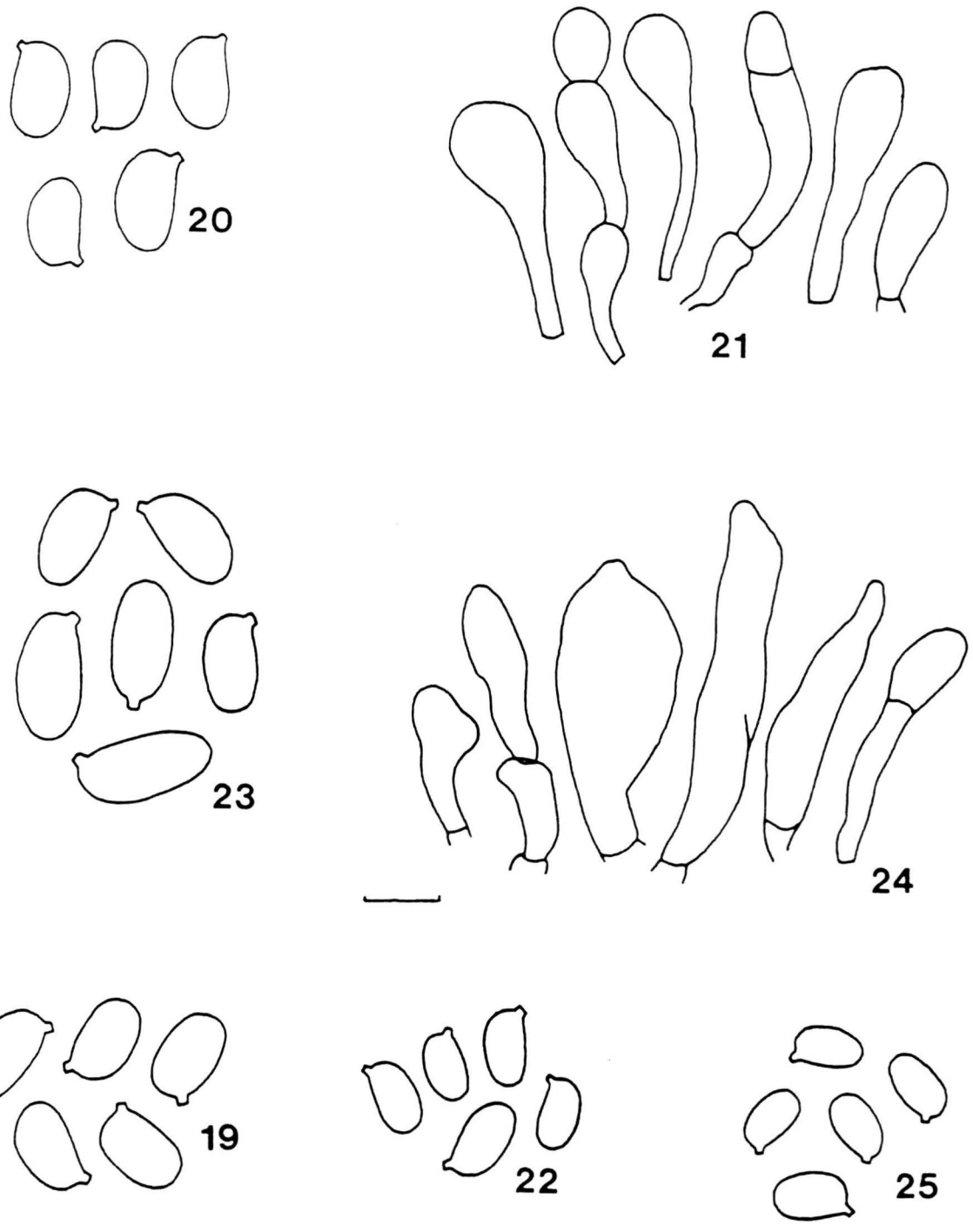
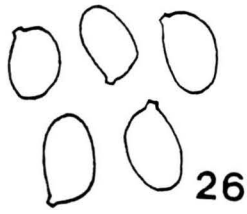


Figure 19. *T. atrosquamosum*. 19. spores. Figures 20-21. *T. myomyces* var. *tephrocystus*. 20. spores. 21. cheilocystidia. Figures 22-23. *T. moseri*. 22. spores. 23. cheilocystidia. Figure 25. *T. cingulatum*. 25. spores. Bar equals 10 µm for spores; 5µm for cystidia.



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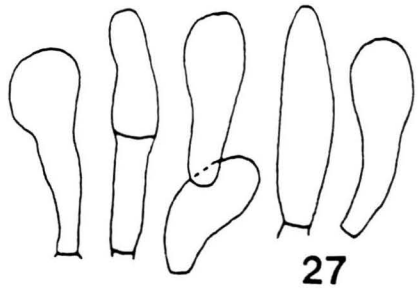

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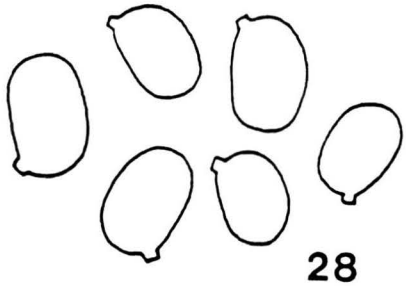

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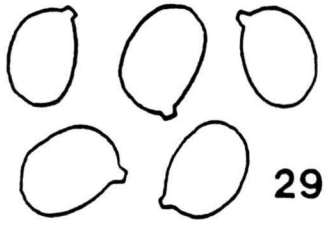

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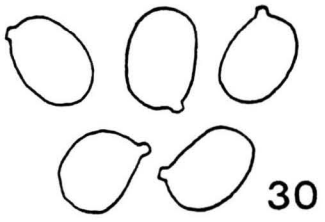
Figures 26-27. *T. focale*. 26. spores. 27. caulocystidia. Figure 28. *T. magnivelare*. 28. spores. Figure 29. *T. caligatum*. 29. spores. Bar equals 10 µm for spores; 5µm for cystidia.



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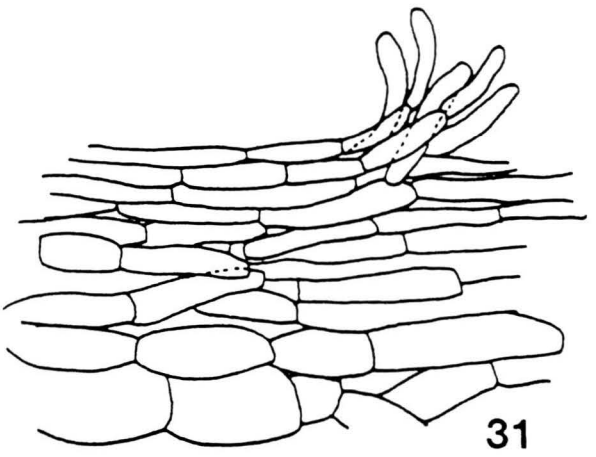

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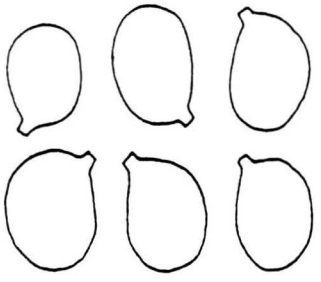

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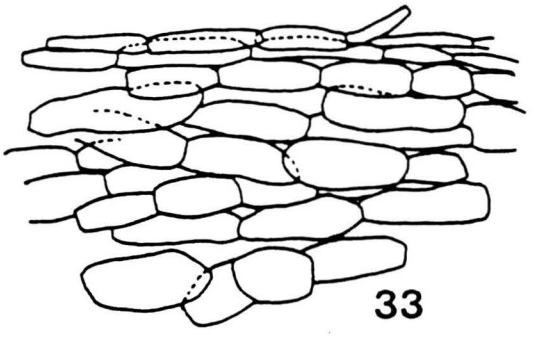

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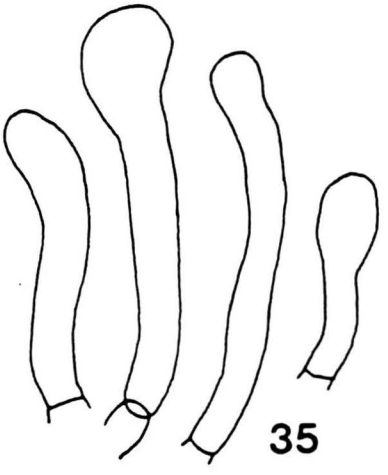

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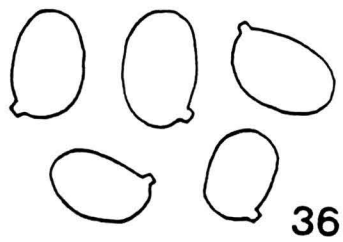
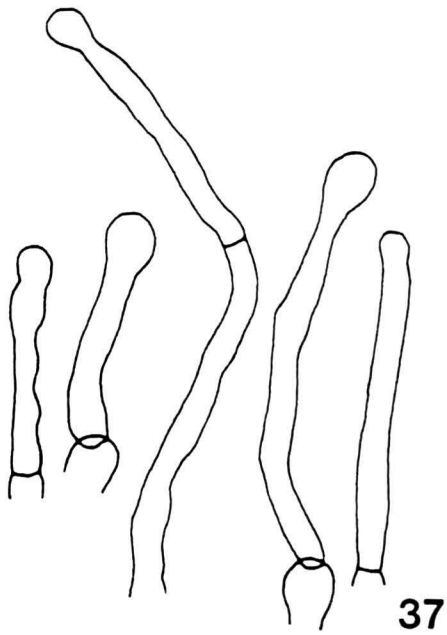
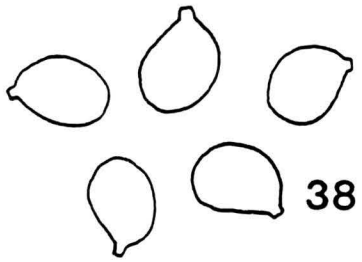
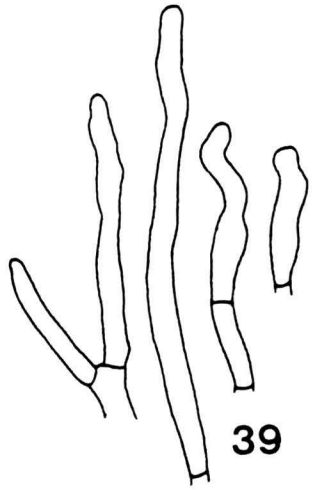
Figures 30-31. *T. imbricatum*. 30. spores. 31. radial section of pileipellis. Figures 32-33. *T. vaccinum*. 32. spores. 33. radial section of pileipellis. Figures 34-35. *T. psammopus*. 34. spores. 35. caulocystidia. Bar equals 10 µm for spores; 5µm for cystidia.

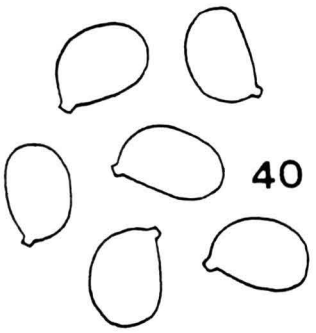


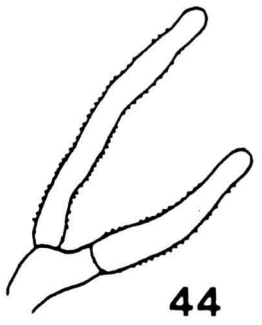


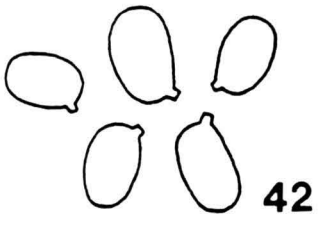


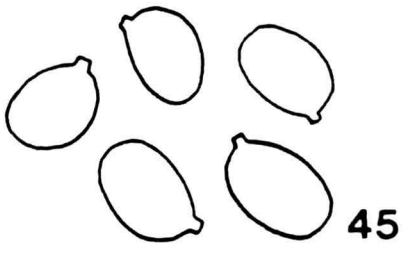


Figures 36-37. *T. manzanitae*. 36. spores. 37. caulocystidia. Figures 38-39. *T. dryophilum*. 38. spores. 39 caulocystidia. Bar equals 10 µm for spores; 5µm for cystidia.

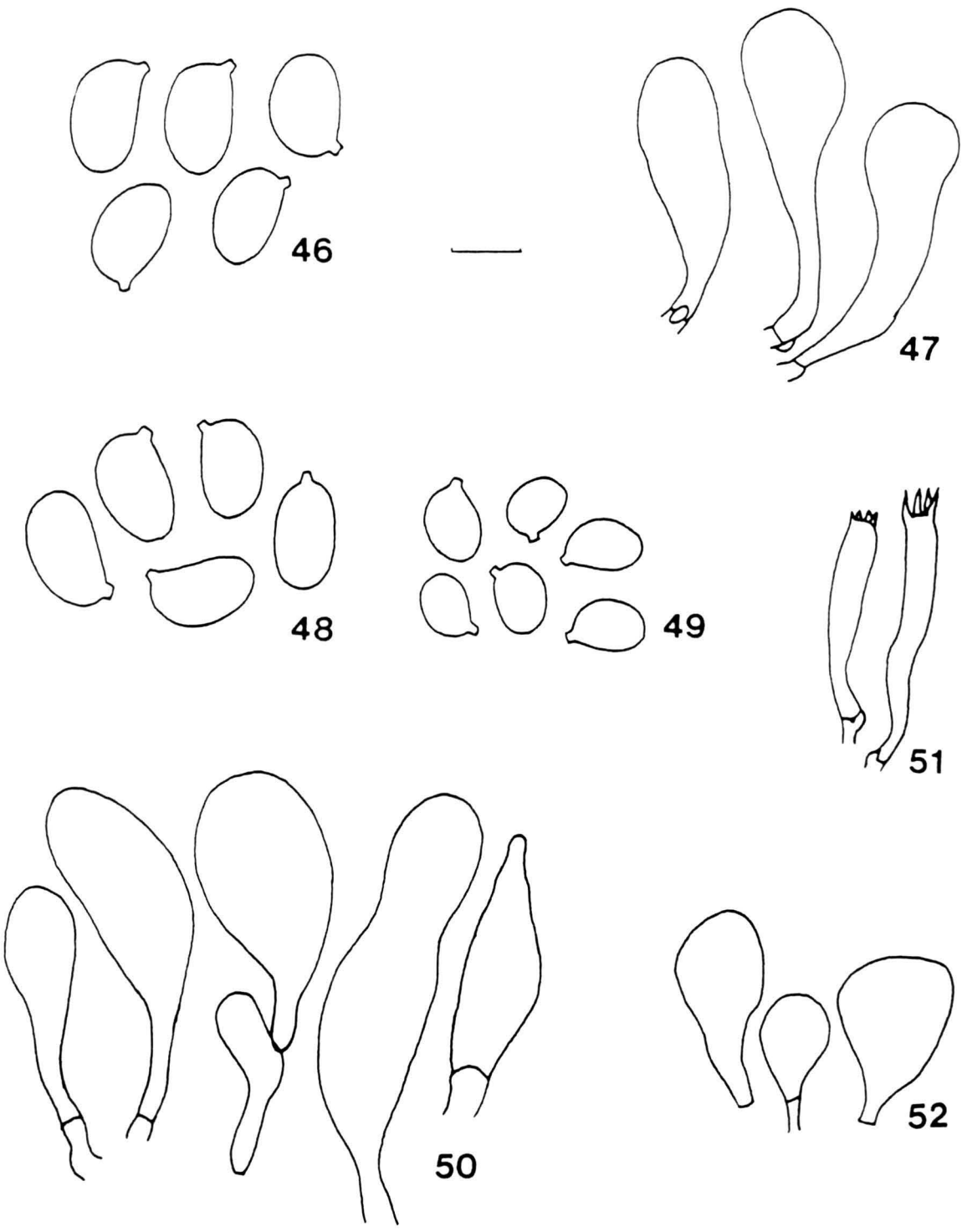




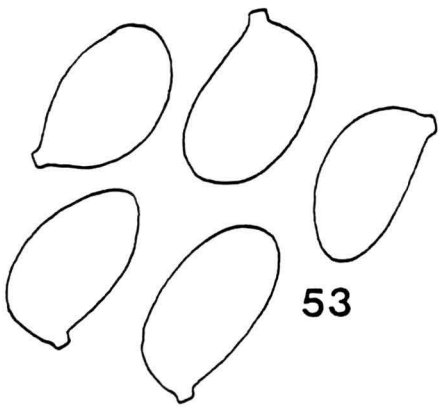


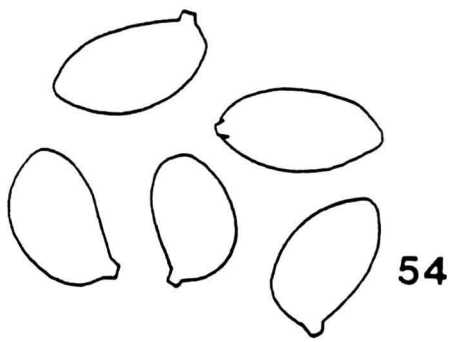


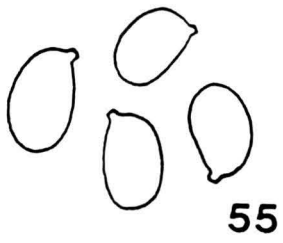
Figures 40-41. *T. nictitans*. 40. spores. 41. pileipellis hyphae. Figure 42. *T. muricatum*. 42. spores. Figures 43-44. *T. ustale*. 43. spores. 44. pileipellis hyphae. Figure 45. *T. fracticum*. 45. spores. Bar equals 10 µm for spores; 5µm for hyphae.



Figures 46-47. *T. pardinum*. 46. spores. 47. cheilocystidia. Figure 48. *T. venenatum*. 48. spores. Figures 49-52. *T. tumidum*. 49. spores. 50 cheilocystidia. 51. basidia. 52. pleurocystidia. Bar equals 10 µm for spores; 5µm for cystidia.







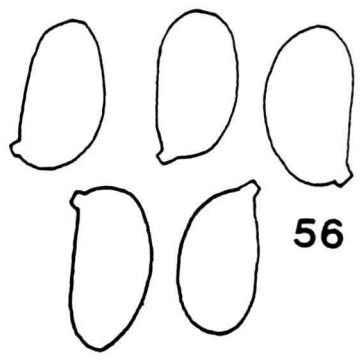


Figure 53. T. inamoenum. 53. spores. Figure 54. T. sulphureum. 54. spores. Figure 55. T. saponaceum. 55. spores. Figure 56. T. olidum. 56. spores. Bar equals 10 µm for spores; 5µm for cystidia.