NEW SPECIES AND RECORDS OF TRICHOLOMA
(Agaricales: Tricholomataceae) SECTIONS GENUINA AND MEGATRICHOLOMA FROM COSTA RICA AND UNITED STATES

Clark L. Ovrebo
Department of Biology
University of Central Oklahoma
Edmond, Oklahoma 73034, U.S.A.
covrebo@uco.edu

Roy E. Halling
Institute of Systematic Botany
The New York Botanical Garden
Bronx, New York 10458, U.S.A.
rhalling@nybg.org

Karen W. Hughes
Department of Ecology and Evolutionary Biology
University of Tennessee
Knoxville, Tennessee 37996, U.S.A.
khughes@utk.edu

Michael Kuo
The Herbarium of Michael Kuo
Post Office Box 742
Charleston, Illinois 61920, U.S.A.
michael@mushroomexpert.com

ABSTRACT
Species of Tricholoma sections Genuina and Megatricholoma are characterized by having pilei that are some shade of brown, and by white or yellow lamellae that also discolor some shade of brown. From Costa Rica in sect. Genuina, we describe as new T. luteopallidum, T. cacumense, and T. talamancense, and confirm the occurrence of Tricholoma stans, and from the United States describe as new Tricholoma brunneoluteum. Tricholoma roseoacerbum from sect. Megatricholoma is confirmed for Costa Rica. Morphology as well as ITS sequences are employed to confirm the species’ identifications or circumscriptions of the new species.

Key Words: Central America, Agaricomycetes, mushrooms, ITS

RESUMEN
Las especies de Tricholoma de las secciones Genuina y Megatricholoma se caracterizan por tener pileo de diversos tonos de marrón, y por lamelas blancas o amarillas, que también se torman marronáceas. Describimos como nuevos T. luteopallidum, T. cacumense y T. talamancense de Costa Rica pertenecientes a la sección Genuina y confirmamos la ocurrencia de Tricholoma stans. Además, describimos la nueva especie Tricholoma brunneoluteum de Estados Unidos. Se confirma Tricholoma roseoacerbum de la sección Megatricholoma para Costa Rica. Se emplean tanto la morfología como las secuencias ITS para confirmar las identificaciones de la especie o la circunscripción de la nueva especie.

INTRODUCTION
Tricholoma taxa with dry or viscid, brown pilei, white, off-white or yellow lamellae and stipes were originally placed in subg. Tricholoma sect. Genuina (Fr.) Sacc. (Singer 1986). More recent work confirmed by molecular analyses supports recognition of a second section, sect. Megatricholoma (Kost) M. Christensen & Noordel., that includes several species originally placed in sect. Genuina (Christensen & Noordeloos 1999; Heilmann-Clausen et al. 2017). Species in these sections, particularly Genuina, form a very complex group of taxa worldwide including North America. Many of the names of taxa in this section are of European origin making it difficult to know with reasonable certainty if the European names can be applied to North American taxa. With the publications of Christensen and Heilmann-Clausen (2013) and Heilmann-Clausen et al. (2017), especially the latter with the phylogenetic treatment which we follow, it is possible to begin analyzing and comparing species in this section that occur in North and Central America.

In this paper, we describe three new species in sect. Genuina from Costa Rica and one new species from the United States, and in the same section report T. stans (Fr.) Sacc. from Costa Rica for the first time; we also report T. roseoacerbum Riva, sect. Megatricholoma, for the first time for Costa Rica. For completeness, we provide descriptions of the latter two species. The new species all have lamellae that are light yellow to yellow as is the stipe surface pigmentation or at least the stipe context. A cladogram of the species treated is found in...
Figure 1. There is much macromorphological diversity within sect. *Genuina* in North America so detailed documentation of both the macroscopic and microscopic morphology along with phylogenetic work will be required to understand fully the diversity of character variation and species limits within these sections.

**METHODS AND MATERIALS**

**Macroscopic and microscopic descriptions**

Macroscopic descriptions are based on field notes recorded by the authors. The color terms in parentheses are from Kornerup and Wanscher (1978), Kelley (1965), Ridgway (1912) and Anonymous (1992). The formula for PDAB can be found in Ovrebo and Smith (1979). Microscopic notes were made by Ovrebo based on sections made from dried collections and mounted in 3% KOH. Spore data are based mostly on 15 or 20 measurements per collection and Q indicates length/width ratio. The Costa Rican collections have been split between...
## Table 1. Collections used in the phylogenetic analysis.

<table>
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<tr>
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### Table 1. continued.

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**Tricholoma orienticolossus**
- MT124443  T. orienticolossus    HAKS99341  China
- MT124444  T. orienticolossus    HAKS98645  China

**Tricholoma quercetorum/T. orientifulvum**
- LT00125  T. quercetorum    C-F-96263  MC99044  Portugal
- MT114682  T. orientifulvum    HAKS107157  China
- MT124445  T. orientifulvum    HAKS107156  China

**Tricholoma luteopallidum**
- MW881171  T. luteopallidum    USJ 109575, NY  Duguay 4  Costa Rica
- MW881172  T. luteopallidum    USJ 65978, NY  Felsch 32  Costa Rica
- MW881173  T. luteopallidum    USJ 65980, NY  Felsch 36  Costa Rica
- MW881174  T. luteopallidum    USJ 66022, NY  Felsch 40  Costa Rica
- MW881175  T. luteopallidum    USJ 53355, NY  Halling 7289  Costa Rica
- MW881176  T. luteopallidum    USJ 53347, NY  Halling 7290  Costa Rica
- MW881177  T. luteopallidum    USJ 53780, NY  Halling 7339  Costa Rica
- MW881178  T. luteopallidum    USJ 109576, CSU  Ovrebo 4359  Costa Rica
- MW881179  T. luteopallidum    USJ 109574, isotype NY  Ovrebo 4385 Holotype  Costa Rica
- MW881180  T. luteopallidum    USJ 109577, NY  Ovrebo 4412  Costa Rica

**Tricholoma cacumense**
- MW881182  T. cacumense    USJ 109578, isotype, NY  Halling 8303 Holotype  Costa Rica
- MW881183  T. cacumense    USJ 109579, NY  Halling 8322  Costa Rica

**Tricholoma talamancense**
- MW881184  T. talamancense    USJ 65976, NY  Felsch 35  Costa Rica
- MW881185  T. talamancense    USJ 53447, isotype, NY  Halling 7150h1 Holotype  Costa Rica
- MW881186  T. talamancense    USJ 53447, isotype, NY  Halling 7150h2 Holotype  Costa Rica
- MW881187  T. talamancense    USJ 66066, NY  Halling 7652  Costa Rica
- EU563477  ECM    Ovrebone M60D4  Mexico

**Tricholoma sp. 1**
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- NW881189  T. sp. 1    CSU  Ovrebo25-08-1995A-h2  USA: Minnesota
- MH979327  T. sp 1 as T. ustale    NAMA 2017-381  Mycoflora MyCoPortal.org #4952132  USA: Wisconsin

**Tricholoma sp. 2 (Predominantly ECM environmental isolates)**
- KP403096  Environmental sample  Ovrebone 46C  Canada: British Columbia
- DQ474755  ECM  Ovrebone 5WUBEC176  Canada: British Columbia
- DQ474757  ECM  Ovrebone 5WUBEC169  Canada: British Columbia
- KM403011  Environmental sample  Canada: British Columbia
- KP406554  T. sp 2 as Tricholoma stans    UBC F28495  Canada: British Columbia
- DQ474749  ECM  Ovrebone M60D4  Mexico

**Tricholoma spp. (unplaced)**
- AJ272072  T. populinum  strain 99/150 culture  Hungary
- KT875118  T. aff. populinum  HC-PNNT-278  Mexico: Mexico State
- MF034244  Tricholoma sp.  MB<DEU-Marburg>:301976  China: Yunnan

**Tricholoma Section Megatricholoma**
- MW881190  T. roseoacerbumb  USJ 72053, NY  Halling 8000  Costa Rica
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herbaria at the Universidad de Costa Rica (USJ followed by an accession number) and the New York Botanical Garden (NY) or the University of Central Oklahoma (CSU). Barcodes were previously designated for several of the cited collections and are searchable at the Mycology Collections data Portal (https://mycoportal.org/portal/). These barcode numbers are preceded by “barcode.”

**Molecular methods**

Collections used for phylogenetic analysis are given in Table 1. Taxa were included in the phylogeny based on preliminary trees showing relative placements of taxa within *Tricholoma*. A subset of the larger phylogeny was used in this manuscript. For highly speciose taxa, a geographically divergent subset of isolates was included. Outgroup taxa were selected from an adjacent clade within section *Genuina* but outside the highly speciose *T. fulvum* clade. Procedures for DNA extractions, PCR amplification and dideoxy sequencing of the ribosomal ITS region (Fungal barcode; Schoch et al. 2012) were performed as described in Ovrebo and Hughes (2018) using primers ITS1F or ITS5 and ITS4 (White et al. 1990; Gardes & Bruns 1993). ITS sequences were obtained as part of a broad survey of 350 *Tricholoma* isolates in 2007. Later attempts to amplify these DNAs for additional genes were unsuccessful. NrITS sequences were manually aligned with an internal *Tricholoma* ITS database in GCG (2000) to evaluate putative associations. Where indels prevented recovery of a complete ITS sequence, alignment of forward and reverse nrITS sequences were used to deduce the individual sequences at the insertion/deletion point. No cloning was performed. Alignments were exported to Geneious version R11 (Geneious 2017). PhyML was performed in Geneious with 1000 bootstrap replications using estimated transition/transversion rates, proportion of invariable sites and gamma distribution parameter. The number of substitution rate categories was 4 (Guindon & Gascuel 2008). Bayesian analysis was performed using Mr. Bayes in Geneious R11. The substitution model was GTR, Rage Variation was “gamma.” There were 4 heated chains with a total chain length of 1,100,000. Burn-in was 100,000. Branch lengths were unconstrained. Outgroups were chosen from the most closely related ITS sequences in GenBank (Table 1).

**RESULTS**

**Descriptions of Costa Rican Taxa**

**Sect. Genuina (Fr.) Saccardo**

*Tricholoma luteopallidum* Ovrebo, Halling, & Hughes, sp. nov. (Figs. 2–3). **Type:** COSTA RICA. SAN JOSE PROV. Dota Co.: San Gerardo, ± 5 km SW of Cerro de la Muerte, Albergue de la Montaña, Savegre, 9°33’N, 83°48’28”W, 4 Jun 2004, Ovrebo 4385 (holotype: USJ 109574, isotype: NY, Mycobank no. 840677; GenBank MW881178).

**Diagnosis.**—Characterized by the very light yellow, narrow, crowded lamellae, brownish orange to orange-brown pilei, bitter farinaceous taste, and by the small spores and presence of cheilocystidia. Also differs from other species in section *Genuina* by the ITS sequence.

**Etymology.**—*luteus* (L.) yellow, *pallidus* (L.) pale, referring to the very light-yellow lamellae.

Pileus 40–110 mm wide, convex when young, expanding to broadly convex to nearly plane, margin inrolled on buttons, down-curved or straight when mature, occasionally wavy or lobed, occasionally ribbed at edge, viscid, at center matted-fibrillose or with scattered small squamules, glabrous elsewhere, occasionally with areolate squamules near edge, brownish orange, brownish-orange to brown overall (5C−D6−5, 6−7−EDF−8, 2.5 YR−5YR−4/6, 55 S. Br−56 deep Br) but generally with center darker brown and margin often lighter yellowish tan (5C7−6), orange buff to cinnamon buff, occasionally with darker brown streaks, occasionally with brown watery spots near the edge; context 5−12 mm thick, buff to pale yellow, not discoloring, odor farinaceous, and taste bitter-farinaceous.

Lamellae narrow, 2–5 mm wide, sinuate, very light yellow (4A2, 3A3−4A3), developing small (± 1 mm) reddish brown to dark brown spots on edge and face in age and often extensively when over-mature, older ones often brownish marginate, crowded, 2−3/mm on mature basidiomes, entire, often forked; lamellulae present and in numerous tiers.

Stipe 40–100(−150) mm long, 8–20 mm thick, equal to subclavate, often bent, base rounded or abruptly tapered, terete or flattened, surface glabrous but often roughened with loosened surface fibrils which often are clumped into minute squamules, buff to yellowish buff, generally developing orange-brown to brown tones in
streaks and sometimes becoming light brown overall with the apex remaining yellowish buff; context solid but soon hollow, buff to very pale yellow, often orange-tan to brown when older. Basal mycelium white.

Spores white in deposit, 5−6 × 3.5−4(4.5) μm (mean = 5.33 × 4.0 μm, Q = 1.25−1.5, mean Q = 1.33), elliptic to broadly elliptic in profile and face view, smooth, thin-walled, hyaline, inamyloid. Basidia 20−30 × 5.5−7 μm, clavate, 4-sterigate, hyaline. Cheilocystidia present but abundance varying among collections, sometimes most evident where the lamellar edge is brown-stained, 25−35 × 5.5−8 μm, cylindric, ventricose-rostrate, fusiform-ventricose, often capitate, smooth, thin-walled, hyaline. Hyphae of lamellar trama 3–10 μm wide, parallel, hyaline, but often yellowish brown near lamellar edge. Hyphae of subhymenium 2 μm wide, hyaline. Pileipellis hyphae narrow, 1.5–4 μm wide, loosely interwoven in a gelatinous matrix, smooth or rarely faintly
incrusted, thin-walled, hyaline to pale yellow in outer region and pale yellowish brown to reddish brown at base where intergrading with pileus trama. Hyphae of pileus trama 4–13 µm wide, hyaline. Stipitipellis hyphae 3–5 µm wide, hyaline, cylindric, smooth thin-walled. Hyphae of stipe trama 5–15 µm wide, hyaline. Caulocystidia present at stipe apex, in the form of long cylindric projecting or entangled hyphae, up to 150 µm long and 3–4 µm wide, or in the form of cystidioid recurved end-cells, 20–35 × 3–5 µm, clavate, fusiform-ventricose, smooth, thin-walled, hyaline. Clamp connections absent.

Scattered, gregarious, on soil, presumed ectotroph of plants listed among collections cited below.
Chemical color reaction.—PDAB light pistachio green after a few minutes (recorded for A.-G. Felsch 23, 32, 40).

*Tricholoma luteopallidum* is characterized by having pale yellow, very crowded, narrow lamellae, stipe that start out pale yellow, and by the presence of cheilocystidia. The bitter farinaceous taste is also distinctive. For several of the collections studied the cheilocystidia were rare and may be missed if several sections are not checked. Cheilocystidia are most likely very rare among species of sect. *Genuina* and none of the species included in Christensen and Heilmann-Clausen (2013) from Northern Europe mentions their presence. Shanks (1997) mentions two species with cheilocystidia from California: *T. aurantium* (Schaeff.) Ricken with occasional filamentous hyphae, 3–4 µm wide, on the lamellar edge, although Ovrebo (unpublished data) has not confirmed their presence in material from Tennessee, Michigan or Illinois; *T. dryophilum* (Murr.) Murr. with cheilocystidia 30–62 × 2.4–3.4 µm although a study of the holotype by Ovrebo (unpublished data) did not confirm their presence. Compared to *T. luteopallidum, Tricholoma aurantium* has lamellae with off-white color, and distinct bands of tiny orange-brown squamules on the stipe; *T. dryophilum* has white or pale cream lamellae and the spores are larger (from holotype, 5.7–6.7 × 4.3–5.3 µm, Ovrebo unpublished data). Also interesting for *T. luteopallidum* are the very narrow hyphae that are mainly unincrusted in the outer layer of the pileipellis (Fig. 2B) which may be a good species characteristic, as compared to most species in this section that have brown walls with either hyaline or brownish incrustations or walls that fracture in the outer part resulting in uneven, banded pattern. A similar situation of narrow, scarcely incrusted pileal hyphae was found in *Tricholoma terriferum* Peck described from New York (Ammirati & Ovrebo 1979), but that species has buff colors to the lamellae and stipe.

*Tricholoma fulvum* (DC.) Bigeard & H. Guill. has been the name generally applied to the species in sect. *Genuina* with yellow lamellae and stipe. This species, based on the description of Christensen and Heilmann-Clausen (2013), has darker brown pileal coloration and lamellae that are medium broad and medium spaced, cheilocystidia are absent, and the ITS sequences do not match with *luteopallidum*. Specific details concerning the walls of the pileipellis hyphae are not given by Christensen and Heilmann-Clausen (2013). The spores of the Costa Rican fungus are also narrower than those of *T. fulvum*, the latter averaging 4.3–5.1 µm wide (Christensen & Heilmann-Clausen 2013).

*Tricholoma cacumen* Ovrebo, Halling, & Hughes, sp. nov. (Fig. 3). Type: COSTA RICA. SAN JOSE PROV.: Cerro de la Muerte, 9°33′16″N, 83°45′18″W, 3491 m, 7 Nov 2002, Halling 8303 (holotype: USJ 109578; isotype: NY, Mycobank no. 840678: GenBank MW881182).

Diagnosis—Characterized by the dark brown, viscid pileus, pale yellow lamellae and stipe, dark brown pileipellis hyphae and by the ITS sequence.

Etymology.—cacumen (L.), summit, peak, referring to the high elevation in the Talamanca Mountains where the fungus was collected.

Pileus 30–90 mm wide, convex, plano-convex to plane, surface dry to subviscid or viscid, appressed fibrillose, sometimes developing areolate squamules at the margin, dark brown (7F6, 7F8) at first, fading to light brown (6D6–5), margin paler brown (7E8); context 10 mm thick, white, odor and taste farinaceous.

Lamellae adnexed-emarginate, white to off-white or yellowish white (4A2, 4A3), developing reddish brown stains in situ with age, close to crowded, edges entire or uneven.
Stipe 30–100 mm long, 5–15 mm thick, equal, clavate or gradually tapered toward base, strict or curved, terete, flattened or cleft, sometimes contorted at the base, dry, fibrillose-striate to finely squamulose-striate, yellowish white with brown fibrils and squamules, developing light brown stains from handling, context becoming hollow. Base with whitish mycelium.

Spores 5–5.5(6) × 3.5–4 µm, (mean = 5.2 × 3.84 µm, Q = 1.25–1.43, mean Q = 1.36), elliptic in profile and face view, smooth, thin-walled, hyaline, inamyloid. Basidia 23–27 × 5–6 µm, 4-sterigate, clavate, hyaline. Hymenial cystidia absent. Hyphae of lamellar trama 2–3 µm wide, hyaline. Pileipellis hyphae 2.5–7 µm wide with widest hyphae towards the base, interwoven in a gelatinous matrix, smooth and thin-walled or roughened due to incrustations or because of fracturing and separation of the outer part of the wall, hyphae reddish brown throughout the layer but darkest where intergrading with pileus trama. Hyphae of pileus trama 4–15 µm wide, hyaline. Stipitipellis hyphae 3–5 µm wide, appressed, smooth, thin-walled hyaline to yellow-ochre. Hyphae of stipe trama 5–13 µm wide, hyaline. Caulocystidia present at stipe apex, 18–40 × 3–10 µm, formed from recurved end-cells, cylindric, clavate, versiform, smooth, thin-walled, hyaline. Clamp connections absent.

Gregarious, on soil, beneath Comarostaphylis arbutoides, Vaccinium consanguineum, Pernettya prostata.

Additional collection studied: COSTA RICA. San Jose Prov.: Cerro de la Muerte, south slope of summit, 9°33'16"N, 83°45'18"W, 3532 m, 13 Nov 2002, Halling 8322 (USJ 109579, NY; GenBank MW881183).

*Tricholoma cacumense* is similar to *T. luteopallidum* in lamellar coloration and crowdedness, but differs by having darker, duller brown pileal colors, more darkly pigmented hyphae in the outer layers of the pileipellis, by the lack of cheilocystidia and by the ITS analysis. The host specificity may be different as well because *T. luteopallidum* was collected under *Quercus* spp. whereas the plant associates indicated for *T. cacumense* are ericoid plants. *Comarostaphylis arbutoides* (Ericaceae) is a confirmed ectotroph associate for *Leccinum monticolae* Halling & G.M. Mueller (Osmundson et al. 2007) and the authors of that paper also suggest that *Tricholoma*, along with several other ectotroph fungal genera, should be considered as likely associates of *C. arbutoides* as well.

*Tricholoma talamancense* Ovrebo, Halling, & Hughes, *sp. nov.* (Figs. 2–3). Type: COSTA RICA. San Jose Prov.: Villa Mills, C.A.T.I.E. Experimental Forest of Villa Mills, 9°33'0"N, 83°41'0"W, 2880 m, 11 Aug 1993, Halling 7150 (holotype: USJ 53447; isotype: NY with barcode 473560; Mycobank no. 840679; GenBank MW881185).

**Diagnosis.**—Characterized by the dark brown, viscid pileus, light yellow lamellae, buff to pinkish cinnamon stipe, yellowish mycelium at the stipe base, and by the ITS sequence.

**Etymology.**—named for the Talamanca mountains of Costa Rica where the species was collected.

Pileus 10–70 mm wide, conic-convex or flattened conic when young, convex to plano-convex or plane when mature, sometimes with a low broad umbo, margin incurved when young, straight and often upcurved and undulating when mature, surface viscid but soon dry, matted-fibrillose over disc, finely appressed-fibrillose toward the margin or glabrous, often with scattered squamules, dark reddish brown overall or with dark brown or fuscous at the disc and lightening to light brown or yellowish brown toward the margin, near the margin sometimes cinnamon buff; context 8–10 mm thick, white but with yellowish and pinkish tones, with reddish brown stains, odor and taste farinaceous.

Lamellae adnexed to emarginate, ivory, yellowish white to pale yellow (4A3, 4B3), developing reddish brown stains, close to crowded, edge even to uneven.

Stipe 30–60(140) mm long, 5–11 mm thick, equal to somewhat broader below, often bent, the lower half often flattened and bumpy, dry, appressed fibrillose- striate, light buff or pinkish cinnamon at first with reddish brown surface fibrils, becoming darker reddish brown with handling; context solid at first, becoming hollow, light yellow, discoloring cinnamon to brown especially at base. Base with yellow mycelium (3A4) and yellow mycelial strands attached.

**Chemical Color Reaction.**—PDAB no reaction (A.-G. Felsch 35).

Spores 6–7 × (4.5)5–5.5 µm (mean = 6.65 × 5.17 µm, Q = 1.2–1.3, mean Q = 1.29, broadly elliptic in profile
and face view, smooth, thin-walled, hyaline, inamyloid. Basidia 25–41 × 7–8 µm, 4-sterigate, clavate, hyaline, but often yellowish brown in mass when seen under low power. Lamellar edge in one collection with filamentous, often flexuous hyphae like elements projecting, 20–55 × 2–4 µm, occasionally branched, tapering gradually to a rounded apex, widest at base, often several-celled and with a short basal cell that can reach 7 µm in dia, smooth, thin-walled, hyaline or sometimes translucent-brown. Hyphae of lamellar trama 3–17 µm wide, parallel, in mass hyaline or yellowish to orange-brown. Hyphae of subhymenium 2.5–3 µm wide, hyaline. Pileipellis hyphae 3–8 µm wide, radially interwoven to slightly interwoven in a gelatinous matrix, some hyphae smooth but most often with brown incrustations, a slightly pigmented banding pattern seen due to fracturing and separation of outer part of the wall, hyphae reddish brown, both as a layer and individual hyphae. Hyphae of pileus context 4–15 µm wide, hyaline. Stipitipellis hyphae 3–5 µm wide, appressed, light reddish brown to reddish brown as a layer as individual hyphae, pale yellowish brown at stipe apex, smooth, thin- to slightly thick-walled. Hyphae of stipe trama 4–20 µm wide, slightly inflated, hyaline. Caulocystidia occasional at stipe apex, 20–40 × 2.5–4 µm, filamentous-cylindric or clavate, thin-walled, hyaline. Clamp connections absent.

Gregarious, on soil, under *Quercus costaricensis*.


*Tricholoma talamancense* is a third Costa Rican species with pale yellow lamellae. The stipe is buff to pinkish cinnamon and discolors brown although the stipe context is light yellow. Also potentially diagnostic is the yellowish mycelium and strands at the stipe base which were reported for the collections cited. For one collection (Halling 7150) the basal hyphae started out white and became yellow, and also had elements projecting from the lamellar edge that could be considered as cheilocystidia but they more resemble very narrow hyphal end-cells, as compared to the more typical cheilocystidia that tend to be inflated cells. *Tricholoma talamancense* has larger spores than either *T. luteopallidum* or *T. cacumense*.

### *Tricholoma stans* (Fr.) Sacc. (Fig. 2)

Pileus 20–80(130) mm wide, convex when young, expanding to plano-convex to plane, margin incurved when young, straight and sometimes partly upturned when mature, surface tacky or subviscid to viscid, soon dry, matted fibrillose to matted fibrillose-scaly at first, when mature to matted-glabrous over central area and with scattered squamules toward and on the margin with age, reddish brown (7−8E8) mostly overall with a white margin at first, medium brown (6C−D7−6) with age and margin lighter brown; context up to 10−15 mm thick, white, unchanging or with orange-brown discoloration below the surface, odor and taste farinaceous.

Lamellae adnate, adnexed or emarginate, medium width (not narrow) white to off-white, discoloring fulvous to brown when mature, close, edges even.

Stipe 20–50 mm long, 5–20 mm thick, equal, surface dry, striate-fibrillose to coarsely fibrillose with abundant recurved reddish brown squamules on white ground color that abruptly end near apex and possible remains of a veil, sometimes brown in areas, apex white and subfibrillose: context white to light buff, becoming hollow.

Spores 6–7 × 4.5−5 µm (mean = 6.5 × 4.9 µm, Q = 1.3−1.4, mean Q = 1.33), elliptic in profile and face view, smooth, thin-walled, hyaline, inamyloid. Basidia 27–36 × 7–8 µm, clavate, 4-sterigate, hyaline. Hymenial cystidia absent. Hyphae of lamellar trama 4–12 µm wide, parallel, hyaline. Hyphae of subhymenium 2.5–3 µm wide, hyaline. Pileipellis hyphae 3–8 µm wide, radially interwoven in a gelatinous matrix, often clumped into recurved squamules, brownish red as a layer, individual hyphae hyaline to translucent brownish red to yellowish brown, smooth, thin-walled or roughened and thickened with hyaline incrustations. Hyphae of pileus trama 4–15 µm wide, hyaline. Stipitipellis hyphae between squamules 4–8 µm wide, appressed, hyaline to brownish yellow, smooth, thin-walled or slightly incrusted, with scattered caulocystidia formed from recurved end cells or intercalary, 20–120 × 3–5 µm, filamentous, hyaline; squamules most obvious and
well-developed on young basidiomes, composed of bundles of recurved hyphae, cells 5–12 \( \mu m \) wide, yellowish brown, slightly thick-walled, sometimes emanating from bundle are thin-walled, hyaline hyphae 30–120 \( \times 3–5 \mu m \). Hyphae of stipe trama 5–18 \( \mu m \) wide, parallel, hyaline. Clamp connections absent.

Gregarious, on soil, under Quercus costaricensis and Comarostaphylis arbutoides.

Collections studied: COSTA RICA. San Jose Prov.: San Gerardo, ± 500 m along road from Interamerican Highway toward San Gerardo, 9°36'13"N, 83°47'26"W, 3000 m, 12 Jun 1996, Halling 7676 (USJ 66082, NY; GenBank MW881170); 1.5 km from Interamerican Highway toward San Gerardo, 9°35'47"N, 83°47'55"W, 2860 m, 9 Jun 1997, A.-G. Felsch 31 (USJ 66013, NY; GenBank MW881169).

Tricholoma stans is a European species and the ITS sequences of the Costa Rican material match those as published by Heilmann-Clausen et al. (2017). Christensen and Heilmann-Clausen (2013) indicate that the European T. stans is characterized by robust basidiomata, a brownish cap with a pale ribbed margin, and association with Pinus. For the Costa Rican material, the ribbed margin was not evident and the collections were associated with hardwoods. Tricholoma stans belongs to a complex of species with brown, viscid pilei and pale white to off-white (non-yellow) lamellae and stipe. A name commonly associated with fungi with these colors is T. pessundatum (Fr.: Fr.) Quél., a name frequently assigned to fungi with these features in North America, but for which there are likely undescribed species in this region. See Christensen and Heilmann-Clausen (2013) for a discussion of species in this group for European taxa, and Bessette et al. (2013) for taxonomic issues of North American taxa in this group. The notes with collection Halling 7676 suggest the possibility of a veil but additional young specimens need to be collected to confirm its presence.

Section Megatricholoma (G. Kost) M. Christensen & Noordeloos

**Tricholoma roseoacerbum** A. Riva (Fig. 2)
Pileus 30–50 mm wide, convex to plano-convex, dry, matted tomentose to matted subtomentose, subviscid, mottled brownish orange to clay color (5C–D6–5) over most areas, staining dark brownish orange, with bright pastel yellow (2A4–3A4) at the inrolled and thick cottony margin; context white, unchanging but brown around larval tunnels, 8–10 mm thick, odor and taste mild.

Lamellae adnexed, white to yellowish white to pale yellow, developing brown stains, with uneven margins.

Stipe 30–50 mm long, 10–20 mm thick, equal, dry, strict or curved, white with pastel yellow squamulose scales, to fibrillose, staining orange to brownish orange; context solid, white, unchanging; context solid, white, unchanging.

Chemical color reaction.—PDAB: no reaction.

Spores 5–5.5 \( \times 3.5–4 \mu m \) (mean = 5.1 \( \times 3.83 \mu m \), mean Q = 1.34), broadly elliptic in profile and face view, smooth, thin-walled, hyaline, inamylloid. Basidia 24–27 \( \times 6–6.5 \mu m \), 4-sterigmate, clavate, hyaline. Hymenial cystidia absent. Hyphae of lamellar trama parallel, hyphae 3–8 \( \mu m \) wide, hyaline to yellowish in mass. Hyphae of subhymenium 2–2.5 \( \mu m \) wide, hyaline. Pileipellis hyphae 3–5 \( \mu m \) wide, embedded in a weak gelatinous matrix, hyphae smooth, thin-walled, hyaline to light yellowish brown in outer region and sometimes translucent, toward base becoming browner due to density of hyphae. Hyphae of pileus trama up to 15 \( \mu m \) wide, hyaline. Stipitipellis hyphae 4–7 \( \mu m \) wide, with scattered loosely interwoven clumps, smooth, thin-walled, hyaline to pale yellowish brown. Hyphae of stipe trama to 10 \( \mu m \) wide, hyaline. Clamp connections absent.

Gregarious, on soil, under Quercus seemannii and Q. copeyensis.

Collection studied: COSTA RICA: San Jose Prov.: Dota, San Gerardo, about 5 km SW of Cerro de la Muerte, Albergue de la Montaña, Savegre, 9°32'02"N, 83°48'27"W, 2220 m, 10 Jul 2000, Halling 8000 (USJ 72053, NY; GenBank MW881190).

Tricholoma roseoacerbum Riva described from Switzerland is regarded as being similar to T. acerbum (Bull.: Fr.) Vent. The latter has a lighter cream to pinkish buff pileus surface coloration (Christensen & Heilmann-Clausen 2013), compared to the more darkly pigmented T. roseoacerbum. The inrolled pileus margin when young is characteristic of both species. The ITS sequence of the Halling collection cited here aligns with European sequences (not shown) so we are confident in applying this name to the Costa Rican material.
New species in section *Genuina* from United States

**Tricholoma brunneoluteum** Ovrebo, Kuo, & Hughes, *sp. nov.* (Fig. 2–3). **Type: OKLAHOMA.** Atoka Co.: Boehler Seeps, Nature Conservancy property, SE of Lane, 34°10.317’N, 95°52.317”W, 9 Oct 1999, Ovrebo 3792 (Holotype: TENN, Mycobank no. 840680; GenBank MW881161).

*Diagnosis.*—Characterized by the viscid, brown pileus that is frequently brownish yellow on the margin, yellow lamellae and by the ITS sequence.

*Etymology.*—brunne (L.) brown, referring to the brown pileus, luteus (L.) yellow, referring to the yellow lamellar color.

Pileus 40–80 mm wide, convex when young, broadly convex at maturity, surface tacky to viscid, glabrous, matted-fibrilloose at center, with scattered innate radiating fibrils elsewhere, occasionally pitted on margin, light brown (Ochraceous Tawny), medium reddish brown to brown and the margin often with yellowish ground color showing through giving a lighter brownish yellow tone (Ochraceous Buff); context 8–11 mm thick, very light yellowish buff, odor and taste farinaceous.

Lamellae 3–9 mm wide, adnate to sinuate, yellow (Amber-Yellow), discoloring brown on edge or in larger areas on face and extensively brown when older, close to crowded, entire, lamellulae in numerous tiers.

Stipe 50–70 mm long, 7–20 mm wide, equal, terete, glabrous, silky appearing and often with loosened surface fibrils projecting, light yellowish buff, discoloring brown in areas or eventually overall (Ochraceous-Tawny); context solid or hollow, very light yellowish buff; basal mycelium white (recorded for one collection).

*Chemical color reaction.*—3% KOH on cap reddish brown (recorded for one collection).

Spores white in deposit. Spores 5.5–6.5 × 4.5–5.5 μm (mean = 5.95 × 4.91 μm, Q = 1.1–1.3, mean Q = 1.21), broadly elliptic to nearly subglobose in profile and face view, smooth, thin-walled, hyaline, inamyloid. Basidia 25–30 × 6–8 μm, 4-sterigmate, hyaline individually but hymenium as a layer orangish-cinnamon or brown. Hymenial cystidia absent. Hyphae of lamellar trama parallel, 3–13 μm wide, hyaline to pale yellow. Hyphae of subhymenium 2–3 μm wide, hyaline. Pileipellis hyphae 3–6 μm wide, interwoven in a weakly to strongly developed gelatinous matrix, walls smooth or incrusted with hyaline to brownish incrustations, hyphae light yellowish brown, orange-brown to brown, darkest where seen in mass, often translucent and opaque where densely pigmented. Hyphae of pileus trama up to 15 μm wide, hyaline. Stipitipellis hyphae 4–5 μm wide, smooth, thin-walled or in mass light brown. Caulocystidia scattered among surface hyphae at apex, clavate, hyaline. Hyphae of stipe trama 5–18 μm wide, hyaline to pale yellow. Clamp connections absent.

Scattered, on soil, under mixed hardwoods.


*Tricholoma brunneoluteum* also has the brown pileus coloration and the yellow lamellae and stipe.

The lamellae have brighter yellow pigmentation compared to the species described from Costa Rica. Fungi with these colorations have frequently been referred to as *Tricholoma fulvum* (DC.) Bigeard & H. Guill. or *T. flavobrunneum* (Fr.) Kumm. in North American field guides (*T. flavobrunneum* is considered a synonym of *T. fulvum*, Christensen & Heilmann-Clausen 2013). The ITS sequence indicates that the fungus described here is not the same as the European *fulvum* (Fig. 1). *Tricholoma transmutans* Peck is another species name to consider in this complex. As pointed out by Ammirati and Ovrebo (1979), the lamellar color is difficult to interpret. Peck in the protologue gave the lamellar color as being whitish or pale yellow with no indication that there is a color change from white to yellow as they mature. Peck also described the stipe of *T. transmutans* as white which would distinguish it from *T. brunneoluteum* which has a pale yellow stipe. Moving forward, molecular comparisons and determinations should be easier to make because it is now possible to anchor the name *fulvum* based on both the description provided by Christensen and Heilmann-Clausen (2013) and the molecular analysis of Heilmann-Clausen et al. (2017). Tricholomas with brown pilei and yellow lamellae and stipes, along with species that have whitish lamellae and stipes, are commonly collected throughout North
America and there are very likely more species in this complex and are in desperate need of study. Many of the species may be cryptic so molecular analyses will be an important part of their documentation.

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