

Tylopilus orsonianus sp. nov. and *Tylopilus eximius* from Guyana

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Abstract: *Tylopilus orsonianus* sp. nov. and *Tylopilus eximius* (Boletaceae, Basidiomycota) are described for the first time from the Pakaraima Mountains of Guyana. Both boletes occur in forests dominated by ectomycorrhizal trees in the genus *Dicymbe* (Caesalpiaceae). A key to *Tylopilus* species distinguishes those known to occur in Guyana.

Key words: Boletaceae, Caesalpiaceae, ectomycorrhizae, Guiana Shield, neotropics, taxonomy

INTRODUCTION

Species of Boletaceae (Basidiomycota) are prominent components of the ectomycorrhizal macromycota associated with the leguminous genus *Dicymbe* (Caesalpiaceae, tribe Amherstieae) in the Pakaraima Mountains of Guyana (Henkel et al 2002). This paper completes the taxonomic descriptions of *Tylopilus* P. Karst. currently known from Guyana (Henkel 1999, 2001). Ninety-six species of *Tylopilus* are known worldwide, with more than half described from either the paleo- or neotropics (Heinemann and Goossens-Fontana 1954, Singer et al 1983, 1991, Halling and Mueller 2001). We describe here a new species, *Tylopilus orsonianus*, and note a new distribution record for *Tylopilus eximius* (Pk.) Singer. A key to *Tylopilus* species known in Guyana is provided.

MATERIALS AND METHODS

Collections. They were made during the May–Jul 2000–2005 rainy seasons from the Upper Potaro River Basin, within a 5 km radius of a permanent base camp at 5°18'04.8"N; 59°54'40.4"W; elevation 710 m. The site is located in an undulating valley approximately 20 km east of Mount Ayanganna (2200 m) and is densely forested with a mosaic of primary *Dicymbe*-dominated and mixed forests of the *Eschweilera-Licania* association (Fanshawe 1952; further

site details Henkel 2003). An additional collection of *Tylopilus orsonianus* was made in the Upper Ireng River Basin, approximately 30 km south of the Potaro site. All collections were made in forests dominated by *Dicymbe corymbosa* Spruce ex Benth. Macroscopic features were described from fresh basidiomata in the field. Colors were described subjectively and coded according to Kornerup and Wanscher (1978), with color plates noted in parentheses (e.g. 3C4). Macrochemical tests were performed according to the methods of Singer (1986). Fungi were dried with silica gel (Miller et al 2002).

Micromorphological features of dried specimens were examined with an Olympus BX51 microscope equipped with bright field and phase contrast optics. Fungal tissue was rehydrated and mounted in either H₂O, 3% KOH, or Melzer's solution. A minimum of 20 basidiospores, basidia, cystidia and other structures were measured for each collection examined. Line drawings were traced from digital photographs. Specimens are deposited in these herbaria: BRG, HSU and NY (Holmgren et al 1990).

TAXONOMY

Tylopilus orsonianus Fulgenzi and T.W. Henkel, sp. nov. FIGS. 1–2

Latin diagnosis: *T. rubrobrunneus* et *T. indecisus* affinis, a qua differt colore pilei, forma stipitis et proprietatibus superficiei, magnitudinibus sporarum basidiorum et cystidiorum, et in KOH colore et textura mediostriati hymenophori.

HOLOTYPE: *Henkel 8106* (BRG; **ISOTYPE:** HSU, NY)

Pileus 26–66(98) mm broad, convex to planoconvex, brown throughout (6E6–7F6) to tannish brown (4B4–4B7) with age, velutinous, becoming minutely areolate when mature (under lens), dry, margin slightly inrolled and entire; trama 1–3 mm thick at margin, 4–10 mm over tubes, 5–17 mm above stipe, white to cream (3A3) to light grayish yellow (3B3), unchanging, solid. **Odor** fragrant; **flavor** mild, nutty (not bitter). **Tubes** 1–3 mm long at margin, 3–9 mm centrally, 1–4 mm at stipe, narrowly and deeply depressed around stipe, cream yellow (3A4) to light yellow (3B4–4B4), slowly and slightly browning with exposure; tube mouths cream yellow (3A3–3A4) to grayish yellow (4B3), browning slightly with pressure; pores 1–2 per mm, isodiametric to subovate. **Stipe** 48–111(140) mm × 11–34(42) mm centrally, 6.5–22(30) mm at apex, 6–23 mm at base, subequal, tapering gradually upward, strongly attenuated at extreme base, occasionally curving, olivaceous brown throughout (5E6) to dark brown (6F5–6F8); extreme apex light grayish yellow (3B4) to light grayish orange



FIG. 1. Basidiomata of *Tylopilus orsonianus* (HOLOTYPE; *Henkel 8106*), $\times 0.7$.

(4B5), smooth, finely pubescent under lens, coarsely reticulate over upper one-third to two-thirds; reticulum less pronounced toward base, lower one-quarter with a low, densely matted dark grayish brown tomentum (5E4–5E5); extreme base with white to cream mycelium, occasionally subtended by grayish

brown rhizomorphs and brown ectomycorrhizae; trama cream in upper three-quarters, lower one-quarter olivaceous brown (4E4) to dark brown (5F6), discoloring throughout along larval tunnels (5F6), otherwise unchanging, solid, less so with age.

Basidiospores flesh pink (6B2–6C2–6C3) in light to medium deposit, $11\text{--}14.5\ \mu\text{m} \times 4.9\text{--}7.4\ \mu\text{m}$ (mean $Q = 2.31$), ellipsoid to subfusiform, faint pink in H_2O , hyaline in KOH, inamyloid, 1–2-guttulate; hilar appendage $0.4\text{--}0.8\ \mu\text{m}$ long; wall $0.5\text{--}0.9\ \mu\text{m}$ thick, smooth. *Basidia* $24.7\text{--}41.3\ \mu\text{m} \times 9.6\text{--}16.9\ \mu\text{m}$, clavate, thin walled, hyaline in H_2O and KOH, 4-sterigmate. *Hymenial cystidia* $39.5\text{--}71.6\ \mu\text{m} \times 5.7\text{--}12.4\ \mu\text{m}$, ventricose to ventricose-rostrate, occasionally more cylindrical, frequent, arising from the subhymenium, projecting $17\text{--}40\ \mu\text{m}$ above the hymenial palisade, hyaline, devoid of refractive contents. *Hymenophoral trama* boletoid; mediostatum $24.7\text{--}44.5\ \mu\text{m}$ wide, of many narrow parallel hyphae, these yellow orange in H_2O , gelatinized and light yellow orange in KOH, lateral stratum hyphae $4.0\text{--}5.7\ \mu\text{m}$ wide, hyaline, nongelatinized, strongly divergent. *Pileipellis* an interwoven trichodermial palisade of cylindrical elements with inflated terminal cells, in mass light golden brown in H_2O , lighter in KOH; terminal cells $15.3\text{--}49.4\ \mu\text{m} \times 7.4\text{--}12.4\ \mu\text{m}$ wide, faint golden brown

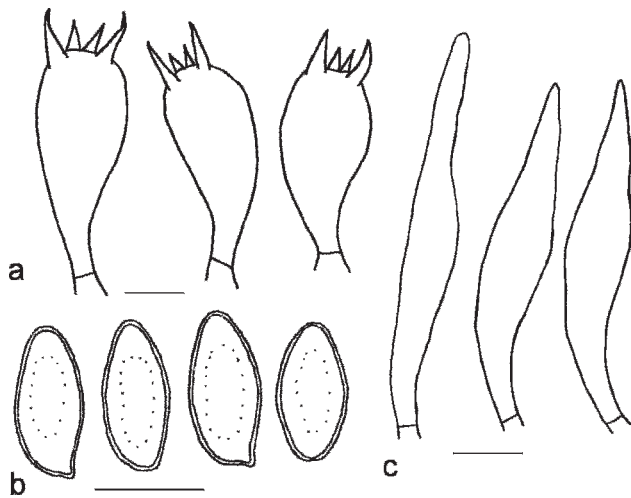


FIG. 2. Microscopic features of *Tylopilus orsonianus* (HOLOTYPE; *Henkel 8106*). a. Basidia. b. Basidiospores. c. Cystidia. Bar = $10\ \mu\text{m}$.

in H₂O, hyaline in KOH, inamyloid, cylindrical to mucronate to ventricose-rostrate, occasionally globose to clavate. *Pileus trama* interwoven; individual hyphae 4–5 µm wide, thin walled, light golden in H₂O, hyaline in KOH, regularly septate. *Stipitipellis* a highly interwoven trichodermial palisade, dark brown in mass in KOH; individual hyphae 6.3–9.4 µm wide; terminal cells golden brown in H₂O, lighter in KOH, thin-walled, clavate to cylindrical, occasionally broadly mucronate; subpellis hyphae with spirally arranged, yellowish encrusting pigments; upper stipe reticulum with infrequent basidia. *Clamp connections* absent. *Macrochemical reactions*: NH₄OH negative on pileus surface, burgundy to black on trama of stipe base; KOH yellowing on pileus surface, burgundy to black on trama of stipe base.

Habitat, habit, and distribution. Solitary to scattered on root mat in forests dominated by *Dicymbe corymbosa*; known from the type locality in the Upper Potaro Basin and adjacent Upper Ireng Basin of Guyana.

Etymology. This species epithet is in honor of the late agaricologist Dr Orson K. Miller Jr.

Specimens examined. GUYANA. REGION 8 POTARO-SIPARUNI: Pakaraima Mountains, Upper Ireng River, 1 km downstream from Kurutuik Falls, 7 Jan 1998, *Henkel 6286* (BRG; HSU); Upper Potaro River, 5°18'04.8"N, 59°54'40.4"W, elevation 710 m, vicinity of Potaro base camp, 19 May 2000, *Henkel 7407* (BRG; HSU); vicinity of Potaro base camp, 26 May 2000, *Henkel 7428* (BRG; HSU); vicinity of Potaro base camp, 23 Jun 2000, *Henkel 7541* (BRG; HSU); vicinity of Potaro base camp, 23 Jun 2000, *Henkel 7548* (BRG; HSU); vicinity of Potaro base camp, 13 Jul 2000, *Henkel 7571* (BRG; HSU); vicinity of Potaro base camp, 18 Jul 2000, *Henkel 7637* (BRG; HSU); 3.5 km east of Potaro base camp, 11 May 2001, *Henkel 8085* (BRG; HSU); 4 km southwest of Potaro base camp near *Dicymbe* plot 3, 12 May 2001, *Henkel 8106* (HOLOTYPE, BRG; ISOTYPE: HSU, NY); 4 km southwest of Potaro base camp near *Dicymbe* plot 3, 18 May 2001, *Henkel 8169* (BRG; HSU); vicinity of Potaro base camp, 29 Jun 2001, *Henkel 8421* (BRG; HSU); vicinity of Potaro base camp, 22 May 2002, *Henkel 8480* (BRG; HSU); 1 km west of Potaro base camp, 30 May 2005, *Henkel 8814* (BRG; HSU); 0.75 km west of Potaro base camp, 3 Jun 2005, *Henkel 8830* (BRG; HSU); 0.3 km southeast of Potaro base camp on *Dicymbe* masting plot 5, 4 Jun 2005, *Henkel 8834* (BRG; HSU); 2 km southeast of Potaro base camp on Benny's ridge on LP1 *Dicymbe* plot, 5 Jun 2005, *Henkel 8837* (BRG; HSU); vicinity of Potaro base camp, 6 Jun 2005, *Henkel 8845* (BRG; HSU).

Commentary. *Tylopilus orsonianus* is a distinctive bolete recognized in the field by the velutinous brown to tan brown pileus, robust subequal brown stipe with coarse reticulations over the upper portion, and cream yellow hymenophore. *T. orsonianus* is distinguished microscopically by elongated spores, abundant ventricose-rostrate hymenial cystidia, a palisadic pileipellis of variously shaped hyphal elements, and a gelatinized

yellow orange mediostratum in the tube trama as revived in KOH. This species fits the genus *Tylopilus* as commonly defined based on smooth spores with a nonolivaceous, flesh pink to pinkish brown deposit; within the genus it is best disposed in section *Tylopilus* due to the lack of autoxidation in the trama and the lack of a bluing reaction with NH₄OH on the pileus (Smith and Thiers 1971, Singer 1986). *Tylopilus orsonianus* is similar to the North American *T. rubrobrunneus* Mazzer & Smith (Mazzer and Smith 1967) but differs from *T. rubrobrunneus* in having a brown pileus that is lacking vinaceous tones, a reticulate stipe that is strongly attenuated at the base, larger basidia (24.7–41.3 µm × 9.6–16.9 µm vs. 20–26 µm × 8–11 µm), longer hymenial cystidia (39.5–71.6 µm vs. 36–52 µm), wider spores (4.9–7.4 µm vs. 3–5 µm), a mediostratum that is gelatinized and yellowish in KOH, and lacking a bitter flavor (Smith and Thiers 1971). *Tylopilus orsonianus* is similar to the North American *T. indecisus* (Pk.) Murrill (Smith and Thiers 1971) for features such as basidioma stature, mild flavor, stipe reticulation, a gelatinized hymenophoral mediostratum in KOH, and basidium shape, but differs from *T. indecisus* in having a stipe that is strongly attenuated at the base, larger basidia (24.7–41.3 µm × 9.6–16.9 µm vs. 18–25 µm × 5–8 µm), more frequent hymenial cystidia, wider spores (4.9–7.4 µm vs. 3–5 µm), and a yellow orange hymenophoral mediostratum in KOH (Smith and Thiers 1971). *Tylopilus orsonianus* is somewhat reminiscent of the montane neotropical *Tylopilus bulbosus* Halling & Mueller in basidioma stature, its nonbitter flavor, and surface features of the pileus and stipe (Halling and Mueller 2001). *Tylopilus orsonianus* differs from *T. bulbosus* in having wider spores (4.9–7.4 µm vs. 4.2–4.9 µm), larger basidia (24.7–41.3 µm × 9.6–16.9 µm vs. 20–30 µm × 8–12 µm), smaller hymenial cystidia (39.5–71.6 µm × 5.7–12.4 µm vs. 50–80 µm × 8–14 µm), and a pileus, stipe, and hymenophore that consistently lack purple tones. In addition the grayish rose tube mouths diagnostic for young *T. bulbosus* are lacking in *T. orsonianus* (Halling and Mueller 2001).

Tylopilus eximius (Pk.) Singer, Amer Midl Nat 37:109. 1947

FIGS. 3–4

= *Boletus robustus* Frost non Fr., Bull Buffalo Soc Nat Sci 2:104. 1874.

= *Boletus eximius* Pk., J Mycol 3:54. 1887.

= *Ceromyces eximius* (Pk.) Murrill, Mycologia 1:148. 1909.

= *Leccinum eximium* (Pk.) Singer, Persoonia 7:319. 1973.

Pileus 46–70 mm broad, convex to planoconvex, dark burgundy maroon throughout (10F5) to dark maroon (11F8–12F8) with age, densely velutinous, finely and irregularly rugulose throughout, dry,

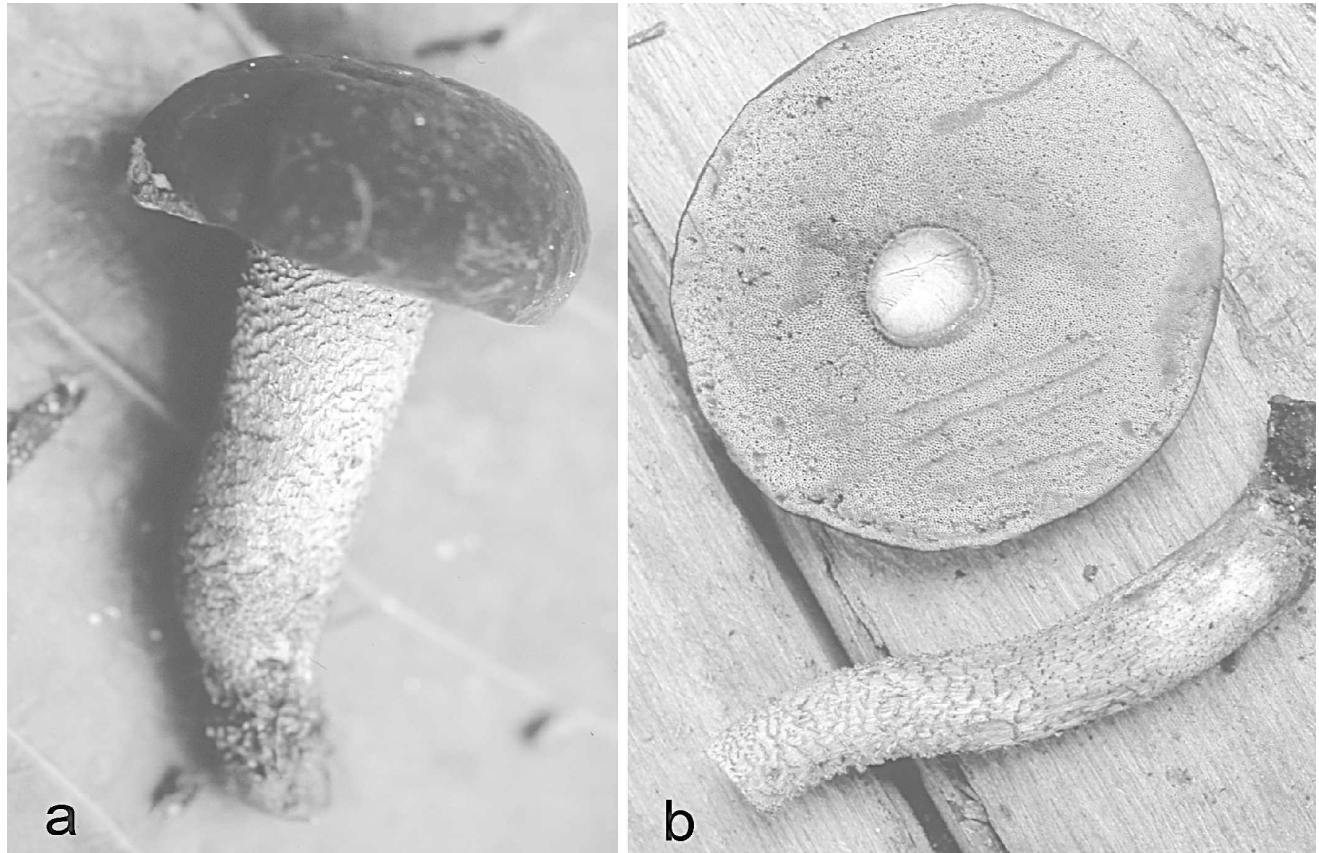


FIG. 3. Basidiomata of *Tylopilus eximius*. a. Immature basidioma (Henkel 7433), $\times 1.5$. b. Mature basidioma showing hymenophore (Henkel 8059), $\times 1$.

margin entire, extreme edge slightly inrolled; trama 1–2 mm thick at margin, 9–10 mm over tubes, 10–11 mm above stipe, off-white, unchanging, yellow around larval channels, solid. *Odor* mild; *flavor* mild (not bitter). *Tubes* 1–2 mm long at margin, 4–7 mm

centrally, 10–11 mm at stipe, slightly and abruptly depressed around stipe, concolorous with tube mouths; tube mouths dull grayish lavender (9C3–10D6) to dark lavender pink (11E3–12E5) with age, quickly and moderately browning with pressure; pores 2–3 per mm, isodiametric. *Stipe* 52–84 mm \times 11–14 mm, equal to slightly tapering basally, more attenuated at extreme base, vinaceous gray (11E4–11D4) to maroon (9F5–10F5) throughout, with concolorous recurved subscabrous scales over upper 7/8, these occasionally darker maroon (10F6), lower 5–8 mm with dark magenta matted tomentum; extreme base with white strigose hairs; trama off-white, densely fibrous, discoloring light yellow slowly with exposure, solid.

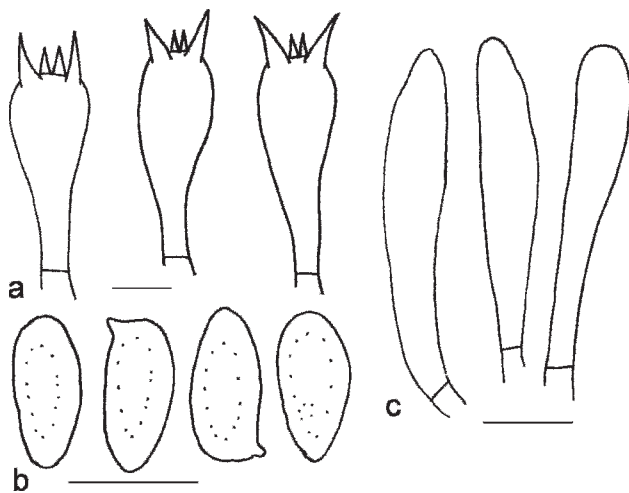


FIG. 4. Microscopic features of *Tylopilus eximius* (Henkel 8059). a. Basidia. b. Basidiospores. c. Cystidia. Bar = 10 μ m.

Basidiospores dull pinkish brown (7C5–7D5) in light to medium deposit, to chestnut brown (8E7) in heavy deposit, 9.7–12 μ m \times 4.2–5.3 μ m (mean $Q = 2.18$), subfusiform, faint pink in H₂O, lighter in KOH, inamyloid, 1–2 guttulate; hilar appendage 0.2–0.7 μ m long; wall 0.2–0.5 μ m thick, smooth. *Basidia* 20.8–36.8 μ m \times 7.4–14.6 μ m, clavate to broadly clavate, thin-walled, in immature hymenium hyaline in H₂O and KOH, in mature hymenium amber brown in

H₂O, lighter in KOH, 4-sterigmate; contents granular. *Hymenial cystidia* 30.4–44.5 µm × 4.9–6.7 µm, sparsely distributed, narrowly fusoid, occasionally more cylindrical, arising from the subhymenium, projecting 8.2–20.3 µm above the hymenial palisade, hyaline, devoid of refractive contents. *Hymenophoral trama* boletoid; mediostratum 19.8–34.6 µm wide, of many narrow parallel hyphae, these golden yellow in H₂O, lighter in KOH, lateral stratum hyphae 3.5–5.8 µm wide, hyaline, regularly septate, strongly divergent. *Pileipellis* a densely interwoven trichodermial palisade of cylindrical elements with inflated terminal cells, in mass golden brown in H₂O, lighter in KOH; terminal cells 8.0–17.7 µm × 4.0–6.0 µm, hyaline in H₂O and KOH, inamyloid, cylindrical to clavate, occasionally mucronate, and rarely ventricose, encrusted with minute purple to bluish purple pigments, these dissolving in KOH; subpellis interwoven with a few oleiferous hyphae. *Pileus trama* densely interwoven; individual hyphae (4.5)6.0–9.0(11.9) µm wide, hyaline in H₂O and KOH, regularly septate, in mass golden brown in H₂O, lighter in KOH. *Stipitipellis* a densely interwoven trichodermial palisade of cylindrical elements with inflated terminal cells, in mass dark golden brown in H₂O, lighter in KOH; terminal cells projecting 17.3–25.2 µm, clavate to mucronate, occasionally cylindrical to ventricose, more concentrated at scabrous regions, encrusted with minute purple to bluish purple pigments, these dissolving in KOH; subpellis densely interwoven with a few oleiferous hyphae. *Stipe trama* of densely packed parallel hyphae, 1.5–2.8 µm wide, hyaline in H₂O and KOH. *Clamp connections* absent. *Macrochemical reactions*: NH₄OH on pileus surface rapidly greenish purple, then blackening gradually, on pileus trama instantly dark burgundy, slightly bluing the stipe scales, and darkening the stipitipellis; KOH bleaching the pileus surface, darkening the stipe surface.

Habitat, habit and distribution. Solitary and rare on root mat in forests dominated by *Dicymbe corymbosa* in Guyana; also known from eastern North America, Costa Rica, Japan, and Indonesia.

Specimens examined. GUYANA. REGION 8 POTARO-SIPARUNI: Pakaraima Mountains, Upper Potaro River, 5°18'04.8"N, 59°54'40.4"W, elevation 710 m, 3 km upstream of Ayanganna airstrip and 1 km upstream from confluence with Whitewater Creek, 2 Jun 2000, *Henkel 7433* (BRG; HSU); 3.5 km east of Potaro base camp, 3 May 2001, *Henkel 8017* (BRG; HSU); 3 km east of Potaro base camp, 7 May 2001, *Henkel 8059* (BRG; HSU); 4 km southwest of Potaro base camp *Dicymbe* plot 3, 15 Jun 2002, *Henkel 8465* (BRG; HSU); vicinity of Potaro base camp, 7 Jun 2003, *Henkel 8538* (BRG; HSU); 4 km southwest of Potaro base camp *Dicymbe* plot 3, 23 Jul 2003, *Henkel 8600* (BRG; HSU; NY). USA. MAINE: *Tylopilus eximius*, 5 Aug 1979, *Halling 2952*

(NY). COSTA RICA. SAN JOSE: *Tylopilus eximius*, 1 Jul 1998, *Halling 7798* (NY).

Commentary. This is the first record for *T. eximius* from tropical South America. The velutinous maroon pileus, lavender hymenophore, maroon stipe with recurved scales and solid trama are distinctive field characters, along with the rapid auto-oxidative reaction on the bruised hymenophore. These field characters are distinctive for, and consistent with, *T. eximius* as described from other regions (Peck 1887, Snell and Dick 1970, Hongo 1974, Halling and Mueller 2003). This species fits the genus *Tylopilus* as commonly defined based on smooth spores with a nonolivaceous, flesh pink to pinkish brown deposit, and is best disposed in section *Oxydabiles* due to the auto-oxidation of the context of the stipe, elongate spores with a pinkish brown print, and a nonbluing NH₄OH reaction on the fresh exterior surfaces (Smith and Thiers 1971, Singer 1986). Guyana specimens deviate somewhat from *T. eximius* from other regions. The spores of the Guyana material (9.7–12 µm) are similar in length to those from Costa Rica (10.5–13.3 µm; Halling and Mueller 2003), but are shorter than those from North America (11–17 (23) µm, Snell and Dick 1970). The Guyana material also has decidedly denser trama and cystidia that are much less frequent than either the Costa Rican or North American material. *Tylopilus eximius* appears to have wide host and geographical ranges, being originally described from Pinaceae and Fagaceae forests of the northeastern USA (Peck 1887) and subsequently recorded in association with Pinaceae in eastern Canada (Snell and Dick 1970), Fagaceae in Costa Rica (Halling and Mueller 2003), Pinaceae and Fagaceae in Japan (Hongo 1974), Dipterocarpaceae in Indonesia (Halling, pers obs) and now with Caesalpiniaceae in Guyana.

KEY TO TYLOPILUS IN GUYANA (HENKEL 1999, 2001,
THIS PAPER)

1. Spores with a Q < 2. 2
1. Spores with a Q ≥ 2. 4
 2. Spore deposit cream to golden yellow; NH₄OH on pileus negative.
. *T. ballouii* (Pk) Singer
 2. Spore deposit flesh pink; NH₄OH on pileus bright blue 3
3. Pileus and tube mouths with lilac to violet tones; stipe with true reticulum on apical portion; spores 8.2–10 µm × 5–5.9 µm; hymenial cystidia 27–40 µm × 7–11 µm *T. pakaraimensis* T. W. Henkel
3. Pileus and tube mouths lacking lilac to violet tones; stipe lacking true reticulum but occasionally striate on basal portion; spores 9–12 µm ×

- 4.8–6.4 μm; hymenial cystidia 20–28 μm × 8–10 μm . . . *T. potamogeton* var. *irengensis* (Singer) T.W. Henkel
4. Hymenophore turning dark brown or black when bruised 5
4. Hymenophore turning light brown when bruised 7
5. Stipe with recurved scales; spore deposit dull pinkish brown *T. eximius* (Pk) Singer
5. Stipe lacking scales; spore deposit dark reddish brown or cinnamon brown 6
6. Basidiomata small; pileus 10–30 mm broad, velutinous to submatted, finely areolate with age; spore deposit dark reddish brown; spores 10–13(15) μm × 4–5 μm; hymenial cystidia 33–50 μm × 6–10 μm
 *T. exiguus* T. W. Henkel
6. Basidiomata larger; pileus 40–120 mm broad, squamulose; spore deposit cinnamon brown, spores 12–15 μm × 3.6–4.8 μm; hymenial cystidia 25–33.8 μm × 6.3–8.8 μm
 *T. rufonigricans* T. W. Henkel
7. Stipe lacking reticulations, hollow and consistently curved; pileipellis a cutis; spores fusiform (mean Q = 2.96); hymenial cystidia 43–50 μm × 10–13 μm
 *T. vinaceipallidus* (Corner) T. W. Henkel
7. Stipe reticulate, solid, irregularly curving to straight, pileipellis a trichodermial palisade; spores subfusiform (mean Q = 2.31); hymenial cystidia 39.5–71.6 μm × 5.7–12.4 μm
 *T. orsonianus* Fulgenzi & T.W. Henkel

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