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Updated annotated checklist, and new records of Boletales from Guerrero, Mexico: biocultural importance and potential

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Abstract. Guerrero is one of the least studied states in Mexico for Fungi, despite its great diversity of vascular plants. The aim of this work was to update previously reported genera, provide new records from Guerrero and discuss the biocultural significance and potential use of Boletales from Guerrero, Mexico. *Astraeus morganii* Phosri, Watling & M.P. Martín is recorded for the first time in Mexico. Sixty-eight species of Boletales reported from Guerrero with an annotated checklist, which includes photographs; 34 species are newly recorded from Guerrero. The family Boletaceae is the most diverse followed by Suillaceae and Sclerodermataceae. *Aureoboletus russellii* (Frost) G. Wu & Zhu L. Yang, *Aureoboletus readii* Ayala-Vásquez, Pérez-Moreno, Martínez-Reyes, Carbajal-Ramírez, *Hygrophoropsis aurantiaca* (Wulfen) Maire ex Martin-Sans, *Scleroderma texense* Berk., and *Tylopilus tabacinus* (Peck) Singer are reported as having biocultural importance to Nahuatl, Na Savi, and Me'phaa native cultures. In addition, 45 species of Boletales are reported as potentially edible.

Key words. Boletaceae, economic significance, mycorrhizal fungi, potencial use, Sierra Madre del Sur

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INTRODUCTION

Mexico is one of the five most biodiverse countries for plants, ranking fifth in plant diversity with a high degree of endemism (Villaseñor 2016). This is especially evident in the Sierra Madre del Sur, which is in the "Zona of Transicion Mexicana" of Morrone (2017), which parallels the Pacific coast and is divided into three subregions: Jalisciense, Michoacana, and Guerrerense-Oaxaqueña (Espinosa et al. 2016); within this zone, 7016 species of vascular plants have been reported (Aragón-Parada et al. 2021). However, in the Guerrero-Oaxaca subregion there has been no significant progress in the diversity of the order Boletales (Fungi, Basidiomycota, Agaricomycetes, Agaricomycetidae).

To date, approximately 300 species of Boletales have been reported from Mexico, especially in the last decade (García-Jiménez et al. 2013, 2019; Ayala-Vásquez 2021; Ayala-Vásquez et al. 2023a, 2023b; Peréz-Moreno et al. 2025). The states of Coahuila, Nuevo León, and Tamaulipas in the north have 165 species (García and Castillo 1981; García-Jiménez 1999, 2013); Jalisco in the northwest has 65 species reported (Saldivar et al. 2021); Oaxaca in the southeast has 140 species (Ayala-Vásquez 2021; Ayala-Vásquez et al. 2022, 2023a, 2023b), and Guerrero has only 33 species reported (Pérez Ramírez et al. 1991; Capello and Cifuentes 1982; Cifuentes et al. 1993; Guzman and Herrera 1973). The family Boletaceae is the most abundant, with 44 genera in Mexico. Boletales are the second most bioculturally important group of fungi in the world, of the 1020 known, 377 are Boletales. (Moreno-Fuentes and Garibay-Orijel 2014; Li et al. 2021; Ramírez-Carbajal et al. 2025). There are 77 species of biocultural importance known in Mexico; these are mainly used by the native peoples of central and southeastern Mexico (Pérez-Moreno et al. 2010; Moreno-Fuentes and Garibay-Orijel 2014; García-Jiménez et al. 2013; Ayala-Vásquez et al. 2023a, 2023b). Here, we provide 34 new records with an annotated

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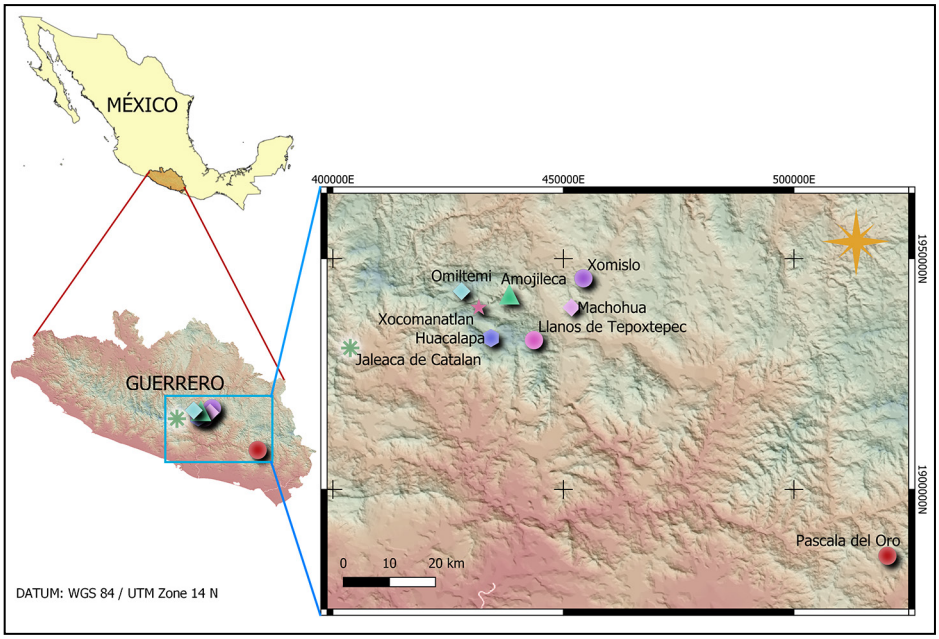

Figure 1. Map showing the localities of the species newly recorded from Guerrero.

list for Guerrero, four species of biocultural importance to the Me'phaa, Nahuatl, and Na Savi native cultures and mestizo of Guerrero.

STUDY AREA

The municipalities sampled were Chilpancingo de los Bravo, Tixtla de Guerrero, and San Luis Acatlán, all in the state of Guerrero (Figure 1). These are in the Sierra Madre del Sur (Morrone 2017). The vegetation types sampled were mainly *Quercus* forest, *Pinus–Quercus* forest, *Quercus–Pinus* forest, mixed conifer forest, and cloud forest. The mixed conifer forest consisted of *Abies guatemalensis* Rehder, *Pinus teocote* Schiede ex Schltdl., *P. pseudostrobus* Lindl., *P. montezumae* Lamb., and *Quercus laurina* Humb. & Bonpl.

METHODS

Sampling and morphological examination. The basidiomata collections were made in 2021–2023 during the rainy season, which is July to October. The method of sampling followed Lodge et al. (2004). The taxonomic descriptions are based on Ayala-Vásquez et al. (2022). Specimens dehydrated at 45 °C. Temporary sections of dehydrated specimens were made, 10% KOH and Congo red were used as staining agents, and microscopic structures, such as basidiospores, basidia, cystidia, pileipellis, and stipitipellis, were described using an optical microscope (Leica CME, Germany). The basidiospores of *Astraeus morganii* were studied using a scanning electron microscope (SEM) Zeiss DSM 950. The specimens were deposited at the mycological collection of the Laboratorio of Investigación of Productos Fitoterapéuticos and Alimentos of Facultad de Ciencias Químico-Biológicas at Universidad Autonoma de Guerrero (LIPFA-FCQB-UAGro) and the Instituto de Biologia of Universidad Nacional Autonoma de Mexico (MEXU-HO-).

We created with QGIS v. 3.16, using a basemap downloaded from the Instituto Nacional de Estadistica and Geografia (INEGI 2010).

We undertook an exhaustive review of the literature on the Boletales of Guerrero, which included: Capello and Cifuentes (1982), Cifuentes et al. (1993), Guzmán and Herrera (1973), and Pérez-Ramírez et al. (1991). The genus- and family-level taxonomy has been updated in our list following the current classification according to Index Fungorum.

Extraction DNA, PCR amplification, and phylogenetic analysis. Genomic DNA was obtained with CTAB (Martínez-González et al. 2017) from 2–3 mg of dry tissue. DNA quantification was performed with Nanodrop (Thermo, USA). Two molecular markers were used: the internal transcribed spacer (ITS) region was amplified with the primer ITS5-ITS4 (White et al. 1990). The editing, assembly, and analysis of the sequences were done with Geneious Prime v. 2012.2.1 (Biomatters Ltd.). The obtained sequences were deposited in GenBank (https://www.ncbi.nlm.nih.gov/) and subjected to a nucleotide Basic Local Alignment Search Tool (BLAST) analysis. As a result of BLAST, 39 sequences were selected. *Tremellogaster surinamensis* (MCA1985, SLM10112) and *Diplocystis wrightii* (DQ644139) were used as outgroups. We undertook maxi-

mum-likelihood analyses with 1,000 replicates using the GTR+Gamma substitution model and a Bayesian posterior inference analysis with 5,000,000 generations and four chains under the GTR+Gamma substitution model using Geneous Prime v. 2019.0.4. Resulting phylogenetic trees were visualized and edited in FigTree v. 1.4.4 (Rambaut 2009).

RESULTS

New records from Mexico

Astraeus morganii Phosri Watling & M.P. Martín

Figures 2, 3

New records. MÉXICO — Guerrero • Chilpancingo de los Bravo Municipality, Machohua; 17°32'02"N, 099°27'01"W; 1764 m alt.; 3.VII.2023; D.U. Bautista-Delgado leg.; BDD-158, MEXU OH 30712, PQ722528 accession GenBank • Huacalapa; 17°28'04"N, 099°37'05"W; 2223 m alt.; 7.VII.2023; D.U. Bautista-Delgado leg.; BDD-190, MEXU OH 30712, PQ722529 accession GenBank) • Ocotepec; 17°32'01"N, 099°27'05"W, 1396 m alt.; 28.VII.2023; D.U. Bautista-Delgado leg.; BDD-FCQB-261.

Identification. Basidiome subglobose. Exoperidium dark to pale brown and beige, and leathery when fresh; opening in 8–18 foliations, which with time and desiccation, crack on obverse side and fractionate, generating 6–15 vertices or tips. Basidiospores 7.6–10 µm, globose, with equinulate ornamentation, brown to reddish-brown in KOH.

Our material agrees with the holotype (Figure 2) from Colorado, USA (Phori et al. 2013). In Mexico it is distributed from Durango to Guerrero.

Habitat. Solitary to gregarious, forming putatively ectomycorrhiza with *Quercus* spp.

Newly recorded species from Guerrero

Aureoboletus auriporus (Peck) Pouzar

New records. MEXICO — Guerrero • Tixtla de Guerrero Municipality, Xomislo place; 17°35'29"N, 099° 22'08"W; 2009 m alt.; 25.IX.2022; S. Román-Sarabia leg.; RS- FCQB-15.

Identification. Pileus convex to flat-convex, pinkish cinnamon to reddish-brown; surface glabrous, pruinose to tomentose. Hymenium golden in fresh, dehydrated material. Stipe 111 × 17 mm, surface costate-reticulated, pale yellow at apex, pale pinkish brown downward. Basidiospores 9.8–15.5 × 3.96–5.75 µm.

This species is a cryptic species complex. Morphologically, *A. auriporus* is most like *A. pseudoauriporus* but differs in having the pileus with pink tones, the surface pileus glabrous, a non-viscid typically longitu-

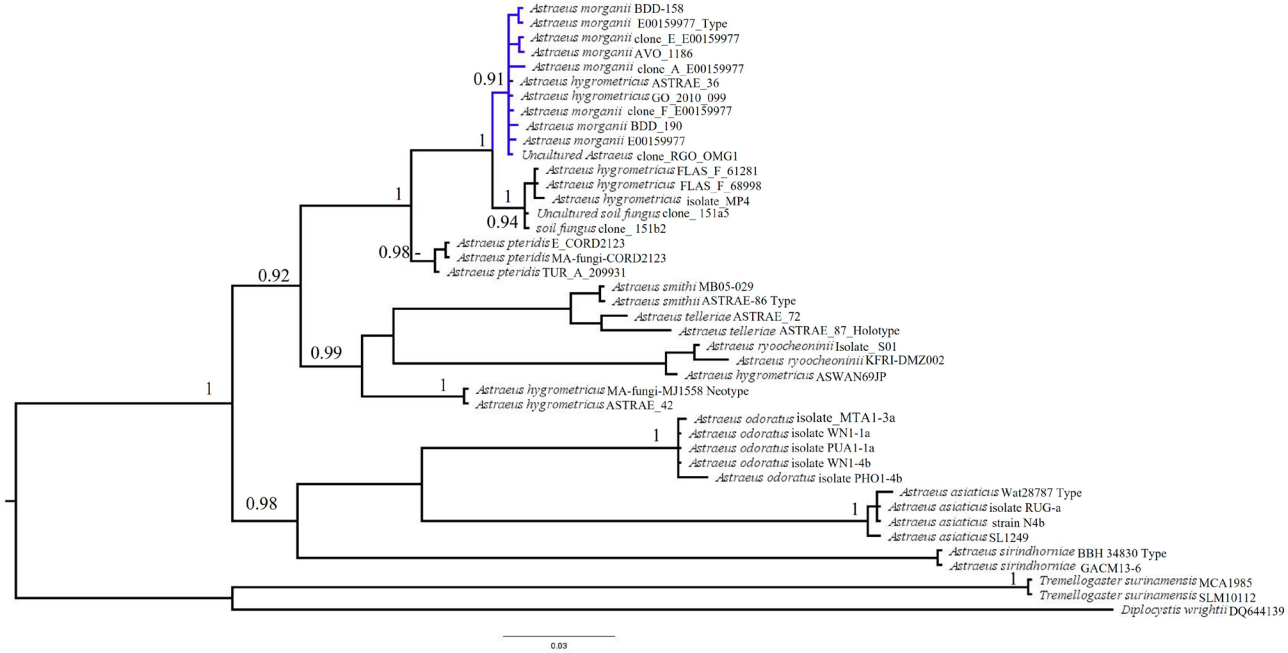

Figure 2. Phylogenetic tree based on a Bayesian analysis using ITS nrDNA sequences of the genus *Astraeus*. Taxa and blue branches correspond to the new record of *A. morganii* from Mexico; *Tremellogaster surinamensis* (MCA1985, SLM10112), and *Diplocystis wrightii* (DQ644139), were chosen as outgroups.

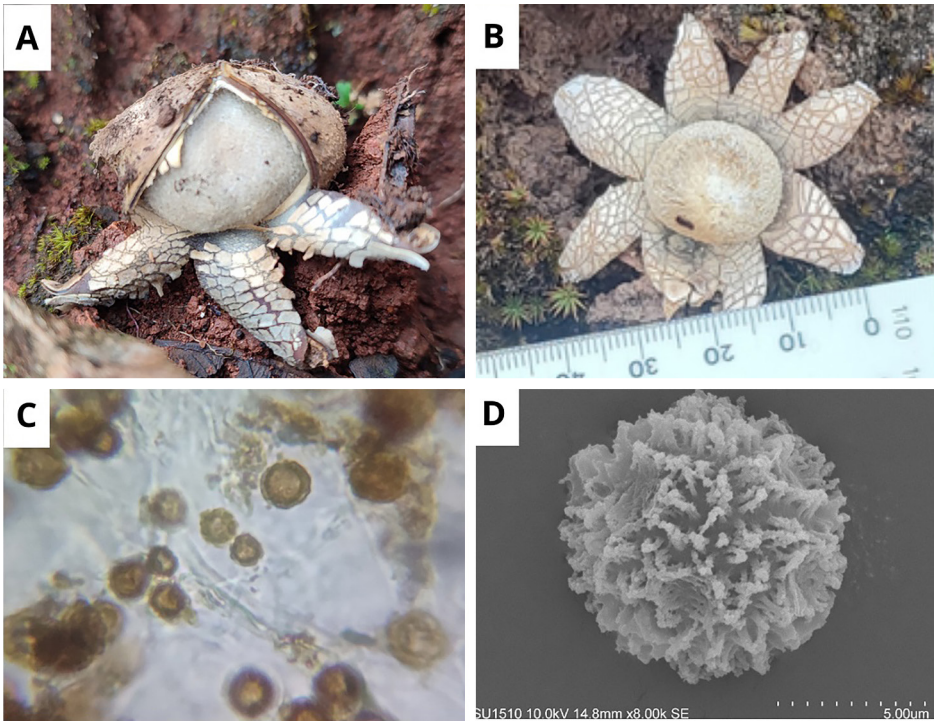

Figure 3. *Astraeus morganii* (BDD_158). **A, B.** Specimens at different stages. **C.** Basidiospores 10 µm. **D.** Basidiospores in SEM.

dinally striate stipe, and larger basidiospores (14–)15–17(–18) × 5–6.5 µm (Farid et al. 2021), while *A. readii* has smaller basidiospores (10–)11–13 (–14) × 3.5– 4(–5) µm and a surface pileus very viscid (Ayala-Vásquez et al. 2023b).

Habitat. Solitary, forming ectomycorrhizal with *Quercus* spp., in *Quercus* forest.

***Aureoboletus readii* Ayala-Vásquez, Pérez-Moreno, Martínez-Reyes & Carbajal-Ramírez**

New records. MEXICO — Guerrero • Tixtla de Guerrero Municipality, Xomislo place; 17°35'29"N, 099°22'08"W; 2009 m alt.; 25.VIII.2024; S. Román-Sarabia leg.; RS-FCQB-32.

Identification. Basidiome medium-sized to small. Pileus surface very viscid; hymenophore adhered; pores circular. Stipe subclavate, with furfuraceous surface with superficial longitudinal streaks; basidiospores (10–) 11–13 (–14) × (3.5–) 4 × 5 µm; pleurocystidia (35–) 38–40 (–50) × (10–) 13–16 (–21) µm, claviform to piriform, with 1–2 basal septa (Ayala-Vásquez et al. 2023b).

Habitat. Solitary in *Quercus* vegetation.

***Aureoboletus projectellus* (Murrill) Halling**
Figure 4B

New records. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Huacalapa; 17°03'50"N, 098°47'39"W; 1126 m alt.; 06.VI.2023; D.U. Bautista-Delgado leg.; BD-FCQB-300.

Identification. Pileus convex to plane-convex, orange-brown to cinnamon; context pale pink, unchanging when cut; hymenophore adhered, yellow to yellow-olivaceous, unchanging to the touch; stipe 7–10 × –5–10 mm, with reticulate surface. Basidiospores 17– 27.5 (–32) × 7–12 µm, smooth, fusoid or subfusoid, thick-walled, 1–1.3 µm.

Our specimens are consistent with the material reviewed by García-Jiménez (1999).

Habitat. Solitary, forming ectomycorrhizas with *Quercus* spp.

***Aureoboletus roxanae* (Frost) Klofac**
Figure 4C

New records. MEXICO — Guerrero • San Luis Acatlán Municipality, Pascala del Oro; 17°03'50"N, 098°47'39"W; 1126 m alt.; 8.VII.2022; S. Román-Sarabia leg.; RS- FCQB-16.

Identification. Pileus surface dry, granular-scaly or glabrous, reddish-brown to pale brown; hymenium white to pale yellow pores, not staining blue; basidiospores 9–12 × 4–5 µm, ellipsoid-fusiform.

Our specimen matches that described by Bessette et al. (2017). This species has some similar character-

Figure 4. Species recorded for the first time from Guerrero. **A.** *Aureoboletus betula*. **B.** *Aureoboletus projectellus*. **C.** *Aureoboletus roxanae*. **D.** *Boletellus ananas*. **E.** *Boletellus coccineus*. **F.** *Boletus atkitsonii*. **G**. *Boletus pseudopinophillus*. **H.** *Boletus variipes*. **I.** *Butyriboletus frostii*. **J.** *Calostoma naaxtututs*. **K.** *Gyroporus castaneus*. **L.** *Harrya chromipes*.

istics to those of *A. elvirae*, including the basidiomata color, but that species has the pileus campanulate to umbonate, salmon to peach-colored, with small, triangular scales and a crenulate margin, and the hymenophore is pale salmon (Ayala-Vásquez et al. 2023b).

Habitat. Solitary, forming ectomycorrhizas with *Quercus* spp.

***Boletellus ananas* (M.A. Curtis) Murrill**
Figure 4D

New records. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Ocotepec place; 17°32'01"N, 098°27'05"W, 1360 m alt.; 29.IX.2022; D.U. Bautista-Delgado leg.; BD- FCQB-128 • Jaleaca de Catalán place; 17°29'3"N, 099°53'02"W, 1168 m alt.; 3.VIII.2022; S. Mastache-Luna and J. Morales-Ramírez leg.; ML-MR-FCQB-53.

Identification. Pileus cream, pale-brown to yellowish-brown, hemispherical; surface squamulose to scaly. Hymenium chrome yellow to golden yellow, with round pores and a veil when immature, becoming blue when touched. Stipe cylindrical to slightly sinuate, smooth to fibrillose. Basidiospores 13.6–17.6× 4.8–7.2 µm, with longitudinal striations (García-Jiménez 1999).

This species is similar of *Boletellus coccineus* in having the surface of the pileus squamulose to scaly, but it differs in color, from pink or red to grayish pink (Ortíz-Santana et al. 2007).

Habitat. Solitary to scattered, forming mycorrhizas in *Quercus* and *Pinus*.

***Boletellus coccineus* (Sacc.) Singer**
Figure 4E

New records. MEXICO — Guerrero • San Luis Acatlán Municipality, Pascala del Oro; 17°03'50"N, 098°47'39"W; 1126 m alt.; 9.VII.2022; S. Román-Sarabia leg.; RS-FCQB-18.

Identification. Pileus broadly convex to hemispherical, pink, red to grayish pink; surface of pileus with scamose to triangular scales, and margin appendiculate. Hymenium adhered and yellow, dark-yellow to yellow-olivaceous, changing to blue when touched. Stipe cylindrical and sinuate, pale red, pink, or grayish-brown, fibrillose. Basidiospores (8.4–) 10.4–19.2 × 6.4–8.8 µm.

Our specimen matches that described by Ortíz-Santana et al. (2007).

Habitat. Solitary to scattered, in *Pinus* forests.

***Boletus atkinsonii* Peck**
Figure 4F

New records. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Huacalapa; 17°28'04"N, 099°37'05"W; 2223 m alt.; 6.VII.2022; D.U. Bautista-Delgado leg.; BD –FCQB-71.

Identification. Pileus broadly convex to convex, dry, finely cracked, grayish brown to yellowish brown. Hymenium yellowish to olive yellow. Context longitudinally fibrous, whitish. Stipe whitish or brownish, usually prominently reticulate with whitish to brownish reticulation; basidiospores 10–15 × 3–4.5 µm, fusiform, smooth, hyaline to yellowish in KOH.

Our material matches that described by Snell and Dicks (1970).

Habitat. Solitary to scattered, in *Pinus* spp. forests.

***Boletus pseudopinophilus* A.R. Bessette, Bessette, J. Craine & J.L. Frank**
Figure 4G

New records. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Ocotepec; 17°32'01"N, 098°27'05"W, 1360 m alt.; 29.IX.2022; D.U. Bautista-Delgado leg.; BD-FCQB-301.

Identification. Pileus 50–170 mm in diameter, broadly convex to nearly plane with age, reddish-brown, orange-brown to dark rusty-brown; surface dry, somewhat wrinkled, viscid when wet; hymenium depressed; pores and tubes white, becoming yellow to olivaceous-yellow and bruising brown at age. Stipe clavate to bulbous, solid, white, yellow to brownish-red with age; surface dry, cross-linked, especially at apex.

This species is distributed across eastern North America and in Mexico. Our species matches the description of Besette et al. (2017).

Habitat. Solitary or scattered, growing in mixed forest (*Abies* and *Pinus* spp., *Quercus laurina*).

***Boletus variipes* Peck**
Figure 4H

New records. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Huacalapa; 17°28'04"N, 099° 37'05"W; 2223 m alt.; 6.VII.2022; D.U. Bautista-Delgado leg.; BD-FCQB-74.

Identification. Basidiome stipe pileated. Pileus bright orange, orange-white, grayish orange, brownish orange, or pale brown with grayish ruby tones. Pileus hemispherical to convex; surface smooth to tomentose; margin appendiculate and smooth. Hymenium with small, rounded, pale-yellow to yellowish-white pores, with orange-white tones in near margin; no color change when bruised. Stipe thick to claviform, lightly reticulated to fibrillose, white to beige. Basidiospores 10.5–17.5 × 4–6.8 µm, fusiform, with subacute apex and suprahilar depression, greenish-yellow in KOH.

Boletus variipes is similar to *B. quercophilus* but differs in having the pileus golden-brown, mustard-brown, or apricot-yellow to brown, the stipe 50–150 × 100–250 mm, clavate to subclavate, pale tan to dark tan, white at the base, and shorter basidiospores (9.8 –13.3× 3.5–5.0 µm), and it is associated with *Quercus copeyensis*, *Q. seemanii*, and other *Quercus* spp. *Boletus quercophilus* was described from Costa Rica (Halling and Muller 1999), while *B. variipes* occurs from eastern Canada and northeastern USA west to Minnesota, Iowa, and perhaps Missouri and Mexico (Smith and Thiers 1971; Ayala-Vásquez 2021).

Habitat. Solitary or gregarious, in *Quercus–Pinus* forest.

***Butyriboletus frostii* (J.L. Russell) G. Wu, Kuan Zhao & Zhu L. Yang**
Figure 4I

New records. MEXICO — Guerrero • Tixtla de Guerrero, Municipality, Xomislo Place; 17°34'00"N, 099° 24'00"W; 2009 m alt.; 25.IX.2022; S. Román-Sarabia leg.; RS-FCQB-19.

Identification. Pileus broadly convex or convex to plane-convex; surface sticky or slimy when fresh, bright red, red deep to brownish-red with age, especially at margin. Hymenium adhered; pores circular when young, dark red, red, or brick-red when mature; often exuding yellowish droplets when young and turning blue when touched. Stipe cylindrical; surface with prominent reticulation along entire length, red, red-deep to pastel-red. Basidiospores 13.0–18.4 × 4.0– 6.0 µm, fusoid, yellow-olivaceous in KOH, brown in Melzer.

Butyriboletus frostii was described as *Suillellus frostii* by Murrill (1909); Singer (1947) redescribed it as *Boletus frostii* and Vizzini and Gelardi (2014) recombined it as *Exsudoporus frostii* based on the ITS gene. Based on multilocus and morphological characters of the genus, Wu et al. (2016) synonymized the above names and placed the species in the genus *Butyriboletus*, Whang et al. (2024) recently placed it in section *Exsudoporus*.

Habitat. Solitary to scattered, ectomycorrhizal with *Quercus* spp. in temperate forests.

***Calostoma naaxtututs* Deloya-Olvera, Virgen-Vásquez, Xoconostle-Cázares & J. Pérez-Moreno**
Figure 4J

New records. MÉXICO — Guerrero • Chilpancingo de los Bravo Municipality, Omiltemi; Cloud forest remnant, and *Quercus–Pinus* forest, 17°33'41"N, 099°43'41"W; 2559 m alt.; 26.XI.2023; D.U. Bautista-Delgado leg.; BD-FCQB-372 • Llanos de Tepoxtepec; Cloud forest remnant, 17°28'35"N, 099°32'40"W; 2596 m alt.; 24.IX.2024; K. A. González-Ramos leg.; GR-FCQB-25.

Identification. Peridium globose, bright orange or reddish; exoperidium hyaline to gelatinous. Pseudostipe short, cylindrical; surface honeycombed to lacunose, pale brown to brown, cartilaginous when fresh and hard when dry. Basidiospores (9–) 9.9–14 (–14.6) × (7.0–) 7.3–10.8 (–11.7) µm, ellipsoid, reticulate.

This species is similar the *C. tooteic* by the color basidiomata but differs by the length of the stipe. In *C. tototeic* the stipe is 15–50 × 18–20 mm and basidiospores are (11–) 12.2–18.0 (–19.2) × (8.5–) 8.8–12 (–12.8) µm (Deloya-Olvera et al. 2023). The holotype of *C. naaxtututs* was described from Oaxaca, where it was associated with *Quercus obtusata* (Deloya-Olvera et al. 2023).

Habitat. Solitary or scattered in cloud forest and *Quercus–Pinus* forest.

***Coniophora puteana* (Schumach.) P. Karst.**

New records. MÉXICO — Guerrero • Chilpancingo de los Bravo Municipality, Jaleaca de Catalán; 17°26'48"N, 099°51'32"W; 1168 m alt.; 06.VIII. 2022; S. Mastache-Luna and J. Morales-Ramírez legs.; ML-MR-FCQB-47.

Identification. Fruiting resupinate, fixed to woody substrate of membranous consistency. Hymenium pruinose, wavy, warty, pale orange with yellowish-white shades and pale gray shading at center.

Habitat. Saprophyte, resupinate, growing on bark of *Pinus* spp.

***Gyroporus castaneus* (Bull.) Quél.**
Figure 4K

New record. MÉXICO — Guerrero • Chilpancingo de los Bravo Municipality, Jaleaca de Catalán; 17°29'03"N, 099°53'02"W; 1168 m alt.; 22.X.2022; S. Mastache-Luna and J. Morales-Ramírez leg.; ML-MR- FCQB-1.

Identification. Pileus broadly convex, convex to convex-flat, cinnamon-brown to dark brown; surface furfuraceous, tomentose or with low fibrillose scales; hymenium adhered; pores whitish to pale yellow. Stipe cylindrical, chocolate-brown in middle to base, cream-colored to yellow-brown at apex; surface smooth at apex, with low, fibrillose scales in middle to base. Basidiospores (10–) 11–15 (–20) × 5–6 (–8) µm, ovoid, hyaline in KOH, thick-walled.

This species belongs to the section *castaneus*, which has seven species; *G. castaneus* is the type species of the section (Zhang et al. 2022). Morphological and molecular studies on this section are still lacking, especially for those species from Mexico.

Habitat. Solitary, under *Quercus* spp., where it putatively forms ectomycorrhizal associations.

***Harrya chromipes* (Frost) Halling, Nuhn, Osmundson & Manfr. Binder**
Figure 4L

New records. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Huacalapa; 17°28'04"N, 099°37'05"W; 2223 m alt.; 5.VIII.2023; D.U. Delgado-Bautista leg.; DB-FCQB-228.

Identification. Pileus convex or flat-convex at maturity, with a dry to slightly sticky surface, at first pink, with shades of pale red, reddish brown, or grayish red at maturity; margin straight; hymenium adhered, or depressed, white to pink. Stipe subclavate, scabrous over the entire surface of the stipe, pink with a whitish base of the scabrous, yellow to chrome at the base. Basidiospores 11–15 × 5–6 µm, ellipsoid prolate to fusiform, smooth, thin-walled, reddish brown to pinkish brown in KOH, yellow in Melzer, inamyloid.

Our materials differ from the holotype, species described by Halling and Mueller (2005), the holotype species has larger basidiospores (13.0–17.5 × 4.0–5.5 µm) (Halling and Mueller 2005). The Mexican specimens are probably part of a complex and continuing molecular studies will be necessary to determine with certainty the species.

Habitat. Solitary and scattered, in *Quercus–Pinus* forests, forming ectomycorrhizal associations with *Quercus* spp.

***Hemiaustroboletus vinaceus* Ayala-Vásquez, García-Jiménez & Saldivar**
Figure 5A

New records. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Llanos de Tepoxtepec Town, "el Llano"Natural Park; 17°28'34"N, 099°32'40"W; 2596 m alt.; 25.IX.2022; K.A. González-Ramos leg.; GR-FCQB-5.

Figure 5. Species recorded for the first time from Guerrero. **A.** *Hemiaustroboletus vinaceus*. **B.** *Hemioporus ivoryi*. **C.** *Leccinum talamancae*. **D.** *Leccinum oaxacanum*. **E**. *Retiboletus griseus*. **F.** *Tylopilus plumbeoviolaceus*. **G.** *Suillus pseudobrevipes*. **H.** *Strobilomyces dryophilus*. **I.** *Suillus americanus*. **J.** *Tylopilus leucomycelinus*. **K.** *Tylopilus pseudoleucomycelinus*. **L.** *Xerocomellus piedracanteadensis*.

Identification. Pileus dark violet to dark brown; context whitish; hymenium pink-purple to violet-brown; hymenium adhered, or depressed, pale-pink, pink-purple, lilac, magenta-grey, ruby-grey, unchanging when injured;stipe surface tomentose to longitudinally fibrillose. Basidiospores 9.0–13.5 × 4.0–5.0 µm, subfusiform to cylindrical, with ornamented pits.

The holotype was described from Jalisco, but molecular data suggest that this species also occurs in the United States and China (Ayala-Vásquez et al. 2022).

Habitat. Solitary to scattered, forming ectomycorrhizae associations with *Quercus* spp.

***Heimioporus ivoryi* (Singer) E. Horak**
Figure 5B

New record. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Llanos de Tepoxtepec, "El Llano" Natural Park; 17°28'34"N, 099°32'40"W; 2596 m alt.; 06.VIII.2022; K.A. González-Ramos leg.; GR-FCQB-1.

Identification. Pileus red, magenta, violaceous brown to grayish ruby when mature; surface of pileus dry, smooth; hymenium yellowish or vinaceous red at maturity; stipe surface reticulate-alveolate, vinaceous red or violaceous brown, yellow at apex. Basidiospores 15.0–16.4 (–18.0) × 7.0–8.0 (–9.0) µm, ellipsoid, reticulate to pitted.

Our material has slightly shorter spores with the material of Singer et al. (1992) from northern Mexico ranging from 12.5–15.7 (–20.0) × 7.5–9.3 µm.

This species is the only *Heimioporus* described from North and Central America of the 19 species known (Ayala-Vásquez et al. 2018; Chen et al. 2019).

Habitat. Solitary, in *Pinus*–*Quercus* forests; ectomycorrhizal on mainly *Pinus* spp.

***Leccinum talamancae* Halling, L.D. Gómez & Lannoy**
Figure 5C

New record. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Llanos de Tepoxtepec, El Parque place; 17°27'03"N, 099°32'01"W, 2430 m alt.; 6.VIII.2023; A. K. González Ramos leg.; BD-FCQB-180.

Identification. Surface of pileus rugulose to areolate, gray to pale-brown or cocoa brown to brown; hymenophore adnexed to depressed, yellowish-white to mustard-yellow, reddish brown when bruised; context of pileus white, reddish to vinaceous when cut; context of stipe turning blue to black-blue when

cut; stipe surface finely scabrous, somewhat pruinose, with small scabrosities longitudinally or grooved in juveniles and white, later greyish-brown. Basidiospores 14.6–21.6 (–22.0) × 4.0–6.0 µm, elongate-ellipsoid to subfusoid, olivaceous to yellow in KOH, inamyloid.

This species, described from Costa Rica by Halling and Mueller (2003), has slightly longer spores (17.5–22.4 × 3–4.9(–6.3) µm and is associated with *Quercus copeyensis*, *Q. costaricensis*, and *Q. seemannii*. Ayala-Vásquez (2021) noted that in Mexico this species occurs in the Sierra Madre Occidental and Sierra Madre of Oaxaca, in cloud forest, *Quercus* forest and *Pinus–Quercus* forest.

Habitat. Solitary, in *Quercus–Pinus* forest; associated with *Q. liebmannii*.

***Leccinum oaxacanum* Ayala-Vásquez, Martínez-Reyes & González-Martínez**
Figure 5D

New record. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Huacalapa; 17º 28'04"N, 099°37'05"W; 2223 m alt.; 6.VIII.2023; D. U. Bautista-Delgado leg.; BD-FCQB-235.

Identification. Pileus broadly convex to convex, brownish red, reddish brown, or cinnamon; pileus surface tomentose; hymenium adhered, whitish, changing to grayish yellow when touched; stipe clavate, with attenuated base, scabrous surface, white when young, cinnamon or reddish brown with a whitish apex at maturity; turning gray-brown when cut. Basidiospores (10.0–) 11.0–14.5 (–15.0) × 4.0–5.0 µm, fusoid or some subfusoid.

The holotype was described from Oaxaca (Ayala-Vásquez et al. 2023a), and our description matches this material.

Habitat. Solitary, in *Pinus–Quercus* forests, forming ectomycorrhizal associations with *Quercus* spp.

***Phlebopus mexicanus* Cifuentes, Cappello, T.J. Baroni & B. Ortiz**

New records. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Santa Barbara; 17°18'34"N, 099°52'20"W; 1044 m alt.; 2.VIII.2024; O. Ayala-Vásquez and S. Mastache-Luna legs.; AV-ML-FCQB-1188.

Identification. Pileus convex to flat, areolate, olive or yellowish brown to dark brown at center, tomentose, with curved margin; surface smooth and dry, with the appearance of velvety scales; hymenophore adhered, yellowish, stipe cylindrical or subclavate, pale yellow or yellowish brown, turning blue-green when cut, light yellow but progressively dark brown down to base. Basidiospores 5.0–7.5 × 4.5–5.6 µm, short ellipsoid, brown-olivaceous in KOH.

Our material conforms with the holotype, which came from southern tropical rainforests of Mexico (Baroni et al. 2015).

Habitat. Solitary, in *Pinus–Quercus* transition forest and rainforest under *Salix* sp.

***Retiboletus griseus* (Frost) Manfr. Binder & Bresinsky**
Figure 5E

New records. MÉXICO — Guerrero • San Luis Acatlán Municipality, Pascala del oro; 17°03'34"N, 098°46'28"W; 1827 m alt.; 29.VII.2022; S. Román-Sarabia leg.; RS-FCQB-22.

Identification. Pileus convex, broadly convex to plane-convex; surface glabrous, dry to fibrillose, grey, greyish-brown, or yellow brownish at maturity; hymenium adhered to depressed, whitish to white, with brown tones at maturity or when cut; stipe cylindrical; surface reticulate, white or greyish to yellowish-brown. Basidiospores 10.0–13.0 (–13.5) × 3.0–4.8 µm, ellipsoid to subfusoid, smooth, with suprahilar depression, pale brownish in KOH.

Our specimen is like that described by Singer (1947).

Habitat. Solitary to scattered, in *Quercus–Pinus* and *Pinus–Quercus* forests.

***Scleroderma bovista* Fr.**

New record. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Huacalapa, La Toma place; 17°28'05"N, 099°36'02"W; 2665 m alt.; 7.VIII.23; D.U. Bautista-Delgado leg.; BD-FCQB-279.

Identification. Basidiomata 22–27 mm in diameter, globose to subglobose, sessile. Peridium thick, 2–4 mm, with scaly surface, rimose to cracked, in the base with cottony mycelium and adhering soil, greyish brown to orange-grey in cracks and brown, greyish brown to dark brown on scales. Gleba dull violet, violet-grey, or dark violet to dark blue, and bile yellow to dark green on base.

Habitat. Scattered or gregarious, in *Quercus–Pinus* forest.

***Scleroderma polyrhizum* (J.F. Gmel.) Pers.**

New records. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Llanos de Tepoxtepec, El llano place; 17°28'35"N, 099°32'41"W; 2430 m alt.; 24.IX.2024; K.A. González-Ramos leg.; GR-FCQB-10.

Identification. Basidiome 40–100 mm in diameter, globose, subglobose to irregularly sessile. Peridium thick, 2–8 mm, smooth to rough or cracked, at base with cottony and glabrous mycelium and adhering soil, whitish to grayish yellow color. Gleba grayish white, grayish brown to violaceous brown, covered by a thin, cottony, mature, dark brown membrane**.** Basidiospores (6.0–) 8.0–12.0 µm in diameter, subreticulate; clamp connections present.

Our specimen agrees with the description of this species by Guzman et al. (2013)

Habitat. Solitary, scattered, or gregarious, in *Pinus–Quercus* forest.

***Serpula lacrymans* (Wulfen) J. Schröt**

New records. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Huacalapa; 17°28'56"N, 099°37'05"W; 2223 m alt.; 5.VII.22; D.U. Bautista-Delgado leg.; BD-FCQB-68.

Identification. Basidiomata resupinate, in the form of a fleshy, spongy crust; hymenium poroid, with more or less bulging rugosities, yellow-orange to yellow-brown, white margin when young and olivaceous shades in mature specimens.

This species is among the economically most damaging fungi due to its ability to infest and cause aggressive brown-rot decay of wooden structures in temperate regions worldwide (Kauserud et al. 2012).

Habitat. Saprotrophic, in *Pinus–Quercus* to subtropical forests, on the bark of pine.

***Suillus americanus* (Peck) Snell**
Figure 5I

New record. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Llanos de Tepoxtepec, El Llano place; 17°28'34"N, 099°32'40"W; 2430 m alt.; 24.IX.2023; K.A. González-Ramos leg.; GR-FCQB-14.

Identification. Pileus 30–70 mm in diameter, broadly convex hemispherical to plane; surface viscid when moist; scales fibrillose to finely flattened; golden, yellowish brown, orange to reddish shades around and at center of pileus, hymenium decurrent, golden yellow or dark yellow, reddish brown when cut or bruised, stipe cylindrical; surface dry or finely scabrous, yellow, orange, or reddish-brown at maturity. Basidiospores 8.0–11.0 (–12.0) × 3.0–4.0 µm, fusoid, inequilateral.

This species is mainly distributed in temperate North America (García-Jiménez 1999).

Habitat. Solitary or scattered, in mixed coniferous forest, under *Pinus pseudostrobus*.

***Suillus placidus* (Bonord.) Singer**

New record. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Llanos de Tepoxtepec, El Llano Natural Park; 17°28'34"N, 099°32'40"W; 2430 m alt.; 24.IX.2024; K.A. González-Ramos leg.; GR-FCQB-17.

Identification. Pileus 30–92 mm in diameter, obtuse to broadly convex, sometimes plane; margin enrolled when young; surface viscid, glabrous, white, or yellowish white to yellow; hymenium decurrent, white, pale yellow to pale yellow-brown, changing to vinaceous when bruised; stipe cylindrical, white, becoming yellow at maturity; surface dry; glandular areas discoloring to gray or blackish on drying. Basidiospores 7.5 –8.8 (–10.4) × 3.0–3.5 (–4.0) µm, ellipsoid, smooth, yellow to olivaceous in KOH.

García-Jiménez (1999) reported this species from Chiapas, where it was associated with *Pinus oocarpa*. In Guerrero it was found associated with the same host.

Habitat. Scattered or in groups, in *Pinus* and *Pinus–Quercus* forests.

***Suillus pseudobrevipes* A.H. Sm. & Thiers**
Figure 5G

New record. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Huacalapa; 17°28'04"N, 099°37'05"W; 2665 m alt.; 03.VII.2022; D.U. Bautista-Delgado leg.; BD-FCQB-65.

Identification. Pileus 17–130 mm in diameter, yellowish brown or orange-brown, with viscid surface; hymenium adhered, pale yellow, becoming darker yellow; not bruising; stipe cylindrical and narrowed downward, granulations whitish present at young material, yellowish in age, reticulate at apical, veil leaving a median annulus or more rarely a fibrillose zone. Basidiospores 9–10 (–11) ×3–4 µm, cinnamon buff, oblong to suboblong.

Our material agrees with the species from the United States, as described by Smith and Thiers (1964).

Habitat. Scattered, in *Pinus* and *Pinus–Quercus* forests, associated with *Pinus teocote.*

***Strobilomyces dryophilus* Cibula & N.S. Weber**
Figure 5H

New record. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Llanos de Tepoxtepec, El Llano place; 17°28'34"N, 099°32'040"W; 2430 m alt.; 24.IX.2024; K.A. González-Ramos leg.; GR-FCQB-12.

Identification. Pileus 25–124 mm in diameter, convex or flatly convex, white, pale grayish or grayish-brown to tan-black; surface dry, covered with coarse, woolly or cotton, appressed or erect, whitish, grayish-pink to pinkish-brown scales; margin fringed with cotton pieces. Hymenium subadhered, white or grey-black, staining reddish-orange then black when bruised. Stipe cylindrical to nearly equal; surface scaly to reticulate, whitish or greyish to tan-black. Basidiospores 9.5–12.0 × 7.0–8.5 (–9) µm, subglobose, completely reticulate.

This is a North American species only known from the USA and Mexico (Bessette et al. 2017).

Habitat. Solitary, *Pinus-Quercus* forest.

***Tylopilus felleus* (Bull.) P. Karst**

New record. MÉXICO — Guerrero • Tixtla de Guerrero Municipality, Xomislo place; 17°35'25"N, 099°26'05"W; 2011 m alt.; 25.IX.2022; S. Román-Sarabia leg.; RS-FCQB-24.

Identification. Pileus convex, broadly convex to plane; surface glabrous to pruinose, brownish purple to Verona-brown; hymenium free to depressed, white or pinkish brown, often staining brown when cut; stipe cylindrical to bulbous; surface dry, typically reticulate, especially on upper portion**.** Basidiospores 11–16 × 3–6 µm, subfusoid, somewhat inequilateral.

This species is distributed mainly in the Holarctic region (Li and Yang 2022).

Habitat. Solitary or scattered, growing in *Quercus* forest.

***Tylopilus leucomycelinus* (Singer & M.H. Ivory) R. Flores & Simonini**
Figure 5J

New records. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Omiltemi Town; 17°34'03"N, 099°29'14.4"W; 2559 m alt.; 26.XI.2023; D.U. Bautista-Delgado leg.; BD-FCQB-357.

Identification. Pileus 24–110 mm in diameter, subhemispherical, plane-convex or even somewhat depressed at center; surface dry or somewhat viscid when wet, very finely subtomentose at early stage of development but soon smooth to glabrous; orange-brown, pale brown, or amber-brown; margin entire; hymenium adnate to decurrent, leaving striations towards stipe, whitish to greyish, ivory, or pale brownish when mature, staining brown when cut; stipe 25–90 × 8–22 mm, cylindrical, tapering towards base; surface subvelvety, dry, brownish, chestnut-orange, or orange over a yellowish ground, whitish towards base.

The species was described from the Dominican Republic and is now known to occur from Mexico to Central America (Ayala-Vásquez et al. 2023a; Gelardi et al. 2019).

Habitat. Dispersed, forming ectomycorrhizal associations with *Pinus* spp.

***Tylopilus plumbeoviolaceus* (Snell & E.A. Dick) Snell & E.A. Dick**
Figure 5F

New records. MEXICO — Guerrero • Tixtla de Guerrero Municipality, Xomislo; 17°35'25"N, 099°26'05"W; 2011 m alt.; 25.IX.2022; S. Román-Sarabia leg.; RS-FCQB-5 • San Luis Acatlán Municipality, Pascala del Oro; 17°03'50"N, 098°46'39"W; 1126 m alt.; 12.XII.2022; S. Román-Sarabia leg.; RS-FCQB-23.

Identification. Basidiomata violaceous when young. Pileus 30–70mm in diameter, convex-flat; surface smooth, glabrous, lilac to violet; margin entire; hymenium, subadhered, liliaceous-pink, staining grayish brown, when cut; stipe 60–90 × 15–25 mm, subclavate, violaceous to violaceous-brown; surface furfuraceous, somewhat velvety, reticulate at apex. Basidiospores (10–) 12–13 (–15) × 4–6 µm, ellipsoid, smooth, hyaline in KOH.

Our specimens are like the description by Smith and Thiers (1971) from the United States.

Habitat. Solitary or scattered, ectomycorrhizal associations with *Quercus* forest.

***Tylopilus pseudoleucomycelinus* Ayala-Vásquez, Pinzón & Montoya**
Figure 5K

New records. MÉXICO — Guerrero • Tixtla de Guerrero Municipality, Xomislo Place; 17°34'00"N, 099° 25'00"W; 2011 m alt.; 22.XI.2023; S. Román-Sarabia leg.; 20 RS-FCQB-20.

Identification. Pileus 18–40 mm in diameter, subhemispherical, broadly convex to plane; surface of pileus dry, furfuraceous, dark yellow to orange when young, cinnamon and orange-brown at maturity; hymenium adhered, white, changing from yellowish brown to brown when cut or touched stipe 13–15 (–24) × 5–17 mm, subcylindrical to clavate, surface furfuraceous, yellow to orangish-yellow, whitish near apex. Basidiospores 5–7 × 4–5 µm, ovoid to lacrymoid.

Our specimen agrees with the description of the holotype (Ayala-Vásquez et al. 2023a). *Tylopilus pseudoleucomycelinus* is distributed in the Sierra Norte and Sierra Madre del Sur according to the biogeographical classification by Morrone (2017).

Habitat. Solitary or scattered, under *Q. rugosa* in *Pinus–Quercus* forests.

***Tylopilus tabacinus* (Peck) Singer**

New record. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Huacalapa, La Toma place; 17°28'00"N, 099°35'52"W; 2665 m alt.; 6.VII.2022; D. U. Bautista-Delgado leg.; BD-FCQB-110.

Identification. Pileus 45–93 mm, broadly convex to plane-convex, surface dry, smooth to become areolate to cracked in age, orange-brown to tobacco-brown; hymenium adhered or depressed, whitish becoming brown to yellow-brown. Stipe clavate, with attenuated base, whitish when young, reddish-brown at maturity; surface dry, with a very superficial reticulum mainly at apex and remainder smooth to pruinose. Basidiospores 8.0–10.4 (–11.0) × 3.2–4.0 µm ellipsoid, slightly shorter than described by Snell and Dick (1979), compared to their Michigan material, 11–13 × 4–5 µm (Snell and Dick 1970).

Habitat. Solitary or scattered, growing in *Pinus–Quercus* forest.

***Xerocomellus piedracanteadensis* Ayala-Vásquez, Pérez-Moreno & Martínez-Reyes**
Figure 5L

New records. MEXICO — Guerrero • Chilpancingo de los Bravo Municipality, Llanos de Tepoxtepec, El llano Place; 17°28'34"N, 099°32'40"W; 2430 m alt.; 24.IX.2024; K.A. González-Ramos leg.; GR-FCQB-20.

Identification. Pileus small to medium-sized; pileus surface dry, tomentose to rivulose or areolate, brown or greyish-brown, whitish or beige to vivid red in cracks; hymenium adnate, light yellow, turning blue-green then dark blue when cut; stipe 70–80 × 10–12 mm, cylindrical, pale brown from middle to apex, remainder red to pink-red; surface fibrillose, turning bluish green when cut. Basidiospores 12–17 (–26) × (4–) 5–6 (–7) µm, smooth, elongate, cylindrical, some truncate (Pérez-Moreno et al. 2025).

The holotype was described from Tlaxcala, where it was probably associated with *Quercus laurina*, (Pérez-Moreno et al. 2025).

Habitat. Solitary or scattered, recorded from mixed forests in *Abies–Pinus–Quercus* forests, under *Q. laurina* putatively forming ectomycorrhizae.

Species of cultural importance to the Me'phaa, Nahuatl, Na Savi, and mestizos of Guerrero

Aureoboletus russellii (Figure 6A) is important for the Na Savi (Mixtec-guerrerense) culture in the Cerro Verde; *Aureoboletus readii* (Figure 6B) is consumed by the native Nahuatl culture of the community of Copanatoyac, and *Hygrophoropsis aurantiaca* (Figure 6C) and *Tylopilus tabacinus* (Figure 6E, F) are consumed by mestizos in the community of Huacalapa and *Scleroderma texense* (Figure 6D) is eaten by the Me'phaa (Tlapanecos)

Table 2. Species of Boletales recorded in the present work with potential use as food in Guerrero, previously recorded as edible in native cultures of central and and southeastern Mexico according to Moreno-Fuentes and Garibay-Orijel (2014), Li et al. (2021), Ramírez-Carbajal et al. (2025), and Pérez-Moreno et al. (2025).

Aureoboletus auriporus	*Phylloporus rhodoxanthus*	*Suillus glandulosipes*
Aureoboletus betula	*Porphyrellus indecisus*	*Pisolithus arhizus*
Aureoboletus projectellus	*Retiboletus griseus*	*Suillus granulatus*
Boletellus ananas	*Scleroderma areolatum*	*Suillus luteus*
Boletus atkinsonii	*Scleroderma bovista*	*Suillus placidus*
Boletus *cf.* edulis	*Scleroderma cepa*	*Suillus plorans*
Boletus pseudopinophilus	*Scleroderma polyrhizum*	*Suillus pseudobrevipes*
Boletus variipes	*Scleroderma verrucosum*	*Suillus punctatipes*
Butyriboletus frostii	*Strobilomyces dryophilus*	*Suillus tomentosus*
Gyroporus castaneus	*Strobilomyces confusus*	*Suillus umbonatus*
Harrya chromipes	*Suillus bovinus*	*Tapinella atrotomentosa*
Hemiaustroboletus vinaceus	*Suillus brevipes*	*Tylopilus felleus*
Leccinellum rugosiceps	*Suillus cothurnatus*	*Tylopilus plumbeoviolaceus*
Leccinellum aff. *griseum*	*Suillus hirtellus*	*Xanthoconium separans*
Pulveroboletus ravanelli	*Suillus flavogranulatus*	*Xerocomellus piedracanteadensis*

Figure 6. Species of Boletales of biocultural significance in Me'phaa, Nahuatl, and Na Savi native cultures and mestizos of Guerrero. **A.** *Aureoboletus russellii.* **B.** *Aureoboletus readii.* **C.** *Hygrophoropsis aurantiaca* **D.** *S. texense.* **E, F.** *Tylopilus tabacinus.*

culture of the Costa Chica region. The consumption preference of the four species is: roasted on the comal and accompanied with a chili sauce with tomato, and prepared in broth with epazote (*Dysphania ambrosioides* (L.) Mosyakin & Clemonts), and Mexican style (*Capsicum* spp., *Lycopersicon esculentum* Mill., *Allium* spp.). Table 2 lists 45 species with potential used as food, and medicine; 95% of the species are used by the native cultures of central and southeast Mexico and the rest are consumed by cultures of other countries.

Update on taxonomic changes at generic level

Table 3. List of 34 species reported from Guerrero by Capello and Cifuentes (1982), Cifuentes et al. (1993), Pérez Ramírez et al. (1991), Guzmán and Herrera (1973), with changes to generic placement based on molecular phylogeny.. Genera are shown in bold have been changed .

Aureoboletus *betula* (Schwein.) M. Kuo & B. Ortiz	*Scleroderma areolatum* Ehrenb.	*Suillus hirtellus* (Peck) Kuntze
Aureoboletus *russelli* (Frost) G. Wu & Zhu L. Yang	*Scleroderma albidum* Pat. & Trab.	*Suillus luteus* (L.) Roussel
Boletus bicoloroides A.H. Sm. & Thiers	*Scleroderma cepa* Pers.	*Suillus plorans* (Rolland) Kuntze

Boletus cf. *edulis*	*Scleroderma texense* Berk.	*Suillus granulatus* (L.) Roussel
Boletus vinaceobasis A.H. Sm. & Thiers	*Scleroderma verrucosum* (Bull.) Pers.	*Suillus punctatipes* (Snell & E.A. Dick) Singer
Leccinellum aff. *griseum*	*Suillus bovinus* (L.) Roussel	*Suillus discolor* (A.H. Sm., Thiers & O.K. Mill.) N.H. Nguyen
Leccinellum *rugosiceps* (Peck) C. Hahn	*Suillus brevipes* (Peck) Kuntze	*Suillus umbonatus* E.A. Dick & Snell
Pisolithus arhizus (Scop.) Rauschert	*Suillus cembrae* Singer	*Suillus tomentosus* Singer, Snell & E.A. Dick
Porphyrellus *indecisus* (Peck) E.-J. Gilbert	*Suillus cothurnatus* Singer	***Tapinella*** *atrotomentosa* (Batsch) Šutara
Pulveroboletus ravenelii (Berk. & M.A. Curtis) Murrill	*Suillus flavogranulatus* A.H. Sm., Thiers & O.K. Mill	***Veloporphyrellus*** *conicus* (Ravenel) B. Ortiz, Yan C. Li & Zhu L. Yang
Phylloporus guzmanii Montoya & Bandala	*Suillus glandulosipes* Thiers & A.H. Sm	***Xanthoconium*** *separans* (Peck) Halling & Both
Phylloporus rhodoxanthus (Schwein.) Bres.		

DISCUSSION

The diversity of Boletales fungi in the state of Guerrero was thought to include 34 species, according to Capello and Cifuentes (1982), Cifuentes et al. (1993), Pérez Ramírez et al. (1991), and Guzmán and Herrera (1973). However, further taxonomic study is needed, for example for *Aureoboletus russelli, Boletus* cf. *edulis, Butyriboletus frostii, Gyroporus castaneus, Leccinellum* aff. *griseum, Harrya chromipes*, and *Strobilomyces* spp., genera in which the number of species is still uncertain. The Boletaceae is the most abundant family in our study and coincides with other studies in Mexico (García-Jiménez 1999; Ayala-Vásquez 2021; Saldívar et al. 2021). According to Ayala-Vásquez (2021), Guerrero has potential for even greater diversity of fungi due to the similarity of its vegetation with Oaxaca, and probably has greater diversity than that state because of its varied microclimates.

The geographic distribution of *Phlebopus mexicanus*, which was described from Tabasco (Baroni et al. 2015), is extended. Likewise, the distributions of *Aureoboletus readii* and *Xerocomellus piedracanteadensis* are expanded; these species were originally described from central Mexico (Ayala-Vásquez et al. 2023b; Pérez-Moreno et al. 2025).

Aureoboletus russellii is very much appreciated as food by southeastern and central cultures of Mexico (Garibay-Orijel et al. 2009). *Aureoboletus readii* is reported as an edible species for the Nahuatl people in the Municipality of Copanatoyac in the Montaña region; this is the second culture where its edibility has been recorded. Ayala-Vásquez et al. (2023b) reported its biocultural importance for the Pjiejakjoo (Tlahuicas) people of the Estado de Mexico. *Hygrophoropsis aurantiaca*, "pumpkin flower", has biocultural importance in the municipality of Huacalapa, a mestizo community founded approximately 60 years ago by sawmill workers who came from different regions. They probably brought with them mycocultural knowledge of this species. This species is consumed Mexican style, a very common stew in Mexico based on tomato, chilli, and onion. Another species consumed in Huacalpa is *Tylopilus tabacinus*, which is consumed raw. Its taste is sweet and spongy, like bread. Its edibility was first reported by Ramirez-Carbajal et al. (2025); ours is the second record. The Pjiekakjoo culture of the Estado de Mexico consume *T. tabacinus* roasted. *Scleroderma texense*, ball or dirty ball mushroom, is consumed by the Me'phaa of the Montaña and Costa Chica regions. This is the second record of its edibility. Cortés-Pérez et al. (2021) reported that the Zapotecs of Santiago Xochiltepec, Santiago Textitlán, in the Sierra Sur de Oaxaca, consume it; this culture calls this species "duck egg", "female turkey egg" or "guitar". Cortés-Perez et al. (2021) mentioned that *S. texense* is little appreciated for its flavor, but for the Me'phaa culture it is the most important edible mushroom.

Boletales (Table 2) are a great alternative for sustainable development in the communities of Guerrero. For example, the genera *Boletus* and *Suillus* are highly appreciated and commercialized in central and southeastern Mexico (Moreno-Fuentes and Garibay-Orijel 20214). The genus *Boletus* has been given different names: in Nahuatl, "Pananacatl" (bread fungus) and Pjiekakjoo "Nchjo pantsi" (belly fungus) (Ramirez-Carbajal et al. 2025; Moreno-Fuentes and Garibay-Orijel 2014), and in Ayu'uk, "Tuupuutx" (fat fungus of the road). The genus *Suillus* is called "plumpy fungus" by the Nahuatl, Pjiekakjoo, and Zapoteca cultures (Ramirez-Carbajal et al. 2025).

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

Author contributions

Conceptualization: AVO, ACLP. Data curation: RSS, BDDU, MRJ, MLS, CVMA, GRKA. Formal analysis: RSS, AVO, ACLP Investigation: RSS, BDDU, MRJ, MLS, CVMA, GRKA, BMJ. Methodology: BDDU, CVMA. Project administration: ACLP, AVO. Resources: AVO, ACLP. Software: AVO, BDDU. Visualization: AVO, BDDU. Validation: ACLP, AVO, PMJ. Writing – original draft: RSS, BDDU, MLS. Writing – review and editing: AVO, PMJ.

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REFERENCES

Aragón-Parada J, Rodríguez A, Munguía-Lino G, De-Nova JA, Salinas-Rodríguez MM, Carrillo-Reyes P (2021) Las plantas vasculares endémicas de la Sierra Madre del Sur, México. Botanical Sciences 99: 643–660. https://doi.org/10.17129/botsci.2682

Ayala-Vásquez O (2021) Taxonomía, biogeografía y filogenia de hongos del orden Boletales en la Sierra Norte de Oaxaca, México. Doctoral thesis, Instituto Tecnológico de Ciudad Victoria, Tamaulipas, México, 304 pp.

Ayala-Vásquez O, Valenzuela R, Aguirre-Acosta E, Raymundo T, García-Jiménez J (2018) Species of Boletaceae (Boletales, Basidiomycota) with ornamented spores from temperate forests at the state of Oaxaca, Mexico. Studies in Fungi 3 (1): 271–292. https://doi.org/10.5943/sif/3/1/28

Ayala-Vásquez O, García-Jiménez J, Aguirre-Acosta E, Castro-Rivera R, Ángeles-Argáiz RE, Saldívar AE, Garibay-Orijel R (2022) A new genus in the subfamily Austroboletoideae (Boletaceae, Boletales). MycoKeys 88: 55–78. https://doi.org/10.3897/mycokeys.88.73951

Ayala-Vasquez O, Perez-Moreno J, Pinzon JP, Garibay-Orijel R, Garcia-Jimenez J, de la Fuente JI, Venegas-Barrera CS, Martinez-Reyes M, Montoya L, Bandala V (2023a) Broadening the knowledge of Mexican boletes: addition of a new genus, seven new species, and three new combinations. Journal of Fungi 9 (12): 1126. https://doi.org/10.3390/jof9121126

Ayala-Vásquez O, Martínez-Reyes M, Pérez-Moreno J, Martínez-González CR, Pinzón, JP, de la Fuente JI, Castro-Rivera R, García-Jiménez J, Balbuena-Carrasco S, Ramírez-Carbajal E (2023b) Five new species of *Aureoboletus* and *Chalciporus* (Boletaceae, Boletales) and their ethnomycological aspects. Journal of Fungi 9 (10): 1041. https://doi.org/10.3390/jof9101041

Baroni TJ, Cifuentes J, Santana BO, Cappello S (2015) A new species of *Phlebopus* (Boletales, Basidiomycota) from Mexico. North American Fungi 10: 1–13.

Bessette A, Roody WC, Bessette AR (2017) North American boletes: a color guide to the flesh and pored mushrooms. Syracuse University Press, New York, USA, 320 pp.

Capello S, Cifuentes J (1982) Nuevos registros del género *Suillus* (Boletaceae) en México. Boletín de la Sociedad Mexicana de Micología 17: 196– 206.

Chen XN, Zhang M, Li T H, Zeng N K (2019) A new species of *Heimioporus* (Boletaceae) from southern China. Phytotaxa 415 (4): 179–188. https://doi.org/10.11646/phytotaxa.415.4.2

Cortés-Pérez A, Pérez-Pacheco CK, Yescas-Arreola E, Ramírez-Cruz V (2021) Primer registro de *Scleroderma texense* (Boletales, Sclerodermatinae) como una especie comestible en la Sierra Sur de Oaxaca, México. Scientia Fungorum 52: e1386. http://dx.doi.org/10.33885/sf.2021.52.1386

Cifuentes J, Villegas M, Pérez L (1993) Hongos Macroscópicos. In: Luna-Vega, I. y J. Llorente-Bousquets (eds.) Historia Natural del Parque Omiltemi, Chilpancingo, Guerrero, México. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. Universidad Nacional Autónoma de México, México, Distrito Federal, México 1-126.

Deloya-Olvera M, Xoconostle-Cazares B, Vasquez SV, Pérez-Moreno J, Martínez-González CR, Almaraz JJ, Jimenez M, Sánchez-García ME (2023) Two new neotropical species of the ectomycorrhizal gasteroid genus *Calostoma* (Sclerodermatineae, Boletales) used as a food source by the Ayuuk jä'äy ethnic group from Southern Mexico. Phytotaxa 612: 148–158. https://doi.org/10.11646/phytotaxa.612.2.3

Espinosa D, Ocegueda-Cruz S, Luna-Vega I (2016) Introducción al estudio de la biodiversidad de la Sierra Madre del Sur: una visión general. In: Luna-Vega I, Espinosa D, Contreras-Medina R (Eds.) Biodiversidad de la Sierra Madre del Sur: una síntesis preliminar. Universidad Nacional Autónoma de México, Ciudad de Mexico, Mexico, 487–500.

Farid A, Bessette AE, Bessette AR, Bolin JA, Kudzma LV, Franck AR, Garey JR (2021) Investigations in the boletes (Boletaceae) of southeastern USA: four novel species, and three novel combinations. Mycosphere 12: 1038–1076. https://doi.org/10.5943/mycosphere/12/1/12

Gelardi M, Angelini C, Costanzo F, Dovana F, Ortiz-Santana B, Vizzini A (2019) *Tylopilus griseiolivaceus* sp. nov. and *T. leucomycelinus* (Boletaceae) revisited from the Dominican Republic within a comprehensive phylogeny of *Tylopilus* s.str. Mycological Progress 18 (8): 1039–1056. https://doi.org/10.1007/s11557-019-01513-2

García J, Castillo J (1981) Las especies de boletáceos y gonfidiáceos conocidas en el Estado de Nuevo León. Boletín de la Sociedad Mexicana de Micología 15: 121–197.

García-Jiménez J (1999) Estudio sobre la taxonomía, ecología y distribución de algunos hongos de la familia Boletaceae (Basidiomycetes, Agaricales) de México. Master's thesis, Facultad de Ciencias Forestales, Universidad Autónoma de Nuevo León, Mexico, 270 pp.

García-Jiménez J (2013) Diversidad de macromicetos en el estado de Tamaulipas, México. Doctoral thesis, Universidad Autónoma de Nuevo León, Mexico, 260 pp.

García-Jiménez J, Singer R, Estrada E, Garza-Ocañas F, Valenzuela R (2013) Dos especies nuevas del género *Boletus* (Boletales: Agaricomycetes) en México. Revista Mexicana de Biodiversidad 84: S152–S62. https://doi.org/10.7550/rmb.31988

García-Jiménez J, Garza-Ocañas F, de la Fuente JI, Saldivar ÁE, Ayala-Vásquez O (2019) Three new records of *Aureoboletus* Pouzar (Boletaceae, Boletales) from Mexico. Check List 15 (5): 759–765. https://doi.org/10.15560/15.5.759

Guzmán G, Herrera T (1973) Especies de macromicetos citadas de México IV Gasteromycetes. Boletín de la Sociedad Mexicana de Micología 7: 105–119.

Guzmán G, Cortés-Pérez A, Guzmán-Dávalos L, Ramírez-Guillén F, Sánchez-Jácome MR (2013) An emendation of *Scleroderma*, new records, and review of the known species in Mexico. Revista Mexicana Biodiversidad 84: 173–191. https://doi.org/10.7550/rmb.31979

Halling RE, Mueller GM (1999) New boletes from Costa Rica. Mycologia 54: 747–753.

Halling RE, Mueller GM (2003) *Leccinum* (Boletaceae) in Costa Rica. Mycologia. 95: 488–499.

Halling RE, Mueller GM (2005) Common Mushrooms of the Talamanca Mountains, Costa Rica. The New York Botanical Garden Press, The Bronx, New York, USA, 70 pp.

Han LH, Feng B, Wu G, Halling RE, Buyck B, Yorou NS, Ebika S, TN, Yang ZL (2018) African origin and global distribution patterns: evidence inferred from phylogenetic and biogeographical analyses of ectomycorrhizal fungal genus *Strobilomyces*. Journal of Biogeography 45: 201–212. https://doi.org/10.1111/jbi.13094

INEGI (Instituto Nacional de Estadistica y Geografía) (2010) Conjunto de Datos Vectoriales de Uso de Suelo y Vegetación. Escala 1:250 000, Mexico. https://www.inegi.org.mx/app/mapas/_ Accessed on: 2024-03-17.

Kauserud H, Knudsen H, Högberg N, Skrede I (2012) Evolutionary origin, worldwide dispersal, and population genetics of the dry rot fungus *Serpula lacrymans*. Fungal Biology Reviews 26: 84e93. https://doi.org/10.1016/j.fbr.2012.08.001

Li YC, Yang ZL (2021) Phylogenetic results and systematic treatments of *Tylopilus* s.l. In: Li YC, Yang ZL (Eds.) The boletes of China: *Tylopilus* s.l. Springer Nature Singapore, Singapore, 31–34. https://doi.org/10.1007/978-981-16-2986-0_4

Li H, Tian Y, Menolli N Jr, Ye L, Karunarathna SC, Perez-Moreno J, Rahman MM, Rashid MH, Phengsintham P, Rizal L, Kasuya T, Lim YW, Dutta AK, Khalid AN, Huyen LT, Balolong MP, Baruah G, Madawala S, Thongklang N, Hyde KD, Kirk PM, Xu J, Sheng J, Boa E, Mortimer PE (2021) Reviewing the world's edible mushroom species: a new evidence-based classification system. Comprehensive Reviews in Food Science and Food Safety 20: 1982–2014. https://doi.org/10.1111/1541-4337.12708

Lodge DJ, Ammirati JF, Dell TO, Mueller GM (2004) Terrestrial and lignicolous macrofungi: collecting and describing macrofungi. In: Mueller G, Bills GF, Foster MS (Eds.) Biodiversity of Fungi. Inventory and monitoring methods. Elsevier Academic Press, New York, USA, 1–158.

Martínez-González CR, Ramírez-Mendoza R, Jiménez-Ramírez J, Gallegos-Vázquez C, Luna-Vega I (2017) Improved method for genomic DNA extraction for *Opuntia* Mill. (Cactaceae). Plant Methods 13: 1–10. https://doi.org/10.1186/s13007-017-0234-y

Moreno-Fuentes A, Garibay-Orijel R (2014) La etnomicología en México, estado del arte. Red de etnomicología y patrimonio micocultural Biocultural. Universidad Autónoma del Estado de Hidalgo-instituto de Biología, Sociedad Mexicana de Micologia, Asociacion Etnobiologica Mexicana, A.C., Grupo Interdisciplinario para el Desarrollo de la Etnomicología en México-Sociedad Latinoamericana de Etnobiología, Distrito Federal, México, 243 pp.

Morrone JJ (2017) Biogeographic regionalization of the Sierra Madre del Sur province, Mexico. Revista Mexicana de Biodiversidad 88 (3): 710–714. https://doi.org/10.1016/j.rmb.2017.07.012

Murrill A (1909) The Boletaceae of North America—II. Mycologia 1 (4): 140–160.

Ortiz-Santana BD, Lodge DJ, Baroni TJ, Both EE (2007) Boletes from Belize and the Dominican Republic. Fungal Diversity 27: 247–416.

Pérez Ramírez L, García J, Cifuentes J (1991) Primer registro de *Fistulinela conica* en México. Revista Mexicana de Micología 7: 79–86. https://doi.org/10.33885/sf.1991.3.775

Pérez-Moreno J, Lorenzana-Fernández A, Carrasco-Hernández V, Yescas-Pérez A (2010) Hongos silvestres comestibles del parque nacional Izta-Popo, Zoquiapan y anexos. Colegios de Postgraduados, Secretaria de Manejo de Recursos Naturales (SEMARNAT), Consejo Nacional de Ciencia y Tecnología (CONACyT), Montecillo, Texcoco, Mexico, 167 pp.

Pérez-Moreno J, Fuentes-García O, Martínez-Reyes M, Martínez-González CR, Lagunes-Reyes M, Díaz Aguilar I, Ayala-Vásquez O (2025) The genus *Xerocomellus* (Boletales, Boletaceae) in Mexico: addition of a new species, a new record, and notes on its biocultural importance. Phytotaxa 689 (1): 001–014. https://doi.org/10.11646/phytotaxa.689.1.1

Phosri C, Martín Maria P, Watling R (2013) *Astraeus*: hidden dimensions. IMA Fungus 4: 347–356. https://doi.org/10.5598/imafungus.2013.04.02.13

Rambaut A (2009) FigTree. Tree Figure Drawing Tool, version v1.4.4. http://tree.bio.ed.ac.uk/software/figtree/.

Ramírez-Carbajal E, Martínez-Reyes M, Ayala-Vásquez O, Rodríguez-Evangelista F, Lagunes Reyes M, Hernández-Santiago F, Rangel Villafranco M, Yu F, Pérez-Moreno J (2025) Revitalizing endangered mycocultural heritage in Mesoamerica: the case of the Tlahuica-Pjiekakjoo culture. Plants, People, Planet.

Saldívar AE, García-Jiménez J, Herrera-Fonseca, MJ, Rodríguez-Alcántar O (2021) Listado actualizado y nuevos registros de Boletaceae (Fungi, Basidiomycota, Boletales) en Jalisco, México. Polibotánica 52: 25–49. https://doi.org/10.18387/polibotanica.52.3

Singer R (1947) The Boletoideae of Florida with notes on extralimital species III. American Midland Naturalist 37: 1–135. https://doi.org/10.2307/2421647

Singer R, García-Jiménez J, Gómez LD (1992) The Boletineae of México and Central America III. Beih. Nova Hedwigia 105: 1–49.

Smith AH, Thiers HD (1964) A contribution toward a monograph of North American species of *Suillus*. Ann Arbor, Michigan, USA, 115 pp.

Smith AH, Thiers HD (1971) The boletes of Michigan. The University of Michigan Press, Ann Arbor, Michigan, USA, 421pp.

Snell WH, Dick EA (1970) The boleti of north eastern North America. J. Cramer, Lehre, USA, 114 pp.

Villaseñor JL (2016) Checklist of the native vascular plants of Mexico. Revista Mexicana de Biodiversidad 87 (3): 559–902. https://doi.org/10.1016/j.rmb.2016.06.017

Vizzini A (2014) *Exsudoporus* Vizzini, Simonini & Gelardi, gen. nov. Index Fungorum 183: 1.

Wu G, Yan-Chun L, Xue-Tai Z, Kuan Z, Li-Hong H, Yang-Yang C, Fang L, Jian-Ping X, Zhu LY (2016) One hundred noteworthy *Boletus* from China. Fungal Diversity 81: 25–180. https://doi.org/10.1007/s13225-016-0375-8

White TJ, Bruns TD, Lee S, Taylor JW (1990) Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenies. In: Innis MA, Gelfand DH, Sninsky JJ, White TJ (Eds) PCR protocols: a guide to methods and applications. Academic Press, San Diego, USA, 322 pp. https://doi.org/10.1016/b978-0-12-372180-8.50042-1

Wang Y, Ma YH, Wu G, Yang XY, Liu YJ, Rao G, Dai D, Gui XY, Tuo YL, Wang LY, Chen X, Zhang B, Li Y (2024) Polyphasic taxonomy clarifies the relationships between *Butyriboletus* and *Exsudoporus,* and new taxa and reports of Boletaceae from China. Mycosphere 15 (1): 881–953. https://doi.org/10.5943/mycosphere/15/1/7

Zhang M, Xie DC, Wang CQ, Deng WQ, Li TH (2022) New insights into the genus *Gyroporus* (Gyroporaceae, Boletales), with establishment of four new sections and description of five new species from China. Mycology 13: 1–20. https://doi.org/10.1080/21501203.2022.2094012