

## New species of *Psilocybe* in the Caribbean, with an emendation of *P. guilartensis*

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**Abstract:** Five new species of *Psilocybe* from the Caribbean are described: *P. caribaea*, *P. egonii*, *P. subpsilocybioides*, *P. zapotecoantillarum* and *P. zapotecocaribaea*. All except *P. zapotecocaribaea*, which is known only from Martinique, are native to Puerto Rico. *Psilocybe guilartensis*, previously described from Puerto Rico, is the most commonly collected species of *Psilocybe* in Puerto Rico. New information on morphology is provided for *P. guilartensis*, and an emendation of the species circumscription is presented.

**Key words:** Agaricales, Antilles, Martinique, Puerto Rico, Strophariaceae

### INTRODUCTION

At least 15 species of *Psilocybe* were reported from the Caribbean region (TABLE I) before this study. The oldest descriptions of what now are known as *Psilocybe* species from the Caribbean region were from Cuba. Berkeley and Curtis (1868) reported *Agaricus* (*Psilocybe*) *plutonius* Berk. & M.A. Curtis and *A. (Psil-*

*ocybe) scatigena* Berk. & M.A. Curtis, while Earle (1906) described *Stropharia (Psilocybe) cubensis* Earle. *Psilocybe cubensis* (Earle) Singer is the most frequently reported species in the Caribbean; it is known from Cuba, Guadelupe, Martinique, Jamaica, Puerto Rico and Trinidad (Guzmán et al 1998). The other known Caribbean species are *P. caerulescens* Murrill, *P. coprophila* (Bull. ex Fr.) P. Kumm., *P. fuliginosa* (Murrill) A. H. Sm., *P. guilartensis* Guzmán, Tapia & Nieves-Rivera, *P. lateritia* (Murrill) A. H. Sm. (= *P. montana* (Pers. ex Fr.) P. Kumm.), *P. mammillata* (Murrill) A. H. Sm., *P. modesta* (Peck) A. H. Sm. (= *P. phyllogena* (Peck) Peck, *P. pallidispora* (Murrill) A. H. Sm., *P. portoricensis* Guzmán, Nieves-Rivera & Tapia, *P. subcubensis* Guzmán, *P. venezuelana* Dennis and *P. yungensis* Singer & A. H. Sm. (Murrill 1918; Seaver and Chardon 1926; Dennis 1968, 1970; Stevenson 1975; Pegler 1983; Rodríguez-Gallart 1989; Navarro and Betancourt 1992; Guzmán et al 1997, 1998; Minter et al 2001) (TABLE I). All these species, except *P. guilartensis* and *P. portoricensis*, were discussed by Guzmán (1983). Smith (1948) provided information on *P. fuliginosa* and *P. pallidispora* from this region, and Guzmán (1986) analyzed the distribution of five species in the Antilles. In addition to the species listed above, Dennis (1970) reported an unidentified taxon from Trinidad. As part of a much larger study, we report five new species of *Psilocybe* for the Caribbean and provide an emended species concept for *P. guilartensis*.

### MATERIALS AND METHODS

Exploration in the Dominican Republic, Jamaica and Puerto Rico from 1994 to 2000 by Baroni, Lodge, Cantrell and Nieves-Rivera, in collaboration with colleagues and students, provided material for this study. Colors of macroscopic features are based on Smithe (1975), with color names uppercase or based on Kornerup and Wanscher (1978) by color names with alphanumeric designations (e.g., yellowish brown 5D-E5-8). Lowercase color names without alphanumeric designations are color ranges indicated by the collectors in field notes or in published manuscripts (e.g., Pegler 1983). Microscopic sections were mounted in 5% aqueous KOH, Meltzer's reagent and/or Congo Red and ammonia solution. Basidiospore measurements include length and width of spores in face view and maximum depth of spores in profile view.

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TABLE I. Species of *Psilocybe* previously reported from the Caribbean region (only the oldest reference is cited). Those names in boldface are recognized species for the Caribbean

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<i>P. caerulescens</i> (Pegler 1983) (= <b><i>P. caribaea</i></b> )
<b><i>P. coprophila</i></b> (Dennis 1970)
<b><i>P. cubensis</i></b> (Earle 1906)
<b><i>P. fuliginosa</i></b> (Murrill 1918)
<b><i>P. guilartensis</i></b> (Guzmán <i>et al</i> 1997)
<i>P. lateritia</i> (Murrill 1918) (= <b><i>P. montana</i></b> )
<b><i>P. mammillata</i></b> (Murrill 1918)
<i>P. modesta</i> (Minter <i>et al</i> 2001) (= <b><i>P. phyllogena</i></b> )
<b><i>P. pallidispora</i></b> (Murrill, 1918)
<b><i>P. plutonia</i></b> (Berkeley and Curtis 1868)
<b><i>P. portoricensis</i></b> (Guzmán <i>et al</i> 1997)
<b><i>P. scatigena</i></b> (Berkeley and Curtis 1868)
<b><i>P. subcubensis</i></b> (Navarro and Betancourt 1992)
<b><i>P. venezuelana</i></b> (Pegler 1983)
<b><i>P. yungensis</i></b> (Pegler 1983) (= <b><i>P. zapotecocaribaea</i></b> )

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## NEW SPECIES

***Psilocybe caribaea*** Guzmán, T. J. Baroni & Tapia, sp. nov. FIGS. 1–5

[*Pileus* (17–)35–60(–70) mm diam., convexus vel plano-umbonatus, mammillato-papillatus, laevis, ochraceus vel obscure rubello-brunneus, praecipue ad umbonem badius vel obscure cinereo-brunneus, hygrophanus vel pallide griseo-luteolus. *Lamellae* sinuatae, pallide brunneae vel violaceo-brunneolae. *Stipes* (20–)80–130(–175) × 3–6(–8) mm, bulbosus, albescens vel pallide brunneolus vel luteolo-brunneus, fibrillis appressis bis obtectus. Omnes partes caerulescentes. Odor atque sapor farinaceus. *Sporae* (6–)6.5–7.5(–8) × 5–5.5(–6.5) × 4.5–5 µm, in aspectu frontali subrhomboideae, in obliquo subellipsoideae, crassitunicatae, luteolo-brunneae. *Pleurocystidia* (9.5–)12–17(–20) × (3.5–)5–8(–12) µm, hyalina, subventricosa, subfusioidea vel subcylindrico-moniliformia, in apice acuta vel colo brevi praedita. *Cheilocystidia* (16–)18–30(–37) × (4–)5–8(–9.5) µm, hyalina, subventricosa, irregulariter ramosa, in apice acuta vel colo brevi praedita. *Pileipellis* hyphis subgelatinosis repentibus vel interdum pileocystidiis praedita. *Psilocybae* subtropicali affinis sed typis pleurocystidiorum atque cheilocystidiorum differt. HOLOTYPE *Baroni* 7971 CORT.]

*Pileus* (17–)35–60(–70) mm diam, convex-umbonate becoming plane with a mammillate-papillate umbo, smooth, lubricous; margin even, translucent-striate or slightly sulcate-striate, yellowish brown (5D-E5-8) to dark reddish brown (8E-F5-6), chocolate brown (6F4) or Verona Brown, or dark grayish brown (5D-F3) mainly on the umbo, hygrophanous, changing to beige or pale brownish-yellow. *Lamellae* sinuate, pale brown or violaceous brown (11F4-6), margin even or somewhat fimbriate, pallid or concolorous. *Stipe* (20–)80–130(–175) × 3–6(–8) mm, hollow, equal with a bulbous base, sordid white, becoming pale brown or yellowish brown (5D-E5-8) or reddish brown (8E5-7) or fuscous reddish toward the apex,

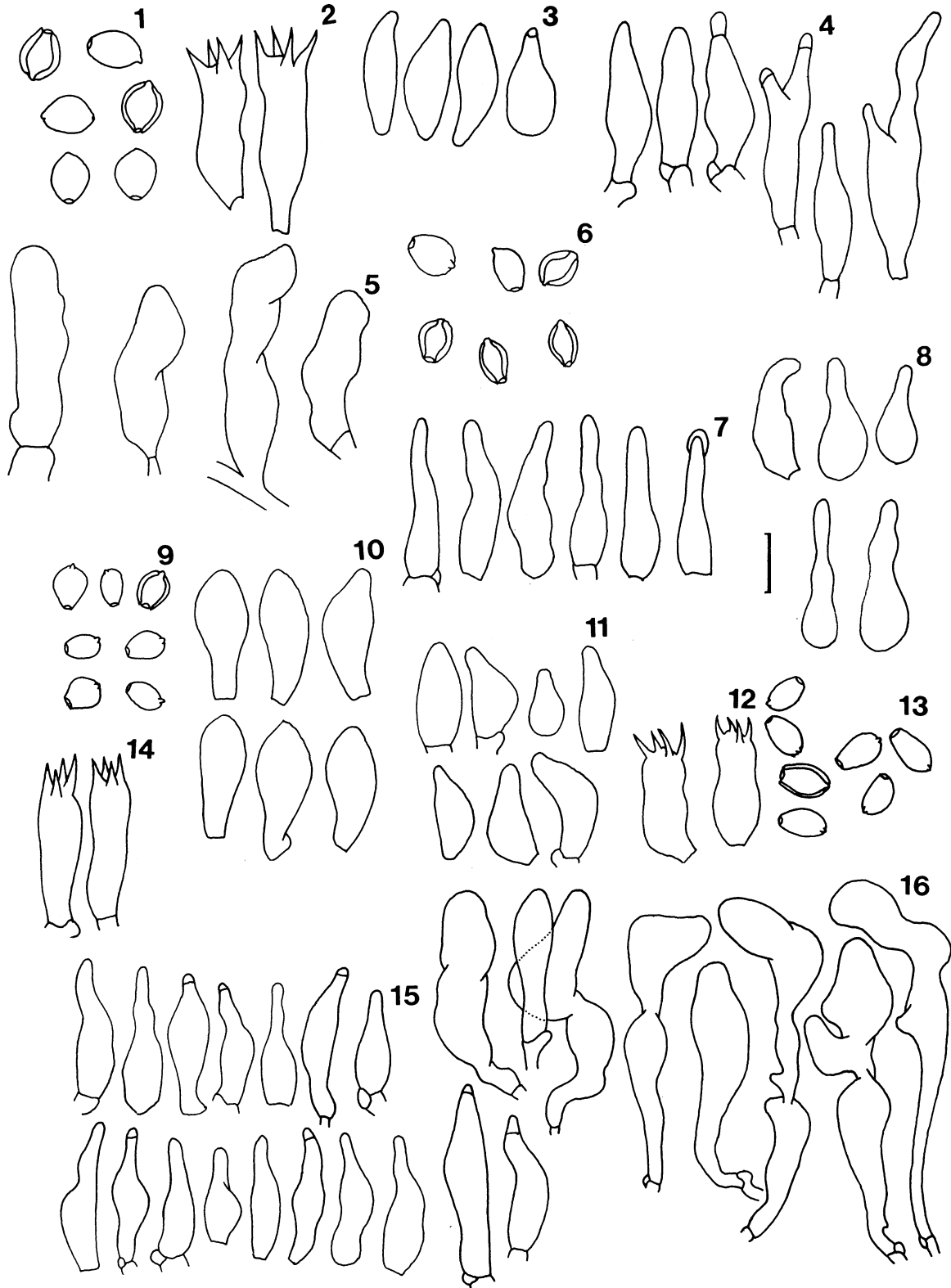
shiny or dull, silky, covered with fibrillose appressed white fibrils toward the base, texture tough-cartilaginous or subwoody, with rhizomorphs at the base, inserted up to ¼ of the total length. *Context* both in pileus and stipe whitish, or reddish-brown in the base of the stipe. All parts except lamellae strongly caerulescent when cut or touched. *Odor and taste* farinaceous. *Spore print* Dark Violaceous Brown.

*Spores* (6–)6.5–7.5(–8) × 5–5.5(–6.5) × 4.5–5 µm ( $Q = 1.25$ ), subrhomboid in face view, subellipsoid in side view, thick-walled, walls up to 1 µm thick, yellowish-brown, with a broad germ pore. *Basidia* (16–)20–25(–28) × 5–6(–7) µm, 4-sterigmate, hyaline, vesiculose, with a median constriction. *Pleurocystidia* (9.5–)12–17(–20) × (3.5–)5–8(–12) µm, hyaline, subventricose, subfusoid or subcylindric-moniliform, with an acute apex or short neck. *Cheilocystidia* (16–)18–30(–37) × (4–)5–8(–9.5) µm, hyaline, subventricose, irregularly branched, with an acute apex or with a short neck. *Subhymenium* very thin, subcellular, with hyaline to yellowish elements, 3–6(–8) µm wide, finely encrusted. *Hymenophoral trama* regular, most hyphae hyaline, cylindrical or with some elements inflated, 3–24 µm wide, with fine, inconspicuous encrustations. *Pileipellis* a subgelatinized layer 8–40 µm thick, composed of repent, hyaline hyphae, 2.5–7 µm diam, *pileocystidia* 25–43 × 6–8 µm occasional, prostrate or erect. *Hypodermium* with both hyaline cylindrical hyphae and subglobose elements, 2–15 µm wide, with encrusted walls. *Context* composed of hyaline or yellowish hyphae, some inflated and becoming subglobose, 3–24 µm wide, thin or thick-walled, up to 1 µm thick. *Clamp connections* common.

*Habitat and distribution.* Gregarious or caespitose on rich organic or sandy soil, mixed with decaying plant debris, in tropical and subtropical forests. Known only from Puerto Rico.

*Material examined.* PUERTO RICO, Mun. Naguabo, Luquillo Mountains, trail from Río Icacos to Río Prieto Dam, 4 Oct 1999, *Laboy* (PR-5772) (CFMR). Tradewinds Trail, 25 Jun 1995, *Lodge, Barley & Wunderle* (PR-2669) (CFMR); *Lodge, Barley & Wunderle* (PR-2671) (CFMR). Mun. Río Grande, Caribbean National Forest, El Yunque, Caimitillo Trail, 29 Jun 1996, *Baroni* 7971 (HOLOTYPE CORT; ISOTYPE XAL). Mun. Río Grande, Luquillo Mountains., La Mina Recreation Area, Mount Britton Trail, 23 May 2000, *Cantrell & Salgado, ledger Cantrell* PR-0022 (PR-6170) (UPRRP). MARTINIQUE, Vallée du Lorrain, Nov 1974, *Fiard* 87 (K(M): 84377); 4 Jun 1975, *Fiard* 87C (K(M): 84376). Between Gran Riniere and Anse Ceron, 17 Jan 1982, *Fiard* 1503 (K(M): 84375).

*Discussion.* Pegler (1983) considered collections of this species from Martinique to be *P. caerulescens*. However, even though *P. caerulescens* is a member of



FIGS. 1–16. Microscopic characters of *Psilocybe* species. Figs. 1–5. *P. caribaea*. 1. Spores. 2. Basidia. 3. Pleurocystidia. 4. Cheilocystidia. 5. Pileocystidia. Figs. 6–8. *P. egonii*. 6. Spores. 7. Pleurocystidia. 8. Cheilocystidia. Figs. 9–12. *P. subpsilocybioides*. 9. Spores. 10. Pleurocystidia. 11. Cheilocystidia. 12. Basidia. Figs. 13–16. *P. zapotecoantillarum*. 13. Spores. 14. Basidia. 15. Pleurocystidia. 16. Cheilocystidia. All drawings from the Holotypes. Scale bar = 8  $\mu$ m.

section *Cordisporae*, it lacks pleurocystidia and is easily separated from *P. caribaea* which has abundant pleurocystidia.

*Psilocybe caribaea* is attractive because of its robust basidiomata, which occur in clusters. Its habit is reminiscent of *P. collybioides* Singer & A.H. Smith, but that species has thin-walled ellipsoid basidiospores (Guzmán, 1983). *Psilocybe caribaea* is most phenetically similar to *P. subtropicalis* Guzmán known from Mexico and Guatemala (Guzmán 1995). However, *P. caribaea* can be separated from *P. subtropicalis* because it possesses two types of pleuro- and cheilocystidia (recent observations on the holotype by Guzmán and Tapia).

One specimen, PR-6170, possesses slightly larger basidia  $28\text{--}37 \times 6\text{--}7 \mu\text{m}$  with 1, 2, 3 and 4 sterigmata and slightly longer pleurocystidia  $(13\text{--})15\text{--}24\text{--}(26) \mu\text{m}$ . However, the differences observed in this collection appear to be reasonably expected morphological variations for *P. caribaea*.

*Psilocybe egonii* Guzmán & T. J. Baroni, sp. nov.

FIGS. 6–8

[*Pileus* 4–11 mm diametro, convexus vel subumbonatus vel fere planus, in statu vivo fusco-brunneus, in statu sicco brunneolo-flavus vel brunneolo-ruber, laevis sed squamulis appressis ornatus, ad marginem laevis. *Lamellae* adnexae, brunneae vel brunneolo-aurantiacae, ad marginem concolores vel albescentes. *Stipes* 6–16  $\times$  1–1.5 mm, aequalis, infuscato–canus, squamulis albescentibus notatus. *Sporae*  $(5.5\text{--})6\text{--}6.5\text{--}(7) \times 4.5\text{--}5\text{--}(5.5) \times 3.5\text{--}4.5 \mu\text{m}$ , aspectu frontali subrhomboideae, ex obliquo subellipsoideae, parietibus crassis. *Pleurocystidia*  $(12\text{--})15\text{--}22.5\text{--}(24) \times 4\text{--}5.5\text{--}(6) \mu\text{m}$ , vulgaría, hyalina, subventricosa vel subfusioidea, colo plus minusve longo. *Cheilocystidia*  $(9.5\text{--})13\text{--}21.5\text{--}(26) \times (4\text{--})5\text{--}6.5\text{--}(7) \mu\text{m}$ , vulgaría, hyalina, in forma facie pleurocystidiorum vel interdum colo undulato. *Pileipellis* stratum tenue subgelatinosum ex hyphis repentibus compositum. Fibulae vulgares. HOLOTYPUS *Llorens 138* (PR-5246) UPRRP.]

*Pileus* 4–11 mm diam, convex to subumbonate or semiplane, dark brown (7F7) when fresh, brownish yellow (5C4 or 5B3) or brownish red (7D8) when dry, dull, smooth but with appressed squamules, margin smooth. *Lamellae* adnexed, brown (7E8) when fresh becoming brownish orange (7D8), edges concolorous or whitish. *Stipe* 6–16  $\times$  1–1.5 mm, equal, hollow, brownish gray (7E4–5), smooth but mottled with whitish squamules or scattered fibrillose patches, base with a white mycelial pad. *Odor* and *taste* not recorded. *Spore print* not recorded.

*Spores*  $(5.5\text{--})6\text{--}6.5\text{--}(7) \times 4.5\text{--}5\text{--}(5.5) \times 3.5\text{--}4.5 \mu\text{m}$  ( $Q = 1.25$ ), subrhomboid in face view, subellipsoid in profile, thick-walled, yellowish brown, with a broad germ pore. *Basidia*  $(17\text{--})20\text{--}24\text{--}(26) \times 5.5\text{--}6.5 \mu\text{m}$ , 4-sterigmate, hyaline, vesiculose, with a median con-

striction. *Pleurocystidia*  $(12\text{--})15\text{--}22.5\text{--}(24) \times 4\text{--}5.5\text{--}(6) \mu\text{m}$ , hyaline, subventricose or subfusoid, with a long neck. *Cheilocystidia*  $(9.5\text{--})13\text{--}21.5\text{--}(26) \times (4\text{--})5\text{--}6.5\text{--}(7) \mu\text{m}$ , hyaline, as the pleurocystidia in form or sometimes with an undulated neck. *Subhyphenium* subcellular, elements hyaline, 2.5–7  $\mu\text{m}$  wide, sometimes with pale-brownish encrustations. *Hymenophoral trama* regular, with hyaline, cylindrical or inflated hyphae, 2–10  $\mu\text{m}$  wide, thin-walled, with pale-brownish encrustations. *Pileipellis* a thin subgelatinized layer of repent, hyaline hyphae, 1.5–5  $\mu\text{m}$  wide. *Hypodermium* and *context* in a continuous layer, formed by hyaline, cylindrical hyphae, with occasional subglobose cells intermixed, 3–14  $\mu\text{m}$  wide, with brownish encrustations on the walls. *Clamp connections* common.

*Habitat and distribution.* Gregarious, lignicolous on dead, decaying palm leaves (*Prestoea montana* [Graham] G. Nicholson), known only from Puerto Rico.

*Material examined.* PUERTO RICO, Mun. Rio Grande, Luquillo Mountains, Caribbean National Forest, La Mina Recreation Area, Caimitillo Trail, 11 Jun 1997, *Llorens 138* (PR-5246) (HOLOTYPE CFMR; SYNISOTYPES ZT-8807 and XAL).

*Discussion.* *P. egonii* belongs in section *Psilocybe* because it possesses subrhomboid thick-walled basidiospores, which are less than 10  $\mu\text{m}$  long, and basidiomata that are not caerulescent when injured (Guzmán 1983). It differs from *P. subpsilocybioides* of section *Psilocybe* (see below) because *P. subpsilocybioides* has a partial veil and broader pleurocystidia,  $(6.5\text{--})7\text{--}8\text{--}(9) \mu\text{m}$  wide.

*P. egonii* is the second species of *Psilocybe* to be named in honor of Professor Egon Horak, viz. *P. horakii* Guzmán of section *Singerianae* (Guzmán, 1978). Horak has contributed significant amounts of information and collections over the years to further our knowledge of these fungi worldwide.

*Psilocybe subpsilocybioides* Guzmán, Lodge & Cantrell, sp. nov.

FIGS. 9–12

[*Pileus* 4–11 mm diam, convexus plano-convexus, subumbonatus vel brevi-mammilatus, rubello-brunneus, rubro-umbrinus vel cinnamomeus, hygrophanus, in statu sicco pallide brunneolus; margo integra vel appendiculata. *Lamellae* sinuatae, bruneolo-rubrae. *Stipes* 5–18  $\times$  0.5–1 mm, uniformis, obscure rubello-brunneus, squamulis albis appressisobtectis. Volva perfecta evoluta. Annulus ephemerus, squamulosus. *Sporae*  $(5\text{--})5.5\text{--}6\text{--}(6.5) \times (3.5\text{--})4\text{--}5 \times 3.5\text{--}4 \mu\text{m}$ , in aspectu frontali subrhomboideae, in obliquo subellipsoideae, pariete 0.5–1  $\mu\text{m}$  crasso, luteolo-brunneus, poro germinationis conspicuo praeditae. *Pleurocystidia*  $(13\text{--})15\text{--}20\text{--}(24) \times (6.5\text{--})7\text{--}8\text{--}(9) \mu\text{m}$ , vulga, hyalina, ventricosa vel subfusiformia, in apice lata vel acuta, interdum colo brevi atque crasso praedita. *Cheilocystidia*  $(9\text{--})11\text{--}18\text{--}(22) \times 5\text{--}$

7(–8)  $\mu\text{m}$ , hyalina, ventricosa vel subfusoida, in apice acuta vel colo brevi atque crasso praedita. *Pileipellis* hyphis prostatatis hyalinis, in strato tenui disposita. Gregaria, in virgulis vel ligno putrido in vegetatione tropica. HOLOTYPE *Cantrell PR9925* (PR-5684) CFMR. ]

*Pileus* 4–11 mm diam, hemispheric to convex or plano-convex, subumbonate or mammillate, reddish-brown, Burnt Umber or Cinnamon, hygrophanus, drying to pale brown or Tawny, radially fibrillose, margin even or appendiculate, not striate or slightly translucent-striate. *Lamellae* sinuate, Tawny to brownish-red, margin even, concolorous or whitish. *Stipe* 5–18  $\times$  0.5–1 mm, uniform, fibrillose, dark reddish-brown, covered by white appressed or recurved squamules toward the base. *Veil* well developed, as a white cottony membrane, at times forming an ephemeral and squamulose annulus, and with white mycelial pad at the base. *Context* and other tissues not caerulescent when injured. *Odor* and *taste* not recorded. *Spore print* purple brown.

*Spores* (5–)5.5–6(–6.5)  $\times$  (3.5–)4–5  $\times$  3.5–4  $\mu\text{m}$  ( $Q = 1.38$ ), subrhomboid in face view, subellipsoid in side view, thick-walled, wall 0.5–1  $\mu\text{m}$  thick, yellowish-brown, with a conspicuous germ pore. *Basidia* 14–18  $\times$  6–7  $\mu\text{m}$ , 4-sterigmate, hyaline, ventricose, with a median constriction. *Pleurocystidia* (13–)15–20(–24)  $\times$  (6.5–)7–8(–9)  $\mu\text{m}$ , hyaline, ventricose or subfusoid, with a broad or acute apex, sometimes with a short, broad, neck-like elongation. *Cheilocystidia* (9–)11–18(–22)  $\times$  5–7(–8)  $\mu\text{m}$ , hyaline, ventricose or subfusoid, with acute apex or apex becoming a short, broad, neck-like projection. *Subhymenium* subcellular, with hyaline to brownish elements 2–7  $\mu\text{m}$  wide, with encrusted brownish-yellow pigment. *Hymenophoral trama* regular, with hyaline hyphae 3–10  $\mu\text{m}$  wide or with inflated globose elements up to 36  $\mu\text{m}$  wide, with an encrusted brownish-yellow pigment. *Pileipellis* a thin layer of repent, cylindrical hyphae, 2.5–4  $\mu\text{m}$  wide, hyaline to yellowish. *Hypodermium* not well formed, with hyaline cylindrical or inflated hyphae, 3–10  $\mu\text{m}$  wide, some elements subglobose up to 24  $\mu\text{m}$  wide, with an encrusted yellowish-brown pigment. *Context* in pileus with hyaline, cylindrical or inflated hyphae, 2.5–20  $\mu\text{m}$  wide. *Clamp connections* common.

*Habitat and distribution.* Gregarious on twigs or rotten wood, in tropical vegetation. Known only from Puerto Rico.

*Material examined.* PUERTO RICO, Mun. Naguabo, Luquillo Mountains, Río Icacos to Río Prieto Dam, 7 Jul 1999, *Cantrell, Clum & Estrada*, ledger Cantrell PR9918 (PR-5515, CFMR, UPRRP and ZT). Mun. Río Grande, Luquillo Mountains, El Cacique area, Palo Hueco, 2 Jul 1999, *Cantrell & Laboy*, led-

ger Cantrell PR9925 (HOLOTYPE PR-5684, CFMR, ISOTYPE XAL).

*Discussion.* This species is best placed in section *Psilocybe* (Guzmán 1983) due to the subrhomboid thick-walled spores and the non-bluing basidiomata. The presence of pleurocystidia and the well-developed veil make this taxon unique and easily identified in this section because no other species has this combination of characters. The presence of pleurocystidia suggests affinities with the section *Singerianae* (Guzmán 1983), but members of that section have thin-walled ellipsoid basidiospores. *Psilocybe subspsilocybioides* does not appear to be phenetically similar to any members in section *Singerianae*.

*Psilocybe zapotecantillarum* Guzmán, T. J. Baroni & Lodge, sp. nov. FIGS. 13–16

[*Pileus* 13–33 mm diam, conicus vel campanulatus, umbonatus, papillatus, rubro-umbrinus vel umbrinus vel fusco-brunneus, hygrophanus, irregulariter colore caeruleo vel rubello-brunneo vel subfusco vel rubrescenti tinctus. *Lamellae* adnexae, pallide brunneae vel obscure rubello-brunneae ad marginem albescentes vel concolores. *Stipes* 15–35  $\times$  1.5–3 mm, uniformis vel subbulbous, albescens vel pallide brunneolus vel obscure rubello-brunneus, irregulariter colore caeruleo vel subfusco vel rubrescenti tinctus. Omnes partes caerulescentes. *Sporae* (5–)6–7(–9)  $\times$  (3–)4–4.5(–5)  $\times$  3–3.5  $\mu\text{m}$ , in aspectu frontali atque obliquo subellipsoideae, tenuitunicatae, luteolo-brunneae, poro germinationis lato praeditae. *Pleurocystidia* (11–)13–20(–22)  $\times$  (3–)4–5(–6)  $\mu\text{m}$ , vulga, hyalina, ventricosa vel subventricosa, colo brevi vel longo flexuoso praedita. *Cheilocystidia* (14–)16–40(–64)  $\times$  (4–)5–7(–10)  $\mu\text{m}$ , vulga, hyalina, valde versiformia, ventricosa vel subcylindrica, saepe irregulariter lobulata, in apice lata vel acuta vel colo brevi vel longo praedita. *Pileipellis* stratum subgelatinosum formans, hyphis prostatatis praedita. HOLOTYPE *Cantrell & Salgado* (PR-6167) CFMR. ]

*Pileus* 13–33 mm diam, conic or campanulate, umbonate, papillate, smooth, Burnt Umber or Raw Umber or dark brownish-red, hygrophanus, drying to Tawny, with irregular blue and reddish-brown staining or with reddish fuscous hues, margin not striate or translucent-striate. *Lamellae* adnexed, light brown to dark reddish-brown or Dark Violaceous Brown, edges even or serrate, concolorous or whitish. *Stipe* 15–35  $\times$  1.5–3 mm, equal or with a subbulbous base, smooth or pruinose, whitish to light brown or dark reddish brown, with irregular dark blue or dark reddish stains, hollow, base inserted. *Context* whitish in pileus, brownish in stipe, caerulescent in all parts. *Odor* and *taste* fungoid or radish-like, or somewhat farinaceous.

*Spores* (5–)6–7(–9)  $\times$  (3–)4–4.5(–5)  $\times$  3–3.5  $\mu\text{m}$  ( $Q = 1.63$ ), subellipsoid, both in face and side view, thin-walled, up to 0.4  $\mu\text{m}$  thick, yellowish-brown, with a broad germ pore. *Basidia* 16–27  $\times$  5–6.5  $\mu\text{m}$ , 2- or 4-sterigmate, hyaline, ventricose, frequently with a

median constriction, sterigmata 0.8–1.6  $\mu\text{m}$  long. *Pleurocystidia* (11–)13–20(–22)  $\times$  (3–)4–5(–6)  $\mu\text{m}$ , hyaline, ventricose or subventricose, with a short or long flexuous neck. *Cheilocystidia* (14–)16–40(–64)  $\times$  (4–)5–7(–10)  $\mu\text{m}$ , hyaline, strongly versiform, subventricose or subcylindric, irregularly lobed, apex broad or acute, short or long. *Subhymenium* subcellular, with hyaline elements, 2.5–8  $\mu\text{m}$  wide, thin-walled, with encrusted yellowish brown pigment. *Hymenophoral trama* regular, with cylindric or inflated, hyaline hyphae, 2–24  $\mu\text{m}$  wide, with encrusted yellowish-brown pigment. *Pileipellis* a subgelatinous layer about 50  $\mu\text{m}$  thick, composed of hyaline to yellowish, thin-walled, repent cylindrical hyphae, 1.5–5.5  $\mu\text{m}$  wide. *Hypodermium* with hyaline, slightly inflated hyphae, 3–16  $\mu\text{m}$  wide, strongly encrusted with a sordid yellowish pigment. *Context* with hyaline, cylindric or inflated hyphae, 2.5–16  $\mu\text{m}$  wide. *Clamp connections* common.

*Habitat and distribution.* Gregarious on bare or mossy soil, in tropical forests. Known only from Puerto Rico.

*Material examined.* PUERTO RICO, Mun. Río Grande, Luquillo Mountains, La Mina Recreation Area, Caimitillo Trail, 11 Jun 1997, coll. *Baroni*, ledger Nieves-Rivera PR-797 (PR-4401, NY); 23 May 2000, *Cantrell & Salgado* (HOLOTYPE PR-6167, CFMR, ISOTYPE XAL); Baño de Oro Trail, 7 Oct 2000, *Lodge & Pérez* (PR-6269, UPRRP, CFMR and XAL).

*Discussion.* *Psilocybe zapotecoantillarum* belongs to section *Zapotecorum* because of the caeruleous nature of fresh basidiomata and thin-walled subellipsoid spores. *Psilocybe zapotecorum* Heim emend. Guzmán (Guzmán 1983) differs most noticeably from *P. zapotecoantillarum* because of differences in the size and form of the pleurocystidia, which are longer and broader (20–38  $\times$  5.5–14  $\mu\text{m}$ ) and of different morphologies (ventricose, fusoid-clavate, submucronate or pyriform). The form of the cheilocystidia in *P. zapotecorum* is also quite different (ventricose, fusoid-pyriform, ventricose-rosatrate or lageniform) (Guzmán 1983).

Other taxa that should be compared with *P. zapotecoantillarum* are *Psilocybe angustipleurocystidiata* Guzmán and *P. sanctorum* Guzmán. These species differ from *P. zapotecoantillarum* in the size of the cheilocystidia, (10–)13–24  $\times$  (2.5–)5–6.5(–8)  $\mu\text{m}$  and 13.5–29  $\times$  6–17  $\mu\text{m}$ , respectively. *Psilocybe subzapotecorum* Guzmán has two types of pleurocystidia (Guzmán 2000) and *P. barrerae* Cifuentes & Guzmán emend. Guzmán has broader pleurocystidia, (6–)7–10(–12)  $\mu\text{m}$  (Guzmán et al 1999, Guzmán 2000). *Psilocybe heliconiae* Guzmán, Saldarriaga, Pineda, García & Velázquez from Colombia (Guzmán et al 1994) dif-

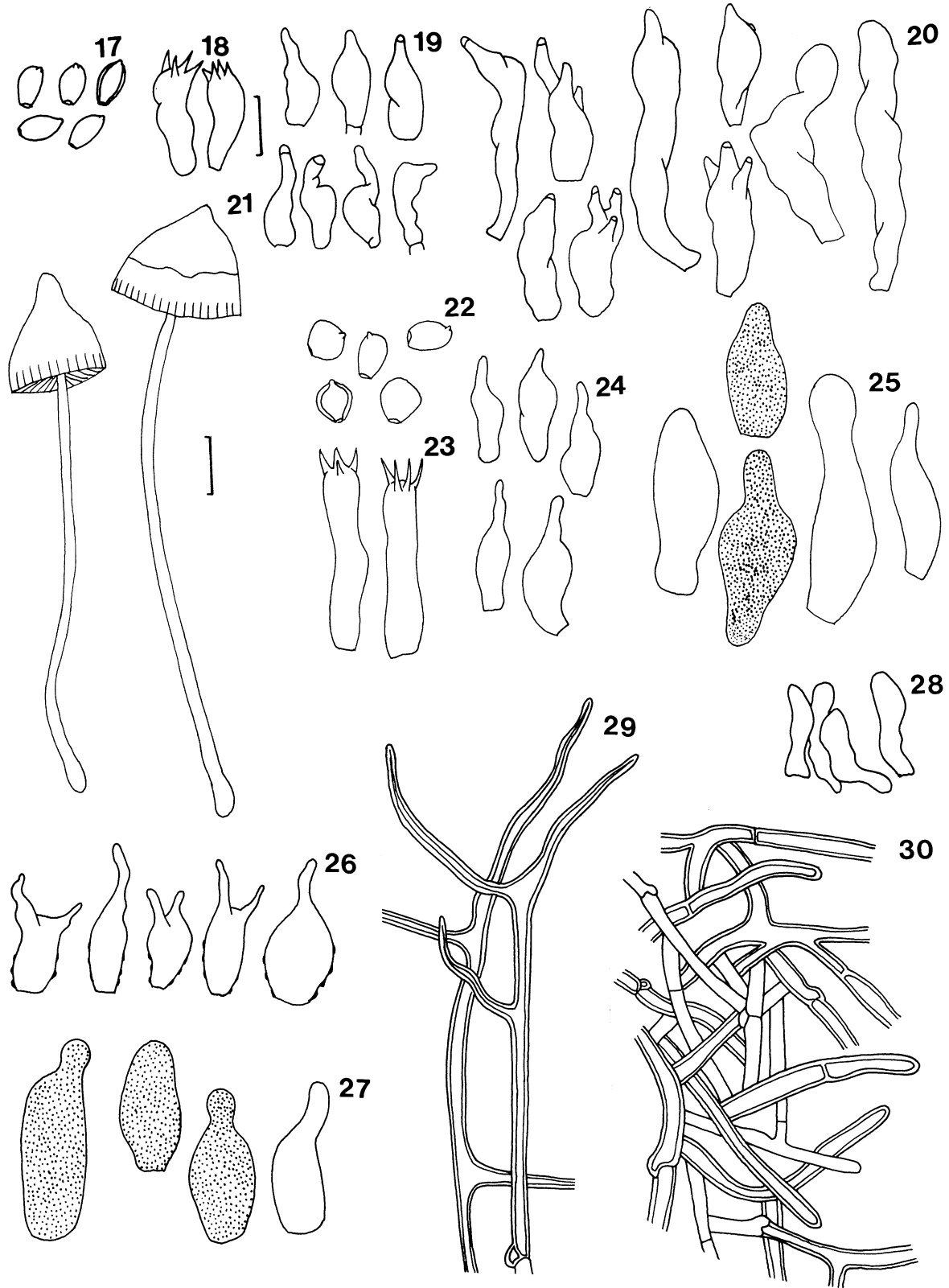
fers in the cheilocystidia, which are only up to 24  $\mu\text{m}$  long and rarely sublageniform, ventricose-fusoid to submoniliform.

*Psilocybe zapotecocaribaea* Guzmán, Ramírez-Guillén & T. J. Baroni, sp. nov. FIGS. 17–20

[*Pileus* 5–20 mm diametro, convexus vel umbonatus vel campanulato-mammillatus, laevis, ad marginem translucenter striatus, obscure rubro-umbrinus vel umbrinus, ad umbonem castaneus, hygrophanus; specimina sicca pallide cinnamomea. *Lamellae* adnexae vel fere liberae, brunneolae vel obscure violaceo-brunneae, ad marginem concolores vel albescentes. *Stipes* 15–65  $\times$  1.5–7 mm, prope basem vel amplificatus vel angustatus, argillaceus vel obscure umbrinus, squamis albescentibus floccosis vestitus, ubi vulneratus cyanescens. *Sporae* (5–)5.5–6.5(–7)  $\times$  3.5–4  $\times$  3–3.5  $\mu\text{m}$ , aspectu frontali atque ex obliquo subellipsoideae, parietibus tenuibus, luteolo-brunneae, poro germinationis angusto. *Pleurocystidia* (11–)12–16(–17.5)  $\times$  (3.5–)4–5.5  $\mu\text{m}$ , sparsa, hyalina, subventricosa vel subfusoidae, colo curto vel longo angusto. *Cheilocystidia* (12–)14–36(–40)  $\times$  (4–)5–7.5(–9)  $\mu\text{m}$ , vulgaria, hyalina, subventricosa, alia capitulo alia acuta colo curto vel moderate longo praedita, saepe irregulariter ramosa. *Pileipellis* parum evoluta, stratum tenue subgelatinosum ex hyphis hyalinis repentibus compositum. Fibulae vulgares. HOLOTYPE *Fiard 318* (K(M) 84366).]

*Pileus* 5–20 mm diam, convex to umbonate or campanulate-mammillate, smooth, dry, margin translucent-striate, some undulating when mature, surface dull Burnt Umber to Raw Umber, with a Chestnut umbo, hygrophamous, drying to Rufous, Tawny or Clay, in dry specimens pale or dark cinnamon brown, with a darker umbo. *Lamellae* adnexed to slightly free, light brown or Clay, edge even, concolorous, in dry specimens the lamellae are Dark Violaceous Brown with whitish edges. *Stipe* 15–65  $\times$  1.5–7 mm, equal to flared or tapered at base, Clay, light brown or dull Raw Umber, covered by whitish floccose scales, smooth or fibrillose, staining blue when handled, in dry specimens becoming reddish-brown, with blackish or dark reddish-brown spots. *Odor* of radish. *Taste* fungoid.

*Spores* (5–)5.5–6.5(–7)  $\times$  3.5–4  $\times$  3–3.5  $\mu\text{m}$  (Q = 1.60), subellipsoid, both in face and side view, thin-walled, yellowish-brown, with a narrow germ pore. *Basidia* (13–)14.5–17.5  $\times$  5–5.5  $\mu\text{m}$ , 4-sterigmate, hyaline, ventricose, with a median constriction. *Pleurocystidia* (11–)12–16(–17.5)  $\times$  (3.5–)4–5.5  $\mu\text{m}$ , uncommon, hyaline, subventricose or subfusoid, with a short or long narrow neck. *Cheilocystidia* (12–)14–36(–40)  $\times$  (4–)5–7.5(–9)  $\mu\text{m}$ , hyaline, subventricose or sublageniform, with an acute apex or a short or long neck, frequently irregularly branched, or some irregularly globose. *Subhymenium* subcellular, with elements 2.5–7  $\mu\text{m}$  wide, thin-walled, with encrusting pale brownish pigment. *Hymenophoral trama* regular, hyaline to yellowish, cylindrical or more frequently



FIGS. 17–30. Microscopic characters of *Psilocybe* species. Figs. 17–20. *P. zapotecocaribaea*. 17. Spores. 18. Basidia. 19. Pleurocystidia. 20. Cheilocystidia (all from Holotype). Figs. 21–30. *P. guilartensis*. 21. Basidiomata. 22. Spores. 23. Basidia. 24. Pleurocystidia type A. 25. Pleurocystidia type B. 26. Cheilocystidia type A. 27. Cheilocystidia type B. 28. Pileocystidia. 29. Setaceous hyphae at stipe base. 30. Hyphae from mycelial pad. (Figs. 21–26 from PR-4400; Figs. 27–28 from PR-6166; Fig. 29 from Holotype; Fig. 30 from PR-6171). Scale bars: 21 = 5 mm, all others = 8  $\mu$ m.

subglobose hyphae, 2–20  $\mu\text{m}$  diam, thin- to thick-walled, walls up to 1.5  $\mu\text{m}$  thick. *Pileipellis* poorly developed, with a subgelatinized layer of hyaline to yellowish, repent cylindrical hyphae, 1.5–4  $\mu\text{m}$  wide. *Hypodermium* with subglobose, hyaline elements, 2.5–18(–20)  $\mu\text{m}$  diam, thin-walled, with a pale brown encrusting pigment. *Context* with cylindrical to inflated elements, 2–20  $\mu\text{m}$  wide hyaline to pale yellowish. *Clamp connections* common.

*Habitat and distribution.* Gregarious or caespitose on soil in tropical forests. Known only from the type locality.

*Material examined.* MARTINIQUE, Lorrain River, 100 m altitude, 1 Jun 1975, *Fiard 318* (HOLOTYPE K(M) 84366, as *P. yungensis* by Pegler).

*Discussion.* *Psilocybe zapotecocaribaea* belongs to section *Zapotecorum* because of the subellipsoid, thin-walled spores and bluing stipe tissues of the basidiomata. This collection originally was studied and considered by Pegler (1983) to be *P. yungensis* Singer & A. H. Smith. However *P. yungensis* has distinctly rhomboid or subrhomboid, thick-walled basidiospores and belongs in section *Cordisporae*.

*Psilocybe zapotecocaribea* is somewhat similar to *P. zapotecoantillarum* but differs by the cheilocystidia that are not branched and rarely lageniform in *P. zapotecoantillarum*. *P. zapotecocaribaea* also has white floccose scales covering the stipe, which are lacking in *P. zapotecoantillarum*.

*Psilocybe zapotecocaribaea* also should be compared to *P. ramulosum* (Guzmán & Bononi) Guzmán. *Psilocybe ramulosum* differs from *P. zapotecocaribaea* in highly branched cheilocystidia and pleurocystidia that are longer than found in *P. zapotecocaribaea* (15–35(–45)  $\mu\text{m}$  long; Guzmán 1995).

#### EMENDATION OF *P. GUILARTENSIS*

An emendation of *P. guilartensis* is presented because morphological features that were not presented in the original protolog of this species (Guzmán et al 1997) have been discovered. Additional taxonomic features include a setaceous and tomentose, mustard-yellow surface coating on the lower part of the stipe, presence of two types of pleuro- and cheilocystidia, cheilocystidia with irregular encrustations at the base, and an occasional odor of mustard.

*Psilocybe guilartensis* Guzmán, Tapia & Nieves-Rivera, *Mycotaxon* 63:378. 1997.

**emend.** Guzmán FIGS. 21–30

[*Pileus* (5–)15–20(–30) mm diam, conic to campanulate, subumbonate or papillate, becoming plano-convex, umbonate or papillate, smooth or subrimose, moist, violet brown (11F4-6) to dark chocolate brown (6F4), hygrophanous, drying at times to Tawny brown, margin translucent-striate

and/or sulcate-striate. *Lamellae* adnexed, whitish to smoke gray (3C2) at first, finally fuscous, dark purplish (14F4-6) or chocolate brown (6F4), edges concolorous, even to subfimbriate. *Stipe* (22–)35–60(–80)  $\times$  1–1.5(–2) mm broad, hollow, white or straw colored at first or concolorous with pileus above; equal with a subbulbous base, inserted to one-third or one-half length, smooth or irregular, appressed squamulose toward the base; base with a tomentose mustard-yellow coating. *Context* whitish in the pileus, becoming brownish in the stipe. All parts caerulescent when cut or bruised, staining blue-green to blackish. *Odor* and *taste* farinaceous or of mustard, although sometimes very slightly so. *Spore print* Dark Violaceous Brown.]

*Spores* (5–)5.5–6.5(–7.5)  $\times$  (4.5–)5–5.5(–7)  $\times$  4–5  $\mu\text{m}$  ( $Q = 1.11$ ), subrhomboid or subglobose in face view, subellipsoid in side view, thick-walled, up to 1  $\mu\text{m}$  thick, brownish-yellow, with a conspicuous pore, 0.8–1  $\mu\text{m}$  wide. *Basidia* 20–32  $\times$  (4–)5–7  $\mu\text{m}$ , 4-sterigmate, hyaline, ventricose or subcylindric, with a median constriction. *Pleurocystidia* of two types, type “A” (9–)13–20(–28)  $\times$  3–5(–9)  $\mu\text{m}$ , common but difficult to find, hyaline, ventricose, submucronate or sublageniform, with a regular or irregular short or long neck; type “B” (12–)16–28(–40)  $\times$  (5.5–)7–10(–14)  $\mu\text{m}$ , common and easily seen, dark brown or grayish opaque, rarely hyaline, ventricose, subfusoid or bowl-shaped, with a subglobose head, with or without a neck. *Cheilocystidia* of two types, type “A” (12–)14–26(–30)  $\times$  (4–)6–8(–12)  $\mu\text{m}$ , common but difficult to find, hyaline, yellowish or grayish opaque, smooth or with irregular encrusted walls toward the base, lageniform, ventricose-rostrate, or occasionally with swollen base and bifurcate branched rostrate apices; type “B” (12–)18–28(–34)  $\times$  (5–)6–9(–12)  $\mu\text{m}$ , common and easily seen, colors and shapes similar to pleurocystidia type “B”. *Subhymenium* poorly developed, subcellular, hyaline or brownish, with elements 3–10  $\mu\text{m}$  wide. *Hymenophoral trama* regular, with hyaline to yellowish or brownish cylindrical or inflated hyphae, 2.5–8  $\mu\text{m}$  wide or 8–30  $\mu\text{m}$  wide, both thick-walled, up to 2  $\mu\text{m}$  thick, with brown encrustations. *Pileipellis* a thin layer of subgelatinized, repent, hyaline or brownish cylindrical hyphae, 1.5–2  $\mu\text{m}$  wide, rarely with hyaline cylindrical or subclavate pileocystidia, these erect, single or in scattered clusters. *Hypodermium* with hyaline to pale yellowish cylindrical or inflated hyphae, 3–9  $\mu\text{m}$  wide, thin-walled, frequently encrusted with brown pigment. *Context* in pileus and stipe with both hyaline, cylindrical hyphae, 2–4  $\mu\text{m}$  diam, and buff-yellow or brownish, globose elements, which are up to 27  $\mu\text{m}$  wide. *Basal mycelioid covering* formed of branching setaceous cylindrical hyphae, up to 70  $\mu\text{m}$  long and 1–4(–5)  $\mu\text{m}$  broad, thick-walled, walls up to 1.5  $\mu\text{m}$  thick, dark yellow brown, arising from hyaline cylin-

dricl clamped hyphae, that are thin- or thick-walled and 1.5–4(–5)  $\mu\text{m}$  wide. *Clamp connections* common.

*Habitat and distribution.* Gregarious on bare clay, covered with mosses, mainly on landslide slopes, in tropical and subtropical forests, known only in Puerto Rico and Dominican Republic.

*Material examined.* PUERTO RICO, Mun. Adjuntas, Guilarte State Forest, trail to Monte Guilarte Peak, Sep 1994, *Nieves-Rivera, Santos-Flores & Betancourt*, ledger Nieves-Rivera PR-1 (HOLOTYPE MAPR; ISOTYPE XAL). Mun. Villalba, Toro Negro State Forest, trail to Tower 3, Oct 1994, *Nieves-Rivera, Santos-Flores & Betancourt* (MAPR; NY as *P. plutonia*). Mun. Río Grande, Luquillo Mountains, El Verde Research Area, 18 Sep 1999, *Rosa & Prieto* (PR-3539); *Carrasquillo* (PR-3537); 19 Feb 1998, *Laboy* (PR-4862). Caribbean National Forest, Sabana, 3 Jun 1998, *Baroni 8744* (CORT); El Yunque, Caimitillo Trail, 29 Jun 1991, *Baroni 7983* (CORT); El Verde, 19 Jun 1996, *Baroni 7900* (CORT). La Mina Research Area, La Coca Trail, 25 Jun 1997, *Llorens, Bonilla & Cantrell* (PR-4834); 23 May 2000, *Cantrell & Salgado*, ledger *Cantrell PR-0019* (PR-6166); 26 Nov 1999, *Salgado & Argüello-López* (PR-5922). Caimitillo Trail, 6 Jun 1997, *Llorens* (PR-4325); *Nieves-Rivera, Llorens & Serrano* (PR-4392); 19 Jun 1997, *Nieves-Rivera, Llorens & Serrano* (PR-4393); *Nieves-Rivera, Llorens, Serrano & Bonilla*, ledger *Nieves-Rivera PR-791* (PR-4394); 11 Jul 1997, *Baroni*, ledger *Nieves-Rivera 796* (PR-4400). Mount Britton Trail, 15 Jul 1997, *Llorens & Rodríguez* (PR-4835). El Toro Trail, 2 Jul 1997, *Cantrell, Nieves-Rivera, Serrano & Llorens* (PR-4840). Mun. Luquillo, Luquillo Mountains, Bisley Watersheds, trail to tower, 6 Jun 1997, *Lodge* (PR-4399); 26 Jun 1997, *Llorens* (PR-4841). Palo Hueco, El Cacique Area, 10 Jul 1998, *Cantrell, Laboy & Negrón*, ledger *Cantrell PR-9869* (PR-4882); 2 Jul 1999, *Cantrell & Laboy* (PR-5680). DOMINICAN REPUBLIC, Prov. Santiago, Los Montones Convention Center, altitude 800 m, 27 Nov 1999, *Baroni 9028* (DR-1064).

*Discussion.* The discovery that all collections of *P. guilartensis* have setaceous hyphae at the base of the stipe is a significant addition to the circumscription of this taxon and provides a very helpful character in distinguishing this species. The distinctive pleuro- and cheilocystidia also are important characters that help to define *P. guilartensis*. *P. guilartensis* is the most common species of *Psilocybe* collected in Puerto Rico, as evidenced by the numerous collections documenting its abundance. It tends to fruit on bare clay along hiking trails where disturbance has occurred. Its relative abundance might be the result of being collected in readily accessible areas.

The record from the Dominican Republic is the first report of this species from the island of Hispan-

iola, although this collection (*Baroni 9028*) lacks the yellowish or grayish opaque pleurocystidia and the brownish or grayish opaque cheilocystidia that are typical of *P. guilartensis*. However, the presence of the highly distinctive setaceous hyphae at the base of the stipe indicates this collection has strong phenotypic affinities with *P. guilartensis*. The lack of pigments in the hymenial cystidia might be due to the immaturity of the specimens that make up this collection. For now, based on macromorphology, basidiospore morphology and setaceous hyphae at the base of the stipe, we consider this collection as conspecific with *P. guilartensis*.

As pointed out by Guzmán et al (1997) *P. guilartensis* belongs in section *Brunneocystidiatae* because of the pigmented hymenial cystidia, thick-walled rhomboid or subrhomboid basidiospores that are less than 8  $\mu\text{m}$  long and bluing of the basidiomata when injured. The setaceous hyphae at the base of the stipe, the two distinct types of pleuro- and cheilocystidia, especially the hyaline inflated cheilocystidia with encrusted bases and bifurcate branched apices, are features that clearly separate *P. guilartensis* from the similar *P. pleurocystidiosa* Guzmán (Guzmán 1983).

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