

## Further studies on *Psilocybe* from the Caribbean, Central America and South America, with descriptions of new species and remarks to new records.

Gastón Guzmán<sup>1\*</sup>, Egon Horak<sup>2</sup>, Roy Halling<sup>3</sup>,  
Florencia Ramírez-Guillén<sup>1</sup>

<sup>1</sup> Instituto de Ecología, Apartado Postal 63, Xalapa 91000, Mexico.

<sup>2</sup> Nikodemweg 5, AT-6020 Innsbruck, Austria.

<sup>3</sup> New York Botanical Garden, New York, Bronx, NY 10458-5126, USA.leiferous

Guzmán G., Horak E., Halling R. & Ramírez-Guillén F. (2009). Further studies on *Psilocybe* from the Caribbean, Central America and South America, with descriptions of new species and remarks to new records. – *Sydowia* 61 (2): 215–242.

Seven new species of *Psilocybe* (*P. bipleurocystidiata*, *P. multicellularis*, *P. neoaxalapensis*, *P. rolfsingeri*, *P. subannulata*, *P. subovoideocystidiata* and *P. tenuitunicata*) are described and illustrated. Included are also discussion and remarks referring to new records of the following taxa: *P. egonii*, *P. fagicola*, *P. montana*, *P. muscorum*, *P. plutonia*, *P. squamosa*, *P. subhoogshagenii*, *P. subzapotecorum*, *P. wrightii*, *P. yungensis* and *P. zapotecoantillarum*. Thirteen of the enumerated species are hallucinogenic.

Key words: Basidiomycotina, Strophariaceae, Agaricales, bluing, not bluing.

In spite of numerous studies on the genus *Psilocybe* in the Caribbean, Central America and South America (Singer & Smith 1958; Singer 1969, 1977, 1989; Guzmán 1978, 1983, 1995; Pulido 1983, Sáenz & al. 1983; Guzmán & al. 1984, 1994, 2003, 2004a, 2004b, 2005; Yokoyama 1987; Stijve & de Meijer 1993; Mata 1999; Halling & Mueller 2005; Da Silva & al. 2006, 2007), there are still new species, new records or new taxonomic or nomenclatural observations to propose and to discuss. This data are an example to emphasize the complexity and diversity of the genus *Psilocybe* in the region which obviously is still under explored. If 50 species of bluing *Psilocybe* are recorded alone from Mexico, and no more than 50 both in the Caribbean, in Central America and in South America (Guzmán 2005), it is very likely that the actual number of taxa in this ecologically much diverse area must be considerably higher. The present contribution proposes seven new species and discusses eleven new and so far unpublished records of *Psilocybe*. This paper is in anticipation of the second edition of world monograph “The Genus *Psilocybe*” that is at present in preparation by the senior author.

\* Corresponding author [gaston.guzman@inecol.edu.mx](mailto:gaston.guzman@inecol.edu.mx)

## Materials and methods

The specimens examined are deposited in the Herbaria BAFC, F, INPA, K, MICH, NY, QCNE, WU, XAL and ZT. Several collections were gathered by R.Singer and others were collected by R.Halling and E.Horak. The majority of drawings are from F.Ramírez-Guillén and G.Guzmán, with the assistance of E.Saavedra, E.Gándara, V.Ramírez-Cruz and R.Castillo Del Moral. There are also figures that were copied from Singer's and Horak's original drawings appended to herbarium sheets. Microscopic observations were made from hand sections of dry herbarium specimens, mounted in 5 % KOH or 5 % NH<sub>4</sub>OH with or without 1 % Congo Red solution on a microscope slide. The stain was necessary to view hyaline structures. Without exceptions, all sections were previously treated with 96 % alcohol for rehydration. Spore dimensions refer to length and width (both in face and side view).

## Taxonomy

1. *Psilocybe bipleurocystidiata* E.Horak & Guzmán, **sp. nov.** – Plate 1. Figs. 1–7.

Mycobank no.: 515516

Pileus 15–35 mm latus, convexus vel subumbonatus, subviscidus, hygrophanus, rufobrunneus vel umbrinus. Lamellae adnexae, umbri-nae, albomarginatae. Stipes 30–80 × 2–3 mm, subbulbous, rufobrunneus vel subfuscus, appresse albosquamosus. Sporae (6–) 6.5–7 (–8) × 5.5–7 × (4.5–) 5.5–6 μm, frontaliter rhomboideae, lateraliter subellipsoideae. Pleurocystidia rostratoventricosa vel sublageniformia, griseola, biformia: 14–17 (–22) × 4.5–6 (–7) μm vel 25–35 × (7–) 8–10 μm. Cheilocystidia (18–) 21–30 × 5–8 μm, sublageniformia. Pileipellis ex hyphis gelatinosis ixocutem formantibus. Fibulae praesentes. Ad terram in silva subtropicalis. Costa Rica, R.Singer B-14484 (holotypus, F-1114295).

Pileus 15–35 mm diam., convex to subumbonate, subviscid, smooth to slightly striate at the margin, hygrophanous, reddish brown or chocolate brown to yellowish brown when dry. – Lamellae adnexed, chocolate brown, with whitish edges. – Stipe 30–80 × 2–3 mm, subbulbous, dark reddish brown, with whitish appressed small scales. – Mycelium at the base of the stipe white to yellowish. – Veil not observed. – Odor and Taste not recorded. – Spore print not obtained.

Basidiospores (6–) 6.5–7 (–8) × 5.5–7 × (4.5–) 5.5–6 μm, rhomboid in face-view, subellipsoid in side-view, thick-walled, wall up to 1 μm thick, yellowish brown, with a broad germ pore in one end and a short hilar appendage on the other. – Basidia 20–25 × 6–7 μm, 4-spored, ventricose. – Pleurocystidia grayish, ventricose-rostrate,

with a short or long neck, or sublageniform, two different shapes are observed viz. A: 14–17 (–22) × 4.5–6 (–7) µm, and B: 25–35 × (7–) 8–10 µm. – Cheilocystidia (18–) 21–30 × 5–8 µm, hyaline, sublageniform, some irregularly branched. – Hymenophoral trama regular, with hyphae 4–15 µm wide, hyaline or yellowish brown, thin- or thick-walled, wall up to 1 µm thick. – Oleiferous hyphae present, 3–4 µm wide, yellowish brown or reddish yellow. – Pileipellis as an ixocutis, up to 45 µm thick, with hyaline hyphae, 3–5 µm wide. – Context of stipe composed of hyaline to reddish-brown hyphae, 5–10 µm wide, thick-walled, wall up to 1 µm thick. – Caulocystidia 20–39 × (4–) 6–10 µm, hyaline to grayish, ventricose-sublageniform, sometimes with in two or more irregular necks. – Mycelium at the base of stipe with hyaline to yellowish hyphae, 2.5–5 µm wide, thin-walled, setose hyphae not observed. Caerulescent hyphae in all tissues. – Clamp connections present.

**Etymology.** – Refers to the two different shapes of pleurocystidia.

**Habitat.** – Gregarious on litter (although Singer described it from dung, but the herbarium material shows soil with mixed with organic material), in cloud forest.

**Distribution.** – Costa Rica. Known only from type locality.

**Material examined.** – COSTA RICA, Punta Arenas, Reserva Biológica del Bosque Nebuloso del Parque Monte Verde, alt. 1650 m, 25 Jul 1986, leg. R.Singer B-14484 (holotype, F-1114295 as *Psilocybe* sp.).

The two types of pleurocystidia are the main taxonomic features that distinguish this species. Although the bluing feature was not noted by the collector, this species is clearly of the caerulescent type, because bluing hyphae were observed in all parts of the basidiomes. It belongs to sect. *Cordisporae* Guzmán, following Guzmán's (1983) classification.

2. *Psilocybe multicellularis* E. Horak & Guzmán, **sp. nov.** – Plate 1. Figs. 8–11; Plate 2. Figs. 12–17.  
MycoBank no.: 515517

Pileus (6–) 10–25 mm latus, convexus vel subcampanulatus, papillatus, hygrophanus, spadiceus vel fuligineobrunneus. Lamellae adnatae, fuscae vel brunneae. Stipes 30–60 × 1.5–2.5 mm, pileo concolor vel brunneus. Sporae (4.5–) 5–6 (–7) × (4–) 5–5.5 (–6) × (3.5–) 4–4.5 µm, frontaliter rhomboideae, lateraliter subellipsoideae. Pleurocystidia 14–26 × (4–) 5–10 (–12) µm, rara. Cheilocystidia (10–) 23–40 (–60) × 4–9 (–16) µm, polymorphica. Pileipellis haud gelatinosa. Subpellis cellularis. Hyphae fibulatae. Ad terram, in silva subtropicali. Puerto Rico, El Yunque. Horak 5693 (holotypus, ZT).

Pileus (6–) 10–25 mm diam., convex to subcampanulate, with a distinctive acute-conical papilla, dry, tough, hygrophanous, date brown to darker brown, finally fuscous or soot brown, opaque, non-

striate margin. Veil remnants not observed. – Lamellae adnate, pale grey to fuscous or dark black brown, subcrenate edges concolorous. – Stipe 30–60 × 1.5–2.5 mm, cylindrical, equal, flexuous, concolorous with pileus, dark brown or blackish brown, apex pruinose, lower half densely covered with appressed, white fibrils, hollow, tough, dry. – Veil absent. – Context dark brown to date brown, tough, obscurely bluing upon exposure. – Odor not distinctive or sourish. – Taste not distinctive.

Basidiospores (4.5–) 5–6 (–7) × (4–) 5–5.5 (–6) × (3.5–) 4–4.5 µm, rhomboid or subrhomboid in face-view or subellipsoid in side-view, thick-walled, wall up to 1 µm thick, yellowish-brown, with broad germ pore. – Basidia 15–32 × 5–6 µm, 4-spored, ventricose subclavate. – Pleurocystidia 14–26 × (4–) 5–10 (–12) µm, rare, ventricose-rostrate, with a narrow or globose neck, hyaline to olivaceous fuscous or yellowish, thin-walled. – Cheilocystidia (10–) 23–40 (–60) × 4–9 (–13) µm, polymorphic, shape ranging from subventricose-rostrate (like the pleurocystidia) to subcylindric, irregularly branched at apex, hyaline. – Subhymenium with hyphae 2.5–4 µm wide, yellowish brown, thick-walled, incrustated with brownish pigment. – Hymenophoral trama regular, composed of thick-walled hyphae, 4–37 µm wide, wall up to 2 µm thick, with brown-olivaceous pigment. – Oleiferous hyphae not observed. – Pileipellis 12–15 µm thick, composed of prostrated, non-gelatinized hyphae, 1.5–5 µm wide, hyaline or strongly incrustated with brownish to dark brown pigment. – Subpellis composed of densely packed, irregular globose, thick-walled cells, 7–40 µm wide, wall up to 5 µm thick, yellowish brown, incrustated with dark brown pigment. – Caulocystidia 8–12 × 2.5–4 µm, scattered, subventricose or subcylindric, pale grayish, only observed on the lower half of the stipe. – Clamp connections present.

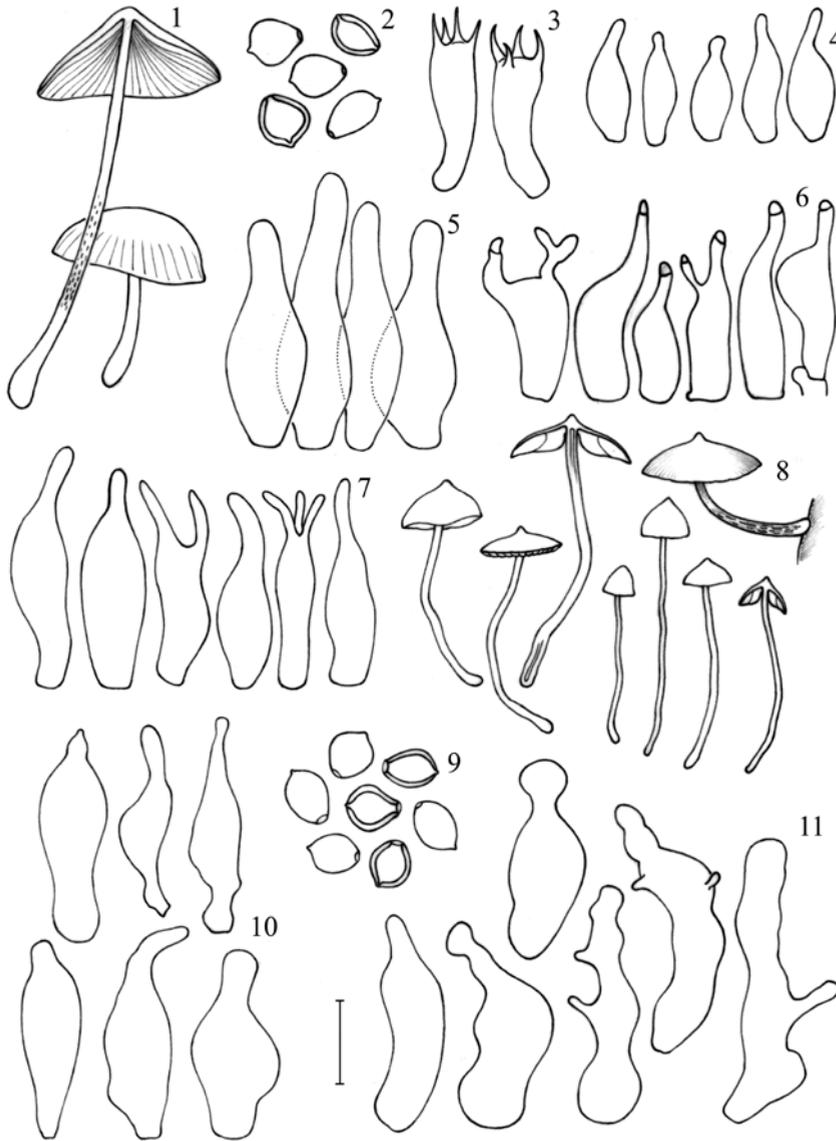
**Etymology.** – Refers to the distinctive, cellular subpellis.

**Habitat.** – Gregarious on bare soil or soil covered by mosses and *Marchantia* sp., in montane subtropical cloud forest, dominated by the palm *Prestaoa montana* (Graham) G.Nicholson, at 700– 800 m altitude.

**Distribution.** – Puerto Rico, known only from type locality.

**Material examined.** – PUERTO RICO, El Yunque, Mt Britton Trail, 21 Jun 1966, leg. E.Horak 5693 (holotype, ZT); same locality, 24 May 1997, leg. E.Horak 6169 (ZT).

This interesting species belongs to sect. *Cordisporae*, but the habit, consistency and color of the young basidiomes are similar to a taxon of *Phaeocollybia*. The thick-walled, globose cells of the subpellis are the most important taxonomic character of this species. Also the rare pleurocystidia and the polymorphic, branched cheilocystidia are distinctive features which separate this taxon from *P. plutonia*. The bluing reac-



**Plate 1. Figs. 1-11.** - 1-7: *Psilocybe bipleurocystidiata*: 1. Basidiomes (Singer's drawing). 2. Basidiospores. 3. Basidia. 4. Pleurocystidia A. 5. Pleurocystidia B. 6. Cheilocystidia. 7. Caulocystidia (all from Singer B14484, holotype). - 8-11: *Psilocybe multicellularis*: 8. Basidiomes (Horak's drawing). 9. Basidiospores. 10. Pleurocystidia. 11. Cheilocystidia. (8-11: Horak 5693, holotype). - (Scale bars: 1, 8 = 15 mm; 2-7, 9-11 = 10  $\mu$ m).

tion is often inconspicuous as it happens in other species of *Psilocybe* (e.g. *P. plutonia*, *P. mexicana*, and even in *P. semilanceata* !).

3. ***Psilocybe neoxalapensis*** Guzmán, Ram.-Gill. & Halling, nom. et sp. nov. – Plate 2. Figs. 18–21; Plate 3. Figs. 22–28.  
MycoBank no.: 511359

Synonym: *P. novoxalapensis* Guzmán & Jacobs. Journal of Microbiology (Korea) 43: 159, 2005 (nom. nud.).

Pileus (8–) 15–20 (–30) mm latus, conicus vel campanulatus, umbonatus vel papillatus, hygrophanus, fuscus, rufobrunneus, umbrinus vel subfulvus. Lamellae adnexae, brunneoviolaceae, albomarginatae. Stipes (30–) 40–50 × 1–2 (–3) mm, rufobrunneus. Pseudorhiza usque 150 mm longa. Contextus caerulescens. Sporae (3.5–) 5–6 (–7) × 4–5 × 3–4 µm, frontaliter rhomboideae, lateraliter subellipsoideae. Pleurocystidia (8–) 12–20 (–28) × (3–) 4–6 (–8) µm, rara, subventricosa vel subfusioidea, hyalina. Cheilocystidia hyalina, bimorphica: A: (11–) 15–27 (–37) × (3–) 5–7 (–9) µm, sublageniformia, saepe ramificata. B: (16–) 25–32 (–70) × (4–) 6–9 (–14) µm, subventricosa, subcylindracea vel utriformia. Pileipellis subgelatinosa. Hyphae fibulatae. Ad terram nudam, in silva subtropicali. Mexico, prope Veracruz. López 2186 (holotypus, XAL).

Pileus (8–) 15–20 (–30) mm diam, conical to campanulate, umbonate or papillate, subviscid, smooth, slightly striate at the margin when moist, irregularly wrinkled or sulcate or sublobulate in age, hygrophanous, dark reddish brown or chocolate brown, fading to brownish yellow or olivaceous brown. – Lamellae adnexed or somewhat sinuate, violaceous-brown or dark reddish-brown, mottled, entire edges whitish. – Stipe (30–) 40–50 × 1–2 (–3) mm, cylindrical, equal, flexuous, reddish-brown or orange-brown, paler at apex, subpruinose in upper half, hollow, lower half covered with small, floccose, whitish fibrils, frequently arranged in several ring-like zones, base covered with a pale mustard yellow mycelium, base elongated into distinctive pseudorhiza, up to 150 mm long, tapering, flexuous, whitish. – Veil poorly developed, as white or grayish, fugacious, cottony fibrils. – Context fleshy to tough, thin and translucent, whitish to brownish in the pileus, yellowish brown or brownish red in stipe. – Odor farinaceous. – Taste farinaceous. – Chemical reactions: KOH staining pileus and stipe black-brown. All parts except lamellae bluing or blackish. – Spore print dark violaceous brown.

Basidiospores (3.5–) 5–6 (–7) × 4–5 × 3–4 µm, rhomboid in face-view or subellipsoid in side-view, yellowish-brown, wall up to 1 µm thick, with broad germ pore. – Basidia 14–25 × 4.5–7.5 µm, 4-spored, hyaline, ventricose or subcylindric, with median constriction. – Pleurocystidia absent or rare, (8–) 12–20 (–28) × (3–) 4–6 (–8) µm, hyaline, subventricose or subfusoid, acute at apex, either with short or long neck, sometimes irregularly branched. – Cheilocystidia hyaline, two different shapes are observed viz. A: (11–) 15–27 (–37) × (3–) 5–7 (–9) µm, sublageniform with a long or short neck, sometimes irregu-

larly and strongly branched mainly at apex; B: (16–) 25–32 (–70) × (4–) 6–9 (–14) µm, subventricose-subcylindrical or narrowly utriform, apex globose, acute or submoniliform, sometimes with a blunt apex similar to leptocystidia. – Subhymenium up to 15 µm thick, subcellular, composed of hyaline cells, 3–5 µm wide, thin-walled to thick-walled, incrustated with yellow pigment. – Hymenophoral trama regular, with hyaline to yellowish, 3–20 µm wide, hyphae thin-walled. – Pileipellis a cutis composed of a thin layer of subgelatinized, repent, hyaline hyphae, 1.5–2.5 µm wide. – Subpellis subcellular, with hyaline to yellowish, composed thin-walled or thick-walled, incrustated cells, 2–10 µm wide. – Caulocystidia 11–40 × 8–14 µm, rare, hyaline, vesiculose or narrowly utriform. – Mycelium at base of stipe formed by branched setaceous hyphae, up to 90 × 3–4 µm, walls 1–1.5 µm thick, yellowish-brown, arising from hyaline, clamped hyphae. – Clamp connections present.

**Etymology.** – Refers to the new name replacing the former invalid *Psilocybe novoxalapensis*.

**Habitat.** – Solitary or scattered, on bare clay soil, in embankments, margin of trails, in subtropical or montane cloud forests.

**Distribution.** – Known from Mexico and Costa Rica.

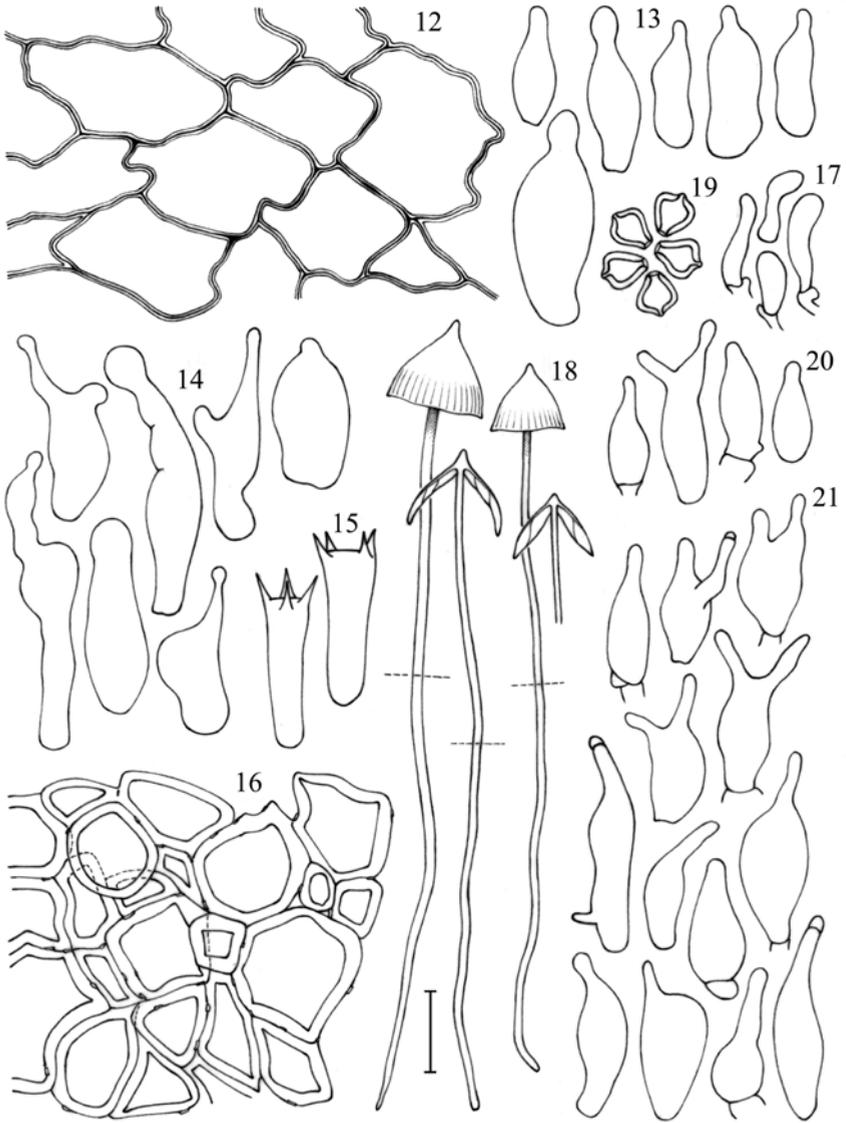
**Material examined.** – COSTA RICA, Provincia San José, Sierra de Talamanca, S. Gerardo de Dota, 5 km SW of Cerro de La Muerte, Albergue de Montaña, 10 Jun 1994, leg. G. Mueller 4695 (F-1112121); same locality, 18 Oct 1994, leg. G. Mueller 5051 (F-1112397); same locality, 21 Jun 1995, leg. G. Mueller 5189 (F-1112535); Savegre, Mirador, 20 Jun 2003, leg. E. Horak 10414 (ZT, CR 10305); La Chonta, 11 Nov 2002, leg. E. Horak 10305 (ZT). – MEXICO, Veracruz, Banderilla, Cerro La Martinica, Jul 1983, leg. López 2186 (holotype, XAL).

Due to an editorial omission, the original name of this species, *P. novoxalapensis* Guzmán & Jacobs, is invalid (nom. nud.; Guzmán & al. 2005) and therefore the new name *P. neoxalapensis* is proposed. The taxon is reported from several localities in Prov. Veracruz, Mexico. The distinctive, morphological features of this *Psilocybe*, besides its smaller, subrhomboid, thick-walled spores and its long pseudorhiza, are the presence of two types of cheilocystidia and the rare or absent pleurocystidia. *Psilocybe neoxalapensis* has bluing basidiomes and thus belongs to sect. *Cordisporae*, following Guzmán's classification (1983).

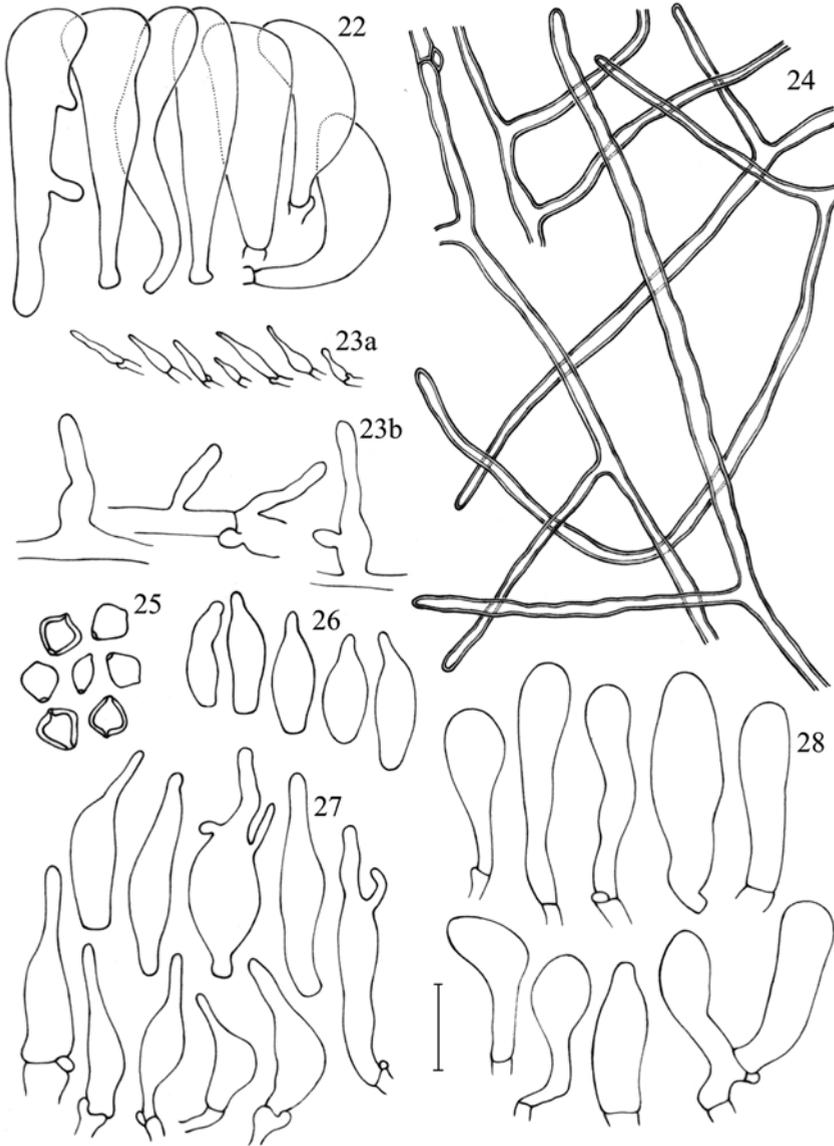
4. *Psilocybe rolfsingeri* Guzmán & Halling, **sp. nov.** – Plate 4. Figs. 29–32.

Mycobank no.: 511356

Pileus 10–14 mm latus, conicus, subcampanulatus vel subcylindricus, hygrophanus, umbrinus vel rubrobrunneus, glabrus, ad marginem substriatus. Lamellae adnexae, brunneolae vel obscure rufobrunneae, ad aciem concolores. Stipes 23–25 ×



**Plate 2. Figs. 12–21.** – 12–17: *Psilocybe multicellularis*: 12. Cells of subpellis. 13. Pleurocystidia. 14. Cheilocystidia. 15. Basidia. 16. Cells of subpellis. 17. Caulocystidia. (12: Horak 5693, holotype; 13–17: Horak 6169). – 18–21: *Psilocybe neoxalapensis*: 18. Basidiomes (Horak's drawing). 19. Basidiospores. 20. Pleurocystidia. 21. Cheilocystidia A. (18–21: Horak 10414). – (Scale bars: 12–17, 19–21 = 10  $\mu$ m; 18 = 15 mm).



**Plate 3. Figs. 22–28.** – *Psilocybe neoaxalapensis*: **22.** Cheilocystidia B, **23a,b.** Caulocystidia (**23a**, Horak's drawing). **24.** Setaceous hyphae. **25.** Basidiospores. **26.** Pleurocystidia. **27.** Cheilocystidia A. **28.** Cheilocystidia B. (22–24: Horak 10414; 25–28: Mueller 5189). – (Scale bars: 22, 23b – 28 = 10 µm; 23a = 30 µm).

2–2.5 mm, subbulbosus, albidus vel griseolus, laevis vel albidosquamulosus, basin versus vix caerulescens. Sporae (7–) 8–9 × (5–) 5.5–6 (–7) × 5–6 µm, frontaliter subrhomboideae, lateraliter subellipsoideae. Pleurocystidia 24–31 × 5–7 µm, tenuitunicata, hyalina, sublageniformia. Cheilocystidia 26–42 × 4–7 µm, hyalina, sublageniformia vel lageniformia. Hyphae fibulatae. Ad terram, in silvis subtropicalis. Costa Rica, prope Cerro de La Muerte. Singer B-14545 (holotypus, F-1114329).

Pileus 10–14 mm diam, mycenoid, conical to subcampanulate or subcylindric-subumbonate, hygrophanous, deep chocolate brown if moist, becoming tawny upon drying, but margin dark reddish brown, smooth, weakly striate at margin. – Lamellae adnexed, pale brown to dark reddish brown, entire edges concolorous. – Stipe 23–25 × 2–2.5 mm, equal but base subbulbous, whitish to grayish, smooth to fibrillose, mottled with whitish squamules, hollow, upon exposure weakly bluing at the base. – Odor and taste not recorded. – Spore print not obtained.

Basidiospores (7–) 8–9 × (5–) 5.5–6 (–7) × 5–6 µm, subrhomboid in face-view or subellipsoid in side-view, brownish yellow, with broad germ pore, walle up to 1 µm thick. – Basidia 26–30 × 7–8 µm, 4-spored or 2-spored, hyaline, ventricose or subclavate, frequently with median constriction. – Pleurocystidia 24–31 × 5–7 µm, rare, hyaline, sublageniform. – Cheilocystidia 26–42 × 4–7 µm, hyaline, sublageniform or lageniform. – Subhymenium subcellular, composed of thin-walled hyaline cells. – Hymenophoral trama regular, composed of hyaline hyphae, 5–20 µm wide, incrustated with pale orange-brown pigment. – Pileipellis an ixocutis, 40–80 µm thick, composed of cylindrical, gelatinized, hyaline hyphae, 2–4 µm wide. – Subpellis composed of hyaline hyphae, 5–15 µm wide, incrustated with pale orange-brown pigment. – Caulocystidia absent. – Hyphae of stipe 4–10 µm wide, thin-walled, incrustated with pale orange-brown pigment. – Clamp connections present.

**Etymology.**– In honor to R. Singer, for his contributions to the knowledge of *Psilocybe*.

**Habitat.** – Gregarious, on soil, in páramo near upper limit of cloud forest.

**Distribution.** – Costa Rica, known only from type locality.

**Material examined.** – COSTA RICA, San José, Cerro de La Muerte, near La Georgina, 31 Jul 1986, leg. R.Singer B-14545 (holotype, F-1114329 as *Psilocybe* sp.).

This species is close to *P. wrightii* (see below), but differs by its smaller basidiomes and the shape and size of the pleurocystidia. Both species belong to sect. *Cordisporae* by virtue of the bluing reaction upon exposure and the subrhomboid, thick-walled basidiospores.

5. *Psilocybe subannulata* E.Horak & Guzmán, **sp. nov.** – Plate 4. Figs. 33–36.

MycoBank no.: 515518

Pileus 20–25 mm latus, conicus vel campanulatus, subhygrophanus, siccs, rufo-brunneus vel fulvus. Lamellae adnatae, albidomarginatae. Stipes 20–35 × 3–4 mm, cylindricus, aequalis, pallide luteobrunneus, squamulis albidis obtectus, cyanesens basim versus. Annulus squamulosus. Caro viridicaerulea. Sporae (5.5–) 6–8 × (4.5–) 5–6 (–6.5) × 4–4.5 (–5)  $\mu\text{m}$ , rhomboideae vel subellipsoideae, crassitunicatae, brunneolae, poro germinativo instructae. Pleurocystidia nulla. Cheilocystidia 15–24 (–26) × (4.5–) 5.5–9  $\mu\text{m}$  hyalina, ventricosorostrata vel sublageniformia. Pileipellis haud gelatinosa. Fibulae praesentes. Puerto Rico, El Yunque. Horak 5691 (holotypus, ZT).

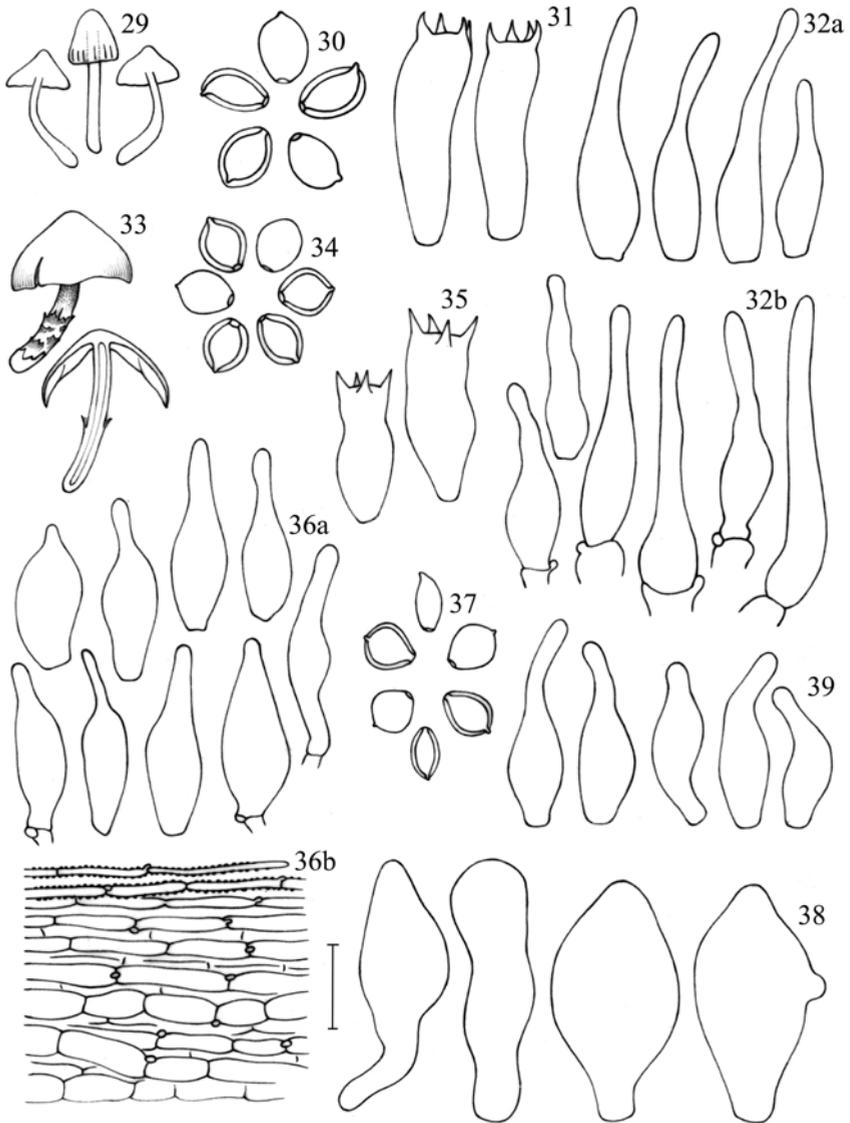
Pileus 20–25 mm diam, conical or broadly campanulate, weakly hygrophanous, reddish brown to yellowish brown when dry, glossy at margin, covered with whitish, subpersistent fibrils of veil, dry. – Lamellae adnate, whitish to argillaceous brown, subfimbriate edges whitish. – Stipe 20–35 × 3–4 mm, cylindrical, equal, pale yellowish brown, apex pruinose, lower half covered with white, appressed fibrils, bluish-greenish age or handling, hollow. – Annulus submembranaceous or squamulose, white, persistent (!). – Context subcartilagineous, brownish in pileus, pale yellowish brown in stipe, with pale green-blue tinge in base. – Odor and taste rancid or like cucumber. – Spore print not recorded.

Basidiospores (5.5–) 6–8 × (4.5–) 5–6 (–6.5) × 4–4.5 (–5)  $\mu\text{m}$ , rhomboid in face-view, subellipsoid in side-view, thick-walled, wall up 1  $\mu\text{m}$  thick, yellowish-brown, with a broad germ pore. – Basidia 16–27 × (5–) 7–8 (–9)  $\mu\text{m}$ , 4-spored, hyaline, ventricose-clavate, with a median constriction. – Pleurocystidia absent. – Cheilocystidia 15–24 (–26) × (4.5–) 5.5–9  $\mu\text{m}$ , hyaline to bluish, ventricose, with a narrow base and subacute apex or sublageniform. – Subhymenium subcellular, thin, with hyaline or yellowish elements, 2.5–4  $\mu\text{m}$ . – Hymenophoral trama regular, composed of hyaline to yellowish hyphae, 2–10  $\mu\text{m}$  wide. – Pileipellis not gelatinous, with prostrate, hyaline hyphae, 1.5–3  $\mu\text{m}$  wide, walls occasionally incrustated. – Subpellis with hyaline, yellowish or brownish hyphae, 2.5–8  $\mu\text{m}$  wide. – Oleiferous hyphae absent. – Clamp connections present.

**Etymology.** – Refers to the presence of a  $\pm$  distinctive annulus.

**Habitat.** – Subgregarious on bare soil among litter, in gullies or ravines, in subtropical cloud forest with broadleaf trees and scattered palms (*Prestoea montana*). **Distribution.** – Puerto Rico, known only from type locality.

**Material examined.** – PUERTO RICO, El Yunque, trail to Mt. Briton, 700–850 m alt., 21 Jun 1996, leg. E. Horak 5691 (holotype, ZT).



**Plate 4. Figs. 29–39.** – 29–32: *Psilocybe rolfsingeri*: 29. Basidiomes (Singer's drawing), 30. Basidiospores. 31. Basidia. 32a. Pleurocystidia. 32b. Cheilocystidia. (all from Singer B14545). – 33–36: *Psilocybe subannulata*: 33. Basidiomes (Horak's drawing). 34. Basidiospores. 35. Basidia. 36a. Cheilocystidia. 36b. Pileipellis (Horak's drawing). (all from Horak 5691, holotype). – 37–39: *Psilocybe subovoideocystidiata*: 37. Basidiospores. 38. Pleurocystidia. 39. Cheilocystidia. (37–39: Singer B10762, holotype). – (Scale bars: 29, 33 = 15 mm; 30–32, 34–36a, 37–39 = 10  $\mu$ m; 36b = 30  $\mu$ m).

Because of the rhombic basidiospores and bluing reaction upon exposure this species belongs to sect. *Cordisporae*. It is remarkable that in this section (Guzmán, 1983, 1995) subannulate veil remnants on the stipe are rarely observed and accordingly this feature represents an useful taxonomic character.

6. *Psilocybe subovoideocystidiata* Guzmán & E.Horak, sp. nov. – Plate 4. Figs. 37–39; Plate 5. Figs. 40–44.  
Mycobank no.:

Pileus circa 10 mm latus, conicus, hygrophanus, rufobrunneus. Lamellae adnatae, violaceobrunneae. Stipes circa 35 × 1 mm, aequalis, rufobrunneus, squamulis albofibrillos obtectus, ad basim caerulecens. Sporae (4.5–) 5–6 (–7) × (3.5–) 4–5 (–6) × 3.5–4 (–4.5) µm, rhomboideae vel subellipsoideae, brunneolus, crassitunicatae, poro germinativo lato instructae. Pleurocystidia (20–) 24–32 × 10–15 (–17) µm, hyalina, ventricosoglobosa vel submoniliformia. Cheilocystidia (10–) 15–20 (–24) × 4–5 (–7) µm, hyalina, ventricosorostrata vel sublageniformia. Pileipellis haud gelatinosa. Fibulae praesentes. Brazil, Manaus. Singer & Araujo B-10762 (holotypus, INPA 82.276 A).

Pileus about 10 mm diam., conical, smooth, hygrophanous, reddish brown to yellowish brown, dry. – Lamellae adnate, violaceous brown. – Stipe about 35 × 1 mm, cylindrical, equal, reddish-brown, covered with white, floccose scales toward the base, weakly caerulescent at base. Veil not developed. – Odor and Taste not recorded.

Basidiospores (4.5–) 5–6 (–7) × (3.5–) 4–5 (–6) × 3.5–4 (–4.5) µm, rhomboid in face-view or subellipsoid in side view, yellowish-brown, broad germ pore present, wall up to 1 µm thick. – Basidia (16–) 17–20 (–22) × 5.5–7 (–7.5) µm, 4-spored, hyaline, ventricose or ventricose-clavate, with median constriction. – Pleurocystidia (20–) 24–32 × 10–15 (–17) µm, hyaline, numerous, polymorphic, globose or ventricose-globose, but narrow at base, occasionally irregular lobate or ventricose-submoniliform. – Cheilocystidia (10–) 15–20 (–24) × 4–5 (–7) µm, hyaline, numerous, ventricose rostrate to sublageniform. – Pileipellis a cutis composed of prostrated, cylindrical, non-gelatinized hyphae. – Subpellis composed of hyaline to yellowish hyphae, up to 10 µm wide. Other microscopic features were not observed due to the rather scarce material. – Clamp connections present.

**Etymology.** – Refers to the pleurocystidia whose shape are similar to those of *Psilocybe ovoideocystidiata*.

**Habitat.** – Subgregarious on litter (rotting twigs), in tropical and subtropical cloud forest, 1000–1900 m alt.

**Distribution.** – Brazil (Amazonas, type locality) and Bolivia (Nor-Yungas).

**Material examined.** – BRAZIL, Manaus, 30 km N of city, EMBRAPA, alt. 100 m, 26 Dec 1977, leg. R.Singer & I.Araujo B-10396 (INPA 77.301 as *P. plutonia*);

same locality, 9 Feb 1978, leg. R.Singer & I.Araujo (INPA 77.302 as *P. plutonia*); same locality, 2 Mar 1978, leg. R.Singer & I.Araujo B-10762 (holotype, INPA 82.276 A, as *P. plutonia*). – BOLIVIA, Nor-Yungas, Coroico, 11 Feb 1956, alt. 1500–1900 m, leg. R.Singer B-1089 (BAFC 51476, as *P. plutonia* var. *minor*).

*Psilocybe subovoideocystidiata* belongs to sect. *Cordisporae* because of the caerulescence of the basidiomes and the rhomboid basidiospores. Due to the shape of the pleurocystidia it is reminding of *P. ovoideocystidiata* Guzmán, Gaines & Ram.-Guill. (Guzmán & al 2007) but this species (belonging to sect. *Stuntzii*) differs by its subrhomboid basidiospores and the annulus on the stipe. Originally, Singer annotated the Bolivian material of *P. subovoideocystidiata* as “*P. plutonia* var. *minor*”. The specimens gathered in Brazil (INPA) were also identified by Singer as *P. plutonia* (in sched.) but Guzmán (1983: 139, figs. 152–154) changed the identification to *P. plutonia* (see below). Taxonomically, *Psilocybe subovoideocystidiata* is closely related to *P. goniospora* (Berk. & Broome) Singer [= *P. lonchophorus* (Berk. & Broome) E.Horak ex Guzmán], only reported from Sri Lanka (Guzmán 1983, 1995). This latter species, however, is distinguished by subventricose pleurocystidia with acute apex.

**7. *Psilocybe tenuitunicata* Guzmán & Ram.-Guill., sp. nov. – Plate 5.**  
Figs. 45–48.

Mycobank no.:

A *Psilocybe truffemii* differt pleurocystidiis tenuitunicatis et cheilocystidiis minutis (23–) 25–36 × (5–) 7–10 µm. Ad terram inter *Sphagnum*. Brasil, prope Rio Grande do Sul, Taimbesinho. Singer B-104 (holotypus, MICH-00067127).

Pileus 10–20 mm diam, at first convex becoming plane, brownish to pale beige if moist, but pale orange-brown in dry specimens, weakly hygrophanous, dry, smooth over disc, sometimes striate-sulcate at margin. – Lamellae subadnate, brownish violaceous, entire edges concolorous. – Stipe 20–40 × 2–4 mm, cylindrical, equal, pale brownish to reddish orange, fibrillose, subbulbous base covered by white mycelium. Veil well developed in young stages, but absent in mature specimens. – Odor and Taste not recorded. – Spore print not recorded.

Basidiospores (7–) 8–9 × 5–6 × 5–5.5 µm, subrhomboid in face view or subellipsoid in side view, germ pore distinctive, wall up to 1 µm thick. – Basidia 18–25 (–30) × 7–8 (–10) µm, 4-spored, hyaline, subpyriform. – Pleurocystidia (30–) 40–52 × (9–) 10–16 µm, thin-walled, abundant, hyaline, clavate or narrowly clavate, apex globose or acute, thin-walled, sometimes apex covered with a hyaline gelatinous coat. – Cheilocystidia (23–) 25–36 × (5–) 7–10 µm, polymorphical, lageniform, sublageniform or subcylindrical. – Subhyemium cellular, hyaline, weakly incrustated with red-brown pigment.

– Hymenophoral trama subregular, composed of hyaline or yellowish hyphae, 2–15  $\mu\text{m}$  wide. – Pileipellis composed of prostrate, weakly gelatinized, hyaline hyphae, 7–12  $\mu\text{m}$  thick. – Subpellis composed of hyaline hyphae, 2–6  $\mu\text{m}$  wide, incrustated with brown pigment. – Clamp connections present.

**Etymology.** – Refers to the thin-walled pleurocystidia.

**Habitat.** – Solitary, on soil among *Sphagnum*.

**Distribution.** – Brazil Rio Grande do Sul). Known only from type locality.

**Material examined.** – BRAZIL, Rio Grande do Sul, Taimbesinho, 5 Nov 1951, leg. R.Singer B-104 (holotype, MICH-00067127 as *Psilocybe* sp.).

*Psilocybe tenuitunicata* is close to *P. trufemii* Guzmán & Bononi (Guzmán & al. 1984), growing on soil among grass and only recorded from the State of Sao Paulo, Brazil. The differences between the two species are the thickness of the pleurocystidial wall (thin in *P. tenuitunicata* but up to 1.5  $\mu\text{m}$  thick in *P. trufemii*) and the distinctly smaller cheilocystidia (as compared to 40–60  $\times$  11–17  $\mu\text{m}$  in *P. trufemii*, cf. isotype in XAL). Guzmán & al. (1984) and Guzmán (1995) considered *P. trufemii* belongs into sect. *Singerianae*. However, because the basidiospores of both species are subrhomboid and thick-walled, the two taxa are better accommodated in sect. *Psilocybe*.

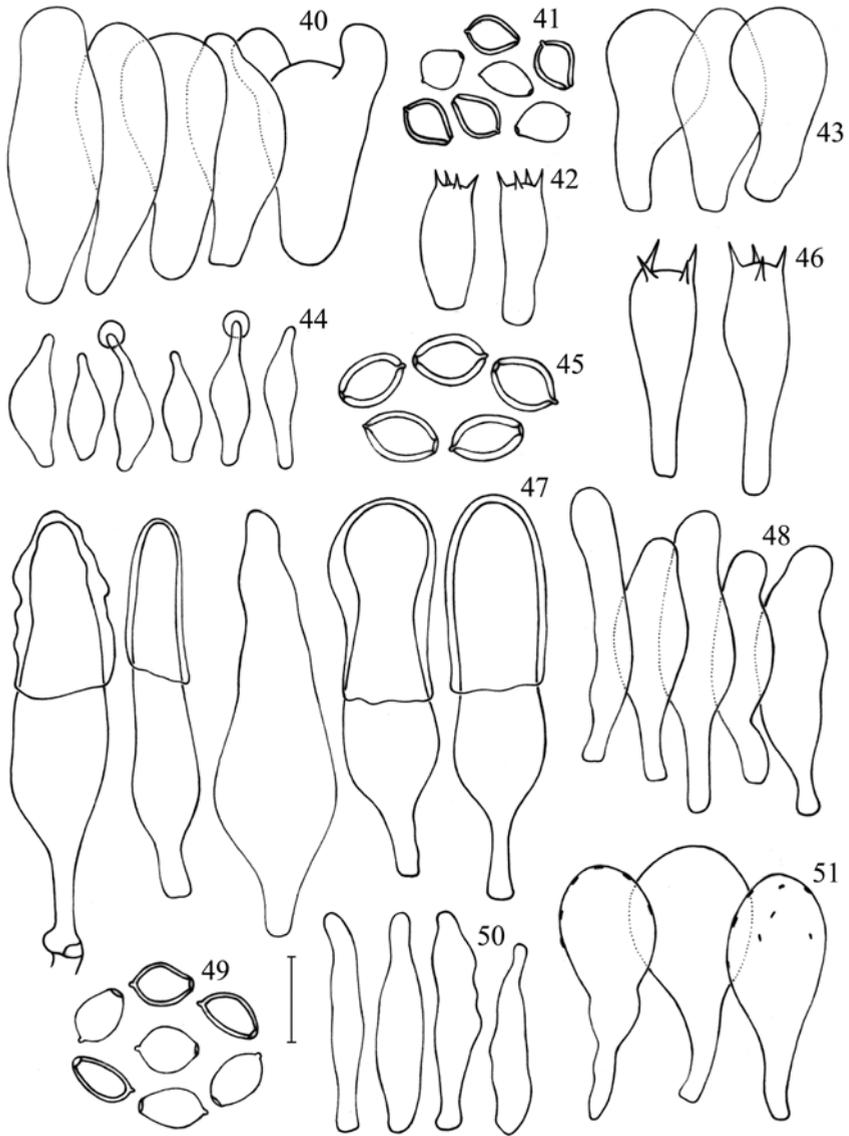
### **Additional remarks and new records of *Psilocybe***

**1. *Psilocybe egonii* Guzmán & T.J. Baroni.** – Plate 5. Figs. 49–51; Plate 6. Figs. 52–53.

This species was originally described from Puerto Rico (Guzmán & al. 2003). The re-examination of the isotypes (Llorens 138) at ZT-8807 and XAL show that this fungus has two types of pleurocystidia and caulocystidia that were not distinguished in Guzmán & al. (2003). Pleurocystidia A: (12–) 15–26  $\times$  (3.5–) 4–5.5 (–6.5)  $\mu\text{m}$ , common, hyaline, subventricose or subfusoid, with a long neck, as those described in Guzmán & al. (2003). Pleurocystidia B: 23–34  $\times$  9–16  $\mu\text{m}$ , scattered, hyaline or pale yellowish, with incrustation at the apex, globose with a narrow base. Caulocystidia are polymorphic, shape either subglobose or ventricose but also subcylindric or sublageniform with long neck. This species belongs to sect. *Psilocybe* because it doesn't stain blue and for presence of subrhomboid basidiospores.

**2. *Psilocybe fagicola* R. Heim & Cailleux emend. Guzmán** from Costa Rica. – Plate 6. Figs. 54–56.

*P. fagicola* was previously only known from subtropical-montane cloud forests in Mexico (Guzmán 1983, 1995; Guzmán & al. 2005). The



**Plate 5. Figs. 40–51.** – 40–44: *Psilocybe subovoideocystidiata*: 40. Pleurocystidia. 41. Basidiospores. 42. Basidia. 43. Pleurocystidia. 44. Cheilocystidia. (40: Singer & Araujo B10396; 41–44 Singer B1089). – 45–48: *Psilocybe tenuitunicata*: 45. Basidiospores. 46. Basidia. 47. Pleurocystidia. 48. Cheilocystidia. (Singer B104, holotype). – 49–51: *Psilocybe egonii*: 49. Basidiospores (Horak's drawing), 50. Pleurocystidia A. 51. Pleurocystidia B. (49–51: Horak 8807). – (Scale bars: 40–48 & 50–51 = 10 µm; 49 = 7 µm).

up to 100  $\mu\text{m}$  long pseudorhiza, the small, rhomboid and thick-walled basidiospores and pleurocystidia and cheilocystidia of similar shape are the main morphological features. In addition, the bluing reaction is also diagnostic for this taxon (Guzmán & al. 2005). The Costa Rican specimens also collected in montane cloud forest represent the first record outside of Mexico. The rhomboid in frontal-view or subellipsoid in side-view basidiospores measure (4–) 4.5–6  $\times$  4–5 (–5.5)  $\times$  3–4  $\mu\text{m}$ , with the wall up to 0.8  $\mu\text{m}$  thick. The sublageniform pleurocystidia [10–16 (–20)  $\times$  (3–) 4–5  $\mu\text{m}$ ] are rarely observed. The lageniform cheilocystidia (15–26  $\times$  4–7  $\mu\text{m}$ ) are frequently irregularly branched at apex.

Material examined. – COSTA RICA, San José, S. Gerardo de Dota, 5 km SW of Cerro de La Muerte, Albergue de la Montaña, 21 Oct 1994, leg. G.Mueller 5177 (F-1112527); same locality, 23 Jun 1995, leg. M.Mata 12 (F-1112779).

**3. *Psilocybe montana* (Pers.: Fr.) P.Kumm. from Costa Rica.** – Plate 6. Figs. 57–61.

In regions with cool-temperate climate *P. montana* is a common muscicolous species with a wide global distribution. Guzmán (1983) reported the occurrence of *P. montana* in Latin America viz. from Argentina, Chile, Colombia, Mexico, Jamaica and Venezuela. Now, we can present here the first record for Costa Rica. The material agrees with the description in Guzmán (1983), except that pleurocystidia are scarce, an observation also reported for a collection from Sardinia, Italy (Guzmán & al. 2002). Previously, Guzmán (1983) and Noordeloos (2001) noted that *P. montana* lacks pleurocystidia. It will be necessary to review further the actual status of this species. The Costa Rican material is characterized by subrhomboid in face-view and subellipsoid in side-view basidiospores (7–) 8–9 (–10)  $\times$  (5–) 5.5–6.5 (–7)  $\times$  5–6.5  $\mu\text{m}$ , with the wall up to 1  $\mu\text{m}$  thick. The pleurocystidia 20–30  $\times$  5–6.5  $\mu\text{m}$ , are sublageniform and rare. The shape of the cheilocystidia (16–) 27–39 (–47)  $\times$  5.5–7 (–8)  $\mu\text{m}$  is also sublageniform. Both the hyphae of the hymenophoral trama and in the context are incrustated with yellowish brown pigment.

Material examined. – COSTA RICA, San José, International Highway, km 95, near Cerro de La Muerte, gregarious on soil covered with *Polytrichum*, páramo at 3350 m altitude, 2 Aug 1981, leg. R.Singer B-12578 (F-1113820 as *Psilocybe* sp.).

**4. *Psilocybe muscorum* (P.D.Orton) M.M.Moser from Colombia and Costa Rica.** – Plate 6. Figs. 62–66.

Taxonomically *Psilocybe muscorum* is close to *P. subviscida* (Peck) Kauffman and has been placed by Guzmán (1983) in sect. *Pratenses*.

Noordeloos (2001) examined the type material (cheilocystidia measuring  $27\text{--}54 \times 5.5\text{--}9 \mu\text{m}$ ) and based upon this data it appears that this species is better accommodated in sect. *Psilocybe*. Guzmán (1983, 1995) reported this taxon with sublageniform cheilocystidia  $(24\text{--}) 27\text{--}33$  ( $\text{--}39$ )  $\times (4.5\text{--}) 5.5\text{--}9 \mu\text{m}$  from several localities in Europe, India and Venezuela. For British collections, Orton (1960) and Watling & Gregory (1987) reported the size of the cheilocystidia as  $24\text{--}42 \times 5\text{--}10 \mu\text{m}$ . Recently Da Silva & al. (2006) recorded *P. muscorum* from Southern Brazil. The specimens collected in Costa Rica and Colombia have obscurely subhexagonal in face-view and subellipsoid in side-view basidiospores  $(6\text{--}) 7\text{--}9$  ( $\text{--}10$ )  $\times (4\text{--}) 4.5\text{--}5 \times 4\text{--}5 \mu\text{m}$ , with the wall  $0.5\text{--}1 \mu\text{m}$  thick. The lageniform or sublageniform cheilocystidia measure  $(18\text{--}) 25\text{--}33$  ( $\text{--}39$ )  $\times 4.5\text{--}7$  ( $\text{--}7.5$ )  $\mu\text{m}$ . Pleurocystidia are absent. The pileipellis is a well developed ixocutis. However, more collections are necessary to clarify the taxonomic position of the specimens of Central American and South American origin. – It is a non-hallucinogenic species.

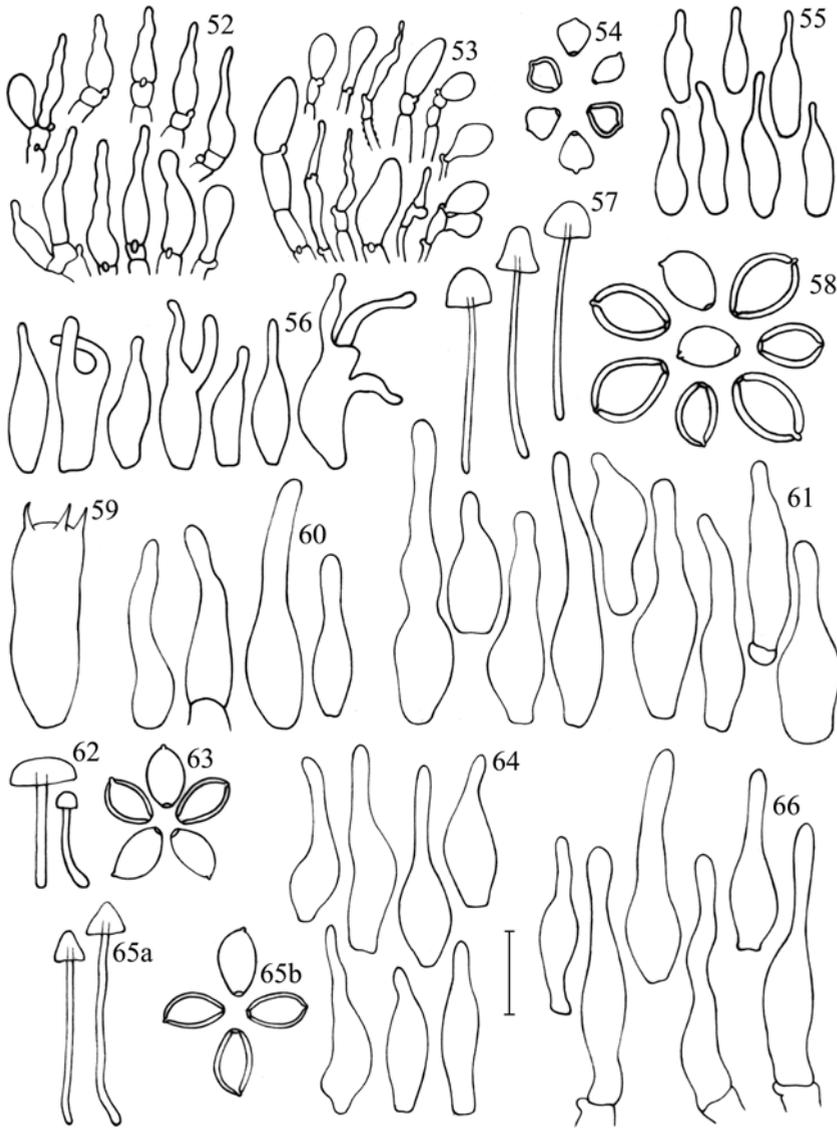
Material examined. – COSTA RICA, Cauca, Taboró, 5 May 1968, leg. R. Singer B-6977 (F-1138590, as *Psilocybe* sp.). – COSTA RICA, Cartago, Volcán Irazú, 19 Jul 1981, leg. R. Singer B-12315 (F-1113687, as *Psilocybe* sp.); locality unknown, 2 Aug 1981, leg. R. Singer B-12613 (F-1113854, as *Psilocybe* sp.).

**5. *Psilocybe plutonia* (Berk. & M.A.Curtis) Sacc. from Costa Rica.** – Plate 7. Figs. 67–71.

*Psilocybe plutonia* is reported from Cuba (type locality), Venezuela, Colombia, and Guadalupe (Dennis 1961; Guzmán 1983; Pegler 1983; Guzmán & al. 2004b). Singer and Guzmán (1983) erroneously identified material collected in Manaus (Brazil) as *P. plutonia* but re-examination demonstrated that this taxon actually belongs to *P. subovoideocystidiata* (see above).

We also can report here the first record of *P. plutonia* from Costa Rica. The relevant material agrees well with the type (FH) and the isotypes (PC, K). The rhomboid basidiospores are  $5\text{--}5.5 \times 4\text{--}5 \times 3\text{--}4 \mu\text{m}$ , with the wall up to  $1 \mu\text{m}$  thick. The frequently observed pleurocystidia  $10.5\text{--}17.5 \times 3.5\text{--}5.5 \mu\text{m}$ , are hyaline, ventricose-rostrate or ventricose-capitate, and sometimes irregularly branched at the apex. By comparison the cheilocystidia  $(17\text{--}) 19\text{--}30$  ( $\text{--}36$ )  $\times (4.5\text{--}) 5\text{--}6.5$  ( $\text{--}8$ )  $\mu\text{m}$  are polymorphic (shape like pleurocystidia or ranging from subcylindric, subfusoid, clavate, with conspicuous globose apex. The pileipellis is composed of repent, non-gelatinized hyphae,  $4\text{--}5 \mu\text{m}$  wide, terminal cells encrusted with dark brown pigment. The hyphae of the subpellis are short-cylindrical, with walls up to  $1.5 \mu\text{m}$  thick.

Material examined. – COSTA RICA, Prov. Guanacaste, Rincón de La Vieja, Biological Station Cacao, Cerro Pedregal, 17 Jun 2003, leg. E.Horak 10408, ZT).



**Plate 6. Figs. 52-66.** – 52-53: *Psilocybe egonii*: 52. Cheilocystidia. 53. Caulocystidia. (52-53: Horak's drawing, Horak 8807). – 54-56: *Psilocybe fagicola*: 54. Basidiospores. 55. Pleurocystidia. 56. Cheilocystidia. (all from Mata 12). – 57-61: *Psilocybe montana*: 57. Basidiomes (Singer's drawing). 58. Basidiospores. 59. Basidium. 60. Pleurocystidia. 61. Cheilocystidia. (all from Singer B-12578). – 62-66: *Psilocybe muscorum*: 62. Basidiomes (Singer's drawing). 63. Basidiospores. 64. Cheilocystidia, 65a. Basidiomes (Singer's drawing). 65b. Basidiospores. 66. Cheilocystidia. (62-64: Singer B-12315; 65-66: Singer B12613). – (Scale bar: 52-53 = 17  $\mu$ m; 54-56, 58-61, 63-64, 65b-66 = 10  $\mu$ m; 57, 62, 65a = 15 mm).

**6. Disjunct distribution of *Psilocybe squamosa* (Pers.: Fr.) P.D.Orton.**  
– Plate 7. Figs. 72–76.

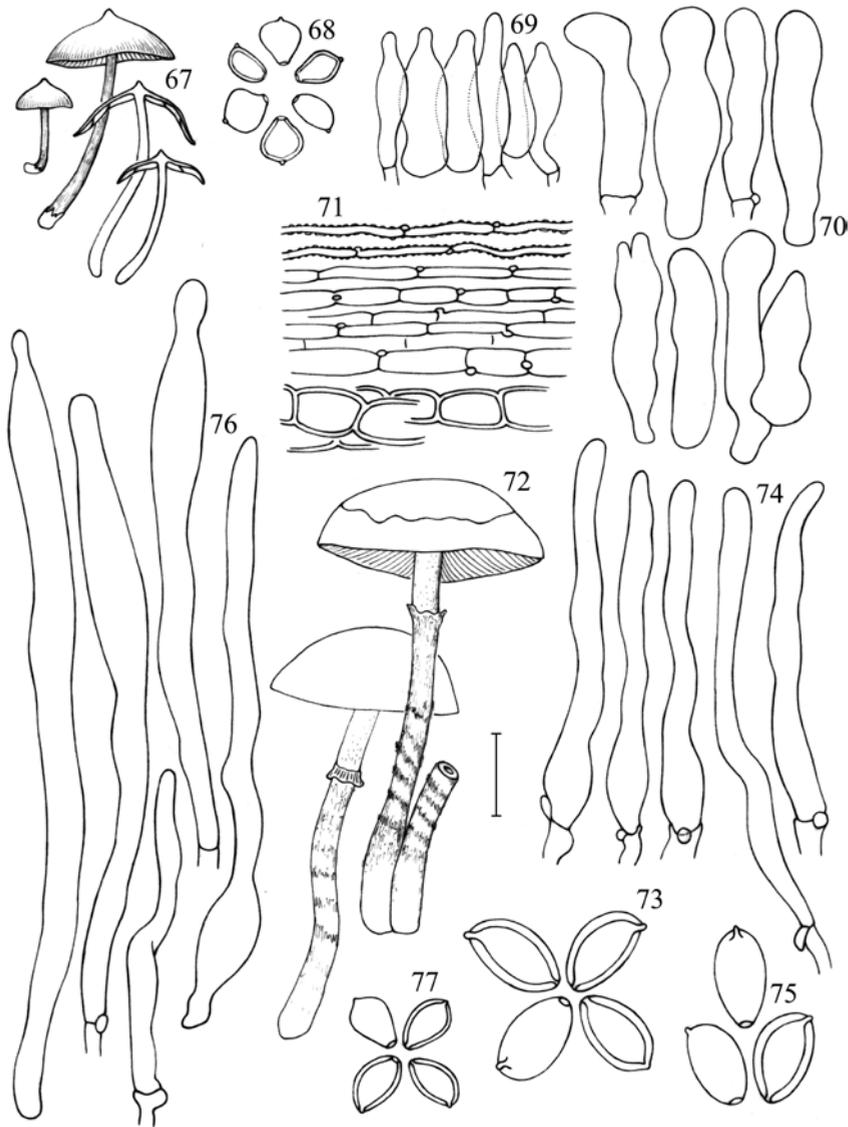
In Europe *Psilocybe squamosa* is a common mushroom which is also reported from temperate regions in the USA and Australia (Guzmán, 1983; Guzmán & Watling 1978). Based upon records published by Mata (1999) and Halling & Mueller (2005) this taxon was also found in Costa Rican montane cloud forest (dominated by *Quercus costaricensis*) at 3000 m altitude. In all taxonomic relevant features, the this material agrees well with the descriptions presented by the aforementioned authors. The pileus of the collybioid and robust basidiomes measures (20–) 40–60 mm diam. The stipe is (60–) 80–130 × 4–6 mm large, and is covered with white squamules below the well formed membranaceous annulus. The subellipsoid (both in face-view and side-view) basidiospores are (11–) 12–14 (–15) × (6–) 7–8 µm, wall up to 1.5 µm thick. Pleurocystidia are absent. The hyaline cheilocystidia (42–) 54–90 (–100) × (3–) 4–6 (–9) µm are cylindrical or sublageniform, with a long neck at apex. It is a non-caerulescent species which belongs to sect. *Squamosae* P.D.Orton emend. Guzmán (Guzmán, 1983).

Material examined. – COSTA RICA, San José, Highway to S. Gerardo Dota, 23 Jun 1985, leg. R.Halling 7470 (NY); same locality: 12 Jun 1996, leg. R.Halling 7673 (NY); 28 Jun 2001, leg. R.Halling 8212 (NY); 4 Jul 2001, leg. R.Halling 8236 (NY).

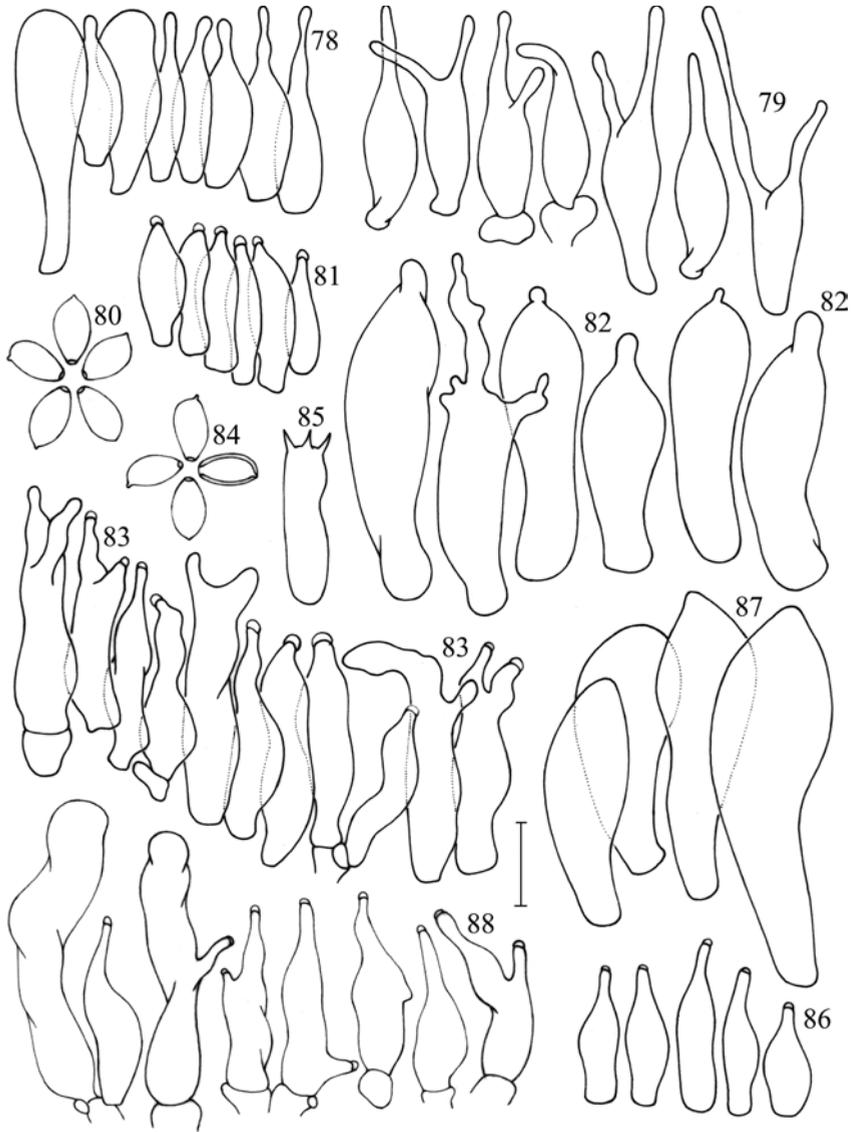
**7. *Psilocybe subhoogshagenii* Guzmán, Torres & Ram.-Guill. from Ecuador.**  
– Plate 7. Fig. 77; Plate 8. Figs. 78–79.

This bluing species belongs to sect. *Cordisporae* and was originally described from Chocó, Colombia (Guzmán & al., 2004b). It is noted here as the first record from Ecuador. All characters observed agree well with the original description. The conical, cuspidate, papillate or campanulate pileus is the specific macroscopical feature for this taxon, which apparently is related to *P. hoogshagenii* R.Heim from Mexico (Guzmán 1983). It differs from the latter taxon by ventricose (not lageniform) and broader pleurocystidia, × 8–12 (–13) µm as compared to the Ecuadorian species whose hyaline, sublageniform or subfusiform (and mucronate), but rarely clavate or narrowly clavate pleurocystidia measure 18–35 × 5–9 (–11) µm. The hyaline, sublageniform (but frequently irregularly branched) cheilocystidia are 20–37 × 5–7 µm. Finally the subrhomboid (in face-view) and subellipsoid (in side-view) basidiospores are (6.5–) 7–8 (–9) × 4–5 × 4–4.5 µm, wall up to 1 µm thick.

Material examined. – ECUADOR, Prov. Pichincha, Quito, Cantón, 3 km E of Vicente Maldonado, ENDESA Reserve, 4 May 1987, leg. R.Halling 5238 (NY).



**Plate 7. Figs. 67–77.** – **67–71:** *Psilocybe plutonia*: **67.** Basidiomes (Horak's drawing). **68.** Basidiospores. **69.** Pleurocystidia. **70.** Cheilocystidia. **71.** pileipellis and subpellis (Horak's drawing). (all from Horak 10408). – **72–76:** *Psilocybe squamosa*: **72.** Basidiomes (from Halling's picture). **73.** Basidiospores. **74.** Cheilocystidia. **75.** Basidiospores. **76.** Cheilocystidia. (72–74: Halling 7470; 75–76: Halling 7673). – **77.** *Psilocybe subhoogshagenii*: **77.** Basidiospores (77: Halling 5238). – (Scale bars: 67, 72 = 15 mm; 68–70, 73–76 = 10  $\mu$ m; 71 = 30  $\mu$ m).



**Plate 8. Figs. 78–88.** – 78–79: *Psilocybe subhoogshagenii*: 78. Pleurocystidia. 79. heilocystidia. (all from Halling 5238). – 80–88: *Psilocybe subzapotecorum*: 80. Basidiospores. 81. Pleurocystidia A. 82. Pleurocystidia B, 83. Cheilocystidia. 84. Basidiospores. 85. Basidium. 86. Pleurocystidia A. 87. Pleurocystidia B. 88. Cheilocystidia. (80–83: Halling 5011; 84–88: Halling 5423). – (Scale bars: 78–88 = 10 µm).

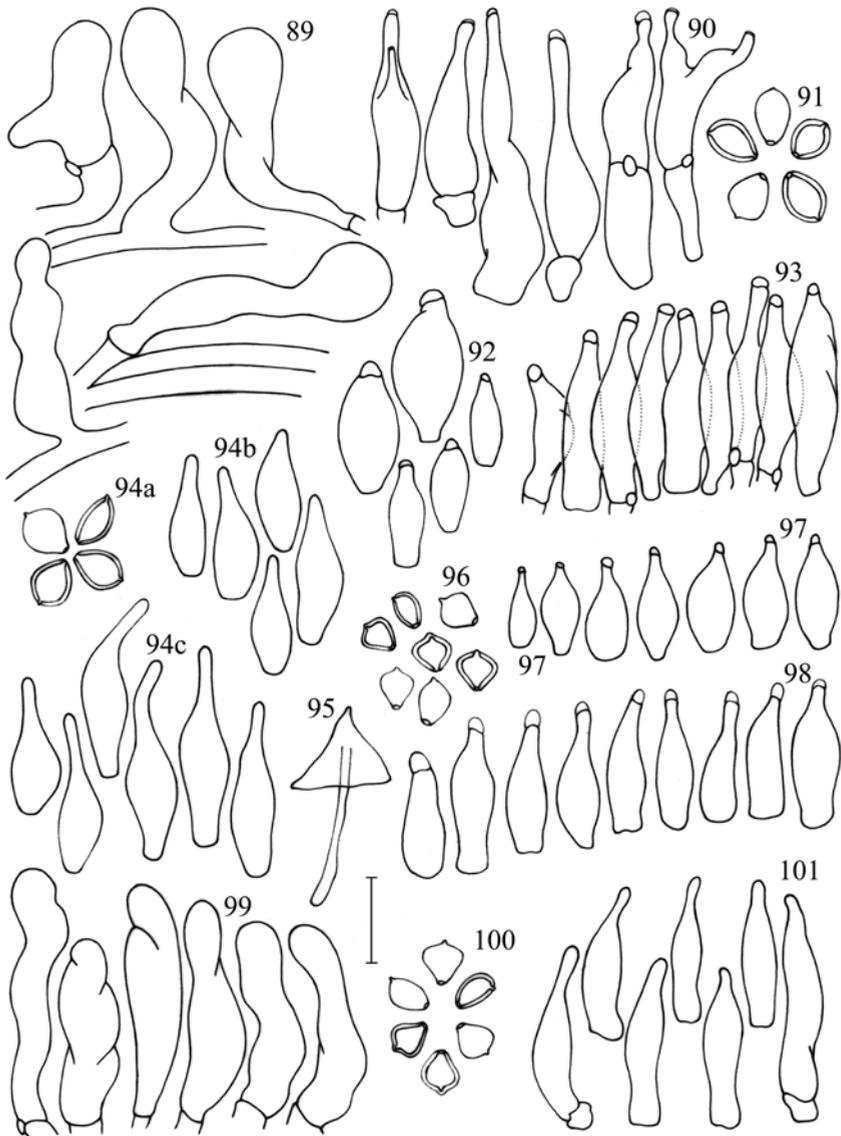
**8. *Psilocybe subzapotecorum* Guzmán from Colombia and Ecuador.** – Plate 8. Figs. 80–88; Plate 9. Figs. 89–90.

*Psilocybe subzapotecorum* is a bluing species in sect. *Zapotecorum* Guzmán. It was previously only known from Mexico, where it is very common in subtropical-montane cloud forests (Guzmán 2000; Guzmán & al. 2004a). This taxon is close to *P. zapotecorum* R.Heim emend. Guzmán (Guzmán 1983) but differs in having two types of pleurocystidia and wider cheilocystidia. *Psilocybe subzapotecorum* is reported here for the first time from Colombia, Ecuador and Venezuela where it also occurs in subtropical forests. The convex or obtusely conical to subpapillate pileus of the basidiomes examined reach up to 60 mm diam, are dark brown to yellowish brown and hygrophanous. The stipe is up to 110 mm long, and the lower half is covered by small, white, squamulose scales. The subellipsoid basidiospores are (5–) 6–8 (–8.5)  $\times$  3.5–4 (–5)  $\times$  3–4  $\mu\text{m}$ , with wall up to 0.5  $\mu\text{m}$  thick. Pleurocystidia are represented by two types viz. A: (12–) 13–16 (–18)  $\times$  (3–) 4–5 (–6)  $\mu\text{m}$ , subclavate or subfusoid, with an acute, blunt or mucronate apex, and B: (21–) 27–38 (–40)  $\times$  (7–) 8–10 (–14)  $\mu\text{m}$ , subclavate, with an acute, mucronate or rostrate, frequently irregularly branched apex, hyaline or grayish. The shape of the cheilocystidia (14–) 20–30 (–40)  $\times$  (4–) 5–7 (–8)  $\mu\text{m}$  can vary from subclavate to sublageniform, subcylindric or submoniliform, and frequently branched at apex. The ventricose-subcylindric, submoniliform or strangulated pileocystidia are 16–40  $\times$  6–8 (–10)  $\mu\text{m}$ .

Material examined. – COLOMBIA, Depto Antioquia, Municipio Guarne, 14 km E of Medellín, Centro Experimental Piedras Blancas, 11 Nov 1986, leg. R. Halling 5010 & 5011 (both in NY). – ECUADOR, Prov. Pichincha, Quito Cantón, Parroquia Nono, Reserva Orquideológica, Pahuma, trail Oreja de Mono, 14 Dec 2002, leg. Martínez & Barrera 15 (QCNE-152757); further collections from same locality: QCNE-152989, QCNE-152986, QCNE-152987, QCNE-152739, QCNE-152823, QCNE-152735, QCNE-152990. – VENEZUELA, Distr. Federal, trail Yagrumal to El Pozo, 22 Jul 1987, leg. R.Halling 5423 (NY).

**9. *Psilocybe wrightii* Guzmán from Argentina and Ecuador.** – Plate 9. Figs. 91–94.

This bluing species from South American with collybioid basidiomes belongs to sect. *Cordisporae* and was originally described from Tucumán in northern Argentina (Guzmán 1978, 1983). Recently it was also reported from Brazil (Guzmán & Cortez 2004). Further new records of *Psilocybe wrightii* from Argentina and from Ecuador are reported here for the first time. All relevant macroscopical and microscopical characters correspond well with the type material, e.g. the subrhomboid (in face-view) and subellipsoid (in side-view), basidiospores (5.5–) 6.5–8 (–11)  $\times$  (4.5–) 5.5–6 (–7)  $\times$  4–5  $\mu\text{m}$ , with wall up to 1  $\mu\text{m}$  thick, the frequent, hyaline, sublageniform or ventricose-fusoid



**Plate 9. Figs. 89–101.** – **89–90:** *Psilocybe subzapotecorum*: **89.** Pileocystidia. **90.** Cheilocystidia. (89: Halling 5423; 90: Martínez & Barrera 36). – **91–94:** *Psilocybe wrightii*: **91.** Basidiospores. **92.** Pleurocystidia. **93.** Cheilocystidia. **94a.** Basidiospores. **94b.** Pleurocystidia. **94c.** Cheilocystidia. (91–93 from Martínez & Barrera 19; 94 a,b,c, from Bettucci). – **95–101:** *Psilocybe yungensis*: **95.** Basidiomes (Singer's drawing). – **96.** Basidiospores. **97.** Pleurocystidia. **98.** Cheilocystidia A. **99.** Cheilocystidia B. **100.** Basidiospores. **101.** Pleurocystidia. (95–99: Singer B14462; 100–101: Halling 7176). – (Scale bars: 89–94, 96–101 = 10 µm; 95 = 15 mm).

pleurocystidia 15–20 × 4–7 µm with an acute to blunt apex or a short neck and finally the sublageniform or ventricose-rostrate cheilocystidia (16–) 20–29 µm. The newly recorded specimens were collected on bare clay soil.

Taxonomically, *Psilocybe wrightii* is closely related to *P. caerulescens* Murrill from the SE of the USA and Mexico (Guzmán 1983) which, however, lacks pleurocystidia.

Material examined. – ARGENTINA, PROV. Buenos Aires, Delta of La Plata river, 28 Apr 1962, leg. Bettucci s.n. (BAFC 51446 as *P. zapotecorum* by Singer). – ECUADOR, PROV. Pichincha, Quito Cantón, Parroquia Nono, Reserva Orquideológica, Pahuma, trail Oreja de Mono, 14 Dec 2002, leg. Martínez & Barrera 19 (QCNE-152988).

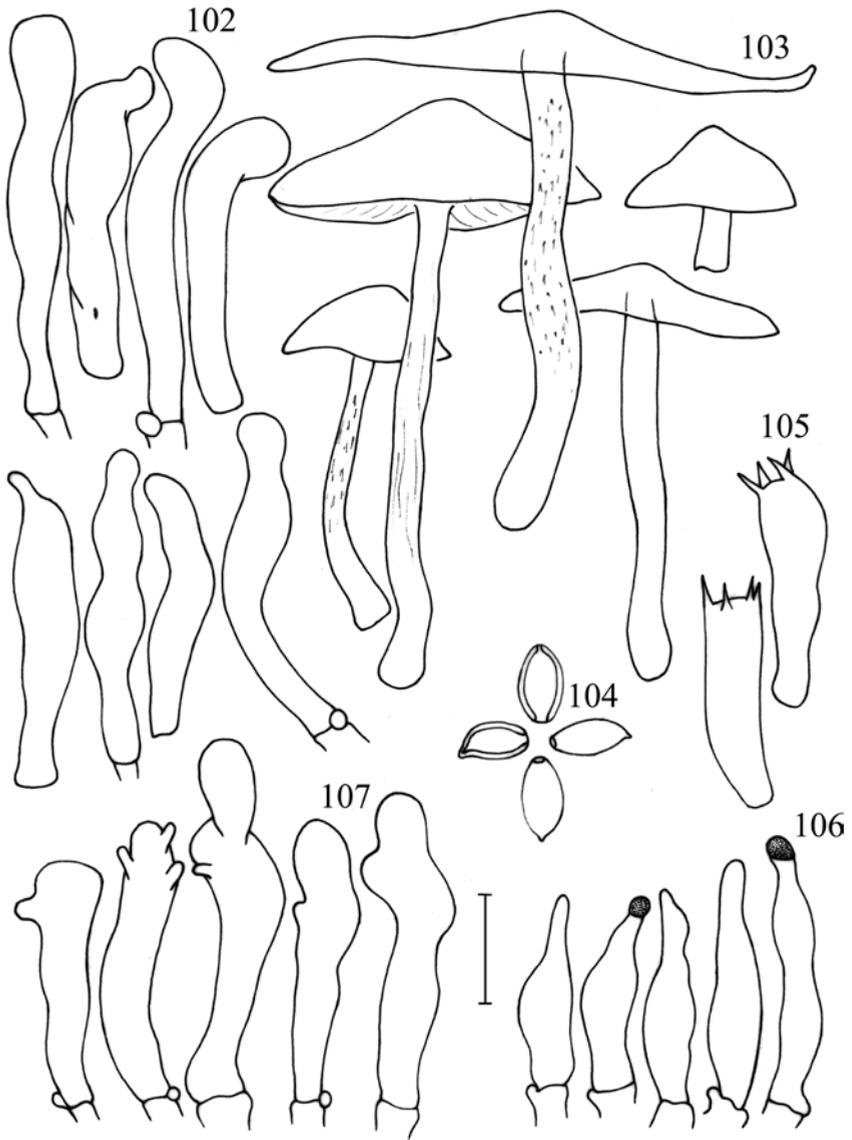
**10. *Psilocybe yungensis* Singer & A.H. Sm. from Costa Rica.** – Plate 9. Figs. 95–101; Plate 10. Fig. 102.

*Psilocybe yungensis* (sect. Cordisporae) is a bluing and hallucinogenic species, occurring both in the Andes of Bolivia (type locality), Colombia and Ecuador and in the mountains of Sierra Madre in Mexico (Singer & Smith 1958; Guzmán 1983). It is noted here as the first record in Costa Rica. The rhomboid in face-view and subellipsoid in side-view basidiospores are 4.5–5.5 (–6) × (3.5–) 4–5 × 3–4 (–4.5) µm, with wall up to 1 µm thick. The pleurocystidia are (11–) 13–19 (–25) × (3–) 4–6 µm are hyaline, subovoid, mucronate, narrowly sublageniform or subcylindrical-rostrate. The polymorphic hyaline cheilocystidia are represented by two types viz. A: 16–20 × 4.5–7 µm, ventricose or fusoid, with short neck, and B: 23–35(–42) × 4–8 (–9) µm, subcylindrical or submoniliform, with acute or globose apex. In the descriptions presented by Singer & Smith (1958) and Guzmán (1983), however, the occurrence and the separation of the two morphologically different cheilocystidia was not taken into consideration. In Costa Rica *Psilocybe yungensis* grows on rooting wood, in montane cloud forests dominated by *Quercus*.

Material examined. – COSTA RICA, Punta Arenas, Monteverde, Reserva Biológica, July 25, 1985, leg. R.Singer B-14462 (F-1114280, as *Psilocybe* sp.); same locality, 18 Nov 1993, leg. R. Halling 7176 (NY).

**11. *Psilocybe zapotecoantillarum* Guzmán, T.J.Baroni & Lodge from Costa Rica.** – Plate 10. Figs. 103–107.

This bluing *Psilocybe* was previously only known from the type locality in Puerto Rico (Guzmán & al. 2003). We now have also examined material from Costa Rica which agrees well with the original description. The collection is characterized by basidiomes with subumbonate or campanulate pileus, up to 90 mm diam. The stipe reaches up to 80 × 8 mm and is covered by whitish floccose scales. The subellipsoid



**Plate 10. Figs. 102–107.** – **102.** *Psilocybe yungensis*: **102.** Cheilocystidia B (Halling 7176). – **103–107:** *Psilocybe zapotecoantillarum*: **103.** Basidiomes (from Singer's drawing). **104.** Basidiospores. **105.** Basidia. **106.** Pleurocystidia. **107.** Cheilocystidia. (all from Singer B-12587). – (Scale bars: 102 & 104–107 = 10 µm; 103 = 15 mm).

basidiospores are (6.5–) 7–9 (–10.5)  $\times$  4–5 (–5.5)  $\times$  (3.5–) 4–5  $\mu\text{m}$ , wall up to 0.5  $\mu\text{m}$  thick. The frequent, hyaline, ventricose-rostrate or sublageniform pleurocystidia are (16–) 20–29  $\times$  4–6 (–8)  $\mu\text{m}$ . Cheilocystidia are 24–35 (–37)  $\times$  6–8 (–10)  $\mu\text{m}$ , hyaline, ventricose to subcylindric, frequently at apex irregularly lobulate or with a short appendix. The Costa Rican material was found on soil in páramo, close to the upper limit of montane forest.

Material examined. – COSTA RICA, locality not recorded, 2 Aug 1981, leg. R.Singer B-12587 (F-1113828 as *Psathyrella velutina* aff.).

### Acknowledgments

This work was supported in part by the Budget Program Research of the Instituto de Ecología at Xalapa, by CONACYT and SNI Agencies at Mexico City to G.Guzmán and by National Science Foundation funding to R.Halling (grants BSR-00424, BEB-9300798 and DEB-997218). G. Guzmán and F. Ramírez-Guillén thank E.Gándara, V. Ramírez-Cruz, M.Hernández, J.Lara Carmona and E.Saavedra (Instituto de Ecología at Xalapa) for help in the laboratory, computation, herbarium and the inking of the drawings. It is a pleasure for the authors to thank the Curators of BAFC, F, K, INPA, MICH, NY, QCNE, WU and ZT for the loan of collections of *Psilocybe*. Special thanks are given to P.Rogers at MICH for her support providing valuable information. R.Halling and E.Horak express their thanks to J.Carranza, Universidad de Costa Rica, for logistical support and collaboration.

### References

- Da Silva P.S., Cortez V.G. & Borges da Silveira R.M. (2006). The mycobiota of Itapua Park, Rio Grande do Sul, Brazil. 1. Species of Strophariaceae. *Mycotaxon* **97**: 219–229.
- Da Silva P.S., Guzmán G., Cortez V.G., Ramírez-Guillén F. & Silveira R.M.B. (2007). *Psilocybe subbrunneocystidiata*: a new species from Southern Brazil. *Mycotaxon* **102**: 203–207.
- Dennis R.W.G. (1961). Fungi venezuelani. 4. Agaricales. *Kew Bulletin* **15**: 67–156.
- Guzmán G. (1978). The species of *Psilocybe* known from Central and South America. *Mycotaxon* **7**: 225–255.
- Guzmán G. (1983). The Genus *Psilocybe*. *Beih. Nova Hedwigia* **74**: 1–439.
- Guzmán G. (1995). Supplement to the monograph of the genus *Psilocybe*. – In: O. Petrini & E.Horak (eds.): Taxonomic monographs of Agaricales. *Bibliotheca Mycologica* **159**: 91–141.
- Guzmán G. (2000). New species and new records of *Psilocybe* from Spain, the USA, and Mexico, and a new case of poisoning by *Psilocybe barrerae*. *Documents Mycologiques* **29** (116): 41–52.
- Guzmán G. (2005). Species diversity of the genus *Psilocybe* in the world mycobiota, with special attention to hallucinogenic properties. *International Journal of Medicinal Mushrooms* **7**: 305–331.
- Guzmán G., Bononi V.L. & Piccolo-Grandi R.A. (1984). New species, new varieties and new records of *Psilocybe* from Brazil. *Mycotaxon* **19**: 343–350.

- Guzmán G. & Cortez V.G. (2004). The neotropical *Psilocybe* in Brazil: a revision of the known species, the first record of *P. wrightii*, and the synonym of *P. caeruleoannulata*. *International Journal of Medicinal Mushrooms* **6**: 383–388.
- Guzmán G., Escalona F. & Ramírez-Guillén F. (2004a). Nuevos registros en México de especies de *Psilocybe*. *Revista Mexicana de Micología* **19**: 23–31.
- Guzmán G., Gaines R.V. & Ramírez-Guillén F. (2007). New species of hallucinogenic *Psilocybe* from the Eastern U.S.A. *International Journal of Medicinal Mushrooms* **9**: 75–77.
- Guzmán G., Jacobs J.Q., Ramírez-Guillén F., Murrieta D. & Gándara E. (2005). The taxonomy of *Psilocybe fagicola*-complex. *Journal of Microbiology (Korea)* **43**: 158–165.
- Guzmán G., Ramírez-Guillén F. & Contu M. (2002). The genus *Psilocybe* in Sardinia (Italy). *Micologia e Vegetazione Mediterranea* **17**: 43–61.
- Guzmán G., Ramírez-Guillén F. & Torres M. (2004b). The hallucinogenic species of *Psilocybe* in Colombia, their Indian use, new records, and new species. *International Journal of Medicinal Mushrooms* **6**: 83–93.
- Guzmán G., Saldarriaga Y., Pineda F., García, G & Velásquez L.F. (1994). New species of *Psilocybe* from Colombia and discussion of the known species. *Mycotaxon* **51**: 225–235.
- Guzmán G., Tapia F., Ramírez-Guillén F., Baroni T.J., Lodge D.J., Cantrell S.A. & Nieves-Rivera A. (2003). New species of *Psilocybe* in the Caribbean, with an emendation of *P. guilartensis*. *Mycologia* **95**: 1171–1180.
- Guzmán G. & Watling R. (1978). Studies in Australian agarics and boletes. 1. Some species of *Psilocybe*. *Notes Royal Botanical Garden Edinburgh* **36**: 199–210.
- Halling E. & Mueller G.M. (2005). *Common mushrooms of the Talamanca Mountains, Costa Rica*. New York Botanical Garden, New York.
- Mata M. (1999). *Macrohongos de Costa Rica*. *Costa Rica Mushrooms*. 1. INBIO. Santo Domingo de Heredia (2nd. ed. in 2003).
- Noordeloos M.E. (2001). Studies in *Psilocybe* sect. *Psilocybe*. *Österreichische Zeitschrift Pilzkunde* **10**: 115–180.
- Orton P.D. (1960). New Check List of British Agarics and Boletes. 3. *Transactions British Mycological Society* **43**: 159–439.
- Pegler D.N. (1983). Agaric flora of the Lesser Antilles. *Kew Bulletin Additional Series* **9**: 1–668. London.
- Pulido M.M. (1983). *Estudios en Agaricales Colombianos (Los hongos de Colombia*. 9). Universidad Nacional de Colombia, Instituto de Ciencias Naturales & Museo de Historia Natural, Bogotá, pp. 143.
- Sáenz J.A., Macaya-Lizano A.V. & Nassar M. (1983). Hongos comestibles, venenosos y alucinatorios de Costa Rica. *Revista de Biología Tropical* **31**: 2001–2007.
- Singer R. (1969). Mycoflora Australis. *Beih. Nova Hedwigia* **29**: 1–405.
- Singer R. (1977). Interesting and new species of Basidiomycetes from Ecuador. 2. *Nova Hedwigia* **29**: 1–98.
- Singer R. (1989). New taxa and new combinations of Agaricales (Diagnoses Fungorum Novorum Agaricalium. 4). *Fieldiana, Botany n.s.* **21**: 1–133.
- Singer R. & Smith A.H. (1958). Mycological investigations on Teonanácatl, the Mexican hallucinogenic mushroom. 2. A taxonomic monograph of *Psilocybe*, section *Caerulescentes*. *Mycologia* **50**: 262–303.
- Stijve T. & de Meijer A.A.R. (1993). Macromycetes from the State of Paraná, Brazil. 4. The psychoactive species. *Arquivos de Biologia e Tecnologia*. **36**: 313–329.
- Watling R. & Gregory N.M. (1987). 5. *Strophariaceae & Coprinaceae p.p.*, vol. 5. – In: *British Fungus Flora, agarics and boleti*. Royal Botanic Garden, Edinburgh.
- Yokoyama K. (1987). *The coprophilous species of Psilocybe from Peru*. – In: Inoue H. (ed.): *Studies on Cryptogams in Southern Peru*. Tokai University Press, Tokyo, pp. 145–149.

(Manuscript accepted 13 Jul 2009; Corresponding Editor: M. Kirchmair)

# ZOBODAT - [www.zobodat.at](http://www.zobodat.at)

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Sydowia](#)

Jahr/Year: 2009

Band/Volume: [61](#)

Autor(en)/Author(s): Guzman Gaston, Ramirez-Guillen Florencia, Horak Egon, Halling Roy

Artikel/Article: [Further studies on Psilocybe from the Caribbean, Central America and South America, with descriptions of new species and remarks to new records. 215-242](#)