

Type studies of *Psilocybe sensu lato* (Strophariaceae, Agaricales)

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A revision of 40 types from ten herbaria is presented to contribute to the taxonomic understanding of *Psilocybe* and *Deconica*. In all cases, descriptions of the types were completed, with characters not previously included such as the presence of pileocystidia, subhymenium type, and arrangement of the hyphae from pileus trama. We found that *P. chiapanensis* and *P. subyungensis* are synonyms of *P. yungensis*, *P. bipleurocystidiata* of *P. subtropicalis*, *P. subacutipilea* of *P. mexicana*, *P. ochreata* of *D. montana*, and *P. overeemii* is a synonym of *D. neocaledonica*. Also, five species that were formerly considered to be bluing actually correspond to the nonhallucinogenic genus *Deconica*: *Psilocybe aureicystidiata*, *P. goniospora*, *P. neocaledonica*, *P. ochreata*, and *P. overeemii*. Thus, the new combinations *Deconica aureicystidiata*, comb. nov., and *Deconica neocaledonica*, comb. nov., are proposed.

Keywords: holotypes, isotypes, nomenclature, protologues, taxonomy.

Psilocybe (Fr.) P. Kumm. and *Deconica* (W. G. Sm.) P. Karst. (Strophariaceae, Agaricales, Basidiomycota) are two independent genera according to the results of Moncalvo *et al.* (2002) and Matheny *et al.* (2006). On the basis of these results, Redhead *et al.* (2007) proposed conserving the generic name *Psilocybe* for the hallucinogenic mushrooms and using *Deconica* for the non-hallucinogenic. The most comprehensive studies on *Psilocybe* s.l. (i.e., including *Deconica*) are the monograph of the section *Caerulescentes* (Singer & Smith 1958 b), the world monograph of *Psilocybe* and its supplement (Guzmán 1983, 1995), the contributions of Singer (1986), and Noordeloos (2011), in this case, who treated *Deconica* and *Psilocybe* independently. Infrageneric classifications were made considering *Psilocybe* in a broad sense.

As a part of a broader study that includes a phylogenetic analysis of *Psilocybe* and *Deconica*, here we present a revision of 40 types. The aim of this work is to better understand the species on the basis of additional information that was not mentioned in the protologues and contribute to the taxonomic understanding of these genera.

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Materials and methods

Types and additional specimens from ten herbaria (ENCB, FH, IB, IBUG, K, LPS, NY, QUE, TENN, and XAL) were studied. Material was mounted in 3 % KOH or 3 % Congo red to observe micromorphology. Patent blue V (1 %), a specific dye that stains the chrysocystidia content blue (Jahnke 1984), was used to confirm their presence. Names for microscopic structures were based on those of Vellinga (1988) and Clémenton (2012). Subhymenium descriptions followed those of Bas (1969). Structures were measured and drawn using a 100× oil-immersion objective on Zeiss K7 or Zeiss Axioskop 40 microscopes and photographed using the Axioskop 40 with AxioVision 4 software.

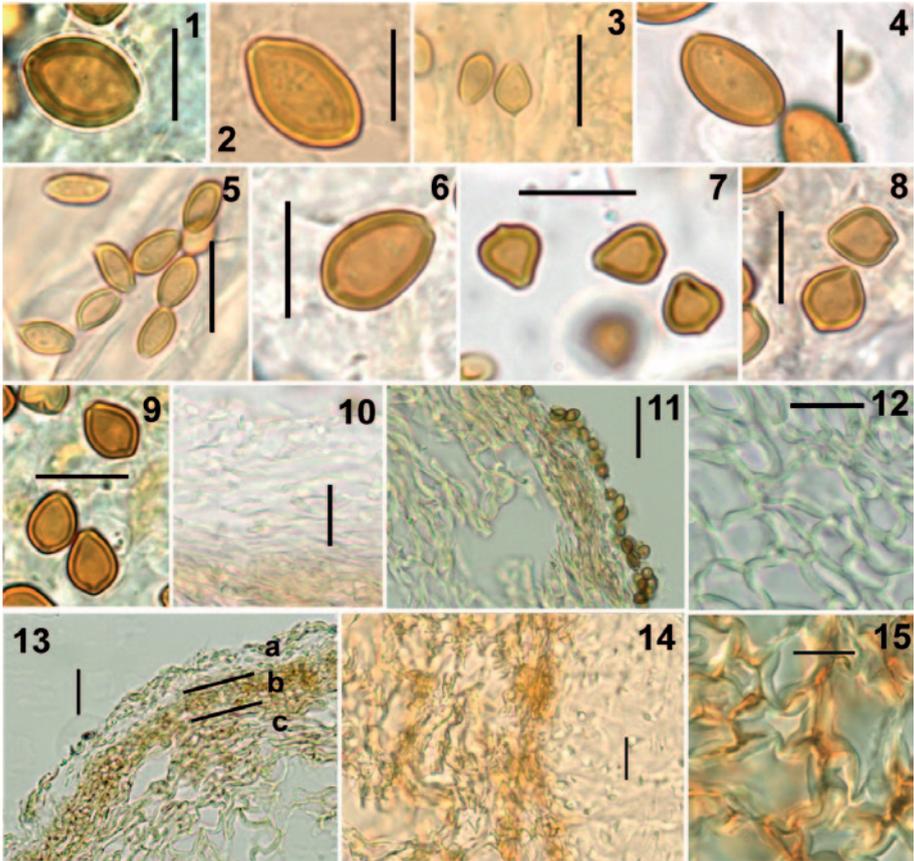
In *Psilocybe* the basidiospores have two views, a frontal view with or without angles and a lateral view always without angles. The spore shape in lateral view was determined according to the Q ratio (length/width ratio, Bas 1969). In angular spores, the shape in frontal view was named according to Vellinga (1988), and Vellinga & Noordeloos (1999). For 20 randomly selected basidiospores, length, width (lateral view), and breadth (frontal view) were measured without including the apiculus. Basidiospore wall was measured from photographs with the AxioVision 4 software. We distinguish three wall thicknesses: thin (0.30–0.50 µm), slightly thick (0.55–0.80 µm), and thick (0.85–1.90 µm), following Ramírez-Cruz *et al.* (2013). Sterigmata were included in basidia measurements. The arrangement of the trama in the pileus and hymenophore in radial sections was described.

Results and discussion

Forty type specimens were studied; only additional information omitted in the protologue and subsequent publications is considered here. Taxa are presented alphabetically by the basionym; the accepted name is given in bold. The study includes species that formerly were placed in the hallucinogenic sections proposed by Guzmán (1983, 1995); of these, five currently correspond to the nonbluing genus *Deconica*. Six names are proposed in synonymy.

Basidiospore shape in frontal view has been an important character in the infrageneric classification of the genera *Psilocybe* and *Deconica* (Guzmán 1983, 1995). Many terms have been applied to the specific shapes, but they were used inconsistently and sometimes with different meanings. Here, we used the following for frontal views: hexagonal and subhexagonal (Figs. 2, 6), rhomboid and subrhomboid (Figs. 3, 7, 9), and without angles (Fig. 5). Rhomboid and hexagonal basidiospores can be present in the same specimen (Fig. 8). In lateral view, the basidiospores always lack angles (Fig. 4).

We observed that the basidiospore wall of some species has at least two layers when viewed with a light microscope, in agreement with Singer & Smith (1958 a: 263) and Singer (1986: 566), who described the basidiospore wall as a “complex wall” when more than one layer can be seen. Ruch &



Figs. 1–15. Microscopic structures: **1.** Basidiospore wall with three layers in frontal view, *Psilocybe cubensis*. **2.** Hexagonal basidiospore, wall with two layers in frontal view, *P. cubensis*. **3.** Subrhomboid basidiospore, wall with one layer in frontal view, *P. zapotecorum*. **4.** Basidiospores without angles in lateral view, *P. hispanica*. **5.** Basidiospores without angles in frontal and lateral view, *P. zapotecorum*. **6.** Hexagonal basidiospore in frontal view, *P. gallaeciae*. **7.** Rhomboid and subrhomboid basidiospores in frontal view, *P. yungensis*. **8.** Hexagonal (below) and rhomboid (above) basidiospores in frontal view, *P. aquamarina*. **9.** Subrhomboid basidiospores in frontal view, *P. subtropicalis*. **10.** Ixocutis, *P. caerulescens*. **11.** Subgelatinized pileipellis, *P. thaizapoteca*. **12.** Pileus trama radial, *P. caerulescens*. **13.** Pileipellis and pileus trama: a, ixocutis; b, subpellis; and c, radial pileus trama; *P. caerulescens*. **14.** Ixocutis (right side) and interwoven pileus trama (left side), *P. hispanica*. **15.** Pileus trama radial, encrusted pigment in the wall, *P. multicellularis*. Bars 10 μm in 1–10, 12, 15; 20 μm in 11, 13–14.

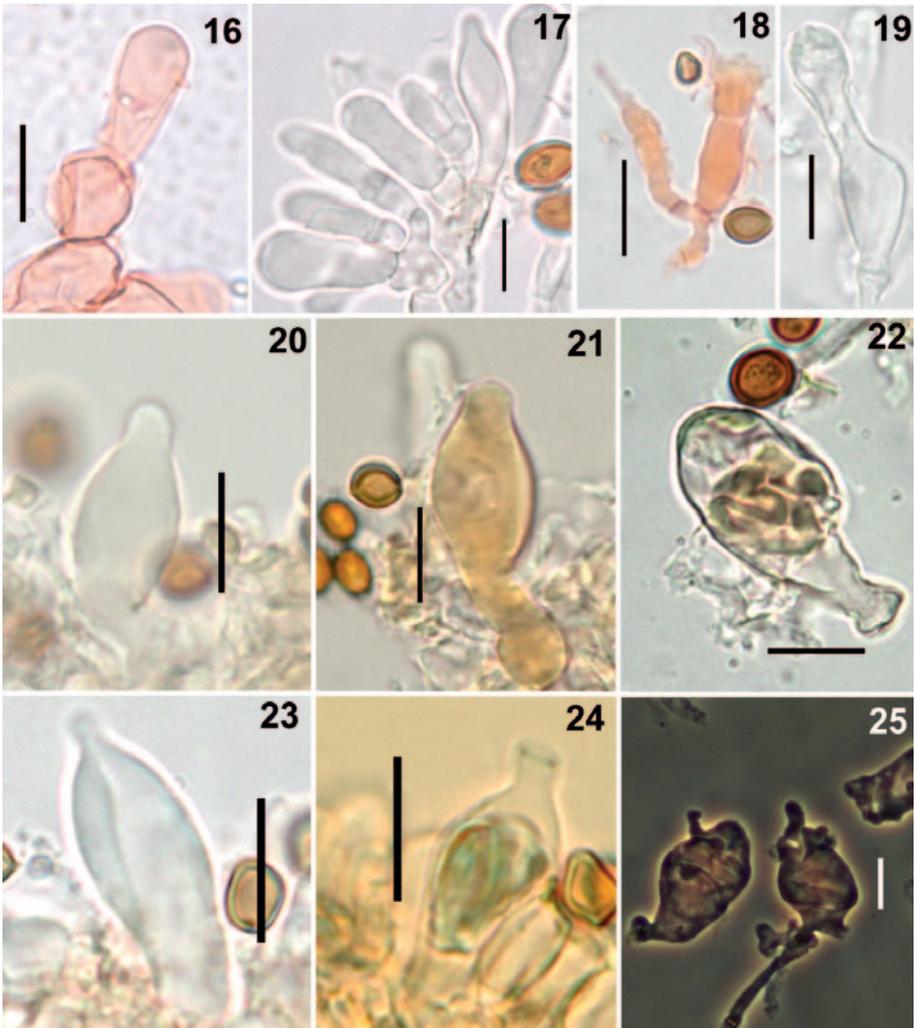
Motta (1987) pointed out that the basidiospores of *P. cubensis*, observed with TEM, have a thick wall with three distinct layers (ectosporium, episporium, and endosporium). With light microscopy, on rare occasion, the three layers can be seen (Fig. 1). However, in most species, only two layers – the episporium and endosporium described by Singer (1986) – can be observed (Fig. 2).

In some basidiospores, the layers were difficult to observe with light microscopy, and just a thin one was evident (Fig. 3).

On the basis of cytoplasmic content, two kinds of cystidia are present in *Deconica*, chrysocystidia and leptocystidia (see Cléménçon 2012: 218, 238 for definitions). Chrysocystidia are either hyaline with refringent content, that is sometimes granular or crystal-like (Fig. 24) similar to that observed in *Pholiota*, or have homogeneous content, that sometimes fills the entire cystidium, hyaline, never yellowish in KOH (Fig. 23). Singer (1986) had already noticed that the content of some chrysocystidia in *Psilocybe* sect. *Chrysocystidiatae* is not yellowish in KOH. Leptocystidia are hyaline, thin-walled, and sometimes with a refringent apex (Fig. 19). In *Psilocybe* there are also two kinds of cystidia: leptocystidia and another type that probably corresponds to some type of deuterocystidia (Cléménçon 2012) but not chrysocystidia, because the contents do not stain with Patent blue V. Guzmán *et al.* (2012) used the term pseudocystidia for this type of cystidia, but only for those borne from the hymenophoral trama, not from the subhymenium, to differentiate them from the typical pleurocystidia (leptocystidia) in *Psilocybe*. We prefer not to use this term for *Psilocybe* because the concept of pseudocystidia, in the sense of Cléménçon (2012), is different. Deuterocystidia in *Psilocybe* (Figs. 20–22) are present in some species, such as *P. banderillensis* Guzmán, *P. brasiliensis* Guzmán, *P. subtropicalis* Guzmán, *P. ovoideocystidiata* Guzmán & Gaines, and *P. zapotecorum* Heim. Deuterocystidial content is not always present or is not pigmented (Fig. 20). At least with light microscopy, elucidating whether they are deuterocystidia or leptocystidia with pigmented vacuoles is difficult.

In this work, we describe the following features of the cystidia: size, shape, colour content, and origin. As already mentioned, the content of the cystidia of *Psilocybe* can be difficult to discern; however, in *Deconica* the chrysocystidia are recognizable with the aid of Patent blue V (Fig. 24). Pileocystidia and caulocystidia are also important structures that we have added to descriptions for relevant species.

According to Vellinga (1988), the pileipellis is a cortical layer of the pileus, and the subpellis is the layer beneath the pileipellis. In *Psilocybe* and *Deconica*, the pileipellis is a true ixocutis (Figs. 10, 13 a), a subgelatinized cutis (Fig. 11) or a cutis. The subpellis is occasionally differentiated; when present, it can be distinguished by the strongly pigment-encrusted hyphae (Fig. 13 b). The arrangement of the hyphae in the pileus trama and subpellis can be interwoven (Fig. 14) or radial, i.e., the hyphae are radially arranged, resembling isodiametric cells when transversely cut in radial section (Figs. 12, 13 c, 15) or as hyphae in tangential section. The pileus trama is never subcellular; such an interpretation from radial sections has been an erroneous one. Singer (1986) and Singer & Smith (1958 b) did not include measurements of the pileus trama in their descriptions; they only described the subpellis, which they called “hypodermium”. On the other hand, Guzmán (1983, 1995) considered the pileus trama as context and sometimes under “hypodermium”, given the diam. of the hyphae. Here, we point out that the arrange-



Figs. 16–25. Microscopic structures: **16.** Cellular subhymenium and basidiole, *Psilocybe thaiduplicatocystidiata*. **17.** Ramose-inflated subhymenium, basidioles, and pleurocystidium, *P. makarorae*. **18.** Ramose subhymenium, *P. yungensis*. **19.** Leptocystidium, *P. ochreata*. **20.** Deuterocystidium, *P. banderillensis*. **21.** Deuterocystidium with homogeneous content, *P. banderillensis*. **22.** Deuterocystidium with brown inclusion, *P. ovoideocystidiata*. **23.** Chrysocystidium in KOH, *Deconica aureicystidiata*. **24.** Chrysocystidium in Patent blue V, *D. overemii*. **25.** Pileocystidia, *P. neoxalapensis* (photo using 40× phase contrast objective). Bars 10 μm in 16–24; 20 μm in 25.

ment of the hyphae in the pileus trama is an important distinguishing feature at the species level in both genera. Furthermore, we observe that there are three types of subhymenium: cellular, ramose-inflated, and ramose present both in *Deconica* and *Psilocybe* (Figs. 16–18).

Guzmán *et al.* (2005: 159) observed the presence of yellowish-brown mycelium, composed of "setaceous" hyphae, on the base of the stipe. We consider these hyphae as an important character in some species of the sections *Cordisporae* and *Brunneocystidiatae*. In the present work, we have found them in the basal mycelium in *P. cabiensis* Guzmán, M. Torres & Ram.-Guill. and *P. yungensis* Singer & A. H. Sm., both belonging to sect. *Cordisporae*.

Taxonomy

Psilocybe acutipilea (Speg.) Guzmán, *Mycotaxon* 7(2): 226. 1978. – Figs. 26–28.

Basionym. ≡ *Deconica acutipilea* Speg., *Bol. Acad. Nac. Cienc.*, Córdoba 11(4): 381. 1889.

Basidiospores 8.4–10.4(11.2) × 5.6–7.2 × 5.6–6.4 μm, Q = 1.3–1.6, ellipsoid, subrhomboid, and hexagonal in frontal view, Q = 1.5–1.7(1.8), ellipsoid and elongate in lateral view, yellowish brown, wall thick (0.9–1.2 μm), with two layers in light microscopy, with germ pore. – Basidia 20–26 × 7–8 μm, clavate, some flexuose, tetrasporic, sterigmata 3–4 μm long, hyaline to yellowish, wall thin. – Pleurocystidia not observed. – Cheilocystidia 16–27 × 4.5–7 μm, narrowly lageniform, flexuose, neck sometimes bifurcated, apex obtuse, refractive, hyaline, wall thin. – Hymenophoral trama subregular, hyphae 3–5.5 μm diam., yellowish to yellowish brown in mass, wall thin. – Pileus trama radial, hyphae 4–8 μm diam., yellowish to yellowish brown in mass. – Pileipellis an ixocutis, 27–45 μm wide, hyphae 1.5–3 μm diam., hyaline, wall thin. – Stipe basal mycelium white, hyphae hyaline, wall thin. – Clamp connections at all hyphal septa.

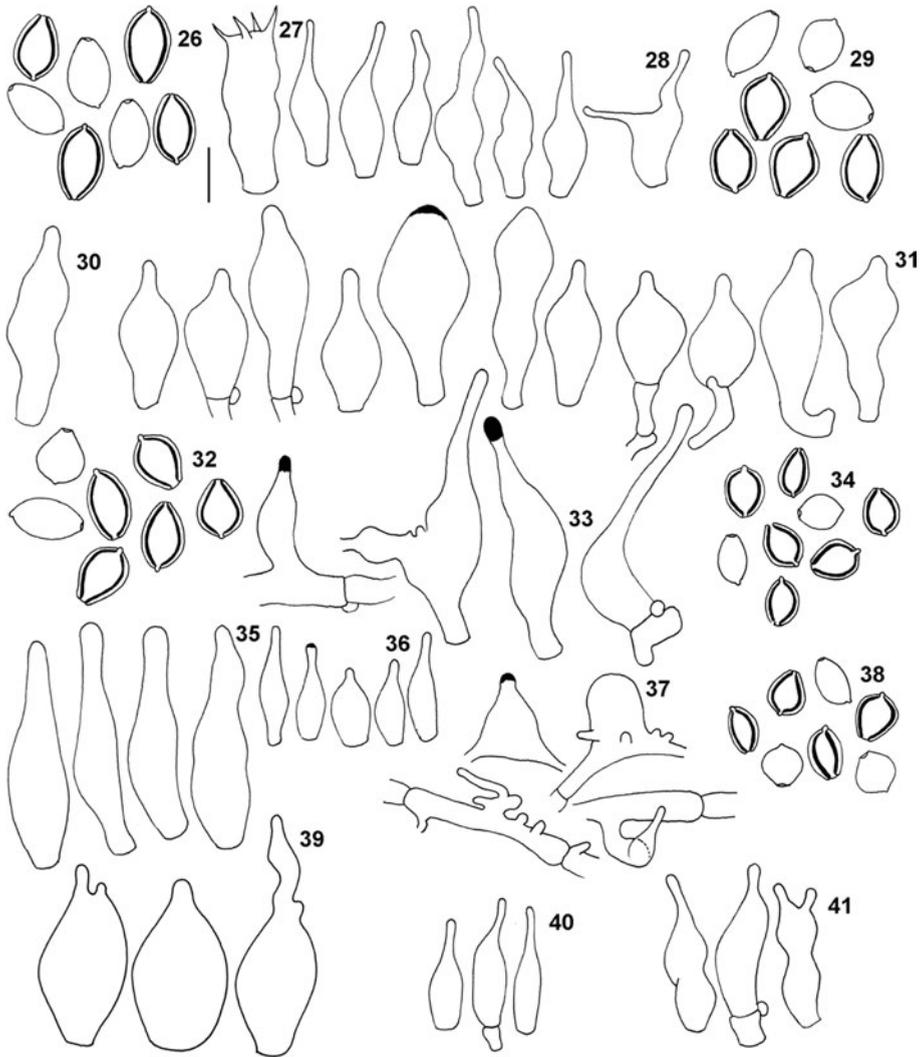
Material examined. – BRAZIL, São Paulo State, Apiaty, Oct 1881, *leg.* C. Spegazzini 1536 (LPS 38307, holotype).

Remarks. – The type specimen is contaminated with molds, so it was difficult to observe all features such as pleurocystidia, subhymenium, pileocystidia, and caulocystidia. Guzmán (1978, 1983) described subrhomboid basidiospores in frontal view; however, we observe that they can be ellipsoid and hexagonal, as well as subrhomboid, and in some spores the angles are not well defined. Furthermore, we found that the pileipellis is an ixocutis, and we describe the basidia characters. As Guzmán (1978, 1983) pointed out, *P. acutipilea* could be a synonym of *P. mexicana* R. Heim, due to the similar size and shape of the basidiospores, basidia, and cheilocystidia, although the poor condition of the type specimen makes the pleurocystidia difficult to observe and does not permit us to confirm synonymy.

Psilocybe aquamarina (Pegler) Guzmán, *Bibl. Mycol.* 159: 109. 1995. – Figs. 29–31.

Basionym. ≡ *Stropharia aquamarina* Pegler, *Kew Bull. Addit.*, Ser. 6: 462. 1977.

Basidiospores 8.8–11.2(12.4) × 6.4–8.8 × 4.8–6.4 μm, Q = 1.1–1.5(1.6), subrhomboid and hexagonal in frontal view, Q = 1.5–1.8(2), ellipsoid and elongate in lateral view, yellowish brown, wall thick (1–1.5 μm), with two



Figs. 26–41. Microscopic structures: **26–28.** *Psilocybe acutipilea* (holotype). **26.** Basidiospores. **27.** Basidium. **28.** Cheilocystidia. **29–31.** *P. aquamarina* (holotype). **29.** Basidiospores. **30.** Pleurocystidium. **31.** Cheilocystidia. **32–33.** *P. atlantis* (holotype). **32.** Basidiospores. **33.** Caulocystidia. **34–37.** *P. bipleurocystidiata* (isotype). **34.** Basidiospores. **35.** Deuterocystidia. **36.** Leptocystidia. **37.** Pileocystidia. **38–41.** *P. brasiliensis* (isotype). **38.** Basidiospores. **39.** Deuterocystidia. **40.** Leptocystidia. **41.** Caulocystidia. Bar 8 μm .

layers in light microscopy, with germ pore. – Pleurocystidia approximately $28 \times 8 \mu\text{m}$, subfusiform-flexuose, apex obtuse, hyaline, wall thin, very scanty. – Cheilocystidia $16\text{--}29 \times 7\text{--}13 \mu\text{m}$, subfusiform-flexuose, pyriform, utriform, and lageniform with short neck, wall thin; embedded in a

subgelatinized layer. – Subhymenium apparently ramose. – Pileipellis an ixocutis, 27–45 μm wide, hyphae 1.5–3 μm diam., hyaline, wall thin. – Stipitipellis a cutis, hyphae 2.5–13.5 μm diam., yellowish, wall thin. – Stipe basal mycelium white, hyphae hyaline, wall thin.

Material examined. – KENYA, Central Province, South Nyeri District, S side of Mt. Kenya, Castle Forest Station, near Thiba River, on the ground at the edge of the forest, alt. 1981 m, 2 Apr 1968, *leg.* D. N. Pegler 370 [(K(M) 160812, holotype)].

Remarks. – An important character of this species is the subgelatinized lamellar edge in which cheilocystidia are embedded, already described by Pegler (1977). We found pleurocystidia, but they were very difficult to observe and measure. Cheilocystidia are slightly wider than those cited by Pegler (1977), 7.5–11 μm wide. Guzmán (1995) made the combination in *Psilocybe* based on the blue tones in the annulus and in some parts of the stipe. A similar species is *P. subaeruginascens* Höhn., differing in its smaller basidiospores (see this species later). It also resembles *P. magnispora* E. Horak, Guzmán & Desjardin in the gelatinized lamellar edge; however, in *P. magnispora* the basidiospores are also smaller (species referred to below).

Psilocybe atlantis Guzmán, Hanlin & C. White, *Mycotaxon* 86: 180. 2003. – Figs. 32, 33.

Basidiospores 8.8–10.0(12.0) \times (5.6)6.0–7.2 \times 5.6–6.4 μm , Q = 1.2–1.6, rhomboid and hexagonal in frontal view, sometimes angles not well defined, Q = 1.3–1.8, ellipsoid and elongate in lateral view, yellowish brown, wall thick (0.8–1.0 μm), with two layers in light microscopy, with germ pore. – Subhymenium ramose, with some pigmented hyphae ascending to the hymenium. – Pileus trama radial, hyphae 6.5–27 μm diam., yellowish to yellowish brown in mass, wall 0.4–0.8 μm thick. – Pileipellis an ixocutis, 10–20 μm wide, hyphae 1.5–4 μm diam., hyaline, wall thin. – Pileocystidia absent. – Caulocystidia 16–41 \times 4–9.5 μm , narrowly lageniform, occasionally branched, hyaline, wall less than 0.8 μm thick, apex obtuse and refractive, in clusters throughout stipe. – Stipe basal mycelium white, hyphae 3–5.5 μm diam., hyaline, wall thin.

Material examined. – USA, Georgia, Fulton Co., North of Atlanta, 7 Aug 2000, *leg.* Lingchi s.n. (XAL, holotype).

Remarks. – A distinctive character in this species is the branched cheilocystidia (see Guzmán *et al.* 2003), unlike those of *P. mexicana*, which are not strongly branched. It is similar to *P. mexicana* in the size and shape of the basidiospores, “(7.7–)8.8.–9.9.(–12) \times (5.5–)6.6–7.7(–8.2) \times 6–7 μm ”, according to Guzmán (1983), but differs in the width of the pleurocystidia, 7–9(12) μm (5–8 μm wide in *P. mexicana*, data not shown). Furthermore, the caulocystidia of *P. atlantis* are always lageniform, but in the type of *P. mexicana*, they vary from globose to cylindrical (data not shown). See discussion under *P. samuensis*.

Psilocybe bipleurocystidiata E. Horak & Guzmán, in Guzmán, Horak, Halling & Ramírez-Guillén, *Sydowia* 61(2): 216. 2009. – Figs. 34–37.

Synonym. = *Psilocybe subtropicalis* Guzmán, *Biblioth. Mycol.* 159: 107. 1995.

Basidiospores 6.4–8.8 × 5.6–7.2(8.0) × 4.8–5.6 μm, Q = 1.3–1.4, subrhomboid and subhexagonal in frontal view, Q = 1.2–1.5, broadly ellipsoid and ellipsoid in lateral view, yellowish brown, wall slightly thick to thick (0.7–1 μm), with two-layers in light microscopy, with germ pore. – **Pleurocystidia** as leptocystidia 11–18.5 × 4–6.5 μm, narrowly lageniform and lageniform with short neck, apex obtuse, refractive, hyaline, wall thin, originating from the subhymenium. – **Pleurocystidia** as deuteroecystidia 31–40 × 4.5–9.5 μm, narrowly utriform, sometimes flexuose, hyaline, wall thin, originating from the hymenophoral trama. – **Pileus trama** radial, hyphae 4–28 μm diam., yellowish to yellowish brown in mass, wall 0.5–0.8 μm thick and pigment-encrusted. – **Subpellis** undifferentiated. – **Pileipellis** an ixocutis, 10–20 μm wide, hyphae 1.5–4 μm diam., hyaline, wall thin. – **Pileocystidia** 10–25 × 4–11 μm, as modified hyphae, with lateral inflated regions or with very short appendices, or lateral branches, hyaline, wall thin, on a subgelatinized pileipellis.

Material examined. – COSTA RICA, Punta Arenas, Monte Verde Cloud Forest Reserve, alt. 1650 m, 25 Jul 1986, *leg.* R. Singer 14484 (XAL, isotype).

Remarks. – Guzmán *et al.* (2009) recognized two types of pleurocystidia in *P. bipleurocystidiata*; here we complement those observations with the origin of each kind of cystidia. An additional character is the presence of pileocystidia that were not described in the protologue. We propose this species as a synonym of *P. subtropicalis* (Guzmán 1995) because of the agreement of the macro- and micromorphologic features (see this species later); for example, both species have two types of pleurocystidia and branched cheilocystidia, but pileocystidia are only seen in *P. bipleurocystidiata*. The presence of pileocystidia is not enough to consider them as separate species because this structure may or may not be present in the pileipellis or sometimes they are not noticed. For example, a new species from Japan, *P. capitulata* Har. Tak., was described by Takahashi (2011) based on the presence of pileocystidia; however, for us this species corresponds to *P. cubensis* because the remaining features of the Japanese species agree with it. We have found pileocystidia in some specimens of *P. cubensis*, e.g., I. Ruvacalba-Gómez 3 (IBUG) and María Sabina s.n. 8-VII-1969 (PC).

Psilocybe brasiliensis Guzmán, *Mycotaxon* 7(2): 234. 1978. – Figs. 38–41.

Basidiospores 5.6–7.2 × (4.0)4.4–6.4 × 4.0–4.8 μm, Q = 1–1.2(1.4), subrhomboid and subhexagonal in frontal view, Q = 1.2–1.5, broadly ellipsoid and ellipsoid in lateral view, yellowish brown, wall thick (0.8–1 μm), with two layers in light microscopy, with germ pore. – **Pleurocystidia** as leptocystidia 14.5–21 × 3–5 μm, narrowly lageniform, apex obtuse, hyaline, wall

thin, originating from the subhymenium. – Pleurocystidia as deutero-cystidia $24\text{--}37.5 \times 10.5\text{--}13$ (14.5) μm , broadly fusiform, apex mucronate or rostrate, sometimes with long neck or bifurcate, hyaline, wall thin, originating from the hymenophoral trama. – Cheilocystidia $17\text{--}25 \times (3) 4\text{--}6.5$ μm , subfusiform and lageniform, flexuose, branched, with two or three necks, apex $0.8\text{--}1$ μm wide, obtuse, refractive, hyaline, wall thin. – Pileus trama radial, hyphae yellowish to yellowish brown in mass, wall $0.5\text{--}0.8$ μm thick, with encrusted pigment. – Pileipellis an ixocutis, $12\text{--}16$ μm wide, hyphae $2.5\text{--}4$ μm diam., hyaline, wall thin. – Pileocystidia absent. – Caulocystidia $11\text{--}35 \times 3\text{--}6.5$ μm , fusiform and lageniform, flexuose or with central constriction, with obtuse apex, hyaline, wall thin, in groups near to apex of the stipe. – Stipe basal mycelium white, hyphae hyaline, wall thin.

Material examined. – BRAZIL, São Paulo State, 10 km E of Campos de Jordão, Forestal Park of State, near to Sapucaí-guaçu River, gregarious in grassy soil in a forest of *Araucaria*, *Podocarpus*, and some arboreal dicotyledons, 9 Mar 1971, *leg.* G. Guzmán 8920 (XAL, isotype).

Remarks. – Guzmán (1978, 1983) described only one kind of pleurocystidia $22\text{--}29 \times 8.8\text{--}12$ μm , ventricose, fusoid or sublageniform, which corresponds with deutero-cystidia, originating from the hymenophoral trama. This species was only found in the mixed ombrophilous forest of South Brazil, and it has not been collected again although there have been studies on *Psilocybe* in this vegetation type (e.g., Silva *et al.* 2012).

Psilocybe cabiensis Guzmán, M. Torres & Ram.-Guill., in Guzmán, Ramírez-Guillén & Torres, *Int. J. Medic. Mushrooms* 6(1): 86. 2004. – Figs. 42–43.

Basidiospores $5.6\text{--}7.2(8.0) \times 4.0\text{--}4.8 \times 3.2\text{--}4.4$ μm , $Q = 1.5\text{--}1.8$, subrhomboid and ovoid in frontal view, $Q = 1.5\text{--}1.8$, ellipsoid and elongate in lateral view, yellowish brown, wall thin ($0.4\text{--}0.5$ μm), with one layer in light microscopy, with germ pore. – Subhymenium ramose. – Hymenophoral trama subregular, hyphae $4\text{--}6.5$ μm diam., yellowish, wall $0.3\text{--}0.5$ μm thick. – Pileus trama radial, hyphae yellowish to yellowish brown in mass, wall $0.5\text{--}0.8$ μm thick, with encrusted pigment. – Pileocystidia $12\text{--}21.5 \times 3\text{--}5$ μm , narrowly lageniform and few clavate, hyaline, wall thin, embedded in the ixocutis. – Stipitipellis a cutis, hyphae $3\text{--}5$ μm diam., yellowish brown, wall up to 0.5 μm thick. – Caulocystidia not found. – Stipe basal mycelium yellowish, hyphae setaceous, $2\text{--}3$ μm diam., yellowish brown, wall up to 0.5 μm thick.

Material examined. – COLOMBIA, Chocó, Quibdó region, SE of Quibdó, Pacurita, 24 Sep 2002, *leg.* G. Guzmán 35331 (XAL, isotype).

Remarks. – In *P. cabiensis* the pileocystidia are immersed in the ixocutis, the arrangement of the pileus trama is radial, and setaceous hyphae are present in the basal mycelium of the stipe. These characters were not previously mentioned by Guzmán *et al.* (2004 a). Furthermore, we point out in the present paper that the subhymenium is ramose and not cellular.

Psilocybe chiapanensis Guzmán, Biblioth. Mycol. 159: 102. 1995. – Fig. 44.

Synonym. = *Psilocybe yungensis* Singer & A. H. Sm., Mycologia 50(1): 142. 1958.

Cheilocystidia 9–32 × 4–8 μm, widely lageniform with short neck, sometimes branched, clavate, narrowly utriform, and cylindrical-flexuose, few rostrate. – Subhymenium ramose. – Hymenophoral trama subregular, hyphae 3–7 μm diam., yellowish, wall up to 0.8 μm thick. – Pileus trama radial, hyphae 4–24 μm diam., yellowish to yellowish brown in mass, wall thick (up to 1.6 μm thick), with yellowish brown, strongly encrusted pigment. – Pileipellis an ixocutis, up to 21 μm wide, hyphae 1.5–3 μm diam., hyaline, wall thin.

Material examined. – MEXICO, Chiapas, region of Tapachula, Municipio of Unión Juárez, Ejido Santo Domingo, 4 Oct 1993, leg. G. Guzmán 30379 (XAL, holotype).

Remarks. – The additional features presented here are the subhymenium type, pileus trama arrangement, and ixocutis thickness. The *Psilocybe chiapanensis* holotype agrees very well with *P. yungensis*; the conical to campanulate pileus, frequently acutely papillate or mammiform, and the very narrow lamellae are typical macroscopic characteristics of *P. yungensis*, according to Heim (1958), Singer & Smith (1958 b), and Guzmán (1983). Also, the micromorphological characters, shape and size of the basidiospores and pleurocystidia and shape of the cheilocystidia, are very similar in the two species. Guzmán (1995, p. 102) described *P. chiapanensis* with “pleurocystidia 11–14.5(–16) × (4–)5–6.5(–7) μm, common, hyaline, ventricose rostrate, with a short apex”, and two types of cheilocystidia: “a) as the pleurocystidia, (10.5–)12–16(–17.5) × 5.5–6.5 μm, hyaline”, and “b) (16–)17–22.5 × 5–8 μm, ventricose, regular or irregularly in shape, hyaline”. Both types of cheilocystidia fit well with those observed in the type of *P. yungensis* (see this species below). Guzmán (1995) pointed out that this species is similar to *P. yungensis* and *P. subyungensis* Guzmán in pileus shape, basidiospore size, and lignicolous habitat, but differs in having more abundant pleurocystidia (scanty in the last two species) and in the size and variability of the cheilocystidia. We found in the present study that *P. subyungensis* is synonymous with *P. yungensis* (see discussion below) and that the pleurocystidia are common to both species. We observed for *P. chiapanensis* that cheilocystidia are larger than those described by Guzmán (1995). Although Guzmán (1995) divided the cheilocystidia into two types, we decided to consider all the variation as one type, according to the previous description of *P. yungensis* by Singer & Smith (1958 b, p. 274), who considered them as “exceptionally variable: some clavate, some ventricose and with capitate to subcapitate apex, some ventricose above and constricted in the middle, others ventricose-fusoid and broadest in mid-portion, some ampullaceous, some capitate-cylindric, some subulate-sublanceolate, all hyaline, narrowest portions 2.7 μm or more”.

Psilocybe eximia E. Horak & Desjardin, *Sydowia* 58(1): 28. 2006. – Figs. 45–49.

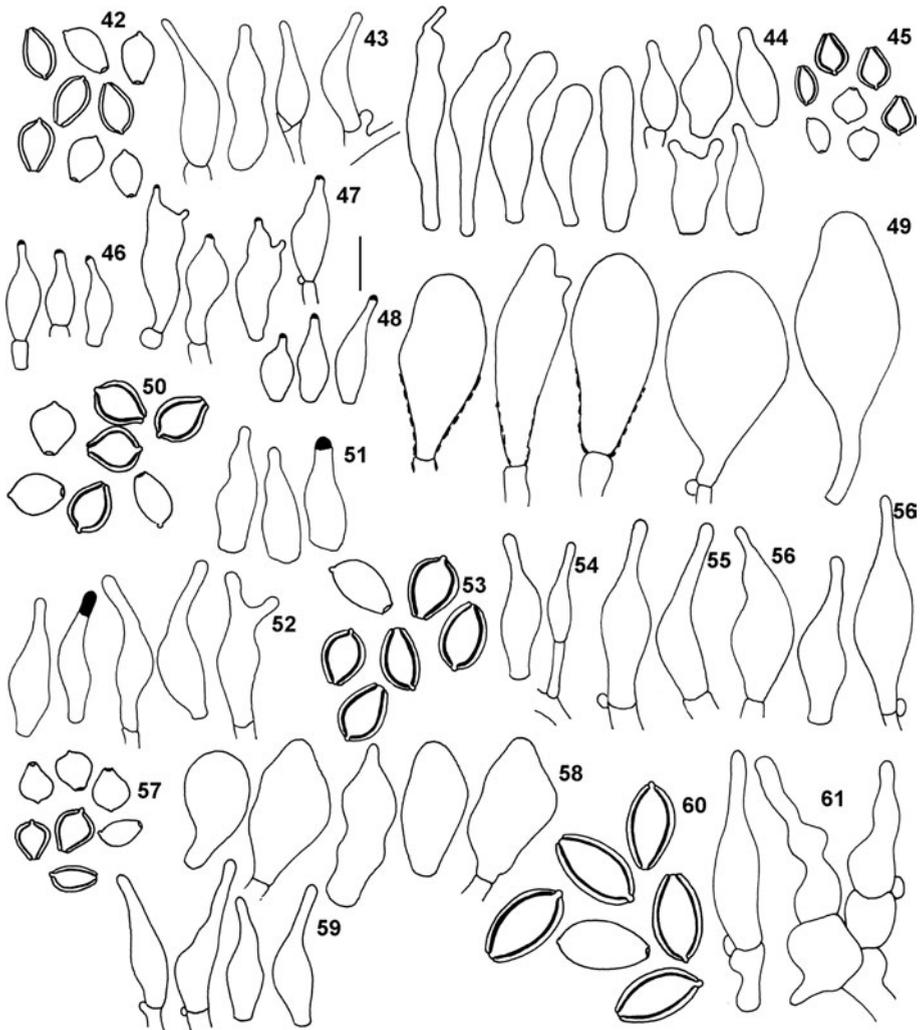
Basidiospores $4.8\text{--}5.6 \times 4.8\text{--}5.6 \times 3.2\text{--}4.2 \mu\text{m}$, $Q = 1\text{--}1.16$, rhomboid and subrhomboid in frontal view, $Q = 1.2\text{--}1.6$, ellipsoid in lateral view, yellowish brown, wall thick ($0.8\text{--}1 \mu\text{m}$), with two-layers, occasionally three layers observable in light microscopy, with germ pore. – Pleurocystidia $12\text{--}16 \times 3\text{--}5 \mu\text{m}$, widely lageniform, lageniform, and fusiform, with short neck, apex refringent, sometimes with two apices, hyaline, wall thin. – Cheilocystidia $24\text{--}44 \times 12\text{--}18.5 \mu\text{m}$, spheropedunculate, cylindrical, and clavate, hyaline, wall thin with yellowish brown, irregularly encrusted pigment. – Pileus trama radial, hyphae $4\text{--}40 \mu\text{m}$ diam., with some short and globose elements, yellowish to yellowish brown in mass, wall $0.8\text{--}1.7 \mu\text{m}$ thick with encrusted pigment. – Subpellis undifferentiated. – Pileipellis an ixocutis, $25\text{--}35 \mu\text{m}$ wide, hyphae $3\text{--}5 \mu\text{m}$ diam., hyaline, wall thin. – Pileocystidia $14\text{--}26 \times 4\text{--}7 \mu\text{m}$, clavate and cylindrical, hyaline, wall thin. – Stipitipellis hyphae $3\text{--}10 \mu\text{m}$ diam., wall $0.5\text{--}1.4 \mu\text{m}$ thick. – Caulocystidia $37\text{--}40 \times 13\text{--}14 \mu\text{m}$, cylindrical and clavate, wall thin with yellowish brown, encrusted pigment.

Material examined. – INDONESIA, Java, Mt. Halimun Salak National Park, near Cikaniki Field Station, alt. 1000–1100 m, 10 Jan 1999, *leg.* E. Horak 7326 (XAL, isotype), alt. 1000 m, 9 Jan 2001, *leg.* D. Desjardin DED 7207 (XAL); 11 Jan 2001, *leg.* D. Desjardin 7234 (XAL).

Remarks. – *Psilocybe eximia* was described without pleurocystidia by Horak & Desjardin (2006); however, we found small lageniform pleurocystidia, although in specimen DED 7207 they are larger and sometimes have two apices. Furthermore, Horak & Desjardin (2006) pointed out that globose or ovoid cells compose the subpellis; however, we do not consider the subpellis to be differentiated because we interpret those cells as part of the pileus trama. The arrangement of the pileus trama is radial, with the hyphae nearest to the pileipellis cylindrical, from $4\text{--}10 \mu\text{m}$ diam., and the cells nearest to the lamellae globose, up to $40 \mu\text{m}$ diam., with a trama that is, at least in part, cellular in tangential and radial sections. All the hyphae of the pileus trama are pigment-encrusted, so it is not possible to clearly separate them into two layers.

Psilocybe farinacea Rick ex Guzmán, *Mycotaxon* 7(2): 241. 1978. – Figs. 50–52.

Basidiospores $7.2\text{--}9.6(11.2) \times 4.9\text{--}7.2(8.0) \times 4.8\text{--}6.4 \mu\text{m}$, $Q = 1.1\text{--}1.4$, rhomboid and hexagonal, in frontal view, $Q = 1.3\text{--}1.6$, broadly ellipsoid in lateral view, yellowish brown, wall thick ($1 \mu\text{m}$), with two layers in light microscopy, with germ pore. – Pleurocystidia $16\text{--}19 \times 5\text{--}6 \mu\text{m}$, utriform and narrowly lageniform with short neck, some flexuose, apex obtuse, refractive, hyaline, wall thin, scarce. – Cheilocystidia $19\text{--}24 \times 5\text{--}6.5 \mu\text{m}$, narrowly lageniform with long neck, sometimes bifurcate, apex obtuse, refractive, hyaline, wall thin. – Pileus trama radial, hyphae $4\text{--}24 \mu\text{m}$ diam., yellowish to yellowish brown in mass, wall $0.5\text{--}0.8 \mu\text{m}$ thick, with encrusted pigment.



Figs. 42–61. Microscopic structures: 42–44. *Psilocybe cabiensis* (isotype). 42. Basidiospores. 43. Pileocystidia. 44. *P. chiapanensis* (holotype), cheilocystidia. 45–49. *P. eximia*. 45. Basidiospores (isotype). 46. Pleurocystidia (isotype). 47. Pleurocystidia (DED 7207). 48. Pleurocystidia (DED 7234). 49. Cheilocystidia (isotype). 50–52. *P. farinacea* (syntype). 50. Basidiospores. 51. Pleurocystidia. 52. Cheilocystidia. 53–56. *P. gallaeciae* (holotype). 53. Basidiospores. 54. Pileocystidia. 55. Caulocystidia (holotype). 56. Caulocystidia (F. Valeiras “B”). 57–59. *P. goniospora* (isotype). 57. Basidiospores. 58. Pleurocystidia. 59. Cheilocystidia. 60–61. *P. hispanica* (holotype). 60. Basidiospores. 61. Caulocystidia. Bar 8 μm .

Material examined. – BRAZIL, São Leopoldo, *leg.* J. Rick (Lloyd Herb., 27598 BPI, holotype).

Remarks. – The type material is contaminated with molds. We observed pleurocystidia, but they were scarce and difficult to see. This species is very similar to *P. mexicana*; however, it is difficult to determine with certainty whether they are the same species because of the bad condition of the type specimen of *P. farinacea*. Guzmán (1978) mentioned that it is similar to *P. caeruleascens*, but the last one has smaller basidiospores.

Psilocybe gallaeciae Guzmán & M. L. Castro, *Bol. Soc. Micol. Madrid* 27: 185. 2003. – Figs. 6, 53–56.

Basidiospores $8.4\text{--}10.4 \times (6.4)7.2\text{--}8.0 \times 6.4\text{--}7.2 \mu\text{m}$, $Q = 1.2\text{--}1.6$, sub-rhomboid, hexagonal, and ellipsoid in frontal view, angles of some spores not well defined, $Q = 1.5\text{--}1.8(2)$, ellipsoid and elongate in lateral view, yellowish brown, wall thick ($0.8\text{--}1.2 \mu\text{m}$), with two layers in light microscope, with germ pore. – Subhymenium ramose. – Pileus trama radial, hyphae $9.5\text{--}20 \mu\text{m}$ diam., yellowish, wall up to $0.5 \mu\text{m}$ thick, with encrusted pigment. – Subpellis undifferentiated. – Pileocystidia approximately $16\text{--}22 \times 4\text{--}5.5 \mu\text{m}$, lageniform, apex obtuse, hyaline, wall thin. – Stipitipellis a cutis, hyphae $4\text{--}16 \mu\text{m}$ diam., yellowish to yellowish brown in mass, wall up to $0.5 \mu\text{m}$ thick. – Caulocystidia $25\text{--}28 \times 4.5\text{--}7.5 \mu\text{m}$, lageniform, apex obtuse, hyaline to yellowish, wall thin, present in upper part of stipe.

Material examined. – SPAIN, Galicia, La Coruña, Caaverio, Monfero, La Coruña, gregarious in soil, 23 Nov 1997, *leg.* J. Comezana “C” (XAL, holotype); Pontevedra, Vigo, 5 Nov 1999, *leg.* F. Valeiras “B” (XAL).

Remarks. – *Psilocybe gallaeciae* is macromorphologically similar to *P. mexicana*, as Guzmán & Castro (2003) already noted, and probably corresponds to the same taxon. The basis that Guzmán & Castro (2003) used to distinguish them, the presence of pseudorhiza and pleurocystidia in *P. gallaeciae*, is weak in light of new observations in the present study. Guzmán (1983) mentioned “pleurocystidia absent or few similar to the cheilocystidia” for *P. mexicana*; however, data on the type and of several specimens that we will publish elsewhere has clearly revealed that this species has pleurocystidia. On the other hand, the type of *P. mexicana* was not properly collected, so we think that the pseudorhiza was left in the soil, based on the observations of an authentic specimen collected by Heim and other recently collected specimens, all with pseudorhiza, that fit very well with the concept of *P. mexicana*. Currently, the reasons to consider *P. gallaeciae* different from *P. mexicana* are basidiospore size and pileocystidial shape. Although, in the type of *P. gallaeciae* the basidiospores are slightly smaller (see dimensions earlier), in the additional specimen studied we found spores of $8.8\text{--}11.2 \times 6.4\text{--}8 \times 5.6\text{--}6.8 \mu\text{m}$, and Guzmán & Castro (2003) cited $9.5\text{--}11(13) \times 7\text{--}7.5(9) \mu\text{m}$. In *P. mexicana* the basidiospores are slightly shorter, with the majority $7\text{--}10 \mu\text{m}$ long, rarely up to 11 or 12 μm , and also narrower up to $7.2 \mu\text{m}$ wide. Finally, the pileocystidia in *P. mexicana* are globose, cylindrical, and

sometimes not well differentiated. On the other hand, *P. gallaeciae* grows in grasslands in Spain, and *P. mexicana* can be found in Mexico and Guatemala. With the available information, we cannot make a decision yet about their synonymy.

Psilocybe goniospora (Berk. & Broome) Singer, Sydowia 15(1–6): 70. 1962 (1961). – Figs. 57–59.

Synonym. = *Deconica goniospora* (Berk. & Broome) Singer, Sydowia 9(1–6): 404. 1955.

Basionym. = *Agaricus goniosporus* Berk. & Broome, J. Linn. Soc., Bot. 11(56): 541. 1871.

Synonym. = *Flammula goniospora* (Berk. & Broome) Sacc., Syll. Fung. 5: 827. 1887.

Basidiospores $4.8\text{--}5.6(6.4) \times 4.4\text{--}5.6 \times 3.2\text{--}4.0 \mu\text{m}$, $Q = 1\text{--}1.1$, rhomboid and subrhomboid, few hexagonal in frontal view, $Q = 1.3\text{--}1.7$, ellipsoid in lateral view, yellowish brown, wall slightly thick ($0.5\text{--}0.7 \mu\text{m}$), with two-layers in light microscopy, with germ pore. – Pleurocystidia $15\text{--}24 \times 6.5\text{--}11 \mu\text{m}$ broadly fusiform, ellipsoid, cylindrical, fusiform, sometimes mucronate, hyaline, with refractive content in KOH, wall thin. – Cheilocystidia $14\text{--}23 \times 5\text{--}6.5 \mu\text{m}$, narrowly lageniform, hyaline, wall thin. – Subhymenium ramose, hyphae $2.5\text{--}4 \mu\text{m}$ diam., wall thin. – Pileus trama radial, hyphae $8\text{--}12 \mu\text{m}$ diam., yellowish. – Pileipellis a subgelatinized cutis, hyphae yellowish, wall thin. – Stipitipellis a cutis, hyphae $2.5\text{--}4 \mu\text{m}$ diam., yellowish, wall up to $0.5 \mu\text{m}$ thick. – Caulocystidia approximately $15.5 \times 6 \mu\text{m}$, present, fusiform, some mucronate. – Stipe basal mycelium whitish yellow, hyphae hyaline, wall thin.

Material examined. – SRI LANKA, Peradeniya, Nov 1868, leg. M. J. Berkeley 835 [K(M) 160814, isotype].

Remarks. – The isotype consists of seven basidiomata and two pieces of a basidioma, all glued on a piece of paper. We observed with light microscopy that the basidiospore wall has two layers, like the “complex wall” previously reported by Pegler (1987: 411). The subhymenium is ramose, instead of pseudoparenchymatose. We observed the presence of caulocystidia, but the stipe was contaminated with mold, and they were difficult to measure. Pegler (1987) described the pleurocystidia with a refractive content distributed in all the cystidia, but not yellowish as in typical chrysocystidia belonging to *Hypholoma* or *Stropharia*. The content of pleurocystidia of *D. goniospora* in KOH looks similar to that observed in *D. neocaledonica* (see below), *D. thailandensis* (E. Horak, Guzmán & Desjardin) Ram.-Cruz & Guzmán, and *D. umbrina* (E. Horak, Guzmán & Desjardin) Ram.-Cruz & Guzmán (unpubl. data). On the basis of the new observations in the present study, as well as the descriptions of Pegler (1987) and Guzmán (1983), we concluded that this species does not belong to *Psilocybe sensu stricto*, but to *Deconica*. Recently, Horak *et al.* (2009) considered this taxon to be in the bluing *Psilocybe* sect. *Neocaledonicae*. Our ongoing phylogenetic study of members of this section

(10 taxa) reveals that species of *Psilocybe s. str.* and *Deconica* surprisingly belong in this section (unpubl. data).

Psilocybe hispanica Guzmán, Doc. Mycol. 29(116): 42. 2000. – Figs. 4, 14, 60–61.

Basidiospores 13.6–14.4(15.2) × 6.4–8.0(8.8) μm, Q = 1.6–2(2.5), elongate in frontal view and lateral view, few cylindrical, fusiform, yellowish brown, wall slightly thick (0.8 μm), with two layers in light microscopy, with germ pore. – Subhymenium ramose-inflated. – Pileus trama interwoven, hyphae 2.5–13 μm diam., yellowish, wall thin. – Subpellis differentiated, hyphae with yellowish brown strongly encrusted pigment. Pileocystidia absent. – Stipitipellis a cutis, hyphae 4.5–13 μm diam., yellowish, wall up to 0.5 μm thick. – Caulocystidia 25.5–35 × 4.5–8 μm, narrowly lageniform, flexuose, apex obtuse, hyaline, wall thin, in the upper part of the stipe.

Material examined. – SPAIN, Province of Aragón, N of Huesca, Pirineos region, Autumn 1995, alt. 2300 m, alpine meadow, on dung, *leg.* I. Seral-Bozal s.n. (XAL, holotype).

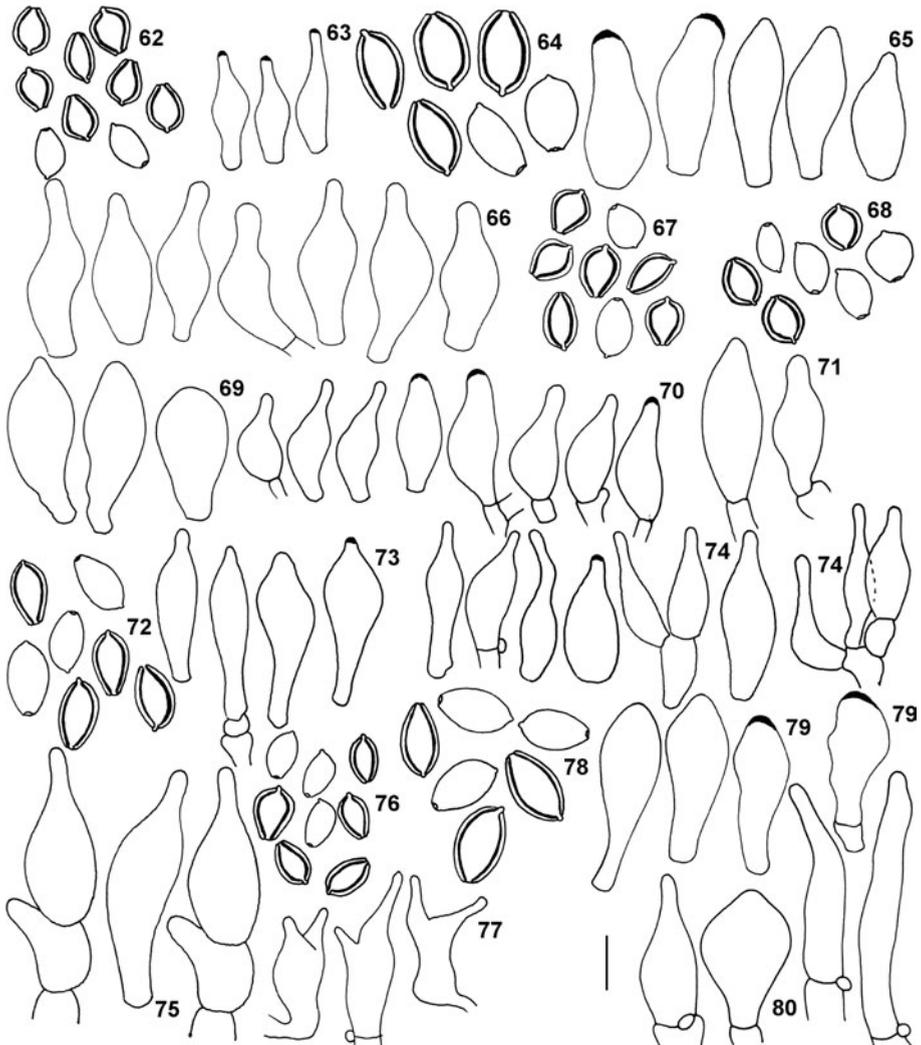
Remarks. – This species is similar to *P. semilanceata* (Fr.) P. Kumm. and *P. liniformans* Guzmán & Bas. The following features are not mentioned in the original description viz. the radial arrangement of the pileus trama, the subhymenium type, and presence of caulocystidia.

Psilocybe isabelae Guzmán, in Guzmán, Ramírez-Guillén, Tapia & Navarro, Acta Bot. Mex. 49: 39. 1999. – Figs 62–63.

Basidiospores 6.4–8.0 × 5.6–6.4 × 4.8–5.2 μm, Q = 1.1–1.4, subrhomboid and subhexagonal in frontal view, Q = 1.3–1.6, ellipsoid and elongate in lateral view, yellowish brown, wall thick (0.8–1 μm), with two layers in light microscopy, with germ pore. – Pleurocystidia 12.5–18.5 × 4–5.5 μm, narrowly lageniform, apex obtuse, refractive, hyaline, wall thin. – Subhymenium ramose. – Pileus trama radial, hyphae 5–24 μm diam., yellowish to yellowish orange in mass, wall thin with encrusted pigment. – Pileipellis a thin subgelatinized cutis, hyphae up to 6.5 μm diam., yellowish, wall thin. – Pileocystidia absent. – Caulocystidia 9–26 × 6–11 μm, narrowly lageniform, fusiform or as modified hyphae, occasionally branched, only in the apical part of stipe.

Material examined. – MEXICO, Veracruz, SW of Xico, 15 Sep 1998, *leg.* G. Guzmán 32466 (XAL, holotype).

Remarks. – The original description of Guzmán *et al.* (1999) is complemented with additional features, such as the arrangement of the pileus trama and the presence of caulocystidia. Further, we observed with light microscopy that the basidiospore walls have two layers. This species is similar to *P. subtropicalis* in all microscopic features except that *P. subtropicalis* has two kinds of pleurocystidia. Because the description of *P. isabelae* was based on one specimen, it is not possible to know for sure whether the specimen manifested all intraspecific variation that may be present within the taxon



Figs. 62–80. Microscopic structures: **62–63.** *Psilocybe isabelae* (holotype). **62.** Basidiospores. **63.** Pleurocystidia. **64–66.** *P. jaliscana* (isotype). **64.** Basidiospores. **65.** Pleurocystidia. **66.** Cheilocystidia. **67.** *P. keralensis* (isotype), basidiospores. **68–71.** *P. magnispora* (isotype). **68.** Basidiospores. **69.** Pleurocystidia. **70.** Cheilocystidia. **71.** Caulocystidia. **72–75.** *P. makarorae* (holotype). **72.** Basidiospores. **73.** Pleurocystidia. **74.** Cheilocystidia. **75.** Caulocystidia. **76–77.** *P. meridionalis* (holotype). **76.** Basidiospores. **77.** Caulocystidia. **78–80.** *P. mescaleroensis* (holotype). **78.** Basidiospores. **79.** Pleurocystidia. **80.** Caulocystidia. Bar 8 μ m.

or whether other specimens may present two kinds of pleurocystidia. So, until more specimens are gathered and reviewed, we treat *P. isabelae* as an independent taxon.

Psilocybe jaliscana Guzmán, Doc. Mycol. 29(116): 46. 2000, nom. inval. – Figs. 64–66.

Basidiospores 10.0–13.0 (15.0) \times 7.2–8.8 \times 6.4–8.0 μm , $Q = 1.2\text{--}1.7$, hexagonal, sometimes angles not well defined in frontal view, $Q = 1.4\text{--}1.7$, ellipsoid and elongate in lateral view, yellowish brown, wall thick (1–1.4 μm), with two layers in light microscopy, with germ pore. – Pleurocystidia 22–31 \times 8.8–9.6 μm , utriform, fusiform, and clavate, apex obtuse, refractive, wall thin. – Cheilocystidia 20–28 \times 5.5–8 μm , utriform and lageniform, apex obtuse, refractive, hyaline, wall thin. – Pileus trama interwoven, hyphae 3–14.5 μm diam., yellowish. – Pileipellis an ixocutis, 20–30 μm wide, hyphae 1.5–3 μm diam., yellowish, wall thin. – Pileocystidia absent. – Stipitipellis a cutis, hyphae 2.5–5.5 μm diam., yellowish, wall <0.5 μm thick. – Caulocystidia not observed. – Stipe basal mycelium hyphae hyaline, wall thin.

Material examined. – MEXICO, Jalisco, Municipality of Mazamitla, near Mazamitla town, 7 Sep 1996, in *Pinus-Quercus* forest with subtropical influence, solitary on soil, leg. G. Guzmán 31693 (IBUG, isotype).

Remarks. – Additional information not included in the protologue is the arrangement of the pileus trama and presence of gelatinized pileipellis. Guzmán (2000, p. 46) described the basidiospores in frontal view as “ellipsoid to obscurely subhexagonal or subrhomboidal”, but we did not observe subrhomboid basidiospores. Also, Guzmán (2000) cited pleurocystidia as ventricose-submucronate to subrostrate, but the drawings represent cylindrical, clavate, and fusiform as in our observations. We also found shorter pleurocystidia. From our study of the isotype, we concluded that *Psilocybe jaliscana* is very similar to *P. subcubensis* Guzmán in macro- and micromorphological features. According to Guzmán (1983, p. 249–250), *P. subcubensis* has basidiospores “(9.9–)11–13(–14) \times 7.7–8.8 \times 6.6–7.1 μm , subhexagonal in frontal view, subellipsoid in lateral view, thick walled (0.5–1 μm)”, pleurocystidia “14–22 \times 8–12 μm , hyaline, scarce, thin walled, ventricose or subpyriform, submucronate”, and cheilocystidia “16–25(–36) \times 6–9 μm , hyaline, abundant, forming a sterile band, thin walled, fusoid-ventricose or sublageniform, with short neck, sometimes with subglobose heads”. In broad outline, *P. jaliscana* could fit within the variation of *P. subcubensis*. Both species differ mainly in the absence of a well-developed membranous annulus in *P. jaliscana* and in their habitat. *Psilocybe subcubensis* grows in dung and sometimes in soils, but *P. jaliscana* is only known from the type specimen growing in soil, so it is very poorly known. In our opinion, *P. jaliscana* is a synonym of *P. subcubensis*.

Psilocybe keralensis K. A. Thomas, Manim. & Guzmán, in Thomas, Manimohan, Guzmán, Tapia & Ramírez-Guillén, Mycotaxon 83: 196. 2002. – Fig. 67.

Basidiospores 7.2–8.4 \times (4.8)5.6–6.4 \times 4.8–5.6 μm , $Q = 1.2\text{--}1.4$, subrhomboid and subhexagonal in frontal view, $Q = 1.3\text{--}1.7$, ellipsoid and elon-

gate in lateral view, yellowish brown, wall slightly thick (0.8 μm), with two layers in light microscopy, with germ pore. – Subhymenium ramose-inflated, hyphae yellowish, wall thin. – Hymenophoral trama subregular, hyphae 6.5–23 μm diam., yellowish, wall thin. – Pileus trama radial, hyphae 5.5–25.5 μm diam., yellowish, wall thin. – Pileipellis an ixocutis, 9–10.5 μm wide, hyphae 1.5–3 μm diam., hyaline, wall thin.

Material examined. – INDIA, Kerala State, Wayanad District, Ponkuzhy, 21 Jul 1999, leg. K. A. Thomas T319a (XAL, isotype).

Remarks. – Additional taxonomic features not described by Thomas *et al.* (2002) are shown here, such as the arrangement of the pileus trama and the type of subhymenium. Thomas *et al.* (2002) described the basidiospores as slightly lenticular, ovo-ellipsoid to subrhomboid in frontal view. Although the authors placed this species in sect. *Cordisporae*, *P. keralensis* is actually more similar to species of sect. *Mexicanae*, e.g., *P. atlantis*, *P. mexicana*, and *P. samuiensis*.

Psilocybe magnispora E. Horak, Guzmán & Desjardin, Sydowia 61(1): 25. 2009. – Figs. 68–71.

Basidiospores 6.4–8.0 \times 5.2–6.4(7.2) \times 4.8–5.6 μm , Q = 1.1–1.25, subrhomboid and hexagonal in frontal view, Q = 1.3–1.5, ellipsoid in lateral view, yellowish brown, wall thick (0.8–1 μm), with two or three layers in light microscopy, with germ pore. – Pleurocystidia 19–31 \times 9.5–12 μm , ovoid, clavate, and fusiform, sometimes mucronate, hyaline, wall thin, without reaction to Patent blue V. – Cheilocystidia 13.5–20 \times 5–7(10) μm , lageniform, with a short neck, apex obtuse with a refractive cap, hyaline, wall thin, embedded in a gelatinized layer at the edge of the lamellae. – Pileus trama interwoven, hyphae 7–20 μm diam., hyaline, wall thin. – Pileipellis an ixocutis, 24–32 μm thick, hyphae 1.6–4 μm diam., hyaline, wall thin. – Caulocystidia 21.5–32 \times 6.5–9.5 μm , utriform and subfusiform, yellowish, wall thin.

Material examined. – THAILAND, Kha Yai National Park, Pong Chang, Princess Trail, in tropical montane broadleaf forest, 10 Jul 2002, leg. E. Horak 10171 (XAL, isotype).

Remarks. – Important information is that this species has bluing basidiomata and lacks chrysocystidia. Horak *et al.* (2009) and Guzmán *et al.* (2012) considered *P. magnispora* as similar to *P. thailandensis*, although the two species are very different in macro- and micromorphological features. *Psilocybe thailandensis* actually belongs to the genus *Deconica* because it is not bluing (Ramírez-Cruz *et al.* 2012). Cheilocystidia in *P. magnispora* are embedded in a gelatinized layer at the edge of the lamellae as in *P. aquamarina* and *P. thaiaerugineomaculans* Guzmán, Karunarathna & Ram.-Guill. (Guzmán *et al.* 2012). However, it differs in having smaller basidiospores, 8.8–11.2(12.4) \times 6.4–8.8 \times 4.8–6.4 μm in *P. aquamarina* and 8.8–10.5(11.7) \times 6.4–8.0 \times 5.6–7.2 μm in *P. thaiaerugineomaculans*. Horak *et al.* (2009) described the pleurocystidial content as refringent; we observed that the content is opaque, hyaline to yellowish brown and did not react with Patent blue

V, so they cannot be considered as true chrysocystidia. According to Horak *et al.* (2009), this species resembles the Indonesian *P. aureicystidiata* E. Horak & Desjardin, based on the annulated basidiomata, but this species also belongs to *Deconica* (see below).

Psilocybe makarorae P. R. Johnst. & P. K. Buchanan, New Zealand J. Bot. 33(3): 382. 1995. – Figs. 17, 72–75.

Basidiospores $8.8\text{--}9.6 \times 4.8\text{--}6.4 \times 5.6\text{--}6 \mu\text{m}$, $Q = 1.3\text{--}1.5(1.8)$, ellipsoid, subrhomboid, and hexagonal in frontal view, angles not well defined in some spores, $Q = 1.4\text{--}1.7$, ellipsoid and elongate in lateral view, yellowish brown, wall thick ($0.8\text{--}1 \mu\text{m}$), with two layers in light microscopy, with germ pore. – Pleurocystidia $19\text{--}29 \times 5\text{--}8(9) \mu\text{m}$, fusiform, some clavate-mucronate, hyaline, wall thin. – Cheilocystidia $16\text{--}25.5 \times 5\text{--}8 \mu\text{m}$, narrowly lageniform to lageniform and utriform, some fusiform-mucronate, hyaline, some with granulose yellowish content, wall thin. – Subhymenium ramose-inflated, wall with yellowish brown, encrusted pigment. – Pileus trama radial with some zones with interwoven hyphae, $6\text{--}16 \mu\text{m}$ diam., hyaline, yellowish in mass, wall thin. – Subpellis differentiated, hyphae $2.5\text{--}12 \mu\text{m}$ diam., hyaline, wall with encrusted pigment. – Pileipellis an ixocutis, $6\text{--}11 \mu\text{m}$ wide, hyphae $2.5\text{--}4 \mu\text{m}$ diam., hyaline, wall thin. – Stipitipellis with hyphae $2\text{--}5 \mu\text{m}$ diam., hyaline, wall slightly thick. – Caulocystidia $22.5\text{--}34.5 \times 6.5\text{--}9.5 \mu\text{m}$, narrowly lageniform, lageniform, and fusiform, hyaline, wall thin.

Material examined. – NEW ZEALAND, Otago Lakes, Haast Pass, vic. Makarora, Blue Pools Track, on rotten *Nothophagus* wood, *leg.* P. R. Johnston, B. P. Segedin & R. H. Petersen, 16 May 1990, (PDD 57396, holotype). Southland, Catlins, 5 km north of Papatowai, Table Hill Reserve, *leg.* P. R. Johnston, T. May & G. S. Ridley, 9 May 1995 (PDD 646666). West coast, Fox Glacier Westland, Westland National Park, 73 km south of Fox Glacier, *leg.* R. H. Petersen (Field # TFB7069) (TENN 054116).

Remarks. – In the protologue, Johnston & Buchanan (1995) described the pleurocystidia as similar to cheilocystidia, but according to our examination they are different. Additional specimens studied here show somewhat larger caulocystidia $25.5\text{--}50 \times 4\text{--}9 \mu\text{m}$, cylindrical, widely lageniform, lageniform, or fusiform. Johnston & Buchanan (1995) pointed out that, based on the basidiospore shape and bluing reaction, this species belongs to sect. *Mexicanae* of Guzmán (1983). However, the shape of the pleurocystidia and cheilocystidia and the macroscopic features are closer to those of *P. cyanescens* Wakef. from sect. *Semilanceatae* of Guzmán (1995). *Psilocybe makarorae* and *P. cyanescens* differ in basidiospore size and shape.

Psilocybe meridionalis Guzmán, Ram.-Guill. & Guzm.-Dáv., in Guzmán, Guzmán-Dávalos, Ramírez-Guillén & Sánchez-Jácome, Mycotaxon 103: 28. 2008. – Figs. 76–77.

Basidiospores $6.4\text{--}8.0(8.8) \times 4.8\text{--}5.6 \times 4.0\text{--}4.8 \mu\text{m}$, $Q = 1.3\text{--}1.6$, subrhomboid and subhexagonal in frontal view, angles not well defined, $Q =$

1.4–1.8, ellipsoid and elongate in lateral view, yellowish brown, wall thick (0.8–1 μm), with two layers in light microscopy, with germ pore. – Pileus trama radial to the lamellae, interwoven to the pileipellis, hyphae 4–16 μm diam., yellowish to yellowish brown in mass, wall thin. – Pileipellis a subgelatinized cutis, 12–16 μm wide, hyphae 1.5–4 μm diam., hyaline, wall thin. – Pileocystidia absent. – Stipitipellis a cutis, hyphae 1.5–4 μm diam., yellowish, wall up to 0.5 μm thick, in the basal part of the stipe with yellowish brown hyphae, some capitate. – Caulocystidia 17.5–24 \times 5.5–8 μm , lageniform-flexuose, bifurcate, hyaline, wall thin, in the apical part of stipe. – Stipe basal mycelium white, hyphae hyaline, wall thin.

Material examined. – MEXICO, Jalisco, Sierra de Cacoma, Municipality of Aulán, Neverías, alt. 2200 m, *Pinus-Quercus* forest, 27 Sep 2005, leg. M. R. Sánchez-Jácome 1163 (IBUG, holotype).

Remarks. – We present the arrangement of the pileus trama, the presence of caulocystidia, and subgelatinized pileipellis. Also, we point out that the basidiospores are hexagonal besides subrhomboid, with a complex wall. Another important observation is that the yellowish brown hyphae of the base of the stipe differ from the setaceous hyphae present in the basal mycelium of some species of sect. *Cordisporae*, e.g., *P. mesophylla* Guzmán, J. Q. Jacobs & Escalona, *P. neoxalapensis* Guzmán, Ram.-Guill. & Halling, *P. fagicola* R. Heim & Cailleux (Guzmán *et al.* 2005). *Psilocybe meridionalis* is very similar to *P. thaicordispora* (see this species below) from Thailand, recently described by Guzmán *et al.* (2012).

Psilocybe mescaleroensis Guzmán, Walstad, Gándara & Ram.-Guill., Mycotaxon 99: 225. 2007. – Figs. 78–81.

Basidiospores 9.6–11.2(12.0) \times (5.6)6.4–7.2 μm , Q = 1.4–1.6(1.8), ellipsoid and elongate in frontal and lateral views, fusiform, yellowish brown, wall slightly thick (0.6–0.8 μm), with two layers in light microscopy, with germ pore. – Pleurocystidia 20–28 \times (5.5)8–9.5 μm , clavate and fusiform, some irregular flexuose, apex refractive, hyaline, wall thin. – Cheilocystidia 17.5–33 \times 5.5–8 μm , lageniform and fusiform, flexuose, apex obtuse, occasionally bifurcate, wall thin. – Subhymenium ramose-inflated, yellowish. – Pileus trama radial, hyphae 4.5–12 μm diam., yellowish, wall thin. – Pileipellis an ixocutis, 80 μm wide, hyphae 2.5–5.5 μm diam., hyaline, wall thin. – Pileocystidia absent. – Stipitipellis a cutis, hyphae 5.5–8 μm diam., yellowish, wall up to 0.5 μm thick. – Caulocystidia 22.5–40 \times 4–11 μm , lageniform, clavate and cylindrical, flexuose, apex obtuse, hyaline, wall thin.

Material examined. – USA, New Mexico, Sacramento, Aug 2007, leg. L. F. Walstad s.n. (XAL, holotype).

Remarks. – Guzmán *et al.* (2007 a) described the basidiospores as subrhomboid and did not mention the presence of pleurocystidia, but they are scarce and very different from cheilocystidia. We also describe the arrangement of the pileus trama and the presence of caulocystidia. Although Guzmán

et al. (2007 a) placed *P. mescaleroensis* in sect. *Stuntzii* for the submembranaceous annulus, we think this species is more closely related to those of sect. *Semilanceatae sensu* Guzmán (1995) or *Cyanescens* in the sense of Guzmán (1983). It is similar to *P. hopii* Guzmán & J. Greene, except *P. hopii* lacks an annulus and has two types of cheilocystidia.

Psilocybe mesophylla Guzmán, J. Q. Jacobs & Escalona, in Guzmán, Escalona, Ramírez-Guillén & Jacobs, *Int. J. Med. Mush.* 6(3): 276. 2004. – Figs. 82–87.

Basidiospores (4.8)5.2–6.4(7.2) × 4.8–5.6(6.4) × 3.2–4.8 μm, Q = 1–1.16, rhomboid and subrhomboid in frontal view, Q = 1.1–1.5(1.7), broadly ellipsoid and ellipsoid in lateral view, yellowish brown, wall slightly thick to thick (0.5–1 μm), with two layers in light microscopy, with germ pore, some with two pores. – Pleurocystidia as leptocystidia 12–21 × 3–5.5(7) μm, lageniform and lageniform-flexuose, always hyaline, wall thin. – Pleurocystidia as deutero-cystidia 16–34.5 × 6.5–9.5 μm, lageniform and utriform, some with flexuose neck, apex obtuse, hyaline or yellowish grey, wall thin. – Cheilocystidia 18.5–29.5 × 4.5–8 μm, fusiform, ventricose, and clavate, with two to five short and narrow, mostly apical branches, few moniliform with a wide base, hyaline to yellowish grey, wall thin. – Subhymenium ramose. – Pileus trama radial, hyphae 9.5–18.5 μm diam., yellowish to yellowish brown in mass, wall 0.8–1 μm thick with encrusted pigment. – Subpellis differentiated, hyphae 2.4–12 μm diam., hyaline, wall thick with encrusted pigment. – Pileipellis a subgelatinized cutis, hyphae 2–3 μm diam., yellowish, wall thin. – Pileocystidia 8–20 × 4–10.5 μm, pyriform, globose, conical, and utriform, hyaline, wall thin. – Caulocystidia 8–22.5(41) × 4.5–8 μm, cylindrical and as modified hyphae, sometimes branched, hyaline, wall thin.

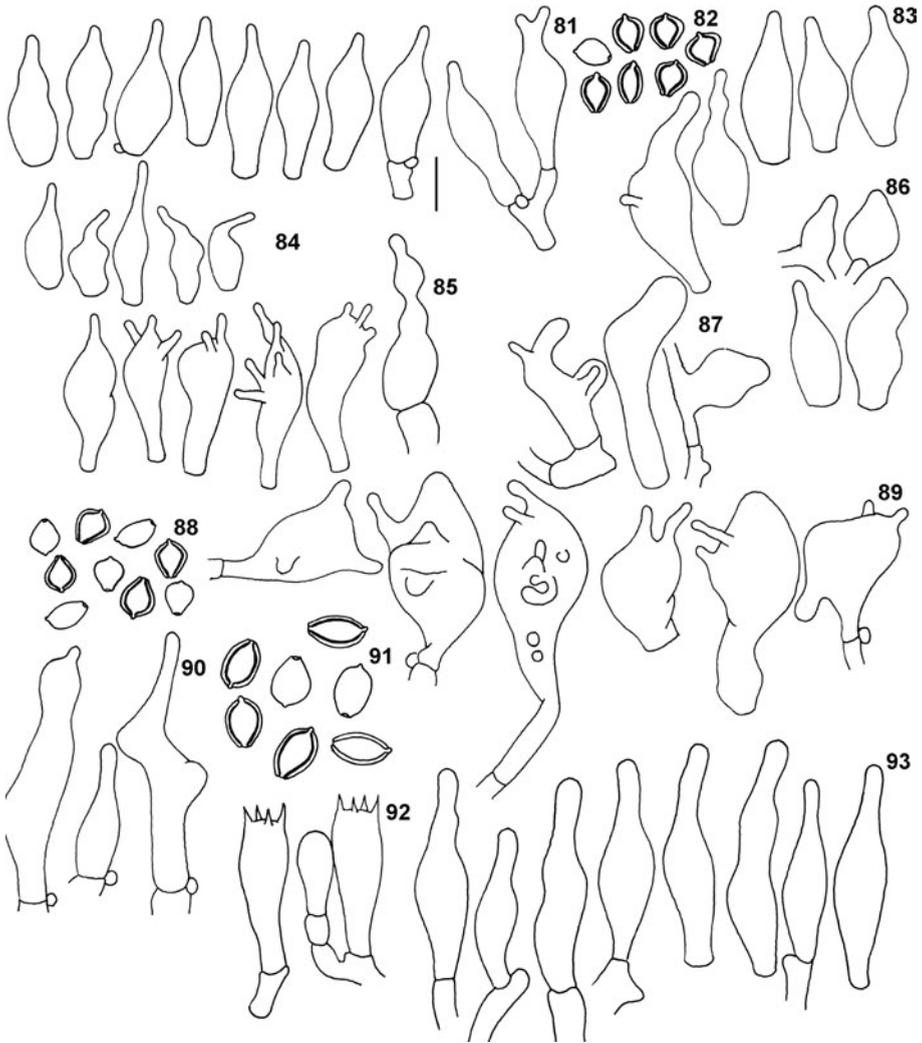
Material examined. – MEXICO, Oaxaca, Tuxtepec, near Llano Grande, on orange-red clay soil without vegetation outside of a mesophytic forest, 5 Jul 1980, *leg.* J. Jacobs 159 (XAL, holotype).

Remarks. – Here we describe subhymenium, pileus trama, pileocystidia, and two types of cystidia on the side of the lamellae. Guzmán *et al.* (2004 b) found only lageniform caulocystidia; we record them here as highly variable in shape.

Psilocybe neoxalapensis Guzmán, Ram.-Guill. & Halling, in Guzmán, Horak, Halling & Ramírez-Guillén, *Sydowia* 61(2): 220. 2009. – Figs. 25, 88–90.

Synonym. = *Psilocybe novoxalapensis* Guzmán & J. Q. Jacobs, in Guzmán, Jacobs, Ramírez-Guillén, Murrieta & Gándara, *J. Microbiol.* 43(2): 159. 2005, nom. nud.

Basidiospores 4.4–5.6 × 4.0–4.8 × 3.2–4.0(4.4) μm, Q = 1–1.2, rhomboid in frontal view, Q = 1.1–1.3, broadly ellipsoid in lateral view, yellowish brown, wall slightly thick (0.5–0.8 μm), with two layers in light microscopy, with germ pore. – Subhymenium ramose. – Pileus trama radial, hyphae 8–36 μm diam., yellowish to yellowish brown in mass, wall 0.8 μm thick, with encrusted pigment. – Subpellis differentiated, hyphae 4–11 μm



Figs. 81–93. Microscopic structures: **81.** *Psilocybe mescaleroensis* (holotype), cheilocystidia. **82–87.** *P. mesophylla* (holotype). **82.** Basidiospores. **83.** Deuterocystidia. **84.** Leptocystidia. **85.** Cheilocystidia. **86.** Pileocystidia. **87.** Caulocystidia. **88–90.** *P. neoxalapensis* (holotype). **88.** Basidiospores. **89.** Pileocystidia. **90.** Caulocystidia. **91–93.** *P. ochreata* (holotype). **91.** Basidiospores. **92.** Basidia, basidiolae, and subhymenium. **93.** Cheilocystidia. Bar 8 μm .

diam., yellowish brown, wall thin with strongly encrusted pigment. – Pileipellis a subgelatinized layer, hyphae 1.5–4 μm diam., hyaline. – Pileocystidia 24–34.5 \times 8.5–15 μm , clavate, as modified hyphae, with short and narrow branches, wall thin, arranged in groups. – Stipitipellis with hyphae 5.5–13 μm diam., yellowish, wall up to 0.5 μm thick. – Caulocystidia

19–25 × 4–9 µm, narrowly lageniform, cylindrical flexuose, sometimes apex mucronate, hyaline, some yellowish, wall thin, in groups in all the stipe.

Material examined. – MEXICO, Veracruz, Banderilla, cerro La Martinica, in subtropical or montane cloud forest, Jul 1983, *leg.* A. López 2186 (XAL, holotype).

Remarks. – We complement the recent re-description of this species (Guzmán *et al.*, 2009) with data on the pileocystidia, subhymenium, and pileus trama. The subpellis is not cellular but has radial hyphae. As far as we know, only *P. eximia* has a pileus trama with inflated hyphae, but the subpellis is never cellular in *Psilocybe* neither in *Deconica*.

Psilocybe ochreata (Berk. & Broome) E. Horak, in Guzmán, *Beih. Nova Hedwigia* 74: 138. 1983. – Fig. 19, 91–93.

Basionym. = *Agaricus ochreatus* Berk. & Broome, *J. Linn. Soc., Bot.* 11(56): 555, 1871.

Synonym. = ***Deconica montana*** (Pers.) P. D. Orton, *Trans. Br. Mycol. Soc.* 43(2): 175. 1960.

Basidiospores 7.2–8.8 × 4.2–5.6(6.4) × 4.4–4.8 µm, Q = 1.2–1.5, rhomboid and hexagonal in frontal view, Q = 1.5–1.8, subellipsoid in lateral view, yellowish brown, wall slightly thick (0.5–0.8 µm), with two layers in light microscopy, with germ pore. – Basidia 21.5–32 × 6.5–8 µm, cylindrical or clavate, tetrasporic, few monosporic, sterigmata 3–5 µm long, hyaline, wall thin. – Pleurocystidia absent. – Cheilocystidia 19–36 × 5.5–8 µm, utriform and narrowly lageniform, some flexuose, hyaline, wall thin, apex 4–7 µm wide, obtuse to subcapitate, refractive, hyaline. – Subhymenium ramose-inflated, with some pigmented hyphae ascending to the hymenium. – Hymenophoral trama subregular, hyphae 4.5–8 µm diam., yellowish, wall thin. – Pileus trama radial, hyphae 6.5–8 µm diam., yellowish, wall thin. – Subpellis differentiated, hyphae 4–11 µm diam., yellowish brown, wall thin with strongly encrusted pigment. – Pileipellis an ixocutis, hyphae hyaline, wall thin. – Pileocystidia absent. – Caulocystidia not observed. – Clamp connections present.

Material examined. – SRI LANKA, Peradeniya, on dead wood, *leg.* C. E. Broome 835 [281] [K(M) 160813, holotype].

Remarks. – This species was described by Berkeley & Broome (1871) only on the basis of macroscopic features. Horak (in Guzmán 1983) proposed the combination in *Psilocybe* and described the basidiospores. Later, Pegler (1987) provided additional data on its micromorphology. We agree with Pegler's and Horak's herbarium notes that there are two species in the specimen labelled as the type of *P. ochreata*. The type specimen consists of six basidiomata or fragments glued on paper and several basidiomata in an envelope. Pegler assigned numbers (1–7) to the glued basidiomata, but not for those in the envelope. According to Horak's and Pegler's notes, basidiomata 1, 3, and 5 belong to *P. ochreata*, and 2, 4, and 6 correspond to *P. goniospora*. We checked the basidiomata contained in the envelope, separated them, and numbered them as 8 and 9. The basidiomata corresponding to number 8 belong to *P. goniospora* (= *Deconica goniospora*), and those for number 9 belong

to *P. ochreata*. Our description here is based only on basidiomata 1, 3, 5, and 9. We found basidia and cheilocystidia larger than those described by Pegler (1987). For us, *P. ochreata* agrees well with *D. montana* in the size and shape of the basidiospores, absence of pleurocystidia, the size and shape of cheilocystidia, and the pigmented hyphae ascending to the subhymenium, according to the characteristics for *D. montana* described by Guzmán (1983). The only difference between *P. ochreata* and *D. montana* is the latter's wider cheilocystidial apex (2–3.5 µm wide). Therefore, we propose that these species are synonyms. The type specimen of *P. ochreata* was described on rotten wood, unlike soil-growing *D. montana*, but the basidiomata are mixed. Some probably grew in soil, and those belonging to *P. goniospora* grew on rotten wood. *Psilocybe magica* Svrček (nonhallucinogenic) is very similar to *D. montana*, according to Guzmán *et al.* (2008 a), only differing in size, shape, and apical width of the cheilocystidia – variable from sublageniform or tibiiform to flexuose-cylindrical, or moniliform, with apex 2–5(8) µm wide in *P. magica*.

Psilocybe overeemii E. Horak & Desjardin, Sydowia 58(1): 30. 2006. – Figs. 24, 94–97.

Synonym. = ***Deconica neocaledonica*** (E. Horak & Desjardin) Ram.-Cruz & Guzmán (see below).

Synonym. = *Psilocybe neocaledonica* Guzmán & E. Horak, Sydowia 31(1–6): 53. 1979 (1978).

Basidiospores 5.0–6.0(7.0) × 5.0–6.0 × 3.5–4.0 µm, Q = 1–1.2, rhomboid and subrhomboid in frontal view, Q = 1.3–1.7, ellipsoid in lateral view, yellowish brown, wall thin to slightly thick (0.4–0.6 µm), with two layers in light microscopy, with germ pore. – Pleurocystidia as chrysocystidia, 18–30 × 9–11 µm, fusiform-mucronate, hyaline, with content irregular hyaline in KOH and staining blue with Patent blue V. – Cheilocystidia 10.5–18.5 × 3.2–5 µm, narrowly lageniform, hyaline, wall thin. – Subhymenium ramose-inflated. – Pileus trama radial, hyphae 4–17 µm diam., yellowish to yellowish brown in mass, wall 0.5–0.8 µm thick, with encrusted pigment. – Pileipellis a thin ixocutis, less than 8 µm thick, hyphae 2.5–3 µm diam., hyaline with encrusted pigment. – Pileocystidia not observed. – Caulocystidia 17.5–27 × 5.5–8.5 µm, narrowly lageniform, subfusiform, and clavate, few with a short lateral branch, some with encrusted pigment from the base to the middle.

Material examined. – INDONESIA, Java, Mt. Halimun Salak National Park, alt. 1200 m, near Cikankiki Field Station, 8 Jan 1999, *leg.* E. Horak 7311 (XAL, isotype).

Remarks. – From the study of the type, we are proposing this species as a synonym under *D. neocaledonica*, described as *Psilocybe* from New Caledonia by Guzmán & Horak (1978). The main reasons for the synonymy are the similar size and shape of their basidiospores, chrysocystidia, and cheilocystidia and the same types of subhymenium and pileipellis (see characteristics of *D. neocaledonica* below). Macromorphologically, they have a convex to

campanulate pileus, covered with concolorous fibrillose squamules, a stipe covered with concolorous or whitish remnant fibrils from the veil, but lacking a distinct cortinate zone or annulus. Both species grow on rotten wood in tropical forests. *Psilocybe overeemii* is related to *P. aureicystidiata* according to Horak & Desjardin (2006), but can be separated mainly by the fibrillose, squamulose veil remnants present on *P. overeemii*.

Psilocybe ovoideocystidiata Guzmán & Gaines, Int. J. Med. Mush. 9(1): 75–77. 2007. – Figs. 22, 98–102.

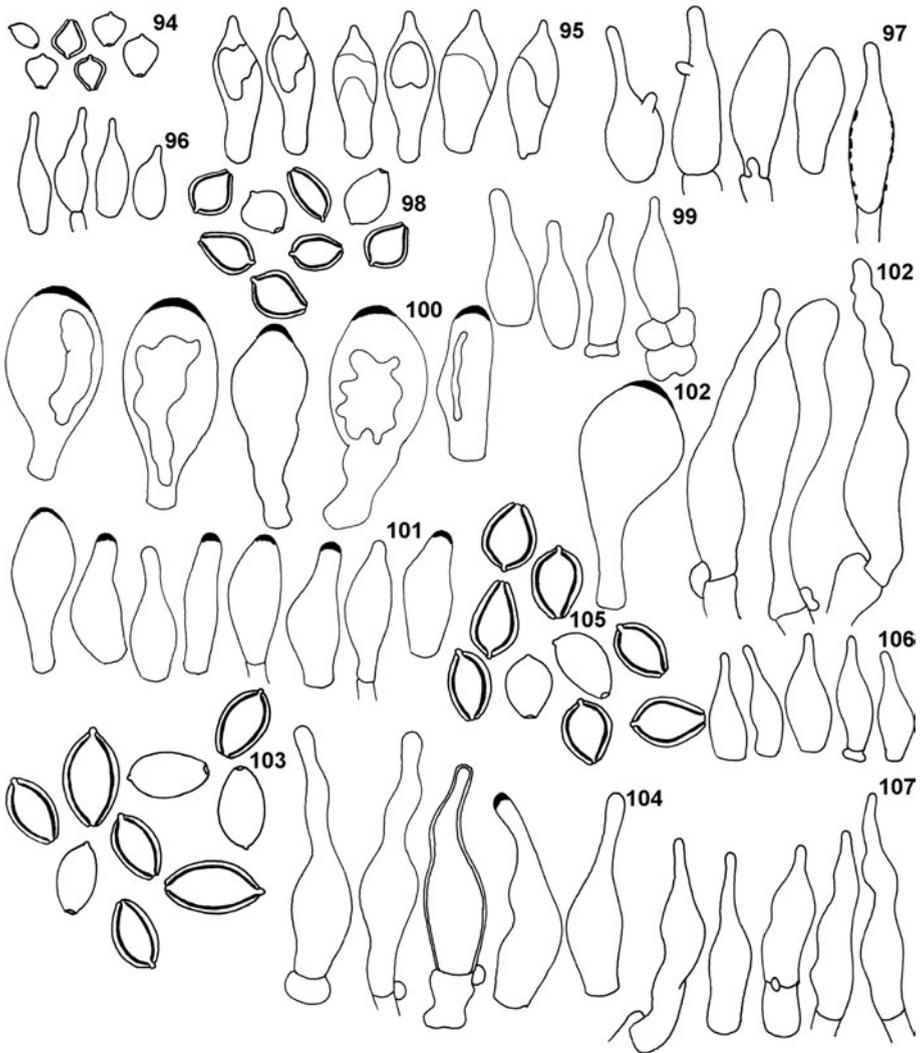
Basidiospores $6.4\text{--}9.6 \times 5.6\text{--}7.2 \times 4.4\text{--}6.4 \mu\text{m}$, $Q = 1.17\text{--}1.5(1.7)$, sub-rhomboid, rhomboid, and hexagonal in frontal view, $Q = 1.3\text{--}1.8(2)$, ellipsoid and elongate in lateral view, yellowish brown, wall slightly thick ($0.5\text{--}0.6 \mu\text{m}$), with two layers in light microscopy, with germ pore. – Pleurocystidia as leptocystidia $17.5\text{--}21 \times 4.5\text{--}7 \mu\text{m}$, lageniform, hyaline, wall thin, originating from the subhymenium. – Pleurocystidia as deutero-cystidia $21.5\text{--}32 \times 7\text{--}16 \mu\text{m}$, clavate and subfusiform, wall thin, with a brown or yellowish brown inclusion, negative to Patent blue V, some of them originating from the subhymenium and others from the hymenophoral trama. – Cheilocystidia $16\text{--}24 \times 5.5\text{--}8 \mu\text{m}$, lageniform with short neck, cylindrical, and clavate, some mucronate, wall thin, hyaline, some with yellowish green content, more evident in the apex. – Subhymenium ramose-inflated and cellular. – Pileus trama interwoven toward the pileipellis and radial to the hymenophoral trama, hyphae $8\text{--}18.5 \mu\text{m}$ diam., yellowish, wall thin. – Pileipellis an ixocutis, $10\text{--}15 \mu\text{m}$ wide, hyphae $3\text{--}5 \mu\text{m}$ diam., hyaline, wall thin. – Pileocystidia absent. – Stipitipellis a cutis, hyphae $4.5\text{--}16 \mu\text{m}$ diam., yellowish, wall up to $0.5 \mu\text{m}$ thick. – Caulocystidia $24\text{--}45.5 \times 8\text{--}14.5 \mu\text{m}$, lageniform with a flexuose or submoniliform neck, utriform, cylindrical, and clavate, apex obtuse or mucronate, hyaline, wall thin, in groups in the upper part of the stipe.

Material examined. – USA, Montgomery Co., Pennsylvania, East of Evansburg, Evansburg State Park, alt. 67 m, 5 Jun 2005, *leg.* R. V. Gaines 51-b (XAL, holotype).

Remarks. – Guzmán *et al.* (2007 b) separated the cheilocystidia into two types according to their shape. Initially, we thought that deutero-cystidia could be chrysocystidia due to the coloured inclusion; however, they do not react with Patent blue V, so they are deutero-cystidia following Cléménçon's (2012) definition, but not chrysocystidia. Pleurocystidia with the same shape but without inclusion were observed in *P. magnispora* (see under this species).

Psilocybe quebecensis Ola'h & R. Heim, C. r. hebdom. Séanc. Acad. Sci., Paris, Sér. D 264: 1601. 1967. – Figs. 103–104.

Basidiospores $(10.4)11.2\text{--}13.0 \times (5.2)6.4\text{--}8.0 \times 6.4\text{--}8.0 \mu\text{m}$, $Q = 1.4\text{--}1.8$, ellipsoid and elongate, few fusiform in frontal and lateral views, yellowish brown, wall thick ($1 \mu\text{m}$), with two layers in light microscopy, with germ



Figs. 94–107. Microscopic structures: **94–97.** *Psilocybe overeemii* (isotype). **94.** Basidiospores. **95.** Chrysocystidia. **96.** Cheilocystidia. **97.** Caulocystidia. **98–102.** *P. ovoideocystidiata* (holotype). **98.** Basidiospores. **99.** Leptocystidia and cellular subhymenium. **100.** Deuterocystidia. **101.** Cheilocystidia. **102.** Caulocystidia. **103–104.** *P. quebecensis* (holotype). **103.** Basidiospores. **104.** Caulocystidia. **105–107.** *P. samuiensis* (isotype). **105.** Basidiospores. **106.** Pleurocystidia. **107.** Caulocystidia. Bar 8 μ m.

pore. – Subhymenium ramose-inflated, yellowish. – Pileus trama radial, hyphae 6.5–24 μ m diam., yellowish, wall thin. – Pileipellis an ixocutis, 16–38.5 μ m wide, hyphae 2.5–5 μ m diam., hyaline, wall thin. – Pileocystidia absent. – Stipitipellis a cutis, hyphae 2.5–14.5 μ m diam., yellow-

ish, wall thin or up to 0.5 μm thick. – Caulocystidia 27–43 \times 6.5–9 μm , lageniform, few cylindrical, apex obtuse, hyaline, sometimes with yellowish content, wall thin to thick. – Stipe basal mycelium white, hyphae hyaline, wall thin.

Material examined. – CANADA, Province of Quebec, Jacques Cartier River Valley, *leg.* R. Heim & G. M. Ola'h 092 (QUE, holotype).

Remarks. – We complement the descriptions of Ola'h & Heim (1967) and Guzmán (1983); the subhymenium is not cellular, the arrangement of the pileus trama is reported, and we observed caulocystidia. According to Guzmán (1978), this species is close to *P. aztecorum* R. Heim, with both in sect. *Aztecorum* Guzmán.

Psilocybe samuiensis Guzmán, Bandala & J. W. Allen, *Mycotaxon* 46: 156. 1993. – Figs. 105–107.

Basidiospores 9.6–12.0 \times 6.4–8.4 \times 5.6–7.2 μm , $Q = 1.2$ –1.6, hexagonal and subrhomboid in frontal view, $Q = 1.4$ –1.8, ellipsoid and elongate in lateral view, yellowish brown, wall thick (1–1.2 μm), with two layers in light microscopy, with germ pore. – Pleurocystidia 14.5–22 \times 4–6.5 μm , narrowly lageniform and lageniform, with short neck, hyaline, wall thin. – Pileus trama radial, hyphae 9–16 μm diam., yellowish to yellowish brown in mass, wall thin. – Pileipellis an ixocutis, 12 μm wide, hyphae 2–3 μm diam., hyaline, wall thin. – Pileocystidia absent. – Stipitipellis a cutis, hyphae 2.5–7 μm diam., yellowish, wall up to 0.5 μm thick. – Caulocystidia 20–33.5 \times 4.5–8 μm , narrowly lageniform and cylindrical-flexuose, sometimes branched, hyaline, wall thin, in groups in upper and middle parts of stipe. – Stipe basal mycelium white, hyphae hyaline.

Material examined. – THAILAND, 2 km west to Ban Hua Thanon, Ko Samui, gregarious to scattered in rice paddies, 8 Aug 1991, *leg.* J. Allen F (XAL, holotype).

Remarks. – Additional features not described by Guzmán *et al.* (1993), such as the arrangement of the pileus trama and the presence of caulocystidia, are provided here. The basidiospores are hexagonal and subrhomboid. This species is very similar to *P. mexicana*; however, *P. mexicana* has shorter basidiospores 8–10(12) μm long. Another similar species is *P. atlantis*, with smaller spores and strongly branched cheilocystidia, as discussed already.

Psilocybe serbica M. M. Moser & E. Horak, *Z. Pilzk.* 34(3–4): 138. 1968 (1969). – Figs. 108–110.

Basidiospores 8.0–12.0(14.4) \times 6.4–7.2 μm , $Q = 1.4$ –1.8(2), ellipsoid and elongate, few cylindrical, fusiform in frontal and lateral views, yellowish brown, wall thick (up to 1 μm), with two layers in light microscopy, with germ pore. – Pleurocystidia 23–27 \times 4.5–6.5 μm , narrowly lageniform, pedicellate, apex obtuse, refractive, hyaline, wall thin, common. – Subhymenium ramose-inflated, yellowish. – Pileus trama radial, hyphae

10.5–19 μm diam., yellowish, wall 0.5–0.8 μm thick. – *Pileipellis* an ixocutis, 48–56 μm wide, hyphae 2.5–5 μm diam., hyaline, wall thin. – *Pileocystidia* absent. – *Stipitipellis* a cutis, hyphae 2.5–14.5 μm diam., yellowish, wall thin or up to 0.5 μm . – *Caulocystidia* 30.5–46.5 \times 4.5–8 μm , narrowly lageniform, some flexuose, apex obtuse, hyaline, wall thin. – Stipe basal mycelium white to yellowish, hyphae hyaline.

Material examined. – SERBIA, bei Mitrovats, Tara, auf Erde oder faulendem Laub und modrigen Holzstückchen unter Buchen (*Fagus sylvatica*) in Mischwald (mit *Abies* gemischt), 11 Oct 1963, leg. M. M. Moser 63/727 (IB, holotype).

Remarks. – Moser & Horak (1968) reported basidiospores of 9–11(12) \times 5.5–6.5(7) μm . Guzmán (1983) considered the pleurocystidia as rare or absent, although they were commonly observed in the present study. We report here a complex basidiospore wall, the subhymenium type, the arrangement of the pileus trama, and abundant caulocystidia.

Psilocybe singularis Guzmán, Escalona & J. Q. Jacobs, in Guzmán, Escalona, Ramírez-Guillén & Jacobs, *Int. J. Med. Mush.* 6(3): 283. 2004. – Figs 111–116.

Basidiospores 4.8–6.4(7.2) \times 4.0–5.6(6.4) \times 3.2–4.0 μm , $Q = 1.1$ –1.2, rhomboid and subrhomboid in frontal view, $Q = 1.2$ –1.5, ellipsoid and broadly ellipsoid in lateral view, yellowish brown, wall thick (0.8–1 μm), with two layers in light microscopy, with germ pore, some with two pores. – *Pleurocystidia* as leptocystidia 12–16 \times 4–8 μm , lageniform and narrowly lageniform, with short neck, hyaline, wall thin, originating from the subhymenium. – *Pleurocystidia* as deuteroecystidia 16.5–27 \times 6.5–9.5 μm , utriform, and lageniform with short neck, apex obtuse, yellowish grey, wall thin, originating from the hymenophoral trama. – *Cheilocystidia* 11–19 \times 4–7 μm , narrowly lageniform, some branched with two or three necks, hyaline, wall thin. – *Subhymenium* ramose. – *Pileus trama* radial, hyphae 1.5–20 μm diam., yellowish to yellowish brown in mass, wall thick (0.8–2 μm) with encrusted pigment. – *Subpellis* differentiated, hyphae 3–7 μm diam., yellowish, wall thick with yellowish brown, encrusted pigment. – *Pileipellis* an ixocutis, 13–20 μm thick, hyphae 1.5–3 μm diam., hyaline, wall thin, in some parts with groups of erect cystidia. – *Pileocystidia* 26.5–41.5 \times 6.5–15 μm , cylindrical-flexuose, clavate, narrowly clavate, sometimes mucronate or with a neck, hyaline, wall thin, in groups. – *Caulocystidia* 21.5–53.5 \times 5–9 μm , narrowly lageniform, apex subcapitate, sometimes with one or two additional lateral necks also with subcapitate apex, in groups near the stipe apex.

Material examined. – MEXICO, Oaxaca, Tuxtepec, near Llano Grande, 5 Jul 1980, leg. J. Q. Jacobs 158 (XAL, holotype).

Remarks. – We found that there are two types of pleurocystidia, the ones mentioned by Guzmán *et al.* (2004 b), here called deuteroecystidia and leptocystidia. To the original description, we also add the presence of pileocystidia in groups, type of subhymenium, arrangement of the pileus trama, and presence of caulocystidia.

Psilocybe stuntzii Guzmán & J. Ott, *Mycologia* 68(6): 1261. 1976 (1977). – Figs. 117, 118.

Basidiospores $8.0\text{--}9.6 \times 5.6\text{--}6.4 \times 5.6\text{--}6.4 \mu\text{m}$, $Q = 1.3\text{--}1.5(1.7)$, ellipsoid and elongate, subfusiform, few widely ellipsoid in frontal view, $Q = 1.4\text{--}1.7$, ellipsoid and elongate in lateral view, yellowish brown, wall slightly thick ($0.8 \mu\text{m}$), with two layers in light microscopy, with germ pore. – Cheilocystidia $20.5\text{--}33.5 \times 4\text{--}6.5 \mu\text{m}$, narrowly lageniform, sometimes apex bifurcated or with a short lateral branch, apex obtuse, refractive, hyaline. – Subhymenium ramose-inflated. – Pileus trama radial, interwoven near the pileipellis, hyphae $4.5\text{--}25.5 \mu\text{m}$ diam., yellowish, wall thin. – Pileipellis an ixocutis, $64\text{--}72 \mu\text{m}$ wide, hyphae $1.5\text{--}3 \mu\text{m}$ diam., hyaline, wall thin. – Pileocystidia absent. – Caulocystidia not observed.

Material examined. – USA, Washington, Seattle, University of Washington, campus, Autumn 1973, *leg.* D. Stuntz s.n. (XAL, isotype).

Remarks. – In the isotype, the pileipellis is a thick ixocutis instead of a “thin pellicle of filamentous more or less subgelatinized hyphae” according to Guzmán & Ott (1976, p. 1263).

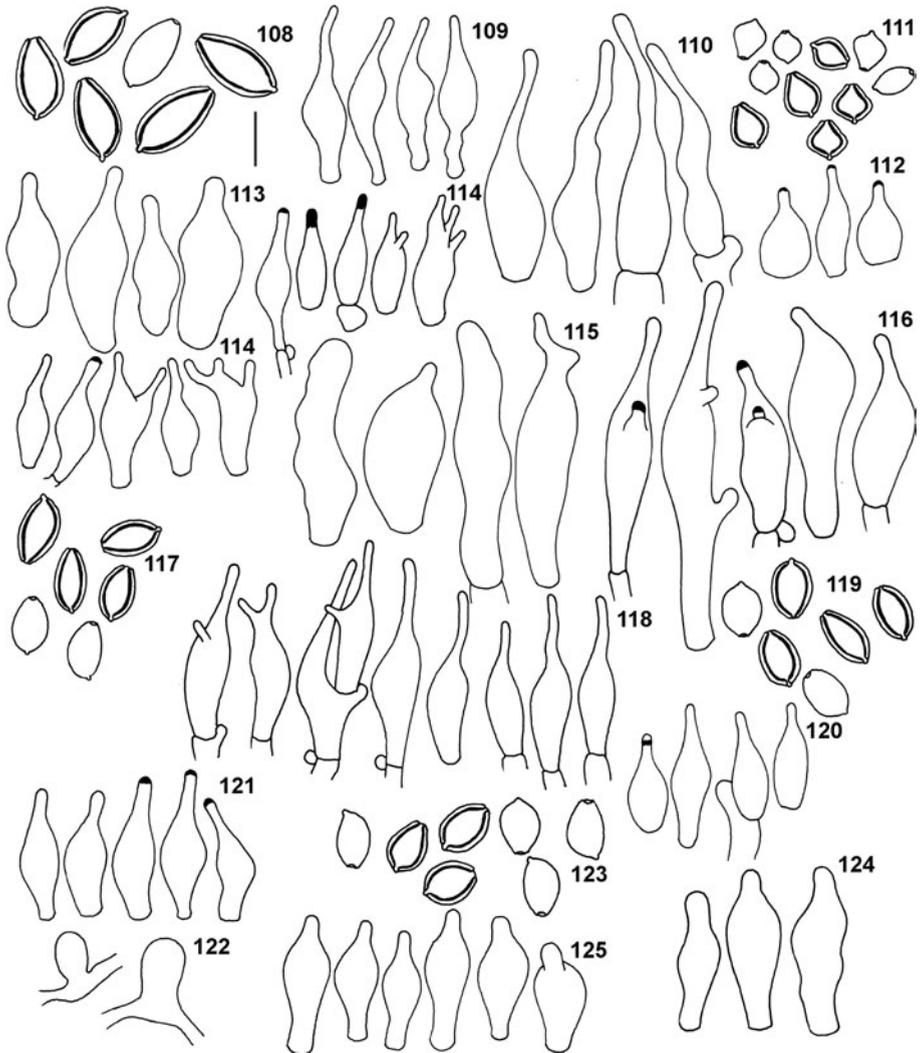
Psilocybe subacutipilea Guzmán, Saldarr., Pineda, G. García & L.-F. Velázquez, *Mycotaxon* 51: 230. 1994. – Figs. 119–122.

Synonym. = ***Psilocybe mexicana*** R. Heim, *Revue Mycol.*, Paris 22: 77. 1957.

Basidiospores $7.2\text{--}9.6 \times 5.6\text{--}6.4 \times 5.6\text{--}6.4 \mu\text{m}$, $Q = 1.3\text{--}1.6$, hexagonal in frontal view, ellipsoid in lateral view, yellowish brown, wall thick ($1 \mu\text{m}$), with two layers in light microscopy, with germ pore. – Pleurocystidia $12.5\text{--}20 \times 4.5\text{--}7 \mu\text{m}$, narrowly lageniform, with short neck, hyaline, wall thin, common. – Cheilocystidia $14.5\text{--}22.5 \times 4\text{--}7 \mu\text{m}$, lageniform, apex obtuse, few subcapitate, hyaline, wall thin. – Subhymenium ramose-inflated. – Pileus trama radial, hyphae $3\text{--}13 \mu\text{m}$ diam., yellowish to yellowish brown in mass, wall thin. – Pileipellis an ixocutis, $24 \mu\text{m}$ wide, hyphae $1.5\text{--}3 \mu\text{m}$ diam., hyaline, wall thin. – Pileocystidia approximately $8\text{--}13 \times 5\text{--}6.5 \mu\text{m}$, globose and subglobose, as lateral hyphae inflations, hyaline, wall thin. – Stipitipellis a cutis, hyphae $1.5\text{--}9 \mu\text{m}$ diam., yellowish, wall up to $0.5 \mu\text{m}$ thick. – Caulocystidia approximately $24\text{--}26 \times 5\text{--}6 \mu\text{m}$, lageniform, hyaline, wall thin.

Material examined. – COLOMBIA, Department of Antioquia, Municipio Porce, near the road from Medellín to Amalfi, zone of Puente Gabino, 31 Aug 1990, *leg.* G. Guzmán 29561-B (XAL, isotype).

Remarks. – We found here that pleurocystidia, not mentioned in Guzmán *et al.* (1994), are common, also observed were larger cheilocystidia, the arrangement of the pileus trama, and the presence of modified hyphae in the pileipellis, although difficult to see and measure. This species was described from Colombia, and based on the present revision, we propose its synonymy with *P. mexicana*. All micro- and macroscopic features agree very well with the holotype of *P. mexicana* and additional studied specimens. The



Figs. 108–125. Microscopic structures: **108–110.** *Psilocybe serbica* (holotype). **108.** Basidiospores. **109.** Pleurocystidia. **110.** Caulocystidia. **111–116.** *P. singularis* (holotype). **111.** Basidiospores. **112.** Leptocystidia. **113.** Deuterocystidia. **114.** Cheilocystidia. **115.** Pileocystidia. **116.** Caulocystidia. **117–118.** *P. stuntzii* (isotype). **117.** Basidiospores. **118.** Cheilocystidia. **119–122.** *P. subacutipilea* (isotype). **119.** Basidiospores. **120.** Pleurocystidia. **121.** Cheilocystidia. **122.** Pileocystidia. **123–125.** *P. subaeruginascens* (holotype). **123.** Basidiospores. **124.** Pleurocystidia. **125.** Cheilocystidia. Bar 8 μm .

description of *P. subacutipilea* was based only on one specimen (Guzmán 29561-B), which lacks pseudorhiza, which was probably lost during collection.

Psilocybe subaeruginascens Höhn., Sitzungsber. Kaiserl. Akad. Wiss. Wien Math.-Naturwiss. Kl. Abt. I, 123: 78. 1914. – Figs. 123–125.

Basidiospores $7.2\text{--}9.0 \times 4.8\text{--}6.4 \times 4.4\text{--}5.6 \mu\text{m}$, $Q = 1.3\text{--}1.5$, hexagonal in frontal view, $Q = 1.4\text{--}1.8$, ellipsoid and elongate, some amygdaliform in lateral view, yellowish brown, wall thick ($1\text{--}1.3 \mu\text{m}$), with two layers in light microscopy, with germ pore. – Pleurocystidia $17.5\text{--}24 \times 8\text{--}11 \mu\text{m}$, fusiform with short and wide neck and utriform, hyaline to yellowish, wall thin, common. – Cheilocystidia $14.5\text{--}21.5 \times 5\text{--}8 \mu\text{m}$, lageniform and fusiform, with short neck, apex obtuse, hyaline, wall thin. – Subhymenium not observed. – Pileus trama interwoven, hyphae $6\text{--}16 \mu\text{m}$ diam., yellowish, wall thin. – Pileipellis an ixocutis, $16 \mu\text{m}$ wide, hyphae $2.5\text{--}4 \mu\text{m}$ diam., hyaline, wall thin.

Material examined. – INDONESIA, Java, Buitenzorg, 1907, leg. F. Höhnel 3942A (FH, holotype).

Remarks. – The type specimen consists of fragmented basidiomata and broken fragments of stipes and pilei. The basidiospores were originally described by Höhnel (1914) as $10 \times 7 \times 5 \mu\text{m}$, rhomboid and rhomboid-limoniform in frontal view, slightly depressed in lateral view, and cystidia absent. Singer & Smith (1958 b) later described the Höhnel species with basidiospores $7.7\text{--}10(11.5) \times 7\text{--}7.8 \times 6\text{--}7 \mu\text{m}$, ovoid to subrhomboid, pleurocystidia $25\text{--}33 \times 9\text{--}12 \mu\text{m}$, cheilocystidia $20\text{--}33 \times 6\text{--}9 \mu\text{m}$, and pileipellis not gelatinized. We modify the description of the species with characteristics of the pleurocystidia, cheilocystidia, and pileipellis. Horak & Desjardin (2006) studied this specimen and a recent collection, considered as a topotype. According to Horak & Desjardin (2006), the topotype has slightly larger basidiospores, pleurocystidia absent, and a nongelatinized cutis, so it probably does not correspond to this species. *Psilocybe subaeruginascens* resembles *P. magnispora* and *P. aquamarina*; however, the gelatinized layer present in the lamellar edge of these two species, and distinct size of basidiospores, larger in *P. aquamarina* and smaller in *P. magnispora*, separate them. *Psilocybe subaeruginascens* has only been known from Asia.

Psilocybe subtropicalis Guzmán, Biblioth. Mycol. 159: 107. 1995. – Figs. 126–129.

Synonym. = *Psilocybe bipleurcystidiata* E. Horak & Guzmán, in Guzmán, Horak, Halling & Ramírez-Guillén, Sydowia 61(2): 216. 2009.

Basidiospores $6.4\text{--}8.0 \times 5.6\text{--}6.4(7.2) \times 4.4\text{--}4.8 \mu\text{m}$, $Q = 1.14\text{--}1.28$, subhexagonal and subrhomboid in frontal view, $Q = 1.3\text{--}1.5$, ellipsoid in lateral view, yellowish brown, wall thick ($0.8\text{--}1 \mu\text{m}$), with two layers in light microscopy, with germ pore. – Pleurocystidia as leptocystidia $14.5\text{--}20 \times 4\text{--}5.5 \mu\text{m}$, lageniform and fusiform, apex obtuse, hyaline, wall thin, originating from the subhymenium. – Pleurocystidia as deutero-cystidia $26.5\text{--}39(41.5) \times (6.5)7\text{--}8 \mu\text{m}$, narrowly utriform, cylindrical-flexuose, sublageniform, neck long and flexuose, hyaline, wall thin, originating from the hyme-

nophoral trama. – Subhymenium ramose-inflated. – Hymenophoral trama subregular, hyphae 5.5–21.5 μm diam., yellowish, wall 0.8 μm thick, with encrusted pigment. – Pileus trama radial, hyphae 17.5–34.5 μm diam., yellowish to yellowish brown in mass, wall 0.5–0.8 μm thick, with encrusted pigment. – Pileipellis an ixocutis, 20–24 μm wide, hyphae 2.5–5.5 μm diam., hyaline, wall thin. – Pileocystidia absent. – Stipitipellis a cutis, hyphae 5.5–11 μm diam., yellowish, wall up to 0.8 μm thick. – Caulocystidia 19–25 \times 5.5–9 μm , fusiform, lageniform, flexuose, with obtuse apex, hyaline, wall thin, in groups only in the upper part of the stipe. – Stipe basal mycelium white, hyphae 2.5–4 μm diam., hyaline, wall thin.

Material examined. – MEXICO, Veracruz, old road Xalapa-Coatepec, km 2.5, Ecological Park Francisco Javier Clavijero, 6 Oct 1986, leg. L. Montoya 910 (XAL, holotype).

Remarks. – The basidiospores are subhexagonal besides subrhomboid. We found deuteroconidia originating from the hymenophoral trama in spite of Guzmán (1995) only mentioning hyaline conidia that correspond to leptocystidia. The subhymenium is ramose-inflated instead of cellular, the arrangement of the pileus trama is mentioned, and caulocystidia were found in the upper part of the stipe. We synonymized *P. bipleurocystidiata* (see above) with this species, because they agree well in all features but the thickness of the ixocutis (wider in *P. subtropicalis* than in *P. bipleurocystidiata*).

Psilocybe subyungensis Guzmán, Mycotaxon 7(2): 249. 1978. – Figs. 130–133.

Synonym. = ***Psilocybe yungensis*** Singer & A. H. Sm., Mycologia 50(1): 142. 1958.

Basidiospores 4.8–5.6(6.4) \times 4.0–4.4(6.4) \times 3.2–3.6 μm , Q = 1.09–1.2, rhomboid and subrhomboid in frontal view, Q = 1.2, ellipsoid in lateral view, yellowish brown, wall slightly thick (0.5–0.6 μm), with two layers in light microscopy, with germ pore. – Pleurocystidia 13–21.5 \times 5–9 μm , lageniform and narrowly lageniform, wall thin, hyaline. – Cheilocystidia 13.5–40 \times 5–9 μm , very variable in shape, cylindrical-flexuose, narrowly lageniform, and lageniform, sometimes branched or with short apical or lateral appendices, hyaline, wall thin. – Pileus trama radial, hyphae 8–24 μm diam., hyaline, wall thick (0.8–2.4 μm) with irregular encrusted pigment. – Subpellis undifferentiated. – Pileipellis a subgelatinous cutis 10–12 μm wide, hyphae 2–3 μm diam., wall thin. – Pileocystidia approximately 17–24 \times 5.5–9.5 μm , cylindrical or variable in shape. – Stipe basal mycelium yellowish, with setaceous hyphae 1.5–4 μm diam., yellowish brown, wall thick (0.5–0.9 μm).

Material examined. – VENEZUELA, Vicinity of El Arado, 12 km SW of Makarao, Edo. Miranda, leg. K. P. Dumont VE6363 (NY, holotype).

Remarks. – We observed larger pleurocystidia and cheilocystidia than those of 8–11 \times 3.8–5.5 μm , and 15.5–25 \times (5.5)7.7–12 μm , respectively, described by Guzmán (1978, 1983). For many years, *P. subyungensis* and *P. yungensis* were considered as independent species, based only on the branched

cheilocystidia observed in *P. subyungensis*. However, in the present study, we found branched cheilocystidia in the type of *P. yungensis* and in several specimens determined as *P. yungensis*. Both *P. yungensis* and *P. subyungensis* have a conical to campanulate pileus, frequently acutely papillate or mamiform, and very narrow lamellae, typical macroscopic characteristics of *P. yungensis* according to Heim (1958), Singer & Smith (1958 b), and Guzmán (1983). We observed pileocystidia but difficult to observe and measure. Pileocystidia were not observed in the types of *P. yungensis* and *P. chiapanensis*; however, this character is not enough to separate these species.

Psilocybe taiwanensis Zhu L. Yang & Guzmán, Sydowia 62(2): 185. 2010. – Figs. 134–136.

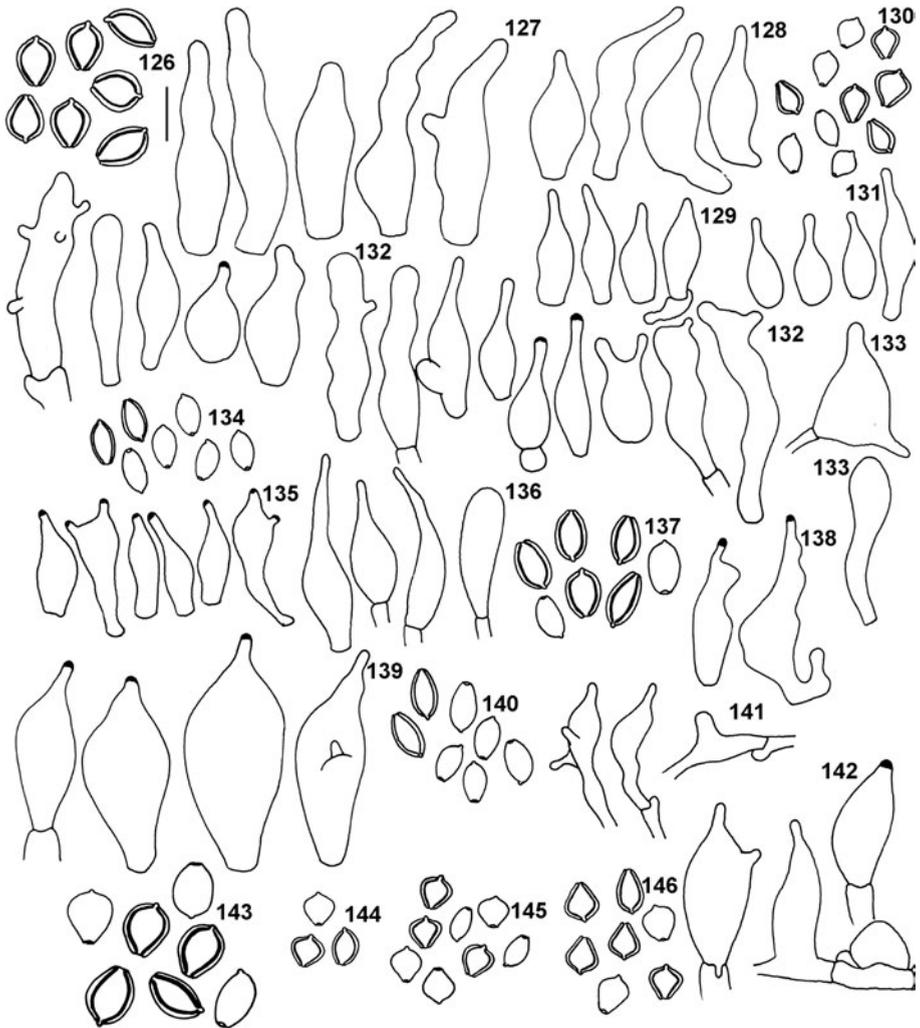
Basidiospores 4.8–6.4(7.0) × 3.2–4.0 × 3.2–3.6 μm, Q = 1.2–1.6(2.0), ellipsoid to elongate, ovoid with slightly defined angles in frontal view, Q = 1.5–1.8, ellipsoid in lateral view, yellowish brown, wall thin to slightly thick (0.4–0.5(0.6) μm), with one layer in light microscopy, with germ pore. – Pleurocystidia 13.5–21.5(32) × 4–8(10.5) μm, narrowly lageniform, fusiform, with short neck, some with two necks, apex obtuse, refractive, hyaline, wall thin. – Subhymenium ramose-inflated. – Pileus trama radial, hyphae 5–21.5 μm diam., yellowish to yellowish brown in mass, wall thin. – Caulocystidia 20–40 × 5–7 μm, narrowly lageniform, clavate, as modified hyphae, apex obtuse, hyaline, wall thin.

Material examined. – CHINA, Taiwan Province, Nantou Country, Shitou, 12 Apr 2006, leg. Z.L. Yang 4637 (XAL, isotype).

Remarks. – Additional features, not mentioned in the protologue, such as type of subhymenium, arrangement of the pileus trama, and size of caulocystidia are indicated. Furthermore, we extend the size range of pleurocystidia, cited as 15–20 × 5.5–6.5(7) μm (Guzmán & Yang 2010). This species is very similar to the recently described *P. thaizapoteca* Guzmán (Guzmán *et al.* 2012), but a remarkable feature to separate them is the persistent annulus in *P. taiwanensis* as opposed to a poorly developed one in *P. thaizapoteca*, present only as fibrillar remnants. In addition, *P. thaizapoteca* has strongly branched cheilocystidia. The interpretation of the basidiospore shape and wall thickness moved Guzmán & Yang (2010) to place *P. taiwanensis* in sect. *Stuntzae*, but we think that it actually belongs to sect. *Zapotecorum* because of the size, shape, and wall thickness of the basidiospores and the size and shape of the pleurocystidia and cheilocystidia. The basidiomata features also resemble *P. zapotecorum* or *P. angustipleurocystidiata* Guzmán (both in sect. *Zapotecorum*).

Psilocybe thaicordispora Guzmán, Ram.-Guill. & Karunarathna, in Guzmán, Ramírez-Guillén, Hyde & Karunarathna, Mycotaxon 119: 72. 2012. – Fig. 137–139.

Basidiospores 6.4–8.0 × 4.8–5.6(7.2) × 4.8–5.6 μm, Q = 1.1–1.5, hexagonal and subrhomboid, sometimes angles not well defined in frontal view,



Figs. 126–146. Microscopic structures. **126–129.** *Psilocybe subtropicalis* (holotype). **126.** Basidiospores. **127.** Deuterocystidia. **128.** Caulocystidia. **129.** Leptocystidia. **130–133.** *P. subyungensis* (holotype) **130.** Basidiospores. **131.** Pleurocystidia. **132.** Cheilocystidia. **133.** Pileocystidia. **134–136.** *P. taiwanensis* (isotype). **134.** Basidiospores. **135.** Pleurocystidia. **136.** Caulocystidia. **137–139.** *P. thaicordispora* (isotype). **137.** Basidiospores. **138.** Caulocystidia (G. Guzmán 38346). **139.** Caulocystidia (isotype). **140–142.** *P. thaizapoteca* (holotype). **140.** Basidiospores. **141.** Pileocystidia. **142.** Caulocystidia. **143.** *P. wayanadensis* (holotype), basidiospores. **144–146.** *P. yungensis*. **144.** Basidiospores (holotype). **145.** Basidiospores (syn-type of *P. isauri*). **146.** Basidiospores (G. Heredia s.n.). Bar 8 μ m.

Q = 1.3–1.5(1.8), ellipsoid and few elongate in lateral view, yellowish brown, wall thick (0.8–1 µm), with two layers in light microscopy, with germ pore. – Pileus trama radial, hyphae 7–20 µm diam., yellowish to yellowish brown in mass, wall up to 0.5 µm thick. – Subpellis undifferentiated. – Stipitipellis hyphae 4–13 µm diam., yellowish, wall 0.4–0.9 µm thick. – Caulocystidia 24–35 × 9–16 µm, lageniform–flexuose, broadly fusiform, apex mucronate to rostrate, refractive, hyaline, wall thin.

Material examined. – THAILAND, Chiang Mai Prov., approximately 100 km from Chiang Mai, near Huai Nam Dang National Park, (19° 16' N, 98° 16' E), alt. 1500 m, rainforest dominated by *Pinus kesiya*, 12 Jul 2010, leg. G. Guzmán 38349 (XAL, isotype), leg. G. Guzmán 38346 (XAL).

Remarks. – Additional features presented here are the caulocystidia, very similar to cheilocystidia in shape but larger, the arrangement of the pileus trama, and the undifferentiated subpellis. This species is very similar to *P. meridionalis* described by Guzmán *et al.* (2008 b) from Mexico (see above); the well-developed veil, which leaves a membranous annulus on the stipe in *P. meridionalis* but is poorly developed in *P. thaicordispora*, distinguishes them. The rest of the macroscopic features, such as the conical to campanulate pileus and the stipe slightly scaly toward the base with a subbulbose base, are very similar. Cheilocystidia in *P. meridionalis* were cited as 5–28 × 3–6.5(8) µm (Guzmán *et al.* 2008 b) and in *P. thaicordispora* as 12–20(28) × (4.5)5–7(8) µm (Guzmán *et al.* 2012); however, in the isotype of *P. thaicordispora*, we found cheilocystidia that were 5–8(10) µm wide, making the cystidia slightly wider in this species. The caulocystidia are also larger in *P. thaicordispora*, as opposed to 17.5–24 × 5.5–8 µm in *P. meridionalis* (Guzmán *et al.* 2008 b).

Psilocybe thaizapoteca Guzmán, Karunarathna & Ram.-Guill. in Guzmán, Ramírez-Guillén, Hyde & Karunarathna, Mycotaxon 119: 77. 2012. – Figs. 11, 140–142.

Basidiospores 5.6–7.2 × 3.2–4.0 × 3.2–4.8 µm, Q = 1.4–1.7(1.8), ellipsoid to slightly subrhomboid in frontal view, Q = 1.2–1.7(2), ellipsoid and some elongate in lateral view, yellowish brown, wall slightly thick (0.5–0.7 µm), with one layer in light microscopy, with germ pore. – Subhymenium ramose-inflated, sometimes seems cellular. – Pileus trama radial, hyphae 4–30 µm diam., yellowish, wall 0.8 µm thick. – Pileipellis a subgelatinized layer 10 µm wide, hyphae 1.6–4 µm diam., wall thin. – Pileocystidia 12–21 × 6.5–9 µm, lageniform, sometimes with lateral short and narrow branches, and cylindrical as lateral branches of the hyphae, hyaline, wall thin. – Caulocystidia 16–23 × 5–9.5 µm, fusiform and conical, apex mucronate to rostrate, hyaline, wall thin, in the upper part of the stipe.

Material examined. – THAILAND, Chiang Mai Prov., close to Huai nam Dang National Park (19° 16' N, 98° 16' E), alt. 1500 m, rainforest dominated by *Pinus kesiya*, 12 Jul 2010, leg. G. Guzmán 38342 (XAL, holotype).

Remarks. – New data for this species are the presence of pileocystidia and caulocystidia, the arrangement of the pileus trama, the subgelatinized

pileipellis, and the type of subhymenium. *Psilocybe thaizapoteca* is very similar to *P. taiwanensis* in nearly all the features, except *P. taiwanensis* has a persistent annulus and weakly branched cheilocystidia. As noted by Guzmán *et al.* (2012), this species is a member of sect. *Zapotecorum* and is very similar to *P. angustipleurocystidiata*.

Psilocybe wayanadensis K. A. Thomas, Manim. & Guzmán, in Thomas, Manimohan, Guzmán, Tapia & Ramírez-Guillén, *Mycotaxon* 83: 198. 2002. – Fig. 143.

Basidiospores $8.0\text{--}8.8 \times 5.6\text{--}7.2 \times 4.2\text{--}5.6 \mu\text{m}$, $Q = 1.16\text{--}1.3$, subhexagonal and subrhomboid in frontal view, $Q = 1.4\text{--}1.8$, ellipsoid in lateral view, yellowish brown, wall thick ($0.8\text{--}1.2 \mu\text{m}$), with two layers in light microscopy, with germ pore. – Subhymenium ramose. – Pileus trama radial, hyphae $3\text{--}13 \mu\text{m}$ diam., yellowish, wall thin. – Pileipellis a subgelatinized cutis, $8\text{--}10.5 \mu\text{m}$ wide, hyphae $1.5\text{--}2.5 \mu\text{m}$ diam., yellowish, wall thin. – Pleurocystidia absent.

Material examined. – INDIA, Kerala State, Wayanad District, Muthanga, 21 Jul 1999, *leg.* K. A. Thomas T-320a (XAL, holotype).

Remarks. – We add subhexagonal to the basidiospore shape described in the protologue and subgelatinized nature of the cutis, and pileus trama and subhymenium arrangement. This species is very similar to *P. subaeruginascens* and *P. magnispora* (see above), in the size and shape of the basidiospores, pleurocystidia, and cheilocystidia; *P. magnispora* also has a gelatinized lamellar edge that makes it more similar to *P. wayanadensis*. Thomas *et al.* (2002) described basidiospores of $8.0\text{--}9.5(11.0) \times 6.5\text{--}7.0(8.0) \times 5.5\text{--}6.0(6.5) \mu\text{m}$ in the holotype, for which we observed smaller basidiospores.

Psilocybe yungensis Singer & A. H. Sm., *Mycologia* 50(1): 142. 1958. – Figs. 144–154.

Synonyms: = *Psilocybe yungensis* var. *diconica* Singer & A. H. Sm., *Mycologia* 50(1): 142. 1958.

= *Psilocybe isauri* Singer, *Sydowia* 12(1–6): 237. 1959 (1958).

= *Psilocybe acutissima* R. Heim, *Revue Mycol.*, Paris 24: 106. 1959.

= *Psilocybe subyungensis* Guzmán, *Mycotaxon* 7(2): 249. 1978.

= *Psilocybe chiapanensis* Guzmán, *Biblioth. Mycol.* 159: 102. 1995.

Basidiospores $(4.5)5.0\text{--}6.0 \times 4.5\text{--}5.0 \times 3.5\text{--}4.0 \mu\text{m}$, $Q = 1.1\text{--}1.2(1.4)$, rhomboid and subrhomboid in frontal view, $Q = 1.2\text{--}1.5$, broadly ellipsoid and ellipsoid in lateral view, yellowish brown, wall slightly thick ($0.5\text{--}0.8 \mu\text{m}$), with two layers in light microscopy, with germ pore, some with two pores. – Pleurocystidia $15\text{--}21 \times 5\text{--}8 \mu\text{m}$, lageniform with short neck, apex obtuse, some refractive, hyaline, wall thin. – Cheilocystidia $14\text{--}32 \times 4\text{--}7(8) \mu\text{m}$, clavate, cylindrical-flexuose, lageniform, hyaline, wall thin. – Subhymenium ramose-inflated and sometimes ramose. – Pileus trama radial, hyphae $5\text{--}16 \mu\text{m}$ diam., yellowish to yellowish brown in mass, wall $0.5\text{--}0.8 \mu\text{m}$, with encrusted pigment; with lactiferous hyphae. – Pileipellis an ixocu-

tis, hyphae 3–5 μm diam., hyaline, wall thin. – Pileocystidia not observed. – Stipe basal mycelium yellow with setaceous hyphae 3–5 μm in diam., wall thick (0.5–0.8 μm).

Material examined. – BOLIVIA, La Paz, Nor-Yungas, Cataratas San Juan, alt. 2400 m, on very rotten woody detritus in a shady place among mosses and hepatics, 28 Jan 1956, *leg.* R. Singer B-648 (MICH, isotype). MEXICO, Oaxaca, east of Huautla de Jiménez, ranchería Agua Fierro, alt. 1600 m, 13 Jul 1959, *leg.* G. Guzmán 1128-B (XAL, syntype of *Psilocybe isauri*); Jalisco, Municipality of Cuautitlán, Sierra de Manantlán, 8 km to northwest of Las Joyas, 18 Aug 1982, *leg.* G. Nieves 138; Tamaulipas, Municipality of Gómez Farías, Reserva de la Biosfera El Cielo, rancho El Cielo, Summer 1987, *leg.* G. Heredia s.n. (IBUG), 22 Jul 1988, *leg.* V. M. Bandala-Muñoz 1428 (IBUG); Veracruz, Municipality of San Andrés Tlalnahuayocan, Agüita Fría, alt. 1520 m, 8 Jul 2007, *leg.* M. A. Gómez 2467 (IBUG); Municipality of San Andrés Tuxtla, Reserva de la Biosfera Los Tuxtlas, slopes of volcano San Martín Tuxtla, alt. 900 m, 30 Oct 2010, *leg.* A. Cortés-Pérez 549 (XAL).

Remarks. – In the protologue, pleurocystidia, pileus trama, and subhymenium were not described. Subsequent work (Singer & Smith 1958 b, Heim 1958, Guzmán 1983) mentioned size and shape of pleurocystidia and the subhymenium type. We contribute here the presence of caulocystidia and setaceous hyphae in the basal mycelium of the stipe. Studies of the type of *P. yungensis*, *P. isauri*, and additional specimens helped us to clarify the concept of *P. yungensis* and to understand the variation in this taxon. The variability of the cheilocystidia is notable: 13–40(53) \times 4.8–8 μm , cylindrical, flexuose, clavate, lageniform, sometimes branched. Caulocystidia were observed in Heredia s.n., Bandala-Muñoz 1428, Gómez 2467, Nieves 138, and Cortés-Pérez 549, being 24–53.5 \times 5–9.5 μm , narrowly lageniform and cylindrical-flexuose, hyaline to yellowish, with lateral branches, in the middle and upper part of the stipe, but were not observed in the type specimen.

New combinations in *Deconica*

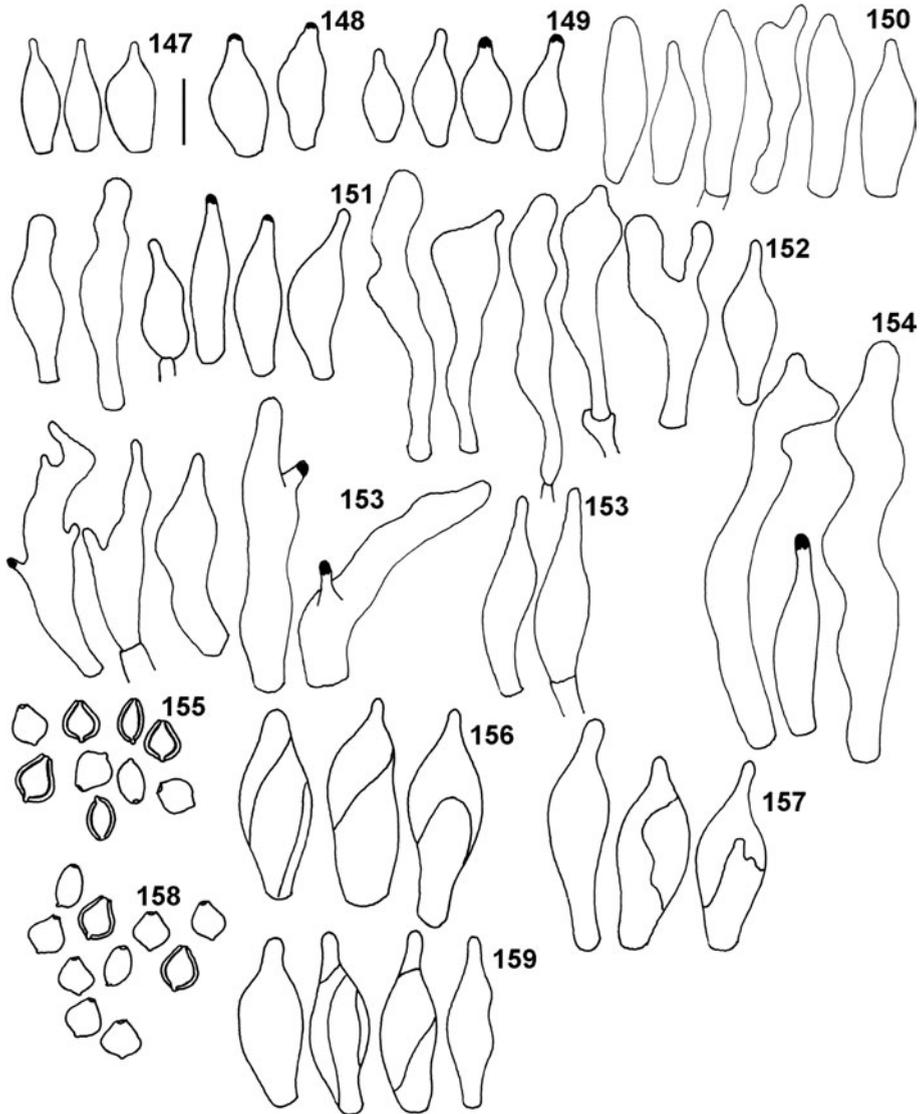
Deconica aureicystidiata (E. Horak & Desjardin) Ramírez-Cruz & Guzmán, **comb. nov.** – Figs. 23, 155–157.

Mycobank no.: MB 803997

Basionym. = *Psilocybe aureicystidiata* E. Horak & Desjardin, *Sydowia* 58(1): 32. 2006.

Basidiospores 4.0–5.6 \times 4.4–5.6 \times 3.2–4.0 μm , $Q = 1.1$ –1.2(1.6) subrhomboid in frontal view, $Q = 1.2$ –1.5(1.6), subellipsoid in lateral view, yellowish brown, wall slightly thick to thick (0.5–0.9 μm), with two layers in light microscopy, with germ pore. – Pleurocystidia as chrysocystidia, 17–29 \times 6.5–9.5 μm , clavate to broadly fusiform, apex mucronate or rostrate, hyaline, with a hyaline content in KOH and blue in Patent blue V, wall thin. – Subhymenium ramose-inflated. – Pileus trama radial, hyphae 4–8 μm diam., yellowish to yellowish brown in mass, wall thin with encrusted pigment. – Subpellis undifferentiated. – Pileipellis an ixocutis, 8–10 μm wide, hyphae 2.5–3 μm diam., hyaline, wall thin.

Material examined. – INDONESIA, Java, Cibodas, trail to Mt. Gedeh, between entrance and waterfalls, 10 Jan 1998, *leg.* E. Horak 7310 (XAL, isotype); Java, Mt. Halimun Salak National Park, Cikaniki Field Station, 8 Jan 1999, *leg.* E. & A. Horak 7310 (XAL).



Figs. 147–159. Microscopic structures: **147–154.** *Psilocybe yungensis*. **147.** Pleurocystidia (holotype). **148.** Pleurocystidia (syntype of *P. isauri*). **149.** Pleurocystidia (G. Heredia s.n.). **150.** Cheilocystidia (holotype). **151.** Cheilocystidia (syntype of *P. isauri*). **152.** Cheilocystidia (G. Heredia s.n.). **153.** Cheilocystidia (M. A. Gómez 2467). **154.** Caulocystidia (M. A. Gómez 2467). **155–157.** *Deconica aureicystidiata* (isotype). **155.** Basidiospores. **156.** Chryso-cystidia. **157.** Chryso-cystidia (E. Horak 7310). **158–159.** *D. neocaledonica* (isotype). **158.** Basidiospores. **159.** Chryso-cystidia. Bar 8 μm .

Remarks. – New observations such as arrangement of the pileus trama, type of subhymenium, and presence of a gelatinized cutis are added to the original description. We confirmed the presence of chrysocystidia with the aid of Patent blue V. Although this species was described by Horak & Desjardin (2006) as lacking a bluing reaction, it had been placed in the bluing *Psilocybe* sect. *Neocaledonicae* (Guzmán 2004). It is separated from *D. neocaledonica* (see below) mainly by the presence of annulus in *D. aureicystidiata*. This species is similar to *D. thailandensis* described by Horak *et al.* (2009) in microscopic features such as size and shape of basidiospores, chrysocystidia, and cheilocystidia, as well as in the fibrillose, membranous annulus.

Deconica neocaledonica (Guzmán & E. Horak) V. Ram.-Cruz & Guzmán, **comb. nov.** – Figs. 7, 158–159.

Mycobank no.: MB 803998

Basionym. = *Psilocybe neocaledonica* Guzmán & E. Horak, *Sydowia* 31(1–6): 53. 1979 (1978).

Synonyms: = *Hypholoma neocaledonicum* (Guzmán & E. Horak) Guzmán, *Doc. Mycol.* 29(114): 66. 1999.

= *Naematoloma neocaledonicum* (Guzmán & E. Horak) Guzmán [as '*neocaledonica*'], *Mycotaxon* 12(1): 236. 1980.

= *Psilocybe overeemii* E. Horak & Desjardin, *Sydowia* 58(1): 30. 2006.

Basidiospores 5.0–5.5(6.0) × 5.0–6.0 × 3.5–4.0 μm, Q = 1–1.2, subrhomboid and rhomboid in frontal view, Q = 1.3–1.7, ellipsoid and elongate in lateral view, yellowish brown, wall thin to slightly thick (0.4–0.8 μm), with two layers in light microscopy, with germ pore. – Pleurocystidia as chrysocystidia, 18–30 × 9–11 μm, fusiform, apex mucronate or rostrate, hyaline in KOH, with content turning blue in Patent blue V, wall thin. – Subhymenium ramose-inflated. – Pileus trama radial, hyphae 4–17 μm diam., yellowish to yellowish brown in mass, wall thin with encrusted pigment. – Subpellis undifferentiated. – Pileipellis an ixocutis, thin (less than 8 μm wide), hyphae 2.5–3 μm in diam., hyaline, wall thin with encrusted pigment. – Pileocystidia not observed. – Caulocystidia not observed.

Material examined. – NEW CALEDONIA, Mt. Mou, N of Paita, 22 Feb 1977, alt. 1000 m, *leg.* E. Horak 77–161 (ENCB, isotype of *Psilocybe neocaledonica*).

Remarks. – Additional features are the following: nonbluing mushroom, pileipellis a gelatinized layer, and the presence of chrysocystidia on the side of lamellae. Guzmán & Horak (1978) mentioned the possibility that this species had hallucinogenic properties for its similarity to the hallucinogenic species of *Psilocybe* stirps *Yungensis*. However, this species differs in its macro- and micromorphological characteristics (see description of *P. yungensis* above). Also, Guzmán & Horak (1978) considered it similar to the bluing *P. naematoliformis* Guzmán, but in a recent type study of *P. naematoliformis*, we observed that the pleurocystidia are hyaline or have a yellowish brown pigment in the vacuoles or sometimes filling the whole cystidium but not reacting with Patent blue V. This species is the type of the sect. *Neocale-*

donicae (Guzmán 2004), considered a section with species having bluing basidiomata (Guzmán 2004; Horak *et al.* 2009). A similar species is *D. aureicytidiata*, but it differs by the annulate basidioma and larger pleurocystidia that are more variable in shape in *D. aureicytidiata* (see this species above).

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