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The Taxonomy of *Psilocybe fagicola*-complex

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Psilocybe fagicola **comprises a complex of more than eight species, six of them in Mexico, and all of them possessing a long pseudorhiza, a characteristic not listed by Heim and Cailleux in 1959 in the original description of the type species, but described by Guzmán in 1978 and 1983. The description of *Psilocybe fagicola* s.s. is here emended to include the length of the cheilocystidia of (6-) 12-20 (-30) µm, as well as the absence or scarcity of pleurocystidia. *Psilocybe xalapensis* and *P. wassoniorum* are considered to be synonymous with *P. fagicola* s.s. However, *Psilocybe banderillensis* and *P. herrerae* from Mexico, *P. columbiana* from Colombia, and *P. keralensis* from India are considered to be valid species within this complex. Moreover, *P. novoxalapensis* and *P. teofilae,* both from Mexico, are described as new species. Length of spores, presence or absence of pleurocystidia and their variations, and type of cheilocystidia constitute the principal defining characteristics of the species. Setaceous hyphae at the base of the stipe, as well as caulocystidia, lack taxonomic value, as do other morphological characteristics, including pileipellis and subpileipellis. A key to the eight considered species is also presented within the paper.**

Key words: *Psilocybe fagicola, P. novoxalapensis, P. teofilae,* pseudorhiza, Mexico, Colombia, India.

The hallucinogenic mushroom *Psilocybe fagicola* R. Heim & Cailleux is defined by its long pseudorhiza (Fig. 11), smaller, subrhombic, thick-walled spores (Figs. 1, 5, 10, 12, 17, 21, 26, 40, 46, 49), papillate or subumbonate pileus, and bluing features (Guzmán, 1983), although the pseudorhiza was not included in the description provided by Heim and Cailleux (1959a, 1959b, 1967). Guzmán (1983) described several species which are closely related to this fungus, as *P. banderillensis*, *P. columbiana*, *P. herrerae*, *P. wassoniorum* and *P. xalapensis*. Recently Thomas *et al.* (2002) described *P. keralensis* from India, and Guzmán *et al.* (2004) described *P. oaxacana*, both species with exhibiting pseudorhiza. Moreover, Guzmán (1978) divided *P. fagicola* into two varieties, the typical and *P. fagicola* var. *mesocystidiata*. The senior author, in the preparation of his new edition of *The Genus Psilocybe*, studied new collections of these pseudorhizic fungi, and determined several materials which did not match with the known species. The present paper addresses a taxonomic revision of the complex, and defines which species actually belong to the complex. Two new species are described.

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Materials and Methods

More than 60 collections of *Psilocybe* with pseudorhiza, in the XAL Herbarium (Instituto de Ecología in Xalapa, Mexico), as well as type specimens in the PC (National Museum of Natural at Paris) and in the ENCB (Escuela Nacional de Ciencias Biológicas in Mexico) Herbaria, were studied in the present report. Microscopic observations were conducted using sections of fruit bodies, mounted in 5% KOH solution, or mixed with 1% Congo Red solution which was added to the slide which had been previously mounted with KOH solution. The size of spores is long and wide on face-view, and thicker from a side-view.

Results

The *Psilocybe fagicola*-complex can be defined by its well-developed pseudorhiza; it belongs to section *Cordisporae* Guzmán for its subrhomboid on face-view, subellipsoid upon side-view, thick-walled, small spores, and for its characteristic bluing reaction (Guzmán, 1983). This complex comprises at least eight species, six of which are found in Mexico (see key). However, the pseudorhiza do not constitute a valid taxonomic feature in *Psilocybe* of separate sections, as other species also exhibit pseu-

dorhiza, most notably in *P. galindii* Guzmán (Guzmán, 1978), which belongs to the section *Mexicanae* Guzmán. The Mexican species of the *P. fagicola*-complex tend to grow in subtropical (mesophyllic) humid forests, at 1000-2000 m altitude, primarily on slopes in the Gulf of Mexico, although some collections from Oaxaca were found at 800 or 900 m altitude, near tropical forests.

Key to the species recognized

1a. Cheilocystidia of one type 2
1b. Cheilocystidia of two types 7
2a. Pleurocystidia of two types, A: (12-) 14-21 × 4-6 (-9) μm, and B: (16-) 20-29 (-40) × 6-9 (-11) μm ..... ***P. teofilae*** (known only in Mexico)
2b. Pleurocystidia absent or if present of only one type 3
3a. Spores (6.5-) 7-8 (-9) × (5-) 5.5-6.5 (-7) × 4.5-5.5 (-6) μm ... 4
3b. Spores (3.5-) 5-6 (-7) × 4-5 × 3-4 5
4a. Pleurocystidia absent ..... ***P. columbiana*** (known only in Colombia)
4b. Pleurocystidia common ..... ***P. keralensis*** (known only in India)
5a. Pleurocystidia absent or rare, when present 9-15 (-20) × 4-6 (-7) μm ..... ***P. fagicola*** (known only in Mexico)
5b. Pleurocystidia common 6
6a. Pleurocystidia hyaline, (5-) 6-8 (-9) μm wide ..... ***P. herrerae*** (known only in Mexico)
6b. Pleurocystidia hyaline or brownish to reddish yellow, 8-14 μm wide ..... ***P. banderillensis*** (known only in Mexico)
7a. Pleurocystidia absent or rare, when present (3-) 4-6 (-8) μm wide ..... ***P. novoxalapensis*** (known only in Mexico)
7b. Pleurocystidia common, 7-14 (-17) μm wide ..... ***P. oaxacana*** (known only in Mexico)

Description of the new species

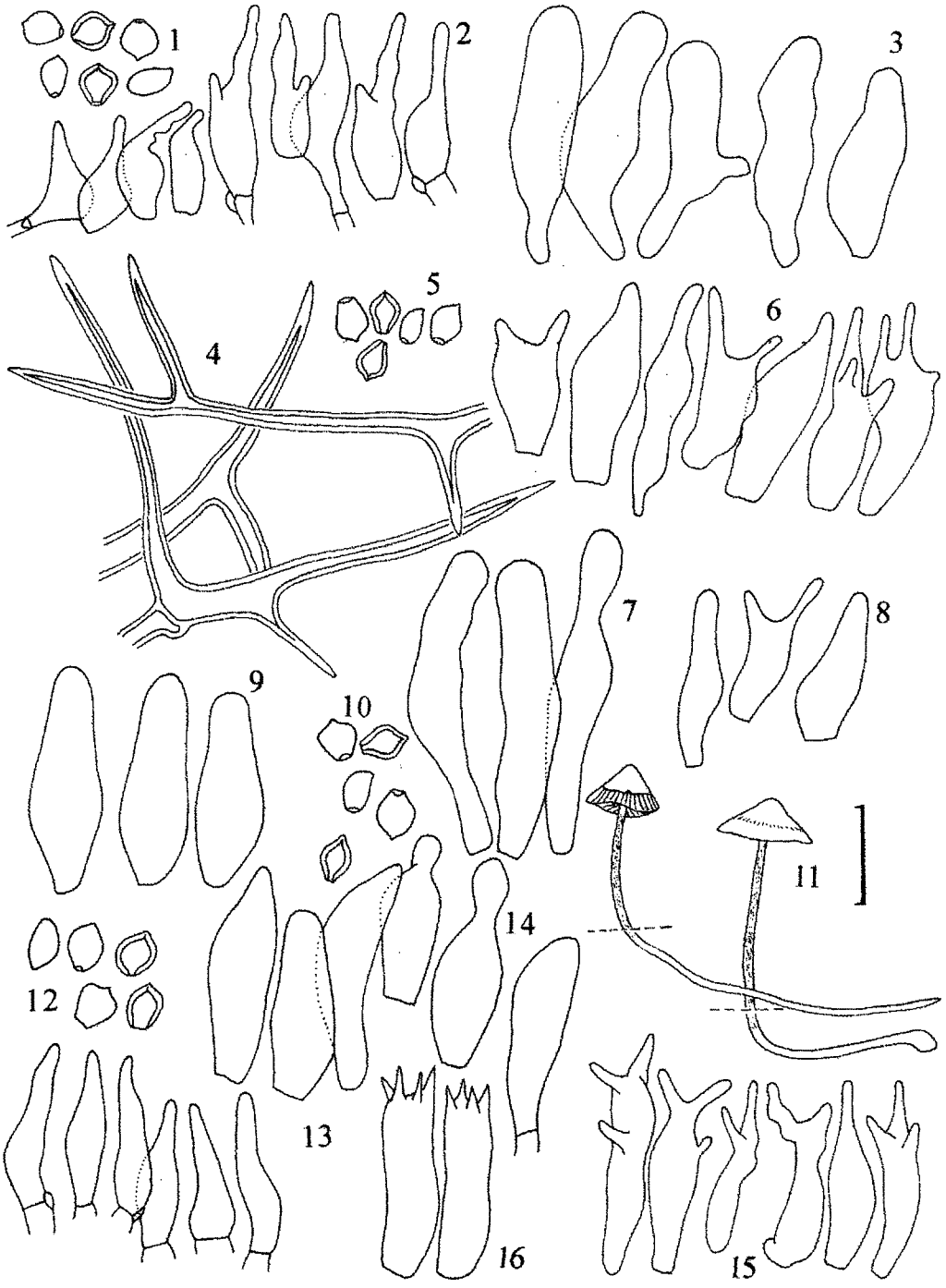
***Psilocybe novoxalapensis* Guzmán and Jacobs, sp. nov. Figs. 1-10**

Pileus (8-) 10-13 (-15) mm wide, conical to campanulate, umbonate, papillate, lubricious, smooth, slightly striated at the margin when moist, or irregularly wrinkled or sulcate to irregularly lobulated with age, hygrophanous, dark reddish brown or brown chocolate, fading to brownish yellow. *Lamellae* adnexed or somewhat sinuate, violaceous brown or dark reddish brown, with whitish, even edges. *Stipe* (30-) 40-50 × 1-2 mm, cylindrical, uniform, hollow, flexuous, reddish brown, paler at the apex, subpruinose above, covered with small floccose, whitish fibrils toward the base, frequently seen in several ring arrangements, base with a inconspicuous yellow mustard mycelium, with a well formed pseudorhiza up to 150 mm long, flexuous, whitish, frequently tapering in a bulb. *Veil* poorly developed, as white or grayish fugacious cottony fibrils. *Context* thin and translucent, whitish to brownish in the pileus, yellowish brown or brownish red in the stipe, bluing. *Odor and taste* farinaceous. KOH stains black brown pileus and stipe. All parts except lamellae bluing to blackish.

Spores (3.5-) 5-6 (-7) × 4-5 × 3-4 μm, subrhomboid on face view, subellipsoid on side view, thick-walled, up to 1 μm thick, yellowish-brown, with a broad germ pore and an acute short appendage. *Basidia* 14-25 × 4.5-7.5 μm, 4-spored, hyaline, ventricose or subcylindric, with a median constriction. *Pleurocystidia* absent or rare, when present similar to cheilocystidia type A, (8-) 10-20 (-25) × (3-) 4-6 (-8) μm, hyaline, subventricose or subfusoid, with either short or long apex neck, sometimes irregularly branched. *Cheilocystidia* hyaline of two types, type "A": (11-) 15-20 (-24) × (3-) 5-7 (-9) μm, frequently strongly and irregularly branched; type "B": (20-) 28-46 (-70) × 4-8 (-14) μm, ventricose-subcylindrical or narrowly utriform, sometimes with a blunt apex similar to a leptocystidium. *Subhymenium* subcellular, up to 15 μm thick, hyaline to yellowish, with thin-to thick-walled, incrusted elements, 3-5 μm wide. *Hymenophoral trama* regular, with hyaline to yellowish, 3-20 μm wide thin-walled hyphae. *Pileipellis* a subgelatinized thin layer, with prostrated, hyaline, 1.5-2.5 μm wide hyphae. *Subpileipellis* subcellular, with hyaline to yellowish, thin-to thick-walled, incrusted elements, 2-10 μm wide. *Context* subcellular, similar to the subpileipellis. *Caulocystidia* 11-40 × 8-14 μm, hyaline, rare, vesiculose, or narrowly utriform. *Basal mycelial* covering formed of branching setaceous hyphae, up to 90 μm long, and 3-4 μm wide, walls 1-1.5 μm thick, yellowish-brown, arising from hyaline clamped hyphae in the mycelium. *Clamp connections* present.

Habitat and distribution. Solitary or scattered, on bare, clay soil, in embankments, close to trails, frequently inside or (rarely) outside of subtropical humid cloud forests. Known only in the state of Veracruz in Mexico.

Discussion. The main taxonomic feature of *Psilocybe novoxalapensis* is the two types of cheilocystidia, a characteristic which is also present in *P. oaxacana* (see key), but that species has broader pleurocystidia, 7-14 (-17) μm wide. The setaceous hyphae in the base of the stipe described above were also reported in *P. guilartensis* Guzmán, Tapia, and Nieves-Rivera emend. Guzmán from Puerto Rico (Guzmán *et al.*, 2003), and in *P. mesophylla* Guzmán, Jacobs, and Escalona, *P. singularis* Guzmán, Escalona, and Jacobs and *P. oaxacana*, all from Mexico (Guzmán *et al.*, 2004). However, only *P. oaxacana* presents pseudorhiza. The caulocystidia described in *P. novoxalapensis* are also observed in *P. fagicola* (see below) and in *P. wayanadensis* from India (Thomas *et al.*, 2002). It has been concluded that both setaceous hyphae and caulocystidia have no taxonomic value. *Psilocybe novoxalapensis* is the most common pseudorhizic species in Mexico, after *P. fagicola* s.s., particularly in the Xalapa



Figs. 1-16. *Psilocybe novaxalapensis* (1-10) and *P. teofilae* (part) (11-16). 1, spores; 2, cheilocystidia type A; 3, cheilocystidia type B; 4, setaceous hyphae; 5, spores; 6, cheilocystidia type A; 7, cheilocystidia type B; 8, pleurocystidia; 9, caulocystidia; 10, spores; 11, basidiomata; 12, spores; 13, pleurocystidia type A; 14, pleurocystidia type B; 15, cheilocystidia; 16, basidia (1-4: holotype; 5: Guzmán 19896-A; 6-9: Jacobs 187; 10: Jacobs 118; 11-16: holotype). Scale bar = 12 μm in all, except in 11 = 20 mm.

region of the state of Veracruz. The fungus cited by Guzmán *et al.* (1988) as *P. herrerae,* is now designated *P. novoxalapensis,* by virtue of its exhibition of two types of cheilocystidia. The name of the species distinguishes it from *P. xalapensis*, which is now considered to be a synonymous with *P. fagicola* (see below).

Material studied. MEXICO, Veracruz, SW of Xalapa, near Río Coapexpan, June 5, 1988, *Bandala 1356.* Plan Sedeño region, July 9, 1988, *Montoya 1153*; Sept. 20, 1989; *Bandala 1770*; *Montoya 1568*; July 7, 1994; *Leal 255-A.* San Andrés Tlalnehuayocan region, June 28, 1986, *Bandala 930.* Road Xalapa to Perote, SW of Banderilla,

Cerro La Martinica, July 1983, *López 2186* (holotype); July 20, 1989, *Bandala 1559*; near Piletas, July 11, 1980, *Jacobs 187*; near Acajete, waterfall zone, July 8, 1980, *Betancourt 296*; June 27, 1992, *Bandala 2090.* Road Banderilla to Santa Rita, near Paz de Enríquez, Sept. 1975, *Guzmán 12481-B*; June 22, 1980, *Jacobs 118*; July 31, 1981, *Guzmán 19896-A* (all in XAL).

***Psilocybe teofilae* Guzmán and Ramírez-Guillén, sp. nov. Figs. 11-20**

Pleus 10-20 mm wide, conic-convex to subumbonate or mammiform, smooth to slightly striated toward the margin, hygrophanous, brownish-red to brownish pale. *Lamellae* subadnate, brown violaceous, edges concolorous. *Stipe* 30-40 × 1-2.5 mm, uniform, flexuousus, reddish-brown to brown chocolate toward the base, covered with small whitish scales, base with a long pseudorhiza up to 70 mm long, whitish, frequently with a bulb at the end. *Context* whitish in pileus, ochraceous in stipe, bluing. *Odor and taste* slightly farinaceous. All parts except for lamellae bluing to blackish.

Spores (5.5-) 6-7 (-9) × (4-) 5-6 (-7) × 3-4 μm, subrhomboid on face-view, subelliptical on side-view, thick-walled, walls up to 1 μm thick, yellowish-brown, with a broad germ pore and a short appendage. *Basidia* 24-28 x 5.6-8 μm, 4-spored, subventricose-subcylindric, with a median constriction. *Pleurocystidia* common, hyaline, of two types, A: (12-) 14-21 × 4-6 (-9) μm, conical, ventricose-sublageniform or narrowly utriform, with a short neck or subcapitate, and B: (16-) 20-29 (-40) × 6-9 (-11) μm, ventricose-rostrate or subfusiform, with acute apex or subcapitate, like a bowling. *Cheilocystidia* (17-) 20-28 (-34) × 4-6 (-7) μm, hyaline, similar to pleurocystidia type A, or strongly and irregularly branched into two or three necks. *Hymenophoral trama* regular with hyaline to yellowish, 2-24 μm wide, thin- or thick-walled hyphae, somwhat incrusted. *Pileipellis* an ixocutis, 10-15 μm thick, hyaline, but with a blue-green pigment in the media, formed by prostrate hyphae, thin-walled, 1-4 μm wide. *Subpileipellis* up to 60 μm thick, with filamentous, brownish pale hyphae, incrusted with a red-brown pigment. *Subhymenium* subcellular, 2-6 μm wide, hyaline to yellowish, thin-walled elements, sometimes with a blue green pigment in the media. *Clamp connection* present.

Habitat and distribution. Solitary or scattered, on bare soil in mesophyllic humid forests. Known from the states of Oaxaca and Veracruz in Mexico.

Discussion. The two types of pleurocystidia constitute the primary taxonomic feature for the distinction of *P. teofilae* (see key). This feature is also observed in *P. guilartensis*, a species without pseudorhiza, and only known in Puerto Rico (Guzmán *et al.*, 2003). The name of the species is in honor of the eminent Mexican mycologist Dr. Teofilo Herrera, at the University of Mexico, and great friend and colleague of the senior author of this paper.

Material examined. MEXICO, Oaxaca, Huautla de Jiménez, bought from Indians, Sept. 1984, *Laudonia* A (ENCB, XAL). Veracruz, Mountains of Cerro Chiconquiaco, Loma Alta, July 1965, *Holroyd* (MEXU 2997 as *P. cordispora*). S of Xico, Xico Viejo, Aug. 31, 1999, *Cuevas 158* (holotype XAL).

Discussion of the previously known species

***Psilocybe banderillensis* Guzmán, *Nova Hedwigia* 29: 642, 1978. Figs. 21-25**

This species is characterized by its common pleurocystidia, 16-30 × 8-14 μm, subfusiform, sublageniform, or subventricose, capitate or subcapitate, hyaline or subhyaline to brownish or reddish yellow, and cheilocystidia of 16-27 × 3-8 μm, hyaline, sublageniform or subfusoid, simple or irregularly branched. The basidia are 4-spored, ventricose or subpyriform, and hyaline. *Psilocybe banderillensis* is similar to *P. herrerae* (see the key), from which it can be differentiated only by its wide pleurocystidia. Due to its colored pleurocystidia, Guzmán (1983) classified this species in the section, *Brunneocystidiatae* Guzmán. However, because as the colored pleurocystidia are uncommon, *P. banderillensis* is now consigned allocated to section *Cordisporae*. Also *P. banderillensis* manifests setaceous hyphae, as described in *P. novoxalapensis*, which, as stated, bear no taxonomic importance.

Habitat and distribution. Identical to that of *P. novoxalapensis*, except that *P. banderillensis* is known from in both Veracruz and Oaxaca (the report from Oaxaca is the first report for this species).

Material examined. MEXICO, Oaxaca, trail Tuxtepec to Huautla, near Llano Grande, July 5, 1980, *Jacobs 156* (XAL). Veracruz, SW of Banderilla, Cerro La Martinica, Aug. 10, 1976, *Guzmán 16365* (holotype, XAL).

***Psilocybe columbiana* Guzmán, *Mycotaxon* 7: 237, 1978.**

As noted in the key, this species is related to *P. keralensis* as evidenced by its bigger spores, up to 9 μm long, but differs with regard to the absence of pleurocystidia. It is known only in the meadows (páramos) of high mountains in Colombia (Guzmán, 1978, 1983).

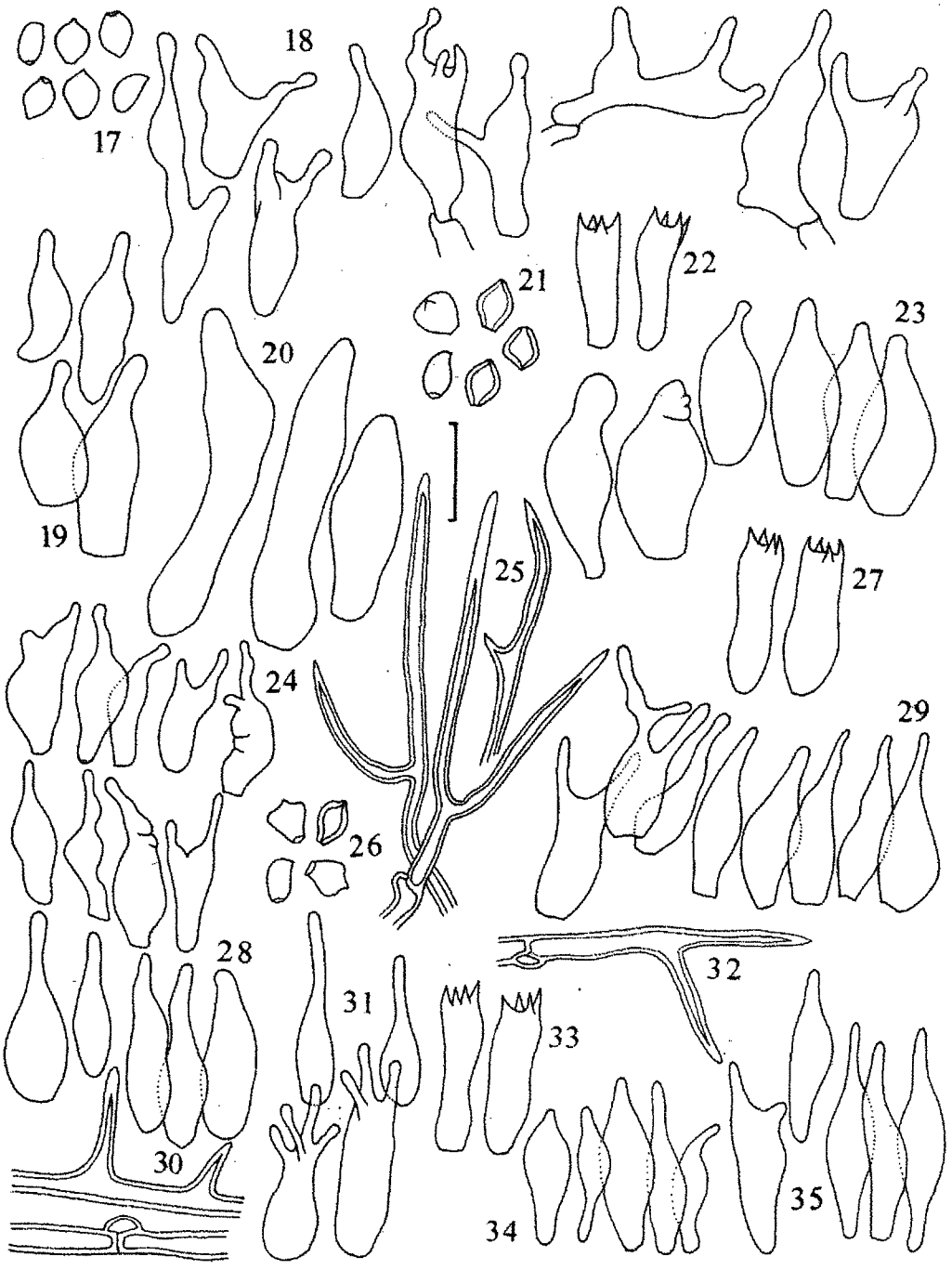
***Psilocybe fagicola* R. Heim and Cailleux, *Rev. Mycol.* 24: 438, 1959, emend. Guzmán, *new emend.* Figs. 26-39**

= *P. fagicola* var. *mesocystidiata* Guzmán, *Nova. Hedwigia* 29: 629, 1978.

= *P. xalapensis* Guzmán & López, *Bol. Soc. Mex. Mic.* 13: 181, 1979.

= *P. wassoniorum* Guzmán & Pollock, *Bol. Soc. Mex. Mic.* 13: 267, 1979

Psilocybe fagicola was described by Heim and Cailleux (1959a, b) from samples obtained in a *Fagus* forest in the State of Hidalgo, Mexico, from which the name of the species was derived. However, the pseudorhiza was not

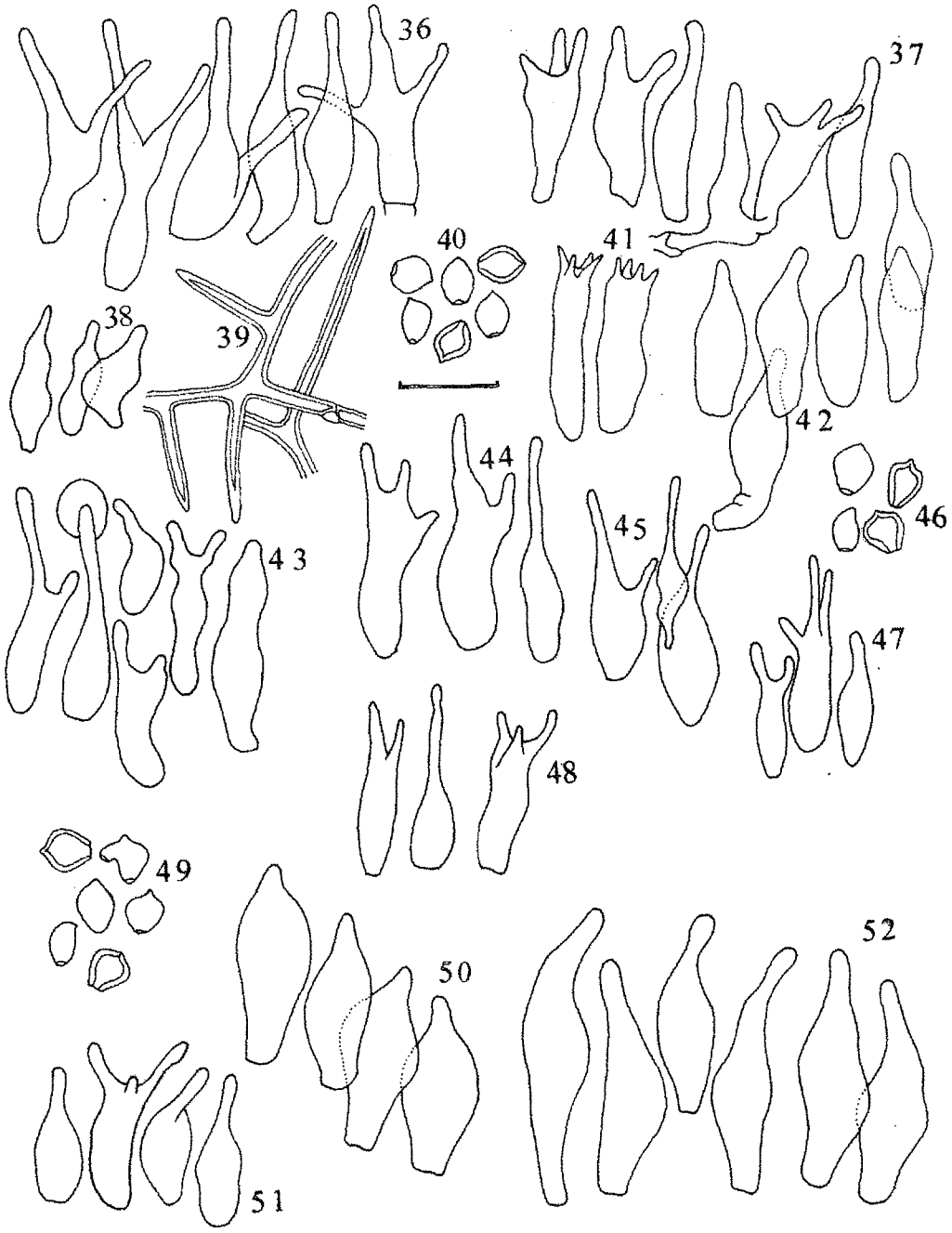


Figs. 17-35. *Psilocybe teofilae* (cont.) (17-20), *P. banderillensis* (21-25) and *P. fagicola* (part) (26-35). 17, spores (the thick wall was not drawing, it is like to figs. 5, 10, 12, 21, 26, 40, 46 and 49); 18, cheilocystidia; 19, pleurocystidia type A; 20, pleurocystidia type B; 21, spores; 22, basidia; 23, pleurocystidia; 24, cheilocystidia; 25, setaceous hyphae; 26, spores; 27, basidia; 28, cheilocystidia; 29, pleurocystidia; 30, setaceous hyphae; 31, cheilocystidia; 32, setaceous hyphae; 33, basidia; 34, pleurocystidia; 35, cheilocystidia (17-20: Laudonia "A"; 21-25: Jacobs 156; 26-30: Guzmán 19375; 31-32: Guzmán 23260; 33-35: Jacobs 108). Scale bar = 12 μm.

considered in the description, neither the pleurocystidia and cheilocystidia were described. Later, Heim and Cailleux (1967) presented a new description (with a color plate of the basidiomata), in which the pseudorhiza is not adequately defined, and the pleurocystidia and cheilocystidia were not considered. Guzmán (1983) described this species based on the type and several topotypes he gathered. He described cheilocystidia 6-13 × 2.5-3.3 μm. Guzmán (1978) also described *P. fagicola* var. *mesocystidiata,* with cheilocystidia which are 3.3-4.3 μm wide. A new study of all the available material, among them the types of the above names, concluded that *P. fagicola* has cheilocystidia (6-) 12-20 (-30) × (2.5-) 4-6 (-9) μm, lageniform, sublageniform, subventricose, or narrow clav-

ate, frequently with two, three or four irregular branches. Therefore, *P. fagicola* var. *mesocystidiata* is synonymous with the typical variety. Pleurocystidia are absent or rare, and when present are 9-15 (-20) × 4-6 (-7) μm, sublageniform or ventricose, capitate or subcapitate, or possessing a short neck. The sizes of the spores are (4.5-) 5-6 (-8) × 4.5-5.5 × 3.5-4.5 μm, subrhombic, and thick-walled. The new size and form of the cheilocystidia described above, as well as the presence of pleurocystidia, constitute the basic key for the new emendation of *P. fagicola* presented in this work. According to this new concept, *P. xalapensis* and *P. wassoniorum* are synonymous with *P. fagicola*, as they exhibit the same variations in microscopic features (Guzmán *et al.*, 1979; Guzmán and Pollock, 1979).

The setaceous hyphae and caulocystidia are identical to those of *P. novaxalapensis* and *P. banderillensis,* and as



Figs. 36-52. *Psilocybe fagicola* (cont.), *P. herrerae* and *P. oaxacana*. 36-39: *P. fagicola*, 36-37 cheilocystidia, 38 pleurocystidia, 39 setaceous hyphae. 40-48: *P. herrerae*, 40 spores, 41 basidia, 42 pleurocystidia, 43-44 cheilocystidia, 45 pleurocystidia, 46 spores, 47 pleurocystidia, 48 cheilocystidia. 49-52: *P. oaxacana*, 49 spores, 50 pleurocystidia, 51 cheilocystidia type A, 52 cheilocystidia type B (36: Jacobs 108; 37-39: Moreno 5; 40-43: Guzmán 10443; 44-45: Tapia 966; 46-48: Jacobs 24; 49-52: holotype). Scale bar = 12 μm.

concluded in those species, these structures possess no taxonomic value. *Psilocybe fagicola* s.s. is the most common species in Mexico, based on its wide distribution, with more than 25 specimens currently revised.

Habitat and distribution. The habitat is the same as that described for *P. novoxalapensis*, with broad distribution in subtropical (mesophyllic) humid forests of Mexico. It is known in the states of Hidalgo and Veracruz.

Material examined. MEXICO, Hidalgo, SE of Zacualtipan, near Zacuatlamaya, "bosque de hayas", July, 1959, *Heim F-636* (P holotype; ENCB isotype); Sept. 21-23, 1960, *Guzmán 2391, 2666, 2667, 2678, 2679 & 2683* (all in ENCB, with exception of *2391* in MICH). Veracruz, Chiconquiaco region, near Acatlán, *Ventura 11542* (holotype of *P. fagicola* var. *mesocystidiata*, ENCB, isotype NY); San Andrés Tlalnehuayocan region, June 28, 1980, *Jacobs 136, 141, 144* (all in XAL); June 28, 1986, *Bandala 898 & 925* (both in XAL); July 22, 1994, *Moreno 5* (XAL). La Galera, July 27, 2001, *Jarvio 1028* (XAL); Tres Cruces, June 18, 2000, *Jarvio 601* (XAL). Perote, SW of Banderilla, Cerro La Martinica, June 9, 1979, *Sosa 110* (holotype of *P. xalapensis*, XAL); June 7, 1980, *Barrera 16* (XAL); July 6, 1981, *Guzmán 19375* (XAL); near Acajete, waterfall zone, June 21, 1980, *Jacobs 108 & 115* (both in XAL); June 30, 1980, *Jacobs 148* (XAL); July 7, 1980, *Sosa 351* (XAL); July 8, 1980, *Betancourt 36* (XAL); July 11, 1980, *Jacobs 182-B* (XAL); Xalapa Region, old road to Coatepec, Botanical Garden of Instituto of Ecology, July 1, 1983, *Guzmán 23260* (XAL); Oct. 8, 1999, *Jarvio 306* (XAL). Road Xalapa to Plan Sedeño region, July 9, 1988, *Bandala 1392* (XAL); Aug. 19, 1988, *Bandala 1454* (XAL); *Montoya 1236* (XAL); Sept. 20, 1989, *Bandala 1776-A & 1778* (both in XAL). Road Banderilla to Santa Rita, near Paz de Enriquez, July 22, 1978, *Pollock 3* (ENCB, holotype of *P. wassoniorum*); June 1979, *Jacobs 80* (XAL).

***Psilocybe herrerae* Guzmán, *Nova Hedwigia* 29: 644, 1978. Figs. 40-48**

Revising the type of this species, and comparing it in light of the new concept of *P. fagicola*, it was found that the only difference between these species is the common and larger pleurocystidia seen in *P. herrerae*, which are (12-) 18-30 (-33) × (5-) 6-8 (-9) μm, hyaline, subfusiform or sublageniform, possessing a short neck. It is probable that the difference with *P. fagicola* is attributable to basidioma development, but without more information, it is more appropriate to maintain both species, until more material is available to study, and to carry out an evaluation of basidioma development. The cheilocystidia are 12-20 (-28) x (3-) 4-6 (-8) μm, hyaline, sublageniform or subventricose, and are frequently irregularly branched. However, the setaceous hyphae are as described for *P. novoxalapensis*. The habitat and distribution is identical to that of *P. fagicola*, although *P. herrerae* is known only in Chiapas and Veracruz. The description of *P. herrerae* by Stamets (1996: 117) is merely a copy of that described by Guzmán (1983), with the exception of the good color picture presented, which was taken by Jacobs. The name of the species refers to Dr. Teofilo Herrera (see *P. teofilae*). (See discussion of *P. banderillensis*).

Material examined. MEXICO, Chiapas, road Teapa to Bochil, between Rayón and Pueblo Nuevo, July 13, 1972, *Guzmán 10443* (holotype ENCB; isotype NY). Veracruz, Xalapa region, San Andrés Tlalnehuayocan region, June 28, 1980, *Jacobs 137* (ENCB). Road Xalapa to Perote, turnoft to Plan Sedeño, July 9, 1988, *Bandala 1394* (XAL); Aug. 19, 1988, *Montoya 1227* (XAL); Acajete, waterfall area, July 11, 1980, *Jacobs 183* (ENCB); June 27, 1992, *Tapia 966* (XAL).

***Psilocybe keralensis* K.A. Thomas, Manim and Guzmán, *Mycotaxon* 83: 196, 2002**

As discussed above, this Indian species is considered to be separate from *P. columbiana* due to its well developed pleurocystidia, (11.5-) 12-20 (-27) × (3-) 4-6.5 (-7.5) μm. The cheilocystidia, which are similar in both species, are (10.5-) 13-28 (-32) × (3-) 5-7 (-8) μm in *P. keralensis*, vs. 22-30 × 3-6.5 μm in *P. columbiana* (Guzmán, 1978, 1983; Thomas *et al.*, 2002).

***Psilocybe oaxacana* Guzmán, Escalona and Jacobs, *Inter. J. Medic. Mushr.* 6: 286, 2004. Figs. 49-52**

As shown in the key, this species is closely related to *Psilocybe novoxalapensis*, as evidenced by the two types of cheilocystidia, which are quite similar between the two species. Also, they manifest setaceous hyphae at the base of the stipe, as described above. However, the width of the pleurocystidia, as well as their abundance in *P. oaxacana*, constitute major markers for the easy differentiation of the species. *Psilocybe oaxacana* manifests pleurocystidia of 15-33 × 7-14 (-17) μm, which are hyaline, and ventricose-clavate, with very short necks. The cheilocystidia are similar to those associated with *P. novoxalapensis*, type A: (14-) 15-22 (-24) × (4-) 5-7 (-8) μm, and type B: (21-) 24-31 (-38) × (7-) 8-10 μm, as was reported for the type: *Jacobs 202*, which was gathered near Llano Grande, trail Tuxtepec to Huautla (XAL). It is only known in the state of Oaxaca (Guzmán *et al.*, 2004).

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