

# The known non-hallucinogenic species of *Psilocybe* in Mexico and description of two new species (Basidiomycotina, Agaricales, Strophariaceae)

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## Las especies no alucinógenas de *Psilocybe* conocidas en México y descripción de dos nuevas especies (Basidiomycotina, Agaricales, Strophariaceae)

**Resumen.** Se conocen en México 12 especies no alucinógenas del género *Psilocybe*, desde 1918 la primera cita hasta el 2000 la última. En este trabajo se describen *P. castillotovarii* y *P. josecastilloa* como especies nuevas. Ambas de la región de Valle de Bravo, en el estado de México, en un bosque de *Pinus-Quercus*. Pertenecen a las secciones *Singerianae* y *Psilocybe*, respectivamente.

**Palabras clave:** *Psilocybe*, especies no alucinógenas, nuevas especies.

**Abstract.** Twelve non-hallucinogenic species of *Psilocybe* are known in Mexico, from the oldest reference in 1918 to the more recent in 2000. In addition *P. castillotovarii* and *P. josecastilloa* are described as new species here. They are known only from Valle de Bravo region in the State of Mexico, in a *Pinus-Quercus* forest. They belong to sections *Singerianae* and *Psilocybe*, respectively.

**Key words:** *Psilocybe*, non-hallucinogenic, new species.

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## Introduction

Although the genus *Psilocybe* (Fr.) P. Kumm. was reported from Mexico in 1918 by Murrill [8] and intensively studied in 1956-1957 relative to the discovery hallucinogenic fungi [7, 11], and the world monograph on the genus [1] with a supplement [2] has been published, new undescribed species remain. This paper critically reviews all the non-hallucinogenic species of *Psilocybe* known in Mexico. In addition two new species are described. The paper is part of the work on the second edition of The Genus *Psilocybe* that the author has been preparing over five years.

This contribution is in honor of the colleague and friend Professor José Castillo Tovar, for his great way teaching mycology and preparing specialists in Mexico.

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## Materials and methods

Besides the review of the literature, the microscopic observations on herbarium specimens were made with sections mounted in 5% KOH solution, after being rehydrated in 96% alcohol. Certainly that for each new species here described, a single collection was studied, but it is considered that this material was sufficient, taking in consideration the experience of the author on the genus [1, 2, 3, 4, 5, 6].

## The known non-hallucinogenic species of *Psilocybe* in Mexico

The first record of a *Psilocybe* in Mexico was by Murrill in 1918 [8], who recorded *P. coprophila* from Cordoba region, in the State of Veracruz, as *Deconica bullacea* (Bull.: Fr.)

Sacc. This report is based in the studied material by the author in Murrill's specimens in NY [1]. Thirty-one years later in 1949 Singer [9] recorded the second species of *Psilocybe* in Mexico, the hallucinogenic *P. cubensis* (Earle) Singer. In 1977 Guzmán *et al.* [6] studied the non-hallucinogenic species of Mexico, reporting 4 species and a new species, *P. borealis*. Later, the first world monograph on the genus was published, where 144 species were accepted and 53 being non-hallucinogenic, but only 6 of these were reported from Mexico. Up to now, 12 species of non-hallucinogenic *Psilocybe* had been recorded from Mexico (Table 1) by the author and his colleagues [2, 3, 4, 5].

Following the criteria of Guzmán (1983), it is consider a non-hallucinogenic species, when the basidioma is not bluing or it has not black stains. Even in fresh condition, the basidioma has not a farinaceous taste and odor.

*Psilocybe argentina*, *P. coprophila* and *P. montana* are the most common non-hallucinogenic species. The two first are fimicolous, *P. argentina* in alpine meadows and *P. coprophila* in temperate and tropical meadows. *Psilocybe montana* is common on mosses in temperate forests.

## Description of new species

### *Psilocybe castillotovarii* Guzmán, sp. Nov.

Figs. 1-4

Pileus 20-25 mm latus, convexus vel planus, laevis, pallide luteobrunneolus, subhygrophanus. Lamellae subadnexae. Stipes 35-40 x 1-2 mm, aequalis, rufobrunneus. Velum debiliter evolutum. Basidiomata haud caerulescentia. Sporae (7-) 8-9 (-9.5) x (4-) 4.5-5.5 (-6)  $\mu\text{m}$ , a fronte et latere subellipsoidae, parietibus tenuibus, luteobrunneae. Pleurocystidia (30-) 43-53 (-60) x (8-) 11-17  $\mu\text{m}$ , rara vel communia, hyalina, ventricoso-rostrata vel sublageniformia. Cheilocystidia (22-) 35-55 x 10-14 (-16)  $\mu\text{m}$ , hyalina, forma eadem est ac pleurocystidia. Pileipellis subgelatinosa. Subpellis hyphis hyalinis. In terra in prato in sylva pinus. Holotypus hic designatus: Mexico, Los Sauces, in regione Valle de Bravo, Guzmán 21874 (ENCB).

Pileus 20-25 mm diam, convex to plane, smooth, pale yellowish brown, subhygrophanous. Lamellae subadnexed, dark violaceous brown, edges concolorous.

Stipe 35-40 x 1-2 mm, equal, hollow, reddish yellow brown, scantily covered by whitish fibrils. Veil poor developed. Context pale brown, pliant. Odor and taste fungoid.

Basidiomata not bluing. Spores (7-) 8-9 (-9.5) x (4-) 4.5-5.5 (-6)  $\mu\text{m}$ , subellipsoid, both in face- and side-view, thin-walled, yellowish brown, with a distinct and broad germ pore on one end and with an apical short appendage in the other. Basidia 16-25 x 7-8  $\mu\text{m}$ , 4-spored, hyaline, ventricose or subclavate, with a median constriction. Pleurocystidia (30-) 43-53 (-60) x (8-) 11-17  $\mu\text{m}$ , scarce to common, hyaline, ventricose-rostrate with a thick and short neck, sometimes sublageniform with a narrow base. Cheilocystidia (22-) 35-55 x 10-14 (-16)  $\mu\text{m}$ , hyaline, same form and variation as the pleurocystidia, in a fertile margin of the lamellae. Subhymenium subcellular, with hyaline elements, 10-15  $\mu\text{m}$  broad, incrustated with brownish pigment. Hymenophoral trama regular, with hyaline hyphae, 4-10 (-17)  $\mu\text{m}$  broad, more or less incrustated with a brownish pigment. Pileipellis subgelatinized, with hyaline, postrate, thin hyphae. Subpellis (hypodermium) with hyaline hyphae, 3-6  $\mu\text{m}$  broad. Context with hyaline hyphae, 3-11  $\mu\text{m}$  broad, yellowish in mass. Clamp connections present.

Habitat and distribution. Gregarious on soil, in a meadow in a *Pinus-Quercus* forest, at 2800 m elev. Known only from the type locality.

Studied material. State of Mexico, Valle de Bravo region, road Toluca to Temascaltepec, S of Los Sauces, July 30, 1982, G. Guzmán 21874 (holotype ENCB).

Discussion. *Psilocybe castillotovarii* belongs to section *Singerianae* Guzmán [1], for their subellipsoid thin-walled spores and lack of bluing of its basidioma. The form and size of the pleurocystidia and cheilocystidia defined the species. *Psilocybe latycistis* Guzmán & A.H. Smith from the northwestern U.S.A. differs in having cheilocystidia 13-30 x 8-13  $\mu\text{m}$  and *P. washingtonensis* A.H. Smith, also from the northwestern of the U.S.A. has cheilocystidia 18-38 x 7-12  $\mu\text{m}$  and more fusiform or subcylindric. *Psilocybe*

*pallidispora* (Murrill) A.H. Smith from Jamaica has smaller pleuro- and cheilocystidia. *Psilocybe tuxtlenensis* from Veracruz has smaller spores, 5.5-6 (-6.5) x 3.4  $\mu\text{m}$  [1].

### *Psilocybe josecastilloa* Guzmán, sp. Nov.

Figs. 5-8

Pileus 15-20 mm latus, convexus vel subumbilicatus, laevis, brunneolus. Lamellae sinuata. Stipites 30-35 x 1.5-2 mm, pileo concolor. Basidiomata haud caerulescentia. Spores (5.5-) 6-7 (-7.5) x 5-6 x 3.5-4.5  $\mu\text{m}$ , a fronte visae subrhomboidae, a latere visae subellipsoidae, parietibus crassis, luteobrunneae. Pleurocystidia 18-26 (-28) x 7-9 (-11)  $\mu\text{m}$ , communia, subventricosa vel sublageniformia, hyalina. Cheilocystidia 18-26 x 6-8  $\mu\text{m}$ , hyalina, subteretiusscula subcapitata vel sublecytiformia vel subventricosa. Pileipellis subgelatinosa. Subpellis haud dissimilis. In terra, sylva pinus. Holotypus hic designatus: Mexico, Los Sauces, in regione Valle de Bravo, Valenzuela 4066 (ENCB).

Pileus 15-20 mm diam, convex to subumbilicate, smooth, pale brown, irregularly spotted by dark reddish brown tones with age. Lamellae sinuate, dark violaceous brown, with whitish edges. Stipe 30-35 x 1.5-2 mm, cylindric, subbulbous, concolours with pileus, but covered with small, whitish fibrils, base white. Veil poor developed. Context pale brownish, pliant in pileus, tough in stipe. Odor and taste fungoid.

Basidiomata not bluing. Spores (5.5-) 6-7 (-7.5) x 5-6 x 3.5-4.5  $\mu\text{m}$ , surrhomboid in face-view, subellipsoid in side-view, thick-walled, yellowish-brown, with a distinct and broad germ pore on one end and with an apical short appendage in the other. Basidia not studied. Pleurocystidia 18-26 (-28) x 7-9 (-11)  $\mu\text{m}$ , common, hyaline, polymorphic, regular or irregularly subventricose, generally with a narrow base and acute apex, or sublageniform, sometimes with a hyaline oil drop at the apex. Cheilocystidia 18-26 x 6-8  $\mu\text{m}$ , hyaline, polymorphic, subcylindric-subcapitate or

Table 1. Non-hallucinogenic species of *Psilocybe* reported from Mexico through 2004 (only the oldest reference is given for each) \*.

1. *P. alpina* Guzmán, F. Tapia & P. Navarro (Veracruz) [5].
2. *P. argentina* Speg. (Coahuila, Distrito Federal, State of Mexico, Hidalgo, Morelos, Nuevo León, Puebla, Veracruz) [6].
3. *P. borealis* Guzmán (Durango) [6].
4. *P. bulbosa* Peck (Veracruz) [5].
5. *P. coprophila* (Bull.: Fr.) P. Kumm. (Chiapas, Distrito Federal, Durango, State of Mexico, Guerrero, Hidalgo, Jalisco, Michoacán, Morelos, Nuevo León, Oaxaca, Querétaro, Veracruz, Zacatecas) [7].
6. *P. inquilina* (Fr.: Fr.) Bres. (Jalisco) [2].
7. *P. luteonitens* (Vahl: Fr.) Park-Rhodes (State of Mexico) [2].
8. *P. montana* (Pers.: Fr.) P. Kumm. (Coahuila, Distrito Federal, State of Mexico, Morelos, Oaxaca, Puebla) [6].
9. *P. panaeoliformis* Murrill (Veracruz) [2].
10. *P. pegleriana* Guzmán (Jalisco, Veracruz) [4] (as *P. merdaria* (Fr.) Ricken in Guzmán *et al.*, 6; *P. pseudobullacea* (Petch) Pegler in Guzmán [1]).
11. *P. tuxtlenensis* Guzmán (Veracruz) [1].
12. *P. zoncuantlensis* Guzmán & Ram.-Guill. (Veracruz) [5].

\* Those names in parenthesis after the species, are the federal states of the country from where the species were reported.



Figs. 1-8. 1-4: *Psilocybe castillotovarii*, 1 spores, 2 basidia, 3 pleurocystidia, 4 cheilocystidia. 5-8: *P. josecastilloa*, 5 basidiomata, 6 spores, 7 pleurocystidia, 8 cheilocystidia (all from the types). Scale bar 20 mm in 5, 12  $\mu$ m in the others.

subcylindrical, some subventricose, others ventricose-rostrate. Subhymenium subcellular, with 6-13  $\mu$ m broad, incrustated elements with pigment dark brown. Hymenophoral trama regular, with normal to inflated hyaline hyphae, 3-17  $\mu$ m broad, hyaline or incrustated. Pileipellis a thin subgelatinous layer, with (1-) 2-3  $\mu$ m broad, hyaline hyphae. Subpellis (hypodermium) not differentiated. Context with incrustated hyphae, 3-14  $\mu$ m broad, thin- to thick-walled. Clamp connections present.

Habitat. Gregarious on soil, in a *Pinus-Quercus* forest, at 2600 m elev. Known only from the type locality.

Studied material. State of Mexico, Valle de Bravo region, road Toluca to Temascaltepec, S of Los Sauces, Sept. 16, 1984, R. Valenzuela 4066 (holotype ENCB; isotype XAL).

Discussion. *Psilocybe josecastilloa* belongs to section *Psilocybe*, in the new sense by the author, for their subrhomboid thick-walled spores, presence of pleurocystidia and lack of bluing of its basidioma. It is close to *P. februaryana* Singer [10], described from Argentina, and to *P. latispora* Murrill from the U.S.A. [1], but these two species have not pleurocystidia. *Psilocybe februaryana* has cheilocystidia

narrow, no more than 5.5  $\mu$ m broad, and *P. latispora* presents cheilocystidia sublageniform, 19-30 x 4-6.5  $\mu$ m.

About the non-hallucinogenic proprieties in the two species here described, it is interesting to observe, that both belong to two different sections of the genus, but as discussed Guzmán [1], the know phylogenetic tree of the genus is a mix of both hallucinogenic and non-hallucinogenic species. However, the author has, with L. Guzmán-Dávalos, a DNA research to understand better the phylogeny of the genus.

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### References

- Guzmán, G., 1983. The genus *Psilocybe*. Beih. Nova Hedwigia 74, Cramer, Vaduz.
- Guzmán, G., 1995. Supplement to the monograph of the genus *Psilocybe*. In: Petrini, O. and E. Horak, Taxonomic Monographs of Agaricales. Bibliotheca Mycologica 159, Cramer, Berlin, pp. 91-141.
- Guzmán, G., 1998. Las especies de *Psilocybe* (Fungi, Basidiomycotina, Agaricales) conocidas en Jalisco (México) y descripción de dos nuevas para la ciencia. Acta Botánica Mexicana 43: 23-32.
- Guzmán, G., 2000. New species and new records of *Psilocybe* from Spain, the U.S.A and Mexico, and a new case of poisoning by *Psilocybe barrerae*. Documents Mycologiques 29 (116): 41-52.
- Guzmán, G., F. Ramírez-Guillén, F. Tapia, P. Navarro, 1999. Las especies del género *Psilocybe* (Fungi, Basidiomycotina, Agaricales) conocidas de Veracruz (México). Acta Botánica Mexicana 49: 35-46.
- Guzmán, G., L. Varela, J. Pérez-Ortiz, 1977. Las especies no alucinógenas del género *Psilocybe* conocidas en México. Boletín Sociedad Mexicana de Micología 11: 23-33.
- Heim, R., 1956. Les champignons divinatoires utilisés dans les rites des Indiens Mazatèques, recueillis au cours de leur premier voyage au Mexique, en 1953, par Mme Valentina Pavlouva Wasson et R.G. Wasson. Comptes Rendus de l'Académie des Sciences, Paris, 242: 965-968.
- Murrill, W.A., 1918. Agaricaceae of tropical North America VII. Mycologia 10: 15-33.
- Singer, R., 1949. The Agaricales (Mushrooms) in Modern Taxonomy. Lilloa 22: 5-832.
- Singer, R., 1989. New Taxa and New Combinations of Agaricales (Diagnoses Fungorum Novorum Agarialium IV). Fieldiana, Botany, new ser. 21 (1402): I-II & 1-133.
- Singer, R., A.H. Smith, 1958. Mycological investigations on Teonanácatl, the Mexican hallucinogenic mushroom. Part II. A taxonomic monograph of *Psilocybe*, section *Caerulescentes*. Mycologia 50: 262-303.