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## A NEW SPECIES AND A NEW VARIETY OF PSILOCYBE FROM NORTH AMERICA

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### SUMMARY

A new species from the Northwestern U.S.A., and a new variety from the Northwestern and Eastern U.S.A. are herein described. Both fungi exhibit the characteristic bluing feature shared by many of the hallucinogenic species in the genus *Psilocybe*. The new species contains psilocybin and psilocin and the new variety contains psilocybin but no psilocin.

### INTRODUCTION

With the increased attention focusing on the hallucinogenic species of *Psilocybe* it is not surprising that new species and varieties are being discovered throughout the world. Guzmán and Vergeer (1978) listed 390 names of *Psilocybe* of which 210 are excluded taxa, and of which 73 are hallucinogenic. More recently, Guzmán (1978A), Guzmán and Pollock (1978,1979), Guzmán and Smith (1978), Guzmán and Horak (1978), and Guzmán and Lopez (in Guzmán *et al.*, 1979) described several species, the majority having hallucinogenic properties.

The first decisive and thorough taxonomic survey of the bluing species in the genus *Psilocybe* was authored by Singer and Smith (1958). Heim (in Heim and Wasson, 1958) presented a study of the hallucinogenic species from Mexico,

and later (in Heim et al., 1967) described additional hallucinogenic species from many regions of the world, including *Psilocybe semilanceata* (Secr. ex Fr.) Kumm., a species originally thought to be non-bluing and therefore excluded from the Singer and Smith monograph. Peck (1912), who reported *P. semilanceata* from the Eastern United States, studied the species in the genus *Psilocybe* endemic to New York State, though many of the species considered by him now belong to other genera (such as *Naematoloma* and *Psathyrella*). Guzmán et al (1976) presented a list of the known hallucinogenic species of *Psilocybe* from the northwestern region of North America where they seem very common. Recently, Stamets (1978) surveyed a majority of the known species in the genus from North America, including those previously described by Earle, Murrill, Kauffman, Olan and Heim, and Smith.

In the present paper a new species from the Pacific Northwest and a new variety from both the Northwestern and Eastern United States are described. Both fungi contain psilocybin and share a strong taxonomic relationship to other known hallucinogenic species.

*Psilocybe cyanofibrillosa* Guzmán and Stamets, sp. nov.

Figs. 1,3, & 4

Pileus 14-35 mm latus, conicus demum convexus, dein planus, laevis, viscidus, glaber udo striato, pellicula separabili intructus, flavido-brunneus, hygrophanus albido-alutaceus. Lamellae adnatae, pallidae demum brunnae. Stipe 30-70 x 1.5-4 mm, strictus, deorsum soride vinaceo brunnea vel pallide griseo-fibrillosa vel cyanofibrillosa. Sporis (9-) 9.5-11 (-12) x (5.5-) 6-6.6 (-7.1)  $\mu$ , ellipsoideis, cocainus brunneolus. Pleurocystidiis nullis. Cheilocystidiis 22-33 x 5.5-7  $\mu$ , hyalinis, sublageniform. Cuticula pileorum gelatinosa. Gregariis vel caespitose in scobis substratum. Typus: Stamets 79-8, (ENCB), South King County, Washington, U.S.A.

Pileus 14-35 mm in diameter, conic to broadly convex, and eventually plane in age, deep chestnut brown, strongly hygrophanous, fading to pale tan to light yellowish brown, viscid when moist from a separable gelatinous pellicle. Lamellae adnate or adnexed to shortly subdecurrent, light grayish when young to purplish brown with age, moderately broad and with pallid edges. Stipe 30-70 x 2-4 mm, flex-

uous or straight, sometimes curved at the base, equal or enlarged downwards, longitudinally striate, fibrous, hollow to stuffed with a yellowish pith; surface light tan to yellowish brown, covered with fine light grayish fibrils that turn bluish in age or when touched. Veil copious at first, whitish and cortinate, leaving fibrillose remnants especially on the upper parts of the stipe, but not forming an annulus. Context brownish in pileus and stipe, mildly bluish when bruised.

Spores (9-) 9.5-11 (-12) x (5.5-) 6-6.6 (-7.1)  $\mu$ , subelliptic in both face and side view, chocolate brown, thick wall, with a distinct apical germ pore. Basidia 22-28 x 6-9.5  $\mu$ , hyaline, ventricose or subpyriform, frequently with a median constriction, 4-spored or sometimes 2-spored, with sterigmata up to 5  $\mu$  long. Pleurocystidia absent. Cheilocystidia 22-33 x 5.5-7  $\mu$ , abundant, forming a sterile band at the edge of the lamellae, hyaline, fusiformlanceolate, sometimes subpedicellate, with an elongated neck, 1-1.5  $\mu$  broad, frequently irregularly incrustated on some walls. Epicutis formed by a thick gelatinous hyaline layer, with more or less parallel hyphae, no more than 4  $\mu$  in diameter. Hypodermium hyaline, with parallel filamentous hyphae, up to 20  $\mu$  in diameter, sometimes irregularly incrustated. Lactiferous hyphae 5-10  $\mu$  broad, commonly colored chocolate brown or pallid yellowish in the hypodermium. Clamp connections present, but not common.

Habitat. Growing in large colonies, caespitosely or subcaespitosely, sometimes scattered in small groups, in decayed urea-enriched fir sawdust during the fall.

Material studied. U.S.A., Washington, South King County.

*Stamets* 79-8 (Type, ENCB); *Stamets* 79-15 (ENCB); *Stamets* 78-20 (ENCB); *Whitcher* (ENCB).

Discussion. This species is delimited from *P. baecystis* Sing. & Smith emend. Guzmán (Guzmán, 1978, B) by its habit and the even non-undulated, non-incurved margin. Microscopically, this new taxon differs from *P. baecystis* in the form of the spores, not being asymmetrical, and in their size ((8.5-) 9.5-13.7 (-17) x 5.5-6.6 (-7.1)  $\mu$  in *P. baecystis*). *P. cyanofibrillosa* is also close to *P. cya-*

*nescens* Wakef. but is easily distinguished from it by the lack of pleurocystidia. *P. pelliculosa* (Smith) Singer & Smith is another related species. However, the tendency of the pileus to expand to plane, the more fibrillose and bluing stipe, and the dark color of the spores (yellowish brown in *P. pelliculosa*), and the incrustated reddish brown pigmented hypodermium readily distinguishes *P. cyanofibrillosa* from that species. Further, the scarcity of clamp connections and the presence of lactiferous hyphae seem yet another set of characters typifying *P. cyanofibrillosa*.

This species is named for the fibrils adorning the stem, initially grayish and soon becoming bluish in age, or when injured.

**Chemistry.** Methanolic extracts of 3 collections of *Psilocybe cyanofibrillosa* were analyzed by high performance liquid chromatography using a reversed phase  $\mu$ C<sub>18</sub> column and uv quantification at 254 nm. The solvent was 75% water; 25% methanol with 0.05M heptanesulfonic acid at pH 3.5.

Both psilocybin and psilocin were detected. The type collection, PS 79-8, contained 0.05 mg psilocybin per gram dry weight and 1.4 mg/g psilocin.

Two other collections made during the fall of 1979 were analyzed. One collection contained 0.31 mg/g psilocybin and 0.62 mg/g psilocin. The other contained 2.1 mg/g psilocybin and 0.4 mg/g psilocin. The observed variation of psilocybin and psilocin levels from one collection to another is typical of several species in the genus and leads us to the conclusion that neither the level of psilocybin and psilocin nor the ratio of the two can be utilized as a chemotaxonomic tool. Further, when we analyzed two herbarium collections of *Psilocybe cyanofibrillosa* from 1978, we found that they had lost most of their psilocybin and psilocin. We thus conclude that collections should be analyzed promptly. However, activity can be retained for at least two years by drying or freeze drying the collections, sealing them in plastic, and storing frozen.

Additional confirmation of the presence of indolealkylamines was obtained by Thin Layer Chromatography (TLC) with n-Butanol/Acetic Acid/Water (12/3/5). Developed plates were examined under short-wave ultraviolet light, then sprayed with Ehrlich's reagent (10% p-dimethylaminobenzaldehyde (pDAB) in concentrated hydrochloric acid diluted

1 to 4 with acetone). The type collection and one other collection from 1979 were analyzed. *Psilocybe cyano-fibrillosa* produced 7 separate spots:  $R_f$  0.18, a brownish spot identical to psilocybin in both  $R_f$  and color;  $R_f$  0.33, a sky-blue spot of an unidentified compound;  $R_f$  0.42, a blue-purple spot identical to psilocin in  $R_f$  and color; as well as four additional spots visible under UV but only slightly resolved by pDAB -  $R_f$  0.5;  $R_f$  0.65;  $R_f$  0.83 and  $R_f$  0.93.

Based on an examination of *Psilocybe* in the Pacific Northwest, we have found the chromatographic patterns of each species to be of potential chemotaxonomic use. The intensity of each chromatographic spot varies from collection to collection, but the number of and location of spots is fairly constant within each species. It is interesting to note that microscopically *Psilocybe cyano-fibrillosa* is quite similar to *Psilocybe baecocystis* Singer and Smith emend. Guzmán. Their TLC chromatographic patterns are also quite similar.

*Psilocybe liniformans* Guzmán & Bas,  
var. *americana* Guzmán & Stamets, var. nov.

Figs. 2 & 5

A var. *typus* differt lamellae margine nulla elastica. Sporis et cheilocystidiis ut in var. *typus*. Pratenis ad terram. *Typus*: Stamets 79-12, November 1979, Oyster Bay Road, Thurston County, Olympia, Washington, U.S.A., (ENCB).

This variety is very close to the type variety, but differs in the absence of the gelatinous layer on the edge of the lamellae, as well as in the terricolous habitat. The other macroscopic and microscopic features are the same, even the bluing reaction.

*P. liniformans* var. *liniformans* was described (Guzmán & Bas, 1977) from the Netherlands, growing on dung in a pasture. The gelatinized edge of the lamellae is the most prominent feature delimiting it from other similar species. The new variety described here is known only from Washington, Oregon, and Michigan in the U.S.A.. It is close to *P. callosa* (Fr. ex Fr.) Quel. and *P. semilanceata* ( Secr. ex Fr.) Kumm., but differs from the former in the size of the spores, (9.5-) 10-12 (-14.5) x (6.5-) 7-8.5  $\mu$  and in the size of the cheilocystidia, 20-45 x 4-7  $\mu$  in that species. From *P. semilanceata* this species differs in its

non-umbonate pileus and in its wider spores (  $\times$  (6-) 7-8  $\mu$  in *P. semilanceata* and  $\times$  7.5-10  $\mu$  in *P. liniformans*.)

Habitat. Scattered on soil in a field.

Material studied. U.S.A., Michigan, Cheyboygan, Smith 35963 (MICH); Washington, Thurston County, Olympia, Stamets 79-12 (Type, ENCB); Oregon, Corvallis, Morgan (Nov. 1979) (ENCB).

Chemistry. Methanolic extracts of 7 collections of *Psilocybe liniformans* var. *americana* were analyzed by high performance liquid chromatography. Psilocybin but no psilocin was detected. The type collection, PS 79-12, contained 5.9 mg psilocybin per gram dry weight. The other collections contained levels of psilocybin ranging from 6.5 mg/g to 12.8 mg/g (average 8.9 mg/g). The high performance liquid chromatograms of *Psilocybe liniformans* var. *americana* are quite similar to those of *Psilocybe semilanceata* (Secr. ex Fr.) Kumm. Herbarium samples of these two species both appear to retain their activity, unlike most other *Psilocybe* species analyzed to date.

Thin layer chromatography of extracts of *Psilocybe liniformans* var. *americana* produced 6 spots:  $R_f$  0.26, identical to psilocybin;  $R_f$  0.31, the same color as psilocybin;  $R_f$  0.34, a light brown, barely visible;  $R_f$  0.44, a sky blue;  $R_f$  0.55, a light blue;  $R_f$  0.94, a brown color. No psilocin was detected. The TLC Chromatographic pattern is very close to that of *Psilocybe semilanceata*.

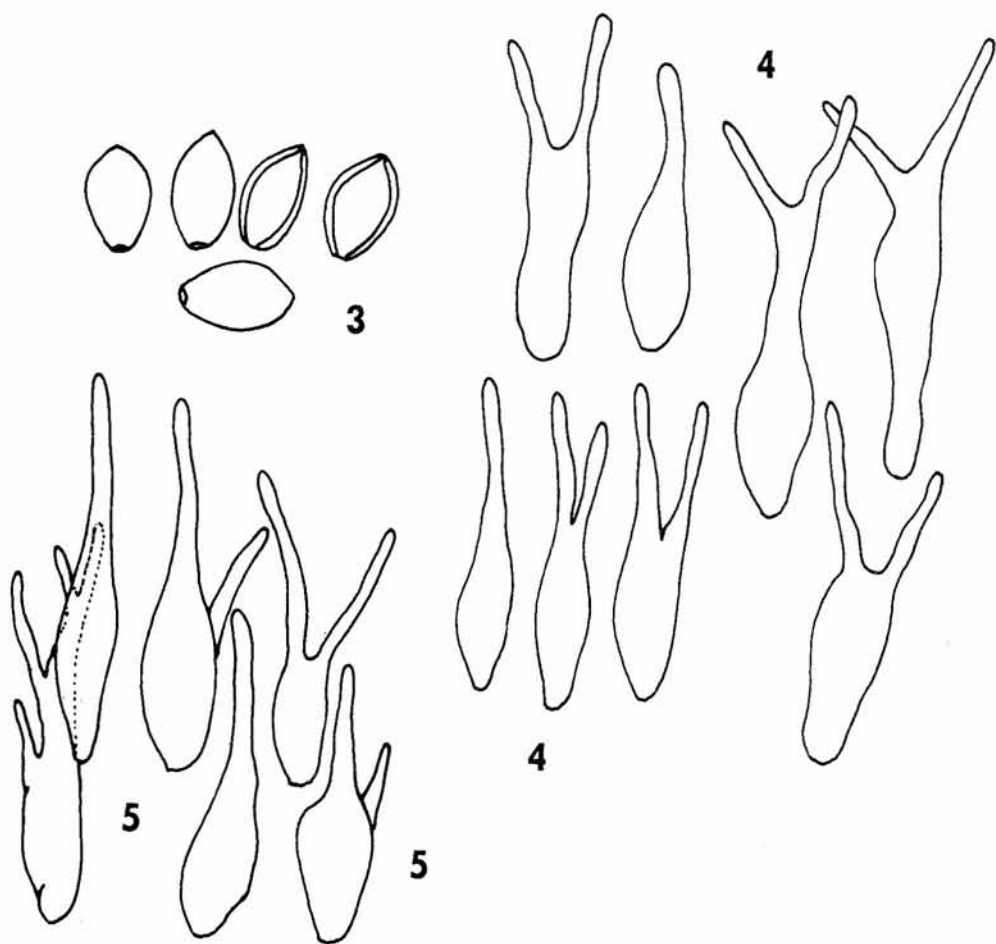
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Figs. 1-2 1(above): *Psilocybe cyanofibrillosa* Guzman & Stamets, fruit bodies in the habitat (type).  
2(below): *Psilocybe liniformans* var. *americana* Guzman & Stamets, fruit bodies in the habitat (type) (Photos - Stamets).





Figs. 3-5 *Psilocybe cyanofibrillosa*; 3: Spores; 4: Cheilocystidia (both from the type); 5: *Psilocybe liniformans* var. *americana*, cheilocystidia (type).

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