

MYCOLOGICAL INVESTIGATIONS ON
TEONANÁCATL, THE MEXICAN
HALLUCINOGENIC MUSHROOM.¹

PART II. A TAXONOMIC MONOGRAPH OF
PSILOCYBE, SECTION CAERULESCENTES

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(WITH 50 FIGURES)

As has been shown by Rolf Singer in Part I of these studies, it may be accepted as probable that the majority of the hallucinogenic mushrooms of Mexico belong to the section *Caerulescentes* of the genus *Psilocybe*. It is not yet known whether all species of the section possess hallucinatory properties, but it is probable that all or at least many of them are hallucinogenic or poisonous, causing cerebral mycetism with or without other symptoms. At all events, a critical taxonomic account of the species in this section is highly desirable to facilitate a biochemical survey of the group. This contribution is a part of two major projects, first the research on hallucinogenic mushrooms carried out by the Bertram and Roberta Stein Neuropsychiatric Research Program Inc., Chicago, Illinois, and second, a monograph of the North American species of *Psilocybe* now in preparation by A. H. Smith.

We wish to express our thanks to the curators of the following institutions from which we have received material for study: Kew Herbarium (K), Dr. G. Taylor, Director, and Dr. R. W. G. Dennis, curator; Farlow Herbarium (FH), Dr. I. M. Lamb; New York Botanical Garden (NY), Dr. D. P. Rogers. Our own collections and those obtained from correspondents are on deposit at the Instituto Miguel Lillo (LIL), Tucumán, Argentina, and at the Herbarium of the University of Michigan (MICH). Valuable data were obtained for us by G. Guzmán, Mexico D.F.

The color terms used in the descriptions were taken from R. Ridgway, Color Standards and Color Nomenclature, Washington, D.C., 1912, and Maerz and Paul, A Dictionary of Color, 1st edition, McGraw-

¹ Papers from the University of Michigan Herbarium and Department of Botany no. 1074, University of Michigan, Ann Arbor, Mich.

Hill, New York, 1935. Those from Ridgway are within quotation marks and those from Maerz and Paul are underlined.

In giving the measurements of spores the length is given first and the width second, but if the spore is somewhat compressed and broader than deep, the width is given following the length and the depth (i.e. breadth in side view or profile) is given last—for example, $8-11 \times 6-7 \times 5-6 \mu$. Measurements of the cystidia (including cheilocystidia) give the length first, the width of the broadest part next (usually the diameter of the basal or central enlargement), then follows the diameter of the “neck” (thinned apical portion) or the narrowed part above the mid-portion, unless the apex is described separately.

The cultural characters as far as now available are not part of the descriptions provided in this monograph since the cultures were described by Singer in Part I. Nevertheless, some of the data provide interesting and even diagnostic characteristics of certain species.

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PSILOCYBE sect. CAERULESCENTES Sing., Sydowia 2: 37. 1948.

Pileus white or pigmented, slightly lubricous to almost glutinous in wet weather, pellicle often separable; lamellae ascending or horizontal, usually adnate, in some species subdecurrent, in others sinuate-adnexed, edges pallid, faces pallid to brownish, becoming purple brown from the spores; stipe slender to fairly robust, strongly purple with metol (p-methylaminophenol-sulfate), usually bluing with guaiac solution, typically bluing when wounded or blue color becoming evident on surfaces or mycelium under certain conditions of growth or in age or on drying.

Spores purple fuscous to lilac in fresh deposits or in water-mounts under the microscope, *after dehydration and then mounting in KOH* becoming dark yellowish brown, terete to laterally compressed and variable in shape from species to species, smooth, wall complex, apical pore distinct and typically causing the apex to appear truncate; basidia typically 4-spored, pleurocystidia present or absent but if present not as chrysocystidia (species with chrysocystidia excluded from *Psilocybe* by definition); cheilocystidia abundant and often causing the gill edge to be heteromorphous (completely sterile and sterile elements different from those of gill face), or nearly so; subhymenium and hymenopodium well developed, gill trama either regular or showing a mediostratum and lateral strata (between the mediostratum and the hymenopodia on each side); cuticle of pileus consisting of a gelatinous or subgelatinous pellicle

or an almost non-gelatinous epicutis (upper layer) and a well-differentiated hypodermium (lower layer), the epicutis (pellicle) of narrow more or less hyaline hyphae, the hypodermium a more compact layer consisting mostly of enlarged hyphal cells but some narrow filaments also present; clamp connections consistently observed on hyphae of all types and at the base of the basidia of the species described below.

SUMMARY OF THE STIRPES

Stirps. CUBENSIS

Spores medium to large ($7.7\ \mu$ or more long) and mostly somewhat compressed, in face view obscurely to distinctly angular-ovate to angular-elliptic; veil typically membranous and the remains persisting on the stipe as a membranous annulus; aspect of carpophores not mycenoid; habitat on dung or rotten wood.

The combination of veil and spore characters is diagnostic of the stirps. The presence of a membranous annulus would cause these species to be classified in *Stropharia* in classical taxonomic arrangements, but the lack of chrysocystidia and the presence of a change to blue when injured point to close relationship with the other species of the section. The true *Strophariae* have chrysocystidia or a viscid to glutinous universal veil. Other species such as *P. aztecorum* and *P. candidipes* may at times show a narrow annulus but these have terete or only very slightly compressed spores.

Species included: 1. *P. cubensis*, 2. *P. subaeruginascens*, and 3. *P. aerugineomaculans*.

Stirps. YUNGENSIS

Spores very small (less than $7.7\ \mu$ long) and strongly compressed, typically angular-ovate in face view; veil floccose over the lower part of the stipe but not forming an annulus; pileus relatively high or acutely papillate; stipe thin; cap margin incurved at first (general aspect almost mycenoid but with incurved margin); habitat on forest litter and much decayed wood particles in the tropical zone; pigmentation dark, hyphae of the hypodermium heavily incrustated.

The combination of floccose veil and the uniquely small and compressed spores along with the characteristic habit determine the stirps which, so far, contains only a single species.

This stirps has as much in common with the deconicas as the preceding has with the stropharias. It differs, however, in habit and chemical

characters from the species usually classified in *Deconica*. Within the section it seems to come closest to the two smaller-spored representatives of the preceding stirps, which are also characterized by relatively small carpophores.

Species included: 4. *P. yungensis*.

Stirps. MEXICANA

Spores compressed, medium sized (7–11 μ long); veil thin and poorly developed, not leaving traces on mature carpophores; pileus acute or obtuse in outline except for an apical conic papilla, with straight margin when young, or margin bent in slightly; pellicle poorly developed; stipe thin; habitat characteristically in pastures, fields, meadows, or generally outside the forest in tropical-montane vegetation or plantations.

This stirps forms a natural transition between the preceding and the following one. The spores are still compressed but are not characteristically small; the habit is mycenoid though perhaps slightly less so than in stirps *Silvatica*.

Species included: 5. *P. mexicana*

Stirps. SILVATICA

Spores not compressed, medium (6–9) to large (10–13 μ long); veil thin and not leaving traces in adult carpophores; pileus relatively high and acute, not fully expanding, with straight margin, thus habit mycenoid; pellicle present, thin to thick; habitat in forests on wood and debris, but extratropical (as far as known).

Species included: 6. *P. silvatica*; 7. *P. pelliculosa*.

Stirps. CYANESCENS

Spores varying from slightly compressed to terete, typically 9 μ or more long; veil varying from well developed (in *P. aztecorum*) to poorly developed, but never floccose or annulate; habit typically collybioid or nearly so; habitat terricolous or on rotten wood in forests, parks, or among scattered trees.

This combines all the large-spored exannulate species which do not have a mycenoid habit. The spores are not even obscurely angular in face view and are terete or at best only slightly compressed. It is remarkable that the habitat is rather similar in all of them and that none of them can be described as truly tropical.

Species included: 8. *P. aztecorum*; 9. *P. cyanescens*; 10. *P. collybioides*; 11. *P. strictipes*; 12. *P. baeocystis*.

Stirps. CAERULESCENS

Spores compressed to terete, small (less than $9\ \mu$ long); stipe typically thick (more than 3 mm at apex); veil well developed; habit collybioid to tricholomatoid but not mycenoid; habitat variable.

The species grouped here have well developed veils and rather thick stipe; they are thermophilous in the sense that they all occur in warm climates.

Species included: 13. *P. caerulescens*; 14. *P. aggericola*; 15. *P. candidipes*.

A fourth species which might belong here, *P. zapotecorum* Heim, has not been studied by us. We prefer not to place it formally in one of the stirps introduced here inasmuch as it might conceivably be closer to some other stirps, or represent a stirps of its own.

Supplement to stirps VI: 16. *P. zapotecorum*.

Stirps. CAERULIPES

Spores $7-9(-10)\ \mu$ long, terete, stipe thin (1-3 mm at apex); veil thin and cortinate; habit collybioid; habitat on rotten wood and debris in the forest and under scattered trees.

But for the small spores and thin stipe this stirps could be united with stirps *Cyanescens*. According to spore size it would be close to stirps *Caerulescens*. But both species are either temperate or montane, and extratropical.

Species included: 17. *P. muliercula*; 18. *P. caerulipes*.

KEY TO SPECIES OF SECTION CAERULESCENTES

1. Annulus typically membranous and persistent2
 2. Spores $11.5-17.3\ \mu$ long1. *P. cubensis*
 2. Spores smaller3
 3. Growing on wood; pileus viscid.....3. *P. aerugineomaculans*
 3. Growing on dung; pileus merely moist2. *P. subaeruginascens*
1. Annulus if present merely a zone of fibrils, or very fugacious4
 4. Spores $5-6.5 \times 4.3-5 \times 3.6-4\ \mu$, strongly compressed; pileus acute.....
 -4. *P. yungensis*
 4. Spores larger and only somewhat compressed or terete5
 5. Pileus margin straight when young or almost so; habit more or less mycenoid6
 6. Spores compressed (broader in face than in side view); growing in open areas (meadows, fields)5. *P. mexicana*
 6. Spores terete; growing in woods on litter and rotten wood7
 7. Spores $6-9.5 (-11.5) \times 4.5-5\ \mu$; pellicle thin6. *P. silvatica*
 7. Spores $9.3-11 \times 5-5.5\ \mu$ ($10.5-13 \times 5.5-7\ \mu$); pellicle thick and separable7. *P. pelliculosa*

5. Pileus margin incurved when young; habit typically collybioid8
8. Spores typically less than 9μ long9
 9. Stipe 10–20 mm thick, 100–200 mm long, cortex very fibrous, hard and elastic16. *P. zapotecorum*
 9. Stipe not as above10
 10. Stipe white, basal half scabrous-strigose, upper half strongly floccose from veil15. *P. candidipes*
 10. Not as above11
 11. Veil copious and flocculose in young specimens12
 12. Spores in face view $5\text{--}6\mu$ broad; stipe whitish when young13. *P. caerulescens*
 12. Spores in face view $4\text{--}5\mu$ broad; stipe colored when young14. *P. aggericola*
 11. Veil thin, cortinate, fugacious13
 13. Pileus not viscid17. *P. muliercula*
 13. Pileus viscid18. *P. caerulipes*
 8. Spores typically more than 9μ long14
 14. Lamellae pallid to white, or brownish only at maturity—sterile to partly sterile collections of *P. collybioides* key out here
 14. Not as above.
 15. Stipe whitish; pileus milk white or disc merely ochraceous8. *P. aztecorum*
 15. Stipe or pileus or both more deeply colored16
 16. Pileus chestnut color; spores slightly compressed9. *P. cyanescens*
 16. Not as above.....17
 17. Cheilocystidia $20\text{--}30\text{--}(36)\times 4\text{--}6\times 1.2\text{--}1.5\mu$ 12. *P. baeocystis*
 17. Cheilocystidia larger18
 18. Odor distinctive—variable, farinaceous to raphanaceous to spermatic.....10. *P. collybioides*
 18. Odor none; taste mild19
 19. Stipe 100–130 mm long, straight.....11. *P. strictipes*
 19. Stipe up to 70 mm long. *H. cyanescens* sensu Malençon (see under *P. collybioides*)

STIRPS CUBENSIS

1. PSILOCYBE CUBENSIS (Earle) Sing., Sydowia 2: 37. 1948. (FIG. 1–3, 40–41.)

Stropharia cubensis Earle, Est. Agron. Cuba 1: 240. 1906.

Naematoloma caerulescens Pat., Bull. Soc. Mycol. Fr. 23: 78. 1907.

Hypholoma caerulescens (Pat.) Sacc. & Trott. in Sacc., Syll. Fung. 21: 212. 1912.

Stropharia caerulescens (Pat.) Sing., Ann. Mycol. 34: 340. 1936.

Stropharia cyanescens Murr., Mycologia 33: 279. 1941.

Pileus 16–80 mm. broad, conic campanulate with an acute papilla at first, gradually becoming convex to plane and at times with a depression around the umbo, umbo becoming more obtuse, more rarely without any umbo or papilla, viscid, glabrous or with fugacious veil remnants near margin, white with more or less fulvous center, eventually entirely fulvous brown, sometimes white to pale yellow (“cartridge buff”) at margin, more “cream buff,” “chamois,” or “honey yellow” toward the “Isabella color” to “clay color” disc, usually staining bluish in age or when injured.

Lamellae gray, becoming deep violet gray and somewhat mottled, finally almost black, adnate to adnexed, seceding, close, narrow, becoming ventricose in mid-portion, broad in age, edges white.

Stipe 40–150 × 4–14 mm, tubular, usually somewhat thickened downward, more rarely subequal, or tapering to the base, white, staining blue (“deep Medici blue”) when injured, eventually discoloring to yellow brown or reddish cinereous, often strongly sulcate at the apex, smooth otherwise, glabrous to slightly fibrillose, dry; annulus membranous but thin, smooth on both sides, white, staining blue, fragile, usually persistent.

Context white, staining blue on injury; odor none; taste farinaceous.

Spores 11.5–17.3 × 8–11.5 × 7–9 μ , dark yellow brown (in KOH) to dark olive brown (in NH_4OH), smooth, nearly elliptic in side view, ovate to broadly elliptic in face view and many obscurely angular, wall thick and complex, apex truncate from a distinct apical pore; basidia (2-, 3-, or) 4-spored, 28–35 × 10–13 μ ; pleurocystidia scattered, 18–23 × 10–13 μ , ventricose and narrowed slightly near apex to an obtuse to rounded tip, thin-walled, contents (in KOH) homogeneous (not protoplasmatic); cheilocystidia numerous, 18–35 × 6–12 μ , fusoid-ventricose with obtuse to subcapitate apex, neck 4–18 μ long, 3–6.5 μ thick, enlarged tip (head) 4–5 μ , wall thin and readily collapsing; gill trama regular, mediostratum of hyaline parallel to somewhat interwoven hyphae, in well pigmented caps this layer flanked on both sides by parallel hyphae with dingy ochraceous walls (in KOH); pellicle of pileus a thin layer of narrow (c. 3.5 μ) gelatinous hyphae which are radially arranged and yellowish to hyaline in KOH; hypodermium of interwoven to more or less radial hyphae up to 26 μ in diameter, with ochraceous brown walls in KOH; clamp connections present.

Chemical characters: metol strongly positive on context of stipe (“dark naphthaline violet” or darker), other reagents negative or accelerating the bluing.

Gregarious on cow dung, more rarely on horse dung or on rich pasture soil, or on sugar cane mulch or straw or sawdust mixed with dung, usually outside the forests, fruiting from February until November or December, south of the Equator from November until April.

Material studied: U.S.A., Florida: TYPE of *Stropharia cyanescens* Murr. and additional collections by G. F. Weber, J. R. Watson, and W. A. Murrill, as *S. cyanescens*, F-19138, F-19630, F-19244, F-17932, F-17735, F-19464 (all FLAS), and R. Singer F 1802, F 1802a (FH, F); Magnesia Springs, W. A. Murrill (NY). Puerto Rico: Mayaguez and Ailonato, Bruce Fink 899 and 1955 (NY). Cuba: Santiago de las Vegas, Earle 109 both on sheets and in box, marked "tipico," TYPE of *Stropharia cubensis* (NY); also Earle 169, 315, 350; Candelaria, Earle 206 (NY); Soledad, Cienfuegos, W. L. White 808, 526 (FH). Mexico: Oaxaca, Huautla de Jiménez, 7-27-38, R. E. Schultes, Plantae Utiles Mexicanae 349 (FH); R. Gordon Wasson 1 (NY); R. Singer M 1512 (MICH). Brit. Honduras: M. E. Peck 478 (NY). Trinidad (collector not given) (NY). Bolivia: Beni, Guayaramerin, R. Singer B (LIL). Argentina: Tucumán, R. Singer T (LIL). Indochina: TYPE of *N. caerulescens* Pat. (FH).

The collections enumerated above should be divided into three color varieties:

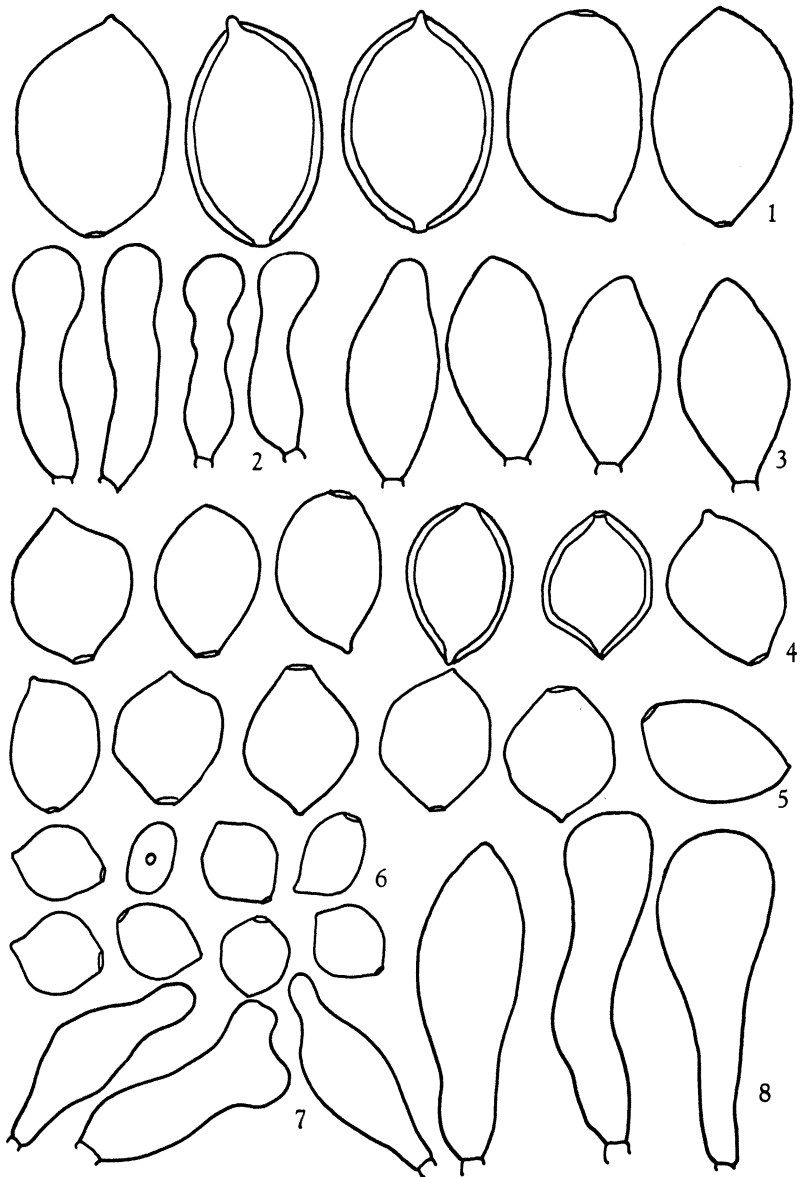
P. CUBENSIS var. CUBENSIS (the type). Here, the pigmentation of the pileus is fulvous. It develops early, and pallid pilei are hardly ever seen. The strain proved to be hallucinogenic belongs here.

P. CUBENSIS var. **cyanescens** (Murr.) comb. nov. The type of this variety is the type of *Stropharia cyanescens* Murr. It differs from the type variety in the virtual lack of pigment or its small quantity; consequently the pileus is pallid to pale isobelline. Known to occur in Florida (10).

P. CUBENSIS var. **caerulescens** (Pat.) comb. nov. The type of the variety is *Naematoloma caerulescens* Pat., type. It differs from the type variety in showing a clear yellow color at least in certain portions of the pileus. Known to occur in Indochina (11).

Illustrations: V. P. & R. G. Wasson, Mushrooms Russia and History 2: pl. 40, fig. 2. 1957; Life, May 13, 1957, p. [107] fig. at lower right. (Both the var. *cubensis*.)

The senior author at one time (14) thought that *Stropharia caerulescens* Imai (*S. venenata* Imai) was identical with *S. cubensis*, but we are treating it now as synonymous with a closely related but distinct species. For more detailed commentary on *S. venenata* see under *P. sub-aeruginascens*.



FIGS. 1-8. 1-3: spores, cheilocystidia and pleurocystidia of *Psilocybe cubensis*. 4: spores of *P. subaeruginascens*. 5: spores of *P. aeruginocomaculans*. 6-8: spores, cheilocystidia and pleurocystidia of *P. yungensis*.

2. PSILOCYBE SUBAERUGINASCENS Höhnelt, Sitzungsber. K. Akad. Wiss. Wien **123**(1): 78. 1914. (Fig. 4.)

Stropharia caerulescens Imai, Trans. Sapp. Nat. Hist. Soc. **12**: 148. 1932.

Stropharia venenata Imai, Journ. Fac. Agr. Hokk. Imp. Univ. **43**(2): 270. 1938.

Pileus 15–25 mm broad, plano-convex, almost membranaceous, glabrous and smooth, whitish with smoke brown center, becoming slightly greenish-blue-spotted when touched.

Lamellae grayish brownish, rather distant, with paler edge, 2–3 mm broad, broadly adnate and somewhat decurrent.

Stipe 30–40 × 1.5–3 mm, cylindric, slightly thickened at base, somewhat flocculose-farinaceous above, otherwise glabrous, somewhat shining, hollow but stuffed with a loose woolly pith, white, weakly greenish blue when touched, with an annulus above the center of the stipe, annulus small, often oblique, scaly-membranous; mycelium abundant, filamentous, white, staining greenish blue or almost steel blue.

Context white, tough in the stipe, bluing; odor and taste not recorded.

Spore deposit beautifully violet-brownish.

Spores 7.7–10 (–11.5) × 7–7.8 × 6–7 μ , ovoid to subrhomboid in face view, in side view somewhat inequilateral, smooth, dingy yellow brown in KOH, apex truncate from a broad flattened germ pore; basidia 2- and 4-spored, very rarely 1-spored or 3-spored, 18–28 × 6.3–9.2 μ , typically with a median constriction; pleurocystidia 25–33 × 9–12 μ , broadly fusoid-ventricose with obtuse apex, hyaline, thin-walled, contents homogeneous; near the edge sometimes some pleurocystidia similar to cheilocystidia; cheilocystidia 20–33 × 6–9 μ , fusoid-ventricose with obtuse apex or neck narrow and cylindric, or in some the apex subcapitate, hyaline, causing the edge to appear heteromorphous; epicutis of pileus not gelatinous, apparently of closely interwoven appressed hyphae; clamp connections present.

Subcespitose on horse dung, Buitenzorg, Java, Indonesia, *v. Höhnelt*, TYPE (FH).

This is a *Psilocybe* of the *P. coprophila* type but staining blue. The spores are more angular in face view than those of *P. coprophila* and also of smaller size.

Stropharia caerulescens Imai (5) is placed in synonymy here although the type is unavailable at present; we base our judgment on the following original description:

Pileus 15–60 mm broad, glabrous, hygrophanous, or scarcely slightly viscid, convex to plane to subumbonate, yellowish to isabelline, more rarely whitish, margin always pallid. Lamellae pallid, then violet fuscous, adnate. Stipe 35–90 $\times$ 5–9 mm, equal, dry, almost hollow, fibrillose below the annulus, whitish, annulus almost apical, very thin membranous, more rarely fibrillose, often evanescent. Context whitish or pallid, bluing. Spores fuscous or violet fuscous, ellipsoid, 7–10.5 $\times$ 4.25–7 μ ; cystidia none. Gregarious or caespitose on earth and dung, fruiting in June, July and October. Japan, Hokkaido, Ishikari province, near Asahigawa and Sapporo. [Specimens are apparently preserved at Sapporo.]

It is interesting to read in Imai's account (5) about the physiological activity of this species. It caused ten deaths in 1929 alone, and is apparently more toxic than the related Mexican species. The symptoms are described as feeling feverish, with a subjective impression as if strong liquor had been imbibed; the limbs became somewhat paralyzed. In the hospital after an emetic had been administered and the stomach washed and eventually a laxative had been given, the patient was now in bed with intermittent constriction or trembling of muscles and finally there were hallucinations, then coma. This patient, a woman, recovered. Her son who did not eat the flesh of the mushroom but drank only the liquid of the soup in which it was cooked felt only paralysis of the limbs and a chill, followed by hallucination. All recovered eventually.

In another case, after similar symptoms were observed, coma, loss of consciousness, and talking in delirium were observed. The pupils had opened to a medium size and did not react to light. (This observation coincides with observations made in Mexico with *psilocybes* of this section.) For more details see Imai's paper (5).

In a later paper (6), Imai renamed his species *S. venenata* Imai. The description was now slightly changed to accommodate also specimens with deeper color of the pileus, more viscid surface, and habitat on rotten wood. The conclusion is very suggestive that the forms later added to the species concept and expressed in the changes of the description at the time of the publication of *S. venenata* can be accounted for if it is assumed that the type form (= *P. subaeruginascens*) was later confused with *P. aerugineomaculans*. Whether this opinion is correct can be proved only if and when specimens from Japan become available.

The original description of *S. caeruleascens* Imai is accompanied (p. 149) by a photograph which, by implication, and with certain reservations, may be cited as an illustration of *P. subaeruginascens* Höhnelt.

3. *Psilocybe aerugineomaculans* (Höhnelt) comb. nov. (FIG. 5.)

Stropharia aerugineomaculans Höhnelt, Sitzungsber. K. Akad. Wiss. Wien 123(1): 78. 1914.

Pileus 25–40 mm broad, campanulate, becoming expanded and umbonate, surface slightly viscid to the touch, disc dark blue, remainder reddish gray-cinereous (as in *Psathyrella gracilis* sensu Höhnelt), margin striatulate.

Lamellae rather distant, 4–5 mm broad—*i.e.*, moderately broad—attenuate-adnate, yellowish olive, marbled as in *Panaeolus*, edges even.

Stipe 40–50 $\times$ 2 mm, not thickened at base, cylindric, hollow, white, slightly flocculose, glabrescent, shining, annulus membranous, small, entire, white; rind 0.15 mm thick when dried.

Context in the middle of the pileus thin (2 mm), membranous toward margin, somewhat cartilaginous in outer layer of stipe, soft inside, staining blue where bruised; odor and taste not recorded.

Spore deposit very deep brown, almost black.

Spores 8.5–10.5 $\times$ 7–8 $\times$ 5.5–6.5 μ , compressed, subelliptic in side view, rhombic to heart-shaped (angular ovate) in face view, with a truncate apex and a distinct germ pore, thick-walled, near bister when revived in KOH; basidia 4-spored, about 22 $\times$ 8 μ ; pleurocystidia not seen in type; cheilocystidia 18–22 $\times$ 6–8 $\times$ 3.5–4 μ , fusoid-ventricose with obtuse apex, typically capped with a hyaline mucilaginous substance, the whole gill edge gelatinizing in KOH; pellicle of pileus distinct but formed by a thin layer of gelatinized epicuticular hyphae; clamp connections present.

On rotten wood. Buitenzorg, Java, Indonesia, *v. Höhnelt*, TYPE (FH).

Although the species is lignicolous, the spores remind one of the coprophilous series. The presence of a distinct gelatinous pellicle separates this species from *P. subaeruginascens*. This was clearly demonstrated from a study of the types. The type of *P. subaeruginascens* is well dried, well preserved, and consists of fruiting bodies that were in prime condition when placed on the drier. Hence, the lack of a gelatinous epicutis is significant. The type of *P. aerugineomaculans* consists of two carpophores which were apparently over-age when dried and as preserved are inferior to quality to those of *P. subaeruginascens*. Under such circumstances one would expect the gelatinous pellicle, if one were present originally, to be pretty well obliterated. The fact that it is still present indicates to us that when fresh material is again collected the pellicle may be found to be rather thick and well developed.

From our comments on *P. subaeruginascens*, one might expect *P. aerugineomaculans*, no less than *P. subaeruginascens*, to occur in Japan.

The macroscopical descriptions of both Javanese species are adapted from Höhnelt's notes.

STIRPS YUNGENSIS

4. *PSILOCYBE YUNGENSIS* Singer and Smith, *Mycologia* 50: 142. 1958.

Var. *YUNGENSIS* (Figs. 6–8, 45).

Pileus about 16 mm broad and equally high, margin at first incurved, conic with an obconic or button-like appendage at the tip, not expanding, deep rusty brown (*leaf mold*), in the marginal region between striae buffish gray (*cracker*), finely marked with long translucent striations when moist, somewhat viscid, staining deep blue (39 H 5) where injured.

Lamellae gray buff (*aloma*), with white edges, staining blue where wounded (39 H 5), very narrow, ascending and never becoming horizontal, crowded, adnate.

Stipe 55 mm long, 2 mm at apex, 3 mm at base, subequal, deep chestnut brown (*Hindu*), reaching *auburn* at apex, bluing less than cap and gills but such a change still evident, densely fibrillose floccose from light brownish fibrils on darker ground, becoming more fibrillose-pruinose toward apex, veil inconspicuous except for the floccons, no annulus formed.

Context concolorous with surfaces or somewhat paler both in pileus and stipe, moderately fragile in stipe; odor slightly raphanaceous.

Spore deposit dark lilac.

Spores $5\text{--}5.5 \times 4.3\text{--}5 \times 3.6\text{--}3.9 \mu$, compressed, dark olive sepia in KOH and NH_4OH , smooth, rhombic in face view and a hilar appendage visible, without suprahilar appplanation or depression in side view, apical pore broad, wall thick and complex; basidia $13\text{--}18.5 \times 4.7\text{--}6.2 \mu$, short-ellipsoid-clavate then elongating and finally ventricose in the middle 2-, 3-, or mostly 4-spored, hyaline; pleurocystidia present as an occasional cystidiolate about the size of a basidium, but often with a low mucro, contents hyaline in KOH and not protoplasmatic; cheilocystidia $13\text{--}34 \times 5\text{--}7.3 \mu$ forming a sterile band along the edge, 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 2.7μ or more; subhymenium of small irregular elements, not regularly arranged; with a brown to stramineous membranous pigment which often breaks up to incrust the walls of the cells; gill trama regular, consisting of elongate cylindric elements, pigmented like the subhymenium, with

0.8–1 μ thick walls; epicutis gradually more differentiated from the hypodermium toward the uppermost surface of the pileus, there often more or less gelatinized, with smooth hyaline filamentous elements subparallel, forming a cutis, ascending hyphal excrescences often present on these hyphae and some of these stramineous and incrustated; hypodermium of a compact layer of hyphae irregular in size and shape but generally repent and radially elongated, all strongly incrustated with ochraceous brown pigment; clamp connections present.

Chemical characters: KOH leaving a dark spot where dropped on any part of the carpophore; FeSO_4 , no reaction.

In small to large groups on very rotten wood or humus containing decomposing woody material, in tropical-montane forest, fruiting in January (summer rainy season). Known only from the type locality, Cataratas de San Juan, road from La Paz to Coroico, Bolivia, 2000 m alt., 1–28–1956, *Singer B 648*, TYPE (MICH).

Var. *DICONICA* Singer and Smith, *Mycologia* **50**: 142. 1958. (FIG. 44)

Pileus as in the preceding variety but lower, with an acute papilla rather than a knob, not quite so long-striate and somewhat darker in color (*Mohawk*, and between striae *kis kilim*).

Lamellae sordid lilac or reddish brown (between *kermanshah* and *Rembrandt*), otherwise as in var. *yungensis*.

Stipe shorter than in the preceding variety.

Context odorless.

Spores 4.4–6.2(–7.2) $\times$ 3.8–5 $\times$ 3.3–3.8 μ , otherwise as in var. *yungensis*; basidia mostly 4-spored; pleurocystidia and cheilocystidia as in preceding variety; gill trama consisting of broad, often short, stramineous hyphae with thick walls; epicutis and hypodermium of pileus as in preceding variety; clamp connections present.

Chemical characters as in var. *yungensis*.

Gregarious on very rotten wood and humus in tropical-montane forest. Bolivia, Departamento La Paz, Provincia Nor-Yungas, Cataratas San Juan, 2000 m alt., *R. Singer B 651*, TYPE, 1–28–1956 (MICH).

The two forms designated temporarily as varieties come from the same place and were gathered the same day as separate populations. Each population had its own characteristic habit and color range as described above, but under the circumstances we did not think them sufficiently distinct to separate them specifically. They were considered “probably the same” when first collected in the field.

P. yungensis is a very strongly pigmented species with typically high, little or not expanding pileus but with originally incurved mar-

gin, and with a non-annular veil remaining in flocons on the surface of the thin stipe. The spores are different from those of all other species of this section.

STIRPS MEXICANA

5. *PSILOCYBE MEXICANA* Heim, Rev. de Mycol. 22: 77. 1957. (FIG. 25-26, 43)

Pileus 5-33 mm broad, 4-15 mm high, conic-campanulate and usually with a central papilla, frequently becoming hemispheric to convex and sometimes papillate in addition, broadly conic in others, and becoming umbonate and in these the umbo sometimes crowned by a papilla, always relatively high and narrow and not fully expanded, eventually, however, often convex with an uplifted margin, glabrous, viscid but soon dry, margin at times sulcate-striate to a small apical smooth disc, disc deep ochraceous to ochraceous brown, then fulvous, marginal zone much paler, hygrophanous, fading to ochraceous over the disc, gray brown in marginal zone and pale ocher-gilvous between, all traces of silky white veil soon vanishing from the margin.

Lamellae pale gray, eventually deep sepia, close to subdistant, ascending to almost horizontal, adnate to adnexed, only moderately broad, edges whitish.

Stipe 20-80 × 1-3 mm, hollow, equal and elongate, sometimes rather distinctly attenuated at the base, ochraceous, at maturity the apex paler, central portion often fulvous, glabrous when mature; veil thin and leaving fine appressed silky fibrils on the upper third, soon evanescent.

Context in pileus paler than surface, turning blue when bruised or on drying; odor always rather strongly farinaceous; taste slightly disagreeable.

Spore deposit deep sepia to dark purple brown.

Spores (7.7-)8.8-10.5(-12) × (5.5-)6.7-7.7 × (5-)5.5-6.7 μ , compressed, in face view elliptic to rhombic and then broadest in mid-portion, subelliptic in side view, dingy yellowish brown in KOH, smooth, with thick walls, furnished with a distinct broad germ pore; basidia 20-32 × 6.3-7.7 μ , 4-spored, variable in size, typically with a median or more superior constriction; pleurocystidia none, or a few similar to cheilocystidia near the edge; cheilocystidia forming a sterile band along edge, 15.5-30.5 × (3-)4-9 μ , usually short pedicellate, hyaline, fusoid-ampullaceous, the neck short (rarely long), apex obtuse to acute (rarely capitate or bifurcate); subhymenium a thin layer of very irregular small elements; hymenopodium of relatively narrow filamentous axially arranged parallel hyphae, layer thin; gill trama regular, hyaline to stramineous, with voluminous (up to 19 μ in diameter) elements, hyphal walls up to 1.5 μ in diameter; epicutis a broad

hyaline layer of filamentous mostly hyaline hyphae, not strongly gelatinized but well differentiated from hypodermium, hyphae $1.7\text{--}3.5\ \mu$ in diameter; hypodermium a colored (yellowish brown) layer of hyphae $2\text{--}14\ \mu$ in diameter, with pigment in the walls (not incrustated); body of context hyaline to yellowish, many hyphae up to $20\ \mu$ in diameter and walls up to $1.5\ \mu$ thick; dermatocystidia none; clamp connections present.

On the earth or on plant fragments such as mulch from sugar cane presses, usually in open fields and springy meadows, never on dung; always solitary but often in large numbers in a limited territory; fruiting from May until October, common in the transition zone between the tropical-montane and the temperate-montane zone—*i.e.*, between 1500 and 1800 m alt.—favoring limestone regions. Reported from Southern Mexico and Guatemala.

Illustrations: Wasson, *Mushrooms Russia and History* 2: pl. 40, fig. 1; Life, May 13, 1957, p. [107], fig. at lower left.

Material studied: Mexico: Oaxaca, Huautla de Jiménez, R. G. Wasson 3, 13–8–1953 (NY); R. Singer M 1502, July 10, 1957 and M 1521, July 11, 1957 (both MICH).

This is the only mycenoid representative of the genus occurring in Oaxaca and consequently the only mycenoid hallucinogenic mushroom used by the Mazatecs. For this reason it is sometimes confused with *Panaeolus sphinctrinus* which has a similar habit but is more obtuse, with blacker lamellae, and grows mostly directly on dung.

STIRPS SILVATICA

6. ***Psilocybe silvatica*** (Peck) comb. nov. (FIGS. 27, 29).

Psathyra silvatica Peck, Ann. Rep. N. Y. State Mus. 42: 20. 1889.

Hypholoma silvaticum (Peck) A. H. Smith, Contrib. Univ. Mich. Herb. 5: 21. 1941.

Pileus 8–25 mm broad and at least half as high, obtusely conic to campanulate, margin straight at first, disc often with a papilla, glabrous, viscid, shining when dried, tawny to rather dark brown, hygrophanous, fading to pale ochraceous buff to grayish melleous or grayish brown.

Lamellae dull ferruginous brown when mature, narrow to broad, adnate, ascending to almost horizontal, close to subdistant, with a pallid edge.

Stipe 20–80 $\times$ 1–3 mm, equal or slightly thickened at the base, tubular, flexuous, pallid to brownish, apparently whitish from a superficial appressed fibrillose covering, this layer thinning out downward

and more brown showing through from cortex of the stipe; veil apparently very weakly developed and all traces gone in mature specimens.

Context in pileus membranous and fragile, in stipe brownish and cartilaginous; taste farinaceous; odor also farinaceous (from crushed flesh).

Spores in deposit "benzo brown" (violaceous brown).

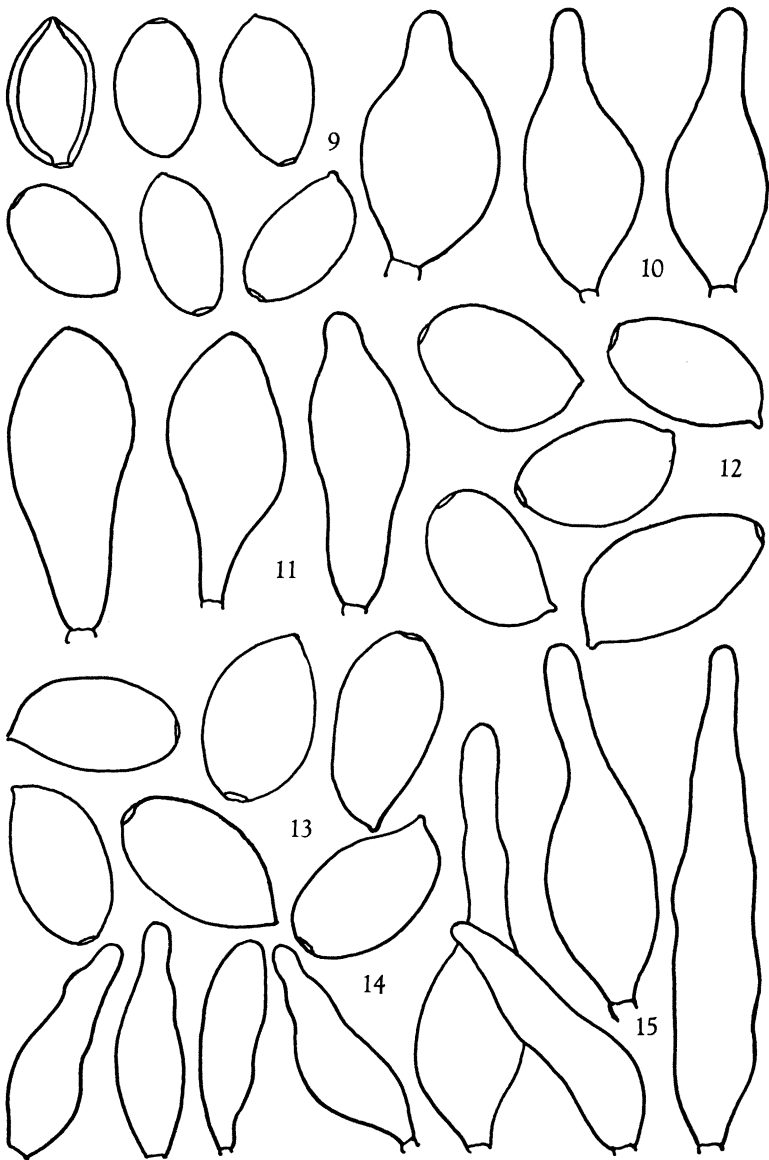
Spores 6-9.5(-11.5 from 2-spored basidia) $\times$ 4.5-5.5 μ , dingy yellowish brown in KOH, smooth; with a complex thick wall, terete in cross section, with a distinct apical germ pore; basidia 19-27 $\times$ 5.7-8 μ , 4-spored, rarely 2-spored; pleurocystidia none; cheilocystidia 24-45 $\times$ 4-10 μ , ventricose below and often ampullaceous with an elongated neck 1.3-2.2 μ thick, tapering to an obtuse to (rarely) subacute apex, often pedicellate, forming a sterile band on gill edge; subhymenium thin, melleous in KOH; gill trama of relatively broad hyphae with walls up to 0.8 μ thick, pale melleous in KOH and lacking pigment incrustations; epicutis of pileus a thin pellicle of gelatinized hyaline to yellowish filaments 1-2.8 μ in diameter, but pellicle not very strongly gelatinous; hypodermium of compactly arranged hyphae 3 μ or more broad and more highly pigmented than in trama proper, pigment incrusting the walls; clamp connections present.

In small groups, gregarious but not caespitose, in the woods on debris around stumps or on leafmold (mostly *Fagus grandifolia*), generally not directly on stumps or logs, fruiting in September and October. Known from New York, Ontario, and Michigan.

Material studied: U.S.A.: New York, Star Lake, Peck, PARATYPE of *Hypholoma fragile* (NYS); North Elba, Peck, TYPE (NYS). Mich., Milford, Smith 20970, 10-4-1949 (MICH). CANADA: Ont., Bear Island, Lake Timagami, Smith 4777, 9-9-1936 (MICH).

Hypholoma fragile was originally reported by Peck from two localities, Star Lake and Painted Post, both in New York. As A. H. Smith (18) previously pointed out, the Painted Post collection should be regarded as the type. This latter is a *Psathyrella* and the same as *P. hymenoccephala* (Peck) Smith. The Star Lake collection is *P. silvatica* (Peck) Sing. & Sm.

When A. H. Smith (17) described *P. pelliculosa* the confusion involving *H. silvaticum* had not been discovered. After working out the details of this problem he considered the apparently slight differences existing between *P. pelliculosa* and *P. silvatica* as of no taxonomic significance and reduced *P. pelliculosa* to synonymy with *P. silvatica*. It now appears from the study of all known species in this section that the slight differences disregarded earlier may have taxonomic significance and so *P. pelliculosa* is re-established here.



FIGS. 9-15. 9: spores of *Psilocybe aztecorum*. 10: cheilocystidia of *P. collybioides*. 11: pleurocystidia of *P. collybioides*. 12 and 15: spores and cheilocystidia of *P. strictipes*. 13: spores of *P. baeocystis*. 14: cheilocystidia of *P. candidipes*.

7. ***Psilocybe pelliculosa*** (Smith) comb. nov. (FIGS. 28, 30, 42).

Psathyra pelliculosa A. H. Smith, *Mycologia* 29: 58. 1937.

Pileus 8–15(–30) mm broad, at least half as high as broad, obtusely conic with a straight margin when young, remaining so or becoming more broadly conic-campanulate, never fully expanding, surface glabrous, smooth, viscid from a separable gelatinous pellicle, hygrophanous, “Saccardo’s umber” to “Isabella color” (dark dingy yellow-brown or more olive showing), usually fading to “pinkish buff” (dull pale alutaceous), often with greenish gray tints in age, margin translucent-striate when moist.

Lamellae dull “cinnamon brown” until darkened by the spores, adnate but eventually separating from the apex of the stipe, rather narrow to moderately broad, markedly ascending at first, less so in age, close, edges pallid.

Stipe 60–80 mm long, 1.5–2 mm thick at apex, equal above an enlarged base (base enlarged from adhering debris), pallid to grayish, appressed silky fibrillose and brownish below and reaching bister in age, pruinose above; veil absent to rudimentary.

Context thin and pliant in pileus, rather tough in stipe, turning slightly bluish or greenish where injured in pileus and stipe; odor none or slightly musty.

Spores $9.3\text{--}11 \times 5\text{--}5.5 \mu$ to $10.5\text{--}13(14) \times 5.5\text{--}7 \mu$ (according to populations, all 4-spored), dark yellow brown in KOH, showing a distinct apical germ pore (often convex), smooth, terete, ellipsoid to subovoid; basidia 4-spored, $22\text{--}30 \times 7\text{--}8 \mu$, hyaline; pleurocystidia none or only near gill edge and similar to cheilocystidia; cheilocystidia $22\text{--}36 \times 5.5\text{--}7.5 \mu$, hyaline, forming a sterile band on gill edge, often pedicellate, fusiform-lanceolate with an elongated neck tapering to an acute to subacute apex, neck rarely cylindric with an obtuse apex, hyaline in KOH; subhymenium narrow and irregular, brownish in KOH; gill trama regular, pale brownish in KOH; epicutis of pileus a thick pellicle of more or less horizontal very loosely arranged strongly gelatinized wavy hyphae $0.8\text{--}5.5 \mu$ in diameter, hyaline, walls never incrustated; hypodermium of compactly subparallel hyphae tawny from having colored walls but walls not incrustated; all hyphae with clamp connections.

Scattered to gregarious or caespitose on debris and humus in and near conifer forests from September to December. California, Oregon, Washington, Idaho.

Illustration: A. H. Smith in *Contrib. Univ. Mich. Herb.* 5: *pl.* 10, *fig.* 1 (*Hypholoma silvaticum*). 1941.

Material studied: Idaho: Granit Creek, Nordman, *A. H. Smith* 54268, 10–8–56 (MICH). Washington: Lake Cushman, Olympic Mts., *C. H. Kauffman*, 10–11–15 (*Psathyra fagicola*) (MICH); Lake

Quiniault, *C. H. Kauffman*, 10-13/27-25 (all three MICH); Lake Crescent, *A. H. Smith* 3074, 10-10-35 (MICH); numerous other collections from nearby places in Washington: *A. H. Smith* 3196, 17875, 39887, 40212, 40465/6, 40526, 40966, 41181, 49088, 49381; Zenith, *J. B. Flett*, 11-3-41 (all MICH). Oregon: Near Lake Tahkenitch, *A. H. Smith* 3431, 11-11-35, TYPE (MICH); other Oregon collections, *A. H. Smith* 3461, 7893, 9298, 25057, 49488 (all MICH). California: Crescent City, *A. H. Smith* 8260, 10-30-37 (MICH).

STIRPS CYANESCENS

8. PSILOCYBE AZTECORUM Heim, Rev. de Mycol. **22**: 78. 1957 (Figs. 9, 31).

Psilocybe mexicana var. *longispora* Heim, C. R. Acad. Sc. **244**: 1393. 1956, nom. subnud.

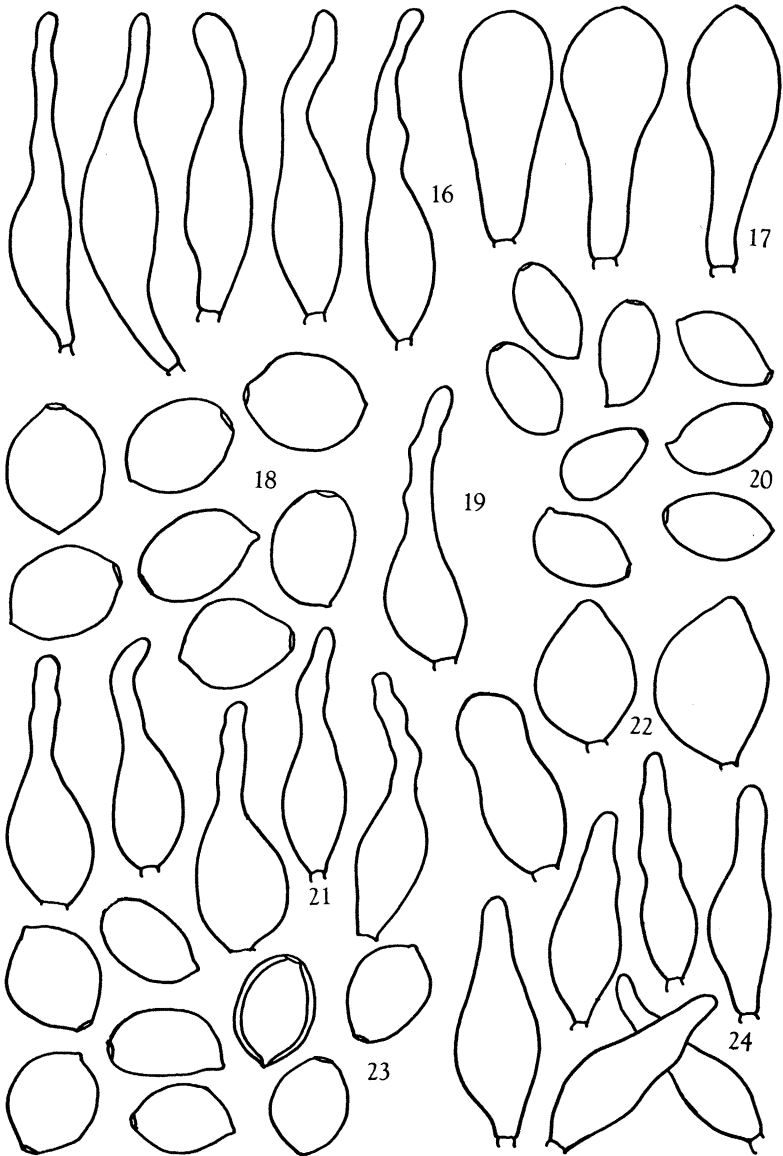
Pileus 15-25 mm broad, obtuse to subumbonate, expanding to broadly conic or campanulate, glabrous except for traces of the veil along margin at first, slightly viscid, hygrophanous, milk white with yellowish disc, striate over about a third of the radius when moist, pale buff faded, disc tending to become rimulose-cracked in some specimens.

Lamellae deep purple brown when mature, adnate, broad, fairly close, with pallid to whitish edges.

Stipe 30-60 mm long, 2-4 mm thick at apex, equal or nearly so, fibrous, base at times enlarged, often flexuous, whitish, staining blue, becoming grayish on discolored portions, especially over lower part in age; veil well developed, sometimes forming a fugacious annulus.

Context white, changing to blue readily, especially in the stipe; odor farinaceous; taste astringent.

Spores $10.5-14(-16.2) \times 5.3-7.7(-8.8)\mu$, elongate-ellipsoid, terete, revived in KOH dark dull ochraceous brown with olive tone and a red brown line showing along the endosporium, thick-walled, germ pore broad and distinct, wall smooth; basidia hyaline to melleous-hyaline, mid-portion usually constricted, $24-31 \times (5-)7.7-10(-10.5)\mu$, (1-, 2-, 3-)4-spored, sterigmata $6-6.5(-7.8)\mu$ long; pleurocystidia similar to cheilocystidia, rare to scattered, rarely a few cystidioles found, their shape reminding one of one-spored basidia; cheilocystidia abundant, causing gill edge to be heteromorphous, $24-45 \times 5-8\mu$, fusoid-ampullaceous with filamentous neck, neck rarely tapered sharply to a subacute apex, $6-11\mu$ long and about 2.5μ in diameter; pilocystidia none; caulocystidia abundant near apex of stipe, variable in shape, $17-43 \times 4-9\mu$, ventricose at base and with or without a short neck; epicutis a thin pellicle consisting of narrow ($1-2.2\mu$) gelatinized hyphae hyaline in KOH; hypodermium poorly differentiated but hyphae up to 14μ broad,



FIGS. 16-24. 16: cheilocystidia of *Psilocybe baeocystis*. 17 and 20: pleurocystidia and spores of *P. candidipes*. 18, 19, 21: spores, pleurocystidia and cheilocystidia of type of *P. caerulescens*. 22-24: pleurocystidia, spores and cheilocystidia of *P. mazatecorum* (Mexican specimens so determined by Heim) = *P. caerulescens*.

having colored (non-incrusted) walls and not gelatinized; clamp connections present.

In small groups on the earth in open pine woods (*Pinus hartwegii*), associated with grasses and *Alchemilla procumbens*. It fruits in September and is known only from around Paso de Cortés, Mexico and Puebla, between 3300 and 3700 m elevation, Mexico. *G. Guzmán VA 1099*, September 1957, *TOPOTYPE* (MICH).

Illustrations: Singer, Chicago Nat. Hist. Mus. Bull. Dec. 1957 (photo); *Life*, May 13, 1957, p. [106], *upper fig.*

In this species are combined the characters of small carpophore size, large spore size, and fairly copious veil development. It is only slightly—never abundantly—pigmented, but the fact that it turns blue when injured has been very clearly established by G. Guzmán on the material on which our description is based, and the local inhabitants likewise consider the bluing one of the mushroom's characteristic features.

9. *PSILOCYBE CYANESCENS* Wakefield, Brit. Mycol. Soc. Trans. 29: 141. 1946.

Pileus 20–40(–75) mm broad, convex, becoming expanded, viscid, hygrophanous, when moist chestnut color, fading yellowish or ochraceous, margin striate when moist, staining blue when touched.

Lamellae cinnamon colored becoming badio-fuscous as spores mature, adnate to adnate-decurrent, subdistant, up to 5 mm broad, edges paler.

Stipe 60–80 × 2.5–5 mm (rarely 100 × 7 mm), fairly rigid, base somewhat enlarged and often curved near the base, whitish, silky fibrillose, changing to blue when bruised or in drying; veil cortinate, snow white and thin, best seen on young fruiting bodies.

Spore print fuscous.

Spores 9–12 × 5.5–8.3 × 5–7.7(–8) μ , mostly slightly broader in face than in side view, smooth, nearly elliptic in side view, more ovate in face view, with a distinct broad apical germ pore, wall thick and complex, dingy yellow-brown in KOH and with a reddish chestnut line along the endosporium; basidia 4-spored, 16–26 × 7.2–9.3 μ , cheilocystidia 12–26 × 5–8 μ , fusoid-ventricose, with the neck 2–4 μ thick and projecting about one-third of the total length of the cheilocystidium, apex obtuse; pleurocystidia few, in form of cystidioles, 21–28 × 5.5–8.8 μ , resembling basidioles but mucronate and lacking both protoplasmic granulation and refractive internal body when revived in KOH (hence neither basidioles nor chrysocystidia); gill trama regular, hyaline to melleous, the hyphae lacking pigment incrustations and having thin to moderately thickened walls; epicutis a pellicle of long loosely arranged

filaments imbedded in a gelatinous mass; beneath this a hypodermium of melleous but not conspicuously incrustated hyphae; pilocystidia none; clamp connections present.

On the earth among leaves and dead twigs in woods, perhaps occasionally on rotten wood, known only from Kew Gardens, Surrey, England, TYPE (K).

The description of the field characters is translated from the original description. The data on microscopical characters were obtained by us from a study of the type.

It is not impossible that this species was introduced to Europe with exotic plant material.

10. *PSILOCYBE COLLYBIOIDES* Singer and Smith, *Mycologia* **50**: 141. 1958. (FIGS. 10–11.)

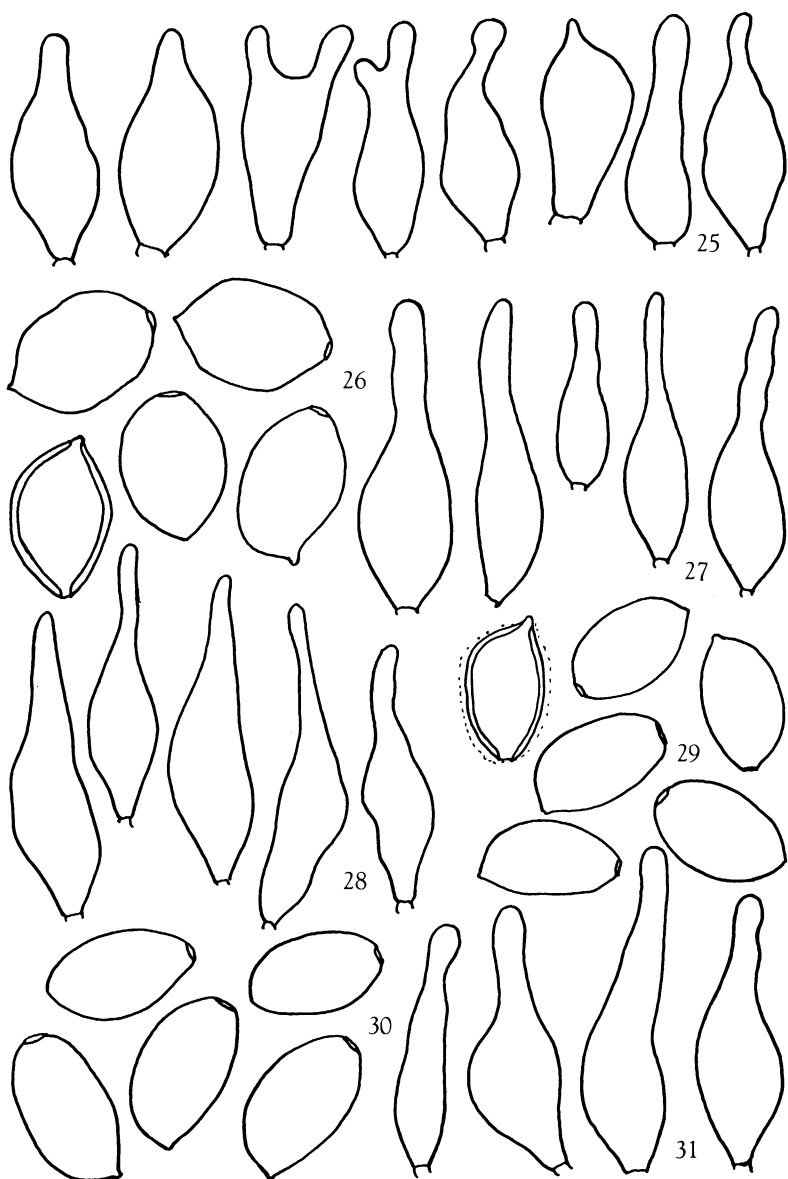
Pileus 13–40 mm broad, at first campanulate and often soon varying toward convex, at maturity convex or retaining a more or less elevated umbo, eventually tending to become flattened and irregular, surface glabrous, viscid when moist, somewhat hygrophanous, when moist usually finely translucent striate and more sordid-pallid all over, faded light ochraceous brown (13K 9) with dingy pallid center, discoloring (where touched and on drying) from the center outward and finally reaching *bottle green* or *bayou*, often with a short sulcate margin.

Lamellae pallid to pure white, in some slightly brownish at maturity, close or subclose, more or less adnate, moderately broad to broad (e.g., 2.5 mm).

Stipe 30–70 × 1.5–4.5 mm, equal to slightly thickened downward, often twisted-contorted, curved, compressed, knotty or variously irregular, stuffed becoming hollow, white at first, often becoming cinnamon-brown from the base upward, at times remaining white or fading out to white again in age, when young silky fibrillose and sometimes sub-squamulose from the veil, later appressed finely fibrillose, apex fibrillose-pruinose; veil cortinate-fibrillose, white, fugacious; basal mycelium sometimes strigose, white, and forming white rhizomorphs.

Context white to pallid or in parts cinnamon, always discolored under the cuticle and in cortex of stipe, turning green to blue (*bottle green* or *bayou*) when injured, fleshy in pileus, somewhat tough in stipe; odor slightly farinaceous becoming spermiatic.

Spores generally none, or few, typical of the Strophariaceae, about $10 \times 6.5 \mu$ (hymenophore nearly sterile or sterile); basidia not seen; pleurocystidia in form of cystidioles forming the hymenium, hyaline, some $24\text{--}32 \times 7.3\text{--}9.5 \mu$, attenuate above and often with a rounded mucro, others more pseudoparaphysoid, vesiculose to broadly clavate, $14.5\text{--}23 \times 9.3\text{--}13 \mu$; chrysocystidia none; cheilocystidia abundant, caus-



FIGS. 25-31. 25-26: cheilocystidia and spores of *Psilocybe mexicana*. 27 and 29; cheilocystidia and spores of *P. silvatica*. 28 and 30: cheilocystidia and spores of *P. pelliculosa*. 31: cheilocystidia of *P. aztecorum*.

ing the gill edge to be heteromorphous, $17-23.5 \times 8-9 \mu$, fusoid-ventricose with narrow ($1.5-2 \mu$) extended neck and with obtuse to capitate (and then up to 3.5μ diameter) tip; subhymenium consisting of irregular very small elements; hymenophoral trama regular, its hyphae with about 0.5μ thick walls, without membrane-pigment; epicutis a pellicle consisting of loosely arranged gelatinized hyphae, hyaline in KOH; hypodermium of nearly non-pigmented hyphae, or in some a slight amount of wall incrustation (melleous) present, especially in young non-contorted carpophores; clamp connections present.

On dry slopes over loose gravel near *Alnus jorullensis* var. *spachii* and on various types of organic debris (humus, grass culms, semi-decomposed alder leaves, etc.) in semi-shade, gregarious, fruiting in the summer rainy season (February), Argentina, prov. Tucumán, Pre-Andine Sierras, Tafí del Valle, 2000 m altitude, *Singer T 1882*, TYPE (MICH).

The above collection was designated type in order to leave open the question of the identity of the North African species whose description follows, even though the latter and the type appear to be the same. If the North African species is not the same as ours it will have to be renamed because the epithet *cyanescens* is preoccupied in *Psilocybe*. The Argentine species described above has the appearance of a *Collybia*, hence the specific epithet proposed.

Description of Maire's sterile to semi-sterile material from Algeria

The following description of *Hypholoma cyanescens* R. Maire, Bull. Soc. Mycol. Fr. **44**: 51. 1928, refers to a North African species which we think probably identical with *P. collybioides*. This description is adapted from the original diagnosis. We have seen no specimens.

Pileus 15-30 mm broad, convex, then expanding, not umbonate, viscid and with a separable glutinous pellicle, hygrophanous, dingy ochraceous, faded pallescent, margin faintly striate or not striate.

Lamellae whitish becoming dingy and pallid ochraceous, finally light rufous-fuscos, close, thin, narrow (1.5-2.5 mm), arcuate, somewhat rounded behind and narrowly attached (rounded-adnexed), not intervenose, lamellulae attenuate, edges whitish pruinete.

Stipe 25-40 $\times$ 2-5 mm, subequal or slightly enlarged below, stuffed with a white silky medulla, eventually tubular, whitish, apex pruinose, innately fibrillose downward; cortina cobwebby, white, fugacious.

Context slightly fulvous, fulvous in the base of the stipe, faded pallescent, white in the stuffing of the stipe, bluing in all parts of trama on injury; odor raphanaceous; taste mild.

Spore deposit purple-brown.

Spores $10-12 \times 5.5-6.5 \mu$, from 4-spored basidia, occasionally up to c. $20 \times 7.5 \mu$ from 2-spored basidia, ellipsoid, light fuscous brown, rather thick-walled, smooth, with a rounded to slightly attenuated apex furnished with a germ pore; basidia clavate, 4-spored, few 2-spored, $28-32 \times 7-9 \mu$; pleurocystidia none or rare and similar to cheilocystidia; cheilocystidia $30-40 \times 6-8 \mu$, fusiform with a subcylindric ampullaceous neck and an apex incrustated with calcium oxalate; subhymenium thin, ramose; gill trama regular, its elements $5-8 \mu$ in diameter and rather long, interwoven.

Chemical characters: guaiac solution negative; NH_4OH negative.

Gregarious under *Cedrus atlantica*, fruiting from October until December. Algeria, Blida and La Chr  a.

Description of fertile material referred to Hypholoma cyanescens
by Malen  on

The following description is translated and adapted from Malen  on (8):

Pileus 15-35 mm broad, almost spheric to convex becoming campanulate to conic-campanulate, the margin finally spreading, viscid from a separable gelatinizing pellicle, naked, hygrophanous, ochraceous then amber yellow with a bister shade, finally dusky olive, bister, fading from the disc outward to yellowish white or dull stramineous ("as if it were gouach  e"), in age at times disc leather color, translucent-striate half way to disc when moist, opaque when faded.

Lamellae pale argillaceous becoming more lilac-beige, eventually dark purple brown, thin, not close, narrow, ascending, free to slightly adnexed, with white fimbriate edges.

Stipe $50-70 \times 2-3$ mm, equal to a slightly thickened base, solid becoming fistulose with a slight silky stuffing, pruinose on apex, lower down with a thickish coating of silvery to yellowish appressed fibrils; cortina silvery white, fugacious; basal mycelium cottony white, agglutinating, long white rhizomorphs present.

Context watery, with an amber color tone, lower part of stipe amber, thick in disc of pileus, thin toward margin, rather rough in stipe, changing green to blue where injured; odor and taste none.

Spore deposit blackish purple fresh, blackish in the herbarium.

Spores $(11-)11.25-13(-13.5) \times 5.5-7 \mu$, most frequently $11.2-11.8 \times 5.5-6.25 \mu$, almond shaped, smooth, thick-walled, violet in water mounts, yellow brown in NH_4OH , apical germ pore obliterated by a hyaline callus; basidia $30-35 \times 8 \mu$, 4-spored, cylindric or constricted, sterigmata 5μ long; cystidioles (?) piriform, $15-17 \times 7.5-8.5 \mu$; pleurocystidia (other than cystidioles) none or similar to cheilocystidia and near gill edge; cheilocystidia $30-40 \times 6-8 \mu$, abundant (edge heteromorphous), ampullaceous and neck often incrustated with a spherical

collar, walls hyaline; subhymenium cellular (?); hymenopodium of thinner more parallel hyphae than the hymenophoral trama proper which consists of broad hyphal cells narrowed at the septa; apex of stipe with numerous dermatocystidia similar to cheilocystidia; pellicle of pileus of interwoven gelatinized hyphae, with those of the extreme surface often diverticulate as in some *Mycenae*; hypodermium filamentose.

Often on small pieces of dead wood but also on the ground, fruiting from October until November in the *Cedretum (atlanticae)* and *Quercetum (ilicis)* above Azrou, Morocco.

In order to represent the facts as free from possible misinterpretation as we reasonably could, we have presented the data available on the collections made by each author. Experience with numerous sterile forms in the genus *Naematoloma* in North America has shown that in these the colors invariably have more yellow in pileus, lamellae, and stipe than do those of normally fertile carpophores, but that there is no correlated variation in spore size and shape. Hence, as long as these characters can be obtained from semi-sterile forms, they can be used in classifying collections. We do, however, believe that in interpreting differences in color, especially as the yellow pigments are concerned, it is best not to attempt fine distinctions between collections in situations such as this one. Also we cannot regard semi-sterility in itself as necessarily being a legitimate species character.

We believe that all of the material on which the descriptions presented here are based belongs in a single species. Spore characters are essentially the same, as are the characters of the cheilocystidia and lack of pleurocystidia. There may be some differences in odor and taste but in no case are the characters pronounced enough to be convincing in view of the small amounts of material tested.

Since the specific epithet *cyanescens* cannot be transferred to *Psilocybe* because of the existence of *P. cyanescens* Wakefield, we are describing the South American material as a new species and designating a type from that region. By doing this we do not prejudice the situation as far as future studies of the African populations are concerned. If some of the slight differences noted in the descriptions presented here are found to be important, adjustments in the classification can then be made. There is the possibility that Malençon's collections are conspecific with Miss Wakefield's *P. cyanescens*.

11. *PSILOCYBE STRICTIPES* Singer & Smith, *Mycologia* **50**: 141. 1958. (FIGS. 12, 15, 50.)

Pileus 20–40 mm broad, when young campanulate to convex, becoming broadly convex to plane or with an elevated wavy margin in age,

glabrous, viscid from a separable pellicle, margin striatulate when moist, hygrophanous, dull yellowish brown to olive brownish ("Isabella color"), fading to cinnamon buff on disc and pallid on margin, becoming dingy over all in age, where bruised staining greenish or bluish green.

Lamellae pallid becoming dark chocolate color from the spores, bluntly adnate to depressed-adnate, horizontal, narrow (4 mm in a 40 mm cap), close but not crowded, with three tiers of lamellulae.

Stipe 100–130 × 2–3 mm, straight, equal or slightly flared at apex, stuffed with a pallid brownish pith, staining brownish where outer fibrils have been removed, surface pallid from appressed fibrils, often zoned near apex from broken veil, with fibrils over lower half and strigose hairs at base, staining bluish green.

Context concolorous with surface in pileus, dingy brownish and cartilaginous in the cortex of the stipe; odor none; taste mild.

Spore deposit purplish.

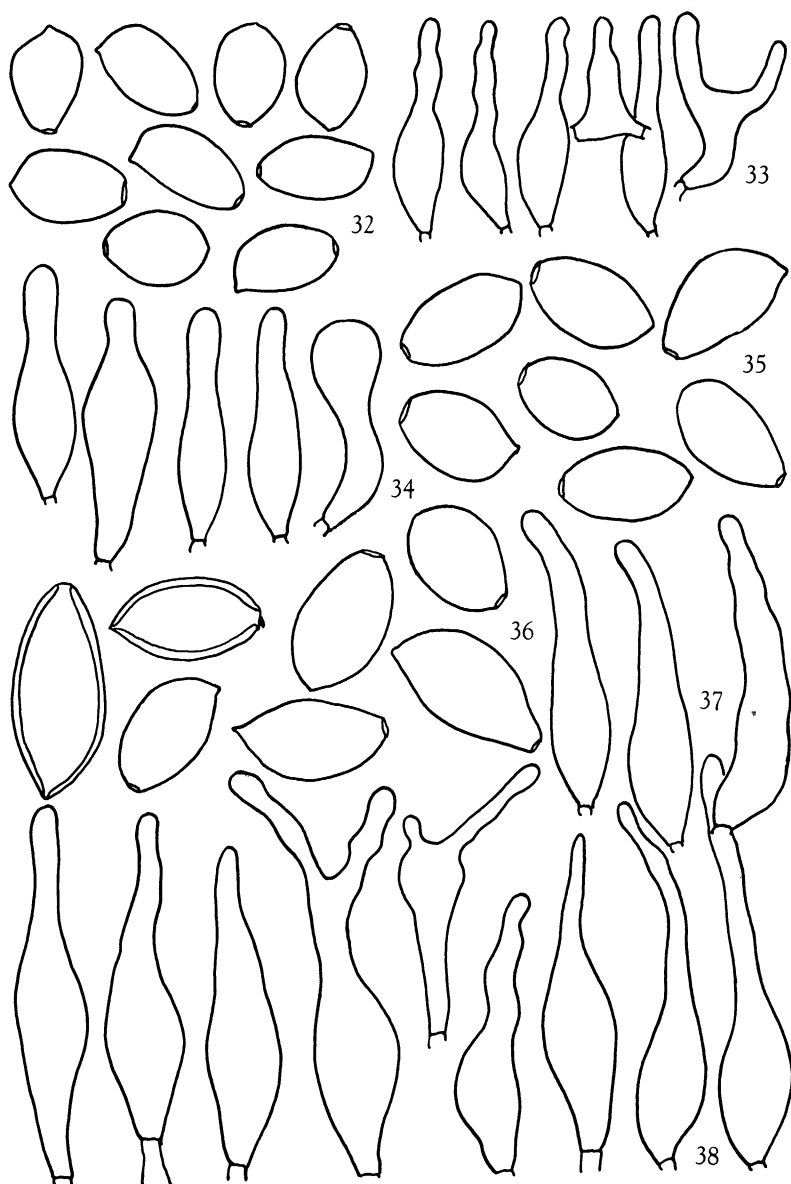
Spores 9–12(–12.7) × 5.5–6.5 μ , smooth, with a distinct apical germ pore, oblong in face view, slightly inequilateral in side view, sordid tawny in KOH; basidia 25–31 × 7–9 μ , 4-spored, clavate or subcylindric with a median constriction, projecting when sporulating; hymenium dull rusty brown to pale yellowish in sections revived in KOH; pleurocystidia none or only near gill edge and similar to the cheilocystidia; cheilocystidia 26–45 × 6–12 μ , abundant, causing gill edge to be heteromorphous, hyaline, ventricose below, subulate, attenuated gradually towards the subacute to obtuse tip; gill trama of enlarged cells pale sordid brownish to hyaline (paler than hymenium in KOH); epicutis a thick gelatinous pellicle of hyaline narrow (1.5–3.5 μ) hyphae; hypodermium of broad (3–10–18 μ), somewhat interwoven hyphae, pigmented but almost as pale as the flesh beneath, not incrustated; clamp connections readily demonstrated.

Subcespitose on wood of conifers and debris in coniferous and mixed woods, fruiting in October, Oregon, U.S.A.

Material studied: Oregon: near Welches, *Gruber & Smith 20248*, TYPE (MICH). Other specimens from the same general region: *Smith 24622*, *24403* (MICH). (No. 202448, indicated as the number of the type in the original diagnosis, is erroneous.)

12. *PSILOCYBE BAEOCYSTIS* Singer and Smith, *Mycologia* **50**: 141. 1958. (Figs. 13, 16.)

Pileus 14–54 mm broad, appearing umbonate when dried but conic when fresh and with incurved margin, finally expanding to convex or plane, viscid from a thin gelatinous pellicle, olive brown to buffy brown, when dried tending toward copper brown in the center, with a faintly striate margin when moist, finally with a greenish fringe around the margin and becoming greenish where touched.



FIGS. 32-38. 32-33: spores and cheilocystidia of *P. aggericola*. 34-35: cheilocystidia and spores of *P. muliercula*. 36-38: spores and cheilocystidia of *P. caeruleipes*.

Lamellae dark cinnamon or gray, also with faint purplish tints in some, eventually nearly "heliotrope gray," adnate to uncinata, subclose, edges whitish.

Stipe 50–70 × 2–3 mm, equal to subequal, stuffed with loose fibrils, with fine white fibrils on surface, white except for apex which is yellowish; veil present but inconspicuous.

Context concolorous or paler than surface in pileus, brown in stipe; odor and taste none.

Spore deposit "heliotrope gray."

Spores (8–)10–13.3 × 6.3–7 μ (mostly 11–12 × 6.3–7 μ), terete or nearly so, with a broad distinct germ pore, deep olive to dingy brownish olive-yellow in KOH, smooth, wall very thick and complex, with a suprahilar depression or applanation; basidia 20–30 × 7–9 μ , 4-spored, hyaline to stramineous; pleurocystidia none; cheilocystidia 20–30(–36) × 4.2–5.7 μ , ampullaceous with a long thin neck (1.2–1.5 μ diameter) and subacute apex, or more often ventricose below or in middle but then pedicellate and tapered to an acute apex, hyaline, causing gill edge to be heteromorphous; subhymenium a rather broad and irregular layer of small versiform elements, slightly pigmented; hymenopodium a thin filamentous layer, regular, not as well separated as in some other species; gill trama hyaline, regular, with a slightly and indistinctly differentiated mediostratum and this flanked by parallel hyphae on either side, progressively more pigmented in the third of the trama closest to the pileus trama; epicutis a very thick hyaline gelatinous layer of narrow loosely arranged hyphae; hypodermium weakly to strongly pigmented, consisting of compactly parallel horizontal hyphae broader than those of the epicutis; clamp connections regularly present.

On decaying "peat moss" (actually apparently a mixture used instead of pure *Sphagnum*) by a green house, Eugene, Oregon, U.S.A., *F. P. Sipe*, 11–1–1945, TYPE (MICH).

This is somewhat similar to *P. strictipes* and may be confused with it, but differs in the size and shape of the cheilocystidia, which are reminiscent of those of *P. caerulipes*.

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13. *PSILOCYBE CAERULESCENS* Murr., *Mycologia* **15**: 20. 1923 (FIGS. 18, 19, 21–24, 46, 48.)

Psilocybe mazatecorum Heim, *C. R. Acad. Sc.* **242**: 1392. 1956, nom. subnud.

Psilocybe caerulescens var. *mazatecorum* Heim, *Rev. de Mycol.* **22**: 78. 1957.

Pileus 20–88 mm broad, at first obtusely campanulate, becoming convex with a decurved margin, at times slightly umbilicate or with a small

umbo, rarely becoming irregular and almost plane or shallowly depressed in age, almost black or very deep olive-umber at first, becoming paler and olive tinge often disappearing, in age often rather pale colored (near *aztec*), umbo either darker than marginal area or at times paler, hygrophanous, fading gradually to ochraceous from disc outwards, sometimes assuming chestnut or fulvous colors in the moist areas while still fading (see illustrations by Wasson), and these at times persistent in the faded specimens, a brownish shade often pervading the disc, glabrous, smooth, slightly viscid to lubricous, short striate by translucence in smaller caps or striate half way to disc in large ones when moist, opaque when faded; veil usually fugacious on pileus, but sometimes more persistently white appendiculate.

Lamellae mostly light avellaneous gray or argillaceous, only in age reaching sepia, sinuate-adnate to bluntly adnate, close to subclose, broad, edge slightly white fringed.

Stipe 40–122 × 2–10 mm, typically equal, hollow, glassy-white to sordid although at first always with a continuous white velutinous soft covering which soon breaks up into a marbled to flocculose covering on a sordid ground color, the apex pallid fibrillose, glabrescent; basal mycelium white, occasionally developing some white rhizomorphs which at times turn blue when injured; veil thin and at first appearing cortinoid, pure white, often forming a ring for a very short time in young or nearly mature specimens, not distinctly bluing.

Context of pileus whitish to sordid or even tawny to fulvous, sometimes dark brown in upper portion of pileus, fleshy, somewhat fibrous-hard in stipe, blue when injured; odor strongly farinaceous; taste astringent.

Spore deposit deep purple fuscous, sepia.

Spores (6–)6.3–7.7(–8) × 5–6 × 3.5–5 μ , compressed, 0.5–1 μ narrower in side than in face view, varying from subrhombic with rounded angles to ovate in face view, and from elliptic to inequilateral in side view, deep yellowish brown in KOH, smooth, with a broad germ pore, wall thick and compound as revived in KOH, showing a rusty line along the endosporium, without a suprahilar depression but at times with a small applanation; basidia (12–)14–21 × 4.9–7 μ , 4-spored, rarely 2-spored; pleurocystidia none except for some permanently sterile basidioles (?) or a few cells resembling the cheilocystidia; cheilocystidia 15–20(–26) × (3–)4–5.5(–6) μ , hyaline, fusoid to fusoid-ampullaceous, the apex acute to slightly enlarged, neck sometimes flexuous to filamentous and 1.5–2 μ in diameter; subhymenium a narrow layer of irregular short elements, melleous to hyaline as revived in NH_4OH ; hymenopodium hyaline, consisting of parallel filamentous hyphae; the hymenophoral trama proper consisting of a lateral stratum of broad (7–11 μ diameter) hyaline hyphae accompanying the mediostratum on

both sides, and the mediostratum consisting of a mixture of broad and narrow ($2.5\text{--}3\ \mu$) hyphae, walls of all cells $0.3\text{--}0.4\ \mu$ thick; epicutis well developed, consisting of thin filamentous hyphae occasionally with an upturned terminal cell, slightly gelatinized; hypodermium denser than the flesh beneath and more deeply colored; hyphae of the context of the pileus short and voluminous, cell walls c. $0.7\ \mu$ or less thick, deep ocher brown from incrusting membrane-pigment; clamp connections present.

Chemical characters: guaiac solution, bluing on white portions of context.

Gregarious to cespitose, rarely solitary on soil or on sugar cane mulch, mostly in shaded places or on rich earth which has recently been moved or altered, fruiting in summer, during the rainy season. Southern United States (Alabama) and Mexico (Oaxaca).

Material studied: U.S.A.: Ala., Montgomery, TYPE (NY). Mexico: Oaxaca, Huautla de Jiménez, R. Heim (as *P. caerulescens* var. *mazatecorum* Heim), (NY); *Singer M 1513* (MICH).

Illustrations: V. P. & R. G. Wasson, *Mushrooms Russia and History 2: pl. 40, fig. 3* (poor); *Life*, May 13, 1957, p. [107], *fig. at upper right*.

Heim first described this fungus as a new species and then, after receiving a letter from Smith suggesting that the species was the same as *P. caerulescens* Murr., he apparently changed his mind and referred to it as *P. caerulescens* var. *mazatecorum* but gave no immediate critical account of how var. *mazatecorum* was actually different from the type variety. There may be a difference in the taste since that was indicated as mild in the type collection, but until the recent interest in hallucinogenic fungi this species remained known almost entirely from the type collection made by R. P. Burke of Montgomery, Alabama, who wrote "no characteristic taste." It is possible that Burke did not regard a slight astringent taste as distinctive, or that in merely tasting the raw specimens he did not chew the material long enough to bring out the true flavor.

The character of the veil's being more developed in var. *mazatecorum* than in var. *caerulescens*, as Heim emphasized in his Latin description, is dubious because from the description of Burke's collection it is likely that his notes referred to mature specimens and the fact that no veil is mentioned cannot be regarded as conclusive. Hence, there seems to be no way to prove these points except by continued collecting and observing, both in the southern United States and Mexico, to determine eventually the range of variability.

14. *PSILOCYBE AGGERICOLA* Singer & Smith, *Mycologia* **50**: 142. 1958.
(FIGS. 32-33.)

Pileus 20-40 mm broad when young, campanulate, then conic campanulate or convex, disc at first umbonate, and with a slight umbilicus in the umbo, later with a pronounced central papilla, margin incurved at first but soon straight, strongly hygrophanous and translucent-striate over outer half when moist, estriate when faded, glabrous and naked, except rarely with vestiges of the veil along the margin, colors light olive brown or brown with a darker disc (*oak*, *Sudan br.* young, disc sometimes *burnt umber*, becoming *khaki* to *Isabella color*, with a *tortoise* colored disc) fading to a dull deep yellow tone (9 J 6) when young, to pale chamois (11 F 4) when old, tending to blacken when drying,

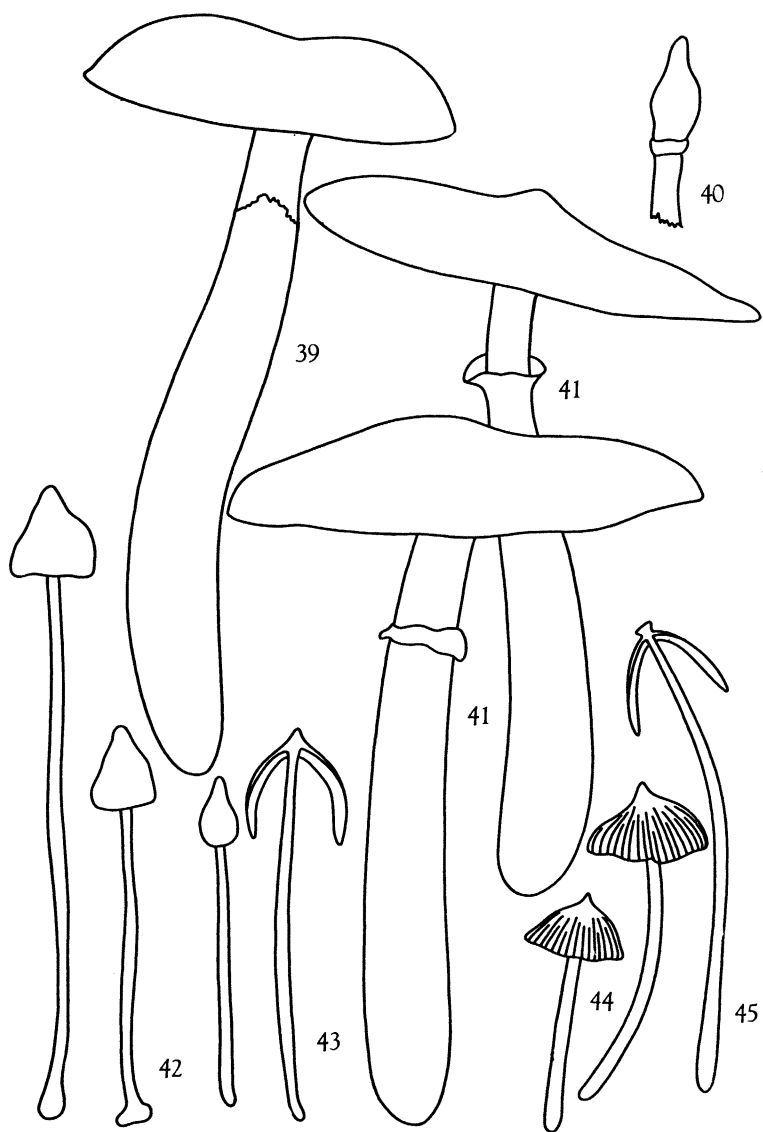
Lamellae narrowly and rather deeply sinuate to adnexed, close or subclose, moderately broad or rather broad and broadest towards the stipe, dingy (olive) brown (*bamboo to stag*), trama staining blue where exposed, edges white and entire.

Stipe 25-80 $\times$ 6-13 mm, later 2.5-6 mm, tapering upward or finally nearly equal, light ochraceous (*Leghorn*) above, later becoming somewhat *burnt umber*, dingy ocher (*maple*) downward and finally coffee-with-milk color (*Mosul*) in lower half, turning blackish in drying, with a sordid cream to pallid floccose-fibrillose covering which is very conspicuous in young material though fugacious in the upper half (persistent in the lower half) of adult stipes, bluing where injured or on handling, the base white mycelioid; veil forming a fugacious, very narrow annular belt at apex but annulus disappearing at maturity.

Context rather firm at first, more fragile in age, not tough in stipe, light ochraceous (*Leghorn*) becoming coffee-with-milk color (*Mosul*), and turning blue (*Quaker blue*, *Arctic*, finally reaching *Rigi blue* in dried condition) when either pileus or stipe is bruised; odor none.

Spore deposit deep purple fuscous.

Spores $6.2-8 \times 4-5.2 \times 3.6-4.5 \mu$, usually $6.7-7.3 \times 4-4.5 \times 3.7-4.2 \mu$, somewhat but little compressed or almost terete (usually $0.3-0.4 \mu$ broader in face than in side view), slightly inequilateral in side view, elliptic-ovate to rarely rhombic in face view, with a broad germ pore, dingy yellow brown in KOH, smooth; basidia $(12.5-14.5-20.5) \times 4.2-5.5(-7) \mu$, 4-spored to rarely 2-spored, hyaline or nearly so, clavate to broadest below the apex, basidioles vesiculose-clavate; pleurocystidia $20-32 \times 6-9 \mu$, originating in the subhymenium, contents homogeneous (not protoplasmatic), with a thin colorless resinous incrustation which renders them opaque, varying from clavate to fusoid or ventricose-ampullaceous or constricted in the middle, often with lateral outgrowths or apical nose-like appendages but these lacking in some preparations; cheilocystidia $20-25(-29) \times (3.5-5-5.5(-8.2) \mu$, usually somewhat ventricose below, upper portion lanceolate narrowed in one or two stages to an acute apex, entirely hyaline and transparent, thin-walled, non-



FIGS. 39-45. 39: *P. candidipes*. 40-41: *P. cubensis*. 42: *P. pelliculosa*. 43: *P. mexicana*. 44-45: *P. yungensis* (44 = var. *acutopapillata*, 45 = var. *yungensis*).

incrusted, causing the gill edge to be heteromorphous; subhymenium when revived in NH_4OH often strongly green from a membrane-pigment, later honey yellow, consisting of a thin layer or irregularly arranged hyphal cells of various shapes; gill trama consisting of elongated subparallel hyphae of variable width and having walls $0.5\text{--}0.7\ \mu$ thick, the mediostratum not sharply differentiated from the hymenopodium and lateral stratum; epicutis of pileus a thin and not sharply differentiated layer of hyaline hyphae, the hyphae not much gelatinized, when revived in NH_4OH , freshly dried material appearing greenish but later losing all color; hypodermium composed of elements which show very variable shape but not isodiametric, brownish melleous as revived but hyphal walls not incrusted; clamp connections present.

Chemical characters: formalin on the flesh immediately brownish, not bluing; FeSO_4 on flesh, causing a bluish gray ring to appear around a brown spot.

Singly or in small cespitose groups of two or three on rich soil along dammed-up earth of the road, outside the forest in subtropical vegetation, fruiting in spring. Argentina, prov. Tucumán, road to Tafi del Valle near Monumento al Indio, 900–1000 m altitude, *R. Singer* T 760, 11–13–1949 (MICH).

The opaque pleurocystidia distinguish this species from all similar ones.

15. *PSILOCYBE CANDIDIPES* Singer & Smith, *Mycologia* **50**: 141. 1958. (Figs. 14, 17, 20, 39.)

Pileus 50–55 mm broad, convex with shallowly depressed disc, always obtuse at first, smooth and glabrous, slightly viscid, when moist translucent-striate over the marginal third, sordid buff to dull buff, hygrophanous, fading from the disc outward, pale buff to whitish when faded, readily staining blue when touched.

Lamellae pale avellaneous to avellaneous-gray, sinuate-adnate, rather broad, fairly close to subdistant.

Stipe about 100 mm long, 7–12 mm thick, hollow, nearly equal, readily staining blue, strongly scabrous-strigose near base, and this coating ascending up to mid-portion, increasingly white floccose upward to the annular zone left by the broken veil; veil white, soft, annular, remnants fugacious, but floccons below annular zone rather persistent, readily staining blue where injured.

Context whitish to dingy white, fleshy in pileus, fibrous-hard in the stipe; odor weakly but distinctively farinaceous.

Spores $6.7\text{--}7.7 \times 3.5\text{--}3.8\ \mu$, terete or nearly so, oblong-ellipsoid to ovoid, smooth, wall complex but relatively thin ($0.7\ \mu$), both epispodium and endospodium differentiated, with a distinct apical germ pore; basidia

4-spored, $13.5\text{--}21 \times 3.5\text{--}6.3 \mu$ (mostly $4\text{--}5 \mu$ broad), clavate, not opalescent; pleurocystidia present only as cystidioles, ventricose-submucronate to fusoid-clavate, body of cell often opalescent but neck emerging and non-opalescent, $21\text{--}24 \times 5\text{--}7 \mu$; cheilocystidia very numerous, lanceolate-fusoid to subulate, hyaline, $18\text{--}27 \times 3.5\text{--}6 \mu$, upper part narrowed to 1.5μ or less in diameter, acute to subacute; subhymenium melleous to brown (brownier near cap trama), consisting of very small elements often appearing cellular in sections but in reality irregular in shape; gill trama regular, hyaline, in the poorly differentiated mediostratum melleous-hyaline, hyphae not markedly enlarged; epicutis well developed, of only slightly gelatinized narrow ($1.3\text{--}3.3 \mu$) hyphae, near surface often giving rise to a cystidioid end-cell which is not gelatinous; velar flocons of stipe everywhere consisting of very irregularly shaped cells of various sizes either inflated or filamentous and strongly interwoven, frequently cystidioid cells arising from the surface hyphae of the velar material, these c. $20 \times 5 \mu$ and ampullaceous, apex 2μ broad; clamp connections present.

Chemical characters: Several chemical substances accelerate and augment the bluing, especially guaiac solution.

On earth, caespitose, among fallen leaves of *Coffea* and *Inga* along irrigation ditches in plantations. Mexico, Oaxaca, Huautla de Jiménez, 1550 m altitude, *R. Singer M 1514*, 7–10–1957, TYPE (MICH).

The small terete spores, strong tendency to turn blue, and copious veil are an interesting set of characters in this genus. The strong development of the veil is a valid additional argument for including the stirps *Cubensis* in this genus. Weight is added to this argument by the fact that in *P. cubensis* the same kind of dermatocystidia are often found on veil and pileus. The two, of course, differ sharply in spore characters.

The young hymenium, typically hymenium just beginning to sporulate, is very interesting in view of the bluing phenomenon. The basidia and basidioles are incrustated with blue granules. The young cystidioles (obviously formed earlier in the development of the hymenium) are not. Does this mean that the early development of these cells did not include the production of the enzyme that causes the formation of the blue pigment? Also, does it prove that those cells which are destined to remain sterile are differentiated physiologically before morphological differences become evident?

16. *PSILOCYBE ZAPOTECORUM* Heim, Rev. de Mycol. 22: 77. 1957.

Pileus 60–110 mm broad, campanulate becoming obtusely umbonate to strongly mammillate but always twisted, asymmetric, most variable

in shape, margin at first white punctate with the veil remnants, (soon) glabrous, color varying from ochraceous citrine to purple-brown-black (Klingcksieck et Valette no. 45) with ochraceous-melleous tones, with dark violet stripes and gradually becoming violet black on margin, apparently hygrophanous and dingy melleous when faded.

Lamellae rather close, with sinuous edges, adnexed-emarginate, not very broad, violet-purple.

Stipe 100–200 mm long, 10–20 mm broad at base, hollow, very fibrous, hard, elastic, often contorted, outer layer of cortex brownish, ochraceous toward the interior and with a central soft white bluing pith, (surface) fibrillose.

Context at first brown-rufous in cortex of stipe, yellow in central portion, entirely and quickly bluing; odor farinaceous; taste astringent.

Spore deposit brown-purple.

Spores $6-8.8 \times 3.5-5 \times 3-4 \mu$ (Heim 1957), rather bright yellow revived in KOH, somewhat compressed, with a broad apical germ pore; cheilocystidia fusoid, with a filiform neck which is covered by a substance stained by dyes (such as “bleu lactique”).

On swamp soil, Yaitepec and San Agustín de Loxicha, Oaxaca, Mexico. Used as hallucinogen by the Chatino and Zapotec Indians, known as “mbey san” or “piule de barda” (according to Heim).

Illustration: *Life*, May 13, 1957, p. [107], fig. at upper left.

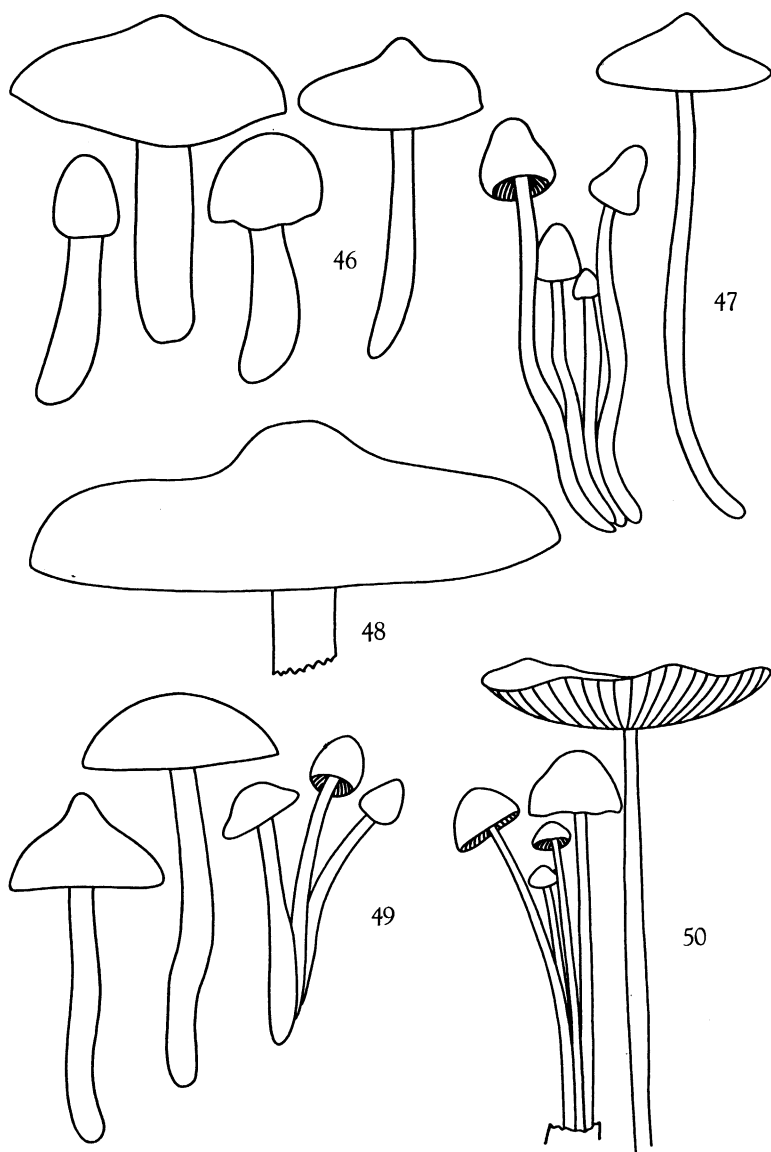
Material studied: None. The above incomplete description is based on fragmentary data and a Latin diagnosis furnished by Heim. Probably there are specimens at Paris.

The habitat is not particularly strange for a *Psilocybe* as far as North American members of the genus are concerned; therefore, it is rather a surprise to find that Heim considered it so. A relatively tough context of the stipe is likewise not unusual in the genus, and it may only be relatively more so in *P. zapotecorum*. Nevertheless, it is possible that this species does not belong with the preceding species. We do not wish to judge its final relationships without having had a chance to study specimens.

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17. *PSILOCYBE MULIERCULA* Singer & Smith, *Mycologia* **50**: 142. 1958. (Figs. 34–35, 49.)

Pileus 20–35 mm broad or more, campanulate then convex, eventually often applanate in a zone between the umbo or papilla and the somewhat decurved marginal area, more or less umbonate, rarely papillate, fulvous brown, hygrophanous, fading out to a pale ocher tone.



FIGS. 46-50. 46 and 48: *P. caeruleascens*. 47: *P. caerulipes*. 49: *P. muliercula*. 50: *P. strictipes*.

glabrous, not viscid, marginal area translucent-striate (up to about half way to disc) when moist, slightly sulcate at times, naked.

Lamellae fuscous-sepia, almost narrow, ascendant to subhorizontal, sinuate-adnate, often seceding, with pallid edges.

Stipe (30-)40-100 $\times$ 2-7 mm, equal or tapering upwards, becoming hollow, sordid flesh-colored-whitish, becoming concolorous with the pileus especially below, staining blue where touched and blue stains eventually very deeply colored, smooth, more or less glabrous and naked; veil very sparse and all traces of it obliterated in mature specimens.

Context tending to turn blue where injured; odor farinaceous; taste in dried specimens not distinctive.

Spores (6-)7-8(-10) $\times$ 4.2-4.8(-5) $\times$ 3.9-4.7 μ , either terete or up to 0.3 μ broader in face view than in side view, elliptic to elliptic-ovate in either view, rarely subrhomboid with rounded angles in face view, sometimes ventricose-fusoid (shaped like a bolete spore) in side view, with a distinct apical germ pore, dark yellowish brown in KOH; basidia 16.5-21 $\times$ 5-5.5 μ , 4-spored; pleurocystidia none; cheilocystidia 12-23 $\times$ 3-5.5 μ , hyaline, subulate to subulate-ampullaceous, apex obtuse and sometimes subcapitate, more often subacute or acute, neck at apex 1.5-2 μ in diameter; subhymenium a thin layer, irregular, of small elements; gill trama regular, walls of hyphae up to 1.5 μ thick (thick-walled for the genus); epicutis a well developed layer of hyaline filamentous hyphae but not strongly gelatinized; hypodermium well colored by membranal pigment often incrusting the walls of the hyphae, the latter arranged into a compact layer or a cutis; hyphae of context and hypodermium with thickened (about 1.5 μ) walls; clamp connections present.

Solitary or in small clusters on earth along ravines of a pine-covered (*Pinus pseudostrobus*) mountain at about 3000 m elevation; fruiting in late August and September, rarely before. Known only from the slopes of Cerro Toluca (Mexico).

Material studied: Mexico, purchased at the market of Tenango del Valle (Toluca Valley), September 30, 1956, *T. Herrera* (MICH, MEX); September 1957, *G. Guzmán* (MICH, MEX); purchased at Piedras Blancas, Cerro Toluca, July 30, 1957, *R. Singer M 1011*, TYPE (MICH).—There must be material of this at Paris since it was sent by *T. Herrera* to *Heim*, purchased at the same place and apparently identical with material earlier purchased in Tenango by the *Wasson* group and determined as *P. mexicana* var. *brevispora*.

This species is quite different from all other known species, particularly from *P. mexicana* which has larger spores and a more typically *P. semilanceata*-like habit.

18. *PSILOCYBE CAERULIPES* (Peck) Sacc., Syll. Fung. 5: 1051. 1887.
(Figs. 36–38, 47.)

Agaricus caerulipes Peck, Ann. Rep. N. Y. State Mus. 38: 89. 1885.

Pileus 10–35 mm broad, when young obtusely conic to convex and with an incurved margin, becoming broadly convex to plane or retaining a slight umbo, at times quite irregular, surface glabrous, viscid, soon dry and shining, closely translucent-striatulate and watery cinnamon brown to dingy “Sayal brown” fresh, hygrophanous and soon fading to dingy ochraceous buff or cinnamon buff, sordid alutaceous in age and often with greenish stains along the margin or with a greenish tinge overall.

Lamellae sordid brown when young, becoming rusty cinnamon, close or crowded, narrow, adnate or arcuate-adnate or with a decurrent tooth, edges whitish and slightly fimbriate.

Stipe 30–60 mm long, 2–3 mm thick at apex, equal or slightly enlarged downwards, stuffed with a pith but becoming tubular or hollow, the pith fairly persistent, surface pruinose at or near the apex, downward appressedly white to grayish fibrillose, usually staining greenish blue where handled, whitish to buff at first, especially above, pallid to bluish when dried, lower part often dingy brown in age; veil whitish, thin, forming an evanescent superior fibrillose zone; basal mycelium white.

Context in pileus thin and pliant, in stipe tough, in both becoming bluish when injured; odor none; taste farinaceous.

Spore deposit very dark purple brown.

Spores $7-9.8 \times 4-5.3(-5.7) \times 4-5.1 \mu$, usually $8-8.5 \times 4.4-5 \mu$, but those from 2-spored basidia $10-11.2(-12) \times 5.7 \mu$, generally terete, only a small minority very slightly broader in face than in side view, ellipsoid, or elliptic in face view and inequilateral in side view, pale tawny to olive fuscous in KOH, truncate with an apical pore, smooth; basidia $15-28 \times 5.2-7.5 \mu$, either all 4-spored, or some 2-spored, often constricted in mid-portion, hyaline in KOH; pleurocystidia none, or present only near gill edge, and then similar to cheilocystidia; cheilocystidia forming a broad sterile band at gill edge (which is heteromorphous), $18-35 \times 4.2-6.7 \mu$, hyaline, with homogeneous contents, narrowly fusoid-ventricose, subulate, or ampullaceous, neck $1-2.2 \mu$ broad and, if ampullaceous, $7-20 \mu$ long, the tip sometimes slightly thickened to almost subcapitate ($1.7-2.2 \mu$ diameter), otherwise acute to obtuse, sometimes bifurcate; subhymenium seemingly cellular, but consisting of very irregularly shaped generally rather short very small elements, stramineous-melleous; hymenopodium of axial filamentous light stramineous-melleous hyphae $2-6.5 \mu$ in diameter; gill trama not clearly differentiated in mediostratum and lateral stratum, regular, consisting of elongated hyphae $6-24 \mu$ thick with $0.7-1.5 \mu$ thick walls, melleous hyaline varying

to pale brownish (in KOH); epicutis a gelatinous pellicle, not very broad, consisting of 2–4.5 μ thick hyaline (rare individual hyphae sometimes stramineous) filamentous hyphae which are loosely arranged; dermatocystidia none; hypodermium more irregular than epicutis, forming a cutis of compactly arranged short hyphal cells with brownish walls, but without any conspicuous incrusting pigment, hyphae 6–12 μ in diameter; this layer gradually merging below into the paler interwoven floccose trama of the pileus; clamp connections present.

Solitary or cespitose on debris of hardwood trees, especially *Betula* and *Acer* but also on their logs rotting on the ground. It fruits during the summer, more rarely in fall in the eastern and mid-western states of the U.S.A. and in Canada (Ontario), south to North Carolina.

Material studied: Canada, Ontario: Petawawa Exp. Forest, *Smith* 26312 (MICH). U.S.A., Maine: near Guerette, *Bigelow* 3531 (MICH). New York: Catlin Lake, Adirondack Mts., *Smith* 219 (MICH); *C. H. Peck*, TYPE (NYS, NY). North Carolina: Indian Creek, Great Smoky Mts., *Hesler* 10166 (MICH); *Smith & Hesler* 17415 (MICH). Flat Creek, *Smith* 10586 (MICH). Ohio: Cleveland, *Walters* 186 (MICH). Tennessee: Grassy Patch, Great Smoky Mts. Nat. Park, *Smith* 10545 (MICH). Michigan: Pontiac, *Smith* 7268 (MICH); common around Pellston, Mackinaw City, *Smith* 22186, 23459, 23460, 32893, 33648, 33824, 33825, 33933, 35872, 42103, 43053 (all MICH); *Thiers* 3523 (MICH); Taquamenon Falls State Park, *Smith* 36916, 37181, 37428, 39442, 41656, 41721, 41722, 41985, 41988, 42235, 49910, 49934, 49935, 49936, 49948, 49952, 49967, 50312; *Thiers* 3214 (all MICH).

The blue to greenish stains may be slow in developing but they usually show in a few hours.

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