

= *Psilocybe aztecorum* =

Psilocybe aztecorum is a species of psilocybin mushroom in the family Hymenogastraceae . Known only from central Mexico , the fungus grows on decomposing woody debris and is found in mountainous areas at elevations of 3 @, @ 200 to 4 @, @ 000 m (10 @, @ 500 to 13 @, @ 100 ft) , typically in meadows or open , grassy forests associated with Hartweg 's pine (*Pinus hartwegii*) . The mushrooms have convex to bell @-@ shaped caps 1 @. @ 5 ? 2 cm (0 @. @ 6 ? 0 @. @ 8 in) in diameter , atop slender cylindrical stems that are up to 7 @. @ 5 cm (3 @. @ 0 in) long . The color of the caps changes with variations in hydration , ranging from dark chestnut brown to straw yellow or whitish when dry . The base of the stem is densely covered with conspicuous white rhizomorphs , a characteristic uncommon amongst *Psilocybe* species .

The species was first reported by French mycologist Roger Heim in 1956 as a variety of *Psilocybe mexicana* before he officially described it under its current name a year later . Named for its association with the Nahua people also called Aztecs , *P. aztecorum* may have been one of the sacred mushroom species , or *teonanácatl* (A Nahuatl word translated variously as " sacred mushroom " or " flesh of the gods ") , reported in the codices of 16th @-@ century Spanish chronicler Bernardino de Sahagún . The mushrooms are still used for spiritual ceremonies by Nahua Indians in the Popocatepetl region , although this traditional usage is waning . The variety *P. aztecorum* var. *bonetii* has smaller spores than the main variety , and is found at lower elevations with Montezuma pine (*Pinus montezumae*) and sacred fir (*Abies religiosa*) . *P. aztecorum* may be distinguished from similar temperate species such as *P. baeocystis* and *P. quebecensis* by their ranges , and by differences in the morphology of microscopic structures like cystidia .

= = Taxonomy and nomenclature = =

The species was first mentioned by French mycologist Roger Heim in 1956 based on material collected by American ethnomycologist R. Gordon Wasson in Paso de Cortés , on the slopes of Popocatepetl mountain in Mexico . Heim originally named the species as a variety of *Psilocybe mexicana* ; limited to dried mushroom material for analysis , he only described the spores , which he explained were " relatively longer and narrower than that of *Psilocybe mexicana* " . A year later , Heim renamed the fungus *Psilocybe aztecorum* and officially described it , in addition to several other Mexican *Psilocybe* taxa . Some of these mushrooms , including *P. aztecorum* , were illustrated in the popular American weekly magazine *Life* (" Seeking the Magic Mushroom ") , in which Wasson recounted the psychedelic visions that he experienced during the divinatory rituals of the Mazatec people , thereby introducing psilocybin mushrooms to Western popular culture .

In 1978 , Mexican mycologist and *Psilocybe* specialist Gastón Guzmán emended the description of *P. aztecorum* to include the color variation of the cap resulting from its strongly hygrophanous nature , the mycenoid form , the rhizoids at the base of the stem , the lignicolous habitat , and the size of the spores ? all features that he thought were either confused , or not sufficiently detailed , in Heim 's original description . In the same publication , Guzmán also characterized the variety *P. aztecorum* var. *bonetii* , distinguished from the main variety by its smaller spores . He had originally described this variant as a separate species , *Psilocybe bonetii* , in 1970 . Further , Guzmán later published *Psilocybe natarajanii* , originally described by him from Tamil Nadu in southern India , as a synonym of *P. aztecorum* var. *bonetii* ; this putative synonymy , however , is confirmed by neither MycoBank nor Index Fungorum . Guzmán called the main variety *P. aztecorum* var. *aztecorum* ; for this reason , the species authority is often cited as " *P. aztecorum* var. *aztecorum* R. Heim emend . Guzmán " .

Psilocybe aztecorum is the type species of Guzmán 's section *Aztecorum* , a group of bluing (i.e. , psilocybin @-@ containing) *Psilocybe* mushrooms characterized by having a strongly hygrophanous cap that dries to brown or brownish white when dry ; spores that appear asymmetrical when seen in side view ; and pleurocystidia that , when present , are hyaline (translucent) . Other species classified in section *Aztecorum* are *P. baeocystis* and *P. quebecensis* .

The specific epithet *aztecorum* refers to the Aztec Indians of central Mexico , who used this

mushroom in traditional ceremonies long before the Spanish came to America . The variety *P. aztecum* var. *bonneti* is named after Dr. Federico Bonet (died 1980) , emeritus professor of the Escuela Nacional de Ciencias Biológicas , who assisted Guzmán with his doctoral studies . The popular names of *P. aztecum* are niños or niños (children or little children) , or in the Nahuatl language *apipiltzin* which means niños del agua (" children of the water ") , alluding to their habitat along ravines .

= = Description = =

The cap is convex to bell @-@ shaped , sometimes developing a broad umbo before expanding and flattening in age ; it reaches a diameter of 1 @. @ 5 ? 2 cm (0 @. @ 6 ? 0 @. @ 8 in) . In maturity , the cap eventually forms a central depression , and , in some old specimens , opens into the hollow stem . The cap surface is slimy to the touch , and has translucent striations along the margin when moist . The cap is strongly hygrophanous , meaning that it will change color depending on its level of hydration . The color ranges from yellowish @-@ brown to golden yellow in young button forms to brownish @-@ gray in age , with greenish @-@ gray tints on the margin . The color later changes to whitish from the center to the margin , finally remaining completely white ; dried specimens are straw colored to pale brownish . In contrast to most psilocybin mushrooms , the cap of *P. aztecum* does not have a strong bluing reaction upon injury ? only the margin stains slightly green @-@ blue .

The gills are adnate (broadly attached to the stem slightly above the bottom of the gill) or adnexed (reaching the stem , but not attached to it) , and are light violet gray to dark violet brown . They are either uniform in color , or have whitish edges . The hollow stem is 5 @. @ 5 to 7 @. @ 5 cm (2 @. @ 2 to 3 @. @ 0 in) by 3 to 4 mm (0 @. @ 12 to 0 @. @ 16 in) thick , equal in width throughout or thicker at the top , cylindric or sometimes flattened , and either straight or with turns and windings . Its surface is smooth , silky @-@ fibrillose , whitish to greyish , and stains blue @-@ green irregularly when touched or in age . The base of the stem is densely covered with well @-@ developed white rhizomorphs . Young mushrooms have a white cobweb @-@ like partial veil that does not last long before it disappears , although it sometimes remains as a non @-@ permanent ring on the upper part of the stem . The flesh is whitish to yellowish or reddish @-@ yellow in the cap , or reddish @-@ brown in the stem , and shows little or no bluing reaction to injury . Like most of the bluing *Psilocybe* mushrooms , the odor and taste of *P. aztecum* is slightly farinaceous (similar to freshly ground flour) in fresh specimens ; dried specimens have a more intense odor . A drop of dilute potassium hydroxide (KOH) stains the cap , stem , and flesh reddish @-@ brown ; sometimes , the stem does not stain or stains slightly yellowish red . The spore print is blackish @-@ violet .

= = Microscopic characteristics = =

The spores are elongated @-@ ellipsoid in face view , roughly terete (more or less cylindrical but usually tapering at both ends) , slightly inequilateral or asymmetrical in side view ? the so @-@ called " mango " form . They typically have dimensions of 12 ? 14 by 6 @. @ 6 ? 7 @. @ 7 by 6 ? 7 @. @ 5 ?m , although some spores have irregular shapes and are strongly elongated , up to 23 ?m . Spores are thick @-@ walled (generally between 1 ? 1 @. @ 5 ?m) , dark yellowish @-@ brown , and have a broad germ pore . The variety *bonetii* has smaller spores measuring 10 ? 13 by 6 ? 7 @. @ 5 by 6 ? 7 ?m .

The basidia (spore @-@ bearing cells) measure 24 ? 33 by 6 @. @ 6 ? 8 @. @ 8 ?m , and may be attached to anywhere from one to four spores , although four @-@ spored basidia are most common . They are hyaline to sometimes somewhat yellowish , club @-@ shaped or roughly cylindrical , and some have a slight constriction around the middle . The cheilocystidia (cystidia on the edge of a gill) are abundant , forming a sterile band on the gill edge . They are hyaline , fusoid @-@ ampullaceous (with a shape ranging from a spindle to a swollen bottle) , with dimensions of 20 ? 45 by 5 ? 8 @. @ 2 ?m , and have a filamentous neck measuring 6 ? 11 by 1 @. @ 6 ? 2 @. @

5 μ m . The pleurocystidia (cystidia on the gill face) are scattered , similar to the cheilocystidia in form and size , hyaline , and some have bifurcated or branched necks .

The subhymenium (a layer of cells immediately below the hymenium) consists of spherical cells that are interwoven with hyphae ; this layer is hyaline to yellowish or brownish , and does not have pigment crusted on the walls of the hyphae . The epicutis (the upper of two layers of the cap cuticle) is made of a thin gelatinous layer of hyaline or brownish hyphae measuring 1 @. @ 5 ? 2 @. @ 5 μ m in diameter . The hypodermium (the cuticle tissue layer under the epicutis) is hyaline , and has elongated to roughly spherical hyphae that are 10 ? 18 μ m in diameter . Clamp connections are present in the hyphae of *P. aztecorum* .

= = = Similar species = = =

Psilocybe pseudoaztecorum , found in India , differs from *P. aztecorum* in the morphology of the pleurocystidia and cheilocystidia . The characteristic filamentous neck present in the cystidia of *P. aztecorum* is absent in *P. pseudoaztecorum* . *P. pseudoaztecorum* had been previously described by K. Natarajan and N. Raman as *P. aztecorum* , but they published the taxon with a new name after consultation with Guzmán . Fresh specimens of *P. aztecorum* resemble *P. pelliculosa* , but this latter species is found only in the Pacific Northwest region of the United States and Canada . Like *P. aztecorum* , the caps of the South African species *P. natalensis* also bleach to nearly white when dried . The closely related *P. baeocystis* also bleaches in color to white when dry . Found in northwest North America from British Columbia to Washington and Oregon , *P. baeocystis* has thinner cheilocystidia than *P. aztecorum* (typically measuring 20 ? 32 by 4 @. @ 4 ? 6 μ m) and its pleurocystidia , when present , are found only near the gill edge . *P. quebecensis* , known only from Quebec , Canada , has pleurocystidia measuring 12 ? 25 by 5 ? 10 μ m . Although the phylogeny of the species comprising section *Aztecorum* is not known with certainty , Guzmán has suggested that *P. aztecorum* was the ancestor of *P. baeocystis* in northwestern North America and of *P. quebecensis* in northeastern North America .

= = Habitat and distribution = =

A lignicolous species , *Psilocybe aztecorum* lives in and decays dead wood , leaves , sticks , or other similar organic debris . Mushrooms typically fruit in groups of 5 to 20 , sometimes in bundles . Usual substrates include wood debris buried in soil , twigs or very rotten logs , and , rarely , pine cones . The mushroom is found in woodlands (a low @-@ density forest or wooded area that allows sunlight to penetrate to the forest floor) containing Hartweg 's pine (*Pinus hartwegii*) in addition to grasses such as *Festuca tolucensis* and *Muhlenbergia quadridentata* , and the herbaceous plant *Alchemilla procumbens* , at elevations of 3 @, @ 200 ? 4 @, @ 000 m (10 @, @ 500 ? 13 @, @ 100 ft) . Heim found the type specimens at an altitude of 3 @, @ 500 m (11 @, @ 500 ft) in an alpine pine forest . *P. aztecorum* fruits from August to October .

Psilocybe aztecorum is known only from the high mountains of central Mexico , such as Sierra Nevada , Nevado de Toluca , and La Malinche in the States of Mexico , Puebla , and Tlaxcala . According to Guzmán , it is likely that the species also grows in other areas with high mountains , such as the States of Nuevo Leon , Veracruz , Colima , and Chiapas , which have ecological conditions similar to those of the known localities . Variety *bonetii* grows in the same substrata as the type variety , mainly on humus , but only in forests with Montezuma pine (*Pinus montezumae*) and sacred fir (*Abies religiosa*) , between 2 @, @ 000 ? 3 @, @ 300 m (6 @, @ 600 ? 10 @, @ 800 ft) elevation ; it has not been recorded from Hartweg 's pine forests . Also known only from Mexico , in the states of Mexico and Morelos , and in the Federal District , *P. aztecorum* var. *bonetii* usually fruits from August to November . According to Guzmán , *P. aztecorum* should be of conservation concern owing to loss of its natural habitat .

= = Entheogenic use = =

Psilocybe aztecorum contains the psychoactive compound psilocybin . In 1958 , Swiss chemist Albert Hofmann reported a relatively low concentration of 0 .02 % psilocybin , but this analysis was performed on two 100 year old specimens . Jonathan Ott and Guzmán indicated the presence of psilocybin in the variety *bonartii* . In terms of psychoactive potency , Paul Stamets rates *P. aztecorum* as " moderately to highly active " .

The statue of the Aztec " god of flowers " , Xochipilli , a 16th century stone effigy unearthed on the side of the volcano Popocatepetl , depicts a single figure seated cross legged upon a temple like base ; his body is covered in carvings of sacred and psychoactive organisms . Circular patterns on his kneecaps , right forearm , and headdress have been interpreted by R. Gordon Wasson as stylized fruit bodies of *Psilocybe aztecorum* . Wasson says that the convex shape and incurved margins depicted in these images show the mushroom caps just before maturity . *P. aztecorum* is , in addition to *P. caerulescens* , one of two mushrooms thought to be the species described by 16th century Spanish chronicler Bernardino de Sahagún as the *teonanácatl* . The word *teonanácatl* (Nahuatl pronunciation : [teoˈnaːnakat͡ɬ]) has been variously translated as " sacred or divine mushroom " or as " flesh of the gods " . These mushrooms , considered holy sacraments by the Aztecs , were consumed during spiritual and divinatory rituals to induce hallucinatory visions .

Psilocybe aztecorum is still used ceremonially by the indigenous people of Oaxaca , and by Nahua people in the Popocatepetl region , although this usage is gradually diminishing . Traditional folk healers , or curanderos , maintain familiarity with psychoactive mushrooms (and other mind altering plants used in ceremonial rituals) , and diagnose illnesses by having the client ingest the mushrooms . One Mixe curandero initiation ritual involves ingestion of mushrooms following a period of " abstinence from talking , sexual intercourse , and all foods except nuts for three days , whereupon the individual goes up to a mountain , subsists on nothing but a little honey , and prays to God for the power to heal . "