= Mycena aurantiomarginata =

Mycena aurantiomarginata , commonly known as the golden @-@ edge bonnet , is a species of agaric fungus in the family Mycenaceae . First formally described in 1803 , it was given its current name in 1872 . Widely distributed , it is common in Europe and North America , and has also been collected in North Africa , Central America , and Japan . The fungus is saprobic , and produces fruit bodies (mushrooms) that grow on the floor of coniferous forests . The mushrooms have a bell @-@ shaped to conical cap up to 2 cm (0 @.@ 8 in) in diameter , set atop a slender stipe up to 6 cm (2 @.@ 4 in) long with yellow to orange hairs at the base . The fungus is named after its characteristic bright orange gill edges . A microscopic characteristic is the club @-@ shaped cystidia that are covered with numerous spiky projections , resembling a mace . The edibility of the mushroom has not been determined . M. aurantiomarginata can be distinguished from similar Mycena species by differences in size , color , and substrate . A 2010 publication reported the discovery and characterization of a novel pigment named mycenaaurin A , isolated from the mushroom . The pigment is responsible for its color , and it has antibiotic activity that may function to prevent certain bacteria from growing on the mushroom .

= = Taxonomy = =

The species , originally named Agaricus marginatus by the Danish naturalist Heinrich Christian Friedrich Schumacher in 1803 , has several synonyms . Elias Magnus Fries renamed it Agaricus aurantio @-@ marginatus in his 1821 Systema Mycologicum , while Christiaan Hendrik Persoon called it Agaricus schumacheri in 1828 . Although Schumacher had the earliest publication date , Fries 's name is sanctioned , and so the specific epithet he used is given nomenclatural precedence . French mycologist Lucien Quélet transferred the species to the genus Mycena in 1872 . In 1930 Karel Cejp considered it to be a variety of Mycena elegans .

According to Alexander H. Smith 's organization of the genus Mycena , M. aurantiomarginata is classified in section Calodontes , subsection Granulatae , which contains species with roughened cheilocystidia (cystidia on gill edges) , such as M. rosella , M. flavescens , M. elegans , and M. strobilinoides . In his 1992 study of Mycena , Dutch mycologist Rudolph Arnold Maas Geesteranus put M. aurantiomarginata in the section Luculentae , characterized by species with an olive to yellowish @-@ olive and moist cap , pallid to gray @-@ olive gills with bright orange margins , brownish to grayish @-@ olive stipes , white spore deposit , and spiny cystidia . M. aurantiomarginata was included in a 2010 molecular analysis focused on clarifying the phylogenetic relationships between Northern European species in the section Calodontes . The results suggested that , based on the similarity of nuclear large subunit ribosomal DNA sequences , the fungus is closely related to M. crocata and M. leaiana . This conclusion was previously corroborated by research that used molecular analysis to demonstrate that several Mycena species can be mycorrhizal partners of the orchid Gastrodia confusa .

The specific epithet aurantiomarginata is Latin , and refers to the orange edges of its gills (aurantius , " orange " ; marginata , " bordered ") . In the United Kingdom , the mushroom is commonly known as the " golden @-@ edge bonnet " .

= = Description = =

The cap of M. aurantiomarginata ranges in shape from obtusely conic to bell @-@ shaped , and becomes flat in maturity , reaching diameters of 0 @.@ 8 ? 2 @.@ 0 cm (0 @.@ 3 ? 0 @.@ 8 in) . The cap color is variable , ranging from dark olive fuscous (dark brownish @-@ gray) to yellowish @-@ olive in the center , while the margin is orangish . Alexander H. Smith , in his 1947 monograph of North American Mycena species , stated that the caps are not hygrophanous (changing color depending on the level of hydration) , while Mycena specialist Arne Aronsen says they are . The overall color fades as the mushroom ages . The surface is moist , and young individuals are covered with fine whitish powder , but this soon sloughs off to leave a polished surface that develops radial

grooves in maturity . The flesh is thin (about 1 mm thick in the center of the cap) and flexible .

Gills are adnate with a decurrent tooth (where the gills curve up to join the stipe but then , close to the stipe , the margin turns down again) , and initially narrow but broaden when old . They are pallid to grayish @-@ olive with bright orange edges . Smith noted that the edge color may spread to the gill faces in some specimens , because the pigment , rather than being encrusted on the walls of the cystidia , is found in the cytosol and therefore more readily diffusible . The gills are spaced close together , with between 16 and 26 gills reaching the stipe , and there are up to three tiers of interspersed lamellulae (short gills that do not extend fully from the cap edge to the stipe) . The cylindrical stipe is 3 ? 6 cm (1 @.@ 2 ? 2 @.@ 4 in) long by 0 @.@ 1 ? 0 @.@ 2 cm (0 @.@ 04 ? 0 @.@ 08 in) thick , hollow , and stiff but flexible ; it is somewhat thicker at the base . It has a brownish to grayish @-@ olive color that is sometimes tinged with shades of orange . The surface is smooth except for orange powder near the top , while the base is covered with stiff orange hairs . Smith reports the mushroom tissue to have no distinctive taste or odor , while Aronsen says the odor is " very conspicuous ; sweet , fruity , often experienced as farinaceous or faintly of anise " . Like many small Mycena species , the edibility of the mushroom is unknown , as it is too insubstantial to consider collecting for the table .

The spores are elliptic , smooth , and amyloid , with dimensions of 7 ? 9 by 4 ? 5 ?m . The basidia (spore @-@ bearing cells of the hymenium) are club @-@ shaped , four @-@ spored , and measure 25 ? 32 by 5 @.@ 5 ? 7 ?m . Pleurocystidia and cheilocystidia (cystidia on the gill faces and edges , respectively) are abundant and similar in morphology : club @-@ shaped to somewhat capitate (with a head) , the tops sparsely to densely covered with small spines (said to resemble a mace) , filled with a bright orange pigment , and measuring 28 ? 36 by 7 ? 12 ?m . The flesh of the cap is covered with a cuticle , on the surface of which are found scattered cystidia similar to those on the gills . Directly beneath the cuticle is a layer of enlarged cells , and beneath this are filamentous hyphae . Clamp connections are present in the hyphae .

Mycena aurantiomarginata uses a tetrapolar mating system , whereby genes at two different locations on the chromosomes regulate sexual compatibility , or mating type . This system prevents self @-@ fertilization and ensures a high degree of genotypic diversity . When the fungal mycelia is grown in culture on a petri dish , the colonies are white , odorless , and typically have a central patch of congested aerial hyphae that grow upward from the colony surface , which abruptly become flattened to submerged , and occasionally form faint zone lines . The hyphae commonly form deposits of tiny amorphous crystals where they contact other mycelial fronts , especially where the hyphae are vegetatively incompatible and destroy each other by lysis .

= = = Similar species = = =

Mycena aurantiomarginata is generally recognizable in the field by its olive @-@ brown to orangish cap , bright orange gill edges , and yellowish hairs at the base of the stipe . M. elegans is similar in appearance to M. aurantiomarginata , and some have considered them synonymous . M. elegans is larger , with a cap diameter up to 3 @.@ 5 cm (1 @.@ 4 in) and stipe length up to 12 cm (4 @.@ 7 in) , darker , and has pale greenish @-@ yellow colors on the gill edges and stipes that stain dull reddish @-@ brown in age . M. leaiana is readily distinguished from M. aurantiomarginata by the bright orange color of its fruit bodies , its clustered growth on rotting wood , and the presence of a gelatinous layer on its stipe . M. strobilinoides closely resembles M. aurantiomarginata in shape , size , spore morphology , and the presence of hairs at the stipe base . It has a cap color that ranges from scarlet to yellow , and features scarlet edges on widely spaced , pale pinkish @-@ orange to yellow gills .

= = Habitat and distribution = =

Mycena aurantiomarginata is a saprobic fungus , deriving nutrients from decomposing organic matter found on the forest floor , such as needle carpets . Fruit bodies of the fungus grow scattered , in groups , or in tufts under conifers (usually spruce and fir) , and are often found on moss . In

North America , it is found in California , Washington , Oregon , and British Columbia , and the species is widely distributed in western and northern Europe . In Central America , the mushroom has been collected on the summit of Cerro de la Muerte in the Cordillera de Talamanca , Costa Rica , on leaf litter of Comarostaphylis arbutoides (a highly branched evergreen shrub or tree in the heath family) . In 2010 , it was reported from Hokkaido in northern Japan , where it was found growing on Picea glehnii forest litter in early winter . It has also been recorded from North Africa .

= = Bioactive compounds = =

In 2010 , a pigment compound isolated and characterized from fruit bodies of Mycena aurantiomarginata was reported as new to science by Robert Jaeger and Peter Spiteller in the Journal of Natural Products . The chemical , mycenaaurin A , is a polyene compound that consists of a tridecaketide (i.e. , 13 adjacent methylene bridge and carbonyl functional groups with two amino acid moieties on either end of the molecule) . The authors posit that the flanking amino acid groups are probably derived biosynthetically from S @-@ Adenosyl methionine . The tridecaketide itself contains an alpha @-@ pyrone , a conjugated hexaene , and a single alkenyl moiety . Jaeger and Spiteller suggest that mycenaaurin A might function as a defense compound , since it exhibits antibacterial activity against the Gram @-@ positive bacterium Bacillus pumilus . The chemical is only present in the fruit bodies , and not in the colorless mycelia . An earlier screening for antimicrobial activity in the fruit bodies revealed a weak ability to inhibit the growth of the fungi Candida albicans and Aspergillus fumigatus .