= Marasmius funalis =

Marasmius funalis is a species of Marasmiaceae fungus known only from Japan . The species produces small mushrooms with reddish @-@ brown caps up to 6 millimetres (0 @.@ 24 in) in diameter and dark @-@ brown , threadlike stems of up to 50 millimetres (2 @.@ 0 in) in length . The species has a number of distinctive microscopic features , including very long cystidia on the stem , visible as bristles . Described in 2002 by Haruki Takahashi , the species grows on dead wood . The closest relative of M. funalis is M. liquidambari , known from Mexico and Papua New Guinea , and it is also similar in appearance to M. hudonii and Setulipes funaliformis , the latter of which was named after M. funalis .

= = Taxonomy = =

Marasmius funalis was first described and named in a 2002 article in Mycoscience by Haruki Takahashi , based on specimens collected in 2000 . The specific name , funalis , is Latin for " rope @-@ like " , and is in reference to the shape and character of the stem . Within the genus Marasmius , the species has traits that suggest that it belongs in the section Androsacei , and , within the section , it seems most closely related to M. liquidambari . The Japanese common name for the species is Kenawatake (???) .

= = Description = =

Marasmius funalis produces fruit bodies in the form of mushrooms . Each mushroom has a convex (sometimes completely hemispherical) cap of between 2 and 6 mm (0 @.@ 08 and 0 @.@ 2 in) in diameter . Unlike the caps of other mushrooms , it does not change shape to a flatter convex with age . The cap is fairly smooth , but can have small , parallel furrows towards the edge , which are arranged radially . The colour differs slightly , depending on the age of the mushroom . While younger specimens sport reddish @-@ brown caps , they are a paler brown in older mushrooms . The cap 's surface is dry and dull , and free from hair . The threadlike stem attaches centrally to the cap , measures from 20 to 50 mm (0 @.@ 8 to 2 in) long by 0 @.@ 2 to 0 @.@ 5 mm (0 @.@ 008 to 0 @.@ 02 in) thick . It is cylindrical , but may taper slightly , and is covered in short , white hairs . The base of the stem enters the substrate , and there are no rhizomorphs visible . The majority of the stem is blackish @-@ brown , but it is a lighter brown at the very top .

The white gills can be adnate or adnexed ; that is , they can be attached to the stem by their whole depth , or only part of it . The individual gills are distantly spaced , with between 8 and 12 reaching the stem . Each gill is up to 0 @.@ 5 mm (0 @.@ 02 in) thick , and the edges are even . There are sometimes lamellulae (short gills that do not reach the cap) . There is a thin layer , up to 0 @.@ 3 mm (0 @.@ 01 in) thick , of whitish flesh in the cap . It is tough , but it can be bent without breaking . The flesh has no smell or taste .

= = = Microscopic characteristics = = =

Marasmius funalis mushrooms leave a white spore print . The individual basidiospores are ellipsoidal , and measure 6 @.@ 5 to 8 by 4 to 5 micrometres (?m) . They have thin cell walls , and they are smooth and colourless . The spores are inamyloid , meaning that they do not stain when they come into contact with iodine from Melzer 's reagent or Lugol 's solution . The spores are borne on club @-@ shaped basidia measuring 20 to 25 by 4 @.@ 5 to 7 ?m , with two spores per basidium . There are also club @-@ shaped basidioles (under @-@ developed basidia) .

The edge of the gill is sterile , made up of a mass of cystidia (cheilocystidia) . The club @-@ shaped cheilocystidia measure from 10 to 25 by 7 to 12 ?m , and sport multiple cylindrical appendages on their tips , measuring 1 to 7 by 1 to 1 @.@ 5 ?m . The cheilocystidia are colourless , with cell walls of variable thickness , and are inamyloid . There are no pleurocystidia (cystidia on the face of the gills) . The caulocystidia (cystidia in the stem) measure 60 to 200 by 4 to 7 µm . They

are cylindrical and erect , forming the visible bristles . The tip is either pointed or rounded , and the cell walls are smooth and colourless , up to 2 µm thick . They are dextrinoid , meaning they stain a reddish @-@ brown when they come into contact with iodine from Melzer 's reagent or Lugol 's solution .

The pileipellis , the top layer of hyphae in the cap , is a cutis . The cutis is made up of cylindrical hyphae between 2 and 5 µm thick . The inamyloid and thin @-@ walled hyphae are covered in brown granules . The flesh in the cap is made up of cylindrical hyphae from 4 to 7 µm wide with thin cell walls . They are all generative hyphae , and run parallel to one another . They can be either inamyloid or only weakly dextrinoid . The flesh in the gills is basically the same as the flesh in the cap , but for the fact that it is completely inamyloid . The hyphae of the stipitipellis , the uppermost layer in the stem , also form a cutis . The cylindrical hyphae making up the cutis run parallel to one another , and measure from 2 @.@ 5 to 4 @.@ 5 µm in width , with walls up to 1 µm thick . They are encrusted with a brown pigment , and are dextrinoid . The flesh of the stem is made up of generative hyphae running lengthways (that is , up and down the stem) . The cells are 5 to 8 µm wide , and are smooth and colourless ; the cell walls up to 1 µm thick . They are dextrinoid . All M. funalis hyphae lack clamp connections .

= = = Similar species = = =

Marasmius funalis differs from its closest relative , M. liquidambari , due to the presence of cheilocystidia , the lack of clamp connections and the fact that the caulocystidia of M. liquidambari do not form bristles ; instead , they are club shaped to cylindrical . The species is known from Mexico and Papua New Guinea . M. hudonii , known from Europe , is similar in appearance to M. funalis . However , the former has a cap covered in hairs or bristles , and differs microscopically ; for instance , the hyphae feature clamp connections . The Malagasy species Setulipes funaliformis was named after M. funalis due to the morphological similarities between the two . The species can be differentiated by the fact that the basidiospores of S. funalformis are slightly larger and narrower , measuring from 7 to 10 by 3 @.@ 5 to 4 @.@ 5 ?m , and the caulocystidia of M. funalis are significantly longer .

= = Distribution and ecology = =

Marasmius funalis is known only from Kawasaki , Kanagawa and Machida , Tokyo , Japan . Mushrooms grow in groups on dead plant matter , and have been recorded on Japanese cedar (Cryptomeria japonica) wood and leaf litter in woodland mostly made up of Chonowski 's hornbeam (Carpinus tschonoskii) and bamboo @-@ leaf oak (Quercus myrsinifolia) . The mushrooms can be encountered from May to July .