= Morchella frustrata =

Morchella frustrata is a later synonym of Morchella tridentina , a species originally described by Giacomo Bresadola from north Italy in 1898 . It is a species of fungus in the family Morchellaceae referred to as the mountain blond or western blond morel in North America , but commonly found throughout the Mediterranean basin . It has conical , grey to buff fruit bodies that grow up to 20 cm ( 7 @.@ 9 in ) tall and 5 cm ( 2 @.@ 0 in ) wide . Recent molecular and morphological studies have also shown Morchella frustrata to be conspecific to M. quercus @-@ ilicis , M. elatoides , M. elatoides var. elegans and M. conica var. pseudoeximia . So far , this cosmopolitan species is known from California and Oregon in North America , from Argentina and Chile in South America , from Spain , France , Cyprus , Italy and Turkey in Europe , and has also been reported from Israel and India .

= = Taxonomy = =

Morchella frustrata was described as new to science in a 2012 publication by Michael Kuo and colleagues . The report resulted from the Morel Data Collection Project , which aimed to clarify aspects of the biology , taxonomy and distribution of North American Morchella , and described 14 new morel species . The type locality was in Placer County , California . The morel was previously referred to as phylogenetic species ( i.e. , defined by DNA sequence rather than morphological characteristics ) Mel @-@ 2 in a study the year before , and informally as the " mountain blond morel " . Despite its light color , M. frustrata belongs to the Elata clade along with other black morels , including M. tomentosa and M. angusticeps . The specific epithet frustrata refers to the " frustrating combination of black and yellow morel features that characterize the species . "

In two subsequent studies , however , Richard and colleagues ( 2014 ) and Loizides and colleagues ( 2015 ) used DNA analysis to determine that this species is identical to morels collected in southern Europe , matching the original description of Morchella tridentina by Bresadola . This name therefore takes precedence over M. frustrata .

= = Description = =

The fruit bodies are often rufescent and 9 ? 20 cm ( 3 @.@ 5 ? 7 @.@ 9 in ) high . The conical cap is 4 ? 6 cm ( 1 @.@ 6 ? 2 @.@ 4 in ) high and 2 @.@ 5 ? 4 cm ( 1 @.@ 0 ? 1 @.@ 6 in ) wide at the widest point . The cap surface features pits and ridges , which are formed from the intersection of 16 ? 22 primary vertical ridges and few shorter , secondary vertical ridges , with frequent , sunken , horizontal ridges . The cap is attached to the stipe with a distinct sinus about 2 ? 4 mm deep and 2 ? 4 mm wide . The smooth , splitting ridges remain persistently pale throughout the maturity process , easily distinguishing this species from other species in section Elata , or black morels , which have ridges that typically darken with age . Pits are usually elongated vertically . They are smooth , dull grayish to pale yellowish or nearly whitish when young , later becoming pale tan to pale pinkish tan . The stipe is 2 ? 6 cm ( 0 @.@ 8 ? 2 @.@ 4 in ) high by 1 ? 4 cm ( 0 @.@ 4 ? 1 @.@ 6 in ) wide and is more or less equal in width throughout its length or sometimes thicker at the base . Its whitish surface is smooth or finely mealy with whitish granules . The flesh is whitish and measures 1 ? 2 mm thick in the hollow cap . The sterile inner surface of the cap is whitish and pubescent ( having soft , short and erect " hairs " ) .

The ascospores are smooth , elliptical , and measure 20 ? 26 by 13 ? 18 µm . Asci ( spore @-@ bearing cells ) are cylindrical , eight @-@ spored , hyaline ( translucent ) when mounted in dilute ( 2 % ) potassium hydroxide ( KOH ) , and measure 225 ? 330 by 15 ? 25 µm . Paraphyses are cylindrical to capitate or moniliform , measuring 95 ? 250 long by 10 ? 25 µm wide , and are septate . Their tips are rounded to somewhat club @-@ shaped or infrequently somewhat fuse @-@ shaped . Elements on the sterile ridges are 50 ? 175 by 12 @.@ 5 ? 20 µm , and septate . The terminal cells are club @-@ shaped or nearly so .

Although the edibility of M. frustrata was not mentioned in the original description , Kuo has

elsewhere written of the edibility of North American Morchella . In general , morels should not be eaten raw , as they can trigger allergic reactions in susceptible individuals . Their flavor is enhanced after they are fried , stuffed , or dried .

= = = Similar species = = =

This species is very similar to Morchella rufobrunnea , another rufescent , cosmopolitan species with pale colours , which is nonetheless found in urban and suburban areas . The latter is distinguished by an adnate cap lacking a sinus and a distinct dark pruinescence on the stem , more pronounced in young fruit bodies . Due to its similar light coloration , M. frustrata may also be confused with Morchella esculentoides ; as Kuo states , " it looks like a black morel with the colors of a yellow morel . " The vertically arranged pits and ridges , as well as the slight indentation where the cap meets the stem on M. frustrata , however , more closely resemble the black morels such as M. elata . M. snyderi is somewhat similar in appearance to young specimens of M. frustrata , but mature specimens of the former species can be distinguished by the brown to black ridges on the cap , and the ridged and pocketed stipe .

= = Habitat and distribution = =

Morchella frustrata fruit bodies grow solitary , scattered , or in small groups in spring , in mountainous forests and maquis . The exact trophic status of the fungus is not yet known with certainty , but it is suspected to be fucaltitive mycorrhizal or biotrophic . Tree species associated with the fungus include pacific madrone ( Arbutus menziesii ) , oaks ( Quercus spp . ) , Douglas fir ( Pseudotsuga menziesii ) , ponderosa pine ( Pinus ponderosa ) , sugar pine ( Pinus lambertiana ) , and white fir ( Abies concolor ) . In Europe it is often found with holm oak ( Quercus ilex ) , strawberry trees ( Arbutus andrachne ) , olive trees ( Olea europaea ) , Spanish fir ( Abies pinsapo ) , Silver fir ( Abies alba ) and Scot 's pine ( Pinus sylvestris ) . Although it was originally hypothesized that collections of M. frustrata from Turkey might have been recently introduced from North America , numerous collections reported since from remote and undisturbed areas in the Mediterranean and the Alps ( including Bresadola 's original collection from Trentino ) , suggest a long @-@ time and well @-@ established presence of this species in Europe . Kuo suggests that it might be also widely distributed in western North America , but so far has only been confirmed to be present in Oregon and California .