

= Rhodotus =

Rhodotus is a genus in the fungus family Physalacriaceae . It is a monotypic genus and consists of the single mushroom species *Rhodotus palmatus* , known in the vernacular as the netted rhodotus , the rosy veincap , or the wrinkled peach . This uncommon species has a circumboreal distribution , and has been collected in eastern North America , northern Africa , Europe , and Asia ; declining populations in Europe have led to its appearance in over half of the European fungal Red Lists of threatened species . Typically found growing on the stumps and logs of rotting hardwoods , mature specimens may usually be identified by the pinkish color and the distinctive ridged and veined surface of their rubbery caps ; variations in the color and quantity of light received during development lead to variations in the size , shape , and cap color of fruit bodies .

The unique characteristics of *R. palmatus* have made it difficult for taxonomists to agree on how it should be classified , resulting in an elaborate taxonomical history and an extensive synonymy . First named *Agaricus palmatus* by Bulliard in 1785 , it was reclassified into several different genera before becoming *Rhodotus* in 1926 . The familial placement of the genus *Rhodotus* within the order Agaricales has also been subject to dispute , and the taxon has been transferred variously to the families Amanitaceae , Entolomataceae , and Tricholomataceae . More recently , molecular phylogenetics analysis has helped determine that *Rhodotus* is most closely related to genera in the Physalacriaceae .

= = History and etymology = =

The type species of genus *Rhodotus* was originally described as *Agaricus palmatus* in 1785 by French botanist Jean Bulliard ; mycologist Elias Magnus Fries later included it under the same name in his *Systema Mycologicum* . It was transferred to the then newly described genus *Rhodotus* in a 1926 publication by French mycologist René Maire . The specific epithet is derived from the Latin *palmatus* , meaning " shaped like a hand " ? possibly a reference to the resemblance of the cap surface to the lines in the palm of a hand . Common names for *R. palmatus* include the netted rhodotus , the rosy veincap , and the wrinkled peach .

= = = Synonymy = = =

French botanist Claude Gillet called the species *Pleurotus subpalmatus* in 1876 . A 1986 paper reported that the species *Pleurotus pubescens* , first described by American mycologist Charles Horton Peck in 1891 , was the same as *Rhodotus palmatus* , making their names synonymous . According to the same publication , another synonym is *Lentinula reticeps* , described by William Alphonso Murrill in 1915 , who thought it to be synonymous with *Agaricus reticeps* (described by Montagne in 1856) , *Agaricus reticulatus* (Johnson , 1880) , *Agaricus alveolatus* (Cragin , 1885) , *Pluteus alveolatus* (Saccardo , 1887) , and *Panus meruliiiceps* (Peck , 1905) .

= = Taxonomy = =

The placement of the genus *Rhodotus* in the order Agaricales is uncertain , and various authors have offered solutions to the taxonomic conundrum . In 1951 , Agaricales specialist Rolf Singer placed *Rhodotus* in the Amanitaceae because of similarities between the tribes Amaniteae and Rhodoteae , such as spore color and ornamentation (modifications of the spore wall that result in surface irregularities) , structure of the hyphae and trama , and chlamydospore production during culture growth .

In 1953 , French mycologists Robert Kühner and Henri Romagnesi placed *Rhodotus* in the family Tricholomataceae ? a traditional " wastebasket taxon " ? on the basis of spore color . In 1969 , Besson argued for the placement of *Rhodotus* with the Entolomataceae after studying the ultrastructure of the spores . By 1986 , Singer had revised the placement of *Rhodotus* in his latest edition of *The Agaricales in Modern Taxonomy* , noting that " It has formerly been inserted in the

family Amanitaceae but is obviously closer to tribus Pseudohiatuleae of the Tricholomataceae . " Tribe Pseudohiatuleae included such genera as Flammulina , Pseudohiatula , Cyptotrama , and Callistodermatium . In 1988 , a proposal was made to split the Tricholomataceae into several new families , including a family , Rhodotaceae , to contain the problematic genus .

The use of molecular phylogenetics has helped to clarify the proper taxonomic placement of Rhodotus . Studies of the ribosomal DNA sequences from a wide variety of agaric fungi have corroborated Kühner and Romagnesi 's placement of Rhodotus in the Tricholomataceae as then understood . A large scale phylogenetic analysis published in 2005 showed Rhodotus to be in the " core euagarics clade " , a name given to a grouping of gilled mushrooms corresponding largely to the suborder Agaricineae as defined by Singer (1986) , but also including taxa that were traditionally classified in the Aphyllophorales (e.g. , Clavaria , Typhula , Fistulina , Schizophyllum , etc .) and several orders of Gasteromycetes (e.g. , Hymenogastrales , Lycoperdales , Nidulariales) . These results corroborated a previous study which showed Rhodotus to be part of a clade containing species such as Cyptotrama asprata , Marasmius trullisatus , Flammulina velutipes , Xerula furfuracea , Gloiocephala menieri , and Armillaria tabescens . The genera containing these latter species have been reassigned to the family Physalacriaceae ; as of 2009 , both Index Fungorum and MycoBank also list Rhodotus as belonging to the Physalacriaceae .

= = Characteristics = =

The fruit body of Rhodotus has a cap , and stem without a ring or volva . The cap initially assumes a convex shape before flattening somewhat with age , and typically reaches widths of 2 ? 6 centimeters (0 @. @ 8 ? 2 @. @ 4 in) . The edges of the cap are rolled inwards , and the cap surface typically has a conspicuous network of lightly colored ridges or veins that outline deep and narrow grooves or pits ? a condition technically termed sulcate or reticulate . Between the ridges , the surface color is somewhat variable ; depending on the lighting conditions experienced by the mushroom during its development , it may range from salmon @-@ orange to pink to red . The texture of the cap surface is gelatinous , and the internal flesh is firm but rubbery , and pinkish in color .

The gills have an adnate attachment to the stem , that is , broadly attached to the stem along all or most of the gill width . The gills are thick , packed close to each other , with veins and color similar to , but paler than , the cap . Some of the gills do not extend the full distance from the edge of the cap to the stem . These short gills , called lamellulae , form two to four groups of roughly equal length . The stem is 1 @. @ 5 ? 3 @. @ 0 cm (0 @. @ 6 ? 1 @. @ 2 in) tall and 0 @. @ 4 ? 0 @. @ 6 cm (0 @. @ 16 ? 0 @. @ 24 in) thick (usually slightly larger near the base) , and may be attached to the underside of the cap in a central or lateral manner . Like the cap color , stem size is also affected by the type of light received during fruit body maturation .

In nature , Rhodotus palmatus is sometimes seen " bleeding " a red- or orange @-@ colored liquid . A similar phenomenon has also been observed when it is grown in laboratory culture on a petri dish : the orange @-@ colored drops that appear on the mat formed by fungal mycelia precede the initial appearance of fruit bodies . The mature fruit body will turn green when exposed to a 10 % aqueous solution of Iron (II) sulfate (FeSO_4) , a common mushroom identification test known as iron salts .

= = = Microscopic features = = =

In deposit , the spore color of Rhodotus palmatus has been described most commonly as pink , but also as cream colored . Viewed microscopically , the spores of Rhodotus have a roughly spherical shape , with dimensions of 6 ? 7 @. @ 2 by 5 @. @ 6 ? 6 @. @ 5 μm ; the spore surface is marked with numerous wart @-@ like projections (defined as verrucose) , typically 0 @. @ 5 ? 0 @. @ 7 μm long . The spores are non @-@ amyloid ? unable to take up iodine stain in the chemical test with Melzer 's reagent .

The spore @-@ bearing cells , the basidia , are club @-@ shaped and 4 @-@ spored , with dimensions of 33 @. @ 6 ? 43 @. @ 2 by 5 @. @ 6 ? 8 μm . Although this species lacks cells called

pleurocystidia (large sterile cells found on the gill face in some mushrooms) , it contains abundant cheilocystidia (large sterile cells found on the gill edge) that are $27 \times 2 - 48 \times 4 - 8 \times 8 \mu\text{m}$ in size . Clamp connections are present in the hyphae . The outer cellular layer of the cap cuticle is made of bladder shaped , thick walled hyphae , each individually supported by a small stalk that extends down into a " gelatinized zone " .

Chlamydospores are asexual reproductive units made by some fungi that allow them to exist solely as mycelium , a process which helps them survive over periods unsuitable for growth ; *Rhodotus* was shown experimentally to be capable of producing these structures in 1906 . The chlamydospores of *Rhodotus* are thick walled cells that develop from single hyphal compartments , and have dimensions of 12×8 by 8×6 micrometres ($0.00031 - 0.00024$ in) .

=== Edibility ===

Depending on the source consulted , the edibility of *Rhodotus palmatus* is typically listed as unknown or inedible . The species has no distinguishable odor , and a " bitter " taste , although one early description referred to the taste as " sweet " .

=== Antimicrobial activity ===

As part of a Spanish research study to evaluate the antimicrobial activity of mushrooms , *Rhodotus palmatus* was one of 204 species screened against a panel of human clinical pathogens and laboratory control strains . Using a standard laboratory method to determine antimicrobial susceptibility , the mushroom was shown to have moderate antibacterial activity against *Bacillus subtilis* , and weak antifungal activity against both *Saccharomyces cerevisiae* and *Aspergillus fumigatus* .

=== Habitat and distribution ===

Rhodotus palmatus is saprobic , meaning it obtains nutrients from decomposing organic matter . It grows scattered or clustered in small groups on rotting hardwoods , such as basswood , maple , and especially elm ; in Europe it is known to grow on horse chestnut . The mushroom prefers low lying logs in areas that are periodically flooded and that receive little sunlight , such as areas shaded by forest canopy . A pioneer species in the fungal colonization of dead wood , it prefers to grow on relatively undecayed substrates . It is often found growing on dark stained wood , especially the dried out upper parts of trunks that have lost their bark . *R. palmatus* tends to fruit in cooler and moister weather , from spring to autumn in the United States , or autumn to winter in Britain and Europe .

Described as having a circumboreal distribution , *R. palmatus* has been reported from Canada , Iran , Hungary , Italy , Poland , Slovakia , Denmark , Sweden , Norway , Germany , the area formerly known as the USSR , Korea , Japan , and New Zealand . In the United States it has been found in Indiana , and elsewhere in eastern North America . Although often described as " rare " , a 1997 study suggests that it may be relatively common in Illinois . It has been suggested that an increase in the number of dead elms , a byproduct of Dutch elm disease , has contributed to its resurgence .

=== Light requirements ===

Light at the red end of the visible spectrum has been observed to be required for the development of *R. palmatus* fruit bodies , contrary to the typical requirement for blue light seen with many other mushroom species . Fruiting occurs in the presence of green , yellow or red light with wavelengths above 500 nm , but only when blue light (under 500 nm) is absent . Consequently , phenotypic variations observed in the field ? such as size , shape , and cap color ? may be influenced by

differing conditions of light color and intensity . For example , specimens grown in the laboratory under green light had fruit bodies with short , straight stems and pale orange , large caps with well @-@ developed ridges and pits , an appearance similar to specimens found in the field that were growing under a canopy of green leaves . Laboratory @-@ grown specimens under amber light had bright orange , small caps with less pronounced reticulations ; similarly , field specimens found in the fall , after the leaves had fallen , were more orange to orange @-@ pink in color .

= = Conservation status = =

In the 1980s in Europe , increases in the levels of air pollution , as well as changing land use practices coincided with reports of declines in the populations of certain mushrooms . Consequently , a number of fungal conservation initiatives were started to better understand fungal biodiversity ; as of October 2007 , 31 European countries have produced fungal Red Lists of threatened species . *Rhodotus palmatus* is a candidate species in over half of the European fungal Red Lists , and is listed as critically endangered , endangered , or near threatened (or the equivalent) in 12 countries . In the Baltic countries Estonia , Latvia , and Lithuania , it is considered by the Environmental Protection Ministries (a branch of government charged with implementing the Convention on Biological Diversity) to be regionally extinct , reported as " extinct or probably extinct " . It was one of 35 fungal species to gain legal protection in Hungary in 2005 , making it a fineable offense to pick them .