= Sarcosphaera =

Sarcosphaera is a fungal genus within the Pezizaceae family . It is a monotypic genus , containing the single species Sarcosphaera coronaria , commonly known as the pink crown , the violet crown @-@ cup , or the violet star cup . It is a whitish or grayish cup fungus , distinguished by the manner in which the cup splits into lobes from the top downward . It is commonly found in the mountains in coniferous woods under humus on the forest floor , and often appears after the snow melts in late spring and early summer . The fungus is widespread , and has been collected in Europe , Israel and the Asian part of Turkey , North Africa , and North America . In Europe , it is considered a threatened species in 14 countries . Although several taxa have been described as Sarcosphaera species since the introduction of the genus in 1869 , most lack modern descriptions , have been transferred to the related genus Peziza , or are considered synonymous with S. coronaria .

The fruit body , typically found partially buried in soil , is initially like a fleshy hollow ball , and may be mistaken for a puffball . Unlike the latter , it splits open from the top downwards to form a cup with five to ten pointed rays , reaching up to 12 cm ( 4 @.@ 7 in ) in diameter . It is lavender @-@ brown on the inside surface , and whitish outside , but usually dingy from adhering soil . Characteristic microscopic features include asci that are amyloid ( so their tips stain blue at the tip with iodine ) , and smooth , blunt @-@ ended , ellipsoid spores with large oil droplets . Sarcosphaera coronaria ? once thought to be a good edible ? is not recommended for consumption , after several reports of poisonings causing stomach aches , and in one instance , death . The fruit bodies are known to bioaccumulate the toxic metalloid arsenic from the soil .

= = Taxonomy , classification , and phylogeny = =

The genus was first described by Bernhard Auerswald in 1869 , to accommodate the species then known as Peziza macrocalyx . Sarcosphaera coronaria was originally named Peziza coronaria by the Dutch scientist Nikolaus Joseph von Jacquin in 1778 , and underwent several name changes before being assigned its current name in 1908 by Joseph Schröter . The Greek genus name means " flesh ball " ; the Latin specific epithet , coronaria , refers to the crown @-@ like form of the open fruit body . The species is commonly known by various names , including the " crown fungus " , the " pink crown " , the " violet crown @-@ cup " , or the " violet star cup " .

Several taxa have been named as belonging to the genus Sarcosphaera over the years , but most lack modern descriptions and have not been reported since their original collections . For example , Sarcosphaera funerata was renamed by Fred Jay Seaver in 1930 based on the basionym Peziza funerata , originally described by Cooke in 1878 . Sarcosphaera gigantea was a species collected from Michigan , originally described as Pustularia gigantea by Heinrich Rehm in 1905 , and considered distinct from S. coronaria on the basis of its smaller spore size . Sarcosphaera ulbrichiana was described by Wilhem Kirschstein in 1943 . Other taxa have been reduced to synonymy with S. coronaria , or transferred to other genera . Sarcosphaera eximia ( originally Peziza eximia Durieu & Lév . 1848 , and later transferred to Sarcosphaera by René Maire ) , Sarcosphaera crassa ( considered by Zden?k Pouzar in a 1972 publication to be the correct name for S. coronaria ) and Sarcosphaera dargelasii ( originally Peziza dargelasii Gachet 1829 , transferred to Sarcosphaera by Nannfeldt ) are now considered synonyms of S. coronaria . Sarcosphaera ammophila ( originally Peziza ammophila Durieu & Mont . ) and Sarcosphaera amplissima ( originally Peziza amplissima Fr . 1849 ) have since been transferred back to Peziza . The 10th edition of the Dictionary of the Fungi ( 2008 ) considers Sarcosphaera to be monotypic , and Index Fungorum has only Sarcosphaera coronaria confirmed as valid .

In 1947 , Helen Gilkey described the genus Caulocarpa based on a single collection made in Wallowa County , Oregon . The type species , C. montana , was thought to be a truffle ( formerly classified in the now @-@ defunct Tuberales order ) because of its chambered fruit body and subterranean growth habit . It was later noted by mycologist James Trappe to strongly resemble Sarcosphaera . Thirty years later , Trappe revisited the original collection site in eastern Oregon and found fresh specimens that closely matched Gilkey 's original description . Some specimens ,

however , had opened up similar to Sarcosphaera , suggesting that the original specimens had " simply not emerged and often not opened due to habitat factors . " Microscopic examination of the preserved type material revealed the species to be Sarcosphaera coronaria ( then called S. crassa ) , and Caulocarpa is now considered a generic synonym of Sarcosphaera .

Sarcosphaera is classified in the family Pezizaceae of the order Pezizales . Phylogenetic analysis of ribosomal DNA sequences suggests that Sarcosphaera forms a clade with the genera Boudiera and Iodophanus , and that the three taxa are a sister group to Ascobolus and Saccobolus ( both in the family Ascobolaceae ) . Species in the families Pezizaceae and Ascobolaceae are distinct from other Pezizalean taxa in the positive iodine reaction of the ascus wall . In a more recent ( 2005 ) phylogenetic analysis combining the data derived from three genes ( the large subunit ribosomal rRNA ( LSU ) , RNA polymerase II ( RPB2 ) , and beta @-@ tubulin ) , Sarcosphaera was shown to be closely related to the truffle genus Hydnotryopsis , corroborating earlier results that used only the LSU rDNA sequences .

= = Description = =

Sarcosphaera is partly hypogeous ( fruiting underground ) and emerges from the ground as a whitish to cream @-@ colored hollow ball . Young specimens are covered entirely by an easily removed thin protective membrane . As it matures , it splits open to expose the inner spore @-@ bearing layer ( hymenium ) . The cup is up to 12 cm ( 4 @.@ 7 in ) in diameter , roughly spherical initially but breaking up into a series of five to ten raylike projections , which give the fruit body the shape of a crown . The outer surface of the cup is white , while the inner surface is lilac @-@ gray , although in age the color may fade to a brownish @-@ lavender color . The flesh is white , thick , and fragile . Some specimens may have a short , stubby stalk .

The spores are hyaline ( translucent ) , smooth , and ellipsoid with the ends truncate . They have dimensions of 11 @.@ 5 ? 20 by 5 ? 9 µm , and usually contain two large oil drops . The paraphyses ( sterile , filamentous cells interspersed among the asci , or spore @-@ producing cells ) are 5 ? 8 µm wide at the tip , branched , septate ( with partitions that divide the cells into compartments ) , and constricted at the septa . The asci are cylindrical , and measure 300 ? 360 by 10 ? 13 µm ; the tips of the asci stain blue with Melzer 's reagent . The finely cylindrical paraphyses have slightly swollen tips and are forked at the base .

= = = Similar species = = =

Immature , unopened fruit bodies can be mistaken for truffles , but are distinguished by their hollow interior . Mature specimens somewhat resemble the " earthstar scleroderma " ( Scleroderma polyrhizum ) , but this yellowish @-@ brown species does not have the purple coloration of Sarcosphaera coronaria . Peziza ammophila ( formerly classified in the genus Sarcosphaera ) has an exterior surface that is colored brown to dark brown , and when young it is cup @-@ shaped . Neournula puchettii also has a pinkish @-@ colored hymenium , but it is smaller and always cup @-@ shaped . Geopora sumneriana is another cup fungus that superficially resembles S. coronaria in its form and subterranean growth habit ; however , the surface of its hymenium is cream @-@ colored with ochraceous tinges , and its outer surface is covered with brown hairs . Geopora sepulta may also be included as a potential lookalike to S. coronaria , as it is macroscopically indistinguishable from G. sumneriana .

= = = Edibility = = =

Sarcosphaera coronaria has no distinctive taste or odor , although one source says that as it gets older the odor becomes " reminiscent of rhubarb " . Although older literature describes it as a good edible species , modern literature does not recommended it for consumption . It gives some individuals gastrointestinal discomfort , reputedly similar to poisoning symptoms caused by morels . A number of poisonings attributed to this species have been reported from Europe , including one

fatal poisoning in the Jura area in 1920 , following which a warning was issued not to eat it raw or in salads . Although the fruit bodies are edible after cooking , they are rarely collected by mushroom pickers , and have no commercial value .

The chemical composition of fruit bodies collected from Turkey has been analyzed , and the dried fruit bodies determined to contain the following nutritional components : protein , 19 @.@ 46 % ; fat , 3 @.@ 65 % ; ash , 32 @.@ 51 % ; carbohydrates , 44 @.@ 38 % ( including 6 @.@ 71 % as non @-@ digestible cellulose ) . Fresh fruit bodies have a moisture content of 84 @.@ 4 % . The mushrooms are a good source of the element vanadium , shown in a 2007 study to be present at a concentration of 0 @.@ 142 mg / kg ( dry weight ) .

= = Ecology , habitat and distribution = =

Historically , Sarcosphaera coronaria has been assumed to be saprobic , acquiring nutrients from breaking down decaying organic matter . The fungus , however , is only found with trees known to form mycorrhiza , and it is often locally abundant where it occurs , year after year in the same location , indicative of a mycorrhizal lifestyle . The results of a 2006 study of Pezizalean fungi further suggest that the species is an ectomycorrhizal symbiont , and more generally , that the Pezizales include more ectomycorrhizal fungi than previously thought .

The fruit bodies are found singly , scattered , or clustered together in broad @-@ leaf woods favoring beech , less frequently with conifers . A preference for calcareous soils has been noted , but they will also grow on acidic bedrock . Because their initial development is subterranean , young fruit bodies are easy to overlook , as they as usually covered with dirt or forest duff . They are more common in mountainous locations , and occur most frequently in the spring , often near melting snow . The fungus is distributed in 23 European countries , North Africa , and North America , from British Columbia eastward to Michigan and New York , south to Veracruz , Mexico . It has also been collected from Israel and the Asian part of Turkey . In Europe , the fungus is red @-@ listed in 14 countries , and is considered a threatened species by the European Council for Conservation of Fungi . It is short @-@ listed for inclusion in the Bern Convention by the European Council for Conservation of Fungi . Threats to the species include loss and degradation of habitats due to clearcutting and soil disturbance .

= = Bioaccumulation = =

The fruit bodies can bioaccumulate the toxic heavy metal arsenic from the soil in the form of the compound methylarsonic acid . Although less toxic than arsenic trioxide , it is still relatively dangerous . Concentrations over 1000 mg / kg ( dry weight ) are often reached . As reported in one 2004 publication , a mature specimen collected near the town of ?eský ?ternberk in the Czech Republic was found to have an arsenic content of 7090 mg / kg dry weight , the highest concentration ever reported in a mushroom . Typically , the arsenic content of mycorrhizal mushrooms collected from unpolluted areas is lower than 1 mg / kg . In a 2007 Turkish study of 23 wild edible mushroom species ( collected from areas not known to be polluted ) , S. coronaria had the highest concentration of arsenic at 8 @.@ 8 mg / kg dry weight , while the arsenic concentration of the other tested mushrooms ranged from 0 @.@ 003 mg / kg ( in Sarcodon leucopus ) to 0 @.@ 54 mg / kg ( in Lactarius salmonicolor ) .

= = = Cited books = = =

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