= Lactarius sanguifluus =

Lactarius sanguifluus , commonly known as the bloody milk cap , is a species of fungus in the family Russulaceae . First described from France in 1811 , the species was given its current name by Elias Fries in 1838 when he transferred it to Lactarius . Found in Asia , Mediterranean Africa , and Europe , fruit bodies (mushrooms) grow scattered or in groups on the ground under conifers , especially Douglas fir . When bruised or cut , the fruit bodies ooze a blood @-@ red to purple latex that slowly turns greenish upon exposure to air . The caps are orangish to reddish @-@ brown , and become funnel @-@ shaped with age . The gills are pinkish to purplish . Different forms have been described from Italy , but these are not universally accepted as distinct . L. sanguifluus mushrooms are edible , and sold in rural markets of Europe and Asia . Fruit bodies grown in polluted soil , including roadsides subject to heavy traffic , can bioaccumulate toxic heavy metals . Several sterols and pigment have been isolated and identified from the mushrooms .

= = Taxonomy = =

The fungus was first described by French mycologist Jean @-@ Jacques Paulet as Hypophyllum sanguifluum in 1811 . It was given its current name by Elias Magnus Fries when he transferred it to Lactarius in his 1838 work Epicrisis Systematis Mycologici . In 1892 , Otto Kuntze called it a Lactifluus , a genus that until 2010 was considered a synonym of Lactarius . Because Paulet 's 1811 type illustration of the species did not represent the typical morphology of the fruit bodies , Jorinde Nuytinck and Annemieke Verbeken designated an epitype in 2005 .

Giovanni Pacioni and Giorgio Lalli described the forms roseus and vinosus from Italy in 2003 ; roseus has a greyish @-@ whitish cap discolouration , while f. vinosus has a less clearly zonate cap that lacks green tones , and gills with a lilac @-@ pinkish sheen . However , form vinosus , originally described by Lucien Quélet as a variety (Lactarius sanguifluus var. vinosus) in 1881 , was invalid , because Quélet 's basionym was an illegitimate nomenclatural synonym of a species named in 1855 by Jean @-@ Baptiste Barla . Later authors did not agree with the delimitation of these forms as distinct taxa , suggesting that the alternations in appearance represent normal morphological variations brought about by differences in age , and environmental factors such as levels of sunlight and humidity . Lactarius vinosus has often been considered as a variety of L. sanguifluus , but morphological (especially macroscopic characters and spore @-@ ornamentation) and molecular evidence (based on internal transcribed spacer @-@ sequencing) has confirmed that they are separate species .

Lactarius sanguifluus is classified in the section Dapetes of the genus Lactarius . This section , which also includes other popular edible species such as L. deliciosus , and the less popular L. deterrimus , is characterized by mushrooms with orange or red latex that often impart a greenish stain on the flesh and gills , an often sticky cap , and association with conifers . The specific epithet sanguifluus is derived from the Latin words sanguis (" blood ") and fluus (" flowing ") .

= = Description = =

The fruit bodies have convex caps with a central depression , reaching a diameter of 4 ? 7 @.@ 5 cm (1 @.@ 6 ? 3 @.@ 0 in) . The cap surface is smooth and sticky , and the margins are curved downward , even as the mushroom matures . Its color is pinkish @-@ buff to orangish , sometimes with patches of grayish or pale greenish @-@ gray , especially where the surface has been bruised . The somewhat crowded gills have an adnate to slightly decurrent attachment to the stipe . They are pale vinaceous with a pale pinkish @-@ buff edge . The cylindrical stipe measures 2 @.@ 0 ? 3 @.@ 5 cm (0 @.@ 8 ? 1 @.@ 4 in) long by 1 ? 2 cm (0 @.@ 4 ? 0 @.@ 8 in) thick . Its smooth surface is colored pale pinkish @-@ buff to pale greyish @-@ buff , sometimes with brownish irregular dots . The flesh ranges from firm to fragile : in the stipe , it is soft and pale pinkish buff ; under the cap cuticle it is brick colored , or brownish @-@ red just above the gills . Its taste ranges from mild to slightly bitter , and it lacks any significant odor .

The spores are roughly spherical to ellipsoidal , measuring 7 @.@ 9 ? 9 @.@ 5 by 8 @.@ 0 ? 8 @.@ 8 µm . They feature surface ornamentations up to 0 @.@ 8 µm high and an almost complete reticulum comprising broad , rounded ridges . The basidia (spore @-@ bearing cells) are somewhat cylindrical , four @-@ spored , and measure 50 ? 70 by 9 ? 11 µm . The cap cuticle is an ixocutis (made of gelatinous hyphae that run parallel to the cap surface) up to 60 µm thick , with hyphae that are 2 ? 6 wide that are usually branched and interwoven .

= = = Similar species = = =

Lactarius vinosus , formerly considered a variety of L. sanguifluus , is quite similar in appearance . In general , L. vinosus can be distinguished by the more vinaceous @-@ red color (lacking orange tones) of its cap , stipe , and gills , the more distinctly downwards @-@ tapered stipe , and the more intense staining of the latex on the cap tissue . The two species can also be distinguished microscopically by differences in the ornamentation of their spore surfaces . L. vinosus has an incomplete reticulum on the spore surface , with ridges that have a wider degree of variation in thickness . Another potential lookalike , L. semisanguifluus , has a characteristic orange latex that turns wine @-@ red in 5 ? 10 minutes after exposure to air . Compared to L. sanguifluus , the fruit bodies of L. semisanguifluus are smaller , have tinges of violet in the cap , and develop a greenish discolouration with age .

= = Habitat and distribution = =

An ectomycorrhizal species , Lactarius sanguifluus fruit bodies grow on the ground in association with pine trees on calcareous soils . L. sanguifluus is widely distributed in Himachal Pradesh in India , where it has been noted to grow in mixed coniferous forests , usually under the fern Onychium contiguum . It is widespread in Southern Europe , where it fruits between September and November (extending to December in the southernmost regions of the continent) . In the Netherlands , it was found in calcareous dunes , growing in a warm , sunny and sheltered place at the edge of a woods dominated in pine species . From Europe , it has also been recorded in Belgium , Estonia , Greece , Cyprus , France , Germany , Italy , Luxembourg , the Netherlands , Poland , Russia , Spain , Slovakia , Sweden , and Switzerland . In Africa , the species has been collected in Morocco ; in Asia , it occurs in Vietnam and China . It is listed in the Red Data Book of the Ukraine , and appeared in a draft red list for Spain as an endangered edible species considered vulnerable due to uncontrolled commercial picking . To illustrate , a September 1998 newspaper report was cited , which reported that 82 @.@ 5 kg (182 lb) of L. sanguifluus mushrooms picked in Poligny were seized from a van .

= = = Edibility = = =

The fruit bodies of Lactarius sanguifluus are edible , and choice . This was noted by Paulet in his original description of the species , who wrote : " This fungus is highly prized for use by those who are acquainted with it , it keeps well : I kept them for a whole year , it hardens without spoiling , then it takes on a taste of morels . The best way to eat is to cook it in the frying pan or on the grill with oil or butter & salt : it does not take long to cook " . The mushrooms are sold in rural markets in France , Spain , Turkey , and Yunnan Province , China . They are also collected by locals in the upper valley of the Serchio River in central Italy . In Spain , where the mushroom is esteemed as a culinary delicacy in Catalonian cuisine , it is known as niscalos or rovello . In Cyprus , it is known as ???????? (meaning " the bloody one ") and it is widely collected by the locals , but considered inferior to the saffron milk cap (Lactarius deliciosus) . In India , young specimens are consumed along with L. deliciosus ; and some consider L. sanguifluus to have a better flavor than its more well @-@ known relative . Its English common name is the " bloody milkcap " .

Fruit bodies can bioaccumulate heavy metals , including toxic ones , from polluted soil . For this reason , consuming mushrooms harvested from potentially contaminated sites ? such as near roadsides subject to heavy traffic ? is not recommended . In a Turkish study of various edible

mushroom species collected from lawns , near roads , and the inner parts of forests , the fruit bodies of L. sanguifluus were determined to have accumulated high levels of zinc , manganese , nickel , cobalt , cadmium , and lead .

= = Bioactive compounds = =

Lactarius sanguifluus contains a mixture of sterols . The predominant sterol is ergosterol (56 @.@ 6 % of total sterols) , with lesser amounts of ergosterol derivatives , including ergost @-@ 7 @-@ en @-@ 3? @-@ ol , ergosta @-@ 7 @,@ 22 @-@ dien @-@ 3? @-@ ol , and ergosta @-@ 5 @,@ 7 @-@ dien @-@ 3? @-@ ol .

The latex contains sesquiterpene pigments with guaiane skeletons ; these include the compounds given the common names lactaroviolin and sangol . Some of these chemicals are thought to undergo enzymatic conversions when the fruit body becomes injured . Fruit body extracts have been shown to have some antimicrobial activity against Gram @-@ positive and Gram @-@ negative bacteria .

= = = Cited literature = = =

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