= Russula brevipes =

Russula brevipes is a species of mushroom commonly known as the short @-@ stemmed russula or the stubby brittlegill . It is widespread in North America , and was reported from Pakistan in 2006 . The fungus grows in a mycorrhizal association with trees from several genera , including fir , spruce , Douglas @-@ fir , and hemlock . Fruit bodies are white and large , with convex to funnel @-@ shaped caps measuring 7 ? 30 cm (3 ? 12 in) wide set atop a thick stipe up to 8 cm (3 in) long . The gills on the cap underside are closely spaced and sometimes have a faint bluish tint . Spores are roughly spherical , and have a network @-@ like surface dotted with warts .

The mushrooms of Russula brevipes often develop under masses of conifer needles or leaves of broadleaved trees , and fruit from summer to autumn . Forms of the mushroom that develop a bluish band at the top of the stipe are sometimes referred to as variety acrior . Although edible , Russula brevipes mushrooms have a bland or bitter flavor . They become more palatable once parasitized by the ascomycete fungus Hypomyces lactifluorum , a bright orange mold that covers the fruit body and transforms them into lobster mushrooms .

= = Taxonomy = =

Russula brevipes was initially described by American mycologist Charles Horton Peck in 1890 , from specimens collected in Quogue , New York . It is classified in the subsection Lactaroideae , a grouping of similar Russula species characterized by having whitish to pale yellow fruit bodies , compact and hard flesh , abundant lamellulae (short gills) , and the absence of clamp connections . Other related Russula species with a similar range of spore ornamentation heights include Russula delica , R. romagnesiana , and R. pseudodelica .

There has been considerable confusion in the literature over the naming of Russula brevipes . Some early 20th @-@ century American mycologists referred to it as Russula delica , although that fungus was described from Europe by Elias Fries with a description not accurately matching the North American counterparts . Fries 's concept of R. delica included : a white fruit body that did not change color ; a smooth , shiny cap ; and thin , widely spaced gills . To add to the confusion , Rolf Singer and later Robert Kühner and Henri Romagnesi described other species they named Russula delica . Robert Shaffer summarized the taxonomic conundrum in 1964 :

Russula delica is a species that everybody knows , so to speak , but the evidence indicates that R. delica sensu Fries (1838) is not R. delica sensu Singer (1938) , which in turn is not R. delica sensu Kühner and Romagnesi (1953) ? It is best to use R. brevipes for the North American collections which most authors but not Kühner and Romagnesi (1953) , call R. delica . The name , R. brevipes , is attached to a type collection , has a reasonably explicit original description , and provides a stable point about which a species concept can be formed .

Shaffer defined the Russula brevipes varieties acrior and megaspora in 1964 from Californian specimens . The former is characterized by a greenish @-@ blue band that forms at the top of the stipe , while the latter variety has large spores . The nomenclatural database Index Fungorum does not consider these varieties to have independent taxonomical significance . In a 2012 publication , mycologist Mike Davis and colleagues suggest that western North American Russula brevipes comprise a complex of at least four distinct species . According to MycoBank , the European species Russula chloroides is synonymous with R. brevipes , although Index Fungorum and other sources consider them distinct species .

The specific epithet brevipes is derived from the Latin words brevis " short " and pes " foot " , hence " short @-@ footed " . Common names used to refer to the mushroom include short @-@ stemmed russula , short @-@ stalked white russula , and stubby brittlegill .

= = Description = =

Fully grown , the cap can range from 7 to 30 cm (3 to 12 in) in diameter , whitish to dull @-@ yellow , and is funnel @-@ shaped with a central depression . The gills are narrow and thin ,

decurrent in attachment , nearly white when young but becoming pale yellow to buff with age , and sometimes forked near the stipe . The stipe is 3 ? 8 cm long and 2 @.@ 5 ? 4 cm thick . It is initially white but develops yellowish @-@ brownish discolorations with age . The mushroom sometimes develops a pale green band at the top of the stipe . The spore print is white to light cream .

Spores of R. brevipes are egg @-@ shaped to more or less spherical , and measure 7 @.@ 5 ? 10 by 6 @.@ 5 ? 8 @.@ 5 µm ; they have a partially reticulate (network @-@ like) surface dotted with warts measuring up to 1 µm high . The cap cuticle is arranged in the form of a cutis (characterized by hyphae that run parallel to the cap surface) comprising interwoven hyphae with rounded tips . There are no cystidia on the cap (pileocystidia) .

The variant R. brevipes var. acrior Shaffer has a subtle green shading at the stipe apex and on the gills . R. brevipes var. megaspora has spores measuring 9 ? 14 by 8 ? 12 µm .

= = = Similar species = = =

The subalpine waxy cap (Hygrophorus subalpinus) is somewhat similar in appearance to R. brevipes but lacks its brittle flesh , and it has a sticky , glutinous cap . The Pacific Northwest species Russula cascadensis also resembles R. brevipes , but has an acrid taste and smaller fruit bodies . Another lookalike , R. vesicatoria , has gills that often fork near the stipe attachment . R. angustispora is quite similar to R. brevipes , but has narrower spores measuring 6 @.@ 5 ? 8 @.@ 5 by 4 @.@ 5 ? 5 µm , and it does not have the pale greenish band that sometimes develops in the latter species . The European look @-@ alike R. delica is widely distributed , although rarer in the northern regions of the continent . Similar to R. brevipes in overall morphology , it has somewhat larger spores (9 ? 12 by 7 ? 8 @.@ 5 µm) with a surface ornamentation featuring prominent warts interconnected by a zebra @-@ like patterns of ridges . The milk @-@ cap mushroom Lactifluus piperatus can be distinguished from R. brevipes by the production of latex when the mushroom tissue is cut or injured .

= = Distribution and habitat = =

It is a common ectomycorrhizal fungus associated with several hosts across temperate forest ecosystems . Typical hosts include trees in the genera Abies , Picea , Pseudotsuga , and Tsuga . The fungus has been reported in Pakistan 's Himalayan moist temperate forests associated with Pinus wallichiana . Fruit bodies grow singly or in groups ; fruiting season occurs from summer to autumn . In western North America , where the mushroom is quite common , it is encountered most frequently in late autumn . The mushrooms are usually found as " shrumps " ? low , partially emerged mounds on the forest floor , and have often been partially consumed by mammals such as rodents or deer .

Studies have demonstrated that geographically separated R. brevipes populations (globally and continentally) develop significant genetic differentiation , suggesting that gene flow between these populations is small . In contrast , there was little genetic differentiation observed between populations sampled from a smaller area (less than approximately 1000 meters) . R. brevipes is one of several Russula species that associates with the myco @-@ heterotrophic orchid Limodorum abortivum .

= = Edibility = =

Russula brevipes is a non @-@ descript edible species that tends to assume the flavors of meats and sauces it is cooked with . It is one of several Russula species harvested in the wild from Mexico 's Izta @-@ Popo Zoquiapan National Park and sold in local markets in nearby Ozumba . The mushrooms are suitable for pickling due to their crisp texture .

Fruit bodies are commonly parasitized by the ascomycete Hypomyces lactifluorum , transforming them into an edible known as a lobster mushroom . In this form , the surface of the fruit body develops into a hard , thin crust dotted with minute pimples , and the gills are reduced to blunt ridges

. The flesh of the mushroom ? normally brittle and crumbly ? becomes compacted and less breakable .

= = = Bioactive compounds = = =

Sesquiterpene lactones are a diverse group of biologically active compounds that are being investigated for their antiinflammatory and antitumor activities . Some of these compounds have been isolated and chemically characterized from Russula brevipes : russulactarorufin , lactarorufin @-@ A , and 24 @-@ ethyl @-@ cholesta @-@ 7,22E @-@ diene @-@ 3? , 5? , 6? @-@ triol .