

= Suillus brevipes =

Suillus brevipes is a species of fungus in the family Suillaceae . First described by American mycologists in the late 19th century , it is commonly known as the stubby @-@ stalk or the short @-@ stemmed slippery Jack . The fruit bodies (mushrooms) produced by the fungus are characterized by a chocolate to reddish @-@ brown cap covered with a sticky layer of slime , and a short whitish stipe that does not have either a partial veil or prominent dark or colored glandular dots . The cap can reach a diameter of about 10 cm (3 @. @ 9 in) , while the stipe is up to 6 cm (2 @. @ 4 in) long and 2 cm (0 @. @ 8 in) thick . Like other bolete mushrooms , *S. brevipes* produces spores in a vertically arranged layer of spongy tubes with openings that form a layer of small yellowish pores on the underside of the cap .

Suillus brevipes grows in a mycorrhizal association with various species of two- and three @-@ needled pines , especially lodgepole and ponderosa pine . The fungus is found throughout North America , and has been introduced to several other countries via transplanted pines . In the succession of mycorrhizal fungi associated with the regrowth of jack pine after clearcutting or wildfires , *S. brevipes* is a multi @-@ stage fungus , found during all stages of tree development . The mushrooms are edible , and are high in the essential fatty acid linoleic acid .

= = Taxonomy = =

The species was first described scientifically as *Boletus viscosus* by American mycologist Charles Frost in 1874 . In 1885 , Charles Horton Peck , who had found specimens in pine woods of Albany County , New York , explained that the species name was a taxonomic homonym (*Boletus viscosus* was already in use for another species named by Ventenat in 1863) , and so renamed it to *Boletus brevipes* . Its current name was assigned by German Otto Kuntze in 1898 . William Alphonso Murrill renamed it as *Rostkovites brevipes* in 1948 ; the genus *Rostkovites* is now considered to be synonymous with *Suillus* .

Agaricales specialist Rolf Singer included *Suillus brevipes* in the subsection *Suillus* of genus *Suillus* , an infrageneric (a taxonomic level below genus) grouping of species characterized by a cinnamon @-@ brown spore print , and pores less than 1 mm wide . Molecular phylogenetic analyses of ribosomal DNA sequences shows that the most closely related species to *Suillus brevipes* include *S. luteus* , *S. pseudobrevipes* , and *S. weaverae* (formerly *Fuscoboletinus weaverae*) .

The specific epithet is derived from the Latin *brevipes* , meaning " short @-@ footed " . The mushroom is commonly known as the " stubby @-@ stalk " or the " short @-@ stemmed slippery Jack " .

= = Description = =

The cap is deep brown to reddish @-@ brown , later fading to tan with age , and it does not bruise with handling . The cap surface is smooth , and , depending on the moisture in the environment , may range from sticky to the touch to slimy . Depending on its maturity , the cap shape may range from spherical to broadly convex . The cap diameter measures 5 ? 10 cm (2 @. @ 0 ? 3 @. @ 9 in) , and the cap cuticle can be peeled from the surface . The tubes are yellow , becoming olive @-@ green with age , and they have an attachment to the stipe that ranges from adnate (with most of the tube fused to the stipe) to decurrent (with the tubes broadly attached , but running somewhat down the length of the stipe) . They are typically up to 1 cm (0 @. @ 4 in) deep , and there are about 1 ? 2 tube mouths (pores) per millimeter . The pores are pale yellow , round , 1 ? 2 mm wide , and do not change color when bruised .

The stipe is white to pale yellow , dry , solid , not bruising , and pruinose (having a very fine whitish powder on the surface) . A characteristic feature of many *Suillus* species are the glandular dots found on the stipe ? clumps of hyphal cell ends through which the fungus secretes various metabolic wastes , leaving a sticky or resinous " dot " . In *S. brevipes* , the form of the glandular dots is variable : they may be absent , slightly underdeveloped or obscurely formed with age . The stipe is

usually short in comparison to the diameter of the cap , typically 2 ? 6 cm (0 @. @ 8 ? 2 @. @ 4 in) long and 1 ? 2 cm (0 @. @ 4 ? 0 @. @ 8 in) thick . It is either of equal width throughout , or may taper downwards ; its surface bears minute puncture holes at maturity , and is it slightly fibrous at the base . Collections made in New Zealand tend to have a reddish coloration at the very base of the stipe . The flesh of the mushroom is initially white , but turns pale yellow in age . The odor and taste are mild . The spore print is cinnamon @-@ brown .

= = = Microscopic characteristics = = =

The spores are elliptical to oblong , smooth , and have dimensions of 7 ? 10 by 3 ? 4 μ m . The spore @-@ bearing cells , the basidia , are thin @-@ walled , club @-@ shaped to roughly cylindrical , and measure 2 ? 25 by 5 ? 7 μ m . They bear either two or four spores . The pleurocystidia (cystidia that are found on the face of a gill) are roughly cylindrical with rounded ends , thin @-@ walled , and 40 ? 55 by 5 ? 8 μ m . The cells often have brown contents , and in the presence of 2 % potassium hydroxide (KOH) will appear hyaline (translucent) or vinaceous (red wine @-@ colored) ; in Melzer 's reagent they become pale yellow or brown . The cheilocystidia (cystidia found on the edge of a gill) are 30 ? 60 by 7 ? 10 μ m , club @-@ shaped to almost cylindrical , thin @-@ walled , with brown incrusting material at the base , and arranged like a bundle of fibers . In KOH they appear hyaline , and are pale yellow in Melzer 's reagent . Caulocystidia (found on the stipe) are 60 ? 90 by 7 ? 9 μ m , mostly cylindrical with rounded ends , and arranged in bundles with brown pigment particles at the base . The caulocystidia stain vinaceous in KOH . The cuticle of the cap is made of a layer of interwoven gelatinous hyphae that are individually 2 ? 5 μ m thick ; the gelatinous hyphae are responsible for the sliminess of the cuticle . There are no clamp connections in the hyphae .

= = = Edibility = = =

Like many species of the genus *Suillus* , *S. brevipes* is edible , and the mushroom is considered choice by some . The odor is mild , and the taste mild or slightly acidic . Field guides typically recommended to remove the slimy cap cuticle , and , in older specimens , the tube layer before consumption . The mushrooms are common in the diet of grizzly bears in Yellowstone National Park .

The fatty acid composition of *S. brevipes* fruit bodies has been analyzed . The cap contained a higher lipid content than the stipe ? 18 @. @ 4 % of the dry weight , compared to 12 @. @ 4 % . In the cap , linoleic acid made up 50 @. @ 7 % of the total lipids (65 @. @ 7 % in the stipe) , oleic acid was 29 @. @ 9 % (12 @. @ 4 % in the stipe) , followed by palmitic acid at 10 @. @ 5 % (12 @. @ 6 % in the stipe) . Linoleic acid ? a member of the group of essential fatty acids called omega @-@ 6 fatty acids ? is an essential dietary requirement for humans .

= = = Similar species = = =

Several *Suillus* species which grow under pines could be confused with *S. brevipes* . *S. granulatus* has a longer stipe , and distinct raised granules on the stipe . *S. brevipes* is differentiated from *S. albidipes* by not having a cottony roll of velar tissue (derived from a partial veil) at the margin when young . *S. pallidiceps* is by distinguished its pale yellow cap color ; and *S. albivelatus* has a veil . *S. pungens* has a characteristic pungent odor , compared to the mild smell of *S. brevipes* , and like *S. granulatus* , has glandular dots on the stipe .

= = = Ecology = = =

Suillus brevipes is a mycorrhizal fungus , and it develops a close symbiotic association with the roots of various tree species , especially pine . The underground mycelia form a sheath around the tree rootlets , and the fungal hyphae penetrate between the cortical cells of the root , forming

ectomycorrhizae . In this way , the fungus can supply the tree with minerals , while the tree reciprocates by supplying carbohydrates created by photosynthesis . In nature , it associates with two- and three @-@ needle pines , especially lodgepole and ponderosa pine . Under controlled laboratory conditions , the fungus has been shown to form ectomycorrhizae with ponderosa , lodgepole , loblolly , eastern white , patula , pond , radiata , and red pines . In vitro mycorrhizal associations formed with non @-@ pine species include Pacific madrone , bearberry , western larch , Sitka spruce , and coast Douglas @-@ fir . Fungal growth is inhibited by the presence of high levels of the heavy metals cadmium (350 ppm) , lead (200 ppm) , and nickel (20 ppm) .

During the regrowth of pine trees after disturbance like clearcutting or wildfire , there appears an orderly sequence of mycorrhizal fungi as one species is replaced by another . A study on the ecological succession of ectomycorrhizal fungi in Canadian jack pine forests following wildfire concluded that *S. brevipes* is a multi @-@ stage fungus . It appears relatively early during tree development ; fruit bodies were common in 6 @-@ year @-@ old tree stands , and the fungus colonized the highest proportion of root tips . The fungus persists throughout the life of the tree , having been found in tree stands that were 41 , 65 , and 122 years old . There is , however , a relative reduction in the prevalence of the fungus with increasing stand age , which may be attributed to increased competition from other fungi , and a change in habitat brought about by closure of the forest canopy . Generally , *S. brevipes* responds favorably to silvicultural practices such as thinning and clearcutting . A 1996 study demonstrated that fruit bodies increased in abundance as the severity of disturbance increased . It has been suggested that the thick @-@ walled , wiry rhizomorphs produced by the fungus may serve as an adaptation that helps it to survive and remain viable for a period of time following disturbance .

= = Habitat and distribution = =

Suillus brevipes grows singly , scattered , or in groups on the ground in late summer and autumn . A common ? and sometimes abundant ? mushroom , it occurs over most of North America (including Hawaii) , south to Mexico , and north to Canada . This species has been found in Puerto Rico growing under planted *Pinus caribaea* , where it is thought to have been introduced inadvertently from North Carolina by the USDA Forest Service in 1955 . Other introductions have also occurred in exotic pine plantations in Argentina , India , New Zealand , Japan , and Taiwan .