= Albatrellus subrubescens =

Albatrellus subrubescens is a species of polypore fungus in the family Albatrellaceae . The fruit bodies (mushrooms) of the fungus have whitish to pale buff @-@ colored caps that can reach up to 14 @.@ 5 cm (5 @.@ 7 in) in diameter , and stems up to 7 cm (2 @.@ 8 in) long and 2 cm (0 @.@ 8 in) thick . On the underside of the caps are tiny light yellow to pale greenish @-@ yellow pores , the site of spore production . When the fruit bodies are fresh , the cap and pores stain yellow where exposed , handled , or bruised .

The species is found in Asia , Europe , and North America , where it grows on the ground in deciduous or mixed woods , usually in association with pine trees . It is closely related , and physically similar , to the more common Albatrellus ovinus , from which it may be distinguished macroscopically by differences in the color when bruised , and microscopically by the amyloid (staining bluish @-@ black to black with Melzer 's reagent) walls of the spores . The fruit bodies of A. subrubescens contain scutigeral , a bioactive chemical that has antibiotic activity . A. subrubescens mushrooms are mildly poisonous , and consuming them will result in a short @-@ term gastrointestinal illness .

= = Taxonomy and phylogeny = =

The species was first described as Scutiger subrubescens by American mycologist William Murrill in 1940 , based on collections that he found growing under oak near Gainesville , Florida , in November 1938 . In 1947 he transferred it to the genus Polyporus . Josiah Lincoln Lowe examined Murrill 's type material and thought that it did not differ from Albatrellus confluens . In 1965 , Zden?k Pouzar made collections from Bohemia (now the Czech Republic) , and described it as a new species (Albatrellus similis) , unaware of the similarity to Murrill 's Florida specimens . Further study revealed that A. similis was identical to Murrill 's Scutiger subrubescens , and Pouzar transferred the latter epithet to Albatrellus . In 1974 , Pouzar recognized that Lowe 's species Albatrellus confluens was distinct from A. subrubescens . The specific epithet subrubescens , " tinted reddish " , is derived from the Latin words sub (" less than ") and rubescens (" growing red ") .

Four Albatrellus species were included in a large @-@ scale phylogenetic analysis of the order Russulales published in 2003 . Based on their ribosomal DNA sequences , the four form a clade , or monophyletic group (that is , they derived from a single ancestor) . Of the four tested species , A. ovinus was most closely related to A. subrubescens . The polypore Wrightoporia lenta (type species of the genus Wrightoporia) occurred on a single branch basal to the albatrellus clade , implying that it shared with the Albatrellus species a common ancestor from which both were descended . In a more recent (2010) molecular analysis by Canadian mycologist Serge Audet aimed at clarifying relationships among species formerly placed in Scutiger , A. subrubescens grouped in a clade with A. ovinus and A. citrinus . According to Audet , these species , in addition to A. avellaneus and A. piceiphilus , are the constituents of an Albatrellus with limits defined by molecular genetics . Other Albatrellus species were transferred to segregate genera : A. fletti and A. confluens to Albatrellopsis ; A. caeruleoporus and A. yasudae to Neoalbatrellus ; A. pes @-@ caprae and A. ellisii to an amended Scutiger .

= = Description = =

The cap of A. subrubescens is between 6 to 14 @.@ 5 cm (2 @.@ 4 to 5 @.@ 7 in) in diameter , with a central , eccentric (away from the center) , or rarely lateral (attached to the edge of cap) stem . Initially , the cap is convex with an involute margin , flattening out with age . The cap margin may be folded or flat . The cap surface in young specimens is smooth but soon forms appressed scale @-@ like spots , which may transform into scales in age . Initially , the cap has white margins and a brownish @-@ violet center with scale @-@ like spots ; the center later becomes orange @-@ brownish or ochraceous brown . According to Canadian mycologist James Ginns , who described North American Albatrellus species in 1997 , some North American specimens may be

covered with blackish @-@ gray to purple @-@ gray fibrils , but this characteristic is not seen in European collections . The cap discolors yellowish when bruised .

The stem is 1 @.@ 6 to 7 cm (0 @.@ 6 to 2 @.@ 8 in) long and 1 to 2 cm (0 @.@ 4 to 0 @.@ 8 in) thick , cylindrical , irregular , and its base may be somewhat pointed , or bulbous . Initially white , the stem develops orange / violet spots and later brownish orange spots ; in old specimens the stem may be brownish brick red . The tubes on the pore surface (underside of the cap) are about 2 @.@ 5 ? 3 mm long and decurrent in attachment . The pores are small , measuring about 2 ? 3 per millimeter . They are initially greenish @-@ white , but later turn dark brown ; dried specimens can have pores that are tinted green . Fruit bodies have a " faintly fragrant , pleasant " odor ; in his original report on the species , Murrill noted that specimens left to dry in an oven developed a strong odor of burnt sugar . The taste of the mushroom has been described variously as indistinct , or " distinctly bitter " . The type material was noted by Murrill to taste bitter , an observation later corroborated by Pouzar with European collections . A. subrubescens mushrooms are mildly toxic : consumption causes a gastrointestinal illness that usually subsides one to four hours after ingestion .

In deposit , the spores are white . The spores are 3 @.@ 4 ? 4 @.@ 7 by 2 @.@ 2 ? 3 @.@ 4 µm , ellipsoid to ovoid in shape , and amyloid (absorbing iodine when stained with Melzer 's reagent) . Most have a single large oil drop . The spore @-@ bearing cells (the basidia) are club @-@ shaped , 12 ? 16 µm long by 5 @.@ 7 ? 7 @.@ 7 µm thick , and have four thin , slightly curved sterigmata that are 3 @.@ 4 ? 4 @.@ 3 µm long . The hymenium lacks any cystidia . The hyphal system is monomitic , meaning that the context is made of thin @-@ walled generative hyphae . These hyphae have lengths in the range of 3 @.@ 5 ? 30 µm (most commonly 6 ? 17 µm) , with thin walls (up to 1 µm thick) , and are hyaline (translucent) . Although they are inamyloid , some hyphae have internal masses that are colored pale bluish @-@ gray to black , which makes them appear collectively grayish @-@ black under the microscope . Gloeoporous hyphae (wide and thin @-@ walled with refractive contents) are also scattered throughout the context , as well as some hyphae with expanded tips that are thick @-@ walled and amyloid .

= = = Similar species = = =

In general , A. subrubescens can be distinguished from other Albatrellus species by its white cap that becomes orange when bruised , its simple @-@ septate hyphae , small amyloid spores , and habitat under pines . In the field , Albatrellus ovinus is difficult to differentiate from A. subrubescens due to its similar appearance . A. ovinus usually lacks the violet color often seen in the cap and stem of A. subrubescens . Microscopic characteristics can be used to reliably distinguish the two species : the spores of A. subrubescens are amyloid , in contrast to those of A. ovinus , and A. ovinus spores are smaller , typically 3 @.@ 8 ? 4 @.@ 6 by 3 @.@ 3 ? 3 @.@ 5 µm . Other similar species include A. tianschanicus , described from the Altai Mountains in East @-@ Central Asia , and the Japanese species A. cantharellus . Unlike A. subrubescens , these species have hairy scales on the surface of their caps , and the scales are darker than the spaces between the scales . Also , the scales of A. subrubescens are not much darker than the area between the scales . Both of these Asian species have larger spores than A. subrubescens : those of A. cantharellus are 4 @.@ 5 ? 7 by 4 ? 5 @.@ 5 µm , while those of A. tianschanicus are 5 ? 7 by 4 ? 5 µm .

Albatrellopsis confluens has caps that are pinkish @-@ buff to pale orange , and white flesh that dries to a pinkish @-@ buff ; it has a taste that is bitter , or like cabbage . The spores of A. confluens are weakly amyloid . Additional differences distinguishing Albatrellopsis confluens from A. subrubescens include the presence of clamp connections in the context hyphae , and mycelium on the base of the stem . The European fungus A. citrinus , originally considered a morphotype of A. subrubescens , was described as a new species in 2003 . It is distinguished from A. subrubescens morphologically by its smaller caps (up to 7 cm (2 @.@ 8 in) in diameter) , the yellowish bruising of the caps with age or after handling , and the absence of violet spots on the cap . A. citrinus associates with spruce rather than pine , and requires calcareous (lime @-@ rich) soil .

= = Habitat and distribution = =

Fruit bodies of A. subrubescens are usually solitary , but sometimes several (typically between two and eight) are stuck together by the stem bases or on the sides of their caps . A strictly terrestrial species , it is not found fruiting on wood . It prefers to grow in pine woods , but has occasionally been associated with silver fir in Europe ; fruit bodies associated with the latter tree species tend to be less robust than those found growing with pine . It is suspected that A. subrubescens may be mycorrhizal with two- and three @-@ needle pines (i.e. , those species that have their needles attached in bundles of two or three) , although its ecological preferences are not known with certainty . Ginns , relating a personal communication with David Arora , wrote that Arora encountered several clumps of fruit bodies in an area in California containing mostly knobcone pine (a three @-@ needle pine) , manzanita , huckleberry and a few mandrones .

The species has been reported from a variety of locations in temperate regions of Asia , Europe , and North America . In North America , its distribution includes Alberta , Quebec , and the Northwest Territories in Canada . In the United States , it is found in Alabama , Arizona , California , Florida , New York , Texas , Washington , and Wisconsin . The North American distribution extends south to Mexico , in Chiapas . In Asia , the fungus has been recorded from Yunnan in southwest China , and Tibet . In Europe , collections have been reported from Austria , Czechoslovakia , Finland , Germany , Italy , Poland , Sweden , Switzerland , Yugoslavia , and the Ukraine .

= = Bioactive compounds = =

Albatrellus subrubescens contains the bioactive compound scutigeral , which has antibiotic activity . This chemical ? also found in the related species A. ovinus ? may contribute to the mushroom 's toxicity by disturbing the body 's intestinal flora . Scutigeral interacts selectively to the dopamine receptor D1 subfamily (the most abundant dopamine receptor in the central nervous system , regulating neuronal growth and development , and mediating some behavioral responses) . A 1999 publication suggested that scutigeral has agonistic activity at vanilloid receptors (a receptor found on sensory nerves in mammals) ; specifically , that it affects the uptake of calcium in the neurons of rat dorsal root ganglia . Later reports failed to corroborate this pharmacological activity . One 2003 study reported that scutigeral acts as a weak antagonist on the human vanilloid receptor VR1 , while another study published that year did not find any activity .