= Boletopsis nothofagi =

Boletopsis nothofagi is a fungus in the family Bankeraceae . The fungus forms grey fruit bodies that grow in clusters . Like all species of Boletopsis , it has a porous spore @-@ bearing surface on the underside of the cap , but differs from other species of Boletopsis by having characteristics such as elongated spores and a green discoloration when stained with potassium hydroxide . Boletopsis nothofagi is endemic to New Zealand and has a mycorrhizal association with red beech (Nothofagus fusca) . It is unknown when exactly the fungus forms its fruit body , but it has so far been found solely in May , during autumn in the Southern Hemisphere .

The first description of B. nothofagi was published in 2012 by Jerry A. Cooper and Patrick Leonard . DNA studies of the fungus suggest that it is a somewhat basal member of the genus Boletopsis . The fungus is most likely a native species of New Zealand and was present there before the arrival of Europeans . As it is very rare and possibly threatened , B. nothofagi is listed in the Red List of Threatened Species as an endangered species .

= = Taxonomy = =

In 2009 , an unknown species of Boletopsis was discovered in the Orongorongo valley near Wellington , New Zealand . In 2010 , the fungus was found again in the same place and also discovered on the South Island . Morphological comparisons and molecular analysis of other species of the genus suggested that the fungus could not be attributed to any known representative of the genus , and so it was described by mycologists Jerry A. Cooper and Patrick Leonard as a new species . The species description of Boletopsis nothofagi appeared in the journal MycoKeys in 2012 . The two authors chose the epithet nothofagi based on the characteristic of the fungus as mycorrhizal symbiont of Nothofagus fusca . Swollen hyphae and smooth spores show that B. nothofagi is a member of the subgenus Boletopsis in the genus Boletopsis .

Boletopsis nothofagi is a genetically clearly differentiated representative of the genus Boletopsis , which according to the investigations of Cooper and Leonard separated relatively early from the precursor of most other known species . Only a North American species , B. leucomelaena , branches off from their phylogenetic tree even earlier . However , the relationships between many of the species were not fully resolved in the study , so in the future , new species may be described .

= = Description = =

The fruit bodies of Boletopsis nothofagi usually grow in tufts and only rarely individually . They have a centrally stalked cap . The cap is convex , measuring 10 ? 80 mm (0 @.@ 4 ? 3 @.@ 1 in) wide and 5 ? 22 mm (0 @.@ 2 ? 0 @.@ 9 in) high . In young specimens , the cap 's edge is slightly bent , whereas the cap of older fruit bodies often curl . The cap cuticle is gray in color , and its texture ranges from smooth to slightly fibrous . Pressure- or scrape @-@ spots are stained darker and eventually blacken .

The stipes are club @-@ shaped to cylindrical , slightly tapering towards both base and cap , with a height of about 20 ? 60 mm (0 @.@ 8 ? 2 @.@ 4 in) and a thickness of 10 ? 25 mm (0 @.@ 4 ? 1 @.@ 0 in) . The stipe is smooth and dry on the surface and has a firm texture on the inside . The stipes have a similar color as the cap and shows the same responses to damage .

The white , porous hymenium has a thickness of 1 ? 2 mm and turns brown when bruised . Per millimeter , there are two to three square pores . When dried , the hymenium 's color becomes pinkish @-@ brown . The hymenium extends slightly down the stipe , and is sharply defined . Dried tissue smells similar to fenugreek . The morphology of the mycorrhiza has not yet been described ; however , as with all other types of Boletopsis it is likely to be ectomycorrhizal .

= = = Microscopic characteristics = = =

Boletopsis nothofagi has a monomitic hyphal structure , whereby all hyphae are generative hyphae

, which serve the growth of the fungus . The cap , when viewed under a microscope , is clearly differentiated and consists of a cutis , a layer of oriented hyphae lying radially . They are up to 2 µm thick , pigmented brown and covered with small , irregularly shaped granules . They become green when stained with potassium hydroxide (KOH) , a diagnostic characteristic of the genus . The subcutis consists of swollen hyphae up to 6 µm thick . These are thin @-@ walled , filled with oil droplets and have clamp connections in the septa . The hymenial layer has porous cystidium structures measuring 4 by 80 µm . The basidia of B. nothofagi are pleurobasidia arising on the sides of the hyphae . They are cylindrical to club shaped , 5 ? 10 by 20 ? 30 µm in size , and clamped at the base . The basidia always have four sterigmata , on which light brown , thin spores are situated . The spores are uneven , with flattened ends and elongated in shape . On average , they measure 5 @.@ 3 by 4 @.@ 1 µm .

= = Distribution = =

The known range of Boletopsis nothofagi is limited to two narrowly defined areas of New Zealand , one on the North Island and the other on the South Island . These areas are in Rimutaka Forest Park near Wellington , and Saint Arnaud in the northern part of the South Island . These locations are relatively far away from each other and isolated , which , together with its absence in the rest of New Zealand , makes it unlikely that the species is a recent import . It is more likely that the species is native to New Zealand and has been overlooked in earlier surveys due to its rarity .

Boletopsis nothofagi is the most southern member of the genus Boletopsis , and as of 2013 the sole known member of the genus in the Southern Hemisphere ; its closest relatives are found in Asia and Costa Rica .

= = Ecology = =

The occurrence of Boletopsis nothofagi seems to be strongly connected to the occurrence of the southern beech Nothofagus fusca , a species of Fagales that is endemic to New Zealand . B. nothofagi has been found exclusively in N. fusca forests spread through New Zealand below 37 ° S. The fungus forms a mycorrhizal association with the trees of N. fusca , in which the hyphae of the fungal mycelium wrap around the roots of the tree and penetrate the cortex , but not its cells . Subsequently , B. nothofagi takes over the function of the root hair and directs water and soil nutrients to the tree . In return , the fungus can , through contact with the root tissue , access the products of the tree 's photosynthesis . The fruit bodies of the species have so far always been found in May , the end of autumn in the Southern Hemisphere .

Little is known about the habitat requirements ? such as humidity , temperature , soil composition and water content ? of B. nothofagi . However , as the species seems to only occur together with N. fusca , it should largely conform to their demands . The tree species prefers lowlands and hills along river valleys and usually grows on nutrient @-@ rich , well @-@ drained soil . The species is more likely to be found inland than in the coastal regions .

= = Status = =

According to Cooper and Leonard , the fact that Boletopsis nothofagi was only found 200 years after the European settlement of New Zealand illustrates the rarity of this species , although it is also possible that the late discovery was caused by rare or infrequent fructification . The authors assume that the species occurs very sparsely and that this cannot be attributed to human activity . Although no data on population trends or historical distribution of the fungus exists , Cooper and Leonard consider the species in accordance to the New Zealand Threat Classification System as " naturally uncommon " .

= = = Cited literature = = =

Cooper , Jerry ; Patrick Leonard (2012) . " Boletopsis nothofagi sp. nov. associated with Nothofagus in the Southern Hemisphere " . MycoKeys 3 : 13 ? 22 @.@ doi : 10 @.@ 3897 / mycokeys.3.2762. ISSN 1314 @-@ 4057 .