Articulo de investigación

Biological and environmental peculiarities of tricholoma caligatum (viv) ricken and artificial selection on Primorsky Krai territory

Particularidades biológicas y ambientales de tricholoma caligatum (viv) ricken y selección artificial en el territorio de Primorsky Krai

Particularidades biológicas e ambientais do tricomaloma caligatum (vida) e seleção artificial no território do Krai de Primorsky

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Abstract

Matsutake mushroom is unique in many ways - it has several names, including two Latin ones, mycorhiza developer, and selects individual conifers or hardwood specifically as the partners from woody plant species in different countries. It is hidden and very shy - the main part of its fruit body (leg) is hidden in soil, and the small compact cap of the fungus is not always visible in forest among the fallen autumn needles and leaves. The mushroom is also unique as it has exceptional nutritional and medicinal properties, therefore the price for this unique species exceeds all reasonable limits. Many hundreds of years they tried to cultivate this mushroom artificially in different countries, but, apparently, unsuccessfully. In the Primorye Territory, at the Institute of Forestry and Forest Park, they also consider the problem of matsutake mushroom artificial cultivation, using the forest nursery of Primorskaya State Agricultural Academy as an experimental test site, fully matching the natural soil and plant cultivation conditions of this very rare and extremely valuable mushroom.

Keywords: Matsutake mushroom, area, nutritional and medicinal properties, artificial cultivation issues.

Resumen

El hongo Matsutake es único en muchos aspectos: tiene varios nombres, entre ellos dos latinos, desarrollador de micorhiza, y selecciona coníferas individuales o madera dura específicamente como socios de especies de plantas leñosas en diferentes países. Es oculto y muy tímido: la parte principal de su cuerpo frutal (pierna) está oculta en el suelo, y la pequeña capa compacta del hongo no siempre es visible en el bosque entre las hojas y las agujas otoñales caídas. El hongo también es único ya que tiene propiedades nutricionales y medicinales excepcionales, por lo tanto, el precio de esta especie única supera todos los límites razonables. Muchos cientos de años intentaron cultivar este hongo artificialmente en diferentes países, pero, aparentemente, sin éxito. En el Territorio de Primorye, en el Instituto Forestal y en el Parque Forestal, también consideran el problema del cultivo artificial de hongos matsutake, utilizando el vivero forestal de la Academia Estatal de Primorskaya como un sitio de prueba experimental, que se ajusta completamente a las condiciones naturales de cultivo de suelo y plantas de este hongo muy raro y extremadamente valioso.

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Palabras claves: hongo Matsutake, área, propiedades nutricionales y medicinales, problemas de cultivo artificial

Resumo

O cogumelo Matsutake é único em muitos aspectos - tem vários nomes, incluindo dois latinos, desenvolvedor de micorhiza, e seleciona coníferas individuais ou madeira de lei especificamente como parceiros de espécies de plantas lenhosas em diferentes países. É oculto e muito tímido - a parte principal do seu corpo de fruto (perna) está escondida no solo, e a pequena tampa compacta do fungo nem sempre é visível na floresta entre as folhas e agulhas caídas do outono. O cogumelo também é único, pois tem excepcionais propriedades nutricionais e medicinais, portanto, o preço para esta espécie única excede todos os limites razoáveis. Muitas centenas de anos eles tentaram cultivar artificialmente este cogumelo em diferentes países, mas, aparentemente, sem sucesso. No Território Primorye, no Instituto de Silvicultura e Parque Florestal, eles também consideram o problema do cultivo artificial de cogumelo matsutake, usando o viveiro florestal da Academia Agrícola do Estado de Primorskaya como um local de teste experimental, combinando totalmente com as condições naturais de solo e cultivo da planta. este cogumelo muito raro e extremamente valioso.

Palavras-chave: Cogumelo Matsutake, área, propriedades nutricionais e medicinais, questões de cultivo artificial.

Introduction

Matsutake belongs to the family of Tricholomataceae and has different names - Tricholoma calidatum (Viv) Ricken, matsutake (Tricholoma matsutake S. Ito et S.Imai), Singer), pine horns, Japanese pine mushroom, etc. Matsutake grows in the forests of the Urals, and in Eastern Siberia (Irkutsk Region) and in Yakutia. As for Russian Far East, it grows in the forests of Primorsky and Khabarovsk Territories, on Sakhalin and in the Amur Region. In the Primorsky Territory, this mushroom is found in the southern and central areas of the region - in Dalnegorsk, Anuchinsk, Partizansky, Shkotovsky, Pogranichny, Khankaysky, Khorolsky, Mikhailovsky and Khasansky districts (Bullah, 2015; Gukov & Rozlomiy, 2014).

Main Content

According to the method of feeding thus mushroom is mycorhiza-forming agent of two tree species - pine and oak. The most common pine tree of Europe (Pinus silvestris L.) does not grow in Primorye, it is replaced by two other species - grave pine (burial) (Pinus funebris Kom.) and densely flowered pine (Pinus densiflora Sieb. Et Zucc.). Mongolian Oak grows in Primorsky Krai everywhere, but pines and dense flowering pines grow in the southern part of Primorsky Krai in small groups, mainly on the southern slopes mixed with Mongolian oak in Khasan, Oktyabrsky, Pogranichny, Khankaisky, Horolsky, Chernigovsky, Spassky, Kirovsky, Ussuriysky, Mikhailovsky, Anuchinsky and Shkotovsky areas. Both species of pine belong to Red Book, they are endangered species, their local populations are degraded under the constant effects of fires, and most of the young growth and young trees are killed during fires (Mohamoud, 1991). It is noteworthy that Matsutake does not grow in the cedar-broad-leaved forests, because it does not form mycorrhiza with Korean cedar. In such places, cedar (Korean pine) develops very similar conditions characteristic of Tricholoma matsutake growth in combination with Mongolian oak. Besides, the Sakhalin example with larch forests suggests that not everything is studied in respect of this fungus (Nelson, 2006).

Figure 1. You can find Matsutake mushroom on the gravelly soils of the pine-oak forest of Anuchinsky district

In 2014, the employees discovered Matsutake mushroom on Sakhalin, and the Sakhalin Matsutake phenomenon is that they grow not in pine forests, like everywhere else, but in larch forests. This particular feature attracted European scientists who came to Sakhalin to study new fungi, to conduct some DNA tests and to show these fungi to scientists from Sweden and Japan. And then they plan to arrange the supply of Sakhalin mushrooms to Japan - this is the place of their greatest demand. For example, the cost of one adult mushroom can reach $ 100, and one kilogram may cost more than 2 thousand dollars.

Matsutake Biology

The cap is from 6 to 25 cm in diameter, initially rounded, hemispherical, then convex, almost flat, with a wide callus, dense, dry, smooth, cracks with age and becomes fibrous-scaly and brown. Its leg is 10-25 cm long, up to 3.5 cm in diameter, rounded, immersed in the substrate at 7-10 cm. The mushroom pulp is white, dense, elastic, crunchy, with a pleasant smell, reminiscent of pear, cinnamon, pine fragrance, etc.

Figure 2. More than half of the mushroom stem length is in the substrate

The first mushrooms begin to appear in Primorsky Krai during late August and continue to grow until mid-October (Dimofte et al, 2013). The yield and the duration of the fruition period are not the same from year to year. They are directly related to weather and temperature conditions. This mushroom is not afraid of the first autumn frosts; it appears with its cap open on the surface. It is noted that the most favorable conditions for the growth of matsutake are created on the southwestern slopes, when the densely flowered and funeral pines closely coexist with such deciduous species as Mongolian oak and dentate oak. Less commonly, this mushroom is found, or is absent in pine forests with burning, in the sun and in rocky places.

This species is a Red Book one and it is protected by Russian Federation law and its collection is prohibited on the territory of the Primorsky Territory, but the lovers of "quiet hunting" inspect forest areas thoroughly in the places where matsutake grows. At the same time, not only residents of nearby settlements, but also citizens, and even guests from neighboring Chinese provinces, are involved in mushroom collection. They harvest mushrooms for the future, both for food and for medicinal purposes. For food purposes, they are dried or frozen, and extracts are prepared on honey and alcohol infusions. It is believed that such drugs strengthen the immune system and sexual functions of men, as well as inhibit the development of neoplastic diseases. For some collectors, this is the time to replenish their budget somehow. Chinese dealers are actively buying conditional (not blooming) mushrooms for nothing. In recent years the purchase price on the black market amounted to 500-1100 rubles per 1 kg.

Since May 2002, matsutake mushroom has been listed in the Red Book of Primorsky Krai with the status "EN - endangered, in a dangerous state" in accordance with the concept of the International Union for the Conservation of Nature (IUCN). The risk of the taxon extinction in the near future is very high; this means that the collection, the consumption and the sale of the fruit bodies of this fungus are prohibited. All "red-book" plant species (a mushroom is also a plant) need special attention from the state and are subject to legal protection. A mushroom picker may be detained, fined or punished otherwise for the collection of these mushrooms. In Primorye, this mushroom is subjected to uncontrolled collection, often in a barbaric way (Fuji et al, 2013). Most of the leg length (up to 10 cm) of an adult fungus remains in the substrate, and in order to extract the entire fruit body, deep potholes and holes are remained in the soil. This violates the integrity of pine roots and causes their death. Over time, this method of harvesting leads to the mycelium decrease, reducing the size of the mushroom fruit bodies and ending the annual fruiting.

Figure 3. Matsutake shapes and sizes

In the middle of October 2018, they prevented the attempt to smuggle matsutake mushroom across the border. At the customs post "Poltavka" of the Ussuriysk customs, a Chinese citizen was detained for the collection of 12 kg of fresh mushroom. This is a rare mushroom that the Chinese tried to take out of Russia, hiding it in the luggage compartment of the bus, pre-packed in a foam box and overlaid with ice. In China, in Dunin, they opened a whole market for the sale of this type of mushrooms that are illegally harvested in our territories.

Artificial CXultivation

In some European and Asian countries, they have learned to grow matsutake mushrooms artificially, although the methods of their growing are deep secrets. We know that the medicinal properties of wild real ginseng (Panax ginseng) and artificially grown, cultivated ginseng are significantly different, and the fungus grown in wild conditions exceeds its greenhouse counterpart in taste and healing properties many times (Li Yu, 2009). The Japanese do not recognize artificially grown matsutake and are buying up the harvest of wild mushrooms around the world. Some gourmets are ready to pay unimaginable sums for unique copies, a few hundred dollars apiece (Gaiotto et al, 2013; Alday et al, 2010).

The Institute of Forestry and Forest Park at Primorskaya State Agricultural Academy also plans to create a site for artificial growing of matsutake mushroom on the territory of the forest nursery (Dunfield et al, 2006). A technique is being developed, a plot of fenced territory is being selected, where the conditions will be created for matsutake mushroom normal growth and development over time.

Methods of Artifical Cultivating

A method for artificial cultivation of Matsutake mashroom comprises: inoculating Matsutake mashroom into a sterile rice medium, cultivating at 9-13° C. for 40-60 days, after the medium is covered with mycelia, performing low-temperature induction at 1-8° C. for 60-80 days to develop a fruiting body primordium, and transferring the cultivation to 11-16° C. till harvest of the fruiting bodies. The method provided by the present invention requires no low-oxygen environment, which can reduce cultivation cost; it only needs 3-4 months from induction to harvest of fruiting bodies; the rice medium for use has a low cost, which is suitable for commercial cultivation of Matsutake mashroom fruiting bodies.

Conclusion

This study concerned cultivating Tricholomataceae artificially in certain territory , at the Institute of Forestry and Forest Park. As studied in this paper by using the forest nursery of Primorskaya State Agricultural Academy as an experimental test site, the fully matching natural soil and plant cultivation conditions of this very rare and extremely valuable mushroom is achieved. The condition to cultivate Matsutake mashroom fruiting bodies showed that the temperature to harvest this planet should be various during each step of cultivation. Considering the above mentioned situations about 3-4 months is adequate to have Matsutake mashroom with fruiting body.

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