Evaluation of the Nutritional Requirement and Wood Decay Properties of a Termite Mushroom, *Termitomyces eurrhizus*

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Abstract

The *Termitomyces eurrhizus* mushroom has high potential market value. The fungi in this genus are called “termite mushrooms”, and have a symbiotic relationship with Mactotermitinae termites. Since to date, most researchers have been focused on this symbiotic relationship, the biological and physiological properties of the fungi themselves are less well understood. The purpose of this study was to evaluate the possibility of artificial cultivation of *T. eurrhizus* by examining the nutritional characteristics of the fungus.

In Chapter 1, strains of *T. eurrhizus* collected in Okinawa Prefecture were screened for the following experiments. Four strains were selected from 27 strains. Strain T3, collected from Okinawa Main Island, had low media specificity and grew tractably. Strain T11 from Ishigaki Island was easy to handle, with a medium growth rate on any media. Strain T25, collected from Iriomote Island, had low media specificity and grew fast, while T26 from Iriomote Island grew very fast on any media.

The author surveyed the effects of carbohydrate substrates on the mycelial growth of *T. eurrhizus* in Chapter 2. Thirteen carbohydrates were tested in this experiment, and all 4 strains showed the most rapid growth on the fructose- and maltose-containing media. In addition, the 4 strains grew positively on mannose-, sucrose- and

trehalose-containing media. *Termitomyces eurrhizus* might utilize starch and cellulose similarly, and demonstrated a poor ability to catabolize lactose.

The decay properties of *T. eurrhizus* were examined in Chapters 3 and 4. In Chapter 3, three softwood species, *Pinus densiflora*, *Cryptomeria japonica* and *Chamaecyparis obtuse*, and two hardwood species, *Fagus crenata* and *Quercus miyagii*, were used as wood specimens. Scanning Electron Microscope (SEM) observations suggested that *T. eurrhizus* could only attack the surfaces of small wood samples (1.0 (R) × 1.0 (T) × 0.5 (L) cm). There was no significant difference in mass-loss rate between heartwood and sapwood specimens exposed to *T. eurrhizus* for 12 weeks. Moreover, the mass loss rates of softwood specimens were generally higher than those of hardwood specimens. Chemical analyses of decayed wood specimens suggested that *T. eurrhizus* does not have high lignin-degradation ability, even though it has been categorized as a white-rot fungus.

In Chapter 4, decay property of the fungus against moso bamboo, *Phyllostachys edulis*, was investigated. *Termitomyces eurrhizus* preferentially catabolized free sugars in the bamboo. The bamboo showed a high concentration of starch (approx. 1%), which the fungus found difficult to utilize.

From the results of Chapter 5, the existence of laccase, one of lignin decomposing enzymes, was detected using Bavendamm test. This method is a simple detection of phenol-oxidase. *Termitomyces eurrhizus* strains did not show positive results except for one strain. The results suggested that *T. eurrhizus* have laccase but its activity is also week.

From the results of these experiments, the use of fine wood chips or sawdust is strongly recommended as a media matrix for the artificial cultivation of *T. eurrhizus*.

Wood species with lower lignin content are more favorable. Fagaseae trees such as Japanese beech (*Fagus crenata*), which are preferentially used for the media matrix of mushroom production in Japan, would not be suitable for *T. eurrhizus*. On the other hand, sugi (*Cryptomeria japonica*) and moso bamboo (*Phyllostachys edulis*), which are the most easily obtained forest resources in Japan, have been suggested as possibilities for use as a media matrix for *T. eurrhizus*.