Cultivation of Thai and Japanese strains of *Pleurotus sajor – caju* on rice straw - based *Volvariella volvacea* mushroom spent and composted rice straw in Central Luzon Region, Philippines

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The mycelial and fruiting body performance of Thai and Japanese strains of *Pleurotus sajor-caju* were compared on two formulated substrates. Evaluation was based on incubation period of inoculated bags, number of days from complete mycelial colonization to primordial formation, number of days from opening the bags to first harvest, number of fruiting bodies per bag, average weight of individual fruiting bodies, total yield of fruiting bodies, diameter of individual pileus, length of stipe and biological efficiency. The Thai strain had a significantly shorter incubation period but longer number of days before primordia appeared. The Japanese strain yielded significantly higher yield and biological efficiency than the Thai strain. *Pleurotus sajor-caju* grown on *Volvariella volvacea* spent mushroom compost had a significantly faster incubation period, lesser number of days from complete mycelial colonization to primordial formation, higher yield and biological efficiency. Those grown in composted rice straw had a longer incubation period, took longer for complete mycelial colonization to primordial formation, and a lower yield and biological efficiency.

Keywords: mushroom production, *Pleurotus sajor caju*, rice straw wastes utilization, spent mushroom compost, *Volvariella volvacea*

Introduction

Pleurotus sajor caju (Fr.) Singer as one of the popular edible mushrooms in the Philippines, is locally known as *kabuteng pamaypay* and is well adapted

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and commercially cultivated in the provinces of Central Luzon (Higaki *et al*. 2000). Though it became popular in the Philippines during the later part of the 1980's (Quimio, 1990), this mushroom was introduced only to the rural people of Central Luzon particularly in the province of Nueva Ecija during the early 1990's by the Center Luzon State University and the Department of Science and Technology (Reyes *et al*., 1997). Mushroom growers who grow paddy straw mushroom (*Volvariella volvacea*) also became *Pleurotus* growers. A number of farmer-cooperatives and entrepreneurs in the region are growing this mushroom as additional source of income.

In the Philippines, the pioneering technology for *Pleurotus sajor – caju* is based on sawdust (Quimio, 1990). Successful attempts of growing this mushroom on a number of agro-industrial and forestry wastes and their combination have been tried in Central Luzon. It can be grown in a mixture of sawdust and rice bran, rice straw and rice bran, sawdust and rice hull and their various combinations (Reyes *et al*., 1993). Other agricultural wastes like corn cobs, cotton hulls, sugarcane bagasse and leaves, corn leaves and water lily leaves are also good substrates for growing this mushroom. Since Central Luzon region has an abundant source of rice straw and most paddy straw mushroom growers generate mushroom spent as waste, we evaluated the yield performance of two strains of *Pleurotus sajor – caju* on formulated rice straw and *Volvariella volvacea* mushroom spent.

Materials and methods

Source of pure culture

Starter cultures of two *Pleurotus sajor-caju* strains from Thailand and Japan were obtained from the Mushroom Gene Pool, Center for Tropical Mushroom Research and Development, Department of Biological Sciences, College of Arts and Sciences, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines.

Preparation of rice straw-based substrates

Two percent molasses (2 ml molasses in 98 ml of water) was added into the main substrate (pre-soaked rice straw) prior to composting. The compost pile was covered with a plastic sheet for 5 days. On the third day of composting, the substrates were aerated by shredding and 3% agricultural lime was incorporated. Sawdust and rice bran were added to the composted rice straw to the ratio of 7:3:1 (v/v) prior to bagging (Reyes *et al*., 1993).

Preparation of Volvariella volvacea mushroom spent compost - based substrates

Volvariella volvacea mushroom spent compost was shredded by hand, and mixed with sawdust and rice bran at 7 parts mushroom spent, 3 parts sawdust and 1 part rice bran (Reyes and Abella, 1997).

Bagging and sterilization of substrates

A 15 cm × 30 cm transparent heat resistant polypropylene bag was filled with 1000 g of substrate and a heat resistant plastic ring placed in the open end of the filled bag (to facilitate plugging and inoculation). The bag was plugged with cotton ball and sterilized at 121ºC at 15 pounds per square inch for one hour.

Inoculation of sterilized substrates

Autoclaved bags were allowed to cool and then inoculated with 40 g of the starter culture of *Pleurotus sajor-caju* and incubated at 28-30ºC.

Fruiting in the growing house

Bags were transferred to a growing room once primordia had formed. Fruiting bags were arranged on shelves inside the growing house, and upper (anterior portion) and lower parts split with a razor blade to expose the mycelium and to encourage the transformation of primordia into mature fruiting bodies. Fruiting bags were sprayed daily with clean water using a mist sprayer and water placed in a reservoir on the floor to increase the relative humidity to 85% and at a temperature of 20-28ºC.

Harvesting of fruiting bodies

Two to three days after opening the bags, primordia started to form and were ready for harvesting in another two days.

Experimental design and analysis of data

A total of 100 fruiting bags (i.e. 50 each strain) were used in this study. The study was set-up following 2 × 2 factorial experiments in Completely Randomized Design (CRD) with five replications consisting of five sample

bags per replicate. The following treatments were evaluated: Factor A- strain of *Pleurotus sajor-caju* (A_1 – Thai strain and A_2 – Japanese strain). Factor B - formulation of substrates (B_1 – composted rice straw + sawdust + rice bran at 7:3:1 v/v and B_2 – *Volvariella volvacea* mushroom spent + sawdust + rice bran at 7:3:1 v/v). The collected data were analyzed in two-way ANOVA. Comparison among means was done using Least Significant Difference (LSD) test.

Results

Incubation period of inoculated bags

Mean incubation period of the inoculated bags for the *Volvariella volvacea* spent mushroom bags was 37 days, and 46 days on composed rice straw. Evaluation of the data on the Japanese and Thai strains yielded mean incubation periods of 41 and 42 days, respectively. Comparing the strain and substrate combinations, the Thai strain gave a mean incubation time of 37 days on spent mushroom and 47 days on rice straw for the Japanese strain.

Days from complete mycelial colonization to primordial formation

Composted rice straw had longer mean incubation period of 5 days while *Volvariella volvacea* mushroom spent compost had 4 days. Of the two *Pleurotus sajor-caju* strains used, Thai strain had longer mean period of 5 days and Japanese strain had 4 days. In terms of the effect of the interaction of strain and substrate, Thai strain grown in composted rice straw had mean of 5 days while Japanese strain on *Volvariella volvacea* mushroom spent compost had 4 days.

Days from opening of the bags to the first harvest

Neither substrates nor strain of *Pleurotus sajor-caju* did not significantly affect the mean number of days of opening the bag up to first harvest.

Diameter of the individual pileus

The strains and the evaluated substrates did not significantly affect the size of the pileus.

Length of stipe

There was no significant effect of the strain, substrate and their interactive effects of strain on the length of stipe.

Weight of individual fruiting bodies

Substrate did not significantly affect the weight of fruiting body production but was statistically different between the two strains.

Number of fruiting bodies per bag

The Japanese strain significantly produced more fruiting bodies than the Thai strains with yields of 40 and 34 respectively on *Volvariella volvacea* spent mushroom compost. However, the performance of the two strains regardless of the substrate used did not influence the number of fruiting bodies formed.

Yield per bag

Japanese strain produced higher mean yield per bag of 239 g while Thai strain had 212 g. *Pleurotus sajor-caju* grown in *Volvariella volvacea* mushroom spent produced higher mean yield of 254 g than in composted rice straw. With regards to the interaction of strain and substrate, Japanese strain grown in *Volvariella volvacea* mushroom spent had higher mean yield of 264 g while Thai strain cultivated in composted rice straw had mean yield of 180 g.

Biological efficiency

Japanese strain had a mean biological efficiency of 24 % and Thai strain had 21%. *Pleurotus sajor-caju* grown in *Volvariella volvacea* mushroom spent had 25% compared to those in composted rice straw having a mean value of 20 %. On the interaction of strain and substrate, Japanese strain grown in *Volvariella volvacea* mushroom spent registered higher mean biological efficiency of 26% while Thai strain cultivated in composted rice straw had lower mean biological efficiency of 18%.

Discussion

The two strains of *Pleurotus sajor caju* performed differently on rice straw - based *Volvariella volvacea* mushroom spent and composted rice straw. The growth performance of *Pleurotus sajor – caju* differed significantly in the two substrates. The better performance of the two strains in *Volvariella volvacea* mushroom spent could be attributed to the immediate availability of nutrients in the mushroom spent. *Volvariella volvacea* and other microorganisms have partially decomposed the substrates thus releasing more of its partially degraded cellulose from its lignocellulosic moiety. Moreover, other microorganisms in the spent participate in the breaking down of macromolecules such as lignin and cellulose into simple compounds including nitrate, ammonia and phosphate (Labarere and Menini, 2000). Quimio (1988) also demonstrated the technical viability of using *Volvariella volvacea* mushroom spent enriched with 20% rice bran for growing *Pleurotus*. The incubation period of the two strains was significantly different from each other. This result indicates that although the two strains belong to the same species, variation on the growth performance also exists. Similar observation was also observed by Reyes *et al*. (1998) on the wild strains of *Volvariella volvacea.* The wild strains were isolated from different geographical areas but exhibited different performances on the ability to colonize the substrates. The important observation on the varying performances of the two strains further strengthens the previous observation of Reyes and Abella (1997) on the different fruiting performances of Asian strains of *Pleurotus sajor-caju.* Variation does not only exist among different species of mushroom but also within the species (Reyes, *et al*., 1998; Reyes and Abella, 1997; Reyes *et al*., 1993).

Conclusion

The better performance of *Pleurotus sajor-caju* on *Volvariella volvacea* mushroom spent offers a very good opportunity for mushroom growers to fully harness the potential of this renewable resource. It also offers the possibility and convert this into high value and protein rich food.

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