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Evaluation of the Yield of *Lentinus squarrosulus* (Mont) Singer on Selected Economic Tree Species

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Abstract: Sawdust from seven economic trees (*Mansonia altissima*, *Piptadeniastrum africanum*, *Nesogordonia papaverifera*, *Combretodendron macrocarpum*, *Terminalia* sp., *Khaya ivorensis* and *Brachystegia nigerica* were used to cultivate *Lentinus squarrosulus* (Mont) Singer. The highest mycelial density was observed in the sawdust of *Mansonia altissimia* and lowest in *Piptadeniastrum africanum.* Time of premodial emergence, fresh weight of mushroom and number of flushes varied from one sawdust to the other. The best sawdust for the growth of this mushroom among the sawdust of the economic trees was that of *Combretodendron macrocarpum.*

Key words: Evaluation, yield, *Lentinus squarrosulus*, economic trees

INTRODUCTION

Man's hunt for food dated back to his origin on earth, thus in course of time, he came across a wide variety of wide plants which could be used as items for food. This items include mushrooms. According to Chang (1999), mushrooms have existed since the lower cretaceous period (approximately 130 million years ago) long before human being evolved on the planet. Documentation of indigenous knowledge on the wage of mushroom has been the major avenue through which we know edible mushrooms.

Lentinus squarrosulus (Mont.) Singer is a white rot fungus which thrives saprophytically on dead woods in the forest (Wuyep *et al*., 2003). It is an agaricaceous fungus with tough fruit bodies. In the wild, fruiting normally occurs at the beginning and end of the rains in the southern part of Nigeria. It is known to be riched in proteins, sugars, lipid, amino acids, vitamins B, C, D and minerals (Royce *et al*., 1990).

The bioconversion of agro industrial wastes into edible mushroom fruit bodies is developing into a lucrative enterprise with a lot of advantages. In Nigeria, studies on the cultivation of mushrooms include those of Fasidi and Kadiri (1993), Okhuoya and Okogbo (1990), Akpaja and Begho (1999), Isikhuemhen *et al*. (1999), Osemwegie *et al*. (2002), Joshua and Agina (2002) and Kuforiji *et al*. (2003).

One of the most efficient ways of making use of agricultural wastes and plant residues like sawdust is to convert them first to edible mushroom and then turn the spent wastes into compost (Tontyaporn, 1997). Sawdust is one of the most readily available agro-industrial wastes and has been extensively used for the cultivation of mushrooms (Quimio *et al*., 1990; Stamets, 2000; Stamets and Chilton, 1983; Kuforiji *et al*., 2003; Joshua and Agina, 2002). Sawdust is known to have caused a lot of pollution in the environment because it is improperly disposed. This waste, instead of being burnt which cause a green house effect or being disposed into water ways, it can be used for the cultivation of edible and medicinal mushrooms since mushrooms can degrade and convert lignocellulosic wastes into value-added products. The present study was therefore undertaken to identify and evaluate the types of sawdust in which the mushroom can grow best so that it can be used in mass production of the mushroom. This can go a long way to alleviate poverty in developing countries and to reduce the pollution effect of sawdust in the environment.

MATERIALS AND METHODS

Pure culture of the mushroom was obtained from mushroom biology unit of Botany Department, University of Benin, Benin City and was used in the preparation of spawn. The spawn was prepared using Sorghum (*Sorghum bicolor*) grains as substrate in November 2005 in the Department of Botany, Delta State University, Abraka. Nigeria. Salad cream bottles were filled with parboiled *Sorghum* grains to three quarter (3/4) full and covered with cotton wool. The bottles were autoclaved at a temperature of 121°C at 15 psi for 20 min, allowed to cool

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down overnight after which they were inoculated with the pure culture of *Lentinus squarrosulus.* The inoculated grains were incubated at room temperature. After the grains have been fully colonized, they were kept in the refrigerator (5°C) until when they were used.

Sawdust from the following economic trees, *Mansonia altissima*, *Piptadeniastrum africanum*, *Nesogordonia paraverivera*, *Combretodendron macrocarpum*, *Terminalia* sp., *Khaya ivorensis*, *Brachystagia nigerica* were obtained during timber processing from Uwasota Sawmill at Uwasota street of Benin City in Edo State Nigeria. Each sawdust type was mixed with 1% $CaCO_3$ and 1% sugar on oven dry weight basis. Thereafter, they were composted by adding enough water and heap up to ferment for 7 days with turning every 2 days (Quimio *et al*., 1990). The moisture content of the fermented sawdust was adjusted to 75% with sterile distilled water. Five hundred grams oven dry weight equivalent of the fermented and moistened substrates were loaded into cellophane bags measuring 15×30 cm each. Five replicate bags were prepared for each treatment. A polyvinyl chloride pipe (Pvc neck) measuring 5 cm wide and 3 cm long was passed through the top of each bag. Thereafter, the mouth of each bag was plugged with cotton wool and cover with foil paper. The bags were then loaded into a steamer and steamed for 4 h at the temperature of about 70°C. They were allowed to cool down to ambient temperature before they were inoculated at 5% level of spawning. After complete colonization of the substrates, they were opened for fruiting. This was followed by periodic watering of bags with sterile water. The environment was humidified and at night, the rooms were ventilated for adequate aeration.

The following parameters were determined:

- Time for complete substrate colonization.
- Time of primordial emergence.
- Fresh weight of mushroom.
- Dry weight of mushroom.
- Flush pattern.
- Percentage organic matter loss.
- Biological efficiency.

The results were analysed using simple descriptive statistics such as mean and standard error. Mean was separated using analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Evaluation of sawdust of seven economic tree species for the cultivation of *Lentinus squarrosulus* showed that the mushroom grew and produced fruit bodies on all the sawdust. However, the level of growth and development varied from one tree species to another. The mean mycelial density was highest in *Mansonia altissima* with 4.67±0.33 and lowest in *Piptadeniastrium africanum* with 1.33±0.33 (Table 1). This observation supported the work of Kuforiji *et al*. (2003) who reported that *Mansonia altissima* supported good growth of *Pleurotus tuberregium*. The poor growth on *Piptadeniastrium africanum* may be due to the fact that the mushroom could not produce appropriate enzymes that could hydrolised and convert the substrate for its vegetative growth (Stamets, 2000). This observation was also supported by Okhuoya *et al*. (1998) who reported that *Pleurotus tuberregium* could not grow well on sawdust of some tree species.

Table 1: Mycelial densities of *Lentinus squarrosulus* on sawdust of selected economic trees

Economic trees	Mean mycelial density
Mansonia altissima	4.67±0.33
Piptadeniastrum africanum	1.33±0.33
Nesogordonia papaverifera	2.33±0.33
Combretodendron macrocarpum	3.00±0.58
Terminalia sp.	4.00±0.58
Khaya ivoreusis	1.67±0.33
Brachystegia nigerica	3.00±0.58

Differences among the sawdust is significant (p = 0.05)

The first primordial emergences was on *Piptadeniastrium africanum* with an average of 40 days and the longest time was observed on *Nesogordonia papaverifera* with an average of 60 days (Table 2). This is in contrary to the report of Quimio *et al*. (1990) and Stamet (2000) who reported shorter period of primordial emergence in other oyster mushrooms. This longer time may be peculiar to this mushroom and this therefore necessitate the need for some breeding experiments in order to reduce the time for fruiting and other qualities of the mushroom such as number of flushes, biological efficiency and yield.

The Biological Efficiency (BE) was maximum in *Mansonia altissima* with 4.27% and lowest in *Terminalia* sp., with 0.8% (Table 2). This value recorded for biological efficiency is very low compare to the study of Kuforiji *et al*. (2003) and Kadiri (1998) who reported a BE of 50% for another Oyster mushroom *Pleurotus sajor-caju.* For commercial or mass production of this mushroom using these sawdust materials, supplementation with nitrogen and carbohydrate based additive or supplements may be needed in order to enhance better BE and yield of the mushroom.

The highest fresh weight was observed on *Brachystegia nigerica* (32.10±1.56 g) followed in order by *Combretodendron macrocarpum* (26.03±9.49 g), *Mansonia altissima* (25.60±1.51), *Khaya ivorensis* (22.63±1.25) and the least was on *Terminalia* sp., with

Table 2: Effect of different sawdust on the growth and development of *Lentinus squarrosulus*

Economic trees	Time of emergence (days)	Fresh weight (mean)	Biological efficiency (%)	No. of flushes
Mansonia altissima	61.00±2.31	25.60±1.51	4.27	1.00±0.00
Piptadeniastrum africanum	40.66±0.88	7.47±0.58	1.25	1.00±0.00
Nesogordonia papaverifera	65.33±2.60	19.73±1.53	3.10	2.00±0.00
Combretodendron macrocarpum	49.67±5.93	26.03±9.49	3.87	1.33±0.33
Terminalia sp.	63.60±1.16	5.20±0.31	0.87	1.00±0.00
Khaya ivoreusis	53.00±3.21	22.63±1.25	3.21	2.33±0.33
Brachystegia nigerica	43.33±1.86	32.10±1.56	3.37	1.67±0.33
Significance	S	S	S	S

S = Significant difference among sawdust (p = 0.05)

Table 3: Organic matter loss in different sawdust due to *Lentinus squarrosulus* activity

Economic trees	Dry weight of mushroom	Organic matterloss (%)
Mansonia altissima	3.00±1.50	17.33
Piptadeniastrum africanum	0.63±0.09	17.74
Nesogordonia papaverifera	2.67±0.12	24.63
Combretodendron macrocarpum	4.97±1.18	8.20
Terminalia sp.	1.10±0.15	29.80
Khaya ivoreusis	3.53±0.48	42.57
Brachystegia nigerica	4.88±0.56	16.41
Significant (p = 0.05)	S	S

5.20±0.31 g (Table 2). This result is in line with the report of Joshua and Agina (2002) who reported a high yield of *Pleurotus ostreatus* on sawdust of *Khaya ivorensis* and *Mansonia altissima* in Jos, Nigeria.

The number of flushes and organic matter loss was highest in *Khaya ivorensis* with 2.33±0.33 and 42.57%, respectively (Table 2 and 3). This is in line with the work of Kuforiji *et al.* (2003) who reported that *Khaya ivorensis* is one of the suitable substrates for the cultivation of sclerotial of *Pleurotus tuberregium*. These observations indicated that *Lentinus squarrosulus* has the ability to transform and convert the organic contents of these sawdust into fruit bodies. It can be inferred from this study that these sawdust materials are suitable for the cultivation of *Lentinus squarrosulus*. Also, the observations showed that the mushroom has the potential in the bioconversion of these sawdust in the environment. However, further investigation is required such as breeding and supplementation of substrates for this mushroom in order to improve its growth and yield performance on these sawdust materials.

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