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Cultivation of Pleurotus Pulmonarius (Mushroom) Using Some Agrowaste Materials

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Abstract: The use of some agrowaste materials as alternative substrates for the cultivation of *Pleurotus pulmonarius* was evaluated. Sawdust, oil palm fibre, dry cassava peels, a mixture of sawdust and oil palm fibre and a mixture of dry cassava peels and oil palm fibre were used to cultivate the mushroom. Experiments were carried out using Completely Randomized Design (CRD) with 5 treatment and 3 replicates. Sawdust, which has been the traditional substrate for the cultivation of this mushroom, used here as the control, supported its growth and yielded the highest number of fruit bodies. Next to it was the dry cassava peels. Mixture of sawdust and oil palm fibre and cassava peels and oil palm fibres produced scanty growth. The fungus did not growth at all on oil palm fibre alone.

Key words: Cultivation, *Pleurotus pulmonarius*, sawdust, oil palm fibre, cassava peel

INTRODUCTION

Mushrooms such as the genus *Pleurotus* are known to be among the largest of fungi composed of filaments and survives very well in a damp or moist condition (Oei, 2003). Man's attention is usually attracted to mushrooms by the unusual shape of their fruitbodies which suddenly appear after rains in striking numbers in fields and woodlands (Onuoha, 2007). Many types of mushroom both edible and non edible exist. The edible mushrooms are widely used as human food (Chang, 1980). In Nigeria, the preferred and commonly consumed species are *Pleurotus*, *Termitomyces*, *Tricholoma* and *Volvariella* (Zoberi, 1972). Other edible species of *Pleurotus* include *Pleurotus tuber-regium*, *P. ostreatus* and *P. pulmonarius*. According to Fasidi *et al.* (1993), all mushrooms are rich in protein.

Many fungi that form mushroom exist in myccorrhizal relationship with trees and this is one of the reasons why forests are often generous to mushrooms hunters (Ogunlana, 1978). Some wild mushrooms are mycoorrhizal ones and cannot be cultivated unless the tree is also cultivated (Okwujiako, 1992). These mushrooms are sometimes available in the market but they are collected from the forests (Kuyper *et al*., 2002).

Mushrooms have been universally recognized now as food and are grown on commercial scale in many parts of the world including Nigeria. *Pleurotus pulmonarius* is one of the species commonly eaten in Nigeria (Zoberi, 1972). The cultivation of mushroom serves as the most efficient and economically viable biotechnology for the conversion of lignocellulose waste materials to high quality protein food and this will naturally open up new job opportunities especially in rural areas (Fasidi *et al*., 1993; Hussain, 2001). Edible mushrooms like *Agaricus* sp. and *Pleurotus oastreatus* are commercially produced and sold in markets in Asia, America and Europe (Okhuoya *et al*., 1998). Mushrooms are still being hunted for in forests and farmland for sale in Africa.

These therefore, need for commercial production of all edible mushrooms in Nigeria in view of its potential contribution to agricultural production and as a source of cheap protein. Nigeria is richly endowed with good quality mushrooms like *Pleurotus* and *Agaricus*, which should be mass-produced for local consumption as well as for international market. Since mushrooms are seasonal and always in short supply, commercial production is, therefore, necessary to ensure their constant availability. The present study, therefore, evaluates the use of some agrowaste materials in the cultivation of *Pleurotus pulmonarius*.

MATERIALS AND METHODS

The spawn used for the cultivation of the fungus was collected from Imo Agricultural Development Programme (ADP) Owerri Imo State in Nigeria. The sawdust was obtained from timber shed in Owerri while the cassava peels and oil palm fibre were collected from Umuakali-elu Naze, Owerri. The 5 substrates used included:

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- Sawdust-T_0
- Sawdust and oil palm fibre-T_1
- Dry cassava peels-T_2
- Dry cassava peels and oil palm fibre-T_3
- Oil palm fibre-T_4
- Each substrate was replicated 3 times

Preparation of substrates for cultivation: One kilogram of each substrate was used. For the mixture substrates, they were in equal proportion of 500 g for each component. This was done using a weighing balance. The cassava peels were sun-dried for 3 days to reduce moisture and microbial activities. The dry cassava peels were manually squeezed into small balls. Sawdust was mildly sprinkled with distilled water. The fresh oil palm fibre was soaked in distilled water overnight in order to melt the remaining oil in the fibre. Excess water was drained off 500 g each of the prepared sawdust and oil palm fibre were mixed up properly. Similarly, equal weight (500 g) of each of dry cassava peels and oil palm fibre were mixed. The 5 prepared substrates were separately packed into polyethene bags and tied up for sterilization. The substrates were sterilized using boiling drum containing stacks of sticks and water up to the level of the sticks. The substrates were packed into the drum and covered with fresh plantain leaves in order to generate enough heat. The substrates were steam-sterilized for 3 h and allowed to cool while still in the drum. The substrates were taken to mushroom house and poured separately on sterile polyethene sheets on a table. The spawn was sprinkled on the substrates, covered with sterile polythene sheet and watered everyday to maintain a high relative humidity of between 75-80%.

Data collection: The yield of *Pleurotus pulmonarius* on the different substrates was determined by recording the number and size of the fruit bodies after sprouting. The measurements from the various replicates were added and their mean value calculated.

The following parameters of growth/yield were measured:

Number of fruit bodies: This was done by directly counting the number of fruit bodies on each substrate.

Height of fruit bodies: The height was measured in centimeters using transparent ruler from the base of the stripe to the pileus.

Diameter of the pileus: This was also measured in centimeter with ruler from one edge of the pileus across the stripe to the other edge.

Fresh weight of fruit bodies: This was done using an electrical weighing balance.

Results obtained from these were subjected to statistical analysis using Completely Randomized Design (CRD) at 5% level of significance.

RESULTS AND DISCUSSION

Nine days after planting whitish mycelia colonized all the substrates with the exception of the oil palm fibre. Three days later (72 h) fruit-bodies appeared on the sawdust (control) 5 days (120 h) after the appearance of mycelial growth, fruit-bodies were observed on the dry cassava peels, then on the mixture of sawdust and oil palm fibre and mixture of dry cassava peel and oil palm fibre. There was no fruit body on the oil palm fibre (Plate 1a-e).

Number of fruit bodies: Sawdust produced the highest number of fruit bodies with a mean value of 6.0. The next was 3.0 produced by a mixture of sawdust and dry cassava peels, then the mixture of sawdust and dry cassava peels, then the mixture of sawdust and oil palm fibre with a mean value of 2.0. The mixture of dry cassava peels and oil palm fibre above did not support the growth of the fungus at all and did not produced any fruit body as shown in Fig. 1.

Height of fruit bodies: The fruit bodies produced on sawdust (T_0) had a mean height of 2.6 cm, while those produced on dry cassava peels (T_2) and a mixture of dry cassava peels and oil palm fibre (T_1) had a mean height of 2.0 and 1.5 cm, respectively. The mean height of the fruit bodies produced on the mixture of dry cassava peels and oil palm fibre was 1.2 cm (Fig. 2).

Diameter of the pileus: The fruit bodies produced on sawdust (T_0) and dry cassava peels (T_2) had wider pileus than those produced on a mixture of sawdust and oil palm fibre (T_1) and mixture of dry cassava peels and oil palm fibre (T_3) (Fig. 3).

Fresh weight of fruit body: Though there was a significant difference between the mean fresh weight of fruit bodies produced on all the substrates, those produced on sawdust (T_0) and dry cassava peels were higher than the mean weight of those produced on the other 2 substrates T_1 and T_3 (Fig. 4).

Four of the 5 artificial substrates screened for the growth of the fungus supported its growth sawdust, which is the traditional substrate produced very good yield and as the best in terms of the number of fruit bodies

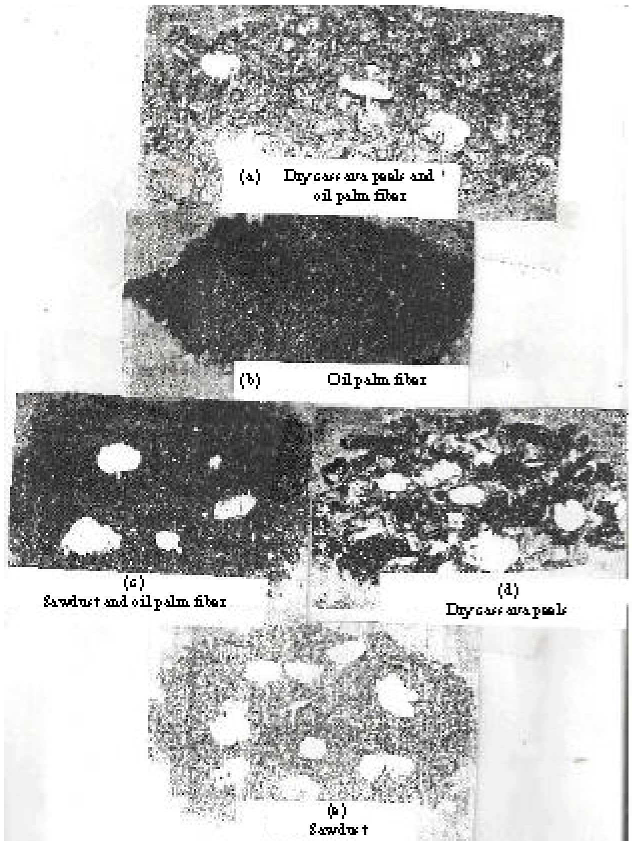

Plate 1a-e: The condition of all the substrates with the exception of the oil palm fiber

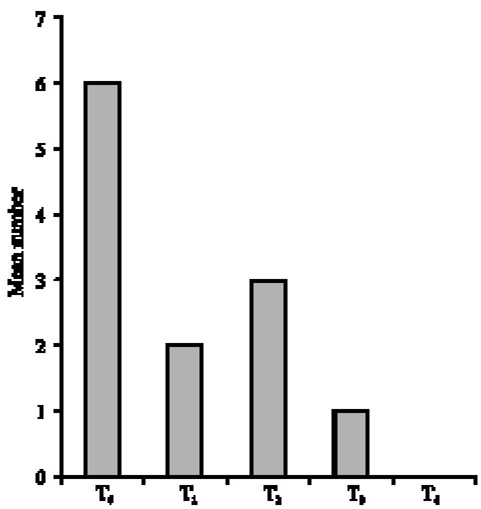

Fig. 1: Men number of fruit bodies from different substrates

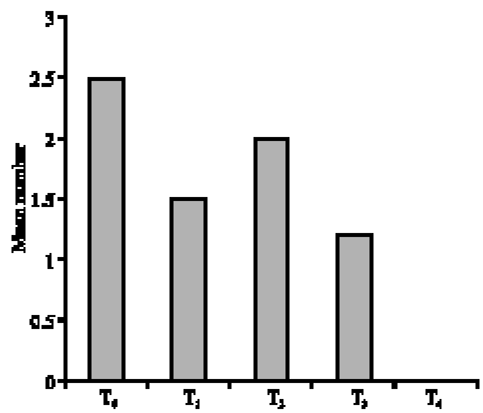

Fig. 2: Mean height of fruit bodies from different substrates

produced, height of these stips, diameter of the pileus and fresh weight of the fruit bodies. This observation is in agreement with that of Okwujiako (1992), who reported that sawdust was consistently the best substrate supporting mycelial growth and fructification of fungi. It could therefore, be stated that sawdust is the best artificial substrate for the growth of *Pleurotus pulmonarius*. Dry cassava peels however, produced remarkable and sizeable fruit bodies. The fact that *Pleurotus* sp. grow on artificial media had earlier been reported by Oso (1977), Zadrazil (1980) and Oei (1996). Dry

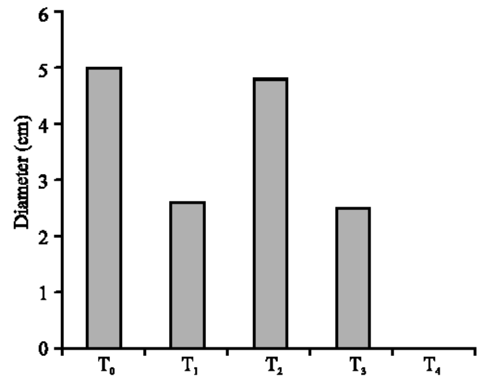

Fig. 3: Mean diameter of fruit bodies produced on different substrates

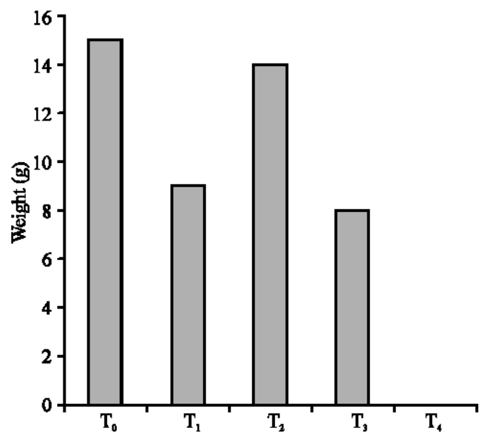

Fig. 4: Mean fresh weight of fruit bodies produced on different substrates

cassava peels, readily absorbs water and this retained water may have provided the humid environment required by the fungus for fruitification. Also the needed cellulose that is available in wood (the natural habitat of the fungus) is also available in the peels of cassava. Mixtures of sawdust and cassava peels with oil palm fibre produced minimal growth probably because of sawdust and cassava peels. The oil palm fibre alone did not support the growth of the fungus at all. This was probably because of the presence of oil in the fibre and perhaps the inability of the fungus to extract the cellulose entrapped in the fibre.

CONCLUSION

From this study, it was observed that sawdust remains the best substrate for the cultivation of *Pleurotus pulmonarius*. However, dry cassava peels (a common agrowaste material) could also be used to grow the fungus because according to Zadrazil (1980) the growth of *Pleurotus* sp. is favoured on substrates of low nitrogen content that is, higher carbon and nitrogen ratio to raise good yield.

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