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CULTIVATION OF OYSTER MUSHROOM (*Pleurotus tuber-regium*) ON SELECTED ORGANIC WASTES

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ABSTRACT
Cultivation of OYSTER MUSHROOM (*Pleurotus tuber-regium*) on selected organic waste was carried out in the Microbiology Laboratory, Faculty of Science of the University of Port Harcourt. The study evaluated the effect of selected organic wastes on the growth and yield of *Pleurotus tuber-regium* (Fr. Singer). The organic wastes (Dry Substrates which include Maize cob, Cassava peelings, Plantain peelings and water melon pod) were used in the study. Experiments were carried out using Completely Randomized Design (CRD) with 4 treatment and 3 replicates. Maize cob (T_1) and Cassava peelings (T_2) Supported very abundant mycelial growth and also the development of healthy fruit bodies of the fungus studied. Plantain peelings (T_3) and water melon pod (T_4) supported abundant and moderate mycelial growth of *P. tuber-regium* respectively but fruit bodies were not developed on them. In all parameters measured fruit bodies produced on T_1 were better than those on T_2 except in dry weight. In terms of average diameter of pileus on T_1 it was 13.0cm while on T_2 it was 10.2cm; average number of healthy fruit bodies formed on T_1 was 20, on T_2, 15: average height of stipe on T_1 was 7.0cm and on T_2, 5.1cm: average fresh weight of fruit bodies on T_1 was 87.3g where as it was 85.0g on T_2 but the dry weight of *P. tuber-regium* was 21.8g on both T_1 and T_2. The Biological efficiency (B.E) of *P. tuber-regium* produced on T_1 was 8.7% and 8.5% on T_2.Corn cobs and cassava peelings which are major agro wastes abundantly found in Nigeria, have been found to excellently support the mycelial growth and fruit body formation of *pleurotus tuber-regium*. *P. tuber-regium* a Nigerian edible mushroom is therefore recommended to both existing and intending mushroom farmers because of its good growth performance on various substrates.

KEY WORDS: Cultivation, *Pleurotus tuber-regium,* Corn cob, Cassava peelings, Plantain peelings, water melon pod.

INTRODUCTION

Mushrooms are non-timber forest products which are often found as saprophytes on soil, open field, farm lands, wood and road sides. The fruiting bodies are large enough to be visible to the naked eyes. They belong to the class Basidiomycetes, order Agaricales. Mushrooms are increasingly becoming popular as proteins rich delicious vegetable. Mushrooms provide a variety of tastes, flavor %) and minerals (8-12%), (Miles and Chang 1997). Mushrooms contain vitamins such as niacin, riboflavin, vitamins D, C, B1, B5 and B6 (Miles and Chang, 1997).

According to Taniguchi (2000), there are four major uses of mushrooms, namely, industrial, as food, pharmaceutical substances, physiological and biotechnology based functions. Mushroom cultivation is a useful method of environmental waste management and waste disposal. Many agricultural and industrial by-products can find uses in mushrooms production (Chinda, and Chinda, 2007). Some of these materials litter and sometimes pollute our environment. *Pleurotus tuber-regium* (Fr.) singer is an edible mushroom that is found growing in the tropical and sub tropical region of the world (Zoberi, 1973). In Nigeria, it colonises wood and produces sclerotis, which are buried in the soil. Such sclerotis are lifted out of the soil by cobs and water melon pods (waste) were obtained from the waste dump in mile one (1) market in Diobu, Port Harcourt, Rivers State. Cassava and plantain peelings were obtained from various locations in choba town.

and texture. *Pleurotus species* are characterized by a white spot print attached to decurrent gills, often with eccentric (off center) stipe, or no stipe at all. They always grow on wood in nature, usually on dead standing trees or on fallen logs. The common name 'oyster mushroom' comes from the white shell-like appearance of the fruiting body. Reported nutrient composition is protein (25-50%), fat (2-5%), sugars (17-47%), mycocellulose (7-38 farmers while cultivating their farms (Oso, 1977). When cropped in a warm and humid atmosphere, sclerotis produces fruiting bodies which are consumed as food or used as condiments to add flavor to food (Zoberi, 1972, 1973; oso, 1977). Pleurotus tuber-regium has great medicinal value among the native doctors in the treatment of many ailments, including asthma, small pox, and high blood pressure (Oso, 1977).

MATERIALS AND METHODS

The *Pleurotus tuber-regium* used for this study was obtained from a farm land in choba town close to university of Portharcourt biodiversity and conservation area. Organic wastes used for the study were obtained as follows; maize

Preparation of culture medium

Malt extract agar (MEA) was employed as medium of growth for culturing *Pleurotus tuber-regium*. MEA was prepared as described by Chang and Hayes (1978).

Culture of fungus
Fresh mushroom was used. With a sterilized needle, a small piece of the mushroom tissue was removed and placed on MEA medium in petri dishes. The inoculated dishes were incubated at 27 $\pm$ 1^0C for one week. It was subcultured to obtain a pure culture.

Spawn preparation
described spawn (active mycelium) production as the inevitable bedrock for the development of the mushroom industry and also the limiting factor to mushroom cultivation or production all over the world

Growth substrate
Four organic wastes were used as substrates. They include;
T1= maize cob
T2= cassava peelings
T3= plantain peelings
T4= water melon pod

Substrate preparation and inoculation
T1, T2, T3 and T4 were dried and chopped in to smaller pieces of 2-4cm in length after which 1000g of each substrate were weighed out and soaked in 395ml of water in different containers and were left over night. The following day, excess water was drained off before it was dispensed into 2.5 litres of transparent perforated plastic buckets at the rate of 1kg of wet substrate per bucket. The transparent perforated bucket and their contents were pasteurized and were allowed to cool. The experimental room was thoroughly swept, washed and properly disinfected with 95% ethanol. Inoculation was done at the rate of 2% (20g) of spawn per 2.5 litre bucket. The mycelia density was rated and described by Kadiri (1998), with some modifications as follows: + = very scanty mycelial growth ($\leq$ 1mm mycelia thickness); 2+ = scanty mycelial growth ($\leq$ 1.5 – 2mm mycelia thickness)
3+ = moderate mycelial growth (2.1 – 4.9 mm mycelia thickness); 4+ = abundant mycelial growth (5mm – 9mm mycelia thickness) and 5+ = very abundant mycelial growth ($\geq$ 10mm mycelial thickness)
250g of white maize (bende local) were soaked in water, drained and put in spawn bottles. 5g of calcium carbonate ($CaCO_3$) were mixed with contents in the bottles to increase alkalinity of the substrate so as to exclude bacterial contaminants and autoclaved at 121^0C for 15 minutes, consecutively for 3 days. Vigorously growing mycelia culture was used to inoculate the substrate bottles, which were incubated at 27 $\pm$ 1^0C. Stanley (2010)

Data collection
The yield of *P. tuber-regium* on the different substrates was determined by recording the number, weight and size of the fruit bodies after sprouting. The measurements from three replicates were added and their mean value calculated. The following parameters of growth/ yield were measured.

1. Height: This was measured in centimeters using meter rule from the base to the stipe of the pileus
2. Number of fruit bodies: The number of fruit bodies were counted for each treatment and the mean calculated.
3 Diameter of pileus: This was measured in centimeters using meter rule from one edge of the pileus, across the stipe, to another.
4. Fresh and dry weight: The fruitbodies were weighed immediately after harvest using electronic balance. After recording the weight, they are then dried in an oven at 80^0C for 24 hours. Their mean weight were also recorded

ANOVA was the statistical method used in the analysis of data. Completely Randomized Design (CDR) was used as the experimental design

RESULTS
Table 1 shows the effect of organic wastes on the mycelial growth of *P. tuber-regium* and in Table 2 shows the assessment of growth parameters of *P. tuber-regium* on various organic wastes

TABLE 1: Effect of Organic wastes on the mycelial growth of *P. tuber-regium*

Organic waste used as substrate	Time of mycelial growth initiation after inoculation (days)	Mycelial growth after 14days of inoculation	Fruit body formation after 22 days of inoculation
T1 = maize cob	3	Very abundant	+
T2 = cassava peelings	3	Very abundant	+
T3 = plantain peelings	3	Abundant	-
T4 = water-melon pods	4	Moderate	-

KEY: + = Fruit bodies formed; -= no fruit bodies formed; Moderate = 3^+ mycelial density [as described by Kadiri (1998) with some modifications]; Abundant = 4^+ mycelial density [as described by Kadiri (1998) with some modifications]; Very abundant = 5^+ [as described by Kadiri (1998) with some modifications]

TABLE 2: Assessment of growth parameters of *P. tuber-regium* on various organic wastes

Treatment	Av. Height of stipe (cm)	Av. Diameter of pileus (cm)	Av no. Of healthy fruit bodies	Av. Fresh wt. Of fruit bodies (g)	Av. Dry weight (g)	Biological efficiency
T1	7.0	13	20	87.3	21.8	8.7
T2	5.1	10.2	15	85.0	21.8	8.5
T3	NIL	NIL	NIL	NIL	NIL	NIL
T4	NIL	NIL	NIL	NIL	NIL	NIL

KEY: Av – Average; Wt – weight; No. – Number; NOTE: Average was taken on 3 replicates

DISCUSSION

All the substrate used in this study, supported the mycelial growth of the mushroom studied but only two (maize cobs, T1 and cassava peelings, T2) sustained the growth and development of fruit bodies. This study is the first effort in obtaining the growth of mushroom mycelial on water melon wastes (water melon pod). The mycelial density after fourteen (14) days of inoculation was very abundant on corn cobs and cassava peelings, moderate on water melon pods and abundant on plantain peelings. The varying degree of mycelial growth on different substrates may be dependent on their nature, nutrient composition and the type of mushroom cultivated. Oei (1991) in his view stated that pH, aeration, available nutrient, water contents and microbial activity determine the quality of substrates which in turn determine yield. From the study, the substrate T1 and T2 supported excellent formation of healthy fruit bodies. In all the growth parameters (average height of stipe, average diameter of pileus, average number of healthy fruit bodies, average fresh weight of fruit bodies, average dry weight of fruit bodies, biological efficiency) considered in this study *P. tuber-regium* had a better performance on T1 and T2 as against T3 and T4 (table 2a and 2b).

Furthermore, T1 proved to be better than T2 except in average dry weight and biological efficiency where there was no significant difference.

CONCLUSION

This study has achieved three main things;

1. The organic wastes (corn cobs and cassava peelings) successfully supported the growth of *P. tuber regium*, this success could also be a method of controlling wastes in the environment and also increase our protein supply through mushroom consumption
2. Nutritious foods have been produced at profit while using materials that would otherwise be considered 'waste'. This constitute a valuable service in the self-sustaining communities we envisage for the future
3. Two organic wastes (maize cobs T1 and cassava peelings T2) used in the study supported the development of mycelia growth and fruiting of the mushroom studied whereas, plantain peelings T3 and water melon T4 supported only the growth of the mycelia. More research is encouraged especially in combination treatments.

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