# STUDIES ON CULTIVATION OF SOME WILD EDIBLE MUSH ROOM ON SOME LIGNOCELLULOSIC SUBSTRATES IN MAIN CAMPUS, AHMADU BELLO UNIVERSITY, ZARIA

**Adamu A. Ambi[1*], Usman. U. Pateh[2], Muhammad I. Sule[2], Garba F. Nuru[3]**

[1*] Department of Pharmacognosy and Drug Development, Ahmadu Bello University, Zaria, Kaduna, Nigeria
[2]Department of Pharmaceutical and Medicinal Chemistry, Ahmadu Bello University, Zaria, Kaduna, Nigeria.
[3]Department of Biological Sciences, Ahmadu Bello University, Zaria, Kaduna, Nigeria

**ABSTRACT**

A study on the cultivation of *Pleurotus ostreatus* and *P. pulmonarius* mushroom on different substrates was conducted at Biological Sciences Department, Main Campus Ahmadu Bello University, Zaria. The aim was to investigate the influence of some substrates on the growth of *Pleurotus ostreatus* and *P. pulmonarius* so as to organically utilize these substrates and minimize the environmental nuisance caused by their burning. The highest yield was recorded from *Gmelina arborea* sawdust, followed by corn cobs. *Gmelina arborea* sawdust is considered the most suitable substrates for growing of *Pleurotus ostreatus* with no growth in *P. pulmonarius*. The chemical properties of the various substrates combined to influence the chemical endowment and growth of *Pleurotus ostreatus*.

## INTRODUCTION

Cultivation of mushroom can be viewed as an effective way to extract bioresources left behind in agricultural residues and as a sound environment protection strategy. The use of the residues in bioprocess may be one of the solutions to bioconversion of inedible biomass residue into nutrition protein rich food in the form of edible mushroom [3; 9; 8.] However, mushrooms cultivation is not easy; it involves many steps from selecting a suitable technique and strain to spawn manufacturing, growing the crops and marketing the final crop [12].

Mushrooms are saprophytes and grow well on organic matter. Mushrooms have been known internationally as far back as when most collectors had no knowledge about their biology. They grow luxuriantly in most part of the world on different substrates. Mushrooms are found growing on rootless of certain trees (as mycorrhiza) and on termitaria, lawns and field [15; 13.] Mushrooms are divided into four based on their natural substrate: Ligncolous (wood inhabiting), Humicolous (humus inhabiting), Caprophilous (dung inhabiting) and Fungicalous (fungus inhabiting [15].

Mushroom cultivation is a worldwide practice which utilizes almost all agricultural and agro-industrial residues as substrate [2]. Presently, cultivation of edible mushroom is still very limited to South Africa and Kenya which have developed viable mushroom industries. Cultivation of mushroom can be viewed as an effective means to extract bio-resources left behind in agro-industrial solid residues and as environmental protection strategy. The use of these residues in bioprocesses may be one of the solutions to bioconversion of inedible biomass residues into nutrition protein rich food in the form of edible mushroom [3; 9; 8.]

There is little knowledge about cultivation of edible mushroom in the tropics but recently science has been studying tropical mushroom [12]. Most of the strains are suitable for cultivation in temperate climate examples include *Pleurotus sp* and *Volvoriella sp* [12; 4].

In Nigeria, cultivation of edible mushroom is almost at the level of commercialization. However, the practical field application of many laboratory results still leaves much to be desired. Many still depend largely on mushroom harvested from the wild.

Mushrooms have been found to contain sugar, protein, fats, minerals as well as vitamins [1; 7]. Mushroom proteins are valued to be of better quality than those of meat, milk, egg and legumes [5]. Polysaccharides of mushroom cellulose stimulated the production of antibodies in human [17]. Mushrooms also contain cholesterol reducing substances and low carbohydrates content which makes them suitable for

***Corresponding author:**

*Email:aaambi@abu.edu.ng*

patients with high blood pressure, heart disease and diabetic [16.]

In view of the importance of mushroom to man, animal and the environment, it is good for their consumption. This study is therefore designed to investigate the suitability of some agricultural wastes as substrates for mushroom cultivation.

## MATERIALS AND METHOD

### *Substrate Collection*

Sawdust was obtained from some economic plants. They are *Khaya senegalensis, Gmelina arborea, Delonix regia* cassava peels, corn cobs, melon chaff, paper waste and water hyacinth. The sawdust was brought from Timber shed, Sabon Gari, Zaria while the other materials were obtained from Samaru Market in Zaria. Calcium carbonate and calcium sulphate were used as supplement. Wheat bran was domestically obtain and used as additive.

### *Tissue Culture*

The first step in any mushroom cultivation is to obtain a pure mycelia culture of the specific mushroom strain. In this study, two varieties of mushroom were used to establish a pure mycelia culture of the mushroom. At first, a potatoes dextrose agar was prepared.

### *Preparation of Potato Dextrose Agar (PDA)*

Materials needed for potato dextrose agar preparation, include Irish potato, glucose, agar powder, measuring cylinder, autoclave, hot plate, knife, distilled water, pot and weighing balance.

The potato is first peeled using the knife and cut into tiny pieces. It is then rinsed with water and rinsed again with distilled water. This is then weighed depending on the amount needed. It is put into a conical flask and distilled water added then placed on hot plate to boil. The potato is allowed to boil until very soft and the water filtered using a cheese cloth. It is then mixed with agar powder and glucose which have also been dissolved using distilled water. The mixture is then put into a pot containing small quantity of water and put on hot plate to heat until a homogenous mixture is obtained.

The mixture is then autoclaved at $104^0$C for 15 minutes. The autoclave is allowed to cool for 1 hour 30 minutes before opening to remove the conical flask. The potato dextrose agar is then ready. The PDA is then poured into the Petri-dish and inoculated in the inoculation chamber which has been sterilized with cotton wool soaked in ethanol for storage purpose, the PDA can be stored in medical bottles.

### *Spawn Preparation*

Spawn of two varieties of wild edible mushroom were prepared using grains of wheat, corn and guinea corn bought from Samaru market, Zaria. Each grain was soaked for five minutes and boiled for ten minutes. The excess water is then drained. The grains were then mixed with 1% calcium carbonate and packed in jam bottles. Each Jam bottle contain a spawn of *Pleurotus ostreatus* and *Pleureotus pulmonarius* mixed with grains of either wheat, corn and guinea corn and *Khaya senegalensis, Gmelina arborea,* paper waste, corn cobs, water hyacinth and melon chaff which serves as the substrates respectively. Each jam bottle was inoculated with mycelia from the tissue culture prepared and were kept at room temperature till use.

### *Substrate Preparation*

Each substrate was mixed with 1% calcium carbonate, calcium sulphate and wheat bran. The mixture was put into Mayonnaise jam bottle and labeled for easy recognition. The bottles were then placed in a drum containing small quantity of water with their lids sealed with aluminum foil paper. The mixture in the jam bottles was then sterilized for two hours heating at constant heat in the air tight drum.

The substrates were allowed to cool and were then inoculated in the inoculation chamber. The substrates were put in a clay pot to moderate the temperature and humidity created by watering both substrates and the pot twice daily. The mycelial growth of the mushroom was observed.

### *Remification and Frutification*

The quantity of mycelial determines the number of fruit bodies produced. Different mushroom species have different nutritional requirements for growth and development. Fruit body induction was achieved by reducing the temperature of the environment by spraying water in the pot and opening the lids of the Mayonnaise jam bottles. Fruiting bodies were harvested and the fresh weight, stipe height and pileus diameter taking.

### *Harvesting and Packaging*

The mushroom was harvested using a pair of scissors which was sterilized with ethanol to cut the stipe from the under and packaged in cans. Mushroom quality detoriates rapidly after picking especially at higher

**Table 1: Comparative Mycelial growth of *Pleuratus ostreatus* and *Pleurotus pulmonarius***

| Substrate | *Pleurotus ostreatus* (cm) | *P. pulmonarius* (cm) |
|---|---|---|
| Wheat | 3.2 | 4.4 |
| Maize | 3.4 | 3.3 |
| Guinea corn | Nil | 3.4 |
| Khaya senegalensis | 8.2 | 8.1 |
| Gmelina arborea | 4.7 | - |
| Paper waste | 5.6 | - |
| Corn cobs | 9.1 | - |
| Water hyacinth | 3.6 | - |
| Melon chaff | 4.1 | - |
| Delonix regia | 6.5 | - |

temperature hence, it is necessary to cool fruit bodies so as to increase their shelf life.

## RESULTS AND DISCUSSION

*Pleurotus ostreatus* colonized faster and covered *Khaya senegalensis* sawdust except guinea corn that did not show any ramification (Table 1). *Pleurotus pulmonarius* also colonizes Khaya senegalensis and the other 3 substrates also show ramification wheat, maize, guinea corn. This result suggests that *Khaya senegalensis* substrate supports the mycelial growth of the mushroom species.

*Pleurotus ostreatus* grown on *Gmelina arborea* sawdust recorded the highest fruit body followed by corn cobs (Table 2). *Pleurotus ostreatus* grown an *Delonix regia* had the highest stipe diameter (2.4cm). The lowest total fresh weight was recorded by *Khaya senegalensis* sawdust. Though, it ramified faster, it recorded few fruiting bodies. This may be due to the environmental factors which did not favour fruiting body production.

*Pleurotus pulmonarius* colonized substrates with no growth in any of the substrates. The lowest mycelial growth colonization was recorded in wheat (Table 3).

## DISCUSSION

The result of this study shows that *pleurotus ostreatus* can be grown successfully on four of the substrates as shown on Table 2 although it colonized all the substrates except Guinea corn. This indicates that these substrates contain nutrients that support the growth of this mushroom. The ability of *Pleurotus ostreatus* to grow successfully on *Gmelina anborea* sawdusts may be associated with the nutrient contained in it. Variations observed in the number of fruit bodies produced may be associated with the differential nutrients status of the substrates and to some extent the physical nature of the substrates as well as the nature of the (mushroom). The number of fruit bodies recorded is related to their mycelial colonization. Although, *Gmelina arborea* sawdust yielded the highest total weight and number of fruit body that cultivated on *Delonix regia* had a wider pileus diameter. This result relates to the findings of [14] with respect to *P. tuberegium*.

**Table 2: Performance characteristics of *Pleurotus ostreatus* and some substrates**

| Substrates | Mycelia colonization (Days) | Total fruit body per bag | Total fresh weight (g) | Stipe Height (cm) | Pileus diameter (cm) |
|---|---|---|---|---|---|
| Guinea corn | 38 | 3 | 1.6 | 2.0 | 2.3 |
| Gmelina arborea | 42 | 4 | 3.0 | 2.3 | 2.1 |
| Khaya senegalensis | 37 | 2 | 0.5 | 1.1 | 1.0 |
| Delonix regia | 44 | 2 | 0.7 | 2.2 | 2.4 |

**Plate 1: Photograph of *Pleurotus ostreatus* growing on corn cobs substrate**

**Plate 2: Photograph of *Pleurotus ostreatus* growing on *khaya senegalensis* substrate**

**Plate 3: Photograph of *Pleurotus ostreatus***

**Plate 4: Photograph of *Pleurotus ostreatus* growing on *Delonix regia* substrate**

**Plate 5: Photograph of *Pleurotus ostreatus* growing on *Gmelina arborea* substrate**

**Plate 6: Photograph of *Pleurotus ostreatus***

The failure of *pleurotus Pulmonarius* to produce fruit body despite colonizing the substrates suggests that they did not contain some growth factors such as required by *Pleurotus pulmonarius*. These results compare favourably with the findings [6,] who obtained fruit bodies of lentinus edodes and *L. subnundus* from sawdust of cotton waste and corn cobs which are all farm waste. *Gmelina arborea* sawdust influenced the growth and yield of *pleurotus*

*ostreatus* fruiting bodies. Therefore, any attempt to produce *pleurotus ostreatus* at subsistence or commercial level can consider *Gmelina arborea* sawdust as substrates.

## CONCLUSION

In conclusion, it has been found that the lignocellulosic substrates examined can be successfully used for the cultivation of mushroom. This study particularly shows that *Pleurortus ostreatus* grow well on some of these substrates especially *Gmelina arborea* sawdust. The chemical properties of the various substrates influenced the chemical endowments and growth of *Pleurotus ostreatus* and *P*. pulmonarius. The observed differences in the substrates yield may be due to the percentages content of cellulose materials and essential nutrients.

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