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Responses of *Lentinus subnudus* Berk to Varying pH and Photoperiods

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Abstract

Studies were carried out on the response of *Lentinus Subnudus* Berk to varying pH and photoperiods. Optimum mycelial extension was obtained with exposure to continuous darkness while exposures to continuous light resulted in the least mycelial extension. In converse, fruitbodies yield was the least for inoculated compost exposed to darkness. Compost exposed to 12hrs light + 12hrs darkness produced the greatest yield. With respect to *L. subnudus* responses to varying pH, pH6 compost gave the best mycelial and fruitbody production whereas pH 11 compost had the least mycelial and fruit body production. The significance of the present findings is discussed.

Keywords: *Lentinus subnudus*, photoperiods, pH, mycelial extension, fruit body production.

1.0 Introduction

Edible mushrooms are cultivated mainly for their high protein content, culinary value and aromatic flavour (Awan, 1983; Kadiri, 2005b). They are also low in dietary fat content, thus making them suitable for patients with cardiac diseases (Jonathon and Fasidi, 2006).

In Nigeria, apart from consumption as food, mushrooms are utilized for the cure of various ailments, like cold, fever, chest pain, stomach pain, chicken pox, small pox, asthma, nervous disorder, high blood pressure, headache, and as aid in foetus development in the womb (Oso, 1977; Kadiri *et al*., 2003).

Numerous plant wastes, examples like banana leaves, coconut husk, Panicum maximum, maize cob, cotton waste, rice and barley straws, water hyacint and water lettuce have been used for mushroomcultivation (Oei, 2003; Kadiri and Arzai, 2004).

Environmental factors and internal condition of the substrate are believed to play important functions in mushroom cultivation (Oei, 1996; Bahl, 1988; Rambelli, 1983). Chandra and Purkayastha (1977) reported pH 5.5 as the optimal pH for the growth of *A. campestus* and *Voluaniella volvcea*.

The fruitbody is usually supplied with nutrient by the mycelia growing in the compost and following spore release, the mushroom enters senescence and cell death, presumably to prevent the mushroom from becoming a drain on the mycelium and the compost (Chang and Miles, 2004).

Agina and Joshua (2004) and Joshua and Agina (2002) observed that *Pleurotus ostreatus* mother spawn could be prepared on different cereal grain and sawdust of mahogany and obeche, with cereal grain spawns being better than sawdust spawns. *Lentinus subnudus* Berk is found naturally growing in decaying dead logs and old stumps of *Spondias Mombin L.* (Kadiri, 2005a). *Lentinus subnudus* has been shown to be rich in ascorbic acid, amino acids, protein and glycogen, with protein being the most abundant nutrient (Fasidi and Kadiri, 1991).

The present study was carried out to assess the effects of photoperiod and pH on mycelial growth and

fructification of *L. subnudus* using cotton waste as basal raw material.

2.0 Materials and Methods

2.1 Preparation of mycelial culture

The mycelial culture of *Lentinus subnudus* was established by tissue culture of the pileus on malt extract agar medium. This was regularly subcultured thereafter.

2.2 Effect of photoperiod on mycelial growth and fructification

The substrate used was a mixture of cotton waste, rice bran and cassava peel powder. The substrate constituents were soaked separately in boiling water for 1 hour and thereafter squeezed. The squeezed cotton waste was teased and the substrate constituents were combined together in the proportion of cotton waste (86%) + rice bran (10%) + cassava peel powder (4%). Large quantity of the substrate mixture was dispensed into 24 autoclaveable polypropylene bags at 1kg per bag. The bags were tied with rubber bands at their top and sterilized at 121^0C for 1 hour. The ensuing sterilized substrate in polypropylene bags was inoculated under a Laminar air-flow chamber with a mycelia-ramified planting spawn of cotton waste (86%) + rice bran (10%) + cassava peels (4%). The planting was obtained by inoculating the above mixture with mycelia-ramified grain mother spawn of sorgum grain (92%) + $CaSO_4$ (8%), which in itself was obtained by inoculating this mixture with mycelial culture prepared as described above (Kadiri and Kehinde, 1996). The inoculated 24 bags were placed under the photoperiods of continuous light, continuous darkness, 8 hours light + 16 hours darkness and 12 hours light + 12 hours darkness at 6 bags per photoperiod at 30 ± 2^0C, 70-85% relative humidity and 200-400 lux light intensity. At 26 days of incubation, the mycelial length and density were taken using a metre rule and visual observation. Two weeks later when primordial formation was observed, the bags were opened to allow for aeration, and spray watering was carried out whenever needed. Thereafter, sprouting of fruitbodies were observed. The ensuring fruitbodies were counted and their weights and diameters determined. The fruitbody maturation time, fruitbody and spore print colours were noted.

2.3 Effects of pH on mycelial growth and fructification

The method emplyed was similar to that of effects of photoperiod on mycelial growth and fructification. The substrate constituents were cotton waste (86%) + rice bran (10%) + cassava peel powder (4%), which were prepared as described above. The substrate was divided into 6 portions, with each portion having 12kg weight. Using IMHCI, IMNaOH, pye unicam pH meter, five substrate portions were adjusted to pH 3,5,9 and 11 by dropwise addition of IMHCI or IMNaOH while the sixth portion, which is the control was found to have pH 7. Each portion was thereafter dispensed into 12 autoclavable bags at 1kg per bag and the bags sterilized at 121^0C for 30 minutes. The contents of the bags were inoculated under a laminar air-flow chamber with a planting spawn as described above. All the bags were incubated at 30 ± 2^0C, 70-85% rel. hum and 200-400lux light intensity. At 26 days of incubation, the mycelial length and density were measured using a meter rule and visual observation. Two weeks later, after full ramification of the substrate by mycelia and primordial formation was noticed, the polypropylene bags were moved into a fruiting chamber with temperature of 27 ± 2^0C., rel. hum 75-90% and 200-350 lux light intensity. The bags were then opened up to allow for aeration, and spray watering with water was done whenever required. The emerging fruitbodies were counted and their weights and diameters determined. The fruitbody maturation time, fruitbody and spore print colours were noted.

3.0 Results and Discussion

Exposure to continuous darkness resulted in best mycelial extension while continuous light exposure resulted in the least mycelial extension and density (see Table 1). In contract, photoperiod of 12hrs light + 12hrs darkness exposure produced the best fructification while continuous darkness produced the worst (see Table 1). Fruitbodies produced from inoculated compost exposed to continuous darkness were thin, had small cap and gave the least yield of 5g. In contrast, compost exposed to 12hrs light + 12hrs darkness produced 25 well-developed fruitbodies and gave the greatest yield of 292g (see Table 1). Darkness is observed to be a stimulator of mycelial growth and this may be responsible for the result obtained. Oei (1996) obtained the highest spawn run for S. *nigosa-annudata* exposed to total darkness. Light, on the other hand, is needed for proper development of mushroom fruitbodies. Gerrits (2006) reported of the importance of light for the formation of reproductive structures and accelerating their phototropic responses. The implication of these findings is that exposure to continuous darkness is necessary for good mycelial production while exposure to partial light is needed for healthy fruitbodies production in mushrooms.

Table 1: Effect of photoperiod on mycelial growth and fructification of *Lentinus subnudus* using cotton waste as basal raw material

Photoperiod	Mean Linear Mycelia Extension at 26 days of incubation (cm)	Mycelia Density at 26 days of incubation	Mean Pileus Diameter of mature Fruitbody (cm)	Mean Number of harvested Fruitbodies	Mean Fresh Weight of harvested Fruitbodies (g)	Fruitbody Maturation Time (days)	Fruitbody and Spore Print Colour
8hrs light + 16hrs darkness	12.3	4+	4 -10	15	145.6	3	White
12hrs light + 12hrs darkness	11.7	4+	4- -12	25	292.0	3	White
Continuous Light	10.0	3+	4 -10	22	151.8	3	White
Continuous Darkness	13.3	4+	3 – 4	05	15.0	3	White

Table 2: Effect of pH on mycelial growth and fructification of *Lentinus subnudus* using cotton waste as basal raw material

pH	Mean Linear Mycelia Extension at 26 days of incubation (cm)	Mycelia Density at 26 days of incubation	Mean Pileus Diameter of mature Fruitbody (cm)	Mean Number of harvested Fruitbodies	Mean Fresh Weight of harvested Fruitbodies (g)	Fruitbody Maturation Time (days)	Fruitbody and Spore Print Colour
3	10.5	3+	4 – 9	33	79.8	3	White
5	13.0	4+	4 – 11	41	187.1	3	White
6	15.0	5+	6 – 12	50	210.6	3	White
7	11.3	4+	4 – 11	43	189.2	3	White
9	10.5	3+	4 – 10	32	77.4	3	White
11	9.5	2+	4 - 9	30	51.6	3	White

Table 2 shows the effects of pH variation on mycelial and fruitbody production of *L. subnudus.* Optimum mycelial and fruitbody production was observed on pH 6 compost while pH 11 compost produced the least. Composts of pH 3 and pH 9 also had low mycelial and fruitbody production. Oso (1977), Kadiri (1998), Joshua and Agina (2002), Agina and Joshua (2004) had earlier reported optimal mycelial growth at pH 6 for *Pleurotus sajor-caju, Pleurotus ostreatus and Pleurotus tuber-regium.* Gerrits (2006) recommended the addition of gypsum to compost with the aim of reducing the acidic condition of the compost.

In conclusion, it is clear from the findings in this study that *L. subnudus* fruitbodies are best cultivated in compost having pH of 6.0 and exposed to equal photoperiodic condition of alternating 12hrs light and 12hrs darkness.

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References

Agina, S.E. and Joshua, V.I. 2004, "Mushroom mother spawn preparation with different grains and sawdust types. Nigerian Journal of Botany", **17**, 128-131.

Awan, J.A. 1983, "Fungi food poisoning", Elements of food borne diseases, (1st edition), Institute of Management and Technology pp. 61-64.

Bahl, N. 1988, Handbook on mushrooms, 2nd edition. Oxford and IBH, New Delhi, India, pp. 29 –38.

Chandra, A. and Purkayastha, K.A. 1977, "Physiological studies on Indian edible mushrooms", Trans. Brit. Mycol. Soc., **69** (1), 63-70.

Chang, S.T. and Miles, P.G. 2004, Mushrooms, nutritional value, medicinal effect and environmental im pact,. CRC press. Washington pp. 46 – 86.

Fasidi, I.O. and Kadiri, M. 1991, "Changes in nutrient contents of *Termitomyces robustus* and *Lentinus subnudus* during sporophore development", *Acta Botanica Hungarica,* **35,** 167-172.

Gerrits, J.P.G. 2006, "Preparation of compost for the production of mushrooms in the Netherlands", Acta Horticulurae, **172,** 60-63.

Jonathan, S.G. and Fasidi, I.O. 2006, "Effect of carbon, nitrogen and mineral sources on growth of psathyella atronumbonata (Pegler), a Nigeria edible mushroom", Food Chem, **77,** 479-483.

Joshua, V.I. and Agina, S.E. 2002, "Cultivation of *Pleurotus ostreatus* on sawdust in Jos Plateau", Nige ria Journal of Botany, **15**, 53-56.

Kadiri, M. 1998, "Spawn and fruitbodies production of *Pleurotus sajor-caju* in Abeokuta, Nigeria", Nigerian Journal of Botany, **11,** 125-131.

Kadiri, M., Arzai, A.H. and Aliyu, B. S. 2003, "Mushrooms and mankind", African Journal of Material and Natural Sciences, **3**, 141-148.

Kadiri, M. and Arzai, A.H. 2004, "Cultivation systems for *Lentinus subnundus*", African Journal of Material and Natural Sciences, Vol. 4 (In press).

Kadiri, M. 2005a, "Cultivation of *Lentinus subnudus* on woodlogs", Bioresource Technology, **94** (1), 65-67.

Kadiri, M. 2005b, "Toxicological evaluation of Lentinus squarrosulus Mont. (Polyporales), an indigenous Nigerian mushroom", International Journal of Medicinal Mushrooms, **7** (3), 417-417.

Kadiri, M. and Kehinde, I.A. 1998, "Production of grain mother and planting spawns of *Lentinus subnudus*", Nigerian Journal of Botany, **12**, 37-44.

Oei, P. 1996, Mushroom cultivation with special emphasis on appropriate technology for developing countries, Tool Publications, Leiden, Netherlands, pp. 171-178.

Oei, P. 2003, Mushroom cultivation, Appropriate technology for mushroom growers (3rd edition), Backhuys Publisher, Leiden, The Netherlands. P. 46-106.

Oso, B.A. 1977, "Mushrooms in Yoruba mythology and medicinal practices", Econ. Bot., **31**, 367-371.

Rambelli, P.A, 1983, Manual on mushroom cultivation, Food and Agricultural Organisation, Protection Paper No. 3, Rome, pp. 2-49.