CULTIVATION OF OYSTER MUSHROOM (*Pleurotus flabellatus*) ON DIFFERENT SUBSTRATES

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ABSTRACT

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The study was conducted at the laboratory of Food Microbiology, Institute of Food Science and Technology, BCSIR, Dhanmondi, Dhaka-1205 during July 2000 to May 2001 to find suitable sawdust as substrate for growing Mushroom. Seven different type of substrates viz. Mango, Jackfruit, Coconut, Jam, Kadom, Mahogony, Shiris sawdust with wheat bran and $CaCO_3$ were evaluated to find their growth and yield of Mushroom. The maximum biological yield per packet was obtained with Mango sawdust (150 gm) followed by Mahogony (148 gm), Shiris (146 gm), Kadom (136 gm), Jam (114 gm), Jackfruit (97 gm) and Coconut sawdust (83 gm). The lowest yield was observed in Coconut sawdust (83 gm). However, highest return was obtained with Mango sawdust (Tk 24.86) while the lowest with Jackfruit sawdust (Tk11.68). Cost benefit analysis revealed that the Mango sawdust and Shiris sawdust were promising substrates for the growing of Oyster Mushroom (*Pleurotus flabellatus*).

Keywords: Mushroom, sawdust, biological yield

INTRODUCTION

Mashroom is rich in protein, some essential amino acids, fiber, potassium, and vitamins and have low cholesterol and fat levels (Rafique, 1996). Mushroom cultivation represents the only current economically viable biotechnology process for the conversion of waste plant residues from forests and agriculture (Wood and Smith, 1987). Sawdust and sugarcane bagasse were the best substrates for growing of Oyster Mushroom than other agro-based substrates (Ahmed, 1998). Wide spread malnutrition with ever increasing protein gap in our country has necessitated the search for alternative source of protein because the production of pulses has not kept pace with our requirement due to high population growth. Animal protein is beyond the reach of the most people in this country because most of the people (over 86%) live beyond poverty level (World Bank, 1992). Edible mushrooms are recommended by the FAO as food, contributing to the protein nutrition of developing countries dependent largely on cereals.

Presently three Mushrooms namely *Pleurotus* species (Oyster Mushroom), *Volvariella volvaceae* (Straw Mushroom) and *Auricularia spp* (Ear Mushroom) are under commercial cultivation in Bangladesh. Compost or uncompost wheat and paddy straw, banana leaves, sugarcane bagasses and leaves, wheat barn, rich husk, sawdust etc can be used as substrate for growing mushroom (Gupta, 1986). Present work was undertaken to find suitable sawdust as substrate for growing Mushroom.

MATERIALS AND METHODS

Collection of sawdust

To study the influence of different substrates on the growth and yield of Mushroom, substrates used were Mango sawdust, Jackfruits sawdust, Jam sawdust, Kadom sawdust, Mahogony sawdust, Shiris sawdustand Coconut sawdust collected from Rajghat, Abhoynager, Jessore. Wheat barn was collected from local market.

Media and culture

Potato dextrose agar (PDA) media was prepared by using dehydrated PDA medium. To obtain pure culture a small piece of the fruiting body of Mushroom and placed on the sterilized PDA media under aseptic condition. It was then kept for 7 – 10 days in an incubator under 25°C for sufficient growth. This pure culture was used for the entire experiment.

Preparation of mother culture

Mother culture (MC) was prepared by using mango sawdust. The MC substance consisting 1.0 kg of sawdust, 500 gm fresh well dried wheat bran and 15 gm $CaCO_3$ for preparation of 30 bag of MC. The substrate was tightly packed and a hole was made (2/3 of its length) with sharp end stick at the centre to have the space to put the inoculums for uniform running of the mycelium. Then the bag was plugged with cotton and covered with brown paper placing a rubber band to hold it in place. The bags were autoclaved and kept 24 hours at room temperature for cooling. Then, a piece of PDA block from pure culture containing mycelia was placed through prepared hole of the bags. The bags

plugged with cotton were kept in an incubator at 25°C for running of the mycelia. After 15 days, the whole substrate became whitish in color due to fungal mycelia and then it was checked whether any contamination occurred or not and then it was ready for spawning.

Preparation of substrates

Spawn packets of seven different substrates using sawdust of Mango (*Mangifera indica*), Jackfruit (*Artocarpus heterophyllus*), Coconut (*Cocos nucifera*), Kadom (*Anthocephalus sinensis*), Mahogony (*Swietonia macrophylla*), Shiris (*Albizzia spp*), Jam (*Syzygium spp*) plants were prepared separately. The spawn preparing substrate and wheat bran nutrient consisting 2:1 V/V and 1.0% $CaCO_3$ were taken in a plastic bowl and mixed thoroughly by hand and moisture was increased by adding water until it reached 65%. A local method was developed for determination of moisture. In this method moisture was determined by passing a handful mixture. If there was no water run off and the material stayed in form indicates that the moisture content was around 65%.

Preparation and culture of spawn packet

The spawn packets were prepared separately with each type substrate. Polyethylene bag 22.5 cm X 30 cm size was filled with prepared substrate and packed tightly. Then spawn packets were prepared as described in the preparation of mother culture. Then two tea spoonfuls of prepared mother culture media containing mycelia was placed through the hole of each packet. The inoculated packets were again plugged and covered properly. The inoculated packets were kept on iron rack in an incubation room at room temperature (25°C - 30°C) and relative humidity 65 – 70%.

Mycelium running rate of each type of substrates was observed after 10 days of inoculation. The data were recorded in every one day interval. Time spent from 17 to 38 days to complete mycelium running all over the substrate of all kinds.

After completion of mycelium running spawn packets were opened. Two ends opposite to each other of the upper position of the plastic bag were opened with a blade by removing plastic sheet in 'D' shape after which the opened surface substrate was scraped slightly with a tea spoon for removing the thin whitish mycelial layer. Then the spawn packets were soaked in water for 15 minutes and invested to remove excess water for another 15 minutes. The packets were placed separately side by side on the floor of the culture house.

Harvesting of mushroom

The first primordia appear 2-4 days after scratching depending upon types of substrate, which were recorded. The harvesting date also varied depending upon types of substrate. Matured mushroom identified by curl margin of the cap was harvested by twisting to uproot from the base. Mushroom matured generally 48 hours after appearing the primordia. Data were recorded periodically during culture.

RESULTS AND DISCUSSION

The experiment was conducted to study the effect of different sawdust based substrate on the growth and yield of Mushroom.

Degree of mycelium running

Mycelium running rate in spawn packet varied remarkably on different substrate types used (Table 1). The highest running rate was observed in Mahogany sawdust (0.765 cm/day) followed by Shiris sawdust (0.76 cm/day), Kadom sawdust (0.75 cm/day), and Mango sawdust (0.745 cm/day). The lowest running rate (0.695 cm/day) of mycelium was observed in Coconut sawdust. However total days required to complete mycelium running in Mahogany, Jam, Shiris, Kadom, and Jackfruit sawdust was 25 days. While Mango and Coconut sawdust took 26 and 30 days respectively to complete mycelial running (Table 1). Bhatti (1987) also suggested that the variation of biological efficiency and incubation period of Oyester Mushroom on different substrates may be due to their different composition.

Duration of cropping period

Cropping period is an important factor for growing mushroom commercially. Remarkable difference was found in stimulation of the spawn packet on the formation of primordia in different kind of substrates (Table 1). The minimum time required for the appearance of primordia was found in Mango sawdust (3.29 days) followed by Kadom sawdust (3.61 days). The longest time (4.33 days) required for the appearance of primordia was found in Jam sawdust. Interim period of primordial formation and harvesting varied remarkably in different substrates. The

lowest interim period (2.40 days) was observed in Kadom sawdust followed by Jackfruit sawdust (2.45 days). The highest interim period (4.78 days) was required in case of Coconut sawdust. Total time of cropping (T) was calculated from sum of mycelium running (Rt), primordia formation (Pt) and primordia formation to harvesting (Ht) is shown in Table 1.

Table 1. Degree of mycelium running, growth pattern and cropping period of Mushroom

Characters	Substrates (Sawdust)							CV (%)
	Mango	Jackfruit	Kadom	Coconut	Mahogony	Jam	Shiris	
Mycelium running rate in spawn packet (cm/day)	0.745	0.705	0.750	0.695	0.765	0.700	0.760	3.84
Time required to complete mycelium running in spawn packet (Rt) in days	26	25	25	30	25	25	25	6.66
Time required to primodia formation (Pt) in days	3.29	3.70	3.61	4.00	3.77	4.33	3.81	7.90
Time required to primodia formation to harvesting (Ht) in days	3.00	2.45	2.40	4.78	2.53	4.00	2.55	27.74
Duration of cropping (T = Rt+Pt+Ht) in days	32.29	31.15	31.01	38.78	31.30	33.30	31.36	7.87

Effect of different substrates on the growth and yield of Mushroom

The effect of different substrates were investigated and found to influence the number of primordia, number of fruit body, size of fruit body and yield per packet (Table 2).

Number of primordia: The average number of primordia grown on different substrate differs remarkably (Table 2). The highest number of primordia per packet (44) was found in Mahogony sawdust. The lowest number of primordia (32.6) noted in Coconut sawdust.

Number of fruiting body: The substrate of Mahogony sawdust produced (34) fruiting body on average, followed by Shiris sawdust (32) and Mango sawdust (31) while the lowest number (27.75) of fruiting body was produced in case of Jackfruit sawdust (Table 2).

Size effective fruiting body*:* The effect of substrates on the size of effective fruiting body was remarkable. Diameter, thickness of pileus, length and diameter of stalk were the parameter for the measurement of size.

The highest pileus diameter was observed in Mango sawdust (7.0 cm) and lowest diameter (4.0 cm) in Coconut sawdust. Diameter of pileus is one of the components to attribute yield (Table 2).

The mango sawdust produced pileus with highest average thickness (0.65 cm) while Coconut sawdust gave lowest (0.47 cm) thickness. Thickness of the pileus is one of the yields contributing character of Mushroom (Table 2).

Fruiting bodies with the highest stalk diameter was found in Mahogony sawdust (0.99 cm) while the lowest diameter (0.64 cm) was found in Coconut sawdust (Table 2).

The highest stalk length was found in Kadom sawdust (3.59 cm) whereas the lowest stalk length (2.20 cm) was found in coconut sawdust (Table 2).

Biological yield*:* Considerable variation was found in yield of Oyster Mushroom using different sawdust (Table 2). The maximum biological yield (150 gm) was found in Mango sawdust based substrate. Coconut sawdust based substrates gave the minimum yield (83gm).

Dry yield of Mushroom*:* Dry yield of Oyster Mushroom varied from 8.21gm to 15.98 gm per packet in different substrates (Table 2). The highest dry yield was obtained from Mango sawdust (15.98gm) and the lowest (8.21gm) in Coconut sawdust.

Cost benefit analysis of different sawdust

Cost benefit ratio was calculated for different substrates. The highest benefit was obtained when Mango sawdust was used as substrate (Tk 24.86) followed by Shiris sawdust (Tk 24.17) while lowest benefit (Tk 11.68) was obtained when Jackfruit sawdust was used. The lowest benefit from jackfruit sawdust was used due to its unavailability, high price and low yield per packet (Table 3).

Table 2. Effect of different substrates on growth and yield of Mushroom

Characters	Substrates (Sawdust)							CV (%)
	Mango	Jackfruit	Kadom	Coconut	Mahogony	Jam	Shiris	
No. of primordia	41.00	34.65	43.00	32.60	44.00	39.00	39.89	9.91
No. of Fruiting bodies	31.00	27.75	29.00	29.61	34.00	30.00	32.00	6.27
Pileus diameter (cm)	7.00	6.11	6.20	4.00	6.16	5.50	6.90	15.56
Pileus thickness (cm)	0.65	0.53	0.59	0.47	0.63	0.54	0.60	12.17
Diameter of stalk (cm)	0.98	0.82	0.87	0.64	0.99	0.77	0.92	13.47
Length of stalk (cm)	3.0	2.98	3.59	2.20	3.36	3.01	3.34	13.42
Fresh weight of mushroom (gm/packet)	150	97	136	83	148	114	146	20.04
Dry weight of mushroom (gm/packet)	15.98	10.10	13.55	8.21	14.33	11.29	14.21	20.27

Table 3. Cost benefit ratio per packet of Mushroom production using different substrates

Treatment	Quantity required per Packet (gm)	Price of substrate per packet (Tk)	Sell price of Mushroom per packet (Tk)	Return per packet (Tk)	Cost benefit Ratio
Mango Sawdust	300.0	1.16	30.00	28.84	24.86
Jackfruit Sawdust	300.0	1.53	19.40	17.87	11.68
Kadom Sawdust	300.0	1.41	27.20	25.79	18.29
Coconut Sawdust	300.0	1.29	16.60	15.31	11.86
Mahogony Sawdust	300.0	1.77	29.60	27.83	15.72
Jam Sawdust	300.0	1.16	22.80	21.64	18.65
Shiris Sawdust	300.0	1.16	29.20	28.04	24.17

CONCLUSION

Considering the yield and cost benefit ratio, Mango sawdust and Shiris sawdust based substrates were found to be suitable for growing mushroom *P. flabellatus* commercially. Further research program using combination of two or more type of substrates for growing Mushroom, the *P. flabellatus* is in progress.

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