

Original Research Article

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Studies on Cultivation and Biochemical Characterization of *Pleurotus florida*

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Mushrooms are fleshy, spore-bearing reproductive structures of fungi grown on organic substrates and for a long time, have played an important role as a human food due to its nutritional and medicinal properties. Mushrooms are white rot fungi regarded as one of the well known food and possessing various kinds of biochemical compounds. The present study, focused on the cultivation of *Pleurotus florida* mushroom and analysis of its nutritional status. *Pleurotus florida* spawn were produced by using sorghum grains. The mushroom was grown on three different substrates like paddy straw, sugarcane trash, and sorghum stem. Among the three substrates paddy straw was gave highest yield 83.4% of biological efficiency compared with sorghum stem 50.3% and sugarcane trash 44.7%. The biochemical analysis confirms that the protein, carbohydrates, lipids and amino acids in *Pleurotus florida*. All the parameters highly present in paddy straw used as a substrate compared with other substrate.

Introduction

Mushroom cultivation is a profitable agribusiness. Incorporation of non conventional crops in existing agricultural system can improve the economic status of the farmer. Mushrooms are the source of protein, vitamins and minerals and are anti-cancerous, anti-cholesterol and anti-tumors. Sawdust produced highest yield, biological efficiency and number of fruiting bodies, recommended as a best substrate for oyster mushroom cultivation (Shah *et al.*, 2004).

Mushrooms, because of their special fragrance and texture, have been used for

many years in oriental culture as tea and nutritional food (Manzi *et al.*, 1999).

The growth of mushrooms on wheat straw and other substrates, the paddy straw was considered as the best substrate in terms of relative digestibility and nutrient status (Calzada, *et al.*, 1987). Cultivation of *Pleurotus* sp. on different substrates like saw dust, oat meal etc were studied (Wood and Smith, 1987).

Mushroom mycoprotein contains about 85-95% water, 3% protein, 4% carbohydrates,

0.1% fats, 1% minerals and vitamins (Tewari, 1986). Mushrooms also contain appreciable amounts of niacin, pantothenic acid and biotin (Subramanian, 1986).

World production of cultivated edible mushroom increased from 170 MT in 1960 to $10,995.5 \times 10^3$ MT in 2007 (Chang, 2007). Mushrooms are now-a-days popularly known as functional foods (Liu and Wang, 2009).

Materials and Methods

Preparation of spawn bottle

The half cooked sorghum grains were used as the substrate for mushroom spawn. Sorghum grains were filled in the polypropylene bag again sterilized in a pressure cooker at 15 lbs pressure for 20 minutes. These sterilized Polypropylene bags were stored in a laminar flow, which previously treated with alcohol and UV radiation.

The mycelium of *P. florida* which appeared in the Petri plates was inoculated in the bottle containing sorghum grains that were closed with non absorbent cotton plug and stored in the “Kalan Kudil” for 15 days.

Preparation of mushroom bed

Mushroom beds were prepared using paddy straw, sorghum stem and sugarcane trash used as substrates to find out the yield and quality of mushroom. The one spawn bottle can use to prepare two mushroom beds. In our study three beds were prepared to each substrate; size of each bed was 30 x 60 cm.

The polypropylene bag method was chosen for mushroom culture. Substrates (paddy straw, sorghum stem and sugarcane trash) were chopped into pieces of 2-3 inches length and soaked in water for 8 hours and

water was then drained off from the paddy straw. After words the substrates were sterilized using vertical autoclave at 15 lbs pressure for 20 min. The sterilized substrates were placed on a wire mesh net for draining off excess water. Polythene bags in the size of 30 x 60 cm were procured and filled with the treated paddy straw as follows.

A polypropylene bag was tied at one end and sterilized substrates were filled through the open end for about 5 cm. A handful of spawn from the bottle was spread towards the periphery of this layer. Over the spawn some more paddy straw was put and pressed lightly. This process was repeated five times. The mouth of polypropylene bag was rolled and closed with toe threads. Holes were made over the polypropylene bags for aeration. One bottle of spawn was enough to inoculate two bags and they were kept in a ventilated dark chamber. After 15 days it was observed that the mycelia of *Pleurotus florida* had grown all over the substrates and sprayed water 3-4 times per day.

Harvesting

The matured fruit body was harvested by hand pick up of clock wise or anti clock wise rotation before spraying of water. The harvested fruit body was weighed and recorded substrate wise individually. The same procedure was followed up to 2nd and 3rd harvesting. Then calculate the total yield and percentage of biological efficiency. Also harvested fruit body was used for further biochemical analysis.

Biochemical Analysis

The various biochemical analysis was carried out in fruit body of *Pleurotus florida* harvested from different substrates such as paddy straw, sorghum stem and sugarcane trash. The following biochemical parameters

analysed by using standard procedures like quantitative estimation of total protein by Lowery *et al.*, 1951, quantitative estimation of free amino acid by Jayaraman, 1981, quantitative estimation of total carbohydrate by Dubois *et al.*, 1956 and extraction of lipid-Liplid analysis by Sato and Murata, 1988.

Results and Discussion

Mushrooms are protein rich ecofriendly food and it is cultivable initially as an empirical process. But the scientific understanding of mushroom cultivation will help in improving the cultivation technology. Rajini Bisaria *et al.*, (1987) cultivated *Pleurotus sajorcaju* on different agro wastes like paddy straw, wheat straw etc and they have reported maximum yield with paddy straw. Singh *et al.* (1995) suggested the use of sugarcane trash for the production of oyster mushroom.

The wide range of plant waste that have been reported include sawdust, paddy straw, sugarcane baggage, corn stalk, corn cobs, waste cotton, leaves and pseudo stem of banana, water hyacinth, duck weed, rice straw etc. and does not require costly processing method and enrichment material (Mondal, 2010; Stanley, 2011).

Mushrooms with their pleasant flavour, texture and high productivity per unit area have been recognized as an exceptional food source to alleviate malnutrition in developing countries. High nutritional values of oyster mushrooms with protein (25-50%), fat (2 - 5%), sugars (17 - 47%), mycocellulose (7 - 38%) and minerals (potassium, phosphorus, calcium, sodium) of about 8 -12% (Stanley *et al.*, 2011).

Karuppuraj *et al.*, (2014) reported that the yield improvement of *P. florida* on unexplored locally available lignocellulosic

materials such as paddy straw, reeds, banana stem, sugar cane leaves, sugar cane bagasse milled and crushed coir pith sorghum husk and sunflower stem was used.

Similarly, in the present study, mycelia of *P. florida* was fast grew on sorghum grains on 16th days. After that spawn was used to further cultivation. In the present investigation, *P. florida* was well grew on all the three substrates and formed mycelium meanwhile *P. florida* was fastest spawn run on paddy straw substrate (16th day) followed by sugarcane trash (19th day) and sorghum stem (20th day). The pin head formation also first formed in paddy straw substrate on 19th day followed by sugarcane trash 23rd day and sorghum stem 25th day. The number of fruit bodies also recorded (Table 1).

In the present study, *Pleurotus florida* was gave highest yield in paddy straw used as a substrate (834 g). The moderate yield was observed in sorghum stem used as a substrate (503 g). The lowest yield was recorded in sugarcane trash used as a substrate (447 g) (Table 2).

In the present study, correlated with Karuppuraj *et al.*, (2014) the maximum bio efficiency of *P. florida* was obtained from paddy straw (124.50%) followed by reeds (100.30%).

Nine spent mushroom substrate were analyzed for reduction of cellulose, hemicelluloses, lignin, and acid detergent lignin. Sugar cane bagasse milled recorded for highest reduction of cellulose (29.40%) and banana stem for hemicelluloses (25.77%). Coir pith recorded for the highest reduction of lignin (24.36%) and acid detergent fibre (15.31%). The reeds can be utilized for successful cultivation of *P. florida* at commercial level than the paddy straw.

Table.1 Cultivation of *Pleurotus florida* on various substrates

S. No	Substrates	Spawn run day	Pinhead formation Day	Mean no of Fruit bodies
1	Paddy straw	16	19	12
2	Sorghum stem	20	25	8
3	Sugarcane trash	19	23	7

Table.2 Production of *Pleurotus florida* using different substrates

S. No	Substrates	Mushroom production (g)			Total production (g)	B.E in (%)
		1 st harvest	2 nd harvest	3 rd harvest		
1	Paddy straw	410	270	185	865	86.5
		436	245	166	847	84.7
		400	230	160	790	79.0
2	Sorghum Stem	300	124	100	524	52.4
		246	150	110	506	50.6
		230	130	120	480	48.0
3	Sugarcane Trash	146	190	126	462	46.2
		200	126	120	446	44.6
		175	150	110	435	43.5

Table.3 Nutrient contents of *Pleurotus florida* on various substrates

S. No	Substrates	Protein mg/g	Carbohydrate mg/g	Amino acid mg/g	Lipid mg/g
1	Paddy straw	22.7	10.1	9.1	4.3
2	Sugarcane trash	20.0	6.7	5.2	0.4
3	Sorghum stem	22.2	4.3	7.6	2.0

Krishna kumar *et al.*, (2009) the highest percent biological efficiency of *P. florida* was recorded on paddy straw (77.35) followed by areca nut pericarp (57.00), coconut leaf (51.25) and in rest of substrate biological efficiency was less than 50%. Mostafa *et al.*, (1991) analysed the chemical composition of *P. florida* and *P. sajorcaju*. The samples were analysed for their moisture total nitrogen, total carbohydrates, crude fat, crude fibre and ash using the standard methods. Similarly, in the present investigation, the maximum content of protein (22.7 mg/g), carbohydrate (10.1

mg/g), amino acid (9.1 mg/g) and lipid (4.3 mg/g) was observed in paddy straw used as a substrate. The moderate contents of protein (22.2 mg/g) and amino acid (7.6 mg/g) observed sorghum stem used as a substrate and carbohydrate (6.7 mg/g) observed sugarcane trash used as a substrate. The minimum content of protein (20 mg/g), carbohydrate (4.3 mg/g), lipid (2 mg/g) was recorded in sorghum stem used as a substrate and amino acid (5.2 mg/g) observed in sugarcane trash used as a substrate (Table 3).

Ghosh *et al.*, (1991) analysed the nutritive value of *P. citrinopileatus* at different stages of growth cycle and compared with that of tropical oyster mushroom. Protein content was more at I and II stage but fell thereafter.

Breene (1990) and Cokuner and Ozdemir (2000) reported that the protein contents of mushroom range from 19 to 39 g in 100g dried matter. Nuhualam *et al.*, (2007) reported that the 4 species *P. ostreatus*, *P. sajor-caju*, *P. florida* and *Calocybe indica* protein 20-25% rich in mushroom, carbohydrate content ranged from 37-48% and low amount of lipid 4.5 mg/g.

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