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PILOT SCALE CULTIVATION OF PLEUROTUS FLORIDA BY UTILIZING REEDS AS THE SUBSTRATE AND NUTRITIONAL ANALYSIS OF ITS HARVESTED FRUIT BODIES

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ABSTRACT

The present study focused on pilot scale cultivation of *Pleurotus florida* throughout the year (12 months) by utilizing reeds as the substrate. The efficacy of reeds as the alternate substrate and recorded the maximum bioefficiency 121.05% at the month of October. Totally 91.35kg of fresh fruit bodies were harvested from 95 kg of dry substrate with bioefficiency of 95.81%. The nutritional parameters of harvested fruit bodies were analysed viz., carbohydrate (46.28g/100g), protein (26.94g/100g), fat (0.37g/100g), crude fiber (28.46g/100g), ash (9.11g/100g) and folic acid (35.0µg/100g). The mineral contents parameters of harvested fruit bodies were analysed viz., calcium (129.24mg/100g), iodine (227µg/100g), iron (31.64mg/100g), magnesium (198.03mg/100g), manganese (1.64mg/100g), phosphorus (1.41g/100g), potassium (2.36g/100g) and zinc (16.18mg/100g). Among seven vitamins tested, vitamin B3 recorded maximum (16.28mg/100g). Heavy metal such as arsenic, cadmium, mercury were recorded at non detectable level whereas chromium (0.54mg/kg), copper (1.28mg/kg), lead (0.16mg/kg), selenium (4.63mg/kg). Hence the present shows a positive path that *P. florida* can be cultivated using alternative substrate and its efficacy was tested at pilot scale. As this mushroom known to several medicinal properties this study will be further focused towards pharmaceutical applications.

KEYWORDS: *Pleurotus florida*, reeds, bioefficiency, nutritional parameters.

INTRODUCTION

In developing countries, malnutrition is one of the major problems. Peasant communities in these countries are only producing for subsistence and their conventional agriculture techniques are often unable to keep up with increasing demand for food. It is thus clear that the present situation calls for alternative strategies to produce a source of protein foodstuff. Mushroom cultivation is considered to be healthy food since they have high protein content. The 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 a good source of protein, vitamins and minerals and are known to have a broad range of uses both as food and medicine [1]. It has high nutritive, medicinal value and contributes to a healthy diet because of its rich source of vitamins, minerals and proteins. Mushrooms with their flavour, texture, nutritional value and high productivity per unit area have been identified as an excellent food source to alleviate malnutrition in developing countries [2-3]. Mushrooms are also known for their medicinal properties, these are low in calories and ideal food for diabetic and heart patient. Mushroom has qualities like lowering the blood cholesterol level and warding against cancer [4]. It is evidently clear that the growing interest in the cultivation of mushrooms can help in solving many problems of global importance such as protein shortage as well as improving the health and wellbeing of people, considering that mushrooms are valuable health foods which are low in calories and provide essential minerals. Mushrooms have a great nutritional value since they are quite rich in protein, with an important content of essential amino acids and fiber, and poor in fat. Edible mushrooms also provide a nutritionally significant content of vitamins (B1, B2, B12, C, D and E) [5-6]. Therefore our present research on cultivation of *P. florida* by utilizing reeds as an alternative substrate was carried out at pilot scale. The yield performance of *P. florida* was continuously monitored for a period of 12 months. The nutritional parameters were also estimated to *P. florida* fruit bodies powder.

MATERIALS AND METHODS

Spawn Preparation

Half cooked sorghum grains were mixed with calcium carbonate at the rate of 2 per cent (20 g/kg of seed) and filled in poly propylene bag (300g) and were autoclaved for 1.5 to 2.0 hour. The sterilized bags were aseptically inoculated with pure mycelium of *P. florida*, maintained on potato dextrose agar (PDA) slopes and incubated at room temperature (28±2 ℃). The spawn growth was completed in 12 to 14 days.

Mushroom Bed Preparation

P. florida was cultivated by using reeds as substrate. Chaffed reeds bits of 3-5cm in length were soaked in cold water for 8 hour and after draining the excess water the reeds bits were boiled for 30 to 45 minutes in a separate drum with fresh water. The excess water was drained and the substrate was shade dried to remove excess moisture. Mushroom beds were prepared by using 30X60cm size polythene bags of 100 gauge with two holes laterally. The reeds (sterilized) placed as one layer over that sandwiched with spawn of *P. florida* in alternative layer (6%) so that, entire bed contained 7 to 8 layers of reeds alternative with the spawn.

P. Florida Mushroom Shed Construction and Maintenance

P. florida mushroom shed was erected towards east to west direction using locally available materials like coconut thatches, bamboo poles, sticks and wood's pillars. The height of the mushroom shed was 8 feet, length 15 feet and breadth 10 feet. The temperature in the mushroom growing room was maintained at 22 - 28 ℃ and the humidity was maintained between 75 to 90 %. The floor of the shed was filled with sand up to 1 feet and water was sprinkled thrice in a day. Wet gunnysacks were tied along the corners of the shed to maintain humidity. A hygrometer was kept inside the shed and thrice a day the temperature and humidity were recorded until the final harvest of the fruit body of *P. florida*.

Yield and Bioefficiency

Total weight of all the fresh fruiting bodies harvested from all the four pickings were measured as total yield of mushroom. The bioefficiency (yield of mushroom per kg substrate on dry wt. basis) was calculated by the following formula [7].

$$\text{B.E. (\%)} = \frac{\text{Fresh weight of mushroom}}{\text{Dry weight of substrate}} \times 100$$

Analysis of Nutritional Parameters

The fruit bodies of harvested *P. florida* mushrooms were dried in an oven at 40℃ for 48 hours. The dried *P. florida* powder was analyzed in an accredited laboratory (SGS), Chennai for nutritional parameters estimation.

RESULTS AND DISCUSSION

The bioefficiency of *P. florida* by utilizing reeds as substrate was evaluated continuously for A period of 12 months. The maximum bioefficiency (121.05%) was recorded during the

month of October, with the temperature ranged between 24.4 ℃ to 18.5 ℃, 95 to 75 % of relative humidity and 105 mm rainfall (Table 1). The minimum bioefficiency (73.68 %) was recorded during the month of May, temperature ranged between 31.4 ℃ to24.4 ℃, 80 to 55 % relative humidity and 11.5 mm rain fall.

Table 1. Bioefficiency of P. florida during different month of a year Month	**Tempera ture (℃)**		**Relative humidity (%)**		**Total Rain fall (mm)**	**Bioefficiency (%)**
Maximum		**Minimum**		**Maximum**		**Minimum**
January	26.1	21.3	90	70	0.75	102.63
February	27.6	24.4	90	65	-	99.47
March	29.5	26.1	90	65	-	96.84
April	29.8	26.3	80	55	30.0	86.31
May	**31.4**	**24.4**	**80**	**55**	**11.5**	**73.68**
June	31.8	23.2	85	70	87.5	84.21
July	29.3	23.4	85	70	47.5	100.00
August	29.7	23.5	85	70	23.0	105.26
September	28.2	22.2	85	70	124.0	118.42
October	**24.4**	**18.5**	**95**	**75**	**105.0**	**121.05**
November	24.5	18.2	95	70	330.1	115.78
December	26.1	18.1	95	65	109.5	105.26

Key: (mm) – millimeter,

In pilot scale cultivation of *P.florida*, the complete colonization of mycelium in mushroom bed was recorded on day 9-19, and the pinhead primordial was appeared on day 18-19. The overall yield (91.35 kg/95 kg) and bioefficiency (95.81 %) of fresh fruit bodies of *P. florida* were recorded within 45 days by utilizing reeds as an alternative cellulosic substrate (Table 2). Jandaik and Kapoor[8] reported that 20 to 28°C temperature was optimum for obtaining maximum yield of *Pleurotus* sp. required relative humidity (RH) of 70 to 80% for its cultivation required. *P. florida* required a temperature range of 22 to 28°C and more than 80% RH for its better yield and several report supports us [9-12].

Table 2. Cultivation of Fruit Bodies of P. Florida on Reeds as an Alternative Cellulosic Substrate at Pilot Scale.

Growth parameters	**Crop cycle**
Spawn run (Days)	9-10
Pin head formation (Days)	18-19
First harvest (kg)	43.95
Second harvest (kg)	26.35
Third harvest (kg)	13.63
Fourth harvest (kg)	8.28

Total fresh mushroom produced per bag (kg)	91.35
Total fresh substrates (kg)	95
Bioefficiency (%)	95.81± 1.52

Table 4. Analysis of minerals, heavy metals and from *P. florida* mushroom powder.

Calcium (mg/100g)	129.24
Iodine (µg/100g)	227
Iron (mg/100g)	31.64
Magnesium (mg/100g)	198.03
Manganese (mg/100g)	1.64
Phosphorus (g/100g)	1.41
Potassium (g/100g)	2.36
Zinc (mg/100g)	16.18
Heavy metals	
Arsenic (mg/kg)	NDL(0.05)
Cadmium (mg/kg)	NDL(0.01)
Chromium (mg/kg)	0.54
Copper (mg/kg)	1.28
Mercury (mg/kg)	ND L(0.01)
Lead (mg/kg)	0.16
Selenium (mg/kg)	4.63

Key: NDL* - Not detectable limit,

Nutritional Properties

The fruit bodies of *P. florida* (/100g) contains carbohydrate (49.28 g), protein (26.94 g), fat (0.37 g), crude fiber (28.46 g), folic acid (35.0 µg), total ash (9.11 mg), moisture (14.30%) and energy values (308.23 kcal). Among seven vitamins (/100g) tested, vitamin B3 (16.28 mg) was recorded the highest amount whereas vitamin E was the least (Table 3). Mineral contents (/100g dried powder) contains calcium (129.24mg), iodine (227µg), iron (31.64mg), magnesium (198.03mg), manganese (1.64mg), phosphorus (1.41g), potassium (2.36g) and zinc (16.18mg) were recorded (Table 4). The heavy metals contents (/kg) such as arsenic; cadmium and mercury were non detectable level. But the heavy metals such as selenium (4.63 mg), copper (1.28mg), chromium (0.54 mg) and lead (0.16 mg) was recorded in *P. florida* (Table 4). Ingale and Ramteke [13] reported that the fruit bodies of *P. florida* has protein (22 %), fat (1.9 %), crude fiber (11.5 %), calcium (23.06 mg), phosphorus (44.8 mg), potassium (235 mg), sodium (139 mg), magnesium (220 mg), iron (17.96 mg), manganese (3.6 mg) and zinc (2.3 mg). Ahmed *et al.*, [14] reported that the *P. florida* contained protein (22.40 %), fat (2.28 %), carbohydrates (55.50 %), crude fiber (8.10 %), ash (6.60 %), calcium (292 mg), phosphorus (860 mg), iron (12.81 mg) and several report supported us [15-16].

CONCLUSION

Hence the present shows a positive path that *P. florida* can be cultivated using alternative substrate and its efficacy was tested at pilot scale. The present studies *P. florida* was recorded high nutritional and minerals contents and as this mushroom known to several medicinal properties. This study will be further focused towards pharmaceutical applications.

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