

Full Length Research Paper

Characterization of *Pleurotus* sp. of mushroom based on phenotypic, biochemical and yield parameter

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Received 11 December, 2014; Accepted 20 March, 2015

The present investigations were carried out to study the cultural characteristics, morphological characteristics and protein percent of 10 different species of genus *Pleurotus* namely *Pleurotus sajor caju*, *Pleurotus flabellatus*, *Pleurotus platypus*, *Pleurotus fossulatus*, *Pleurotus florida*, *Pleurotus citrinopileatus*, *Pleurotus sapidus*, *Pleurotus djamor*, *Pleurotus ostreatus* and *Hypsizygus ulmarius*. Results obtained show that the fruiting bodies of the 10 species were of seven different colors. Diameter of the fruiting bodies ranges between 5.4 and 8.8 cm whereas length ranges between 4.9 and 13.9cm. *H. ulmarius* was found to be the best yielder (97.50% B.E.) with highest percentage (33.6) of protein content.

Key words: Oyster mushroom, morphological character, cultural character, protein, biological efficiency, yield.

INTRODUCTION

For vegetarian's mushrooms are considered as healthy food because their mineral content is higher than that of meat or fish. Besides their nutritional value, they have medicinal properties also. Mushrooms are an important source of income and nutrition in both developed and developing countries (Chan, 1981). There are more than 5000 varieties of mushrooms present which could be employed as a source of food and medicine (Chang and Miles, 1991; Boa, 2004). Almost all edible mushrooms are members of Basidiomycotina and Ascomycotina (Sharma, 1989). Mushrooms have low fat content, high fiber and all essential amino acids (Sadler, 2003). On

exposure to UV light, mushrooms produce large amounts of vitamin D. it has been found that mushrooms have some beneficial effects on cancer, HIV-1, AIDS and other diseases (Beelman et al., 2003). The three primary factors which are essential of mushroom production are temperature, compost component and humidity (Dung, 2003). Cultivation process of oyster mushrooms include 3 main steps- Isolation of mushrooms from fruiting bodies, preparation of primary and secondary spawn and cultivation of oyster mushrooms from these spawns to harvest fruiting bodies (Dung et al., 2012). The genus *Pleurotus* (Fr.) comprises various edible mushroom

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species and has important medical and biotechnological properties and environmental applications (Nelson et al., 2010). *Pleurotus* mushroom generally called oyster mushroom has gained prominence as a type of edible mushroom due to their culinary properties and wider adaptability.

There are 38 species of the genus *Pleurotus* recorded throughout the world (Singer, 1986). In recent year, 25 species were commercially cultivated in different parts of the world, such as follows: *Pleurotus ostreatus*, *Pleurotus flabellatus*, *Pleurotus florida*, *Pleurotus sajor caju*, *Pleurotus sapidus*, *Pleurotus eryngii*, *Pleurotus fossulatus*, *Pleurotus opuntiae*, *Pleurotus australis*, *Pleurotus purpurcoolivaceus*, *Pleurotus populinus*, *Pleurotus levis*, etc. The present study was conducted to assess the cultural and morphological characters along with yield and protein content in ten *Pleurotus* species.

MATERIALS AND METHODS

Cultural characteristics

The cultures of 10 species of oyster mushroom in which *P. djamor* and *H. ulmarius* were first time included for such typical study were obtained from Mushroom Research Laboratory of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur for the present study. Cultural characteristics such as growth pattern, colors, diameter and length of fruiting bodies were observed on potato dextrose agar medium and wheat straw substrate, respectively.

Spawn production

Grain spawn of all ten species was prepared using the standard methodology suggested by Garcha (1994). Healthy, uncrumpled wheat grains were washed and boiled (grain: water 1:25 w/v) to tender without rupturing of the seed coat. Extra water was drained off and the grains were allowed to dry on sieve. Commercial grade gypsum and calcium carbonate were mixed at 3% of grain to maintain pH level. The grains were filled in clean glass bottles and the bottles were plugged with non-absorbent cotton and sterilized at 22 lbs steam pressure for 90 min. Sterilized bottles were taken out of the autoclave, while still hot and were shaken to avoid clumping of the grains. The next day, the bottles were inoculated with bits of agar medium colonized with mycelium of pure culture (7-10 days old). Inoculated bottles were incubated at 25°C. After 7 and 10 days of inoculation, bottles were shaken vigorously so that mycelial threads were broken and become well mixed with the grains. Entire grains were covered with fine mycelial growth after 18 days of inoculation.

Substrate preparation

The substrate wheat straw was filled in gummy bags and these bags were soaked in a tank with water chemically treated with Bavistin 7 g + formalin 115 ml per 100 L water for 12 h (tank was covered with polythene sheet to prevent the evaporation of formalin). Thereafter, substrate were taken out of tank and spread on cemented floor treated with 2% formalin solution for 2-4 h to drain out excess water. The correct water content of the substrate was determined by squeezing the substrate in the palm; about 67% moisture was maintained (Savalgi and Savalgi, 1994).

Spawning and spawn run

Spawning was done under aseptic conditions. The grain spawn of different species of *Pleurotus* were mixed thoroughly @ 2% in the substrate containing 65-70% moisture filled up in polythene bags @ 4 kg each. After spawning, bags were kept in the crop room temperature (24 to 28°C) and relative humidity (80 to 85%) was maintained for spawn run. Humidity was maintained by spraying water twice a day.

After the completion of spawn run in the straw, it became a compact mass, which is also sticking to the polythene bags. The polythene bags were then cut by sharp and sterilized blade and opened for sporophore formation. At the time of sporophore formation, the windows were kept open for 1-2 h to provide fresh air inside the crop room and release of CO₂ and maintaining the relative humidity at 80-90%. Total harvesting period given was 40 days. The required care was taken to avoid the occurrence of pests by spraying Dimacron @ 0.2%.

Biological efficiency

Biological efficiency of the substrate was calculated by using following formula:

$$\text{Biological efficiency} = \frac{\text{Fresh weight of fruit body}}{\text{Dry weight of substrate}} \times 100$$

The protein content was estimated through Kjeldahl method (A.O.A.C., 1970). The estimation was done thrice, to compare the protein content of different species of oyster mushroom.

Protein estimation

Total protein content of different species of selected mushrooms was estimated by Kjel plus nitrogen analyzer. Total protein nitrogen was estimated by this method, multiplied by a factor for estimating the total protein content.

RESULTS AND DISCUSSION

Cultural characteristics

Observations on the morphological characteristics *viz.* growth pattern, colour, diameter and length of fruiting bodies are summarized in Table 1. The pattern of mycelial growth on potato dextrose agar in Petri plate in the case of *P. sajor caju* and *P. platypus* were compact whereas in *P. citrinopileatus* was highly fluffy. Similarly pattern of mycelium in *P. fossulatu*, *P. flabellatu* and *P. sapidus* were slightly fluffy, sparse growth in *P. djamor* and cottony growth in *H. ulmarius* were observed. Colour of fruiting bodies of all 10 species was of seven types (off white to bluish grey). As far as diameter and length of fruiting bodies is concern, the ranges are from 5.4 to 8.8 cm and 4.9 to 13.9 cm, respectively as given in Table 1.

Yield performance

From the data presented in the Table 2, it is clear that *H. ulmarius* gave significantly higher yield (975.0 g/kg of

Table 1. Cultural and morphological characteristics of *Pleurotus* species.

Name of species	Growth pattern on PDA	Characteristics of fruiting bodies on Wheat straw substrate		
		Colour	Diameter (cm)	Length (cm)
<i>P. sajor caju</i>	Compact	Grey	5.4	11.0
<i>P. citrinopileatus</i>	Highly fluffy	Milky white	8.5	12.8
<i>P. fossulatus</i>	Slightly fluffy	Off white	7.6	11.4
<i>P. florida</i>	Sparse	Milky white	6.7	12.5
<i>P. flabellatus</i>	Slightly fluffy	Milky white	8.2	13.9
<i>P. ostreatus</i>	Fluffy	Cream white	8.8	13.2
<i>P. sapidus</i>	Slightly fluffy	Off white	5.9	11.6
<i>P. djamor</i>	Sparse	Pink	7.5	4.9
<i>P. platypus</i>	Compact	Cream	6.1	9.5
<i>H. ulmarius</i>	Cottony	Bluish grey	8.1	13.0

Table 2. Yield performance and protein analyses of different *Pleurotus* species used under the study.

Name of Species	No. of fruiting bodies	Yield in g/kg substrate	Biological efficiency (%)	Protein (%)
<i>P. sajor caju</i>	46	638.5	63.85	32.3
<i>P. citrinopileatus</i>	88	685.2	68.52	31.5
<i>P. fossulatus</i>	57.2	270.0	27.00	28.8
<i>P. florida</i>	96.2	531.7	53.17	33.5
<i>P. flabellatus</i>	17.7	538.7	53.87	30.3
<i>P. ostreatus</i>	86.5	755.5	75.55	27.6
<i>P. sapidus</i>	68.0	501.2	50.12	32.3
<i>P. djamor</i>	48.2	750.5	75.05	30.6
<i>P. platypus</i>	77	390.0	39.00	28.4
<i>H. ulmarius</i>	48	975.0	97.50	33.6

substrate) followed by *P. ostreatus* (755.5 g/kg of substrate), *P. djamor* (750.5 g/kg of substrate) *P. citrinopileatus* (685.2 g/kg of substrate). *P. sajor caju* (638.5 g/kg of substrate), *P. flabellatus* (558.7 mg/kg substrate) *P. florida* (531.7 g/kg substrate), *P. sapidus* (501.2 g/kg of substrate), *P. platypus* (390.0 g/kg of substrate) and *P. fossulatus* (270 g/kg of substrate).

These results are in partial agreement and disagreement with the findings of the earlier worker (Dundar et al., 2008) who determined that fresh mushroom yield from WS, CS, MS and SS substrate media were 17.9, 14.3, 22.7 and 31.5 g, respectively. *P. djamor* and *H. ulmarius* were included in such type a study for the very first time. Singh et al. (2010) also found *H. ulmarius* as the best yielder with the highest percentage of protein (33.6).

Protein analysis

The protein content of oyster mushrooms was estimated by Kjeldahl method on dry weight basis, the data is pre-

sented in the Table 2. *Hypsizygyus ulmarius* gave significantly higher protein (33.6%) followed by *P. florida* (33.5%), *P. sajor caju* and *P. sapidus*, which both have equal amount of protein (32.3%), *P. citrinopileatus* (32.5%) *P. djamor* (30.6 %), *P. flabellatus* (30.3%) *P. fossulatus* (28.8%), *P. platypus* (28.4%) and *P. ostreatus* (27.6%) had different protein contents. In a study conducted by Khan et al. (2008), it was found that protein content was highest in *P. sajor-caju* (24.5 g/100 g of dry weight). Dundar et al. (2008) conducted a study with three species of mushrooms and found that *P. sajor-caju* is best among all the other species.

Studies carried out on crude mushroom protein by Lintzel (1943) suggested 34 - 89% of the protein digest easily. Further, Fitzpatrick et al. (1946) and Gilbert and Robinson (1957) indicated a digestibility of 60 - 70%. Various scientists such as Bose and Bose (1940), Bano et al. (1964) and Chang (1990) observed the protein content of various species of mushrooms.

It is concluded from the present study that the cultivation of *H. ulmarius* could be popularized at large scale due to greater biological efficiency (97.5) and higher

protein content (33.6).

Conflict of interests

The author(s) did not declare any conflict of interest.

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