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Yield performance of *Pleurotus sajor- caju* on different agro-based wastes

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ABSTRACT

Pleurotus sajor-caju, a nutrient rich mushroom was cultivated on four different substrates, viz. Paddy straw, Wheat straw, Apple leaf and Chinar leaf substrates. It was observed that its yield or biological efficiency was maximum on Paddy straw followed by Wheat straw, Apple leaves and Chinar leaves. It was also observed that P. sajor-caju gave the maximum yield in the first flush followed by second, third and fourth flush except in case of Chinar leaves where the yield obtained in second flush was comparatively higher than first flush.

Key Words: *Pleurotus sajor-caju*, Cultvation, Biological efficiency, Substrate.

INTRODUCTION

Food production in large quantity is a challenge but safe disposal of crop residues is a great problem. Edible fungi are natural recycler which converts lignocelluloses wastes into protein rich health food. Malnutrition is a problem in developing third world countries. The Food and Agriculture Organization have recognized mushrooms as food contributing protein nutrition to the countries depending largely on cereals. Mushrooms with their flavour, texture, nutritional value and high productivity per unit area have been identified as an excellent food source [1]. *P. sajor-caju* commonly known as Dhingri is an important edible mushrooms gaining popularity in recent years because of its high nutritional value and ability to grow on diverse agricultural wastes. The genus is characterized by its high protein content 30- 40% on dry weight basis [2] which is twice that of vegetable. Dhingri mushroom can help in solving the problems of malnutrition and disease. Poppe [3] reported that there are about 200 kinds of waste in which edible mushrooms can be produced. Various agricultural wastes rich in cellulose are being used as substrates for cultivation of Dhingri mushrooms [4]. Most of all, *Pleurotus* spp. can utilize various kinds of substrate materials than any other mushrooms. *Pleurotus* species require a temperature of 20-30°C both for its vegetative growth and reproductive phase in natural habitat [5]. Since the climate of Kashmir is quite conducive for the growth of *Pleurotus* species, therefore its cultivation can be carried out on large scale easily which in turn can empower the economy of farmers. Also in Kashmir a lot of agricultural residues rich in lignocelluloses are generated every year, which can be used as base material for cultivation of mushrooms *P. sajor-caju*. The present study aimed to examine the biological efficiency or yield of *P. sajor-caju* on different agro-based wastes used for its cultivation.

MATERIALS AND METHODS

The pure mycelial culture was maintained on potato-dextrose agar (pH=7) containing 20% potato extract; 2% dextrose; 2% agar as recomended by earlier workers [6]. For preparing the pure spawn Wheat grains were used as a nutrient capsule. Wheat grains were mixed with gypsum and chalk powder (to maintain a neutral pH and avoid clumping of grains) in a definite proportion (1Kg wheat grains, 20g of gypsum and 5g of calcium carbonate). The grains were filled in bottles and plugged with non absorbent cotton and subjected to sterilization by autoclaving at 21 lb pressure for half an hour followed by the inoculation with pure mycelia. For initiation of mycelial growth, inoculated bottles were kept in an incubator at 25C ^{o} till the mycelium spreads homogenously. When all the grains in the bottles were run over by mycelium they were used as spawn for mass cultivation of mushrooms on different substrates.

The substrate materials viz. Paddy straw, Wheat straw, Apple leaves and Chinar leaves were cut in to 4-5 cm pieces followed by overnight (12 hrs) dip in water. After this the substrate was washed in a formalin solution (36 parts of water and 1 part formaldehyde) followed by another solution containing 1gm carbendazim in10 liters of water. Now the drained substrates was put in polythene bags of 35 x 50 cm size to 3/4th of its capacity, perforated with holes all over the surface to allow free exchange of gases. Inoculation of the bags, i.e. spawning was carried out through multilayered spawning. The inoculated bags were kept in the cropping room in dark at the temperature of 25±2°C till the cottony growth proliferates. When the substrate was completely covered by the white cottony mycelia growth, the polythene bags were removed and white light was switched on. For the initiation and subsequent development of fruiting bodies the temperature and relative humidity inside the cropping room was maintained between 20-22^{o}C and 80-85% respectively.

Observations on period of spawn run, appearance of pinhead, maturation of fruiting bodies were recorded upto forth flush. Fresh weights of mature fruit bodies were also recorded upto forth flush to calculate the total yield and corresponding biological efficiency. Total yield was calculated as the fresh weight of mushrooms harvested upto forth flush per 500g of dry substrate used for its cultivation. Biological efficiency (B.E.) was determined by the ratio of fresh weight (g) of mushrooms upto forth flush to dry weight (g) of substrate and expressed as percentage.

$$\text{Biological efficiency} = \frac{\text{Fresh weight(g) of mushrooms harvested}}{\text{Dry weight (g) of substrate}} \times 100$$

RESULTS

The analysis of yield on all the four substrates (Paddy straw, Wheat straw Apple leaves and Chinar leaves) used for the cultivation of *P. sajor-caju* gave more or less significant results. However the there was a quite momentous variation in the time interval needed for completion of spawn running, pinhead formation and fruiting body formation on different substrates. In all the cases the time duration for the formation of fruiting bodies was longer in case of Chinar leaf substrate (47-49 days), followed by Apple leaf substrate (42-44), Wheat straw (32-34 days) and Paddy straw substrate (25-27 days) as shown in table 1. The trend was same for the spawn running and pinhead formation i,e more time was consumed in case of Chinar leaf substrate followed by Apple leaf substrate, Wheat straw and Paddy straw substrate. While analyzing the total yield of *P. sajor-caju* on the above mentioned substrates the trend was opposite, where the highest yield was found on Paddy straw substrate (747.1g/500g dry weight), followed by Wheat straw (623.7/500g dry weight), Apple leaf (478.1/500g) and Chinar leaf substrate (426.8/500g dry weight) as shown in table 2. The biological efficiency of mushroom was 149.4, 124.7, 95.62 and 85.3 on Paddy straw, Wheat straw, Apple leaf and Chinar leaf substrate respectively. While examining the yield achieved in each flush it was observed that *P. sajor-caju* gave the maximum yield in the first flush followed by second, third and fourth flush except in case of Chinar leaf substrate where the yield obtained in second flush was comparatively higher than first flush (table 2). It is also quite evident that the Paddy straw proved the most efficient while leaf Chinar leaves proved least efficient substrate both in terms of yield and time consumption.

Table 1: Days for completion of spawn running, pinhead formation and fruiting body formation of different phases of *P. sajor-caju* production on different substrates.

Substrates	Spawn running	Pinhead formation	Fruiting body formation
	(Days)		
Paddy straw	17-19	21-23	25-27
Wheat straw	22-24	28-30	32-34
Apple leaves	25-28	31-36	42-44
Chinar leaves	30-34	40-44	47-49

Table 2: Yield performance of *P. sajor-caju* on Paddy straw Wheat straw Apple leaves and Chinar leaves.

Substrates	Yield (g)/500 g dry substrate					Biological Efficiency (%)
	first flush	second flush	third flush	fourt flush	Total	
Paddy straw	280.4±4.3	265.7±3.9	120.6±2.7	80.4±2.1	747.1±3.2	149.4
Wheat straw	225.1±2.6	220.4±2.9	113.5±3.1	64.7±2.8	623.7±2.8	124.7
Apple leaves	169.3±3.1	146.5±2.4	101.2±2.7	61.1±2.3	478.1±2.1	95.62
Chinar leaves	115.4±2.7	145 .2±3.2	110.4±2.9	55.8±2.9	426.8±2.9	85.3

The values are mean of three replicates ±S.D

Figure 1: Mature fruiting bodies of *P. sajor-caju* on a) Chinar leaf s, b) Paddy straw, c) Wheat straw and d) Apple leaf substrates

DICUSSION

Since *P. sajor-caju* can easily grow on the by-products or wastes rich in cellulose and lignin, therefore a large number of agricultural, forests, and agro-industrial by-products can be used for its cultivation. In the present study *P. sajor-caju* was cultivated under *in-vitro* conditions on different substrates, viz. Paddy straw, Wheat straw, Apple leaves and Chinar leaves. The study revealed that highest biological efficiency *P. sajor-caju* on Paddy straw, followed by Wheat straw and Chinar leaf substrates. Zhang *et al.* [7] cultivated *P. sajor-caju* on rice straw and wheat straw and observed 10% higher yield in case of rice straw under the same cultivation conditions. Madan *et al.* [8] cultivated *P. sajor-caju* on leaves of *Morus alba* and *Ricinus communis.* Several species of *Pleurorus* are known to be cultivated on different substrates in India [9]. Ragunathan *et al.* [10] cultivated three species of *Pleurotus, viz. P. sajor-caju, P. platypus* and *P. citrinopileatus*, on various agro-residues such as Paddy straw, maize stover, sugarcane bagasse, coir pith and a mixture of these wastes, where the maximum yield was obtained that of *P. sajor-caju* cultivated on Paddy straw. According to Chang and Miles [5] nutrient content of substrates affects the growth and formation of fruit bodies of *Pleurotus* species. Banik and Nandi [11] observed that yield of *P. sajor-caju* can be increased significantly when grown on a lignocellulosic crop residue-rice straw supplemented with biogas residual slurry manure in 1:1 ratio as substrate. Khan [12] studied the impact of various sterilization methods using different substrates on the yield of *Pleurotus* sps. In Kashmir there is a lot of potential for growing mushrooms from Paddy straw as Paddy cultivation takes place on 140970 hectares of land generating 245992.65 tons of Paddy straw annually [13]. Only 5706 quintals of mushrooms were produced during 2001-2002 in Kashmir [14]. Large scale cultivation of *P. sajor-caju* using suitable substrates can help people in rural areas improve their income. Mushroom cultivation is not just an agribusiness but also a noteworthy means for restoration, replenishment and remediation of earths overburden ecosphere, thereby benefiting all the inhabitants of the planet earth.

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