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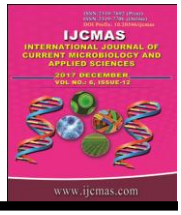

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Effect of Different Substrates on Growth and Yield of Oyster Mushroom (*Pleurotus sajorcaju*)

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A B S T R A C T

The present investigation was carried out to know the effect of different substrates such as paddy straw, wheat straw, banana leaves, sugarcane bagasse, sugarcane leaves, newspapers and maize stalks and leaves on spawn running time, primordial initiation time, fruiting body formation time, yield performance and biological efficiency of oyster mushroom (*Pleurotus sajorcaju*). Lowest time required for spawn running, primordial initiation and fruiting body formation was recorded in sugarcane bagasse followed by newspapers, paddy straw, banana leaves and wheat straw. Amongst the substrates, paddy straw showed highest yield and biological efficiency followed by banana leaves, wheat straw, sugarcane bagasse, newspapers and sugarcane leaves. Least yield of mushroom was obtained in maize stalks and leaves.

Introduction

Oyster mushroom (*Pleurotus* species) is an edible fleshy fungi which is the third largest commercially produced mushroom in the world. It is popularly called as Dhingri in India which grows as saprophytes on dead branches of trees. It belongs to the sub division basidiomycotina. Among different species of *Pleurotus*, *P. sajorcaju* is an important edible mushroom which is grown commercially all over the world. Oyster mushroom is gaining popularity in India because of its high yield potential, excellent taste, flavor, texture and longer shelf life. It can be grown within a temperature range of 20°- 30 °C. It is cultivated in tropical and subtropical regions of the world.

Oyster mushroom can convert easily available unused lignocellulosic agro wastes to edible protein rich food of high market value. Mushroom contains high protein, vitamins and minerals (Caglarirmak, 2007). Thus mushroom helps in overcoming problem of protein malnutrition of poor people in India. Oyster mushroom can be used as health beneficial food items especially against heart disease and diabetes as it contains low lipid and high fiber (Randive, 2012). Apart from food value, its medicinal value for diabetics and in cancer therapy has been reported (Sivrikaya *et al.*, 2002). Mushroom growing technology is simple with low cost which gives high profit to farmers. It provides

employment opportunities to rural people especially women.

Oyster mushroom can be grown on different substrates containing lignin and cellulose like corn cobs, various grasses and leaves, rice and wheat straw, paper, wood sawdust and chips, coffee pulp, cotton seed hulls, peanut shells, sunflower seed hulls, sugarcane and tequila bagasse etc. (Pandey *et al.*, 2008; Nurudeen *et al.*, 2013). Demand of mushroom for consumers has been increasing day by day. As substrate plays an important role in determining yield of mushroom, it is necessary to evaluate different substrates for mushroom yield and also to find the best suitable substrate for its cultivation. Therefore, the present investigation was carried out to evaluate yield performance of *Pleurotus sajorcaju* on different agro substrates locally available to obtain highest yield.

Materials and Methods

Culture cultivation

Pure culture of *Pleurotus sajorcaju* was obtained from Orissa University of Agriculture and Technology, Bhubansewar. The cultures were maintained on potato dextrose agar slants at 4°C. Subculturing were done in every 15 days.

Spawn preparation

Healthy wheat grains were collected and washed thoroughly in tap water and soaked overnight in water till they become soft. Then grains were boiled, drained off excess water and mixed with calcium carbonate at the rate of 2 % on dry weight basis of the grains. The grains were filled into glucose bottle, plugged with non -absorbent cotton and sterilized in autoclave at 121 °C for 30 min. Grains were then inoculated with actively growing mycelium of *P. sajorcaju* maintained on PDA and incubated at 25°C for mycelial growth until the mycelium fully covered the grains (Modified method of Michael *et al.*, 2011).

Preparation of substrate and cultivation

Different agro wastes such as paddy straw, wheat straw, banana leaves, sugarcane leaves, and maize stalks and leaves were collected from students' plot, College of Agriculture, Chiplima and used as cultivation substrate. The substrates were chopped into 2-3 cm pieces. Sugar cane bagasse was collected from local juice shop, Chiplima, sun dried and chopped into small pieces. Newspapers was collected from houses and shredded into pieces manually. The substrate materials except newspapers were soaked in 100 liters of water in a 200-litre G.I. drum for 12 hours, whereas newspapers were soaked for one hour.10g of carbendazim and 120 ml of formalin were mixed with water. After soaking, different substrates were taken out and excess water was drained. The substrates were spread as thin layer on cemented floor and shade dried to get 60% moisture.

The beds were prepared by using polythene bags of 35 x 45cm. One kg of substrate was used to fill up in each bag. Three replications were done for each treatment. Spawning was done in five layers and spawning rate was 2% of wet substrate. The inoculated bags were kept in the spawn running room in dark at room temperature (20 to 28°C).

When the substrate was completely covered by the white cottony mycelia growth, the bags were shifted to cropping room in the thatched shed, where the diffused light and good ventilation were provided for initiation of buttons. Using a new blade polythene covers were cut and removed fully from the substrates. Water was sprayed on the bed from second day of opening using an

atomizer. The watering was withheld a day before harvesting. Time required for completion of spawn run, pin head and fruiting body formation was recorded. Total yield of mushroom fruiting body from each bed was recorded immediately after harvest. Biological efficiency was calculated by dividing average yield of mushroom per bed by dry weight of substrate.

Biological efficiency =

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

Results and Discussion

Spawn running, pin head and fruiting body formation

Seven different types of substrates were used to know the growth and yield of *P. sajorcaju*. Time required for completion of spawn run, pin head and fruiting body formation are presented in Table 1. Time required for completion of spawn running varied on different substrates ranged from 17 to 26 days. Lowest time required for completion of spawn run was recorded in sugarcane bagasse (17 days) which was on par with newspapers (18 days). It was followed by paddy straw, banana leaves, wheat straw which took for completion of spawn run 21days, 21.5 days and 22 days, respectively. Longest time required for completion of spawn run was recorded in maize stalks and leaves (26days). Similar trend was also observed in case of pinhead formation and fruiting body formation by *P. sajorcaju* on different substrates. Lowest days required for pinhead formation was found in sugarcane bagasse (21 days) which was on par with newspapers (22.50 days). It was followed by paddy straw (24 days), banana leaves (24.20 days), wheat straw (25 days). Longest time required for pin head formation was recorded in maize stalks and leaves (30 days). Minimum days required for fruiting body formation was recorded in sugarcane bagasse (24 days)which was on par with newspapers (25.5 days) and paddy straw (27 days). It was followed by banana leaves (28 days) and wheat straw (28.5 days). Maximum time required for fruiting body formation was recorded in maize stalks and leaves (35 days).

Table.1 Days for completion of spwan run, pin head formation and fruiting body formation of *Pleurotus sajorcaju* on different substrates

Substrates	Spawn running (days)	Pinhead formation (days)	Fruiting body formation (days)
Sugarcane bagasse	17.00	21.00	24.00
Paddy straw	21.00	24.00	27.00
Wheat straw	22.00	25.00	28.50
Newspapers	18.00	22.50	25.50
Banana leaves	21.50	24.20	28.00
Sugarcane leaves	23.00	26.00	30.50
Maize stalks and leaves	26.00	30.00	35.00
SEm±	0.57	0.44	0.71
CD at 1% level	2.44	2.35	3.01

Table.2 Yield and biological efficiency of *Pleurotus sajorcaju* on different substrates

Substrates	Yield (g/ kg dry substrate)	Biological efficiency (%)
Sugarcane bagasse	560.00	56.00
Newspapers	455.00	45.50
Paddy straw	803.00	80.30
Banana leaves	724.00	72.40
Wheat straw	601.00	60.10
Sugarcane leaves	430.00	43.00
Maize stalks and leaves	260.00	26.00
SEm±	6.02	
CD at 1% level	25.36	

The appreciable days to complete spawn run of *P. sajorcaju* on different substrates might be due to variation in their chemical composition and C: N ratio as reported by Bhatti *et al.,* (1987). Our findings in the present experiment are almost similar to the findings of Shah *et al.,* (2004) who reported that the spawn running in case of oyster mushroom took 16-25 days after inoculation. Almost similar results were reported by *Pala et al.,* (2012). They cultivated *P. sajorcaju* on different substrates such as paddy straw, wheat straw, apple leaves and chinar leaf substrates. They observed that time required for completion of spawn run, pin head formation and fruiting body formation on different substrates by this mushroom fungus was 17-34, 21-44 and 25-49 days, respectively.

Mushroom yield

Total yield and biological efficiency of *P. sajorcaju* cultivated on different substrates are presented in Table 2. Amongst different substrates, paddy straw recorded highest yield (803.00 g) followed by banana leaves (724.00 g), wheat straw (601.00 g), sugarcane bagasse (560.00 g), newspapers (455.00 g). Lowest yield was obtained in maize stalks and leaves (260.00 g). Highest biological efficiency was recorded in paddy straw (80.30%) followed by banana leaves (72.40%), wheat straw (60.10%), newspapers (45.50%). Lowest biological efficiency was recorded in maize stalks and leaves (26.00%). The increase in the yield of mushroom in paddy straw is due to easier way of getting sugars from the cellulosic substances (Ponmurugan *et al.,* 2007). Superiority of paddy straw over other substrates in cultivation of *P. sajorcaju* with respect to yield and biological efficiency has been reported earlier by Pala *et al.,* (2012). They used different substrates viz. paddy straw, wheat straw, apple leaves and chinar leaves for cultivation of *P. sajorcaju*. They obtained highest yield on paddy straw substrate followed by wheat straw, apple leaf and chinar leaf substrate. Ragunathan *et al.,* (1996) 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. They obtained maximum yield by cultivating *P. sajor-caju* on paddy straw.

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