ORIGINAL ARTICLE

Influence of *Butea monosperma* Floral Powder on Growth Parameter of *Pleurotus florida* (Mont.) Singer Cultivation

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ABSTRACT The present experiment was conducted in order to prepare a suitable substrate composition using different substrate and also the effect of various concentration of *Butea monosperma* floral powder supplementation on the yield and biological efficiency of Oyster mushrooms (*Pleurotus florida*). Six substrate were used, namely wheat straw (WS), soybean straw (SS), paddy straw (PS), domestic waste (DW), sugarcane bagasses (SB) and Pinus needle (PN). Wheat straw of 2% and 4% supplementation showed significantly higher mycelia colonization rate taking an average of 18 days to complete full spawn run, 22 days from spawning to pinhead formation, 3 days for pin mature and 27 days to first harvest. Maximum biological efficiency was recorded in wheat straw of 4% supplementation and minimum in Pinus needle of 3% supplementation.

Keywords: Supplementation, Substrate, Biological efficiency, *Butea monosperma*

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INTRODUCTION

Oyster mushroom is the world's second-largest mushroom, accounting for 25% of all farmed mushroom production (Singh *et al*., 2021). The oyster mushroom has a more flexible growth habit than any other mushroom species, allowing it to thrive in a wide range of temperatures (Rosado *et al*., 2002). The majority of agricultural byproducts and wastes are appropriate as mushroom growing substrate (Ahmed *et al*., 2016). Mushroom cultivation contributes to nutritional security while also allowing for proper agro-waste recycling (Sinha and Chourasia 2021). Vitamin C, B-complex (thiamin, riboflavin, folic acid, and niacin), minerals (Ca, P, Fe, K, and Na), and protein are abundant in Pleurotus species. Pleurotus species make mushrooms a healthy food for people with high blood pressure, heart disease, hypercholesterolemia, diabetes, and cancer (Maheswari *et al*., 2020).

Unprecedented in the worldwide, the production of value-added mushrooms using medicinal plant parts as a substrate. Incorporating medicinal plant extracts for mushroom development is a first for our research. Flowers of *Butea monosperma* were chosen as the medicinal plant parts to give value to mushrooms, based on chemical components and biological activities (Bandhakavi and Batchu 2020). Flavonoids and glucosides have been found in *Butea monosperma* flowers. The primary phytoconstituents of flowers are butin, isobutrin, and butein. Other phytoconstituents found in the flower include chalcones, aurones, isobutyine, palasitrin, coreopsin, isocoreopsin (butin 7-glucoside), monospermoside, and triterpene steroids (Basu *et al*., 1999; Mishra *et al*., 2000). It also contains myricyl alcohol, stearic, palmitic, arachidic, lignoceric acids, glucose, fructose, phenylalanine, aspartic acid, alanine and histidine (Sindhia *et al.,* 2010). They have a variety of beneficial biochemical and antioxidant properties related to diseases like cancer, Alzheimer's disease (AD), atherosclerosis, and others. Flavonoids are an essential component in a number of nutraceutical, pharmacological, medical, and cosmetic uses because they have a wide range of health-promoting benefits. This is due to their ability to control important cellular enzyme functions as well as their antioxidative, anti-inflammatory,

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anti-mutagenic, and anti-carcinogenic capabilities (Panche *et al.*, 2016).

The present study focused to evaluate the growth and yield (biological efficiency) of *Pleurotus florida* using different substrate such as wheat straw, soybean straw, paddy straw, domestic waste, sugarcane bagasses and pinus niddle supplemented with different concentration of *Butea monosperma* floral powder, therefore the aim of this study was to investigate the feasibility of using locally available substrate for oyster mushroom cultivation. The study aimed on the comparison of different substrate with supplements for *Pleurotus florida* growth and yield.

MATERIALS AND METHODS

Preparation of Culture Media

Pure cultures of oyster mushroom maintained on different media potato dextrose agar (PDA), Czepedox agar medium (CZ) and Malt extract agar (MEA). Maximum mycelium growth observed in potato dextrose agar (49 mm) followed by malt extract agar (47 mm) after six days while thin and minimum mycelium growth observed in Czepedox agar medium.

For the research of carbon and nitrogen sources, potato dextrose agar medium was employed as the basal media. To optimise the growth of *Pleurotus* spp., eight carbon sources were used: glucose, dextrose, fructose, maltose, manitol, lactose, sucrose, and starch; and eight nitrogen sources were used: sodium nitrate, ammonium nitrate, potassium nitrate, ammonium phosphate, ammonium ferrous sulphate, ammonium chloride, glycine, and proline (Kumar *et al.*, 2018).

Spawn Preparation

Spawn is made from many grains (paddy, wheat, and maize), all of which are clean whole grains. Grain that has been broken should be avoided. The grains are pre-wetted by boiling them for 20-30 minutes in water (Mehta and Kumar, 1988). This increases the moisture content of the grains to 40-50% while also softening them so that mycelium can grow on them. Excess water is extracted from the grains using a wire mesh after they have been boiled. On a dry weight basis, grains are now mixed with gypsum (Calcium sulphate) and chalk powder (Calcium carbonate) at a rate of 2% and 0.5%, respectively. The gypsum prevents grains from sticking together, while the lime balances the pH. The grains are now put in containers, which have non-absorbent cotton plugged into the mouths. After that, they're sterilized in an autoclave for 1.5-2 hours at 22 Ib pressure. This produces a temperature uniformity of 126.5 °C, which is sufficient to eliminate bacteria and other pollutants. The grains will now be allowed to cool overnight at room temperature. The mycelium of pure cultures is inoculated into bottles next day. Bottles are vigorously shaken 7-10 days after inoculation to break mycelium threads and mix them with grains. After three weeks of incubation, the stock cultures are ready for additional spawn multiplication or cultivation. Inoculated bottles are incubated at 26 ± 2 °C.

Substrate Preparation

Substrates are treated by chemical solution of bavistin (75 ppm) and formalin (500 ppm) for a period of 16-18 hrs to avoid mould infestation because some time they do not allow the growth of mushroom mycelium. Spawning was done at 2% wet weight basis of substrate by thoroughly mixing. Spawned substrate is filled up in perforated polythene bags (60 × 40 cm). Three replicates were maintained for each substrate. These bags were transferred to crop room for spawn run. Several (6-8) holes were punched on the sides of the plastic bags to facilitate cross-sectional ventilation (Girmay *et al.,* 2016).

Estimation of Biological efficiency

Biological efficiency is a way of measuring how much a substrate is converted into a mushroom (Oseni *et al.*, 2012). Different amounts of supplements were added to the substrate to increase biological efficiency and yield (Tikdari and Bolandnazar, 2012). The following measurements were taken: days to spawn run, days to pinning, stipe length, cap diameter, total biological yield (gm), and biological efficiency (BE%) (Barh *et al.*, 2021). The total yield of mushroom was calculated by adding the weight of all the fruiting bodies taken from all three pickings. The following formula was used to calculate the biological efficiency (yield of mushroom per kilogramme substrate on a dry weight basis) (Ahmed *et al.*, 2009).

$$\text{Biological efficiency (\%)} = \frac{\text{Yield of fruiting body (gm)}}{\text{Total weight of substrate used (gm)}} \times 100$$

RESULTS

The data presented in (Table 1) shows the impact of supplementation of *Butea monosperma* on the growth and yield of *Pleurotus florida* cultivated on different substrates viz. wheat straw, soybean straw, paddy straw, domestic waste, sugarcane bagasses and *Pinus* needles. It was observed that supplementation of 2% powder of *Butea monosperma* improves growth parameter as well yield but significant change was recorded with 4% supplementation. In the entire substrates comparatively higher yield was recorded in Wheat straw substrate. As Wheat straw was give 103.03 gm, 80 gm and 147 gm at 2%, 3% and 4% supplementation respectively. In soybean straw 92.3 gm,

108.4 gm and 141 gm yield at 2%, 3% and 4% supplementation respectively, this is also a significant result. Paddy straw was give 90.2 gm, 112.01 gm and 135 gm at 2%, 3% and 4% supplementation respectively.

Domestic waste was give 76 gm, 76.6 gm and 75 gm at 2%, 3% and 4% supplementation respectively. Least yield was obtained in sugarcane bagasses and Pinus needles. In sugarcane bagasses 50 gm, 50.7 gm and 51 gm yield was obtained in 2%, 3% and 4% supplementation respectively. In Pinus needles no growth was obtained in 2% supplementation, 20 gm and 22 gm yield was obtained at 3% and 4% supplementation per 400 gm dry weight of substrate.

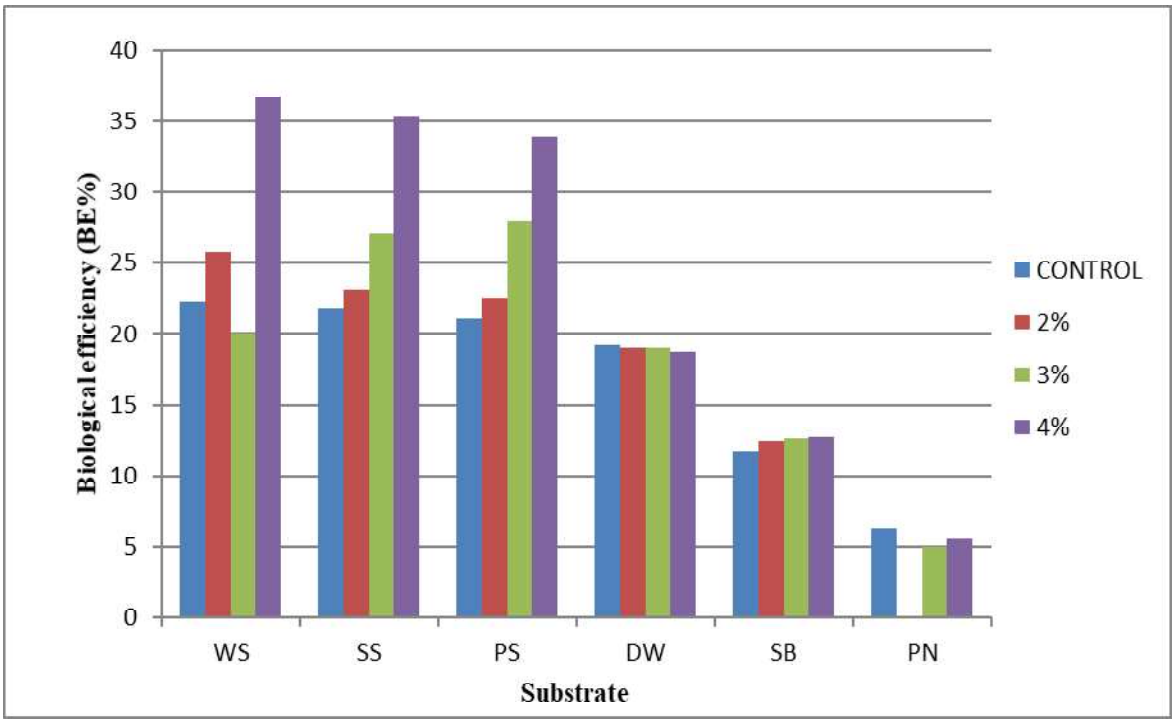
This is clearly indicated from the above given data that supplementation of *Butea monosperma* is the good supplementation for the growth of *Pleurotus florida*. Among all the test substrates Wheat straw and soybean straw are best substrates for the growth of *Pleurotus florida*. As paddy straw, domestic waste and sugarcane bagasses was also suitable for the growth of *Pleurotus florida* but Pinus needle was not suitable substrate for the growth of *Pleurotus florida*.

Table 1: Effect of Supplementation in Different Substrate on Growth Yield of *Pleurotus florida*

Substrate	Supplementation Concentration	Spawn Run (Days)	Pinhead Appearance (Days)	Stipe Length (cm)	Cap Diameter (cm)	Total Yield (gm)	BE (%)
Wheat straw	Control	19	23	2.8	8.5	89	22.25
	2%	18	22	2.8	8	103.03	25.75
	3%	18.6	22.7	2.9	8.6	80	20
	4%	18	22	2.9	8.7	147	36.75
Soybean straw	Control	20.6	24	2.7	8	87	21.75
	2%	20	24	2.8	7.9	92.3	23.07
	3%	20	24	2.7	7.9	108.4	27.1
	4%	19	23	2.6	8.1	141	35.25
Paddy straw	Control	22	25	2.8	7.8	84.4	21.1
	2%	22	24.6	2.7	7.6	90.2	22.55
	3%	20.4	24	2.9	7.9	112.01	28
	4%	19.2	23	2.8	8	135.6	33.9
Domestic waste	Control	24.3	28.3	2.3	5.5	77	19.25
	2%	24.7	27.2	2.5	5.4	76	19
	3%	24	27.2	2.3	5.5	76.2	19.05
	4%	23	27	2.4	5	75	18.75
Sugarcane bagasses	Control	28.4	35	2.3	5.1	47	11.75
	2%	28.7	32	2.3	5	50	12.5
	3%	28.4	34	2.4	5.2	50.7	12.67
	4%	28	34	2.3	5	51	12.75
Pinus niddle	Control	32.6	42	2.3	4.8	25	6.25
	2%	31.4	41.7	NG	NG	NG	NG
	3%	32	41.7	2.3	5	20	5
	4%	30.7	40.6	2.2	5.2	22	5.5

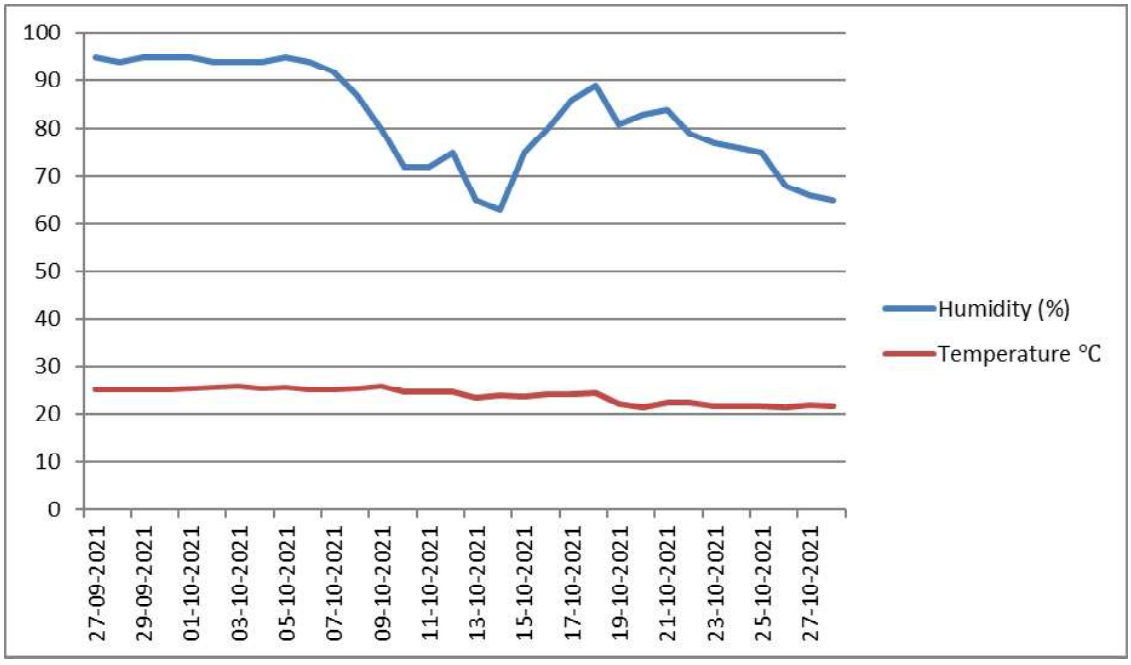
Note: NG: No growth; Bag weight: 400 gm; Value are given in average of three replicates.

Graph 1: Effect of Different Substrate on Biological Efficiency of *Pleurotus florida* Treated with *Butea monosperma* Flower Powder



Note: WS: wheat straw, SS: soybean straw, PS: paddy straw, DW: domestic waste, SB: sugarcane bagasses, PN: pinus niddle.

Graph 2: Effect of Temperature and Humidity on Growth of *Pleurotus florida*



DISCUSSION

In nature, *Pleurotus* spp. mostly grows on dead parts of plants, which are generally poor in nutrients and vitamins. It has been established that both mycelial growth and fruit body development depends on lignocellulosic materials particularly with reference to their C:N ratio, which has been reported 50:1 in various substrates (Balakrishnan and Nair, 1995).

The addition of amendments to the substrates influence the sporophore production of *Pleurotus* spp. (Jandaik, 1974). (Zedrazil, 1980) has studied the effect of supplementing straw substrates with ammonium nitrate, soybean meal or alfalfa meal on the fructification and yield coefficient. Organic supplements affected not only yield raise but also raise in protein content and higher yield coefficient. Addition of organic supplements in the form of horse gram powder, cotton seed powder yeast mud, ground nut cake or rice bran also showed enhance yields coupled with increase in the protein content of fruit bodies. Several nitrogen sources tried as supplements to the rice straw substrate during the growth and fructification of *Pleurotus* species, oil seed cakes proved ideal in increasing the mushroom yield and its protein content (Rajarathnam *et al.*, 1986 and Bano *et al.*, 1993).

Supplementation with various materials is recommended prior to spawning for enhancement of yield of Oyster mushrooms. Various oil seed meals and cakes, powdered pulses, wheat and rice bran, etc. (Bahukhandi, 1990), sterilized chicken manure (Vijay and Upadhyay, 1989), addition of oat meal (Jandaik, 1974), starch at 10 g/kg substrate, wheat bran and cotton meal, broken corn and mineral solution (Moda *et al.,* 2005), soybean choker (Jain and Vyas, 2005), rice and wheat bran (Pedra and Marino, 2006), bran and bean straw, wheat bran and urea (Silva *et al.,* 2007), Gupta and Raina (2008) reported effect of supplements on the yield of some high adaptive *Pleurotus species* in sub-tropics of Jammu. Perhaps the level of nitrogen content might be one of the most important criteria to decide one of the positive effects on mushroom.

In the present study, we observed that appropriate amount of additives observed well growth rate of fungal mycelium. The mushroom mycelium requires specific nutrients for its growth and the addition of supplements increases mushroom yield by providing specific nutrients for the mycelium growth (Sinha and Chourasia, 2021). According to this study *Butea monosperma* flower was the best supplement which protects the mycelia growth from type of infection and attributes enhanced efficiency to the availability of several phytoconstituents. Complete mycelia running within 6-7 days after spawning and got first crop within 26 days. Hence good growth and better yield of mushroom with minimum infection can be achieved when different additives are supplemented.

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