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Research Article

EFFECT OF SUPPLEMENTS ON PIN HEAD EMERGENCE AND BIOLOGICAL EFFICIENCY OF THREE *PLEUROTUS* SPP.

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Abstract- Nine different brans and flours *viz.,* Gram flour, gram chokar, bajra flour, jawar flour, wheat bran, rice bran, and maize bran were used with wheat straw for supplementation at the rate of 5 per cent on the dry weight basis of substrate and found that *P. flabellatus* takes minimum period (18 days) was recorded with bajra flour Whereas, maximum pin head emergence period of 21 days in both control and gram powder was recorded .The maximum biological efficiency of *Pleurotus flabellatus* was 985 g / BE 98.5% with jowar flour followed by maize bran (950 g / BE 95.0%). Yield / BE of *P. florida with* Rice bran recorded maximum (935 g / BE 93.5%) yield / BE followed by maize bran (935 g / BE 93.5%) and gram flour (875 g / BE 87.5%). While, in *P. sajor-caju,* It was maximum (895 g / BE 89.5%) with gram chokar supplementation followed by 880 g / BE 88.0% (bajra flour) and minimum yield / BE (705 g / 70.5%) was obtained in control.

Keywords- *Pleurotus flabellatus, P. florida, P. sajor,* biological efficiency, supplementation.

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Introduction

Mushrooms are used as delicious flavored food and having nutritional value between meat and vegetables. Mushrooms are rich in protein, vitamins and minerals. It contains 27-35% protein, along with 19 essential amino acids, vitamins, very little fat and sugar. It is low caloric food with very high potassium and sodium ratio and without starch and cholesterol, which is ideal for patients of heart, hypertension and diabetes. Since centuries, mushrooms have been recognized as important food item and their usage is being increased day by day for their significant role in human health, nutritional and medicinal properties [1]. *Pleurotus spp*. are also rich in medicinal values and so provide a wide variety of medicinal properties and they are effective against certain life-threatening diseases. Oyster mushrooms have medicinal properties such as anticancer, antibiotic, anti-inflammatory antiviral activities, immune- modulator effect and blood lipid lowering effects [2]. Oyster mushroom (*Pleurotus species*) belongs to the family of Tricholomataceae and is the second widely cultivated mushroom worldwide following the *Agaricus bisporus* [3-4]. However, [5] reported that oyster mushroom is the third largest commercially produced mushroom in the world market. *Pleurotus* species are popular and widely cultivated throughout the world mostly in Asia, America and Europe because of their simple, low cost production technology and high biological efficiency (BE). Mushroom cultivation in India has increased continuously from last few decades. Cultivation of Oyster mushroom is gaining popularity because of its less investment. Studies were made on the cultivation of Oyster mushroom using various substrates like wheat straw [6-7]. The wheat, ragi and rice straw are used as a substrate for Oyster mushroom cultivation [8]. Supplemented substrates lead to improved growth [9]. In the present study different supplements are used to evaluate to know the effect the supplements on yield.

Materials and Methods

Experimental site

The experiments were conducted at Mushroom Production Unit and Mushroom Spawn Laboratory Department of Plant Pathology, B.M. College of Agriculture Khandwa, RVSKVV, Gwalior (M.P.).

Isolation and purification

Sporophores of *Pleurotus flabellatus, P. florida* and *P. sajor caju* were collected from Mushroom Production Unit. The culture of the *Pleurotus* spp. was obtained by tissue culture method under aseptic conditions. First of all, hands were washed and sterilized by ethyline alcohol. The outer surface of sporophore was sterilized by rubbing the alcohol rinsed cotton. Forcep was sterilized by dipping in alcohol and flamed until red hot and cooled for 30 seconds and mushroom stipe was split open lengthwise from the cap downwards with bare hands. A small piece of the internal tissue of the splitted sporophore was cut and removed with the help of flamed forcep. The cut piece was placed into the potato dextrose agar slants. The inoculated tubes were incubated at 25 ± 1 ^{0}C for 7 days. Seven days old culture was purified by cutting single hyphal tip and maintained on potato dextrose agar medium for further studies.

Preparation of mother spawn

Clean and healthy wheat grain was used for the preparation of mother spawn. The wheat grain was washed and soaked in fresh water for two hours then boiled with two-liter water per kg seed for 15-20 minutes till they become soft but remained firm. Water was drained off and boiled wheat was spread over blotting paper to remove the excess water for 20 minutes. The grains were impregnated with 2% calcium carbonate and 1% calcium sulphate on the dry weight basis. Two hundred g of coated wheat was filled in each bottle of glucose saline. The bottles were plugged by nonabsorbent cotton. These bottles were sterilized at 15 PSI for 20 min. The sterilized bottles were left for 12 hours and shaked for reabsorption the

condensed water droplets. Sterilized bottles containing wheat were inoculated with seven days old half plate culture of *Pleurotus* sp. under aseptic conditions and the bottles were incubated at 25 ± 1 ^{0}C for 15 days.

Spawn run

The bags were kept for 15-18 days in dark cropping room of the mushroom house for spawn run. The spawn was considered complete when the straw was fully covered with milky white mycelial growth.

Opening the bags

After the spawn run was over the bags were opened by making vertical slits on the sides and removed the polythene completely. Exposed blocks were tied with nylon twin and hanged ten inch apart on bamboo in cropping room. Water was sprayed daily once or twice depending on the weather conditions.

Harvesting

Mushroom was harvested 3-4 hours prior to watering. The fruit bodies appeared in 4-5 days after opening of bags and the mature fruit bodies were harvested when they were approximately 5-8cm in diameter.

A maximum of three flushes were taken from each bag during cultivation period of 50 days. All the fruiting bodies produced on a day were harvested at the same day and no selective harvesting was practiced.

Yield of the mushroom

Single pan balance with a sensitivity of one g was used for weighing freshly harvested sporophores. Yield was calculated by adding the fresh weight of all the three flushes of mushroom fruiting bodies produced per kg dry substrate.

Biological efficiency

The biological efficiency (BE) expressed in percentage and was calculated by following formula given by Chang *et al.* (1981).

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

Method of spawning

Layer method of spawning was used in the experiment. Appropriate layer (15 cm thick) of substrate was placed in the polythene bag on which a layer of spawn (20-25 g) was placed in the periphery of the substrate alternately. Five layers of substrate and four layers of spawn were kept in 18" x 12" bags. The mouth of the filled bags closed with rubber band.

Supplementation of straw substrate

Straw of wheat was chopped in 5-10 cm size. Dry substrate was dipped in the suspension of carbendazim (0.05%) + formaline (1.5%) prepared in 10 litre water for 1 kg substrate and the container was covered with polythene sheet for 16-18 hours. Prior to spawning the excess water was drained to maintain 75-80% moisture content in substrate. Palm test was used to test moisture content of the substrate. Treatment combinations of straw with supplements were prepared by mixing on dry weight basis. Gram flour, gram chokar, bajra flour, jawar four, wheat bran, rice bran, and maize bran were used for supplementation at the rate of 5 per cent on the dry weight basis of substrate. All the supplements were sterilized in autoclave at 15 PSI for 20 minutes before mixing. The sterilized supplements were thoroughly mixed (separately) in sterilized wheat straw before filling the bags for spawning.

Statistical analysis

Completely Randomized Design (CRD) was employed for the experiments. All the experimental data were analyzed statistically. The critical differences were worked out at five per cent probability level.

Results and Discussion

The data presented in [Table-1] indicate that in the cultivation of *P. flabellatus*, minimum period (18 days) was recorded with bajra flour for the pin head emergence followed by both gram chokar and rice bran (19.33 days). These treatments did not differ significantly with each other. Whereas, maximum pin head emergence period of 21 days in both control and gram powder was recorded. Minimum pin head emergence period (17 days) of *Pleurotus florida* was observed on maize bran and was at par with gram chokar and wheat bran (18 days each). These treatments did not differ significantly with each other. Maximum period (22.33 days) for pin head emergence was recorded in control. *Pleurotus sajor-caju* recorded minimum period (18 days) for pin head emergence with gram powder followed by gram chokar (18.33 days) and these treatments were per *se*. However, wheat bran registered maximum pin head emergence period (23 days).

The yield (g/kg substrate) / biological efficiency of *P. flabellatus* was influenced highly significant by different supplements. It was maximum (985 g / BE 98.5%) with jowar flour followed by maize bran (950 g / BE 95.0%). These treatments did not differ significantly with each other. Minimum (790 g / BE 79.0%) yield / BE was recorded in control. Yield / BE of *P. florida* was significantly influenced by different supplements on wheat straw substrate. Rice bran recorded maximum (935 g / BE 93.5%) yield / BE followed by maize bran (935 g / BE 93.5%) and gram flour (875 g / BE 87.5%). While, minimum yield / BE (741.66 / BE 74.16) was recorded in control.

Table-1 *Effect of supplementation on spawn run, pin head emergence and sporophore yield of three Pleurotus spp.*

Supplement	*P. flabellatus*				*P. florida*				*P. sajor-caju*			
	Period of spawn run (days)	Period of pin head emergence (days)	Sporophore yield (g)	Biological efficiency (%)	Period of spawn run (days)	Period of pin head emergence (days)	Sporophore yield (g)	Biological efficiency (%)	Period of spawn run (days)	Period of pin head emergence (days)	Sporophore yield (g)	Biological efficiency (%)
Gram chokar	12.33	19.33	915	91.50	11	18	800	80.00	11.66	18.33	895	89.50
Gram flour	14.33	21	896.66	89.66	13	20	875.00	87.50	11	18	786.66	78.66
Maize bran	11	19	950	95.00	9.66	17	910.00	91.00	13	22.33	754	75.40
Bajra flour	13	18	810	81.00	10.33	18.66	831.66	83.16	9	20	880	88.00
Jowar flour	11	19.66	985	98.50	13	21	803.33	80.33	11	21.66	790	79.00
Wheat bran	15	20	870	87.00	15	18	785.00	78.50	13.66	23.00	745	74.50
Rice bran	10.33	19.33	835	83.50	11	18.66	935.00	93.50	13	19.66	825	82.50
Control	15	21	790	79.00	17	22.33	741.66	74.16	17.66	20.33	705	70.50
SEm±	0.61	0.54	12.49		0.60	0.51	9.84		0.57	0.44	16.18	
CD 5%	1.83	1.61	37.46		1.80	1.54	29.50		1.73	1.32	48.52	

*Average of three replications.

It was clear form [Table-1] that different supplements increased the yield / BE significantly of *P. sajor-caju*. It was maximum (895 g / BE 89.5%) with gram chokar supplementation followed by 880 g / BE 88.0% (bajra flour) and minimum yield / BE (705 g / 70.5%) was obtained in control. *Pleurotus flabellatus* took minimum period for spawn run when wheat straw supplemented with rice bran and was *at par* with gram chokar, maize bran and jowar flour. However, minimum period for spawn run of *P. florida* was observed with maize bran followed by bajra flour, gram chokar and rice bran. Whereas, bajra flour recorded minimum period for spawn run of *P. sajor caju*. The similar results have been reported by [10] who observed that wheat straw supplemented with rice flour required lesser period for spawn run

of *P. columbinus*. The pin head emergence period influenced significantly with supplements. Minimum period for pin head emergence of *P. flabellatus* was with bajra flour followed by rice bran and gram chokar and in *P. florida* with maize bran and in *P. sajor caju* was with gram powder followed by gram chokar. All the supplements which were used in the experiments reduced the period required for pin head emergence. The similar result has been reported by [10] who observed that wheat straw substrate supplemented with rice flour required lesser period for pin head emergence. The yield / biological efficiency of *Pleurotus* spp. was influenced significantly and it was higher by use of different supplements. Maximum yield / BE of *P. flabellatus* was recorded with jowar flour followed by maize bran and yield (BE) was increased by all the supplements as compared to non-supplemented wheat straw (control). Maximum yield (BE) of *P. florida* was recorded with rice bran followed by maize bran and in *P. sajor caju* with gram chokar followed by bajra flour. These findings are in accordance with those of [11] who found supplementation with rice bran increased the yield of *P. flabellatus* by 40% as compared to control. [12] reported that horse gram powder, rice bran and other supplements increased the yield of *P. sajor caju*. [13] also reported that supplementation of wheat straw substrate with rice flour produced maximum yield of *P. florida*. [14] reported that rice bran and wheat bran increased the yield of *P. sajor caju*. The similar results have also been reported by [15] who observed that gram used as flour supplement increased yield of *Pleurotus* spp. [16] used supplements and find higher yield in Pleurotus *ostreatus* and the fin dings are in support of present findings.

Conclusion

Wheat straw supplemented with rice bran, maize bran and gram choker increases the yield of *Pleurotus flabellatus, P. florida, and P. sajor caju*. The supplements are also reducing the duration of spawn run and pin head emergence as compare to control.

Application of research: The supplementation of substrates increases the efficacy of oyster mushroom and farmers can increase their income. The supplements are also reducing the duration of spawn run and pin head emergence

Abbreviations:

BE- Biological efficiency
Y- Yield
g- Gram

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