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Effect of different Substrate supplements on the growth and yield of two species of Mushroom *Pleurotus florida* and *P. sajor-caju*.

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Abstract

The present experiment entitled "response of mushroom (*Plurotus* spp.) to various substrate supplements" was under taken with the aim to determine the morpholigcal parameters and to evaluate different *Pleurotus* spp. For this investigation, two species of *Plurotus* viz. *P. sajor-caju* and *P. florida*were taken. The cultures of these speices were multiplication potato dextrose agar medium (PDA. Yield performance of *Pleurotus sajor caju* and *P. florida* over different substrate using different supplements was studied. *Pleurotus sajor-caju* produced maximum yield of (719.2 g) on wheat straw substrate with soybean flour supplement @ 5% (SF @ 5%).With the same supplement i.e. SF @ 5%, *Pleurotus florida* produced the maximum yield of 690.00 g on wheat straw substrate.

Keywords: Mushroom, Substrate Supplements, *Plurotus* spp., Soybean flour.

INTRODUCTION

As a nutritious and delicious food Mushroom is becoming popular among people these days. Mushrooms are the fungi, which lack chlorophyll and therefore, they cannot use solar energy to manufacture their own food (Photosynthesis) as green plants. However, mushroom can produce a wide range of enzymes, that degrade the complex substrates in to simple form on which they grow and absorb the soluble substrates for their own nutrition.

According to systematic position, mushroom belongs to Basidiomycota, order Agaricales and family Pleurotaceae (Kirk *et al.*, 2001). It grows naturally on tree stumps and dead wood logs. However, the first attempt to grow this fungus for human consumption was made by Flack (1917) in Germany. The process of cultivation on readily available substrate was taken up earlier on paddy straw in India by Bano and Srivastava (1962) and on saw dust in Japan (Schanel *et al.*, 1966). This attracted attention of a number of researchers all over the world and today various species of *Pleurotus* are appreciated for their culinary attributes, and broad adaptability under varied agro–climatic conditions.

In India, mushroom is cultivated in different states among which, Punjab is the largest producer (*Agaricus*), followed by Tamil Nadu (*Agaricus pleurotus, Volveriella, Calocybe*) and Rajasthan (*Agricus, Pleurotus*).

Unlike other cultivated species of mushroom, *Pleurotus* exhibits much diversity in the adaptability to varying climates, and this flexible nature makes it a more cultivated species than any other cultivated mushroom. Out of 28 species reported from India, more than a dozen are under cultivation in different part of the country (Balakrishnan and Nair, 1995; Verma, 1998).

In spite of excellent climatic conditions, multiple cropping possiblity, low cost of production and better shelf – life, *Pleurotus* spp. are cultivated on a limited scale. This is mainly due to non-availability of suitable strains, with attractive colour, fleshy sporophore, economic yields and low range of temperature tolerance.

Species of *Pleurotus* are grown on a more limited scale (Royse and Schisler, 1980). *P. cystidiosus* or abalone (summer oyster) has been cultivated commercially in subtropical Taiwan during the summer season (Han *et al.*, 1974). *P. florida* was isolated from subtropical Florida in U.S.A. (Block *et al.*, 1958) and commercially exploited (Zadrazil, 1980). In India *P. Sajor–caju* was isolated and cultivated by Jandaik and Kapoor (1974). *P. flabellatus* was grown successfully in India (Bano and Srivastava, 1962) and Philippines (Quimio, 1978).

MATERIAL AND METHODS

Culture and Their Maintenance

- The culture of two available species of *Pleurotus viz. P. sajor-caju* and *P. florida* was received
- , Each culture was multiplied on potato dextrose agar media (PDA) and maintained in culture tubes at 3 to 7^{0}C for further studies.
- Both the species of fungus were cultivated using wheat straw as substrates with supplements employing standard practices. At last selection of the species having outstanding characteristics were made on the basis of yield and morphological parameters of sporophore.

Cultivation technique

- **Spawn Preparation: Wheat** grain spawn was prepared using the standard methodology (Garcha 1994).

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- **Substrate Preparation:** The substrate used for this experiment was wheat straw. It was soaked in a tank with solution of Carbendazim (75ppm) + Formalin (500ppm) for 18 hr (tank should be covered with polythene sheet to prevent the evaporation of formalin (Vijay and Sohi, 1987). Thereafter, straw was taken out from the solution and kept for 2-3 hours to drain out the excess water.

Supplementation: For the experiment, three supplements were selected:

(i)Wheat bran (WB)
(ii)Soybean flour (SF)
(iii)Cow dung (CD)

Each supplement was applied in two concentrations (a) 2% and (b) 5%. Before the time spawning, they were added and mixed thoroughly with the substrate. Thus, the supplements constituted 7 treatments including control.

OBSERVATION

Wheat Straw Substrate (W.S.) was used with six different supplements such as wheat brawn (W.B.) @ 2% and 5%, soybean Flour (S.F.) 2% and 5% and cow dung (CD) 2% and 5%. Control was used to make seven treatments. A total of nine characteristics viz. spawn run period, pin head appearance, time of appearance of first flush, number of fruit bodies, number of crops, mushroom yield, average fresh weight of single fruiting body, average dry weight of fruiting bodies per bag, average dry weight of single fruiting body were studied in both the species namely *P. sajor-caju* and *P. florida* in this experiment.

Analysis of variance for *P. sajor-caju* revealed that there were significant differences among the treatments (Wheat straw supplements) regarding all the parameters. In *P. florida* differences were significant for all the characters except average dry weight of single fruiting body for which difference was not significant.

Spawn run Period

In case of *P. sajor-caju* spawn run period was significantly lesser with the supplement (W.B.) @ 2% and 5% (7 Days) and W.S. @ 2% and 5% (8 days) as compared to control (10 days) and C.D. @ 2% (12 days) But in case of *P. florida,* spawn run period was significantly lesser with the supplement W.B. @ 2% and 5% (9 days) and S.F. 2% and 5% (5 days) as compared to C.D. @ 2% (10 days) C.D. @ 5% (11 days) and control (12 days)

Pin Head Appearance (Days)

For *P. sajor-caju* pin head appearance took significantly lesser time with the supplement W.B. @ 2% and 5% (10 days), S.F. @ 2% and 5% (11 days) as compared to control (13 days) and other supplements. C.D. @ 2% supplements took maximum period (15 days) for pin head appearance (Table 1). In case of *P. florida,* pin head appearance was significantly earlier with the supplements. W.B. @ 2%, 5% (11 days), S.F. @ 2% and 5% (12 days) as compared to C.D. @ 2% (13 days) and C.D. @ 5% (14 days). Maximum days taken for this trait were 15 days in control.

Time of appearance of first flush

In case of *P. sajor-caju,* time of appearance of first flush was significantly lower with the supplement W.B. @ 2% and 5% (14 days), S.F. @ 2%, 5% (15 days) as compared to control (16 days) and other supplements as like C.D. @ 5% (17 days) and C.D. @ 2% (19 days) (Table 4.7) but in case of *P. florida* days taken to first flush appearance were significantly lesser with the supplement W.B. @ 2% and 5% (14 days) and S.F. 2% and 5% (15 days). Maximum days to appearance of first flush was recorded in control condition (18 days)

Number of fruit bodies per bag

In case of *P. sajor-caju,* number of fruit bodies per bag was significantly higher with the supplement W.B. @ 2% (26) S.F. @ 5% (26), C.D. @ 5% (25) and W.B. @ 5% (24) as compared to other supplement treatments. Minimum number of fruit bodies per bag was recorded in the control (18) (Table 1). For *P. florida* significantly maximum number of fruit bodies were recorded with the supplement W.B. @ 2% (50), W.B. @5% (48), S.F. @ 2% (45). These three treatments produced maximum number of fruit bodies as compared to other supplements as given in the table-2.The minimum number of fruit bodies per bag was recorded in control (26).

Table 1. Effect of different supplements to the substrate on yield of *P. sajor-caju*

S. No.	Additive	Spawn run (days)	Pin head appearance (days)	Time of appearance of first flush (days)	Number of fruit bodies	Number of crops (plucking of fruit bodies)	Yield (g)	Avg. fresh weight of single fruiting body	Avg. dry weight of fruiting bodies/ bag	Avg. dry weight of single fruiting body
1.	Wheat straw + WB @ 2%	7.00	10.00	14.00	26.00	4.00	635.0	24.42	63.50	2.45
2.	Wheat straw + WB @ 5%	7.00	10.00	14.00	24.00	4.00	640.0	26.66	64.00	2.67
3.	Wheat straw + SF @ 2%	8.00	11.00	15.00	22.00	3.00	665.0	30.22	66.00	3.10
4.	Wheat straw + SF @ 5%	8.00	11.00	15.00	26.00	4.00	675.0	25.96	67.40	2.60
5.	Wheat straw + CD @ 2%	12.00	15.00	19.00	22.00	5.00	505.0	22.95	50.00	2.30
6.	Wheat straw + CD @ 5%	11.00	14.00	17.00	25.00	3.00	525.0	21.00	52.20	1.91
7.	Wheat straw (control)	10.00	13.00	16.00	18.00	3.00	455.0	25.27	45.40	2.45
	CD at 5%	1.13	1.27	1.85	2.60	0.63	54.56	3.63	8.27	0.57
	GM	9.00	12.00	15.71	23.28	3.71	585.71	25.21	58.35	2.50
	S.Em.±	0.37	0.42	0.61	0.85	0.20	17.99	1.19	2.72	0.19

Table 2. Effect of different supplements to the substrate on yield of *P. florida*

S. No.	Additive	Spawn run (days)	Pin head appearance (days)	Time of appearance of first flush (days)	Number of fruit bodies	Number of crops (plucking of fruit bodies)	Yield (g)	Avg. fresh weight of single fruiting body	Avg. dry weight of fruiting bodies/ bag	Avg. dry weight of single fruiting body
1.	Wheat straw + WB @ 2%	8.00	11.00	14.00	50.00	4.00	625.0	12.50	62.40	1.26
2.	Wheat straw + WB @ 5%	8.00	11.00	14.00	48.00	4.00	645.0	13.43	64.32	1.35
3.	Wheat straw + SF @ 2%	9.00	12.00	15.00	45.00	3.00	665.0	14.77	66.40	1.48
4.	Wheat straw + SF @ 5%	9.00	12.00	15.00	43.00	4.00	670.0	15.58	66.90	1.56
5.	Wheat straw + CD @ 2%	10.00	13.00	16.00	30.00	4.00	500.0	16.66	49.90	1.64
6.	Wheat straw + CD @ 5%	11.00	14.00	17.00	35.00	3.00	525.0	15.00	52.40	1.49
7.	Wheat straw (control)	12.00	15.00	18.00	26.00	3.00	483.0	18.57	48.20	1.83
	CD at 5%	1.42	1.83	2.25	6.02	0.55	55.40	1.06	7.32	0.34
	GM	9.57	12.57	15.57	39.57	3.57	587.57	15.21	58.64	1.51
	S.Em.±	0.47	0.60	0.74	1.98	0.18	18.27	0.35	2.41	0.11

Number of Crops

In case of *P. sajor-caju,* significantly maximum number of crops i.e. number of times of plucking the fruit bodies were recorded with the supplement C.D. @ 2% (5 crops). Next better supplements were S.F. @ 5% (4 crops), W.B. @ 5% (4 crops) and W.B. @ 2% (4 crops). Lowest number of crops was recorded in control (3 crops) (Table 4.7). For *P. florida,* significantly maximum number of crops were recorded with the supplements W.B. @ 2% and 5% (4 crops) and S.F. @ 5% and C.D. @ 2% (4 crops). Minimum number of crops were recorded in C.D. @ 5% supplement as well as in control (3 crops)

Yield Per bag (g)

In case of *P. sajor-caju* significantly highest yield were recorded with the supplements S.F. @ 5% (675 g), S.F. @ 2% (665g), W.B. @ 5% (640 g), W.B. @ 2% (635 g) and these four treatments were found at par with each other. The supplement C.D. @ 5% (525 g) was significantly inferior to the above four supplements. The minimum yield per bag was recorded under control (455g) as observed from the

In *P. florida* (Table 4.8; Fig. 4.4) significantly greater yield was recorded with the supplement S.F. @ 5% (670g), S.F. 2% (665g), W.B. @ 5% (645g) and W.B. 2% (625g). All the above four supplements fall in the same significant group. The minimum yield was recorded in control (483.00g).

A perusal of the data presented in Tables 4.7, 4.8 and Fig. 4.3 and 4.4 indicated that four supplements namely S.F. 5%, S.F. 2%, W.B. 5% and W.B. 2% produced significantly greater yield in both species of mushroom, compared to other treatments.

Average Fresh Weight of Single Fruiting Body

In case of *P. sajor-caju* significantly maximum average fresh weight of single fruiting body were recorded with the supplement S.F. 2% (30.22 g) and W.B. 5% (26.66 g) in comparison to other supplement treatment like S.F. 5% (25.96 g) and control (25.27 g). The minimum average fresh weight of single fruiting body was produced by C.D. 5% supplement (21 g) For *P. florida,* significantly maximum yield was recorded in control (18.57 g) as compared to other supplement treatments viz. C.D. 2% (16.66 g), S.F. 5% (15.58 g) and C.D. 5% (15.00 g). The minimum average fresh weight of single fruiting body was recorded under W.B. 2% supplement (12.50 g)

Average Dry Weight of Fruiting Bodies Per Bag

In case of *P. sajor-caju* significantly maximum average dry weight of fruiting bodies per bag were recorded with the supplement S.F. 5% (67.40g), S.F. 2% (66g), W.B. 5% (64g), W.B. 2% (63.50g). These four supplements were significantly at par. The minimum average dry weight of fruiting bodies per bag was recorded in control (45.4 g) as indicated in Table 4.7 and Fig. 4.3. For *P. florida* significantly maximum average dry weight of fruiting body per bag were recorded with the supplements S.F. 5% (66.90g), S.F. 2% (66.40g), W.B. 5% (64.32g), and W.B. 2% (62.40g). All these four supplements belonged to the some significant group. The minimum average dry weight of fruiting bodies per bag was recorded in control (48.20g)

Average dry weight of single fruiting body

Average dry weight of single fruiting body in *P. sajor-caju* was with the supplements S.F. 2% (3.10 g) W.B. 5% (2.67 g) and S.F. 5% (2.60 g) was significantly superior to others. All these three supplements were significantly at par. The minimum average dry weight of single fruiting body was recorded in the supplement C.D. 5% (1.91 g)

For *P. florida,* differences among the treatments including control were not significant with respect to the average dry weight of single fruiting body. However maximum average dry weight was recorded in control (1.83 g)

DISCUSSION

Various additives to the substrate have given encouraging results. Jandaik and Kapoor (1976) reported that on addition of oat meal, arhar dal and Bengal gram powders singly to the substrate (banana pseudostems and paddy straw), increased the yield of *P.sajor-caju*. Bano *et al.* (1979) supplemented cotton seed substrate with horse gram powder, which resulted in enhanced yield in *P.flabellatus.* Cho *et al.* (1981) recorded more yield of *P.sajor-caju*,when the substrate was supplemented with wheat brawn.

It was observed in the present study that the yield of both fungi (*P.sajor-caju and P.florida*) considerably increased, when the substrate(wheat straw) was supplemented with wheat brawn, soybean flour, and cow dung.Amongst the factors affecting production of fruit bodies of mushroom in general, temperature, relative humidity (R.H.) have been considered to play a significant role.

Summary of literature recorded by Kurtzman and Zandrazil (1982) reveals that temperature requirement of *Pleurotus* mushroom vary from species to species. In some species like *P.sajor-caju,* it was found that optimum temperature for vegetative growth lies between 20 and 30^{0}C and fruit bodies could be obtained from 20–28^{0}C.Records shows that there is not much difference between temperature requirements of vegetative and fruiting stage, unlike *Agaricus bisporus,* where the favorable temperature for vegetative growth is between 22-27^{0}C and fruiting below 18^{0}C. *P.sajor-caju* and *P.florida* have a wide range of temperature for its fruiting but most favorable is 2-3^{0}C below optimum for vegetative growth.

REFERENCES

[1] Balakrishnan, B. and Nair, M.C. 1995. Production technology of oyster mushroom (*Pleurotus* spp). In : "Advances in Horticulture Vol 13 (Chadha, K.L. and Sharma, S.R. eds.). Malhotra publishing House, New Delhi, pp. 109-11

[2] Bano, Z. and Srivastava, H.C. 1962. Studies on cultivation of Pleurotus spp. on paddy straw : *Food Science*, 11 : 363-365.

[3] Bano, Z. Nagaraja, N. Rajarathnam, S. and, Patwardhan, M.V. 1979b. Cultivation of *Pleurotus* spp. in a village model hut. Indian Fd. Packer 33 (6): 19-25.

[4] Block, S.S. Tsao, G. and Horn, L.H. 1958. production of mushrooms from saw dust. *J. Agric. Food Chem,* 6: 923-927.

[5] Cho, K.Y., Nair, N.G., Bruniges, P.A. and New, P.B. 1981. The use of cotton seed hulls for the cultivation of *Pleurotus sajor-caju* in Australia. *Mushroom. Sci.,* 11 : 679-690.

[6] Garcha, H.S. 1994. A Manual of Mushroom Growing PAU, Ludhiana. *J. Plant Resourse and Environ*. 14(1) :3 5 -3 9

[7] Han, T.H., Chen, K.M. and Cheng, S. 1974. Characterstics and cultivation of new *Pleurotus* in Taiwan. *Mushroom. Sci.,* 2(2) : 167-173.

[8] Jandaik, C.L. and Kapoor, J.N. 1976. Studies on Pleurotus sajor - caju (Fr.) *Singer. Mush. Sci.* 9(1) : 667-672

[9] Jandaik, C.L. and Kapoor, J.N.: 1974. Studies on the cultivation of pleurotus sajor-caju (Fr.) *Singer. Mush. Sci.,* 9(1) : 667-672

[10] Kirk, P.M. : Cannon, P.F.; David, J.C. and Stalpers, J.A. 2001. Ainsworth and Bisby's dictionary of the fungi. Biddies, London. P. 655

[11] Kurtzman, R.H. and Zadrazil, F. 1982. Physiological and taxonomic consideration for cultivation of pleurotus mushrooms. In : Tropical

[12] Quimio, T.H. 1978. Introducing *Pleurotus flabelllatus* for your dinner table. *The Mushroom. J.,* 69: 282-283.

[13] Royse, D.J. and Schisler, L.C. 1980. Mushrooms, their consumption, production and culture development. *Intr. Discipl. Sci. Rev.,* 5(4) : 324-332.

[14] Schanel, L.I.; Herzig, M. and Dvorak, Z. 1966. Veznik : Zpusob vyuziti mene hodnotynch druhu slamy ke krmym ucelum. Ziepsovaci navrh C. 13: 1-4 (c.f. Advances in mushroom biology and production(R.D. Rai; B.L.Dhar and Verma, R.N.,eds.) NRCM, Chambaghat, Solan.

[15] Verma, R.N. 1998. Recent Advances in Mushroom Research in India In : Advances in Mushroom Biology and Production (Rai, R.D., Dhar, B.L. and Verma, R.N. eds). Mushroom Society of India NCRM, Chambagahat, Solan . pp. 1-30.

[16] Vijay, B.and Sohi, H.S.I 987. Cultivation of oyster mushroom *Pleurotus sajor-caju*, on chemically sterilized wheat straw. Mush. J. Tropics, 7 : 67- 75.

[17] Zadrazil, F. 1980. Conservation of different plant waste in to feed by basidiomycetes. *Europ. J. Appl. Microbiol. Biotechnol.,* 2 : 243-248.