

RESEARCH ARTICLE

Performance of *Pleurotus florida* on paddy straw substrates and its correlation with prevailing weather conditions

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ABSTRACT

The time required for spawn run by *Pleurotus florida* during Jan.-Feb., Aug.-Sep. and Sep.-Oct. was less and the yield was considerably higher under Raipur conditions. There was strong positive correlation between temperatures (max., min. and ave.) and spawn run, pinning. However, the correlation between temperatures and biological efficiency was found to be negative and non-significant except maximum temperature and biological efficiency. The correlation between relative humidity during morning and spawn run period, pinning was found to be negative and non-significant, whereas, the relative humidity during evening was found to be positive. The environmental conditions prevailing under Bastar plateau were little bit different than environmental conditions prevailing at Raipur. The temperatures (max. min. and avg.) in Bastar plateau were comparatively lower than Raipur for pretty long period of time and humidity was higher resulting in earlier spawn run and better yield in most of the months of *P. florida* cultivation. The correlation between temperatures and spawn run, pinning was found to be positive but non-significant. On the contrary, the correlation between temperatures and biological efficiency was found to be negative and significant except minimum temperature and biological efficiency. The correlation between relative humidity and yield attributing parameters was found to be negative except relative humidity during morning and biological efficiency, but the correlation was non-significant except relative humidity during morning and spawn run. On the other hand, relative humidity during morning and spawn run period exhibited significant negative correlation but it was positive and significant with biological efficiency.

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INTRODUCTION

Oyster mushrooms (*Pleurotus* spp.) are a group of edible fleshy fungi belonging to division Basidiomycotina and family Tricholomataceae. It now ranks third among the important cultivated mushrooms of the world. Out of 28 species of *Pleurotus* reported from India (Verma, 1996), more than a dozen are under cultivation in different parts of the country (Balakrishnan and Nair, 1995). A large number of substrates viz., wheat straw, paddy straw, cotton stalks and various other

agro and industrial wastes were evaluated for cultivating different *Pleurotus* spp. by several workers all over the country (Jandaik, 1974; Bano *et al.*, 1987; Khandar *et al.*, 1991; Mehete *et al.*, 1996; Biswas, 1992 and Ram, 1995). But, cereal straws gave consistently good yields. Yields of edible mushroom are known to be greatly influenced by the temperature, humidity and light. These are very important weather factors influencing the period of spawn run, primordia formation and fruiting of edible mushrooms. Temperature was found to influence the mycelial growth and fruiting bodies

development. Different species of oyster mushroom namely, *P. citrinopileatus*, *P. flabellatus*, *P. florida*, *P. ostreatus* and *P. sajor-caju* were evaluated for their yield performance under Haryana conditions. Among the species tested, *P. florida* gave maximum yield (690 g), followed by *P. sajor-caju* (650 g), *P. ostreatus* (590 g) and *P. flabellatus* (510 g) with prevailing temperature of 18-26°C. Best period of cultivation was found to be February-March (Singh *et al.*, 1997). Role of different environmental factors like temperature, humidity, aeration, light in cultivation of *Pleurotus* spp. were studied by various workers under different agro-climatic conditions (Zadrazil and Schneidereit, 1972; Ram, 1995; Block *et al.* 1959; Chadha and Sharma, 1995; Cochrane, 1958; Eger, 1978; Zadrazil, 1978 and Purkayastha and Jana, 1983). However, the informations on environmental conditions prevailing during cultivation of *P. florida* in Chhattisgarh particularly Bastar plateau are lacking. In the present study, it was tried to cultivate *P. florida* on paddy straw substrate under Chhattisgarh plains and Bastar plateau agro-climatic conditions.

MATERIALS AND METHODS

The meteorological observations on temperature (maximum and minimum) and relative humidity (morning and evening) were recorded every day with the help of maximum-minimum thermometer and hygrometer placed in the cropping room of both the places *i.e.* Raipur and Jagdalpur. The data on temperature (max. and min.) were recorded twice in a day *i.e.* morning (8 am) and evening (5 pm). For analysis, the data on meteorological parameters were averaged for the whole cropping period. The experiment was conducted during April-May, 2002 to March-April, 2003 (under Raipur condition) and April-May, 2004 to March-April, 2005 (under Jagdalpur condition).

Correlation variables between yield related parameters of mushroom (dependent variables) and meteorological parameters (independent variable) *viz.*, maximum, minimum and average temperature, relative humidity during morning and evening were determined by Karl Pearson's formula and correlation coefficient values were tested individually at 5 per cent probability level employing following formula :

$$t = \frac{\sqrt{n-2}}{1-r^2}$$

where,

t = test of significance

r = correlation coefficient

n = number of observations

RESULTS AND DISCUSSION

The findings of the present study well as relevant discussions have been presented under following heads:

Influence of environmental factors on growth and yield under Raipur conditions :

Impact of weather parameters *viz.*, maximum and minimum temperature, relative humidity during morning and evening on spawn run, pinhead and biological efficiency of *P. florida* were studied for 12 successive months (April-May, 2002 to March- April, 2003) at Raipur. The results presented in Table 1 indicate that the period of spawn run varied widely depending upon the temperature and relative humidity prevailing in cropping room during different months of the year. The period of spawn run was considerably less (16 days) during the month of August - September, December, 02-January, 2003 and February-March, 2003 when the temperature varied from 22.9°C (min.) to 29.3 °C (max.) and relative humidity ranged from 73

Table 1 : Influence of environmental conditions on spawn run, pinning and biological efficiency of *Pleurotus florida* under Raipur conditions during 2002-2003

Months (cropping period)	Temperature (°C)			Relative humidity (%)		Spawn run (days)	Pinhead stage (days)	B.E. (%)
	Max.	Min.	Avg.	Morning	Evening			
April-May,02	42.1	25.9	34.0	49	18	-		
May-June,02	40.2	26.8	33.5	61	34	-		
June-July,02	34.6	24.9	29.8	78	69	30	37	49.0
July-Aug.,02	30.9	23.9	27.4	87	84	29	35	71.0
Aug.-Sep.,02	29.3	22.9	26.1	92	73	16	23	72.5
Sep.-Oct.,02	30.5	21.2	25.8	91	59	18	25	67.0
Oct.-Nov.,02	30.0	16.2	23.1	90	42	20	26	68.0
Nov.-Dec.,02	28.9	12.1	20.5	89	33	19	25	66.7
Dec.02-Jan.,03	27.9	10.4	19.2	86	32	17	23	67.5
Jan.-Feb.,03	28.1	12.1	20.1	84	36	21	26	76.0
Feb.-March,03	31.2	13.5	22.3	80	35	17	24	65.0
March-April,03	36.2	19.6	27.9	66	32	27	33	61.0

per cent (evening) to 92 per cent (morning). However, the period of spawn run was considerably increased during June-July, 2002 to July-August, 2002 when there was considerable increase in maximum and minimum temperature and reduction in relative humidity during morning and evening. It was observed that there was no spawn run at 25.9^o-26.8 °C (minimum temperature), 40.2-42.1 °C (maximum temperature) and relative humidity of 18-34 per cent (evening) and 49-62 per cent (morning) during May to June. Time required for pinning was less during August-September 2002 and December, 2002 - January, 2003 when the temperature and humidity were moderate. However, the time required for pinning was considerably delayed with increase in minimum as well as the maximum temperature. The biological efficiency was considerably higher when *P.florida* was cultivated during January- February, 2003 (76%) followed by August-September, 2002 (72.5%) and July-August, 2002 (71%) with varying in temperature from 28.15 to 38.95°C (maximum) and 12.1 to 23.9°C (minimum) and relative humidity from 84 to 92 per cent (morning) and 36 to 84 per cent (evening). On the other hand biological efficiency was minimum during June to July-02 when the minimum as well as maximum temperature was very high and humidity, 87 per cent (morning) and 84 per cent (evening) was comparatively low. In rest of the month, the biological efficiency of *P.florida* was still satisfactory.

Correlation analysis between environmental factors and spawn run pinning and biological efficiency of *P. florida* under Raipur conditions :

The correlation between temperatures (maximum, minimum and average) and spawn run period, pinning was found to be positive and significant in most of the cases (Table 2). However, the correlation between temperatures with biological efficiency was found to be negative but only significant in case of maximum temperature and biological efficiency. It indicates that with increase in maximum temperature, there was significant increase in the period required for spawn run and pinning but there was significant decrease in biological efficiency. The correlation between relative humidity (morning and evening) and yield related parameters of *P. florida* was found to be both positive and negative but it was non-significant in all the cases.

Influence of environmental factors under Jagdalpur conditions :

Impact of weather parameters *viz.*, maximum, minimum average temperature, relative humidity during morning and evening on spawn run, pinhead and biological efficiency of *P. florida* were studied for 12 successive months (April-May, 2004 to March- April, 2005) at Jagdalpur.

The period of spawn run varied widely depending upon the temperature and relative humidity prevailing during different months of the year (Table 3). The period of spawn

Table 2 : Correlation coefficient between environmental conditions and yield related parameters under Raipur condition

Sr. No.	Yield parameters	Temperature (°C)			Relative humidity (%)	
		Max.	Min.	Average	Morning	Evening
1.	Spawn run period	0.709*	0.571	0.686*	-0.558	0.385
2.	Pinning	0.755*	0.643*	0.757*	-0.551	0.444
3.	Biological efficiency (%)	-0.754*	-0.367	-0.551	0.546	-0.060

* Indicate significance of value at P=0.05

Table 3 : Influence of environmental conditions on spawn run, pinning and biological efficiency of *Pleurotus florida* under Jagdalpur conditions during 2004-2005

Months (cropping period)	Temperature (°C)			Relative humidity (%)		Spawn run (days)	Pinhead stage (days)	B.E. (%)
	Max.	Min.	Avg.	Morning	Evening			
April-May,04	35.8	22.9	29.4	78	42	21	27	54.1
May-June,04	32.8	22.6	27.7	78	57	22	28	51.4
June-July,04	28.8	22.2	25.5	87	68	24	31	60.6
July-Aug.,04	26.7	22.0	24.4	92	77	18	25	64.0
Aug.-Sep.,04	27.7	21.8	24.8	93	76	14	21	82.3
Sep.-Oct.,04	29.4	20.4	24.9	93	70	16	22	68.0
Oct.-Nov.,04	28.2	15.6	21.9	93	56	15	21	87.5
Nov.-Dec.,04	26.9	10.1	18.5	93	35	20	26	82.0
Dec.04-Jan.,05	27.0	9.3	18.2	94	31	17	24	76.0
Jan.-Feb,05	26.7	11.4	19.1	93	35	20	27	74.2
Feb.-March,05	31.5	14.6	23.1	90	25	19	25	60.0
Mar.-April,05	35.5	20.0	27.7	86	27	20	26	70.0

run was considerably less (14 days) during August - September, 2004 when the temperature varied from 21.8°C (min.) to 27.7°C (max.) and relative humidity ranged between 76 per cent (evening) to 93 per cent (morning). However, the period of complete spawn run was considerably increased during the month of May-June to June-July, 2004 when there was considerable increase in maximum and minimum temperatures and moderate higher relative humidity during morning and evening. Time required for pinning was less during Aug. to Sep.-04 and October to November-04 when the temperatures and relative humidity were moderate. However, the time required for pinning was considerably delayed with increase in minimum as well as maximum temperature. The biological efficiency was considerably higher when *P. florida* was cultivated during the month of October to November-04 (87.5%) followed by Aug. to Sep.-04 (82.3%) and November to December-04 (82%). On the other hand, biological efficiency was minimum during May to June-04 when the minimum as well as maximum temperatures were very high and humidity was 78 per cent during morning and 57 per cent during evening. In rest of the months, biological efficiency of *P. florida* was quite satisfactory. Several workers reported above range of maximum, minimum and average temperature and relative humidity to be favourable for vegetative as well as reproductive phase of *Pleurotus* spp. (Gupta, 1999; Ram, 1995; Shanmugam, 1986; Singh *et al.* 1997; Gupta, 1989 and Kumar, 1997).

Correlation analysis between environmental factors and spawn run, pinning and biological efficiency under Jagdalpur conditions :

The correlation between temperatures (maximum, minimum and average) spawn run, pinning was found to be positive whereas it was found to be significantly and negatively correlated with biological efficiency except minimum temperature and biological efficiency (Table 4). The correlation between relative humidity (morning and evening) and yield related parameters were found to be negative but it was non-significant except relative humidity during morning and biological efficiency and spawn run period. Thus, it can be said that with rise in temperatures (maximum, minimum and average), time required for spawn run and pinning was though increased but not significantly. However, with rise in temperatures (maximum and average) there was significant

decrease in BE. On the contrary, with rise in humidity (morning), significant increase in BE was noticed but the BE, was decreased when there was increase in humidity during evening. The correlation between temperatures (max. and min.) and spawn run, pinning was found to be positive and significant in most of the cases. However, the correlation between temperatures and biological efficiency was found to be negative and significant with maximum temperature but non significant with minimum and average temperature. Similar results in *P. florida* were reported by Thakur *et al.* (2001). However, Kumar (1997) found negative correlation with yield of *P. flabellatus* and with an average minimum temperature in the range of 13.58 – 21.29°C. The correlation between relative humidity during morning and spawn run period, pinning was found to be negative and non-significant whereas, the relative humidity during evening was found to be positive and non-significant. Ram (1995) also reported positive correlation between yield of *P. florida* and relative humidity. The trend was however, reversed with biological efficiency. From the results, it appears that there was a strong positive correlation between temperatures (max. min. and avg.) and spawn run period, pinning in *P. florida* while relative humidity and yield related parameters showed both positive and negative correlations which were non-significant.

The environmental conditions prevailing under Bastar plateau were little bit different than that existing at Raipur. The temperatures (max. min. and avg.) at Jagdalpur were comparatively lower than Raipur for pretty long period of time and humidity during morning was very high and evening was higher resulting in earlier spawn run and better yield in most of the months during *P. florida* cultivation. Similar findings were reported by Vijay and Sharma (1992-93, 1993-94) in *P. sajor-caju* at Solan (H.P). Delay in spawn run and comparatively lower yield was observed during April- May and May-June when the temperatures were higher and relative humidity was lower. Extended period for spawn run or no spawn run in *P. florida* during the month from April-July was also reported by Ram (1995).

The correlation between temperatures and spawn run, pinning was found to be positive but non-significant. On the contrary, the correlation between temperatures and biological efficiency was found to be negative and significant except minimum temperature and biological efficiency. Negative significant correlation between yield and maximum temperature

Table 4 : Correlation coefficient between environmental conditions and yield related parameters under Jagdalpur conditions

Sr. No.	Yield parameters	Temperature (°C)			Relative humidity (%)	
		Max.	Min.	Average	Morning	Evening
1.	Spawn run period	0.387	0.168	0.290	-0.627*	-0.253
2.	Pinning	0.277	0.156	0.233	-0.556	-0.193
3.	Biological efficiency (%)	-0.605*	-0.556	-0.660*	0.781*	-0.021

* Indicate significance of value at P=0.05

was also reported by Thakur *et al.* (2001) in *P. florida*. Similarly negative correlation between yield of *P. flabellatus* and minimum temperature was reported by Kumar, (1997). The correlation between relative humidity and yield attributing parameter was found to be negative except relative humidity during morning and biological efficiency, but the correlation was non-significant except relative humidity during morning and spawn run. From the results, it appears that decrease in maximum and average temperature played a key role in increasing the yield of *P. florida*. On the other hand, relative humidity during morning and spawn run period exhibited significant negative correlation but it was positive and significant with biological efficiency. Ram (1995) also reported a positive and non-significant correlation between biological efficiency *P. florida* and relative humidity.

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