

Short Communication

Influence of environmental factors on spawn run and biological efficiency of *Pleurotus* species

L.K. CHHATA and B.B.L. THAKORE*

Agriculture Research Station Arjia, Bhilwara (Raj.)

* Department of Plant Pathology, Rajasthan College of Agriculture, Udaipur

Oyster mushroom (*Pleurotus* spp.) is commonly known as Dhingri in India. The genus comprises of 38 species out of which 25 have been reported from India. Among these 12 species are cultivated in different parts of the country. Its cultivation can be done on a number of agricultural wastes and organic wastes. Different mushrooms require different climatic conditions for their mycelial growth and fruiting. Most of the mushroom species have unique ability to degrade cellulose, hemicellulose and lignin of different agro and organic wastes and utilize them to produce edible biomass of high nutritive value. Mushroom provides a low calorie diet having high amount of protein, vitamin and minerals. In general mushroom contains 55% carbohydrate, 32% protein 2% fat and rest as minerals and vitamins. These are excellent source of thiamin (vitamin B₁), riboflavin (B₂), niacin, pantothenic acid (vitamin B-complex) biotin, folic acid and vitamins like C, D, A and K which are retained even after cooking. Mushroom are rich in protein and contain all the nine essential amino acids required for human body. World production of mushroom is nearly five million tons of which largest share (37.7%) is of button mushroom followed by shitake (16.8%) and oyster mushroom (16.3%).

The experiments were carried out at the dry land farming Research Station Arjia, Bhilwara, MPUAT. Udaipur (Raj.). Wheat straw was utilized as substrate for cultivating the different species. The experiment was conducted for nine months (July-March) for two years i.e. 2005-06 and 2006-07 to find out the best suitable species for the area under prevailing relative humidity and temperature conditions of Bhilwara district, for this purpose three spp. viz., *P. florida*, *P. citrinopileatus* and *P. sajor-caju* procured from mushroom Research Laboratory, Department of Plant Pathology, Rajasthan College of Agriculture, Udaipur were cultivated through out the year to find out best species for maximum production of sporophores. Meteorological observations viz. temperature (maximum-minimum) prevailing in the cropping room was recorded daily. All the experimental data were analyzed as per Completely Randomized Design (C.R.D.) with equal replications. The critical differences was assessed at 5% probability.

The chopped wheat straw steeped for 18 hrs in water

having 75 ppm carbendazim and 500 ppm formaldehyde for 18 hr (Vijay and Sohi, 1987), excess water was drained off and spawning was done at 65-70% moisture content of the substrate. The rate of spawning was 4% on wet weight basis. Spawn mixing method was employed during present investigation. The spawned substrate of each species was filled in polyethylene bags (30 x 45 cm – 150 gauge) and nylon string was used for tying the mouth of bags. Perforations were made with the sterilized nail to allow free passage of air within the poly ethylene bags.

A unit of 0.5 kg dry straw was used for each polyethylene bag and 10 bags were maintained for each species to evaluate yield performance. The filled bags were kept in the cropping room at 22-30°C and relative humidity of 80-85 per cent was maintained by measurement it with using hydro meter and frequent watering till the spawn run was completed. Complete spawn run was considered when the straw was fully covered with milky white mycelial growth. Polyethylene bags were removed after the completion of spawn run. These bags were hanged by nylon string at a distance of 30-40 cm. Watering was stopped a day before harvesting and again continued. The crop was taken in cropping room under natural conditions. Pin head mushroom started appearing after 2 or 3 days of removing the bag. First flush of matured fruiting bodies were picked up 7-10 days after the appearance of pin heads. Maturity of the sporophores was judge when the edges of pilei begin to fold or curl upwards. For successive flushes sporophores of mushroom were harvested at an interval of 7-8 days from the same bag. The biological efficiency expressed in percentage was calculated by following formula (Chang *et al.* 1981).

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

The results indicated that the period of spawn run vary widely depending upon the temperature and relative humidity prevailing in cropping room during different months of the year. The period of spawn run in case of all the three species, was considerably less (15 to 18 days) during August – September and September – October, when the temperature

Table 1 : Effect of temperature and humidity on spawn run and biological efficiency of *P.florida*, *P. citrinopileatus* and *P. sajor-caju* under Bhilwara conditions during 2005-06 and 2006-07

Month (cropping period)	Temperature (°C)				Humidity (%)			<i>P. florida</i>				<i>P. citrinopileatus</i>				<i>P. sajor-caju</i>				
	Max.	Min.	Mor.	Eve.	Spawn run days	Yield g/500 of dry substrate	B.E. (%)	CBR	Spawn run days	Yield g/500 of dry substrate	B.E. (%)	CBR	Spawn run days	Yield g/500 of dry substrate	B.E. (%)	CBR	Spawn run days	Yield g/500 of dry substrate	B.E. (%)	CBR
	2005-06																			
1 July-15 Aug	38.0	22.5	79.51	64.77	23	320	64.0	1:1.90	22	289	57.0	1:1.66	21	245	49.00	1:1.46				
1 Aug-15 Sept	37.0	21.0	85.00	61.70	16	330	66.0	1:1.96	13	261	52.0	1:1.54	16	224	45.00	1:1.31				
1 Sept-15 Oct	40.0	20.5	81.63	56.13	15	298	60.0	1:1.78	16	271	54.0	1:1.60	16	231	46.00	1:1.37				
1 Oct-15 Nov	34.5	10.5	72.54	35.96	20	325	65.0	1:1.93	20	270	54.0	1:1.60	21	226	45.00	1:1.34				
1 Nov-15 Dec	32.0	8.0	69.43	34.10	21	313	63.0	1:1.86	22	249	50.0	1:1.47	22	201	40.00	1:1.19				
1 Dec-15 Jan	27.0	2.5	71.33	47.80	24	259	50.0	1:1.53	25	206	41.0	1:1.23	22	179	36.00	1:1.04				
1 Jan-15 Feb	29.0	2.0	51.51	30.00	24	175	35.0	1:1.04	25	134	27.0	1:0.77	25	128	26.00	1:0.76				
1 Feb-15 March	36.0	7.5	59.85	31.00	23	211	42.0	1:1.25	22	184	37.0	1:1.09	22	161	32.00	1:0.95				
1 March-15 April	36.0	13.0	63.60	28.00	21	220	44.0	1:1.31	21	184	37.0	1:1.07	22	170	34.00	1:1.01				
1 April-15 May	41.0	17.5	47.9	25.8	-	No spawn run			-	-	-		-	-	-					
1 May-15 June	45.0	21.0	62.8	37.3	-	No spawn run			-	-	-		-	-	-					
1 June-15 July	45.0	22.0	74.9	53.5	-	No spawn run			-	-	-		-	-	-					
SEm ±					0.49	5.60			0.40	4.40			0.45	3.61						
CD at 5%					1.44	16.25			1.18	12.77			1.30	10.49						
2006-07																				
1 July-15 Aug	40.0	24.0	79.61	54.93	21	345	69	1:2.00	24	300	60	1:1.78	20	265	53	1:1.60				
1 Aug-15 Sept	32.5	20.5	94.38	80.00	18	354	71	1:2.11	18	267	53	1:1.60	17	225	45	1:1.34				
1 Sept-15 Oct	37.0	20.5	81.0	52.66	16	305	61	1:1.81	15	284	57	1:1.69	15	245	49	1:1.46				
1 Oct-15 Nov	36.0	11.0	77.19	41.25	20	314	63	1:1.87	19	250	50	1:1.48	21	231	46	1:1.37				
1 Nov-15 Dec	32.5	8.0	76.53	31.20	22	293	59	1:1.74	23	270	54	1:1.60	22	187	37	1:1.14				
1 Dec-15 Jan	29.0	5.5	86.73	54.67	24	241	48	1:1.43	24	224	45	1:1.33	23	170	34	1:1.01				
1 Jan-15 Feb	26.0	2.0	58.0	36.48	22	180	36	1:1.72	25	165	33	1:0.98	25	145	29	1:0.86				
1 Feb-15 March	33.0	2.0	68.78	39.32	20	224	45	1:1.33	21	190	38	1:1.13	23	190	38	1:1.13				
1 March-15 April	37.0	10.5	71.22	29.61	21	190	38	1:1.13	20	175	35	1:1.04	21	195	39	1:1.16				
1 April-15 May	43.0	15.0	45.9	22.3	-	No spawn run			-	-	-		-	-	-					
1 May-15 June	43.0	20.4	46.9	18.8	-	No spawn run			-	-	-		-	-	-					
1 June-15 July	44.8	22.0	62.4	34.7	-	No spawn run			-	-	-		-	-	-					
SEm ±					0.40	5.06			0.45	4.53			0.41	4.53						
CD at 5%					1.18	14.70			1.30	13.17			1.21	12.98						

* B.E.-Biological efficiency • Average of 10 replications

varied from 21°C (minimum) to 40°C (maximum) and relative humidity ranged from 56.13 to 85 per cent. Whereas, the period of spawn run was considerably increased (22 to 24 days) in all three species during December – January and January – February when there was considerable reduction in maximum (27°C) and minimum (2.0°C) temperatures along with relative humidity 30-50 per cent. Moreover, it was observed that there was no spawn run in all three species during April to June when temperature reached higher as 41-45°C and relative humidity ranged between 25-54 per cent.

It was found that the biological efficiency (B.E.) of *P. florida* was highest among three species of *Pleurotus* tested during two years. However, maximum yield 330g during 2005-06 and 354 g during 2006-07 from *P. florida* was recorded when it was cultivated in August – September. The lowest yield of *P. florida* (175 g and 180 g) was obtained during January – February due to considerably decrease in maximum and minimum (29°C and 2.0°C) temperature (Table 1).

It is clear from two years experimentation that in comparison to other two species tested i.e. *P. citrinopileatus* and *P. sajor-caju* the yield performance of *P. florida* was best under Bhilwara conditions. *P. citrinopileatus* gave us highest yield (289 g and 300 g) during month of July-August in 2005-06 and 2006-07, respectively, while lowest yield was harvested during the month of January-February i.e. 134 g and 165 g/500 g of wheat straw. However, *P. sajor-caju* yielded the least in comparison to other two species tested. Yield and biological efficiency of *Pleurotus* species were influenced with environmental conditions. During present investigation yield was obtained with all the *Pleurotus* spp. during the rainy seasons. The yield of *P. sajor-caju* and *P. citrinopileatus* were relatively less throughout the year as compared to the yield of *P. florida*. From the results it may be inferred that out of three species of *Pleurotus*, *P. florida* can be recommended as the best species for commercial cultivation in Bhilwara district from July to March for getting good economic returns.

Shukla (1995) in his investigation found July to October as favourable months for cultivation of *Pleurotus* spp. in Raipur. Ram (1995) reported August – September as the best months for the cultivation of *P. florida*. Bano and Rajarathnam (1982) also obtained maximum yield of *Pleurotus* spp. during rainy seasons.

The results of this study showed that there was no spawn run during the months of April – May and June when the mean temperature was above 30°C. Similar results were obtained by Singh *et al.* (1997).

Maximum CBR ratio (1:1.96) was recorded in case of *P. florida* when grown during August-September and *P. citrinopileatus* exhibited maximum (1:1.66) BC ratio when it was grown in month of July-August. Similarly, *P. sajor-caju* showed highest (1:1.46) CBR ratio when it was cultivated in month of July-August 2005-06.

From all the species tested highest BC ratio (1:2.11) was recorded with cultivation of *P. florida* when it was cultivated in month of August – September, while *P. citrinopileatus* and *P. sajor-caju* performed highest BC ratio 1:1.78 and 1:1.60 respectively, when these were grown in month of July-August.

Data of economic analysis of *P. florida* was found better than other two spp. which showed that the investment in *P. florida* mushroom production is economically viable.

Thus, it can be said that out of nine months, six month (July-December) are very favourable for cultivation of oyster mushroom in Bhilwara district of Rajasthan.

REFERENCES

- Bano, Z. and Rajarathnam, S. (1982). *Pleurotus* mushroom as nutritious food. In : Tropical Mushroom : Their Biological Nature and Cultivation Methods (Eds. S.T. Chang and T.H. Quimio). The Chinese University Press, Honkong pp. 363-382.
- Chang, S.T., Lau, O.W. and Cho, K.Y. (1981). The cultivation and nutritive value of *Pleurotus sajor-caju*. *European J. Applied Microbiol. Biotechnol.*, **12** : 58-62.
- Ram, R.N. (1995). Studies on oyster mushroom (*Pleurotus florida*) and mycoflora associated with paddy straw substrate, M.Sc. Thesis submitted to Indira Gandhi Agriculture University, Raipur 1-97.
- Shukla, C.S. (1995). Yield performance of *Pleurotus* spp. Paper presented in National Symposium on "Recent trends in the management of biotic and abiotic stress in plants" November 2-3, 1995.
- Singh, S., Rana, R.S. and Srivastva, M.P. (1997). Studies on yield potential of different oyster mushroom species in Haryana conditions. Paper Presented in Indian Mushroom Conference 97 at NCMRT, Solan from 10-13th September pp. 7.
- Vijay, B. and Sohi, H.S. (1987). Cultivation of oyster mushroom (Fr.) Singer on chemically sterilized wheat straw. *Mushroom J. Tropics*, **7** : 67-75.