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Impact of prevailing environmental conditions on growth and yield of different *Pleurotus* species

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Abstract

Mushrooms are valuable healthy food in modern society. Oyster mushrooms represent basidiomycetous fungi, characterized by edible fruit bodies with eccentric stalk attached to the pileus that opens like an oyster shell during morphogenesis. These mushrooms namely *Pleurotus* species are described as 'food delicacies' because of their characteristic biting texture and flavour. The present investigation was under taken to find out the prevailing environmental conditions for growth and yield of twelve *Pleurotus* species. Impact of prevailing environmental conditions *i.e.* temperature (min., max.) and relative humidity on mycelial growth, pinhead initiation and cumulative sporophore weight of twelve species of *Pleurotus* was studied and data are presented in tables. August and September months gave fastest complete colonization of substrates and its required 8.90, 8.90 days respectively. Quickest (4.10 days) bud initiation was recorded in June. However it was delayed (5.50 days) in March month. The highest (426.25g) cumulative sporophore weight of *Pleurotus* species was obtained in September. Whereas, the lowest (209.00g) cumulative sporophore weight was obtained in May month.

Keywords: Oyster mushroom, *Pleurotus* species, basidiomycetous, environment, temperature, RH

Introduction

Mushroom is a cash crop grown worldwide on small as well as commercial scale for domestic consumption and export. Mushroom is also called macro fungi, it is a rich source of proteins, minerals and vitamins with low calorie value with no cholesterol. Oyster mushroom is one of the edible mushrooms cultivated in the tropics subtropics and temperate region and gaining more popularity in the last decade in many countries including India. Now, in most countries of the world, mushroom cultivation has become a multimillion dollar industry. Oyster mushroom (*Pleurotus* sp.) belonging to Class Basidiomycetous and Family pleurotaceae and popularly known as "dhingri." Naturally it grows on wood logs in temperate and subtropical forests on dead and decaying wood logs or sometimes on dying trunks of deciduous or coniferous woods. It may also develop on organic matter that declines. These mushrooms namely *Pleurotus* species are described as 'food delicacies' because of their characteristic biting texture and flavour. Cultivation of different species of oyster mushrooms around the world represents the commercial, large scale conversion of lignocellulosic residues into food. Oyster mushrooms have a sensitive, chanterel-like texture and taste. Oyster mushroom can grow in all season except during hot wave months. Oyster mushroom (*Pleurotus* spp.) can be grow in winter season when temperature is about 20 °C to 30 °C. This mushroom is being cultivated in all the countries.

Material and Methods

The period of spawn run, pin head initiation and yield varied widely depending upon the temperature and relative humidity prevailing during different months of the year. impact of weather parameters *viz.* maximum, minimum average temperature, relative humidity during morning and evening on spawn run, pin head and biological efficiency of *Pleurotus* spp. To know the effect of prevailing environmental conditions on the growth and yield of different spp. of oyster mushroom was studied on wheat straw substrate from September 2017 to June 2018. "The spawning was done on first week of every month by layer method @ 4% w/w basis. Spawned straw (0.5 kg dry straw/bag) was filled in poly propylene bag and transferred to growing room at the existing environmental conditions. Observations on period for spawn run and yield were recorded and" 5 replications were maintained for each spp. throughout the study period.

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Biological efficiency

The yield was expressed in biological efficiency and calculated using the formula (Chang *et al.*, 1981).

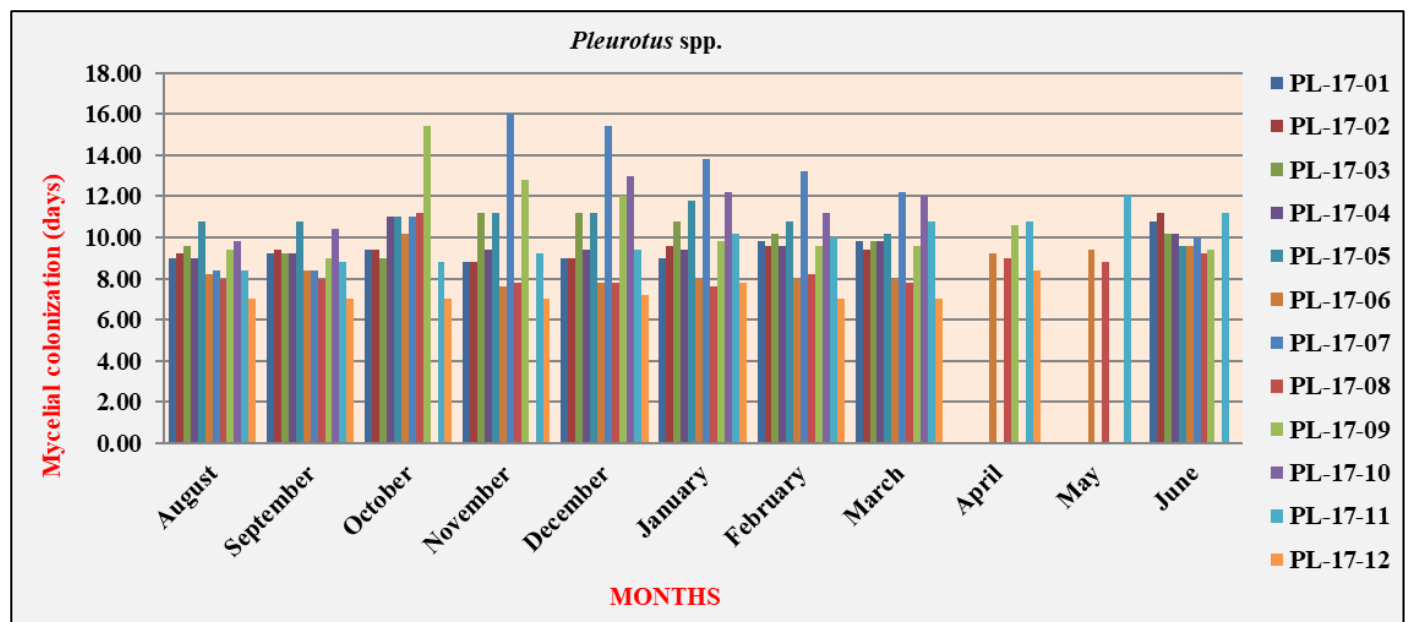
$$\text{Biological efficiency\%} = \frac{\text{Fresh weight of mushroom}}{\text{Dry weight of substrates}} \times 100$$

Results and Discussion**Table 1:** Prevailing environmental condition on spawn run of different spp. of *Pleurotus*

month	Spawn run (days)*												
	SPECIES												
	PI-17-01	PI-17-02	PL-17-03	PI-17-04	PL-17-05	PI-17-06	PL-17-07	PI-17-08	PL-17-09	PI-17-10	PL-17-11	PL-17-12	Mean
August	9.00	9.20	9.60	9.00	10.80	8.20	8.40	8.00	9.40	9.80	8.40	7.00	8.90
September	9.20	9.40	9.20	9.20	10.80	8.40	8.40	8.00	9.00	10.40	8.80	7.00	8.98
October	9.40	9.40	9.00	11.00	11.00	10.20	11.00	11.20	15.40	-	8.80	7.00	9.45
November	8.80	8.80	11.20	9.40	11.20	7.60	16.00	7.80	12.80	-	9.20	7.00	9.15
December	9.00	9.00	11.20	9.40	11.20	7.80	15.40	7.80	12.00	13.00	9.40	7.20	10.20
January	9.00	9.60	10.80	9.40	11.80	8.00	13.80	7.60	9.80	12.20	10.20	7.80	10.00
February	9.80	9.60	10.20	9.60	10.80	8.00	13.20	8.20	9.60	11.20	10.00	7.00	9.77
March	9.80	9.40	9.80	9.80	10.20	8.00	12.20	7.80	9.60	12.00	10.80	7.00	9.70
April	-	-	-	-	-	9.20	-	9.00	10.60	-	10.80	8.40	9.60
may	-	-	-	-	-	9.40	-	8.80	0.00	-	12.00	-	10.07
June	10.80	11.20	10.20	10.20	9.60	9.60	10.00	9.20	9.40	-	11.20	-	10.14
Mean	9.42	9.51	10.13	9.67	10.82	8.58	12.04	8.49	10.76	8.58	9.96	7.27	

*Average of five replication,

** spawn run not appear

**Fig 1:** Prevailing environmental condition on mycelial colonization on different spp. of *Pleurotus*.**Table 2:** Prevailing environmental condition on pinhead initiation of different spp. of *Pleurotus*

Month	Pinhead initiation* (days)												
	SPECIES												
	PI-17-01	PI-17-02	PL-17-03	PI-17-04	PL-17-05	PI-17-06	PL-17-07	PI-17-08	PL-17-09	PI-17-10	PL-17-11	PL-17-12	Mean
August	4.00	5.00	4.80	4.60	6.00	5.00	8.40	4.20	5.20	9.40	3.40	2.80	5.23
September	3.60	4.80	4.60	4.40	5.80	5.20	8.80	4.60	5.40	9.20	3.40	2.60	5.20
October	4.20	5.80	4.60	4.60	5.20	5.40	9.40	5.00	4.60	-	3.00	3.00	4.57
November	5.40	6.20	4.80	4.60	5.40	5.80	9.40	4.80	4.60	-	3.00	3.00	4.75
December	5.00	6.20	4.80	4.40	5.00	5.60	7.20	4.80	5.20	9.80	2.60	2.60	5.27
January	4.80	6.20	4.80	4.40	5.00	5.40	7.80	4.80	5.20	11.0	3.40	2.60	5.45
February	4.80	5.60	4.80	4.40	5.00	5.60	8.20	5.00	5.20	9.60	3.00	2.80	5.33
March	5.20	5.40	4.80	4.60	4.80	5.60	10.4	4.80	5.40	9.40	3.40	2.20	5.50
April	-	-	-	-	-	5.20	-	5.20	6.00	-	3.40	3.00	4.56
may	-	-	-	-	-	5.40	-	5.80	-	-	5.00	-	5.40
June	3.80	-	-	4.40	-	-	-	-	-	-	-	-	4.10
Mean	4.53	5.65	4.75	4.48	5.27	5.42	8.70	4.90	5.20	7.30	3.36	2.73	

*Average of five replication

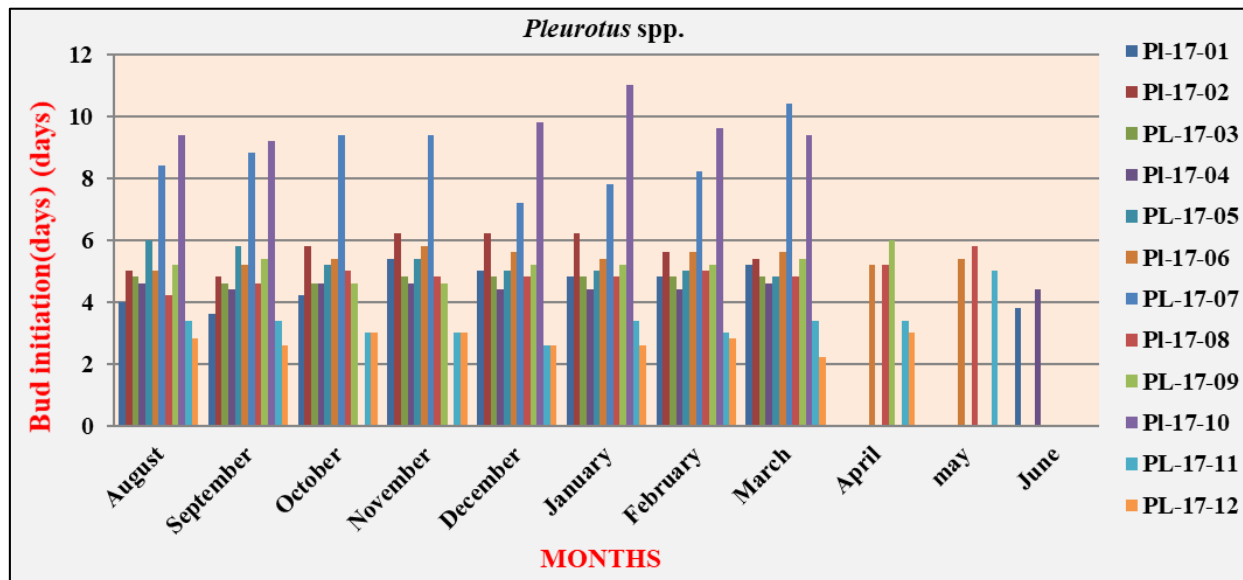


Fig 2: Prevailing environmental condition on bud initiation of different spp. of *Pleurotus*.

Table 3: Prevailing environmental condition on yield of different spp. of *Pleurotus*

Month	Yield*(gm)												Mean
	SPECIES												
	PI-17-01	PL-17-02	PI-17-03	PL-17-04	PI-17-05	PL-17-06	PI-17-07	PL-17-08	PI-17-09	PL-17-10	PI-17-11	PL-17-12	
August	419	513	429	352	411	457	383	499	375	97.00	523	434	407.66
September	527	522	428	411	413	451	402	499	380	97.00	536	449	426.25
October	406	384	368	353	366	483	364	514	289	-	540	447	376.16
November	466	441	385	340	383	477	346	502	326	-	547	456	389.08
December	451	426	402	343	382	446	264	515	237	241	636	509	404.33
January	426	400	390	384	396	447	297	483	303	240	590	481	403.08
February	415	396	398	352	413	297	297	436	341	246	474	436	375.08
March	340	365	309	321	355	415	313	426	348	178	461	391	351.83
April	-	-	-	-	-	396	-	420	189	-	443	174	324.40
may	-	-	-	-	-	216	-	297	-	-	114	-	209.00
June	225.00	-	-	223	-	-	-	-	-	-	-	-	224.00
Mean	408.33	430.87	388.62	342.11	389.87	408.50	333.25	459.10	309.77	183.16	486.40	419.66	

(*) = average of five replication

(-) = yield not obtained

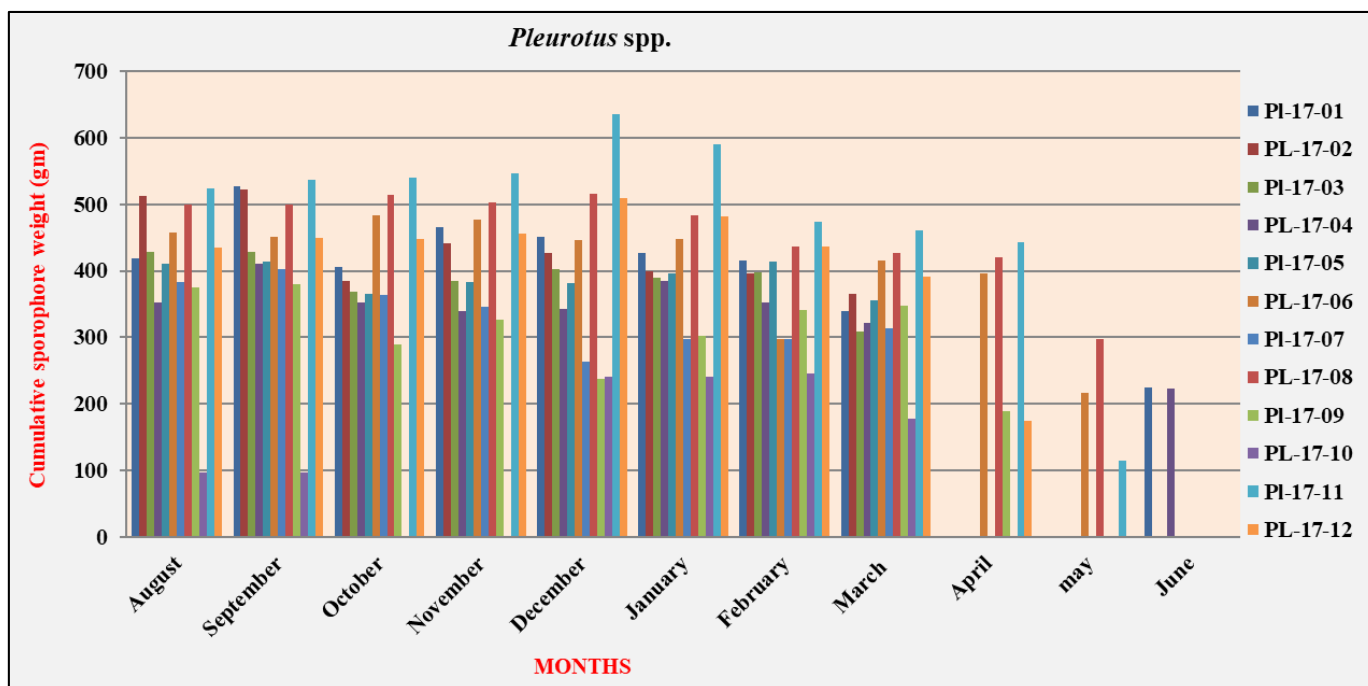


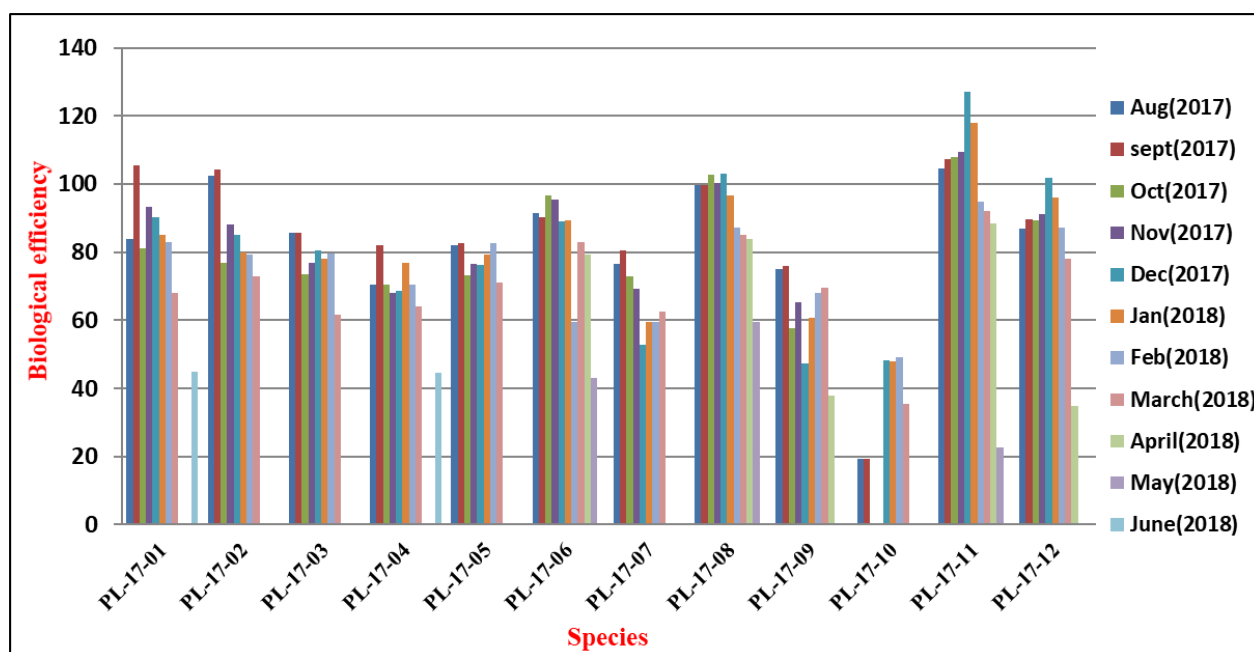
Fig 3: Prevailing environmental condition on cumulative sporophore weight of different spp. of *Pleurotus*

Table 4: Impact of prevailing environmental condition on Biological efficiency of different spp. of *Pleurotus*

Month	Biological efficiency* (%)												
	SPECIES												
	PL-17-01	PL-17-02	PL-17-03	PL-17-04	PL-17-05	PL-17-06	PL-17-07	PL-17-08	PL-17-09	PL-17-10	PL-17-11	PL-17-12	Mean
August	83.80	102.60	85.80	70.40	82.20	91.40	76.60	99.80	75.00	19.40	104.60	86.80	81.53
September	105.40	104.40	85.60	82.20	82.60	90.20	80.40	99.80	76.00	19.40	107.20	89.80	85.25
October	81.20	76.80	73.60	70.60	73.20	96.60	72.80	102.80	57.80	0.00	108.00	89.40	75.23
November	93.20	88.20	77.00	68.00	76.60	95.40	69.20	100.40	65.20	0.00	109.40	91.20	77.82
December	90.20	85.20	80.40	68.60	76.40	89.20	52.80	103.00	47.40	48.20	127.20	101.80	80.87
January	85.20	80.00	78.00	76.80	79.20	89.40	59.40	96.60	60.60	48.00	118.00	96.20	80.62
February	83.00	79.20	79.60	70.40	82.60	59.40	59.40	87.20	68.20	49.20	94.80	87.20	75.02
March	68.00	73.00	61.80	64.20	71.00	83.00	62.60	85.20	69.60	35.60	92.20	78.20	70.37
April	-	-	-	-	-	79.20	-	84.00	37.80	-	88.60	34.80	64.88
May	-	-	-	-	-	43.20	-	59.40	-	-	22.80	0.00**	41.80
June	45.00	0.00**	0.00**	44.60	-	-	-	-	-	-	-	-	44.80
Mean	81.66	86.17	77.72	68.42	77.97	81.70	66.65	91.82	61.95	36.63	97.28	83.93	

(*) = average of five replication

(-) = yield not obtained

**Fig 4:** Impact of Prevailing environmental conditions on biological efficiency of different spp. of *Pleurotus*

Impact of prevailing environmental conditions *i.e.* temperature (min., max.) and relative humidity on mycelial colonization, bud initiation and cumulative sporophore weight of twelve species of *Pleurotus* was studied and data are presented in tables. The prevailing environmental conditions greatly influence the colonization of twelve *Pleurotus* species. During different months of cultivation, August and September months gave fastest complete colonization of substrates and it required 8.90, 8.98 days respectively. However, maximum (10.20 days) days taken by December month. The other months required 9.15 - 10.14 days. Among the tested species of *Pleurotus*, PL-17-12 required minimum (7.27) days whereas, more (12.04) days for colonization of substrates took by PL-17-07. In other species it varied from 8.58- 10.82 days. In interaction PL-17-12 required comparatively less time in (7.27) days during August, September, October, November, February and March. While, it was more (15.40 days) period was recorded during October and December with PL-17-12. In other interactions, there was no great difference observed during different studied months with PL-17-12 and it varied from 7.0-8.4 days. However, PL 17-07 and PL 17-09 with December and October month took more (15.40 days) time for colonization of mycelium on substrates. Data are present

in Table no.1

Likewise the bud initiation of *Pleurotus* species greatly influenced by prevailing environmental conditions. Quickest (4.10 days) bud initiation was recorded in June. However, it was delayed (5.50 days) in March month. The other months took from 4.56–5.40 days. Among tested species of *Pleurotus*, PL-17-12 took 2.73 days whereas more (8.70) days to observed in PL-17-07. In other species it varied from 8.58-10.82 days. In interaction, quickest (2.20 days) bud initiation was found in PL-17-12 x March than other combinations. Whereas, it was delayed (11.00 days) in PL-17-10 x January and data are present in Table no. 2.

The highest (426.25g) cumulative sporophore weight of *Pleurotus* species was obtained in September. Whereas, the lowest (209.00g) cumulative sporophore weight was obtained in May month and in other months it ranges from 407.66–224.00g. Among tested species the highest (486.40g) cumulative sporophore weight was recorded in PL-17-11. Whereas the lowest (183.16g) cumulative sporophore weight was recorded in PL-17-10 and in other species it varied from 459.10 – 309.77g. In interaction the highest (636g) cumulative sporophore yield was found in December x PL-17-11 than other combinations and lowest (114g) cumulative

sporophore yield was found in May x PL-17-11 and data are present in Table no.3. According to obtained yield among the species highest B.E. was observed in PL-17-11 (97.28%) and lowest by PL-17-10 (36.63%), while in some species in some months yield are not obtained. Among the months highest yield gained in September and lowest in may due to low humidity and high temperature.

According to investigation, it is clear that august to march months were found to be favorable and November (2017) to January (2018) months are most favorable for obtaining better growth and yield for the cultivation of *Pleurotus* spp. with prevailing weather conditions the impact of weather parameters on spawn run, primordial initiation, and yield of different spp. of *Pleurotus*. From August (2017) to June (2018) was studied. The fresh yield of *Pleurotus* spp. was found better in the month of august to march month, on an average temperature is min 23.33±, max 30.28±, and RH 81.71%, while other month April May and June was not suitable due to high temperature for growth and yield. in analyzing the role of temperature and humidity, it was observed that both maximum and minimum temperature as well as RH did not vary much and were favorable for the growth and yield except three month April, May, and June, average temperature of April, May, and June is min 29.92±, max 35.29± and on an average relative humidity is 62.69%. In the present investigation conformity with results Anon (2007)^[2] who reported 17-25 °C and 55-71% relative humidity to be more suitable for obtaining higher yield of *Hypsizygous ulmarius*. Similarly Anon (2006)^[1] also found good yield of *Hypsizygous ulmarius* during October months. Earlier spawn run and higher yield of *Pleurotus columbinus* during January month was also reported by Chaurasia (1997)^[5]. When minimum temperature (13.93-20.62 °C), maximum temperature (23.57-28.16 °C) and relative humidity (76.38-84.34%) prevailed in cropping room.

Conclusion

The results obtained, August to March month were found most favorable months for cultivation of *Pleurotus* spp. under natural conditions but we found November to January month were most suitable for colonization and yield. while April, May June months are not suitable for cultivation. Based on the result of current study, it could be concluded that the environmental conditions of Chhattisgarh during August to March month having suitable relative humidity or temperature for basidiospore formation. While hot climate are unfavorable for the cultivation of oyster mushroom.

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