



Research Article

DETERMINATION OF OPTIMUM TEMPERATURE AND PH FOR MYCELIAL GROWTH OF *PLEUROTUS* SPP / STRAINS

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Abstract- Three species of Oyster mushroom viz. *Pleurotus ostreatus*, *Pleurotus sajor-caju*, *Pleurotus florida* were procured from DMR, Solan and a wild strain was collected from Bankura district in West Bengal during the monsoon season of 2017-18. The effect of temperature and pH on mycelial growth of different *Pleurotus* spp. and a wild collected strain was observed at temperatures 20°C, 25°C, 28°C and 32°C and pH 4.5, 5.5, 6.5, 7, 7.5 and 8.5. The study revealed that a temperature of 25°C was optimum for most of the *Pleurotus* isolates on PDA plates. Although, the collected strain showed the restricted mycelial growth of 3.20 cm after 5 and 7 days of inoculation at 28°C. Also, a pH range of 6.5 to 7.5 was found to be optimum for *P. ostreatus*, *P. sajor-caju* and *P. florida* while the wild collected showed optimum mycelial growth at an acidic pH 4.5-5.5 on PDA plates.

Keywords- *Pleurotus*, temperature, pH, mycelia growth, growth inhibition

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Introduction

Pleurotus is generally known as Oyster mushroom all over the world and Dhingri in India [1]. Representatives of genus *Pleurotus* form a heterogeneous group of edible species of high commercial importance [2]. Mushroom is a fungus which is macro in nature with distinctive fruit body. It can either be epigeous or hypogeous and can be seen without any eye-aid [3]. It is the most choicest edible mushroom species. Its cultivation started in Germany [4] and with time its cultivation has spread across the globe. This mushroom species are the wood decomposers so can be grown on straw. It has many medicinal properties [5]. It is tough to define the genus *Pleurotus* due to similarity of morphological traits [20]. Studies have demonstrated that Oyster mushrooms are healthy foods, which are low in calories and fat, rich in protein, chitin, vitamins and minerals [6,22]. At present, the annual production of button mushroom is 94676 mt and ranks 1st in India and 2nd is Oyster mushroom with a production of 21272 mt. West Bengal rank 6th in Oyster mushroom production in India. *Pleurotus* spp. are popular and widely cultivated throughout the world [7, 8,]. In the present study *Pleurotus* spp. were cultivated under the mushroom house conditions to determine the most efficient substrate, optimum temperature and other growth parameters suitable for high yield under West Bengal climatic conditions. The mushroom production comes out as an excellent alternative to deal with the economic crisis for the family and society. *Pleurotus* has the capacity to grow under different agro-climates, thus has proved most favorite mushroom by farmers [9]. *Pleurotus* cultivation was started by [10] in India. *Pleurotus ostreatus* was the first commercial species. The environmental factors play an important role in the cultivation of *Pleurotus* spp. It is an exceptional mushroom which contains vital bioactive molecules [21]. The genus *Pleurotus* possesses divergent temperature requirements. The spread of the mycelium has shown variation under a range of temperatures and pH on *Pleurotus* spp. / strains. A few studies have been done in the past where a temperature range of 21-26°C was found to be optimal for mycelial growth of *Pleurotus ostreatus* [11]. The mycelium of Spain isolate of *P. eryngii* grew best at 25°C and that of Kabul isolate at 20-25°C [12].

But, to confirm the optimum temperature and pH for the mycelial growth of *Pleurotus* spp. in West Bengal, the present study was carried out to determine the optimum temperature and pH for the mycelial growth of *Pleurotus* spp./strains.

Materials and Methods

The experiment on mushroom (*Pleurotus* spp.) was conducted in the laboratory of plant Pathology, Faculty of Agriculture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India, during the year 2017-2018.

a) Collection, isolation and maintenance of pure culture:

Three species of Oyster mushroom like, *Pleurotus ostreatus*, *Pleurotus sajor-caju*, *Pleurotus florida* mother culture were procured from DMR, Solan (Table 1) and wild strain was collected from Bankura district in West Bengal during the monsoon season of 2017-18 i.e., July-August. Isolations from the fresh specimen, collected from the wild were made following the standard tissue culture technique [13]. Sub-culturing of the stock cultures was done after a period of 7-10 days on fresh YPDA slants.

b) Effect of temperature on mycelium growth of different *Pleurotus* spp. with a wild collected strain.

The sterilized petri plate having 9 cm diameter were filled with PDA medium and then inoculated with 5 mm mycelium disc from actively growing region of 7 days old culture of each isolates on individual plates. The plates were incubated at temperatures viz. 20°C, 25°C, 28°C and 32°C growth of mycelium was recorded at 3 days, 5 days and 7 days.

c) Effect of different pH on mycelium growth of different *Pleurotus* spp and a wild collected strain.

The experiment was done in PDA by maintaining six different level of pH which are 4.5, 5.5, 6.5, 7, 7.5 and 8.5 by the use of digital pH meter.

The different pH level was adjusted by adding HCl and NaOH. Twenty millimeter of PDA having different pH was dispensed into each petriplates and 5 mm mycelium disc from actively growing region of 7 days old culture of each isolates was placed in centre of individual petriplates. The petriplates were incubated after inoculation on PDA plates at 25±2°C and growth of mycelium was record at 3 days, 5 days and 7 days respectively.

Results and Discussion

i) Collection and culture

Mycelial cultures of three species of *Pleurotus* were procured from DMR, Solan and one was collected wild from Bankura district of West Bengal during the monsoon months of 2017-18. Thus, a total of four species/strains were taken for further studies as shown in [Table-1].

Table-1 Procured/ Collected spp./strains of *Pleurotus*

Collection from DMR, Solan	Culture/ Species/ Strain
P1	<i>Pleurotus Ostreatus</i>
P2	<i>Pleurotus sajor-caju</i>
P3	<i>Pleurotus florida</i>
Collection from DMR, Solan	Culture/ Species/ Strain
P4	Unidentified

ii) Effect of temperature on mycelial growth

Mycelial growth pattern of various isolates of *Pleurotus* was recorded at four different temperatures viz. 20°, 25°, 28° and 32°C (Fig. 1). A temperature range of 25°C was observed to be the optimum for most of the *Pleurotus* isolates after 3, 5 and 7 days of inoculation for its mycelia growth on PDA plates [Table-2,3,4]. The study showed that with the increase in temperature, the collected strain showed the restricted mycelial growth after 5 and 7 days of inoculation while at 28°C, it showed an average diameter of 3.20 cm with a reduction in growth with advancing days and temperature.

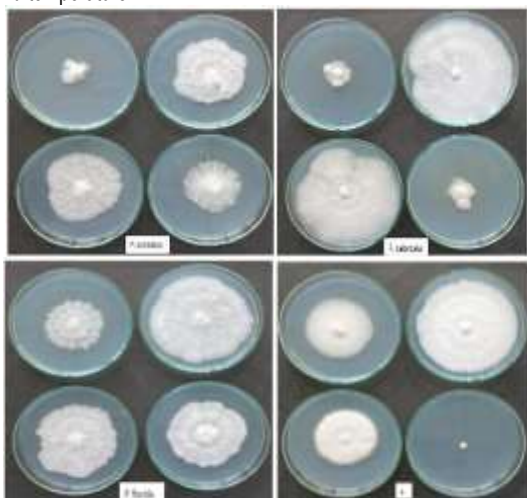


Fig-1A Mycelial growth pattern of P1, P2, P3 and P4 spp./ Strains 7days after Inoculation at different temp

Though, the culture of *P. sajor-caju* showed a higher mycelia growth in comparison rest of the strains/ spp. Out of all the procured/ collected *Pleurotus* spp./strains, whereas *P. ostreatus* exhibited a reduced mycelia growth at 20°C. Also, the wild collected strain showed an extreme reduced mycelia growth at 32°C. Similar results were observed by [14] who did an experiment with *Pleurotus columbinus* and *P. pulmonarius* and found that those species exhibited an optimum growth at a temperature of 25°C and a reduction in growth was observed at higher range of temperature i.e., 28-32°C. (Fig-1A, 1B). The results obtained by [1] are also in congruence to our results in the present study. They also observed an inhibition in growth of *Pleurotus* spp. at a temperature equal to or greater than 30°C. Similar optimum temperature has also been reported by several workers [15-17]. [16] studied a temperature range of 25.31°C on *P. flabellatus* and concluded that a temperature of 25°C is optimum. Mycelial growth type in all the isolates was found to be silky and strandy while the strain P4

showed cottony and thick mycelium. Some of the isolates showed specific zones (P2 and P3).

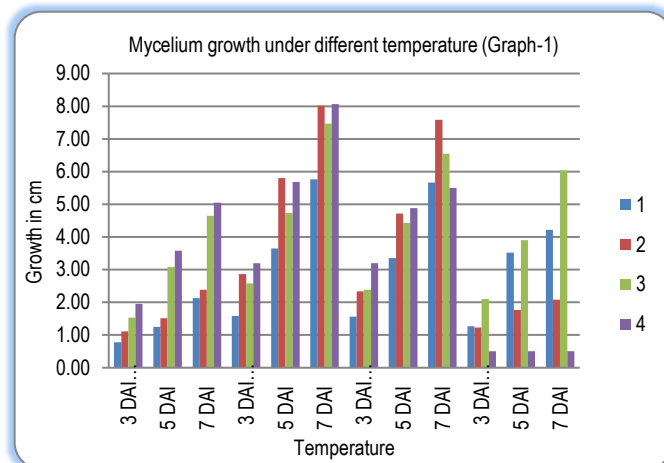


Fig-1B Bar diagram representation mycelial growth of procured/ collected *Pleurotus* spp under different temperatures

Table-2 Mycelial growth of different *Pleurotus* spp./strains under different temperatures at 3 Days after inoculation.

Species	Temperature				Mean(spp)
	20°C	25°C	28°C	32°C	
1	0.78	1.58	1.57	1.27	1.30
2	1.12	2.87	2.33	1.23	1.89
3	1.53	2.58	2.38	2.10	2.15
4	1.95	3.20	3.20	0.50	2.21
Mean(temp)	1.35	2.56	2.37	1.28	
	Spp.	Temp.	Spp×Temp.		
SEm±	0.055	0.055	0.109		
CD	0.158	0.158	0.316		

Table-3 Mycelial growth of different *Pleurotus* spp./strains under different temperatures at 5 Days after inoculation.

Species	Temperature				Mean(spp)
	20°C	25°C	28°C	32°C	
1	1.25	3.65	3.35	3.52	2.94
2	1.52	5.80	4.72	1.77	3.45
3	3.08	4.73	4.43	3.90	4.04
4	3.58	5.68	4.88	0.50	3.66
Mean(temp)	2.36	4.97	4.35	2.42	
	Spp.	Temp.	Spp×Temp.		
SEm±	0.076	0.076	0.151		
CD	0.219	0.219	0.438		

Table-4 Mycelial growth of different *Pleurotus* spp./strains under different temperatures at 7 Days after inoculation.

Species	Temperature				Mean(spp)
	20°C	25°C	28°C	32°C	
1	2.13	5.77	5.67	4.22	4.45
2	2.38	8.02	7.58	2.08	5.02
3	4.65	7.47	6.55	6.04	6.18
4	5.05	8.07	5.5	0.5	4.78
Mean(temp)	3.55	7.33	6.33	3.21	
	Spp.	Temp.	Spp×Temp.		
SEm±	0.115	0.115	0.23		
CD	0.332	0.332	0.665		

iii) Effect of pH on mycelial growth

Mycelial growth pattern of various isolates of *Pleurotus* spp was recorded at six different pH, 4.5, 5.5, 6.5, 7, 7.5 and 8.5 four different temperatures viz., (Fig. 2A,B,C, D). 7 days of after inoculation, pH range of temperature 6.5 to 7.5 was found to be optimum for *P. ostreatus*, *P. sajor caju* and *P.florida* while the wild collected showed optimum mycelia growth at an acidic pH 4.5-5.5 on PDA plates.

The study showed that with the increase in pH upto 8.5, the *Pleurotus* spp showed inhibited mycelia growth after going down from pH 7.0. (Fig-2E). Similar, results were given by [18] who observed that an initial pH of 6.4 and 6.2 is optimum for cultivation of *P. florida* and *P. citrinopileatus* in submerged culture. The studies by various workers [19, 14] has revealed that a pH of 6.5-7.5 is optimum for the growth of *Pleurotus* spp which is in congruance to our obtained results. Mycelial growth type in all the isolates was found to be silky and strandy while the strain P4 showed cottony and thick mycelium which also showed no growth at 32°C. Some of the isolates showed specific zones (P2 and P3).



Fig-2A, 2B, 2C, 2D: Mycelial growth pattern of P1, P2, P3 and P4 after 7 days of inoculation at different pH

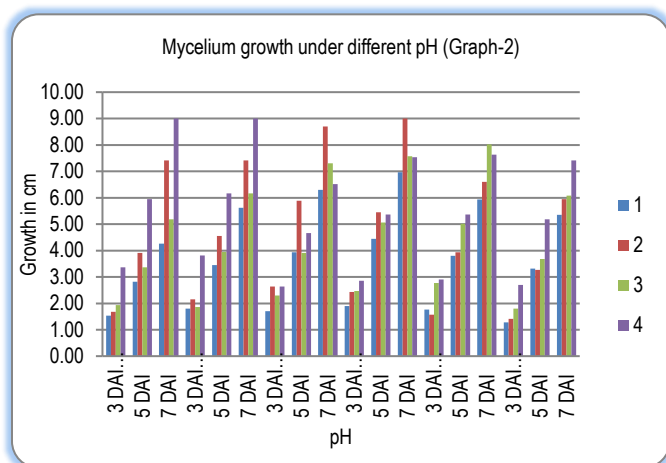


Fig-2E Bar diagram representing mycelial growth of procured/ collected *Pleurotus* spp under different pH

Conclusion

The effect of temperature on mycelial growth of different *Pleurotus* spp. and a wild collected strain was observed at temperatures 20°, 25°, 28° and 32°C which revealed that a temperature range of 25 °C was optimum for most of the *Pleurotus* isolates on PDA plates. The study showed that with the increase in temperature, the collected strain showed the restricted mycelial growth after 5 and 7 days of inoculation while at 28°C, it showed an average diameter of 3.20 cm with a reduction in growth. Also, the effect of pH on mycelial growth of various isolates of *Pleurotus* spp was recorded at six different pH 4.5, 5.5, 6.5, 7.5 and 8.5 pH after 7 days after inoculation, a pH range of 6.5 to 7.5 was found to be optimum for *P. ostreatus*, *P. sajor caju* and *P.florida* while the wild collected showed optimum mycelial growth at an acidic pH 4.5-5.5 on PDA plates. The study showed that with the increase in pH upto 8.5, the *Pleurotus* spp showed inhibited mycelial growth after pH 7.0.

Application of research: The determination of optimum temperature and pH for *Pleurotus* spp. Istarins could be used for commercial as well as at farmer's level without using much resources and thus saving the time and money. Also, the suitable spp. can be grown according to the environment. In future, it can be linked to other small units and can be a source of regular income to farmers by

cultivation at suitable time of the year.

Research Category: Plant Pathology

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