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Effect of different culture media, temperature and pH on the mycelial growth of *Pleurotus eryngii* (King Oyster Mushroom)

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Abstract
Mushrooms respond differently when grown on different culture media with respect to their mycelial characters and growth pattern. pH and temperature also affect the mycelial growth rate. Among the various culture media tested *Pleurotus eryngii* grew well on Potato palm sugar media. Among the various temperature and pH conditions tested, it grew well at 25 ℃ at pH 5-6. This study showed that *P. eryngii* prefers Potato palm sugar medium at 25 ℃ under slightly acidic to neutral pH condition.

Keywords: *Pleurotus eryngii*, Temperature, pH, media

1. Introduction
Pleurotus eryngii is the largest of the Oyster Mushrooms, commonly known by the name King Oyster Mushroom. It has the longest shelf-life (Szili and Vessey, 1980) [5] and it is the third most popular mushroom in the world in terms of production. It is called as the 'king' oyster mushroom due to its remarkably large fruiting body, superior flavour and texture. *Pleurotus eryngii* is by far the best tasting oyster mushrooms (Stamets, 1993) [1]. It has a more tender stem and smaller cap when compared to other oyster mushrooms. They are widely used as delicacies in different parts of the world because of their excellent flavour and taste (Jonathan and Esho, 2010) [6]. Mushrooms are considered as highly nutritious food which contains protein, amino acids, vitamins, crude fiber, lipids, sugars, glycogen and important mineral contents, which are essential for normal functioning of the human body (Gbolagade *et al*., 2006) [7].
Numerous elements, including spawn, growing medium, pH, temperature, moisture content and light intensity have a significant impact on the growth of mushrooms (Kadiri and Kehinde, 1999) [3]. A crucial operation and the first phase of effective mushroom growing is the maintenance and development of a stable pure culture spawn with the required potentials. Tolerance to high temperatures in the cultivable mushroom species is essential to obtain optimum yield and quality (Miles and Chang, 1997) [4]. For usage as reference strains on both a scientific and an industrial scale, it is important to store and maintain mushroom species in a pure, healthy, and stable state (Bhatt *et al*., 2010) [2]. The life cycle and other features of mushroom culture that are significant for medicine require study of mycelial behaviour. Due to inability to cultivate edible mushrooms and a lack of technical understanding, mushroom output has been constrained around the world.
This study focuses on the effect of various media, temperature and pH on the growth of the *Pleurotus eryngii in vitro* conditions.

2. Materials and Methods
2.1 Experimental layout
Three experiments were conducted. The first experiment was performed to evaluate the effect of different media on the mycelial growth of *Pleurotus eryngii*. The second and third experiments were performed to determine the effects of temperature and pH respectively using the best culture media. The experiments were laid out in a completely randomized design and three replications were maintained in each treatment. Each experiment was repeated three times and the data presented are the mean of values obtained from these experiments.

2.2 Effect of different media on mycelial growth
Total of eight different culture media were used for this experiment, such as

2.2.1 Potato dextrose agar (PDA)
Extract of 200gm boiled potato+20gm dextrose+20gm agar (made up to 1lt)

2.2.2 Wheat agar (WA)
Extract of wheat powder 30gm+ 15gm agar (made up to 1lt)

2.2.3 Oatmeal agar (OMA)
Extract of 30gm rolled oats+15gm agar (made upto 1lt)

2.2.4 Maltose agar (MA)
Maltose 12.75gm+2.75gm dextrin+2.35gm glycerol+0.78gm peptone + agar 20 gm (made upto 1lt)

2.2.5 Yeast peptone dextrose agar (YPDA)
Peptone 20gm+yeast extract 10gm+dextrose 20gm+agar 20 gm (made upto 1lt)

2.2.6 Czapek dox agar (CZ)
Sucrose 30gm+sodium nitrate 2gm+dipotassium phosphate1gm+magnesium sulphate 0.5gm+potassium chloride 0.5gm+ferrous sulphate 0.01gm+agar 20 gm (made upto 1lt)

2.2.7 Potato Palm sugar media (PPSM)
Extract of 200gm boiled potato+palm sugar 30gm+peptone 3gm+yeast 3 gm (made upto 1lt).

2.2.8 Corn meal agar (CMA)
Extract of corn seed powder of 50gm+agar 20gm (made upto 1lt) All the media were autoclaved at 121 ^{0}C and 15psi pressure for 20min and poured in 9 cm petri plates after adding streptomycin at 1g/l. *Pleurotus eryngii* culture was inoculated in each medium and was inoculated. Plates were incubated at 20 ^{0}C. The radial growth of the mycelia was recorded every 3 days interval.

2.3 Effect of various temperature on the mycelial growth
The media showing fast growth among all the culture media was selected for this experiment. The culture was inoculated in the potato palm sugar agar medium at 20, 25, 30 and 35 ℃ and three replications were maintained and radial growth was recorded at an interval of 4 days of incubation.

2.4 Effect of various pH conditions on the mycelial growth
The plates were incubated at 25 ℃ temperature at various pH conditions such as 5, 5.5, 6, 6.5, 7, 7.5 and 8 and the radial growth of the culture was recorded.

2.5 Statistical analysis
The collected data was analysed for significant difference through CRD among various treatments in all the three experiments.

3. Results and Discussion
3.1 Effect of different media on mycelial growth
P. eryngii showed significant difference in its mycelial growth when grown on various media mentioned above. It showed significantly maximum growth per day in case of PPSM at 0.69cm/day.
The results obtained with regard to the best media showed that the PPSM medium which was not used earlier in any study showed the maximum mycelial growth. Whereas the mycelial growth on PDA was 0.441cm/day. Similarly, the mycelial growth was 0.43cm/day on PDA in the experiment conducted by Hasan Sardar *et al.*, (2015) [8]. The mycelial character on plates and their growth per day is given in table 1 (Fig 1).

Table 1: Effect of various media on the growth of mycelium of *Pleurotus eryngii*

Sl. No.	Media	Mycelial growth character	Growth after 13 days of inoculation(cm)	Growth per day(cm/day)
1	PPSM	Thick velvety	8.97^{a}	0.69
2	OMA	Moderately thick	7.52^{ab}	0.57
3	WA	Scattered velvety growth	7.48^{ab}	0.57
4	CMA	Moderately thick	6.01^{bc}	0.46
5	PDA	Dense velvety	5.73^{c}	0.44
6	YPDA	Concentric growth of mycelia	5.56^{c}	0.42
7	MA	Moderately thick	3.86^{d}	0.29
8	CZ	Very thin distribution of mycelia	3.82^{d}	0.29
		CD	0.854	

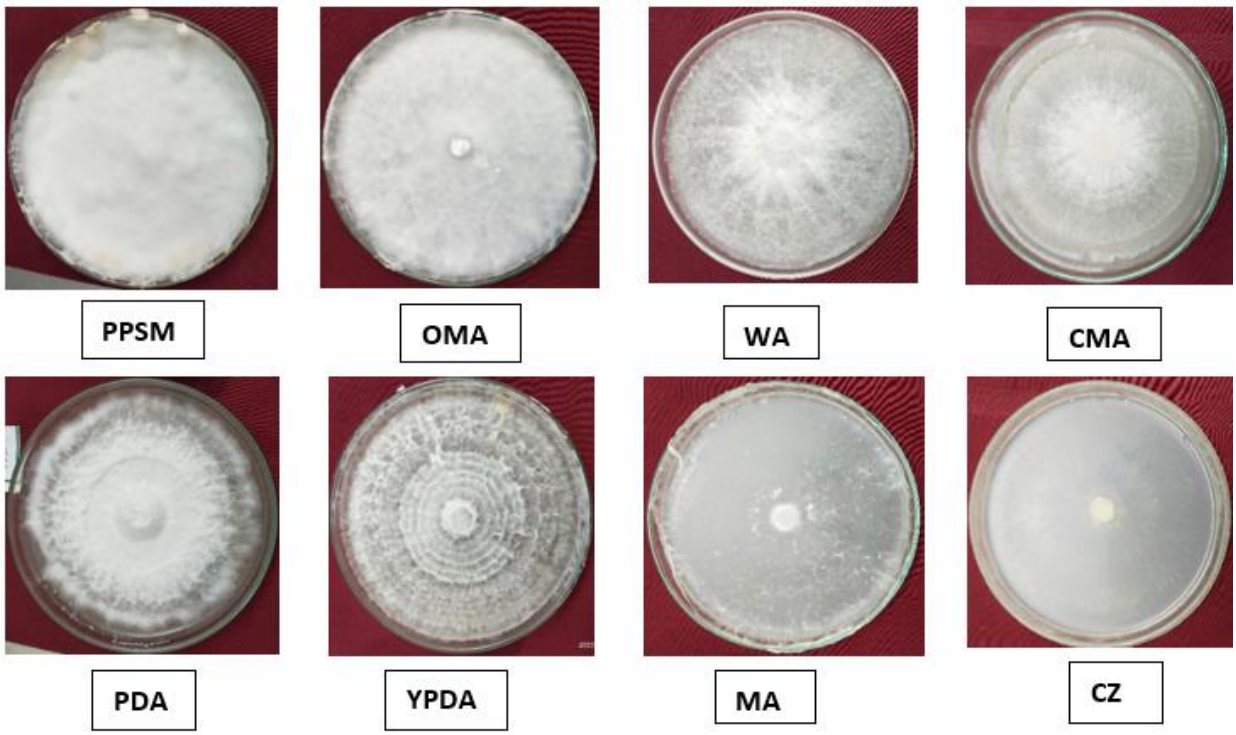

Fig 1: Morphological characters of *Pleurotus eryngii* mycelia on different culture media

3.2 Effect of various temperature on the mycelial growth
Among the four different temperatures tested on PPSM, growing at 25 ℃ showed significantly the maximum growth per day by recording 0.75 cm/day. When PPSM was supplemented with vitamin B at 40mg/100ml media, the growth was 0.79 cm/day followed by 20 ℃, 30 ℃ and 35 ℃, giving 0.6, 0.56, 0.4 cm/day growth respectively (Fig 2).

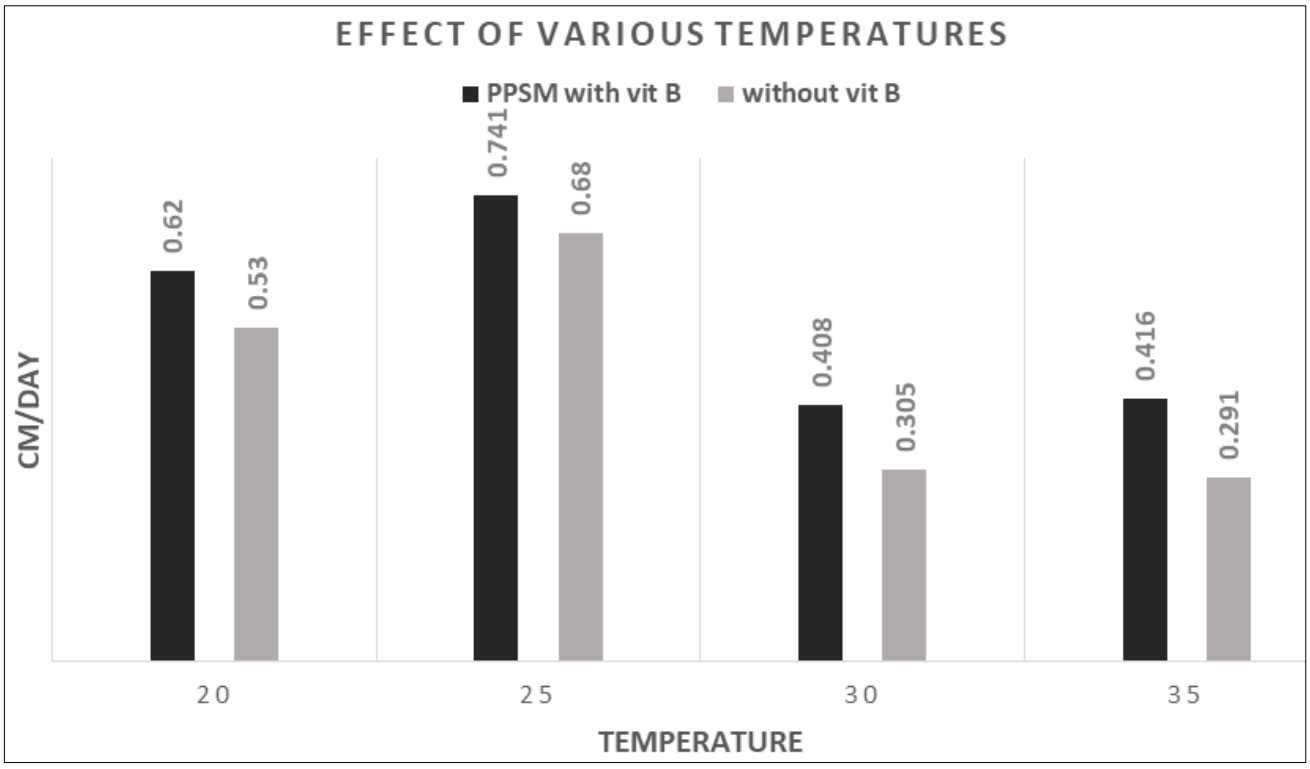

Fig 2: Effect of various temperatures on mycelial growth of *P. eryngii.*

3.3 Effect of various pH conditions on the mycelial growth
When PPSM with vit B was checked for its growth at various pH conditions, pH 5, 5.5 and 6 showed maximum growth by recording 0.83 cm, 0.82 cm and 0.82 cm/day respectively followed by pH 6.5 (0.7cm/day), pH 7(0.65cm/day), pH 7.5(0.52cm/day) and least growth was recorded at pH 8 i.e., 0.3cm/day.

Table 2: Effect of various pH on the mycelial growth of *P. eryngii*

Sl. No.	pH	Growth per day(cm/day)
1	5	0.83[a]
2	5.5	0.82[a]
3	6	0.82[a]
4	6.5	0.7[b]
5	7	0.65[c]
6	7.5	0.52[d]
7	8	0.3[e]
	CD	0.10

4. Conclusion

According to the results obtained in this experiment, mycelial growth is proved to be fast growing when the PPSM media was used at 25 ℃ and pH between 5 and 6.

5. Acknowledgment

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