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Effect of Different Temperatures and pH on Radial Growth of Different Strains of *Calocybe indica.*

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ABSTRACT

Milky mushroom (*Calocybe indica*) is robust, fleshy and milky white in colour even after flattening. As it grows in hot humid climate hence this mushroom is highly suitable for cultivation in most of the plains of India almost throughout the year. The objective of the present study is to observe the range of temperature and pH for proper mycelial growth of different strains of *Calocybe indica* in PDA media. The present study revealed that all strains (i.e. APK-2, CI-6, CI-8, CI-9, CI-10) showed maximum mycelial growth at 30^0C and minimum at 21^0C. Similarly all strains showed maximum mycelial growth at pH 8.0 followed by 7.5 and 8.5. The mycelial growth of each strain was varied significantly at all the temperature and pH tested.

Keywords: Milky mushroom, mycelia growth, temperature, pH, *Calocybe indica,* strains

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INTRODUCTION

Mushrooms were so far considered as luxury food especially among the rich community because of their unique flavour and excitingly different taste but now they have grown to a common man's food. Mushrooms are low in calories but rich in protein, and the nutritionally mushrooms can be placed between meat and vegetable and therefore mushrooms are aptly called as vegetable meat or slimming foods. Milky mushroom (*Caocybe indica*) is a promising mushroom which was introduced to the world of edible mushrooms from India [1] and commercialized from the Tamil Nadu Agricultural University, Coimbatore. It is also known as "Dudh Chhatta/Milky Mushroom" because of its milky white appearance and large sized sporophores or as "white summer mushroom" because of its tropical nature. It is more attractive with excellent shelf-life, grows on several agricultural wastes and on wide range of temperatures [2]. Different *Calocybe indica* strains are reported to show much diversity in their adaptation to the wide range of the temperature, pH levels and yield potential depending on the substrates used. Thus, a need was felt to evaluate most favourable temperature range for enhancing growth and yield of milky mushroom. In this study, five different temperature ranges were evaluated to determine their effects on productivity of five strains of milky mushroom, viz. APK-2, CI-6, CI-8, CI-9 and CI-10.

MATERIAL AND METHODS

The cultures of different strains of *Calocybe indica* viz. APK-2, CI-6, CI-8, CI-9 and CI-10 were collected from GBPUA&T, Pantnagar and Vivekanand Parvatiya Krishi Anusandhan Shala, Almoraha. The experiments were conducted at S. V. P. University of Agriculture & Technology, Meerut, Uttar Pradesh during 2010-11. The cultures of different strain of Milky mushroom were further purified by single hyphal tip method.

The culture of five strains of *Calocybe indica* were incubated at five different temperature viz. 21, 24, 27, 30, and 33^{0}C. Petri plates containing 25 ml of sterilized PDA medium were inoculated at the centre with 9 mm diameter disc of seven days old actively growing mycelium under aseptic condition. Three replications for each treatment were maintained. Observations for radial growth were taken at each 48 hrs till the colony covered the full plate.

Effect of pH (in the range of 6.0-9.0) on the growth of five different strains of *Calocybe indica* i.e. APK-2, CI-6, CI-8, CI-9, and CI-10 was investigated. Required pH of the culture media were adjusted with N/10 solutions of NaOH or HCl and after sterilization, it was measured by a digital pH meter. After sterilization at 121^{0}C (1.1 kg/cm^2 pressure) for 20 minutes in autoclave with the amount of two per cent agar, the test media were poured into the Petri plates (90 mm @ 25 ml/plate). The plates after cooling were inoculated centrally with a 9 mm disc of one week old culture and incubated at 28±1^{0}C. The observations of radial growth were taken at each 48 hrs till the colony covered the full plate.

RESULT AND DISCUSSION

The results reveal that all strains showed maximum mycelial growth at 30^{0}C followed by 27^{0}C and minimum at 21^{0}C on 3rd, 5th, 7th and 9th day's observations (Table 1). However, the mycelial growth of each strain was varied significantly at all the temperature tested. At 30^{0}C temperature on 9th day's strain APK-2 showed maximum radial growth (full growth) of mycelium (9.0 cm). The other strains showed significant variation to each other giving diametric growth ranging from 8.45-8.95 cm. However, at the temperature 24^{0}C the highest average mycelial growth was recorded 6.67 cm from strain CI-6 which was significantly superior to other strains. The least growth of the strains was recorded at temperature 21^{0}C obtained from CI-9 followed by strain CI-8 and CI-10 (Table-1).

These results are in accordance with the findings of Shukla and Jaitly [3], Tandon and Kalha [4]; they evaluated the most suitable temperature for mycelial growth of *Calocybe indica* that 30^{0}C as the optimum for fast and full mycelial impregnation. According to Sharma and Kumar [5], APK-2 strain grew successfully under temperature ranges from 30^{0}C to 49^{0}C. Varshney [6] reported temperature requirement for mycelial growth of *Calocybe indica* ranges from 25-35^{0}C. Previous studies report that all strains of *Calocybe indica* showed maximum mycelial growth at 28^{0}C followed by 32^{0}C and minimum at 20^{0}C. At 28^{0}C temperature on 8th day's strain CI-6 was at par showing maximum diametric growth of mycelium (9.0 cm) in observations. Similar results also observed by Shukla et al. [7]

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Table 1: Effect of different temperature on the radial growth (in cm) of strains of *Calocybe indica* on potato dextrose agar medium (PDA).

S.N.	Strains	Days																			
		3rd					5th					7th					9th				
		21°C	24°C	27°C	30°C	33°C	21°C	24°C	27°C	30°C	33°C	21°C	24°C	27°C	30°C	33°C	21°C	24°C	27°C	30°C	33°C
1.	APK-2	0.87	1.43	1.50	4.27	2.10	1.67	3.50	3.60	5.47	3.52	2.67	4.53	5.20	7.12	4.90	3.87	6.23	8.50	9.00	6.45
2.	CI-6	0.90	1.53	1.63	3.28	2.12	1.60	3.53	3.63	4.73	3.47	2.93	4.50	5.27	6.82	4.60	3.73	6.67	8.40	8.95	6.07
3.	CI-8	0.67	1.37	1.47	3.70	2.17	1.23	3.20	3.50	5.10	3.25	2.37	4.23	5.10	6.95	4.77	3.43	5.93	8.17	8.90	6.17
4.	CI-9	0.63	1.10	1.40	3.38	1.92	1.33	3.17	3.50	4.55	3.17	2.20	4.13	4.83	5.85	4.60	3.17	5.60	8.00	8.45	5.98
5.	CI-10	0.73	1.37	1.40	2.77	2.47	1.17	3.43	3.27	4.03	3.82	2.90	4.20	4.97	5.40	4.95	3.43	5.63	8.20	8.67	6.32
CD at 5% Temperature = 0.0937 Strains = 0.0937 Temperature X Strains = 0.209																					

Table 2: Effect of different pH levels on radial growth (in cm) of strains of *Calocybe indica* on potato dextrose agar medium (PDA).

S.N.	pH	Days																			
		3rd					5th					7th					9th				
		APK-2	CI-6	CI-8	CI-9	CI-10	APK-2	CI-6	CI-8	CI-9	CI-10	APK-2	CI-6	CI-8	CI-9	CI-10	APK-2	CI-6	CI-8	CI-9	CI-10
1.	6.0	0.97	1.10	1.10	0.97	1.07	1.28	1.32	1.37	1.17	1.40	2.27	2.12	2.50	1.88	2.38	3.97	4.13	3.45	2.92	3.13
2.	6.5	1.42	2.22	1.97	2.05	2.45	3.72	3.63	4.03	3.92	4.70	5.75	5.23	4.93	5.63	6.58	7.27	6.87	6.80	7.37	8.08
3.	7.0	1.97	2.55	2.07	2.10	2.80	4.03	4.07	4.13	3.98	4.75	6.50	6.02	5.93	5.70	6.78	7.70	7.33	7.13	7.48	8.12
4.	7.5	2.58	2.60	2.30	2.18	2.88	4.42	4.50	4.28	4.00	4.95	6.63	6.25	6.20	5.70	6.60	8.37	7.92	7.72	8.23	8.23
5.	8.0	4.23	3.12	3.77	3.37	2.97	5.47	4.73	4.63	4.55	5.05	7.05	6.78	6.48	5.82	6.32	8.97	8.93	8.83	8.48	8.65
6.	8.5	2.38	2.60	2.12	2.25	2.73	4.33	4.52	3.75	4.03	4.67	6.58	6.50	5.52	5.53	6.77	8.23	8.17	7.03	7.43	8.15
7.	9.0	1.72	2.52	2.03	2.03	2.72	3.88	4.15	3.42	3.73	4.58	6.42	5.97	4.88	5.37	6.50	7.82	7.47	6.55	7.35	8.12
CD at 5% pH = 0.1339 Strains = 0.1132 pH X Strains = 0.299																					

To study effect of different pH on mycelial growth, The results reveal that among the pH tested (i.e. 6.0-9.0), all strains showed maximum mycelial growth at pH 8.0 followed by 7.5 and 8.5 on 3rd, 5th, 7th and 9th day of observation. The mycelial growth of each strain was varied significantly at all the pH tested. At pH 8.0 on 9th days, strain APK-2 was showing maximum (approximately full growth) diametric growth of mycelium (8.97 cm). The other strains showed significant variation with each other giving diametric growth ranges from 8.93-8.48 cm. However, at pH 7.5 the highest average mycelial growth was recorded 8.37 cm from strain APK-2 which was significantly superior to other strains. The least growth of all the strains was recorded at pH 6.0 on which mycelial growth recorded for the strain CI-9 followed by strain CI-6 (Table-2).

The results are almost similar with the findings of Shukla and Jaitly [3] and Varshney (2007), she studied ten *Calocybe indica* strains for mycelial growth at pH 6, 7, 8 and 9. She found maximum mycelial growth at pH 8.0 followed by 7.0 pH. All other related studies observe that all strains showed maximum mycelial growth at pH 7.5 followed by 8.0. At pH 7.5 on 8th day's strain CI-6 was at par showing maximum full growth. However, at pH 8.0 the highest average mycelial growth recorded 8.23 cm from strain CI-6 which was significantly superior to other strains. All *Calocybe indica* strains were able to grow in a pH range of 6.0-9.0. This result also shows similarity with the result of Shukla et al. [7].

CONCLUSION

All strains (i.e. APK-2, CI-6, CI-8, CI-9, CI-10) showed maximum mycelial growth at 30^0C followed by 27^0C and minimum at 21^0C. Similarly all strains showed maximum mycelial growth at pH 8.0 followed by 7.5 and 8.5. The mycelial growth of each strain was varied significantly at all the temperature and pH tested.

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