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Effect of Different Temperature on Biomass of Milky Mushrom (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. In nature, milky white mushrooms are seen grown on humus rich soil in agricultural fields or along the roadside in tropical and subtropical parts of India, especially in the plains of Tamil Nadu(South Indian State) and in Rajasthan (located in the western edge of India). The objective of the present study is to observe the effect of different temperature on the biomass of milky mushroom. The results reveal that all strains showed maximum mycelial growth at 30°C followed by 28°C and minimum at 20°C on 3rd, 5th, 10th and 15th day's observations
Keywords: milky mushroom, edible uses, medical uses, cultivation of milky mushroom

INTRODUCTION

Calocybe indica commonly known as milky mushroom is a well recognized tropical edible mushroom and promising for cultivation in India (Purkayastha and Chandra, 1976). It contains highest protein (17.2%) and has 12 essential amino acids. Cropping requires an optimum temperature of 32 – 35c, humidity of 85-90%,diffused light and ventilation. Shelf life of milky mushroom is 2-3 days at 25-30c and 10-15 days at 4c if the microbial spoilage is taken care of (ICAR-IIHR,2016).Mushrooms grow from dust-like particles called spores, which develop in to a mass of dense white tangled threads called mycelium. Mushroom spawn is essentially sawdust permeated with mushroom mycelia. From mycelium emerges an upward-growing umbrella-shaped fruit, called mushroom. The six major constituents of mushrooms are water, proteins, carbohydrates, dietary fiber, fat, and ash (Reis, Brros, and Ferreira). Milky mushroom is considered as valuable health foods since they are known for rich proteinacious food, it cosists about 75% protein and are low in calories, fat, fatty acids, vitamins and minerals. Mushrooms as functional foods are used as nutrient supplements to enhance immunity in the form of tablets. Calocybe indica is an indigenous popular edible mushroom, having a variety of secondary metabolites such as phenolic compounds, terpenes, and steroids possibly involved in their medicinal effects and nutritive value. Milky mushroom is highly suitable and beneficial for promoting and maintaining health. Blood profile of the subjects showed a significant decrease in blood sugar, blood cholesterol and blood pressure levels in the subjects(Anju and Mary 2016).

Several chronic diseases like rheumatoid arthritis, cirrhosis and life threatening diseases like cancer are caused due to reactive oxygen species and free radicals. Enzymes like superoxide dismutase, catalase and chemicals compounds like vitamin E, C, polyphenols, carotenoids,

and glutathione play important role in neutralizing free radicals. Mushrooms are a good source of some of these biologically active compounds that protect the human body against several chronic and degenerative diseases. As well as ergosterol and biotin, vitamin A in fresh and dry milky white mushroom have been reported to be 0.35 mg and 0.27mg per gram respectively (Alam, Amin,khan and Shim. Nutritional analysis of cultivated mushrooms in banglaesh, 2008).
Water soluble vitamin C (a free radical scavenger and a well-known antioxidant and inhibitor of lipid peroxidation{LPO}) has been reported in fresh and dry milky mushrooms(1.03 and 0.4mg/100g, respectively) (Selvi, Devi, Suja and Chinnaswamy. Comparison of non-enzymic antioxidant status of fresh and dried form of P.florida and Calocybe indica. Park J Nutr.2007).

METHODOLOGY:
CLIMATIC REQUIREMENT

Temperature : Milky Mushroom can be grown in the temperature range of 25^0 - 40^0C. However, for best yields, 25^0 - 35^0C is necessary. Hence, this mushroom can be cultivated from the month of March to October in major states of India. During summer months, it may be necessary to bring down the temperature and to improve the relative humidity for obtaining higher yields. In this experiment different temperature was taken (20,25,28,30 and 35^0**C**) for observe the effect of different temperature on biomass of milky mushroom.
Relative humidity: Atmospheric relative humidity should be in the range of 80 – 85 %. Under low humidity, young fruit bodies dry up or the upper surface of the mushroom becomes rough.
Light : During fruiting, low light(200 lux) is necessary. However during the mycelium growth period, light requirement is still minimal.
Ventilation : During fruiting stage, more oxygen is required and therefore, bags are kept in a well-ventilated room.

MATERIALS AND METHODS:
Substrate : Paddy straw is the best substrate for cultivation of Milky Mushroom. About one kilogram of dry straw is necessary for raising a single bag.
Mushroom Spawn : Three weeks to one month old 100 grams of good quality seeds (10 % of dry weight of straw) is necessary for raising a bag. The spawn should be procured from a recognized spawn laboratory.
Organic Supplement : For improving productivity one may use pasteurized maize meal, wheat bran, paddy husk or boiled wheat grain at 100-150 gm per bag during spawning.

Polythene Bag : Polythene tube of dimension **60 cm x 40 cm** with 100 gauge thickness and open at both sides is required for milky mushroom cultivation.

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CULTIVATION PROCEDURE

Substrate Processing : Good quality paddy straw is chopped to 4-5 cm size with chaff cutter. The chopped straw is soaked in clean and cold water for six hours. However, the soaking period is varied with nature of substrate. Excess water is drained from the straw and it is subjected to physical and chemical means of pasteurization as in the case of oyster mushroom. Straw should contain **50-55%** moisture at the end for giving better productivity.

Raising of Bags: One end of the polythene tube is tied with rubber band and the moistened and pasteurized substrate is put inside to a height of **7.5 cm**. Substrate is then gently pressed and **one third each** of spawn and supplement (35 gm) spread at the **periphery** close to polythene. Likewise, **three such layers** are made and the bag is closed at the upper end after pressing the substrate. **15 to 20 small holes** (0.5 cm to 1.0 cm dia) should be made on all sides to facilitate gas exchange. Instead of layer spawning, mixed spawning may also be followed where the required quantity of spawn is mixed with the prepared substrate (soaked and pasteurized straw) and incorporated into the bag. The bags are then incubated in a dark room at different temperature (20,25,28,30,35 ^{0}**C**) and a relative humidity of **80%** are maintained. It takes about **20 days** when substrate is fully colonized and bags are ready for casing. Bags are shifted to cropping room for casing and cropping.

Casing and after care : Casing means covering the top surface of bags after spawn run is over, with pasteurized casing material in about **2-3 cm** thickness. Casing provides physical support, moisture and allows gases to escape from the substrate. **Casing material(soil 50% + Compost 50%)** with pH adjusted to 7.8 to 7.9 with **chalk powder** is pasteurized in autoclave at 15 psi for one hour or chemically treated with **4 % formaldehyde** solution about a week in advance of casing. It is covered with polythene sheet to avoid escape of chemical and turned at 2 days interval so that at the time of casing, soil is free from formalin smell. Top of the bag is opened, polythene is folded and casing material is uniformly spread in 2-3 cm thickness.

Cropping : It takes about 10 days for the mycelium to reach the top of the casing layer when fresh air is introduced along with appropriate temperature and humidity. The changes thus made in the environment, result in the initiation of fruit bodies within 3-5 days which may mature in about a week.
Mushroom of **7-10 cm** diameter are harvested by twisting, cleaned and packed in perforated polythene/polypropylene bags for marketing. In a **40 days** duration crop, around 800-1000 g of mushroom may be harvested per bag. Hence, the biological efficiency of milk mushroom is 80-100%.

RESULT

The results reveal that all strains showed maximum mycelial growth at 30°C followed by 28°C and minimum at 20°C on 3rd, 5th, 10th and 15th day's observations (Table 1). However, the mycelial growth of each strain was varied significantly at all the temperature tested. At 30°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 25°C the highest

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average mycelial growth was recorded 6.67 cm from strain CI-1 which was significantly superior to other strains.

The least growth of the strains was recorded at temperature 20°C obtained from CI-3 followe by strain CI-2 and CI-4 (Table-1). These results are in accordance with the findings of Shukla and Jaitly , Tandon and Kalha ; they evaluated the most suitable temperature for mycelial growth of Calocybe indica that 30°C as the optimum for fast and full mycelial impregnation. According to Sharma and Kumar, APK-2 strain grew successfully under temperature ranges from 30°C to 49°C. Varshney reported temperature requirement for mycelial growth of Calocybe indica ranges from 25-35°C. Previous studies report that all strains of Calocybe indica showed maximum mycelial growth at 28°C followed by 32°C and minimum at 20°C. At 28°C temperature on 8th day's strain CI-1 was at par showing maximum diametric growth of mycelium (9.0 cm) in observations. Similar results also observed by Shukla et al.

Table 1: Effect of different temperature on the biomass growth (in cm) of strains of Calocybe indica **.**

Strains	Days									
	3rd					5 th				
	20°C	25°C	28°C	30°C	35°C	20°C	25°C	28°C	30°C	35°C
APK-2	0.87	1.43	1.50	4.27	2.10	1.67	3.50	3.60	5.47	3.52
CI-1	0.90	1.53	1.63	3.28	2.12	1.60	3.53	3.63	4.73	3.47
CI-2	0.67	1.37	1.47	3.70	2.17	1.23	3.20	3.50	5.10	3.25
CI-3	0.63	1.10	1.40	3.38	1.92	1.33	3.17	3.50	4.55	3.17
CI-4	0.73	1.37	1.40	2.77	2.47	1.17	3.43	3.27	4.03	3.82

Strains	Days									
	10th					15 th				
	20°C	25°C	28°C	30°C	35°C	20°C	25°C	28°C	30°C	35°C
APK-2	2.67	4.53	5.20	7.12	4.90	3.87	6.23	8.50	9.00	6.45
CI-1	2.93	4.50	5.27	6.82	4.60	3.73	6.67	8.40	8.95	6.07
CI-2	2.37	4.23	5.10	6.95	4.77	3.43	5.93	8.17	8.90	6.17
CI-3	2.20	4.13	4.83	5.85	4.60	3.17	5.60	8.00	8.45	5.98
CI-4	2.90	4.20	4.97	5.40	4.95	3.43	5.63	8.20	8.67	6.32

DISCUSSION

The influence of spawn storage period on bio efficiency of milky mushroom revealed that the fully colonized fresh spawn (20 days old),was superior in regard to sporophores yield (1260 g/bag) and bio efficiency (84%). However, with the increase in the storage period of the spawn from 3-12 weeks, the yield and the bio efficiency declined substantially

These results are in accordance with the findings of Varshney (2007) reported temperature requirement from 25-35°C for mycelial growth of Calocybe indica. All strains of Calocybe indica showed maximum mycelial growth at 28°C followed by 32°C and minimum at 20°C. At 28°C temperature on 8th day's strain CI-6 was at par showing maximum diametric growth

of mycelium (9.0 cm) in observations. Shukla et al., (2013) studied on effect of temperature on mycelia growth of the strains of milky mushroom (Calocybe indica) viz. CI-4, CI-6, CI-7, CI- 8, CI-9 & CI-10

CONCLUSION

All strains (i.e. APK-2, CI-1, CI-2, CI-3, CI-4) showed maximum mycelial growth at 30°C followed by 27C and minimum at 21C. The mycelial growth of each strain was varied significantly at all the temperature

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