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POSSIBILITY OF MILKY MUSHROOM CULTIVATION IN ASSAM AND USE OF MOSS AS A CASING MATERIAL

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ABSTRACT

The cultivation technology of milky white mushroom was conducted to find out whether it can be grown under the natural conditions of Assam or not. Present investigation revealed that this mushroom can be successfully grown from May to August under the prevailing climatic conditions. The mean temperature, mean relative humidity and mean light intensity during this period ranged between 26.1 to 32.5 °C, 79.5 to 85 percent and 4925-5900 lux, respectively. Yield was not obtained below 5265 lux. The highest yield was scored in the month of June. Moss was blended with casing soil and its suitability was evaluated with different casing materials. Vermicompost combined with moss 3:1 (w/w) was the best casing treatment over control [soil + moss, 3:1 (w/w)].

Key words : Milky mushroom, *Calocybe indica,* moss, vermicompost, farm yard manure.

Mushroom cultivation in India has witnessed a tremendous revolution in the recent years with respect to the types and strains of mushrooms cultivated (Krishnamoorthy, 2002). In Assam, the most commonly grown mushroom is oyster mushroom (*Pleurotus* spp.) requiring a temperature of 23-25 °C and best grown during October to April, while paddy straw mushroom (*Volvariella* spp.) which likes hot and humid weather is prevalent only during May to August. In contrast, white button mushroom, (*Agaricus* spp.) requiring low temperature below 20°C can be grown under natural conditions during winter months from November to January.

Milky mushroom (*Calocybe indica*) or summer mushroom discovered by Purkayastha and Chandra in 1974 grows under hot and humid climate with a temperature of 35-35°c and 80 per cent relative humidity (Upadhyay, 1990). Cultivation of this mushroom had never been attempted in the entire north-east region of India. Introduction of the mushroom into Assam may help to diversify the choice from the dominating species of oyster mushroom and also help in the year round production of mushrooms apart from paddy straw mushroom grown during summer. Therefore, present study was conducted as a novel endeavour for the benefit of the state. Unlike oyster mushroom cultivation, milky mushroom production involves an additional process called casing. Moss, a small flowerless green plant growing abundantly in damp places was exploited for its suitability as a blend in casing soil during experimentation of milky mushroom cultivation.

MATERIALS AND METHODS

The experiment was carried out for two years from 2003-2004 in the laboratory and mushroom house of the Department of Plant Pathology, Assam Agricultural University, Jorhat. The culture of *C. indica* collected from the Department of Plant Pathology, TNAU, Coimbatore, was maintained in PDA by periodic sub-culturing. Sterilized parboiled rice grains were used for the preparation of spawn. Mycelial mats from the tissue culture coded as T_1 was inoculated into grain filled saline bottles for the preparation of mother spawn and from mother spawn, planting spawn was prepared.

Cultivation of *C. indica* was done adopting the polythene bag method as described by Bano and Nagarajan (1976) and also following the protocol of Marimuthu *et al.* (2002) with slight modifications. Month-wise cultivation was done from May to September keeping ten replications

in each month. Paddy straw chopped into pieces of 3-5 cm was soaked in cold water for about 4 hours. The soaked straw was boiled for one hour and then sun dried until approximately 65-70 per cent moisture. Prior to sun drying, a solution prepared with Bavistin 1g + Formalin 5 ml + garlic extract 5 ml in one lite of water was sprayed on the boiled straw to prevent contamination by green mold fungus *Trichoderma harzianum*. Polybag beds (40 x 60 cm size) with 15-20 numbers of holes were made following layer spawning at the rate of 20 per cent. Each bed contained 500 g substrate. The beds were then kept in the cropping room for mycelial run. A Horticultural Polyhouse was converted to a cropping room with modification. In Assam, during May to September, the temperature remains below optimum for milky mushroom. The polyhouse has the ability to increase the inside temperature above 30°C. The roof is made of UV stabilized low density polyethylene film. Therefore, one Nelton Agro shade of 75 per cent was placed above the UV film to reduce light intensity. Weather data. viz., temperature, relative humidity and rainfall were obtained from the observatory of the Department of Agrometeorology and daily light intensity in the mushroom house was measured using a Lux meter.

After 18 days of spawning, when the substrate was completely covered by the mycelium, the bags were opened for the application of casing material (soil + mass @ 3:1 w/w). Prior to application, the casing materials were supplemented with 10 per cent CaCO3 and then sterilized. After application of the casing materials, the bags were kept in the cropping room without disturbance for pinhead formation. Water was sprayed lightly twice daily to keep the casing materials damp. First flush of matured mushroom with well differentiated pileus, gills and stipe were harvested after 14-18 days of casing. The yield obtained from each bed was recorded and the Biological Efficiency (B.E.) was determined as per the formula (Chang, 1978) given below :

$$\text{B. E. (\%)} = \frac{\text{Weight of mushroom}}{\text{Dry weight of straw}} \times 100$$

The yield was expressed in g per 500 g substate and the data was subjected to statistical analysis.

In another set of experiment, seven different casing materials (Table 2) were used both alone and in combination with moss in the ratio of 3:1 (w/w).

Results and Discussion

During the time of cultivation, the month-wise yield of milky mushroom was recorded. Table 1 shows that the best growing season of this mushroom was from May to August. The average number of days required for complete mycelial run in the months of May and July in 2003 were the least, i.e., 18 days, whereas a maximum of 21 days were required in the month of August. The highest average yield was recorded in the month of June (518.16 g/500 g) substrate) which accounted to 103.63 per cent B.E. Similar results were obtained by Krishnamoorthy and Muthusamy (1997) who recorded a mean yield of 712 g/500 g substrate. The lowest yield was obtained in the month of August (304.5g/500 g substrate). Although the mean relative humidity and mean light intensity was optimum during the month of August, yet the yield obtained in that month was the lowest which might be due to the decline in mean temperature, i.e. 27.1°C only, that was comparatively lower compared to the previous two months of June and July. Further, paddy straw used as the main substrate for raising milky mushroom gave the encouraging yield. in this context, Krishnamorthy (2002) opined that paddy straw can be the best substrate for the commercial cultivation of *C. indica.* However, it is noteworthy that although all the weather factors viz., temperature, relative humidity and light intensity were optimum in 2004, total crop failure was recorded in that year as well as in the month of September of the previous year because all the beds were more frequently contaminated by the two fungal species, viz., *Trichoderma harzianum* and *Coprinus* sp. that lead to poor mycelial run in the substrate. Similar type of contamination was recorded by Pongener (1998) in case of *V. volvacea*. In Assam, *T. harzianum* is the major contaminating microflora that frequently spoils the beds of oyster

Table 1. Effect of weather factors on the month wise yield of mushroom

Months	Days required for complete mycelial run		Yield (g/500g substrate)		Biological efficiency (%)		Temperature (°C)				Relative humidity (%)				Light intensity (Lux)		Rainfall (mm)		Rainy days	
	2003	2004	2003	2004	2003	2004	2003		2004		2003		2004		2003	2004	2003	2004	2003	2004
							Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
May	18	*	474.08	*	94.82	*	30.1	22.1	29.7	21.9	90	69	91	73	5265	4925	201.5	311.7	18	20
June	20	*	518.16	*	103.63	*	32.0	24.8	31.2	25.0	90	75	91	77	5455	5135	241.4	187.9	13	21
July	18	*	458.10	*	91.62	*	32.9	26.0	29.9	24.7	94	76	93	82	5665	5225	267.3	373.5	15	24
August	21	18	304.50	392.00	60.90	78.40	32.7	25.5	32.5	25.5	92	71	89	78	5900	5415	326.7	194.6	12	18
September	*	*	*	*	*	*	31.8	25.0	30.5	23.5	91	76	90	69	5235	5235	174.0	163.4	24	22
C.D. (0.05)			17.54																	
S.Ed. (±)			8.27																	

* Very poor mycelial run and no yield.

mushroom (Siddique, 2000). Another reason for total crop failure in the month of September in 2003 from May to July in 2004 was more number of rainy days which ranged between 20-24 days per month. Owing to continuous downpour, the temperature inside the cropping room was declined to a level which was below optimum for the growth of *C. Indica*. Further, the light intensity was less in May to July and September 2004 as compared to the experimental months of the year 2003. The intensity of light was critical at 5265 lux below which mycelial run in the substrate was hampered and lost the fruiting ability. However, more repetition is needed to draw a precise conclusion about the critical light intensity that favours the growth and yield of the milky mushroom under Assam condition.

Moss regarded as a waste plant species, is found abundantly in Assam because of high rainfall. It is generally found to be grown in damp and shady places like walls, roofs of old houses, cemented playground floor, etc. As it is a readily available waste, hence it was used as a blend in casing materials to evaluate its efficiency and suitability.

It is observed from Table 2 that almost all the casing materials gave significantly better yield over control. Of the different casing materials used, both in combination with moss and alone, vermicompost combined with moss in the ratio 3:1 (w/w) was found to be the best treatment which yielded a total of 610.13 g/500 g substrate followed by vermicompost alone (446.5 g/500 g substrate). These two treatments exhibited best performance in giving higher yield because the vermicompost was made nutrient free by leaching prior to application as casing. Moreover, this casing medium was found to have moderate bulk density, more porosity, good water holding capacity, low electrical conductivity and cation exchange capacity. This is the first report about the use of vermicompost with moss as a casing material in milky mushroom cultivation. Our result corroborates the earlier report of ICAR (Anon., 1986) where also garden soil in combination with moss served as a better medium for growing white button mushroom than standard casing medium, i.e.,

Table 2. Effect of different casing materials on yield of *Calocybe indica*

Treatments	Days required for pinhead formation after casing	Yield (g/500 g substrate)	B.E. (%)
Farm yard manure + moss, 3:1	7	412.75	82.55
Vermicompost + mass, 3:1 (/w)	6	610.63	122.13
Only soil	9	355.00	71.00
Only moss	10	401.88	80.38
Only farm yard manure	7	292.63	58.53
Only Vermicompost	6	446.50	89.30
Control [Soil + moss, 3:1 (w/w)]	9	392.00	78.40
C.D. (0.05)		7.94	

soil only. However, Krishnamoorthy *et al*. (2002) used different casing media namely peat moss, clay loam soil, sand, red soil, farm yard manure (FYM), coirpith compost and biogas slurry. Of these, clay loam soil (pH 8.4) was the best casing medium which gave a mean yield of 338 g/bed (135% B.E.). Next to vermicompost and moss, FYM combined with moss 3:1 (w/w) was useful which yielded a total of 412.75 g/500 g substrate. Shandilya (2002) also obtained the yield of button mushroom as high a 25 kg/100 kg of ready compost by using FYM + vermicompost -leached + spend compost (1 : 1 : 1) as a casing material and concluded that the increased yield of mushroom was due to the exceptional water holding properties and presence of beneficial bacterial flora in the FYM.

To conclude, milky mushroom can be cultivated successfully in Assam as well as in the North-Eastern Indian during the months of may to August. In addition, moss in combination with different casing materials like vermicompost, FYM, etc., can be recommended as casing materials for growing milky mushroom.

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