IMPACT OF DIFFERENT CASING MATERIALS FOR PRODUCTION OF MILKY MUSHROOM (CALOCYBE INDICA*)*

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Abstract:

Milky mushroom (Calocybe indica) is an indigenous tropical edible mushroom becoming popular among people these days during summer and rainy season. This experiment was conducted in mushroom cultivation laboratory, Dept. of Agricultural Sci., &RD, Loyola Academy Degree and PG College Hyderabad, India in completely randomized design (CRD) replicated thrice. The temperature of Hyderabad ranges from 27 to 34 ^{0}C with Relative humidity (RH) ranging from 70-85% and continued by gentle spraying of water over cemented floor 2-3 times during day time. The morphological characters i.e. pileus diameter (cm), average number of pinheads, length of stalk (cm), biological efficiency (%) and yield (g) were recorded. Paddy substrate is used for growing milky mushroom with different casing materials viz., T_1 (cocopeat), T_2 (cocopeat+ vermicompost), T_3 (FYM), T_4 (vermicompost), T_5 (sandy loam soil), T_6 (FYM+ sandy loam soil) and T_7 (Vermicompost + sandy loam soil) were tested. The result of the experiment revealed that, out of seven different casing material evaluated T_6(FYM + sandy loam soil gave significantly highest yield (1428g), average number of Pinheads(41.66), length of stalk(7.76cm), Pileus Diameter (7.78cm), with early first harvest(33days) and biological efficiency (142.36%) ,followed by T_7 (Vermicompost + sandy loam soil) compared to other treatments. Lowest values were observed in T_5 (sandy loam soil).This study confirms the suitability of locally available wild strain APK2 which can be recommended for cultivation by mushroom growers by using paddy straw as substrate with FYM +Sandy soil as a casing material for achieving higher yield.

Keywords: *Milky Mushroom, Casing materials, growth, Yield, biological efficiency.*

INTRODUCTION

Calocybe indica P&C called as milky mushroom or dudh chatta or summer mushroom due to its milky white appearance **(A K Srivatsava G Singh, B kumar et al., 2014)** and is a large sized delicious mushroom reported in India by **Purkayastha and Chandra (1976).** It is an attractive mushroom with large, milky white sporophores, belonging to the family Tricholomataceae of the order Agaricales.It grows in nature on humus soil under the roadside trees in the forest. It is sold in city and village markets collected from forests in West Bengal and liked because of its attractive robust white sporocarps, long shelf life and taste. It grows at a temperature range of 25-35°C **(Kumar et al .,2017)***Calocybe indica is* a tropical edible mushroom and is popular because it has good nutritive value (proteins 70%, fats 4% and essential vitamins and minerals) and can be cultivated commercially **(Amin Ruhl et al 2010).**It is recommended as the suitable diet for diabetic patients **(SB Yadav, RP Singh et al 2021).**Mushrooms are the most valuable healthy foods, which has less calories and are high in proteins of non - animal origin, vitamins, iron, zinc and potassium **(Ouzouni et al 2009).**In addition to this, it has most of the mineral's salts required by the human body. Due to this alkaline and high fiber content, it is highly suitable for people with hyper acidity and constipation. Experiment was conducted in Hyderabad, Loyola College. It has attractive milky white color, large sized fruit shaped and better shelf life. Milky mushroom has become the 3rd commercially grown mushroom in India after button and oyster mushrooms **(Maurya et al., 2019).** It is a robust, fleshy, milky white and resembles button mushroom. The mushroom is of Indian origin**.** It is gaining popularity among the potential mushrooms growers as well as perspective consumer owing to attractive shape and size; simple growing techniques, low capital investment, wide substrate range, sustainable yield, long shelf life and ability to thrive in the wide range of climatic conditions **(Pani B.K 2011).**Mushrooms are eukaryotic, non-photosynthetic organisms that form characteristic fruiting bodies. These are used by human beings from thousands of years as food and medicine **(M.Prabhu, R Kumathakalavallai).**

Milky mushroom is a new Introduction of mushrooms from India being used as substrates for cultivation of milky mushroom**(R kumar, G singh).***Calocybe indica* was cultivated during the winter season of 2021 for high yield of growth the temperature 27-35˚C and relative humidity of 80-90% can be maintained **(S Kumar et al.,2017).** Introduction of new mushroom is important meet out the increasing public appetite for new and different mushrooms. In this context milky mushroom has great scope in our country. Quality and quantity of spawn plays an important role in successful production of any mushroom species. Cultivation processes of milky mushroom resemble oyster mushroom but include an additional process of casing **(S maheshwari, K Chetan et al 2018).**

The current investigation is to examine different casing materials used to cultivate milky mushroom. The production trail of milky white mushroom was conducted with seven different casing materials viz. cocopeat, farmyard manure (FYM), sandy loam soil, vermicompost, cocopeat+ vermicompost (3:1), FYM + soil (3:1), compost + soil (3:1). The agronomic traits included were days for pinhead formation, first harvest, average no. of fruit bodies, pileus diameter, length of stalk, yield, biological efficiency. Paddy straw was found to be the best substrate for cultivation of milky mushroom.

Mushrooms produce several numbers of volatile compounds varying with species, variety, and sometimes cultural conditions. The flavor profile also changes when mushrooms are died mainly due to high level of oxidation **(Raipor et al.,1997).**The major compound in fresh milky mushrooms was 1-octen-3-ol (58.7%) followed by n-octanol (17.93%)and 3-Octanone (3.8%) **(MV Chandravadana G venkateshwaralu et al 2005).**

MATERIALS AND METHODS

Cultivation of milky mushroom by using different casing materials:

Milky mushroom *(Calocybe indica)* can be grown on wide range of substrates as in case of oyster mushroom. It can be grown on substrates containing lignin, cellulose, and hemicelluloses. Substrate should be fresh and dry. Substrates exposed to rain or harvested premature (green color) are prone to various weed moulds which may result in failure of the crop. This experiment was conducted in mushroom cultivation laboratory, Dept. of Agricultural Sci., &RD, Loyola Academy Degree and PG College Hyderabad, India in completely randomized design (CRD) replicated trice. It can be grown on straw of paddy, wheat, ragi, maize etc., However cereal straw (paddy/wheat) easily available in abundance, is being widely used.

Straw is chopped in small pieces (2-4cm size) and soaked in fresh water for 8-16 hours. This period can be reduced when pasteurization is to be done by steam. Main purpose of soaking is to saturate the substrate with water. It is easier to soak if straw is filled in gunny bag and dipped in water. The purpose of pasteurization is to kill harmful microbes. This can be achieved in two ways. Water is boiled in wide mouth container and chopped wet straw filled in gunny bag is submersed in hot water for 40 minutes at 80-90˚C to achieve pasteurization. This is very popular method particularly with small growers. Wet straw is filled inside insulated room either in perforated shelves or in wooden trays. Steam is released under pressure from a boiler and temperature inside substrate is raised to 65˚C and maintained for 5-6 hours. Air inside the room should be circulated to have uniform temperature in the substrate. Substrate is filled in polypropylene bags (35x45cm, holding 2-3 kg wet substrate) and sterilized at 15lb psi for 1hour. Once pasteurization/sterilization is over straw is shifted to spawning room for cooling, bag filling and spawning.

Calocybe indica Strain APK2 spawn was procured from PJTSAU, RAJENDRA NAGAR. Spawning was done in layer method, 2%spawn is used for 1kg dry weight of straw and kept in dark room for 21 days for spawn run **(Pani B.K 2011).** Casing means covering the top surface of bags after spawn run is over with pasteurized casing material in thickness of about 2-3cm. Casing provides physical support, moisture and allows gases to escape from the substrate. Casing material (FYM 75% + soil 25%) with pH adjusted to 7.8-7.9 with chalk powder is pasteurized in autoclave at 151b psi for one hour or chemically treated with formaldehyde solution (4%) about a week in advance of casing. Solution should be enough to saturate the soil. It is covered with polythene sheet to avoid escape of chemical and at a interval of 2 days soil is turned so

that at the time of casing soil is free from formalin fumes. Bag's top is made uniform by ruffling top surface of the substrate and sprayed with solution of carbendazim (0.1%) + formaldehyde (0.5%).
Casing material is spread in uniform layer of 2-3 cm thickness and sprayed with solution of carbendazim and formaldehyde to saturation level. Temperature 30-35˚C and R.H. 80-90% are maintained. It takes about 10 days for mycelium to reach on top of casing layer when fresh air is introduced while maintaining temperature and R.H. as above. Light should be provided in long time. The changes thus made in environment, result in the initiation of fruiting bodies within 3-5 days in the form of needle shape which mature in about a week. Mushrooms 7-8cm diameter are harvested by twisting, cleaned, and packed in perforated polythene/polypropylene bags for marketing.
The mushroom requires high temperature and high humidity along with good light and aeration. Yield is adversely affected when these conditions are not provided. While good mycelial growth occurs between 20-37°C. For fruiting the temperature requirement is from 25-35°C. The pH of the casing material should be around 7.0 so that competitor moulds do not attack the beds.
Biological efficiency of a mushroom can be calculated as fresh weight of mushroom divided by dry weight of substrate multiplied by 100.
Biological efficiency % = Fresh weight of mushroom / Dry weight of mushroom × 100 **(Nuhu alam et al., 2010).**

RESULTS
Results on days for Days for first harvest, average number of pinheads, pileus diameter, Length of the stalk, and yield were discussed in table.

Average number of pinheads formed after casing
The highest number of pinheads were observed in the treatment of T6(FYM+ Sandy loam soil) 41.66, T7 (Vermicompost+Sandy loam soil)30.66, T3(FYM)26.11, T1(Cocopeat)22.03, T2(Cocopeat+Vermicompost) 8.11,T4(Vermicompost) 17.66, and the least number of pinheads were observed in T5 (sandy loam soil) 10.

Days for first harvest
The first harvest was observed in the treatment of T6 (FYM+ Sandy loam soil) is 33 days after spawning.

Diameter of pileus
The diameter of pileus was significantly highest in treatment of T6 (FYM+ Sandy loam soil) 7.76cm, T7 (Vermicompost+Sandy loam soil) 7.36cm, T3 (FYM) 7.13cm, T1 (Cocopeat) 6.46, T4 (Vermicompost) 6.13, T2 (Cocopeat+Vermicompost) 5.51cm and the least is in treatment of T5 (sandy loam Soil) 4.26cm.

Length of the stalk
The results in length of the stalk showed significantly highest in the treatment T6 (FYM+ Sandy loam soil) 7.76cm. Treatment T7 (Vermicompost+Sandy loam soil) 7.36cm, T3 (FYM) 7.26cm, T1 (Cocopeat) 6.76, T4 (Vermicompost) 6.43, T2 (Cocopeat+Vermicompost) 5.16 and the least is in treatment T5 (Sandy loam soil) 4.66cm.

Yield:
Overall, the yield ranged from 1428-840gm, and the highest yield was recorded in treatment of T6(FYM+ Sandy loam soil)1420gm, T7(FYM+ Sandy loam soil)1102gm, T3(FYM)1080.66gm, T1(Cocopeat)911.33gm, T4(Vermicompost)840.11gm, T2(Cocopeat+Vermicompost) 536.11gm, and the least was recorded in treatment of T5 (Sandy loam soil) 116gm.

Biological efficiency
The biological efficiency of different casing materials ranged from 142.36 – 52.86%. The highest biological efficiency was recorded in treatment of T6(FYM+ Sandy loam soil) 142.36% is treatment T7(Vermicompost+Sandy loam soil)110.36%, T3(FYM)108.68%, T1(Cocopeat)88.43%, T4(Vermicompost) 83.69%, T2(Cocopeat+Vermicompost) 52.86%, and the least is in treatment T5(Sandy loam soil) 11.42%.

Fig.1 FYM +Sandy loam Soil

Fig.2 Pin heads initiation

Fig.3 Harvesting Stage 33 days after bedding

Table-1. Effect of different casing materials on growth and yield of milky mushroom

Treatment	Treatment names	Av. no. of pinheads*	First harvest (days)*	Pileus dia.(cm)*	stalk length (cm)*	Yield (g/bed)*	Biological efficiency (%)
T1	Cocopeat	22.03	39	6.46	6.76	911.33	88.43
T2	Cocopeat+Vermicompost	18.01	42	5.51	5.16	536.01	52.86
T3	FYM	26.03	37	7.13	7.26	1080.66	108.68
T4	Vermicompost	17.66	41	6.13	6.43	840.01	83.69
T5	Sandy loam soil	10.01	45	4.26	4.66	116.01	11.42
T6	FYM+ Sandy loam soil	41.66	33	7.78	7.76	1428.12	142.36
T7	Vermicompost	30.03	35	7.36	7.36	1102.01	110.36
C.D.		-	-	0.49	0.75	216.67	216.67
SE(m)		9.32	2.218	0.15	0.24	70.74	70.74
SE(d)		13.18	3.317	0.22	0.34	100.05	100.05
C.V.		68.08	10.67	4.29	6.54	14.26	14.26

*Average number of three replications

T_1 (cocopeat), T_2 (cocopeat+ vermicompost), T_3 (FYM), T_4 (vermicompost), T_5 (sandy loam soil), T_6 (FYM+ sandy loam soil) and T_7 (Vermicompost + soil)

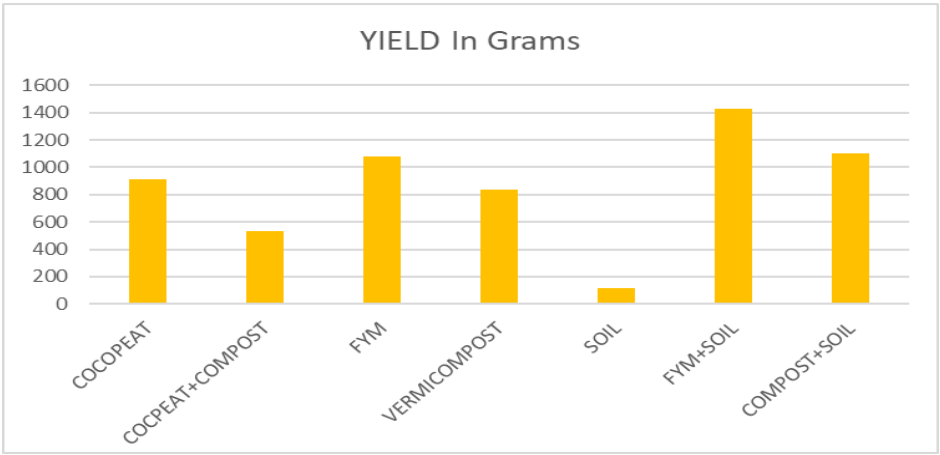

Fig.1 Effect of different casing materials on yield

DISCUSSIONS

The different casing materials (FYM, vermicompost, sandy loam soil, cocopeat + compost, FYM+ sandy loam soil, Vermicompost+ sandy loam soil) were tested for their effect on characters of *Calocybe indica*. The results obtained are given table1. Different casing materials have shown significant differences from each other for producing several fruiting bodies per bag. The highest number of fruiting bodies per bag were observed in T6 (FYM+ sandy loam soil) followed by T7 (Vermicompost+ sandy loam soil) and the least was observed in T5 (Sandy loam soil). The maximum fresh weight of milky mushroom was obtained from T6 (FYM+ sandy loam soil) whereas the lowest weight is observed in T5 (Sandy loam soil). This varied production potential of different casing materials might be due to their variations in their physical properties and nutritional composition. Moreover, **Kerketta et al., (2018)** used various casing materials for the growth of milky mushroom and found that casing materials positively affected the growth and yield of mushroom. Casing soil protects supports the mushroom against pests and diseases, provides support for developing sporophores and provides a gaseous exchange for growth and development of mushrooms **(AS Krishnamoorthy 2016).** The casing layer has microorganisms and provides an environmental change that helps mushroom to shift from vegetative stage to reproductive stage.

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