WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 5.990
Volume 4, Issue 11, 1499-1508. Research Article ISSN 2277– 7105

YIELD POTENTIAL OF MILKY MUSHROOM – *CALOCYBE INDICA* (APK-2) WITH RESPECT TO VARIOUS AGRICULTURAL WASTES

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Article Received on
07 Sep 2015,

Revised on 27 Sep 2015,
Accepted on 17 Oct 2015

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ABSTRACT

Mushrooms belong to a group of fleshy macroscopic fungi (Class: Basidiomycetes) and many of them are treated as incredibly popular food in most countries including India. Mushrooms have become an appropriate replacement for non-vegetarian food. The Milky mushroom - *Calocybe indica*, widely known as white vegetable is the most commonly cultivated mushroom. It is grown at high temperatures, during summer season in India. As any other plant, it is susceptible to a variety of Viral, Bacterial and Fungal diseases. However, it has a superior shelf life, as compared to other edible fungi and it can be transported to long distances for marketing without any damage to its quality. The aim of this study was to find out the efficiency of different substrates (Paddy straw, Sugar cane bagasse, Coconut coir & Banana leaves) in proportion to its growth and yield with respect to the cultivation of the milky mushroom. Among the four different treated substrates, paddy straw was the most favourable substrate for cultivation of Milky mushroom.

KEYWORDS: Fungi, Basidiomycetes, *Calocybe indica*, Substrates, Cultivation.

1. INTRODUCTION

Mushrooms are macroscopic fungi with visible and attractively coloured and designed fruit bodies. With high values of nutrients, and bioactive substances (Chang, 1996), sum of them are even edible and also medicinal. They have a long history of traditional use in oriental therapies and also modern clinical practices ((Ferriera *et al.*, 2010).

The available archaeological records reveal that edible mushrooms were associated with people living about 13000 years ago in Chile (Rojas and Mansur, 1995). In China, eating of wild fungi was reported several hundred years ago, before the birth of Christ (Aaronson, 2000). The nutritional and medicinal properties of mushrooms were recognized for a long time (Mattila *et al.*, 2000).

Greeks believed that mushrooms provided strength for their warriors in battle. The Pharaohs preisedd mushrooms as a delicacy and Romans regarded mushrooms as "Food of the Gods" and served them only on festive occasions. Chinese treasured mushrooms as a health food, the "Elixir of life." (Shu - Ting Chang and Philip G. Miles, 2004).

In recent times, the fast-growing mushrooms have received a remarkable amount of interest from people, as a delicious food with high nutritional values. It is a known fact that the human body requires carbohydrates, fats and proteins and also vitamins and several inorganic compounds, indispensible for good health. Mushrooms are a good source of essential nutrients and high amounts of vitamins, minerals and proteins. Mushrooms are regarded "Poor Man's Protein" (Pandey, 2004). They are also reported as therapeutic foods, preventing diseases like hypertension, hypercholesterolemia and cancer (Bobek and Galbavy, 1999 & Bobek *et al.*, 1995).

The mushroom *Calocybe indica*, commonly known as milky mushroom is a tropical edible fungus in great demand for its healthy, highly nutritive, fleshy, tasty, attractively designed and bright white coloured structure.

The cultivation of edible mushrooms has become an attractive and low- costing alternative to others, over the past few years with a great demand in market value (Chang, 2006). The milky mushroom grows on uncomposted substrate under *invitro* conditions. Attempts were made to cultivate the mushroom with limited success. (Purkayastha and Nayak, 1979; Chakravarty *et al.*, 1981; Doshi *et al.*, 1989; Pandey & Tewari, 1993). A variety of diverse cellulosic substrates were tried for cultivation, including Paddy straw, wheat straw, soybean straw, sugarcane bagasse, cotton waste and coconut coir (Chakravarthy *et al.*, 1981 & Doshi *et al.*, 1989).

The present study was aimed at finding out the potentiality of different substrates on the growth and yield of milky mushroom.

2. MATERIALS AND METHODS

The present study was conducted at Mushroom research and cultivation laboratory, D.G. Vaishnav College, Chennai- 106, Tamil Nadu. Mother spawn (*Calocybe indica* APK-2) was obtained from TNAU, Coimbatore, Tamil Nadu.

2.1. Substrates

Four different agro wastes (Paddy straw, Sugarcane bagasse, Coconut coir and Banana leaves) were used as substrates, as they are readily and locally available in plenty.

2.2. Mushroom Bed- preparation

Healthy materials of the substrates - Paddy straw, Sugarcane bagasse, Coconut coir and Banana leaves - were selected and processed for cultivation of the milky mushroom. Chemical sterilization method was adopted with the fungicide Carbendazim (75 ppm), Formalin (500ppm). All the substrates were taken in separate containers with sufficient amount of water and chemicals and soaked for 14-18 hrs. After soaking, the substrates are taken out and spread on the floor for evaporation of excess moisture. Then, the substrates are packed in polythene bags (60×30 cm) in alternate layers with the spawn powder and bags mouths were tied up with rubber bands. Using a needle, 10-12 holes are made randomly at the surface of each bag. Each bag is stuffed with substrates, roughly weighing 1 kg.

2.3. Spawn - running

The mushroom beds (polythene bags with substrates) are pasteurized and cooled for one day in the spawn running room. At controlled temperature (30-35 ^{o}C), the mushroom spawn ramifies the entire area of the beds. Humidity is maintained 85-90 per cent by sprinkling water on the floor at intervals everyday when the substrates are completely colonized by the fungal hyphae, the beds are removed from the rope and horizontally cut into equal halves. At the cut surface of each half is applied casing soil to about 2 cm height.

2.4. Preparation of casing soil

Clay loam soil with pH 8 - 8.5 is taken in mud pots after removing the clods. Its moisture content of the soil is adjusted to 40 % by gravimetric method (Devadoss, 1971). The pots are subsequently covered with the old newspapers and steamed in an autoclave at 110°C for 60 min. After 24 hrs., of cooling, the soil is used for casing. While casing, the soil is uniformly spread over the cut surface of the beds. Later, the beds are transferred to the ropes in the cultivation room under controlled conditions for the harvest.

2.5. Cropping and Harvesting

The Cultivation room is maintained under controlled conditions with humidity 80-90%, light intensity- 1600-3200 flux and specific temperature. Humidity is maintained by sprinkling water thrice a day on the floor of a room. The specified intensity of light, at least for six hours is essential to avoid loss in yield and size of pileus and stalk.

Periodical observation is required to find out the data on period of spawn running, formation of pin head, total number of fruit bodies, diameter of pileus, length of stalk, time of first harvest, total yield and Biological efficiency (%).

The Biological efficiency is also calculated (Royse *et al.,* - 2004).

Bio-efficiency % = Fresh weight of mushroom (g) / Dry weight of substrate (g) × 100.

2. RESULTS

The Table below, shows the number of days required for various stages of cultivation of the mushroom (spawn run, pinhead formation harvesting period, No. of fruit-bodies, pileus dia, stalk length, total yield and biological efficiency), against the selected substrates.

Spawn run

The maximum duration required for spawn run with paddy straw (S1) is 14 days.

Pin-head formation

The maximum duration is 27 days for pin head formation in paddy straw (S1) as compared to the other substrates and Coconut coir (S3) requires 32 days.

First harvest

The maximum period required for the first harvest of milky mushroom grown on paddy straw is 36- 42 days.

Number of fruit bodies

Of all the substrates, paddy straw recorded the best results with highest number of fruit bodies (25/ bed).

Diameter of pileus

The diameter of pileus was highest about 7.1 cm on paddy straw (S1). Sugarcane bagasse (S2) recorded next with 6.5 cm.

Length of stalk

The treatment with paddy straw results in lengthy stalks, the maximum with 7.6 cm. while the substrates coconut coir and sugarcane bagasse stand next.

Total yield

The percentage of yield of the edible mushroom ranges between 545g and 1184g / 1000g substrate, highest yield percentage is recorded for paddy straw (S1) 1184 g/ 1000g dry substrate. The lowest yield is recorded in banana leaves (S4) 545 g/ 1000g dry substrate.

Biological efficiency

The biological efficiency of different substrates ranges between 54.50 - 118.40 %. The maximum biological efficiency is observed in paddy straw (S1) with 118.40%. The next best in order was coconut coir (S3) with 98.60%. Whereas, sugarcane bagasse (S2) and banana leaves (S4) performed minimum biological efficiency with 61.50% and 54.50% respectively.

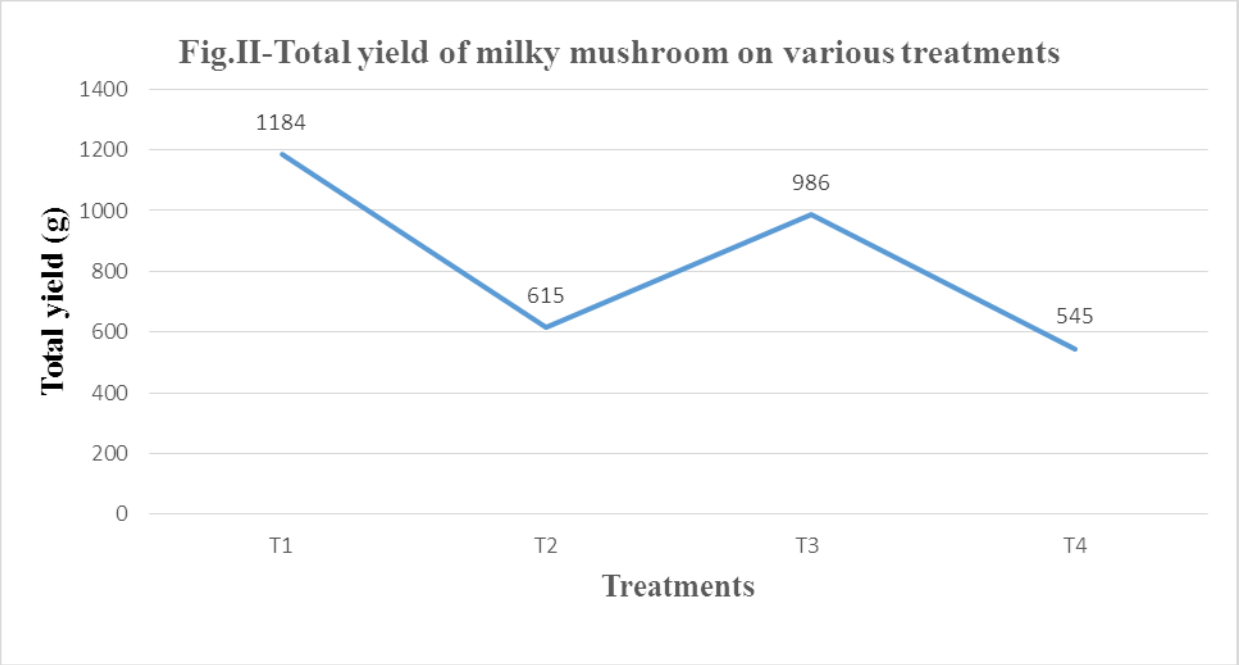
Fig- I: Milky mushroom – *Calocybe indica.*

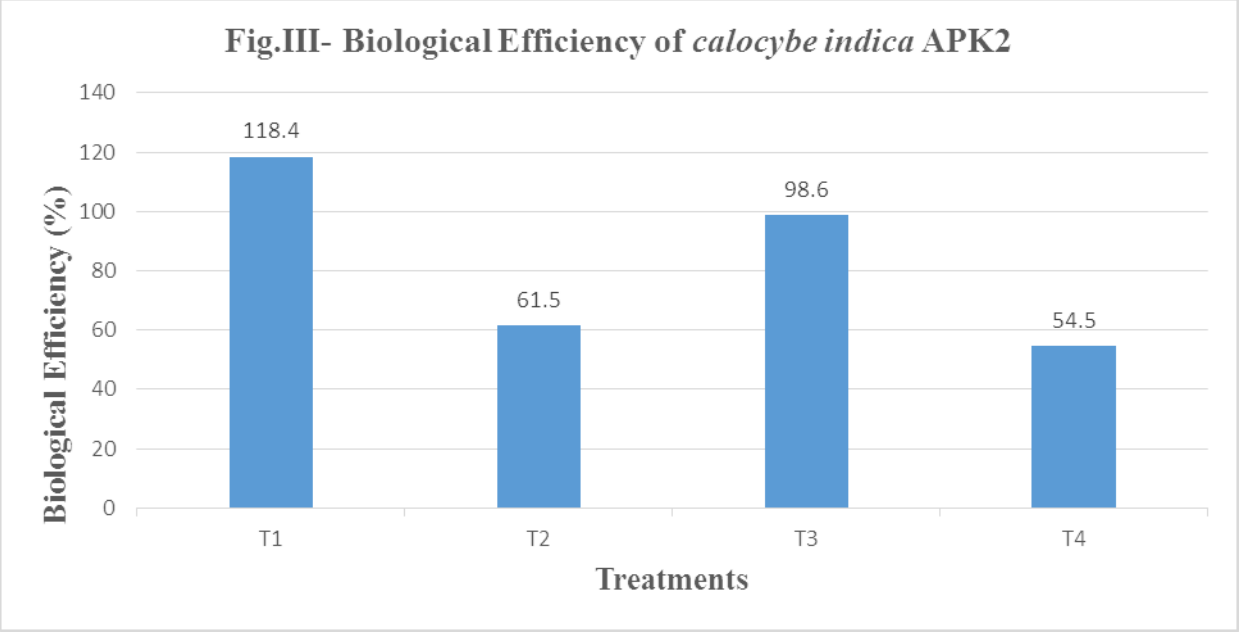
Table - Evaluation of substrates for cultivation of milky mushroom.

S. No	Test Substrates	Spawn run	Pinhead formation (In Days)	First harvest	Average No. of fruit bodies (Per bag)	Pileus diameter (Cm)	Length of stalk (Cm)	Total Yield (g)	Biological efficiency = FWM/ DWS X100 (%)
1	Paddy straw(S1)	14	27	36	25	7.1	7.6	1184	118.40
2	Sugarcane bagasse(S2)	19	34	40	20	6.5	6.9	615	61.50
3	Coconut coir(S3)	16	32	38	24	6.3	7.2	986	98.60
4	Banana leaves(S4)	20	35	42	14	5.3	6.4	545	54.50

FWM- Fresh weight of mushroom

DWS- Dry weight of substrate





Figures I, II, III show the following details:

Fig- I: Photograph - showing a massive fruit body growing upon the paddy straw substrate.

Fig- II: Graph showing the percentage of total yield on various substrates.

Fig-III: Biological efficiency of the selected substrates on the growth of the Mushrooms.

3. DISCUSSION

In the present investigation, paddy straw is found to be a suitable substrate for cultivation of milky mushroom as reported in earlier investigations.

The paddy straw substrate was reported to be the best for cultivation of milky mushroom (Krishnamoorthy and Muthusamy, 1997; Biswas and Singh, 2009; Pani, 2010 and Saranya *et al*, 2011).

Evaluation of different substrates for cultivation of milky mushroom reveals that the paddy straw was highly efficient and more suitable with minimum period of spawning (14 days) emergence of pin heads (27 days) and period of harvest (36 days) and production of highest number of fruit bodies 25 / bed. With broad pileus (7.1 cm dia) and stalk length (7.6 cm), maximum yield (1184 g / 1000 g substrate) and high biological efficiency (118.40 %), milky mushroom recorded the best results with the substrate paddy straw.

Besides, paddy straw, the substrate waste coconut coir also found to be a better substrate, while other substrates did not record favorable data.

The vast variation in the percentage of yield, nutrient values, faster growth and short spawn of harvest, is attributed to the sharp variation in the physical and chemical properties of the substrates.

4. CONCLUSION

The advantages of cultivating and marketing the milky mushroom as compared to other types of mushrooms include, easy and short period of cultivation with less investment, large, fleshy and attractive fruit body with bright white colour, long shelf life and high levels of nutrients. Moreover, the process is less expensive and Eco-friendly. The present study reveals that the best substrate for cultivation of milky mushroom with high yield is paddy straw.

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