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Different cultivation methods of *Hericium erinaceus* (Bull: Fr.) Pers. in Chhattisgarh

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Abstract
Among the cultivated edible and medicinal mushrooms, Lion's Mane Mushroom (*Hericium erinaceum* (Bull. Fr.) Pers.) Is an important mushroom and grown in North America, Europe and Asia. It is also known as monkey head mushroom in China, and 'cendawan bunga kobis' in Malaysia. In nature, the fruit body grows out of the knotholes or wounds of a tree. The fresh, young fruit body is edible and is regarded as a delicacy. Different containers *i.e.* bottle, bucket and poly propylenebag methods were evaluated to see thier effect on spawn run and yield of *H. erinaceus* and poly propylene bag method was found superior then other methods to achieve maximum yield (191.33g) with 38.26% BE of *H. erinaceus* while least yield (107.0g) with 10.7% BE was observed on bucket methods.

Keywords: *Hericium erinaceus*, bottle, bucket and poly propylenebag, spawn run, yield, biological efficiency

Introduction
Mushroom is the term commonly used for edible fleshy fungi and they are diverse unicellular or multi cellular eukaryotic organism, lacking chlorophyll therefore unable to the use energy from the sunlight directly. In nature edible, meditional, poisonous and non-edible mushrooms are grows in moist and dump places where sufficient lignocelluloses litters are available for their growth activities. Mushrooms are considered as a special kind of food from immemorial times, nutritional point of view they are placed in between meat and vegetables. They are rich in protein, carbohydrates, fiber, vitamin and minerals and low in caloric value so they are recommended for diabetic and heart patients. Among the cultivated edible and medicinal mushrooms, Lion's Mane Mushroom (*Hericium erinaceus* (Bull. Fr.) Pers.) is an important mushroom and grown in North America, Europe and Asia. Lion's mane is an edible species and grown on temperature from 18-24^{0}C, with relative humidity 80-90%. It was first time cultivated in China and today it is grown widely in many countries as well as edible and medicinal purpose. Lion's mane (*H. erinaceus*) was first time cultivated on artificial media during 1988 in polypropylene bags and bottles (Suzuki *et al.*, 1997). In India, the production technology for the cultivation of *H. erinaceus* has been developed by DMR, Solan (H.P.).

Materials and Methods
Materials
Pure cultures of *H. erinaceus* were procured from Mushroom Research Laboratory, Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur (C.G.). The culture were maintained on potato dextrose agar medium (PDA) medium and stored at 4^{o}C.

Plastic bags: For the cultivation of lion's mane mushroom (*H. erinaceus*) polypropylene bags (12" x 18" - 150gauges) were used and taken from All India Coordinate Mushroom Research Laboratory, Department of Plant Pathology, I.G.K.V., Raipur, Chhattisgarh. Wheat straw substrate was prepared for cultivation of *H. erinaceus* and 1.5kg steam sterilized substrate (wheat straw + wheat bran + $CaCO_3$) bags were inoculated in a laminar flow @ 10 percent on dry weight basis.

After inoculation, bags were sealed with a non-absorbent cotton plug and shaken for 3 minutes and then shifted in cropping room where appropriate temperature and humidity were maintained.

Bottles method: The empty amber glass bottles (2.5 lt.) were procured from Department of soil science, College of Agriculture, I.G.K.V., Raipur (C.G.). These sterilized bottles were filled with wheat straw+ wheat bran+$CaCO_3$ as described earlier for growing of *H. erinaceus*, each bottle had 300g mixed substrates.

Bucket method: For the cultivation of lion's mane mushroom (*H. erinaceus*) plastic buckets (7.0 lts) were used and one kg mixed substrate was filled aseptically in sterilized empty plastic buckets and spawning was done by layers method @ 10% on dry weight basis of substrate.

After complete colonization of substrate by mycelium of *H. erinaceus* 4 holes (appox. 3mm in diameter) were made in each bag where very small primordia formation was initiated. The observations were recorded for mycelium growth, pin head initiation, yield and BE%.

Results and Discussion

Table 1: Effect of different containers on growth and yield of *H. erinaceus*

S. N.	Containers	Spawn run (Days)*	Primordial initiation(Days)*	Days for 1st harvest	Yield*(g)	BE%
1.	Poly propylene bag	20.00	11.66	8.33	191.33	38.26
2.	bottle	27.66	7.33	7.00	89.66	29.88
3.	Plastic bucket	42.33	19.00	10.33	107.00	10.7
SEm±		1.27	0.63	N/A	6.91	
CD (5%)		4.50	2.25	0.79	24.40	

PP bag method **Bottle method** **Plastic bucket method**

Fig 1: Cultivation of *H. erinaceus* on different containers

Evaluation of different containers for cultivation of *H. Erinaceus*

An experiment was conducted to evaluate different containers on growth and yield of *H. erinaceus*. The results have been obtained and are given in table.

Spawn run

From the table it is clear that different containers significantly influenced the spawn run period of *H. erinaceus*. Among the evaluated containers considerably earlier (20.00days) spawn run was observed in poly propylene bags and next was bottle (27.66days). Whereas significantly more (42.33days) time required by plastic buckets.

Primordial initiation

Significantly fastest (7.33days) primordial initiation was noticed in bottle and poly propylene bag method (11.66days) which were differ each other. However, more period taken by plastic buckets (19.00 days).

Days to 1st harvest

There was significant difference noticed in period of first harvesting with respect to different containers used for cultivation of *H. erinaceus*. Significantly earliest (7.00days) first harvest was obtained in bottle and next was poly propylene bag (8.33days) while plastic buckets took significantly more (10.33days) span for first harvest of *H. erinaceus*.

Yield and Biological efficiency

The fresh yield of *H. erinaceus* differ significantly with regards to different containers used for growing of *H. erinaceus* and highest yield was found in poly propylene bag (191.33g) with 38.26% biological efficiency and next was bottle method (89.66g) with 29.88% B.E. However, lowest (107.00g) yield with 10.70% B.E. was occurred in plastic buckets.

Poly propylene bag method was found superior then other container to obtain higher yield of *H. erinaceus*. These finding are partially matched with the earlier workers, Chang *et al*., (1999) used different containers *viz*. bottle, pot and logs of oak and black locust for growing of *H. erinaceus* and obtain maximum fresh yield of *H. erinaceus* from bottles. Jung *et al.*, (2007) [3] demonstrated production technology of nameko mushroom (*Pholiota nameko*) in plastic containers. Yamanaka (2017) [5] cultivated shitake, nemako, enokitake and oyster (*P. eryngii*) mushroom in bags and bottles and bottles were found as best container for cultivation of memako and oyster mushroom. Mamiro *et al*., (2014) [2] used different types of container *i.e.* hanging clear plastic bags, re-usable substrate container (visado), coloured plastic bag (rambo) and shelved clear plastic bags (vipete) and hanging clean plastic bags were found superior as compared to other containers for higher yield of *Pleurotus* spp. Panjikkaran and Mathew (2011) [4] evaluated polypropylene bags and perforated plastic buckets for production of *P. florida* and found both containers equally good.

Conclusion

Poly propylene bag method was found suitable for growing of *H. erinaceus.*

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