

An Effort to Domesticate Wild Edible Mushrooms Growing in the Forest of Jharkhand

Ajay K Srivastava*, Fr Prabhat Kennedy Soreng s.j. **

*Head, Dept of Botany, St. Xavier's College, Ranchi, INDIA.

**Asst Professor, Department of Botany, St. Xavier's College, Ranchi, INDIA.

*Corresponding Address:

ajaysrivastava11@gmail.com

Research Article

Abstract: Jharkhand has a rich biodiversity of wild edible mushrooms. A number of edible mushrooms growing in their natural habitats are being collected by the local people during the rainy season for their consumption or sale. Some of the common wild edible mushrooms of Jharkhand are *Macrolepiota procera*, *Termitomyces chypeatus*, *T. heimii*, *Lycoperdon*, *Calvatia*, *Gastrum*, *Boletus edulis*, *Russula*, *Termitomyces microcarpous*, *Amanita*, *Clitocybe*, *Armillaria* etc. They are rich in protein and can easily fit into all's platter, being a vegetarian product. The villagers are acquainted with them, but they just collect them and consume. The idea to conserve and cultivate them is still eluding them. The ongoing study is an effort to domesticate some of these wild edible mushrooms in an artificial condition that they can be conserved and grown all throughout the year and standardize a package of practice for these mushrooms so that villagers could find some avenues to generate income through mushroom cultivation and marketing.

Keywords: domesticate, standardize, package of practice.

Introduction:

Mushrooms are fruiting bodies of Fungi especially of Ascomycetes or Basidiomycetes. They are nature's gift as they are protein rich food for human beings. Jharkhand has a rich diversity of wild edible mushrooms. The tribal people over here have a very good knowledge of wild edible mushrooms. They have achieved this knowledge out of their experience and it is being passed on from generation to generations. Since these mushrooms are being sold in the market during rainy season by the local people, the edibility of these mushrooms is now known to others. These mushrooms could serve as protein rich food for all if they are cultured and standardized.

Method:

Culture methods used in this research

- Collection of fresh edible mushrooms from the field
- Preparation of PDA medium
- Pure cultures were obtained through mycelium culture on PDA medium
- Spawn preparation

- Compost preparation
- Cultivation of individual mushroom

Collection of fresh edible mushrooms from the field:

Field trip was done especially in the forest of Khunti district of Jharkhand with the help of the tribal women. They play a vital role in collecting these wild edible mushrooms as they have to look after the children; they look for the nutritious food. Mushrooms were collected from their natural habitats and were verified with the help of these tribal women that these mushrooms are edible and we ourselves have tasted some of them, they are delicious. Study of their natural habitat was made. Their common names were recorded and their scientific names were also verified from different books. These mushrooms were used to prepare spawn for their cultivation.

Preparation of PDA Medium

To obtain pure culture, through mycelia culture the Potato Dextrose Agar (PDA) medium was prepared in the following way

Requirements:

Potato tubers	200g
Dextrose	20g
Agar	15g
Peptone	2g
Distilled water	1 litre
HCl	1N
NaOH	1N
Knife	
Muslin cloth	
Beaker	1 litre capacity
Conical flasks	
Heater	
Autoclave	
Cotton plugs	
Test tubes	

Procedure

Potato tubers were taken; they were peeled off and weighed 200g. They were chopped into small pieces with the help of a knife. Chopped potato pieces were transferred into a beaker containing about 100 ml of distilled water. The content was boiled with the help of a heater for about 20 minutes. The supernatant was filtered with the help of the muslin cloth and the filtrate was collected into a beaker. This filtrate was Potato extract. To this extract Dextrose, Agar and Peptone were transferred and gently heated and stirred to dissolve the ingredients. This medium was transferred to a measuring cylinder of 1 litre capacity and made the volume to 1 litre by adding distilled water. The pH of this medium was adjusted to 5.6 by using HCl or NaOH. Then the medium was poured into conical flasks and they were plugged with cotton and were autoclaved at 121°C for 20 minutes. When the temperature was cooled down, the flasks were taken out from the autoclave and the medium was used to prepare Agar slants for mycelia culture.

Preparation of Agar Slants

The autoclaved PDA medium was poured into the culture tubes, they were cotton plugged and were placed in slanting position. It gave Agar slants after solidification. Preparation of agar slants was done in the Laminar Air Flow Chamber to prevent contamination.

Mycelia culture or pure culture

There are two mechanisms by which mushrooms can reproduce—by spores, similar to the seeds of plants or by propagation of tissue extracted from a fruitbody similar to plant propagation through cuttings. To get started the latter technique, which is simpler and which offers a better chance of success for the beginning cultivator. To these Agar slants dikaryotic cells of *Macrolepiota procera* was inoculated. The dikaryotic cells were removed from the central portion of the pileus of fresh mushrooms collected from the field. The transfer of dikaryotic cells to the Agar slants was done in the Laminar Air Flow Chamber. Prior to this, the surface of the Laminar Air Flow Chamber was cleaned with 70% Alcohol to sterilize and the VU light was on for about half an hour. There was cob web like white mycelia growth on the Agar slants within 10-15 days.

Preparation of spawn

Sorghum or wheat grains were boiled with water to make them soft but they were not split. The

water was drained off and grains were collected in a clean container and left on the open air for some times to cool and to reduce moisture content. Then the grains were filled (half filled) in the clean saline glass bottles and they were cotton plugged. These bottles were autoclaved at 121°C for 20 minutes. When it was cool down bottles were removed from the autoclave, some grains were transferred to plastic bags and cotton plugged and to these autoclaved sorghum grains, the mycelia grown on Agar slants were transferred for multiplication of mycelia. Mycelia grew on the sorghum grains and got ready as spawn. Spawn preparation were also done on saline glass bottles too.



Selection of suitable substratum

The study of the natural habitats of the wild mushrooms to be domesticated reveals that these mushrooms grow in the soil enriched by the humus of the decaying leaves. Therefore to grow these mushrooms compost manure was prepared. In the compost leaves of *Shorea robusta*, *Syzygium cumini*, *Mangifera indica*, *Bassia latifolia*, and *Schleichera oleosa* were added as they are the main trees in the forest of Jharkhand.

Due to lack facilities, we were not able to preserve the spawn and not able to spawn on the compost prepared but it is our ongoing research. We will use readymade compost manure too which is used to cultivate already domesticated mushrooms. We have tried to identify them with their scientific names as well as their taxonomic position. Following are some of them:

Scientific name/ common name	Classification		
	Column1	Column2	Column 3
Macrolepiota procera	Phylum: Basidiomycota Class: Hymenomycetes Order: Agaricales Family: Agaricaceae Genus: Macrolepiota procera	Class: Basidiomycetes Order: Agaricales (Hymenomycetes) Family: Agaricaceae Genus: Macrolepiota procera syn.	Kingdom: Fungi Division: Basidiomycota Class: Agaricomycetes Subclass: Homobasidiomycetidae Order: Agaricales Family: Lepiotaceae Genus: Macrolepiota
Termitomyces clypeatus T. heimii (Chirko, Bada Khukri, Patiyari)	Phylum: Basidiomycota Class: Hymenomycetes Order: Agaricales Family: Tricholomataceae Genus: Termitomyces		Kingdom: Fungi Division: Basidiomycota Class: Basidiomycetes Subclass: Agaricomycetidae Order: Agaricales Family: Lyophyllaceae Genus: Termitomyces
Lycoperdon (Tumba Putu) Calvatia	Phylum: Basidiomycota Class: Gasteromycetes Order: Lycoperdales Family: Lycoperdaceae	Class: Basidiomycetes Order: Lycoperdales (Gasteromycetes) (Stomach fungi) Family: Lycoperdaceae Sub-family: Lycoperdae Genus: Lycoperdon, Calvatia	Kingdom: Fungi Division: Basidiomycota Class: Agaricomycetes Order: Agaricales Family: Lycoperdaceae Genus: Lycoperdon, Calvatia
Gastrum (Rugra, Putu)	Phylum: Basidiomycota Class: Gasteromycetes Order: Lycoperdales Family: Geastraceae Genus: Gastrum	Class: Basidiomycetes Order: Lycoperdales (Gasteromycetes) (Stomach fungi) Family: Lycoperdaceae Sub-family: Geastrae Genus: Geaster	Kingdom: Fungi Phylum: Basidiomycota Class: Agaricomycetes Subclass: Phalloctetidae Order: Geastrales Family: Geastraceae Genus: Gastrum
Boletus edulis (Jamun khukri)	Phylum: Basidiomycota Class: Hymenomycetes Order: Agaricales Family: Boletaceae Genus: Boletus edulis	Kingdom: Fungi Division: Basidiomycota Class: Agaricomycetes Order: Boletales Family: Boletaceae Genus: Boletus Species: B. edulis Bull.	Class: Basidiomycetes Order: Agaricales Family: Polyporaceae Genus: Boletus

Column1: according to the book *Introductory Mycology* by C.J. Alexopoulos, C.W.Mims, M. Blackwell

Column 2: according to the book *a Guide to the Mushrooms* by Louis C.C. Krieger

Column 3: From net: <http://en.wikipedia.org/wiki/>

Macrolepiota procera

It has a tall stipe (up to 25 cm) and a large cap with rusty brown coloured umbo. It is coated with pink granules, spore print is white. June is the best month for this mushroom. Rain always precedes the emergence of this mushroom. It tastes good. Its protein content is 32% on dry weight basis (Gogoi, Robin and Rathaiah, Yella and Rahman Borah, Tasvina 2006). Nutritional value of *Macrolepiota* is moisture 91.0%, ash 1.09%, protein 3.30%, fat 0.18%, carbohydrate 0.86% (Dutta, Ram

2007). Pulses have 16-24% proteins and they are not as digestible.

Termitomyces clypeatus

The distinguishing character of this mushroom is the prominent, cone-like pointed, dark colour projection at the centre of the cap. It is found between June and August. It grows from termite mounds. This is one of the most delicious mushrooms found in nature (Gogoi, Robin and Rathaiah, Yella and Rahman Borah, Tasvina 2006). Its nutritional value is, 'moisture is 91.3%, ash 0.81%, protein 4.1%, fat 0.22% and carbohydrate 1.13% (Dutta,

Ram 2007).’ The other mushroom which is poisonous looks similar to it but its colour is dark.

Termitomyces heimii

In Jharkhand this mushroom is known as *bada khukri* (big mushroom) and most abundantly found. It comes up exclusively from termites nests (Gogoi, Robin and Rathaiah, Yella and Rahman Borah, Tasvina 2006). A patch of veil is present at top of the pileus. The skin of the cap peels off. The stalk is about 25 cm long and swollen near the attachment with the cap. The spore print is deep pink. Found between July and August. It is a very delicious mushroom. There is another species of *Termitomyces* (photo no.10) which looks similar to *Termitomyces heimii* but little smaller in size, appears at least one month before *Termitomyces heimii* appears which has annulus and is most abundantly found mushroom.

Lycoperdon and Calvatia

The order Lycoperdales has been divided into four or five families, like, Lycoperdaceae, Geastraceae (Dring, 1973; Miller and Miller, 1988) etc. *Lycoperdon* is a genus of puffball mushrooms. Fruit body spherical or pear shaped with round top and tapering stem, 1-6 cm wide, 3-7 cm high. Most of the time they grow from dead wood and if they grow through the ground they usually indicate that wood is buried. It grows in the beginning of the rainy season. In ancient times, the spore mass of ripe puffballs were used to stop bleeding which was probably due to the good virtue of its powdery nature (Tripathi,

D.P. 2005). *Lycoperdon pyriforme*, *L. gemmatum* and *L. umbrinum* are common species. Lycoperdons grow fast and decay very soon. There seems to be no pore at the centre of the fruiting body for spore dispersal, fruiting body decays and the spores are released.

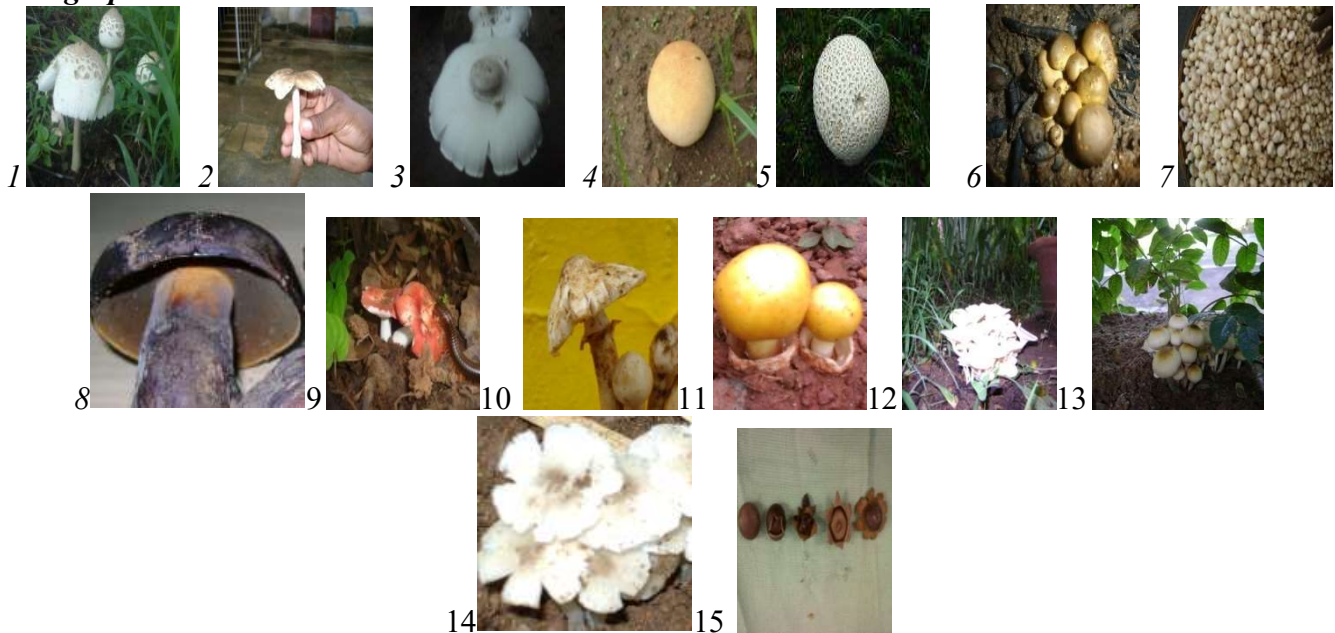
Geastrum

It is commonly known as earthstars. The name comes from, ‘geo’ meaning earth and ‘aster’ meaning star. The name refers to the behavior of the outer peridium. At maturity, the outer layer of the fruiting body splits into segments which turn outward creating a star-like pattern on the ground. The inner peridium is a spore sack. In some species, the outer peridium splits from a middle layer, causing the spore sack to arch off the ground. If the outer peridium opens when wet and closes when dry, it is described as hygroscopic. It is found June to July. It is found abundantly in the *Sal* forest (*Shorea robusta*). In Jharkhand local people call it *rugra* or *putu*. Two varieties of *Geastrum* are mainly found in Jharkhand. (Photo no.6 and no.7

Boletus edulis

The name is derived from the Latin term *Bōlētus* 'mushroom' from the Ancient Greek ultimately from *bōlos* 'lump' or 'clod'. The genus *Boletus* contains many members which are edible and tasty. This is a symbiotic Fungus. The edible *Boletus* of Jharkhand is always found in association with *Syzygium cuminii*, therefore it is called *Jamun Khukhri*. In size this is the biggest mushroom of Jharkhand.

Photographs



1. *Macrolepiota procera* 2. *Termitomyces clypeatus* 3. *T. heimii* 4. *Lycoperdon* 5. *Calvatia* 6. *Geastrum* appears first 7. *Geastrum* appears later 8. *Boletus edulis* 9. *Russula* 10. *Termitomyces* 11. *Amanita* 12. *Clitocybe* 13. *Armillaria* 14. *Termitomyces* (sand mushroom) 15. Stages in the breaking of outer peridium of *Geastrum*

Discussion and conclusion:

Though mushrooms are rich protein food, people are hesitant to consume them especially when it is collected from the field. Local people have made known the edibility of these wild mushrooms to the public. Thus these wild mushrooms need to be tapped as food source by domesticating them; otherwise they will remain hidden in the forest and will become extinct.

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