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Cultivation of Polypore Mushroom (*Ganoderma resinaceum*)

Fauzia Hafiz,[a] Fauzia Begum,[a] Abu Md. Imtiaz Hossain,[a] Sahana Parveen,[a] Majeda Begum,[a] Zaibun Nessa,[a] Motahar Hossain[b] and John Liton Munshi[b]

[a]Institute of Food Science and Technology, BCSIR and
[b]BCSIR Laboratories Dhaka, Dhaka-1205, Bangladesh

Abstract

Polypore mushroom was found to be rich in protein, fiber and cellulose. Polypore mushroom is found to grow on rotting hard wood logs. So, attempt was made to cultivate the species in laboratory condition. The present paper describes the process of cultivation of polypore mushroom in laboratory condition. The selected substrates (e.g. mango saw dust, rice hull, different kinds of wood chips, etc.) were mixed with calcium carbonate and water in a specific ratio, fermented and then placed in polypropylene bags. The bags weighed 500 g each. Locally isolated polypore mushroom mycelium were used as inoculum. The desired result was obtained with Garjan and Segun spawn bags. Some of the bags had perforations and the others were cut into one half of a circle. The production of polypore mushroom was about 12.3 g/ bag in perforated ones and about 13.9 g/bag in the other. The cultivated polypore mushroom species was found to be rich in fiber (28.9 g %), protein (16.9 g %) and cellulose (54.5 g %). No adverse effect was recorded when crude extract of polypore mushroom species was administered orally to rats (*Long evans*) with their normal diet.

Introduction

The polypores are a fascinating group of fungi, although they are usually ignored by most mycophiles because of their typical inedibility, commonly small size, unfamiliar habitat and general obscurity. However, these fungi are very interesting from an ecological, microscopic, and biotechnological standpoint, and their microscopic features, are well worth observing. Unlike fleshy mushrooms, most of these fungi can be found even during dry weather or in the winter, since many are tough or perennial and many other produce basidiocarps only beneath the surface of logs lying on the forest floor, where it remains wet most of the year.

Polypores can be easily distinguished from the other common poroid fungi, by their typically hard exterior, their usual “non-mushroom” shape, and their usual growth on wood as wood decomposers. The polypores are important in natural ecosystems as decomposer of wood, recycling the nutrients and minerals in the wood. Polypores are also

rich sources of natural antibiotics. The hypothesis, increasingly substantiated, is that mushrooms, especially polypores, provide a protective immunological shield against a variety of infectious diseases (Chihara, 1992; Hobbs, 1986 and Mizuno, *et al.* 1995) In a recent *in vitro* study, extracts of more than 75 % of polypore mushroom species surveyed showed antimicrobial activity and 45 % of 204 mushroom species (polypores and gilled mushrooms alike) inhibited growth of a wide variety of microorganisms (Suay, *et al.* 2000).

The present study comprised of the cultivation of polypore mushroom, in BCSIR in spawn bags (using different wood chip like Segun, Garjan and Teak Chambol) having one half of a circle opening, perforation or open mouths. This study also made a proximate analysis. The mushroom turned into fluffy cotton like mass on grinding. The cellulose contained in polypore was determined and compared with cellulose powder, Carpus atri and shimul tula. All the experiments in this study were carried out at IFST, BCSIR, Dhaka.

Attempt has been made to cultivate polypore mushroom in laboratory condition in saw dust in polypropylene bag.

Materials and Methods

One of the cultivation methods is simply to inoculate hard wood logs (Fig.1). By burying the inoculated logs in saw dust or soil, where moisture is better preserved, the fruiting can extend over several years. Stumps can also be inoculated.

Fig. 1. Polypore mushroom growing on Eucalyptus log

By far the most dependable and rapid production system is the cultivation of polypore indoor under controlled environmental conditions. Among the various methods applied, the one with the perforated bag and the other with one half of a circle opening produced the desired results. One of the main difference of polypore with gilled mushroom is that the polypore do not enjoy, nor require heavy watering schedules nor high humidities. Like most mushrooms, the polypores are sensitive to changes in carbon dioxide levels and light conditions. The development of the fruit bodies are extremely sensitive to changes within the growing room.

Preparation of sawdust spawn bags

The spawn bags were prepared with fermented mango saw dust, wood chips (shavings), rice hull in the ratio of 2:0.5:0.5, calcium carbonate (1 %) and water (60-65 %). The net weight of the bag was 500gm. Through a plastic neck the free end of the bag was pulled up tightly and then the edges were

pulled down and secured with a rubber band. With a wood stick a hole was made through the contents of the spawn bag from the open end to the bottom of the bag. The hole was plugged like a cork or stopper with absorbent cotton. This was covered with a piece of brown paper and tied with a rubber band. The bags were autoclaved at 121^{O} C under 15 psi for 20 minutes and were allowed to stand for 24 hours at room temperature. Each bag was opened in a clean room and inoculated with mycelium of polypore mushroom which was cultured on malt extract agar plate (Fig. 2) . The bags were then kept on racks at 24^{O} C for

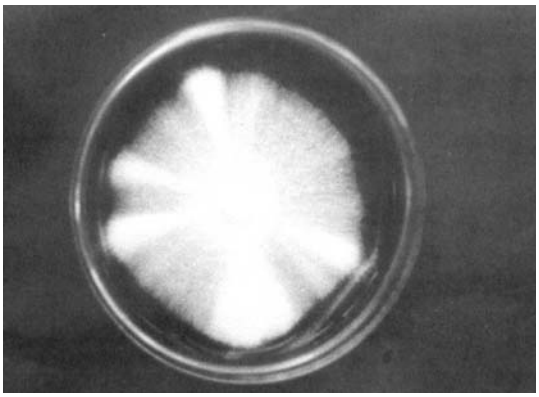

Fig. 2. Growth of Polypore mushroom mycelium on malt extract agar plate

the mycelium to grow. After the mycelium has grown throughout the bag, the bags were cut, perforated or kept open as,

1. One half of a circle (Fig. 3) : The spawn bag was cut into one half of a circle and the hard mycelium was scratched out. The bags were soaked in water for half an hour. These were taken out of water and kept in a position to drain off the water. The bags were then kept on floor to allow the primordia to appear and grow into mushrooms. The bags were watered frequently to keep them moist.

Fig. 3. Growth of Polypore mushroom in spawn bag with half a circle opening

2. Perforation (Fig. 4) : The bags were punched with a board having nails pinned to it. Then they were soaked in water as done in case of bags with one half of a circles and the mushrooms were allowed to grow.

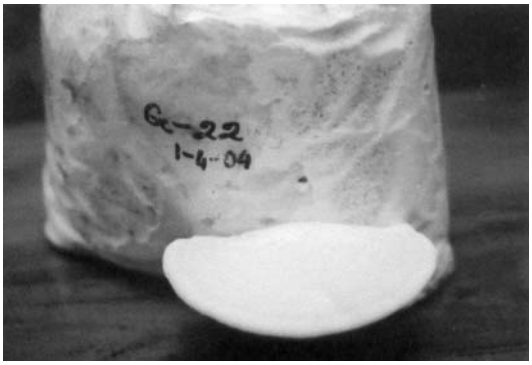

Fig. 4. Polypore mushroom growing through the opening of a perforated spawn bag

3. Open mouth : The bags were kept open to allow the growth of mushrooms.

Results and Discussion

Polypore mushroom was cultivated in mango saw dust mixed with different wood chips like Segun (*Tectona grandis*), Garjan (*Dipterocarpus turbinatus*) and Teak chambol (*Michelia champaca*). The results obtained are shown in Table I below.

Table II. Proximate analysis of polypore mushroom (gm. % av.)

Parameter	Wet weight basis
Moisture	60.8
Protein	4.3
Fat	0.8
Ash	0.7
Crude fiber	11.3
Carbohydrate	22.1

Table I. Growth of Polypore mushroom in Segun, Garjan and Teak Chambol chips

Number	Wood chips Used	Type of opening in spawn bag	Weight of mushrooms (g.)
A	Segun	One half of a circle	10.2 (5.2-15.2)
		perforated	12.3 (9.3-15.3)
		open mouth	5.4 (2.3-8.5)
B	Garjan	One half of a circle	12.7 (11-14.4)
		perforated	11.1 (10-12.3
		open mouth	4.2 (4.2-4.3)
C	Teak chambol	One half of a circle	4.0 (2.2-5.8)
		perforated	5.6 (4.1-7.2)
		open mouth	3.9 (2.5-5.4)

It has been seen from the result that maximum growth of mushroom was obtained from Garjan (*Dipterocarpus turbinatus*) wood chips, with one half of a circle opening in bags. Mushroom also showed good growth in perforated bags of Segun and Garjan chips. In case of Teak chambol chips, the results were not encouraging. Discouraging results were observed in open mouth bags of all the chips.

Table II shows the proximate analysis of polypore mushroom on wet weight basis. The protein content was found to be 4.3 g % (wet basis). Cellulose composition of different carbon substrates has been shown in Table III. Polypore mushroom contains 54.8 % cellulose.

Table III. Cellulose content in different item

Name of the item	Cellulose (g %)
Cellulose powder	95
Carpus atri tula	92.5
Shimul tula	66.5
Polypore mushroom	54.8

Table IV . Results of rat feeding test with polypore mushroom (Ganoderma resinaceum) extracts

Body weight (g.)									Total diet given/ 3 rats	Total diet residue	Total diet consume/ 3 rats	Remarks
Tail			RBL			UM						
Final weight	Initial weight	Increased weight	Final weight	Initial weight	Increased weight	Final weight	Initial weight	Increased weight				
179	162	17/7 days 0.8/rat/day	174	160	14/7 days 0.6/rat/day	171	165	6/7 days 0.28/rat/day	375	70	305/7 days 14.52/rat/day	1ml test material added with 45gm of colony diet.
134	116	18/7 days 0.85/rat/day	130	124	6/7 days 0.28/rat/day	139	125	14/7 days 0.66/rat/day	375	74	301/7 days 14.33/rat/day	2ml test material added with 45gm of colony diet.
135	124	11/7 days 0.52/rat/day	135	125	10/7 days 0.47/rat/day	130	120	10/7 days 0.47/rat/day	375	73	302/7 days 14.38/rat/day	45gm of colony diet.

Marking in the rats body :

RBL = Right body leg.

UM = Unmark.

Rat feeding trial (Table IV)

Rat feeding trial (Anon, 1963; Miller and Bender, 1955) with liquid extracts from Polypore mushroom : The study intended to observe the effects of Polypore mushroom extracts on rats (*Long evans* variety). Three cages of *Long evans* rats of two and half a month ages weighing between 116-125g were selected for the study. There were nine rats of both sexes. During the study period the cages were cleaned, diets and water were given regularly. During the 7 days experiment, the body and the residual weight of the rats were recorded every two days. Forty five (45) g of colony (regular) diets was prepared with 1ml Polypore mushroom extracts for one cage and 2ml of extracts of the same, added to another 45g of colony diets for another cage and the control experiment was also performed. The results obtained is shown in Table IV. It is evident from the result that average body weight of the treated rat was found to have increased with 2ml extracts and no adverse effect was recorded during the period of the experiment.

Conclusion

Polypore mushroom grows on log or trunk of trees and can also be cultivated in laboratory conditions in polypropylene bags. It can be grown in spawn bags using different kinds of wood chips.

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