

Studies on the *Ganoderma* Species of Bangladesh

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Abstract: Mushrooms have brought revolutions in mycology and hence mushroom science has recently been created to encompass, for convenience, members in the class of Ascomycetes and Basidiomycetes used from ancient times as food materials or food products. Out of 280 described species reported to be present in different countries of the world, *Ganoderma lucidum* appears as the pivotal species due to its manifold pharmacological attributes as well as artistic values. The samples collected from Bangladesh were pure cultured on potato dextrose agar (PDA). After growth for one week on PDA, mycelium was transferred aseptically to previously sterilized spawning material composed of sawdust (60%), wheat bran (40%) and calcium carbonate (2-4%) distributed in polybags weighing about one kilogram, and the bags were incubated at room temperature. The neck of the spawning packets were punctured and watered weekly. Fruiting bodies appeared on average after three weeks following inoculation and were harvested after one week. Fruiting bodies, 3-4 per packet, weighed 2.68gms on average and were red in colour. The records indicate that this is the first report of the occurrence of *G. lucidum* (red mushroom) in Bangladesh. Further studies are being planned for devising profitable production technology for *G. lucidum*.

Key words: Bangladesh, *Ganoderma* spp., *G. lucidum*, Mushroom Centre Development Project

1 Introduction

Out of myriad of agents causing plant diseases reported to be present in Bangladesh,^[1] mushrooms represent a specific group of fungi. Since the 1980's, the cultivation of mushrooms has increased among the farming communities. Prospects for growing vegetable mushrooms such *Pleurotus* (oyster mushroom) and *Volvariella* (straw mushroom) spp. in the country have been indicated,^[2] and details of the relevant production technology has been described.^[3]

It is necessary to mention that the levels of nutrients such as vitamins, minerals and proteins remain inadequate or deficient in most of the diets consumed by the people of Bangladesh. Due to the realization that mushrooms represent a cheap and major source of vitamins, minerals, protein and other nutrients, the dissemination of mushroom production technology had been continuing by the Government of Bangladesh through The Horticulture Centre at Sobhanbag, Savar, located 20-25 kms from the capital city, Dhaka.

Spawn of the vegetable mushrooms is being distributed among the farmers through the Centre's 10-12 substations located in different parts of Bangladesh under the project entitled "Mushroom Centre Development Project", Horticulture Centre, Savar. Extension of mushroom cultivation with special reference to the oyster mushroom has also been maintained by a private organization named "Centre for Mass Education in Science (CMES)". CMES, with its branches scattered throughout Bangladesh is trying to motivate people, including children, by giving them an incentive to earn money while learning mushroom cultivation. Ahmed et al.^[4] conducted studies on the effect of different substrates on the growth and yield of oyster mushroom. They concluded that mango sawdust produced the best results followed by Jack fruit sawdust. In other studies,^[5] they

concluded that growth regulators such as IAA, IBA and NAA helped to increase size, yield, protein and mineral contents of the oyster mushroom.

Ganoderma mushroom has now become very much familiar to the scientific communities than hitherto, mainly because (a) it forms food materials/products of great nutritional value, (b) bioactive materials/components reported to be present in the vegetative and mature phases of growth possess pharmacological/therapeutic qualities, (c) recognition of the artistic value of *Ganoderma* in China and Japan, and (d) it was consumed by the emperors in the Ch'in, Ming, Shu, Han and Reishi dynasties of China and Japan because it was believed that Ling Zhi and Reishi help prolong the life span by apparently halting the normal ageing process. *G. lucidum* (Curtis and Fries) Karsten, being the only pivotal candidate amongst several hundreds species, has come to the forefront of intensive research and study throughout the world and has laid down the grounds for establishing the *Ganoderma* International Research Institute (GIRI) in New York, USA. Vigorous programmes of activities have been conducted at GIRI. Reviews, monographs and books^[6-10] now available on *Ganoderma* are worthy of perusal by medical (e.g. Ayurvedic, Homeopathic, Unani, Biochemic) and other scientific personnel.

In the context of the MLM system of products made in 2003 from six species of *Ganoderma* by the Gano Excel, SDN, BHD, a private company in Malaysia,^[11] possibilities have arisen for the occurrence, cultivation and medicinal use of *Ganoderma* in Bangladesh. This is because the products made from ingredients of the *Ganoderma* mushroom by the company in Malaysia are too expensive to consume by the poor masses in rural areas of the country. Moreover, reports of the appearance of red mushroom (as *Ganoderma* species are commonly known) in natural environments serve as indicators to their presence. Under these circumstances, it was therefore necessary to initiate this study carried out in the laboratories of the Mushroom Centre Development Project, Bangladesh.

2 Materials and Methods

2.1 Isolation

Based on their red colouration, fruiting bodies found growing naturally in different areas of Bangladesh were collected in polybags. Sterile PDA plates were inoculated aseptically with basidiospores remaining inside the gills of the pileus using a sterilized sharp scalpel/knife and incubated at 20-25°C. After 4-5 days, growth was noticed on some plates that were then kept for about a week.

2.2 Spawn preparation

Spawning materials used were sawdust, wheat bran and calcium carbonate. Spawning substrate, composed of 60% saw-dust, 40% of wheat brand and 2-4% of calcium carbonate) was placed in polybags (1 kg/bag), sterilized and then inoculated with mycelium prepared on PDA plates. The inoculated polybags were then kept in specially prepared cultivation rooms under three sets of conditions as follows:

- (i) the soil floor of the rooms was covered with polythene sheets which, in turn were covered with a sand layer 10-12" thick so that water was conserved. The cultivation room itself consisted of a thatched roof and walls. Rooms contained racks built of bamboo pieces on which the polybags were placed.
- (ii) the inoculated poly bags were submerged up to their necks in previously pulverized soil which was kept moistened daily with water.
- (iii) the inoculated polybags were incubated in cultivation rooms with a concrete floor and were watered 2-3 times daily after making punctures at the neck of the bag.

Mushrooms were harvested one week after fruiting initiation in each case. The inoculated bags with punctures around the topside were watered 2-3 times daily for 5-7 days. After 7 days they were sprayed with water 4-5 times daily. In the case of the concrete floor set, the bags were watered 2-3 times daily.

3 Results

Ten poly bags each containing 1 kg of spawning material were each inoculated on three different dates (1-4 replicates). The results obtained under the different incubation conditions are shown in Table 1 (A-C).

Table 1. Fruiting characteristics of *G. lucidum* fruit bodies produced under three sets of growth conditions

Date inoculated	Incubation period (initiation of fruiting bodies)	No. of fruiting bodies	Average weight of fruiting body (gm)	Normal or good fruiting body
A. Polythene sheet with water spread on soil surface covered with 10-12 inch high sand layer.				
1.6.04	27.7.04 30.7.04	6 (3+3)	1.70	5
2.6.04	28.7.08 29.7.04	4 (1+3)	1.60	4
3.6.04	29.7.04 30.7.04	6 (4+2)	1.35	4
B. Submerged inside soil				
1.6.04	21.6.04 22.6.04 22.6.04 23.6.04	15(4+2+4+5)	2.55	10
2.6.04	22.6.04 22.6.04 22.6.4 23.6.04	9(3+3+1+2)	2.38	8
3.6.04	24.6.04 24.6.04	3 (2+1)	2.30	2
C. Concrete floor				
1.6.04	20.7.04 22.07.04	5 (3+2)	1.17	5
2.6.04	None	None	-	All destroyed
3.6.04	15.7.04	4	1.20	2

4 Discussion

Mushrooms are reported to be very sensitive to environmental conditions. They also vary in their requirements for vegetative growth and fruiting. For example *Ganoderma* bonsai production is dependent upon *inter alia*, the species, substrates, CO₂ requirements.^[12] The incubation period, i.e. the initiation of fruiting bodies (pinhead size) was around three weeks after inoculating the spawning material in the case of the treatment B. On the other hand, the fruiting bodies were found to emerge after about eight weeks in the case of treatments A and C.

The former corresponds to results obtained by other workers dealing with *Ganoderma* mushroom.^[9,13] Primodium formation in the case of both A and C seemed quite abnormal. However, overall performance in the case of the treatment C appeared worse than the other two. Many more normal fruiting bodies were produced under treatment B conditions, and the average weight of the fruiting body was also higher.

This reflects not only the first report of occurrence of *Ganoderma* mushroom from Bangladesh but it is also the first report of in vitro cultivation of *Ganoderma* mushroom in Bangladesh.

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