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Degradation of organic waste and cellophane by mycelia of some basidiomycetous fungi

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Fungi with other microorganisms are present in all ecological niches and play an important role in decomposing almost all known substrates. Fungi particularly, mushroom mycelia, have inherent biological ability, which can be used as significant tool for healing soil by decomposing organic matters(agricultural wastes, wood debris, paper product, food waste etc). So they enhance soil condition and provide adequate biomass. Mushroom mycelium produces extra cellular enzymes and acids that breakdown recalcitrant molecules such as, lignin and cellulose, the two primary components of woody plants. The adaptive technology is the foundation of ecological stability and vitality in a rapidly changing environment. Present study is to evaluate the role of decomposition of different organic matters such as., filter paper, leaf litter, fallen twigs, cellophane etc by mushroom mycelia of some basidiomycetous fungi viz. *Coprinus micaceus, Cortinarius armillatus* and *Schizophyllum commune.*

Key words: Cellophane, decomposition, mushroom mycelium, organic matters

INTRODUCTION

The importance of fungal biodiversity in ecosystem is well documented (Lodge, 1996; Rossman and Farr, 1997; Molina *et al.*, 2001). They are believed to be the most important decomposers of organic matter into their molecular constituents. Fungi particularly, mushroom mycelia unusually have powerful degradative properties (Stamets, 2000). They exude extracellular enzymes such as., cellulases and lignin peroxidases which are capable of breaking down recalcitrant molecules into simple compound to their surroundings. These can be used as significant tools for healing soil by decomposing organic matter (agricultural waste, wood debris, paper products, food waste etc). So they are enhancing soil condition and providing adequate biomass. Lignin peroxidases dismantle the hydrocarbons, the base structure common to oils, petroleum products, pesticides, PCBs (polychloralbiphenols) and many other pollutants (Stamets, 2004).

The present study is a preliminary attempt to evaluate the degradative ability of mycelia of some basidiomycetous fungi collected from Allahabad to decompose different substrates such as., filter paper, leaf litter, fallen twigs, cellophane etc.

MATERIALS AND METHODS

Survey was carried out to collect basidiomycetous fungi from Allahabad and its adjoining areas in year 2009. These were identified, brought in pure culture by tissue culture method on Potato Dextrose Agar (PDA) with 0.5% Yeast extract medium.

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The fungi taken for the present investigation were *Coprinus micaceus, Cortinarius armillatus* and *Schizophyllum commune.* These were screened and tested for decomposition of different substrates. These are wood decay fungi, cause white rot in host plants. The description of the fungi are given in Table 1 and Fig. 1

The following three substrate (10 g) were taken, leaf litter and fallen twigs (LT), Whatman no. 1 Filter paper (FP) and mixture of substrate i.e. above two with soil (S) and cellophane (C) [3 g LT + 3 gm FP + 3 g S + 1 g C]. Sample of 10 g of substrates in different combinations were taken in 250 ml conical flasks, added moisture and then autoclaved for 15 minutes at 121^{0}C. Three replicates of each combination of flasks were inoculated centrally with a mycelial disc of uniform size cut off from the growing margin of colony of test fungus grown on Potato Dextrose Agar with 0.5% Yeast extract medium. Control flasks were prepared containing same weight of substrates without mycelial disc. The flasks were incubated at 27^{0}C (±2^{0}C) for 15 days, 30 days, 45 days and 60 days. On the basis of test fungal mycelial growth, these were categorized as poor, moderate, good and excellent.

RESULTS AND DISCUSSION

After 15 days more or less mycelial growth was visible in each flask (Fig.2). After 30 days mycelial growth was moderate in flasks of leaf litter and mixture of substrates of all three fungi . After 45 days dense mycelial growth was observed in flasks of leaf litter and mixture of substrates of *C.micaceus* and *S.commune* in comparisons to *C.armillatus* .

After 60 days extensive mycelial growth was observed in flasks of leaf litter of *C.micaceus* and *S.commune,* but not in flask of *C.armillatus* (,Fig-3). Also extensive mycelial growth was observed in flasks of mixture of substrates of all the three fungi. In case of *S.commune* fruiting body was also formed (Fig-3). Decomposition was clearly visible.

Degradation of Cellophane

Various stages of mycelial growth on cellophane pieces were studied. After 30 days very little mycelial growth was observed. After 45 days dense and well developed mycelial growth on cellophane pieces was observed, due to this it became weak. After 60 days cellophane pieces became very weak and fragile (Fig, 4).

Table 1 : Description of Fungus

Systematic position (Hawksworth *et al.*, 1995)	Fungus	Substratum	Details	Comment
Basidiomycotina Basidiomycetes Holobasidiomycetidae Agaricales Coprinaceae	*Coprinus micaceus* (Bull ex, Fr.) Fr. (glistening ink cap)	log, stump, trunk of tree, soil etc.	Basidiocarp in dense clusters, cap thin fleshed covered with glistering grains disappear with time; stipe hollow slender. Spore print – Blakish brown	Edible
Cortinariales Cortinariaceae	*Cortinarius armillatus* (Fr.)Fr.	dead stump	Basidiocarp in group, cap reddish, rusty brown, thick, fleshy; stipe tall, sturdy Spore print – Rusty brown	Edible
Schizophyllales Schizophyllaceae	*Schizophyllum commune* (Fr. ex Fr.) (Split gill fungi)	log, dead stump, trunk of tree etc.	Basidiocarp gregarious, fan-shaped, softly coriaceous; ridges gill-like. Spore print- white colour	Edible in Manipur (Singh *et al.*, 2001)

It is concluded from the experiment that flask of filter paper of all three fungi viz., *C.micaceus, C.armillatus* and *S.commune* show poor growth showing their non-cellulolytic activity. In case of leaf litter two fungi i.e. *C.micaceus* and *S.commune* grew very well and degraded it also in comparison to *C.armillatus.* In leaf litter *S. commune* also

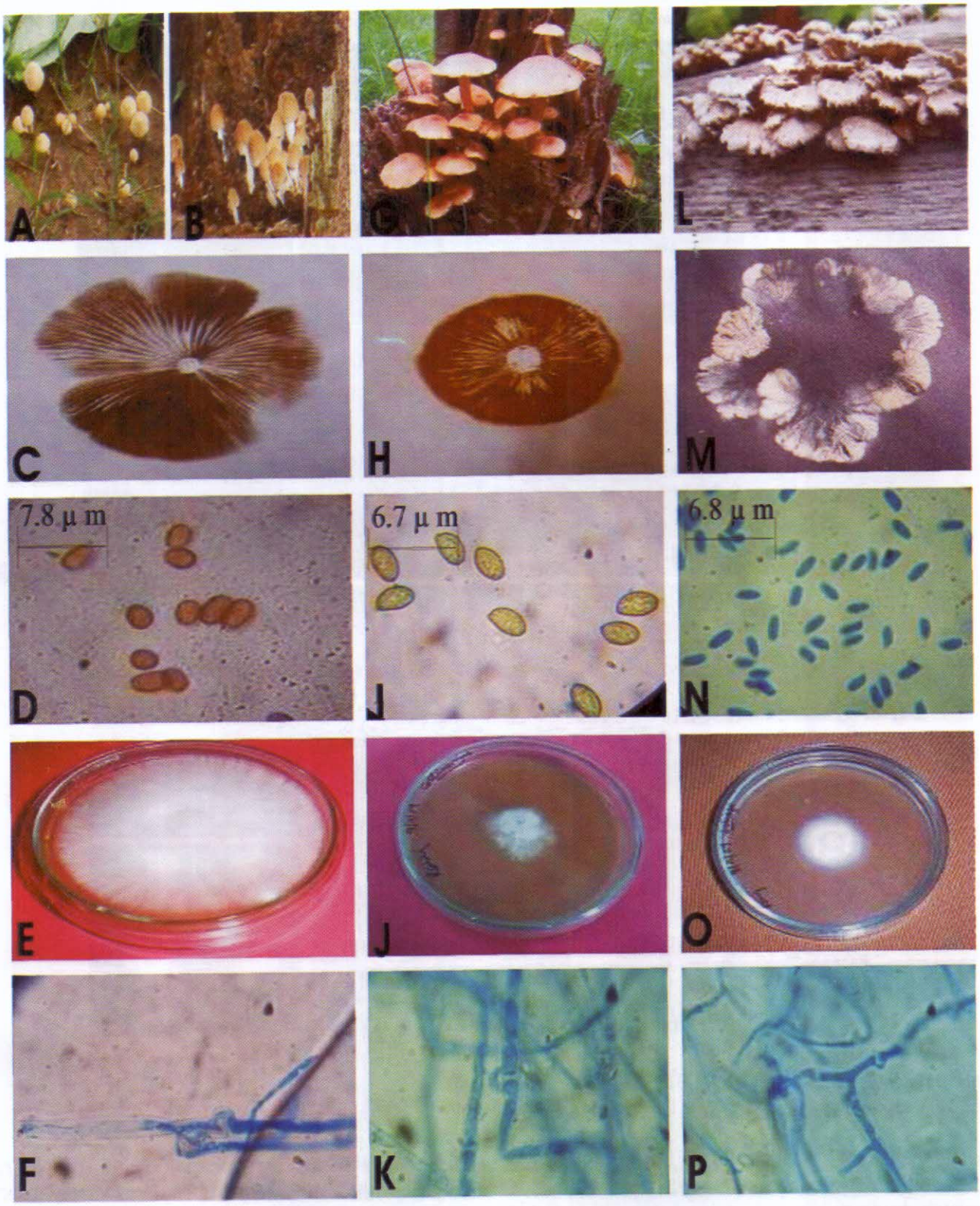

Fig. 1 : A-F *Coprinus micaceus* (A. Basidiocarp on soil, B. Basidiocarp on tree trunk C. Spore print, D. Basidiospores, E. Colony in Petri dish, F. Clamp connexion).
G-K *Cortinarius armillatus* (G. Basidiocarp, H. Spore print, I. Basidiospores, J. Colony in Petri dish, K. Clamp connexion).
L-P *Schizophyllum commune* (L. Basidiocarp, M. Spore print, N. Basidiospores,O. Colony in Petri dish, P. Clamp connection).

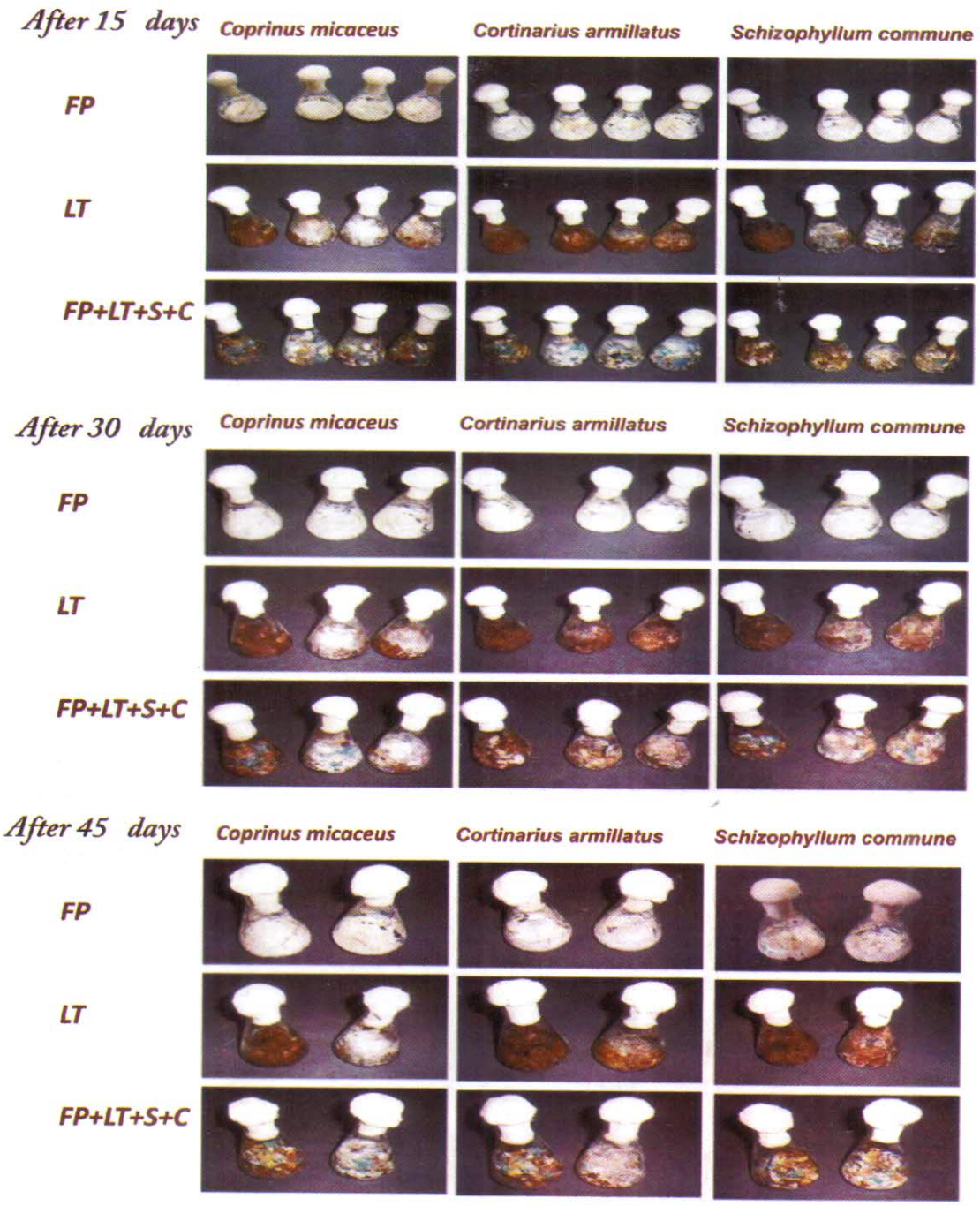

Fig. 2 : Showing mycelial growth of test fungi after 15days, 30days and 45days

showed initials of fruiting bodies. In case of mixture of substrates all three fungi showed extensive growth in flasks. Most striking outcome of the experiment was mycelial growth of *C.micaceus* and *S.commune* on cellophane pieces and their ability to degrade it also. If formulated properly it can lead to solve the huge problem of plastic garbage causing environmental problem.

Mushroom mycelium technology is the very foundation of ecological stability and vitality in an increasing more rapidly changing environment (Stamets, 2004).Mushroom growing is not just a rapidly expanding agribusiness; it is also a significant tool for the restoration, replenishment and remediation of earth's overburdened ecosphere.

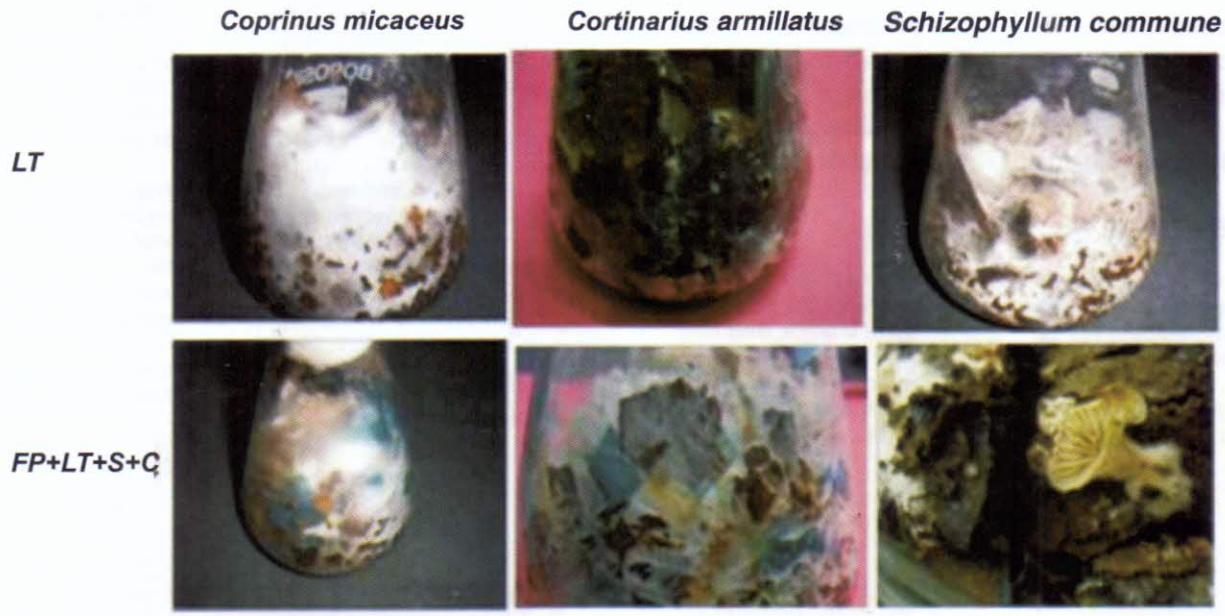

Fig.3 : Mycelial growth after 60 days

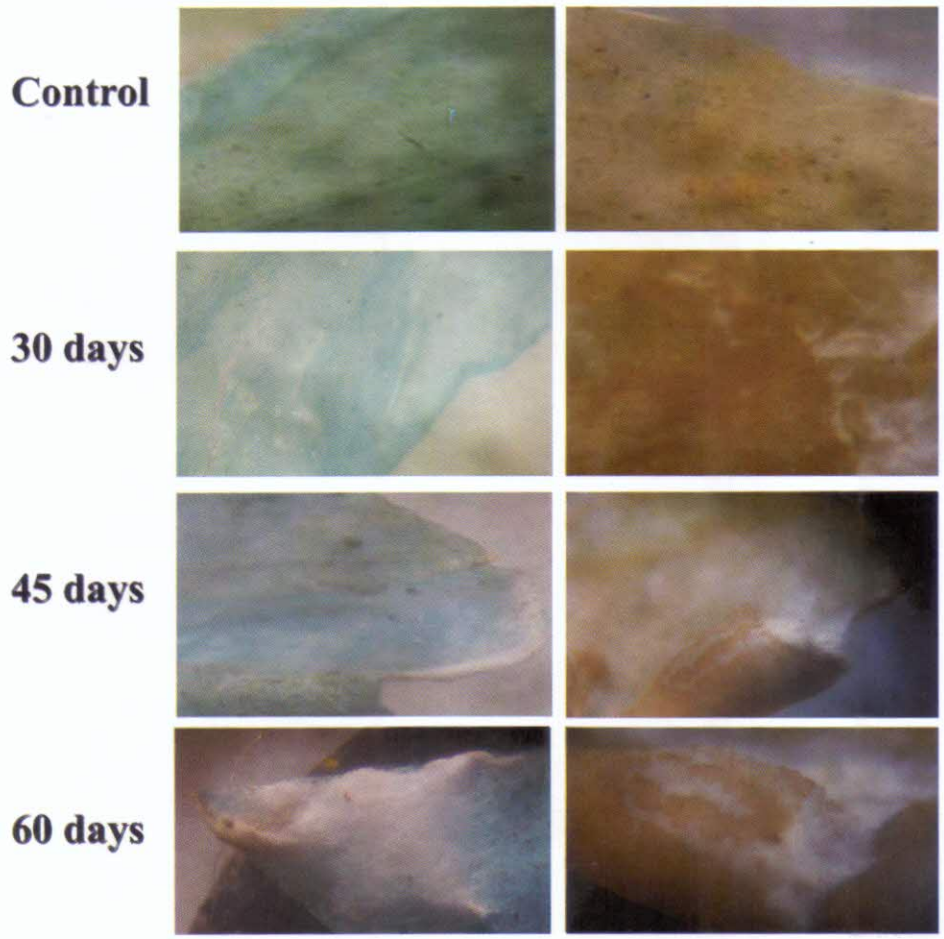

Fig.4 : Mycelial growth on cellophane pieces

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REFERENCES

Hawksworth, D.L., Kirk, P.M., Sutton, B.C. and Pegler, D.N. 1995 Ainsworth Bisby's Dictionary of the Fungi 8th Edition, By Commonwealth *International Mycological Institute*, CAB International, U.K. 1995. pp. 616.

Lodge, D.J. 1996. Fungi of Puerto Rico and the United States Virgin Islands: A history of previous surveys, current status, and the future. *Annals New York Acd. Sci.* **76:**123-129.

Molina, R, Pilz, D., Smith, J., Dunhams S., Dreisbach, T, O'Dell T and Castellano, M. 2001. Conservation and management of forest fungi in the Pacific Northwestern United States: an integrated ecosystem approach 19-63. In: Moore D, Nautra MM, Evans SE and Rotheroe M. eds. *Fungal Conservation Issues and Solutions. Cambridge Univ.* Press. New York. pp. 262.

Rossman, A.Y. and Farr, D.F. 1997. Toward a virtual reality for plant associated fungi in the United States and Canada. *Biodiversity and Conservation*, ; **6**: 739-751.

Singh, T.C., Singh, S.M., and Singh, N.I. 2001. *Schizophyllum commune*: A favourite wild edible mushroom among the Manipuris. *Proceeding of National Symposium on Tropical Mycology in the 21st Century*,8-10 February, Kolkata, India.

Stamets, P. 2004. Mushroom Power. Retrieved September 3, 2009, from YES! Magazine Web site: http://www.yesmagazine.org/issues/our-planet-our-selves/mushroom-power. 2004.

Stamets, P. 2000. *The role of mushrooms in nature from growing gourmet and medicinal mushrooms*. Third edition, Ten Speed Press. Berkeley, CA.