

Mushroom growth on different media

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Abstract

Growth response of different species of mushrooms viz. *Agaricus bisporus*, *Ganoderma lucidum*, *Lentinula edodes* and *Pleurotus ostreatus* were investigated on synthetic (Kirk and Tein), semi-synthetic (Potato dextrose agar) and natural (Wheat straw) growth media. *P. ostreatus* exhibited the best growth on Kirk and Tein medium and *G. lucidum* showed maximum growth on Potato dextrose agar. Whereas, none of the growth medium was found effective for growth of *A. bisporus* and *L. edodes*.

Keywords: growth medium, mushroom, *Agaricus bisporus*, *Ganoderma lucidum*, *Lentinula edodes*, *Pleurotus ostreatus*.

Introduction

Mushroom is a fleshy, spore bearing fruiting body of a fungus. In nature, mushrooms grow wild in almost all type of soils, on decaying matter and wooden stumps etc. Mushrooms lack chlorophyll and cannot manufacture their own food, however, they can produce a wide range of enzymes that degrade the complex substrates on which they grow and then absorb the soluble substance for their own nutrition. They are good and higher source (20 to 30%) of quality proteins than vegetables and fruits. Mushrooms have a high percentage of all the nine essential amino acids and are very rich in lysine and tryptophan, the two essential amino acids, deficient in cereals. They are good source of many minerals, e.g., P, K, Fe, Ca, and Na (Regula and Siwulski, 2007). Most of the mushrooms have very low starch content and can form an ideal food for diabetic patients. Mushrooms are low in calories (less than 30 g 100 g⁻¹) with traces of sugar and no cholesterol (Isikhuemhen *et al.*, 2000).

In addition to their nutritional value, mushrooms have been used medicinally for centuries. *Grifolia umbellata* is good for edema, urinary difficulties and diarrhea amongst other things (Chu *et al.*, 2002). *Ganoderma* spores powder has saved many cancer patients from, for example, lung cancer, colon cancer and cirrhosis of the liver (Sliva *et al.*, 2002).

A huge quantity of plant residue remains unused, mainly straw and leaves. These agricultural wastes are partially burned or disposed off on land after being shredded or composted. By a suitable treatment, they can also be converted into substances for the cultivation of higher fungi. Fruiting bodies of higher fungi serve as a delicious

food. Spent mushroom compost can be utilized as humus fertilizer, and widely grown substrates, e.g. straw, might be valuable as upgraded feed for animals (Zadrazil, 1980; Diez and Alvarez, 2001). Mushrooms are unique in nature for being able to degrade a wide variety of natural polymeric substances i.e. lignin (Kurbanogl, 2004). The great advantage is that mushrooms have the capacity to convert nutritionally valueless substances into high protein food (Martin, 1992; Gordon, 2002).

The present research work was planned to study growth responses of *A. bisporus*, *G. lucidum*, *L. edodes* and *P. ostreatus* on synthetic (Kirk and Tein), semi-synthetic (Potato dextrose agar) and natural (Wheat straw) growth media.

Materials and Methods

Four cultures of mushrooms viz. *A. bisporus*, *G. lucidum*, *L. edodes* and *P. ostreatus*, were procured from National Agriculture Research Council (NARC), Islamabad, Pakistan. These cultures were sub-culture on general growth media for further experimentation.

Mass culturing (spawn formation) of these fungi was done on barley seeds. Seeds were soaked in water for half an hour, boiled, drained and spread on a piece of newspaper in a tray for drying in the sun till nearly 60% moisture remained in the seeds. Seeds were in 250 mL flasks and were autoclaved for 20 minutes (Gordon *et al.*, 1998.). After one day, these flasks were inoculated with four each of the fungal specie. Spawn was ready within 10 days in case of *P. ostreatus*, *G. lucidum* and *L. edodes*, while 20 to 30 days for *Agaricus* species. The spawn was utilized for further trials.

Three different type of growth substrates viz. Kirk and Tein, Potato dextrose agar (PDA) and wheat straw were utilized to assess the growth response of four fungi.

Kirk and Tein growth medium was prepared by dissolving 0.42 g KH_2PO_4 , 0.08 g CaCl_2 , 0.06 g of MgSO_4 , 0.4 g $(\text{NH}_4)_2\text{SO}_4$, 0.08 g yeast extract, 0.8 g glucose and 3 g agar in 200 mL of distilled water.

For preparation of potato dextrose agar, 70 g potatoes, 3 g dextrose and 3 g agar were dissolved in 200 mL of distilled water.

Wheat straw was weighed, boiled and excess of water was drained off and then spread on trays for drying. After drying, 50-60% moisture was retained in it. Substrate was stuffed in (heat resistant) polythene bags (17.5 cm \times 23.25 cm). The bags were plugged with absorbent cotton by using PVC pipe.

Each of three growth media was autoclaved for 20 minutes at 121 °C. Kirk and Tein and PDA were poured into sterilized Petri plates and kept for solidifying.

After 24 hours, media plates and wheat straw bags were inoculated with mushrooms cultures under aseptic conditions and kept in the incubator at a 25 \pm 2 °C.

Growth of fungus was monitored regularly and data regarding growth was recorded 20 days of incubation.

Results and Discussion

Generally, Kirk and Tein and PDA were found as good media for growth of fungi as compared to wheat straw. Amongst the four fungi, *P. ostreatus* and *G. lucidum* were noticed as fast growing fungi than *A. bisporus* and *L. edodes*.

Kirk and Tein medium was found as the best substrate for the *P. ostreatus* with significantly greater mycelial growth of 8.8 cm. It was followed by *G. lucidum* (5.4 cm), whereas, *A. bisporus* and *L. edodes* showed 0.5 cm and no growth, respectively. PDA served as the good medium for *G. lucidum* with significantly greater mycelial growth (6.4 cm) as compared to rest of fungi. However, mycelial growth noticed for *P. ostreatus* was 5.1 cm and rest of two fungi did not show pronounced growth. Wheat straw also provided the better growth to *P. ostreatus* and *G. lucidum* in comparison to rest of two fungi (Fig. 1).

Fast growth rate of *P. ostreatus* and *G. lucidum* could be due to utilization of essential amino acids present in Kirk and Tein and PDA than on wheat straw (Labuschagne *et al.*, 2000).

Conclusion

P. ostreatus showed best on Kirk and Tein medium. *G. lucidum* exhibited the maximum growth on PDA. Growth of *A. bisporus* and *L. edodes* showed negligible growth on either of growth substrate.

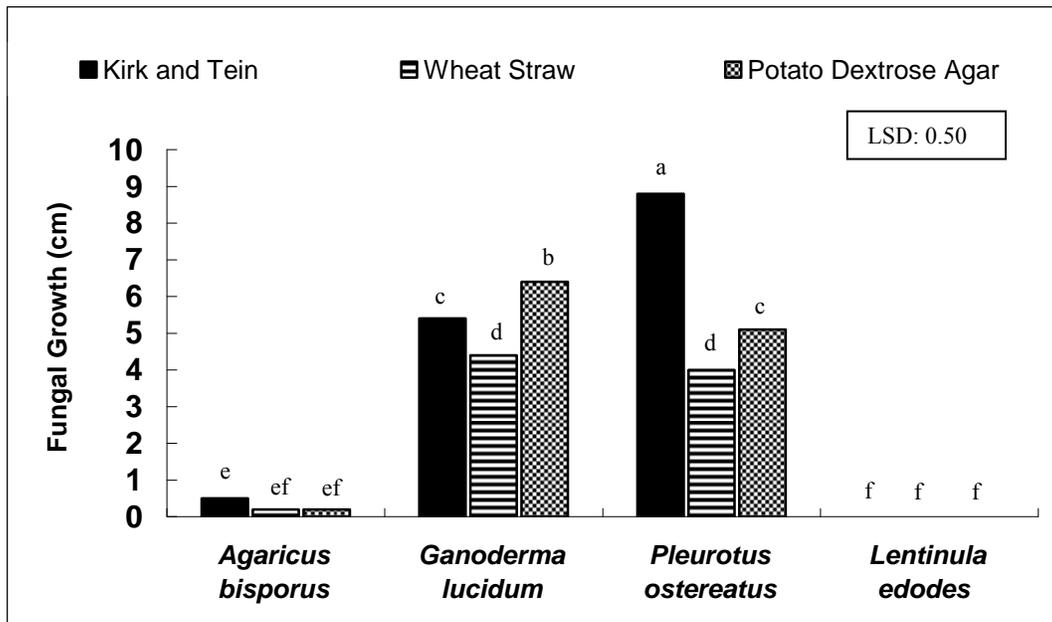


Fig. 1: Comparison of the growth of *Pleurotus osetereatus*, *Ganoderma lucidum*, *Agaricus bisporus* and *Lentinus edodes* on different growth media.

References

- Chu KKW, Ho SSS, Chow AHL, 2002. *Coriolus versicolor* a medicinal mushroom with promising immunotherapeutic values. *J. Clin. Pharmacol.*, **42**: 976-984.
- Diez VA, Alvarez, A, 2001. Compositional and nutritional studies on two wild edible mushrooms from northwest Spain. *Food Chem.*, **75**: 417-422.
- Gordon M, Arinaga A, Zhang W, 1998. A placebo- controlled trial of the immune modulator, lentinan, in HIV- positive patients: a phase I/II trial. *J. Med.* **29**: 305-309
- Gordon DT, 2002. Intestinal health through dietary fiber, prebiotics, and probiotic. *Food Technol.*, **56**: 23.
- Isikhuemhen OS, Nerud F, Vilgalys, 2000. Cultivation studies on wild and selected hybrid strains of *Pleurotus tuberregium*. *World J. Microbiol. Biotechnol.*, **16**: 431-435.
- Kurbanoglu EB, Algur OF, 2002. The influence of ram horn hydrolyzate on the crop yield of the mushroom *Agaricus bisporus*. *Sci. Hort.*, **94**: 351-357
- Labuschagne PM, Eicker A, Aveling TAS, Demeillon S, Smith MF, 2000. Influence of wheat cultivars on straw quality and *Pleurotus ostreatus* cultivation. *Bioresour. Technol.*, **71**: 71-75.
- Martin AM, 1992. Study of the growth and biomass composition of the edible mushroom *Pleurotus ostreatus*. *Dev. Food Sci.*, **29**: 239-248
- Reguła J, Siwulski M, 2007. Dried shiitake (*Lentinula edodes*) and oyster (*Pleurotus ostreatus*) mushrooms as a good source of nutrient. *Acta Sci. Pol. Technol. Aliment.*, **6**: 135-142.
- Sliva D, Labarrere C, Slivova V, Sedlak M, Lloyd FP, Ho NW, 2002. *Ganoderma lucidum* suppresses motility of highly invasive breast and prostate cancer cells. *Biochem. Biophys. Res. Commun.*, **298**: 603-12
- Zadrazil F, 1980. Conversion of different plant wastes into feed by basidiomycetes. *Eur. J. Appl. Microbiol. Biotechnol.* **9**: 31-35.