PROTEIN AND FAT CONTENTS OF VARIOUS *PLEUROTUS* SPECIES RAISED ON DIFFERENT WASTE MATERIALS

Muhammad Asif Ali*, Muhammad Siddiq**, Shabbir Ahmad*** and M. Asif Hanif*
*Institute of Horticultural Sciences, University of Agriculture, Faisalabad
**Agriculture Officer, Radio Pakistan, Faisalabad
*** Orange Research Station, Sargodha.

Studies to investigate the chemical analysis for fat and protein contents of fruiting bodies of different *Pleurotus* species grown on various industrial and agricultural waste materials were conducted. It is revealed that each species showed different results on for fat (%) only. *P. florida* showed maximum fat when grown on blow gutter, while minimum on luckrine razing. *P. sajor-caju* showed maximum fat on luckrine razing and minimum on ring sweeping. *P. ostreatus* grown on chimney gutter revealed maximum fat contents while it showed minimum fat on ring sweeping. Maximum protein was determined from *Pleurotus cornucopiae* grown on blow gutter and saw dust, respectively. Whereas minimum protein contents were observed in mushrooms grown on chimney gutter.
Keywords: Cultivation, mushroom, substrate, protein, fat

INTRODUCTION

Mushrooms have been used as food and medicine from time immemorial. Oyster mushroom locally known as “Dhingri” grows wild on logs and stumps of trees in forests of North Western Frontier Province, Azad Kashmir and other plantations in the plains of Punjab and Sindh, during monsoon. The fruiting bodies are collected by mushroom enthusiasts for food and are sold in the Islamabad, Lahore and Karachi. Oyster mushroom is one of the popular edible fungus cultivated in many countries in the subtropical and temperate zone. This group of mushroom has gained considerable importance recently, and when cultured artificially, they grow well on different agricultural waste materials supplemented with additives (Shah *et al.* 2004).

Mushrooms have attracted the attention of man from very ancient times, and the use of mushrooms as food is as old as human civilization. The cultivation of mushrooms can be considered as the most economic method of converting lignocellulosic agricultural wastes to consumable, protein-rich biomass. Use of edible fungi forms are an important step in the process of microbial biotechnology, in which a useful edible product is obtained from agricultural or industrial waste, which may otherwise pose environmental problems (Khadar, 2005). Since oyster mushroom, *Pleurotus* species require a minimum level of environmental control and relatively simple cultivation techniques; it has been used extensively for investigation by several workers. (Khan, *et al*, 1981, Basaria *et al*, 1987, Ali *et al*, 2004). The nutritional values of different cultivated *Pleurotus* species grown on various substrates have been compared. The fat content in different species of *Pleurotus* ranges from 1.08% to 9.4% on dry weight basis and average *Pleurotus* species contain 2.85% fat. It has been reported that major neutral lipid of oidia of was a triglyceride in nature and constituted 29% of dry weight (Hassan *et al*.1965*).*The protein content varies from 8.9% in *P. Opuntia* to 3.8% in *P. limidu*. The average protein is about 19.8% as compared to 26.3, 28.5and 17.5% in *A.bisporus*, *V.diplasia*, and *L.edodes* respectively. The composition of the substrate has a significant effect on the protein content of *P. ostreatus*. Bano *et al*,(1979) have found that *P. flabellatus* cultivated on rice straw supplemented with cotton seed powder after spawn run, produced sporophores with higher protein content as compared to those produced just on rice straw substrate and similar result have also been obtained for *P.sajor-saju (*Bano and rajarathnam 1978-79*).* Values for same reported by different workers vary to great extent. Jennison *et al*, (1957) analysed 17 different species of fleshy fungi including *Pleurotus* spp. and reported protein contents ranging between 27.07 to 40.8 percent. Kostadinov and Stefanov (1977) suggested that cultivation of *P. ostreatus* on maize cobs had higher lipids, protein and amino acid contents than wild *P. ostreatus.* Sabir *et al,* (2003) performed the proximate analysis of different eleven edible mushrooms for fat ant protein. The fat contents of these mushrooms were ranged between 0.05-2.66percent, whereas protein contents varied from 15.65-30.65%. It is known that environmental factors like temperature, humidity, type of substrates, stage of fruit-body development and

post harvest storage affect the composition of mushrooms (Rai *at al,* 1988). This research work was aimed to investigate the protein and fat contents of four *Pleurotus* species cultivated on different waste materials and to as certain its nutritional value in relation to different growing media.

MATERIALS AND METHODS

The studies were conducted on Asjid Mushroom Farm located in People's Colony, Faisalabad. Four species of oyster mushroom i.e. *Pleurotus ostreatrus, P. sajor-caju, P. florida and P. corunucopiae* were taken from culture collection of farm laboratory. These species were multiplied on Malt Extract Agar Media(Malt Extract 20gm,Dextrose 20gm,Peptone 1gm,Agar 20gm,Distilled water for 1 liter).The medium was sterilized at 15 psi (121°C) for 15 minutes and was then poured in 90 mm Petri dishes. To avoid bacterial contamination, streptopencilline was poured into the sterilized media at the rate of 1gm/litre. Four strains were inoculated into the MEA medium in 90 mm Petri dishes. Petri dishes were incubated at 25°C for mycelial growth.

Table 1. Fat percentage in fruiting bodies of *Pleurotus* spp.

Species	Ring sweeping	Saw dust	Luckrine razing	Cotton boll locules	Chimny gutter	Blow gutter	Means
P. ostreatus	1.43	2.15	2.87	2.54	3.29	2.76	2.51c
P. sajor-caju	1.72	2.21	3.37	2.70	2.91	1.86	2.46c
P .florida	3.53	3.38	3.20	3.49	3.44	3.88	3.48a
P.corunucopiae	2.37	2.83	4.07	2.64	3.14	3.67	3.12b
Means	2.26e	2.64d	3.38a	2.84c	3.19ab	3.04b	

Spawn was prepared on wheat grains as described by Pal and Thapa (1979). Whole wheat grains were boiled for 30 min and mixed with 2% calcium carbonate and 4% calcium sulfate to avoid clumps of grains. These grains were sterilized in autoclave at 121°C for one hour and inoculated with *Pleurotus* species. The spawn was ready after about 15-20 days incubation at 25°C during which the mycelium fully covered the grains.

Six substrates viz. blow-gutter, chimney gutter, ring sweeping, luckrine-razing, saw dust and cotton boll locules were evaluated to study the performance of aforesaid species. Blow-gutter, chimney-gutter, ring sweeping and luckrine-razing were soaked in water for 30 minutes to moisten, whereas cotton boll locules were immersed in water for 24 hours. Then the substrates were stacked on a cemented floor to remove excessive moisture. Saw dust was soaked for 5 minutes and excessive moisture was removed. Then $CaCo_3$ and wheat bran were thoroughly mixed at the rate of 4% on dry weight basis of each substrate.

These substrates were filled into polypropylene bags (20x30cm) at the rate of 200 gms per bag on dry weight basis. The open ends of bags were tied up with rubber bands. Four replications of each species were used for each substrate. The bags were sterilized in an autoclave at 121° C and 15 lbs psi for 30 minutes. Next day bags were inoculated with grain spawn at the rate of 10 gm per bag. When the bags become white due to impregnation by fungal mycelium, the mouth were opened and placed in the racks in a growing room for cropping. Temperature was maintained at 25°C for spawn running and 15-20°C for fruiting body formation. During the cropping period the bags were sprinkled with water twice a day. Chemical analysis of the substrates and fruit-bodies of *Pleurotus* species was performed according to the method approved by A.O.A.C. (1984).

RESULTS AND DISCUSSIONS

Fat percentage of oyster mushroom was significantly affected by different substrate (Table 1). Regarding substrate, maximum fat (3.38%) was observed on luckrine razing while minimum (2.276%) on ring-sweeping. Genotypicaly variable was observed in *Pleurotus spp.* to fat percentage, the highest percentage was observed in *P. florida* whereas, *P. sajor-caju* showed the lowest amount.

Duncan's Multiple Range test depicted interaction of substrate and species for fat percentage. Maximum fat (4.07%) was determined from *P. corunucopiae* grown on luckrine-razing and minimum (1.44%) from *P.ostreatus* grown on ring-sweeping. It was revealed that each species showed different results with different substrate. In case of *P. florida,* it showed maximum fat (3.88 %/) on blow-gutter while showed minimum fat (3.21%) on luckckrine razing. *P.sajor-caju* showed maximum fat (3.37%) grown on luckrine-razing but it contained minimum fat (1.72%) on ring-sweeping. *P. ostreatus* grown on chimney gutter showed maximum fat (3.29%) while it showed minimum (1.44 %) on ring sweeping. Our results were in line with Khana and Garcha (1981b).

Data regarding protein percentage of *Pleurotus spp.* grown on six substrates are given in Table 2. Protein percentage of *Pleurotus spp.* was significantly affected by different substrates. Effect of species and interaction between species and substrate were also found highly significant. Maximum protein (24.60%) was determined in mushroom grown on sawdust. Minimum protein (23.35%) was observed on chimney-gutter. All the species significantly differed for protein contents. Maximum protein contents (25.92%) were found in *P. ostreatus,* and minimum (22.97%) in *P.sajor-caju.*

Table 2. Protein percentage in fruiting bodies of *Pleurotus* spp.

Species	Ring-swee ping	Saw dust	Luckrine-raizing	Cotton boll locules	Chimny gutter	Blow-gutte r
P. ostreatus	26.20	26.80	25.50	25.27	26.33	25.72
P. sajor-caju	22.20	23.41	24.02	22.08	21.80	24.08
P. florida	23.48	24.09	23.38	23.08	21.95	23.32
P. corunucopiae	23.68	24.08	23.23	24.30	23.30	24.78
Means	23.87bc	24.60a	23.95b	23.73c	23.34a	24.47

Regarding species substrate correlation, *P. ostreatus* contained maximum protein (26.80%) grown on saw-dust while it showed minimum (25.20%) on luckrine razing. Highest protein contents (24.78%) were determined in *P. corunucopiae* when grown on blow gutter and minimum (23.23%) was evaluated when grown on luckrine-razing. *P. florida* gave highest protein contents (24.10%) on saw-dust while lowest (21.95%) on chimney-gutter. Maximum protein (24.08%) was showed by *P.sajor-caju* when grown on blow-gutter, while it gave minimum (21.80%) on chimney-gutter. It is manifested from the table that *P. corunucopiae* grown on saw dust and *P.sajor-caju* grown on blow-gutter showed equal protein percentage. The variation in the reported nutritional analysis in different *Pleurotus* species is due to several factors such as strains, type of substate, spawning media and rate (Stamets, 1993).

REFERENCES

Ali, M.A., S. Hussain, R. Nawaz, A. Ahson and M. Sidddiq. 2004. Effect of pasteurization techniques on mycelial growth of oyster mushroom, *Pleurotus* species. J. Agri. Res: 42 (2): 201-207.

A.O.A.C. 1984. Official methods of Analysis of the Association of Official Analytical Chemists. (14th ed), Arlington, Virginia.

Bano, Z., N.,Nagaraja., S., Rajarathnam and M.V. Patwardhan. 1979. Cultivation of *Pleurotus* species in a village model hut.Indian Fd.Packer. 33(6) ;19-25.

Basaria, R., M. Madan and V.S. Basasria. 1987. Mineral content of mushroom *Pleurotus sajor-caju* cultivated on different agro-residues. Mushroom J. Tropics. 7(2): 53-60.

Jennison, M.W., D. Newcomb and H. Henderson. 1957. Physiology of wood rotting Basidiomycetes (11). Growth and Nutrition in Submerged culture in Synthetic media. Appl. Microbiol, 5:87.

Hassan, M., Yusef, D.R. Threlfall and T.W. Goodwin. 1965. Some lipids of theoidia of *Pleurotus osteatus*, phytochemistry 4(4):559-62.

Khader, V. 2005. Health benefits of the *Pleurotus sajor-caju*. Int. J. Medicinal Mushrooms. 3: 421-422.

Khan, S.M., A.G. Kausar and M.A. Ali. 1981. Yield performance of different strains of oyster mushroom (*Pleurotus ostreatus*) on paddy straw in Pakistan. Mushroom Science X1: 675-678.

Khanna, P. and H.S. Garcha. 1981b. Nutritive value of mushroom *Pleurotus florida.* Mush. Sci. 11(1): 561-572.

Kostadinov, I. and S. Stefanov. 1977. Studies on the chemical composition of oyster mushroom. Gradinarska, I. Lozarsaka. Optina stansiya, Gradinarstro-Negovan, Sofia, Dist., Bulgaria, 14(5):110-112.

Pal, J. and C.D. Thapa. 1979. Cultivation of Dhingri (*Pleurotus sajor-caju* made easy. Indian Journal of Mushroom. 5: 17-20.

Rai. R.D., S. Saxena, R.C. Upadhyay and H.S. Sohi. 1988. Comparative nutritional values of various *Pleurotus* species grown under identical conditions. Mush. J. Tropics. 8(3): 93-98.

Sabir, M.S., I. Hayat, I. Hussain and S.R.A. Gardezi. 2003. Proximate analysis of mushrooms of Azad Kashmir. Plant Pathology J. 2(2): 97-101.

Shah, Z.A., M. Ashraf and M.I. Chaudhry. 2004. Comparative study on cultivation and yield performance of oyster mushroom (*Pleurotus ostreatus*) on different substrates (wheat straw, leaves, saw dust). Pak. J. Nutrition. 3(3): 158-160.

Stamet, P. 1993. The oyster mushroom of the Genus *Pleurotus*. Growing Gourmets & Medicinal Mushrooms: 283-284.