Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(3): 231-234
Received: 26-03-2019
Accepted: 29-04-2019

Uday Pratap Singh
Department of Plant Pathology, T.D. (P.G.) College, Jaunpur, Uttar Pradesh, India

Kalpana Maurya
Department of Plant Pathology, T.D. (P.G.) College, Jaunpur, Uttar Pradesh, India

D Singh
Department of Plant Pathology, T.D. (P.G.) College, Jaunpur, Uttar Pradesh, India

Correspondence
Uday Pratap Singh
Department of Plant Pathology, T.D. (P.G.) College, Jaunpur, Uttar Pradesh, India

Evaluation of agro-wastes for the production of oyster mushroom (*Pleurotus sajor caju*)

Uday Pratap Singh, Kalpana Maurya and D Singh

Abstract
Oyster mushrooms draw their nutritional requirement from a host substrate or from the agricultural wastes rich in lignin, cellulose and hemicellulose used for their cultivation. Nutrient content varied with the substrate which lead to varied mushroom yield. An experiment was conducted to evaluate commonly available agro – wastes viz. paddy straw, wheat straw, leaves and stalks of maize, leaves and stalk of sorghum straw, sugarcane leaves and sugarcane bagasse for the cultivation of oyster mushroom (*Pleurotus sajor caju*). Among tested substrates paddy straw was found most suitable for the cultivation of *P. sajor caju*.

Keywords: Oyster, *Pleurotus sajor caju*, paddy straw, biological efficiency, lignocellulolosic

Introduction
Oyster mushroom (*Pleurotus sajor- caju*) is a nutritionally rich edible mushroom, contains adequate amount of phosphorous, iron, protein, lipid, riboflavin and thiamine. Calorific value of oyster mushroom is about 345 kilocalories per 100 g dry weight. Mushrooms are known vegetarian's meat due to the rich source of minerals and proteins. The proteins of mushroom are considered to be intermediate between that of vegetables and animals. Amino acids required for different biological activity in human body was also found in oyster mushroom. *P. Sajor caju* productivity is maximum in a very short time providing more protein per unit area than any other crop. Due the high content of nitrogen and protein which increases the biological efficiency of oyster mushroom is very high. Oyster mushroom also produces metabolites of medicinal and pharmacological value, such as antimicrobials, immunostimulants, antioxidants and Antitumourals/ *Pleurotus* is an efficient lignin degrading mushroom and can grow well on different types of substrates containing lignocellulolosic materials. *Pleurotus sps.* can grow well in variable temperature conditions; hence they are ideally suited for cultivation throughout the year in tropica; regions of the world. They are able to colonize and degrade a large variety of lignocellulosic residues and required very short time for the growth than other edible mushrooms. Their fruiting bodies are not very often attacked by diseases and pests and they can be cultivated in a simple and cheap way.
Agricultural wastes are rich in various types of nutrients and disposal of huge quantity of agro wastes is very difficult to manage as excess of nutrients in them can cause leaching is left in field, as a compost. Mostly they are disposed by means of incineration which causes pollution. Hence, there is always a high demand of an agricultural waste management method which is cost effective and contributes less in environment pollution. Mushroom cultivation on agro - wastes fulfills these requirements. An attractive feature of oyster mushrooms is that they can utilize a large variety of agricultural waste products and transform the lignocelluloses biomass in to high quality food, flavor and nutritive value (Quimio, 1978; Bano and Rajarathanam, 1982) [27, 2]. Oyster mushroom posses the appropriate enzymatic mechanism for the transformation of complex organic macromolecules into simple compounds have been exploited as the means for biodegradation of a wide range of agro – wastes due to their ability of selective delignification (Mayson & Verachtert, 1991; Martinez *et al.*, 1994) [14, 13]. Most agricultural residues are rich in lignocelluloses compounds whose handling and disposal often problematic. Wheat straw, Paddy straw, leaves & stalk of maize, leaves & stalk of sorghum and Sugarcane bagasses are the substrates of interest, Since they are produced in large quantities and rich in cellulose and lignin. The potential of bioconversion of lignocelluloses waste into value added products is emphasized in earlier studies (Poppe, 2000) [26].
In view of the above observations present study was carried out to evaluate different agricultural wastes for growth and production of *Pleurotus sajor caju* in climatic condition of eastern Uttar Pradesh.

Materials and Methods

Preparation of pure culture of *Pleurotus sajor-caju*

Matured pileus/cap of *P. sajor-caju* was placed in the sterile glass petri plates (90 mm) lined with dark black coloured drawing sheet paper, facing gills underside covered with lid and kept as such for a overnight. Next day morning abundant white coloured circular spore print on paper sheet was obtained. From this spore prints, spores were gently lifted with the wire loop and transfered on autoclaved and cooled PDA medium in glass petri dishes under Laminar air flow cabinet. These plates were then incubated at 200C in an incubator. After a week of incubation, profused whitish, cottony growth was developed. From these plates, pure culture of *P. sajor-caju* was prepared on PDA slants in glass test tubes and preserved in refrigerator.

Preparation of master spawn

Apparently healthy, unbroken and clean sorghum grains were paraboiled in clean water (1:1 w/v). After boiling, excess water was drained of by spreading the grains on wire mesh/sieve. Then these were spread on surface sterilized (4% formalin) polythene sheet to which calcium sulphate @ 2% and calcium carbonate @ 5% were mixed on dry weight basis. These grains were filled in glass conical flasks (200 g/flask), plugged with non-absorbent cotton and then sterilized in autoclave at 15 Lbs pressure for 20 min, for two consecutive days. After sterilization, the flasks were transferred to Laminar-Air-Flow Cabinet, allowed to cool at room temperature and inoculate with 4-5 mycelial discs (5mm) of pure cultures of *P. sajor-caju* and incubated at 20 ^{0}C. These flasks were shaken intermittently to facilate through spreading on the mushroom mycelium on the grains. After three weeks of incubation, the grains in flasks were fully covered with the mycelium of *P. sajor-caju*. Thus the master spawn was prepared.

Evaluation of agro-wastes

Standard polythene bag method of *Pleurotus* spp. mushroom cultivation is used for the evaluation agro-wastes. The following substrates are used to cultivation i.e. paddy straw, wheat straw, leaves and stalks of maize, leaves and stalk of sorghum straw, sugarcane leaves and sugarcane bagasse. The dry agro wastes were chopped to small pieces (5-8 cm long). The chopped substrate were weighed and soaked in water for two days until the moisture content reached about 75%. After soaking substrates were be taken out and excess of water drained off. After draining excess of water these straws were weighed. As supplements wheat bran, slope waste and granulated stones from dates were added to some substrates to furnish nitrogen, vitamins and minerals requirement for the mushroom growth. Calcium carbonate was added to adjust the pH of the medium. Pasteurization of the media was carried out using chemical sterilization. Substrates were immersed in 75 ppm Cabendazim (50 WP), 500 ppm Formalin (40%) solution for 18 hrs.

The polypropylene bags of the size 35 × 55 cm2 (100 gauge thickness) will be sterilized by dipping in 2% formalin prior to use and lower corners of the bags was tied with the string so that the bed assumes a round shape after filling the straw and were filled with sterilized substrates and multilayered spawning @ 2 percent of wet weight of the substrate. The bags was filled up to their 90 percent capacity and mouths will be closed tightly with threads with the help of sterilized needle, about 20-25 minute holes all-round the filled bags was made.

A spawned substrate bag was kept in mushroom house where the temperature and humidity were maintained around 20-25 ^{0}C and 80-90%, respectively with sufficient light and ventilation for 20 days. After completion of spawn run the bags were removed by cutting longitudinally with sharp blade and these beds was kept on bamboo racks/platform at 15-18 ^{0}C temperature and 80-90% relative humidity for cropping. Pinhead initiation was evident within 3-4 days after removal of poly bags. The beds were maintained up to the harvest of the third flush, which was completed in 35-40 days after sowing. A small layer of substrate was scrapped off from all the side of the beds after each harvest.

Mushroom yield

The total yields of oyster mushroom were measured for each treatment. The accumulations of three flushes were noted as the total mushroom yield.

Biological efficiency: the biological efficiency (yield of mushroom per kg substrate on dry wt. basis) of oyster mushroom was determined by the following formula.

$$\text{Biological efficiency \%} = \frac{\text{Weight of fresh mushroom fruiting bodies}}{\text{Weight of dry substrate}} X\ 100$$

Results and Discussion

On perusal of data presented in table-1 it was revealed that among evaluated agro-waste substrate paddy straw was found most suitable for the cultivation of *Pleurotus sajor caju* in the climatic condition of eastern Uttar Pradesh. Paddy straw gave highest yield of 410.50 g/ kg dry substrate (2013-14) and 408.30 g/ kg dry substrate (2014-15) in both the year of study which was significantly superior than other treatments viz. wheat straw, leaves & stalk of maize, leaves & stalk of sorghum, sugarcane leaves and sugarcane bagasse. Similar results were also reported by earlier workers (Kirbag and Akyuz., 2008; Pandey *et. al*, 2008 and Raja and Ganesh, 2013) [10, 18, 28].

Biological efficiency of Pleurotus sajor caju was computed since certain substrates were denser than others. The effect of substrates on yield contributing characters such as biological efficiency was varied with the substrates. Maximum biological efficiency 41.05 (2013-14) and 40.83 (2014-15) of mushroom was noticed in treatment in which paddy straw used as substrater in both the years of study. Similar differential biological efficiency of *Pleurotus sajor-caju* with different substrates has been reported by Kirbag and Akyuz., 2008; Pandey *et. al*, 2008 and Raja and Ganesh, 2013. [10, 18, 28]

Table 1: Effect of different agrowastes for production of *P. sajor caju*.

S. No.	Substrate	Moisture content of the substrate at spawning %		Mushroom Yield (g/kg dry substrate) in 30 days		Biological Efficiency (%)	
		2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
1	Paddy Straw	68	68	410.50	408.30	41.05	40.83
2	Wheat Straw	68	67	350.70	356.40	35.07	35.64
3	Leaves & Stalk of Maize	74	75	326.20	320.50	32.62	32.05
4	Leaves & Stalk of sorghum	75	74	245.30	218.54	24.53	21.85
5	Sugarcane Leaves	68	66	248.00	216.50	24.80	21.65
6	Sugarcane bagasse	74	75	385.30	387.40	38.53	38.74
	CD at 5%	-	-	16.30	15.30	-	-

4. Conclusion

On the basis of present study, it was concluded that paddy straw can be used as substrates for the commercial cultivation of oyster mushroom in climatic condition of eastern Uttar Pradesh. Promotion of mushroom cultivation using paddy straw also leads to eco-friendly way of agro- waste management.

5. References

1. Ahmad SA, Kadam JA, Mane VP, Patil SS, Baig MMV. Biological efficiency and nutritional contents of *Pleurotus florida* cultivated on different agro-wastes. Nature and Science. 2009; 7:44-48.
2. Bano Z, Rajarathanam S. Studies on the Cultivation of *Pleurotus sajor-caju*. The Mushroom Journal. 1982; 115:243-245.
3. Bonatti M, Karnoppa P, Soaresb HM, Furlana SA. Evaluation of *Pleurotus ostreatus* and *Pleurotus sajor-caju* Nutritional Characteristics When Cultivated in Different Lignocellulosic Wastes. Food Chemistry. 2004; 88:425-428.
4. Dundar A, Acay H, Yildiz A. Effect of using different lignocellulosic wastes for cultivation of *Pleurotus ostreatus* on mushroom yield, chemical composition and nutritional value. African J Biotec. 2009; 8(4):662-666.
5. Elahe KJ, Mehrdad J, Shahin E. King oyster mushroom production using various sources of agricultural wastes in Iran. International J Rec Org Waste Agr. 2016; 5:17-24.
6. Gregori A, Svagelj M, Pohleven J. Cultivation techniques and medicinal properties of *Pleurotus* spp. Food Technol. Biotechnol. 2007; 45(3):236-247.
7. Hassan FRH, Medany GM, Hussein SDA. Cultivation of king oyster mushroom (*Pleurotus eryngii*) in Egypt. Australian J. Basic Appl. Scie. 2010; 4(1):99-105.
8. Hobbs C. Medicinal Mushrooms: An Exploration of Tradition, Healing and Culture. Botanica Press, Santa Cruz, CA, 1996.
9. Inagle A, Ramteke A. Studies on cultivation and biological efficiency of mushroom grown on different agro-residues. Innov. Romanian Food Biotechno. 2010; 6:25-28.
10. Kirbag S, Akyuz M. Effect of various agro-residuces on growing period, yield and biological efficiency of Pleurotus eryngii. J Food Agric. Envt. 2008; 6(3-4):402-405.
11. Mandhare VK. Productivity of *Pleurotus* spp. on different straw and it's effect on nutritional indices of spent straw. PhD. (Agri.) thesis submitted to Marathwada Agri. Univ. Parbhani (India), 2000.
12. Mane VP, Patil SS, Syed AA, Baig MMV. Bioconversion of low quality lignocellulosic agricultural wastes into edible protein by *Pleurotus sajor-caju* (Fr.) Singer. J Zehejiang Univ. of Sci. B. 2007; 8(10):745-751.
13. Martinez AT, Camarero S, Guillen F, Gutierrez A, Munoz C, Varela E *et al*. Progress in biopulping of non-woody materials: Chemical, Enzymatic and ultrastructural aspect of wheat straw delignification with lignolytic fungi from the genus Pleurotus. FEMS Microbiology Reviews. 1994; 13:265-274.
14. Mayson E, Verachert H. Growth of higher fungi on wheat straw and their impact on the digestibility of the substrate. Applied Microbiology and Biotechnology. 1991; 36:421-424.
15. Mondal SR, Rehana J, Noman MS, Adhikary SK. Comparative study on growth and yield performance of oyster mushroom (*Pleurotus florida*) on different substrates. J Bangladesh Agri. Univ. 2010; 8(2):213-220.
16. Musieba F, Okoth S, Mibey RK, Wanjiku S, Moraa K. Suitability of locally available substrates for cultivation of the Kenyan indigenous Golden oyster mushroom (*Pleurotus citrinopileatus* Siner). Aric. J. 2000; 2012; 7(4):240-244.
17. Nicolcioiu MB, Popa G, Matei F. Mushroom Mycelia Cultivation on Different Agricultural Waste Substrates. Romania Scientific Bulletin Series F. Biotechnologies 2016, 20.
18. Pandey RK, Pandey IB, Jha S. Performance of oyster mushroom (*Pleurotus sajor-caju*) on different agricultural wastes. Agricultra-Stiintasi- Practica, 2008; 3(4):26-33.
19. Patil KK, Kulkarni RV, Gupta DN. Enhancing yield and biological efficiency (BE) in oyster mushroom by supplementation. Academic J Plant Sci. 2010; 4(2):41-44.
20. Patil RR, Mate GD, Swami KV. Studies on production of oyster mushroom on different substrates. In Souvenir and Abstract, National Symposium (IPS) on "Microbial consortium approaches for plant health management. 2012; PDKV. Akola, 2016, 102.
21. Patil SS. Cultivation of *Pleurotus sajor-caju* on different agro- wastes. Sci. Res. Repo. 2012; 2(3):225-228.
22. Patrabansh S, Madan M. Studies on cultivation, biological efficiency and chemical analysis of *Pleurotus sajor-caju* (Fr.) Singer on different biowastes. Acta Biotechnologica, 1997; 17:107-122.
23. Peksen A, Yakupoglu G. W Micro Biotech. 2009; 25:611-618.
24. Philippoussiis A, Zervakis G. Management of agro-industrial wastes through the cultivation of edible mushrooms. Proceedings of the fourth waste Forum, Milano, 2000.
25. Poonam D, Deepak V. Effect of different agro-waste substrates and their combinations on the yield and biological efficiency of *Pleurotus sajor- caju*. IOSR J Pharm Bio Sci. 2013; 8:60-64.
26. Poppe J. Use of agricultural waste materials in the cultivation of mushrooms. In Proceedings of the 15 th

International Congress on the Science and Cultivation of edible fungi, ed. Van Griensive L.J.L.D., 3-23. Rotterdam; Balkema, 2000.
27. Quimio TH. Introducing Pleurotus Flabellatus for Your Dinner Table. Mushroom Journal. 1978: 69:282-283.
28. Raja E, Ganesh P. Studies on oyster mushroom (*Pleurotus florida*) on using different substrates. Indian streams Res. J. 2013; 3(3):1-3.
29. Sonali DR. Cultivation and Study of Growth of Oyster Mushroom on Different Agricultural Waste Substrate and Its Nutrient Analysis. Adv. Appl. Sci n b Res, 2012.
30. Sturion G. Utilização Da Folha De Bananeira Como Substrato Para O Cultivo De Cogumelos Comestíveis (*Pleurotus* Spp.). Piracicaba: Esalq/Usp. 56p. (Tese Mestrado), 1994.
31. Survase DM. Bioconversion of agro-waste into edible protein rich mushroom by *Pleurotus sajor-caju* (Fr.) singer. Int. Peet-Reviewed J. 2012; 1(1):60-62.
32. Wani BA, Bodha RH, Wani AH. Nutritional and medicinal importance of mushrooms. Journal of Medicinal Plants Res. 2010; 4(24):2598-2604.
33. Zakia B, Rajrathnam S, Nagaraja N. Some aspect on the cultivation of *Pleurotus flabellatus* in India. Indian Mush. Sci. 1979; 10(2):597-608.