Production Potential and Biological Efficiency of Five *Pleurotus species*

H.Rawte & R. Diwan
Department of Botany, Govt. Nagarjuna College of Science, Raipur (C.G.) 492001, India.

Received: September 23, 2018 Accepted: November 04, 2018

***ABSTRACT**: Mushroom cultivation is a profitable agribusiness.Incorporation of non conventional crops in existing agricultural system can improve the economic status of protein, vitamins and minerals. Mushrooms are the source of extra ordinary power and have medicinal properties too. Five isolates of Pleurotus spp. viz. P.florida (PF) , P.sajor - caju (PSC) , P. eous (PE), P. flabellatus (PFl) , P.sp. were selected to estimate their potential biological efficiency during the summer season. The experiment was carried out for the cultivation of oyster mushroom. 2.5 kg paddy straw substrate was taken in polyproplene bags which produced highest yield and biological efficiency and can be recommended as a best substrate. The crop of oyster mushroom was harvested in three flushes under proper humidity and temperature condition. The spawn running , pin head formation and fruiting body formation are the three important phases in the cultivation of species of Pleurotus. The final data was recorded after 42 days in five replicates. P.sajor-caju emerged out as the most potential isolate as it exhibited maxium yield and its biological efficiency was 65.20% on the basis of dry weight of substrate . It was followed by 65% in P .sp. , 62.40% in P.flabellatus, 62% in P.florida and 60% in P.eous . The production capacity and hence the biological efficiency can be equated as PSC> PSp > PFl > PF.> PE.*

Key Words:

Introduction:

Mushroom cultivation is now getting very popular as it is very much helpful in increasing the economic and nutritional standard of the rural and urban people. Mushroom is a HEALTH FOOD and the day would not be too far when mushroom eating will become a health habit and both producers and consumers will make this health habit a house hold commodity.

The oyster mushroom is cultivated in about 25 countries of far-east Asia, Europe and America. Oyster mushroom is the 3rd largest cultivation mushroom in the world and its annual world production is around 797,000 tonnes (Chang, 1996). It seems much education is needed before full advantage can be taken of this readily available, nutritionally rich food source. (Mshandete M.A.2007). Whether there is shortage of calories or protein in human diet is a debatable question, but there is no doubt that much larger supplies of protein will be needed to meet the demand of increasing population (Shah, 1983: Stahemann, 1975). Oyster mushroom has been cultivated using various agro wastes such as rice straw and wheat straw (Yang et.al.,2013; Rezania et.al., 2017).

In Chhattisgarh,both rural and urban population accept edible mushrooms as a food, however it is more common in rural and tribal areas where edible mushrooms grow naturally during monsoon periods.Availability of mushrooms throughout the year can be had only by its artificial cultivation .It is therefore necessary to develop mushroom cultivation technology for a common man. The production of mushroom is regarded as the second most important commercial microbial technology next to yeast (Pathak et.al.2009).

The successful cultivation of this fungus has been adopted in tropical to subtropical climatic condition of India because it requires moderate temperature between 25 and 30^0C . The climatic conditions in Chhattisgarh remain ideal for its cultivation. increasing consumption of mushrooms can not be alternative protein source for of meat,fish and egg (Caglarirmark et.al ;2002). Today mushrooms are being considered as alternative food source to provide adequate nutrition to world's increasing population. Mushroom are useful against diabetes,ulcer and lungs diseases (Quimio,1976). Mushroom are the good source of protein, vitamins and minerals (khan et.al;1981). Therefore the significant impact of mushroom cultivation and mushroom derivatives and product on human wel fare in the 21st century can be considered as a 'non-green' revolution (R.P. singh and k.k mishra ,2006).

The present study deals with different aspects of oyster mushroom so that it can provide sufficient food and protein for the future generation through recycling the agricultural and industrial wastes into delicate food which are available in large quantities and are cost effective. It's cultivation as a cottage industry will be quite helpful to fight out the employment problems.

Materials and Methods:

Five isolates of *Pleurotus spp*. viz. *P.florida*,*P.sajor-caju, P.eous*, *P.sp*. were selected to estimate their potential biological efficiency during the summer seasons (2008).

Preparation or procurement of spawn :

For the preparation of master culture healthy wheat grains were soaked in tap water over night and next day boiled for about 10-15 minutes till they become soft but do not rupture. These grains were put on wire netting to remove the excess water, air dried and mixed with 2% calcium carbonate by wet weight basis. Then it was filled up to half capacity in 250 ml conical flasks and plugged with non absorbent cotton before autoclaved at 20 Ibs P.S.I, for 2 hours. After overnight cooling the flasks were inoculated with pure culture and incubated for 7 days at 25±10C. The wheat grains were dipped in water, boiled air dried and calcium carbonate (2%w/w) was mixed in the similar way. These grains were filled in empty glucose bottles. In each bottle 200 g were filled which were autoclaved at 20 Ibs P.S.I. pressure for 2 hours. Next day sterilized bottles were incubated at 28 ± 10C for 15 days. For all the experiments fresh spawn was prepared separately.

Preparation of substrate:

For substrate preparation chemical method of sterilization was used (Vijay and Sohi 1987).Complete decontamination and thorough mixing of spawn at the rate of 4%by wet weight basis was followed. The spawned substrate was filled in polypropelene bags. The mouth of the bags were tied with nylon string and perforations were made in the lower portion of the bags.

A unit of 2.5 kg of dry straw was used for each treatment which was equally distributed in five bags representing each as a replication. The moisture content of the straw at the time of spawning was kept around 72-75%.The filled bags were incubated in the laboratory at a temperature running between 25-30ºc where 90% relative humidity was maintained till the spawn run was complete.

Harvesting of the mushroom:

Pinhead started appearing after 3-8 days of the bag removal. First flush of the mushroom was obtained within 7-12 days of pinhead appearance. Mature sporophores were picked up just before the edges of the pilei begin to fold or curl up wards. Picking was done by slight pulling and twisting of the sporophore. Thus, two to three flushes were harvested from the same bed at an interval of 8-10 days and it was continued for the total period of four weeks in all the cases.

Weighing and measurement of size of sporophore:

The freshly harvested sporophore were measured length wise and widthwise with the help of scale and the average was considered as the size of the sporophore. The freshly harvested spore fruits were immediately weighed with help of electronic balance. The yield was summed up by taking the fresh weight of three flushes of all *Pleurotus spp.*

Result and Discussion :

The experiment was conducted in March-April (2008) when the average temperature recorded was36.9^{0}C maximum and 20.9^{0}C minimum, rainfall 15mm, relative humidity was 65% maximumand 25.5% minimum.

Pleurotus sajor-caju emerged out as a most potential isolate as it exhibited maximum yield and its biological efficiency was 65.20% in five replicate on the basis of dry weight of substrate followed by *P.sp*. (65%), *P.flabellatus* (62.40%) and *P.florida*(62%). The minimum yield and its biological efficiency was 60% in five replicates of *P.eous* on the basis of dry weight of substate. It was also observed that average number of sporophores were well suited to their corresponding biological efficiencies. Cultivation during summer season was found to require minimum time of 42 days for complete 3 flushes of *P.sajor-caju* yields, and 22 days for complete spawn run. [Table-1]. The equation of summer season in all the test isolates was PSC> PSp > PFl > PF >PE.

Paddy straw produced highest yield, biological efficiency and recommended as a best substrate for *Pleurotus* mushroom cultivation. The crop of *Pleurotus spp*.was harvested in three flushes. Gujral et.al., (1987) was observed highest yield on paddy straw. Cultivation of oyster mushroom (*Pleurotus flabellatus*) Evaluation of various substrates and supplements for biological efficiency of *Pleurotus sajor-caju* and *Pleurotus ostreatus* was studied by M. Fanadzo *et.al*. (2010). Comparative study on cultivation and yield performance of oyster mushroom (*Pleurotus ostreatus*) on different substrates (wheat straw, leaves, saw dust) was studied by Z.A. Shah *et. al*. (2004).

Pleurotus sajor-caju gave maximum yield and biology efficiency during summer season. [Fig-1-i-ii]. The results are in accordance with Khanna and Garcha (1981). Tewari (1991) studied effect of different doses of grain spawn in summer and rainy seasons and recommended higher does of spawn during unfavourable seasons.

An easy and practicable cultivation technology for oyster mushroom has been developed through this investigation and the technology is transferable to rural and tribal masses as a cottage industry and protein rich food for them.

References:

1. Chang ST; Buswell J A (1996). Mushroom nutriceuticals. world J. microb. Biotechnol 12: 473 -476.
2. Chang ST, Mushigeni KE (2001). Mushroom and their human health: Their growing significance as potent dietary supple ments .The University of Namibia, windhoek ,pp 1-79
3. Caglarirmak N, Unal K,Otles S (2002). Nutri tive value of edible wild mushroom grown in Black sea region of Turkey .Myco Appl. Int 14 (1) ; 1-5
4. Gujral, G. S., Bisaria, R., Madan, M. and Vasudevan, P.(1987): Solid state fermentation of saccharum munja residues into food through Pleurotus cultivation.J.Ferment.Technol.65, 101-105.
5. Khan, S.M ; A.G. Kausar and M.A. Ali (1981). Yield performance of different stains of oyster mushroom (Pleurotus spp.) on paddy straw in pakistan , mush .sci x1 sydney (1) : 675 -67
6. Khanna,P. and Gurcha, H.S.(1981): Introducing the cultivation of Pleurotus.florida in the plains of India. Mushroom Science.
7. M. Fanadzo, D.T. Zireva, E. Dube and A.B. Mashingaidze (2010): Deptt. Of agronomy; University of Fort Hare, African Journal of Biotech. Vol 9 (19), PP. 2756-2761.
8. Mshandete M.A. and Cuff J. (2007): African Journal of food agriculture nutrition and development vol. 7 No.6 2007
9. Pathak R joshi N Dwivedi RR (2009) ; Eco friendly production of Agaricus bispores (lange) imbach (white button mushroom) Net sdi :6: 57-6o.
10. Quimio , T .H , (1976). Cultivation Gandoderma the "Pleurotus- way" Mushroom new sletler for tropics,6:12-30.
11. Rezania,S.,Din,M.F.M.,Taib,S.M.,Sohaili,J.,Chelliapan,S.,Kamyab,H.,Saha,B.B.,(2017).Review on fermentative biohydrogen production from water hyacinyh, wheat straw and rice straw with focus on recent perspectives. Int.J.Hydrog.Energy 42 (33),20955-20969.
12. Shah, F.H. (1983): The future of leaf protein concentrate in Pakistan, In: Leaf protein concentrate. Published by AVI publishing Co. Connecticut, U.S.A. pp. 760-794.
13. Singh R.P, K,K, Mishra (2006) : status and prospects of edible and medicinal mushroom . Mushroom research and training centre ,G .B pant univ. of Agri and tech ; pantnagar (uttaranchal).
14. Stahmann, M.A.(1975):Workshop on unconventional Sources of protein (April 22,1975),University of Wisconsin,Madison USA,P.53.
15. Tewari, R.P. (1991): Effect of Soaking period and spawn dose on oyster mushroom (Pleurotus sajor-caju) production IN: Indian mushrooms, proceeding of National Symposium on mushroom, organized by Kerala Agric. University, Thiruvanthpuram. PP. 81-84.
16. Vijay, B and Sohi, H.S. (1987) : cultivation of oyster mushroom Pleurotus sajor-caju (Fr.) singer on chemically sterilized wheat straw. Mushroom J Tropics 7:67-75.
17. Yang,W.,Guo,F.,Wan,z., 2013.Yield and size of oyster mushroom grown on rice/wheat straw basal substrate supplementedwith cotton seed hull.Saudi.J.Biol. Sci. 20 (4),333-338.
18. Z.A. Shah , M. Ashraf and M. Ishtiaq ch. (2004): University College of Agriculture Rawalakot (VAJ OP K), Azad Kashmir, Pakistan Journal of Nutrition 3 (3): 158-160.

Table - 1 Evalution of paddy straw substrate for spawn run total yield and Biological efficiency of Pleurotus spp. during summer season

Species	Time required for complete spawn run (days)	Fresh weight yield (g)/ Kg straw						Biological Efficiency %	Average Size of Sprophores		Average Number of Sporophores	Duration of 3 flushes (days)
		R1.	R2	R3	R4	R5	Average		Stipe Length (cm).	Pileus Diameter (cm)		
P. florida	20	290	355	305	280	320	310	62	0.80	6.87	67	44
P.sajor-caju	22	363	350	327	300	290	326	65.20	0.77	5.76	80	42
P.eous	20	340	300	290	270	300	300	60	0.84	6.87	62	45
P.flabellatus	22	290	350	320	310	300	312	62.40	0.80	5.35	72	44
P.sp.	22	410	290	325	290	300	325	65	0.60	6.80	77	42

Note: Average no. of 5 replicate.
R1-R5 no. of bags.

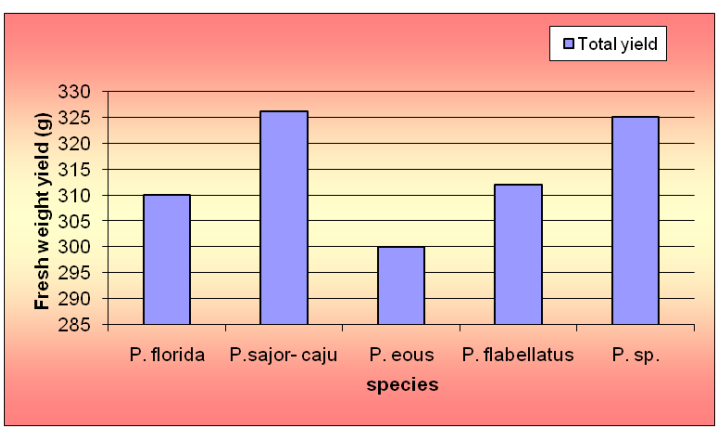

Fig-1 (i) Cultivation on total yield of *Pleurotus spp*. during summer season

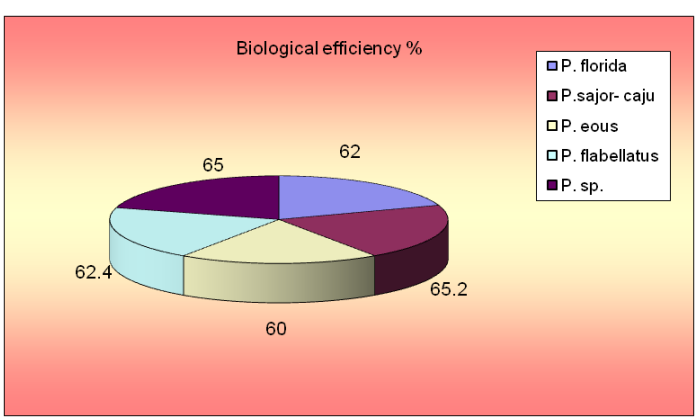

Fig-1 (ii) Biological efficiency of *Pleurotus spp*. during summer season.