J.Mycopathol.Res. 63(1) : 141-145, 2024, ISSN : 0971-3719 (Print), 2583-6315 (Online) 10.57023/JMycR.63.1.2025.141

Oyster mushroom (*Pleurotus sajor-caju* P112) cultivation in North Gujarat using various agricultural substrates

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Received : 23.09.2024 Accepted : 31.01.2025 Published : 31.03.2025

The oyster mushroom (*Pleurotus* spp.), also known as dhingri in India, is the second most produced fungus in the world and one that is commercially grown worldwide. Producing oyster mushrooms from agricultural byproducts with high lignin concentration is possible because oyster mushrooms grow and develop their mycelium on these substrates before becoming edible fruit bodies. In order to ascertain the impact of various agricultural wastes on spawn running, pinhead development, yield (g), and biological efficacy (%), oysters (*Pleurotus sajor-caju* P112) were planted on a variety of agricultural straws, including wheat, maize, bajra, mustard, and castor straws. Much early pinhead formation 16.08(days) and spawn running13.30(days) was recordedin mustard straw. Nonetheless, in comparison to other substrates, wheat straw had the noticeably largest yield (2105.23 g/3 kg straw) and biological efficacy (70.17%).

Keywords: Biologicalefficacy, oyster mushroom, straw, wheatstraw, yield

INTRODUCTION

The global food and nutritional security of growing population is a great challenge. Mushroom finds a favour in the quest of new crop which could be a good source for proteinaceous food and can be grown even by landless people, that too on waste material, rendering food security. Use of mushrooms as food and medicine have been documented in old epics Vedas and Bible. FAO has recognized mushrooms as the food contributing to protein nutrition in the countries depending largely on cereals due to its high quality and quantity of protein (Dhakad*et al*. 2017).Edible mushrooms once called the “Food of the Gods” and still treated as a garnish or delicacy can be taken regularly as part of the human diet or be treated as healthy food or as functional food.

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The extractable products from medicinal mushrooms, designed to supplement the human diet not as regular food but as the enhancement of health and fitness can be classified into the category of dietary supplements/mushroom nutriceuticals.It is important to dispose agricultural waste in a green way, which is environmentally friendly in this era of climate change. Mushroom cultivation is one of the most important steps towards diversification of agriculture. Microbia technology can help in large scale recycling of agro waste in India (Singh, 2017).As India has witnessed an enormous change in its agricultural pattern due to the continuous increase in the population rate. The excellent texture with unique flavor of edible and medicinal mushrooms makes them universally accepted by all age groups (Prasad *et al*.2018).Oyster mushroom (*Pleurotus* species) the second widely cultivatedmushroom worldwide following the *Agaricus bisporus*.

Large-scale food production is difficult, but

properly disposing of crop leftovers is a major issue. Edible fungi are a type of natural recycler that turns waste lignocellulose into nutritious, high-protein food. The success of mushroom cultivation can be attributed to its minimal input requirements. For approximately one-fourth of the global yearly supply of straw, an estimated 300 million tonnes of fresh mushrooms can be produced (Somashekhar *et al*. 2020). People have been eating mushrooms for their nutritional and medicinal benefits for thousands of years all across the world. With a 19% share in global edible mushroom output, *Pleurotus* species is the second most produced in the world. Many Pleurotus species are suitable for year-round cultivation in many tropical countries, such as India, because they grow well in a wide range of temperatures (Dhar*et al*.2024).

Mushrooms are edible macroscopic fungi which have fleshy fruiting bodies. Mushrooms can grow on decayed organic matters which are rich in lignin, cellulose and other carbohydrates whereas oyster mushroom requires less nitrogen and more carbon source. A huge amount of agro based lignocellulosoic crop residues and byproducts are generated annually(Nithyatharani and Kavitha, 2018). The production of these wastes can cause environmental and many health problems (Garg and Gupta, 2009). Mushrooms provide people with high quality proteins, minerals and vitamins. They are highly nutritious and can be compared with eggs, milk and meat. They are easily digestible as they have no cholesterol (Oei, 2003). Oyster mushrooms are the group of mushroom belonging to the genus *Pleurotus* and the family Pleurotaceae. They possess number of therapeutic properties like anti-inflammatory, immunostimulator and anticancer activity, immunomodulatory, ribonuclease activity, etc. (Patel *et al.* 2012).

Growing mushrooms is a profitable solution to address the issue of managing agricultural waste in rural areas, as it not only produces a very nutritious food item but also improves the surrounding region. Hence to know the good source or substrate for cultivation of oyster mushroom (*Pleurotus sajor-caju* (P112)this research was conducted in North Gujarat region.

MATERIALS AND METHODS

Procurement of mycelia culture and its maintenance

The experiment was carried out in the Polytechnic of Agriculture, S. D. Agricultural University, Deesa, in 2022–2023. *Pleurotus sajor-caju* (P112) pure mycelia culture was acquired from DMR, Solan. Every 12 to 15 days, a subculture of the culture was carried out on potato dextrose agar, which included 20% potato extract, 2% dextrose, and 2% agar.

Spawn preparation

A 250 ml conical flask was used to prepare the seed. Water was added to sorghum gains and cooked for 20 to 30 mins. It was then combined with 2% $CaSO_4.2H_2O$ and 5% $CaCo_3$ (lime) after boiling and spread out on cotton fabric to absorb extra moisture. Sorghum grains, $CaCo_3$, and $CaSO_4.2H_2O$ were placed in a 250 ml conical flask and autoclaved for 30 mins.at 121°C. Pure mycelia culture was then added, and the mixture was incubated at 27 ± 2°C for 7–10 days to allow the mycelium to grow and completely cover the sorghum grains. They were utilized as spawn for the bulk multiplication of mushrooms on various substrates when all the sorghum grains in the flask were covered in mycelium.

Substrates preparation

The straws that were chosen for mushroom cultivation include wheat straw, maize straw, bajra straw, mustard straw, groundnut shell, and castor shell. These straws were cut into little pieces, with an average length of 4-5 cm. In this experiment, the chemical sterilization methods standardized by DMR, Solan were used. Each of the chopped substrates—wheat, maize, bajra, mustard, groundnut, and castor—was immersed in a plastic drum for 14–16 hrs at a time in water containing formaldehyde (500 ppm) and carbendazim (75 ppm). Subsequently, the substrate was removed from the solution and left for two to three hrsin order to dry off any remaining moisture. Each treatment bag was filled with 3 kg of various substrates on a dry basis and 150 gm of oyster mushroom spawn, using polythene

bags measuring 43 x 16 cm and 100 gauge bags for the filling process. To eliminate any extra moisture that might have been present in the substrate, pin holes spaced 10 cm apart were made in each bag after they were filled. These bags were kept in an incubator in a pitch-black chamber with a constant temperature of 25. Wet gunny bags and water spraying on the floor were used to highlight the room's 75–85% humidity.

To analyze the data using a completely randomized design (CRD), 3 kg of dry substrates were used for each of the six treatments, which were replicated four times. Notable effects of the treatments were noted on the growth of mycelium in days, the formation of pinheads, the days of the first, second, and third flush, and the total yield (kg).The temperature ranged from 18 to 27°C during the experiment, which was conducted in the months of November through January 2022-23. The following formula (Jwanny*et al*., 1995) was used to determine biological efficacy (%): Biological effectiveness is calculated as (A/B * 100), where A is the fresh mycelium weight and B is the dry substrate weight.

RESULTS AND DISCUSSION

Results of the yield analysis on the six substrates (wheat straw, maize straw, bajra straw, mustard straw, groundnut shell, and castor shell) utilised in *P. sajor-caju* culture were more or less significant. Seven variations exist in the amount of time needed to complete the spawn running, pinhead formation, first, second, and third flush days on various substrates. Mustard straw had the shortest timespan (Table 1), followed by wheat straw, with spawn running taking 13.30 days, pinhead development taking 16.08 days, first flush taking 19.05 days, second flush taking 30.22 days, and third flush taking 43.32 days.Maize straw was shown to have the longest maximum times for spawn running, pinhead development, first flush, second flush, and third flush. The yield and biological efficacy (B. E.) of *P. sajor-caju* on six agricultural wastes are shown in Table 2. The cultivation of wheat straw (2105.23 g/3kg straw) yielded a significantly higher yield (70.17% B.E.), followed by mustard straw (1860.43 g/3kg straw) at 62.11% B.E. Bajra straw yielded the lowest overall yield (881.26 g/3 kg straw) and biological efficacy (27.37% B. E.) of any straw tested. More or less similar results were reported by various scientist. Dheeraj (2017), who found that mustard straw required 19.30 days for the spawn run of blue oyster mushrooms (*H. ulmaris*), are largely consistent with the results of variation in spawn run obtained in the current experiments. Gautam and Ram(2019) also found highest yield (475gm/ half kg of straw) of *P. sajor-caju on* wheat straw while lowest yield on maize straw. Pradeep (2017) reported early spawn running, fruit bodies formation and pinhead formation and highest yield and biological efficiency(8.6 % B.E)in wheat straw.Similar outcomes were observed with *P. sajor-caju,* according to Bhivaji (2016), who used two different types of straw were *P.eous*. Wheat straw for *P. eous* had the highest yield (420.00 g/ bed) and the highest biological efficacy (168.0%)

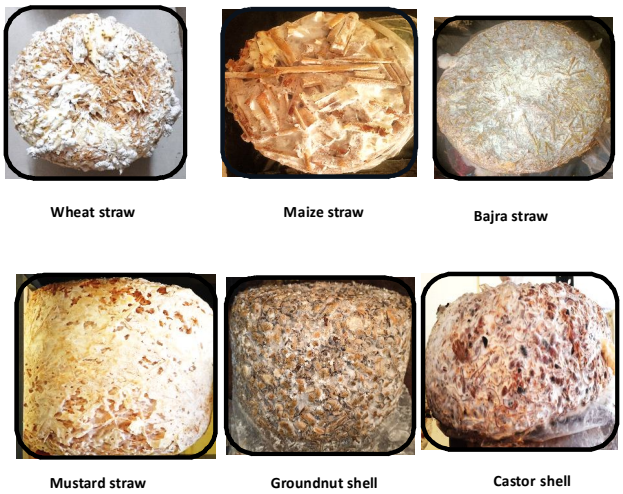

Fig. 1 : Mycelial mat formation of oyster mushroom (*Pleurotus sajor-caju*) on different substrates

Fig. 2 : Fruiting Body of oyster mushroom (*Pleurotus sajor-caju*) on different substrates

Table1: Daysrequiredforspawnrun,pinheadformation,firstflush,secondflushandthirdflushofdifferentphasesof*P.sajor-caju*productionondifferentagrowastes.

Tr. No.	Agrowaste/Substrates	Spawn running	Pinhead formation	First flush	Second flush	Third flush
				Days		
T_1	Wheat straw	16.17	19.08	22.22	35.14	47.22
T_2	Maize straw	24.31	28.09	31.46	48.14	60.98
T_3	Bajra straw	21.76	26.36	29.19	45.25	58.79
T_4	Mustard straw	13.30	16.08	19.05	30.22	43.32
T_5	Groundnut shell	16.49	20.40	23.21	36.17	49.11
T_6	Castor shell	19.37	22.49	25.21	39.22	55.57
	S.Em.±	0.28	0.24	0.26	0.25	0.26
	C. D. at5%	0.83	0.73	0.78	0.76	0.78
	C.V.%	3.02	2.20	2.10	1.31	1.01

Table 2: Effect of different agrowastes on yield of *P.sajor-caju*.

Tr. No.	Agrowaste/Substrates	Yieldofmushroom(g)/3kgofdryagro waste			Totalyield(g)	Biologicalefficacy (%)
		1st harvesting	2nd harvesting	3rd harvesting		
T_1	Wheat straw	1034.84	658.00	413.20	2105.23	70.17
T_2	Maize straw	670.33	338.00	186.50	1194.83	39.81
T_3	Bajra straw	500.07	234.44	146.75	881.26	27.37
T_4	Mustard straw	944.90	641.28	274.25	1860.43	62.01
T_5	Groundnut shell	875.29	539.39	225.00	1639.68	54.65
T_6	Castor shell	925.30	594.79	253.75	1773.84	59.12
	S.Em.±	10.18	2.94	2.91	16.03	-
	C. D. at5%	30.26	8.74	9.49	48.49	-
	C.V.%	2.46	1.17	2.33	1.98	-

of harvested fruiting bodies. Pandey *et al.* (2008), on the other hand, reported highest biological efficiency (86.62 percent) with paddy straw which was at par with wheat straw (81.39 percent).Dundar*et al*. (2008) conducted an experiment to study the yield performance and biological efficacy of three different species of oyster mushroom viz., *P. sajor-caju, P. ostreatus* and *P. eryngii*on wheat stalk and obtained highest total yield and biological efficacy from *P. sajor-caju* on wheat straw. The biological efficiency also varied among the different substrates. Variable ranges of BE have been reported when different lignocellulosic materials were used as substrates for cultivation of oyster mushroom (Liang *et al*. 2009). Mycelial mat formation and fruit body formation have been depicted in Figs. 1 &2.

CONCLUSION

In order to assess these agricultural wastes' potential as a foundational raw material for culture, *Pleurotus sajor-caju* was cultivated on six different types of agricultural waste: wheat straw, maize straw, bajra straw, mustard straw, groundnut shell, and castor shell.This investigation verified that *P. sajor-caju* was successfully grown using these six agricultural wastes. The creation of the maximum maximum yield (g) and biological efficacy (%) in wheat straw was discovered to occur during the shortest time period for spawn run, pinhead formation, first

flush, second flush, and third flush in mustard straw.

DECLARATION

Conflict of Interest : Authors declare no conflict o interest.

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