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SHORT COMMUNICATION

Growth and yield performance of Pink Oyster Mushroom *Pleurotus eous* (Berk.) Sacc. on various lignocellulosic substrates

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Abstract

Pink oyster mushroom (*Pleurotus eous*) (Berk.) Sacc. is one of the popular edible species widely cultivated on various lignocellulosic substrates in subtropical to tropical regions across the world for its excellent taste and nutrition. In this study, we explored some commonly available substrates namely, Paddy straw (PS), Paddy straw + Rice bran (PS+RB) and Paddy straw + *Saccharum spontaneum* (PS+SS), to determine the most promising substrates for the cultivation of this species. The substrates PS+RB and PS+SS were prepared in a 1:1 ratio based on dry weight. Each substrate treatment was replicated three times. The study was conducted in an outdoor cropping room with a temperature ranging from 20 to 27 °C and relative humidity between 73% and 96%. The efficiency of the substrate was evaluated based on several factors including the time taken for complete spawn run, appearance of pinheads, maturation of fruiting bodies, flushing intervals, cropping period, total mushroom yield (g), and biological efficiency. Among the tested substrates, PS proved to be the most effective, supporting faster spawn run (9.3 days), a greater number of fruiting bodies (46.0), higher mushroom yield (246.3 g), and a relatively shorter cropping cycle (15.3 days). However, in terms of biological efficiency, all tested substrates appeared equally promising for *P. eous*.

Keywords: Oyster mushroom cultivation, *Pleurotus eous*, Paddy straw, Rice bran, *Saccharum spontaneum*

1. Introduction

Pleurotus spp., commonly known as oyster mushrooms, belongs to the class Basidiomycetes, order Agaricales, and family Pleurotaceae (Tsujiyama and Ueno 2013). Due to their good taste, flavor, simple and comparatively low-cost production technology, minimal preparation time, and space requirements coupled with high biological efficiency, they rank second after button mushrooms in terms of commercial production (Mandeel et al., 2005; Sharma et al., 2013; Royse, 2014). As potential decomposers of lignocellulosic substrates, they have been successfully cultivated on a wide range of agro-wastes; however, the choice of substrate and environmental conditions significantly affect mushroom yield (Poppe, 2004; Tsujiyama and Ueno, 2013). The highly favorable climatic conditions throughout the year, coupled with the abundance of agricultural wastes and forest-based materials in the region of Arunachal Pradesh confers significant opportunities for cultivating various edible species of oyster mushrooms (Rina, 2012). In recent years, a few selected species such as *P. sajor-caju*, *P. flabellatus*, *P. sapidus* have been cultivated on a small scale in outdoor conditions using paddy straw in Arunachal Pradesh. The Pink oyster mushroom, *Pleurotus eous* (Berk.) Sacc. is a summer species that typically thrives within a temperature range of 22 – 30 °C and relative humidity of 75 – 85% (Siddhant et al., 2013a; Mandaviya et al., 2018). It has been cultivated elsewhere in India using various agro-forest wastes (Eswaran and Ramabadran, 2000). To establish *P. eous* as a promising oyster mushroom for cultivation, we investigated the suitability of Paddy straw, Rice bran and *Saccharum spontaneum* L. (a wild tall grass abundantly available in the state) for its cultivation in an outdoor mushroom house.

2. Materials and methods

A pure culture of *Pleurotus eous* was obtained from Directorate of Mushroom Research, Solan, Himachal Pradesh. The mother culture was maintained on Potato Dextrose Agar at 25±2 °C. Spawn was prepared on whole wheat grain by inoculating two-week old pure culture and incubated it in a BOD incubator at 25±1 °C for 15 days (Biswas and Biswas, 2015). Paddy straw (PS), paddy straw mixed with rice bran (PS+RB), paddy straw mixed with *Saccharum spontaneum* (PS+SS) in combination ratio of 100%, 1:1, and 1:1, respectively, on a dry weight basis were used for cultivation. The substrates were sun-dried, cut into small pieces (2–4 cm length), then sterilized by autoclaving (Mondal et al., 2010). Spawning was done at 3% using the layering method. Inoculated substrate bags were kept in dark for 2-3 weeks for spawn running, and thereafter, they were opened to allow the formation of fruiting bodies of the mushroom. The entire cultivation trail was conducted in an outdoor mushroom house during the month of March – May, 2021 at room temperature and relative humidity ranging between 20 °C – 27 °C and 73– 96% respectively.

The time taken for complete spawn running, pinhead formation, appearance of the first and second flush, and the entire cropping cycle was recorded. The number and average weight of all fruiting bodies, pileus diameter, stipe length and diameter, and total mushroom yield (g) were also recorded. The biological efficiency (BE) of different substrates was calculated using the formula:

$$BE = \frac{\text{Weight of fresh mushroom harvested (g)}}{\text{Dry weight of substrate used (g)}} \times 100$$

2.1. Statistical analysis

The data obtained were analyzed using ANOVA, and the results were presented as Mean ± Standard deviation (SD). Mean separation was conducted using Tukey's honestly significant difference (HSD) test at the $p < 0.05$ level, utilizing SPSS Version 18.0.

Table 1. Effect of substrates on various growth and yield attributes of Pink Oyster mushroom

Parameters	Substrates		
	PS (absolute)	PS+RB (1:1)	PS+SS (1:1)
Substrate Colonization, Fruiting and Cropping (days)			
Spawn running (St)	9.3±0.6[a]	10.3±0.6[a]	13.0±1.0[b]
Pinhead formation (Pt)	2.3 ±1.2[a]	2.3±0.6[a]	4.0± 1.0[a]
Primordia formation to 1st flush (Ft1)	2.0±1.0[a]	1.7±0.6[a]	2.7±1.2[a]
1st flush to 2nd flush (Ft2)	1.7±0.6[a]	2.3±0.6[ab]	4.3±1.5[b]
One Cropping cycle (T=St+Pt+Ft)	15.3±1.2[a]	16.7±0.6[a]	24.0±4.4[b]
Growth of fruiting bodies			
Number/bag	46.0±7.2[b]	21.3±7.1[a]	30.0± 2.6[a]
Weight (g)	6.0±1.7[a]	6.3±2.0[a]	4.4±1.2[a]
Pileus diameter (cm)	6.4±1.0[a]	7.0±2.6[a]	5.4±1.1[a]
Stipe diameter (cm)	1.1±0.1[b]	0.4±0.2[a]	0.6± 0.1[a]
Stipe length (cm)	1.2±0.2[a]	0.7±0.3[a]	0.7±0.4[a]
Mushroom yield & BE			
1st flush (g)	141.7±7.0[b]	117.0±13.1[ab]	98.7± 14.3[a]
2nd flush (g)	104.7±5.5[a]	118.0±20.7[a]	93.7±14.3[a]
Total yield (g)	246.3±3.5[b]	235.0±22.9[b]	192.3±28.6[a]
BE (%)	81.3±1.2[a]	68.3±6.8[a]	65.4±9.7[a]

PS: Paddy straw; RB: Rice bran; SS: *Saccharum spontaneum* L.
The results are the mean ± standard deviation (SD). Means in a row with same letter are not significantly different (p≥0.05).

3. Results

The type of substrate had varying effects on the duration of spawn running, pinhead formation, appearance of the first flush, the interval between two flushes, and the total cropping period. Complete spawn running and pinhead formation occurred earlier on both PS and PS+RB, but they were significantly delayed on PS+SS. The time taken from primordial formation to the first flush was statistically similar for all substrates. The interval between the first and second flush of fruiting bodies, as well as the cropping period, was the shortest on PS, followed by PS+RB, but relatively longer on PS+SS (Table 1).

The type of substrate did not significantly affect various attributes of the fruiting bodies, except for the number of fruiting bodies formed on the bags and their stipe diameter. Significantly more fruit bodies appeared on PS than on PS+RB and PS+SS; however, their average weight was similar on each substrate. Stipes were significantly thicker on PS than on PS+RB and PS+SS, but pileus size and stipe length did not vary significantly (Table 1).

The type of substrates influenced the total mushroom yield but not the biological efficiency (Table 1). Mushroom yield in the first flush was significantly higher on PS (141.7g) but comparable to PS+RB (117g). Yield in the first flush on PS+SS was comparatively lower (98.7g). Mushroom yield in the second flush was statistically similar on all substrates, ranging between 93.7g and 118.0g. The total yield of mushrooms in the two flushes was statistically similar on PS (246.3g) and PS+RB (235g) but significantly higher than on PS+SS (192.3g). However, in terms of biological efficiency (percent mushroom yield per unit dry weight of the substrate), all the substrates were found to be equally promising (p>0.05; Table 1).

4. Discussion

The various types of substrates used for oyster mushroom cultivation displayed variations in the duration from spawn running to cropping period, yield, and biological efficiency (BE). The initial phase in mushroom cultivation is the mycelial growth (vegetative phase), which establishes appropriate interior conditions for the initiation of fruiting. Therefore, excellent growth of mushroom mycelia is a crucial feature in mushroom cultivation (Pokhrel et al., 2009). In this study, complete spawn run of *P. eous* occurred on PS in 9.3 days. Senthilraja (2014) reported a minimum duration of 8 days for *P. eous* on this substrate, consistent with our study. Furthermore, our findings regarding pinhead formation and maturation time of fruiting bodies on PS and PS+RB are in agreement with similar findings made by Kortei and Wiafe-Kwagyan (2014) and Wiafe-kwagyan et al. (2016). It It has been reported that a substrate with a high amount of polymers, cellulose, and lignin contents requires a longer time for pinning and maturation of fruiting bodies (Oei, 2003), which might be the reason for the longer period spawn running, pinhead formation, and maturation of fruiting bodies on PS+SS. Kortei and Wiafe-Kwagyan (2014) reported 29–51 numbers of fruiting bodies of *P. eous* on various substrates, which aligns with our results. However, Wiafe-Kwagyan et al. (2016) found a larger number of fruiting bodies (36 – 60) of *P. eous* on different substrates. Siddhant et al. (2013b) reported wei a fruiting body weight of *P. eous* in the range of 3.35–6.84g on wheat straw, similar to the present study. Telang et al. (2010) also reported the weight of the fruiting body of *P. eous* in the range of 3.80–5.98g. Fresh weight of mushroom per bag (g/kg) ranging from 101.6–213.2g in *P. eous* has been recorded by Mandaviya et al. (2018). In this study, the highest mushroom yield was recorded on PS and PS+RB followed PS+SS but these substrates were equal in terms of their BE. The high yield of mushrooms on these substrates might be due to their higher nutrient content as well as lingnocellulosic structure.

5. Conclusion

In conclusion, this study demonstrated that PS, PS+SS, and PS+RB are potential substrates for the cultivation of P. eous in outdoor conditions in Arunachal Pradesh.

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Author's contribution

Tenya Rina designed and supervised the experiment, as well as edited the manuscript. Titel Megu conducted the experiment, analyzed the data, and prepared the manuscript. Litnya Tangjang assisted in conducting the experiment and in manuscript preparation.

Conflict of interest

Authors have no conflict of interest.

References

Biswas MK and Biswas SB. 2015. Recycling of lignocellulosic waste materials through oyster mushroom cultivation for sustainable food production. The Ecoscan 93(4):655-659.

Eswaran A and Ramabadran R. 2000. Studies on some physiological, cultural and postharvest aspects of oyster mushroom, *Pleurotuseous* (Berk.) sacc. Tropical Agricultural Research 12:360-374.

Kortei NK and Wiafe-Kwagyan M. 2014. Evaluating the effect of gamma radiation on eight different agro-lignocellulose waste materials for the production of oyster mushrooms (*Pleurotus eous* (Berk.) Sacc. strain P-31). Croatian Journal of Food Technology, Biotechnology and Nutrition 9:83-90.

Mandaviya TK, Brahmbhatt AB and Chaudhari RI. 2018. Comparative study on growth and yield performance of pink oyster mushroom on different substrates. International Journal of Current Microbiology and Applied Sciences 7:1981–1985.

Mandeel Q, Al-Laith A and Mohamed S. 2005. Cultivation of oyster mushrooms (*Pleurotus* spp.) on various lignocellulosic wastes. World Journal of Microbiology and Biotechnology 4:601-607.

Mondal SR, Rehana MJ, Noman MS and Adhikary SK. 2010.Comparative study on growth and yield performance of oyster mushroom (*Pleurotus florida*) on different substrates. Journal of Bangladesh Agricultural University 8(2):213–220.

Pokhrel CP, Yadav RKP and Ohga S. 2009. Effects of physical factors and synthetic media on mycelial growth of *Lyophyllum decastes*. Journal of Ecobiotechnology 1: 46-50.

Poppe J. 2004. Agricultural wastes as substrate for oyster mushroom. In: *Mushroom Growers Handbook*. 1(5):75-85.

Rina T. 2012. Studies on the cultivation of oyster mushroom (*Pleurotus* spp.) in Arunachal Pradesh on various ligno-cellulosic agro-forest wastes. PhD Thesis submitted to Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh (unpublished).

Royse DJ. 2014. A global perspective on the high five: *Agaricus*, *Pleurotus*, *Lentinula*, *Auricularia* and *Flammulina*. In: *Proceedings of the 8th International Conference on Mushroom Biology and Mushroom Products*. pp. 19-22.

Senthilraja K. 2014. Cultivation of *Pleurotus eous* on Paddy straw supplemented with press mud fibre. Research Journal of Agricultural Science 5(1): 23-26.

Sharma S, Yadav RKP and Pokhrel CP. 2013. Growth and yield of oyster mushroom (*P. ostreatus*) on different substrates. Journal on New Biological Reports 2(1):3-8.

Siddhant O, Yadav S and Singh CS. 2013a. Conversion of crop waste in to pink oyster mushroom *Pleurtus eous*. Trends in Biosciences 6(4):418-420.

Siddhant O, Yadav S, Ahmad A and Singh CS. 2013b. Effect of wheat straw components on the yield of *Pleurotus eous*. International Journal of Current Microbiology and Applied Sciences 2(8):221-225.

Telang SM, Path SS and Baig MMV. 2010. Comparative study on yield and nutritional aspect of *Pleurotus eous* mushroom cultivated on different substrate. Food Science Research Journal 1(2):60-63.

Tsujiyama S and Ueno H. 2013. Performance of wood-rotting fungi-based enzymes on enzymatic saccharification of rice straw. Journal of the Science of Food and Agriculture 93:2841-2848.

Wiafe-Kwagyan M, Obodai M, Odamtten GT and Kortei NK. 2016. The potential use of rice waste lignocellulose and its amendments as substrate for the cultivation of *Pleurotus eous strain* P-31 in Ghana. International Journal of Advances in Pharmacy, Biology and Chemistry 5(2):116–130.