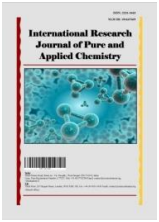

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Suitability of Oyster Mushroom Species for Cultivation in the Southern Zone of Andhra Pradesh

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Authors' contributions

This work was carried out in collaboration among all authors. Author NKK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors KV and CS managed the analyses of the study. Author ASK managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The 3 oyster mushroom species namely *Pleurotus florida, P. eous*, and *Hypsizygus ulmarius* were evaluated for their biological efficiency (BE) and net returns from the rupee invested (NRRI) in late kharif and rabi seasons. The BE and NRRI of *P. florida* and *H. ulmarius* were on par and significantly superior to *P. eous* in both the seasons. The present study provided corroboration for the suitability of *P. florida* and *H. ulmarius* cultivation in the late kharif and rabi seasons whereas, *P. eous* cultivation in the summer and early kharif seasons. Thus, the season-specific selection of oyster mushroom species promotes the concept of year-round mushroom cultivation.

Keywords: Kharif; mushroom; Pleurotus florida; southern zone; species; temperature.

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1. INTRODUCTION

The mushroom industry in India witnessed a 4 fold increase in production within the span of 5 years with a production of 0.2 million MT in 2019-20 [1]. Amidst the cultivated mushrooms *Agaricus bisporus* occupies a major share of 73%. This is followed by *Pleurotus* spp (16%), *Volvariella* spp (7%), *Calocybe indica* (3%) [2]. Andhra Pradesh contributes to about 3% of the total mushroom production of India. The southern zone of Andhra Pradesh comprises Nellore, Chittoor, parts of Prakasam, Anantapur, and Cuddapah districts, where the area under paddy cultivation is being increased gradually. This ensued the increased availability of paddy straw, the suitable substrate for cultivation of *Pleurotus* spp [3]. The locally available paddy straw can potentially be converted into fresh mushrooms for improving the economy of the farmers.

Species of *Pleurotus* were highly valued for their ability to convert the lignocellulosic substrates into high-quality food with a nutraceutical nature with minimal requirements [4,5,6]. The presence of a maximum number of cultivated species is the advantage for year-round cultivation of *Pleurotus* spp [7]. The production of *Pleurotus* species is often limited despite the presence of maximum cultivated species, ease of cultivation, the requirement of fewer inputs, suitable agro-climatic conditions, and substrate availability [8]. Mushroom productivity depends upon the available climatic conditions, for instance *P.eous*, and *C. indica* were found to be suitable for cultivation in summer during the months of (march to june) whereas *P. florida* was suitable for cultivation in monsoon (july to november) and winter seasons (december to february) [9,10]. From this, it is perspicuous that the prevailing climatic conditions decides the biological efficiency (BE). Suitability of the specific *Pleurotus* spp to the locally available climatic conditions needs to be delineated for facilitating the year-round species-specific cultivation of oyster mushrooms. The present study was conducted to identify the suitability of white oyster mushroom (*P. florida*), pink oyster mushroom (*P. eous*), and grey oyster mushroom (*H. ulmarius*) for cultivation in the southern zone of Andhra Pradesh.

2. MATERIALS AND METHODS

The present study was conducted during late kharif (2019), and rabi (2019-20) seasons at Regional Agricultural Research Station, Tirupati.

2.1 Preparation of Spawn

Mother spawns of *P. florida*, *P. eous* and *H. ulmarius* were obtained from the mushroom research laboratory, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore, India. Subsequently, bed spawn was prepared by using the sorghum grains. The grains were boiled in a water bath for 15 min and mixed with calcium sulphate (2% w/w) and calcium carbonate (4% w/w). The grains of 300 g was filled in polythene bags of 40-micron thickness with 1000 g capacity. The bags were autoclaved at 15 psi for 30 min; then cooled to room temperature. The sterilized grains were inoculated with the grains of the mother spawn; incubated at 28± 2°C for 20 d. The fully covered grains with the white mycelium is used for the preparation of mushroom beds.

2.2 Cultivation of Mushroom Species

Cultivation of P. florida, P.eous and H. ulmarius was carried out by following the method suggested by Bano and Srivastava [3] with little modifications. The well dried paddy straw was chopped into pieces of 2-3 cm length and was soaked in the water overnight. Later, the excess water was drained off and the slightly wet substrate was sterilized at 121°C for 30 min; and cooled to room temperature. The substrate was inoculated with spawn @ 30 g kg^{-1}. The small holes were made in the spawned beds and were placed initially in the darkroom at 28±2°C and 70±5% relative humidity for 15 d. The fully covered beds were transferred to the cropping room where the temperature of 24±2°C and relative humidity of above 90% was maintained. The cropping room was watered twice a day; watering was avoided a day before the harvest of fresh mushrooms. The 3 flushes of mushrooms were collected at the stage wherein the margins of the caps start to flatten. After harvesting of each flush, the substrate around the harvested portion is scraped. The weight of each flush was recorded. After the third harvest from all the beds, the yield data was piled up and used for calculating the BE by using the following formula, BE (%) = (weight of the fresh harvested mushrooms / dry weight of the substrate) x 100. The costs incurred during the cultivation and the returns obtained from the yield was accumulated and used to calculate the net returns from the rupee invested (NRRI). The colour change in the pileus was visually recorded.

2.3 Statistical Analysis

The data were analyzed in complete randomized design (CRD), using univariate- one way ANOVA analysis. Significant data were subjected to post hoc using Tukey's HSD test. Analysis of the statistical data was carried out using SPSS statistical software version 20.0 (IBM, 2012).

3. RESULTS AND DISCUSSION

The yield attributes of the mushrooms depend upon the climatic requirements; and the similar trend exists between different species of oyster mushroom. In the current study 3 *Pleurotus* spp (*P. florida*, *P.eous* and *H. ulmarius*) were evaluated for their BE and NRRI in late kharif and rabi seasons and recorded significant variation among the species. Wherein the BE and NRRI of *P. florida* (66.6%, 1.6 and 85%, 2.4) and *H. ulmarius* (62.2%, 1.3 and 83%, 2.2) were on par with each other (Table 1). However, *P.eous* exhibited the minimum BE (31.2%, 70.4%) and NRRI (0.6, 1.8) in both seasons, respectively. Margins of the *P. florida* and *P.eous* were inrolled initially and lobed at later stages of growth, whereas, the margins of *H. ulmarius* were inrolled initially and focused upside irregularly at the later stages of growth. The colour of the pileus varied with the species; white colour in case of *P. florida*; initially grey and later white coloured in case of *H. ulmarius*; initially pink and later trans formed to light pink colour in case of *P.eous* (Fig. 1).

The results indicated the superior yield performance of *P. florida* (35.4% and 14.6%) and *H. ulmarius* (31% and 12.6%) than *P.eous*, respectively in both late kharif and rabi seasons. The growth of *P. florida* and *H. ulmarius* might be facilitated by the lower temperatures encountered during the cropping in both the seasons. Whereas, the minimum BE of the *P.eous* might be due to its adaptability to high temperatures, which is not encountered during the cropping cycle [9,10]. In a similar study, Myronycheva et al. [8] screened 12 strains of *P. ostreatus* and 6 strains of *P. pulmonarius* and identified the suitability of 5 strains of *P. ostreatus* (2251, 2292, 2316, 2319, and 2320) and 1 strain of *P. pulmonarius* (2314) to the climatic conditions of Ukraine. They also identified the requirement of higher temperature (30°C) for the growth and fructification of 2287 and 2317 strains of *P. ostreatus* and 2314 strain of *P. pulmonarius*. In a different study, the growth requirements of 4 strains of *Pleurotus sp* namely PL 1, PL 3, PL 4, and PL 5 were evaluated and recorded that PL 1, PL 3, and PL 4 strains preferred to grow at 30°C while PL 5 strain preferred to grow at 20°C [11]. Despite the more number of thin fruiting bodies production by *P.eous*, the weight of the fruiting bodies was very low compared to *P. florida* and *H. ulmarius*. Henceforth, it is perspicuous that the growth and fructification of the oyster mushroom species depend upon the climatic conditions.

Table 1. Performance of oyster mushroom species

S.No.	Species	Late Kharif		Rabi	
		Biological efficiency (%)	NRRI	Biological efficiency (%)	NRRI
1	*Pleurotus florida*	66.6[a] (55.3)	1.6[a]	85.0[a] (67.8)	2.4[a]
2	*Pleurotus eous*	31.2[b] (31.7)	0.6[b]	70.4[b] (57.4)	1.8[b]
3	*Hypsizygus ulmarius*	62.2[a] (52.4)	1.3[a]	83.0[a] (66.2)	2.2[a]
CD (0.05)		13.1	0.4	7.5	0.3
CV		25.1	29.3	11.3	13.3

Values are the means of 10 replications. The treatments were compared at p ≤ 0.01 i.e. results with p- value less than 0.01 were considered significant following post hoc testing

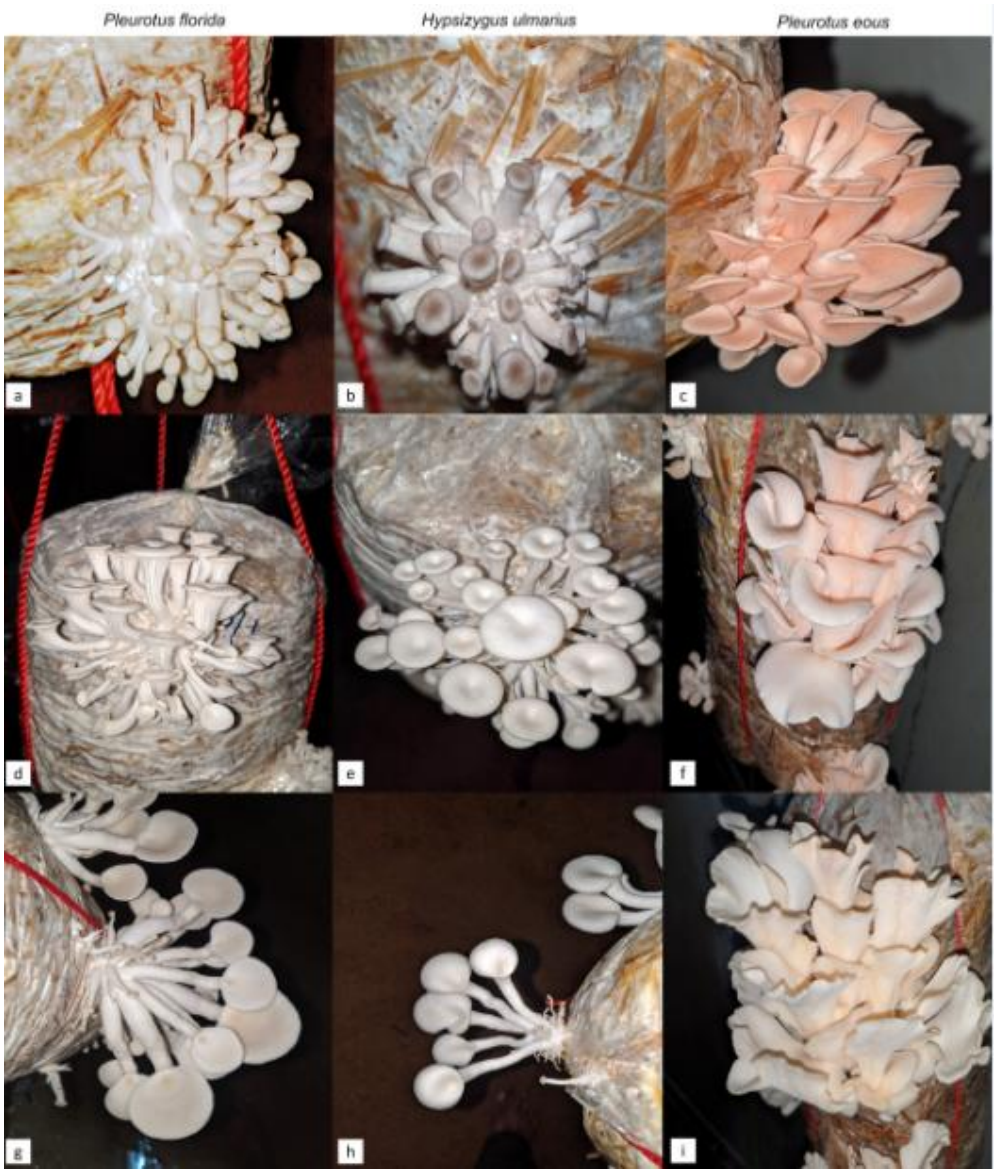

Fig. 1. Growth stages of white oyster mushroom, *P. florida* (a, d, g), grey oyster mushroom, *H. ulmarius* (b, e, h) and pink oyster mushroom, *P. eous* (c, f, i). Grey and pink coloured pin head stages of *H. ulmarius* and *P. eous* (b and c)

4. CONCLUSION

The present study corroborated the suitability of *P. florida* and *H. ulmarius* cultivation in late kharif and rabi seasons; *P. eous* in the summer and early kharif season, thereby fulfilling the concept of year-round cultivation of mushrooms.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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