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Influence of Spawn Density, Number of Holes on the Polybags and Epidemiological Factors on Sporophore Production of *Hypsizygus Ulmarius*

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ABSTRACT

Studies were conducted to assess the effect of spawn density, no of holes on the polybags and the epidemiological factors on the production of Hypsizygus ulmarius. Among the different spawn densities viz., 5,10,15,20,25 & 30 %. spawn density at 20 per cent level completely colonized the beds within 17.6 days and the same treatment recorded comparatively lesser number of days for pin head formation (3.6 days). The polybag beds provided with ten holes at random recorded minimum spawn run (17.2) days, minimum days for pin head formation (4.2), maximum sporophore yield (491 g/bed) and biological efficiency (98.2%). A temp. level of 28℃ and a RH of 80 per cent was found to be conducive for the growth and sporophore yield of H. ulmarius.

1. Introduction

Hypsizygus ulmarius commonly known as “elm or blue oyster”, is similar to oyster mushroom, but differ in morphology and biological efficiency. Oyster mushroom is the second largest cultivated mushroom around the world accounting for twenty seven per cent of world production and its cultivation has increased rapidly during last decade (Oloke and Adebayo, 2015). They are rich in protein, minerals, carbohydrates, unsaturated fatty acids, phenolic compounds, tocopherols, ascorbic acid and carotenoids (Reis *et al*., 2011). Many studies revealed that mushrooms possess biopharmaceutical compounds that can be used for therapeutic applications. They have antifungal, antibacterial, antiviral, anti-inflammatory, antitumor, hepato-protective, anti-diabetic, and hypotensive properties (Nandakumar, 2013).

In India, owing to varied agro –climatic zones and large quantity of farm waste, different types of temperate, tropical and sub-tropical mushrooms are cultivated throughout the country all through the years. With ever increasing demand for quality food, mushroom cultivation is now emerging as an important activity in different parts of our country (Ambili and Nithya, 2014).

The environmental factor is very important for the production of oyster mushrooms. The major environmental factors like temp. humidity, fresh air and compact materials affect in mushroom production (Shah, 2004). Growers have sought, in the past, to optimize the amount of spawn used to inoculate their substrate. Increasing the amount of spawn used (up to 5per cent of the wet weight of the substrate) has resulted in increased yields (Royse, 2002). Increasing spawn rates from 1.25 to 5 per cent may result in increases of nearly 50 per cent. With this background, this research has been carried out to identify the most suitable spawn density and the most favorable environmental factor for the cultivation of *Hypsizygus ulmarius* mushrooms

2. Materials and Methods

Source and maintenance of culture

The pure culture of *H. ulmarius* Co(OM)$_2$ was obtained from National Research Centre for Mushroom (NRCM), Solan, Himachal Pradesh. Subcultures were made periodically and maintained on potato dextrose agar (PDA) slants at 25 ± 2°C of temp. for further investigations.

Bed preparation

Cultivation of *H. ulmarius* was carried out in transparent polythene bags of 60 × 30 cm size with a thickness of 100 gauge and cylindrical beds were prepared using 0.5 kg of paddy straw on dry weight basis following layer spawning method as described by Sivaprakasm (1980) with below mentioned modification. The unchopped whole straw was made into coils and used. A layer of coiled paddy straw was placed at the bottom of polythene bag, over this a twenty g of spawn was sprinkled. In this manner five layers of coiled paddy straw and four layers of spawn were kept in the polythene bag and then bag was tied at the top (modified cylindrical bed method). Ten holes of one cm diameter were made at random in the polythene bags. The mushroom beds were hung from the ceiling by means of ropes (‘uri ‘ method). After spawn running stage, The beds were kept in cropping room, were the temp. was maintained at 23 to 28°C and relative humidity at 80 to 90 per cent. Water was sprinkled regularly as in the standard cylindrical bed preparation method. The following yield parameters were observed in all the experiments

Effect of spawn density on the sporophore yield of *H. ulmarius*

The effect of spawn density on the yield of *H. ulmarius* was studied. The paddy grain spawn was prepared and mixed in 0.5 kg substrate on dry weight basis @ 5, 10, 15, 20, 25 and 30 per cent levels as per layer spawning method (Sivaprakasam, 1980). Standard cultivation practices were followed and the data on yield attributes *viz*., spawn run days, pinhead formation, number of sporophores, sporophore weight, yield and biological efficiency were recorded

Effect of no. of holes on the polybags on the yield of *H. ulmarius*

The beds were prepared as in polybag method and varying no. of holes *viz*., 2, 4, 6, 8, 10 and 12 were punched in the polybag beds to assess their effect on the yield of *H. ulmarius*. Bags without holes served as control and the beds were incubated at 28 ± 2°C for spawn running and cropping.

Effect of temp. on the yield of *H. ulmarius*

The beds were prepared as in polybag method and the beds were incubated at six different temp. levels *viz.,* 22ºC, 24ºC, 26ºC, 28ºC, 30ºC and 32ºC. Room heaters were used inside the cropping rooms to maintain the above temp. levels. A relative humidity of around 80 to 95 per cent was maintained in the growing rooms. The parameters namely spawn run days, pinhead formation, sporophores weight, yield and biological efficiency were assessed and recorded.

Effect of relative humidity on the yield of *H. ulmarius*

Six different humidity levels *viz*. 65, 70, 75, 80, 85, 90, and 95 per cent were tested. An aerosol disinfector was used for maintaining different relative humidity levels inside the humidity chambers specially fabricated for the trial. A temp. of around 28°C was maintained inside the mushroom house. The various yield parameters *viz*., spawn run days, pinhead formation, sporophore weight, sporophore yield and biological efficiency were observed and recorded periodically.

3. Results and Discussion

Effect of spawn density on the various yield components of *H. ulmarius*

Data pertaining to the influence of spawn density on the yield parameters of *H. ulmarius* is indicated in table 1 and it reveals that the spawn density at 20 per cent level completely colonized the beds within 17.6 days and also recorded the least number of days for pin head formation followed by 25 and 15 per cent, However, an increase in the spawn density beyond 20 per cent level recorded no significant increase in the yield. The spawn density @ five per cent levels recorded the minimum yield with a biological efficiency of 59.9 per cent.

The fastest mycelial growth observed with 20 per cent level of spawn density could be due to rapid colonization of the substrate, which minimized chances of contamination by the competitors and thus attributed to higher yields. Many workers have reported beneficial effect of increased rate of spawning (Kathiravan *et al*., 2014). However, in the present study, it was also observed that the increase in the spawn density beyond 20 per cent resulted in insignificant increase in the yield. This might be due to the reason that the higher spawn density may have resulted in increased temp., higher CO_2 conc. and decreased the oxygen conc. of the substrate (Kannan, 2011).

Growers have sought, in the past, to optimize the amount of spawn used to inoculate their substrate. Increasing the amount of spawn used (up to 5per cent of the wet weight of the substrate) has resulted in increased yields (Royse, 2002). Increasing spawn rates from 1.25 to 5 per cent may result in increases of nearly 50 per cent. Yield increases may be due to several factors. First, the increased level of nutrient available in higher levels of spawn used would provide more energy for mycelial growth and development. Second, more inoculum points, available from increased spawn levels, would provide faster substrate colonization and, thus, more rapid completion of the production cycle. Finally, a more rapid spawn run would reduce the time of exposure of non-colonized substrate to competitors such as weed molds and bacteria

Effect of number of holes in the polybags on the yield of *H. ulmarius*

The data depicted in table 2 revealed that provision of holes in the polythene bags showed positive effects in enhancing the yield parameters when compared to control (without holes). Among the treatments, the poly bags provided with ten holes at random recorded the minimum spawn run days, minimum days for pin head formation, day of the first harvest and the maximum yield of mushrooms and biological efficiency (17.2 days, 4.2 days, 25.4 days, 491.0 g bed^{-1} and 98.2%) respectively. An increase in the number of holes beyond ten resulted in reduction in the sporophore yield. The days taken for spawn run and pinhead formation were the maximum in poly bags provided with no holes (23.6 and 7.9 days, respectively). A yield of 226.4 g bed^{-1} and biological efficiency of 45.3 per cent was recorded in control.

The number of holes in the poly bag beds had a profound influence on various yield parameters. The formation of sporophore has been observed to be directly related to the composition of air present inside the beds (Zadrasil, 1978). Kaul (1987) emphasized the requirement of optimum levels of CO_2 for the initiation of fruiting bodies. An increase in the holes beyond ten would have resulted in the beds failing to maintain adequate temp. and loss of moisture levels, due to excess evaporation there by exposing the fungus to moisture stress which recorded a reduction in the sporophore yield parameters.

Beds with less number of holes generally recorded poor growth. This might be due to lack of aeration and excessive accumulation of CO_2 (Eswaran, 1998). Thus, it can be concluded that, provision of adequate number of holes in the polythene bags is a must to maintain optimum aeration, moisture and temp. levels to facilitate enhancement in the sporophore yield.

Effect of different temperature on the yield of *H. ulmarius*

The mushroom beds incubated at different temp. showed significant variations in the sporophore yield and biological efficiency (Table 3). Among the different levels of temp. the maximum biological efficiency (97.8%) was obtained at 26°C. The number of days taken for spawn run (17.3 days) pinhead formation (3.5 days) and sporophore weight (24.6 g) were also found to be minimum at this temp. A substantial decline in the yield of mushroom was noticed at 32°C.

Jatav *et al*. (2014) recorded higher production of cellulose, polymethyl galacturonase, pectin transeliminase and polygalacturonase at 26 ± 1°C. Garraway and Evans (1984) reported that at optimum temp. the increased enzyme and metabolic activities were the reason for the enhanced mycelial growth of the fungus. In the present study also, the increase in the mycelial growth and maximum yield obtained at 26ºC might be due to the increased enzyme and metabolic activity of the fungus.

Effect of different levels of relative humidity on the yield of *H. ulmarius*

From the results presented in table 4, it was found that a relative humidity of 80 per cent was optimum for the maximum growth of *H. ulmarius* recording a yield of 486.5 g bed^{-1} followed by 85 and 75 per cent RH recording a yield of 472.2 g and 458.7 g bed^{-1}, respectively in the decreasing order of merit. At 80 per cent RH the number of days taken for spawn run, pinhead formation and the average weight of a sporophore was found to be 17.5 days, 3.5 days and 24.6 g bed^{-1}, respectively. The least yield parameters were recorded with the RH level of 65 per cent.

Generally, oyster mushrooms require high humidity (80-90%) and a temp. between 25-30°C for the maximum vegetative growth and a lower temp. of 18-25°C. for formation of fruiting bodies (Onyango *et al.,* 2011). Accordingly, Bano and Rajarathnam (1982) reported a RH of 70-90 per cent as optimum for the production of *P. sajor-caju*. Also, Uddin (2011) observed that 70-80 per cent RH was optimum for the primordial initiation, maximum number of fruiting bodies and the highest biological efficiency of *Pleurotus* sp.

References

1. Ambili, S. and Nithya, T. P. (2014). Oyster mushroom culti-vation- A study in Palakkad district, Kerela. *Interna-tional Journal of Management and Social Science Re-search Review.,* 1: 104-105
2. Bano, Z. and Rajarathram S. 1982. Studies on the cultivation of *P. sajor-caju. The Mush. J.,* **115:** 243-245
3. Eswaran, A., Usharani, S. and Ramanujam, K. 1998. Suitability of straw of different paddy varieties and new method of mushroom bed preparation for cultivation of the oyster mushroom, *Pleurotus eous. Mush. Res.,* **7(2):** 77-78.
4. Garraway, O.M. and Evans. 1984. *Fungal Nutrition and Physiology,* John Wiley and Sons, New York. pp. 117.
5. Jatav, R.S., Gupta, A.K. and Anil Doshi. 2014. Effect of different temperature and growth stage of blue oyster mushroom on the activity of enzymes. *Mush. Res.,* **23(1):** 47-51.
6. Kannan, C. 2011. Evaluation of medicinal value of *Lentinus edodes* (Berk.) *Ph.D. Thesis,* Annamalai University, India.
7. Kathiravan, S., Krishnakumari. S. and Nagalakshmi. M. 2014. Spawn production and cultivation strategies for *Pleurotus eous* (pink oyster mushroom). *World J. Pharm. Pharmaceu. Sci.,* **3(10):** 915- 924.
8. Kaul. 1987. Biological conversion of paddy straw into feed. *Biol. Wastes,* **22:** 11-21.
9. Nandakumar, T. 2013. KAU to promote new varieties of mushroom. *The Hindu***,** 13Sep.2013. Available: http://www.thehindu.com/news/national/kerala/kau-to-promote-new-varieties-of-mushroom/article5138857.ece [12 March 2016].
10. Oloke, J.K. and Adebayo, E.A. 2015. Effectiveness of immunotherapies from oyster mushroom in the immunocompromised patients. *Asian J. Med.,* **4:** 78.
11. Onyango, B.O., Palapala, V.A., Arama, P.F., Wagai, S.O. and Gichumu, B.M. 2011. Sustainability of selected supplemented substratesfor cultivation of Kenyan native wood ear mushrooms. *Am. J. Food. Technol.,* **6:** 395-403.
12. Reis, F., Baros, L., Martins, A. and Ferreria, I. 2011. Chemical composition and nutritional value of the most widely appreciated cultivated mushrooms. *Food Chemi.,* **128:** 674- 678.
13. Royse, D.J. 2002. Vacuum soaking of wood chip shiitake *Lentinula edodes* logs to reduce soak time and stimulate mushroom yield. http://www.mushworld.com/tech/view.asp?cata_id=1120&vid=5136
14. Shah, Z.A., Ashraf, M. and Ishtiaq, C.H.M. 2004. Comparative study on cultivation and yield on performance of oyster mushrooms (*Pleurotus ostreatus*) on different substrates (wheat straw leaves and saw dust). *Experientia*. **25:** 1237-1238.
15. Sivaprakasam, K. 1980. Studies on oyster mushroom *Pleurotus sajor-caju* (Fr.) Singer. *Ph.D. Thesis*, Tamil Nadu Agricultural University, India.
16. Uddin, M.N., Yesmin, S.Y., Khan, M.A., Tania, M., Moonmoon, M. and Ahmed, S. 2011. Production of oyster mushrooms in different seasonal conditions of Bangladesh. *J. Sci. Res.,* **3(1):** 161-167.
17. Zadrazil, F. 1978. The Oyster mushroom-importance and prospectus. *Mush. Res.,* **1:** 25-32.

Tables

Table 1. Effect of spawn density on the various yield components of *H. ulmarius*

Tr. No.	Spawn density (g bed^{-1})	Spawn run (days)	Pin head formation (days)	Sporophore number bed^{-1}	Sporophore (wt)	Yield (g bed^{-1})	Biological efficiency (%)
1	5	22.9^{e}	6.1^{d}	86.2^{e}	21.2^{d}	284.7^{d}	59.9
2	10	20.4^{d}	5.2^{c}	94.6^{d}	21.7^{d}	378.3^{c}	75.7
3	15	19.3^{c}	4.5^{b}	104.7^{c}	22.4^{c}	465.1^{b}	93.0
4	20	17.6^{a}	3.6^{a}	116.4^{a}	24.1^{a}	487.7^{a}	97.5
5	25	18.2^{b}	3.8^{a}	110.3^{b}	23.8^{b}	487.9^{a}	97.6
6	30	18.4^{b}	3.7^{a}	108.1^{b}	23.5^{b}	485.8^{a}	97.2

Values not sharing a common superscript differ significantly at $P < 0.05$ (DMRT)

Table 2. Effect of number of holes on the polybags on the sporophore yield of *H. ulmarius*

Tr. No	Number of holes on polybags	Spawn run (days)	Pinhead formation (days)	Days for 1st harvest	Sporophore (wt)	Yield (g bed^{-1})	Biological efficiency (%)
1	0	23.6^{e}	7.9^{f}	32.9^{f}	21.8^{d}	226.4^{f}	45.3
2	2	22.1^{d}	5.6^{e}	31.4^{e}	19.9^{e}	274.3^{e}	54.86
3	4	19.8^{c}	5.0^{d}	29.3^{d}	22.8^{c}	318.5^{d}	63.7
4	6	18.4^{b}	4.5^{b}	27.8^{c}	23.2^{c}	406.3^{c}	81.3
5	8	17.7^{a}	4.8^{c}	26.3^{b}	24.4^{b}	478.4^{b}	95.7
6	10	17.2^{a}	4.2^{a}	25.4^{a}	25.1^{a}	491.0^{a}	98.2
7	12	17.4^{a}	4.1^{a}	26.0^{b}	24.3^{b}	483.9^{b}	96.8

Values not sharing a common superscript differ significantly at $P < 0.05$ (DMRT)

Table 3. Effect of different temperature on the sporophore yield of *H. ulmarius*

Tr. No.	Temperature (°C)	Spawn run (days)	Pinhead formation (Days)	Sporophore weight (g)	Yield (g bed^{-1})	Biological efficiency (%)
1	22	19.4^{c}	4.3^{b}	21.3^{d}	336.4^{e}	67.2
2	24	19.2^{c}	4.1^{b}	22.8^{b}	368.1^{d}	73.6
3	26	17.3^{a}	3.5^{a}	24.6^{a}	489.3^{a}	97.8
4	28	17.6^{a}	3.7^{a}	24.1^{a}	470.8^{b}	94.1
5	30	18.7^{b}	4.8^{c}	23.2^{c}	463.4^{c}	92.7
6	32	22.6^{d}	6.8^{d}	15.6^{e}	328.7^{f}	65.7

Values not sharing a common superscript differ significantly at $P < 0.05$ (DMRT)

Table 4. Effect of different levels of relative humidity on the sporophore yield of *H. ulmarius*

Tr. No.	Relative humidity (%)	Spawn run (days)	Pinhead formation (days)	Sporophore (wt)	Yield (g /bed)	Biological efficiency (%)
1	65	22.9^{d}	6.8^{c}	17.6^{e}	264.7^{f}	52.9
2	70	20.4^{c}	5.1^{c}	21.8^{c}	392.9^{d}	78.6
3	75	18.9^{b}	4.9^{b}	23.0^{b}	458.7^{c}	91.7
4	80	17.5^{a}	3.5^{a}	24.6^{a}	486.5^{a}	97.3
5	85	17.9^{a}	3.8^{b}	23.3^{b}	472.2^{b}	94.4
6	90	18.7^{b}	4.3^{b}	23.4^{b}	451.6^{c}	90.3
7	95	22.3^{d}	5.8^{d}	20.5^{d}	318.4^{e}	63.9

Values not sharing a common superscript differ significantly at $P < 0.05$ (DMRT)