

Production of Oyster Mushrooms in Different Seasonal Conditions of Bangladesh

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Received 21 September 2010, accepted in revised form 22 October 2010

Abstract

Oyster mushrooms (*Pleurotus* spp.) are widely cultivated all over the world. Its production is remarkably affected by the environmental conditions like temperature and relative humidity. In this study, we investigated the production of four species of oyster mushroom: *Pleurotus ostreatus*, *P. florida*, *P. sajor-caju* and *P. high king* cultivated in every season (January to December) in Bangladesh. The temperature (in °C) and relative humidity (% RH) of culture house in each month, and parameters of mushroom production were recorded. In all of the selected species of this study, the minimum days required for primordial initiation, and the maximum number of fruiting bodies, biological yield and biological efficiency were found during December to February (14-27 °C, 70-80% RH). The production was found minimum during the cultivated time August to October. We suggest cultivation of selected *Pleurotus* spp. in winter (temperature zone 14-27 °C with relative humidity 70-80%) for better production and biological efficiency.

Keywords: *Pleurotus* mushroom; Different seasonal conditions; Growth and yield; Biological efficiency.

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doi:10.3329/jsr.v3i1.6130

J. Sci. Res. 3 (1), 161-167 (2011)

1. Introduction

Mushrooms are being recognized as important food items from ancient times. Their usage is being increased day by day for their significant role in human health, nutrition and disease. Mushrooms of *Pleurotus* spp. are commonly known as oyster mushrooms which occupy the second position among cultivated edible mushrooms worldwide due to their nutritional and medicinal values [1]. The environmental factor is very important for the production of oyster mushrooms. Various mushrooms are known to be sensitive to the climatic conditions [2]. The major environmental factors like temperature, humidity, fresh air and compact materials affect in mushroom production [3-5].

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Pleurotus spp. grows in wide range of temperature (15-30 °C) which also varies from species to species [6]. Bano and Rajarathnam [7] observed maximum yield of oyster mushroom (*Pleurotus sajor-caju*) during rainy seasons, when the temperature was nearly 20-26 °C and relative humidity 70-90%. A fairly good yield can be obtained up to 30 °C. Production of *P. fossulatus* prefers 20±1 °C but *P. eous* prefers 21-35 °C and humidity of 65 to 100% [8]. Maximum growth of *P. ostreatus* was recorded at 25 °C by Rangad and Jandaik [9], whereas *P. florida* gave the highest yield at 30 °C. *P. flabellatus* also have a similar temperature requirement [10, 11]. Kong [12] reported that *P. ostreatus*, *P. florida*, *P. sajor-caju* reach their optimum growth at 25 °C, while *P. cornucopiae* and *P. cystidiosus* reach their optimum growth at 25-35 °C temperature.

In Bangladesh, oyster mushrooms are most popular and four different species of this mushroom like *Pleurotus ostreatus*, *P. florida*, *P. sajor-caju* and *P. high king* are commercially cultivated all over the year by using sawdust and/or rice straw as main substrate [13]. But the productions of these mushrooms are not economically beneficial in every season. The environmental variation is supposed to be the main cause behind this problem. But the performances of these species of oyster mushroom have not yet properly been investigated in the climatic conditions of different seasons. Therefore the present study was undertaken to identify the specific season or cultivation time for the four specific species of oyster mushroom.

2. Materials and Methods

The experiment was conducted at the National Mushroom Development and Extension Centre, Sobhanbag, Savar, Dhaka during January to December, 2009. Four selected species of oyster mushroom such as, *Pleurotus ostreatus*, *P. florida*, *P. sajor-caju* and *P. high king* were cultivated in the culture house of the centre.

2.1. Spawn packet preparation and inoculation of mother culture

The substrate of oyster mushroom was prepared by using sawdust and wheat bran at the ratio of 2:1. Calcium carbonate was added at 0.2% of the substrate mixture and the moisture was adjusted at 65% by adding water. The mixture was filled into heat tolerant polythene bags (500 g/ packet) of 7" × 10" size and their mouth were plugged by inserting water absorbing cotton and covered with brown paper and tied with a placing rubber band. Then bags were autoclaved at 121 °C and 15 PSI for 1 hour and then allowed to cool. Spawn packets were inoculated separately with the mother culture of selected species of oyster mushroom at the rate of two teaspoonfuls per packet. Packets were then incubated for mycelium running and mushroom cultivation in the incubation room at 25 °C.

2.2. Experimental conditions

After 30 days of inoculation, when mycelium running was completed, the spawn packets were transferred to culture house and opened by D-shaped (1" × 2") cut on the shoulder of the spawn packets. Temperature and relative humidity of culture house and the outside places throughout the year is given in Table 1.

Table 1. Temperature and relative humidity of culture house and outside during oyster mushroom cultivation throughout the year.

	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Temp. (^o C) of culture house	14-25	14-25	22-30	22-33	23-33	24-30	23-30	25-30	25-30	24-30	20-28	16-27
RH (%) of culture house	72-80	70-80	70-78	71-78	72-79	80-88	75-88	90-95	85-90	80-90	65-70	70-80
Outside temp. (^o C)	16-28	20-32	23-34	24-33	26-32	26-32	26-31	26-31	26-31	24-31	20-29	14-26
Outside RH (%)	50-58	47-51	42-48	50-60	68-76	77-81	75-85	76-80	75-81	70-74	65-67	60-66

RH: Relative humidity.

2.3. Harvesting

Mushroom was harvested before the fruiting body showed any splitting on the edges. The yield of mushrooms and their different quality parameters: days required to first primordial initiation (DPI), number of effective fruiting bodies (NFB) and biological yield were recorded regularly. Biological efficiency (BE) was determined by the following formula:

$$BE = (\text{wt. of fresh mushroom fruiting bodies}) \times 100 / \text{wt. of dry substrate}$$

3. Results

The DPI in four species ranged from 5 to 8 days (Fig. 1). The lowest time (5 days) was required for DPI of *P. ostreatus* and *P. high king* in January which was followed by *P. sajor-caju* (5.5 days) in December. The maximum DPI (8 days) was recorded for *P. ostreatus* in April, May and August; for *P. florida* in March to May, August and November; for *P. sajor-caju* in March, July and August; for *P. high king* in March, September and October.

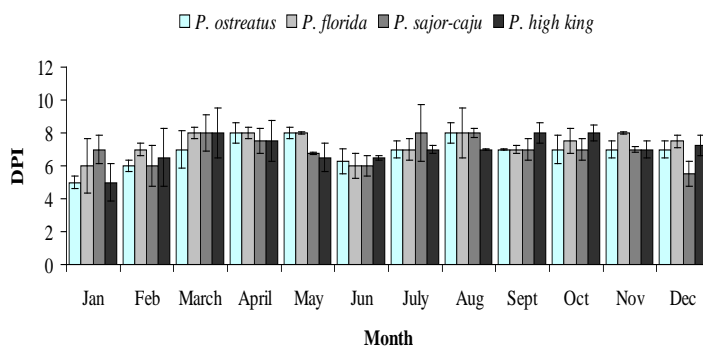


Fig. 1. Days required to first primordial initiation (DPI) of selected *Pleurotus* spp. in different month of the year. Values are mean \pm SEM of 10 replicate.

Fig. 2 shows that NFB of selected species in different months of the year, ranging from 6.0 to 44.0. The highest NFB (44.0) was produced in *P. ostreatus* in December followed by *P. florida* in January and the lowest NFB was produced in *P. ostreatus* in September (6.0) and *P. high king* in August (6.0) which was almost similar to *P. sajor-caju* in October (6.25). In all of the selected species of this study, the maximum NFB was found in December to March, moderate NFB in April to July and minimum NFB was found in August to November.

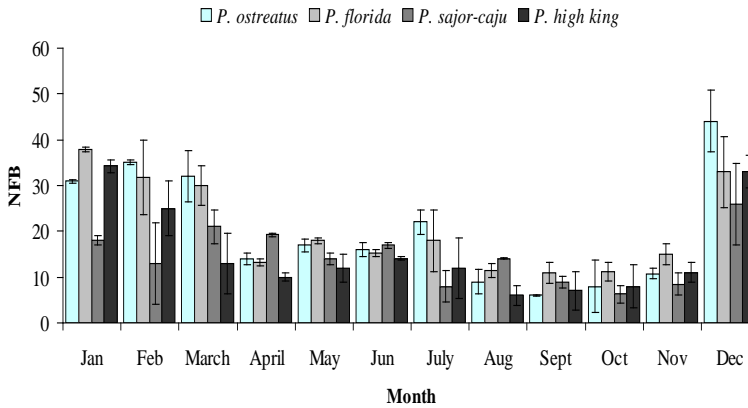


Fig. 2. Number of effective fruiting bodies (NFB) of selected *Pleurotus* spp. in different month of the year. Values are mean±SEM of 10 replicate.

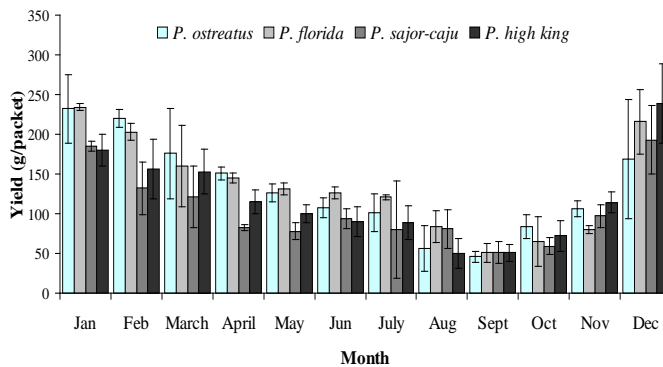


Fig. 3. Biological yield of selected *Pleurotus* spp. in different month of the year. Values are mean±SEM of 10 replicate.

The biological yield of four selected species of oyster mushroom throughout the year is shown in Fig. 3. The yield ranged from 46.0 to 239.0 g/packet, with the maximum yield in *P. high king* in December and minimum yield in *P. ostreatus* in September. In case of *P. ostreatus*, maximum yield (232.0 g/packet) was found in January and minimum yield (46.0 g/packet) in September. Similar result was observed in *P. florida* with maximum

yield in January (234.0 g/packet) and minimum yield in (51.0 g/packet) in September. In *P. sajor-caju*, the maximum yield (193.0 g/packet) was observed in December and minimum yield (51.0 g/ packet) in September. In *P. high king*, the maximum yield (239.0 g/packet) was observed in December and minimum yield (50.0 g/packet) in August.

Fig. 4 shows the pattern of change of BE throughout the year. The BE of selected species in different month of the year ranged from 23.0 to 119.5 %. The highest BE (119.5 %) was recorded to *P. high king* in December and the lowest (23.0 %) to *P. ostreatus* in September which was followed by *P. high king* in August. In case of all species, BE maintained the similar trends of biological yield. From figure 3 and 4, it is clear that the BE and production of oyster mushroom reach in peaks which are cultivated in December, January and February. From March to July, the production and BE were found to be decrease and moderate. From August to October, the production and BE were in minimum level. From November, the production again increased.

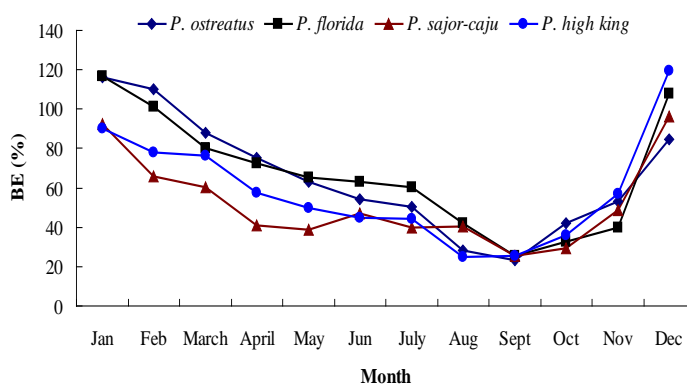


Fig. 4. Change of biological efficiency (BE) of selected *Pleurotus* spp. through different month of the year.

4. Discussions

In this study, we have found that the lowest time for DPI was recorded in January for all of the selected varieties when the average temperature and relative humidity of culture house were respectively, 14-25 °C and 72-80%. Kong [12] reported that 10-25 °C temperature required for primordial formation of selected *Pleurotus* species. Our result is also similar to Viziteu [14], who reported that the required temperature is 18-25 °C for primordial formation of oyster mushroom.

According to Das *et al.* [15, 16], variations in season seriously affected the number, weight and crop production period of mushroom. They reported that favorable temperature and moisture condition enhanced the production of fruiting bodies of mushroom. The highest number of effective fruiting body was produced in December to February for selected *Pleurotus* species. During this time the average temperature and

relative humidity of culture house were respectively, 14-27 °C and 70-80%. Kong [12] also recommended 10-25 °C temperature for fruit body development of selected mushroom species. Tripathi [17] reported that 16-22 °C for *P. ostreatus* and 10-26 °C for *P. florida* and *P. sajor caju* were suitable for fruit body development.

Maximum yields of the selected four species were recorded from December to February when the average temperature and relative humidity of culture house were 14-25 °C and 72-80%, respectively. Kong [12] reported that *P. florida* and *P. sajor-caju* produce best yield at 15-25 °C temperature. Upadhyay *et al.* [18] found maximum yield of *P. membranaceus* in October to January. The mild winter temperature was probably more conducive for the growth of *Pleurotus* mushrooms [19]. In this study, minimum yields of the selected four species were recorded in August to October when the average temperature and relative humidity of culture house were 24-30 °C and 80-95% respectively. During this period fungal infection and insect infestation were more, that is why it is supposed that production rate were reduced. Upadhyay *et al.* [18] also reported the minimum yield of *P. membranaceus* in June to September. Tripathi [17] suggested that *P. ostreatus* and *P. florida* give very poor yields during summer season. In our study, we have found the maximum biological efficiency of *P. ostreatus* and *P. florida* in January and of *P. sajor-caju* and *P. high king*, in December. According to Annual Progress Report of Indira Gandhi Krishi Vishwavidyalaya, Raipur [20], *Pleurotus* spp. are produced considerably higher in yield in December.

Based on the result of current study, it could be concluded that the environmental conditions of Bangladesh during winter months (December to February) are more suitable while August to October are unfavorable for the cultivation of oyster mushroom. We suggest cultivation of *Pleurotus* spp. in the temperature zone 14-27 °C with relative humidity 70-80%. If country's environmental condition is not suitable to provide this temperature and relative humidity, mushroom should be cultivated in controlled condition.

Acknowledgements

This study was supported by the Strengthening Mushroom Development Project of the Ministry of Agriculture, Peoples Republic of Bangladesh.

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