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Studies on influence of supplements on biological efficiency of five *Pleurotus* spp. in East and South Eastern coastal plains of Odisha

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*Pleurotus*genus is one of most extensively studied white-rot fungi due to its exceptional ligninolytic properties. It is an edible mushroom. In the investigation on the effect of different organic additives on mushroom yield, six additives were evaluated against the unadded check. Significant variation was observed among the supplements in respect of weight of sporophores of five oyster species. Boiled wheat was found superior for *P. eous* (777.50 g) and *P. sajor-caju* (CTMRT strain), whereas wheat bran significantly improved the yields of *P. florida* (883.33 g). Rice bran was superior in improving the yields of *P. citrinopileatus* (684.16 g) and *P. ostreatus* (698.16 g). Substantial yield increase was observed in organic supplement incorporation with the exception of mustard cake and poultry manure having shown least/no improvement over the control. Accordingly, biological efficiency improved appreciably in wheat bran, rice bran, boiled wheat and maize powder (52.58-78.72 %) in comparison to control (50.95-58.95 %).

Key words: Biological efficiency, organic supplements, *Pleurotus*, yield

INTRODUCTION

Oyster mushroom is an edible mushroom of the tropics and sub-tropics. Mushrooms are delicacy food items praised for their characteristic texture when biting and enjoyable flavour. Edible mushroom as a boon to human health and nutrition has been documented by Barman *et al*. (2018). In India, Odisha is one of the leading states in terms of oyster mushroom production. Mild winter coupled with humid coastal agro-ecological situation with abundance of manpower and agricultural waste has made it most suitable for cultivation of oyster mushroom.The nutritional supplementation of cultivation substrate is an important cultural practice of mushroom cultivation (Ayodele and Okhuoya, 2007). Most of the growth, yield and quality parameters varied when mushroom was cultivated with different levels of supplements (Mahbuba *et al*.2010).

The substrate supplementation is a practice used in producing *Pleurotus* spp. in order to increase its productivity (Roy *et al*, 2015a). Inclusion of additives to mushroom substrate is very important especially for substrates having low protein content to enhance the growth and yield of mushrooms (Assan and Mpofu, 2014).Potential of macrofungi in waste management, human health and social upliftment has been documented by Thakur and Singh (2020). Therefore, the present study has been undertaken with the objectives to study on influence of supplement on biological efficiency of five *Pleurotus*species.

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MATERIALS AND METHODS

Test fungus

Different studies were undertaken during the course of investigation by taking five species of oyster mushroom fungus, such as *P.eous, P.florida, P. sajor-caju* (CTMRT strain), *P. citrinopileatus and P. fossulatus*. The test fungi were procured from the Centre for Tropical Mushroom Research and Training (CTMRT), Department of Plant Pathology, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar.

Maintenance of culture

The pure cultures of the fungi were maintained on Potato Dextrose Agar (PDA) slants throughout the period of investigation. The fungus was sub cultured at an interval of two months and stored at 25 ± 1°C. Fifteen days old pure mycelial cultures of the test fungi were used in various studies.

Cultivation of Pleurotus

Material used in bag preparation

Straw from improved or tall indica varieties of rice was preferred for preparation of bag and growth of oyster fruiting body. Well dried, hand threshed and not more than one year old rice straw was taken. The straw bundles were stored in protected condition in order to avoid wetting. The straw was chopped to a size of 1.5 – 2.0 inch with the help of chaff cutter. For preparation of a single bag, 1.5 kg of dry chopped straw was required.

The farm house

All the experiments were conducted in the farm house of Centre for Tropical Mushroom Research and Training, Department of Plant Pathology, College of Agriculture, OUAT, Bhubaneswar and Krishi Vigyan Kendra, Kendrapara.

The farm house structure was as follows: Length - 50 ft, Breadth-20 ft, Roof – Asbestos, Floor - Cemented, Windows - Wider, covered with fine wire net.

Light and air

To regulate the light and air in the farm house of CTMRT and KVK, the wide windows were covered with gunny bags which were opened in east-west direction so that light in the morning and evening percolates through the open windows. Further, the farm house was well ventilated.

Humidity

To maintain proper humidity, the gunny bags screened were soaked with water during cultivation. Moreover, aerial spraying of water was done and the sand put on the floor was also kept moist besides watering the substrate.

Temperature

Mycelial growth of all the *Pleurotus* spp. can take place between 20-30°C. However, for fruiting, different species have different temperature requirements. Therefore, all the experiments were conducted during the period from November, 2010 to February, 2011.

Construction of raised platforms/shelves

Rack consisting of three shelves at 2.5 feet apart was raised in the incubation room for mycelia growth of the test fungi. Fully colonized bags were hanged in bamboo sticks in three tiers in the farm house for fruit body induction.

Preparation of substrate

A single bag (80 cm x 40 cm) needed three bundles of paddy straw which weighed approximately 1500 g. The hand threshed, uncrumpled straw devoid of leafy materials was preferred. The straw was chopped into 1.5-2.0 inch size through a chaff cutter, packed in gunny bags and was soaked in water containing 125 ml of formalin and 7.5 g of bavistin per 90 litres of water for a period of 6 hours. Straw was pressed and covered with a polythene sheet. The straw was taken out and excess water was drained by spreading the straw on a cemented floor. Prior to raising bags, the moisture content of substrate was maintained at 65% which was confirmed through palm test.

Spawning of the substrate

Freshly prepared grain spawn (20-30 days old) was procured for spawning. The spawning was done in pre-fumigated room (48 h with 2% formalin). The spawn requirement was 10% of the dry weight of the substrate (150 g spawn per bag having 1.5 kg of dry substrate). The spawn was removed from the bottle with a cleaned and sterilized iron rod and divided into four parts. Likewise, 200 g of boiled wheat used as supplement during spawning was divided into four parts. Each part of spawn as well as the supplement were put inside the polythene bag of 80 cm x 40 cm size on each layer of substrate having 5-6 inch thickness close to the edge. Four layers of substrate were seeded along with supplement and the upper edge of the bag was tied up, 10-15 small holes (0.5-1.0 cm) were made on all sides of the bag including 2-4 holes in the bottom to leach out excess water and to facilitate gas exchange.

Crop production

Incubation

Spawned bags were kept on shelves in the

incubation room for mycelia colonisation of the substrate. During mycelia growth bags were not opened and no ventilation was needed. Moreover water was not spread in the room, as there was no need of maintaining high relative humidity. Daily maximum and minimum temperature of incubation room was recorded.

Fruit body induction

Once the mycelium fully colonized the substrate and formed thick mycelia mat, the bags were removed from the incubation room and made naked and arranged on wooden shelves with a minimum distance 15-20 cm between two beds in tiers in the cropping room. Appropriate light (200 lux or 12 h per day), temperature (20-30^{0}C) and relative humidity (70-80%) were maintained to facilitate fruiting. The bags were sprayed with water twice daily during morning and afternoon hours to maintain moisture status of the substrate.

Fruiting and harvesting

Three to four days after opening of bags, mushroom primordia (fruit bodies) started to appear. Fruiting bodies were harvested in about three days after their appearance. Harvesting was done by grasping the stalk and gently pulling or twisting the mushroom from the substrate level. Mushroom fruiting continued after harvesting of first flush at an interval of 7-10 days up to 3-4 flushes covering a crop period of 45-60 days.

Yield

The yield of *Pleurotus* spp. varied widely depending upon the productivity of the species concerned, environmental conditions and the aftercare.

RESULTS AND DISCUSSION

Keeping this in view,the experiment was designed to evaluate a number of organic additives such as wheat bran, rice bran, boiled wheat, maize powder, mustard cake and poultry manure for their role in improving mushroom productivity over the untreated check (control). Growth of different *Pleurotus* species on various substrates have been shown in Fig.1.The nitrogen contents in most of the substrates range between 0.5-0.8 % and hence, addition of organic nitrogen in the substrate helps in obtaining higher yields. Some of the common supplements in use are wheat bran, rice bran, cotton seed meal, soybean cake, groundnut cake, boiled wheat grain, chicken manure, maize powder etc. They are used at 5-10 % on dry weight basis of the substrate for yield improvement in oyster mushroom. In the investigation on the effect of different organic additives on mushroom yield, six additives were evaluated against the unadded check. Significant variation was observed among the supplements in respect of weight of sporophores of five oyster species. Boiled wheat was found superior for *P. eous* (777.50 g) and *P. sajor-caju* (CTMRT strain), whereas wheat bran significantly improved the yields of *P. florida* (883.33 g). Rice bran was superior in improving the yields of *P. citrinopileatus* (684.16 g) and *P. ostreatus* (698.16 g). Substantial yield increase was observed in organic supplement incorporation with the exception of mustard cake and poultry manure having shown least/no improvement over the control. Accordingly, biological efficiency improved appreciably in wheat bran, rice bran, boiled wheat and maize powder (52.58-78.72 %) in comparison to control (50.95-58.95 %) (Table1).

Table1. Influence of supplement on biological efficiency of five *Pleurotus* spp.

Treatment (supplement)	*P. eous*	*P. sajor-caju*	*P. florida*	*P. citrinopileatus*	*P. ostreatus*
Wheat bran	66.31	76.46	88.33	56.33	63.42
Rice bran	70.86	61.81	62.00	68.42	69.82
Boiled wheat	77.75	78.41	64.08	67.72	65.95
Maize powder	63.61	66.56	78.72	61.48	52.58
Mustard cake	52.95	54.43	40.78	47.45	68.38
Poultry manure	48.13	54.00	51.32	55.46	38.12
Control (no supplement)	50.95	61.58	61.28	57.58	58.95
CD (0.05)	4.76	3.97	4.80	3.73	4.71
CV (%)	6.42	5.21	6.29	5.28	6.68

Various workers have evaluated diverse groups of supplements for yield promotion of *Pleurotus.*It is indicated that rice bran at 5 % level was the appropriate supplement for growth of *Pleurotus*.

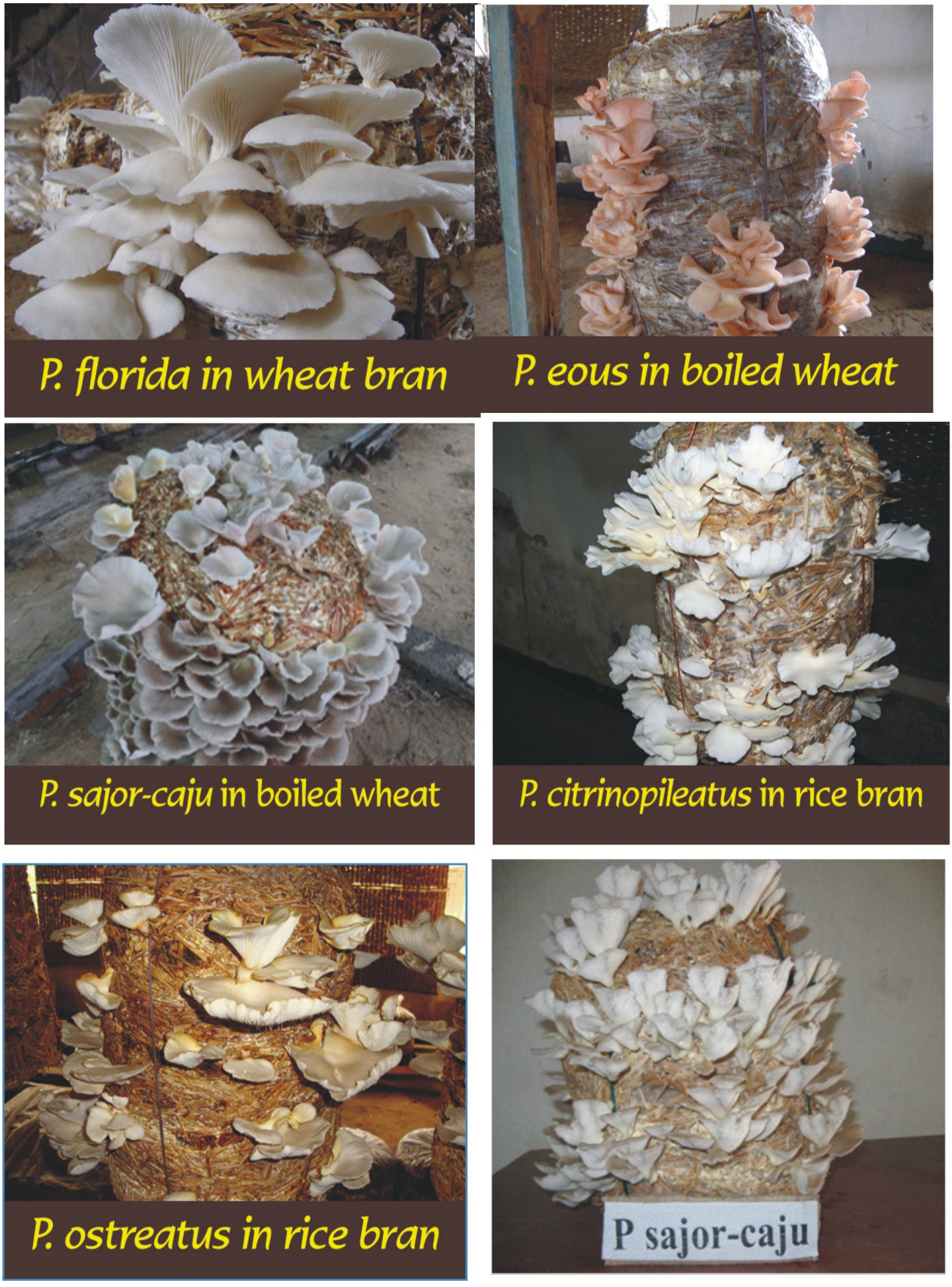

Fig. 1 : Fruit bodies of different species of *Pleurotus* growing on various substrates

On the other hand, when wheat bran and poultry manure were used as supplements, yields obtained were lower than that of rice bran.

However, *P. florida* performed well with supplements in combination of rice bran and soybean powder. Oilseed cakes, dried leaves, starch have also been evaluated. However, better yield increment over control (3.20-43.43 %) obtained from supplements like wheat bran, rice bran, boiled wheat and maize powder could be a boon for the mushroom farmers in view of their wider availability at cheaper rates.

Cultivation of a new species of oyster mushroom (*Pleurotus djamor*) has been recorded (Roy *et al*, 2015b). Effect of pruned tea leaves on the yield and nutritional quality of two species of *Pleurotus* in North Bengal has also been demonstrated by Roy and Chakraborty (2018). Recently, nutritional value of edible mushroom have been reviewed by Chatterjee and Samajpati (2021).

CONCLUSION

The study on influence of supplements on yield of five *Pleurotus* species indicated that biological efficiency of five different species of oyster mushroom also varied significantly under the influence of six organic supplements. With the exception of mustard cake and poultry manure, biological efficiency improved appreciably in the four remaining supplements (52.58-78.72 %) in comparison to control (50.95-58.95 %).

REFERENCES

Ayodele, S.M., Okhuoya, J.A. 2007. Effect of substrate supplementation with wheat bran, NPK and urea on *Psathyrellaatroumbonata* Pegler on sporophore yield. *Afr. J.Biotechnol.***6**:1414-1417.

Assan, N., Mpofu ,T. 2014. The influence of substrate on mushroom productivity. *Scientific J. Crop Sci.* **3**:86-91.

Barman, S., Chakraborty, B.N., Chakraborty, U. 2018. Edible mushroom: Boon to human health and nutrition. *J. Mycopathol. Res*. **56**: 179-188.

Chatterjee, A., Samajpati, N. 2021. Nutritional value of edible mushroom. *J. Mycopathol. Res.* **59**: 357-362.

Mahbuba, M., Nasrat, J.S., Asaduzzaman, K., Nazim, U., Kamal, H., Mousumi, T., Saleh, A.2010. Effects of different levels of wheat bran, rice bran and maize powder supplementation with sawdust on the production of shiitake mushroom (*Lentinusedodes*). *Saudi J.Biologic. Sci.***18**: 323-324.

Roy, S., Barman, S., Chakraborty, U., Chakraborty, B.N. 2015a. Production of *Pleurotusostreatus* grown in different substrates and evaluation of spent substrate as organic manure for growth improvement of Capsicum Chinese Jacq. *J. Mycol. Plant Pathol.* **45**: 267-272.

Roy, S., Barman, S., Chakraborty, U., Chakraborty, B.N. 2015b. Cultivation of *Pleurotusdjamor* – a new species of oyster mushroom in North Bengal. *J. Mycopathol. Res*. **53**: 59-63.

Roy, S., Chakraborty, B.N. 2018. Effect of pruned tea leaves on the yield and nutritional quality of two species of *Pleurotus* in North Bengal. *J. Mycopathol. Res*. **55**: 341-345.

Thakur, M.P., Singh, H.K. 2020. Potential of macrofungi in waste management, human health and social upliftment: A review. *J. Mycopathol. Res*. **58**: 1-14.