PREVALENCE OF COMPETITOR MOULDS AND DISEASES IN STRAW MUSHROOM (*VOLVARIELLA VOLVACEA*) BEDS AND THEIR MANAGEMENT

NIRANJAN CHINARA* AND KB MOHAPATRA
AICRP- Mushroom, Orissa University of Agriculture and Technology, Bhubaneswar 751003, Odisha, India
niranjanchinara@gmail.com

ABSTRACT

Volvariella volvacea, commonly known as paddy straw mushroom, is the most popular and palatable mushroom in South-East Asian countries. It ranks sixth among the edible mushrooms accounting for 3% of the global production. Odisha is the leading state in terms of straw mushroom production in India. However, a number of competitor moulds infest the beds at different stages of crop growth and bring down the productivity substantially. Data from a comprehensive survey conducted in the leading mushroom growing districts of Khurda and Puri at 10 locations both in outdoor and indoor conditions revealed as many as eight competitor moulds contaminating the straw mushroom beds during the fruiting stage. *Coprinus* spp. was predominant of all in both outdoor and indoor farming situations. However, outdoor farming recorded more bed contamination (46.8%) compared to the indoor one (27%). Bacterial button rot disease was recorded to the tune of 9 and 13% in outdoor and indoor situations, respectively. Pre-soaking of the substrate with 2% calcium carbonate solution for six hours was significantly superior among the treatments in giving a fruit body yield of 1016.67 g/bed with a corresponding biological efficiency of 14.52%. Application of 2% neem leaf extract was next in order in respect of yield (946.67 g/bed) and biological efficiency (13.52%). Further, the intensity of *Coprinus* spp. was low in the above mentioned treatments as compared to the untreated control.

Keywords: straw mushroom, competitor moulds, diseases, management

INTRODUCTION

Paddy straw mushroom (*Volvariella volvacea*) has become the nutritional and economic main stay of the predominantly agrarian population of the state. At present the state is producing approximately 8000 tonnes of paddy straw mushroom annually contributing to 66% of the total mushroom production of the state [1]. It is largely cultivated outdoor, in open fields and in low cost thatched houses. In most of the cases, cultivation is done in non-pasteurized paddy straw with incorporation of wheat bran as the additive. Large number of competitor moulds namely *Coprinus* spp., *Aspergillus flavus, A.niger, Penicillium* spp., *Mucor* sp. and *Rhizopus oryzae* have been recorded in the beds because of non-pasteurization or improper pasteurization of the straw and raising of beds in non-congenial environmental conditions. Hence, the biological efficiency varies from 8-10%, which is unusually low even though factors like hot and humid coastal agro-ecological situation of Odisha, abundance of agricultural waste and manpower are most favourable for raising paddy straw mushroom crop. There is ample scope for improving yield standards through effective substrate management. In this context, an investigation has been planned for evaluating management practices of competitor moulds with physical, chemical and biological agents.

MATERIALS AND METHODS

An exhaustive survey was conducted in the leading mushroom growing districts of Khurda and Puri at 10 locations both in indoor and outdoor situations to observe and record the contamination of paddy straw mushroom beds with competitor moulds. A minimum number of 100 beds per location were observed for the contaminants and diseases. Per cent contamination of beds by moulds and incidence of diseases of all the locations were recorded. Samples having contaminant moulds and bacterial button rot were collected, pure cultured on appropriate nutrient medium, identified in the laboratory of the Department of Plant Pathology, OUAT, Bhubaneswar and preserved for further studies.

For effective management of competitor fungus like *Coprinus* spp. and bacterial bud rot pathogen, a trial was designed with 10 treatments including the untreated control with three replications for each treatment. Paddy straw mushroom beds of recommended size (1.5' x 1.5' x 1.5') were raised after soaking the straw in clean and cold water for six hours, followed

by draining off excess water. Beds were spawned at the rate of 3% of the dry weight of the substrate in three layers at 1:1:2 proportions. The beds were supplemented with wheat bran @ 200 g/bed. After raising beds, they were sprayed treatment wise with benomyl (0.2%), bleaching powder (0.02%), streptocycline (0.01%), benomyl (0.2%) + streptocycline (0.01%), benomyl (0.2%) + bleaching powder (0.02%) and 4% tamarind leaf extract. Besides, three treatments received pre-treatments namely, soaking of straw in solution of formalin and carbendazim (each 90 litres of water mixed with 125 ml of formalin and 7.5 g of bavistin), soaking of straw in 2% calcium carbonate powder and treatment of straw in boiled water at 70-80 ^{o}C for one hour. The untreated control received no specific treatment.

Observations on time taken (days) to pin head emergence, first harvest, number of sporophores/bed, average weight of sporophore, fresh weight of sporophores and incidence of competitor fungi/bacterial bud rot were recorded. Biological efficiency in respect of individual treatments was calculated.

RESULTS AND DISCUSSION

Data on survey conducted in the leading mushroom growing districts of Khurda and Puri at 10 locations both in outdoor and indoor situations revealed as many as eight competitor moulds contaminating the straw mushroom beds during the fruiting stage (Table 1). *Coprinus* spp. was predominant of all both in outdoor and indoor farming situations. However, outdoor farming recorded more bed contamination (46.8%) in comparison to the indoor one (27 %). The incidence of other contaminants namely, *Aspergillus* spp., *Mucor* sp., *Penicillium* sp., *Rhizopus* sp., *Sclerotium rolfsii* and *Trichoderma* sp. was in the range of 2 to 17.8% in both situations. Bacterial button rot was recorded to the tune of 13 and 9% in indoor and outdoor situations, respectively. It was observed that appearance of competitor moulds was more (14.17%) in outdoor farming in comparison to indoor one (10.98%). Mean per cent incidence of bed contamination of both the situations was recorded at 12.58% in the investigation. Prevalence of *Coprinus* spp., *S. rolfsii* and *Aspergillus* spp. in higher proportions in non-pasteurized paddy straw under conventional method of cultivation has been reported by many workers [2-5].

Table 1. Prevalence of competitor moulds and diseases in straw mushroom beds

Sl.No.	Competitor moulds/ disease	Per cent incidence (Indoor)	Per cent incidence (Outdoor)	Mean per cent incidence
1	*Aspergillus flavus*	6.00	11.00	8.50
2	*A. niger*	13.90	17.80	15.85
3	*Coprinus* sp.	27.00	46.80	36.90
4	*Mucor*sp.	2.90	2.00	2.45
5	*Penicillium* sp.	6.60	12.00	9.30
6	*Rhizopus* sp.	11.70	8.00	9.85
7	*Sclerotium rolfsii*	12.00	16.00	14.00
8	*Trichoderma* sp.	5.80	5.00	5.40
9	Bacterial button rot (*Pseudomonas* spp.)	13.00	9.00	11.00
	Mean	10.98	14.17	12.58

The data depicted in Table 2 revealed that pre-soaking of substrate with 2% calcium carbonate for six hours was superior among the treatments in giving a yield of 1016.67 g/bed with the corresponding biological efficiency of 14.52%, which was followed by treatment of the bed with 4% tamarind leaf extract and benomyl (0.2%) + streptocycline (0.01%) with yields of 946.67 g and 643.33 g/bed, respectively. Pre-soaking of substrate with formalin (37.5 ppm) and bavistin (500 ppm) for the same period was found inferior giving a yield of 650 g/bed in the investigation. Further, pre-treatment of substrate with

boiled water at 70-80 °C for one hour after six hours of soaking yielded only 790 g/bed with 11.28% biological efficiency. The difference in days to first harvest was found non-significant among the treatments. Beds without any treatment (control) gave a mean yield of 630 g/bed accounting 9% biological efficiency. Overall intensity of *Coprinus* was found to be low in all the treatments as compared to untreated control, which recorded high incidence in the trial.

Table 2. Effect of different physical, chemical and biological agents on the incidence of *Coprinus* and yield of *V. volvacea*

Sl. No.	Treatment	Days to emergence of pin head	Days to first harvest	No. of fruit bodies	Av. weight of fruit bodies (g)	Wt. of fruit bodies (g)	Biological efficiency (%)	Intensity of *Coprinus**	% yield increase over control
1	Control	8.0	13.00	33.33	20.33	630.00	9.00	+++	-
2	Benomyl (0.2%)	10.0	15.00	41.33	18.00	726.67	10.38	+	15.34
3	Bleaching powder (0.02%)	10.0	15.00	32.33	20.66	637.00	9.10	++	1.11
4	Streptocycline (0.01%)	8.0	13.00	33.00	25.00	820.00	11.71	++	30.15
5	Benomyl (0.2%) + Streptocycline (0.01%)	9.0	15.00	51.67	20.00	943.33	13.47	+	49.73
6	Benomyl (0.2%) + Bleaching powder (0.02%)	9.0	14.33	42.33	18.00	743.33	10.61	+	17.98
7	Calcium carbonate (2.0%)	9.0	13.66	40.67	25.00	1016.67	14.52	+	61.37
8	Formalin + Bavistin (125 ml of formalin and 7.5 g bavistin / 90 litres of water)	10.0	15.00	34.33	19.00	650.00	9.28	+	3.17
9	Boiled water	7.0	13.00	44.67	148.00	790.00	11.28	+	25.39
10	Tamarind leaf extract (4.0%)	8.0	14.00	37.00	22.33	646.67	15.32	+	50.26
	CD (0.05)	0.85	NS	3.92	3.06	56.64	-	-	-
	C.V. (%)	5.22	7.76	7.04	8.66	6.65	-	-	-

A number of harmful fungi are encountered in the beds during straw mushroom cultivation, as majority of the growers lack proper substrate processing and pasteurization facilities. Use of non-pasteurized substrate coupled with unhygienic conditions help in the perpetuation of various moulds, besides resulting in reduced level of production. At times, there is complete crop failure depending upon the stage of infection, quality of substrate and environmental conditions. The improvement of pH of the substrate through calcium carbonate supplementation could be the sole factor in suppression of *Coprinus* and consequently yield improvement. Application of anti-bacterial agents like bleaching powder (0.02%) and streptocycline (0.01%) had little role on yield improvement, which suggested that *Coprinus* infestation of beds was the most important reason for yield deterioration. Workers observed that alkaline pH helped in suppressing the growth of weed fungi including *Coprinus* [6]. Likewise, role of phytoextracts in suppressing weed fungi in mushroom beds has earlier been demonstrated by Rivera-Vargas and Hepporly [7]. Further, positive role of fungicides like carbendazim and benomyl has been observed by several researchers [7, 8].

CONCLUSION

Paddy straw mushroom (*V. volvacea*) largely grown as an outdoor crop in the hot and humid coastal agro-ecological situation is infested with number of competitor moulds during fruiting stage. *Coprinus* spp. is the most encountered one as recorded in both the situations. At time, it results in substantial crop yield loss or complete crop failure. Pre-soaking of the straw with calcium carbonate for a period of six hours proved to be useful in suppression of contaminating moulds as well as improvement of yield standards. Being a low cost technology, this could well be adopted by the resource poor mushroom growers of the state.

REFERENCES

[1] Thakur MP and Mohapatra KB. (2013). Tropical mushrooms: present status, constraints and success story. Proceedings of Indian Mushroom Conference, 16-17 April, 2013, PAU, Ludhiana. pp. 42-43.

[2] Pani BK and Patra AK. (1997). Utilization of some phytoextracts for the control of *Sclerotium rolfsii* during paddy straw mushroom (*Volvariella volvacea*) cultivation; a new approach. *Mushroom Research.* 6(1): 37-41.

[3] Ahlawat OP and Tewari RP. (2007). Cultivation technology of paddy straw mushroom (*Volvariella volvacea*). National Research Centre for Mushroom (ICAR), Chambaghat, Solan (HP), 36 p.

[4] Mohapatra KB *et al.* (2007). Management of competitor fungi in paddy straw mushroom. Proceedings of National Symposium on sustainable pest management for safer environment, 6-7 December, 2007, OUAT, Bhubaneswar, pp.122-123.

[5] Sahoo AK *et al.* (2012). Effect of substrate processing and bed dimension on production of straw mushroom (*V. volvacea*) following conventional method of cultivation. *Environment and Ecology.* 30 (4A): 1413-1415.

[6] Yee NT and Yung CH. (1980). Interaction between *Volvariella volvacea* and some weed fungi. *Transactions of British Mycological Society.* 75(3): 498-501.

[7] Rivera-Vargas LI and Hepperly PR. (1987). Fungicides to control fungal competitors in Chinese straw mushrooms. *Journal of Agriculture of the University of Puerto Rico.* 71(2): 165-176.

[8] Vijay B and Sohi HS. (1987). Cultivation of oyster mushroom, *Pleurotus sajor-caju* (Fr.) Singer on chemically sterilized wheat straw. *Mushroom Journal of Tropics.* 7: 67-75.