



ISSN (E): 2277- 7695

ISSN (P): 2349-8242

NAAS Rating: 5.23

TPI 2022; 11(2): 403-407

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[www.thepharmajournal.com](http://www.thepharmajournal.com)

Received: 16-11-2021

Accepted: 24-01-2022

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## Status of competitor moulds and diseases of white button mushroom (*Agaricus bisporus*) at different mushroom farm of Jammu

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### Abstract

An extensive survey conducted during 2019-20 and 2020-21 in major mushroom growing farm in districts Jammu, Samba and Udhampur of Jammu division was undertaken to record the status of the disease. The main diseases that occur in mushroom are dry bubble, wet bubble, green mould, and bacterial blotch mainly and the diseases caused by competitor moulds are, white plaster mould, brown plaster mould, false truffle etc. Survey conducted at different mushroom farms of Jammu division revealed maximum incidence of wet bubble disease whereas incidence of brown plaster mould was recorded second highest in Jammu and Samba districts while in case of Udhampur district, white plaster mould was observed second highest to the green mould. In case of mixed infections dry bubble along with green mould was observed higher in Samba and Udhampur. The higher disease incidence in district Jammu could probably be attributed the levels of sanitation adopted and the method of composting was not ideal and also the growers from district Jammu were not so progressive. The onset of pathogen-favourable environmental conditions relating to temperature and high relative humidity outside mushroom production houses seem to promote competitor moulds growth and proliferation in contaminated spent compost, casing materials of button mushroom.

**Keywords:** Mushroom, survey, competitor moulds, Jammu

### Introduction

Mushroom cultivation represents one of the commercially important microbial technologies for large scale recycling of agro wastes into highly nutritious food. Owing to large increase in human population resulting in scarcity of nutritious food, the mushrooms offer a good source of nutrition as they are rich in proteins, minerals, vitamins and antioxidants. Among commercially cultivated mushrooms, *Agaricus bisporus* popularly known as white button mushroom or European mushroom is extensively cultivated throughout the world. World mushroom production at present is estimated to be more than 6 million tonnes and is still increasing at a rate of 7 per cent per annum. Mushroom production in India started in the 1970 and with the development of technologies for environmental control and understanding of the cropping systems, mushroom production has risen considerably. The country's production in 2010 was 1.13 lakh metric tons, of which button mushroom accounted for 89% of the total production followed by oyster (6%), milky (1%) and others (4%). However, presently the total white button mushroom produced in India from both seasonal and high tech cultivation units is estimated at 94,676 metric tons and it contributes around seventy three percent of mushroom production in India (Sharma *et al.*, 2017) [17]. It is generally being cultivated under semi-scientific conditions with limited inputs. Hence, the commercial productivity is much less than that of other countries. The most important pathogens of *A. bisporus* are green moulds (*Trichoderma* sp.), *Papulaspora byssina*, *Coprinus* sp., *Rhizoctonia* sp., *Lecanicillium fungicola* etc. The number and composition of microorganisms which accompany mushroom cultivation depends on the healthiness of the compost, casing and *A. bisporus* spawns. (Amra *et al.*, 2008). *Papulaspora byssina* (Brown Plaster mould) is also reported to cause 90-92% yield loss in *A. bisporus*. This mould has also been reported to cause complete crop failure in oyster mushroom in Kasuali, HP (Anonymous, 2012) [1]. The aim of this study was selection of suitable casing materials using different agricultural wastes which can inhibit the enhanced growth and incidence of *Papulaspora byssina*.

## Materials and Methods

Survey of the competitor moulds associated with the cultivated white button mushrooms were collected from the mushroom growing areas *Agaricus bisporus* in three districts of Jammu province viz. Jammu, Samba and Udhampur during the cropping season 2019-20 to 2020-21. Samples from pasteurized and unpasteurized compost, casing material spent compost, cropping beds, platform soil and sporophores were collected individually and kept into paper bags or polythene bags and sealed tightly with rubber band, a tag containing relevant information like name of the farmer, date of sampling, locality are analyzed to record the incidence of diseases. Five representative mushroom farms were randomly selected in each district. For working out the disease incidence for each mushroom farm, the number of infected bags/ trays out of the total number of bags/ trays observed was recorded and the per cent disease incidence was calculated by the formula given by Fletcher *et al.* (1983) [5].

$$\text{Disease incidence} = \frac{\text{Number of infected trays/bags}}{\text{Total number of trays/bags}} \times 100$$

## Results

Survey was conducted at different mushroom farms of three districts viz., Jammu, Samba and Udhampur of Jammu division. Regular visits were made during the cropping period (September-March) for identification and assessment of diseases and insect pests associated with button mushroom (*Agaricus bisporus*) during 2019-20 and 2020-21.

### Status of competitor moulds and diseases of white button mushroom

A survey was conducted for two consecutive year's viz., 2019-20 and 2020-21 for the occurrence of button mushroom diseases viz., wet bubble, dry bubble, brown plaster mould, white plaster mould, false truffle and green mould in three districts of Jammu division. Data presented in Table 1 reveals that in Jammu district, 59 mushroom farms of five blocks i.e., Marh, R.S. Pura, Pouni chak, Mandal and Sarora were surveyed, out of which ten farms were observed in the Marh block, fourteen in R.S. Pura, eight farms each in Pouni Chak and Mandal, while nineteen farms were surveyed in Sarora block. In block Marh, incidence of dry bubble plus green mould was recorded to be the lowest i.e., two farms out of ten in the cropping season 2019-20, while none in the consecutive year. The occurrence of mixed infection of wet bubble with green mould was observed in the maximum farms i.e., six and five farms during 2019-20 and 2020-21, respectively. Out of the fourteen farms of R. S. Pura block, wet bubble was recorded to be the highest i.e. thirteen farms during the year 2019-20 while white plaster mould was highest during the year 2020-21 as it appeared in ten out of fourteen farms surveyed in R.S. Pura.

In the block Pouni Chak, incidence of brown plaster mould remained highest in seven and six farms respectively during 2019-20 and 2020-21, while dry mould + green mould was minimum i.e. 2 and 0 in 2019-20 and 2020-21 respectively. In the block Mandal eight farms were surveyed and during 2019-20, six farms were observed to have infected with white plaster mould while in 2020-21, all the eight farms observed were infected with dry bubble. Out of the nineteen farms surveyed in the block Sarora, the incidence of white plaster

mould was in fifteen farms during 2019-20 where as wet bubble was observed in seventeen farms during the year 2020-21.

Similar survey was conducted in the district Samba where 60 mushroom farms distributed across five blocks viz., Samba, Sumba, Patriyari, Nud and Ghagwal were surveyed. In block Samba incidence of wet bubble was reported to be in maximum number of farms i.e. six and ten during 2019-20 and 2020-21 while no farm was observed to have mixed infection of dry bubble with green mould during 2019-20 while one farm recorded mixed infection of dry bubble and green mould during 2020-21. In Sumba, white plaster mould was observed in thirteen farms during 2019-20, while during 2020-21 brown plaster mould was maximum with an occurrence in nineteen out of twenty farms surveyed. In Patriyari block, brown plaster mould was observed in five out of the ten blocks surveyed while during 2020-21, wet bubble was observed in five farms. In the block Nud, out of the seven farms surveyed dry bubble was observed to be in maximum farms (2 during 2019-20 and 4 during 2020-21) while incidence of wet bubble was on higher side i.e. 3 and 4 during 2019-20 and 2020-21 respectively. Overall, disease incidence was lower in Nud and Ghagwal blocks of Samba District.

Udhampur was the third district that was surveyed and a total of 38 mushroom farms were surveyed over the course of two years. The five blocks that were surveyed were, Chenani, Tikri, Dudu, Mantalai and Khoon. In the block Chenani, nine farms were surveyed and wet bubble was reported in eight farms during 2019-20 and in six farms during 2020-21 while white plaster mould was absent during both the years of study from this block. In block Tikri, wet bubble the most prominent disease as it was observed in seven farms during 2019-20 and during 2020-21, wet bubble was observed in five farms while false truffle was observed in none of the farms during 2019-20 while it was observed in two farms. In block Dudu, out of the six farms observed dry bubble, white plaster mould and brown plaster mould were observed in four farms each while during 2020-21, incidence of dry bubble, white plaster mould and brown plaster mould was observed in four, four and five farms respectively. In Mantalai, incidence of all the diseases was observed to be relatively low as compared to all other block in the district of Udhampur as during 2019-20 white plaster mould was observed in three farms while during 2020-21, maximum (4) numbers of farms were infected with brown plaster mould. In block Khoon during 2019-20, out of the nine farms surveyed, six were infected with white plaster mould during 2020-21, while during 2020-21, seven farms were observed to be infected with white plaster mould.

### Diseases of incidence of button mushroom in different mushroom farms

During the survey of two consecutive cropping seasons i.e., 2019-20 and 2020-21, 59 mushroom farms of various blocks of Jammu district were surveyed. Data presented in Table 2 reveal the percent incidence various diseases viz., wet bubble, dry bubble, brown plaster mould, white plaster mould, false truffle, green mould, wet bubble + green mould and dry mould + green mould. The mean disease incidence of various diseases varied between 23.72 to 66.10 per cent. The incidence of wet bubble was maximum (66.10%) in Jammu division, whereas, minimum incidence was recorded in case of false truffle (23.72%). The per cent disease incidence of green mould, dry bubble, brown plaster mould and white

plaster mould was 46.61, 36.44, 65.20 and 60.16 per cent while the mixed infection of wet bubble + green mould and dry bubble+ green mould disease was recorded to be 38.13 and 25.42, respectively.

In Samba district 60 mushroom farms were surveyed, which were distributed across five blocks. Data presented in Table 3 depicted that the mean disease incidence varied between 15.83 to 42.50 per cent. The incidence of wet bubble was recorded to be highest with a mean incidence of 42.50 per cent while false truffle was lowest with 15.83 per cent. The per cent disease incidence for green mould, dry bubble, brown plaster mould, white plaster mould, wet bubble+ green mould and dry bubble+ green mould disease was 25.83, 35.83, 38.33, 30.00, 19.16 and 25.00 respectively.

Data presented in Table 4 regarding survey of 38 mushroom farms of the district Udhampur revealed incidence of wet bubble, dry bubble, brown plaster mould, white plaster mould, false truffle, green mould, wet bubble + green mould and dry mould + green mould diseases to be varying between 17.10 per cent to 46.05 per cent. The incidence of wet bubble was maximum (46.05%), whereas, minimum incidence was recorded in case of false truffle (17.10%). The per cent disease incidence of green mould, dry bubble, brown plaster mould and white plaster mould was 23.68, 26.31, 28.94 and 34.21 per cent, while the mixed infection of wet bubble+ green mould and dry bubble + green mould disease was recorded to be 21.05 and 22.36 respectively.

## Discussion

During the survey of two consecutive cropping seasons *i.e.*, 2019-20 and 2020- 2021, mushroom farms of various blocks of Jammu district were surveyed and the results revealed the incidence of wet bubble, dry bubble, brown plaster mould, white plaster mould, false truffle, green mould, wet bubble + green mould and dry mould + green mould. The mean disease incidence varied between 23.72 to 66.10 per cent. The per cent disease incidence for green mould, dry bubble, brown plaster mould, white plaster mould, wet bubble+ green mould and dry bubble+ green mould disease was 25.83, 35.83, 38.33, 30.00 & 19.16 and 25.00 respectively. Amongst the three districts surveyed incidence of wet bubble remained highest. The incidence of 'Brown plaster mould' was second highest in both Jammu and Samba districts with a mean incidence of 65.20 and 38.33 per cent, while in case of Udhampur, white plaster mould was observed second highest to the green mould with a mean incidence of 34.21 per cent. The incidence of false truffle was lowest in all the three districts. This confirms the observations made by Sharma *et al.* (2000) [15] who found that yield loss of *Agaricus bisporus* due to incidence of wet bubble disease varied from 15.72-21.97 per cent and 65.2-80.13 per cent when the pathogen was inoculated at spawning and casing stage respectively. Bhat and Singh (2002) [3] conducted survey in North India during 2002 and reported 2.17 to 25.00% incidence of

*Verticillium fungicola* in button mushroom crop at Shimla and Chail. Thapa and Jandaik (1985) [20] recorded the incidence of dry bubble from 25-50% at Solan and Kasauli and up to 15% at Shimla and Chail in a survey conducted regularly during 1981-1983. Sharma (1997) [18] recorded the incidence of false truffle caused by *Diehliomyces micros pores* in *Agaricus bisporus* and *Agaricus bitorquis* crop during 1990-1992 that varied from 12 to 80 per cent in H.P U.P, Haryana and Punjab. Nielson (1932) [12] reported heavy losses due to false truffle in Denmark. Kligman (1944) [8] also recorded the contamination of mushroom beds with *Pseudobalsamia microspora* resulting in substantial yield losses in United States and Great Britain. Zaayan and Pol-Luiten (1977) emphasized that false truffle posed serious problems during mushroom cultivation. Stage of infection is important in determining the extent of crop losses and Fletcher (1987) [5] recorded that when crop is attacked during vegetative phase, the reduction in yield may be as high as 75 per cent. Sharma and Jandaik (1996) [14, 16] reported 66 to 80 per cent incidence of mushroom diseases from 1993-1966 resulting in 58-80 per cent yield loss. The losses caused by other moulds are also not uncommon. Mann (1947) [10] estimated 50-70 per cent losses in USA due to the presence of *Myceliophthora lutea*. Whereas Munjal and Seth (1974) [11] reported about 90-92 per cent damage on certain mushroom farm due the brown plaster mould (*Papulaspora byssina*). In our studies the per cent disease incidence of green mould, dry bubble, brown plaster mould and white plaster mould was 46.61, 36.44, 65.20 & 60.16 per cent, while the mixed infection of wet bubble+ green mould and dry bubble+ green mould disease was recorded to be 38.13 and 25.42 respectively. Similar observations have been made by Bhat and Singh (2000) [2] reported that yield loss by *Trichoderma* spp. ranging from 22.23-62.24% at different inoculum loads in compost and casing soil. During the survey of button mushroom from Northern India, Sharma and Vijay (1996) [14, 16] reported incidence of *Trichoderma* spp. up to 3-50% they also estimated yield loss by this fungus *i.e.* 12.5 to 80.08%. Lambert (1932) [9] later reported its occurrence on mushroom beds and recorded delayed yields in the presence of this mould. This disease has also been reported from India (Munjal and Seth, 1974) [11] causing 90-92% yield loss in *A. bisporus*. This mould has also been reported to cause complete crop failure in oyster mushroom in Kasauli, Himachal Pradesh (Dar and Seth, 1981) [4]. At present this fungus now is frequently found at almost all the mushroom farms in India and appearing usually during spawn run (Kaul *et al.*, 1978; Garcha *et al.*, 1986; Sharma, 1992) [7, 6]. This mould has invariably been isolated from different compost and casing samples collected from mushroom farms in Northern India and the incidence of the disease has been recorded from 5 to 90% (Sharma and Vijay 1996) [14, 16]. Dar and Seth (1981) [4] have reported complete crop failure in oyster mushrooms due to *Papulospora byssina*.

**Table 1:** Status of competitor moulds and diseases in button mushroom farms of Jammu division

District (No. of farms surveyed)	Location	Total No. of farms	Green mould				Dry bubble	Brown plaster mould	White plaster mould			False truffle		Wet bubble		Wet bubble + Green mould			Dry bubble + Green mould	
			2019-20	2020-21	2019-20	2020-21			2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21		2019-20
Jammu (59)	Year of observation						2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21
	Marh	10	2	3	5	2	4	6	0	3	0	6	5	3	6	5	2	0		
	R.S. Pura	14	3	2	9	0	10	9	8	10	3	5	13	7	0	2	5	2		
	Pouni Chak	8	4	3	2	5	7	6	4	4	2	0	6	5	5	0	2	0		
	Mandal	8	5	6	0	8	4	4	6	5	5	3	3	6	4	7	5	4		
Sarora	19	13	14	6	6	13	14	15	16	2	2	12	17	12	4	4	6			
Samba (60)	Samba	12	2	3	6	5	4	2	3	2	4	2	6	10	4	3	0	1		
	Sumba	20	8	5	10	9	7	19	13	11	0	4	10	9	6	5	2	2		
	Patriyari	10	3	4	4	1	5	2	3	1	0	1	2	5	2	0	1	4		
	Nud	7	0	2	2	4	2	2	0	1	3	0	1	1	1	2	3	0		
	Ghagwal	11	1	3	0	2	3	0	0	2	2	3	3	4	0	0	1	1		
Udhampur (38)	Chenani	9	3	5	0	2	0	2	0	0	1	0	8	6	2	2	3	5		
	Tikri	7	2	3	3	2	2	0	4	0	0	2	7	5	3	3	4	3		
	Dudu	6	1	2	4	5	4	3	4	5	2	0	1	3	2	2	2	0		
	Majalta	7	2	0	2	1	0	4	3	0	0	1	0	3	2	0	0	0		
	Khoon	9	0	0	0	1	6	1	3	7	4	3	2	2	0	0	0	0		

**Table 2:** Incidence of diseases in button mushroom farms of district Jammu

Disease(s)	2019-20		2020-21		Overall mean	
	No. of farms with disease occurrence	Incidence (%)	No. of farms with disease occurrence	Incidence (%)	No. of farms with disease occurrence	Incidence (%)
Green mould	27	45.76	28	47.45	27.5	46.61
Dry bubble	22	37.28	21	35.59	21.5	36.44
Brown plaster mould	38	64.44	39	66.10	38.5	65.20
White plaster mould	33	55.93	38	64.40	35.5	60.16
False truffle	12	20.33	16	27.11	14.0	23.72
Wet bubble	39	67.79	38	64.40	39	66.10
Wet bubble + Green mould	27	45.76	18	30.50	22.5	38.13
Dry bubble + Green mould	18	30.50	12	20.33	15	25.42

**Table 3:** Incidence of diseases in button mushroom farms of district Samba

Disease(s)	2019-20		2020-21		Overall mean	
	No. of farms with disease occurrence	Incidence (%)	No. of farms with disease occurrence	Incidence (%)	No. of farms with disease occurrence	Incidence (%)
Green mould	14	23.33	17	28.33	15.5	25.83
Dry bubble	22	36.66	21	35.00	21.5	35.83
Brown plaster mould	21	35.00	25	41.66	23	38.33
White plaster mould	19	31.66	17	28.33	18	30.00
False truffle	9	15.00	10	16.66	9.5	15.83
Wet Bubble	22	36.66	29	48.33	25.5	42.50
Wet bubble + Green mould	13	21.66	10	16.66	11.5	19.16
Dry bubble + Green mould	7	11.66	8	13.33	15	25.00

**Table 4:** Incidence of diseases in button mushroom farms of district Udhampur

Disease(s)	2019-20		2020-21		Overall mean	
	No. of farms with disease occurrence	Incidence (%)	No. of farms with disease occurrence	Incidence (%)	No. of farms with disease occurrence	Incidence (%)
Green mould	8	21.05	10	26.31	9	23.68
Dry bubble	9	23.68	11	28.94	10	26.31
Brown plaster mould	12	31.57	10	26.31	11	28.94
White plaster mould	14	36.84	12	31.57	13	34.21
False truffle	7	18.42	6	15.78	6.5	17.10
Wet bubble	18	47.36	17	44.73	17.5	46.05
Wet bubble + green mould	9	23.68	7	18.42	8	21.05
Dry bubble + green mould	9	23.68	8	21.05	8.5	22.36

**Conclusion**

In this article we will learn about various diseases caused in various edible mushrooms by pathogens and competitor

moulds and also various competitor moulds that attack the mushroom beds and losses caused by them to mushroom production and finally how to control them in eco- friendly



manner by using various Biological control methods like essential oils, plant extracts or botanicals so that to reduce the losses caused by the pathogens and competitor moulds to get more mushroom yield.

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