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Efficiency of Spent button mushroom substrate for managing of Chickpea Dry root rot incited by *Rhizoctonia bataticola*

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Dry root rot (DRR) of chickpea caused by fungus *Rhizoctonia bataticola* (Taub.) Butler is emerging as a serious threat to the chickpea production worldwide. Mushroom growing is an ecofriendly activity as it utilizes the waste from agriculture, horticulture, poultry, brewery etc. for its cultivation. However, piling up of the button spent mushroom substrate SMS used as different concentrations with soil to manage against *Rhizoctonia bataticola* in chickpea dry root rot under pot conditions. The observations were recorded for effect of spent mushroom substrate and their combinations on dry root rot disease incidence, severity index and phenotypic parameters. All the treatments are significant results over control. The above findings are very useful for the farmers for making decision over the use of organic materials for management of dry root rot disease which is safe management practice for environment and also increased yield of chickpea.

Key words: Spent Button Mushroom Substrate (SMS), chickpea, dry root rot,*Rhizoctonia bataticola*

INTRODUCTION

Chickpea is an important pulse crop being cultivated in almost all over the world including temperate and sub-tropical regions. It originated in South West Asia and is cultivated from ancient times both in Asia and European countries. India is the largest producer of chickpea contributing over 70 per cent of the world production occupying an area of 10.22 million ha with a production of 9.88 million tonnes and with productivity of 920 kg/ha (Anon. 2016).

The major chickpea growing states of our country are Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Andhra Pradesh and Karnataka. Dry root rot of chickpea caused by necrotropic fungus *Rhizoctonia bataticola* (Taub.) Butler is emerging as a serious threat to the chickpea production worldwide (Sharma and Pande, 2010). It generally appears during late flowering and podding stages and the infected plants appear completely dried and is an important component of the disease complex that causes root rots and seedling blight in many grain legumes. when they are weakened by other stress factors. In the absence of the host crop, it survives in soil as a competitive saprophyte on available dead organic matter. The abundance of mushroom compost as well as its antagonistic nature to fungi made it an ideal candidate to blend with landscape mulch to suppress fungi without the use of fungicides. Higher levels of phenolic compounds were found in spent of oyster than button mushroom. The phenolic compounds present in SMC have antimicrobial activity, which could be an effective bio-control of *Meloidogyne spp.* on tomato (Aslam and Saifullha. 2013).The present investigation is designed to use spent button mushroom on dry root rot and their phenotypic characteristics of chickpea susceptible variety.

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MATERIALS AND METHODS

The following material and methods were used

***Seed source*:** Chickpea (BG 212) Variety.

Test pathogen

Rhizoctonia bataticola causal organism of Dry root rot of chickpea.

Spent mushroom substrate

Two year old spent button mushroom substrate (SMS) obtained from mushroom production unit,

Department of Plant Pathology, JNKVV, Jabalpur (M.P.). Sterilized soil and spent mushroom were mixed in four different combination 25%, 50%, 75%, 100% and filled in the sterilized pots.

Treatment combination Used in Pot Culture

T1 25%SMS + 75%soil, T2 50%SMS + 50%soil, T3 75%SMS + 25%soilT4 100%SMS + inoculum, T5 Treated control (control + inoculum) and T6 Untreated control (control without inoculum)

Pathogenicity test and mass multiplication of Rhizoctonia bataticola

Pathogenicity test was conducted by soil infestation method. The bags containing sorghum seeds were autoclaved at 15 psi for 20 min. The pathogen was mass multiplied on sterilized sorghum grains in 250 ml conical flasks. Then the flasks were inoculated with 4 discs of 5.0 mm diameter mycelial growth of three days old culture of *Rhizoctonia bataticola* grown on PDA plate. The flasks were incubated at 28 ± 2°C for seven days. Then the inoculum was mixed with sterilized soil @ 100 g kg^{-1} soil and filled in the pots (30 cm diameter). The seeds of chickpea were sown simultaneously with pathogen inoculation @ 5 seeds per pot and an uninoculated control was maintained. The plants were observed for root rot symptoms. Each treatment replicated three times .

Effect of spent button mushroom on growth parameters

Five seeds were sown in sterilized earthen pots filled with sterilized soil. Germination percentage was recorded. Plant height (cm), pod weight (g), seed weight (g) were recorded at maturity.

$$\text{Germination (\%)} = \frac{\text{Total number of seed germinated}}{\text{Total number of seed sown}} \times 100$$

Germination percentage and pre and post emergence mortality were recorded. Per cent mortality will be calculated by using the following formula;

$$\text{Disease incidence} = \frac{\text{Number of diseased plants}}{\text{Total number of seedlings}} \times 100$$

Disease severity index

The extent of infection by *Rhizoctonia bataticola* was indicated by the presence of dark brown lesion and also by the presence of microsclerotia of the fungus on root systems. Healthy and infected plants were divided into four groups as follows:
Healthy plants 1 = No root rot symptoms,
Slightly infected plants 2 = Dark brown to black spots on collar as well as on primary roots.
Heavily infected plant 3 =Weak and stunted plants with rotting of roots,
Plants dead 4 = Dead and fallen plants Lesions on the entire root system and the disease severity index
(D.I.) were calculated as follows :

$$\text{D.I.} = \frac{0\,(\text{Hn}) + 1\,(\text{Sn}) + 2\,(\text{Hn*}) + 3\,(\text{Dn})}{\text{Total number of plants examined}} \times 100$$

where -
(Hn) = Number of healthy plants
(Sn) = Number of slightly infected plants
(Hn*) = Number of heavily infected plants
(Dn) = Number of dead plants

Germination percentage

Data presented in table 1 .showed that all the treatments were significantly increased the germination percentage as compared to treated control (72.00 %). Among the treatment minimum germination per cent 88.00 % was observed in treatment 100 % SMS + inoculum followed by 92.00 % at 25 % SMS + 75 % soil, 50 % SMS + 50 % soil, 75 % SMS + 25 % soil and by untreated control.

Plant height

Data presented in table 1 at maturity showed that plant height was significantly increased in all treatments. Maximum height 51.80 cm was recorded in treatment 100 % SMS + inoculum followed by untreated control (51.00 cm), 75 % SMS + 25 % soil (50.20 cm), 50 % SMS + 50 % soil (48.40 cm) and by 25 % SMS + 75 % soil (45.80 cm) as compared to treated control (44.20 cm).

Number of pod per plant

Data presented in table 1 showed that number of pods per plant all the treatment were significant. Maximum number of pod were recorded in treatment 100 % SMS + inoculum (19.20) and in untreated control (19.20) followed by 75 % SMS + 25 % soil (18.80), 50 % SMS + 50 % soil (12.20) and minimum number of pods 9.60 recorded in

treatment 25 % SMS + 75 % soil as compared to treated control (7.60).

Pod weight

Data presented in Table 1 showed that among the treatments pod weight varied from 16.35 to 25.17 g/plant as compared to treated control (14.23 g/ plant). All treatments showed significantly increased pod weight, maximum pod weight was recorded in untreated control (25.17 g) followed by treatments 100 % SMS + inoculum (24.49 g), 75 % SMS + 25 % soil (24.51 g) , 50 % SMS + 50 % soil (18.37 g), minimum significant increased pod weight was recorded 16.35 g at 25 % SMS + 75 % soil as compare to treated control.

Seed weight

Data presented on seed weight indicated that (table 1) untreated control (23.09 g) was highly significant as compared to treated control (12.20 g), followed by treatments 75 % SMS + 25 % soil (22.33 g), 100 % SMS + inoculum (22.01 g), 50 % SMS + 50 % soil (16.89 g) and minimum seed weight was recorded in treatment 25 % SMS + 75 % soil (14.08 g) as compared to control (12.20 g).

Disease incidence

Disease incidence caused by *Rhizoctonia bataticola* in the susceptible variety BG - 212 of chickpea was highly significant at treatment 100 % SMS + soil (16.00 %), untreated control (16.00 %) and in treatment 75 % SMS + 25 % soil (16.00 %) as compared to treated control (40.00 %), twenty percent disease incidence was showed in treatment 50 % SMS + 50 % soil and maximum disease incidence was recorded in treatment 25 % SMS + 75 % soil (24.00 %) as compared to control (40.00 %).

Disease severity index of Rhizoctonia bataticola

Rhizoctonia bataticola

The results presented in Table 2 showed that *Rhizoctonia bataticola* disease (32.00%) was least in treatment 100 % SMS + inoculum, 75 % SMS + 25 % soil and in untreated control as compared to treated control (100.00 %), maximum disease severity 44.00 % was recorded in treatment 25 % SMS + 75 % soil followed by 50 % SMS + 50 % soil (36.00 %) as compared to treated control.

Analogy of assessment of various factors against Rhizoctonia bataticola
Efficiency percentage

Data presented in Table 3 showed that treatment 100 % SMS + inoculum ,untreated control and treatment 75 % SMS + 25 % soil were most effective against *Rhizoctonia bataticola* as compared to treated control, followed by treatment 50 % SMS + 50 % soil, minimum efficiency was recorded in treatment 25 % SMS + 75 % soil against *Rhizoctonia bataticola* as compared to treated control.

Roy *et al.* (2015) found Influence of spent mushroom substrate (SMS) of oyster mushroom and button mushroom on the improvement of health status of *Capsicum annuum* L. Analysis of growth promotion in terms of height, no of branches, yield and no of leaf drop indicated that the use of the spent mushroom substrate of oyster mushroom and spent compost of button mushroom had a positive effect on the overall growth of the tested plants. Chorover, *et al*. (2000)reported that spent mushroom substrate is a good source of carbon, nitrogen and other elements. Nitrogen content varies from 0.4- 13.7% with a C: N ratio of 9 to 15: 1 which enhances the growth of plants. Khan *et al*. (2019) reported that button spent mushroom substrate used as different concentrations with soil to manage aginst *Fusarium oxysporum f.sp. ciceris* in chickpea wilt under pot conditions. The observations were recorded for *effect* of spent mushroom substrate and their combinations on Fusarium wilt disease incidence, severity index and phenotypic parameters.SMS for the control of Fusarium wilt in tomato and also showed that spent mushroom compost was a soil amendment. It is reported that SMS play imported role in its further decomposition but also exert antagonism to the normal pathogens surviving and multiplying in the soil ecosystem, restricts the root knot infections of tomato plant, presence of *Pseudomonas* and *Bacillus* present in the SMS exert antagonism to a number of soil pathogens (Mohapatra and Behera, 2011).

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Table 1: Effect of spent button mushroom substrate and their combinations on dry root rot (*Rhizoctonia bataticola)* disease incidence and phenotypic parameters

Treatments	Germination %	Plant height (cm)	No. pods/plant	of Pod weight/plant (gk)	Seed weight/plant (gk)	Disease incidence (%)
25 % SMS + 75 % soil	90.00	45.80	9.60	16.35	14.08	24.00
50 % SMS + 50 % soil	92.00	48.40	12.20	18.37	16.89	20.00
75 % SMS + 25 % soil	92.00	50.20	18.80	24.51	22.33	16.00
100 % SMS + inoculum	88.00	51.80	19.20	24.49	22.01	16.00
Treated control	72.00	44.20	7.60	14.23	12.20	40.00
Untreated control	92.00	51.00	19.20	25.17	23.09	16.00
SE(m)	4.83	1.556	0.60	2.23	2.20	4.16
C.D.	14.18	4.568	1.77	0.76	0.75	12.36

Mean of 5 replications

Table 2: Disease severity index of *Rhizoctonia bataticola*

Treatments	*Rhizoctonia bataticola*
25 % SMS + 75 % soil	44.00
50 % SMS + 50 % soil	36.00
75 % SMS + 25 % soil	32.00
100 % SMS + inoculum	32.00
Treated control	100.00
Untreated control	32.00
SE(m)	7.11
C.D.	20.90

Mean of 5 replications

Table 3 : Analogy of assessment of various factors against *Rhizoctonia bataticola*

Treatments	Control factor	Efficiency	Relation-ship factor
25 % SMS + 75 % soil	0.60	0.40	0.79
50 % SMS + 50 % soil	0.50	0.50	0.59
75 % SMS + 25 % soil	0.40	0.60	0.39
100 % SMS + inoculum	0.40	0.60	0.29
Treated control	1.00	0.00	0.99
Untreated control	0.40	0.60	0.39
SE(m)	0.10	0.10	0.10
C.D.	0.30	0.30	0.29

Mean of 5 replications

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