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Efficacy of fungicides and bioagents against *Rhizoctonia bataticola* causing root rot of cotton

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Abstract

Fourteen fungicides and two bioagents spp. were evaluated *in vitro* against *Rhizoctonia bataticola*, causing root rot of cotton. The results revealed that the systemic fungicides Benomyl and Carbendazim @ 0.1% and contact fungicides Mancozeb @0.3% and Thiram @ 0.2% completely inhibited mycelial growth of the pathogen. The biocontrol agent *Trichoderma harzianum* and *Trichoderma viride* @ 0.5% inhibited mycelial growth 73.77 and 75.55%, respectively.

The four fungicides and two biocontrol agents founded effective in *in vitro* were evaluated in *in vivo* (pot culture) against root rot of cotton during *Kharif* -2014. Results revealed that Thiram @0.2% recorded significantly maximum disease control (76.67%) and was at par with biocontrol agent *T. harzianum* @0.5% (73.34%) over all other treatments and control.

Keywords: fungicides, bioagents, *Rhizoctonia bataticola*, root rot, cotton, efficacy

Introduction

Cotton (*Gossypium* spp.) is one of the oldest cultivated natural fibre and oilseed crop of great economic importance in world. In India, during the year 2013-14 the area under cotton was 119.60 lakh ha with production of 398 lakh bales. (Anonymous, 2013). India accounts for approximately 25% of the world's total cotton area and 16% of global cotton production. The crop is invariably affected by economically important diseases *viz.*, anthracnose, leaf blight, wilt, dahiya, root rot appears severely on cotton with severe economic losses. Now the root rot disease became a major limiting factor in cotton cultivation. It is severe in all parts of country, where the cotton is grown. The disease affects both hirsutum and arborium cotton species. The disease appears 30 – 45 days after sowing in the field (Moonga and Raj, 2003) [4]. Therefore, considering its economic importance, present study was undertaken to find out the suitable control measure against the pathogen by evaluating *in vitro* and *in vivo* various fungicides and bioagents against *Rhizoctonia bataticola* causing root rot disease of cotton.

Materials and Methods

The fungicides *viz.*, Azoxistrbin (0.1%), Benomyl (0.1%), Bordeaux mixture (1.0%), Captan (0.2%), Carbendazim (0.1%), Chlorothalonil (0.2%), Copper oxychloride (0.3%), Hexaconazole (0.1%), Iprobenphos (0.1%), Mancozeb (0.3%), Propiconazole (0.1%), Tricyclazole (0.1%), Thiophanate methyl (0.1%), Thiram (0.2%) and bioagents *Trichoderma harzianum* and *T. viride* both at 0.5% were tested for their efficacy *in vitro* against *Rhizoctonia bataticola* causing root rot of cotton by applying "poisoned food technique" (Nene and Thapliyal, 2002) [5] and using potato dextrose agar medium as basal culture medium. The two bioagents *Trichoderma harzianum* and *T. viride* were evaluated *in vitro* against *R. bataticola* applying dual culture technique (Denis and Webster, 1971) [2]. The trial was laidout in CRD with 17 treatments including control and three replications. The observations on colony growth and sporulation were recorded until petri plate in control treatment was fully covered with mycelia growth (Schmitz, 1930) [8]. The percent inhibition of fungal growth was calculated as per following formula given by Vincent (1947) [10].

$$I = \frac{C - T}{C} \times 100$$

Where, I = Per cent growth inhibition

C = growth (mm) in control

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T = growth (mm) in treatment

The fungicides Benomyl, Carbendazim, Mancozeb and Thiram and bioagents *Trichoderma harzianum* and *Trichoderma viride* were found effective in *in vitro* inhibition were evaluated against *Rhizoctonia bataticola* *in vivo* pot culture experiment. during *kharif* 2014 on variety Rashi -2. The experiment was laidout in CRD with seven treatments and three replications. For this purpose, earthen pots of 25 cm diameter were filled with sick soil of *R. bataticola*. Ten seeds of Rashi -2 were sown in each pot with seed treatment of respective concentration of fungicides and bioagents and drenching @ 50 ml /pot. Further three drenchings were done at 30 days interval. The untreated treatment kept as control. Observations on root rot disease incidence was recorded and per cent disease control (PDC) was worked out by using scale and formula of Vincent (1947) [10].

$$\text{Percent disease control} = \frac{\text{PDI in control} - \text{PDI in treatment}}{\text{PDI in control}} \times 100$$

In vitro (poison food studies)

The observations regarding colony diameter and growth inhibition are presented in table 1. The treatment differences in respect of colony diameter due to various fungicides and bioagents were statistically significant. The fungicides benomyl, carbendazim, mancozeb and thiram completely habited mycelia growth followed by the fungicides tricyclazole @0.1%, captan @0.2%, thiophanate methyl @0.1%, chlorothalonil @0.2% and bioagents *T. harzianum* and *T. viride* showed 1.3 to 3.0 mm colony diameter with mycelia growth inhibition to the tune of 66.0 to 85.55%. The rest of the 4 fungicides azoxystrobin, Bordeaux mixture, Copper oxychloride, Hexaconazole, Iprbenphos, showed less than 50% growth inhibition. The results in respect of Benomyl,

Thiram and Carbendazim are matched with the results of Patel and Patel, 1990. Similar effective results of *Rhizoctonia bataticola* growth inhibition by *Trichoderma* spp. were reported by Parakhia and Vaishnar (1986) [6], and Singh *et al.* (2003) [9].

In vivo (Pot Culture) Evaluation

The most effective fungicides and bioagents were evaluated in pot culture against root rot of cotton. The observations

regarding disease incidence and control were presented in Table 2. All the four fungicides and two bioagents tested were found significantly effective in reducing root rot of cotton.

Among the fungicides Thiram @ 0.2% was recorded significantly minimum disease incidence 23.33% and maximum disease control (76.67%) after 3rd drenching i.e. 90 days after sowing followed by carbendazim 69.67% control.

Among the bioagents *Trichoderma harzianum* was found significantly superior and recorded disease incidence (26.66%) and disease control (73.34%). Which was at par with fungicide Thiram over rest of the treatments. These results are in agreement with Vyas (1994) [11] and Kumari *et al.* (2012) [3].

The foregoing results clearly indicated that the fungicide Thiram @ 0.2%, Carbendazim 0.1% and *Trichoderma harzianum* were proved to be the most effective to control the *Rhizoctonia bataticola* root rot of cooton.

Table 1: Effect of fungicides and bioagents on growth of *Rhizoctonia bataticola* *in vitro*.

Tr. No.	Fungicides	Concentration %	Mean colony diameter (cm) *	Inhibition %
T1	Azoxystrobin	0.1	6.0	33.22
T2	Benomyl	0.1	0.0	100.00
T3	Bordeaux mixture	1.0	4.6	48.88
T4	Captan	0.2	1.8	79.11
T5	Carbendazim	0.1	0.0	100.00
T6	Chlorothalonil	0.2	3.0	66.00
T7	Copper oxychloride	0.3	8.7	3.33
T8	Hexaconazole	0.1	4.6	48.33
T9	Iprobenphos	0.1	6.7	24.66
T10	Mancozeb	0.3	0.0	100.00
T11	Propiconazole	0.1	2.2	75.55
T12	Tricyclazole	0.1	1.3	85.55
T13	Thiophanate methyl	0.1	2.0	77.77
T14	Thiram	0.2	0.0	100.00
T15	<i>Trichoderma harzianum</i>	0.5	2.3	73.77
T16	<i>Trichoderma viride</i>	0.5	2.2	75.55
T17	Control	-	9.0	0.00
	S. E. ±		0.3	
	C. D. at 5%		1.03	

* Average of three replications

Table 2: Evaluation of fungicides and bioagents on root rot of cotton caused by *Rhizoctonia bataticola* *in vivo* (pot culture).

Tr. No.	Treatments	Conc. (%)	PDI * 30DAS (%)	PDC (%)	PDI * 60 DAS (%)	PDC (%)	PDI 90 DAS (%)	PDC (%)
T1	Benomyl	0.2	40.00 (36.93)	20.00	40.00 (36.93)	42.85	43.33 (41.07)	56.67
T2	Carbendazim	0.2	23.66 (28.78)	52.68	26.66 (30.99)	61.91	30.66 (33.21)	69.67
T3	Mancozeb	0.3	43.33 (41.07)	13.40	56.66 (48.93)	19.05	70.00 (61.92)	30.0
T4	Thiram	0.2	16.30 (19.92)	67.40	20.00 (26.07)	71.42	23.33 (28.78)	76.67
T5	<i>Trichoderma harzianum</i>	0.5	20.00 (26.56)	60.00	23.33 (28.78)	66.67	26.66 (30.99)	73.34
T6	<i>Trichoderma viride</i>	0.5	26.66 (30.78)	46.68	30.00 (33.00)	57.14	40.00 (38.85)	60.00
T7	Control	-	50.00 (45.00)	-	70.00 (56.99)	-	100 (90.00)	-
	S. E. ±		0.7	-	1.24	-	1.24	-
	C. D. at 5%		2.3	-	3.84	-	3.83	-

* Mean of three replications

PDI : Percent Disease Incidence, PDC : Percent Disease Control

Figures in parenthesis indicate Arc sin transformed value

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