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EVALUATION IN VITRO DIFFERENT FUNGICIDES FOR GROWTH OF RHIZOCTONIA BATATICOLA

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ABSTRACT
The present study was conducted to test the efficacy of some systemic, non-systemic and combine fungicides like Propiconazole, carbendazim, captan, carboxin, benomyl, mancozeb, thiram, carbendazim + mancozeb against dry root rot of chickpea. A variant with no application of fungicide was used as control. In laboratory condition result revealed that fungicides evaluated against R.bataticola exhibited a wide range of mycelial growth of R. bataticola and was found to be decreased drastically and showed inhibition with increased concentration of fungicides tested.
The suppression of growth of pathogen was maximum with Carbendazim (Bavistin 50%WP) (100.00 per cent) followed by Benomyl (Benlate 50 WP) (93.61 (75.35)) per cent) and the least effective fungicides was Carboxin (Vitavax 75 WP) (61.17 (51.45) per cent). Carbendazim (Bavistin 50%WP) showed best performance against the pathogen.

INTRODUCTION

The cultivated chickpea (*Cicer arietinum* L.) was one of the first grain legume to be domesticated in the old world. The genus Cicer belongs to family Leguminoceae and sub family Papilionoidae. Chickpea has been well recognized as a valuable source of protein particularly in the developing countries , where majority of the populations depends on the low priced food for meeting it's dietary requirements nutritionally , chickpea is low in sodium, contains (21.1%), fats (4.5%), no cholesterol and overall an excellent source of both soluble and insoluble fiber,complex carbohydrates (61.5%),vitamins(especially B vitamins)and minerals (especially potassium,phosphorous,calcium,magnesium, copper,iron and zinc).Therefore, chickpea is an excellent heart healthy food that may be beneficial to the prevention of coronary and cardiovascular diseases and by reducing blood lipids also help some serious complications of diabetes.

In India chickpea is primarily grown as Rabi (post rainy) season crop on residual soil moisture. It ensures nutritional security besides being a rich source of protein and is also important in substantial agriculture as it improves physical, chemical and biological properties of soil by mixing atmospheric nitrogen symbiotically. Deep roots of pulse crop also open up the soil by increasing soil aeration and fit well in various cropping ecosystem and hence have got unique position in rainfed agriculture.

Chickpea is grown throughout the world. In India on large scale in Punjab, Hariyana, Uttar Pradesh, Madhya Pradesh, Rajasthan, Andhra Pradesh, Karnataka, and Maharashtra it is mostly cultivated under Rainfed condition in a variety of soil, varying in a residual moisture. In India area under chickpea was 10.57 M/ha with production 11.16 MT and productivity 1056 kg/ha during 2018.suceptibility of the crop to different biotic and abiotic stress. Abiotic stress is basically due to insufficient moisture. regarding biotic stresses, diseases, insect pest, nematodes and parasitic weeds account major losses for example , extend of yield loss due to wilt and root rot disease is far more in the event of drought high temperature in the country. The chick pea crop is attacked by 172 pathogen *viz* as 67 fungi, 22 viruses, 3 bacteria, 80 nematodes and mycoplasma from all over the world (Nene *et al*.,1996).

Being soil borne in a nature it is very difficult to control this pathogen. In primary use of resistant cultivar is more effective strategy for sustainable chickpea cultivation, and cultural scounting, sanitation and development of the host plant resistance with the application of fungicides. Regarding the management of dry root rot of chickpea many workers had done lots of works based on chemical control. Earlier workers reported application of fungicides is the most effective method (Sangeetha and Jahagirdar 2013), reported that dry root rot causing pathogen Rhizoctonia bataticola, In –vitro screening of fungicides was undertaken to identify an effective compound against R. bataticola. Mancozeb, carbendazim, thiophanate methyl, hexaconazole, propiconazole, were found effective in inhibiting mycelia growth of pathogen. Therefore, the present investigation was carried out to evaluate with some systemic, non-systemic and combine fungicides for management of dry root rot of chickpea.

MATERIALS AND METHODS

The effect of nine fungicides on R.bataticola (Taub) Butler was

evaluated in-vitro by employing "Poisoned food technique"(Kumari *et al.*,2012).The requisite amount of each fungicide @ 500, 1000 and 2000 ppm based on active ingredient was added in an autoclaved and cooled (450C) potato dextrose agar medium to obtain desired concentrations(Singh and chohan),(Ramadoss and Sivaprakasam) The fungicides used with their concentrations were propiconazole ,carbendazim, captan , carboxin ,benomyl ,mancozeb , thiram , carbendazim + mancozeb, Plain PDA without fungicide served as control. The PDA was then poured into sterile glass petriplates (90 mm diameter) and allowed to solidify. These plates were inoculated with a 5 mm mycelial disc of the test fungus and incubated for 7 days at 28 $\pm$20 C. All the treatments were replicated thrice. Observations on radial mycelial growth in treatment plates were recorded after 7-8 days .Per cent inhibition of the test fungus over control was calculated by applying the formula given below,(Vincent 1947).

Details of the experiment :-

Design	- Complete Randamized Design (CRD)
Replications	- Three
Treatments	- Nine
T1	- Propiconazole
T2	- Carbendazim
T3	- Captan
T4	- Carboxin
T5	- Benomyl
T6	- Mancozeb
T7	- Thiram
T8	- Carbendazim + mancozeb
T9	- Control

$$\text{Per cent inhibition(I)} = \frac{C - T}{C} \times 100$$

Where,

C = Growth (mm) of test fungus in control plate.

T = Growth (mm) of test fungus in treatment plate.

RESULTS AND DISCUSSION

Results (Table and Fig.) revealed that fungicides evaluated in - vitro against *R.bataticola* exhibited a wide range of mycelial growth of *R. bataticola* and was found to be decreased drastically and showed inhibition with increased concentration of fungicides tested.

Mycelial growth

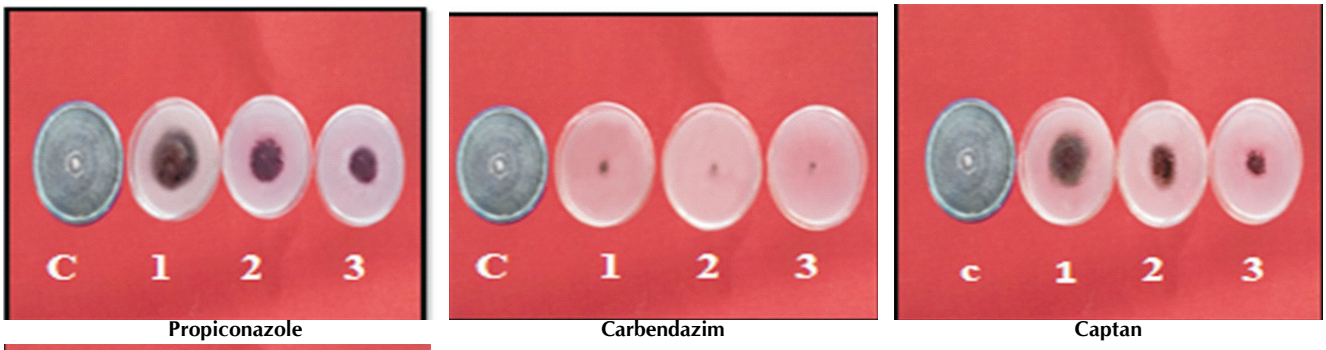
At 500 ppm, radial mycelial growth of the test pathogen was ranged from 00.00 mm (carbendazim) to 37.94 mm (carboxin), as against 90.00 mm in untreated control. However, significantly least mycelium growth was recorded in carbendazim (0.00mm).This was followed by the fungicides *viz*., benomyl (07.22mm), Saff (08.19mm) and mancozeb (09.83mm) all these three were statistically at par.These were followed by thiram(16.07mm), propiconazole (26.95mm) and captan (30.12mm). Fungicide carboxin (37.94mm) was found comparatively less effective with maximum mycelial growth (Singh and Chohan).

At 1000 ppm, all the 09 fungicides tested exhibited similar trend of mycelial growth as that of observed at 500 ppm, but growth was comparatively reduced and was ranged from 00.00 mm (carbendazim) to 35.58 mm (carboxin), as against 90.00 mm in untreated control. However, significantly least mycelial growth was recorded in carbendazim (00.00mm). This was followed by the fungicides *viz*., benomyl (05.08mm), Saff

Table1: In vitro efficacy of fungicides against mycelial growth and inhibition of R.bataticola.

Tr. No.	Treatments	Col. dia. *(mm) at conc.			Av. (mm)	% Inhibition*			Av. (%) inhibition
		500 ppm	1000 ppm	2000 ppm		500 ppm	1000 ppm	2000 ppm	
T_1	Propiconazole (Tilt 25% EC)	26.95	22.39	13.06	20.07	70.06 (56.82)	75.12 (60.07)	78.58 (62.43)	74.58 (59.72)
T_2	Carbendazim (Bavistin 50%WP)	0	0	0	0	100 (90)	100 (90)	100 (90)	100.00 (90.00)
T_3	Captan (Captaf 75% WP)	30.12	26.17	19.19	25.16	66.52 (54.64)	70.91 (57.36)	78.83 (62.6)	72.08 (58.1)
T_4	Carboxin (Vitavax 75 WP)	37.94	35.58	31.28	26.02	57.83 (49.5)	60.45 (51.03)	65.24 (53.87)	61.17 (51.45)
T_5	Benomyl (Benlate 50 WP)	7.22	5.08	5.06	6.2	92.13 (73.7)	94.34 (76.23)	94.37 (76.27)	93.61 (75.35)
T_6	Mancozeb (Indofil M-45 75% WP)	9.83	6.76	5.65	7.41	89.13 (70.74)	92.48 (74.08)	93.88 (75.67)	91.83 (73.39)
T_7	Thiram (Thiram 75% WP)	16.07	16.07	11.94	14.69	82.13 (64.99)	82.13 (64.99)	86.72 (68.62)	83.66 (66.15)
T_8	Carbendazim + mancozeb (Saff 75% WP)	8.19	6.09	5	6.69	90.89 (72.43)	93.25 (74.94)	94.59 (76.55)	92.91 (74.55)
T_9	Control (Untreated)	90	90	90	90	0 0	0 0	0 0	000.00 (00.00)
	S.E. $\pm$	1.2	0.62	2.68	1.5	1.34	0.69	0.67	0.9
	C.D. (P=0.01)	3.27	1.68	7.29	4.08	3.64	1.87	1.82	2.44

*-Mean of three replications, Col. = Colony, Dia. = Diameter, Conc. = Concentration;Av. = Average, Figures in parentheis are arc sine transformed value.



Propiconazole | Carbendazim | Captan

Carboxin

Effect of fungicide on mycelial growth of *R.batatícla*
C = control, 1 = 500 ppm, 2 = 1000 ppm, 3 = 2000 ppm

Plate V

(6.09mm) and mancozeb (06.76mm) all these three were statistically at par and was followed by thiram (16.07mm), propiconazole (22.39mm) and captan (26.17mm).In fungicides, fungicide carboxine was found least effective with maximum colony diameter (35.58mm).

At 2000 ppm, all the fungicides tested exhibited somewhat similar trend of mycelial growth as that of observed at 500 ppm and 1000 ppm and it was ranged from 00.00 mm (carbendazim) to 31.28 mm (carboxin), as against 90.00 mm untreated control. However, with the fungicide carbendazim significantly least mycelium growth (00.00mm) was observed. This was followed by the fungicides *viz*., Saff (05.00mm), benomyl (05.06mm), mancozeb (5.65mm) and thiram which at par. Followed by other fungicides propiconazole (13.06mm) and captan (26.17mm), while the fungicide carboxin was recorded comparatively less effective with maximum mycelia growth of (31.28mm),(Ramdoss and Sivaprakasam).

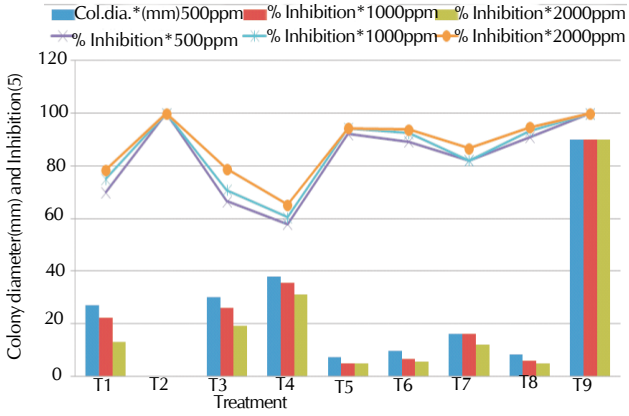
Average radial mycelial growth recorded in all the 09 fungicides tested was ranged from 00.00 mm (carbendazim) to 26.02 mm (carboxin), as against 90.00 mm in untreated control. However, the least average mycelia growth was recorded with carbendazim (00.00mm), (Taneja and Grover). This was followed by the fungicides *viz*. benomyl (06.20mm), Saff (06.69mm) and mancozeb (07.41mm)all these three were at par and was followed by thiram (14.69mm), propicinazole(20.07mm) and captan (25.16mm).the highest average colony diameter was recorded in carboxin(26.02mm).

Mycelial growth inhibition

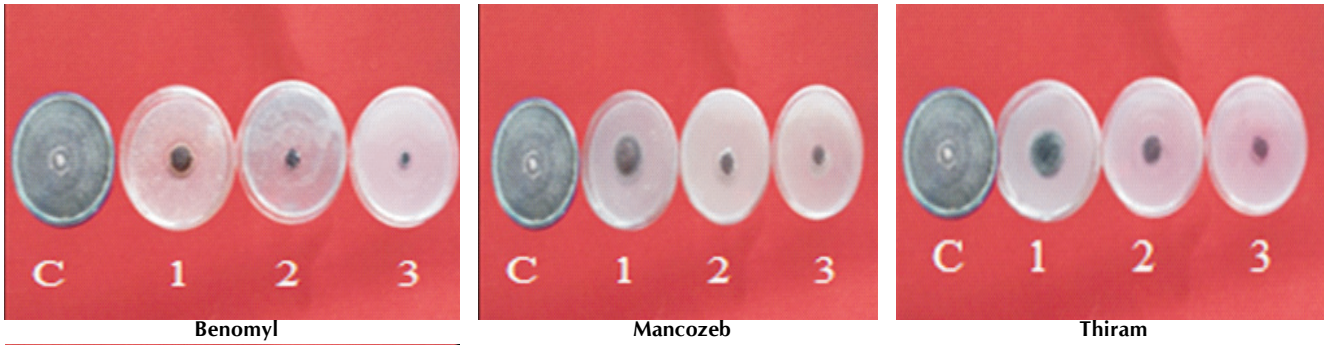
Results (Table and Fig.) revealed that all the fungicides tested (@ 500, 1000 and 2000 ppm each) significantly inhibited mycelial growth of *R.bataticola* over untreated control (00.00%). Further, the percentage mycelial growth inhibition of test pathogen was increased with increase in concentrations of the fungicides tested (PLATE 5 and 6).

At 500 ppm, percentage mycelial growth inhibition of the test pathogen was ranged from 57.83 (carboxin) to 100.00 per cent (carbendazim). However, significantly higher mycelia inhibition was recorded with fungicide carbendazim (100.00%).The second, third and fourth best fungicides found were benomyl (92.13%) and Saff (90.89%) and mancozeb (89.13%) which were at par followed by thiram (82.13%), propiconazole (70.06%), captan(66.52%). The fungicide carboxin was found less effective with 57.83 per cent inhibition of the test pathogen.

At 1000 ppm, mycelial growth inhibition was increased compared to 500 ppm and similar trends of mycelial growth inhibition were observed. It was ranged from 60.45 (carboxin) to 100.00 (carbendazim) per cent. However, significantly highest mycelia inhibition was found with fungicide carbendazim (100.00%). The second, thired best fungicides,



In vitro efficacy of fungicides against mycelial growth and inhibition of R.bataticola.



Benomyl **Mancozeb** **Thiram**

Carbendazim + Mancozeb

Effect of fungicide on mycelial growth of R.batiticla
C = control, 1 = 500 ppm, 2 = 1000 ppm, 3 = 2000 ppm

Plate vI

viz. benomyl (94.34%), Saff (93.25%) both were at par.These were followed by fungicides *viz*. mancozeb (92.48%), thiram(82.13%), propiconazole(75.12 %), and captan (70.91%). The fungicide carboxin was found less effective with 60.45mm inhibition of the test pathogen.

At 2000 ppm, all the 09 fungicides tested exhibited comparatively increased mycelial growth inhibition than that of at 500 and 1000 ppm and it was ranged from 65.24 (carboxin) to 100 (carbendazim) per cent However, significantly highest mycelia inhibition was recorded with fungicide carbendazim (100.00%).This was followed by the fungicides, *viz*. saff (94.59%), benomyl (94.37%) and mancozeb (93.88) were at par followed by thiram (86.72%). The fungicides captan (78.83%), propiconazole (78.58%) were at par the fungicide carboxin was reported comparatively less effective with growth inhibition of 65.24%.

Average mycelial growth inhibition recorded in the test fungicides was ragged from 61.17 (carboxin) to 100.00 (carbendazim) per cent. However, significantly by highest average mycelial growth inhibition was recorded in carbendazim (100.00%). The second and third best fungicides found were benomyl (93.61%) and Saff (92.91%), both were at par. These were followed by the fungicides *viz*., mancozeb (91.83%), thiram (83.66%), propiconazole (74.58%),captan (72.08%). The fungicide carboxin was comparatively less effective with minimum growth inhibition of 61.17 per cent. Thus, all the fungicides tested were found fungistatic against R.bataticola and significantly inhibited its mycelial growth over untreated control. However, fungicides found most effective in the order of merit were carbendazim, benomyl, Saff, mancozeb, thiram, propiconazole and captan.

Similar fungistatic effects of the test fungicides against R.bataticola infecting chickpea and many other crops were reported earlier by several workers, Goyal and Mehrotra 1981, Taneja and Grover 1982, Sarwar and Gopal Raju 1985,Ramadoss and Shivprakasham 1987,Singh and Sindan 1988, Peshney *et al*., 1992, Prajapati *et al*., 2004,Sandipan *et al*., 2007, Date 2015.

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