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EVALUATION OF FUNGICIDES AND BIO-CONTROL AGENTS AGAINST *COLLETOTRICHUM* BLIGHT OF CHICKPEA AND DEVELOPMENT OF SUITABLE INTEGRATED DISEASE MANAGEMENT (IDM) STRATEGY IN ANDHRA PRADESH

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ABSTRACT

Sensitivity of *C. capsici*to different fungicides *viz*., mancozeb (0.25%), carbendazim (0.05% and 0.1%), SAAF (carbendazim + mancozeb) (0.2%), chlorothalonil (0.2% and 0.3%), hexaconazole (0.2%), thiophanate methyl (0.1%), copper oxy chloride (0.3%) and tebuconazole (0.1%) was assessed by poisoned food technique. Mancozeb, hexaconazole, tebuconazolewere found to be effective which inhibited the growth of the pathogen completely (100%) whereas chlorothalonil (0.2%) and copper oxy chloride showed the least efficacy with inhibition of 69.7 and 67.1 per cent, respectively. The bio-control agent, *T. koningii*showed the highest rate of inhibition (85.7%) compared to *T. viride*(74.8%) in dual culture technique. In integrated disease management, seed treatment with carbendazim @ 2g/kg + foliar spray with SAAF (12% carbendazim+ 63% mancozeb) @ 0.2% immediately after onset of disease + foliar spray with SAAF (12% carbendazim + 63% mancozeb) @ 0.2% 15 days after the first spray was found to be effective as it recorded the least PDI of 15.5 per cent, maximum plant height (20.7 cm), maximum shoot dry weight (7.1 g) and maximum root dry weight (0.24 g), while Seed treatment with *Trichodermaviride*@ 4g/kgwas found to be the least effective with PDI of 38.8 per cent in pot culture studies.

KEYWORDS: Chickpea, *Colletotrichum*, Fungicides, Integrated Disease Management

INTRODUCTION

Chickpea is one of the most important cool season food crops mostly grown in dry lands. Dry root rot and *Fusarium* wilt are the major diseases of chickpea prevailing in Andhra Pradesh. In addition to these two diseases, incidence of *Colletotrichum* blight was observed in severe form in Kurnool, Prakasam and Anantapur districts of Andhra Pradesh during *rabi*2009 and 2010. The use of fungicides has become an inevitable method in the management of plant diseases particularly in the absence of resistant cultivars. Environmental concerns and the development of pathogen resistance to fungicides resulted in an increased need to find alternative disease control strategies which include the use of antagonistic microorganisms (bio-control agents).

MATERIALS AND METHODS

Four systemic, three non-systemic and one combination of systemic and non systemic fungicides were evaluated against *C. capsici in vitro* by poisoned food technique (Nene and Thapliyal, 1993). The details of fungicides and concentrations used are given in Table 1.To 50 ml of sterile distilled water, required quantity of fungicide was added and after thorough mixing it was poured into 50 ml of sterilized cooled molten double strength PDA medium. Later entire

content was poured into Petriplates. 5 mm discs of fungal colony from 7 days old culture was placed in the centre of the petriplate and then incubated at 27 ± 2°C. Five replications were maintained for each fungicide and medium without fungicide was kept as control. Radial growth of the fungus was recorded after obtaining full growth of the pathogen in control plates and per cent inhibition of mycelial growth over control was calculated by using the formula given by Vincent (1947).

Effect of Bio-Control Agents

The effect of bio-control agents on growth of *C. capsici*was studied by dual culture technique (Dhingra and Sinclair 1985). Two bio-control agents *T. koningii* (from NBAII, Bangalore) and *T. viride* (from Bio-control laboratory, Department of Agriculture, Nandyal) were tested. Twenty ml of sterilized melted PDA was poured into sterile 90 mm diameter petriplates and allowed to solidify. A 5 mm diameter disc of actively growing three days old antagonistic fungus was cut with sterile cork borer and placed at one end of plate over the PDA medium. On the opposite side to the antagonist, with a 2 cm distance mycelia disc of *C. capsici*(7 days old culture) was placed. The petriplates with pathogen inoculated at one end alone, served as control. The plates were incubated at 27 ± 2°C. Five replications were maintained for each treatment. After required period of incubation i.e. when fungal growth in control plate reached 90 mm in diameter, the radial growth of pathogen in dual culture plate was measured.

Integrated Disease Management

Integrated Disease Management was studied in pot culture experiments. Chickpea variety JG-11 and design CRD with three replications was used for these studies. The treatment details are given in Table 2. Inoculum was sprayed at 30-45 days after sowing.

PDI was calculated by using formula given by Wheeler (1969).

$$\text{PDI} = \frac{\text{Sum of the numerical ratings}}{\text{Total number of observations}} \times \frac{100}{\text{Maximum disease grade}}$$

PDI was recorded by using 1-9 scale for *Colletotrichum* blight of chickpea developed by Nene *et al.* (1981).

The average plant height in pot culture was recorded. The samples were kept in hot air oven at 80°C and the dry weights of shoots and roots were recorded.

RESULTS AND DISCUSSION

Efficacy of Fungicides

The results revealed that all the fungicides were effective in inhibiting the growth of the pathogen over control significantly. Mancozeb (0.25%), tebuconazole (0.1%) and hexaconazole (0.2%) recorded 100 per cent inhibition over control. The next best treatments were thiophanate methyl (0.1%) and carbendazim (0.1%) which recorded per cent inhibition of 96.8 and 95.7 per cent, respectively. Least inhibition was recorded with copper oxy chloride (67.1%) and chlorothalonil, 0.2 per cent concentration (69.7%).The results of the efficacy of different fungicides against *C. capsici*on PDA were presented in Table 1 and fig 1.Varaprasad (2000) evaluated the efficacy of different fungicides on growth of *Colletotrichumdematium*, blight pathogen of chickpea and reported that carbendazim (0.1%) and mancozeb (0.2%) completely inhibited (100%) the growth of the pathogen followed by Kitazin (81.48%), difenconzole (71.48%) and

triademefon (69.2%).

Efficacy of Bio-Control Agents

The antagonistic effect of fungal bio-agents on pathogen growth was evaluated based on their ability to inhibit the pathogen growth in dual culture technique under *in-vitro* and the results were recorded after complete growth of the pathogen in control plate are presented in Table 1. The results revealed that among the two fungal antagonists, *Trichodermakoningi* (85.75%) was found to be most effective compared to *Trichodermaviride* (74.87%) in inhibiting the growth of *Colletotrichumcapsici*. Chirame and Padule (2005) also reported that *Trichodermaviride*, *T. hamatum*, *T. harzianum*, *T. longiflorum*and *T. Koningii* significantly inhibited the growth of *Colletotrichumcapsici*.

Integrated Disease Management

Chickpea *Colletotrichum*blight is a serious and devastating disease in recent years in chickpea growing areas. In view of very limited research on the disease there is an immediate need to develop integrated disease management strategies for the disease. The chickpea variety JG-11 was used for pot culture studies and different treatments were imposed as indicated in the Table 2.The results on per cent disease index (PDI) of *Colletotrichum*blight and plant growth parameters *viz.,* plant height, dry weight of shoot and root were recorded and presented in Table 2. PDI was recorded based on 1 to 9 disease scale developed by Nene *et al.* (1981).The results revealed that all the treatments were significantly superior over control. The treatment T7 [Seed treatment with carbendazim @ 2 g kg-1 + Foliar spray with SAAF (12% carbendazim + 63% mancozeb) @ 0.2 per cent immediately after onset of disease + foliar spray with SAAF (12% carbendazim + 63% mancozeb) @ 0.2 per cent 15 days after the first spray] gave less PDI (15.5%) and more disease reduction (83.3%) over control (93.7%) followed by treatment T5 [Seed treatment with Carbendazim @ 2 g kg-1 + foliar spray with SAAF (12% carbendazim + 63 % mancozeb) @ 0.2 per cent immediately after onset of disease] which recorded PDI of 22.2 per cent and disease reduction of 76.2 per cent and treatment T6 [seed treatment with *Trichodermaviride*@ 4g/kg + foliar spray with SAAF (12% carbendazim + 63% mancozeb) @ 0.2% immediately after the onset of disease] which recorded PDI of 24.8 and disease reduction of 73.5 per cent.Maximum plant height (20.7 cm) was recorded in treatment T7 [seed treatment with carbendazim @ 2 g kg-1 + foliar spray with SAAF (12% carbendazim + 63 % mancozeb) @ 0.2 per cent immediately after onset of disease + foliar spray with SAAF (12% carbendazim + 63% mancozeb) @ 0.2 per cent 15 days after the first spray] while the minimum plant height was recorded in control (16.4 cm).The maximum shoot weight was recorded in treatment T7 (7.1 g) followed by treatment T5 (7.0 g) and T8 (7.0 g) which were statistically on par each other. The minimum shoot weight was recorded in control (5.4 g). The maximum root weight was recorded in treatment T7 (0.24 g) and minimum was recorded in control (0.09 g).From these results it is evident that the treatment T7 [seed treatment with carbendazim @ 2 g kg-1 + foliar spray with SAAF (12% carbendazim + 63% mancozeb) @ 0.2 per cent immediately after onset of disease + foliar spray with SAAF (12% carbendazim + 63% mancozeb) @ 0.2 per cent 15 days after the first spray] was more effective as integrated disease management strategies with the lowest PDI, maximum plant height, shoot and root dry weight compared to other treatments.

Rao and Narayana (2010) also reported that the maximum control of *Colletotrichumdematium*on chickpea was observed with the integrated treatment *viz*., seed treatment with carbendazim at 2 g kg-1 + foliar spray with SAAF (12% carbendazim + 63% mancozeb) at 0.05 per cent + foliar spray with SAAF (12% carbendazim + 63% mancozeb) at 0.05 per cent at 15 days after the first spray.

CONCLUSIONS

Diseases with limited distribution may still be economically important locally. Because of continuous changes in cultural practices, human interventions and climate change, some of the minor diseases may become economically important. One such example is dry root rot (*Rhizoctoniabataticola*) of chickpea, which is emerging as a potential threat to chickpea cultivation in semi-arid regions because the host plant is predisposed to infection by moisture stress and high temperatures during the flowering to pod filling stage (Sharma et al. 2012). Colletotrichum blight which is a minor disease at present can emerge as major threat in coming days. Keeping in view its importance an attempt was made to control disease of which Mancozeb, Tebuconazole, hexaconazole and *Trichodermakoningii* were effective against disease and with regard to IDM treatment, T7 [Seed treatment with carbendazim @ 2 g kg-1 + Foliar spray with SAAF (12% carbendazim + 63% mancozeb) @ 0.2 per cent immediately after onset of disease + foliar spray with SAAF (12% carbendazim + 63% mancozeb) @ 0.2 per cent 15 days after the first spray was more effective in inhibiting growth of pathogen.

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APPENDICES

Table 1: *E*valuation of Efficacy of Different Fungicides on Radial Growth of *Colletotrichumcapsici*in Poisoned Food Technique

S. No.	Fungicides	Concentration (%)	Radial Growth of *Colletotrichumcapsici* (mm)*	Per Cent Inhibition Over Control
1.	Carbendazim	0.05	2.8	93.2 (74.90)
		0.1	1.74	95.7 (78.12)
2.	Chlorotholonil	0.2	12.5	69.7 (56.94)
		0.3	8.0	80.6 (63.40)
3.	Copper Oxy Chloride	0.3	13.5	67.1 (55.42)
4.	Carbendazim + Mancozeb	0.2	3.4	91.7 (73.69)
5.	Hexaconazole	0.2	0.0	100.0 (90.0)
6.	Mancozeb	0.25	0.0	100.0 (90.0)
7.	Tebuconazole	0.1	0.0	100.0 (90.0)
8.	Thiophanate methyl	0.1	1.3	96.8 (79.91)
9.	*Trichodermaviridae*		10.4	74.8 (60.02)
10.	*Trichodermakoningii*		5.9	85.7 (67.99)
11.	Control	-	41.4	-
	C.D ($P < 0.05$)			3.32
	C.D ($P < 0.01$)			4.43
	SEm ±			1.16

Figure 1: In-vitro efficacy of Different Fungicides on Growth of C Capsiciby Poisoned Food Technique

Table 2: Integrated Disease Management: Pot Culture Studies

S. No.	Treatment	Per cent Disease Index*	Per cent Disease Reduction Over Control*	Plant Height (cm)*	Dry Weight (gm)*	
					Shoot	Root
T1	Seed treatment with Carbendazim @ 2g/kg.	29.6 (32.95)	68.3 (55.71)	20.1	6.8	0.21
T2	Seed treatment with *Trichodermaviride*@ 4g/kg.	38.8 (38.55)	58.4 (49.84)	19.4	6.5	0.14
T3	T1 + T2	28.1 (31.99)	69.9 (56.72)	20.2	6.8	0.22
T4	Foliar spray with SAAF (12% carbendazim + 63% mancozeb) @ 0.2 % immediately after the onset of disease	32.9 (34.97)	64.8 (53.61)	19.7	6.7	0.18
T5	T1 + T4	22.2 (28.11)	76.2 (60.74)	20.5	7.0	0.22
T6	T2 + T4	24.8 (29.84)	73.5 (59.02)	20.2	6.9	0.20
T7	T1 + T4 + Foliar spray with SAAF (12% Carbendazim + 63% Mancozeb) @ 0.2% 15 days after the first spray	15.5 (23.18)	83.3 (65.85)	20.7	7.1	0.24
T8	Adopting spacing of 45 x 10 cm + T5	22.2 (28.11)	76.2 (60.74)	20.5	7.0	0.22
T9	Control	93.7 **(75.44)**	0.0 **(0.0)**	16.4	5.4	0.09
	C.D ($P < 0.05$)	1.14	1.07	1.27	0.29	0.03
	C.D ($P < 0.01$)	1.57	1.47	1.75	0.39	0.05
	SEm ±	0.38	0.36	0.42	0.10	0.01