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Management of Root Rot Disease of Chick Pea (*Cicer arietinum* L.) Caused by (*Macrophomina phaseolina* (Tassi) Goid.) using Fungicides and Herbicides

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Eleven fungicides of four different categories *viz.*, six systemic, two non-systemic and three mixed formulations and Six herbicides at their three different concentrations were tested *in vitro* by poisoned food technique for evaluating their efficacy against *M. phaseolina* causing root rot of chickpea. Among all concentrations tested, the higher concentrations of each of fungicides and herbicides produced maximum growth inhibition of the pathogen. From tested fungicides, carbendazim (Bavistin 50WP), tricyclazole (Beam 75 WP), propiconazole (Tilt 25 EC), Quintal 50%WP (carbendazim 25 % + iprodine 27 %) and Sixer 75WP (carbendazim 12% + mancozeb 63%) at all three concentrations completely inhibited growth of the pathogen and proved to be highly toxic to the pathogen. Among all herbicides tested, pendimethalin (Stomp 30 EC), oxyflourfan (Galagan 23.5 EC) and alachlor (Laso 50 EC) were proved to be effective in inhibiting the mycelial growth of the pathogen.

Key words: Chickpea, Root Rot, *Macrophomina phaseolina,* fungicides, Herbicides.

Chickpea (*Cicer arietinum* L.) is one of the important pulse crops of India. In India, chickpea is grown in 7.57 Million hectares with 5.75 Million tones production with 759 kg/ha productivity. In Gujarat, area under chickpea has been 2.50 lakh hectares with total production of 2.10 lakh tones and productivity of 840 kg/ha (Anon., 2009)[1]. There are several constraints limiting the potential yield of chickpea, diseases of chickpea is one of them. Bagri *et al.* (2004)[2] observed that Chickpea suffers from seed borne fungal diseases *viz,* black root rot, dry root rot, wet root rot, seed rotting, root rot, stem rot, crown rot, foot rot, sclerotinia wilt and gray mould. Amongst these diseases, dry root rot [*Macrophomina phaseolina* (Tassi.) Goid] has been reported to cause severe losses right from seedling to maturity of the crop. In India, the first report on chickpea dry root rot (*M. phaseolina*) was given by Mitra in 1931 and Dastur in 1935 carried out some studies on the disease in central India (Nene and Reddy, 1987)[3]. The grain losses due to chickpea wilt and root rot has been estimated around 10 per cent which amounts to approximately 520 thousand tons annually. *M. phaseolina* (Tassi.) Goid has a wide host range and is responsible for causing

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losses on more than 500 cultivated and wild plant species (Khan, 2007)[4]. Considering the importance of root rot and the subsistence chickpea cultivation in Gujarat, research priority was given to manage root rot disease. To achieve this objective, present investigation was carried out on various fungicides and herbicides to find out suitable management for preventing crop losses.

MATERIAL AND METHODS

Eleven fungicides of four different categories *viz.*, six systemic, two non-systemic and three mixed formulations at three different concentrations (Table- 1) were tested for their efficacy *in vitro* against *M. phaseolina* using poisoned food technique. The required quantity

Table 1. Efficacy of different fungicides against *M. phaseolina*

S. No	Fungicides	Concentration (ppm)	Av. colony diameter (mm)	Per cent growth inhibition over control
T1	Carbendazim (Bavistin 50WP)	A. 500	0.70*(0.00)**	100
		B. 1000	0.70(0.00)	100
		C. 1500	0.70(0.00)	100
T2	Tricyclazole (Beam 75WP)	500	0.70(0.00)	100
		1000	0.70(0.00)	100
		1500	0.70(0.00)	100
T3	Propiconazole (Tilt 25EC)	500	0.70(0.00)	100
		1000	0.70(0.00)	100
		1500	0.70(0.00)	100
T4	Tridemorph (Calixin 80EC)	500	2.91(8.00)	91.01
		1000	0.70(0.00)	100
		1500	0.70(0.00)	100
T5	Thiophanate methyl (Topsin-M 75WP)	500	3.53(11.96)	86.56
		1000	3.24(10.03)	88.73
		1500	2.65(6.53)	92.66
T6	Propineb (Antracol 70WP)	500	5.05(25.00)	71.91
		1000	4.74(22.00)	75.28
		1500	4.56(20.36)	77.12
T7	Copper oxychloride (Blitox 50WP)	1000	2.76(7.13)	91.98
		2000	2.62(6.36)	92.85
		3000	0.70(0.00)	100
T8	Mancozeb(DithaneM-45 75 WP)	1000	3.27(10.23)	88.5
		2000	2.91(8.00)	91.01
		3000	0.70(0.00)	100
T9	Quintal 50WP (Carbendazim 25 %+ Ipridione 27 %)	1000	0.70(0.00)	100
		1500	0.70(0.00)	100
		2000	0.70(0.00)	100
T10	Sixer 75WP (Carbendazim 12%+Mancozeb 63%)	1000	0.70(0.00)	100
		1500	0.70(0.00)	100
		2000	0.70(0.00)	100
T11	Curzate 72 WP (Cyomoxil 8 %+ Mancozeb 64 %)	1000	5.62(31.16)	64.98
		1500	5.36(28.33)	68.16
		2000	4.99(24.50)	72.47
T12	Control	-	9.46(89.00)	-
	S.Em. $\pm$		0.026	
	C.D. at 5%		0.074	
	C.V.%		2.00	

Mean of three repetitions

*Figures are SQR + 0.5 transformed values. ** Figures in parenthesis are retransformed values

of each test fungicide was incorporated in a conical flask containing 100 ml molten sterilized PDA medium so as to get required concentration in parts per million (ppm). The flask containing poisoned medium was well shaken to facilitate uniform mixing of fungicides and 20 ml of the mixture was poured in each sterilized Petri plate. On solidification of the medium, the plates were inoculated in the centre by placing 5 mm diameter mycelial culture block cut aseptically with the help of cork borer from 10 days old actively growing pure culture of *M. phaseolina* grown on PDA. The PDA medium without fungicides served as control. Three repetitions were kept for each concentration of respective fungicide. The inoculated plates were incubated at 27±2^{0}C temperature. The observations on linear growth of fungus were recorded at 24 h. interval till the plate of control treatment was completely covered with mycelial growth. The per cent growth inhibitions (PGI) of the pathogen was worked out by using formula given by Vincent (1947)[5].

The same procedure has been followed by using herbicides at three different concentrations (Table 2).

RESULTS AND DISCISSION

The results presented in Table – 1 and depicted graphically in Fig. - 1 indicated that all fungicides evaluated significantly reduced the growth of *M. phaseolina* as compare to control but all the fungicides and their concentrations significantly differ within themselves. Among all concentration, the higher concentration of each fungicide produced maximum growth inhibition of the pathogen. From systemic fungicides, carbendazim (Bavistin 50WP), tricyclazole (Beam 75WP) and propiconazole (Tilt 25 EC) at all the three concentration (500, 1000, 1500ppm), tridemorph (Calixin 80EC) at 1000 and 1500 ppm concentration completely inhibited the growth of the pathogen. From non systemic fungicides, copper oxychloride (Blitox 50WP) and mancozeb

Table 2. Effect of herbicides on growth of *M. phaseolina in vitro*

S. No	Herbicides	Concentration (ppm)	Av. colony diameter (mm)	Per cent growth inhibition over Control
T1	Pendimethalin 30%	A. - 500	4.47*(19.56)**	74.58
	EC (Stomp)	B. - 1000	4.19(17.10)	77.78
		C. - 1500	3.21(9.90)	87.13
T2	Glyphosate 41% EC	500	5.98(35.30)	54.13
	(Glycel)	1000	5.11(25.70)	66.60
		1500	4.41(19.03)	75.27
T3	Alachlor 50% EC	500	6.09(36.83)	52.14
	(Laso)	1000	4.77(22.33)	70.98
		1500	4.15(16.83)	78.13
T4	Oxyfluorfen	500	8.59(73.66)	4.97
	23.5%EC (Galagan)	1000	4.99(24.50)	68.16
		1500	3.75(13.60)	82.32
T5	2,4-D sodium salt80	500	6.86(46.60)	39.44
	% WP (Vimaxone)	1000	6.25(38.86)	49.50
		1500	5.43(29.00)	62.31
T6	Atrazine 50%WP	500	8.65(74.50)	3.19
	(Atrataf)	1000	8.14(65.83)	14.46
		1500	8.10(65.10)	15.41
T7	Control	-	8.79(76.96)	-
	S.Em. ±		0.18	
	C.D. at 5%		0.51	
	C.V.%		5.22	

Mean of three repetitions
*Figures are SQR + 0.5 transformed values. ** Figures in parenthesis are retransformed values

(Dithane m-45 75WP) at 3000 ppm concentration completely inhibited growth of the pathogen. From mix formulations, carbendazim 25% + iprodine 27% (Quintal 50WP) and carbendazim 12% + mancozeb 63% (Sixer 75WP) at 1000, 1500, 2000 ppm concentration completely inhibited growth of the pathogen.

The next best in order of merit were copper oxychloride (Blitox 50WP) 2000 ppm (92.85%), thiophanate methyl (Topsin-M 75WP)1500 ppm (92.66%), copper oxychloride (Blitox 50WP) 1000ppm (91.98%), tridemorph (Calixin 80EC) 500 ppm (91.01%) which was statistically at par with mancozeb (Dithane m-45 75WP) 2000 ppm (91.01%) followed by thiophanate methyl (Topsin-M 75WP)1000 ppm (88.73%) were highly toxic to the pathogen. Mancozeb (Dithane m-45 75WP) 1000ppm (88.50%), thiophanate methyl (Topsin-M 75WP)500 ppm (86.56%), propineb (Antracol 70WP) 1500 ppm (77.12%), propineb (Antracol 70WP) 1000 ppm (75.28%), cymoxanil 8% + mancozeb 64% (Curzate M-8 72WP) 2000 ppm (72.47%) and propineb (Antracol 70WP) 500 ppm (71.91%) were moderately effective. Cymoxanil 8% + mancozeb 64% (Curzate M-8 72WP) 1500ppm (68.16%) and cymoxanil 8% + mancozeb 64% (Curzate M-8 72WP) 1000 ppm (64.98%) proved very poor in inhibiting the growth of *M. phaseolina*.

The results presented in Table 2 and depicted graphically in Fig. 2 indicated that all herbicides evaluated significantly reduced the growth of *M. phaseolina* as compare to control but all the herbicides and their concentrations significantly differ within themselves. Among all concentration, the higher concentration of each herbicides produced maximum growth inhibition of the pathogen. Pendimethalin (stomp 30EC) 1500

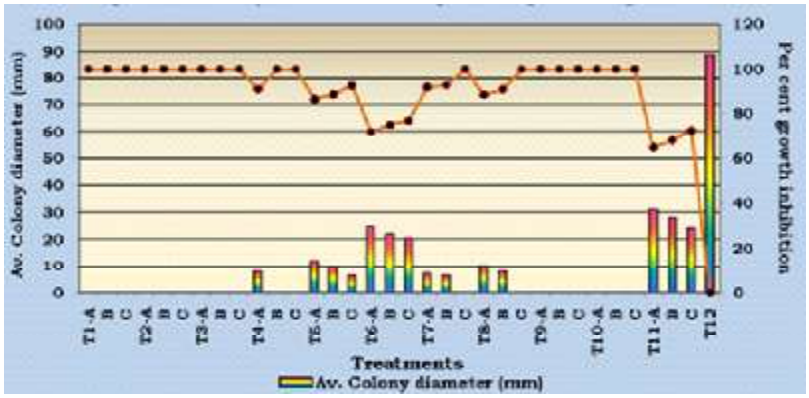

Fig. 1. Efficacy of different fungicides against *M. phaseolina*

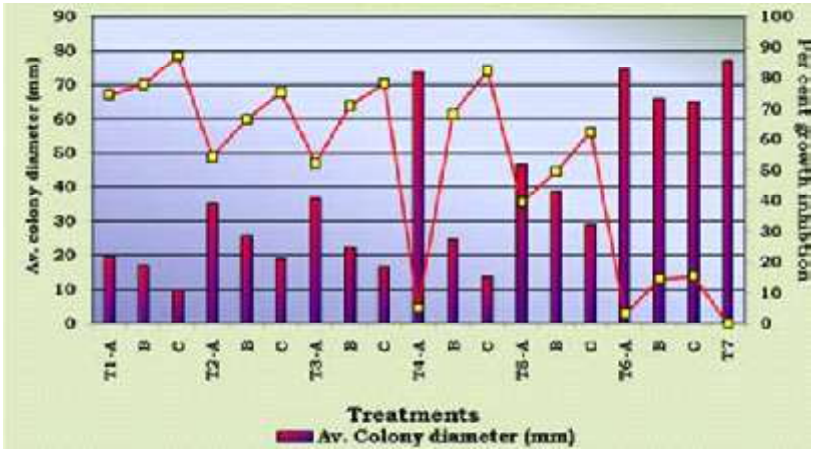

Fig. 2. Efficacy of herbicides against *M. phaseolina in vitro*

ppm (87.13%), oxyflourfan (galagan 23.5EC) 1500 ppm (82.32%) which were statistically at par with alachlor (laso 50 EC) 1500 ppm (78.13%) and pendimethalin (stomp 30EC) 1000 ppm (77.78%) were highly toxic to the pathogen. The next best in order of merit were glyphosate (glycel 41EC) 1500 ppm (75.27 %), pendimethalin (stomp 30 EC) 500 ppm (74.58 %), alachlor (laso 50 EC) 500 ppm (70.98%), oxyflourfan (galagan 23.5EC) 1000 ppm (68.16 %), glyphosate (glycel 41EC) 1000 ppm (66.60 %), 2-4 D (Vimaxone 80 WP) 1500 ppm (62.31%), glyphosate (glycel 41 EC) 500 ppm (54.13 %) and alachlor (laso 50 EC) 500 ppm (52.14 %) were moderately effective. Whereas, 2-4 D (Vimaxone 80WP) 1500 ppm (62.31%), 2-4 D (vimaxone 80 WP) 500 ppm (39.44 %), atrazine (atrataf 50WP) 1500 ppm (15.41%), atrazine (atrataf 50WP) 1000 ppm (14.46%), oxyflourfan (galagan 23.5 EC) 500 ppm (4.57%) and atrazine (atrataf 50 WP) 500 ppm (3.19%) were poorly effective against the pathogen.

DISCUSSION

It is evident from the results that the growth inhibition of *M. phaseolina* increased as increase in the concentration of the chemicals. Carbendazim, tricyclazole, propiconazole, carbendazim + iprodine and carbendazim + mancozeb proved most effective followed by tridemorph, copper oxychloride, mancozeb, thiophanate methyl, propineb and cymoxanil + mancozeb. Lambhate *et al.* (2002)[6] tested the efficacy of fungicides against *M. phaseolina*, root rot pathogen of cotton *in vitro* and reported that Bavistin, Ridomil M Z-72 and Topsin-M at 0.1, 0.2 and 0.3 per cent showed cent per cent inhibition of mycelial growth of the fungus. Jaiman *et al.* (2009)[7] reported that carbendazim 50 WP (2 gm/kg), thiophanate methyl 70 WP (2 gm/kg), thiram 75 WP (2.5 gm/kg) and captan 50 WP (2.5 gm/kg) were superior in reducing pre and post emergence seedling rot and root rot disease (*M. phaseolina*) of cluster bean. The present results are in conformity with the findings of earlier workers.

Among all herbicides pendimethalin (Stomp 30EC), oxyflourfan (Galagan 23.5 EC) and alachlor (Laso 50EC) were highly fungi toxic. Chavan (2006)[8] studied the effect of different herbicides against *M. phaseolina* under laboratory condition among them pendimethalin inhibited maximum growth (73.37 %) of fungus. The result of present study is in confirmity with those of earlier worker mentioned above.

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