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Evaluation of fungicides and bioagents in pot condition for management of dry root rot of Chickpea (*Cicer arietinum* L.) caused by *Macrophomina phaseolina* (Tassi) Goid.

R. LOKESH [1*], Y. B. MADAGOUDRA[2], C. SAI SRUJAN[2] AND PRAKASH TERIN[2]

[1]Department of Plant Pathology, N. M. College of Agriculture, Navsari Agricultural University, Navsari-396450, Gujarat*

[2]Department of Agronomy, N.M.College of Agriculture, Navsari Agricultural University, Navsari - 396450, Gujarat

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Chickpea (*Cicer arietinum* L.) is one of the important legume pulse crops and it is grown in India and other semi-arid regions of the world. It originated in south-eastern Turkey. Dry root rot of chickpea is the most devastating disease of chickpea. A pot culture experiment was conducted with the aim of finding out an effective integration of various methods for management of dry root rot of chickpea,. The fungicides and bioagents were evaluated in pot conditions. Experimental results revealed that seed treatment with *Trichoderma harzianum* @ 10g/kg seed shows cent per cent disease reduction of root rot of chickpea; the next treatment is *T. viride* @ 10g/kg seed, carboxin 37.5% + thiram 37.5% at 2.7g/kg, carbendazim @ 2g/kg seed showed minimum disease incidence of (26.57%), mancozeb @ 3.3g/kg (54.99%) disease incidence of chickpea and followed by carbendazim 12% + mancozeb 63% @ 2.7g/kg (39.23%) disease incidence, thiophanate methyl @ 0.71g/ kg (50.77%), chlorothalonil @ 3.3 g/kg seed showed more root rot incidence (63.44%), while, control recorded maximum (90.00%) disease incidence of root rot of chickpea.

Key words : Chickpea, dry root rot, *Macrophomina phaseolina*, bioagents, fungicides

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is one of the important legume pulse crops and it is majorly grown in India and other semi-arid regions of the world. It belongs to the family Fabaceae, subfamily Faboideae. Chickpea is a self-pollinating diploid crop with chromosome number (2n=16) and a genome consisting of 740 Mbp. It originated in south-eastern Turkey from where it has spread to other countries of the world.

Among the major pulse crops, chickpea contributes nearly 32.60 per cent and 40.50 per cent of total pulse area and total pulse production, respectively. In India, chickpea is cultivated in an area of about 8.32 million ha with a production of 9.8metrictone and 925 kg/ha productivity (Anonymous, 2018). The chickpea crop was reported to be attacked by nearly 172 pathogens (67 fungi, 22 viruses, 3 bacteria, 80 nematodes) from all over the world. Some of the serious diseases in chickpea are of dry and wet root rot [*Macrophomina phaseolina* (Tassi) Goid, asexual stage of *Rhizoctonia bataticola,* (Taub.) Butler], wilt [*Fusarium oxysporum* f. sp. *ciceri*, (Padwick) Snyd. & Hans.], ascochyta blight [*Ascocthya rabiei*, (Pass.) Labr.] and collar rot (*Sclerotium rolfsii* Sacc.). Among the diseases of chickpea, dry root rot is an emerging destructive disease and and is a constraint to chickpea productivity and production, as the disease is more prevalent during hot temperature of 30 to 35°C and low soil moisture conditions (Pande and Sharma, 2010). *R. bataticola* is a soil-inhabiting pathogen and capable of infecting chickpea at any crop stage, but most commonly infects chickpea at post-reproductive stage in dry and warm regions (Sharma and Pande, 2013).

*Correspondence: abhiramloke@gmail.com

MATERIALS AND METHODS

A pot experiment was conducted to test the effectiveness of fungicides and bio-agents. The most effective fungicides viz., carbendazim, thiophanate methyl, mancozeb, chlorothalonil, and carboxin + thiram, carbendazim + mancozeb, antagonists viz., *Trichoderma harzianum* and *Trichoderma viride* were used in pots condition against *M. phaseolina* individually for the management of the dry root rot of chickpea under net house conditions.

The chickpea seeds were treated with respective fungicides and bioagents, whereas control with only distilled water. The healthy seeds of chickpea were surface sterilized with 0.1 % mercuric chloride ($HgCl_2$) solution and washed thoroughly with sterile distil water to remove traces of the mercuric chloride (HgCl2). Surface sterilized seeds were dipped in the mycelial mat of *Macrophomina phaseolina* for 30 minutes and were sown in trays filled with autoclaved soil and the seeds were sown in pots.

In each pot five chickpea seeds of GG-05 either treated or untreated were sown in each pot and watered sufficiently. Untreated seeds were sown in pathogen uninoculated pots to compare the disease incidence. Observations on the disease incidence was recorded at 30 days and 45 days after sowing.

Observations were recorded on seed germination, plant population at 30 and 45 DAS and based on which was calculated as per the following formula was given by Wheeler (1969).

$$PDI = \frac{\text{Number of diseased plants} \times 100}{\text{Total number of plants}}$$

RESULTS AND DISCUSSION

Results of the trial revealed that seed treatment with *Trichoderma harzianum* @ 10g/kg seed shows cent per cent disease reduction of root rot of chickpea, the next best being *T. viride* @ 10g/kg seed, carboxin 37.5% + thiram 37.5% at 2.7g/kg, carbendazim @ 2g/kg seed which showed minimum disease incidence (26.57%),followed by mancozeb @ 3.3g/kg (54.99% disease incidence), carbendazim 12% + mancozeb 63% @ 2.7g/kg (39.23% disease incidence), thiophanate methyl @ 0.71g/ kg (50.77%), chlorothalonil @ 3.3 g/kg seed showed more root rot incidence (63.44%), while control recorded maximum (90.00%) disease incidence of root rot of chickpea. The obtained experimental results were similar and compared with the results of Girija and Maheswaran (2003) who reported the compatibility of *T. virens* with carbendazim *in vitro* at three concentrations i.e.,100,150 and1000 ppm and observed that the

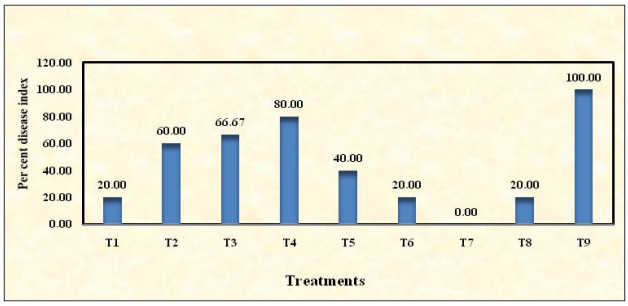

Fig. 1 : Management of dry root rot of chickpea in pot condition

T_1 - Carbendazin 50 WP T_2- Thiophanate methyl 70 WP T_3-Mancozeb 75WP T_4- Chlorothalonil 75WP T_5 - Carbendazim (12%) + Mancozeb (63%) WP T_6- Carboxin (37.5%)+Thiram (37.5%) WP T_7- *Trichoderma harzianum* T_8- *Trichoderma viride* T_9 - Control

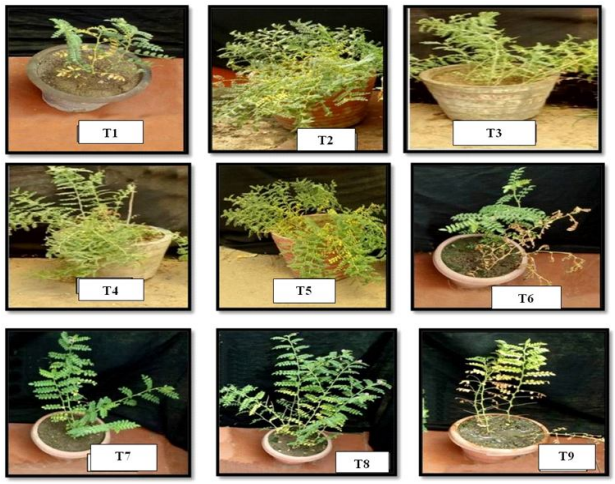

Fig. 2 : Effect of bioagents and fungicides against dry root rot of chickpea in pot condition

T_1 - Carbendazin 50 WP T_2- Thiophanate methyl 70 WP T_3-Mancozeb 75WP T_4- Chlorothalonil 75WP T_5 - Carbendazim (12%) + Mancozeb (63%) WP T_6- Carboxin (37.5%)+Thiram (37.5%) WP T_7- *Trichoderma harzianum* T_8- *Trichoderma viride* T_9 - Control

antagonist *T. virens* was compatible with carbendazim at 100ppm concentration. Chavan (2006) reported that application of *T. harzianum* @ 10g/kg seed was more effective for the root rot disease control (68.39%) with higher germination of chickpea seeds. Kaushal (2008) also reported that seed treatment with carbendazim @ 2g/kg was effective in control of chickpea dry root rot.

Table 1: Management of dry root rot of chickpea in pot condition

Tr. No.	Treatment details	Quantity (g/kg)	Method of application	Per cent disease incidence (%)
T_1	Carbendazim 50 WP	1.2	Seed treatment	20.00 (26.57)
T_2	Thiophanate methyl 70 WP	2.2	Seed treatment	60.00 (50.77)
T_3	Mancozeb 75 WP	3.3	Seed treatment	66.67 (54.99)
T_4	Chlorothalonil 75 WP	3.3	Seed treatment	80.00 (63.44)
T_5	Carbendazim (12%) + Mancozeb (63%) WP	2.7	Seed treatment	40.00 (39.23)
T_6	Carboxin (37.5%) + Thiram (37.5%) WP	2.7	Seed treatment	20.00 (26.57)
T_7	*Trichoderma harzianum,* NAU isolate	10	Seed treatment	0.00 (0.00)
T_8	*Trichoderma viride*, NAU isolate	10	Seed treatment	20.00 (26.57)
T_9	Control	-		100.00 (90.00)
S. Em. ±				1.41
C. D. at 5%				4.18
C. V. %				5.80

@ Average of three replications
*Figures outside parenthesis are original value
**Figures in parenthesis are arc sine transformed value

Choudhary *et al*. (2010) reported that the combination of soil application of biocontrol agents, *T. viride* and *T. harzianum* @ 1.5 to 2kg/ha reduced disease incidence of mungbean root rot (23%), while *T. harzianum* and *A. versicolor* showed higher disease incidence (31%) (Table 1, Figs.1and 2).

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