

## RESEARCH ARTICLE

# Studies on variability on different fungicides in the growth of twenty isolates of *Fusarium oxysporum* f.sp. *ciceri* causing vascular wilt of chickpea

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## ARTICLE INFO

**Received** : 11.10.2012  
**Revised** : 30.01.2013  
**Accepted** : 20.02.2013

## Key Words :

Variability,  
 Chickpea wilt,  
 Fungicides

## ABSTRACT

Field survey was undertaken and seventy one samples of chickpea wilted plants were collected from twenty three locations in different districts namely, Bhopal, Raisen, Rajgarh, Sagar, Sehore and Vidisha of Vindhyan Plateau Zone of Madhya Pradesh. Out of seventy one isolates, only twenty were found pathogenic to chickpea. These isolates were categorized into six different groups on the basis of colony diameter, growth pattern and number of micro and macro conidia. The physiological studies of the representative isolates of these six groups were made on six different fungicides at 1000 ppm concentration. All the fungicides differed significantly from each other. The minimum mean radial growth (39.68 mm) was recorded in groups 5 of isolates Ri4, Ri5 and V<sub>2</sub> and maximum (41.04 mm) in group one consisting of B<sub>2</sub>, B<sub>3</sub>, Se<sub>6</sub> and Se<sub>8</sub>. The maximum mean radial growth (84.46 mm) was obtained on untreated control and minimum (15.36 mm) on Thiram. These isolates exhibited three types of growth pattern namely, fluffy partially submerged and submerged. The maximum number of micro conidia were produced on untreated (control) (7.58 million/ml) and minimum (1.29 million/ml) on Thiram. Similarly, the maximum number of macro conidia were produced on untreated control (2.67million/ml) and minimum (0.19 million/ml) on Thiram.

**How to view point the article :** Shrivastava, Ashish (2013). Studies on variability on different fungicides in the growth of twenty isolates of *Fusarium oxysporum* f.sp. *ciceri* causing vascular wilt of chickpea . *Internat. J. Plant Protec.*, 6(1) : 86-89.

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## INTRODUCTION

Chickpea (*Cicer arietinum* L) is one of the important pulse crops grown throughout the country. The crop is prone to several diseases, out of which wilt caused by *Fusarium oxysporum* f.sp. *ciceri* is much dangerous than other diseases (Singh and Dahiya, 1973). The incidence of the disease varies from 10-100 per cent depending on the locality. In Madhya Pradesh, its incidence has been reported from 0-60 per cent (Gupta *et al.*, 1983). In order to find suitable lines resistant to this disease, it is necessary to study the variability of the pathogen. The isolates of the chickpea wilt pathogen obtained from various locations in Vindhyan plateau zone of Madhya

Pradesh, were grouped into six groups on the basis of morphological and cultural characters (Gupta *et al.*, 1986) and physiological basis (Kushwaha *et al.*, 1974). The variability in the growth of twenty isolates on six different fungicides is reported in this paper.

## MATERIALS AND METHODS

All the pathogenic isolates were grown on six fungicides namely, Carbendazim (Bavistin 50% wp), Triadimefan (Bayleton 25 % wp), Myclobutinal (sythane 10% wp), Thiram (75 % DS), Mancozeb (75% Wp) and Fytolan (Copper oxychloride 50 % Wp) (Kotwal, 1981) at a 1000 ppm concentration *in vitro*.

Fungicides were tested by "poisoned food technique". The desired quantity of the fungicide was incorporated in the molten P.D.A. Three replications were maintained for each fungicide and isolate. The medium without fungicide served as control. Five mm disc cut from the margin of seven day old pure culture was transferred to each Petriplate containing fungicide amended medium. The plates were then incubated at  $28 \pm 1^\circ\text{C}$  for seven days. The diameter of the colony was measured in mm after seven days of incubation. The growth pattern along with the pigmentation of medium both on upper and lower surfaces was noted. On tenth day of incubation, one disc (5 mm diameter) of the culture was cut randomly from each of the Petriplates, suspended in 2.0 ml of sterilized water shaken well and was examined under the low power of the micro-scope on haemocytometer. The number of macro and micro-conidia/ml of suspension were calculated using the following formula:

$$\text{Conidia / ml} = X \times 250000$$

where,

$$X = \text{Number of conidia / square of haemocytometer of } 1/25 \text{ mm}^2$$

## RESULTS AND DISCUSSION

Observations were recorded on the radial growth (mm),

growth pattern as fluffy, partially submerged and submerged and the number of micro and macro conidia/ml. All the groups of isolates of *Fusarium oxysporum* f. sp. *ciceri* differed from each other. The radial growth (mm) on six fungicides at a 1000 ppm concentration *in vitro* (Agrawal *et al.*, 1974) is given in Table 1. The data revealed that all the fungicides reduced the radial growth significantly over control. The minimum mean radial growth (39.68 mm) was obtained in case of group 5 consisting of Ri4, Ri5 and V<sub>2</sub>, while maximum (41.04 mm) in group 1 of B<sub>2</sub>, B<sub>3</sub>, Se<sub>6</sub> and Se<sub>8</sub>. Radial growth of the pathogen was different on the most of the fungicides. The maximum mean radial growth (35.04 mm) was observed on Triadimefan and minimum in Thiram (15.36 mm) as compared to 84.46 mm in untreated (control). The interaction effect between isolates and fungicides was also significant statistically. As regards the growth pattern, only group 1 of B<sub>2</sub>, B<sub>3</sub>, Se<sub>6</sub> and Se<sub>8</sub> isolates was found to produce the same growth pattern (fluffy). Other groups varied in this respect. On the basis of growth pattern, isolates could be placed into six groups as shown in Table 2.

The number of micro conidia of *Fusarium oxysporum* f.sp. *ciceri* on six different fungicides are recorded in Table 3. It is clear from the data that all the fungicides reduced the sporulation over control. The maximum sporulation (2.33 million/ml) was recorded on Triadimefan. The sporulation was

**Table 1: Radial growth (mm) of 20 isolates of *Fusarium oxysporum* f.sp. *ciceri* on different fungicides at 1000 ppm concentration *in vitro***

Group No.	Fungicides						Untreated (control)	Mean	Isolate included
	Carbendazim	Triadimefan	Myclobutinal	Thiram	Mancozeb	Fytolan			
1.	20.16	35.66	25.16	16.49	30.99	34.16	83.66	41.04	B <sub>2</sub> , B <sub>3</sub> , Se <sub>6</sub> and Se <sub>8</sub>
2.	15.99	34.99	22.66	14.99	34.99	35.33	83.33	40.38	Ri <sub>1</sub> and Sa <sub>2</sub>
3.	17.82	37.83	25.49	14.99	32.66	33.49	83.83	41.01	B <sub>5</sub> , Ri <sub>8</sub> Sa <sub>4</sub> and Se <sub>3</sub>
4.	19.10	34.44	24.66	15.99	30.21	32.66	84.22	40.21	B <sub>8</sub> , Rj <sub>4</sub> V <sub>4</sub> and V <sub>5</sub>
5.	17.66	31.49	23.32	14.83	30.32	32.99	82.49	39.68	Ri <sub>4</sub> , Ri <sub>5</sub> and V <sub>2</sub>
6.	17.77	35.77	22.88	14.88	31.77	31.77	84.22	39.84	Se <sub>2</sub> , Se <sub>5</sub> and V <sub>6</sub>
Mean	18.08	35.04	24.02	15.36	32.16	33.40	84.46		

C.D. at 5% for Isolates 0.62 and for fungicides 0.36, B- Bhopal, Ri-Raisen, Sa- Sagar, Se- Sehare and V- Vidisha

**Table 2 : Growth pattern of 20 isolates of *Fusarium oxysporum* f.sp. *ciceri* on different fungicides at 1000 ppm concentration *in vitro***

Group No.	Fungicides						Untreated (control)	Isolate included
	Carbendazim	Triadimefan	Myclobutinal	Thiram	Mancozeb	Fytolan		
1.	Fluffy	Fluffy	Fluffy	Fluffy	Fluffy	Fluffy	Fluffy	B <sub>2</sub> , B <sub>3</sub> , Se <sub>6</sub> and Se <sub>8</sub>
2.	Fluffy	Fluffy	Submerged	Submerged	Fluffy	Submerged	Fluffy	Ri <sub>1</sub> and Sa <sub>2</sub>
3.	Partially submerged	Submerged	Fluffy	Partially submerged	Submerged	Fluffy	Fluffy	B <sub>5</sub> , Ri <sub>8</sub> Sa <sub>4</sub> and Se <sub>3</sub>
4.	Partially submerged	Partially submerged	Submerged	Submerged	Partially submerged	Submerged	Partially submerged	B <sub>8</sub> , Rj <sub>4</sub> V <sub>4</sub> and V <sub>5</sub>
5.	Submerged	Fluffy	Partially submerged	Fluffy	Submerged	Partially submerged	Fluffy	Ri <sub>4</sub> , Ri <sub>5</sub> and V <sub>2</sub>
6.	Submerged	Submerged	Partially submerged	Partially submerged	Submerged	Partially submerged	Submerged	Se <sub>2</sub> , Se <sub>5</sub> and V <sub>6</sub>

B- Bhopal, Ri-Raisen, Sa- Sagar, Se- Sehare and V- Vidisha

reduced significantly in all the other fungicides. It was minimum in Thiram (1.29 million/ml) followed by Fytolan (1.37 million/ml), Carbendazim (1.60 million/ml), Myclobutinal (2.01 million/ml) and Mancozeb (2.11 million/ml) as compared to 7.58 million/ml in control.

The maximum micro conidia were produced by group 5 of (3.16 million/ml) Ri<sub>4</sub>, Ri<sub>5</sub> and V<sub>2</sub> while group 6 of Se<sub>2</sub>, Se<sub>5</sub> and V<sub>6</sub> had minimum micro conidia (2.99 million/ml). The interaction effect between isolates and fungicides with regard to micro conidia production was significant statistically indicating the difference among different groups.

The number of macro conidia of *Fusarium oxysporum* f.sp. *ciceri* on six fungicides are recorded in Table 4. It is evident that all the fungicides reduced macro-conidia formation greatly (Agrawal and Khare, 1975). The maximum reduction was by Thiram (0.19 million/ml), Fytolan (0.23 million/ml), Carbendazim (0.24 million/ml), Mancozeb (0.34 million/ml), Myclobutinal (0.35 million/ml) and Triadimefan (0.38 million/ml) as compared to 2.67 million/ml in control.

As regard the groups, maximum macro conidia were formed by group No. 1 (0.77 million/ml) of B<sub>2</sub>, B<sub>3</sub>, Se<sub>6</sub> and Se<sub>8</sub>. The minimum macro conidia were produced by group No. 6 (0.70 million/ml) of Se<sub>2</sub>, Se<sub>5</sub> and V<sub>6</sub>. The statistically significant effect of interaction between isolates and fungicides with regard to formation of macro-conidia indicated that the isolates

differed from each other (Agrawal and Khare, 1975). In general, it is clear that much less macro conidia were produced as compared to micro-conidia irrespective of isolates of the fungus and different fungicides.

The radial growth of isolates in general reduced on all six fungicides to a variable extent when compared with untreated (control). On the other hand, the mean radial growth did not differ much from each other. Although, the data were statistically significant with regard to isolates, the significant interaction effect however, showed the variability amongst the isolates. Probably the qualitative characters can only be the best criterion for such type of grouping of isolates.

The 20 isolates exhibited three types of growth pattern that is fluffy, partially submerged and submerged. As regards the growth pattern only group 1 of B<sub>2</sub>, B<sub>3</sub>, Se<sub>6</sub> and Se<sub>8</sub> isolates had same growth pattern (fluffy) on all the fungicides. Group 2 of Ri<sub>1</sub> and Sa<sub>2</sub> isolates had fluffy mycelium on Carbendazim, Triadimefan, Mancozeb and Untreated (control) but it changed submerged on Myclobutinal, Thiram and Fytolan. Similarly, group 6 of Ri<sub>2</sub>, Se<sub>5</sub> and V<sub>6</sub> isolates were submerged on Carbendazim, Triadimefan, Mancozeb and untreated (control) except on Myclobutinal, Thiram and Fytolan on which their growth was partially submerged.

As observed, the sporulation was also influenced by different fungicides. The higher number of micro as well as

**Table 3: Micro-conidia million/ml of 20 isolates of *Fusarium oxysporum* f.sp. *ciceri* on different fungicides at 1000 ppm concentration *in vitro***

Group No.	Fungicides							Mean	Isolate included
	Carbendazim	Triadimefan	Myclobutinal	Thiram	Mancozeb	Fytolan	Untreated (control)		
1.	1.53	2.25	2.06	1.33	2.35	1.31	7.83	3.11	B <sub>2</sub> , B <sub>3</sub> , Se <sub>6</sub> and Se <sub>8</sub>
2.	1.49	2.00	2.00	1.49	2.04	1.41	7.58	3.00	Ri <sub>1</sub> and Sa <sub>2</sub>
3.	1.53	2.30	1.94	1.25	1.97	1.43	7.77	3.03	B <sub>5</sub> , Ri <sub>8</sub> Sa <sub>4</sub> and Se <sub>3</sub>
4.	1.72	2.22	2.00	1.22	2.14	1.47	7.35	3.02	B <sub>8</sub> , Rj <sub>4</sub> V <sub>4</sub> and V <sub>5</sub>
5.	1.89	2.72	2.05	1.33	2.25	1.43	7.31	3.16	Ri <sub>4</sub> , Ri <sub>5</sub> and V <sub>2</sub>
6.	1.49	2.52	2.01	1.16	1.93	1.22	7.66	2.99	Se <sub>2</sub> , Se <sub>5</sub> and V <sub>6</sub>
Mean	1.60	2.33	2.01	1.29	2.11	1.37	7.58		

C.D. at 5 % for Isolates 0.18 and for fungicides 0.10 B- Bhopal, Ri-Raisen, Sa- Sagar, Se- Sehore and V- Vidisha

**Table 4: Macro-conidia million/ml of 20 isolates of *Fusarium oxysporum* f.sp. *ciceri* on different fungicides at 1000 ppm concentration *in vitro***

Group No.	Fungicides							Mean	Isolate included
	Carbendazim	Triadimefan	Myclobutinal	Thiram	Mancozeb	Fytolan	Untreated (control)		
1.	0.31	0.47	0.40	0.23	0.37	0.30	2.58	0.77	B <sub>2</sub> , B <sub>3</sub> , Se <sub>6</sub> and Se <sub>8</sub>
2.	0.30	0.40	0.30	0.22	0.25	0.17	2.83	0.74	Ri <sub>1</sub> and Sa <sub>2</sub>
3.	0.20	0.36	0.43	0.17	0.35	0.26	2.60	0.73	B <sub>5</sub> , Ri <sub>8</sub> Sa <sub>4</sub> and Se <sub>3</sub>
4.	0.22	0.34	0.27	0.16	0.35	0.26	2.81	0.72	B <sub>8</sub> , Rj <sub>4</sub> V <sub>4</sub> and V <sub>5</sub>
5.	0.23	0.40	0.36	0.18	0.30	0.21	2.69	0.73	Ri <sub>4</sub> , Ri <sub>5</sub> and V <sub>2</sub>
6.	0.20	0.36	0.36	0.18	0.41	0.23	2.49	0.70	Se <sub>2</sub> , Se <sub>5</sub> and V <sub>6</sub>
Mean	0.24	0.38	0.35	0.19	0.34	0.23	2.67		

C.D. at 5 % for Isolates 0.088 and for fungicides 0.048 B- Bhopal, Ri-Raisen, Sa- Sagar, Se- Sehore and V- Vidisha

macro conidia were recorded on untreated (control). While, the numbers were reduced drastically on other fungicides. The number of macro conidia in all the cases was much less as compared to micro conidia. The data on sporulation were statistically significant so as the isolates on the basis of these characters.

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