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EVALUATION OF CHILLI GERMPLASM FOR RESISTANCE TO *COLLETOTRICHUM CAPSICI* AND ITS MANAGEMENT

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A B S T R A C T

The present investigation was done to find out a resistant source among chilli germplasm against anthracnose (*Colletotrichum capsici*) by two methods of inoculation viz; pin prick and spray method. All the available germplasm was screened out against C*. capsici* in micro plots. None of the cultivar/lines was found to be fully resistant against C*. capsici* while Talhar, Sanam, C-33, C-19 and C-72 were moderately resistant. Longi was found to be highly susceptible. *In vitro* studies were conducted to evaluate the efficacy of different fungicides (Dithane M-45, Alliet, Carbendazim, Acrobit and Antracol) against *C. capsici* at different concentrations after three time intervals. All fungicides exhibited differential effects in inhibiting the mycelial growth of C. *capsici.* Among these fungicides, Carbendazim was the most effective in inhibiting the mycelial growth after 4, 8 and 12 days followed by Acrobit, Dithan M-45 and Antracol. The least effective fungicide was Alliet. The results of this study will serve in finding the resistance source against *C. capsici* and to select the most effective means for the management of *C*. *capsici*.

Keywords: Chillies, *C*. *capsici*, fungicides, germplasm, mycelial growth.

INTRODUCTION

Chilli (*Capsicum* sp.) is considered to be one of the most important crops in the tropics. The global area cultivated with chilli in 2011 was 66500 ha with a total production of 191800 tonnes in Pakistan (FAO, 2011). Chilli is an important economic crop worldwide (Poulos, 1992) and is severely infected by anthracnose which may cause up to 50% (Pakdeevaraporn *et al*., 2005) or even 84% yield losses due to attack of *Colletotrichum capsici* (Thind and Jhooty, 1985). Typical anthracnose symptoms on chilli fruit include sunken necrotic tissues with concentric rings of acervuli and fruits showing blemishes have reduced marketability (Manandhar *et al*., 1995).

Chemicals are the most common and practical method to control anthracnose diseases but the use of resistant cultivar is the better and environmental friendly option against *C. capsici* (Akram e*t al.,* 2004). However, fungicide tolerance often arises quickly, if a single compound is relied upon too heavily (Staub, 1991). Manandhar *et al*. (1995) found that fungicide spraying is the most common and practical method to control anthracnose. Since the pathogen frequently affects green or red peppers, chemical spraying is concentrated in July and August, when these fruits are formed. However, pepper anthracnose also can infect young seedlings as well as small immature fruits (Lewis-Ivey *et al*., 2004).

Taking under consideration the importance of chilies, the present study was designed to screen out different varieties/lines of chillies against *Colletotrichum capsici* and its chemical management.

MATERIALS AND METHODS

Anthracnose affected chilli fruits were collected from farmers' fields. Pathogen was isolated from anthracnose lesions of disease affected fruits and cultured on PDA. Pathogen was identified on the basis of size and morphology of sprouting acervuli, conidia setae and morphology of culture medium and microscopic observations. The experiment was conducted in research area of Department of Plant Pathology, University of Agriculture Faisalabad. A disease free

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nursery of available germplasm of chillies was taken from Ayub Agriculture Research Institute Faisalabad and grown in sterilized soil. One month old seedlings were planted with RCBD design. Plot size was 3 m x 3 m. Each treatment was replicated five times. All cultural practices were done according to recommendations. Weeding was done manually. Artificial inoculation was practiced on chilli plants of the available germplasm by two methods; spray and pin prick method. Un-inoculated plants served as control. Percent indices of anthracnose and response of germplasm against anthracnose were recorded. Data was analyzed by ANOVA and mean separation was done by Duncan's multiple range test using a statistical programme MSTATC.

Different fungicides; Dithane M-45, Alliet, Carbendazim, Acrobit and Antracol were tested *in vitro* to evaluate their effect on colony growth of *C. capsici* by poisoned food technique. Fungicidal suspensions of different concentrations were prepared by dissolving requisite quantities of each fungicide in warm PDA. The fungicides were thoroughly mixed with the medium by shaking with hands after autoclaving. About 15 ml of sterilized medium was poured in each 9 cm sterilized Petri dish. After solidification, the plates were inoculated by placing 5 mm discs of 7 days old PDA culture of *C. capsici.* Five replicates were used for each concentration of each fungicide. PDA plates receiving no fungicide served as control. The inoculated plates were incubated at 28 ^{0}C and data on radial colony diameter was recorded after 4-5 days of incubation when the growth of control colony completely covered the plate. Diameter of colonies on PDA with and without fungicide was measured from the bottom of the Petri dishes. Inhibition of radial growth was computed based on colony diameter on control plate using the following formula as stated by Sundar *et al*. (1995).

$$\%inhibition = \frac{x - y}{y}$$

x = growth of control plate, y = growth of test plate.

RESULTS AND DISCUSSION

Screening results indicated that there was no completely immune or resistant germplasm found from both of the inoculation methods. Maximum percent disease incidence was recorded in Gola Peshawari and was ranked as highly susceptible followed by Longi which was also found highly susceptible from both of the inoculation methods. Among the available germplasm; Talhar, Sanam, C-33, C-19 and C-72 were moderately resistant (Table 1). Anthacnose disease caused by *Colletotrichum* species is one of the most economically important diseases reducing remarkable yield of the crop. The results of screening studies indicated that no line was fully immune or resistant against anthracnose disease. Taylor (2007) observed that *C. capsici* also infects on resistance varieties or genotypes and symptoms appear on fruits soot and leaves, decaying of mature and red fruits also seemed that cause heavy reduction in yield of chillies.

Table 1: Response of chilli germplasm against *Colletotrichum capsici.*

Cultivars	Spray Method			Pin Prick Method		
	*PDI	Grade	Reaction	PDI	Grade	Reaction
Longi	50	4	HS**	55	4	HS
Talhar	17.5	2	MR	22.5	2	MR
Ghotki	305	3	S	35	3	S
Tata Puri	47.5	4	S	52.5	4	HS
Sanam	16.25	2	MR	17.5	2	MR
C-33	25	2	MR	32.5	3	S
C302	45	3	S	50	3	S
C-19	25	2	MR	30	2	S
Gola Peshawari	55	4	HS	60	4	HS
C-68	37.5	3	S	45	3	S
C-72	15	2	MR	20	2	MR

*PDI stands for Percent Disease Incidence, ** S= Susceptible, HS= Highly Susceptible, MR= Moderately Resistant.

Significant difference among fungicides in inhibiting the mycelial growth of *C. capsici* was observed. Among fungicides Carbendazim was found most effective at its 0.1g/100ml and 0.2g/100ml concentrations after 4 days followed by Acrobit which was less effective than Carbendazim at 0.1g/100ml and 0.2g/100ml concentrations but most effective at its 0.3g/100ml concentration after four days as compared to control. Dithan M-45 was least effective at 0.1g/100ml after 4 days. Carbendazim was again found most effective at its all three concentrations after 8 days followed by Acrobit. Alliete was found to be least effective at all the concentrations after 8 days as compared to control. The effects of fungicides were also observed after 12 days. Carbendazim caused maximum growth inhibition at its all the concentrations followed by Acrobit as compared to control. Alliete was least effective at all the concentrations after 12 days. The results showed that fungicides caused growth inhibition of *C. capsici* at their all concentrations as compared to control (Table 2).

Table 2: Efficacy of various fungicides for the management of *Colletotrichum capsici.*

Fungicides	**After 4 days**			**After 8 days**			**After 12 days**		
	0.1g*	0.2g	0.3g	0.1g	0.2g	0.3g	0.1g	0.2g	0.3g
Dithan M-45	4.3d**	3.32d	3.02e	4.5e	4.22f	3.9g	5.5ef	5.18g	4.72h
Alliete	4.0b	3.74c	3.4d	5.52b	5.22c	4.84d	7.0b	6.6c	5.82d
Carbendazim	1.94i	1.52j	1.24k	3.0j	2.48l	2.22m	4.0k	3.54l	3.22m
Acrobit	2.5fg	2.18h	1.76i	3.5h	3.18i	2.8k	4.5i	4.2j	3.7i
Antracol	3.0e	2.62f	2.32gf	4.0g	3.6h	3.26i	6.0d	5.62e	5.32fg
Control	5.02a	5.02a	5.02a	7.02a	7.02a	7.02a	8.7a	8.7a	8.7a

*Concentration is g/100 ml, **Means within a column followed by the same letter are not significantly different according to Duncan's multiple Range Test at P = 0.05.

Out of five fungicides belonging to different chemical groups, three were more effective (Carbendazim, Acrobit and Antracol) at their different concentrations and time intervals. Our results are in conformity with the other scientists (Hegde, 1998). Mesta (1996) reported that among the non-systemic fungicides mancozeb, captan and chlorothalonil were found to be highly effective in inhibiting the growth of *C. capsici* at 3000 ppm concentration and among the systemic fungicides carbendazim, bitertinol and tridemefon were found effective at 1000 ppm concentration.

Smith (2000) used manganese (Maneb) against anthracnose of chillies for its management and also recommended traditionally for management of anthracnose. Gopinath *et al.* (2006) tested the efficacy of 3 Triazole fungicides *viz.,* Hexaconazole (0.1%), Propiconazole (0.1%) and Triadimefon (0.1%) against *C. capsici* by poison food technique. Similar results were obtained by Mali and Joi (1985) who reported Difolatan (Captafol), Thiram and Vitavax (Carboxin) as most effective against colony growth and sporulation of *C. capsici*. Significant inhibition of mycelial growth was recorded with all three fungicides.

Our findings will serve to find out the proper management option in reduction of losses caused by anthracnose of chillies.

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