



EVALUATION OF BIO-EFFICACY OF SOME NOVEL FUNGICIDES AGAINST *COLLETOTRICHUM CAPSICI* (SYDOW) DISEASE OF CHILLI (*CAPSICUM ANNUM* L.)

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Abstract

Chilli (*Capsicum annuum*) is one of the major cash crops in India. Chilli crops are affected by fungal, bacterial and viral diseases. However, fungal diseases are found to be the major factor to constraint of the chilli production. For the control of these disease used mostly used fungicides which are reduced their severity and suppress their growth. In the present investigation used seven fungicides viz., Carbendazim, Captafol, Thiram, Azoxystrobin 23% SC, Hexaconazole 2% SC, Chlorothalonil 75% WP and Indofil M-45. All the treatments were found superior on the control and reduced fungal growth. Most effective fungicides found Carbendazim in both the year which reduced fungal growth and increased yield while the yield over the control plot. Maximum fruit yield (17.93 and 16.70 q/ha) was recorded with foliar spray of Carbendazim 600 ml/ha which was at par with foliar spray of Captafol 500 ml/ha (17.32 and 12.03 q/ha) and significantly superior over rest of the treatments, during 2012-13 and 2013-14 respectively. However, minimum disease incidence (12.14 and 12.37%) was recorded in foliar sprays with Carbendazim, which was found most effective treatment against anthracnose disease of chilli, during both the years.

Introduction

Chilli (*Capsicum annuum* L.), an annual sub-shrub constitutes one of the most important spices cultivated all over the world except in colder parts. India is the well known as the land of spices all over the world. Chillies are grown practically all over India. In India, chilli is cultivated over an area of 792.1 thousand hectares with an annual production of 1223.4 thousand tonnes (NHB, 2011). Which accounts for 25% of the world production. As a medicinal plant, the Capsicum species has been used as a carminative, digestive irritant, stomachic, stimulant, rubefacient and tonic. The enzyme isolated from chilli is used in the treatment of certain type of cancers. Oleoresin capsicum is used in pain balms and vaporous. Dehydrated green chilli is a good source of vitamin 'c' capsaicin, vanillin, solanine. A number of biotic and a biotic factor responsible for reduction of Chilli yield. In a biotic factor mainly, fungus, bacteria, virus, nematode and phytoplasma cause disease to chilli crops. Fifty one

different pathogens have been reported to cause diseases on various parts of chilli. Out of them, thirty nine belong to the fungi of classes Mastigomycotina, Ascomycotina and Deuteromycotina. Among the three major fungal diseases, anthracnose affects the yield directly by infecting fruits and indirectly by infecting stems and leaves and causing flower drop. Among these diseases fungal diseases, powdery mildew, leaf spot and anthracnose or fruit rot are the most prevalent ones. Anthracnose or fruit rot caused by is *Colletotrichum capsici* a major constraint in chilli production in India causing heavy yield loss ranging from 20 to 60%, due to severe defoliation and reduction in photosynthesis, size and number of fruits per plant. The anthracnose caused by *Colletotrichum capsici* (Sydow) Butler and Bisby is a major problem which limiting the yield in chilli growing areas of India. The disease was reported for the first time in India by Sydow in 1913 from Coimbatore of Madras Presidency.

The occurrence of anthracnose observed in three different phase's viz., (i) common in the nursery stage is seedling blight or damping off stage, (ii) leaf spotting and

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die back stage which is initiated at different stages of growth and (iii) fruit rot stage in which the ripe fruits are infected. When the disease occurs in the last phase, it causes extensive damage to the fruits and considerable reduction the market value of the products. The disease is both seed borne and air borne and affects seed germination and vigour to a greater extent (Ahmed, 1982; Perane and Joi, 1988; Mesta, 1996 and Asalmol *et al.*, 2001). Fruit rot up to 32% and dieback up to 29% has been noticed.

A number of management approaches *viz.*, development of tolerant varieties, and application of fungicides, cultural practices and combination of approaches leading to integrated management of the disease have been evaluated and recommended (Negron *et al.*, 1991; Dhruj *et al.*, 2000; Pawar *et al.*, 1985b). Many systemic and non-systemic fungicides are reported to control the anthracnose of chilli (Sekhar *et al.*, 1988 and Fugro *et al.*, 2004). The information on the efficacy of different new fungicides against anthracnose chilli is insufficient. Hence there is a need to evaluate new fungicides against *Colletotrichum capsici*. Effective management of Anthracnose disease is a necessary strategy using systemic fungicides for controlling spread of pathogen. Therefore, the present investigation was undertaken with fungicides for its bio efficacy against *Colletotrichum capsici* disease on chilli.

Materials and Methods

The field trial was conducted during *Kharif*, 2012-2013 & 2013-14 at Student Research Farm Pilikothi of Tilak Dhari P.G. College, Jaunpur (U.P.) India. The experiment was laid out in Randomized Block Design with three replications and eight treatments with control. The seeds of chilli were sown in small beds and the nursery was raised. The seedlings were transplanted at four leaf stage at a spacing of 60×60 cm in plot size was 5×3 m. All recommended agronomical practices were followed for good crops.

Isolation of *Colletotrichum capsici* (Sydow)

The test fungus *Colletotrichum capsici* (Sydow) was isolated from anthracnose of chilli by cutting and placing the affected fruit part on potato dextrose agar (PDA). The fungus was identified based on morphology and microscopic features (Barnett and Hunter, 1998). The fungus produced dense whitish to dark grey aerial mycelium, reverse dark, conidial mass pale buff to salmon. Asexual fruiting bodies acervellus present, setae were abundant. Conidia are falcate, fusiform, with acute apices. Appressoria are abundant, medium brown and clavate to circular. The isolate was maintained in

refrigerator on PDA slants.

Sprayings

All the foliar-sprays of chemical fungicides (treatments) were given as per their recommendation of predicated dose (table-1). The first spray of fungicides was done after appearance of disease. The second and third sprays were done at seven days interval with same concentration. The unsprayed/ untreated plots served as control.

Table 1: Treatments details.

Treatments	Name of fungicide	g active ingredient (a.i.)
T ₇	Indofil M-45	75
T ₄	Azoxystrobin 23% SC	125
T ₆	Chlorothalonil 75% WP	600
T ₂	Captafol	125
T ₅	Hexaconazole 2% SC	60
T ₃	Thiram	150
T ₁	carbendazim	100
T ₈	Untreated (control)	-

Observations recorded

During the experiment some observations were recorded like, appearance of diseases, disease incidence and fruit yield per plot (q/ha.) for checking efficacy of the fungicides, and incensement of fruit yield per hectare over the control.

PDI (Percent disease incidence): The data on disease-severity were recorded, after 10 days of last spraying. The percent disease incidence (PDI) was calculated using the following formula:

$$\text{Percent Disease Incidence (PDI)} = \frac{\sum \text{Class rating} \times \text{Class frequency}}{\text{Total no. of leaves} \times \text{Maximum class rating}} \times 100$$

Incidence of anthracnose disease of chilli was recorded by scoring five plants in each plot randomly.

Yield: The Fruit yields were recorded after harvesting the crop at maturity and the weight of crops at every plot separately for calculate the yield per hectare.

Statistical Analysis

All the data related to diseases incidence and yield were statistically analyzed. Calculations were made after applying the test of significance of the means. The per cent data of disease incidence was transformed using the following formula which given by Arch sine (Fisher and Yates, 1963).

$$\text{Sin}^{-1}\sqrt{\text{Percent disease incidence before statistical analysis}}$$

Results and Discussion

Percent disease incidence of anthracnose of Chilli

Results presented in table-2 indicated that all the treatments were superior over control against anthracnose disease. However, minimum disease incidence (12.14 and 12.37%) was recorded in foliar sprays with Carbendazim, which was found most effective treatment against anthracnose disease of chilli, during 2012-13 and 2013-14 respectively. Foliar sprays with Captafol (12.56 and 12.85) was next in order of efficacy, followed by Thiram (13.32 and 18.75%), Azoxystrobin 23% SC (15.75 and 16.23%), Hexaconazole 2% SC (15.86 and 16.75%), Chlorothalonil 75% WP (18.60 and 14.24%) and Indofil M-45 (18.95 and 19.43%) and as compared with control plot (65.88 and 67.72%) percent disease incidence against anthracnose disease of chilli, during 2012-13 and 2013-14 respectively.

Table 2 : Effect of treatments on disease severity (%) and yield of chilli.

Treatments	Disease severity (PDI) (%) Anthracnose		Yield (q/ha)	
	2012-13	2013-14	2012-13	2013-14
	Indofil M-45	18.95	19.43	11.61
Azoxystrobin 23% SC	15.75	16.23	14.58	13.60
Chlorothalonil 75% WP	18.60	14.24	12.84	12.93
Captafol	12.56	12.85	17.32	12.03
Hexaconazole 2% SC	15.86	16.75	13.43	15.56
Thiram	13.32	18.75	16.48	11.66
Carbendazim	12.14	12.37	17.93	16.70
Untreated (control)	65.88	67.72	7.94	6.76
C.D. (5%)	0.134	0.096	0.048	0.103

Yield

Results presented in table-2, revealed that all the treatments were sowing superior over control and increased the fruit yield. Maximum fruit yield (17.93 and 16.70 q/ha) was recorded with foliar spray of Carbendazim 600 ml/ha which was at par with foliar spray of Captafol 500 ml/ha (17.32 and 12.03 q/ha) and significantly superior over rest of the treatments, during 2012-13 and 2013-14 respectively. Next treatment in order of superiority was treatment Thiram (16.48 and 11.66 q/ha) followed by Azoxystrobin 23% SC (14.58 and 13.60 q/ha), Hexaconazole 2% SC (13.43 and 15.56 q/ha),

Chlorothalonil 75% WP (12.84 and 12.93 q/ha) and Indofil M-45 (11.61 and 10.80 q/ha) as compared with control plot (7.94 and 6.76 q/ha) yield.

Ushakiran *et al.* (2006) evaluated five fungicides against anthracnose *in vitro* and found that the Carbendazim completely inhibited mycelia growth followed by Thiophanate methyl. Desai *et al.* (2002) also reported that newer fungicides particularly Penconazole gave effective control of powdery mildew. Sharmila (2001) reported that three sprays of Penconazole gave best result among other fungicides tested in controlling the disease. Such finding was also reported by (Das and Mohanty, 1988 and Biswas, 1992).

Conclusion

Chilli (*Capsicum annum*) is one of the major cash crops in India. So many factors including to fungal disease, reduces the crop yield. Anthracnose disease *Colletotrichum capsici* a major disease which cause severe damage and affected to economic value of chilli production. For the control of this disease farmers used many chemical fungicides which not only increase cost of cultivation but also create resistance against disease. To encounter all the problems conducted a research trial to manage this fungal disease. Maximum fruit yield (17.93 and 16.70 q/ha) was recorded with foliar spray of Carbendazim 600 ml/ha which was at par with foliar spray of Captafol 500 ml/ha (17.32 and 12.03 q/ha) and significantly superior over rest of the treatments, during 2012-13 and 2013-14 respectively. However, minimum disease incidence (12.14 and 12.37%) was recorded in foliar sprays with Carbendazim, which was found most effective treatment against anthracnose disease of chilli, during both the years.

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