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Management of *Alternaria* leaf blight of *Mateera* (watermelon) by fungicides, bio-agents and botanical

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Abstract

The field trials were conducted for management of *Alternaria* leaf blight (*Alternaria cucumerina* var. *P.* watermelon) in *mateera (watermelon) by* fungicides, bio-agents and botanical during summer season of 2013 and 2014 at Plant Pathology Block of ICAR-Central Institute for Arid Horticulture, Bikaner (Rajasthan). Three fungicides (copper oxychloride, carbendazim and mancozeb), four bio-agents (*Aspergillus niger*, *Pseudomonas fluorescens* CIAH-196, *Trichoderma viride* CIAH-240 and *Trichoderma viride* Non-Resistant) and one botanical such as onion leaf extract were taken for the study. Disease incidence and disease severity of *Alternaria* leaf blight in *mateera* ranged from 10.0 to 34.17% and 8.88 to 29.01%, respectively. Among nine treatments, one foliar spray of mancozeb (0.25%) proved the most effective fungicide for the management of this disease in *mateera* under field conditions with the minimum disease incidence (10.0%) and disease severity (8.88%) and the maximum disease control (69.39%). Further, next best treatment was *Trichoderma viride* CIAH-240 (5%). However, the maximum disease incidence (34.17%) and disease severity (29.01%) were observed in control followed by onion leaf extract (5%) with disease incidence (27.85%), disease severity (24.34%) and the minimum disease reduction (16.09%).

Key words: *Alternaria* leaf blight, *mateera (watermelon),* bio-agents, botanical, fungicides, management

Introduction

Watermelon [*Citrullus lanatus* (Thunb) Mansf.] is a popular desert crop throughtout the tropics and the Mediterranean regions of the world. Presently, it is not only a summer season fruit but also becoming an everyday fruit like apples and bananas. The fruits are rich source of B-carotene, vitamin B, C and E, minerals (K, Mg, Ca and Fe), citrulline amino acid and phenolics. Watermelon is also known as *Tarbooj* in some parts of India and *Mateera,* particularly in Rajasthan. *Mateera* is drought hardy landraces crop (Anon., 2003). It is an indigenous type of watermelon and is extensively grown with mixed cropping on sand-dunes landscape in Thar desert. *Mateera* fruits are attributed to sweet and refreshing edible flesh (pulp) and consumed fresh and have juicy properties.

Mateera is subjected to attack of a number of bacterial, viral and fungal diseases, which inflict heavy damage to the crop every year. Among the fungal diseases, *Alternaria* leaf blight incited by *Alternaria cucumerina* (Ell. & Ev.) Elliot is an important disease in Rajasthan as well as major watermelon growing states of India. In India, the disease was first reported by Khandelwal and Prasada (1970) on watermelon from Jobner (Rajasthan), where it occurs almost every year. This disease is found to cause serious losses in watermelon production throughout the Rajasthan (Prasada *et al.*, 1973). Yield losses due to the leaf necrosis and foliage loss are variable according to the type of cucurbitous crop and its susceptibility, reaching at 80% on pumpkins and 88% on watermelons in India (Bhargava and Singh, 1985). Characteristic disease symptoms first appear on foliage as small circular spots. These spots expand to form large reddish brown spots with a concentric ring. This disease needs regular monitoring for evolving effective management strategies. Attempts have been made to manage *Alternaria* leaf blight of *mateera* through application of fungicides, bio-agents and botanical as foliar spray. Keeping in view, the above facts, the present investigation was undertaken to study the efficacy of fungicides, bio-agents and botanical for management of this disease under hot arid conditions of Rajasthan.

Materials and Methods

The field trials were conducted in Randomized Block Design using *mateera* variety 'Thar Manak' with three replications at Plant Pathology Block of ICAR-Central Institute for Arid Horticulture, Bikaner (Rajasthan) in the last week of February of 2013 and 2014. The row to row and plant to plant distance were maintained 2.0 m x 0.50 m. Infected leaves of *mateera* were collected from Plant Pathology Block of this Institute. Small bits with typical disease symptoms along with healthy tissues were cut with the help of sterile blade, surface sterilized with 0.1% mercuric chloride for 30 seconds followed by three washing with sterilized water and plated aseptically in the petri plates containing Potato Dextrose Agar (PDA) medium and incubated at 25 ± 2° C in BOD incubator for seven days. Fungus was isolated and culture was purified by single spore technique as *Alternaria cucumerina* and further maintained on PDA medium. Pathogenicity was done on *mateera* plants by isolating *Alternaria cucumerina* from infected leaves of mateera. After 30 days, the plants were artificially inoculated by spraying

spore-cum-mycelial suspension, prepared in sterile water. Leaves were used for inoculation purpose. The inoculated plants were covered with polythene bags for 48 hours to provide sufficient humidity for infection. Disease symptoms were produced in the plant leaves. The reisolation of the pathogen was done. The recommended packages of practices for this crop were adopted.

Three fungicides such as copper oxychloride (0.25%), carbendazim (0.1%) and mancozeb (0.25%), four bio-agents such as *Aspergillus niger*, *Pseudomonas fluorescens* CIAH-196, *Trichoderma viride* CIAH-240 and *Trichoderma viride* Non-Resistant (5% of each bio-agent) and one botanical such as onion leaf extract (5%) were used for management of *Alternaria* leaf blight. One foliar spray of each treatment was given separately on the crop at appearance of the first disease symptoms.

Data on disease incidence and disease severity were recorded on maturity stage of this crop. Disease severity was recorded into rating scale (0- 4) on the basis of leaf area covered by spots (Prasada *et al.* 1973), where 0= Healthy, 1= Trace (1-10% of the leaf area covered by spots), 2= Moderate ((11-20% of the leaf area covered by spots), 3= Severe ((21-30% of the leaf area covered by spots) and 4= Very severe (31% and above of the leaf area covered by spots). Disease incidence was calculated on the basis of per cent plants infected. Total number of plants and number of infected plants by this disease were counted. Disease incidence and disease control were calculated by following formula:

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

$$\text{Per cent disease control} = \frac{\text{Disease severity in control - Disease severity in treatment}}{\text{Disease severity in control}} \times 100$$

The percentage data of 2013 and 2014 for disease incidence and disease severity were converted into angular transformation and pooled data were subjected for statistical analysis (Table 1 & 2).

Results and Discussion

Pooled data of 2013 and 2014 on disease incidence and disease severity were given in the results and all the treatments including fungicides, bio-agents and botanical tested under field conditions reduced the disease incidence as well as disease severity and gave better disease control as compared to control. Disease incidence and disease severity of *Alternaria* leaf blight in *mateera* were found with ranging from 10.0 to 34.17% and 8.88 to 29.01%, respectively (Table 1 & 2). Out of which, one foliar spray of mancozeb (0.25%) was found most effective for the management of *Alternaria* leaf blight of *mateera in vivo* with the minimum disease incidence (10.0%), followed by *Trichoderma viride* CIAH-240 (5%) which was differed statistically in case of disease incidence (16.30%) with mancozeb. However, the maximum disease incidence (34.17%) was observed in case of untreated control. The least effective treatment was onion leaf extract (5%) with disease incidence (27.85%), followed by *Pseudomonas fluorescens* CIAH-196 (5%) having 23.60% disease incidence, which was not statistically at par in case of disease incidence with each other against *Alternaria* leaf blight of *mateera* (Table 1).

Pooled data revealed that one foliar spray of mancozeb (0.25%) was also found the most efficient fungicide against *Alternaria* leaf blight of *mateera* with the minimum disease severity (8.88%) and maximum disease control (69.39%), followed by *Trichoderma viride* CIAH-240 (5%)

Table 1. Field efficacy of fungicides, bio-agents and botanical on disease incidence *of Alternaria* leaf blight of *mateera (pooled data of 2013 and 2014)*

S. No.	Treatments	Disease incidence (%) (2013)	Disease incidence (%) (2014)	Pooled data
1.	Copper oxychloride (0.25%)	25.0 (30.00)*	20.0 (26.57)*	22.50 28.32)*
2	Carbendazim (0.1%)	20.0 (26.57)	15.0 (22.79)	17.50 (24.73)
3	Mancozeb (0.25%)	10.0 (18.43)	10.0 (18.43)	10.0 (18.43)
4	*Aspergillus niger* (5%)	22.20 (28.11)	23.50 (29.00)	22.85 (28.56)
5	*Pseudomonas fluorescens* CIAH-196 (5%)	25.0 (30.00)	22.20 (28.11)	23.60 (29.06)
6	*Trichoderma viride* CIAH-240 (5%)	15.0 (22.79)	17.60 (24.80)	16.30 (23.81)
7	*Trichoderma viride* CIAH-NR (5%)	17.60 (24.80)	21.10 (27.35)	19.35 (26.10)
8	Onion leaf extract (5%)	26.30 (30.85)	29.40 (32.83)	27.85 (31.85)
9	Control	33.33 (35.26)	35.00 (36.27)	34.17 (35.77)
	SE(m)	1.85	2.10	1.42
	CD (p= 0.05)	5.53	6.28	4.08

*Figures in parentheses are angular transformed values for analysis

Table 2. Field efficacy of fungicides, bio-agents and botanical on disease severity *of Alternaria* leaf blight of *mateera (pooled data of 2013 and 2014)*

S. No.	Treatments	Disease severity (%) (2013)	Disease severity (%) (2014)	Pooled data	Disease control (%)
1.	Copper oxychloride (0.25%)	20.70 *(27.06)	22.50 (28.32)*	21.60 (27.69)*	25.54
2.	Carbendazim (0.1%)	17.52 (24.74)	15.70 (23.34)	16.61 (24.05)	42.74
3.	Mancozeb (0.25%)	8.25 (16.69)	9.50 (17.95)	8.88 (17.34)	69.39
4.	*Aspergillus niger* (5%)	18.77 (25.67)	20.35 (26.81)	19.56 (26.25)	32.57
5.	*Pseudomonas fluorescens* CIAH-196 (5%)	21.90 (27.90)	24.77 (29.85)	23.34 (28.89)	19.54
6.	*Trichoderma viride* CIAH-240 (5%)	12.77 (20.94)	11.80 (20.09)	12.29 (20.52)	57.63
7.	*Trichoderma viride* CIAH-NR (5%)	14.27 (22.19)	14.10 (22.06)	14.19 (22.13)	51.08
8.	Onion leaf extract (5%)	22.77 (28.50)	25.90 (30.59)	24.34 (29.56)	16.09
9.	Control	26.77 (31.16)	31.25 (33.99)	29.01 (32.59)	-
	SE(m)	1.42	0.95	0.87	
	CD (p= 0.05)	4.25	2.86	2.49	

*Figures in parentheses are angular transformed values for analysis

which was not statistically at par in case of disease severity (12.29%) with mancozeb. The bio-agent (*Trichoderma viride* CIAH-240) gave 57.63% disease control. However, the maximum disease severity (29.01%) was appeared in case of control without treatment. The least effective treatment was onion leaf extract (5%) with disease severity (24.34%) and disease control (16.09%), followed by *Pseudomonas fluorescens* CIAH-196 (5%) with 23.34% disease severity and disease control (19.54%), which was found statistically at par against this disease (Table 2).

Prasada *et al.* (1973) reported that *Alternaria* blight caused by *Alternaria cucumerina* in watermelon crop can be effectively controlled with dithane Z-78, followed by dithane M-45 under field conditions. Batta (2003) found that difenoconazole (0.35%) completely inhibited disease-lesion of *Alternaria* leaf spot (*Alternaria cucumerina*) on treated cucumber leaf-discs. Mancozeb (0.2%) was found effective against purple blotch of onion caused by *Alternaria porri* and *Alternaria* spp. causing blights in other crops as reported by several workers (Deshmukh *et al.*, 2007; Pandey *et al.*, 2008; Ilhe *et al.*, 2008). Dushyant *et al.* (2014) found that the minimum disease intensity of early blight of tomato caused by *Alternaria solani* was observed by carbendazim + mancozeb (0.2%), followed by mancozeb (0.2%) in the field. Mane *et al.* (2014) revealed that mancozeb (0.2%) was the most effective fungicide against early blight (*Alternaria solani*) of potato.

Conclusion

However keeping in mind the huge losses caused by *Alternaria* leaf blight, it is advisable to reduce the disease severity in *mateera*/watermelon through foliar spray of mancozeb (0.25%) under hot arid conditions of Rajasthan. This disease may attain an alarming status and may wreak havoc in *mateera* growing areas if not taken care well in time.

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