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Fungicidal management of *Alternaria alternata* (Fr.) Keissler causing blight of gerbera (*Gerbera jamesonii* H. Bolus ex J.D. Hook)

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Abstract: *Alternaria*, the fungal pathogen has wide host range generally attacks the aerial parts of plants causing leaf spots and blights. Gerbera is a genus of ornamental flower plants. Gerbera plants are infected by many diseases. Different disease management practices are adopted in gerbera cultivation. The fungicidal management of *Alternaria* blight is one of the important strategies for the disease management in gerbera in polyhouse condition. In this study, preventive and curative fungicidal sprays were adopted for the management of blight disease in polyhouse. This study revealed that preventive fungicidal sprays were significant over curative fungicidal sprays for the management of *Alternaria alternata* blight of gerbera (*Gerbera jamesonii* H. Bolus ex J.D. Hook) in polyhouse. The preventive sprays made of Bordeaux mixture (0.6 %), tricyclazole (0.1%) and iprodione + carbendazim (0.1%) fungicides were found effective with 95.85 %, 96.59 % and 95.88 % disease control respectively, under polyhouse condition.

Keywords: *Alternaria alternata,* Blight, Fungicides, *Gerbera jamesonii*

INTRODUCTION

Gerbera is a genus of ornamental plants from the sunflower family (Asteraceae). It was named in honour of the German botanist and naturalist Traugott Gerber. It has approximately 30 species in the wild, extending to South America, Africa and tropical Asia. *Gerbera jamesonii*, a South African species known as Transvaal Daisy, Barberton Daisy or African Daisy which produces very attractive flowers. It is being cultivated in greenhouses and polyhouses for better yield and quality of cut flowers. Gerbera as cut flower has great export potential under protected cultivation. However, production of high quality cut flowers depends on precision farming practices. Many of the diseases have been observed on gerbera which limits its quality and production. In India, number of diseases has been observed on gerbera during past decades. Some important diseases are leaf spot caused by *Alternaria alternata* (Fr.) Keissler, the foot rot (*Pythium irregularae, Phytophthora cryptogea* and *Rhizoctonia solani*),wilt(*Fusarium oxysporum*), Sclerotium rot (*Sclerotium rolfsii*), grey mould (*Botrytis cinerea*), powdery mildew (*Erysiphae cichoracearum)* bacterial leaf spot (*Pseudomonas cichorii*) and mosaic. *Alternaria* blight is among important diseases gerbera (Ghosh, 1998 and Nagrale, 2007).Recently, first report of *Alternaria* leaf spot on gerbera (*Gerbera Jamesonii*) was observed by Mirkova and Konstantinova (2003) and Farhood and Hadian (2012) respectively in Bulgaria and in North Iran. The pathogen, *A. alternata* mostly infect leaves causing blight as light to dark brown, roundish-oval to irregular spots which often coalesced and produced 'shot holes' during severe infection. During the routine field observations, the severe incidence of *Alternaria* blight disease was noticed on two to three months old plants of gerbera under greenhouses and polyhouses of western Maharashtra. However, management of *Alternaria* blight in protected cultivation by fungicide sprays is important strategy (Horsfield *et al*., 2010). Recently many researchers have reported the effective fungicidal management of diseases caused by *Alternaria* spp. (Surviliene *et al*., 2006, MacDonald *et al.*, 2007, Peres and Timmer,2006). Singh and Singh (2006) found hexaconazole (1000 ppm) very effective followed by mancozeb, copper oxychloride, chlorothalonil and propineb each at 2500 ppm against *A. alternata*. Amaresh and Nargund (2004) reported mancozeb and iprodione as most effective at 2000 ppm each among non-systemic fungicides and propiconazole and hexaconazole as most effective each at 2000 ppm among systemic fungicides against *Alternaria* leaf blight of sunflower. Also, Mahalinga *et al.* (2003) reported effective management of *Alternaria* blight of sunflower using two sprays of mancozeb (0.2%). Hence, it was decided to undertake fungicidal management of *Alternaria* blight in gerbera by using newer fungicides.

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MATERIALS AND METHODS

Collection of samples: The samples of gerbera showing typical symptoms of blight were collected from different greenhouses and polyhouses in western Maharashtra. In varietal screening of gerbera against *A. alternata*, 'Ruby red' variety was found to be highly susceptible to blight disease. Thus, it was further selected for fungicidal screening against *A. alternata*. The experiment was carried out in Completely Randomized Design (CRD) with three replications. The fungicides tested against *A. alternata* in polyhouse are given in Table 1.

Isolation and characterization of fungal pathogen: The blight infected samples of gerbera were collected for isolation from different greenhouses and polyhouses of western Maharashtra. The affected part of gerbera were cut into smaller pieces with a sterile scalpel and these were disinfected with mercuric chloride solution (0.1%) for one minute and subsequently three washings were given in sterilized distilled water. The samples were dried by sterilized blotting paper. The isolation of blight causing organisms was made by standard agar plate technique (APT) on potato dextrose agar. The plates were then incubated at 27 $\pm$ 1^{0}C temperature. The growth of fungi noticed after four to six days of inoculation was subsequently sub-cultured on PDA slants for obtaining pure cultures. The pathogenicity was proved in artificial moisture chamber. The gerbera plants were kept in chamber for 48 hrs prior to and after inoculation to provide maximum humidity for infection and disease development. The inoculation of fungus was done by spraying spore suspensions containing 10^5 conidia ml^{-1} in artificially made moisture chamber. The inoculated plants were observed daily for development of disease symptoms. The control plants were sprayed with sterilized water only. The fungi thus obtained was purified by hyphal tip method and transferred on PDA slants for comparison with original culture. The pure culture slants thus obtained were maintained at 4^{0}C for subsequent studies. Morphological characters of the pathogen infecting gerbera were studied from the culture growth on Potato dextrose agar (PDA) for 5 to 10 days at 27 $\pm$ 1^{0}C.As suggested by Chowdhry and Varshney (2000) and Zang (2003), observations regarding morphological characters of different structures *viz.*, mycelium (young and matured), conidiophores, conidia and chlamydospores were noted by adopting slide culture technique.

Bioefficacy of fungicides against *A. alternata* under polyhouse conditions: All the twelve fungicides (Table 1) were tested under polyhouse conditions on highly susceptible 'Ruby red' variety of gerbera in two sets as preventive sprays (i.e. fungicidal sprays followed by inoculation) and curative sprays (i.e. inoculation followed by fungicidal sprays). The inoculation on test variety was done by spraying spore suspension of 10^5 conidia ml^{-1} as per the methodology described earlier with slight modification to suit for the experiment. An appropriate quantity of required concentration of each fungicide was added in 1000 ml distilled water in each flask. The flask was then shaken well to ensure uniform distribution of fungicides. Then, the sprays were taken with the help atomizer. The utmost care was taken to avoid the drift of spray from one treatment set to another. The pots with inoculated plants without any fungicide spray served as control. For each fungicide, three pots were maintained. Three sprays of the fungicides were taken at ten days interval. A gap of eight hours was kept in between inoculation to curative sprays of fungicides and preventive sprays to inoculation with pathogen, *A. alternata*.

The data: For disease incidence and intensity was recorded ten days after last spray of fungicide as per the standard methodology .The disease severity (PDI) was recorded by adopting 0-7 grade score card as cited below. The disease incidence and intensity were calculated by the formula (Wheeler, 1969).

Incidence (%) = (Number of leaves infected ÷ Total no. of leaves examined) × 100

PDI = (Total numerical rating ÷ Total number of units examined) × 100

Maximum rating is 7.

The highest disease intensity shown by each leaf was taken into consideration for judging the reaction of susceptible variety 'Ruby Red' against fungicide. On the basis of kind of symptoms and PDI, bioefficacy of fungicides against *A. alternata* for 'Ruby red' variety was ranked as immune to highly susceptible Table 2.

RESULTS

Isolation and characterization of fungal pathogen: Isolations were made from the affected leaves of gerbera and the pure cultures of the fungi thus obtained were later maintained for further studies by sub culturing. The pathogenicity study was done by spraying spore suspensions containing 10^5 conidia ml^{-1} and the study showed that the fungus could infect the gerbera leaves as well as flower stalks and caused typical symptoms of disease in polyhouse. Initially the symptoms on the leaves were appearance of small, circular to irregular spots of 2 to 4 mm in size. The disease symptoms started appearing 3 days after spraying spore suspension. Light brown to dark brown patches with characteristic concentric zonnations inside the spots were conspicuous. In addition, shot hole symptoms were also noticed. The observations recorded ten days after inoculation showed that the spots enlarged in size with complete drying and blightening of leaves, which may or may not remain attached to plants. The reisolation was carried out from artificially infected leaves and flowers. The pure culture

Table 1. Fungicides tested against pathogen *A. alternata.*

S. No.	Trade name	Common name	Chemical name	Source
1.	Blitox-50	Copper oxychloride 50 % WP	Copper oxychloride containing 50 % metallic copper	Rallis India Ltd., Mumbai
2.	Indofil M-45	Mancozeb 70 % WP	Zinc ions and manganous ethylene bis dithiocarbamate	Indofil Chem. Co., Mumbai
3.	Antracol	Propineb 70 % WP	Zinc propylene bisdithio carbamate	Bayer Crop Science, Himattnagar, Gujarat
4.	Kavach	Chlorothalonil 75 % WP	Tetrachloroisophtha -lonitrite	Syngenta Agro Chemicals, Mumbai
5.	Score	Difenoconazole 25 % EC	1-{2-[4-(4-chlorophenoxy)-2-chlorophenyl-(4-methyl-1, 3-dioxolan-2-yl)-methyl]}-1H-2,2,4-trizole	Syngenta Agro Chemicals, Mumbai
6.	Contaf	Hexaconazole 5 % EC	(RS)-(2,4-dichlorophenyl)-1-(1H-1,2,4-trizole-1 yl) hexan-2-O1 (IUPAC)	Rallis India Ltd., Mumbai
7.	Tilt	Propiconazole 25 % EC	1-[2-(2,4-dichlorophenyl)-4-propyl-1, 3-dioxolan-2-yl-methyl]-1H, 1, 2, 4-triazole	Syngenta Agro Chemicals, Mumbai
8.	Beam	Tricyclazole 75 % WP	5-methyl-1-2-4-triazole (3,4-b) benzothiazole	Nagarjuna Agri. Chem. Ltd., Hyderabad
9.	Tagkit	Iprobenphos 48 % EC	5-benzyl-0-0-di-iso propyl phosphorothioate	Tropical Agrosystem (India) Ltd., Chennai
10.	Quintal	Iprodione 25 % + arbendazim 25 % WP	3(3,5-dichlorophenyl)-N-(1-methylethyl)-2,4-dioxo-1-imidazolidine carboxamide + 2-(methoxycarbonylamino)-benzimidazole	Bayer (India) Limited, Chennai
11.	Bordeaux mixture	Bordeaux mixture	$CuSO_4$ + $Ca(OH)_2$ in equal proportions	Lab prepared
12.	Captaf	Captan 50 % WP	N-Trichloromethyl-thiotetrahydro-phtalimide	Rallis India Ltd., Mumbai

of the *A. alternata* thus obtained was transferred on PDA slants for comparison with original culture. The pure culture slants thus obtained were used for subsequent studies. Morphological characters of the pathogen, *A. alternata* infecting gerbera, were studied from the culture growth on Potato dextrose agar (PDA) for 5 to 10 days at 27 ± 1^0C. As suggested by Chowdhry and Varshney (2000) and Zang (2003), observations regarding morphological characters of different structures *viz.,* mycelium (young and matured), conidiophores, conidia and chlamydospores were noted by adopting slide culture technique. From the pathogenicity, symptomatological and morphological studies, the fungal pathogen was confirmed as *Alternaria alternata* (Fr.) Keissler.

Bioefficacy of different fungicides against *Alternaria* blight of gerbera under polyhouse (Pot culture trial): The twelve fungicides with recommended concentrations as mentioned in Table 1 were evaluated under polyhouse conditions. The bioefficacy of fungicides was evaluated on the basis of preventive as well as curative sprays against *A. alternata*.

Bioefficacy of fungicides as preventive sprays : The results (Table 3) regarding bioefficacy of fungicides as preventive sprays indicated that the fungicides *viz.*, tricyclazole (0.1%), Bordeaux mixture (0.6%) and iprodione + carbendazim (0.1%) had significantly least intensity of 1.10, 1.34 and 1.33 percent and thereby maximum disease control of 96.59, 95.85 and 95.88 per cent. Thereafter, the fungicides difenoconazole, propiconazole and hexaconazole were effective in managing the blight of gerbera with 94.21, 93.09 and 92.41 percent disease control. On the contrary, the fungicides *viz.*, chlorothalonil, iprobenphos and copper oxychloride were found to be less effective with the recorded disease reduction just 51.47, 52.52 and 61.81 percent respectively. The remaining fungicides were moderately effective.

Bioefficacy of fungicides as curative sprays : The data presented in Table 4 showed that the treatment

Table 2. Disease reaction classification for *A. alternata* blight of gerbera under polyhouse by spore suspension of 10^5 conidia ml^{-1}

Disease index	Leaf and flower area infection (%)	Kind of symptoms produced on leaves/flower	Reaction
0	-	Nil	Immune (I)
1	< 1	Plants looking healthy, only minute light brown, pin point, few spots on leaves, rarely yellowish specks may be observed.	Highly resistant (HR)
2	1.01 to 10.00	Leaves with small, light to dark brown spots of about 0.5 to 1.00 mm in diameter and 5 to 10 spots.	Resistant (R)
3	10.01 to 20.00	Leaves with small, slightly sunken brown spots of 2 to 5 mm in size and 10 to 20 spots.	Moderately resistant (MR)
4	20.01 to 30.00	Leaves with medium sized, moderately sunken, light brown to black, concentric zonnate spots of 5 to 8 mm in diameter and 20 to 30 spots. Florets showed discolouration.	Moderately susceptible (MS)
5	30.01 to 40.00	Leaves with medium to large sized, dark brown to black spots of about 8 to 15 mm in diameter and 30 to 40 spots scattered all over canopy with or without concentric zones. Flower stalks showed elliptical depressed spots of about 7 mm and 3-4 spots.	Susceptible (S)
6	40.01 to 50.00	Leaves with large, dark brown to black, with or without zonnate spots of about 15 to 20 mm in size, often coalesced and with shot hole appearance. Florets often showing discolouration and dryness.	Highly susceptible (HS)
7	50.01 and above	Leaves with large, blighted concentric spots, which often coalesce with each other resulting in drying of leaves. Flower often showing discolouration of petals and dryness. Large elliptical spots on flower stalks.	Highly susceptible (HS)

differences in respect of blight incidence and intensity were statistically significant. The curative sprays with tricyclazole (0.1%), iprodione + carbendazim and Bordeaux mixture (0.6%) showed significantly least intensity of 1.33, 1.62 and 1.38 percent, respectively. Thus, the recorded maximum disease control of 95.88, 94.83 and 95.85 percent respectively was observed. The next fungicide treatments in order of superiority were difenoconazole (0.1%), propiconazole (0.1%) and hexaconazole (0.1%) which recorded disease intensity of 2.08, 2.92 and 3.08 percent respectively, thereby showed disease control of 93.40, 90.96 and 90.46 percent. The fungicides, chlorothalonil (0.25%) and iprobenphos were least effective wherein the PDI was 17.89 and 16.09 per cent. Hence, these fungicides showed least disease control of 44.60 and 50.14 percent respectively. In control treatment, the blight incidence (72.66 and 65.48%) and intensity (56.72 and 32.29%) were significantly maximum in curative sprays. When the comparison (Table 5) was made between preventive and curative sprays, it was noticed that the preventive sprays of all fungicides were more effective in controlling disease as compared to curative sprays. Thus, the results regarding bioefficacy of fungicides against *Alternaria* blight of gerbera under polyhouse conditions clearly indicated that the preventive sprays of tricyclazole (0.1%), Bordeaux mixture (0.6%) and iprodione + carbendazim (0.1%) were most effective for management of disease followed by difenoconazole (0.1%), propiconazole (0.1%) and hexaconazole (0.1%).

DISCUSSION

Blight is one of the most common diseases of many cultivated and ornamental plants. Occurrence of the blight disease on gerbera incited by *A. alternata* was observed to be severe in most of the polyhouses cultivation in the state. Gualaccini (1954), Rao (1963), Jackson (1962), Kulibaba (1972), Ghosh (1998),Mirkova and Konstantinova (2003),Nagrale (2007) and Farhood and Hadian(2012) have also reported *Alternaria* spp. to cause the disease in gerbera. The pathogenicity test carried out in the present investigation in respect of *A. alternata* is in agreement with the findings of Mirkova and Konstantinova (2003), Nagrale (2007) and Farhood and Hadian (2012) who also proved the Koch's Postulate of *A. alternata* on gerbera. Initially, the symptoms on the adaxial side of the affected leaves appeared as small, brown spots of 1 to 2 mm in size with light to dark brown and black margin. The spots those were roundish to oval in the beginning, expanded measuring 2 to 50 mm in diameter after two weeks and often coalesced and covered

Table 3. Efficacy of fungicides against *A. alternata* under polyhouse condition as preventive sprays.

S. No.	Name of fungicides	Conc. (%)	Method of inoculation Spore suspension 10^5 conidia ml^{-1}		
			Percent disease		
			Incidence	Intensity	Control
1.	Copper oxychloride	0.25	34.23 (35.800)*	12.33 (20.553)	61.81
2.	Mancozeb	0.25	26.65 (31.086)	8.24 (16.646)	74.48
3.	Propineb	0.25	29.17 (32.673)	10.33 (18.706)	68.01
4.	Chlorothalonil	0.25	35.71 (36.683)	15.67 (23.306)	51.47
5.	Difenoconazole	0.1	18.42 (25.403)	1.87 (7.803)	94.21
6.	Hexaconazole	0.1	15.51 (23.116)	2.45 (9.00)	92.41
7.	Propiconazole	0.1	10.62 (18.940)	2.23 (8.696)	93.09
8.	Tricyclazole	0.1	3.67 (11.016)	1.10 (6.02)	96.59
9.	Iprobenphos	0.1	31.49 (34.096)	15.33 (23.040)	52.52
10.	Iprodione + Carbendazim	0.1	5.22 (13.176)	1.33 (6.633)	95.88
11.	Bordeaux mixture	0.6	3.80 (11.223)	1.34 (6.593)	95.85
12.	Captan	0.25	10.97 (19.293)	5.84 (13.886)	81.91
13.	Control		65.48 (54.036)	32.29 (34.623)	-
	S.E. ±		1.09	0.70	
	CD at 5 %		3.16	2.10	
	C.V. (%)		4.09	4.65	

*Figures in the parentheses are arc sin transformed values

the whole leaf. The affected area often produced 'shot hole' appearance on the leaves. Ghosh (1998) also observed black patches and 'shot hole' symptoms on gerbera. The artificially inoculated gerbera leaves, flowers and flower stalks produced the symptoms within 48 hrs after inoculation and later characteristic symptoms appeared on leaves after ten days. Initially, the spots were small, dark brown to black coloured. These findings are in agreements with the report of Ghosh (1998) who observed black patches on infected leaves of gerbera. Finally, the spots enlarged in size resulting into complete blightening of leaves, which remained attached to plants. The present findings are in agreements with the symptoms reported by Wellman (1949) and Ghosh (1998) who noticed complete drying of petunia and gerbera leaves, respectively by infection of *Alternaria* spp. and such leaves found attached to the plants.

The studies of fungicides as curative sprays under polyhouse condition revealed that tricyclazole (0.1%), Bordeaux mixture (0.6%) and iprodione + carbendazim (0.1%) were superior and showed highest disease control of 95.88, 95.73 and 94.83 percent respectively. The present findings are in conformity with the result of Shayam and Sharma (1975) who noticed Bordeaux mixture (0.8%) as most effective against *Alternaria* blight of tomato under field conditions. While the effectivity of iprodione + carbendazim are in agreements with Srinivas *et al.* (1997), Singh *et al.* (1995), Mondal *et al.* (1999) and Lahase (2006) against *Alternaria* blight of sunflower. The effectivity of tricyclazole did not match with the reports of earlier workers.

The next fungicide treatments in order of superiority were difenoconazole (0.1%), propiconazole (0.1%) and hexaconazole (0.1%). As curative sprays these fungicides recorded disease control of 93.40, 90.96 and 90.46 percent respectively, while as preventive sprays it was recorded 94.21, 93.09 and 92.41 percent respectively. These findings are in agreement with the reports of Srinivas *et al.* (1997),

Table 4. Efficacy of fungicides against *A. alternata* under polyhouse condition as curative sprays.

S. No.	Name of fungicides	Conc. (%)	Method of inoculation Spore suspension 10^5 conidia ml^{-1}		
			Percent disease		
			Incidence	Intensity	Control
1.	Copper oxychloride	0.25	36.95 (37.440)*	13.20 (21.293)	59.12
2.	Mancozeb	0.25	28.42 (32.190)	9.54 (17.986)	70.45
3.	Propineb	0.25	32.09 (34.490)	12.26 (20.490)	62.03
4.	Chlorothalonil	0.25	38.33 (38.246)	17.89 (24.976)	44.60
5.	Difenoconazole	0.10	21.48 (27.583)	2.08 (8.253)	93.40
6.	Hexaconazole	0.10	17.72 (24.893)	3.08 (10.05)	90.46
7.	Propiconazole	0.10	13.19 (21.276)	2.92 (9.830)	90.96
8.	Tricyclazole	0.10	5.26 (13.226)	1.33 (6.716)	95.88
9.	Iprobenphos	0.10	34.12 (35.716)	16.09 (23.653)	50.14
10.	Iprodione + Carbendazim	0.10	6.64 (14.896)	1.62 (7.333)	94.83
11.	Bordeaux mixture	0.60	6.59 (14.896)	1.38 (6.723)	95.73
12.	Captan	0.25	12.82 (20.926)	6.94 (15.26)	78.51
13.	Control		65.48 (54.036)	32.29 (34.623)	-
	S.E. ±		0.94	0.69	
	CD at 5 %		2.71	2.06	
	C.V. (%)		3.29	4.32	

*Figures in the parentheses are arc sin transformed values

Singh and Singh (2006) and Lahase (2006). Amaresh and Nargund (2004) noticed propiconazole and hexaconazole as most effective systemic fungicides at 2000 ppm and Mesta (2006) has reported triazoles as effective fungicides against *Alternaria* blight of sunflower. Arun Kumar *et al.* (2011) found that that hexaconazole (0.1%) was effective in minimizing the percent disease index and getting higher yields.

The fungicides *viz.,* captan (0.25%) and mancozeb (0.25%) showed the disease control of 70.40 percent as curative sprays and 72.37 percent as preventive sprays, respectively. The present findings nearly tallying with the results of Shayam and Sharma (1975) who noticed captan (0.3 %) and Dithane M-45 (0.2 %) as most effective fungicides against *Alternaria* blight of tomatoes. Srinivas *et al.* (1997) also found the efficacy of captan and mancozeb in reducing disease severity against *Alternaria* blight of sunflower. Singh *et al.* (1995), Mondal *et al.* (1999), Mahalinga *et al.* (2003) and Lahase (2006) found good efficacy of mancozeb against *Alternaria* spp. Chatage and Bhale (2011) found mancozeb effective range from 20 µg/ml to 300 µg/ml. in *vivo.* Similarly the results are slightly nearer to Narain *et al.* (2006) who reported that foliar sprays of Indofil M-45 (0.2%) significantly reduced leaf blight of broccoli under *in vivo* conditions. On the other hand, the fungicides chlorothalonil (0.25%) and copper oxychloride (0.25%) were found less effective. The present finding in respect of chlorothalonil (0.20%) is not in agreement with the report of Srinivas *et al.* (1997) and Narain *et al.* (2006) wherein they obtained good control of *Alternaria* leaf spot of sunflower and broccoli by these fungicides under *in vivo* conditions. The experimental results revealed that preventive sprays were superior to curative sprays.

Therefore, the foregoing results regarding bioefficacy of fungicides against *A. alternata* causing blight of gerbera,

Table 5. Comparative bioefficacy of preventive and curative sprays for management of blight of Gerbera.

S. No.	Name of fungicides	Conc. (%)	Percent disease control		Increased disease control due to preventive sprays (%)
			Preventive sprays	Curative sprays	
1.	Copper oxychloride	0.25	61.81	59.12	2.69
2.	Mancozeb	0.25	74.48	70.45	4.03
3.	Propineb	0.25	68.01	62.03	5.98
4.	Chlorothalonil	0.25	51.47	44.60	6.87
5.	Difenoconazole	0.10	94.21	93.40	0.81
6.	Hexaconazole	0.10	92.41	90.46	1.95
7.	Propiconazole	0.10	93.09	90.96	2.13
8.	Tricyclazole	0.10	96.59	95.88	0.71
9.	Iprobenphos	0.10	52.52	50.14	2.38
10.	Iprodione + Carbendazim	0.10	95.88	94.83	1.05
11.	Bordeaux mixture	0.60	95.85	95.73	0.12
12.	Captan	0.25	81.91	78.51	3.40
13.	Control	-	-	-	-

clearly, indicated that the preventive sprays of tricyclazole (0.1%), Bordeaux mixture (0.6%) and iprodione + carbendazim (0.1%) were most effective for the management of disease followed by difenoconazole (0.1%), propiconazole (0.1%) and hexaconazole (0.1%).

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