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Management of Powdery Mildew of Coriander (*Coriandrum sativum* L.) incited by *Erysiphe polygoni* DC with Fungicides

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ABSTRACT: Coriander (*Coriandrum sativum* L.) is a significant spice crop known locally as "Dhana" or "Kothmir" that belongs to the Umbelliferae family and is primarily grown in India. It caused significant damage in South Gujarat. Given the high disease incidence and economic damage caused by powdery mildew disease, an experiment was conducted to evaluate the performance of several fungicides in the field for powdery mildew disease management. Reduce the yield loss of coriander due to powdery mildew disease through proper fungicides at right time is aim to study. All of the fungicides tested considerably reduced disease compared to the control. Propiconazole 25 EC (0.025%) was found to be the most effective against with a minimum of 19.17 percent disease intensity and a maximum of 72.80 percent disease control, followed by hexaconazole 5 EC (0.025%) with a minimum of 23.17 percent disease intensity and a decrease of 67.13 percent disease intensity over the control after two sprays at 15-day intervals. Similarly, the maximum seed yield was 1106.17 kg ha^{-1} with an increase of 160.47% over control with the application of propiconazole (0.025%), which was equal to hexaconazol (0.025%) by 958.02 kg ha^{-1} with an increase of 125.58% yield over the control treatment. The minimum seed output in the control treatment was 424.69 kg ha^{-1}. The study found that two sprays of propiconazole (0.025%) and hexaconazole 5 EC (0.025%) at 15-day intervals are the most efficient fungicides for managing coriander powdery mildew.

Keywords: Coriander, powdery mildew, fungicides, management, seed yield.

INTRODUCTION

Coriander (*Coriandrum sativum* L.) which belongs to the family *Apiaceae* (*Umbelliferae*). Coriander is indigenous to the Mediterranean region and mainly cultivated in Russia, Central Europe, North Africa and Asia (Singh, 2006). In India major coriander growing states are Rajasthan, Madhya Pradesh, Gujarat, Uttar Pradesh, and Southern states like Andhra Pradesh, Karnataka and Tamil Nadu (Sharma *et al*., 2014). The coriander crop suffers from many biotic and abiotic factors to reduce crop yield. Among the various disease of coriander powdery mildew caused by *Erysiphe polygoni* DC is one of the most important disease (Dange *et al*., 1992) and has become a serious menace in recent past causing considerable yield loss up to 50 percent in the absence of effective control measures (Amin *et al*., 2019). *Erysiphe polygoni* DC caused powdery mildew disease in many crops *viz.*, coriander (Khare *et al.*, 2017), fenugreek (Acharya *et al*., 2014), cumin (Didwania, 2019) to significantly reduced crop yield. Powdery mildew is most common on the upper side of leaves, but it also affects the underside of leaves, young shoots and stems, buds, flowers, and young fruits (Agrios, 2005). Powdery milder disease appears in February-March as favoured by dry conditions with warmer days. Powdery white masses are observed sprinkled on the foliage and tender plant parts which cover the whole foliage and plant parts. The leaves turn yellow then brown. When the disease appears early seed is not produced but in case of late infection some seeds are formed but most of them remain small in size (Khare *et al*., 2017). Aim of study to found suitable fungicides at appropriate period to minimized powdery mildew disease incidence of coriander and reduce the yield loss of coriander due to powdery mildew disease in South Gujarat region.

MATERIALS AND METHODS

An experimental was conducted at Agriculture Research Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari during *Rabi*-2021-22 season in field conditions. Susceptible genotype NCOR-136 was used for these studies. Genotype was sown in gross plot size was 2.25 ×3 m and net pot size was 1.35× 2.70 with maintained at 45 cm ×15 cm spacing and the plots were laid out in Randomized Block Design (RBD) and replicated three times. Land preparation was done by 3-4 ploughing and initial application of decomposed FYM @ 200 kg in experiment plot. Fertilizer NPK as 60:30:0 kg/ha as applied full dose of Phosphorus and half dose of

nitrogen were gave as basal application at the time of sowing and remaining 50 per cent dose of nitrogen gave at pre-flowering stages as top dressing (Anon., 2019). Thinning operation was done at 25 DAS to maintain optimum plant population. Total five irrigations at 15 days intervals were given at different crop growth stage and according to the crop need. Similarly, inter-culture operation was done to keep the field free from weeds. Total seven fungicides with their respective concentration were used under treatment details as T_1: Wettable sulphur 80% WP (0.20%), T_2: Propiconazole 25% EC (0.025%), T_3: Hexaconazol 5% EC (0.025), T_4: Dinocap 48% EC (0.048%), T_5: Difenoconazole 25% EC (0.025%), T_6: Azoxystrobin 18.2% + Difenconazole 11.4% SC (0.05%), T_7: Picoxystrobin 25% EC (0.025%), T_8: Control (Absolute control).

The experimental plots were regularly visited for observing appearance of disease. 1st spray of the fungicide was applied at disease was initiated and 2nd spray was applied after 15 days of first spray. First spray of fungicide with respective doses was done after initiation of disease and second spray done at 15 days after 1st spray. One plot per replication was maintained without spraying of any fungicide which served as control. Initial disease observation was recorded from fifty randomly selected plants from each plot. Three observations of disease incidence were recorded *viz.*, initially at disease appearance, 15 days after 1st spray and 15 days after 2nd spray. Disease scoring was done using 0-4 scale (Anon., 2004) and described in fig.1 as 0 = Healthy; 1 = Whitish small spots on leaf; 2 = Whitish growth covering entire leaf; 3 = Whitish growth on leaf and stem; 4 = Whitish growth on leaf, stem and umbel.

Per cent disease intensity was calculated by using following formula (Hudge and Datar 2010)

$$\text{Disease Intensity (\%)} = \frac{\text{Sum of all numerical ratings}}{\text{Total no. of leaf observed} \times \text{max. disease grade}} \times 100$$

The per cent disease control and the percentage deviation in seed yield were calculated with the help of the following formula given by Mathur *et al*. (1971)

$$\text{PDC(\%)} = \frac{\text{PDI in check} - \text{PDI in tratment}}{\text{PDI in check}} \times 100$$

On crop maturity stage seeds of coriander were harvested from each plot and seed yield kgha^{-1} was calculated. Percent deviation in seed yield over control was worked out with the help of the following formula

Seed yield increase (%) =

$$\frac{\text{Seed yield in treatment} - \text{Seed yield in check}}{\text{Seed yield in check}} \times 100$$

RESULTS AND DISCUSSION

The results are presented in Table 1 revealed that initially all the treatment were more or less similar with each other before first spray of fungicide and showed no significant difference with PDI. The percent disease intensity of powdery mildew on coriander was recorded before spraying (initiation of disease) was recorded in ranged from 1.67 to 3.00 per cent. After 15 days of first sprayed a significant difference was showed among the treatments to disease intensity as compared to the control. Fungicide, propiconazole (0.025%) was most effective fungicide with minimum disease intensity by 9.17 per cent which was at par with hexaconazol (0.025%) with 10.17 per cent disease intensity. Other treatments were found moderately effective. Wettable sulphur (0.2%), dinocap (0.048%), picoxystrobin (0.025%), difenoconazole (0.025%) and azoxystrobin + difenconazole (0.05%) was observed least disease intensity by 12.83, 13.17, 14.17, 15.00 and 15.33 per cent, respectively. Highest disease intensity was observed in control (21.83%). Similarly, after 15 days of second spray results showed that all the treatment were found significantly superior to the control. Minimum disease intensity was recorded in sprayed with propiconazole (0.025%) by 19.17 percent disease intensity followed by hexaconazol (0.025%) with 23.17 percent disease intensity. While sprayed with difenoconazole (0.025%), wettable sulphur (0.2%), azoxystrobin + difenconazole (0.05%), dinocap (0.048%), and picoxystrobin (0.025%) recorded disease intensity with 28.00, 28.67, 28.83, 29.50 and 30.67 per cent, respectively. Maximum (70.50%) disease intensity was recorded in control. From the results stated that all the fungicides reduced disease intensity over control. Maximum, 72.80 per cent disease reduction over control was observed in plots treated with propiconazole (0.025%), followed by hexaconazole (0.025%), with 67.13 per cent. This was followed by difenoconazole (0.025%) was observed with 60.28 per cent decrease in disease intensity over the control. Other fungicides such as azoxystrobin + difenconazole (0.05%), wettable sulphur (0.2%) and dinocap (0.48%) was found moderately effective with 59.81, 59.33 and 58.15 percent decrease in disease intensity, respectively. Among the fungicides picoxystrobin (0.025%), was found least effective with 56.49 per cent decrease in disease intensity over the control (Table 1).

The results of seed yield presented in (table 1) showed that a significant difference was recorded among the all treatments in seed yield. Highest seed yield 1106.17 kg ha^{-1} was recorded in twice sprayed with propiconazole and it was increasing 160.47 per cent over the control which was at par with hexaconazol by 958.02 kg ha^{-1} with increased 125.58 per cent. While in wettable sulphur (0.2%), 770.37 kg ha^{-1} seed yield was recorded with 81.40 per cent increasing over control seed yield. Sprayed with fungicide, azoxystrobin + difenconazole (0.05%), dinocap (0.048%), picoxystrobin (0.025%) and difenoconazole (0.025%) harvested yield by 720.99, 696.30, 671.60 and 656.79 kg ha^{-1} and 69.67, 63.95, 58.14, and 54.65 per cent yield increased, respectively. Lowest, 424.69 kg ha^{-1} seed yield was recorded in control. Results of our findings are more or less similarly with earlier workers in various crops likely, Singh (2006) revealed that maximum powdery mildew disease reduction was observed in hexaconazole (0.1%) which was at par with propiconazol (0.1%) and wettable sulphur (0.3%). Seed

yield of coriander was higher compared to the control recorded by 2.54, 2.00 and 2.20 times in hexaconazole, propiconazol and wettable sulphur treatment, respectively. Similarly, Ushamalini and Nakkeeran (2017) tested fungicides as azole compound for the management of powdery mildew in coriander and found that two prayed of propiconazol (0.15%) at 15 days interval *i.e.*, 30 and 45 DAS was highly effective against powdery mildew disease which was at par with tebuconazole (0.15%), azoxystrobin (0.15%) and difenconazole (0.05%). Highest seed yield of 774.56 kg ha^{-1} were recorded in sprayed with propiconazole (0.15%). Powdery mildew of cumin effectively managed by two spraying with propiconazole (0.025 %) at 15 days after interval which was at par with wettable sulphur at 0.2 percent concentration (Khunt *et al*., 2017). Powdery mildew disease of coriander caused by *E. polygoni* effectively managed by two sprays of hexaconazole (0.05 %) at 15 days interval was found effective to minimized disease by 22.53 per cent and got higher yield (1257.34 kg ha^{-1}) which was at par with wettable sulphur (0.30%) and dinocap (0.10%) with 24.17 and 29.83 per cent disease intensity and 1243.86 and 1106.58 kg ha^{-1} seed yield, respectively (Patel *et al.*, 2017). Deshmukh *et al*. (2018) tested various fungicides against Powdery mildew disease severity in pea due to *Erysiphe polygoni* reduced by three spraying with hexaconazole (0.1%) followed by propiconazole (0.1%), wettable sulphur (0.2%) and dinocap (0.1%) and highest pod yield 88.80 qt ha^{-1} was harvested from hexaconazole which was at par with propiconazole by got 86.60 qt/ha pod yield. Goswami *et al*. (2018) reported that two spray with propiconazol (0.025%) was found highly effective with 11.58 per cent powdery mildew disease intensity and gave highest seed yield of 1473 kg ha^{-1} followed by wettable sulphur (0.2%) with 16.14 per cent disease intensity and 1485 kg ha^{-1} seed yield. Hexaconazole and difenoconazole 0.025 per cent concentration recorded 20.46 and 22.90 per cent disease intensity with 1252 and 1197 kg ha^{-1} seed yield, respectively. Amin *et al*. (2019) revealed that minimum powdery mildew disease intensity (14.88%) of coriander was recorded when two sprayed with propiconazole (0.1%) which was at par with hexaconazole (0.1%) and wettable sulphur (0.2%) with 15.58 and 16.55 percent, respectively. Maximum (1804 kg ha^{-1}) seed yield was also recorded in propiconazole which was at par with hexaconazole and wettable sulphur with 1713 and 1621 kg ha^{-1}, respectively.

Table 1: Evaluation of different fungicides for the management of coriander powdery mildew disease during *Rabi* 2021-2022 season.

Treatment	Conc. (%)	Percent Disease Intensity			PDC (%)	Seed yield (Kg/ha)	Increase in yield over control (%)
		Initial	15 days after 1st spray	15 days after 2nd spray			
Wettable sulphur 80% WP	0.20	8.09* (2.00)	20.99 (12.83)	32.37^{b} (28.67)	59.33	770^{bc}	41.09
Propiconazole 25% EC	0.025	8.38 (2.17)	17.61 (9.17)	25.96^{d} (19.17)	72.80	1106^{a}	61.60
Hexaconazol 5% EC	0.025	7.29 (1.67)	18.58 (10.17)	28.77^{c} (23.17)	67.13	958^{ab}	55.67
Dinocap 48% EC	0.048	7.77 (1.83)	21.11 (13.17)	32.89^{b} (29.50)	58.15	696^{c}	39.07
Difenoconazole 25% EC	0.025	9.95 (3.00)	22.75 (15.00)	31.94^{b} (28.00)	60.28	657^{c}	35.33
Azoxystrobin 18.2% + Difenconazole 11.4% SC	0.05	9.39 (2.67)	23.03 (15.33)	32.46^{b} (28.83)	59.81	721^{c}	36.76
Picoxystrobin 25% EC	0.025	8.09 (2.00)	22.11 (14.17)	33.62^{b} (30.67)	56.49	672^{c}	44.87
Control (Absolute control)	-	9.39 (2.67)	27.85 (21.83)	57.11^{a} (70.50)	-	425^{e}	-
S.Em±	-	0.46	0.99	0.62	-	38.12	-
C.D	-	1.42	3.03	1.90	-	188.85	-
CV%	-	9.45	7.87	3.12	-	14.36	-

( ) original value mean of three replication. * Arcsine transformed value; Treatment comparison by Duncan Multiple Range Test

Fig. 1. Disease rating scale for powdery mildew of coriander.

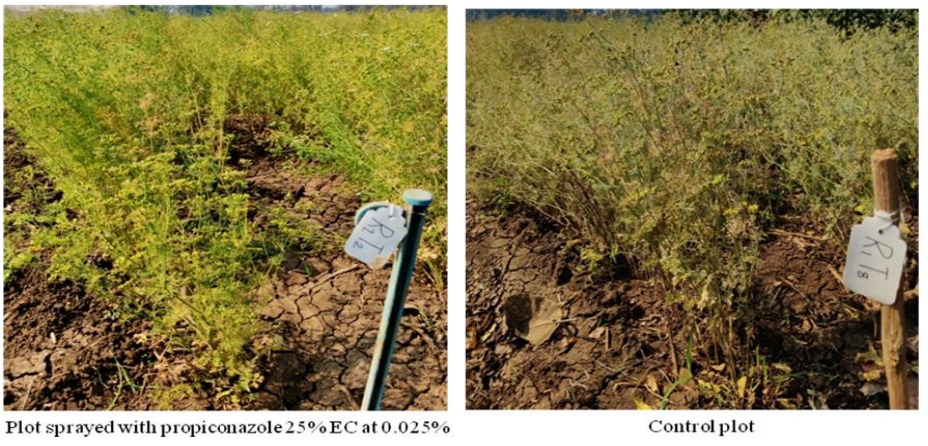

Fig. 2. Comparison of plot sprayed with fungicide and control treatment.

CONCLUSIONS

Two sprayed at 15 days interval of propiconazole (0.025%) and hexaconazole (0.025%) were found highly effective to reduced 72.80 and 67.13 per cent disease intensity, respectively. Similarly, highest seed yield 1106.17 kg ha^{-1} by increased 160.47 per cent over the control was recorded in propiconazole (0.025) which was at par with hexaconazol by 958.02 kg ha^{-1} with increased 125.58 per cent. While seed yield in wettable sulphur (0.2%), 770.37 kg ha^{-1} seed yield was recorded with 81.40 per cent increased over control.

Author's Contributions. Darshankumar N. Patel and Kedar Nath, both the author's design an experiment, prepared the materials and conducted the experiment. Darshankumar N. Patel analyzed data, performed the statistical analysis and drafted the manuscript. Kedar Nath, edited previous versions of the manuscript. Idea of research work and seeds of susceptible genotypes provided by Madhu Bala, Department of Genetics and Plant Breeding, N.M. College of Agriculture, Navsari Agricultural University, Navsari. All the authors have read and approved the final manuscript.

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Conflict of Interest. None.

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