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Management of powdery mildew (*Erysiphe polygoni* DC) in coriander (*Coriandrum sativum* L.)

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Abstract
Coriander (*Coriandrum sativam* L.) is one of the most important spice crop in India. The powdery mildew disease caused by *Erysiphe polygoni* DC is one of the most destructive disease of coriander causing severe losses in yield. Farmers have to spray fungicides regularly for management of disease. A field trial was conducted at the Department of Plant Pathology, JAU, Junagadh to study efficacy of various fungicides for controlling powdery mildew disease of coriander caused by *E. polygoni* during *Rabi* season of 2014-15 and 2015-16. Among the different fungicides, propiconazole (0.025%) was the most effective fungicide with 11.58 per cent (two year pooled) disease intensity and highest yield 1473 kg/ha (two year pooled) followed by wettable sulphur (0.2%) with 16.14 per cent mean disease intensity and yield 1385 kg/ha. Hexaconazole, difenoconazole, dinocap and picoxystrobin were found moderately effective with 21.24, 22.90, 33.82 and 35.15 per cent disease intensity, respectively.

Keywords: Coriander, *Erysiphe polygoni*, powdery mildew, fungicides

Introduction
Coriander (*Coriandrum sativam* L.) is one of the most important spice crop belonging to the family *Aapiaceae*. It is commonly known as 'Dhania" or "Dhana" and grown in Gujarat and other states of India. Gujarat occupies an area of 92100 hectares, with production of 143378 metric tonnes (Anon. 2015) [2]. *Erysiphe polygoni* DC is an important and destructive pathogen causing powdery mildew in coriander. The present investigation was carried out at P.G. Research farm, Department of Plant Pathology, Junagadh Agricultural University, Junagadh, during 2014-15 and 2015-16.

Disease appears after flowering and continues up to maturity of the crop in severe form and cause reduction in yield. Under cool and dry condition the disease spreads in entire field within short duration. In such congenial condition the crop must be protected with frequent applications of fungicides. Farmers start fungicidal applications onward from disease appear generally in flowering stage. Srivastava (1971) [9] reported losses 15-20% in Rajasthan due to *Erysiphe polygoni* in coriander. The effectiveness of propiconazole in coriander (Akbari and Parakhia, 2010) [1] and penconazole and propiconazole (Dhruj *et al*., 2000) [3] in fenugreek for control of powdery mildew has been reported. The wettable sulphur has been reported effective against powdery mildew in (Mathur *et al.* 1971) [5], pea (Rana *et al.* 1991 and Loganathan *et al.* 2011) [7, 4] and coriander (Singh 2006, Patel *et al.* 2008 and Tomer and Tomer, 2010) [8, 6, 10].

Methodology
For studying the efficacy of different fungicides against *E. polygoni* on coriander *in vivo*, six different fungicides *viz*., hexaconazole, difenoconazole, propiconazole, picoxystrobin, dinocap and wettable sulphur were tested on. coriander *cv*. Gujarat Coriander-2 under field conditions during the *Rabi*, 2014-15 and 2015-16. The first spray was given on initiation of disease and remaining two sprays of fungicides were done at 15 days interval. Control was maintained by water spraying (400 lit/ha) and without spraying of any fungicides. Observations on disease intensity were recorded from randomly selected ten plants from each treatment after seven days of last spray using 0-5 scale given by Singh (2006) [8] for coriander crop. Each plant was evaluated for its disease reaction using following score.

Table 1

Grade	Per cent disease severity with description
0	No symptoms on the plant
1	1 to 10 small patches on leaves
2	11 to 20 small patches on leaves
3	More than 50 % leaf area covered with patches
4	Symptoms on the leaves and stems covering more than 75% plant area
5	Symptoms on the umbel and capsules

Per cent disease intensity (PDI) was calculated by using the following formula:

$$PDI = \frac{\text{Sum of total rating}}{\text{Total no. of plants observed}} X \frac{100}{\text{Maximum disease rating}}$$

The per cent disease control and the percentage deviation in seed yield were calculated with the help of the following formula (Mathur *et al*., 1971) [5].

$$PDC(\%) = \frac{\text{P.D.I. in check - P.D.I. in treatment}}{\text{P.D.I. in check}} X100$$

Results and Discussion

Data presented in Table 1 revealed that all fungicides tested reduced the disease intensity significantly as compared to the control. The propiconazole (0.025%) was the most effective fungicides with 4.10 per cent (pooled) least mean disease intensity followed by wettable sulphur (0.2%) with 7.73 per cent mean disease intensity. Hexaconazole, difenoconazole, dinocap and picoxystrobin were found moderately effective with 13.14, 15.21, 31.00 and 33.10 per cent disease intensity, respectively. Maximum disease control of 80.73 per cent was also observed in the treatment of propiconazole followed by treatment wettable sulphur by 73.14 per cent as compared to control. Similar trend was observed in both the seasons. It is evident from data presented in table that propiconazole performed the best with minimum mean per cent disease intensity of 4.10 per cent (pooled). These results are in agreement with in various crop *viz*, coriander (Akbari and Parakhia, 2010) [1] and fenugreek (Dhruj *et al*., 2000) [3].

The results presented in table 2 showed significant differences in seed yield due to fungicidal sprays of different treatments. Mean seed yield of both year was found significantly maximum in the treatment of propiconazole (1473 kg/ha) and it was at par with wettable sulphur (1385 kg/ha). Water spray control produced 970 kg/ha mean seed yield as compared to no spray control with the minimum mean seed yield of 877 kg/ha. However, they were statistically at par with each other. Per cent increase in seed yield over no spray control was also higher in the treatment of propiconazole (40.50%) followed by wettable sulphur (36.70%), hexaconazole (29.96%), difenoconazole (26.74%), dinocap (23.44%), picoxystrobin (12.91%), respectively (Fig. 1).

Table 1: Effect of different fungicides against powdery mildew of coriander caused by *E. polygoni in vivo* during winter 2014-15 and 2015-16

S. No.	Fungicides	Concen tration (%)	Disease intensity (%)		Mean	Disease Control (%)
			2014-15	2015-16		
1	Hexaconazole 5% EC	0.025	22.02** (14.05)*	20.46 (12.22)	21.24 (13.14)	64.65
2	Difenoconazole 25% EC	0.025	24.70 (17.46)	21.10 (12.97)	22.90 (15.21)	61.88
3	Propiconazole 25% EC	0.025	13.16 (5.18)	10.00 (3.01)	11.58 (4.10)	80.73
4	Dinocap 48% EC	0.048	32.82 (29.38)	34.82 (32.61)	33.82 (31.00)	43.70
5	Picoxystrobin 25% EC	0.025	36.27 (35.00)	33.96 (31.21)	35.12 (33.10)	41.55
6	Wettable sulphur 80% WP	0.2	16.31 (7.88)	15.97 (7.57)	16.14 (7.73)	73.14
7	Control (water spray)	-	46.68 (52.94)	47.08 (53.62)	46.88 (53.28)	21.97
8	Control	-	59.86 (74.79)	60.29 (75.44)	60.08 (75.12)	
	Mean		36.08 (29.58)	30.46 (28.58)	30.97 (29.08)	
Y	S. Em. ±				0.57	
	CD at 5%				NS	
T	S. Em. ±		1.81	1.41	1.15	
	CD at 5%		5.50	4.27	3.32	
	CV%		9.98	8.00	9.08	
YxT	S. Em. ±		-	-	1.62	
	CD at 5%		-	-	NS	

*Data given in parentheses are retransformed values

**Data were transformed (Arcsine) prior to analysis

Water was used average 500 lit/ha for spraying

Table 2: Effect of different fungicide on seed yield

Sr. No.	Fungicides	Seed yield (kg/ha)		Mean	Yield Increased (%)
		2014-15	2015-16		
1	Hexaconazole 5% EC	1133	1370	1252	29.96
2	Difenoconazole 25% EC	1067	1327	1197	26.74
3	Propiconazole 25% EC	1437	1510	1473	40.50
4	Picoxystrobin 25%EC	930	1083	1007	12.91
5	Dinocap 48% EC	1023	1267	1145	23.44
6	Wettable sulphur 80% WP	1333	1437	1385	36.70
7	Control (water spray)	903	1037	970	9.62
8	Control	800	953	877	-
	Mean	1078.25	1248	1163.25	-
Y	S. Em. ±	-	-	24.48	-
	C.D. at 5%	-	-	70	-
T	S. Em. ±	65.7361	72.6114	48.97	-
	C.D. at 5%	199	220	142	-
	C.V. %	10.56	10.08	10.31	-
YxT	S. Em. ±	-	-	69.25	-
	C.D at 5%	-	-	NS	-

T = Treatment
YxT = Year x Treatment
Water was used average 400 lit/ha for spraying

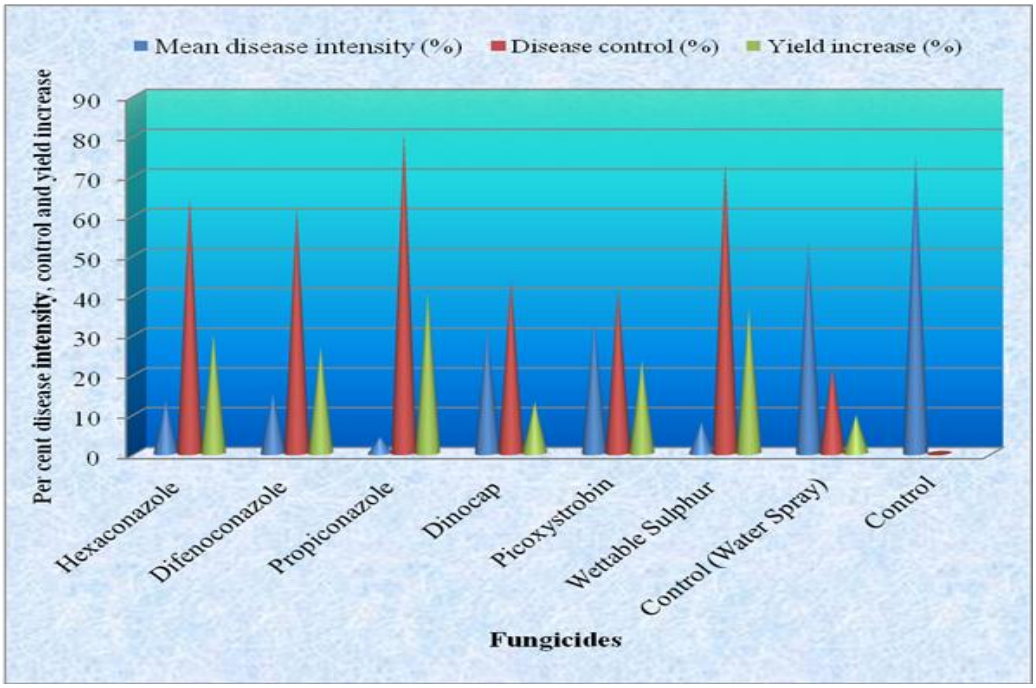

Fig 1: Per cent disease intensity, control and yield increase as influenced by different fungicides *in vivo* during *Rabi* 2014-15 and 2015-16

Conclusion

It is concluded from the experiment that effect of different fungicides against *Erysiphe polygoni* on coriander was tried in field condition during *Rabi* 2014-15 and 2015-16. Propiconazole (0.025%) was the most effective fungicides with 4.10 per cent (pooled) least mean disease intensity followed by wettable sulphur (0.2%) with 7.73 per cent (pooled) mean disease intensity. Hexaconazole, difenoconazole, dinocap and picoxystrobin were found moderately effective with 13.14, 15.21, 31.00 and 33.10 per cent disease intensity, respectively. The highest coriander yield of 1473 kg/ha (two year pooled) was recorded in the treatment of propiconazole 0.025 per cent followed by wettable sulphur (1385 kg/ha).

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