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Screening of coriander (*Coriandrum sativum* L.) genotypes for powdery mildew tolerance under natural field conditions

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Abstract

Coriander (*Coriandrum sativum* L.) is an important seed spice crop. however, its productivity is severely constrained by powdery mildew caused by *Erysiphe polygoni* DC. The present investigation was conducted at the College of Horticulture, Bagalkot, to evaluate the response of coriander genotypes against powdery mildew under natural field conditions. A total of ninety nine genotypes were screened and disease severity was recorded at peak incidence using a 0–4 scale. The Per cent Disease Index (PDI) was computed and genotypes were categorized following standard classification criteria. The results revealed considerable variability among genotypes, with PDI values ranging from 50 to 100 per cent. None of the genotypes exhibited immune or resistant reactions, indicating the absence of complete resistance in the evaluated material. A small group of genotypes, namely DCC-77, DCC-74, DCC-79, DCC-83, DCC-6, DCC-59 and DCC-75, recorded relatively lower PDI values (50–55%) and were categorized as moderately resistant. Twenty-seven genotypes showed moderately susceptible reactions (60–75% PDI), while the majority were susceptible (80–95% PDI) or highly susceptible (100% PDI). At the third week of observation, only 13 genotypes were classified as susceptible (41–60% PDI), whereas the remaining genotypes were highly susceptible (>60% PDI). The predominance of susceptible reactions suggests that cool and humid environmental conditions favoured disease development and highlights the quantitative nature of resistance. Nevertheless, the identification of moderately resistant genotypes provides useful genetic resources for breeding programs aimed at improving disease tolerance. However, the observed tolerance requires further confirmation through repeated evaluation across seasons and environments to establish its consistency.

Keywords: Powdery mildew, tolerance, *Erysiphe polygoni* DC, per cent disease index

Introduction

Coriander (*Coriandrum sativum* L.) is an important seed spice crop widely cultivated for its culinary and medicinal value. However, its productivity is significantly constrained by several biotic stresses, among which powdery mildew caused by *Erysiphe polygoni* DC is one of the most destructive diseases. The disease commonly appears under cool and humid environmental conditions, leading to severe infection on leaves, stems and umbels, ultimately resulting in reduced photosynthetic efficiency, poor seed set and significant yield losses. In many coriander-growing regions, powdery mildew occurs as a recurring problem, necessitating effective management strategies. The host plant resistance is considered one of the most economical and environmentally sustainable approaches for disease management. However, the availability of resistant sources in coriander is limited and most cultivated genotypes exhibit varying degrees of susceptibility. Therefore, systematic screening of available germplasm is essential to identify potential sources of resistance or tolerance. The present study was undertaken to evaluate a diverse set of coriander genotypes under natural field conditions to assess their reaction to powdery mildew and to identify promising genotypes that could be utilized in breeding programs aimed at improving disease tolerance.

Materials and Methods

The reaction of each genotype for powdery mildew was scored at peak incidence. The observations on the powdery mildew disease was recorded from 5 randomly selected plants from each genotype using 0.0-4.0 scale (Kumawat *et al.*, 2021) [2]. This scale helps to calculate Per cent Disease Index (PDI).

Disease rating scale used for screening of coriander germplasm (Kumawat *et al.*, 2021) [2]

Rating	Symptoms
0.0	Healthy/ No. incidence
1.0	Whitish small spots on the leaf
2.0	Whitish growth covering the entire leaf
3.0	Whitish growth covering on leaf and stem
4.0	Whitish growth on leaf, stem and umbel

The number of lesions on each leaf was counted and the following formula was used to compute the Per cent disease index (PDI) based on the collected data. The Per cent disease index (PDI) was calculated by using following formula:

$$PDI = \frac{\text{sum of all numerical ratings}}{\text{No. of leaves observed} \times \text{maximum rating}} \times 100$$

Following Datar & Mayee's criteria, the various genotypes were grouped according to the Per cent Disease Index (PDI).

Table 1: Categorization of germplasm lines based on PDI (Percent Disease Index)

Sl. No.	PDI	Category
1	0	Immune
2	1-20	Resistance
3	21-40	Moderately susceptible
4	41-60	Susceptible
5	>60	Highly susceptible

Results

During the study, coriander genotypes were assessed for their response to powdery mildew disease caused by *Erysiphe polygoni* DC under natural field conditions. A total of ninety-five genotypes along with checks were observed during crop growth, and disease incidence was recorded at appropriate crop stages. Each genotype was scored for disease severity based on

standard scales, which enabled their classification into resistant, moderately resistant, susceptible and highly susceptible categories.

The reaction of ninety-five coriander genotypes along with checks to powdery mildew disease, as assessed under field conditions, is presented in Table 2. Considerable variation was observed among the genotypes, with Percent Disease Index (PDI) values ranging from 50 to 100 per cent. Based on the disease severity scores, genotypes were classified into different reaction groups. A total of seven genotypes (7.37%) namely DCC-77, DCC-74, DCC-79, DCC-83, DCC-6, DCC-59 and DCC-75 recorded lower PDI values (50–55%), and were categorized as moderately resistant. Another set of twenty-seven genotypes (28.42%), including DCC-12, DCC-23, DCC-25, DCC-26, DCC-21, DCC-24, DCC-64, DCC-61, DCC-72, Local-1, DCC-22, DCC-19 and DWD-3, exhibited PDI values between 60 and 75 per cent and were grouped as moderately susceptible. The fifty-three genotypes (55.79%), showed PDI values in the range of 80–95 per cent and were identified as susceptible. This group included widely distributed genotypes such as DCC-14, DCC-29, DCC-30, DCC-33, DCC-35, DCC-42, DCC-44, DCC-49, DCC-66 and C-4. The remaining ten genotypes (10.52%), including DCC-1, DCC-2, DCC-5, C-1, C-2, C-3, Local-2 and DCC-8, recorded PDI values of 100 per cent and were categorized as highly susceptible.

The categorization of coriander genotypes based on Percent Disease Index (PDI) values at the third week of disease observation is presented in the the Table 3. None of the genotypes were found to be immune (0 PDI) or resistant (1–20 PDI), indicating the absence of highly resistant sources in the evaluated material. Similarly, no genotype fell under the moderately susceptible class (21–40 PDI).

A total of 13 genotypes (12.63%) namely DCC-6, DCC-75, DCC-76, DCC-77, DCC-83, DCC-89, DCC-59, DCC-7, DCC-12, DCC-23, DCC-84, DCC-27 and DCC-79 recorded PDI values between 41 and 60 per cent and were categorized as susceptible. The remaining 83 genotypes (87.37%), including checks, exhibited PDI values above 60 per cent and were grouped as highly susceptible. This category comprised a wide range of genotypes such as DCC-1, DCC-2, DCC-5, DCC-13, DCC-16, DCC-29, DCC-33, DCC-40, DCC-44, DCC-60, DCC-63, DCC-72, DCC-73, DCC-91, DCC-93, along with checks C-1 to C-5, Local-1 and Local-2.

Table 2: Per cent Disease Index of powdery mildew disease in coriander genotypes

Sl. No.	Genotypes	PDI values (%)	Sl. No.	Genotypes	PDI values (%)	Sl. No.	Genotypes	PDI values (%)	Sl. No.	Genotypes	PDI values (%)
1	DCC-1	100	26	DCC-26	70	51	DCC-53	90	76	DCC-79	55
2	DCC-2	100	27	DCC-27	60	52	DCC-54	85	77	DCC-80	95
3	DCC-3	95	28	DCC-28	85	53	DCC-55	90	78	DCC-82	95
4	DCC-4	95	29	DCC-29	80	54	DCC-56	85	79	DCC-83	55
5	DCC-5	100	30	DCC-30	85	55	DCC-58	85	80	DCC-84	60
6	DCC-6	55	31	DCC-31	85	56	DCC-59	55	81	DCC-85	80
7	DCC-7	60	32	DCC-32	80	57	DCC-60	75	82	DCC-86	75
8	DCC-8	95	33	DCC-33	85	58	DCC-61	75	83	DCC-87	90
9	DCC-9	90	34	DCC-34	75	59	DCC-62	90	84	DCC-88	65
10	DCC-10	95	35	DCC-35	90	60	DCC-63	85	85	DCC-89	55
11	DCC-11	90	36	DCC-36	95	61	DCC-64	65	86	DCC-90	75
12	DCC-12	60	37	DCC-37	90	62	DCC-65	90	87	DCC-91	80
13	DCC-13	75	38	DCC-38	95	63	DCC-66	85	88	DCC-92	75
14	DCC-14	80	39	DCC-39	85	64	DCC-67	90	89	DCC-93	95
15	DCC-15	90	40	DCC-40	90	65	DCC-68	85	90	C-1	100
16	DCC-16	75	41	DCC-41	95	66	DCC-69	75	91	C-2	100
17	DCC-17	95	42	DCC-42	95	67	DCC-70	80	92	C-3	100
18	DCC-18	95	43	DCC-43	95	68	DCC-71	90	93	C-4	85

19	DCC-19	80	44	DCC-44	90	69	DCC-72	85	94	C-5	80
20	DCC-20	75	45	DCC-45	95	70	DCC-73	80	95	LOCAL-2	100
21	DCC-21	70	46	DCC-47	95	71	DCC-74	875	96	DCC-46	85
22	DCC-22	80	47	DCC-48	90	72	DCC-75	55	97	DCC-81	90
23	DCC-23	60	48	DCC-49	95	73	DCC-76	55	98	DWD-3	80
24	DCC-24	65	49	DCC-51	95	74	DCC-77	50	99	Local-1	75
25	DCC-25	65	50	DCC-52	95	75	DCC-78	85			

Table 3: Categorization of coriander genotypes based on PDI (Per cent Disease Index) values

Sl. No.	Category	PDI	Genotypes scored at third week
1	Immune	0	Nil
2	Resistance	1-20	Nil
3	Moderately susceptible	21-40	Nil
4	Susceptible	41-60	DCC-6, DCC-75, DCC-76, DCC-77, DCC-83, DCC-89, DCC-59, DCC-7, DCC-12, DCC-23, DCC-84, DCC-27, DCC-79
5	Highly susceptible	>60	DCC-1, DCC-2, DCC-3, DCC-4, DCC-5, DCC-8, DCC-9, DCC-10, DCC-13, DCC-16, DCC-17, DCC-18, DCC-20, DCC-22, DCC-26, DCC-29, DCC-30, DCC-33, DCC-36, DCC-38, DCC-39, DCC-40, DCC-42, DCC-43, DCC-44, DCC-55, DCC-58, DCC-60, DCC-61, DCC-63, DCC-64, DCC-65, DCC-67, DCC-68, DCC-69, DCC-78, DCC-46, DCC-81, DWD-3, DCC-28, DCC-31, DCC-32, DCC-35, DCC-37, DCC-11, DCC-14, DCC-15, DCC-19, DCC-21, DCC-24, DCC-25, DCC-34, DCC-41, DCC-45, DCC-47, DCC-48, DCC-49, DCC-51, DCC-52, DCC-53, DCC-54, DCC-56, DCC-62, DCC-66, DCC-70, DCC-71, DCC-72, DCC-73, DCC-74, DCC-80, DCC-82, DCC-85, DCC-86, DCC-87, DCC-88, DCC-90, DCC-91, DCC-92, DCC-93, C-1, C-2, C-3, C-4, C-5, LOCAL-2, LOCAL-1

Discussion

The evaluation of 95 coriander genotypes and four checks under natural field conditions revealed considerable variation in reaction to powdery mildew, although none of the entries expressed complete resistance (Table 2). The absence of immune or resistant sources confirms earlier reports that coriander lacks strong genetic resistance to *Erysiphe polygoni* and most cultivated types remain vulnerable.

A small set of genotypes, including DCC-77, DCC-79, and DCC-83, exhibited moderate resistance, likely due to the presence of partial resistance mechanisms such as slower pathogen development or reduced conidial sporulation (Table 3). These genotypes are valuable for resistance breeding because partial resistance, although not absolute, tends to be more durable than single-gene resistance (Singh *et al.*, 2016) [4]. The identification of such moderately resistant accessions has also been reported by Amin *et al.* (2017) [1], indicating that useful variability exists within coriander germplasm despite the absence of complete resistance.

The large number of susceptible and highly susceptible genotypes in this study indicates that environmental conditions such as cool and humid weather strongly favored disease development, leading to rapid pathogen spread and severe epidemics. Similar reports of heavy yield loss under favorable conditions for powdery mildew have been noted by Swaroop *et al.* (2024) [5], Nath *et al.* (2022) [3] and Kumawat *et al.* (2021) [2]. As resistance to the disease is mainly quantitative and influenced by the environment, breeding efforts should focus on combining several moderately resistant genotypes to enhance tolerance. These findings confirm that although complete resistance to powdery mildew is rare in coriander, the presence of moderately resistant genotypes offers a valuable starting point for resistance breeding and for developing sustainable disease management strategies.

Conclusion

The study revealed significant variability among coriander genotypes for response to powdery mildew, with genotypes such as DCC-77, DCC-79, and DCC-83 exhibiting moderate resistance under field conditions. These genotypes can serve as valuable genetic resources for breeding programs aimed at improving disease tolerance. The findings provide a basis for the

development of improved cultivars and sustainable disease management strategies. However, the observed tolerance requires further confirmation through repeated evaluation across diverse environments and seasons to establish its stability.

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