Journal of Scientific Research and Reports

Volume 30, Issue 3, Page 199-205, 2024; Article no.JSRR.112735
ISSN: 2320-0227

Evaluation of Coriander (*Coriandrum sativum* L.) Genotypes for Powdery Mildew Disease (*Erysiphe polygoni* DC) Resistance

Swaroop VenkatR [a++*], Bapurayagouda B. Patil [b#], Sarvamangala Cholin [c#], Shivayogi Y. Ryavalad [d†] and Shashikant Evoor [e#]

[a] Department of Biotechnology and Crop Improvement, College of Horticulture, UHS Bagalkot, Karnataka, India.
[b] Department of Seed Science and Technology, Seed Unit, UHS, Bagalkot, Karnataka, India.
[c] Genetics and Plant Breeding, Department of BCI, COH, Bagalkot, Karnataka, India.
[d] Department of Seed Science and Technology, RHREC, Dharwad, Karnataka, India.
[e] Department of Vegetable Science, DOE Office, UHS, Bagalkot, Karnataka, India.

Authors' contributions

This work was carried out in collaboration among all authors. Author SVR wrote the manuscript. Author BBP performed the analysis. Author SC conceived and designed the analysis. Author SYR contributed to data and analysis tools. Author SE collected the data All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JSRR/2024/v30i31872

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/112735

Original Research Article

Received: 04/12/2023
Accepted: 08/02/2024
Published: 15/02/2024

[++] M. Sc. (Horitculture) Scholar;
[#] Assistant Professor;
[†] Assistant Professor and Farm Superintendent;
**Corresponding author: E-mail: r.swaroopvenkat777333@gmail.com;*

ABSTRACT

Coriander (*Coriandrum sativum* L.) is short and bushy crop of Apiaceae family with linalool as aromatic compound, this crop is used mainly as culinary spice in India. Majorly this coriander crop is associated with powdery mildew (*Erysiphe polygoni* DC) disease incidence, causes serious problem in many parts of India. Screening for resistant source through artificial inoculation method which was an eco-friendly approach conductedduring *Rabi*-2022 at Department of Biotechnology and Crop Improvement, University of Horticultural Sciences, Bagalkot. 35 coriander accessions where are collected from Karnataka, Gujarat and Andhra Pradesh. Percent Disease Index (PDI %) was calculated for four weeks after inoculation and scored based on disease rating scale. Among them only eight genotypes (Surabhi, Asian (A-5), Mrityunjaya, Kalaburagi local, Nutan, Caribe, Samarat Ashok and Pokhara) showed slower powdery mildew symptoms (PDI value of 3.9 to 5.4%) after third week of inoculation but in fourth week all the 35 genotypes falls under susceptible (PDI more then 100%) and highly susceptible category which represents the high virulence nature of powdery mildew strain.

Keywords: Coriander; powdery mildew; disease incidence; susceptible; percent disease index; disease rating scale.

1. INTRODUCTION

Coriander an important crop of Apiaceae family, originated in the Mediterranean area. This highly prized herbaceous annual plant has a diploid chromosome number of 2n=22 and is widely cultivated in India during the *Rabi* season. India is the world's largest producer, consumer, and exporter of coriander, accounting for around three lakh tons per year. Particularly in Madhya Pradesh, Rajasthan and Gujaratstates contributes considerably to the nation's coriander production [1-7].

This requires cool-season conditions, since it thrives best in temperatures ranging from 20 to 25°C, with a preference for frost-free areas during flowering and seed development. This crop were grown in both irrigated and rain-fed cropping systems demonstrates its flexibility, albeit it prefers well-drained, heavy black, clayey cotton soils or rich silt loams over salty, alkaline and sandy soil compositions [8].

However, coriander faces susceptibility to various fungal diseases, notably powdery mildew caused by *Erysiphe polygoni*. This omnipresent disease adversely impacts coriander crops by reducing photosynthesis, causing leaf and shoot deformities and diminishing seed quality, resulting in 15-40% yield losses [1,3,4,9].

The pathogen survives overwinter through cleistothecia which are present in crop debris in the field and which contain ascospores (sexual spores). Infection occurs when ascospores or conidia (asexual spores) are able to germinate and penetrate the plants leaf. After infection, the pathogen grows as hyphae within the leaf, begins producing conidia on short conidiophores. Both ascospores and conidia (air born) can be the source of a primary inoculum or "first infection" [10].

This fungus, like all powdery mildews, has a white powdery appearance. It appears as tiny, white circular patches normally begins on stems and older leaves, typically close to the junction between the lamina and petiole and it develops by increases in size of the patches, often coalesce to encompass on both abaxial and adaxial surfaces of leaves. Affected leaves are reduced in size, distorted and premature sterility is also common. In serve cases, the umbels dry up, seeds will be small and shriveled or nonexistent. Attack of this disease is seen during cloudy weather condition. White powdery growth appears on the leaves and bunds during its primary stage [11,10].

The management of this pathogen traditionally involves chemical strategies, but their drawbacks, including environmental pollution and residual effects, necessitate exploring alternative approaches [11]. Efforts to prevent powdery mildew in coriander highlight the importance of discovering disease-resistant sources. This effort aims not only to prevent losses, but also to sustainably conserve the crop's yield and quality, which are critical for culinary, medicinal, and economic uses across the world [11,10]. Understanding coriander's genetic diversity and exploring resistant varieties holds the key to securing this herb's pivotal role in agriculture and

culinary practices while minimizing environmental impacts and ensuring sustainable production for future generations.

2. MATERIALS AND METHODS

The present study conducted at the Department of Biotechnology and Crop Improvement, University of Horticultural Sciences, Bagalkot, Total 35 diverse genotypes of coriander were evaluated for powdery mildew disease resistance. Along with two checks viz., Bagalkot local and DCC-46, are known to be susceptibility to powdery mildew in the region (Table 1). The experiment was conducted in a shade house by sowing coriander seeds in earthen pots filled with a mix of soil, sand and FYM in equal proportions [1]. Upon reaching the flowering stage, artificial inoculation of powdery mildew was performed to assess the resistance levels of the various coriander genotypes, providing insights into potential sources of resistance against this prevalent disease.

Table 1. Responses of cultivars for powdery mildewresistance under artificial inoculation

Sl.No.	Genotypes	PDI values after weeks inoculation in %			
		First week	Second week	Third week	Fourth week
1	Surabhi	0.00	5.46	38.28	89.84
2	Gouribidanur local	0.00	4.16	57.29	96.87
3	Asian (A-5)	0.00	3.44	38.79	89.65
4	Mrityunjaya	0.00	2.27	35.60	96.96
5	Kolar local	0.00	3.40	60.22	96.59
6	Srinivaspura local	0.00	1.92	57.69	100.00
7	Kalaburagi local	0.00	1.98	39.28	94.44
8	Pala local	0.00	3.84	59.61	96.15
9	Nutan	0.00	5.00	30.83	93.33
10	Caribe	0.00	4.03	39.51	94.35
11	Kachi	0.00	4.46	58.92	100.00
12	Samarat Ashok	0.00	3.98	39.13	94.20
13	Guntur local	0.00	4.68	61.71	97.65
14	Param	0.00	4.00	64	96.00
15	Nayana	0.00	4.80	69.23	96.15
16	Pokhara	0.00	2.01	38.70	95.16
17	Ranebennur local	0.00	4.46	62.5	100.00
18	Anantapur local	0.00	5.00	60.83	95.00
19	Nargund local	0.00	3.48	62.79	90.69
20	Bagalkot local	0.00	2.77	62.77	87.77
21	Bijapura local	0.00	4.16	63.88	90.97
22	Hubballi local	0.00	4.34	59.23	90.76
23	DCC – 81	0.00	3.44	60.34	93.10
24	DCC – 40	0.00	8.03	72.31	100.00
25	DCC – 41	0.00	5.83	72.5	95.00
26	DCC – 42	0.00	7.69	72.11	100.00
27	DCC – 43	0.00	7.14	73.21	100.00
28	DCC – 44	0.00	7.81	71.87	98.43
29	DCC – 45	0.00	8.66	96.66	100.00
30	DCC – 46	2.53	8.33	72.91	97.22
31	DCC – 47	0.00	8.65	76.92	100.00
32	DCC – 48	0.00	8.33	76.04	97.91
33	DCC – 49	0.00	8.06	72.58	100.00
34	Bagalkot local 2	0.00	3.84	61.05	87.98
35	Bagalkot local 3	0.00	3.65	57.92	89.02
Check 1	Bagalkot local	0.00	2.77	62.77	87.77
Check 2	DCC – 46	0.00	8.33	72.91	97.22

Disease rating scale used for screening of coriander germplasm (Anon., [8])

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

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

The artificial inoculation approach was used in the experiment to screen 35 genotypes of coriander under controlled circumstances for a powdery mildew-resistant source. Samples of the leaves with powdery mildew were taken from the field. By tapping or brushing the leaves in sterile water, spores were collected. The coriander genotypes were sprayed with collected powdery mildew spores.

The reaction of each genotype for powdery mildew was scored at first, second, third and fourth week after inoculation. The observations on the powdery mildew incidence was recorded from 10 randomly selected plants form each using 0.0- 4.0 scale [8]. This scale helps to calculate Percent Disease Index (PDI).

The number of lesions on each leaf was counted, and the following formula was used to compute the Percent Disease Index (PDI) based on the collected data.

The Percent Disease Index (PDI) was calculated by using following formula:

$$\text{PDI} = \frac{Sum of all numerical ratings}{No. of leaves observed X Maximum rating} \text{ X } 100$$

Following Datar & Mayee's [12] criteria, the various genotypes were grouped according to the Percent Disease Index (PDI).

3. RESULTS AND DISCUSSION

The objective of this experiment was to assess the different source of resistances against powdery mildew disease caused by *Erysiphe polygoni* DC in coriander. The 35 genotypes were encountered with pathogen through artificial inoculation, this method was employed due to the obligate biotrophic nature of powdery mildews, preventing their cultivation on artificial media [13]. Which were screened for the disease incidence and scored for determining the disease severity.

Genotypes resistances against powdery mildew incidence was recorded at first week, second, third and fourth week after inoculation (Table 1) with the help of disease rating scale. A total of 35 germplasm lines along with the two checks of coriander were evaluated against powdery mildew disease incidence. Asper the PDI (Percent Disease Index) of first week of inoculation (Table 1), DCC-45 genotype exhibited higher powdery mildew disease symptoms (2.53%) compared to checks and other genotypes. In the second week, all the genotypes were found susceptible whereas, Surabhi, Asian (A-5), Mrityunjaya, Kalaburagi local, Nutan, Caribe, Samaratashok and Pokhara exhibited mild powdery mildew symptoms as compared to checks and other genotypes (Table 1). After third week, all the genotypes were considered for categorizing as moderate susceptible, susceptible and highly susceptible to powdery mildew with the help of PDI values (Table 1). Surabhi, Asian (A-5), Mrityunjaya, Kalaburagi local, Nutan, Caribe, Samaratashok and Pokhara were moderately susceptibe and Gouribidanur local, Kolar local, Srinivaspura local, Pala local, Kachi and Hubballi local were susceptible to powdery mildew incidence. Rest of the 21 genotypes were highly susceptibility to powdery mildew incidence (Table 2).

Table 2. Categorization of germplasm lines based on PDI (Percent Disease Index)

Sl.No.	Category	PDI	Genotypes scored at third week	Genotypes scored at fourth week
1	Immune	0	Nil	Nil
2	Resistance	1-20	Nil	Nil
3	Moderately susceptible	21-40	Surabhi, Asian (A-5), Mrityunjaya, Kalaburagi local, Nutan, Caribe, Samaratashok and Pokhara	Nil
4	Susceptible	41-60	Gouribidanur local, Kolar local, Srinivaspura local, Pala local, Kachi and Hubballi local	Nil
5	Highly susceptible	>60	Param, Nayana, Ranebennur local, Anantapur local, Nargund local, Bagalkot local, Bagalkot local, Bijapura local, DCC – 81, DCC – 40, DCC – 41, DCC – 42, DCC – 43, DCC – 44, DCC – 45, DCC – 46, DCC – 47, DCC – 48, DCC – 49.	Surabhi, Asian (A-5), Mrityunjaya, Kalaburagi local, Nutan, Caribe, Samarat Ashok and Pokhara, Gouribidanur local, Kolar local, Srinivaspura local, Pala local, Kachi and Hubballi local, Param, Nayana, Ranebennur local, Anantapur local, Nargund local, Bagalkot local, Bagalkot local, Bijapura local, DCC – 81, DCC – 40, DCC – 41, DCC – 42, DCC – 43, DCC – 44, DCC – 45, DCC – 46, DCC – 47, DCC – 48, DCC – 49.

The genotypes like Surabhi, Asian (A-5), Mrityunjaya, Kalaburagi local, Ankur, Kalash, Samarat Ashok and Pokhara displayed slower disease symptoms and variation in the degree of resistance in the third week represented in the Table 2, these could be explored further in breeding programs. The slower disease symptoms and variation showed in degree of resistance in different varieties or genotypes of coriander against powdery mildew has also been reported by Kumawat et al. [11]; Kashyap et al. [10] in coriander.

At the fourth week after inoculation, the final result revealed that the minimum disease severity of 87.77% for bagalkot local (check) followed by Bagalkot local 2 (87.98%), Bagalkot local 3 (89.02%), Asian (A-5) (89.65 %) and Surabhi (89.84 %). The maximum disease severity of 100% was recorded in Srinivaspura local, Kachi, Ranebennur local, DCC-40, DCC – 42, DCC – 43, DCC – 45, DCC – 47 and DCC – 49. The remaining 21 genotypes recorded disease severity of powdery mildew range from 90.69 to 98.4% [DCC-44 (98.43%), DCC-48 (97.91%), Guntur local (97.65%), DCC- 46 (97.22%) (check), Mrityunjaya (96.96%), Gouribidanur local (96.87%), Kolar local (96.59%), Pala local (96.15%), Nayana (96.15%), Param (96%), Pokhara (95.16%), DCC-41 (95%), Anantapur local (95%), Kalaburagi local (94.44%), Caribe (94.35%), Samaratashok (94.20%), Nutan (93.33%), DCC-81 (93.10%), Bijapura local (90.97%), Hubballi local (90.76%) and Nargund local (90.69%)] respectively (Table 1). Finally, it is concluded from the study that all the 35 genotypes screened for powder mildew resistance are shown more than 60% disease severity and they are highly susceptibility (Table 2). This similar highly susceptibility also recorded with Sravanthi et al. [5].

This investigation's findings underscore the urgent need to identify coriander germplasm lines that exhibit resistance against powdery mildew. Host plant resistance and the use of resistant cultivars emerge as the most effective, practical and economical methods for managing this disease in farming systems. These resistant

cultivars not only save resources but also offer a sustainable solution, conserving time, money and natural resources while countering the detrimental impact of powdery mildew on coriander yields. Consequently, the identification and utilization of resistant genotypes stand as pivotal strategies to mitigate the losses caused by this persistent and damaging disease in coriander cultivation [11].

4. CONCLUSION

It is concluded from study that the genotypes like Surabhi, Asian (A-5), Mrityunjaya, Kalaburagi local, Ankur, Kalash and Samarat Ashok had shown mild powdery mildew disease symptomsand varied in the degree of resistance as compared to check varities. Majority of the genotypes were highly susceptible for powdery mildew disease reaction.

5. FUTURE SCOPE

This slower powdery mildew symptoms and varied degree of resistance could be studied in detail, before using for breeding program and need of further evaluation of much more genotypes for resistant source for powdery mildew.

ACKNOWLEDGMENT

It is genuine pleasure to express my deep sense of thanks and gratitude to my major advisor, Dr. Bapurayagouda Patil, Assistant Professor, Seed science and technology, Seed unit, UHS, Bagalkot and I will take this opportunity to especially pay my gratitude to my advisory committee members (Dr. Sarvamangala S. Cholin, Dr. Shashikant Evoor, Dr. Shivayogi Y. Ryavalad) My activities that took on actual shape and spirit as a result of their enlightening counsels and beneficial advise.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Yadav MB, Nair R, Chanderia UK and Hussain N. Bioefficacy of biopesticides and pesticides for the management of coriander powdery mildew caused by *Erysiphe polygoni*, seed yield and economics of coriander (*Coriandrum sativum* L.). Biological Forum – An International Journal. 2022;14(1): 1720-1725.
2. Anonymous. Estimated production volume of coriander seed India in financial year. Statista research department; 2021.
3. Goswami GJ, Akbari LF and Khunt, AR. Management of powdery mildew (*Erysiphe polygoni* DC) in coriander (*Coriandrum sativum* L.). International Journal Chemical Studies. 2018;6(2):1301-1304.
4. Amin NR, Patel BG, Patel DG. Field evaluation of coriander genotypes against powdery mildew. International Journal Seed Spices. 2017;7(1):86-88.
5. Sravanthi B, Sreeramu B, Swamy NB, Umesha K, Rajasekhar RB. Correlation coefficient and path analysis in coriander (*Coriandrum Sativum* L.) genotypes. International Journal of Current Microbiology and Applied Sciences. 2014; 6(6):418-422.
6. Mhemdi H, Rodier E, Kechaou N and Fages J. A supercritical tunable process for the selective extraction of fats and essential oil from coriander seeds. Journal of Food Engineering. 2011;105(4):609-616.
7. Verma A, Pandeya SN, Sanjay KY, Styawan S. A Review on *Coriandrum sativum* (L.) an ayurvedic medicinal herb of happiness. Journal of Advanced Pharmaceutical Technology & Research. 2011;1(3):28-48.
8. Shiwangi P, Hadimani HP, Satish D, Awati M, Kantharaju V, Biradar IB. Assessment of genetic variability parameters in coriander (*Coriandrum sativum* L.) genotypes for growth, foliage yield and quality traits. Plant Archives. 2020;20**(**1): 721-726.
9. Singh SP, Katiyar RS, Rai SK, Yadav HK, Tripathi SM, Nigam HK, Srivastava JP. Studies on genetic variability and character association in coriander (*Coriandrum sativum* L.) grown on sodic soil. Journal of Medicinal Plants Studies. 2008;30(2):164-167.
10. Kashyap RP, Nag UK and Dewangan M. Evaluation of cultivars against powdery mildew disease (*Erysiphe polygoni* DC) of coriander (*Coriandrum sativum* L.). Journal of Pharmacognosy and Phytochemistry. 2020;9(3):1230-1232.
11. Kumawat GL, Gothwal DK, Ram K, Shivran AC, Priyanka K, Meena AK. Screening of powdery mildew (*Erysiphe polygoni* DC.) tolerance in coriander

(*Coriandrum sativum* L.) germplasm. Journal of Pharmaceutical Innovation. 2021;10(4):1112-111.

12. Datar VV, Mayee CD. Assessment of losses in tomato yield due to early blight. Indian Phytopathology. 1981;34:191-195.

13. Urbanietz A, Dunemann F. Isolation, identification and molecular characterization of physiological races of apple powdery mildew (*Podosphaera leucotricha*). Journal of Plant Pathology. 2005;54(2):125-133.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/112735