International Journal of Plant & Soil Science

Volume 36, Issue 5, Page 727-731, 2024; Article no.IJPSS.114766
ISSN: 2320-7035

Screening of Germplasms for Disease Resistance Against Anthracnose of Chilli Caused by *Colletotrichum capsici*

Shambhavi Tiwari [a], Pradip Kumar [a], Gaurav Ayodhya Singh [a*], Siddhant Kr Pundir [b] and Arjun Singh [b]

[a] Department of Plant Pathology, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya -224229 (U.P.), India.
[b] Department of Plant Pathology, Sardar Vallabh Bhai Patel University of Agriculture and Technology, Modipuram, Meerut- 250110 (U.P), India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2024/v36i54571

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/114766

Original Research Article

Received: 03/02/2024
Accepted: 06/04/2024
Published: 06/04/2024

ABSTRACT

Chilli (*Capsicum annuum* Linn.) is an important extensively grown spice crop. It belongs to the family Solanaceae. Approximately 20-27 species of chilli are found, out of which five are domesticated *viz., C. annuum, C. baccatum, C. chinense, C. frutescens*, and *C. pubescens* in different parts of the world. Chilli crop suffers from various diseases in which anthracnose caused by *Colletotrichum capsici* is a very serious one, causes huge yield losses in India. Severely infected fruits look straw colour and bear numerous acervuli in concentric rings. Around 27℃ temperature, 80% relative humidity and soil pH 5-6 promote infection and disease progress. The average disease incidence level ranges between 66 and 84% which results in yield loss upto 12-50% This

**Corresponding author: E-mail: singhgaurav9828@gmail.com;*

investigation was carried out at the Main Experiment Station Vegetable Science and Department of Plant Pathology, Acharya Narendra Deva University of Agriculture & Technology Kumarganj, Ayodhya (U.P) during the year 2021 -2022. Twenty genotypes of chilli were screened and none one genotypes are found resistant, nine genotypes namely, Mahycojalna, Arkalohit, Phulemukta, Arkaharita, Madhurima, Classica 152, Arkameghna, Sonakshi 44 and Divyajyoti were found moderately resistant and rest of the genotype were susceptible and highly susceptible.

Keywords: Chilli; anthracnose; screening; resistance; susceptible.

1. INTRODUCTION

Chilli (*Capsicum annuum* Linn.) is an important extensively grown spice crop. It belongs to the family Solanaceae. It occupies an important place in daily diet and used as a principle ingredient in various curries and dishes. Chilli fruits are also used for making pickles, sauces, ketchup, essence and oleoresins. Chilli is a good source of Capsaicin, Vitamin A, Vitamin C,

"Riboflavin and Thiamine. It contains about 8.8g carbohydrates, 5.3g sugar, 1.9g protein, and 534 micro mg beta carotene/100g of chilli. Alkaloid capsaicin is also extracted from chilli having high medicinal properties. Approximately 20-27 species of chilli, five of which are domesticated *viz., C. annuum, C. baccatum, C. chinense, C. frutescens*, and *C. pubescens* in different parts of the world. Among them, *C. annuum* is one of the most common cultivated worldwide followed by *C. frutescens"* [1] "In India, total area under chilli cultivation is 377 thousand ha with production of 3783 thousand mt during 2019-20" [2]. "The major chilli growing states are Andhra Pradesh, Karnataka, Maharashtra, Orissa, Tamil Nadu, Madhya Pradesh, West Bengal and Rajasthan that account for more than 80% of the total area and production. It can be grown well in warm and humid climate with optimum temperature of 20 to 25℃. Sandy loam, clay loam and loamy soils are best suited for its cultivation. It comprises numerous chemicals including steam-volatile oils, fatty oils, capsaicinoids, caretenoids, vitamins, proteins, fiber and mineral elements" [1]. "Chilli constituents are important for nutritional value, flavor, aroma, texture and colour. Fresh green chilli contain more vitamin C than citrus fruit and fresh red chilli has more vitamin A than carrots" [3]. Marin *et al*., 2004).

"This crop suffers from many diseases caused by fungi, bacteria, viruses and nematodes along with abiotic stresses. Among the fungal diseases damping off (*Pythium aphanidermatum*), powdery mildew (*Leveillula taurica*), anthracnose of fruit rot (*Colletotrichum capsici*) and Cercospora leaf spot (*Cercospora capsici*) are the major diseases. Out of these fungal disease anthracnose/ dieback/ fruit rot caused by *Colletotrichum capsici* is a major obstacle for successful chilli cultivation. Typical anthracnose symptoms on fruit include sunken necrotic tissues with concentric ring of acervuli. Fruit showing blemishes have reduced marketability" [4]. "During the die back stage of the disease, growing tip shows the start of infection as sunken lesions leading to death of the growing tip and finally the infection proceeds backward on the branch. Severely infected fruits look straw colour and bear numerous acervuli in concentric rings. Around 27℃ temperature, 80% relative humidity and soil pH 5-6 promote infection and disease progress. The disease has been observed to occur in three phases *viz*., (i) seedling blight or damping off stage, prevalent in the nursery, (ii) leaf spotting and die back stage which is initiated at different stages of growth and (iii) fruit rot stage in which the ripe fruit are infected. The average disease incidence level ranges between 66 and 84% which results in yield loss upto 12-50%" [5]. "The extracted capsaicin is used in pain balms, cosmetics and medicines related to heart diseases. Oleoresin can also be obtained from chillies and is extensively used in western countries in food preparations, beverage industries, cosmetics and as medicine for treatment of inflammation. Chilli also stimulates saliva and gastric juices and help in digestion. It is used as counter irritant in prickly heat powders, skin ointment, cosmetics and pain balms. Chilli extracts are used in wide range of medicines against tonsillitis, diphtheria, loss of apetite, intermitted fever, rheumatism, sore throat, swelling and hardened tumours. Twenty genotypes of chilli is screened, for screening of varieties/ genotype. It is one of the most economically important disease reducing marketable yields from 10 to 80 per cent in some developing countries" [6]. It is the major problem on matured fruits, causing severe losses due to both pre and post- harvestfruit decay [7,1].

2. MATERIALS AND METHODS

A total twenty germplasm lines of chilli obtained from MES Vegetable farm of ANDUAT, Kumarganj, Ayodhya and some are purchased from local market and collected during survey and germplasm were screened against anthracnose disease under natural epiphytotic condition in the field at MES Vegetable Science of University, ANDUAT during Rabi 2021, with an objective to identify source or sources of resistance.

2.1 Plot Screening

The plots showing over 90 percent anthracnose incidence in susceptible cultivars 'Jwala' of chilli were used for screening the test varieties. Chilli genotype, which were screened in this experiment, have been given in (Table1).

3. RESULTS AND DISCUSSION

3.1 Screening of Varieties / Germplasms of Chilli for Disease Resistance

To identify the source of resistance a total of twenty chilli varieties were screened against *C. capsici* under natural condition as explained in 'material and methods' and the results are presented in Table 3. Result revealed that all the twenty chilli varieties exhibited different reaction against *C. capsici.* However, Nine test entries *viz,* Mahycojalna, Pusajyoti, Arkalohit, Phulemukta, Arkaharita, Madhurima, Arkameghna, Sonakshi 44 and Divyajyoti were found moderately resistant with mean anthracnose intensity in the range of 08.65% to 10.00% while three test entries *viz*, EC- 341075, LAC-434 and Classica 152 were found moderately susceptible with mean anthracnose intensity in the range of 12.00% to 16.55% whereas, seven test entries *viz*, Tejas, LCA312, Agnirekha, PantC-1, PBN-7, BSS-141 and Pant C-2 were found susceptible with mean anthracnose intensity in the range of 26.53% to 33.35%, whereas, one test entry that is Jwala were found highly susceptible with mean anthracnose intensity of 51.25%. Among the twenty test entries none of the entry was found resistantor immune to the disease. Several researchers have studied and screened various genotypes but none found completely resistant or immune variety against *Colletotrichum capsici* of chilli. Setiawati *et al.* [8] reported only two moderately resistant variety (Tanjung -2 and Lembang 1) against anthracnose. Gupta *et al.* [9] observed that varieties Arka Harita, Classica-152 and Madhurima -148 were showing resistance reaction under two drop of conidial suspension after injury the fruit, while EC-341075, Pusa Jwala, Pant C-1, Arka Meghna, LAC-434 and Sonakshi-44 were shown moderately resistance reaction as compared to rest of varieties after five, seven and ten days of inoculation.

Begam *et al.* [10] evaluated 47 chilli genotype out of which two hybrids and nine open pollinated varieties fall under resistant categories; 25 hybrids and 10 open pollinated varieties as moderately resistant and one pollinated varieties as to be susceptible and none of the test genotype was immune to anthracnose.

Table 1. List of chilli germplasm used for screening

No. of Germplasm	Germplasm
20	Tejas, Jwala, LCA312, Agnirekha, Pant C1, PBN-7, BSS-141, Pant C-2, Mahycojalna, Pusajyoti, Arkalohit, Phulemukta, Arkaharita, Madhurima, Classica 152, Arkameghna, Sonakshi 44, EC-341075, LAC- 434, Divyajyoti

Table 2. Disease resistance scale of *Coletotrichum capsici* given by Mayee and Datar, 1986

Scale	Reaction	Disease intensity
0	Immune	0.0%
1	Resistant	‹ 1%
3	Moderately Resistant	1-10%
5	Moderately Susceptible	11-25%
7	Susceptible	26-50%
9	Highly Susceptible	More than 51%

Fig. 1. Effect of anthracnose at different disease severity

Fig. 2. Symptoms of anthrase cno at experimental field

Table 3. Screening of germplasm line against *Colletotrichum capsici.*

Genotypes	Average PDI (Percent Disease Intensity)	Reaction type
Jwala	51.25	HS
Tejas	30.20	S
LCA 312	28.40	S
Agnirekha	26.53	S
Pant C1	32.00	S
PBN-7	31.24	S
BSS-141	32.56	S
Pant C-2	33.35	S
Mahycojalna	09.50	MR
Pusajyoti	10.56	MS
Arkalohit	08.65	MR
Phulemukta	10.00	MR
Arkaharita	09.55	MR
Madhurima	08.50	MR
Classica 152	12.00	MR
Arkameghna	10.00	MR
Sonakshi 44	09.53	MR
EC-341075	15.22	MS
LAC-434	16.55	MS
Divyajyoti	09.56	MR

HS= Highly susceptible, S= Susceptible,MR= Moderately Resistant,

Table 4. Reaction type and PDI range of various chilli germplasm against *C. capsica*

S.No	Reaction type	PDI range (%)	Genotype/ Varieties
0	Immune	0.0	-
1	Resistance	0.0-1.0	-
3	Moderately Resistant	01-10	Mahycojalna, Pusajyoti, Arkalohit,Phulemukta, Arkaharita, Madhurima, Arkameghna,Sonakshi 44, Divyajyoti
5	Moderately susceptible	11-25	Ec-341075, LAC-434, Classica 152
7	Susceptible	26.00-50.00	Tejas, LCA 312, Agnirekha, Pant C1, PBN-7, BSS-141, Pant C-2
9	Highly susceptible	More than 51	Jwala

4. CONCLUSION

Twenty genotypes of chilli were screened against the anthracnose disease. During the screening none of the genotypes were found resistant whereas nine genotypes *viz* Mahycojalna, Pusajyoti, Arkalohit, Phulemukta, Arkaharita, Madhurima, Arkameghna, Sonakshi 44, and Divyajyoti were moderately resistant; three genotypes *viz*, EC-341075, LAC-434, and Classica 152 were moderately susceptible; seven *viz*, Tejas, LCA 312, Agnirekha, Pant C1, PBN-7, BSS-141, Pant C-2 were susceptible and only one genotype namely jwala was highly susceptible.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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