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SCREENING OF CHILLI GENOTYPES AGAINST CHILLI ANTHRACNOSE CAUSED BY *COLLETOTRICHUM CAPSICI*

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ABSTRACT

Chilli (*Capsicum annuum*) is a vital spice and vegetable crop cultivated worldwide, particularly in tropical and subtropical regions. Among the major challenges in chilli production is anthracnose disease, which affects leaves, stems, and both pre- and post-harvest fruits. This disease, caused by *Colletotrichum* spp., leads to significant yield and quality losses ranging from 10% to 60%, depending on the variety. To ensure successful chilli cultivation, identifying resistant and tolerant varieties against anthracnose is crucial. In this study, 30 chilli genotypes and four varieties *viz.*, Byadagi Kaddi, Sukha (S.R.S.-2), GCS 94/68 and Rudra (GPM-120-SM1) were evaluated for resistance to fruit rot caused by *Colletotrichum* spp. The evaluation was conducted under natural disease pressure induced by the susceptible check variety, Byadagi Dabbi, at HREC, Devihosur and also following artificial screening. Among the thirty genotypes screened, 8 genotypes *viz.*, BDE1, BDE2, BDE3, ST13, ST21, ST26, ST33 and ST36 were found resistant. At green fruit stage, eighteen genotypes *viz.*, BDE1, BDE2, BDE3, BDE5, BDE6, BDE8, ST2, ST7, ST11, ST13, ST14, ST17, ST18, ST21, ST32 and ST36 were found resistant. During 5 days after inoculation at red ripe stage, five genotypes (BDE1, BDE2, BDE6, ST13 and ST33) were found resistant. The genotypes, BDE2, ST13, ST33 and ST36 were found resistant to the *C. capsici* in natural and artificial inoculated conditions screening. Hence, these genotypes with resistance genes can be used for resistant breeding programmes.

Key words : Chili, Anthracnose, *Colletotrichum* spp., Screening, Genotypes, Resistant.

Introduction

To ensure successful chilli cultivation, identifying resistant and tolerant varieties against anthracnose is crucial. Chilli (*Capsicum annuum*) is an important spice as well as vegetable crop cultivated worldwide. In India, the major chillies growing states are Andhra Pradesh, Karnataka, Maharashtra, Orissa, Tamil Nadu, Madhya Pradesh and Rajasthan. Among the leading states, Madhya Pradesh ranks first with a production of 1,017.87 thousand MT from 64.12 thousand hectares, achieving a high yield of 15.88 MT per hectare. Karnataka also ranks as a significant contributor, with a production of 646.16 thousand MT over 47.26 thousand hectares and a productivity of 13.67 MT per hectare (Anonymous, 2024). *Colletotrichum* spp. are among the most important plant pathogen worldwide, causing the economically important disease anthracnose (die back or fruit rot, leaf spot, wilt, damping off, etc) in a wide range of hosts, including cereals, legumes, vegetables and tree fruits (Bailey and Jeger, 1992). Anthracnose of chilli (*Capsicum annuum* L.) caused by *Colletotrichum capsici* (Syd.) Butler and Bisby, is one of the major and devastating diseases of chilli causes severe losses (10-60%) both in yield and quality of the chilli depending upon the varieties (Bansal

and Grover, 1969). Management strategies for this disease include use of disease free seed, resistant/tolerant cultivars and fungicidal sprays. The present investigation was aimed to identify the resistant cultivars/genotypes against *Colletotrichum capsici* under natural condition and artificial inoculation where the 30 genotypes and 5 varieties were screened against *Colletotrichum capsici* in search of resistant genotypes.

Materials and Methods

Screening of chilli genotypes against fruit rot under natural conditions : The genotypes used in this study (Table 1) were selected from the germplasm pool of the Horticultural Research and Extension Center (HREC), Devihosur, Haveri based on their superior yield potential and other desirable traits. A total of thirty chilli genotypes and four varieties *viz.*, Byadagi Kaddi, Byadagi Kaddi, Sukha (S.R.S.-2), GCS 94/68 and Rudra (GPM-120-SM1) were evaluated for resistance to fruit rot caused by *Colletotrichum spp.* under natural disease pressure created by susceptible check, Byadagi Dabbi in the field at HREC, Devihosur (Fig. 1). The experimental layout was designed with 60×60 cm spacing with 5m single line distance. Two replications where maintained for each genotype. Observations recorded at 90 days after transplanting and during harvest with respect to percent disease index (PDI) and yield.

b. Overview of the germplasm screening field

a. Byadagi Dabbi (Susceptible check)

Fig.1 : Genotype screening against chilli anthracnose under natural condition during *kharif* 2022.

Artificial screening of chilli genotypes against fruit rot : Fruits from each accession, at the green and red ripe stages, were collected and brought to the laboratory. The fruits were surface sterilized using 70% ethanol and subsequently rinsed with sterile distilled water. For each accession, three fruits were inoculated with mycelia bit of 7 days old *C. capsici* culture plates where the mycelia bits were placed on each fruit creating a direct contact between pathogen and the host. The inoculation fruit was maintained as a control by spraying sterile distilled water on wounded fruits without spores. The inoculated fruits were placed in Petri plates lined with moist tissue paper to ensure adequate humidity within the plates and the respective plates were incubated in the desiccators at relative humidity of 85%. Disease severity in terms of lesion size was assessed at 2 and 5 days post inoculation. Observations were recorded on per cent disease index and disease reaction of each genotype based on scoring. The per cent disease index (PDI) was calculated to record the disease intensity, according to the following formula given by Wheeler (1969).

Table 1 : List of genotypes evaluated under natural field conditions against anthracnose disease.

S. no.	Accession number	S. no.	Accession number
1.	BDE-1	19	ST- 15
2.	BDE-2	20	ST-17
3.	BDE-3	21	ST-18
4.	BDE-4	22	ST-20
5.	BDE-5	23	ST-21
6.	BDE-6	24	ST-22
7.	BDE-7	25	ST-26
8	BDE-8	26	ST-28
9	ST-1	27	ST-29
10	ST-2	28	ST-32
11	ST-3	29	ST-33
12	ST-5	30	ST-36
13	ST-7	31	Byadagi Dabbi
14	ST-8	32	Byadagi Kaddi
15	ST-11	33	Sukha (S.R.S-2)
16	ST-12	34	GCS 94/68
17	ST-13	35	Rudra (GPM -120-S1)
18	ST-14		

$$PDI = \frac{\text{Sum of numerical disease rating}}{\text{Total number of samples} \times \text{maximum of disease rating scale}} \times 100$$

Grade	Percent fruit/leaf area infection	Resistance level
0	No infection	Highly resistance
1	1-10	Resistance
3	11-25	Moderately resistance
5	26-50	Moderately susceptible
7	51-75	Susceptible
9	>75	Highly susceptible

Results and Discussion

Screening of chilli genotypes under natural conditions : Results of Table 2 revealed that out of thirty genotypes and four varieties screened, none of them was gave immune reaction to the pathogen during all the stages of the plant growth (90 DAT and during harvest).

Among the thirty genotypes screened, 8 genotypes *viz*., BDE1, BDE2, BDE3, ST13, ST21, ST26, ST33 and ST36 (Fig. 2) were found resistant and remaining were found moderately resistant at 90 days after transplanting. The results observed during harvesting period revealed that genotypes *viz.*, BDE2 and ST13 were resistant, while eight genotypes *viz.*, BDE1, BDE3, BDE6, ST3, ST21, ST32, ST33 and ST36 were found moderately resistant and twenty genotypes were found moderately susceptible. Byadagi Dabbi was susceptible to the pathogen. The severity was more in case of red ripe stage of fruit as compared to unripe fruit; this was because of depletion of biochemical constituents in chilli fruits in red ripe stage (Mesta *et al*., 2007).

Previous studies have reported varying degrees of resistance among genotypes against the fruit rot fungus *C. capsici* under natural endemic conditions. Hegde and Anahosur (2001) identified genotypes such as LCA-301, LCA-324, K-1 and Byadagi Kaddi as resistant, while KDSC-210-10 and S-32 were highly susceptible. Genotypes like Arka Lohit, Pepper Hot, CA 97, KDC 1, CC 4, CA 95, CA 115 and CA 59 were categorized as moderately resistant to anthracnose. Additionally, the high-yielding chilli hybrid CCH1 (Sln 1 × CA 97) was found to be moderately resistant to fruit rot disease (Pugalendhi *et al*., 2010). These findings are consistent with the observations of Ruth *et al*. (2007), Kaur and Singh (2009), Singh and Chowdhury (2011), Varma *et al*. (2012) and Prasanth and Ponnuswami (2008).

Screening of chilli genotypes against fruit rot under artificially inoculated conditions : The reaction of different entries of chilli genotypes to *C. capsici* infection at field screening and artificial screening are depicted in Table 3 and Fig. 3.

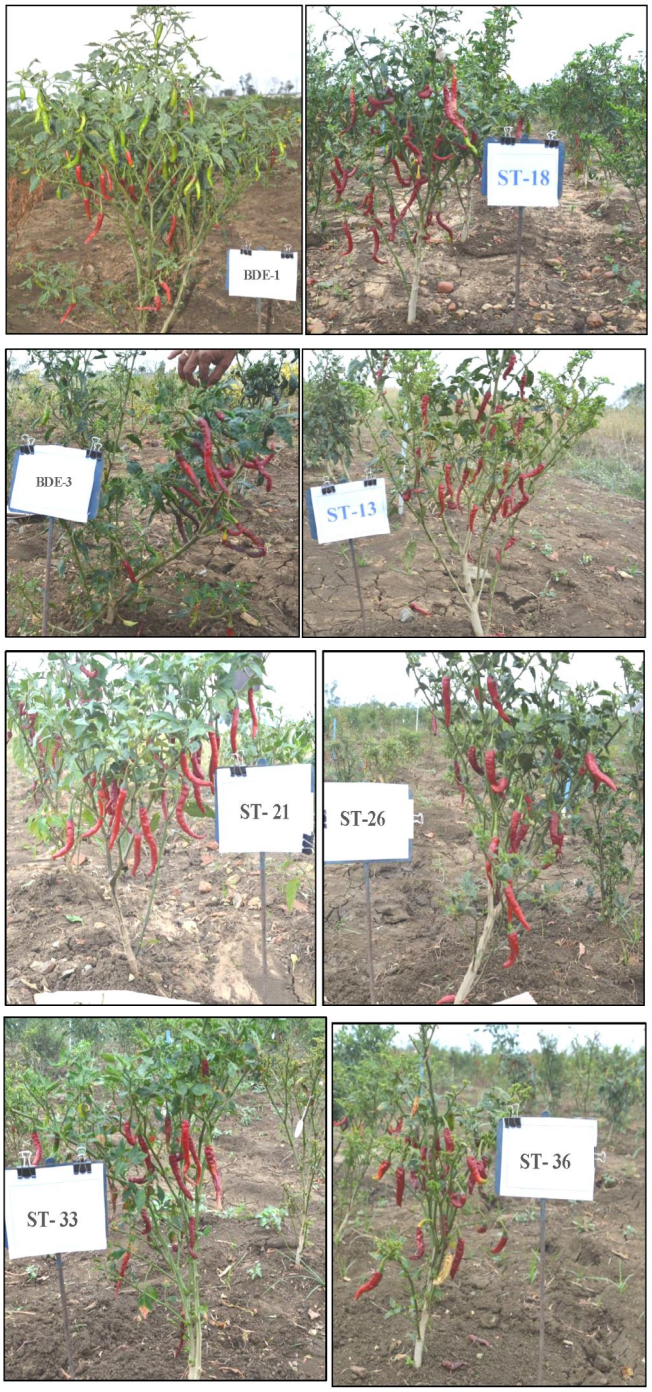

Fig. 2 : Genotypes showing resistance reaction against chilli anthracnose under natural condition during *kharif* 2022.

At green fruit stage, eighteen genotypes *viz.*, BDE1, BDE2, BDE3, BDE5, BDE6, BDE8, ST2, ST7, ST11, ST13, ST14, ST17, ST18, ST21, ST32 and ST36 were found resistant, eight genotypes (BDE7, ST8, ST12, ST15, ST22, ST26 and ST28) were moderately resistant, two genotypes (ST20 and ST33) were moderately susceptible

Table 2 : Screening of chilli genotypes under natural field conditions against fruit rot during *kharif*-2024.

S. no.	Genotypes	Green unripe (90 days after transplanting)		Red ripe (During harvest)	
		Max. grade	Disease Reaction*	Max. grade	Disease Reaction
1	BDE1	1	R	3	MR
2	BDE2	1	R	1	R
3	BDE3	1	R	3	MR
4	BDE4	3	MR	5	MS
5	BDE5	3	MR	5	MS
6	BDE6	3	MR	3	MR
7	BDE7	3	MR	5	MS
8	BDE8	3	MR	5	MS
9	ST1	3	MR	5	MS
10	ST2	3	MR	5	MS
11	ST3	3	MR	3	MR
12	ST5	3	MR	5	MS
13	ST7	3	MR	5	MS
14	ST8	3	MR	5	MS
15	ST11	3	MR	5	MS
16	ST12	3	MR	5	MS
17	ST13	1	R	1	R
18	ST14	3	MR	5	MS
19	ST15	3	MR	5	MS
20	ST17	3	MR	5	MS
21	ST18	3	MR	5	MS
22	ST20	3	MR	5	MS
23	ST21	1	R	3	MR
24	ST22	3	MR	5	MS
25	ST26	1	R	5	MS
26	ST28	3	MR	5	MS
27	ST29	3	MR	5	MS
28	ST32	3	MR	3	MR
29	ST33	1	R	3	MR
30	ST36	1	R	3	MR
31	ByadagiDabbi	5	MS	7	S
32	Byadagi Kaddi	3	MR	5	MS
33	Sukha (S.R.S-2)	5	MS	5	MS
34	GCS 94/68	5	MS	5	MS
35	Rudra (GPM -120-S1)	5	MS	7	S

***Disease Reactions:** R-Resistance, MR-Moderately Resistance, MS- Moderately Susceptible and S- Susceptible.

and three genotypes (ST1, ST5 and ST29) were susceptible.

The drastic change was noticed in the reaction of these entries during red ripe stage of the fruit development. During 5 days after inoculation at red ripe stage, five genotypes (BDE1, BDE2, BDE6, ST13 and ST33) were found resistant, eighteen were moderately resistant, six genotypes (BDE4, BDE5, ST18, ST21, ST26 and ST32) were moderately susceptible and ST11, Byadagi Dabbi, Sukha (S.R.S-2), GCS 94/68 and Rudra (GPM -120-S1) were susceptible to the pathogen.

These findings align with those of Yoon and Park (2005), who demonstrated that wound inoculation using a micro injector is an effective method for studying symptom development. Parey *et al*. (2013) reported that while none of the genotypes evaluated against *C. capsici*

a. Unripe fruits of chilli germplasm showing resistance reaction

b. Ripe fruits of chilli germplasm showing resistance reaction

Fig. 3 : Screening of chilli genotypes against chilli anthracnose (fruit rot) under artificially inoculated condition.

Table 3 : Artificial screening of chilli genotypes against *C. capsici*.

S. no.	Genotypes	Per cent disease index					
		Green stage			Red ripe stage		
		2DAI	5DAI	Disease Reaction	2DAI	5DAI	Disease Reaction
1	BDE1	0.00	3.70	R	3.70	7.41	R
2	BDE2	0.00	7.40	R	0.00	3.70	R
3	BDE3	3.70	7.41	R	3.70	18.52	MR
4	BDE4	0.00	3.70	R	0.00	40.74	MS
5	BDE5	0.00	7.41	R	3.70	40.74	MS
6	BDE6	0.00	3.70	R	0.00	7.41	R
7	BDE7	0.00	11.11	MR	0.00	18.52	MR
8	BDE8	0.00	7.41	R	0.00	25.93	MR
9	ST1	7.41	55.56	S	3.70	18.52	MR
10	ST2	0.00	3.70	R	7.41	25.93	MR
11	ST3	0.00	7.41	R	7.41	25.93	MR
12	ST5	11.11	62.96	S	0.00	25.93	MR
13	ST7	0.00	7.41	R	0.00	18.52	MR
14	ST8	0.00	11.11	MR	0.00	11.11	MR
15	ST11	0.00	7.41	R	7.41	55.56	S
16	ST12	0.00	11.11	MR	3.70	25.93	MR
17	ST13	0.00	3.70	R	0.00	7.41	R
18	ST14	0.00	3.70	R	0.00	18.52	MR
19	ST15	3.70	11.11	MR	0.00	11.11	MR
20	ST17	0.00	7.41	R	0.00	25.93	MR
21	ST18	0.00	7.41	R	7.41	33.33	MS
22	ST20	7.41	33.33	MS	0.00	18.52	MR

Table 3 continued...

Table 3 continued...

23	ST21	0.00	3.70	R	3.70	33.33	MS
24	ST22	3.70	11.11	MR	3.70	25.93	MR
25	ST26	0.00	18.52	MR	0.00	33.33	MS
26	ST28	0.00	18.52	MR	0.00	25.93	MR
27	ST29	11.11	55.56	S	7.41	11.11	MR
28	ST32	0.00	7.41	R	0.00	33.33	MS
29	ST33	0.00	33.33	MS	0.00	7.41	R
30	ST36	0.00	7.41	R	3.70	11.11	MR
31	ByadagiDabbi	11.11	62.96	S	3.70	55.56	S
32	Byadagi Kaddi	3.70	11.11	MR	3.70	25.93	MS
33	Sukha (S.R.S-2)	7.41	33.33	MR	7.41	40.74	S
34	GCS 94/68	7.41	11.11	MR	3.70	55.56	S
35	Rudra (GPM -120-S1)	11.11	55.56	MR	11.11	55.56	S

***Disease Reactions:** R-Resistance, MR-Moderately Resistance, MS- Moderately Susceptible and S- Susceptible.

were fully resistant, genotypes such as DC-4, Arka Lohit, LCA-235, LCA-333 and LCA-301 exhibited moderately resistant reactions under both field and pot culture conditions. These genotypes also showed minimal lesion sizes in *in vitro* evaluations using the pin-prick method. Notably, certain lines of *Capsicum baccatum* displayed resistance to the pathogen with limited lesion development on chilli fruits following pathogen inoculation (Yoon, 2003). However, no resistance has been identified in *Capsicum annuum*, the species cultivated worldwide (Park, 2007).

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