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Reaction of Chilli Genotypes against *Chilli veinal mottle virus* (ChiVMV) under Glass House Condition

Nandappa Chorgasti*, R. Ganesha Naik and H.M. Renuka

Department of Plant Pathology, College of Agriculture,
University of Agricultural and Horticultural Sciences, Shivamogga-577225, India

**Corresponding author*

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A B S T R A C T

Chilli veinal mottle virus (ChiVMV) is an aphid-borne major destructive virus affecting chilli crop. To identify sources of resistance against ChiVMV is essential. In this study, fifty chilli genotypes were screened for ChiVMV resistance through mechanical inoculation in an insect-proof glass house. Totally 50 Chilli genotypes were screened against ChiVMV, through symptomatology and serology (DAC-ELISA) under glasshouse conditions showed that five genotypes *viz*., BKS-02, BKS-19, BKS-25, BKS-36 and BKS-42, showed highly resistant (HR) reaction. Ten genotypes *viz*., BKS-05, BKS-09, BKS-16, BKS-36, BKS-39, BKS-40, BKS-41, BKS-43, BKS-45, and BKS-50 showed resistant (R) reaction. Six genotypes *viz*., BKS-03, BKS-06, BKS-14, BKS-28, BKS-33, and BKS-38, showed moderately resistant (MR) reaction and remaining were shown a susceptible reaction.

Introduction

Chilli (*Capsicum annuum* L.) is one of the most important vegetable and spice crop belonging to the family Solanaceae and widely grown in India. It is commercially grown in tropical and subtropical regions of the world. It requires a long and warm climate for its growth and development. Chilli has been widely distributed across the world and prone to many biotic and abiotic stresses. Biotic agents like fungi (Fruit rot/Dieback, Damping off), bacteria (*Ralstonia* wilt), viruses (*Chilli veinal mottle virus, Chilli leaf curl virus* and *Cucumber mosaic virus*) and nematodes (Root-knot nematode). Among these, viral diseases are known to be a major threat to the production of chilli resulting in low yields and poor fruit quality (Alanso *et al.*, 1989 and Fujisawa *et al.*, 1986). Among the viral diseases, after *Chilli leaf curl virus*, *Chilli veinal mottle virus* (ChiVMV) is a most

destructive virus affecting the chilli cultivation. It is the member of potyvirus genus in the family *Potyviridae*. Potyvirus is the largest of the 34 plant virus groups and families currently recognised (Van-Regenmortel *et al.,* 2008), ChiVMV is transmitted by several species of aphids *viz.*, green peach aphid (*Myzus persicae)* cotton melon aphid (*Aphis gossypii)* cowpea aphid, (*Aphis craccivora)* in a non-persistent manner (Ward and Shukla., 1992). Continuous breeding effort should also be made to screen and evaluate available chilli germplasm so that breeders could get resistant material to incorporate resistance gene in highly susceptible cultivars as well for farmers to improve chilli yield (Moury *et al.,* 2005 and Shah *et al.,* 2011). The use of conventional phytosanitary practices is often inefficient against these potyviruses because they spread rapidly in the field through non-persistent manner by aphids. Thus, resistant cultivars remain the most economical and reliable method of control. Hence, an effort was made to screen the available chilli germplasms against ChiVMV through most reliable, authentic and convenient approach, *i.e.*, serology (DAC-ELISA) under insect proof glasshouse conditions.

Materials and Methods

Maintenance of virus culture inoculation and ELISA

The ChiVMV culture was maintained on *Datura metel* plants by mechanical inoculation and renewed every 2 to 3 weeks in an insect proof glass house. To identify sources of resistance against *Chilli veinal mottle virus* (ChiVMV), different genotypes of chilli were screened in an insect-proof glass house. Totally 50 Chilli genotypes were collected from Horticulture Research and Extension Service, (HRES) Devihosur of Haveri district, University of Horticultural Sciences, Bagalkot, Karnataka, India.

Test plants were raised in portrays of 50 seedlings capacity, and for each set of test seedlings, a tray of susceptible check Byadgi kaddi was included. Screening of germplasm for ChiVMV resistance was done by mechanical inoculation. The infected leaf tissue was ground in a sterilized pre-chilled mortar and pestle in chilled 0.05M phosphate buffer pH: 7 with 0.15 M β-mercaptoethanol, sieved through muslin and then mechanically inoculated at the first true leaf stage. Plants were monitored regularly until the experiment was completed. Leaf samples were taken for ELISA and the final phenotypic evaluation was performed six weeks after inoculation. Direct antigen coated ELISA (DAC-ELISA) was performed following the method of Hobbs *et al.,* (1981) using ChiVMV specific antibodies (Bioreba AG, Reinach, Switzerland). A sample was considered positive for infection when the ELISA absorbance value was greater than the average absorbance of healthy un-inoculated control tissue. Based on the per cent incidence and OD (Optical density) values detected the presence of *Chilli veinal mottle virus* (ChiVMV) in all 50 chilli genotypes through DAC-ELISA. The chilli germplasm were categorized as, 0 % – Immune, 1–10 %- Highly resistant, 11–25 %- Resistant, 26–40 %- Moderately resistant, 41–60 %- Susceptible and >60 %- Highly susceptible (Reddy *et al.,* 2001).

The following diseased rating scale was adopted (Krishna Reddy *et al.,* 2001) (Table 1).

Results and Discussion

Results on reaction of chilli genotypes against *Chilli Veinal Mottle Virus* (ChiVMV) during 2017-2018 are presented in Table 2. The expression of ChiVMV symptoms including, chlorotic local lesions, mosaic, mottling, vein banding and leaf distortion. The typical dark green vein banding was observed in

susceptible plants. To assess the resistance of chilli genotypes against ChiVMV a total of 50 genotypes were screened under the insect-proof glasshouse condition. The per cent disease incidence was recorded as soon as symptom appeared on each genotype up to six weeks and each genotype was confirmed through DAC-ELISA and the genotypes were categorized into immune (I), highly resistant (HR), resistant (R), moderately resistant (MR), susceptible (S) and highly susceptible (HS).

Accordingly five genotypes *viz*., BKS-02, BKS-19, BKS-25, BKS-32 and BKS-42 were found highly resistant and exhibited low incidence of disease and lower absorbance values in ELISA, ten genotypes *viz*., BKS-05,BKS-09, BKS-16, BKS-36, BKS-39, BKS-40, BKS-41, BKS-43, BKS-45 and BKS-50 were resistant and six genotypes *viz*., BKS-03, BKS-06, BKS-14, BKS-28, BKS-33 and BKS-38 showed moderate resistant reaction.

However, twelve genotypes *viz*., BKS-04, BKS-07, BKS-08, BKS-10, BKS-15, BKS-21, BKS-29, BKS-31, BKS-34, BKS-44, BKS-47 and BKS-49 were found susceptible, while seventeen genotypes *viz*., BKS-01, BKS-11, BKS-12, BKS-13, BKS-17, BKS-18, BKS-20, BKS-22, BKS-23, BKS-24 BKS-26, BKS-27, BKS-30, BKS-35, BKS-37, BKS-46 BKS-48 and Byadagi kaddi (Local cultivar) were found highly susceptible reaction and positive reaction to ChiVMV by ELISA.

Krishna Reddy *et al.*, (2004) screened 25 chilli pepper genotypes against the *Chilli veinal mottle virus* (ChiVMV) isolates and classified them into five groups based on the disease intensity and ELISA OD values and reported that three lines found to be immune to all the isolates, 10 lines were reacted immune to the resistant reaction, two lines showed resistant to the susceptible reaction and the remaining 10 lines were highly susceptible to different isolates of *Chilli veinal mottle virus* (ChiVMV). Hidayat *et al.*, (2012) in Indonesia reported different chilli varieties with disease reaction *i.e.* highly resistant, resistant, moderately susceptible, Susceptible and highly susceptible. Naresh *et al.*, (2016) screened 50 *Capsicum* genotypes against *Chilli veinal mottle virus* (ChiVMV) and reported 17 genotypes were found immune, one was highly resistant, whereas five genotypes were resistant and two genotypes were moderately resistant against *Chilli veinal mottle virus* (ChiVMV). These results are in accordance with the results of the present investigation.

Table.1 Disease Incidence Scale for *Chilli veinal mottle virus* (ChiVMV)

Reaction	% incidence	OD values
Immune	0	<0.109
Highly resistant	1-10	0.109-0.300
Resistant	11-25	0.301-0.600
Moderately resistant	26-40	0.601-0.800
Susceptible	41-60	0.801-1.000
Highly susceptible	>60	>1.000

Table.2 Reaction of chilli genotypes against ChiVMV under glasshouse condition by mechanical inoculation

Sl. No.	Genotypes	Per cent incidence (%)	OD Value	Type of symptoms	Disease reaction
1	BKS-01	90.00	1.5630	Ld, Vb, MMo	HS
2	BKS-02	10.00	0.2331	M, MMo	HR
3	BKS-03	30.00	0.6706	Vb, Ld	MR
4	BKS-04	50.00	0.8020	Vb, Ld	S
5	BKS-05	20.00	0.5172	M, Ivc	R
6	BKS-06	30.00	0.6940	M, MMo	MR
7	BKS-07	50.00	0.9722	Vb, Ld	S
8	BKS-08	50.00	0.9026	Vb, Ld	S
9	BKS-09	20.00	0.4206	M, Ivc	R
10	BKS-10	50.00	0.8760	Vb, Ld	S
11	BKS-11	70.00	1.0151	MMo, Ld, Vb	HS
12	BKS-12	80.00	1.0303	SM, Vb, Ld	HS
13	BKS-13	90.00	1.0011	SMMo, Vb, Ivc	HS
14	BKS-14	30.00	0.6196	M, Ivc	MR
15	BKS-15	50.00	0.9810	SMMo, Vb	S
16	BKS-16	20.00	0.5309	M, Vb	R
17	BKS-17	70.00	1.0020	SMMo, Vb, Ld	HS
18	BKS-18	80.00	1.0050	SM, Vb, Ld	HS
19	BKS-19	10.00	0.2393	Vb	HR
20	BKS-20	60.00	1.0010	SM, Vb, Ld	HS
21	BKS-21	50.00	0.8240	M, Vb	S
22	BKS-22	80.00	1.0000	SM, Vb, Ld	HS
23	BKS-23	90.00	1.0010	SMMo, Vb, Ivc	HS
24	BKS-24	80.00	0.9990	SM, Vb, Ld	HS
25	BKS-25	10.00	0.2376	SMMo	HR
26	BKS-26	90.00	1.0200	SMMo, Vb, Ivc	HS
27	BKS-27	90.00	1.1100	SMMo, Vb, Ivc	HS
28	BKS-28	40.00	0.7024	MMo	MR
29	BKS-29	60.00	0.8224	Vb, Ld	S
30	BKS-30	100.00	1.1223	MMo, Ld, Cp, Vb	HS
31	BKS-31	60.00	0.8252	Vb, Ld	S
32	BKS-32	10.00	0.2559	Vb, SMMo	HR
33	BKS-33	40.00	0.6808	M, Vb, Ld	MR
34	BKS-34	50.00	0.9010	SMMo, Vb	S
35	BKS-35	70.00	1.0010	SMMo, Vb, Ld	HS
36	BKS-36	20.00	0.3865	M, Vb,	R
37	BKS-37	70.00	1.1001	SMMo, Vb	HS
38	BKS-38	30.00	0.6254	MMo	MR
39	BKS-39	20.00	0.3862	M, Vb,	R
40	BKS-40	20.00	0.4345	M, Vb,	R
41	BKS-41	20.00	0.3606	MMo	R
42	BKS-42	10.00	0.2407	Vb, SMMo	HR
43	BKS-43	20.00	0.3394	SMMo, Vb	R
44	BKS-44	60.00	0.8214	SM, Vb, Ld	S
45	BKS-45	20.00	0.3414	SMMo, Vb, Ivc	R
46	BKS-46	80.00	1.1020	SMMo, Vb, Ld	HS
47	BKS-47	70.00	0.9112	SM, Vb, Ld	S
48	BKS-48	80.00	1.1341	SMMo, Vb, Ld	HS
49	BKS-49	50.00	0.8154	SMMo, Vb, Ld	S
50	BKS-50	20.00	0.4002	SMMo, Vb	R
51	Byadagi kaddi (Local cultivar)	100.00	1.1324	M, SMMo, Vb, Ld	HS

It may be concluded that some resistant genotypes were identified which can be used in the breeding programme for varietal improvement against the virus. The present study showed that, five genotypes showed highly resistant, ten were resistant, six were moderately resistant, twelve were showed a susceptible reaction and remaining seventeen were showed a highly susceptible reaction to the disease.

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