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Host range studies of *Chilli veinal mottle virus* (Chi VMV) in chilli (*Capsicum annuum* L.)

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Abstract
Chilli (*Capsicum annuum* L.), being the most important remunerative vegetable and is susceptible to a wide range of viruses which are the major constraints in its production resulting to heavy crop losses. Among these, after *Chilli leaf curl virus*, *Chilli veinal mottle virus* (Chi VMV) is the major prevalent virus. Host range studies under glasshouse conditions revealed that Chi VMV is transmitted mechanically. Among 41 host plants tested, nine different plant species (*Datura metel*, *Capsicum annuum*, *Physalis floridana*, *Solanum nigrum*, *Lycopersicon esculentum*, *Amaranthus spp*, *Nicotiana tabaccum* cv. White Burley, *Nicotiana tabaccum* cv. Samsun and *Capsicum frutescense*.) induced characteristic systemic mottling symptoms within 7 to 14 days of inoculation. The rest of the hosts remained asymptomatic.

Keywords: Host range, *Chilli veinal mottle virus*, *Capsicum annuum*

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) [2]. Among the viral diseases, after *Chilli leaf curl virus*, *Chilli veinal mottle virus* (Chi VMV) 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) [9], Chi VMV 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). Chilli is susceptible to a wide range of virus diseases and ChiVMV as such infecting some crop plants including weed hosts. Hence, removal of alternate hosts is help full for the prevention of this virus. It would be possible to eradicate the disease with less obstruction through exact identification of host range. Therefore, this study was emphasized to investigate the host range of Chi VMV in order to put an effort to manage this virus by exploring its different hosts. It would help to suggest crop recommendations such as mix cropping and crop rotation.

Material and Methods
Crop plants *viz*., *Cucumis sativa*, *Capsicum annuum*, *Capsicum frutescens Lycopersicon esculentum*, *Solanum melangena*, *Gossypium hirsutum*, *Abelmoschus esculentus*, *Vigna radiata*, *Vigna mungo*, *Vigna unguiculata*, *Cajanus cajana*, *Eleusina corocana*, *Sorghum bicolour*, *Panicum miliaceum*, *Setaria italica*, *Paspalum scrobiculatum*, *Solanum tuberosum*, *Brassica oleraceae var oleraceae*, *Brassica oleraceae var botrytis*, *Glycine max*, *Nicotiana tabacum* cv. White Burley, *Nicotiana tabacum* cv. Samsun, *Nicotiana tabacum* genotypes *viz*., FCK-6, FCK-7, FCJ-27, FCJ-32, FCJ-33, FCJ-35, FCR-36, FCR-49, FCR-50, FCS-1, FCS-3, FCS-22, Kanchana and *Arachis hypogaea* were used for host range studies. Weed hosts *viz*.,

Datura metel, Physalis floridana, Amaranthus spp, Chenopodium spp. and *Solanum nigrum* were also used. Seeds of above host plants and weeds were sown in portrays. Later seedlings were transplanted into individual earthren pots containing soil+sterilized coconut coir pith. After attaining the required growth, seedlings were mechanically inoculated with standard virus inoculum. For mechanical transmission of the virus, inoculum was prepared by crushing the virus infected young leaf tissues of chilli with sterile and chilled pestle and mortar in a cold 0.1 M phosphate buffer (pH 7.0) containing 0.1 per cent sodium diethyldithiocarbamate (DIECA) of fresh leaf tissue.

Ten seedlings in each host plants were inoculated with standard virus inoculums at 2-3 true leaf stage and smeared on the top leaves with saturated cotton swap. Uninoculated plants of each plant species served as controls. The leaves were dusted previously with 600-mesh Carborandum (Silicon carbide) abrasive. After inoculation, test seedlings were rinsed with sterilized water from a squeeze bottle. The inoculated seedlings, including controlls were kept in a insect proof glass house for symptom expression. Observations were recorded after appearance of the symptoms and were confirmed through back inoculating into the indicator host plant (*Datura metel* L.).

Results and Discussion

Studies on the host range of the virus provide the information related to the status of virus on different hosts, infectivity of virus and the symptoms induced on test plants. Host range study helps to identify the weed species surrounding the field and field crops that could act as a reservoir host for the virus. Forty one different plant species belonging to seven families, viz., *Solanaceae*, *Chenopodiaceae*, *Poaceae, Fabaceae*, *Malvaceae*, *Cruciferaceae* and *Cucurbitaceae* were tested to find out the possible natural reservoirs of the virus (Table 1).

Among 41 host plants tested, only nine host plants belonging to the two families viz., *Solanaceae* and *Chenopodiaceae* exhibited the symptoms of Chi VMV. These nine host plants viz., *Datura metel, Capsicum annuum, Physalis floridana, Solanum nigrum, Lycopersicon esculentum, Amaranthus spp, Nicotiana tabacum* cv. White Burley *Nicotiana tabacum* cv. Samsun and *Capsicum frutescens* were back inoculated to the highly susceptible host plant (*Datura metel*) for confirmation. These nine host plants were shown different types of symptoms, were described below table 1. Rest of the plants did not showed any symptom of the Chi VMV under glass house condition.

Host range studies carried out by earlier workers (Sathyaprakash *et al*., 2002, Kantharaju, 2003; Green and Kim, 1991; Siriwong *et al*., 1995) [7] were similar to that of present investigation. The host plants induced necrotic lesions and systemic necrotic lesions on *Nicotiana tabacum* cv.White Burley and necrotic local lesions, chlorotic local lesions, systemic necrotic lesions and systemic necrosis on *Nicotiana tabacum* cv. Samsun, which were different from reports of Green and Kim (1991) [3]. Satyaprakash *et al.* (2002) [5] reported that the virus produced systemic symptoms on *Capsicum annuum* var. Suryamukhi, Pusa Jwala, California Wonder, Gauribidanur and Byadagi Kaddi, *Capsicum frutescens* L. *Solanum lycopersicon* var. Pusa Ruby, and *Nicotiana tabacum* vars. White Burley and Samsun. Shah *et al*. (2008) [6] reported that among 44 host plants tested against *Chilli veinal mottle virus* (Chi VMV), plant species *viz., Nicotiana. tabacum* cv. Samsun, *Solanum nigrum*, *Datura metel* and *Physalis floridana* induced characteristic systemic mottling symptoms within 7 to 14 days of inoculation.

The present findings are in conformity with the reports given by earlier workers while working with crop species and some of them were inconsistent with the earlier workers.

Table 1: Reaction of host plants to ChiVMV by mechanical inoculation under glass house condition

Sl. No.	Name of the host	Family	No. of plants inoculated	No. of plants infected	Symptoms observed
1	*Capsicum annuum* L.	Solanaceae	10	07	Mosaic mottling leaf distortion, Mosaic, stunting
2	*Capsicum frutescens*	Solanaceae	10	05	Mosaic and chloratic lesions
3	*Datura metel L.*	Solanaceae	10	10	Mosaic mottling and leaf distortion
4	*Lycopersicon esculentum* Mill.	Solanaceae	10	05	Mosaic and necrosis,
5	*Cucumis sativa*	Cucurbitaceae	10	00	No symptoms
6	*Nicotiana tabacum* cv. White Burley	Solanaceae	10	10	Necrotic local lesions and systemic mottling
7	*Nicotiana tabacum* cv. Samsun	Solanaceae	10	10	Systemic mottling and chloratic lesions
807	FCK-6	Solanaceae	10	00	No symptoms
9	FCK-7				
10	FCJ-27				
11	FCJ-32				
12	FCJ-33				
13	FCJ-35				
14	FCR-36				
15	FCR-49				
16	FCR-50				
17	FCS-1				
18	FCS-3				
19	FCS-22	Solanaceae	10	00	No symptoms
20	*Nicotiana tabacum* cv. Kanchana				
21	*Physalis floridana*	Solanaceae	10	05	Systemic chlorotic local lesions and Necrosis
22	*Solanum melongena* L.	Solanaceae	10	00	No symptoms

23	*Solanum nigrum* L.	Solanaceae	10	06	Mottling, leaf distortion, stunting and necrosis
24	*Solanum tuberosum* L.	Solanaceae	10	00	No symptoms
25	*Eleusine coracana*	Poaceae	10	00	No symptoms
26	*Panicum miliaceum* L.	Poaceae	10	00	No symptoms
27	*Panicum sumatranse*	Poaceae	10	00	No symptoms
28	*Paspalum scrobiculatum* L.	Poaceae	10	00	No symptoms
29	*Setaria italica* L.	Poaceae	10	00	No symptoms
30	*Sorghum bicolour* L.	Poaceae	10	00	No symptoms
31	*Arachis hypogaea*	Fabaceae	10	00	No symptoms
32	*Glycine max* L.	Fabaceae	10	00	No symptoms
33	*Vigna mungo* L.	Fabaceae	10	00	No symptoms
34	*Vigna radiata* L.	Fabaceae	10	00	No symptoms
35	*Vigna unguiculata* L.	Fabaceae	10	00	No symptoms
36	*Amaranthus spp*	Chenopodiaceae	10	03	Mottling of leaves
37	*Chenopodium spp*	Chenopodiaceae	10	00	No symptoms
38	*Abelmoschus esculentus* L.	Malvaceae	10	00	No symptoms
39	*Gossypium hirsutum* L.	Malvaceae	10	00	No symptoms
40	*Brassica oleraceae var oleraceae*	Cruciferaceae	10	00	No symptoms
41	*Brassica oleraceae var botrytis*	Cruciferaceae	10	00	No symptoms

Conclusion

Host range studies under insect proof glass house conditions revealed that Chi VMV is transmitted mechanically via sap. *Datura metel, Capsicum annuum, Physalis floridana, Solanum nigrum, Lycopersicon esculentum, Amaranthus spp, Nicotiana tabacum* cv. White Burley *Nicotiana tabacum* cv. Samsun and *Capsicum frutescens* were acts as alternate hosts for ChiVMV. The information can be used in the management of Chi VMV in Chilli

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