

Prevalence and Distribution of Four Pepper Viruses in Sindh, Punjab and North West Frontier Province

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Abstract: To ascertain the prevalence and distribution of four major pepper viruses viz. chili veinal mottle potyvirus (CVMV), cucumber mosaic cucumovirus (CMV), tobacco mosaic tobamovirus (TMV) & potato virus Y (PVY). Surveys of chili crop in three major provinces of Pakistan were conducted during 1996-98. At each location 3-5 farmer's fields were inspected and samples showing virus-like symptoms were collected. A total of 500 samples (200 Punjab, 200 Sindh and 100 NWFP) were collected and tested through direct double antibody sandwich Enzyme-Linked Immunosorbent Assay (DAS-ELISA). CVMV & CMV appeared as the most prevalent viruses in almost all the surveyed areas. In Sindh, the incidence of CVMV, CMV, TMV, and PVY was 9, 16, 5 and 3.5%, respectively. In Punjab, CVMV appeared as the most important virus (63%) infecting pepper crop in all districts followed by CMV (20%). Co-infection of CVMV and CMV (10%) was recorded in Faisalabad, Multan and Darya Khan. In most CMV positive samples, TMV or CVMV or PVY were also detected (co-infection). In NWFP, CVMV incidence was 50% followed by CMV (17.8%). On the average, survey data showed that CVMV (40.6% incidence) is still the most prevalent virus infecting pepper followed by CMV (17.8%) in these three provinces. PVY was only detected in Sindh (3.5%) and NWFP (6%). TMV was not detected in any place of NWFP and Punjab, but detected in mixed infection in Sindh (5%). Thus there is 19.6% increase in CVMV incidence while frequency of other three viruses remained the same as compared to previous reports.

Key words: Survey, DAS-ELISA, pepper viruses, prevalence, distribution

Introduction

Chili (*Capsicum spp.*) is among the most important remunerative vegetables of Pakistan occupying 90.4 thousand hectares that produced 140.2 thousand tones with an average yield of 1.5 tones/ha and valued Rs. 3871 million at current factor cost (Anonymous, 1997-98). The crop is mainly concentrated in the provinces of Sindh, Punjab, Baluchistan and southern parts of North-West Frontier province (NWFP). Diseases of viral nature are considered to be the major constraint to its production, resulting in heavy crop losses (Makkouk and Gumpf, 1974; Hameed *et al.*, 1995). So far 35 viruses have been reported infecting pepper worldwide (Green and Kim, 1991). Among these, chili veinal mottle virus (CVMV), potato virus Y (PVY), potato virus X (PVX), tobacco mosaic virus (TMV), cucumber mosaic virus (CMV) are commonly associated with chili crop (Gorter, 1977; Hameed *et al.*, 1995; Swanepoel and Nel, 1995). In Pakistan and some other parts of the world CVMV and CMV are the major prevalent viruses reducing yield upto 50 and 60%, respectively (Hameed *et al.*, 1995; Ong *et al.*, 1980; Joshi and Dubey, 1973).

To ascertain whether the viruses infected pepper in Pakistan are still prevalent with same intensity in the main growing areas or not. Because previous reports suggested that CVMV and CMV were the two major viruses infected pepper/chilies in Pakistan (Hameed *et al.*, 1995). To confirm the latest trend along with prevalence and distribution of the important pepper viruses in the three provinces of Pakistan, this study was undertaken. Moreover, work on identification of resistance source against the major ones could be initiated.

Materials and Methods

Sample collection: Samples were collected during 1996-98 from major chilies growing areas of Sindh province (Mirpurkhas, Kunri, Halla, Thatta, Tandul Alayar, Hyderabad, Sunn & Jhole); Punjab (Gujranwala, Chakwal, Faisalabad,

Multan, Darya Khan & Bhakkar) and North West Frontier Province (NWFP) (Kohat, Hangu, Karak, Bannu, Lakki Marwat, D.I. Khan, Mardan, Malakand Agency & Swat). At each location 3-5 farmer fields were visited and samples were collected moving diagonally across the field from plants showing virus-like symptoms. The cut portion of excised branches was covered with wet cotton swab, wrapped in polythene bags and placed in icebox until processed. Symptoms manifested by the infected plants were recorded.

DAS-ELISA: The samples were tested through DAS-ELISA as described by Clark and Adams, (1977). Coated/conjugated IgGs to CVMV, CMV, PVY and Tobamovirus used in this study were supplied by AVRDC, Taiwan. Substrate was used at the rate of 0.6mg/ml and the reaction strength was measured at 405 nm in Multiscan SLT 340 ATC after an hour incubation at room temperature. Reference blank, known positive and negative samples were also included in each plate as control. The samples giving at least double the reading of healthy control were considered positive.

Results and Discussion

Symptomatology: The most conspicuous symptoms of mottling were recorded in CVMV positive samples. The overall symptoms recorded during these surveys were mild to severe mottling, mosaic, distortion and narrowing of leaves. The disease syndrome was uniform everywhere in chili growing areas of the country with different disease severity and intensity.

Prevalence and Distribution: All the four pepper viruses were found prevalent and distributed variably with different incidence in the surveyed areas.

Sindh: Sindh is the major pepper/chili growing area of Pakistan. The survey data revealed that CMV is the most

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Table 1: Chili viruses detected through DAS-ELISA in different locations of Sindh province

Locations	# of tested samples	# of +ive sample	Viruses detected			
			CVMV	CMV	TMV	PVY
Farm sugar mill Ali Mughal Hyderabad	15	4	-	4+	-	-
Daythebu, Hyd	15	-	-	-	-	-
Tandu M. Khan	10	6	3+	1+	3+	2+
Meer Wah, Goth Nazar Laghari, Mirpurkhas	10	10	7+	1+	3+	1+
Goth Ghulam Mohd, Kunri Rd	10	5	-	2+	-	3+
Somaro, Kunri Rd	10	3	2+	1+	2+	-
Rahoo Abad, Kunri Rd	15	3	1+	-	2+	1+
Khuda Abad, Halla	15	5	2+	3+	-	-
Sanden, Halla	15	-	-	-	-	-
Kaddu Kuraju, Halla	15	3	3+	-	-	-
Tandu Yousaf, Thatta	15	-	-	-	-	-
Tandu Soomro, Tandu Allayar	15	-	-	-	-	-
Husri, Hyd	10	-	-	-	-	-
Jhoole	15	10	-	10+	-	-
Sunn	15	10	-	10+	-	-

Reaction Strength: - = No reaction (No Virus) + = Strong reaction

Table 2: Chili viruses detected through DAS-ELISA in different locations of Punjab province

Locations	# of tested samples	# of +ive samples	Viruses detected			
			CVMV	CMV	TMV	PVY
Faisalabad	8	8	8+	7+	-	-
Taman, Talagang	6	6	6+	-	-	-
Bhadarr, Talagang	10	10	10+	-	-	-
Laiti, Talagang	8	8	8+	-	-	-
Mianal, Talagang	8	8	8+	-	-	-
Multankhurd, Talagang	8	-	-	-	-	-
Dhok-hum	8	-	-	-	-	-
Dhok Baza	10	10	10+	-	-	-
Saggar	8	-	-	-	-	-
Ochali	8	8	8+	-	-	-
Talagang	8	-	-	-	-	-
Chaki Shahjee	8	-	-	-	-	-
Jhatta	8	-	-	-	-	-
Covered Company	8	8	8+	-	-	-
Kot Sarung	6	-	-	-	-	-
Niraghee	7	-	-	-	-	-
Therabi	9	9	9+	-	-	-
Bhattal	5	-	-	-	-	-
Dhali	8	-	-	-	-	-
Kot Qazi	8	-	-	-	-	-
Lawa	0	8	8+	-	-	-
Chakwal	9	9	9+	-	-	-
Bhakkar	8	8	8+	-	-	-
Darya Khan	8	8	8+	6+	-	-
Multan	8	8	8+	7+	-	-
Gujranwala	10	10	10+	-	-	-

Reaction Strength: - No reaction (No Virus) + Strong reaction

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Table 3: Viruses detected through DAS-ELISA in major chili areas of NWFP

Locations	# of tested samples	# of +ive samples	Viruses detected			
			CVMV	CMV	TMV	PVY
Takht Bhai	4	0	00	-	-	-
Jalala	4	4	2+	2+	-	2+
Sher Garh	4	4	2+	3+	-	-
Sakha Kot	4	4	2+	2+	-	-
Dargai	4	4	2+	2+	-	-
Batkheela	4	4	2+	2+	-	-
Mingora Swat	4	4	2+	3+	-	2+
Khwaza Khela	4	4	2+	2+	-	-
Chal Yar	4	4	2+	2+	-	2+
Matta	4	0	00	-	-	-
Ghulam Banda Pindi-Kohat Rd.	4	4	3+	2+	-	-
Lachi, Kohat Rd.	4	4	2+	2+	-	-
Tul Rd.	4	4	2+	-	-	-
Shahbaz Khan Banda (Karak)	4	0	00	-	-	-
Toor Merch (Karak)	4	3	2+	3+	-	-
Garoor Charkhail (Karak)	4	3	2+	-	-	-
Metah Khail	4	4	2+	-	-	-
Bezen Khail	4	4	3+	-	-	-
Lakky Marwat	4	0	00	-	-	-
Prowa Rd (D.I. Khan)	4	4	3+	2+	-	-
Shahla Sharif (D.I. Khan)	4	4	3+	1+	-	-
Shor Kot (D.I Khan)	4	4	4+	2+	-	-
Himmat (D.I. Khan)	4	4	4+	2+	-	-
Bannu	4	4	2+	2+	-	-

Reaction Strength: - No reaction (No Virus) + Strong reaction

prevalent virus detected in 16% samples followed by CVMV (9%). The incidence of TMV was 5% while PVY was detected in 3.5% samples. CVMV incidence (15.5 %) was higher in district Mirpurkhas, while CMV was detected in 20% samples in the districts of Hyderabad. Mixed infection of CVMV and CMV was detected in Thatta, Halla, Sunn and Jhoole areas. Moreover, CMV was also detected in co-infection with TMV, CVMV or PVY (Table 1). In district Hyderabad CMV incidence was higher where chili was inter-cropped with banana. It has been reported that banana is also a host of CMV in Pakistan (Khalid *et al.*, 1998). Therefore, it is quite possible that CMV is transmitted from banana to pepper through a large number of aphids that are generally parasitizing chilies or from a number of weeds in or around banana and chili fields.

Punjab: From the province Punjab, a total of 200 samples were tested. Of these CVMV and CMV were detected in 63% and 10% samples, respectively. CVMV was mostly prevalent in Gujranwala, Chakwal and Multan. Mixed infection of CVMV and CMV was recorded in Faisalabad, Bhakkar and Darya Khan. PVY and TMV were not detected in any of the samples (Table 2).

NWFP: In NWFP, out of 100 tested samples collected from different locations, CVMV appeared as the major virus infecting chili crop. Out of 11 locations, two places in North (Takht Bhai and Matta) and two in Southern part (Shahbaz Khan Banda & Lakky Marwat) were CVMV free. The incidence of CMV in the districts of Mardan, Malakand and Swat was 37% while in the lower tail (Ghulam Banda, Karak, & D.I. Khan) was 1-2%. PVY was detected in 6% samples from Jalala, Mingora (Swat) & Chal Yar (Table 3). TMV was not

detected in any of the samples.

Results of the present study showed that overall in the surveyed areas CVMV (average 40.6%) is the most prevalent virus followed by CMV (average 17.8%) and these viruses are still the most important viruses associated with chilies. The incidence of these viruses in span of 3-4 years increased when compared with the early surveys' reports (Hameed *et al.*, 1995). The causes of this increase (19.6%) is not well understood but might be due to a number of factors (climatic conditions, low quality seeds, alternate hosts and vector activity). TMV and PVY were detected in 2% and 2.6% samples, respectively. Mix infection (8%) of four viruses was only detected in Sindh. Co-infection of three viruses was 3.6% while two viruses were detected in 13% samples in different combination. A number of aphid species transmit these viruses in a non-persistent manner, prevalent in high proportion on *solanaceous* hosts, especially in Sindh (Solangi *et al.*, 1983). As chilies are grown in warmer part of the year, therefore, climatic conditions favor vector's activity. Moreover, general sanitation conditions are not good and large number of weeds are often found in and around chili field, providing rearing place for vectors as well as reservoir of viruses. These might serve as a source of primary inoculum of these viruses. The high incidence of CMV in Sindh as compared to other surveyed areas might be due to a large number of cucurbits grown prior to chilies. Virus free areas in each province need more investigations to clarify the situation and to identify the missing factor(s) of disease triangle.

It became obvious from these observations that CMV and CVMV are still the major viruses infecting pepper/chili in Pakistan and almost all commercially grown chili cultivars are susceptible to these viruses while the other viruses though low

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in frequency were prevalent and distributed in some locations of these provinces. Regular monitoring of the major pepper growing areas for prevalence will help in epidemiological study of these viruses that will definitely assist in the management strategy. No study on the production losses caused by these viruses has been done so far at farmer's field.

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