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Survey for the Incidence of Cucumber Mosaic Virus in Tomato Growing Areas of Telangana and Andhra Pradesh

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ABSTRACT

Survey conducted in tomato growing areas of Ranga Reddy district during kharif 2013 and in Guntur district during rabi 2013-14 revealed natural occurrence of disease incidence with an per cent ranged from 6.9 - 15.7 among different mandals. Apparent disease incidence was more (18.0 per cent) in Sayyedguda village followed by Sanghiguda (16.3 per cent) and Shamshabad (14.2 per cent) villages of Shamshabad mandal. DAC-ELISA results indicated the presence of CMV incidence in all the three villages of Shamshabad mandal (with per cent incidence of 6.25 to 7.60) of Ranga Reddy district, while the remaining surveyed areas in both the districts were devoid of CMV incidence.

Key words: *Kharif, Cucumber, Virus, Tomato.*

INTRODUCTION

Tomato is under the constant threat of diseases and about 200 diseases are known to infect tomatoes worldwide (J**o**nes *et al.*, 1997)[1]. Among these, *Cucumber mosaic virus* (CMV) is most devastating disease, as it can completely destroy the crop (Galliteli *et al.*, 1991)[2]. The characteristic field symptoms of CMV disease include stunting, yellowing, mottling of leaves, extreme filiformity or shoe stringing of leaf blades, depending on virus strain and the host (Carrere *et al.*, 1999[3] and Emy Sulistyowati *et al.*, 2004[4]). CMV also impairs the fruit yield and quality of tomato fruits as CMV infected plants often produce small and misshapen fruits, besides delaying the fruit maturity. CMV occurs worldwide and is considered as a very important disease in temperate, tropical and subtropical regions of the world.

Effect of CMV on yield depends on number of factors, including plant age at the time of infection and environmental conditions. Yield losses up to 15-20% were recorded on tomato with a mild strain of CMV (Montasser *et al.*, 1991) [5]. On an average, losses of 10-20% are common, and in some instances the crop may still be harvested, but is of poorer quality and appearance (Zitter and Murphy, 2009) [21]. CMV is a type species of the genus *Cucumovirus*, in the family Bromoviridae.

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It has been classified into two major subgroups designated as I and II according to serological relationships and nucleic acid identities (Palukaitis *et al.,* 1992) [7]. Further, group I was divided into two subgroups *viz.,* IA and IB (Roossinck, 2002) [8]. Tomato is found to be infected with all subgroups of CMV (Sudhakar *et al.,* 2006; [9] Akhtar *et al.,* 2008[10] and Pratap *et al.,* 2012[11]). In tomato, subgroup I strains cause fern shaped filiform leaves and stunting (Hellwald *et al.,* 2000; [12] Stamova and Chetelat, 2000; [13] Akhtar *et al.,* 2008 [10] and Pratap *et al*., 2012[11]), whereas subgroup II strains lead to severe mosaic, leaf puckering and stunting (Sudhakar *et al.*, 2006) [9].

MATERIALS AND METHODS

Survey for CMV disease on tomato was undertaken during *kharif* 2013 in Ranga Reddy and *rabi* 2013-14 in Guntur districts. In each district, two mandals and in each mandal, three fields were randomly selected. During survey, tomato fields were observed for the occurrence of various types of symptoms of CMV, *viz*., chlorosis, leaf mottling, shoe-string symptoms, stunting, deformed fruits etc. Depending upon the field size, 4 to 8 random sites were chosen in each field and at each site, total number of plants was counted and among them, number of CMV infected plants based on apparent symptoms was recorded

During the survey, detailed information on the tomato cultivar/hybrid grown, soil type, cropped area, irrigated/rainfed, age of the crop, previous crop grown, adjacent crops, incidence of insect pests, weeds within the crop area, surrounding weeds etc. were recorded. In each field, young leaves from the plants showing characteristic CMV symptoms along with weed samples were collected in ziplock polyethylene bags, labelled and placed in a vasculum containing ice.

The per cent disease incidence based on apparent symptoms was calculated by using the following formula:

$$\text{Per cent disease incidence (PDI)} = \frac{\text{No. of plants suspected to be infected}}{\text{Total no. of plants}} \times 100$$

All the samples were subjected to Direct Antigen Coating-Enzyme Linked Immunosorbent Assay (DAC-ELISA) (Hobbs *et al.,* 1987) [15], for the confirmation of virus presence using polyclonal antiserum of CMV procured from Indian Agricultural Research Institute, New Delhi.

RESULTS AND DISCUSSION

Tomato plants exhibiting CMV suspected symptoms such as mottling, mosaic, shoe string, leaf distortion and stunting were chosen in the target sites of each field and leaf samples were collected from both the districts (289 from Ranga Reddy and 308 from Guntur). As per the visual observations, incidence of the disease was variable among the mandals (6.9-15.7 per cent). High disease incidence was recorded in Shamshabad mandal (15.7%), followed by Chevella (10.6%), Guntur (8.7%), Tadikonda (7.8%), Moinabad (7.6%) and Pedakakani (6.9%).

Tomato cultivars, *viz*., Arka Vikas, Lakshmi, Ferry-Morse 3140 and 6140 were commonly grown by the farmers in Ranga Reddy and the disease incidence ranged from 6.7-18.0 among different villages during *kharif* 2013. Percentage of plants suspected with CMV infection was highest in Sayyedguda village (18.0) followed by Sanghiguda (16.3) and Shamshabad village (14.2) of Shamshabad mandal. Low disease incidence was suspected from Nakkalapalle village (6.7%) and Yethbarpallae (7.3%) of Moinabad mandal.

In all, eight fields located in seven villages were surveyed and tomato cultivars commonly grown in these villages were Annapurna, Panchali, 1321 and JKTH 2040. The disease incidence ranged from 6.9-8.7 per cent in different mandals during *rabi* 2013-14 and Takkelapadu village recorded lowest per

cent (6.4) plants suspected with virus infection, followed by village (6.7) Ponnekallu village of Tadikonda mandal in Guntur district recorded high percentage of plants (9.6%), suspected with CMV infection. The per cent plants suspected with CMV infection was more in Guntur mandal (8.7%) followed by Tadikonda (7.8%) and Pedakakani (6.9%).

Surveys conducted in both Ranga Reddy and Guntur districts revealed that the most commonly found weeds were *Parthenium hysterophorus, Cynodon dactylon, Tridax procumbens, Euphorbia geniculata, E. hirta, Amaranthus tricolor, Sida cardifolia, Cassia occidentalis, Commelina benghalensis, Lanatana camara, Solanum nigrum* and *Acalypha indica*. Although incidence of aphids, whiteflies and mealy bugs were commonly noticed in majority of the fields, it was clearly noticed that aphid incidence was recorded in all the fields Shamshabad mandal and one field in Kummera village of Chevella mandal. The presence of aphid incidence can be correlated with the high per cent (15.7) of plants suspected with CMV infection from Shamshabad mandal, as aphid is the vector for transmitting the CMV disease.

DAC-ELISA results revealed that all the villages in Shamshabad mandal of Ranga Reddy district recorded CMV infection, and the per cent infection ranged between 6.25 to 7.60. Sanghiguda village recorded infection percentage as high as 7.60, followed by Sayyedguda village (7.21) and Shamshabad village (6.25). The weeds *viz., P. hysterophorus, S. cordifolia* and *E. hirta* collected from Shamshabad mandal were also found positive to CMV antisera.

Several factors can be attributed for the presence of increased CMV incidence in Shamshabad mandal. Some of them are presence of suitable vector population *viz*., aphids within the crop field (Srivastava *et al.*, 1992[16]; ACES, 2011[21]), presence of alternate hosts, *viz*., brinjal (Kiranmai *et al.*, 1997) [14], marigold (Parvin et al., 2007) [17] in the adjacent fields; presence of weeds within the field and on field bunds, which act as collateral hosts for the virus (Shomaila *et al.*, 2012); [18] having tomato/brinjal as previous crop grown in the field etc. During survey, all the cultivars grown were naturally infected with disease under field conditions. Increased incidence of disease in some areas might be due to vector population, age of the crop, season and susceptibility of the crop (Jagadeeshwar, 2004)[19].

CMV was detected only in Shamshabad mandal where shoe string symptoms were prominent. Shoe string type was reported as characteristic symptom of CMV in tomato by several workers earlier *viz.*, Zitter (1984),[6] Carrere *et al.* (1999), [3] Zitter and Murphy (2009) [20]and ACES (2011) [21].

Table 4.1. Survey for CMV disease incidence on tomato in Ranga Reddy and Guntur districts of Andhra Pradesh during Kharif 2013and Rabi 2013-14

District	Mandal	Village	No. of fields surveyed	Total no. of plants present in the selected sites	No. of collected samples suspected with CMV infection based on symptoms	Per cent disease incidence (PDI) based on symptoms	Mandal PDI (Mean)	No. of samples with confirmed CMV infection in ELISA (Per cent disease incidence)
Ranga Reddy	Moinabad	Nakkalapallae	1	358	24	6.7	7.6	Nil (0.0)
		Yethbarpallae	2	494	42	8.5		Nil (0.0)
				366	27	7.3		Nil (0.0)
	Chevella	Kummera	1	254	28	11.0	10.6	Nil (0.0)
		Ibrahimpalle	1	266	27	10.1		Nil (0.0)
		Kesavaram	1	262	28	10.6		Nil (0.0)
	Shamshabad	Shamshabad	1	352	50	14.2	15.7	22 (6.25)
		Sayyedguda	1	194	35	18.0		14 (7.21)
		Sanghiguda	1	171	28	16.3		13 (7.60)
Guntur	Guntur	Bandarupallae	1	564	54	9.5	8.7	Nil (0.0)
		Etukuru	1	286	22	7.6		Nil (0.0)
		Damarapally	1	579	53	9.1		Nil (0.0)
	Tadikonda	Ponnekallu	1	279	27	9.6	7.8	Nil (0.0)
		Kantheru	1	295	23	7.7		Nil (0.0)
		Nidumukkala	1	588	41	6.9		Nil (0.0)
	Pedakakani	Pedakakani	1	369	25	6.7	6.9	Nil (0.0)
		Takkelapadu	2	574	37	6.4		Nil (0.0)
				317	26	8.2		Nil (0.0)

Table 4.2. Survey for CMV incidence on tomato in Ranga Reddy district during *Kharif* 2013

Mandal: Moinabad

Village	Cultivar/ hybrid	Cropped area (Acres)	Age of the crop (days)	Symptoms	Soil type	Adjacent crops	Previous crop grown	I/ R	Pests	Weeds within the crop area	Weeds in the adjacent fields
Nakkalapallae (26-8-13)	Lakshmi	0.5	50	MT, ST	Black	Cotton	Cotton	I	nil	*Cynodon dactylon, Parthenium hysterophorus, Sida cordifolia*	*Amaranthus tricolor, Commelina benghalensis, Euphorbia geniculata, P. hysterophorus, Tridax procumbens*
Yethbarpallae (26-8-13)	Arka Vikas	1.0	45	MT, ST	Red	Cotton, Chilli	Chilli	I	White flies, Mealy bugs	*C. dactylon*	*C. dactylon, Lantana camara, P. hysterophorus, T. procumbens*
Yethbarpallae (26-8-13)	Arka Vikas	0.5	45	MT, ST	Red	Cotton	Chilli	I	White flies	*C. dactylon*	*L. camara*

Mandal: Chevella

Kummera (26-8-13)	local	0.25	45	MT	Black	Maize	Maize	I	Aphids	*Euphorbia hirta, P. hysterophorus*	*Cassia occidentalis, E. hirta, L. camara, P. hysterophorus*
Ibrahim palle (26-8-13)	6140	0.25	40	MT, ST	Black	Sorghum, Rice	Maize	I	nil	*Amaranthus tricolor, C. dactylon, P. hysterophorus*	*Acalypha indica, C. dactylon, P. hysterophorus, T. procumbens*
Kesavaram (26-8-13)	Ferry-Morse 3140	0.25	40	ST	Black	Maize	Tomato	R	nil	*A. indica, C. dactylon, P. hysterophorus*	*C. benghalensis, C. dactylon, P. hysterophorus*

Mandal: Shamshabad

Shamshabad (8-9-13)	Lakshmi	0.5	55	ST, SS	Black	Brinjal, Maize	Brinjal	R	Aphids, White flies, Mealy bugs	*C. dactylon, P.hysterophorus*	*A.indica, Cassia occidentalis, C. benghalensis, C. dactylon, E. geniculata, P. hysterophorus*
Sayyed guda (8-9-13)	local	0.3	45	MT, ST	Black	Brinjal, Bhendi	Bhendi	R	Aphid, White flies, Mealy bugs	*C. dactylon, P.hysterophorus*	*C. benghalensis, C. dactylon, P. hysterophorus*
Sanghiguda (8-9-13)	local	0.25	52	ST, SS	Black	Marigold, Rose	Tomato	I	Aphids, Mealy bugs	*C. dactylon*	*C. dactylon, E. hirta, P. hysterophorus, Psida cordifolia*

Table 4.3. Survey for CMV incidence on tomato in Guntur district during *rabi* 2013-14

Mandal: Guntur

Village	Cultivar/hybrid	Cropped area (Acres)	Age of the crop (days)	Symptoms	Soil	Adjacent crops	Previous crop	I/ R	Pests	Weeds within the crop	Surrounding weeds
Bandarupallae (2-12-13)	JKTH 2040	0.5	60	MT, ST	Black	Chilli, Cauili flower	Chilli	I	nil	*C. dactylon, P. hysterophorus, S. cordifolia*	*C. dactylon, P. hysterophorus, Solanum nigrum, T. procumbens*
Etukuru (2-12-13)	local	0.25	55	MT	Black	Brinjal, Cottton	Tomato	I	Mealy bugs	*Corchorus olitorius, C. dactylon*	*C. olitorius, C. dactylon, L. camara, P. hysterophorus*
Damara pally (2-12-13)	local	0.5	60	M, MT	Black	Okra, Coriander	Brinjal	I	nil	*C. dactylon*	*C. dactylon, E. hirta, P. hysterophorus, S. nigrum*

Mandal: Tadikonda

Ponnekallu (3-12-13)	Annapurna (hybrid)	0.25	65	M, MT, ST	Black	Chilli	Tomato	I	nil	*Amaranthus tricolor, C. dactylon, S. cordifolia, T. procumbens*	*Corchorus olitorius, C. dactylon, P. hysterophorus*
Kantheru (3-12-13)	1321	0.25	60	MT	Black	Tobacco, Chilli	Tobacco	I	nil	*A. tricolor, C. dactylon*	*Acalypha indica, Corchorus olitorius, C. dactylon, E. hirta*
Nidumukkala (3-12-13)	local	0.5	55	MT	Black	Chilli, Brinjal, Maize	Maize	I	White flies	*C. dactylon, E. hirta, S. nigrum, T. procumbens*	*C. olitorius, C. dactylon, E. hirta, S. nigrum, T. procumbens*

Mandal: Pedakakani

Pedakakani (3-12-13)	local	0.5	40	MT, ST	Black	Maize	Tomato	R	nil	*Cynodon dactylon, P. hysterophorus*	*Cassia occidentalis, C. dactylon, E. geniculata, S. cordifolia*
Takkelapadu (3-12-13)	Panchali (Hybrid)	0.5	60	MT	Black	Tobacco, Chilli	Tobacco	I	nil	*Amaranthus tricolor, T. procumbens*	*A. indica, S. nigrum, T. procumbens*
Takkelapadu (3-12-13)	local	0.25	55	ST	Black	Chilli	Tobacco	I	nil	*A. tricolor, P. hysterophorus, T. procumbens*	*A. indica, C. dactylon, P. hysterophorus*

Note: M: Mosaic, MT: Mottling, SS: Shoe string, ST: Stunting, I: Irrigated, R: Rainfed

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