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RESEARCH ARTICLE

STUDIES ON WEED RESERVOIRS OF TOMATO LEAF CURL VIRUS (TLCV) IN EASTERN U.P., (INDIA), AND IT'S ROLE IN EPIDEMIOLOGY OF DISEASE

***Ravindra Kumar Pandey, Nafees Ahmad Ansari and Tewari, J. P.**

Plant Pathology Research Laboratory M.L.K. (P.G.) College Balrampur-271201

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ABSTRACT

Tomato is very important fruit vegetable grown in tarai region of Uttar Pradesh. The crop suffers a great loss due to infection of a whitefly borne virus tomato leaf curl. The present investigation deals with the role of weed reservoirs harbouring the virus inside the crop, nearby the crops and adjacent areas. TCLV has a very wide host range and the vector whitefly *Bemisia tabaci* Genn. can multiply on wide variety of host therefore, some of the host plants harbouring both virus and vectors were recorded. A total 38 plants including weeds, ornamental and cultivated plants were surveyed. Some of them were perennials and including plants grown as food, fodder and vegetables and were permanent source of inoculum of TLCV in nature having a potential role in the epidemiology of the disease. Influence of the climatic conditions and cultural practices were observed on the level of infection.

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INTRODUCTION

Tomato (*Lycopersicon esculentum Mill.*), a member of family Solanaceae is one of the very popular fruit vegetable grown in eastern UP, India. The tomato is a good source of vitamins in addition to the endless flavouring characters for other fruits. Medicinally fresh tomato is the rich source of vitamin c which is a safeguard against many diseases. Besides, tomato also contains Lycopene which is chiefly responsible for red colour and helpful in checking cancer and cardioivasculr diseases. It is also effective in reducing cholesterol (Anonymous, 1981, Chhabra, 1992, Varghese and Chandramony, 2003, Sachan, 2004, Ansari, 2007). The crop is subjected to attack by a number of biotic agents like fungi, bacteria, viruses, mycoplasma and nematodes (Tewari *et al*., 2007). Among the factors responsible for low yield of tomato, viral diseases are considered as the most serious. Tomato is susceptible to more than 200 diseases, out of which 40 are caused by viruses. Among these viral diseases, *Tomato leaf curl virus* (*TLCV*) belonging to family *Geminiviridae* and genus *Begomo virus* is considered most devastating. Mostly crop suffers great loss due to infection of a whitefly borne virus tomato leaf curl. A recent socio-economic survey ranked Tomato leaf curl virus (*TLCV*), transmitted by *B. tabaci*, as the most important disease causing virus of tomato (Chowda, 2004). Epidemics of Tomato leaf curl virus associated with upsurge of whiteflies (*Bemisia tabacci*) on tomato crops has been frequently reported with up to 100% yield losses. There are 21 different types of *Tomato leaf curl virus*es found in India. Tomato leaf curl disease is manifested by yellowing of leaves, upward leaf curling, bushy growth, leaf distor-tion, shrinking of leaf surface, stunted plant growth, excessive branching, abnormal growth of plants and flower and fruit abscission (Vasudeva and Somraj, 1948, Martyn, 1968, Verma, 1993, Dasgupta *et al*, 2004, Chowda, *et al*., 2004). Weeds are the major harbouring source of disease causing entities for succeeding crops as they provide shelter to vector and virus inoculum, either alone or in combination. A diversity of hosts gives a virus much greater opportunity to maintain itself and spread widely. Viruses that have perennials as host have become wide spread around the world. (Plumb and Thrush 1983, Campbell and Madden, 1990, Verme, 2003, Ansari *et al*., 2004). Many viruses have weed or other alternative hosts that provide a reservoir of virus from which economically important crop plants may become infected (Duffus, 1971, Sarika and Muniyappa, 1986) Thus, weed act as permanent source of infection (Ansari *et al*, 2004). They have a potential role in the epidemiology (Sastry *et al*. 1978, Saikia and Muniyappa, 1989). The present paper deals with the role of weeds in the spread of TLCV in eastern UP.

MATERIALS AND METHODS

During regular surveys, a total of 38 samples including weeds, cultivated and ornamental plants were collected from tarai region in eastern Uttar Pradesh between years 2015-2016. The

Corresponding author:* **Ravindra Kumar Pandey,
Plant Pathology Research Laboratory M.L.K. (P.G.) College Balrampur-271201

infected samples were collected on the basis of symptoms and the presence of whiteflies. All transmission studies were conducted in an insect proof chamber of the department. Vector whitefly *Bemisia tabaci Genn.* were reared on their common hosts namely. *Lycopersicon esculentum Mill., Capsicum annum L., and Nicotiana tobacum L.* in separate insect proof cages. Vector whitefly were given an acquisition feeding period of overnight hour on diseased *Lycopersicon esculentum Mill. p*lants and transferred to test plants. An inoculation period of one hour was given using 10 whiteflies per test plant. Transmissions were confirmed by back inoculation test.

Table 1. Different Plant Species Found as Alternate Hosts

WEEDS	
1-Abutilon indicum(Linn.) sweet	+*
2-Acalypha indica Linn.	+
3-Achyranthus aspera L.	+
4-Ageratum conyzoides	+*
5-Chenopodium album L.	+
6-Cleome viscosa L.	+
7-Croton bonplandianum Baill.	+*
8-Euphorbia hirta L.	+*
9-Euphorbia geniculate Orteg. Nov. Rar.	+*
10-Jatropha gossypifolia Linn.	+
11-Mazus pumilus (Burm.F.)Van Steenis	+
12-Nicandra physaloides Linn.	+*
13-Nicotiana plumbaginifolia Viv. Elench.	+*
14-Oxalis corniculata Linn.	+
15-Parthenium hysterophorus Linn.	+*
16-Physalis minima Linn.	+
17-Rumex dentatus Linn.	+*
18-Salvia plebia R. Br. Prodr.	+*
19-Sida mysoriansis Linn.	+*
20-Sida rhombadifolia Linn.	+*
21-Solanum nigrum L.	+*
22-Sonchus arvensis Linn.	+*
23-Triathema portulacastrum L.	+
24-Veronia cineria L.	+*
25-Xanthium strumarium L.	+*
Cultivated and ornamental plants	
1-Abelmoschus esculentus Moench.	+
2-Capsicum annum L.	+*
3-Capsicum fruitiscence L.	+*
4-Carica papaya L.	+*
5-Lens esculenta Moench.	+*
6-Lycopersicon esculentum Mill.	+*
8-7-Nicotiana glutinosa L.	+*
9-Nicotiana tobacum L.	+*
10-Phaseolus vulgaris L.	+
11-Solanum melongena	+
12-Clitoria ternatea L.	+
13-Hibiscus rosa sinensis Linn.	+
14-Zinnia elegans Jacq.	+*

NOTE- + = presence of whitefly only +* = presence of virus and whitefly

RESULTS AND DISCUSSION

A total of 25 out of the 38 samples were found positive for tomato leaf curl virus and the disease was successfully transmitted by vector whitefly which produced symptoms curling, dwarfing, twisting, stunting & typical mosaic on tomato test plants 15 to 25 days after transmission (Table 1). Fourteen samples including weeds, cultivated & ornamental plants were recorded as harbouring hosts of the vector. Out of these 24 host species listed half a dozen of them are always there in the field to provide sufficient opportunities for the perpetuation of the inoculum of the TLCV and also to serve as alternate host for the continuous maintenance and buildup of the vector population, which further help the infection in spreading to other areas where new plants are coming up. The importance of the infection of these weeds by the virus lies in the fact that these plants are abundant in this area and probably serve as potent natural reservoirs of tomato leaf curl disease (Duffus, 1971, Sastry *et al*, 1978, Rataul and Brar, 1989, Ansari *et al*, 2004). The results suggest the importance of weeds as alternate host in relation to the incidence of the disease. The main source of the viruli Ferrous vectors is infected plants by species that support breeding colonies. Weeds play a significant role in the buildup of vectors. The occurrence of infected weeds different seasons clearly indicate that they are acting as potential source of infection. Weeds play an important role in survival of the plant pathogen and vectors in the absence of their main host plant during of seasons. Thus they have potential role in epidemiology (Nitzany, 1975, Sastry *et al*, 1978, Yassin and Nour, 1965, Ansari, 2007). Similar results were found by various workers (Joshy and Dubey 1975, Ansari *et al*., 2004a,b,c, Ansari and Tewari, 2004).

Conclusion

Based on the data observed as alternate host of TLCV, it can be concluded that *TLCV* infection is widely spread in all regions of Study area crafting a definitive need to control and manage the virus. Various factors such as climatic conditions and cultural practices and weed plants act as a natural host reservoir to play a vital role in the level of infection that leads to loss of yield. So it can be concluded that virus control mechanism requires to control the alternative host.

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