

# Prevalence and distribution of *Tomato leaf curl virus* in major agroclimatic zones of Gujarat

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## ABSTRACT

A study was conducted to establish the prevalence and severity of *Tomato leaf curl viral disease* in the major agroclimatic tomato cultivating regions of Gujarat. Districts of Gandhinagar, Kheda, Mehsana, Panchmahal and Rajkot of Gujarat were surveyed. The survey aimed at assessing types of symptoms, severity and yield loss in the tomato plants. Results obtained indicate vast spread of *Tomato leaf curl virus* in majority of the tomato fields in Gujarat. The maximum infection was observed in the Kheda district with almost complete crop loss followed by Mehasna and Gandhinagar districts showing high prevalence of infection. Influence of the climatic conditions and cultural practices were observed on the level of infection.

## KEYWORDS

Field Survey; Geographical Distribution; *TLCV*; Yield Loss

## 1. INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is one of the most widely grown vegetable crops and popular due to its high nutritive value, taste and versatile use. It is a good source of vitamins (A and C) and minerals [1,2]. Total production of tomatoes is very high in India with Gujarat contributing approximately 22% of annual production. Although the total cultivated area and production of tomato in Gujarat has increased gradually over last few years but productivity is still very low compared to the average yield of other states. 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 [3,4]. Among these viral diseases, *Tomato leaf curl virus (TLCV)* belonging to family *Geminiviridae* and genus *Begomovirus* is considered most devastating [2].

A recent socio-economic survey ranked *Tomato leaf curl virus (TLCV)*, transmitted by *B. tabaci*, as the most important disease causing virus of tomato [5]. Epidemics of *Tomato leaf curl virus* associated with upsurge of whiteflies (*Bemisia tabaci*) on tomato crops has been frequently reported with up to 100% yield losses. There are 21 different types of *Tomato leaf curl viruses* found in India. Tomato leaf curl disease is manifested by yellowing of leaves, upward leaf curling, bushy growth, leaf distortion, shrinking of leaf surface, stunted plant growth, excessive branching, abnormal growth of plants and flower and fruit abscission. In 2001, *TLCV* was first reported in Gujarat by Chakraborty, S. *et al.* [6]. Recently, *TLCV* has become the prime limiting factor for tomato production in Gujarat. However, due to this virus studies on the prevalence and damage of tomato in Gujarat, have yet not been carried out. The present work therefore focuses on analysing the prevalence and severity of tomato leaf curl viral disease in different tomato growing regions of Gujarat.

## 2. MATERIAL AND METHODS

### 2.1. Field Survey

A survey was conducted in the major tomato growing regions of Gujarat. Five different regions were chosen and three different fields were studied from each region. In each visited field, three plots of size 10 × 10 m were randomly selected. The overall disease incidence and severity was recorded based on visual symptoms.

## 2.2. Analysis of Symptoms

Samples analyzed were observed for presence of Tomato leaf curl disease symptoms. Disease severity was scored using the scale of Horsefall and Barret with modifications, where: 1 = no disease, 2 = 1% - 3% infection, 3 = 5% - 12% infection, 4 = 12% - 25% infection, 5 = 25% - 50% infection and 6 = >50% infection. Scores of 1 - 2 were classified as low severity, 3 - 4 as moderate severity and 5 - 6 as high severity.

## 2.3. Occurrence of *TLCV*

Occurrence of *TLCV* was determined by calculating the percentage viral infection for each plot observed. The percentage infected samples were calculated by dividing the infected samples with total number of samples.

## 2.4. Statistical Analysis

The field experimentation and the sample selection from the studied regions were carried out according to the standards of the Completely Randomized Design (CRD) [7]. The analysis of the data was conducted using the Two-Sample Tests of Proportions (TSTP) to compare the rate of occurrence of the virus in each of the studied regions. The results were then analysed using a level of significance when  $\alpha = 0.05$ .

## 3. RESULTS AND DISCUSSION

Based on the rainfall, soil and geographical situations Gujarat has been classified into eight major agroclimatic zones. The fields analysed in this study fell under four such zones. High occurrence of *TLCV* infection was observed in all the studied fields of Gujarat. Maximum *TLCV* infection was observed in Kheda district prevailing in the agroclimatic zone of Gujarat classified under middle Gujarat having deep black to loamy sand soil with average rainfall of 1000 - 1500 mm. This was followed by Mehsana district and Gandhinagar district. Both these regions have been classified under North Gujarat known to have sandy loam to sandy soil with 625 - 875 mm of rain (Table 1).

Although variation was observed in the level of infection in two villages under the same district of Rajkot, these villages again have been classified into two different agroclimatic zones. Munjka is known to fall under the agroclimatic zone of Bhal and coastal regions having a high average rainfall of 625 - 1000 mm whereas Paddhari is known to fall under North Saurashtra characterized by low average rainfall of 400 - 700 mm and shallow medium black soil.

Two major factors known to be responsible for high *TLCV* infection are cultural practices and climatic conditions. Our study thus supports reports of climatic influ-

**Table 1.** Occurrence of TLCD in different agroclimatic zones of Gujarat.

Sr. No.	Districts	Town/Village	Agroclimatic Zone*	Cultivation Practices**	Field No.	Tomato variety	Average Percentage of TLCD incidence	Severity score of <i>TLCV</i> ***
1)	Gandhinagar	Chandrala	North Gujarat	OFC with Mulching	1)	Abhinav	50%	6
				OFC	2)	Abhinav	100%	6
				OFC	3)	Abhinav	100%	6
2)	Kheda	Nadiad	Middle Gujarat	OFC	1)	Him Sohna	100%	6
				OFC	2)	Alankaar	100%	6
				OFC	3)	Alankaar	100%	6
3)	Mehsana	Khanderavpura	North Gujarat	OFC	1)	Him Sohna	80%	6
		Hirpura		OFC	2)	Abhinav	80%	6
				OFC	3)	Abhinav	60%	6
4)	Panchmahal	Godhra	Middle Gujarat	OFC	1)	Namdhari	60%	6
5)	Rajkot	Munjka	Bhal & Coastal area	OFC	1)	Desi	100%	6
		Paddhari	North Saurashtra	OFC	2)	US 440	80%	6
				OFC	3)	Him Sohna	70%	6

\*In accordance with official report submitted by Directorate of economics and statistics (GUJCOST), Govt. of Gujarat under the heading "Horticulture in Gujarat 2009"; \*\*OFC: OPEN FIELD CONDITION; \*\*\*1 = no disease, 2 = 1% - 3% infection, 3 = 5% - 12% infection, 4 = 12% - 25% infection, 5 = 25% - 50% infection and 6 = >50% infection.

ence on development of *TLCV* infection [8].

Level of infection in all fields falling under the same agroclimatic zone was found to be similar. However, one particular field of Gandhinagar region although growing the same variety of tomato plant showed half the level of infection as compared to other fields of Gandhinagar. Further inquiry into the cultural practices showed the utilization of mulching during cultivation in that particular field. The results further support the view that cultural practices greatly influence the level of infection of *TLCV* [8,9]. The overall prevalence of *TLCV* infection was found to be very high.

Statistical analysis based on T test showed no significant difference observed among the plots of the same fields as well as the different fields of same regions.

#### 4. CONCLUSION

Based on the above data, it can be concluded that *TLCV* infection is widely spread in all regions of Gujarat crafting a definitive need to control and manage the virus. Various factors such as climatic conditions and cultural practices play a vital role in the level of infection.

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