Short communication

Genetics of resistance to ToLCV in tomato (*Solanum lycopersicum* L.)

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Abstract

Genetics of ToLCV resistance was studied at College of Horticulture, Vellanikkara, Thrissur using the ToLCV resistant genotype IIHR 2195. Pusa Ruby (susceptible to ToLCV) was crossed with IIHR-2195 (resistant to ToLCV) to develop F_1 population during September-December, 2009. The F_1s were raised in the pots filled with sterilised media during Feb-2010. F_1s were selfed to develop F_2. Simultaneously, F_1s were backcrossed to susceptible parent to develop B_1. F_1s were backcrossed to resistant parent to develop B_2. Inheritance of resistance to ToLCV was studied using the parents, F_1, F_2, B_1, and B_2 populations of cross involving susceptible and resistant genotypes. The populations of six generations were screened for ToLCV resistance. The inheritance studies in six generations of cross combination Pusa Ruby x IIHR-2195 clearly revealed that the resistance to ToLCV in IIHR-2195 is controlled by a single dominant gene.

Key words: Tomato leaf curl virus (ToLCV), Pusa Ruby

Tomato leaf curl virus (ToLCV) disease is one of the most serious diseases of tomato in the Indian sub-continent and many other tropical and subtropical Asian countries. This disease is caused by geminivirus transmitted by the whitefly *Bemisia tabaci* (Gennadius) (Anbinder et al*.,* 2009). Leaf curl disease of tomato was first reported in India by Vasudeva and Samraj (1948). The affected tomato plants exhibit curling, puckering, reduction in leaflet size, severe stunting and reduction in fruit set. However, severely infected young plants almost fail to produce any fruits. The disease is serious in all parts of India. This disease can cause yield losses up to 99-100% (Singh et al*.,* 2008). The disease incidence is correlated with the size of the *B. tabaci* population. Hence disease incidence is severe in the late dry season/early wet season when the prevailing high temperatures favour rapid growth of white flies. Chemical control measures as well as integrated pest management (IPM) strategies employed for controlling the vector have not been successful in controlling the disease. Under these circumstances breeding for resistant varieties appears to be a promising and eco-friendly approach for controlling the disease.

In the present study, genetics of resistance to ToLCV in the resistant genotype IIHR 2195 was studied in detail. IIHR -2195 was resistant to ToLCV in field screening during peak season, graft transmission studies and vector transmission studies. Pusa Ruby (susceptible to ToLCV) was crossed with IIHR-2195(resistant to ToLCV) to develop F_1 population during September-December, 2009. The F_1s were raised in the pots filled with sterilised media during Feb-2010 (The plants were grown in sterilized media to rescue them from the incidence of bacterial wilt). F_1s were selfed to develop F_2. Simultaneously, F_1s were backcrossed to susceptible parent to develop B_1. F_1s were backcrossed to resistant parent to develop B_2.

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To study the genetics of Tomato Leaf Curl Virus (ToLCV) disease resistance, parents, F_1s, F_2s, B_1 and B_2s were raised in pots filled with sterilized medium. No plant protection measures were undertaken. These were screened for ToLCV using a 0-4 scale score chart as suggested by Banerjee and Kalloo, 1987.

0 : Symptoms absent
1 : Very mild curling (Up to 25% leaves)
2 : Curling, puckering of 26-50% leaves
3 : Curling, puckering of 51-75% leaves
4 : Severe curling, puckering of >75% leaves

The plants were classified into 2 categories namely, resistant to virus and susceptible to virus. The gene action of virus resistance was determined by subjecting the F_2 and back cross ratios to chi-square test (Fisher, 1950).

In the F_1, 16 plants out of 20 showed resistance. This points to the dominance of resistance over susceptibility. In the F_2 generation out of the total 200 plants, 146 were resistant while 54 showed susceptibility. This fitted very well into the monogenic mendelian ratio 3:1 (÷2=0.24, *p*= 0.7-0.5). In the B_1 generation, 17 were resistant and 13 were susceptible which fitted well into the ratio of 1:1 (÷2= 0.53, *p*= 0.5-0.3) while in the B_2, 25 plants were resistant and 5 were susceptible which fitted well into the ratio 1:0 (÷2=0.08, *p*= 0.95-0.90) (Table-1).

The F_2 segregation ratio was in agreement with the Mendelian genetic ratio of 3:1 (Resistant : Susceptible). The reactions of the test cross B_1 (F_1 back crossed to Pusa Ruby) confirmed this with a genetic ratio of 1:1 (Resistant : Susceptible) and the B_2 (F_1 back crossed to IIHR-2195) generation reaction to ToLCV fits into a genetic ratio of 1:0.

The inheritance studies in six generations of cross combination Pusa Ruby x IIHR-2195 clearly revealed that the resistance to ToLCV in IIHR-2195 is controlled by a single dominant gene. Kasrawi (1989) noted single dominant gene governing the ToLCV resistance in *L. pimpinellifolium*. The resistance gene to ToLCV in tomato is incompletely dominant (Chomdej et al., 2007). Singh et al. (2008) observed that the gene action for resistance to ToLCV in tomato variety H-24 is single completely dominant gene.

As the gene governing the resistance to ToLCV in IIHR-2195 is single dominant, hybridization followed by selection for yield and desirable horticultural attributes will be required to incorporate ToLCV resistance in commercially superior varieties. As the resistance is governed by single dominant gene, it can be easily incorporated in F_1 hybrids.

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Table 1. Reaction of the parents, F_1, F_2, and backcross generations of the cross Pusa Ruby x IIHR-2195 to ToLCV

Parent/Cross	Total plants taken	Resistant genotypes	Susceptible genotypes	Ratio	Expected ratio	÷2	Probability (*p*)
Pusa Ruby	20	0	20	-	-		
IIHR-2195	20	20	0	-	-		
Pusa Ruby x IIHR-2195	20	16	4	-	-		
Pusa Ruby x IIHR-2195 (F_2)	200	146	54	3:1	3:1	0.24	0.7-0.5
(Pusa Ruby x IIHR-2195) x Pusa Ruby (B_1)	30	17	13	1:1	1:1	0.53	0.5-0.3
(Pusa Ruby x IIHR-2195) x IIHR-2195 (B_2)	30	25	5	1:0	1:0	0.08	0.95-0.90

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