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Response of tomato genotypes to tomato leaf curl virus*

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Tomato leaf curl virus caused by geminivirus transmitted through whitefly (*Bamisia tabaci*) belongs to family geminiviridae and genus begmovirus (Anbinder *et al*. 2009). The first case of tomato leaf cure virus was identified in eastern Mediterranean and later it was reported to be a serious problem in the Middle East, African continents, south-east Asia and southern Europe (Abhary *et al*. 2007). The disease is characterized by curling, shrinking and cupping of leaves, thick rubbery and stunted growth with majority of flower (up to 90%) abscises after infection, therefore only few fruits are produced and it is tomato leaf cure virus devastating problem for cultivation of tomato in northern India which causes upto 99–100% losses and became a big impediment for tomato producers (Singh *et al*. 2008). Since, there is lack of resistant and stable genotype against tomato leaf cure virus, therefore present investigation was carried out to find out resistant source for utilization in developing line/variety resistant/tolerant against tomato leaf cure virus.

The experimental material comprised 22 genetically diverse genotypes, were screened in field under natural condition for both rainy and winter seasons for 2 years (2006–2007 and 2007–2008) at Indian Institute of Vegetable Research, Varanasi. Twenty days old seedlings were transplanted in randomized block design at spacing of 60 cm × 45 cm in plot size of 4.5 × 3.7 m consisting 60 plants in each replication. The standard agronomical practices were followed to raise good crop. Disease was scored on 0–4 scale at 30 days (vegetative growth), 60 days (flowering stage) and 90 days (matured stage) after transplanting and scaling procedure given by (Banerjee and Kalloo 1987). After natural screening, all genotypes were further subjected for artificial screening in greenhouse by insect proof cage for tomato leaf curl virus disease inoculation. After inoculation data was recorded at 15 days intervals as on 15 days, 30 days, 45 days and 60 days and computed in same score scale as used in natural screening.

The various calculations, like per cent disease incidence (PDI) and coefficient of infection (CI) were calculated as follows:

$$CI = PDI \times RV$$

PDI, per cent disease incidence; CI, coefficient infection; RV, response value. Total phenol analysis of few resistant and susceptible genotypes was estimated as per the standard method.

Data presented in Table 1 showed the incidence of tomato leaf curl virus on tomato under natural condition during both the years (2006 and 2007) of rainy and winter seasons revealed that of the 22 genotypes, 4 and 11 highly resistant, 2 and 7 resistant, 9 and 4 moderately resistant, 7 and none moderately susceptible, respectively in rainy season. While, 3 and 2 highly resistant, 2 and non-resistant, none and 2 moderately resistant, 11 and 17 moderately susceptible, 6 and 1 susceptible respectively in winter season. Data presented in Table 1 also showed coefficient of infection (CI) and disease reaction against tomato leaf curl virus under artificial condition reveals that out of 22 genotypes, only 'H 88-78-1' highly resistant, 2 moderately resistant ('H 88-87' and 'H 88-78-2'), 4 moderately susceptible, 13 susceptible and two ('Punjab Chhuhara' and 'Sel 7') highly susceptible.

Earlier the findings of Rodrigues *et al*. (1997) indicated that whitefly populations reduced with low temperature causing non-significant incidence of tomato leaf curl virus but our finding reveals that in both seasons, the incidence of tomato leaf curl virus was higher in winter season grown crop than rainy season crop which may be due to high population of whitefly in winter seasons as favourable temperature and humidity for its multiplication. It was also observed that due to global warming effect, during the course of investigation there was no sever winter causing in maintaining the population of vector whitefly in winter season. In present finding, it was also observed that the peak incidence of tomato leaf curl virus was recorded in Feburary–

*Short note

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Table 1 Reaction of genotypes of tomato to tomato leaf curl virus (ToLCV) in field and artificial conditions

Genotypes	Natural screening				Artificial screening
Years	2006–07		2007–2008		
	Rainy	Winter	Rainy	Winter	
Total lines	22	22	22	22	22
Highly resistant CI range- (0-4) RV-0	'H 88-87' (0) , 'H 88-78-1' (0), 'H 88-78-2' (1.15), 'Agata-32' (0)	'H 88-87' (4), 'H 88-78-1' (0), 'H 88-78-2' (3.4)	'TLBR 5' (0), 'Meghalaya Local', (4.14), 'H 88-87' (0), 'H 88-78-1' (0), 'H 88-78-2' (0), 'IIHR 2200' (4.41), 'Agata 32' (0), 'FLA 7421' (0), 'Sankranti' (0), 'Sel. 7' (4.75), 'H 86' (2.98)	'H 88-78-1' (0), 'H 88-78-2' (3.64)	'H 88-78-1' (0.8)
Resistant CI range- (5-9) RV-0.25	'Sankranti' (6.91), 'H 24' (7.84)	'Agata-32' (8.72)	'TLBR 3' (6.17), 'Sikkim Local' (7.88), 'Tura Local' (5.72), 'IIHR 2201' (6.45), 'PKM 1' (6.02), 'H 24' (8.39), 'DVRT 2' (6.79)	None	None
Moderately resistantCI range- (10-19)RV-0.50	'TLBR 3' (18.89), 'TLBR 5' (11.66), 'Sikkim Local' (15.33), 'IIHR 2200' (15), 'IIHR 2201' (17.4), 'Vaibhav' (17.61), 'Arka Vikas' (16.86), 'FLA 7421'(13.66), 'H 86' (12.3)	None	'Vaibhav' (10.73), 'Arka Vikas' (12.34), 'Pusa Ruby' (11.88), 'Punjab Chhuhara' (10.86)	'H 88-87' (11.64), 'PKM 1' (14.81)	'H 88-87' (13.27), 'H 88-78-2' (15.65)
Moderately susceptible CI range- (20-39)RV-0.75	'Meghalaya Local' (24.4), 'Tura Local' (25.83), 'PKM 1'(22.29), 'Sel. 7' (31.01), 'Pusa Ruby' (21.64), 'DVRT 2' (21.81), 'Punjab Chhuhara' (25.80)	'TLBR 5' (22.4), 'TLBR 3' (32.43), 'IIHR 2200' (37.86), 'IIHR 2201' (31.45), 'PKM 1' (32.5), 'Vaibhav' (32.2), 'Arka Vikas' (27.96), 'FLA 7421' (22.95), 'Sankranti' (25.46), 'H 24' (25.34), 'H 86' (31.75)	None	'TLBR 3' (26.17), 'TLBR 5' (30.73), 'Sikkim Local' (32.87), 'Meghalaya Local' (21.78), 'Tura Local' (23.06), 'IIHR 2200' (29.71), 'IIHR 2201' (37.72), 'Vaibhav' (28.60), 'Agata 32' (21.82), 'Arka Vikas' (23.44), 'FLA 7421' (22.27), 'Sankranti' (20.26), 'Sel. 7'	'TLBR 3' (39.03), 'TLBR 5' (32.55), 'Agata 32' (32.92), 'H 24' (39.53)

(continued ...)

(*Table 1 concluded*)

Genotypes	Natural screening				Artificial screening
Years	2006–07		2007–2008		
	Rainy	Winter	Rainy	Winter	
Total lines	22	22	22	22	22
				(37.56), 'Pusa Ruby' (35.28), 'H 24' (21.66), 'H 86' (27.96), 'DVRT 2' (28.4)	
Susceptible CI range-(40-69) RV-1	None	'Sikkim Local' (41.06)'Meghalaya Local'(43.22)'Tura Local' (51.07)'Sel. 7' (51.35)'Pusa Ruby' (52)'DVRT 2' (54.2)	None	'Punjab Chhuhara'(42.90)	'Sikkim Local' (49.78), 'Meghalaya Local' (55), 'Tura Local' (62.95), 'IIHR 2200' (48.07), 'IIHR 2201' (41.85), 'PKM 1' (49.17), 'Vaibhav' (57.2), 'Arka Vikas' (43.8), 'FLA 7421' (42.25), 'Sankranti' (44.2), 'Pusa Ruby' (61.55), 'H 86' (41.86), 'DVRT 2' (63.94)
Highly susceptibleCI range- (70-100)	None	'Punjab Chhuhara' (70.40)	None	None	'Sel. 7' (70.27), 'Punjab Chhuhara' (81.95)

Data in parentheses indicates CI value; CI, Coefficient infection; RV, response value

March which is inconformity with finding of Konate *et al*. (2008) who recorded tomato leaf curl virus incidence reaching a high in March.

Fig 1 shows role of total phenol in resistance/tolerance to tomato leaf curl virus indicated that there was positive relation with total phenol and resistance. It was observed that the highly resistant line 'H 88-78-1' possesses maximum (155mg/ 100g catcol) total phenol as compared to highly susceptible line 'Punjab Chhuhara' (40 mg/ 100g catcol). Earlier more total phenol in tomato leaf curl virus resistant/ tolerant has also been recorded by Hayati (1978) which is inconsonance with our finding.

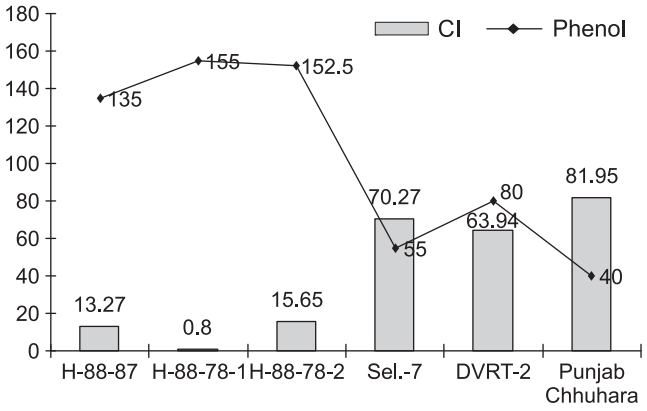

Fig 1 Phenolic reaction against tomato leaf curl virus resistant and susceptible lines

SUMMARY

Twentytwo tomato genotypes of different geographical origin were screened for resistant to tomato leaf curl virus in 2 years of different seasons (rainy and winter) in both field and artificial conditions. The genotypes 'H 88-78-1', 'H 88-78-2' and 'H 88-87' were highly resistant under field conditions however, later only 'H 88-78-1' showed highly resistant and two 'H 88-78-2' and 'H 88-87' were moderately resistant under artificial inoculation conditions. The genotype 'H 88-78-1' highly resistant both in natural and artificial screenings possessed more amount of phenol as compared

to other genotypes and can be used as resistance source for developing resistant/tolerant varieties/hybrids against ToLCV.

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