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Management of mosaic disease of tomato (*Solanum lycopersicum* L.) through host resistance

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Abstract

Tomato mosaic is considered to be the most destructive disease of the crop which causes considerable losses in yield. The investigation regarding the studies on mosaic of tomato was conducted in the year 2018-2019. Twenty tomato germplasm/ varieties/ cultivar viz. Pusa ruby, EC-620406, Arka vikas, EC-771607, EC-676791, Hisar anmol, EC-514109, EC-677191, EC-677049, EC-677123, Avinash 2, Arka sourabh, Kashi vishes, kajal, Hiasr arun, Money maker, EC-620417, Arka ananya and EC-617048 collected from National Bureau of Plant Genetic Resources and local from local market Jammu were screened for determining resistance against tomato mosaic disease under natural conditions. EC-771607 and Hisar Anmol were found resistant, Kashi Vishes, Hisar Arun and Arka Ananya were found moderately resistant, EC-620406, Arka Vikas, EC-676791, EC-514109, EC-677191, EC-677123, Arka Sourabh, kajal and Local were found moderately susceptible, EC-677049, Avinash 2, Money Maker, EC-620417 and 617048 were found susceptible Pusa Ruby was found highly susceptible.

Keywords: tomato mosaic disease, screening, host plant resistance, disease incidence

Introduction

Tomato (*Solanum lycopersicum* L.) is a member of Solanaceae family. It is very popular and important vegetable grown throughout the world. It is also known as "red gold" with moderately high content of vitamin A and C. Tomato is grown as winter and summer vegetable all over the world (Chowdhury, 1979) [6]. In India the disease was first reported by Das and Raychoudhary in 1952. The area under tomato cultivation in India is about 7.9 Thousand hectare producing about 19,542 MT of fruit (Anonymous, 2017) [2]. In Jammu & Kashmir tomato is cultivated over an area of 4.5 Thousand hectare with the production of 1, 41,850 quintals (Anonymous, 2016) [1]. Tomato is affected by a number of fungal, bacterial and viral diseases causing severe losses in yields. Among the viral diseases, tomato mosaic is one of the most destructive disease in India and is known to cause 59 per cent reduction in weight of tomato fruits (Giri and Mishra, 1990) [9]. Viruses are a serious threat to tomatoes worldwide, which can cause significant yield losses (Tomlinson 1987; Brunt *et al.* 1997) [14, 4]. The disease is most devastating, as it completely destroys the crop (Galliteli *et al.*, 1991). The characteristic field symptoms of the disease include stunting, yellowing, mottling of leaves, extreme filiformity, typical green or yellow patches, mild or severe mosaic, chlorosis coupled with various types of discoloration and small sized leaves (Giri and Mishra, 1990; Carrere *et al.*, 1999; Sulistyowati *et al.*, 2004) [9, 5, 13]. The virus is transmitted by sap and horticultural workers through contaminated hands, clothing, and tools during routine horticultural operations such as transplanting, tying, pruning, grafting, pollinating, cultivating, spraying, watering, and picking. In Jammu region, the diseases occur at regular interval in different tomato growing areas resulting in great loss to the crop. The information regarding status and detection of tomato mosaic disease is very scanty in Jammu region. Thus keeping in view all the aspects and losses caused, the present study was undertaken for Identification of resistant source from available tomato germplasm and its management against disease.

Material and Method

For determining resistance against tomato mosaic virus diseases under natural conditions, twenty tomato germplasm lines viz. Pusa Ruby, EC-620406, Arka Vikas, EC-771607, EC-676791, Hisar Anmol, EC-514109, EC-514109, EC-677191, EC-677049, EC-677123, Avinash 2, Arka Sourabh, Kashi Vishes, Local, Kajal, Hiasr Arun, Money Maker, EC-620417, Arka Ananya, EC-617048 collected from National Bureau of Plant Genetic Resources and local market of Jammu were screened for determining resistance against tomato mosaic disease under field conditions Observations of disease incidence were recorded at 15

days interval starting from appearance of symptoms by using the scale given by Bashir *et al.* (2005)^[3]. (Table 1).

Percent disease incidence was recorded by using the following formula:

$$\text{Percent Disease incidence} = \frac{\text{No. of infected plants}}{\text{Total No. of plants observed}} \times 100$$

The germplasm lines were rated as R (Resistant) 0-10% infection, MR (Moderately resistant) >10-20% infection, MS (Moderately susceptible) >20-30%, S (Susceptible) >30-50% and HS (Highly susceptible) >50% based on accumulated data of host response.

Table 1: Disease rating scale to determine the level of resistance or susceptibility of tomato germplasm against tomato mosaic virus (ToMV)

Disease incidence (%)	Grade	Reaction group
Resistant	0-10%	R
Moderately Resistant	>10-20%	MR
Moderately Susceptible	>20-30%	MS
Susceptible	>30-50%	S
Highly Susceptible	>50%	HS

Result and Discussion

It was observed that EC-771607 and Hisar Anmol were found resistant against the disease while Pusa Ruby was found highly susceptible with mean disease incidence of 62.22 per cent, while EC-677049, Avinash 2, Money Maker, EC-620417 and 617048 were found susceptible with mean disease incidence of 37.77, 35.55, 44.44, 37.77 and 35.55 per cent respectively. EC-620406, Arka Vikas, EC-676791, EC-514109, EC-677191, EC-677123, Arka Sourabh, Kajal and Local were found moderately susceptible with mean disease incidence of 22.22, 24.44, 26.66, 22.22, 22.21, 26.66, 26.66 and 28.88 per cent respectively. However Kashi Vishes, Hisar

Arun and Arka Ananya were found moderately resistant with the mean disease incidence of 15.55, 11.11 and 17.77 per cent respectively (Table 2).

At 45 DAT, maximum disease incidence was recorded in Pusa Ruby (53.33%) followed by Money Maker (33.33%), EC-677049 (26.66%), EC-6120417 (26.66%), Arka Vikas (20.00%), Avinash 2 (20.00 %) Local (20.00%), EC- 617048 (13.33%), EC-676791 (13.33%), EC- 514109 (13.33%), EC-677123 (13.33%), Arka Sourabh (13.33%), Kajal (13.33%), Arka Ananya (13.33%), EC- 677191 (16.66%), Kashi Vishes (6.66%), EC-771607 (0.00%), Hisar Anmol (0.00%), Hisar Arun (0.00%).

At 60 DAT maximum disease incidence was recorded in Pusa Ruby (60.00%), followed by Money Maker (46.66%), EC-677049 (40.00%), Avinash 2 (40.00%), EC- 620417 (40.00%), EC-617048 (40.00%), Arka Sourabh (33.33%), Kajal (33.33%), EC-620406 (26.66%), Arka Vikas (26.66%), EC-676791 (26.66%), EC-677191 (26.66%), EC-677123 (26.66%), Local (26.66%), EC- 514109 (20.00%), Kashi Vishes (20.00%), Arka Ananya (20.00%), Hisar Arun (13.33%), Hisar Anmol (6.66%), EC-771607 (0.00%).

At 75 DAT maximum disease incidence was recorded in Pusa Ruby (73.33%), followed by Money Maker (53.33%), EC-617048 (46.66%), EC-620417 (46.66%), Avinash 2 (46.66%), EC-677049 (46.66%), EC-676791 (40.00%), EC-677123 (40.00%), Arka Sourabh (40.00%), Kajal (40.00%), EC-620406 (33.33%), EC-677191 (33.33%), EC-514109 (33.33%), Local (33.33%), Arka Vikas (26.66%), Kashi Vishes (20.00%), Hisar Arun (20.00%), Arka Ananya (20.00%), Hisar Anmol (13.33%), EC-771607 (0.00%). The screening of different germplasm against tomato mosaic disease had been also reported by Mahjabeena *et al.* (2011); Gurudevi (2015)^[10] and Ullah *et al.* (2017)^[15]. Similar type of varietal evaluations were documented by Imran *et al.* (2012)^[11] who reported that VRI-19 were found highly resistance, VRI-49 was resistant, Nagina, VRI-15, VRI-5, VRI-29 were moderately susceptible.

Table 2: Screening of tomato germplasm against tomato mosaic disease under field conditions

S. No.	Germplasm	Disease incidence (%)			Mean%	Grade
		45DAT	60 DAT	75 DAT		
1	Pusa Ruby	53.33	60.00	73.33	62.22	HS
2	EC-620406	6.66	26.66	33.33	22.22	MS
3	Arka Vikas	20.00	26.66	26.66	24.44	MS
4	EC-771607	0	0	0	0	R
5	EC-676791	13.33	26.66	40.00	26.66	MS
6	Hisar Anmol	0.00	0.00	0.00	0.00	R
7	EC- 514109	13.33	20.00	33.33	22.22	MS
8	EC-677191	6.66	26.66	33.33	22.21	MS
9	EC-677049	26.66	40.00	46.66	37.77	S
10	EC- 677123	13.33	26.66	40.00	26.66	MS
11	Avinash 2	20.00	40.00	46.66	35.55	S
12	Arka Sourabh	13.33	33.33	40.00	28.88	MS
13	Kashi Vishes	6.66	20.00	20.00	15.55	MR
14	Local	20.00	26.66	33.33	26.66	MS
15	Kajal	13.33	33.33	40.00	28.88	MS
16	Hisar Arun	6.66	13.33	20.00	11.11	MR
17	Money Maker	33.33	46.66	53.33	44.44	S
18	EC-620417	26.66s	40.00	46.66	37.77	S
19	Arka Ananya	13.33	20.00	20.00	17.77	MR
20	EC-617048	20.00	40.00	46.66	35.55	S

Table 3: Disease reaction of different germplasm against tomato mosaic disease underfield conditions

Reaction	Disease incidence (%)	No of entries	Germplasm
Resistant	0-10	2	EC-771607, Hisar Anmol
Moderately Resistant	> 10-20	3	Kashi Vishes, Hisar Arun, Arka Ananya
Moderately Susceptible	> 20-30	9	EC-620406, Arka Vikas , EC-676791, EC-514109, EC-677191, EC-677123, Arka Sourabh, KajaLocal
Susceptible	> 30-50	5	EC-677049, Avinash 2, Money Maker, EC-620417, EC-617048
Highly Susceptible	>50	1	Pusa Ruby

Conclusion

From the above studies it was concluded that during screening of different germplasm of tomato EC-771607 and Hisar Anmol were found resistant, Kashi Vishes, Hiasr Arun and Arka Ananya as moderately resistant, Pusa Ruby as highly susceptible, EC-677049, Avinash 2, Money Maker, EC-620417 and EC-617048 as susceptible and EC-620406, Arka Vikas , EC-676791 , EC- 514109, EC-677191 , EC- 677123, Arka Sourabh, Local and KajaLocal as moderately susceptible (Table 3). These resistant lines/varieties can further be exploited in tomato breeding programmes .

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