

Original Research Article

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## Screening of Tomato Genotypes against Early Leaf Blight (*Alternaria solani*)

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### ABSTRACT

An experiment was conducted for evaluation of tomato genotypes both in uninoculated field conditions and by artificial inoculated controlled conditions against early leaf blight at Research farm, SKUAST-Kashmir. A total of 50 tomato genotypes were screened under uninoculated field conditions. Among these germplasms, 07 test lines viz., 2014/TODHYB-7, 2015/TODHYB-2, 2016/TODHYB-4, 2016/TODHYB-6, 2016/TODHYB-7, 2016/TODVAR-10 and 2016/TODVAR-12 exhibited complete resistant against early blight and 14 lines viz., 2014/TODHYB-1, 2014/TODVAR-3, 2014/TODVAR-1, 2014/TODVAR-4, 2014/TODVAR-6, 2015/TODVAR-1, 2016/TODVAR-3, 2016/TODVAR-4, 2016/TODVAR-6, 2016/TODVAR-7, 2016/TODVAR-8, 2015/TOINDVAR-2, 2015/TOINDVAR-3 and 2015/TOINDVAR-5 were found moderately resistant. The rest were found to exhibit moderately susceptible to susceptible reaction. The 21 genotypes found to be moderately resistant to resistant under field conditions were further screened under artificial inoculated controlled conditions. Three test lines (2016/TODHYB-4, 2016/TODHYB-7, 2016/TODHYB-6) were found resistant and six test lines (2016/TODVAR-10, 2016/TODVAR-3, 2015/TODHYB-2, 2014/TODHYB-7, 2016/TODVAR-6, 2016/TODVAR-12) were exhibited moderately resistant response. The rest were found to exhibit moderately susceptible to susceptible reaction.

#### Keywords

Tomato genotypes,  
*Alternaria solani*,  
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#### Article Info

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### Introduction

Tomato (*Lycopersicon esculentum* Mill.) is the second most important remunerable solanaceous vegetable crop after potato. It is native to South America and is widely cultivated in 140 countries of the world with an annual production of 150 million tons.

Varied climatic adaptability and high nutritive value has made tomato cultivation more popular in the recent years but the production has been fluctuating due to various diseases and insect pest damage. Tomato suffers from many diseases caused by fungi, bacteria, viruses, nematodes and abiotic factors (Balanchard, 1992). Among fungal diseases,

early blight, caused by *Alternaria solani* is the most important disease in terms of reduction of yields and commercial values of production. The pathogen is not only responsible for damage to standing crop but also causing losses during transit and storage. The most efficient and economical method to manage plant diseases is the use of resistant varieties. Cultivation of resistant varieties can be effective approach to reduce the cost of cultivation, risk of development of resistance in pathogen, risk to human health and environmental pollution. In order to breed the varieties with durable resistance to the early blight of tomato, there is need for identification of source of resistance against the range of virulence present in the pathogen population. Although vast genetic diversity exists in well-adapted cultivars/germplasm in tomato in Kashmir, so far not much systematic study on resistance or susceptibility level of existing tomato genetic resources has been conducted. Therefore, the present study has been undertaken to screen the available genotypes against the pathogen.

## **Materials and Methods**

A study was conducted to screen the tomato genotypes against early leaf blight both in uninoculated field conditions and artificial inoculated controlled conditions.

### **Screening of genotypes under uninoculated field conditions**

Fifty tomato genotypes available with the Division of Vegetable Science, SKUAST-K, were screened under natural field conditions. The experiment was laid out at the Research Farm, Faculty of Agriculture, SKUAST-K. Plots of 2m × 2m size were prepared and four weeks old seedlings were transplanted at recommended spacing of 60cm × 45cm. Recommended doses of fertilizers were applied. Disease intensity of early blight was

recorded up to 90 days of transplanting to assess the level of resistance and susceptibility of each genotype using 0 - 5 rating scale of Datar and Mayee (1986). Following genotypes were screened (Table 1).

### **Screening of genotypes under artificially inoculated controlled conditions**

Genotypes found resistant to moderately resistant under uninoculated field conditions were further screened under artificially inoculated controlled conditions. Five-week-old seedlings of each genotypes were transplanted in the polyethylene bags containing sterilized soil. The seedlings were then inoculated by spraying conidial suspension of *A. solani*. Inoculated plants were covered with clear polyethylene cover for 72 h immediately after inoculation to allow infection (Bokshi *et al.*, 2003). The disease intensity was recorded by visualizing the area of necrotic spots as per 0-5 scale given by Datar and Mayee (1986) (Table 2).

## **Results and Discussion**

### **Screening of genotypes under field conditions**

Fifty tomato genotypes which included 8 commercial cultivars and 42 germplasm lines were screened under field conditions against early blight disease. Out of the commercial cultivars, four (Shalimar-I, Shalimar-II, Arka Vikas and Kashi Anupama) showed moderately susceptible reaction with average disease intensity ranging from 27.83 to 38.23 per cent while as rest of cultivar lines (Swarna Ratna, Bhagya, BSS-488 and H-86) exhibited susceptible reaction with the average disease intensity ranging from 52.09 to 57.70 per cent respectively. Among 42 germplasm lines, fourteen (2014/TODHYB-1, 2014/TODVAR-3, 2014/TODVAR-1, 2014/TODVAR-4, 2014/TODVAR-6, 2015/TODVAR-1

2016/TODVAR-3, 2016/TODVAR-4, 2016/TODVAR-6, 2016/TODVAR-7, 2016/TODVAR-8, 2015/TOINDVAR-2, 2015/TOINDVAR-3, 2015/TOINDVAR-5) showed moderately resistant reaction with average disease intensity ranging from 10.11 to 24.69 per cent while as only seven (2014/TODHYB-7, 2015/TODHYB-2, 2016/TODHYB-4, 2016/TODHYB-6, 2016/TODHYB-7, 2016/TODVAR-10, 2016/TODVAR-12) exhibited resistant reaction with average disease intensity ranging from 4.06 to 8.79 per cent respectively (Table 3). None of the genotypes showed highly susceptible response. Thus, the evaluated genotypes were arbitrarily categorized into four groups on the basis of disease intensities recorded (Table 4).

#### Screening of genotypes under artificially inoculated controlled conditions

In order to validate the resistance, 21 genotypes found moderately resistant to resistant under uninoculated field

conditions were further screened against *A. solani* under artificially inoculated controlled conditions. Three test lines (2016/TODHYB-4, 2016/TODHYB-7, 2016/TODHYB-6) were found resistant with average disease intensity ranging from 3.46 to 8.16 per cent, six test lines (2016/TODVAR-10, 2016/TODVAR-3, 2015/TODHYB-2, 2014/TODHYB-7, 2016/TODVAR-6, 2016/TODVAR-12) were exhibited moderately resistant response with average disease intensity ranging from 11.32 to 24.59 per cent, six test lines (2014/TODVAR-6, 2015/TODVAR-1, 2016/TODVAR-8, 2016/TODVAR-7, 2016/TODVAR-4, 2014/TODHYB-1) were found moderately susceptible with average disease intensity ranging from 29.86 to 42.74 per cent and other remaining six test lines (2015/TODINVAR-5, 2015/TODINVAR-2, 2015/TODINVAR-3, 2014/TODVAR-1, 2014/TODVAR-3, 2014/TODVAR-4) exhibited susceptible response with average disease ranging from 51.16 to 60.93 per cent respectively (Table 5).

**Table.1** Screened Genotypes

S. No	Genotype	S. No	Genotype	S. No	Genotype
1	Shalimar-I	18	2015/TODHYB-3	35	2015/TODVAR-1
2	Shalimar-II	19	2015/TODHYB-4	36	2016/TODVAR-1
3	Swarna Ratna	20	2016/TODHYB-4	37	2016/TODVAR-3
4	Bhagya	21	2016/TODHYB-6	38	2016/TODVAR-4
5	BSS-488	22	2016/TODHYB-7	39	2016/TODVAR-5
6	Arka Vikas	23	H-86	40	2016/TODVAR-6
7	Kashi Anupama	24	2014/TODVAR-2	41	2016/TODVAR-7
8	2014/TODHYB-1	25	2014/TODVAR-3	42	2016/TODVAR-8
9	2014/TODHYB-2	26	2014/TODVAR-5	43	2016/TODVAR-10
10	2014/TODHYB-3	27	2014/TODVAR-1	44	2016/TODVAR-12
11	2014/TODHYB-4	28	2014/TODVAR-7	45	2015/TOINDVAR-1
12	2014/TODHYB-5	29	2014/TODVAR-4	46	2015/TOINDVAR-2
13	2014/TODHYB-6	30	2014/TODVAR-6	47	2015/TOINDVAR-3
14	2014/TODHYB-7	31	2015/TODVAR-5	48	2015/TOINDVAR-5
15	2014/TODHYB-8	32	2015/TODVAR-2	49	2015/TOINDVAR-6
16	2015/TODHYB-1	33	2015/TODVAR-4	50	2015/TOINDVAR-8
17	2015/TODHYB-2	34	2015/TODVAR-7		

**Table.2** Disease intensity

Reaction Category	Per cent Disease Index (PDI)
<b>Resistant</b>	0.0- 9.0
<b>Moderately resistant</b>	10.0-25.9
<b>Moderately susceptible</b>	26.0-50.9
<b>Susceptible</b>	51.0-75.9
<b>Highly susceptible</b>	< 76

**Table.3** Screening of tomato genotypes against early leaf blight under uninoculated natural field conditions

S. No.	Genotype	Disease intensity (%)	Reaction
1	Shalimar-I	27.83	MS
2	Shalimar -II	38.23	MS
3	Swarna Ratna	57.70	S
4	Bhagya	54.10	S
5	BSS-488	52.09	S
6	Arka Vikas	30.66	MS
7	Kashi Anupama	31.51	MS
8	2014/TODHYB-1	19.56	MR
9	2014/TODHYB-2	34.56	MS
10	2014/TODHYB-3	40.35	MS
11	2014/TODHYB-4	44.56	MS
12	2014/TODHYB-5	54.56	S
13	2014/TODHYB-6	29.12	MS
14	2014/TODHYB-7	4.06	R
15	2014/TODHYB-8	27.20	MS
16	2015/TODHYB-1	28.70	MS
17	2015/TODHYB-2	4.17	R
18	2015/TODHYB-3	31.32	MS
19	2015/TODHYB-4	35.68	MS
20	2016/TODHYB-4	4.52	R
21	2016/TODHYB-6	8.79	R
22	2016/TODHYB-7	7.66	R
23	H-86	52.31	S
24	2014/TODVAR-2	47.67	MS
25	2014/TODVAR-3	20.69	MR
26	2014/TODVAR-5	43.76	MS
27	2014/TODVAR-1	24.69	MR
28	2014/TODVAR-7	30.28	MS
29	2014/TODVAR-4	15.28	MR
30	2014/TODVAR-6	14.83	MR
31	2015/TODVAR-5	54.71	S
32	2015/TODVAR-2	51.28	S
33	2015/TODVAR-4	54.86	S

34	2015/TODVAR-7	39.18	MS
35	2015/TODVAR-1	20.44	MR
36	2016/TODVAR-1	40.58	MS
37	2016/TODVAR-3	15.37	MR
38	2016/TODVAR-4	11.33	MR
39	2016/TODVAR-5	39.12	MS
40	2016/TODVAR-6	10.11	MR
41	2016/TODVAR-7	13.48	MR
42	2016/TODVAR-8	22.21	MR
43	2016/TODVAR-10	4.91	R
44	2016/TODVAR-12	7.29	R
45	2015/TOINDVAR-1	48.45	MS
46	2015/TOINDVAR-2	14.06	MR
47	2015/TOINDVAR-3	16.54	MR
48	2015/TOINDVAR-5	17.93	MR
49	2015/TOINDVAR-6	51.16	S
50	2015/TOINDVAR-8	55.86	S

**Table.4** Grouping of various tomato genotypes into different reaction categories on the basis of their response to Early Blight disease

Reaction category	Percent disease index (PDI)	Genotype
Resistant	0.0-9.0	2014/TODHYB-7, 2015/TODHYB-2, 2016/TODHYB-4, 2016/TODHYB-6, 2016/TODHYB-7, 2016/TODVAR-10, 2016/TODVAR-12
Moderately resistant	10.0-25.9	2014/TODHYB-1, 2014/TODVAR-3, 2014/TODVAR-1, 2014/TODVAR-4, 2014/TODVAR-6, 2015/TODVAR-1, 2016/TODVAR-3, 2016/TODVAR-4, 2016/TODVAR-6, 2016/TODVAR-7, 2016/TODVAR-8, 2015/TOINDVAR-2, 2015/TOINDVAR-3, 2015/TOINDVAR-5
Moderately susceptible	26.0-50.9	Shalimar-I, Shalimar-II, Arka Vikas, Kashi Anupama, 2014/TODHYB-2, 2014/TODHYB-3, 2014/TODHYB-4, 2014/TODHYB-6, 2014/TODHYB-8, 2015/TODHYB-1, 2015/TODHYB-3, 2015/TODHYB-4, 2014/TODVAR-2, 2014/TODVAR-5, 2014/TODVAR-7, 2015/TODVAR-7, 2016/TODVAR-1, 2016/TODVAR-5, 2015/TOINDVAR-1,
Susceptible	51.0-75.9	Swarna Ratna, Bhagya, BSS-488, 2014/TODHYB-5, H-86, 2015/TODVAR-5, 2015/TODVAR-2, 2015/TODVAR-4, 2015/TOINDVAR-6, 2015/TOINDVAR-8
Highly susceptible	>76	–

**Table.5** Screening of genotypes under artificially inoculated controlled conditions

S. No	Genotype	Disease intensity (%)	Reaction
1	2015/TODINVAR-5	51.16	S
2	2015/TODINVAR-2	51.96	S
3	2015/TODINVAR-3	54.26	S
4	2016/TODHYB-4	4.28	R
5	2016/TODVAR-10	13.86	MR
6	2016/TODVAR-3	12.39	MR
7	2014/TODVAR-6	42.74	MS
8	2014/TODVAR-1	59.64	S
9	2014/TODVAR-3	60.93	S
10	2014/TODVAR-4	58.21	S
11	2015/TODVAR-1	34.36	MS
12	2016/TODHYB-7	3.46	R
13	2016/TODVAR-8	34.41	MS
14	2016/TODVAR-7	29.86	MS
15	2015/TODHYB-2	13.07	MR
16	2014/TODHYB-7	12.14	MR
17	2016/TODVAR-4	30.83	MS
18	2016/TODVAR-6	11.32	MR
19	2016/TODHYB-6	8.16	R
20	2016/TODVAR-12	24.59	MR
21	2014/TODHYB-1	35.39	MS

**Table.6** Grouping of various tomato genotypes into different reaction categories on the basis of their response to early blight disease

Reaction category	Percent disease index (PDI)	Germplasm
Resistant	0.0-9.0	2016/TODHYB-4, 2016/TODHYB-7, 2016/TODHYB-6
Moderately resistant	10.0-25.9	2016/TODVAR-10, 2016/TODVAR-3, 2015/TODHYB-2, 2014/TODHYB-7, 2016/TODVAR-6, 2016/TODVAR-12
Moderately susceptible	26.0-50.9	2014/TODVAR-6, 2015/TODVAR-1, 2016/TODVAR-8, 2016/TODVAR-7, 2016/TODVAR-4, 2014/TODHYB-1
Susceptible	51.0-75.9	2015/TODINVAR-5, 2015/TODINVAR-2, 2015/TODINVAR-3, 2014/TODVAR-1, 2014/TODVAR-3, 2014/TODVAR-4
Highly susceptible	>76	–

Hence, the genotypes screened in artificially inoculated conditions were categorized into four different groups on the basis of disease intensities recorded (Table 6). None of the genotypes exhibited highly susceptible response.

Fifty tomato genotypes were screened under field conditions against early blight disease followed by screening of moderately resistant to resistant lines under artificially inoculated controlled conditions against single virulent isolate of *A. solani*. Among the test genotypes screened under field conditions, 7 were categorised as resistant, 14 as moderately resistant, 19 as moderately susceptible and remaining as susceptible. Of these 21 moderately resistant to resistant test lines, tested under controlled conditions only 3 were found resistant with resistant response against the test isolate, 6 were moderately resistant, another 6 were moderately susceptible and remaining all as susceptible. Similar efforts have been made earlier to identify the tomato genotypes with early blight resistance and tomato genotypes with varied levels of resistance have been identified by various workers (Upadhyay *et al.*, 2009; Kumar and Srivastava, 2013; Kumar *et al.*, 2015; Rani *et al.*, 2015). Five Hybrids (2016/TODHYB-4, 2016/TODHYB-7, 2016/TODHYB-6, 2015/TODHYB-2, 2014/TODHYB-7) were observed to be resistant to moderately resistant among test lines claiming that the genetical factors from their parents would have contributed for the resistance in the hybrids. This finding is in agreement with Bharathkumar *et al.*, (2017) who also reported that parental lines (IIHR1816, IIHR977, IIHR2850, IIHR2891 and IIHR2890) and some of their derived hybrids to be resistant or moderately resistant during screening of tomato genotypes against the disease. Thus, improvement programs from a base population with high genetic variability will

increase the chances of establishing superior genotypes successfully in subsequent generations of selection (Hallauer and Miranda, 1988).

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