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Screening of Tomato Cultivars/varieties against *Fusarium oxysporum* f. sp. *Lycopersici* causing Wilt of Tomato

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A B S T R A C T

Tomato (*Lycopersicon esculentum* Miller) cultivars/varieties were evaluated to identify the source of resistance against wilt caused by *Fusarium oxysporum* f. sp. *lycopersici*. Therefore, efforts were made to evaluate the different varieties/cultivars of tomato for screening against *Fusarium oxysporum* f. sp. *lycopersici in vivo* (poly bag culture) condition. Among seven varieties tested for screening *in vivo*, two varieties *i.e.*, US 440 and Master F1 found tolerant with mean disease incidence in the range of 7.14% to 8.92% respectively. Jigar variety was found moderately susceptible with mean disease incidence of 18.57%. Two varieties S-22, and Pusa hybrid-4 were found susceptible with mean disease incidence of 33.73% and 23.80%. Whereas, PKM-1 (55.95%) and Pusa rubi (62.69 %) were found highly susceptible to wilt disease.

Introduction

Tomato (*Lycopersicon esculentum* M.) is one of the most important vegetable crops cultivated for its fleshy fruit and also considered as important commercial and dietary vegetable crop. India is the second largest producer and consumer of tomato in the world after China. In India, tomato was grown in about 0.797 million ha with an annual production of 207.08 million tonnes and productivity of 25.98 tonnes per ha during 2017 (FAOSTAT, 2019). The major tomato growing states in India are Madhya Pradesh, Orissa, Karnataka, West Bengal, Chhattisgarh, Andhra Pradesh, Telangana, Gujarat, Bihar, Maharashtra and Tamil Nadu which accounted for 91 per cent of the total production of the country (Anonymous, 2017). Among various factors responsible for low production and productivity of tomato, the diseases caused by biotic agents are major one. The crop is vulnerable to number of diseases such as Bacterial wilt (*Ralstonia solanacearum),* Fusarium wilt (*Fusarium oxysporum),* Early blight (*Alternaria solani),* Late blight (*Phytophthora infestans),* Damping off (*Pythium and Rhizoctonia)* and Yellow leaf curl. Among all these diseases, *Fusarium* wilt caused by *Fusarium oxysporum* f. sp. *lycopersic*i is the most devastating fungal disease. Joshi *et al.*, (2013)

reported that the soil borne fungus *F. oxysporum* is the causal agent of vascular wilt, the disease that affects a large variety of economically important crops worldwide. Considering these issues, present study was planned and conducted with the aim to evaluate the screening of different varieties/cultivars *in vivo* condition against *F. oxysporum* f. sp. *lycopersici* causing wilt in tomato.

Materials and Methods

Screening of available varieties of tomato against the disease

Screening of available tomato cultivars were conducted in polythene bag containing *F. oxysporum* f. sp. *lycopersici* inoculum developed by the mass multiplication (sick soil) in non-replicated manner.

Disease rating Scale

Scale	Description	Disease reaction
0	No wilting	Resistant
1	1 % or less plant wilting	Moderately resistant
3	1 to 10 % plant wilting	Tolarent
5	11 to 20 % plant wilting	Moderately susceptible
7	21 to 50 % plant wilting	Susceptible
9	51 % and more plant wilting	Highly Susceptible

Observation on disease severity of the varieties were recorded as per rating scale given by Mayee and Datar, (1986) and the varieties were categorized as resistant (R), moderately resistant (M), tolerant (T), moderately susceptible (MS), susceptible (S) and highly susceptible (HS) as described by Nene *et al.*, (1981).

Based on numerical rating observed, per cent disease intensity was calculated by applying the formula (Mckinney, 1923) as given below.

$$\text{Per cent disease Intensity} = \frac{\text{Summation of numerical rating}}{\text{No. of plants observed} \times \text{maximum rating}} \times 100$$

Results and Discussion

Screening of tomato cultivars/varieties against *Fusarium oxysporum* f. sp. *lycopersici*. (poly bag culture).

In order to find out the sources of resistance in tomato for *Fusarium* wilt, seven tomato varieties were collected from Vegetable Research Scheme, V.N.M.K.V, Parbhani and screened under artificial inoculation condition in poly bags at College of Agriculture Latur during *Rabi* 2018-

Results (Table 1 & PLATE I) revealed that, under poly bag culture, all the 7 tomato entries exhibited different reactions against *Fusarium oxysporum* f. sp. *lycopersici*. However, two varieties found tolerant with mean disease incidence in the range of 7.14% (US 440) to 8.92% (Master F1). One variety was found moderately susceptible with mean disease incidence of 18.57% (Jigar). Two varieties S-22, and Pusa hybrid- 4 were found susceptible with mean disease incidence of 23.80% and 33.73%. Whereas, PKM-1 (55.95%), and Pusa rubi (62.69%), were found highly susceptible to wilt.

Categorization of tomato cultivars/varieties against *Fusarium oxyspor um* f. sp. *lycopersici* (poly bag culture).

A total of 7 varieties of tomato were collected from Vegetable Research Scheme, V.N.M.K.V, Parbhani and screened under

artificial inoculation condition in poly bags at college of agriculture, Latur during *Rabi* 2018-19 against *Fusarium oxysporum* f. sp. *lycopersici***.** The observations on per cent wilt incidence were recorded after starting of fruiting of the crop and test entries of tomato were graded and categorized as resistant (no incidence), moderately resistant (< 1%), tolerant (1-10%), moderately susceptible (11-20%), susceptible (21-50%) and highly susceptible (< 50 %) and are presented in (Table 2 & PLATE I).

The data revealed that the two cultivars found tolerant (US 440 and Master F1). One variety was recorded as moderately susceptible (Jigar). Two varieties S-22, and Pusa hybrid - 4 were recorded as susceptible whereas, PKM-1 and Pusa Rubi recorded as highly susceptible reaction under artificial inoculation in pot culture which needs to be confirmed under sick pot condition rigorously for two or more years before utilizing it in breeding program.

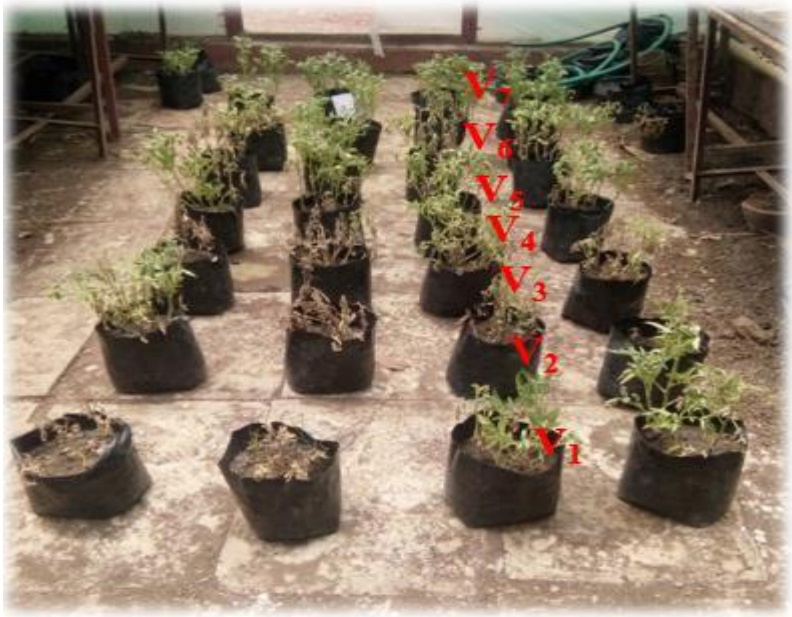
Table.1 Reaction of tomato cultivars/ varieties to wilt (poly bag culture)

Sr. No	Tomato lines	Wilt incidence (%)	Disease reaction
1	Pusa rubi	62.69	Highly Susceptible
2	PKM-1	55.95	Highly Susceptible
3	S-22	33.73	Susceptible
4	Pusa hybrid 4	23.80	Susceptible
5	Jigar	18.57	Moderately Susceptible
6	US 440	7.14	Tolerant
7	Master F1	8.92	Tolerant

Table.2 Categorization of tomato cultivars/ varieties according to wilt incidence against *F. oxysporum* f. sp. *lycopersici* (poly bag culture)

Category	Reaction	Avg. wilt incidence (%)	Varieties/ Cultivars
0	Resistant	No wilting	__
1	Moderately Resistant	< 1	__
3	Tolerant	1 to 10	US 440, Master F1
5	Moderately Susceptible	11 to 20	Jigar
7	Susceptible	21 to 50	S-22, Pusa hybrid - 4
9	Highly Susceptible	>51	Pusa rubi, PKM-1

Plate.1 Tomato cultivars showing reaction to *F. oxysporum* f. sp. *lycopersici* inoculation



Sr. No	Variety Name	Sr. No.	Variety Name
V_1	Pusa rubi	V_5	Jigar
V_2	PKM-1	V_6	US 440
V_3	S-22	V_7	Master F1
V_4	Pusa hybrid 4		

Similar results were earlier reported by Serife *et al.*, (2018); Onyekachukwu *et al.*, (2017); Akram *et al.*, (2014); Chebri (2012); and Ashwag (2003). They revealed that the results showed clear variation among the tested differential tomato cultivars. According to the percentage of infection on differential cultivars against the isolate of *Fusarium oxysporum* f. sp. *lycopersici*. It was revealed that the % of dead and stunted plants were 58.25 and 41.5, respectively for cv. Marmande verte which gave susceptible reaction whereas Motelle and Marporum were resistant to tested isolate.

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