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Performance Assessment of Tomato Advanced Lines to Late Blight and Early Blight under Natural Epiphytotics

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Abstract: Fifteen advanced lines of tomato including two check cvs. 'Manik' and 'BARI-10' were assessed under natural epiphytotics for their performance to late blight (*Phytophthora infestans*) and early blight (*Alternaria solani*). The highest late blight disease incidence was found in V-52 & V-215 and the lowest in V-378. Two lines were found resistant (V-426 & V-259), two moderately resistant (V-187 & V-385), two were tolerant (V-282 & V-422), four moderately susceptible (V-378, V-138, V-258 and BARI 10), three were susceptible (V-330, V-201 and Manik) and two highly susceptible (V-52 & V-215), but none was found highly resistant. In case of early blight V-259 showed the highest and V-215 showed the lowest disease incidence. On the basis of early blight disease intensity, one was found resistant (V-52), three were moderately resistant (V-138, V-201 and V-215), six were moderately susceptible (V-378, V-282, V-330, V-426, V-422 and Manik), four were susceptible (V-187, V-385, V-258 and BARI 10), one was highly susceptible (V-259) and none was found highly resistant.

Key words: Performance, late blight, early blight, tomato lines

Introduction

Tomato (*Lycopersicon esculentum* Mill.) is one of the most nutritious vegetables. The average yield of this crop in Bangladesh is 2.75 ton/ha (BBS, 2000) which is very low as compared to other leading tomato producing countries (FAO, 1999). This crop suffers from as many as 200 diseases in the world, of which 30 are routinely important (Watterson, 1986). Out of these diseases, late blight caused by *Phytophthora infestans* is quite important in Bangladesh (Talukdar, 1974) as 80-90% of its production may be damaged by this disease if control measures are not taken in time (Zahid *et al.*, 1993). Another most important disease is early blight, caused by *Alternaria solani*. Most of the cultivated varieties are susceptible to this disease and it can cause loss to the extent of 78% in fruit yield (Singh, 1985). Under severe epiphytotics loss of fruits may be as high as 95% (Sridhara & Naik, 1983). For healthy tomato cultivation use of resistant cultivars is gaining popularity because it is cheap, safe and easy way to manage diseases. It is imperative to screen tomato cultivar/lines against the above mentioned major diseases and thus research to locate resistant/tolerant genotypes.

On the above mentioned perspective the study was undertaken to assess performance of 15 tomato lines against late blight (*Phytophthora infestans*) and early blight (*Alternaria solani*) under natural epiphytotics.

Materials and Methods

Fifteen tomato advance lines including 2 checks (Manik and BARI 10) were evaluated under natural field conditions at the field laboratory of the Department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh during October 1999 to March 2000. The experimental field was well prepared into good tilth by ploughing and cross ploughing followed by laddering.

The recommend doses of urea, TSP & MP were applied during final land preparation 4 days before the transplanting of the seedlings (BARC, 1997). The experiment was laid out in RCB design with three replications. Each experimental field was divided into 15 small plots. Thus there were 45 unit plots for the study. The size of the unit plot was 8.4 sq.m. Seedlings were in 15 different seed beds. Twenty five days old healthy seedlings were transplanted in the experimental field. Twenty eight seedlings were transplanted per unit plot. The incidence of late blight and early blight was calculated by the formula :

$$\% \text{ incidence} = \frac{\text{No. of infected seedlings/plant}}{\text{Total no. of seedling/plant}} \times 100$$

The severity of the late blight infestation was recorded using a standard scale (Anonymous, 1985) and early blight infestation was recorded using the scale described by Vakalounakis (1983). For diagnosis collected diseased leaf samples were surface sterilized by dipping in 0.1% $HgCl_2$ for 30 seconds and rinsed in sterile water before placing in acidified potato dextrose agar medium in petridish with sterile forceps. The plated tissue were incubated at 20 $\pm$ 2 ^{0}C for 7 days or more to allow associated organisms to grow. *Phytopthora infestens* was identified under a compound microscope following the keys out - lined by Alexopoulus (1961) and Ingram and Williams (1971). *Alternaria solani* was identified following the key out lined by Ellis & Gibson (1975). Data on the % plants infected, % leaves infected and % leaf area infected due to the two diseases were recorded and were subjected to statistical analysis (ANOVA) following RCBD to determine the level of significance (Gomez and Gomez, 1983).

Results and Discussion

The highest disease incidence, 97.62% was observed in the lines V-52 and V-215 in present experiment (Table 1). It was not unpromidented as Anonymous (1997) reported that 100% late blight disease incidence may occur in different tomato varieties/genotypes. In check cultivar Manik, the disease incidence was 78.28%. which is in conformity with the report by Anonymous (1995) that per cent disease incidence in cultivar Manik could vary from place to place and also reported that disease incidence was 52.1% at Ishurdy and 100% at BINA farm, at Mymensingh in 1994-95.

The average per cent infected leaves per plant was found between 16.93 to 72.54 at 80 days after transplanting (Table 1). This resembled the findings of Anonymous (1995). Cultivar Manik, in this study showed 59.20% leaves infected.

The disease severity due to late blight in terms of per cent leaf area infected (LAI) varied between 4.83 to 96.61 (Table 1).

Table 1: Reaction of 15 tomato cultivars/lines against late blight under field conditions.

Varieties /lines	% plant infected (incidence)	% infected leaves/ plant	% leaf area infected (LAI)
V-187	34.52 d-f	46.35 cd	22.86 fh
V-378	16.67 f	35.35 de	62.92 cd
V-282	46.43 d	35.67 de	36.50 e
V-138	70.24 bc	67.14 ab	65.74 cd
V-330	86.91 ab	64.60 ab	75.29 bc
V-52	97.62 a	67.17 ab	96.13 a
V-385	41.67 de	27.46 ef	13.63 gh
V-426	19.05 ef	19.18 ef	4.83 h
V-215	97.62 a	72.54 a	96.61 a
V-258	28.57 d-f	16.93 f	67.65 cd
V-259	17.85 f	20.90 ef	4.96 h
V-201	80.95 ab	63.93 ab	4.96 h
V-422	50.00 cd	53.44 bc	34.09 ef
Manik	78.28 ab	59.20 a-c	82.69 b
BARI 10	29.76 d-f	27.16 ef	59.24 d
LSD ($p = 0.01$)	23.36	16.55	13.26

Means followed by the same letter(s) in a column are not significantly different at 1% level.

Table 2: Reaction of 15 tomato cultivars/lines against early blight under field conditions.

Varieties /lines	% plant infected (incidence)	% infected leaves/ plant	% leaf area infected (LAI)
V-187	64.28 a-d	36.79 b	62.00 a
V-378	70.24 a-c	39.51 b	38.83 b
V-282	54.76 b-c	36.22 b	36.34 b-d
V-138	33.33 f-h	63.14 a	18.75 c-e
V-330	28.75 gi	42.46 b	37.59 bc
V-52	10.53 ij	10.38 c	8.67 e
V-385	52.37 c-f	72.94 a	64.46 a
V-426	69.05 a-c	68.15 a	37.49 bc
V-215	8.33 j	17.95 c	17.73 de
V-258	74.82 a	79.31 a	64.55 a
V-259	74.99 a	73.20 a	80.75 a
V-201	25.00 hi	35.93 b	23.32 b-e
V-422	45.23 d-g	38.69 b	41.52 b
Manik	38.10 e-h	46.11 b	37.10 bc
BARI 10	73.74 ab	67.66 a	67.32 a
LSD ($p = 0.01$)	19.18	16.92	19.00

Means followed by the same letter(s) in a column are not significantly different at 1% level.

Table 3: Reaction of tomato cultivars/lines to late blight (*Phytophthora infestans*) and early blight (*Alternaria solani*).

Reaction	List of tomato cultivars/lines	
	Late blight	Early blight
Highly resistant	-	-
Resistant	V- 426, V- 259	V- 52
Moderately resistant	V- 385, V- 187	V- 138, V- 201, V- 215
Tolerant	V- 282, V- 422	-
Moderately susceptible	V- 378, V- 138, V- 258, BARI- 10	V-378, V- 282, V- 330, V- 426, V- 422, Manik
Susceptible	V- 330, V- 210, Manik	V- 187, V- 385, V- 258, BARI- 10
Highly susceptible	V- 52, V- 215	V- 259

In case of late blight of tomato: Cultivars/lines were classified using 0-6 scale. (Anonymous, 1985)
In case of early blight of tomato: Cultivars/lines were classified using 0-5 scale (Vakalounakis, 1983)

Anonymous (1995) also revealed such wide range of leaf area infection (7.2-100%). In check cv. Manik per cent leaf area infected observed was 82.69 (Table 1). This was very similar to the finding of Anonymous (1995), where it was 85.8%. Two genotypes (V-426 and V-259) were found to be resistant to late blight of tomato (Table 3) and one genotype (V-52) was found to be resistant to early blight of tomato (Table 3). Although the genotype V-52 was found resistant to early blight of tomato but found highly susceptible to late blight of tomato. The result has similarity with the statements made by some author's findings and Institutions annual reports such as Mlungu (1996), Anonymous (1990a), Anonymous (1990b) and Kaur *et al.* (1988). Two genotypes (V-385 and V-187) were found moderately resistant (MR) to late blight (Table 3). Suhardi (1986) and Anonymous (1990b) reported that they located 6 and 12 tolerant entries/lines out of 27 and 58 entries/lines to late blight disease of tomato and the present study observed 2 genotypes (V-282 & V-422) tolerant (T) to tomato late blight out of 15 genotypes (Table 3). Anonymous (1989, 1990a, 1990b) reported that 2, 5 and 10 genotypes/entries were found moderately susceptible out of 11, 23 and 58 genotypes/entries and the present study observed 4 genotypes (V-378, V-138, V-258, BARI 10) moderately susceptible (MS) to late blight disease of tomato and 2 genotypes were found highly susceptible (V-52 and V-215) to late blight (Table 3) . The observations are supported by Anonymous (1990b), Anonymous (1989) and Kaur *et al.* (1988). Three genotypes (V-138, V-201, V-215) were found to be moderately resistant, six genotypes (V-378, V-282, V-330, V-426, V-422 and cv. Manik) were found moderately susceptible, four genotypes (V-187, V-385, V-258, BARI 10) were susceptible and one genotype (V-259) was found highly susceptible to early blight of tomato (Table 4). Begum (1992) found 14 genotypes moderately resistant out of 40 genotypes. The highest incidence of early blight caused by *Alternaria solani* was found in advance line V-259 and the lowest incidence was found in V-215. The lowest and the highest per cent infected leaves/plant were observed in V-52 and V-258 respectively. The severity in terms of per cent leaf area infected due to early blight varied from 8.67 to 80.75. The lowest severity (% LAI) was found in V-52 and the highest severity (% LAI) was found in V-259 (Table 2).

Out of 15 advance genotypes none was found highly resistant to early blight. However one material (V-52) was found resistant, 3 (V-137, V-215, V-210) were moderately resistant, 6 (V-378, V-282, V-330, V-426, V-422 and Manik) were moderately susceptible, 4 (V-187, V-395, V-258 and cv. BARI-10) were susceptible and one was highly susceptible(V-259) to early blight disease of tomato (Table 3).

Different workers found different percentages of resistant cultivars/genotypes in their respective studies. Sridhra *et al.* (1983), Avdeev and Shcherbinin (1988), Begum (1992), Banerjee *et al.* (1998a) and Banerjee *et al.* (1998b) found 9, 5, 9, 23 and 7 resistant lines to early blight respectively out of 38, 200, 40, 81 and 54 cultivars/genotypes.

Three genotypes (V-138, V-215 and V-201) were found to be moderately resistant (Tables 3) to early blight. In different screening 15, 13 and 22 moderately resistant genotypes were obtained out of 40, 38 and 81 cultivars/lines by Begum (1992), Banerjee *et al.* (1998a, 1998b) and Anonymous (1984).

It is interesting to note that among the fifteen test lines, no genotype was found to be resistant simultaneously to both *Phytophthora* and *Alternaria*. On the contrary the genotype which has shown considerable amount of resistance to *Phytopathora infestans* (viz. V-259, V-378 & V-426) suffered from very high incidence and severity of *Alternaria* blight. Among the tested lines V-215 was found to be susceptible to both the designated pathogens. The check cultivars, Manik and BARI-10 were also found to be susceptible to both of these major tomato diseases and these cultivars need replacement.

For that matter manipulation-recombination of resistant genes must be continued to breed new cultivars fairly resistant to both of these major pathogens without compromising the agronomic characters and market-qualities. The advanced test tomato lines V-378, V-426, V-259, V-215, V-52 could be used as the sources of resistance.

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