

Identify the Source of Resistant Against Early Blight of Tomato Caused by *Alternaria solani*

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ABSTRACT

Cultivation of resistant varieties seems to be the most economical and sustainable control measure of early blight disease of tomato. Ten tomato varieties were evaluated against early blight disease caused by *Alternaria solani* under natural epiphytotic conditions. Among them two cultivars Pusa Ruby and Arka Rakshak were showed 1-10% disease intensity and considered as resistant. Three cultivars Pusa Rohini, Arka Abhed and Arka Samrat, were showed 11-25% disease intensity and considered as moderately resistant. One cultivar Arka Apeksha, were showed 26-50% disease intensity and considered as moderately susceptible, whereas Arka Vikas and VL- Tamatar 4 were showed highly susceptible reaction.

HIGHLIGHTS

- Growing of resistant variety is the most economical and sustainable control measure of early blight.
- Pusa Ruby and Arka Rakshak varieties were resistant to early blight of tomato.

Keywords: Screening, Early blight, Varieties, *Alternaria solani*, PDI

Tomato (*Solanum lycopersicum* L.) is one of the most popular and widely consumed vegetable crops all over the world, and high-quality yield is an essential condition for its economical success in the world. It is an excellent source of carotenoids and particularly lycopene, which is an unsaturated alkylic compound, which help to reduce the risk of heart disease and cancer. As a result, tomato fruits are in high demand throughout the year. The tomato is the world's fourth most cultivated crop, an estimated global production of over 130 million metric tons and an area of 5.2 million hectares (Anonymous 2020). India is the world's second largest tomato producer after China, with an area of 778 thousand hectares and a production of 19397 metric tons, accounting for 11% of global production (Anonymous 2020). Cultivated tomatoes have a narrow genetic diversity as a result of intense selection and inbreeding during evolution and domestication, these species are more susceptible

to disease epidemics during the growing season (Zhang *et al.* 2002).

Early blight disease is one of the dreadful diseases of tomato resulting up to 78% yield and production loss (Datar and Mayee 1981 and Bessadat *et al.* 2014). It directly harms the plant and reduces both the quantity and quality of the economic yield. This disease, which can cause severe defoliation in severe condition, is most damaging to tomato in areas with heavy rainfall, high humidity and fairly high temperatures 24-29°C (Peralta *et al.* 2005 and Choudhary *et al.* 2021). Epidemics can occur in semi arid climates where frequent and prolonged nightly dews occur (Rotem and Reichert 1964). The symptom of early blight of tomato appears on aerial part of the plant such as leaves, stem and

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fruits. On leaves spots are round brown and can grow up to half inch in diameter. Larger spots have concentric rings appear after sporulation which forms typical “target board” symptoms or bull eye shaped spots, as a result of sporulation pattern. Different types of fungicides have been used for the control of *Alternaria* blight, but fungicide treatment is not economically feasible, nor environmentally sound. Fungicides are first applied 1–2 days after transplantation and then require routine application at the interval of 7 to 10 days for effective control, thereby increasing production cost and environment pollution (Kemmitt *et al.* 2002). Development of resistant varieties is the most economical and sustainable control measure of early blight. Hence, the present study was planned to identify resistance sources against early blight disease in tomato variety, which could provide a broader genetic base to facilitate the development of resistant cultivars.

MATERIALS AND METHODS

Screening of different tomato varieties against early blight disease

Tomato varieties were screened under natural epiphytotic for their reactions against *Alternaria* blight (*A. solani*) during *Kharif*, 2019-20 at GTC Farm, College of Agriculture, and Jodhpur. The tomato plants of 10 varieties were transplanted in month of August in earthen pot, each variety replicated thrice. The crop was grown applying all recommended package of practices. Based on mean percent disease intensity, the tomato entries screened were categorized (Pandey and Pandey 2002) as follows:

Table 1: Early blight disease severity categorisation based on mean of PDI

Disease intensity (%)	Disease reaction
No disease	Highly resistant
1-10	Resistant
11-25	Moderately resistant
26-50	Moderately Susceptible
51-75	Susceptible
76-100	Highly susceptible

Early blight infection was recorded 90 and 120 days after transplanting starting from first initial symptoms on older leaves. Observations on disease severity were recorded on five plant selected in each

replication by applying 0-5 grade disease rating scale by Pandey *et al.* (2003)

Table 2: Disease rating scale for early blight of tomato given by Pandey *et al.* 2003

Rating	Reaction description
0	Free from infection
1	< 10% surface area covering leaf, stem and fruit infected by early blight
2	11-25% foliage of plant covered with a few isolated spot
3	Many spot coalesced on the leaves, covering 26-50% surface area of plant
4	51-75% area of the plants infected, fruits also infected at peduncle end defoliation and blighting started. Sunken lesions with prominent concentric ring on stem, petioles and fruits
5	< 75% area of plant part blighted, severe lesion on stem and fruit rotting on peduncle end

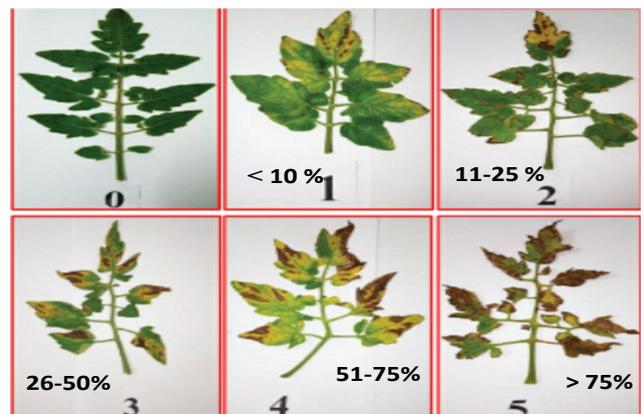


Fig. 1: Rating scale of early blight disease in tomato

Table 3: Tomato varieties used for screening against *Alternaria* blight disease

Sl. No.	Name of varieties	Sl. No.	Name of varieties
1	Arka Vishesh	6	Arka Rakshak
2	Arka Abedh	7	Pusa Rohini
3	Arka Samrat	8	Pusa Ruby
4	Arka Apeksha	9	VL- Tamatar 4
5	Arka Vikash	10	Kashi Adarsh

Per cent disease intensity was calculated by using the formula mentioned under here:

$$PDI = \frac{\text{Sum of individual disease ratings}}{\text{Total No. of plant assessed}} \times \frac{100}{\text{Maximum diseases rating}}$$

Table 4: Response of different tomato cultivars against early blight disease

Groups	Disease intensity %	Cultivar reaction	Details of cultivars
Group I	No disease	Highly resistant	—
Group II	1-10	Resistant	Pusa Ruby, Arka Rakshak
Group III	11-25	Moderately resistant	Pusa Rohini, Arka Abhed, Arka Samrat
Group IV	26-50	Moderately susceptible	Arka Apeksha
Group V	51-75	Susceptible	Kashi Adarsh, Arka Vishesh
Group VI	76-100	Highly susceptible	Arka Vikas, VL- Tamatar 4

RESULTS AND DISCUSSION

Screening of available cultivars against early blight disease of tomato

Based on the per cent number of plants (foliage) affected by the early blight pathogen, the tomato cultivars were categorized into five groups. The cultivars present in group I (Highly resistant) having no incidence, group II (resistant) having 1-10%, group III (Moderately resistant) having 11-25%, group IV (Moderately susceptible) having 26-50% incidence, group V (Susceptible) having >51-75%, Group VI (Highly susceptible) having 76-100% (Table 1).

Ten tomato cultivars along with one susceptible check Arka Vikas were screened against *A. solani* under field conditions. None of entry was found immune or highly resistant to early blight disease. Two cultivars Pusa Ruby and Arka Rakshak were shown 1-10% disease incidence and considered as resistant. Three cultivars Pusa Rohini, Arka Abhed and Arka Samrat, were shown 11-25% disease incidence and considered as moderately resistant. One cultivar Arka Apeksha, were shown 26-50% disease incidence and considered as moderately susceptible. Two cultivars Kashi Adarsh and Arka Vishesh were shown 21-50% disease incidence and considered as susceptible and Arka Vikas and VL-Tamatar 4 were shown >76-100% disease incidence and considered as highly susceptible. However, the differences among these cultivars based on the per cent early blight incidence were not significant (Table 4). Similarly result was also found by Singh *et al.* (2015).

Similar results were also found by Kumar *et al.* (2013) reported that of the 13 varieties tested, eight varieties showed moderately susceptible reactions but three cultivars showed susceptible reaction and two varieties were found moderately resistant

reaction against early blight. Yadav *et al.* (2014) screened two hundred and two advanced lines and nine genotypes of tomato. Nineteen advanced line were found resistant against, *A. solani*. The thirty one advanced lines and three genotypes were found medium resistance, fifteen advanced lines and genotypes were found moderate susceptible, ninety lines and one genotype were found susceptible and two lines and five genotypes were found highly susceptible against *A. solani*. Akhtar *et al.* (2019) screened 401 tomato genotypes and represented 11 species against early blight of tomato caused by *A. solani* in a net-house. Only one genotype was resistant and 56 were moderately resistant while the rest were found susceptible to highly susceptible reaction. Similar results were also found by Chohan *et al.* (2015). Majeed *et al.* (2020) screened 21 tomato genotypes against early leaf blight of tomato under artificial inoculated controlled conditions. Three test lines were showed resistant and six test lines were exhibited moderately resistant response and rest were found to exhibit moderately susceptible to susceptible reaction.

CONCLUSION

Ten tomato cultivars along with one susceptible check were screened under field condition against early blight disease among them Pusa Ruby, Arka Rakshak were categorized as resistant (R) while, Pusa Rohini, Arka Abhed and Arka Samrat were moderately resistant (MR) and one cultivar Arka Apeksha was moderately susceptible (MS) whereas, Kashi Adarsh, Arka Vishesh were susceptible (S) and Arka Vikas, VL- Tamatar 4 were highly susceptible (HS).

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