

## Research Article

# Survey and Screening of Genotypes against *Alternaria Solani* Caused Early Blight of Tomato in Southern Part of Rajasthan

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## Abstract

Early blight is one of the most important diseases of tomato (*Lycopersicon esculentum* Mill) worldwide. The disease was prevalent in all the tomato growing areas of southern Rajasthan viz; Udaipur, Rajsamand and Chittorgarh district were surveyed during *kharif* 2014. The overall mean disease incidence recorded from 35.14 to 51.88 percent in open field and 33.94 to 69.28 percent in protected condition (Polyhouse) on different cultivars, respectively. The highest disease incidence (51.88%) was recorded in field condition on cultivar Nandani in district Rajsamand (Location- Nakali) and the lowest level of disease recorded (35.14%) in district Udaipur (Location- RCA) on cultivar Global Omni, respectively. The highest disease incidence in protected condition (polyhouse) was recorded (69.28%) on cultivar Mithili in district Rajsamand (Location-Nandoli) and lowest incidence (33.94%) recorded in district Udaipur (Location- RCA) on cultivar NUN-7711, respectively. Traditional breeding programs are the main way to produce new cultivars for early blight resistance.

In this study, seven different genotypes namely: PKM-1, S-22, Navodaya, Uday, Sardar Sonal-21, P-21 and J.K. Special were screened under field condition to be evaluated for early blight disease. The highest early blight disease incidence was found in Uday (71.88%), Sardar Sonal-21 (65.40 %) and S-22 (54.18%) at 75 day after sowing. Other three genotypes showed moderately resistant and one genotype (J.K. Special) was found highly resistant on the basis of early blight disease intensity.

**Keywords:** Early blight, *Alternaria solani*, survey, screening, open field, Polyhouse

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## Introduction

Early blight (*Alternaria solani*) of the tomato (*Solanum lycopersicum* Mill) is most destructive disease in tropical and subtropical countries. The disease in severe cases can lead to complete defoliation and is most damaging on tomato in regions with heavy dew, rainfall, high humidity, and fairly high temperatures [1]. All aboveground parts of the plant can have symptoms of this disease. Leaf spots are circular, up to 1/2" in diameter, and dark to light brown. Spots may occur singly or in large numbers on the leaf. The leaf may turn yellow, then brown and fall off. Older leaves are usually affected before the disease works up the plant. This disease, which in severe cases can lead to complete defoliation, is most damaging on tomato [2]. Yield losses up to 79% due to early blight were reported from Canada, India, USA, and Nigeria [3-7]. Later by then various workers reported early blight incidence 30 to 65% in various states of India [8-10]. Several systemic and contact fungicides have been recommended to control the disease, however, high dose and continue using of the systemic fungicides set off the environmental hazards as well as fungicidal resistance in fungi. Thus the availability of resistant to moderately resistant genotypes may reduce the dependency on fungicides and can also be an effective component of integrated disease management strategy. Among the various recognized methods of plant disease control, the use of resistant varieties is considered to be cheapest and the best way. Therefore, screening of the available advanced line and genotypes of tomato was carried out to find out the source of resistance against the pathogen of early blight of tomato.

## Material and Methods

### Survey

Surveys were carried out to know the distribution and prevalence of early blight of tomato disease at farmer's fields and polyhouse units of Udaipur, Rajsamand, and Chittorgarh districts of southern Rajasthan during the *kharif* season

2014. Such intermittent visits were aimed to record the incidence of disease and exploring the pathogens responsible to cause early blight of tomato. During fields and polyhouse visit, the disease severity / incidence was recorded in all surveyed fields of various places. For this, observation for early blight incidence were recorded on 5 randomly selected tomato plants in 2x2 m<sup>2</sup> area at 5 randomly selected locations of each field while in the case of polyhouse units the observations were recorded on 5 randomly selected plants. In each districts two fields and two polyhouse units were examined and disease severity for early blight of tomato was recorded on a standard 0-5 disease rating scale described by [11].

Description of disease rating scale (0-5), for early blight in tomato:

Scale	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 spots.
3	Many spots 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.

### Screening

To find out the stable source of resistance against early blight pathogen (*A. solani*) seven tomato cultivar viz., P.K.M-1, S-22, Navodaya, Uday, Sardar sonal-21, P-21, and J.K. Special were evaluated under artificial inoculated condition in pot. Seeds of different tomato cultivars were obtained from market and department of Horticulture, RCA, Udaipur. Surface sterilized seeds of these cultivars were sown in plastic trays filled with sterilized soil. One month old seedlings were transplanted in 6 inch earthen pots containing sterilized soil and allowed to grow. There were 4 pots as four replications of each cultivar were maintained and each pot accommodated two plants and disease incidence was recorded according to above cited scale for rating of early blight disease in tomato. The pathogenic culture was inoculated on different cultivars to find out the source of resistance under pot condition.

### Result and Discussion

Since, no precise information was available on the distribution of disease in both protected and natural cultivated tomato crop in southern Rajasthan. Therefore surveys were conducted in three districts of southern Rajasthan viz., Udaipur, Chittorgarh and Rajsamand in open fields as well as in polyhouse units during *kharif* 2014. In fields of farmers early blight of tomato was observed moderate to severe form in all surveyed fields with the tune of 35.14 to 51.98% severity (**Table 1**). It was also noticed that the level of incidence of early blight in polyhouse units was higher (33.94 to 69.28%) compare to open field due to controlled climatic conditions [12] (**Table 2**). In this study, seven genotypes were tested for know the resistance source under under artificially inoculated condition. The disease severity increased with growth of the plants. It has been observed that even on susceptible plants, the topmost younger leaves are usually free from early blight symptoms, whereas the older and lower leaves may be greatly affected and necrotized by the fungus [13]. Among the cultivars “Uday” exhibited highly susceptible reaction (HS) with the mean PDI (33.05, 47.20, 58.75 and 71.88%) at 45, 55, 65 and 75 day after transplanting, respectively. The minimum mean PDI (2.25, 6.25, 10.60 and 17.90%) was recorded for “J.K. Special” that showed resistant (R) reaction on all of seven tomato cultivars against *A. solani*, respectively (**Table 3**). The work on host resistance in tomato crop against early blight reported by [14] evaluated one hundred forty two tomato genotypes including wild and cultivated lines were screened for resistance. Similar work was also done by [15-17].

**Table 1** Occurrence and distribution of early blight of tomato at different locations in open fields condition during 2014

S.N.	Name of District	Location	Tomato cultivar	Date of Survey	Early blight severity*
1	Udaipur	RCA	Global Omni	20-07-2014	35.14 (36.70)
2	Udaipur	Ghanoli	Smriti	20-07-2014	41.26 (39.93)
3	Chittorgarh	Kapasan	Sungro-575	21-07-2014	37.26 (37.56)
4	Chittorgarh	Nandwai	Damini-131	21-07-2014	45.12 (41.78)
5	Rajsamand	Odha	Bhagya	22-07-2014	51.98 (45.90)
6	Rajsamand	Nakali	Nandani	22-07-2014	51.88 (45.46)
SEm <sup>±</sup>					0.44
CD ( $p=0.05$ )					1.30
CV%					2.42
*Mean of Five Replication, Values in parenthesis (s) are angular transformed value					

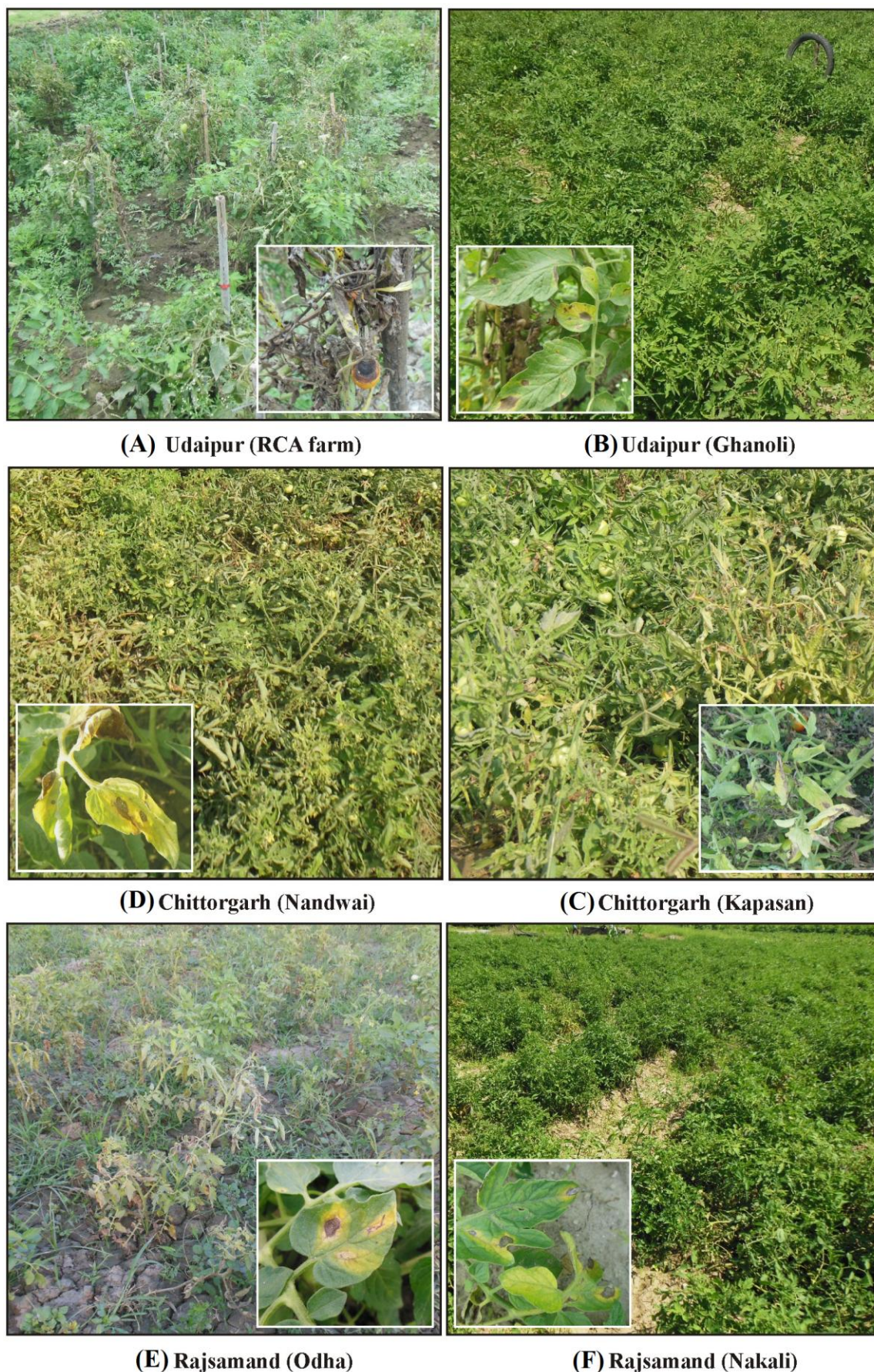
**Table 2** Occurrence and distribution of early blight of tomato at different locations in poly house units during 2014

S.N.	Name of District	Location	Tomato cultivar	Date of Survey	Early blight severity*
1	Udaipur	RCA	NUN-7711	20-07-2014	33.94 (36.30)
2	Udaipur	Narayanpura	Subhrano	20-07-2014	59.80 (51.09)
3	Chittorgarh	Jaisinghpura	US-3812	21-07-2014	60.64 (52.34)
4	Chittorgarh	Rajpura	Dev	21-07-2014	53.36 (46.68)
5	Rajsamand	Tarsigada	Abhinav	22-07-2014	40.88 (40.08)
6	Rajsamand	Nandoli	Mithili	22-07-2014	69.28 (57.04)
SEm <sup>±</sup>					0.65
CD( $p=0.05$ )					1.91
CV%					3.11

**Table 3** screening of tomato cultivars for source of resistance against early blight of tomato in 2014

Days	Varieties of Tomato						
	Mean PDI*						
	PKM-1	S-22	Navodaya	Uday	Sardar Sonal-21	P-21	J. K. Special
45	17.50 (24.71)	20.58 (26.96)	15.25 (22.97)	33.05 (35.09)	26.85 (31.20)	19.30 (26.05)	2.25 (8.61)
55	27.00 (31.30)	31.73 (34.28)	26.50 (30.97)	47.20 (43.34)	38.48 (38.33)	27.75 (31.78)	6.25 (14.47)
65	37.15 (37.55)	43.48 (41.25)	34.88 (36.19)	58.75 (50.04)	52.03 (46.16)	36.43 (37.12)	10.60 (19.00)
75	45.40 (42.36)	54.18 (47.40)	45.00 (42.13)	71.88 (57.98)	65.40 (53.97)	44.00 (41.55)	17.90 (25.05)
Disease Reaction	Moderately Susceptible	Susceptible	Moderately Susceptible	Highly Susceptible	Susceptible	Moderately Susceptible	Resistant
SEm <sup>±</sup>	0.49 1.53	0.48	0.48	0.41	0.51	0.54	0.22
CD ( $p = 0.05$ )	2.93	1.47	1.49	1.29	1.59	1.67	0.67
CV %		2.56	2.93	1.84	2.44	3.19	2.62
*Mean of Five Replication, Values in parenthesis (s) are angular transformed value							





**Figure 1** (A-F) Occurrence and distribution of early blight of tomato at different locations in open fields conditions 2014



**(A) Udaipur (RCA)****(B) Udaipur (Narayanpura)****(C) Chittorgarh (Jaisinghpura)****(D) Chittorgarh (Rajpura)****(E) Rajsamand (Tarsigada)****(F) Rajsamand (Nandoli)**

**Figure 2 (A-F)** Occurrence and distribution of early blight of tomato at different locations in poly house conditions 2014





**Figure 3** Group view of seven tomato cultivars showing different level of disease severity

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**Publication History**

Received 31<sup>st</sup> May 2017  
Revised 24<sup>th</sup> June 2017  
Accepted 05<sup>th</sup> July 2017  
Online 30<sup>th</sup> July 2017