

## Original Research Article

# Screening of Tomato Line/Varieties for Bacterial Wilt (*Ralstonia solanacearum*) Resistance in Hill Zone of Karnataka, India

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## ABSTRACT

Present investigation was conducted to evaluate the 11 lines of tomato for bacterial wilt resistance in initial evaluation trail (IET) and advanced varietal trial (AVT) during the year 2015-16 in sick plot of Department of vegetable science at COH, Mudigere under open field condition. Among the lines, UK Local-2 showed highest resistance to bacterial wilt in initial evaluation trail, followed by AR-56 and AR-28 respectively. While, during advanced varietal trial maximum resistance was observed in AR-4 (no wilting) which was followed by AR-29 (11.12 % wilted plant) and UK Local-2 (18.27 % wilted plant), respectively at 100 days after transplanting. The line UK Local-2 didn't showed any wilting symptom while AR - 56, AR- 4 and AR-28 showed the wilting population of 11.11, 16.66 and 33.33 per cent, respectively at initial evaluation trial. Whereas, the control hybrid Arka Samrat didn't showed any wilting symptom represents highly resistance to bacterial wilt.

### Keywords

Bacterial Wilt  
(*Ralstonia solanacearum*),  
Tomato

## Introduction

There are several soil borne bacterial pathogens which directly or indirectly affects the crop production and results in severe yield loss. Among these bacterial pathogen, the most destructive soil borne pathogen is *Ralstonia solanacearum* (Smith, 1896) which cause severe yield loss mostly in Solanaceous vegetables (Yabuuchi *et al.*, 1996) as well as in other crops which are grown in tropical, subtropical and temperate climate of the world (Ghosh and Dutta, 2014). Based on host range and acid production capacity from carbohydrate, *R. solanacearum* strains were grouped into five

races and five biovars, respectively (Tahat and Sijam, 2010). In tomato, limits the production from 4.24 to 86.14 per cent while in hot and humid climate, the disease can cause up to 100% losses.

More than 200 plant species have been infected by different races of this soil borne bacterial pathogen (Buddenhagen *et al.*, 1962). This disease occurs almost all climatic region of world but cause severe damage in wet tropical regions. The disease is widely spread in every state of India. In Karnataka, it occurs almost every vegetable

growing area but causes maximum loss in high rainfall as well as coastal area. Mudigere, located in hilly region of Karnataka with very high rainfall of 2500mm is considered as hot spot for most of soil borne disease but more specific to bacterial wilt due to more soil acidity resulting in total yield loss up to 95 per cent. Due to these soils borne diseases, vegetable cultivation in this hilly area is almost negligible.

Large number of races and biovars of this pathogen exist in the world but in India race 2 and 3 are more dominant. At the initial stage of disease development, first symptoms appear on leaves. During hottest part of day, wilting of youngest leaves occurs at the end of branches. Under favourable condition, quick wilting of whole plant occurs and dehydration of leaves took place but dried leaves remain green. Later on, wilting and yellowing of foliage leads to entire plant death.

Tomato is considered as one of the most widely grown warm season vegetable crop due to its wider adaptability and high yield potential. It is originated at Peru Ecuador region and first domesticated in Europe. It is primarily a self-pollinated crop belongs to Solanaceae family with diploid chromosome number of  $2n = 24$ . It is an annual and short lived herbaceous plant which gives better performance under short day condition.

As most of hilly area have common problem of runoff soil minerals which leads to soil acidity so bacterial wilt is the common disease in these areas. Most of commercially cultivated varieties of tomato are susceptible to this disease and difficult to control by chemical treatment. Hence, there is a need to identify the stable source of resistance for bacterial wilt which can be use as donor parent to transfer the resistant gene in commercially cultivated high yielding

varieties. Keeping the above points in view, the present investigation was conducted to screen the bacterial wilt resistant breeding lines for hilly zone of Karnataka.

## **Materials and Methods**

To conduct the present investigation, total of 11 lines and varieties (Tommy Toe, AR-4, AR-29, Black Prince, Bony Best, Podlandt Pink, AR-28, and Sioux, Pant C-3, UK Local-2 from KRCCCH, Arbhavi, IARI, New Delhi and UUH&F, Bharsar) were screened in Initial Evaluation trial and Advanced Evaluation Trial in sick plot after artificial inoculation with bacterial culture of  $1 \times 10^8$  cfu/ml (Fig 1. a). Root dip and soil drenching methods were used for inoculation purpose. Root dip was done in two ways- 1) inoculation with root tip cutting and (2) inoculation without root tip cutting.

The seedlings were transplanted 30 days after sowing at the spacing of 90 x 60 cm in well prepared field of 3.2 m x 2.8 m sized plot during February, 2016 in a randomized block design with two replications of each. The F<sub>1</sub> hybrid Arka Samrat was used as control (Fig 1. b). Nature of soil in experiments plot was acidic with low nitrogen (N) and phosphorus (P) content. Fertilizers were applied as per the recommendation of package of practices i.e. 115 kg N, 100 kg P<sub>2</sub>O<sub>5</sub> and 60 kg K<sub>2</sub>O/ha. One third dose of N and full doses of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O were applied at the time of field preparations. Remaining two-third dose of N was top dressed in equal amounts after 30 and 45 days of transplanting. Irrigation and weeding was followed on regular interval. To raise a good crop all the recommended cultural operations were followed. No chemical was applied during the experiment to get the better results. Disease symptom (Fig 1. c) and number of wilted plant were recorded based on visible appearance of

plant. The grading of disease was done by following the disease scale 0-5 with few modifications, given by Winstead and Kelman (1952). The modified rating scale is given below:

Highly resistant (HR): Plants did not show any wilt symptom

Resistant (R): 1-20% plants wilted

Moderately resistant (MR): 21-40% plants wilted

Moderately susceptible (MS): 41-60% plants wilted

Susceptible (S): 61-80% plants wilted

Highly susceptible (HS): More than 80% plants wilted

Categorization of genotypes in resistant to highly susceptible group was based on the percentage of wilt of the plants.

### Results and Discussion

With respect to disease resistance large variability was observed in each line/variety. The results showed that UK Local-2 having the maximum resistant (no wilting symptom) to bacterial wilt during initial evaluation trial. Whereas the line AR-56 and

AR-28 were resistant with the plant wilting per cent of 11.11 and 16.66, respectively. Among all lines/varieties only AR-28 was found moderately resistance to this disease. While the remaining lines/varieties showed moderately susceptible/susceptible/highly susceptible to the disease during this trial (Table 1). Dutta and Rehman (2012) also reported the similar results in varietal evaluation of tomato in NE region. During advanced varietal trial the line AR-4 was found highly resistant with no wilting symptom whereas two lines AR-29 and UK Local-2 were resistant with 16.18 and 18.27 per cent. The remaining lines/varieties were categorised into moderately susceptible/ susceptible/ highly susceptible based on their performance at 100 days after planting (Table 2). At the time of initial evaluation trial maximum yield was observed in UK Local-2 (35.80q/ha) which was followed by AR-4 (35.65q/ha), AR-56 (27.57q/ha) and Pant T-3 (25.32 q/ha). During advanced varietal trial line AR-4 provided the highest yield (41.83 q/ha) which was followed by UK Local-2 (39.91 q/ha) and AR-4 (30.36 q/ha).

**Table.1** Periodical bacterial wilt (%), wilt reaction and yield in the IET lines during 2015-2016

Lines/Varieties	Per cent wilt at days			Reaction at 100DAP	Yield (Q/ha)
	45 DAP	70DAP	100 DAP		
Tommy Toe	44.38	72.21	94.44	HS	11.23
AR-4	0.00	11.11	16.66	R	31.65
AR-29	27.77	44.44	66.66	S	16.21
Black Prince	38.88	55.55	88.88	HS	8.24
Bony Best	11.11	38.88	66.66	S	14.99
Podlandt Pink	22.22	44.44	77.77	S	10.91
AR-56	0.00	0.00	11.11	R	27.57
AR-28	0.00	22.22	33.33	MR	22.66
Sioux	16.66	38.88	66.66	S	20.23
Pant T-3	0.00	11.11	18.22	R	25.32
UK Local-2	0.00	0.00	0.00	HR	35.80
Arka Samrat (C)	0.00	0.00	0.00	HR	41.42
SEM ±					2.16
CD					6.23

**Table.2** Periodical bacterial wilt (%), wilt reaction and yield in the AVT lines (F<sub>1</sub>s) during 2015-2016

Lines/Varieties	Per cent wilt at days			Reaction at 100DAP	Yield (Q/ha)
	45 DAP	70DAP	100 DAP		
Tommy Toe	44.38	72.21	94.44	HS	18.83
AR-4	0.00	0.00	0.00	HR	41.83
AR-29	11.06	13.21	16.18	R	30.36
Black Prince	44.44	66.35	93.58	HS	11.36
Bony Best	11.11	38.88	77.43	S	15.99
Podlandt Pink	27.38	55.55	88.88	HS	18.91
AR-56	22.22	38.93	63.86	S	17.57
AR-28	38.92	78.17	96.31	HS	12.80
Sioux	33.33	62.45	77.77	S	17.89
Pant T-3	18.62	28.76	38.49	MR	20.59
UK Local-2	0.00	11.32	18.27	R	39.91
Arka Samrat (C)	0.00	0.00	0.00	HR	40.05
SEM ±					3.26
CD					8.73

**Figure.1** (a) Wilt Sick Plot (b) Healthy Tomato Plant (c) Wilted Tomato Plant



The most important soil borne disease in Solanaceous crops is bacterial wilt caused by *R. solanacearum* has wide host range and infect more than 300 plant species belongs to more than 30 families (Hayward, 1964, 1991). Several complex taxonomic features have been observed in *R. solanacearum* at every stage which includes genotypic, phenotypic, physiological and host preference (Melanie *et al.*, 2007, Geninand Boucher, 2004). Several authors had studied the bacterial wilt resistance in different crop more specific to tomato (Acosta, 1972; Singh, 1961), but then also, there is a need to go for more research for identifying the highly stable source of resistance.

The line/ variety UK Loal-2, AR-56, AR-28 and AR-28 can be used in breeding programme for development of variety resistant to bacterial wilt with high yield characters. Even development of resistance variety with high yield and good quality is a challenging task since from many years. But then also several scientists have developed many numbers of varieties by using the stable sources of resistance.

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