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EVALUATION OF GRAFTED TOMATO FOR RESISTANCE TO BACTERIAL WILT UNDER TELANGANA CONDITIONS

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ABSTRACT

The present investigation was conducted at the College of Horticulture, Rajendranagar, Hyderabad, during *Rabi* 2022. The experimental material consisted of three graft combinations *i.e.* T_1 – Arka Vikas on *Solanum torvum*, T_2 – Arka Vikas on Surya and T_3 – Arka Vikas on Arka Keshav, along with T_4- Arka Vikas (Susceptible ungrafted check), which were screened under artificial inoculation conditions in poly bags. The lowest per cent disease incidence of bacterial wilt was observed in three graft combinations, *i.e.* T_1 – Arka Vikas on *Solanum torvum* (0.00%), T_2 – Arka Vikas on Surya (0.00%), and T_3 – Arka Vikas on Arka Keshav (0.00%). The highest per cent of disease incidence (94.44%) was observed in T_4- Arka Vikas (Susceptible ungrated check). Three graft combinations T_1 – Arka Vikas on *Solanum torvum* and T_2 – Arka Vikas on Surya, T_3 – Arka Vikas on Arka Keshav showed highly resistance (HR) to bacterial wilt (plants didn't showed any wilting symptoms) whereas, T_4- Arka Vikas (Susceptible un grafted check) found highly susceptible (HS) to bacterial wilt (>80% plants wilted).
Keywords **:** Tomato, Graft combinations, Bacterial wilt, per cent disease incidence.

Introduction

In India, tomato and brinjal cultivation is severely affected by the bacterial wilt caused by *Ralstonia solanacearum* (Smith) (Yabuuchi *et.al.* 1992). It is reported to be among the top five diseases (Elhinstone, 2005) and is a major yield constraint of brinjal in the coastal region of India (Ramesh *et al.*, 2016). The disease is soil-borne, and the pathogen invades the host through wounds in roots or underground parts of the plant. The lower leaves of the plants droop and show partial wilting. The plants suddenly collapse and die in a day or two. The death of the plants is seldom accompanied by chlorosis of the leaves. The management of this pathogen is difficult due to the presence of diverse *R. solanacearum* strains and the ability of the pathogen to survive longer even in adverse soil conditions. Different management strategies *viz.*, resistant varieties (Dalal *et al.*,1999), soil amendments (Islam and Toyota, 2004), soil solarization (Kumar and Sood, 2001), use of bio-fumigants (Pradhanang *et al.*, 2003), transgenic resistant plant (Jia *et al.*, 1999), plant growth promoting rhizobacteria (Guo *et al.*, 2001; Singh *et al.*, 2012), use of systemic acquired resistance (SAR) inducers (Anith *et al.*, 2004), biological control (Ramesh and Phadke, 2012 and Achari and Ramesh, 2014), had been developed with limited success in the bacterial wilt management.

Material and Methods

This experimental study was conducted at PG Students Research Block, College of Horticulture, Rajendranagar, Hyderabad during *Rabi*, 2022. The experiment was laid out in a Randomized Block

Design (RBD) with four treatments (Rootstocks - 3 and Scion -1) in five replications. The general view of the experimental plot is presented in (Plate. 1).

Treatment Details

T_1 – Arka Vikas on *Solanum torvum* + soil inoculated with *Ralstonia solanacearum*

T_2 – Arka Vikas on Surya + soil inoculated with *Ralstonia solanacearum*

T_3 – Arka Vikas on Arka Keshav + soil inoculated with *Ralstonia solanacearum*

T_4 – Arka Vikas (Susceptible un grafted check) + soil inoculated with *Ralstonia solanacearum*

Inoculation of the seedlings

Before inoculation, the roots were slightly severed by inserting a sharp knife 1.0 cm away from the stem. Root severing ensured bacterial penetration through the roots.

Procedure for inoculation: (Patrick Juma, 2018)

- Uproot the seedlings and wash the roots lightly with tap water in batches of about 20 seedlings. 106
- Place the seedlings in a cup or beaker.
- Pour 100ml of bacterial wilt solution with a certain concentration (4x108 cfu/ml inoculum) prepared into the cup (beaker).
- Inoculate the roots of the seedlings by dipping them in the bacteria suspension (Plate. 2 and 3).
- The inoculated seedlings are transplanted into pots with soils that are not contaminated (not infected) with disease-causing microorganisms.
- Thereafter, inoculated seedlings are grown and observed the degree of wilting of each seedling.
- The bacterial wilt symptoms should be observed in a period of 2-4 weeks depending on the cultivar and weather factors particularly atmospheric temperature.

Plate 1: Evaluation of grafted tomato for resistance to Bacterial wilt under Telangana conditions during *Rabi*, 2022

***Ralstonia solanacearum* pure culture (Source: ITCC, New Delh**

Mass multiplication in NA media

Plate 2: Seedling roots were washed with water to remove soil debris

Seedlings of Arka Vikas on *Solanum torvum*, Surya and Arka Keshav

Arka Vikas seedling (ungrafted) check

Plate 3: Root Dipping in Suspension

Observations recorded

Disease scoring

The number of wilted plants in each accession recorded and classified into five different groups according to Hussain *et al*. (2005).

Disease reaction	Percentage of wilt incidence
Highly Resistant (HR)	Plants do not show any wilt symptom
Resistant (R)	1-20 % wilted plants
Moderately Resistant (MR)	21-40 % wilted plants
Moderately Susceptible (MS)	41- 60 % wilted plants
Susceptible (S)	61-80 % wilted plants
Highly Susceptible (HS)	More than 80 % wilted plants

Percent disease incidence

The Per cent disease incidence was calculated by using following formula.

$$\text{Per cent Disease Incidence (PDI)}\,\% = \frac{\text{Number of infected plants}}{\text{Total number of plants observed}} \times 100$$

Results and Discussion

The present investigation was conducted at the College of Horticulture, Rajendranagar, Hyderabad during *Rabi*, 2022. The experimental material consisted of three graft combinations *i.e*. T_1 – Arka Vikas on *Solanum torvum*, T_2 – Arka Vikas on Surya and T_3 – Arka Vikas on Arka Keshav along with T_4- Arka Vikas (Susceptible un grafted check) were screened under artificial inoculation conditions in poly bags. Among the four treatments, observations on bacterial wilt incidence were recorded by using disease rating scale suggested by (Winsted and Kelman, 1952).

The lowest per cent disease incidence of bacterial wilt was observed in three graft combinations *i.e*. T_1 – Arka Vikas on *Solanum torvum* (0.00%), T_2 – Arka Vikas on Surya (0.00%) and T_3 – Arka Vikas on Arka Keshav (0.00%) (Table 1). Highest per cent of disease incidence (94.44%) was observed in T_4- Arka Vikas (Susceptible un grafted check) (Fig.1). Three graft combinations T_1 – Arka Vikas on *Solanum torvum* and T_2 – Arka Vikas on Surya, T_3 – Arka Vikas on Arka Keshav showed highly resistance (HR) to bacterial wilt (plants didn't showed any wilting symptoms) whereas, T_4- Arka Vikas (Susceptible un grafted check) found highly susceptible (HS) to bacterial wilt (>80% plants wilted) (Plate 4).

Table 1: Interaction of scion and rootstocks on bacterial wilt disease

Treatments	Percent disease incidence (%)	Disease reaction
T_1 – Arka Vikas on *Solanum torvum*	0.00	HR
T_2 – Arka Vikas on Surya	0.00	HR
T_3 –Arka Vikas on Arka Keshav	0.00	HR
T_4- Arka Vikas (Susceptible ungrafted check)	94.44	HS

HR- Highly resistant, HS- Highly susceptible

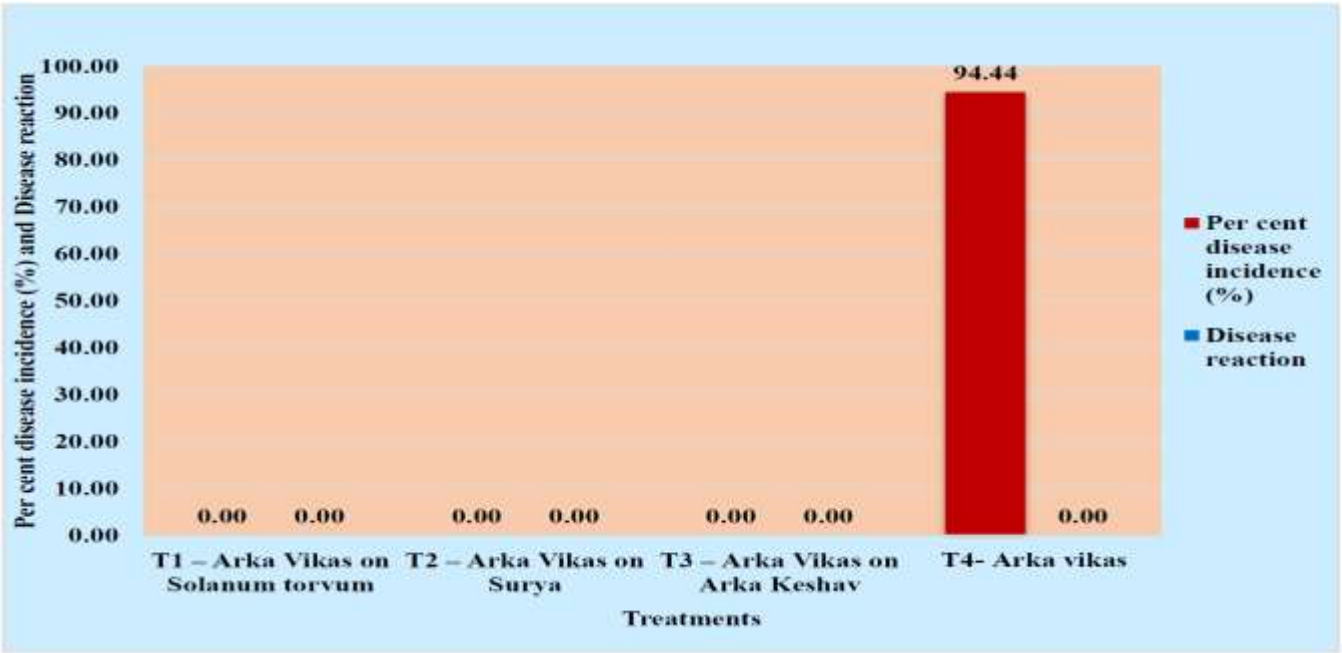

Fig. 1 : Interaction of scion and rootstocks on bacterial wilt disease

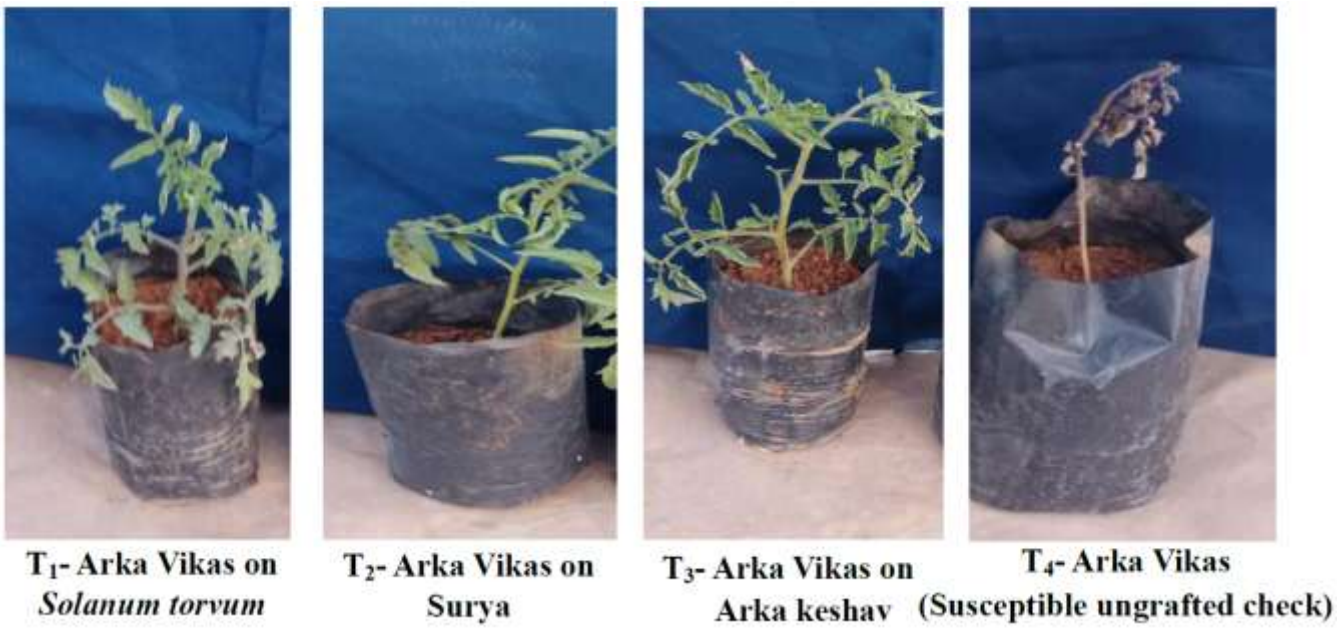

Plate 4: Disease reaction on Bacterial wilt screening

Shetty and Reddy (1985) and Ali *et al.* (1990) reported that *S. sisymbrifolium* and *S. torvum* were the effective rootstock to control bacterial wilt. Hussain *et al.* (1999) stated that *Solanum torvum* and *S. sisymbrifolium* were identified as resistant to bacterial will. It was also mentioned that between these two species; *S. torvum* was more suitable for grafting as it contains few numbers of spines on leaves and stems compared to *S. sisymbrifolium*.

A study was conducted on bacterial wilt in sick bed to assess the reaction of rootstocks of wild *Solanum* spp. and cultivated eggplant variety against bacterial wilt. *Solanum torvum*, *S. sisymbrifolium*, *S. melongena* (Var Khotkhotia long) and *S. melongena* (Var Sufala) showed 0.00, 0.00, 19.44 and 100.00% wilt incidence, respectively (Rashid *et al.*, 2000) Singh and Malhotra, (2010) observed Arka Keshav and Arka Anand (F1 hybrid) as commercially available resistant varieties against *Ralstonia solanacearum*. Kumar *et al*. (2017a) revealed that grafted plants showed resistance and the non-grafted plants showed vulnerability against bacterial wilt disease. Among grafted and non-grafted plants, the highest percentage of wilt infection observed in non-grafted plants (90.90 %) followed by Pusa Shyamala grafted with *Solanum surathense* (58.52 per cent).

Biswas and Ghosh (2018) observed out of 20 brinjal cultivars ten were found resistant (R), four moderately susceptible (MS) and six cultivars were found susceptible (S). Variety Blue star, Utkal, LB-24, Surya, VNR-B5, Swarna Shyamli, VNR-218, Rajgaon, Suvarna and Isha showed enough resistance against *Fusarium oxysporum f*.sp. *melongenae* and *Ralstonia solanacearum* exhibited 4.53, 5.53, 6.59, 7.86, 8.56, 11.11, 12.18, 11.11, 12.85 and 13.89 per cent disease incidence respectively and categorized under the reaction group II (Resistant).

These results were in uniformity with the findings of Mochizuki *et al.* (1979), Reboul (1981), Rahman *et al.* (2002), Lu *et al*. (2004), Cary Rivard *et al.* (2008), Mcavoy *et al*. (2012), Suane (2012), Yoonah Jang *et al*. (2012), Rivard, *et al*. (2012), Onduso, (2014), Reshmi Upreti and Pious Thomas (2015), Ramesh *et al*. (2016) and Bhanwar *et al.* (2019).

Conclusion

Results from Bacterial wilt screening revealed that T_1- Arka Vikas on *Solanum torvum*, T_2- Arka Vikas on Surya, and T_3- Arka Vikas on Arka Keshav showed highly resistant (HR), whereas T_4- Arka Vikas was highly susceptible (HS) to *Ralstonia solanacearum.* Bacterial wilt is one of the devastating diseases of tomato and brinjal, causing high yield losses in fields and commercial greenhouses, emphasizing the necessity for the development of disease resistance. Based on the results, the identified genotypes can be further tested and be used in Marker Assisted Selection or gene pyramiding programs to develop disease-resistant commercial cultivars.

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Competing Interests

Authors have declared that no competing interests exist.

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