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Evaluation of Wilt Resistance of Wild *Solanum* Species through Grafting in Brinjal

B. Ashok Kumar[1*], P. Raja[2], A.K. Pandey[3] and P. Rabindro[1]

[1]Bidhan Chandra Krishi Vishwavidyalaya (BCKV), PhD Scholar, Department Vegetable crops, Mohanpur, West Bengal-741252, India
[2]College of Horticulture and Forestry, Department of Plant Pathology, (CAU) Pasighat, Arunachal Pradesh-791102, India
[3]College of Horticulture and Forestry, Dean, Department of Vegetable Science (CAU) Pasighat, Arunachal Pradesh-791102, India
**Corresponding author*

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A B S T R A C T

The grafting in eggplant was carried out to obtain resistance sources among *Solanum* rootstocks against bacterial wilt and to evaluate graft compatibility of eggplant varieties with *Solanum* rootstocks. The experiment was laid out in Complete Randomized Design (CRD) with four replications. Bacterial wilt is one of the major problems in production of brinjal in North Eastern hill regions. The four *Solanum* species and two varieties were screened against bacterial wilt, among all *Solanum* speciesi.e. *Solanum torvum* and *Solanum khasianum* found resistant but remaining *Solanum* species and cultivated genotypes i.e. Pusa Shyamala and Pusa Hybrid-6 were found susceptible. The highest graft compatibility observed in plants grafted with *Solanum torvum* followed by *Solanum surathense*. The data recorded regarding the percent of bacterial wilt infection varied with rootstock used in grafting. The highest infection rate was observed in non-grafted plants (71.35%) followed by *Solanum surathense* × Pusa Shyamala (58.525%). The lowest infection rate was recorded in *Solanum torvum* × Pusa Shyamala (12.22%). Based on mean performance of the grafted plants with *Solanum torvum* and *Solanum khasianum* were found to be superior and they can be used for resistance against soil borne bacteria.

Introduction

Eggplant (*Solanum melongena* L.) belongs to the family Solanaceae. India is the world's second largest producer with 7.22 lack hectare areaand 13 lack tonnes production annually (NHB, 2013-14), accounting nearly 26% of global production. The West Bengal is leading producer of brinjal and it contributes 22% of total country production (NHB, 2013-14). The yield is very low due to numerous diseases and parasites, in particular to *Ralstonia solanacearum*, Fusarium wilt, Verticellium wilt and Bacterial wilt, nematodes and several insect pests (Collonnier *et al.*, 2001).Among all, bacterial wilt is extreme disease expressed rapid wilting by yellowing of foliage followed by collapse of entire plant. Soil treatment with chemicals and resistant sources were used so far but due to residual nature of chemicals only alternative left is resistant sources. The

number of wild relatives of *Solanum* species was resistant and graft compatible to eggplant. Grafting of vegetable crops is a simple method of propagation in which preferred rootstocks are used to improve vigour, precocity, enhanced yield and quality, better survival under abiotic and biotic stress conditions (Pandey and Rai, 2003). To get maximum success of grafting selection of rootstock resistant to wilt is necessary. However, to get positive effect of grafting on vegetable quality, rootstock/scion combinations should be necessary for specific climatic and geographic situations (Davis *et al.,* 2008).It is difficult for farmers to provide intensive care required to raise newly grafted plants, often requiring the added cost of a transplant facility that has healing chambers and trained personnel. Concerning above problems the present investigation was undertaken to evaluate the graft compatibility among wild *Solanum* rootstocks onto cultivated eggplant genotypes and to identify resistant rootstocks against bacterial wilt.

Materials and Methods

The field experiments were carried out in experimental farm, Department of Vegetable Science, College of Horticulture and Forestry, CAU, Pasighat, Arunachal Pradesh during August, 2014 to assess the wild *Solanum* species and cultivated eggplant genotypes against bacterial wilt and to know the graft compatibility of *Solanum* species as a rootstocks. The experiment was laid out in Complete Randomized Design (CRD) with four replications.

Experiment-1: Evaluation of wild *Solanum* species and eggplant genotypes against bacterial wilt

The experimental materials for present study comprised of four wild *Solanum* species and two eggplant genotypes grown in nursery beds. The seeds were sown on1stJune, 2014. Before sowing, seeds were treated with GA_3 solution (100ppm) for 24 hrs at room temperature for quick germination. The fifteen days old seedlings were transferred to plastic trays containing mixture of sand and farm yard manure. For inoculation, the pathogen was isolated from roots and stems of diseased eggplant by serial dilution method and incubated in Petriplates to obtain pure culture of bacteria. The 10 day's old bacterial colonies were selected for further multiplication in nutrient agar medium using streak plate method. The obtained pure culture from mixture of different bacteria, selected a well isolated colony from each plate and recorded their features. The well isolated colony from each plate was selected from pure bacterial culture. The spore suspension prepared by scraping the surface of 10 days old growth on agar plate. The 5×10^5 spores/ml of diluted spore suspension was prepared with help of Haemocytometer. The spore suspension was applied near root zone of plants by making damage to the root system. After inoculation, pots were kept inside the inoculation chamber where sufficient relative humidity and optimum temperatures were maintained.

The disease incident was calculated using PDI formula

The Percent Disease Incidence (PDI) = Number of infected plants / total number of plants observed ×100

Experiment-2: Graft compatibility of wild *Solanum* species on cultivated eggplant genotypes

The experimental materials for the present study comprised of four wild *Solanum* species namely *Solanum torvum*, *Solanum xanthocarpum*, *Solanum khasianum* and *Solanum surathense* and two eggplant

genotypes i.e. Pusa Shyamala and Pusa Hybrid-6. The seeds of wild *Solanum* species were sown on 1st June, 2014 and seeds of eggplant genotypes were sown on 10thJune, 2014 in plastic trays containing sandy soil. Ten daysbefore sowing, seeds were treated with GA_3 solution (100ppm) for 24 hrs at room temperature for quick germination. The fifteen days old seedlings were transferred to plastic trays containing mixture of sand and farm yard manure.

Forty to fifty days old rootstock seedlings (4-5 leaf stage) and seedlings of eggplant varieties at 3-4 leaf stage were grafted. All plants were grafted by cleft method of grafting (Johnson *et al.*, 2011; Lee and Oda, 2003).The number of plantlets with successful grafting was recorded ten and thirty days after grafting (DAG).

Experiment-3: Evaluation of grafted plants against bacterial wilt

For inoculum, freshly isolated pathogen from pure culture was selected and spore suspension was prepared by diluting 5×10^5 spores/ml of water with help of Haemocytometer.

The adequate 2ml of spore suspension was applied near root zone of plants by making damage to the root system. The minimum 10 number of grafted plants from each combination were selected for inoculation and allowed to grow one month by adopting normal package of practices. After inoculation, the pots were kept inside the inoculation chamber where sufficient relative humidity and optimum temperatures were maintained.

Statistical analysis

The data obtained were analyzed by using the analysis of variance for Completely Randomised Design (CRD) as described by Panse and Sukhatme (1985) with four replications consisting of 3 plants. The level of significance used in F-test was 0.05 and critical difference (CD) values were calculated whenever the F-test was significant.

Results and Discussion

Experiment-1: Evaluation of wild *Solanum* species and eggplant genotypes against bacterial wilt

The data recorded in table 1 shows that all non-grafted eggplant genotypes i.e. Pusa Shyamala, Pusa Hybrid-6 were found susceptible to bacterial wilt. Among four wild *Solanum* species *Solanum torvum* (5.708%) gave resistant reaction and *Solanum khasianum* (15.825) moderately resistant to bacterial wilt and remaining *Solanum xanthocarpum* and *Solanum surathense* were found susceptible.

Similar reports of wilt resistance sources among *Solanum* species were found by Singh and Gopalakrishna (1997), Lee and oda (2003).

Experiment-2: Graft compatibility of wild *Solanum* species on cultivated eggplant genotypes

The graft compatibility study in table 2 shows that among all graft combinations Pusa Hybrid-6 onto *Solanum torvum* rootstock noted highest survival rate (81.85% 10DAG &67.35% 30DAG) followed by Pusa Shyamala with *Solanum torvum* (78.625% 10DAG &66.57% 30DAG) compared to all other graft combinations. The lowest survival rate was observed in *Solanum xanthocarpum* (30.02% 30DAG) when grafted with Pusa Shyamala. Highest survival rate of grafted plants using *Solanum torvum* rootstock was in contrast with the observations of Petron and Hoover (2014).

Table.1 Response of wild *Solanum* species and eggplant genotypes/varieties against Bacterial wilt

Wild *Solanum* species and eggplant genotypes	% wilt infection	Grading
Solanum torvum	5.768	R
Solanum Xanthocarpum	46.125	S
Solanum khasianum	15.825	MR
Solanum surathense	54.475	S
Pusa Shyamala	72.175	S
Pusa Hybrid-6	68.375	S
C.D.	2.503	
SE(m)	0.836	
SE(d)	1.182	
C.V.	3.819	

R- Resistance, S- Susceptibility, MR- Moderately resistance, %- Percentage

Table.2 Effect of different wild *Solanum* species as a rootstocks on survival rate of grafted Eggplant genotypes

Grafting combinations	Survival Rate 10 DAG (%)	Survival Rate 30 DAG (%)
Solanum torvum **× Pusa Shyamala**	78.625	66.575
Solanum torvum **× Pusa Hybrid-6**	81.850	67.350
Solanum xanthocarpum **× Pusa Shyamala**	40.025	30.025
Solanum xanthocarpum **× Pusa Hybrid-6**	39.875	30.150
Solanum khasianum **× Pusa Shyamala**	61.125	40.300
Solanum khasianum **× Pusa Hybrid-6**	59.375	39.225
Solanum surathense **× Pusa Shyamala**	52.825	53.500
Solanum surathense **× Pusa Hybrid-6**	51.900	49.675
C.D.	4.027	4.534
SE(m)	1.372	1.544
SE(d)	1.940	2.184
C.V.	4.713	6.557

DAG- Days after grafting, %- Percentage

Table.3 Effect of different wild *Solanum* species on percent bacterial wilt infection of Grafted plants

Grafting combinations	Bacterial wilt infection (%)	Grading
Solanum torvum **× Pusa Shyamala**	12.225	R
Solanum torvum **× Pusa Hybrid-6**	13.475	R
Solanum xanthocarpum **× Pusa Shyamala**	45.500	S
Solanum xanthocarpum **× Pusa Hybrid-6**	48.175	S
Solanum khasianum **× Pusa Shyamala**	29.600	MR
Solanum khasianum **× Pusa Hybrid-6**	31.475	MR
Solanum surathense **× Pusa Shyamala**	58.525	S
Solanum surathense **× Pusa Hybrid-6**	55.300	S
Control plants	71.350	S
C.D.	2.361	
SE(m)	0.809	
SE(d)	1.145	
C.V.	3.985	

R- Resistance, S- Susceptibility, MR- Moderately resistance, %- Percentage

Experiment-3: Evaluation of grafted plants against bacterial wilt

It is evident from results 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. The Highest infection was observed in non-grafted plants (90.9%) followed by Pusa Shyamala grafted with *Solanum surathense* (58.52%). The plants grafted with *solanum torvum* showed resistance reaction followed by moderate resistance reaction observed in plants grafted with *Solanum khasianum* against bacterial wilt infection. The similar results of *solanum torvum* as resistant rootstock against bacterial wilt was observed by Ali (1993); (Rahman *et al.,* 2002).The maximum resistance against bacterial wilt was observed in *Solanum torvum* followed by *Solanum Khasianum*. Superiority of *Solanum torvum* rootstock against bacterial wilt infestation caused by *Ralstonia solanacearum* may be observed inline of the work concluded by Aribaud *et al.,* (2014) who observed, an increased cell wall mono amine oxidase activity in *Solanum torvum* after *Ralstonia solanacearum* inoculation (Table 3).

Among all rootstocks used ingrafting, *Solanum torvum* was found best rootstock followed by *Solanum khasianum*and promising for resistance towards bacterial wilt. Whereas *Solanum surathense* and *Solanum xanthocarpum* showed maximum susceptible reaction against bacterial wilt infection among all grafted plants. The non-grafted control plants showed highly susceptible compare to grafted ones. The results recommended that eggplant could be grafted on *Solanum torvum* and *Solanum khasianum* for graft compatibility controlling bacterial wilt. However, Further refinement of the technology is require particularly in respect of age of rootstocks and scion seedlings and the management of grafted seedlings immediately after grafting.

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