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Grafting Compatibility of Cultivated Eggplant Varieties with Wild *Solanum* Species

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Abstract: Resistant rootstock of six *Solanum* species and 21 cultivated eggplant varieties were identified against bacterial wilt and the graft compatibility of eggplant varieties was studied with wild *Solanum* rootstocks. *Solanum torvum* and *Solanum sisymbriifolium* showed resistance against bacterial wilt. Most of the cultivated varieties showed susceptibility against bacterial wilt. Three cultivated eggplant varieties viz. sufala, singnath and uttara were grafted on *Solanum torvum* and *Solanum sisymbriifolium*. The highest grafting success was 95% in case of *Solanum torvum* x sufala and the lowest 85% in *Solanum sisymbriifolium* x singnath. The success of grafting was not affected significantly due to the effect of scion and rootstocks. The grafted plants showed resistance against the disease while the scion plants showed susceptibility in the sick beds. The grafted plants also showed resistance reaction against the disease in the field conditions. The fruit maturity was delayed due to grafting but grafting at least 15 days prolonged the harvesting period. The grafted plants also out yielded the scion plants. The grafting combination *Solanum torvum* x sufala gave the highest yield compared with other grafting combinations and non-grafted plants.

Key words: Grafting, compatibility, wild *Solanum* and eggplant, sufala, singnath, uttara

Introduction

Eggplant (*Solanum melongena* L.) is the most important and widely consumed vegetable in Bangladesh. The annual production of eggplant is about 168000 tons (Anonymous, 2000). An early crop of eggplant is very profitable for the farmers in Bangladesh but the early crop is particularly vulnerable to bacterial wilt. It is the most destructive bacterial plant pathogen especially in the warm regions (Hildebrandt, 1950). A report from India reveals that bacterial wilt can cause 27% loss in eggplant (Reddy, 1986). The main effort to control this disease has been directed towards the development of resistant cultivars (Obraro, 1969). But available information suggests that very few of the cultivars are resistant to this disease. Information from home and abroad indicated that grafting of eggplant with wild *Solanum* sp. to the causal organism resistant rootstock is an effective technique to control the bacterial wilt. A number of wild species of *Solanum* were recorded as resistant to the disease. These species were reported as graft compatible to cultivated eggplant varieties (Mochizuki and Yamakawa, 1979a; 1979b; Ali *et al.*, 1990ab; 1992 and Shethy and Reddy, 1985). Recent reports from Bangladesh indicated that grafting of eggplant on resistant rootstocks like wild *Solanum* is an effective technique to control bacterial wilt (Ali *et al.*, 1994). Therefore, the present investigation was undertaken to evaluate the graft compatibility of cultivated eggplant varieties with wild *Solanum* species resistant to bacterial wilt both under artificial inoculation and field conditions and also to find the yield performance of grafted and non-grafted eggplant varieties in the field.

Materials and Methods

Three experiments were carried out at the Bangladesh Agricultural Research Institute (BARI), Joydebpur, during August, 1998 to May 1999 to evaluate the resistance of grafted plants against bacterial wilt and yield performance under field conditions.

Experiment 1:

Screening of wild *Solanum* spp. and cultivated eggplant varieties against bacterial wilt (*Ralstonia solanacearum*): Five wild *Solanum* species and twenty one cultivated eggplant varieties were screened against bacterial wilt (Table 1). Seeds of the *Solanum* species and the cultivated eggplants were sown in a nursery bed on 10th August 1998. Before sowing, the seeds were treated with GA_3 solution (100 ppm) for 24 hrs at room temperature for quick germination. Ten days after seed germination young seedlings were transferred to 9 cm (diameter) plastic pots containing sterilized soil mixed with 50% organic matter (v/v). The experiment was conducted in the glass house of BARI, Joydebpur. Pure culture of *Ralstonia solanacearum* was prepared on TZC (tetrazolium chloride) medium by isolating the organism from the eggplant showing typical symptoms of bacterial wilt. The identification of the isolate was confirmed by Cock's Postulate. Root dipping method was followed for inoculation. Five weeks old seedlings were uprooted and cut one-fourth root by sterilized scissors. Then the roots of each seedling were dipped in bacterial suspension for five minutes and were replanted in the same pots. The plants were arranged in the glass house following completely randomized design with three replications and ten plants were inoculated in each replication. The population of *R. solanacearum* from soil was detected in MS medium by soil dilution method. Plant to plant and line to line distance were maintained 25 and 30 cm, respectively. Data on wilting was recorded at 15 days interval. Final data on wilting was converted into percent wilt and reaction of the genotypes was graded following the scale furnished below (Anonymous, 1974).

Highly resistant (HR) = No wilting
Resistant (R) = 0-20% wilting
Moderately resistant (MR)= 20-40%wilting
Moderately susceptible (MS)= 40-60%wilting
Susceptible (S) = 60 to 80% wilting
Highly susceptible (HS)= 80-100% wilting

Experiment 2:

Graft compatibility of eggplant varieties on wild *Solanum* species: Experimental materials consisted of plants of *Solanum torvum* and *Solanum sisymbriifolium* as rootstocks and sufala, singnath and uttara varieties were the scion. Seeds of the two wild *Solanum* species were sown in plastic tray containing sandy soil on 1st August, 1999. Ten days after germination seedlings were transferred to 9 cm dia. plastic pots containing soil and well decomposed compost in equal proportion. Seeds of the eggplant varieties were sown in plastic tray containing sandy soil and well decomposed on 10th August, 1999. Seedlings were transferred to 9 cm dia polybag 10 days after germination. All care were taken for proper growth of the seedling. Rootstock seedlings (40-50 days old) (3- 4 leaf stage) and seedlings of eggplant varieties at 3-4 leaf stage were grafted. Grafting was done following the steps laid down by Ali *et al.* (1994).

Experiment 3:

Reaction of grafted plants planted in sickbed: Grafted plants were transplanted in sick beds previously infected by bacterial wilt pathogens. The sick plots were developed by adding bacterial suspension in soil. The population of *R. solanacearum* from soil was detected in MS medium by soil dilution method. The population of the pathogen was 1.2 x 10^6 cfu/g soil before transplanting. Planting was done following a randomized complete block design with three replications. Ten plants were accommodated in a unit plot and the plants were spaced at 30 x 20 cm. Transplanting was done on 10th September, 1999. Data on wilting were recorded at seven days interval. Final data on wilting were converted into percent wilt and reaction of the lines were graded following the scale of Anonymous (1974).

Experiment 4:

Yield performance of the grafted plants in field conditions: The grafted plants were transplanted in field on 10th September, 1999. The experiment was laid out in randomized complete block design with three replications. Twelve plants were planted per replication on a 1m wide bed at a spacing of 70 cm. The fruit yield per hactre was calculated from per plant yield and also recorded percent of bacterial wilt infected plants. Manures and fertilizers were applied at the rate of cow dung 15 tons, urea 250 kg, TSP 175 kg and MP 150 kg ha^{-1}. The entire cow dung, TSP and half of the MP were applied during final land preparation while the entire urea and half of MP were applied at three equal installments as top-dressing. First and second top dressing were done 15 and 30 days after transplanting respectively and the third dose after first harvest of the fruits. Data in respect of mortality of plants and fruit yield were recorded daily and analyzed statistically for interpretation.

Results and Discussion

Experiment 1: It was revealed from the results (Table 1) that most of the eggplant varieties/genotypes showed susceptible reaction against bacterial wilt. However, one line BL 081 showed resistant reaction while the genotype BL099 showed moderately resistant reactions. Six genotypes BL117, ISD011, ISD001, BLS18, BLS2 and Tarapuri were found moderately susceptible to bacterial wilt. All other varieties/genotypes showed susceptible to highly susceptible reactions. It was revealed that all the wild *Solanum* species had low wilt incidence. *S. sisymbriifolium, S. torvum* and *S. integrifolium* showed resistant reaction. *Solanum indicum* and *S. khasianum* showed moderately resistant while *S. sanitwongsci* showed medium susceptible reaction. Shetty and Reddy (1985) and Ali *et al.* (1990 a, b) reported that *S. sisymbriifolium* and *S. torvum* are the effective root stocks to control bacterial wilt. Mochizuki *et al.* (1979b) reported that *S. torvum* showed potential for use as eggplant root stock because of high resistance to bacterial wilt and good fruit yield of the scion.

Experiment 2: In the graft compatibility study, maximum (95.71%) success in grafting was obtained. The variety 'sufala' was more grafts compatible with *S. torvum* than the other eggplant varieties. It had 95.71% grafting success which was followed by sufala x *S. sisymbriifolium* (94.29%). Grafting success was the lowest in singnath x *S. sisymbriifolium* (88.51%). Uttara had grafting success of 92.24% and 90.08% respectively with *S. sisymbriifolium* and *S. torvum*. Ali (1992) observed 70-95% success in grafting eggplant varieties with non-tuberous wild *Solanum* which was similar with the results of the present study. There was no interaction between the rootstock species and the eggplant varieties. There was no significant difference in grafting success among the six graft combinations (Table 2).

Experiment 3: In the sick plot all the grafted plants showed highly resistant to bacterial wilt with no mortality. There was 100% mortality of sufala, singnath (66.67%) and uttara (44.44%) were found highly susceptible and moderately susceptible, respectively (Table 3). Mochizuki *et al.* (1979b) reported *S. torvum* as highly resistant to bacterial wilt showing potential for use as rootstock. He also obtained good fruit yield scion varieties grafted on *S. torvum.*

Table 1: Reaction of wild *Solanum* and cultivated eggplant varieties/genotypes against bacterial wilt

Treatments	Wilt (%)	Disease reaction
BL 072	84.00	HS
BL 039	88.67	HS
BL 034	76.00	S
Singnath	80.56	HS
Islampuri	65.33	S
BL 032	69.33	S
BL 117	49.33	MS
ISD 011	57.33	MS
ISD 001	58.00	MS
Uttara	62.67	S
Sufala	100.00	HS
BL S18	44.00	MS
BL 009	94.00	HS
BL S2	50.00	MS
BL 099	28.67	MR
Suktara	71.33	S
Tarapuri	44.44	MS
Bl S4	63.33	S
Katbirali	89.56	HS
BL 081	19.44	R
BL 118	88.89	HS
S. sisymbriifolium	0.00	R
S. torvum	0.00	R
S. integrifolium	0.00	R
S. indicum	38.00	MR
S. khasianum	28.00	MR
S. sanitwongsci	56.00	MS

Highly resistant= HR Moderately resistant= MR
Moderately susceptible = MS Highly susceptible = HS

Table 2: Grafting success of eggplant varieties with wild *Solanum* rootstocks

Eggplant varieties	*Solanum* rootstocks		Mean (%)
	S. torvum (%)	*S. sisymbriifolium* (%)	
Sufala	95.71	94.29	95.00
Singnath	90.51	88.51	89.51
Uttara	90.24	90.08	91.16
Mean	92.82	90.96	91.89

Table 3: Reaction of grafted and non-grafted rootstock in the bacterial wilt infection observed in the sick field (bed)

Treatments	Wilting (%)	Reaction
S. torvum x Singnath	0.00	HR
S. torvum x Sufala	0.00	HR
S. torvum x Uttara	0.00	HR
S. sisymbriifolium x Singnath	0.00	HR
S. sisymbriifolium x Sufala	0.00	HR
S. sisymbriifolium x Uttara	0.00	HR
Singnath (non-grafted)	66.67	HS
Sufala (non-grafted)	100.00	HS
Uttara (non-grafted)	44.44	MS

R: Resistant MR: Moderately resistant HR: Highly resistant
S: Susceptible MH: Highly susceptible HS: Highly susceptible

Experiment 4: Plants of all eggplant varieties, grafted and non-grafted started flowering within 56-73 days after seed sowing (Table 4). It was generally observed that non-grafted plants bloomed earlier than grafted ones. Flowering was late in singnath grafted with *S. torvum* and *S. sisymbriifolium* which was followed by sufala and uttara when grafted with wild *Solanum*. Uttara grafted on *S. torvum* and *S. sisymbriifolium* bloomed earlier than sufala and singnath grafted on *S. torvum* and *S. sisymbriifolium*. The earliest an thesis was observed in non-grafted uttara,

Table 4: Yield potentiality of eggplant varieties when grafted on different *Solanum* rootstocks

Treatments	First flower opening	Harvestable maturity (day)	No. of fruits/plant	Fruit yield/plant (Kg)	Fruit yield ton ha^{-1}	Duration of harvest	% of BW infected plants
S. torvum x Singnath	73.0 a	90.00 a	38.67 cd	3.8 a	34.69 abc	136.0 bc	Nil
S. sisymbriifolium x Singnath	68.67 b	91.00 a	38.0 d	3.7 a	31.99 c	134.0 bc	Nil
S. torvum x Sufala	69.0 b	86.33 b	56.67 a	4.2 a	36.05 a	146.7 a	Nil
S. sisymbriifolium x Sufala	67.0 bc	84.00 b	53.67 a	3.8 a	35.63 abc	137.7 b	Nil
S. torvum x Uttara	67.67 bc	79.67 c	53.67 a	4.0 a	33.56 ab	137.7 b	Nil
S. sisymbriifolium x Uttara	64.67 cd	78.00 c	48.33 b	3.7 a	33.01 bc	135.3 bc	Nil
Singnath	63.0 d	74.00 d	28.67 e	2.30 d	14.93 e	124.3 d	54.67
Sufala	61.33 d	74.00 d	41.33 cd	2.57 b	14.54 e	128.7 cd	66.67
Uttara	56.0 e	65.00 e	41.67 c	2.77 b	21.82 d	124.3 d	26.74
CV(%)	3.24	2.11	4.22	8.24	5.14	3.08	

In a column, means having a common letters do not differ significantly at 5% level of significance.

sufala and singnath which was statistically identical. The delayed flowering in grafted plants may be due to the growth of the scion plants that was interrupted or slowed down for a week nearly due to grafting. Similar trends of delayed flowering in grafted plants were also reported by Matsuzoe *et al.* (1990). Among the scion varieties studies, uttara required 65 days after seed sowing to attain harvestable fruit maturity which was significantly earlier than those of other varieties. In grafted plants delayed flowering, fruit set and fruit maturity were common phenomenon due to grafting shock of the scion. Similar results were reported by Matsuzoe *et al.* (1990). Among the scion varieties studied, number of fruits per plant were statistically significant. Significantly higher number of fruits were recorded in grafted plants. Among the grafted plants on different root stocks, the highest number of fruits per plant was (57) obtained in *S. torvum* x sufala followed by *S. torvum* x uttara (54) and *S. sisymbriifolium* x sufala (53), *S. torvum* x singnath (39) and *S. sisymbriifolium* x singnath (38). Among the scion varieties studied, uttara was the highest yielder (2.77 kg/plant) followed by sufala (2.57 kg/plant) and singnath (2.30 kg/plant) (Table 4). Grafting eggplant on *Solanum* rootstock significantly increased the fruit yield per plant. Sufala grafted on *S. torvum* gave the highest yield (4.2 kg/plant) followed by uttara grafted on *S. torvum* (4.0 kg/plant), Sufala grafted on *S. sisymbriifolium* (3.8 kg/plant), Singnath grafted on *S. torvum* (3.8 kg/plant), singnath grafted on *S. sisymbriifolium* (3.7 kg/plant) and uttara grafted on *S. sisymbriifolium* (3.7 kg/plant) and they were statistically identical in this respect. Matsuzoe *et al.* (1990) and Ali (1993) also reported higher fruit yields in eggplant when grafted on *Solanum* rootstock. It was revealed from the results (Table 4) that the duration of fruit harvest was significantly longer in grafted plants than those of non-grafted plants. The highest duration of harvest was recorded in Sufala when grafted on *S. torvum* which was significantly longer compared with those of all other grafted and non-grafted treatments.

The field reaction of grafted and non-grafted plants against bacterial wilt is also presented in Table 4. It was revealed from the results that grafted plants showed complete resistance against bacterial wilt. Whereas the non-grafted plants showed vulnerability against this disease at different levels. The highest wilting percentage was recorded in the variety sufala (66.67) followed by singnath (54.67) and uttara (26.74). Ali (1993) also reported the similar results.

From the results it is recommended that eggplant could be grafted on *Solanum torvum* and *Solanum sisymbriifolium* for controlling bacterial wilt and for higher yield. However, further refinement of the technology is required particularly in respect of age of rootstocks and scion seedlings for grafting and the management of grafted seedlings immediately after grafting.

References

Ali, M., H. Okubo and K. Fujieda, 1990a. Production and characterization of solanum amphidiploid and their resistance to wilt. Sci. Hort., 181-196.

Ali, M., M.A. Quadir, H. Okuba and K. Fujieda, 1990b. Resistance of eggplant, its wild relatives and their hybrids to different strains of *Pseudomonas solanacearum*. Scientia Hort., 45:1-9.

Ali, M., N. Matsuzoe, H. Okubo and K. Fujieda, 1992. Resistance of non-tuberous *solanum* to root knot nematode. J. Japan Soc. Hort. Sci., 60: 921-926.

Ali, M., M.Z. Alam and M.A.M. Akanda, 1994. Grafting: A technique of control soil-borne diseases of tomato and eggplant. IPSA-JICA Pub. No. 4. Institute of Post Graduate Studies in Agriculture (IPSA), Gazipur-1703. Bangladesh, pp: 10.

Anonymous, 1974. Annual Report. Asian Vegetable Research and Development Centre (AVRDC), pp: 57-59.

Anonymous, 2000. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, pp: 178.

Hildebrandt, A.C., 1950. Some important galls and wilts of plants and the inciting bacteria, Bio. Rev., 14: 259-272.

Matsuzoe, N., M. Al., H. Okubo, K. Fujieda, 1990. Growth behavior of tomato plants grafted on wild relatives of *Solanum melongena*. J. Japan Soc. Hort. Sci., 59 : 358-359.

Mochizuki, H. and K. Yamakawa, 1979a. Resistance of selected eggplant cultivars and related wild *Solanum* species to bacterial wilt *(Pseudomonas solanacearum)*. Bull. Veg. Ornam Crop. Res. Stn. Ser., A No., 6: 1-1.

Mochizuki, H. and K. Yamakawa, 1979b. Potential utilization of bacterial wilt resistant *Solanum* species as rootstocks for eggplant production. Bull. Veg. Ornam. Crop. Res. Stn. Ser., A. 6:1-10.

Obraro, F.P., 1969. Grafting tomatoes to control tomato bacterial wilt. Hawii Fm. Su.,18: 1-4.

Reddy, P.P., 1986. Analysis of crop losses in certain vegetables due to *Meloidogyne incognita*. Int. Nematol. Net. Newslett., 3: 3-5.

Shetty, K.D. and P.P. Reddy, 1985. Resistance in *Solanum* species to root- knot nematode (*Meloidogyne incognita*). Indian J. Nematol., 15: 230.