

GRAFT COMPATIBILITY, WILT RESISTANCE AND GRAFT INDUCED CHANGES ON *SOLANUM MELONGENA* BY TWO WILD SPECIES, *S. TORVUM* AND *S. INDICUM*

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ABSTRACT

Two wild species, *Solanum torvum* and *S. indicum* have been reported to be resistant to bacterial wilt caused by *Pseudomonas solanacearum*. The possible use of these species as resistant root stocks in grafting to overcome bacterial wilt in *S. melongena*, cultivar SM164, was investigated.

The wild species were found to be graft compatible with *S. melongena* and gave highest plant survival when 90 and 75 day old scions were grafted on to 90 and 75 day old root stocks respectively. The union was determined to be perfect when the top grafting method was adopted. The resistance possessed by the wild species was resolved to be insufficient to warrant their use as resistant root stocks. Under certain environmental conditions, it was observed that the thorny calyx rarely encountered in SM164 was accentuated by grafting on to the wild root stocks.

INTRODUCTION

Decline in the cultivation of the eggplant, *Solanum melongena*, specially in the mid country wet zone could largely be attributed to substantial crop losses caused by bacterial wilt. The popular local variety, SM164, once reported to be a resistant cultivar (Winstead and Kelman, 1960; Daily, 1970) is now fast succumbing to this disease. It is becoming imperative that a resistant cultivar should be found if the cultivation of this crop is to be promoted. Several introduced varieties with good marketable qualities have been tested but were proved to be highly susceptible. This absence of resistance in cultivated species hinders the development of resistant varieties through hybridization.

Udugama and Seneviratne (1983) reported that two wild species, *S. torvum* and *S. indicum* exhibit wilt resistance. While initiation of a breeding programme to transfer the resistant gene from these wild species to *S. melongena* offers a long term solution to this problem, an attempt was made to use graft technology as an interim measure to help circumvent the occurrence of bacterial wilt in *S. melongena*.

MATERIALS AND METHODS

Studies were conducted during two consecutive years, 1984 and 1985, at Central Agricultural Research Institute greenhouses and fields in Gannoruwa. Variety SM164 was used as the scion and the wild species as root stocks in all instances.

In yala 1984 only *S. torvum* was tested as the root stock and two methods of grafting were employed, namely, side and top grafting. Nine age combinations of scion and stock were utilized as listed in Table 1. Each treatment consisted of 20 plants replicated thrice. Ungrafted SM164 was used as the control.

Seedlings of both the root stock and scion were raised in polythene bags under greenhouse conditions. Root stocks for top grafting were prepared by excising the apical portion with a sharp budding knife and slitting the stem vertically to a depth of 1.5 cm from the base of the cut. Diagonal cuts were made on the stems for the purpose of side grafting. Scions were cut 3—5 cm and trimmed to a wedge. Grafts were prepared by inserting the wedge into the slits in the root stock and binding with polythene strips. These preparations were kept in shaded conditions under greenhouse benches for three weeks after which the binding polythene strips were discarded and the plants exposed to normal greenhouse conditions. Percent plant survival was recorded at this stage and again three weeks later prior to planting in the field in soil known to be heavily infested with *Pseudomonas solanacearum*.

Field observations on wilt incidence were taken periodically and the confirmatory test was performed on both stocks and scions of all plants succumbing to wilt. The stocks and scions were cut at the base and dipped in distilled water contained in test tubes. Infection was confirmed in cuttings emitting the milky white bacterial ooze (Kelman, 1953).

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Based on the results obtained in the foregoing study, trials were conducted in maha 1984/85 and yala 1985 including both wild species as root stocks and employing the top grafting technique. Both the root stocks and the scions used in these studies were 75 days of age, and ungrafted SM164, *S. torvum* and *S. indicum* were used as controls. The randomized complete block design with three replicates was adopted as the experimental procedure.

RESULTS AND DISCUSSION

Graft compatibility

Percent plant survival of the nine age combinations of stock and scion using two methods of grafting in the yala 1984 season are presented in Table 1. Survival rate varied greatly depending on the age of the root stock as well as the scion and also the method of grafting.

Table 1. Effect of different age combinations of stock and scion and the method of grafting on percent plant survival at six weeks after grafting (yala 1984).

<i>Graft age combinations</i> <i>R-root stock S-scion</i>	<i>Percent plant survival</i>	
	<i>Side grafting</i>	<i>Top grafting</i>
R ₃₀ S ₃₅	83.3	33.3
R ₆₀ S ₅₀	75.0	41.7
R ₈₀ S ₈₀	53.3	30.0
R ₇₅ S ₃₅	16.6	8.0
R ₇₅ S ₈₀	83.3	66.6
R ₇₅ S ₇₅	91.6	91.6
R ₉₀ S ₃₅	100.0	50.0
R ₉₀ S ₈₀	83.3	91.6
R ₉₀ S ₉₀	91.6	100.0
LSD (0.05)	39.73	
CV	27.13%	

Treatments R₉₀S₉₀ (90 days old root stock and 90 days old scion) and R₇₅S₇₅ gave over 90% survival with both grafting procedures. Treatment differences were statistically insignificant. However, the R₇₅S₇₅ combination would obviously be preferable since it is less time consuming and hence more economical than R₉₀S₉₀.

A consistent reduction was observed in all replicates of the $R_{76}S_{36}$ graft. Yet, $R_{90}S_{36}$ and $R_{100}S_{36}$ did not show similar trends although the age disparity between the stock and scion is found in these treatments also. In all instances where the 35 days old scions were used, side grafting gave 100% or greater survival than the top grafted complement. This superior performance of the side grafting method in these instances may be due to the provision of a favourable microenvironment to the tender, susceptible scion by the leaves of the stock until the union was complete.

Surviving plants showed no abnormalities at the point of graft union. After field planting, the growth of the grafted plants were normal, the scion continuing to grow producing normal internodes and leaves, and flowering at the same time as the control.

On comparing the two grafting methods, data obtained from greenhouse observations show that overall, side grafting was superior to top grafting giving 75 % and 56 % plant survival respectively. However, under field conditions, at the pod-bearing stage, 40 % of the side grafted plants toppled at the bud union due to wind damage. The top grafted plants on the other hand continued normally until crop termination, suggestive of inadequate interlocking of stock and scion when the side grafting procedure was practised. Results of the maha 1984/85 studies with *S. indicum* species using R_{76} S_{76} and the top grafting method gave 75—80 % plant survival confirming the suitability of the top grafting method. Again, no breakage was observed at or after the pod bearing stage.

The ability of two plants on grafting together to successfully unite and develop into a composite plant is termed compatibility. Callus production in the cambial region of both stock and scion with subsequent proliferation and interlocking to establish a strong connection would be an expected characteristic of such a compatible combination (Fuji and Nito, 1972). These results therefore indicate that the wild species *S. indicum* and *S. torvum* are graft compatible with *S. melongena*, provided the suitable age classes and grafting procedure are employed.

Wilt resistance

Observations made on percent wilt incidence in *S. melongena* using *S. torvum* as the root stock in yala 1984 are presented in table 2. Wilting

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symptoms first appeared 26 days after planting and the infection spread fast. Sixty days after planting, more than 75% of grafted plants became diseased and died. By the 72nd day, the disease percentage increased upto 83.9 for the grafted plants and 75.1 for the control SM164 plants.

Table 2. Percent wilting in grafted and non-grafted plants of *S. melongena* (yala 1984).

Treatments	Number of days after planting									Cumulative No. of plants
	26	33	39	41	42	47	53	61	72	
Grafted plants										
(SM164 on <i>S. torvum</i>)	5.5	7.5	20.9	4.0	4.2	13.9	4.2	20.9	2.8	83.9
Control										
(SM164 non grafts)	0	12.5	12.5	8.3	4.1	8.3	16.6	8.3	4.5	75.1

The data obtained in the maha 1984/85 trials indicated that all treatments including the three controls were affected by bacterial wilt and were not statistically different from each other (Table 3). Highest number of plants infected was in the *S. torvum* non grafts (Arcsine transformed value of 58.5%), while the *S. indicum* non grafts were the least affected (Arcsine value of 17.6%). However, the number of wilted plants in *S. indicum* varied greatly among the replicates (3—36%). This indicates that although the species *S. indicum* gave a mean value of 17.6 mortality, it does not possess an appreciable amount of resistance. When SM164 was grafted on to *S. indicum*, percentage of wilt incidence rose upto 50 and appeared in both the stock and scion. This evidence validates that this species is susceptible to bacterial wilt.

Table 3. Arcsine values for percent wilt incidence in *S. melongena* (SM164), two wild spp. *S. torvum* and *S. indicum* and in grafts using SM164 as the scion (maha 1984/85).

Treatments	Arcsine values for percent wiltling (mean values)
SM164 on <i>S. torvum</i>	48.6
SM164 on <i>S. indicum</i>	55.5
<i>S. indicum</i> non grafts (control)	17.6
<i>S. torvum</i> non grafts (control)	58.5
SM164 non grafts (control)	35.8
Treatments	NS
CV	38%

The high percentage of wilt affected grafted plants in these studies indicates that the two wild species do not possess adequate level of resistance to warrant their use as resistant root stocks and hence cannot be used to overcome bacterial wilt in *S. melongena*.

Graft induced changes

The presence of thorns on the calyx of *S. melongena*, variety SM164, is a rare character and is absent in *S. torvum* and *S. indicum*. If at all thorns are present on calyx of SM164 they are weakly exhibited. While thorns on the stem, leaves and petioles are absent in SM164 it is a character present in both the wild species.

The phenotypic change from smooth calyx to spiny calyx was observed in the grafted scion, namely SM164. The spines were noticeably large in size, thickness and number. The spiny calyx conditions was only seen during the yala seasons of 1984 and 1985 where 37—40 % of grafted plants showed this character. However, in maha 1984/85, this phenotypic change did not occur at all.

Induction of character changes due to grafting is an interesting feature and has been reported by Friedlander *et al* (1977), Hirata (1980), Murfet and Reid (1973), Ohta and Pan Van Chuong (1975), Sinoto (1955) and Thompson and Axlell (1978), some of which were found to be hereditary. The occurrence of graft transmissible substances have been described by Friedlander *et al* (1977) and Murfet and Reid (1973). The thorny condition observed in this study may be attributed to the formation of such a graft transmissible substance which in turn is induced by environmental factors.

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