Importance of Rootstock and Scion Tomato Mosaic Virus Resistance for Grafting Heirloom Tomatoes

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During the 2011-2012 tomato production season at a Florida organic farm, heirloom tomato scions grafted onto Tomato yellow leaf curl virus (TYLCV)-resistant tomato rootstocks were observed to undergo a rapid and severe wilt, and ultimately died. The soilborne fungus, Sclerotium rolfsii, was isolated from one plant, but no additional fungi or bacteria were isolated from any of the other wilted plants occurring in two of three grafted varieties. Tomato mosaic virus (ToMV) was detected in many plants, in both research plots and commercial production areas.

These on-farm trials were conducted to evaluate heirloom tomatoes used as scions grafted to the commercial cultivar 'Tygress' (T) and to the small-fruited tomato variety 'Matt's Wild Cherry.' These varieties were selected as experimental rootstocks due to their reported resistance to TYLCV. Heirloom tomato variety scions evaluated were ‘Purple Calabash,’ ‘Black Prince’ (BP), and ‘Moskvich.’ These heirloom varieties are highly susceptible to TYLCV and early-season infection with this virus can completely eliminate crop yields. All three heirloom varieties were grafted onto each of the rootstocks. Only BP grafted onto T wilted in the field study.

In an early grafting experiment, Pilowsky (1971) reported that plant necrosis resulted from ToMV infection when rootstock and scion did not have the same tobamovirus resistance genes. During the 1970s, this was widely reported in the Japanese literature (Yamakawa 1978, Muramatsu et al, 1979). The phenomenon has not been of significant concern in grafting standard, most open-field US commercial tomato varieties, if not all, are highly resistant hybrids, being homozygous resistant (Tm-2a/Tm-2a). The problem has arisen when ToMV-resistant rootstocks (Tm-2/Tm-2 and Tm-2a/Tm-2a) are grafted with susceptible (Tm-1 or tm) scions.

A series of greenhouse experiments were conducted to test the hypothesis that wilt occurs as a result of virus infection of grafted plants in which rootstocks and scions contain different genes for ToMV resistance. BP and T were reciprocally grafted using each variety as both the scion and the rootstock, and were inoculated with ToMV. Control plants were mock inoculated and produced no symptoms. Plants that were grafted with T as the scion and BP as the rootstock (T/BP) developed a foliar mosaic, whereas BP/T plants wilted within one week of inoculation. Non-grafted T plants exhibited no symptoms, while BP non-grafted and BP/BP exhibited mosaic. Plants were sampled and tested for ToMV by ELISA at the root, the stem below the graft, the stem above the graft, the middle of the plant, and at 15 and 5cm from the apex. Sample location was not significant (p=0.735) and there was no interaction between treatment (graft
combination) and sample location. The greatest ELISA absorbance was recorded in the non-grafted BP and BP/BP, followed by T/BP and non-grafted T. Grafting BP onto Cheong Gang (CG), a TYLCV-resistant hybrid rootstock, resulted in the same wilt observed when grafting BP/T. Allele-specific primers (Shi et al 2011) amplified homozygous Tm-2 ToMV resistance genes to ToMV strains in T and CG; no ToMV resistance genes were amplified for any of the heirloom tomatoes tested.

As grafting becomes more commonly used in the US, particularly for the niche market of heirloom tomatoes, it will become increasingly important for information on ToMV resistance to be developed and made available to transplant producers.


Pilowsky, M. 1971. Grafting studies with Tm-2a stock. TGC Report No.21: 36
