

Pest Resistance Derived from *S. pimpinellifolium* Accession TO-937

Juan M. Alba¹, María J. Rodríguez-López¹, María Salinas², Juan Capel², Rafael Lozano², Jesús Cuartero¹, and Rafael Fernández-Muñoz^{1*}

¹ Departamento de Mejora Vegetal, Estación Experimental La Mayora – CSIC, E-29750 Algarrobo-Costa, Málaga, Spain

² Departamento de Biología Aplicada – Genética, Universidad de Almería, Ctra. Sacramento s/n, E-04120 Almería, Spain

Pest resistance based on trichome secretions has been extensively studied in green-fruited wild tomato species such as *S. habrochaites*, *S. habrochaites* f. *glabratum*, and *S. pennellii*. In 2000 we reported TO-937 as an accession from *S. pimpinellifolium*, much closer to the cultivated tomato, that was highly resistant to the twospotted spider mite (*Tetranychus urticae* Koch). Based on evaluation of F₂ and BC₁ generations from an interspecific cross with susceptible *S. lycopersicum* cv. MoneyMaker, we showed in 2003 that resistance of TO-937 seemed to have a relatively simple control and that it was probably due to presence of type IV glandular trichomes. Herein we report our advances since then. One hundred and sixty four recombinant inbred lines (RIL) derived from the cross cv. MoneyMaker x TO-937 were obtained. Intermediate generations while obtaining the RILs were repeatedly evaluated for resistance by infestation in greenhouse and repellence thumbtack laboratory bioassays, which served for searching of linked markers. After a bulked segregant analysis in those intermediate generations, a few markers from chromosome 2 seemed to be associated with resistance. That was confirmed after obtaining the RILs, evaluating them in the greenhouse and the construction of a low-density molecular map. A single QTL for resistance to *T. urticae* was located in chromosome 2 long-arm in the proximity of *ovate* and *fw2.2* loci. We sought assistance from chemists who helped to know that TO-937 epicuticular secretions were rich in acylsugars, specifically acylsucroses. Segregation for spider mite resistance in the greenhouse, leaf trichomes densities, and acylsucrose contents was evaluated in the RIL population. Also, laboratory bioassays of mite mortality, repellence, and oviposition were performed in the population. Wide segregation was observed for all traits. Multiple regression analysis revealed that acylsucrose content was the most important variable to explain both greenhouse and laboratory resistance to *T. urticae*. Genetic correlations and high heritability values pointed to that successful selection for acylsucrose production / resistance was feasible. Recently we analyzed trichome exudates of parents and RILs by thin layer chromatography. Seven different bands were present on TLC plates of TO-937 nonpolar extracts and only one on those of cv. MoneyMaker. Multiple regression analysis of segregation in the RIL population showed that three of the TO-937 bands could statistically explain resistance to the spider mite and one of those bands explained alone 54% of variance of resistance. From the beginning of our studies with spider mite resistance, we aimed to obtain a resistant line nearly isogenic to cv. MoneyMaker. We started a recurrent backcross selection scheme by selecting for high type IV trichome density and acylsucrose production and currently we have already reached BC₆ lines with leaf type IV trichome densities and acylsucrose contents similar to those of the donor parent that at the same time recovered most of recurrent parent traits, particularly fruit size and shape. From segregation for type IV trichomes in

BC3, a couple of sister lines contrasting deeply for that trait were obtained. Together with the parents and the F1, the sister lines were studied for resistance to the whitefly *Bemisia tabaci* Genn. (biotype Q) in both free-choice and non-choice greenhouse experiments. Type IV trichome-bearing genotypes exhibited resistance to the whitefly in terms of reduced oviposition and egg hatching, almost impeded larval stages development, and moderate adult infestation. Interestingly, tomato yellow leaf curl disease natural incidence was reduced in TO-937 and the whitefly resistant BC3 line. Currently we are studying by controlled whitefly inoculations whether or not presence of *S. pimpinellifolium* type IV trichomes and associated resistance to *B. tabaci* in the advanced backcross resistant line result in reduced transmissibility of TYLCV. We also aim to combine this source of resistance with known genes for geminivirus resistance.