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Development of Transgenic Tomato Immunity to Pepino Mosaic Virus and Tomato Yellow Leaf Curl Virus by Gene Silencing Approach

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Abstract : Viral diseases of tomato crops result in heavy yield losses and may even jeopardize the production of these crops. Classical tomato breeding for disease resistance against Tomato yellow leaf curl virus (TYLCV), leads to partial resistance associated with a number of recessive genes. To author's best knowledge Pepino mosaic virus (PepMV) genetic resistance is not yet available. The generation of viral resistance by means of genetic engineering was reported and implemented for many crops, including tomato. Transgenic resistance against viruses is based, in most cases, on Post Transcriptional Gene Silencing (PTGS), an endogenous mechanism which destroys the virus genome. In this work, we developed immunity against PepMV and TYLCV in a tomato based on a PTGS mechanism. Tomato plants were transformed with a hairpin-construct-expressed transgene-derived double-strand-RNA (tr-dsRNA). In the case of PepMV, the binary construct harbored three consecutive fragments of the replicase gene from three different PepMV strains (Italian, Spanish and American), to provide resistance against a range of virus strains. In the case of TYLCV, the binary vector included three consecutive fragments of the IR, V2 and C2 viral genes constructed in a hairpin configuration. Selected transgenic lines (T0) showed a high accumulation of transgene siRNA of 21-24 bases, and T1 transgenic lines showed complete immunity to PepMV and TYLCV. Graft inoculation displayed immunity of the transgenic scion against PepMV and TYLCV. The study presents the engineering of resistance in tomato against two serious diseases, which will help in the production of high-quality tomato. However, unfortunately, these resistant plants have not been implemented due to public ignorance and opposition against breeding by genetic engineering.

Keywords : PepMV, PTGS, TYLCV, tr-dsRNA
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