Molecular determinants of the selective advantage of an invasive recombinant begomovirus in tomato plants carrying a Ty-1 resistance gene

Margaux Jammes, Victor Golyaev, Clémence Plissonneau, Cica Urbino, Michel Peterschmitt, Mikhaïl M Pooggin

MJ, VG, CU, MP, MMP : PHIM, Univ Montpellier, INRAE, CIRAD, INRD, Institut Agro, Montpellier, France;

CP : Gautier Semences, Eyragues, France

TYLCV-IS76 is a recombinant begomovirus (family Geminiviridae) between Tomato yellow leaf curl virus (TYLCV) and Tomato yellow leaf curl Sardinia virus. It was detected in 2010 in Southern Morocco, and subsequent large field surveys showed that it had replaced its parental viruses. The fact that TYLCV-IS76 was positively selected in tomato plants carrying the begomovirus resistance gene Ty-1, and the co-occurrence of its emergence with the replacement of susceptible tomato cultivars with Ty-1 resistant cultivars, both support a Ty-1 resistance-driven emergence of TYLCV-IS76. The virus-plant interactions that determine positive selection of begomovirus recombinants are thought to involve gene silencing, because the Ty-1 gene encodes a gamma-clade RNA-dependent RNA polymerase (RDRγ) implicated in biogenesis of viral small interfering RNAs (siRNAs) and methylation of viral DNA. To further investigate the mechanisms of RDRγ-mediated antiviral defence and defence evasion by TYLCV-IS76, we performed a comparative small RNA-ome and transcriptome profiling of Ty-1 resistant and control susceptible plants infected with TYLCV or TYLCV-IS76. We found that RDRγ strongly enhances production of 22 and 24 nt viral siRNAs from both TYLCV and IS76 recombinant. The TYLCV-IS76 recombination event enhances transcription of viral silencing suppressor and coat protein genes and triggers more potent antiviral silencing responses. Compared to TYLCV, TYLCV-IS76 better evades transcriptional silencing of viral genes promoted by RDRγ, which may explain why the recombinant virus outcompetes its parents in Ty-1 plants.

*****