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Some homologs of Verticillium dahliae effector Ave1 contribute to virulence in other plant pathogens

Verticillium dahliae is a fungal pathogen that causes vascular wilt in a broad range of host plants, including commercially important crops. The immune receptor Ve1, of which homologs are found in several host plants, confers resistance to *Verticillium* race 1 strains in tomato. Genome and RNA sequencing of *V. dahliae* race 1 and race 2 strains resulted in the identification the highly expressed race 1-specific *Ave1* gene that encodes the effector protein that is recognized by Ve1. Deletion of *V. dahliae Ave1* does not only result in loss of recognition on *Ve1* plants, but also makes the fungus less aggressive on tomato plants lacking *Ve1*. Homologs of *Ave1* were mainly found in plants, but also in the plant pathogens *Fusarium oxysporum, Cercospora beticola, Colletotrichum higginsianum* and *Xanthomonas axonopodis*. To determine whether these *Ave1* homologs can contribute to virulence, *V. dahliae Ave1* deletion mutants were complemented with the homologs of *F. oxysporum*, *C. beticola*, *C. higginsianum* and *X. axonopodis*, and tested for aggressiveness on tomato plants lacking *Ve1*. Remarkably, only homologs of *C. higginsianum* and *X. axonopodis* complemented virulence of *V. dahliae Ave1* deletion mutants. This suggests that there are different functions among the various Ave1 homologs. *Ave1* deletion mutants are generated in *F. oxysporum*, *C. beticola* and *C. higginsianum* to study their contribution to virulence in these pathogens.