SESSIE 3B

Homologues of Cladosporium fulvum effector proteins are present in species of Dothideomycetes, are recognized by cognate Cf tomato resistance proteins, and can be exploited in molecular resistance breeding

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Cladosporium fulvum is a non-obligate biotrophic fungus that belongs to the Dothideomycete class of fungi and causes leaf mould of tomato. During infection and colonization of its host, *C. fulvum* secretes effectors that function as virulence factors in the absence of cognate Cf resistance proteins and induce effector-triggered immunity in their presence. Till now, fungal effector proteins were assumed to be species specific and homologues of the C. *fulvum* effectors had never been found in other fungal species. Here we provide evidence for the first time for the existence of homologous *C. fulvum* effectors in species of Dothideomycetes that are pathogenic on distantly related monocot and dicot plant species. In particular, we have identified functional homologues of the *C. fulvum* Avr4 and/or Ecp2 effectors in *Mycosphaerella fijiensis,* causal agent of the devastating black Sigatoka disease of banana, *Cercospora beticola,* causing Cercospora leaf spot of sugar beet and other phylogenetically related fungal pathogens. We further demonstrate that *M. fijiensis* Avr4 is a functional orthologue of *C. fulvum* Avr4 that protects chitineous fungi against plant chitinases and, very importantly, triggers a Cf-4- and Hcr9-Avr4-mediated hypersensitive response (HR) in tomato. Three homologues of Ecp2 were identified in *M. fijiensis,* one of which induces an HR in a *Cf-Ecp2* tomato line. Collectively, our data suggest that Avr4 and Ecp2 represent core effectors with conserved domains that are recognized by single cognate Cf proteins. The presence of homologous effectors in fungal pathogens that are collectively recognized by

single Cf-like resistance proteins provides novel strategies for disease resistance breeding, by transferring such resistance proteins into distantly related plant species. This concept of exploiting Cf-like genes from *Solanaceous* species, for achieving broad spectrum resistance in mocot and dicot plant species attacked by Dothideomycete fungal pathogens that produce functional homologues of *C.fulvum* effectors is currently tested in our laboratory. As a first target we will generate banana transgenic for *Cf-4* and *Hcr9-Avr4s* that will be tested for resistance to the black Sigatoka fungus.