

Fighting on many fronts – effector-assisted breeding for multiple pathogens

Richard Oliver, Huyen Phan, Kar-Chun Tan, Kasia Rybak, Caroline Moffat, Pao Theen See & Simon Ellwood

Centre for Crop and Disease Management, Curtin University, Perth, Australia

The role of necrotrophic effectors in promoting virulence can be exploited as a way to select more resistant germplasm. Resistance to necrotrophic diseases was typically found to be partial, in contrast to the major gene resistance noted in some cases for biotrophic pathogens. This has meant that breeding for disease resistance is much more demanding and explains why necrotrophic pathogens have grown in importance whilst progress in controlling biotrophic diseases was often rapid (until the emergence of the next mutant pathogen race). However the identification and production of cloned and expressed effectors of necrotrophic pathogens allows breeders to select introgressions that are insensitive. Effectors from both *Parastagonospora nodorum* and *Pyrenophora tritici-repentis* have been expressed in microbial systems and used to identify germplasm that is insensitive to the effector. Thus, in the case of multi-effector systems like *P. tritici-repentis* and *P. nodorum*, selection of cultivars insensitive to each effector promises to assist breeders improve disease resistance in an incremental, step-wise fashion.

There are several complications to consider; Effectors are not present in all isolates of the pathogen present locally; effector genes vary in expression levels and activity; effectors interfere with recognition by other effectors. We argue that whilst these factors complicate the exploitation of effectors they do not compromise our ability to achieve sustained improvements in resistance to these necrotrophs.

I will also briefly mention the barley powdery mildew epidemic in Western Australia and steps taken to end it.