Wheat effector assisted breeding for resistance to fungal pathogens (WEAB)

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P27: Marc-Henri LEBRUN

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The discovery that fungal effector proteins are important for infection represents a novel opportunity for controlling plant diseases. Use of fungal effectors for resistance breeding is a game-changing technology creating opportunities and innovative methods to identify novel resistances to fungal diseases in plants. These methods are amenable to high throughput phenotyping. The recent availability of high-density genetic marker coverage of the wheat genome allows the mapping of novel resistances identified through such high throughput phenotyping. We are using necrotrophic protein effectors from Parastagonospora nodorum (Pn) and toxic proteins from Fusarium graminearum (Fg) and Zymoseptoria tritici (Zt) to detect resistance genes/QTLs in wheat. Complementary strategies will be used to detect a large array of resistance mechanisms to fungal effectors. Recombinant necrotrophic protein effectors and toxic proteins are produced in yeast and the purified proteins are delivered into wheat leaves by syringe infiltration. Symptom development is scored few days after infiltration. Screening of 220 elite French wheat cultivars with Pn ToxA, 1 and 3 has highlighted a large number of cultivars insensitive to the 3 necrotrophic effectors, and only a few cultivars that were sensitive to all three effectors, suggesting that previous breeding for field resistance to Pn (1960-1980) led to the accumulation of insensitivity alleles. To validate this hypothesis, we are currently pathotyping these wheat cultivars with a French Pn isolate producing Tox1 and 3. Mapping of loci controlling insensitivity to Pn necrotrophic effectors and resistance to Pn isolate will be performed using genome-wide association analyses. This project will facilitate plant breeding efforts to select for resistance to important fungal pathogens by providing a 'toolkit' of bio-molecular markers.