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**Research Area: GET**

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**Project Title: A Rapid Assay System for Transgenes that Confer Resistance to DON and FHB.**

### PROJECT 1 ABSTRACT

(1 Page Limit)

Transgenic genes have the potential to enhance resistance to Fusarium Head Blight (FHB) in wheat and barley. However, the construction of transgenic wheat and barley is very time consuming and the behavior of transgenes is not always predictable. We have developed a rapid and efficient assay system that can assess the effectiveness of transgenes against DON and FHB before their introduction into wheat and barley. The assay system is based on the recombinogenic plant *Physcomitrella patens*, whose genome can be readily manipulated in a manner similar to that of yeast. We have used this assay system to define a collection of genes involved in programmed cell death (PCD) and plant defense responses that affect DON sensitivity. Recently, we have shown that plant and yeast PCD genes confer resistance to both DON and FHB.

The specific goals of this project are:

1. Characterize additional PCD and defense genes for their efficacy against FHB in *Physcomitrella*. Genes of both the PCD pathway and the plant defense response will be functionally assayed against activity FHB. This project component will be carried out by the Lawton lab.
2. Assay novel wheat L3 point mutants for their ability to confer resistance to DON and FHB in *Physcomitrella*. These mutants are effective against mycotoxins in yeast. Their assay in *Physcomitrella* will help select the best performing genes for introduction into transgenic wheat plants. This project component will be carried out by the Lawton lab together with the lab of Nilgun Tumer (Rutgers).
3. Use FHB-VIGS to characterize the efficacy of PCD and defense genes against FHB in wheat. We have demonstrated the efficacy of several plant PCD genes against DON and (in some cases) FHB in *Physcomitrella*. FHB-VIGS assays in wheat will show whether these genes also contribute to FHB resistance in wheat; they will also help assess the validity of the *Physcomitrella* rapid gene assay. This project component will be carried out in collaboration between the Lawton lab and the lab of Steve Scofield (Purdue).

Relevance of the project to the goals of the US Wheat and Barley Initiative. Development of a rapid assay system for genes active against FHB fulfills the GET goal to 'Develop methods/systems for rapid screening (e.g., transient expression) of potentially useful antifungal genes in wheat, barley or Durum.' The assay of genes in wheat by FHB-VIGS fulfills the GET goal to 'Transform wheat, barley, and durum to demonstrate the effectiveness of anti-*Fusarium* transgenes to limit *Fusarium* infection, growth and spread.' This assay provides other researchers with a tool for assessing transgenes, prior to their introduction into wheat or barley as well as offering a platform for the discovery of genes effective against FHB and DON.