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Research Category: **GDER** **Duration of Award: 1 Year**

Project Title: Rapidly Identify and Test Scab Resistance Genes.

PROJECT 2 ABSTRACT

(1 Page Limit)

Fusarium head blight (FHB, scab), a fungal disease of small grain crops caused by *Fusarium graminearum*, threatens to reduce wheat and barley to economically unviable crops in the United States. During infection the fungus produces trichothecene mycotoxins that have been shown to increase fungal virulence. To complement the current breeding efforts, my laboratory seeks to rapidly characterize genes that encode enzymes that potentially detoxify trichothecenes and proteins that potentially transport trichothecenes away from their site of action, and further test the function of a barley *UDP-glucosyltransferase* gene in wheat. There are two major objectives in the proposed work including: (1) rapidly test genes for trichothecene resistance; and (2) characterize the function of the barley *UDP-glucosyltransferase* gene in transgenic wheat.

We have conducted a wide array of RNA profiling experiments on barley and wheat during *F. graminearum* infection and identified potential trichothecene resistance genes (e.g., ABC transporters, glutathione-S-transferases, and UDP-glucosyltransferases). ABC transporters and glutathione-S-transfereases may be involved in sequestering trichothecenes away from their site of action. Moreover, we have evidence that glutathione levels play a role in resistance. UDP-glucosyltransferases have been shown to detoxify trichothecenes. Thus, we will test these potential resistance genes in functional assays in yeast and *Arabidopsis*. We have established a collaboration with Dr. Gerhard Adam (Universität für Bodenkultur Wien, Austria) to screen plant genes in yeast for trichothecene resistance. Dr. Adam will screen barley genes encoding UDP-glucosyltransferases and glutathione-S-transferases. My laboratory has established a screen in *Arabidopsis* for trichothecene resistance genes. The genes encoding ABC transporters, and the genes exhibiting resistance in yeast will be expressed in *Arabidopsis* and tested for trichothecene resistance.

In a previously funded USWBSI project, we collaborated with Dr. Adam to identify a barley *UDP-glucosyltransferase* gene that exhibits resistance to the trichothecene deoxynivalenol (DON). We will develop and characterize transgenic wheat plants overexpressing the barley *UDP-glucosyltransferase* gene. These transgenic plants will likely result in wheat with enhanced resistance. Other trichothecene resistance genes that are identified in the yeast or *Arabidopsis* assays will be transformed into wheat.

The proposed research meets the objectives of the USWBSI and fits within the Gene Discovery and Engineering Resistance (GDER) area of research. The proposed research has specific reference to the priorities of efficiently identifying and characterizing genes that provide FHB resistance and DON reduction, and engineering transgenic wheat exhibiting FHB resistance and DON reduction.