PI: Gary Muehlbauer **PI's E-mail: muehl003@umn.edu**

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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 functionally characterize regulatory genes that respond to trichothecene accumulation and genes that encode enzymes that detoxify trichothecenes, and further test the function of NFX-1 and UDP-glucosyltransferase genes. There are two major objectives in the proposed work including: (1) rapidly test genes for FHB resistance/susceptibility; and (2) characterize the function of the *NFX-1* and UDP-glucosyltransferase genes.

We have conducted a wide array of RNA profiling experiments on barley and wheat during *F. graminearum* infection and identified potential resistance/susceptibility genes, including a large set of regulatory genes, and genes encoding UDP-glucosyltransferases that may detoxify trichothecene mycotoxins. We will test a subset of these potential resistance genes in two functional assays including: (1) virus-induced gene silencing (VIGS); and (2) a yeast screen for UDP-glucosyltransferases that detoxify trichothecenes. We have also established a collaboration with Dr. Gerhard Adam to screen nine UDP-glucosyltransferases for the ability to detoxify trichothecenes.

We have identified the wheat *NF-X1* and UDP glucosyltransferase genes as playing an important role in the host response to trichothecene accumulation. The wheat NF-X1 gene is a potential susceptibility factor. In our VIGS assay, downregulation of the *NFX-1* gene in the susceptible genotypes Bobwhite and Wheaton results in increased resistance. We have also identified an UDP-glucosyltransferase gene that exhibits resistance to the trichothecene deoxynivalenol (DON). We will develop and characterize transgenic wheat plants downregulating NFX-1 and upregulating the UDP-glucosyltransferase genes. These transgenic plants will likely result in wheat with enhanced resistance. Other genes that are identified in the VIGS or yeast 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 characterizing genes that provide FHB resistance, identification of FHB resistance genes and reduced DON accumulation, and developing transgenic wheat exhibiting FHB resistance.