Project Abstract

Project Title:	Characterize the regulatory mechanism of DON biosynthesis in infected wheat heads	
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Project Summary

Fusarium graminearum is a major causal agent of Fusarium head blight (FHB) and a producer of deoxynivalenol (DON). *TRI6* and *TRI10* are two key transcriptional regulators of *TRI* genes responsible for DON biosynthesis. However, the exact functional relationship between *TRI6* and *TRI10* in regulating DON biosynthesis is not clear and most of the studies on regulation of *TRI* gene expression deal with axenic cultures induced for DON biosynthesis. Recently, we found that *TRI6* and *TRI10* differ significantly in gene regulation between LBT (liquid trichothecene biosynthesis) cultures and infected wheat heads, and *TRI14* that is specifically required for DON biosynthesis during infection interacts with TRI6 in yeast two-hybrid assays. Therefore, the regulation of *TRI* gene expression and DON biosynthesis in axenic cultures and infected wheat heads must be different, likely due to the interactions of *TRI14* with *TRI6* and/or *TRI10*.

The overall goal of this project is to characterize the molecular mechanism for regulating *TRI* gene expression and DON production by *TRI14* during plant infection and its functional relationship with *TRI6* and *TRI10*. Objective 1 will further characterize the interaction of Tri14 with Tri6 and its role in *TRI* gene regulation in infected wheat heads. The putative Tri6-binding site in its promoter also will be functionally characterized. Objective 2 is to characterize the interaction and functional relationship between Tri14 and Tri10 by assaying their physical interactions and transcriptional regulation. The effect of Tri14 on the Tri6-Tri10 interaction and binding of Tri6 to its target sequences also will be determined. Objective 3 aims to identify genes that are differentially regulated by *TRI14, TRI6,* and *TRI10* during plant infection and analyze their regulatory relationship in regulating *TRI* genes and other genes important for pathogenesis and production of farnesyl pyrophosphate, the precursor for DON biosynthesis. The interaction of Tri6 with Tri14 may be responsible for Tri6-specific regulation of these genes that are not affected in the *tri10* mutant during plant infection.

Overall, results from proposed strand-specific RNA-seq analysis will not only be important for characterizing the role of *TRI14* in DON biosynthesis but also significantly improve our understanding of transcriptional regulation of *TRI* genes by *TRI6* and *TRI10* during plant infection. Better understanding of the regulation of DON biosynthesis in infected wheat heads may lead to the development of novel strategies for reducing DON contamination and FHB control in the future. Proposed study fits research needs of PBG on characterizing the mechanism of DON accumulation during infection and will benefit PBG goal on reducing DON contamination in barley and wheat.