

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY08 Final Performance Report (approx. May 08 – April 09)
July 15, 2009**

Cover Page

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Fiscal Year:	2008
USDA-ARS Agreement ID:	59-0790-6-071
USDA-ARS Agreement Title:	Genes Regulated by the Gmpk1 Pathway and Pathogenesis in Fusarium Graminearum.
FY08 USDA-ARS Award Amount:	\$ 32,939

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Adjusted Award Amount
PBG	Identifying Fungal and Plant Factors influencing DON Production.	\$32,939
	Total Award Amount	\$ 32,939



7-14-2009

Principal Investigator

Date

* MGMT – FHB Management
 FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
 GDER – Gene Discovery & Engineering Resistance
 PBG – Pathogen Biology & Genetics
 BAR-CP – Barley Coordinated Project
 HWW-CP – Hard Winter Wheat Coordinated Project
 VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
 SPR – Spring Wheat Region
 NWW – Northern Winter Wheat Region
 SWW – Southern Sinter Wheat Region

Project 1: Identifying Fungal and Plant Factors influencing DON Production.

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

The *CID1* C-type cyclin gene plays an important role in DON production and plant infection in the wheat head blight fungus *Fusarium graminearum*. In addition, *CID1* is critical for the production of ascospores, which are responsible for the primary infection in Fusarium head blight. Because the same cyclin gene also is important for mycotoxin production in a closely-related fungal pathogen *Fusarium verticillioides*, genes regulated by or interacting with this C-type cyclin may be conserved for mycotoxin production in plant pathogenic fungi. We used the microarray analysis approach to identify genes regulated by the *CID1* gene in *F. graminearum*. Three kinase genes that had reduced expression levels in the *cid1* mutant were selected for functional characterization. Targeted deletion mutants of these kinase genes have been identified. In addition, we have characterized the protein kinase gene (FGSG_04484, temporarily named *CDK1*) that was predicted to interact and be functionally related with *CID1*. Our preliminary data indicated that this putative C-type cyclin-dependent kinase gene also was important for DON production and plant infection in *F. graminearum*. These results suggest that the Cid1 and Cid1-dependent kinase system plays a regulatory role in mycotoxin synthesis. Disruption of the Cid1-Cdk1 system may lead to the reduction of wheat head blight and DON accumulation.

2. List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):

Accomplishment:

The *CID1* cyclin C-like gene plays a critical role in regulating DON synthesis and plant infection in *Fusarium graminearum*. We have used microarray analysis to identify genes that are regulated by *CID1* and functionally characterized three selected kinase genes. In addition, we have identified the putative Cid1-dependent kinase gene *CDK1*. Like *CID1*, *CDK1* is important for DON production and pathogenesis.

Impact:

In this study, we identified and characterized genes that are regulated by or functionally related with the *CID1* cyclin C-like gene. Our results indicate that the Cid1 and Cid1-dependent kinase system plays a regulatory role in mycotoxin synthesis. Disruption of the Cid1-Cdk1 transcription regulatory complex and interfering with genes controlled by this well-conserved system may lead to the reduction of wheat head blight and DON accumulation.

Include below a list of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles written about your work that resulted from all of the projects included in the grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

- 1) Ma, L., Rep, M., Borkovich, K. A., Coleman, J. J., Daboussi, M., DiPietro, A., Dufresne, M., Freitag, M., Grabherr, M., Henrissat, B., Kang, S., Park, J., Shim, W., Woloshuk, C. Xie, X., **Xu, J. -R.**, Antoniw, J., Baker, S., Brown, D., Chapman, S., Coulson, R., Coutinho, P. M., Danchin, E., G. J., Diener, A., Gale, L., Goff, S., Kodira, C. D., Hammond-Kosack, K., Hua-Van, A., Hilburn, K., Jonkers, W., Li, L., Koehrsen, M., Miranda-Saavedra, D., O'Leary, S., Park, G., Proctor, R., Regev, A., Ruiz-Roldan, C. M., Sain, D., Sykes, S., Wapinski, I., Schwartz, D. C., Turgeon, G., Yoder, O., Young, S., Zeng, Q., Zhou, S., Galagan, J., Birren, B. W., Cuomo, C. A., and Kistler, H. C. *Fusarium* comparative genomics reveals pathogenicity related lineage-specific genome expansion. Submitted to *Nature*.
- 2) Zhou, X., Heyer, C., Choi, Y., **Xu, J. -R.** 2009. The *CID1* cyclin C-like gene is important for plant infection in *Fusarium graminearum*. *Fungal Genetics and Biology*, in press.
- 3) Yang, J., Zhao, X., Sun, J., Kang, Z., Ding, S., **Xu, J. -R.**, Peng, Y. 2009. A novel nuclear protein Com1 is required for normal conidium morphology and full virulence in *Magnaporthe oryzae*. *Molecular Plant-Microbe Interactions*. In press. (In this paper, this transcription factor gene also was characterized to be important for pathogenesis in *Fusarium graminearum*)
- 4) Ding, S., Mehrabi, R., Koten, C., Kang, Z., Wei, Y., Seong, K., Kistler, H. C., and **Xu, J. -R.** 2009. The transducin beta like gene *FTL1* is essential for pathogenesis in *Fusarium graminearum*. *Eukaryotic Cell*. 8: 867–876.
- 5) Seong, K.Y., Pasquali, M., Zhou, X., Song, J., Hilburn, K., McCormick, S.P., Dong, Y., **Xu, J. -R.**, and Kistler, H.C. 2009. Global gene regulation by *Fusarium* transcription factors Tri6 and Tri10 reveals adaptations for toxin biosynthesis. *Molecular Microbiology*. 72: 354-367.

If your FY08 USDA-ARS Grant contained a VDHR-related project, include below a list all germplasm or cultivars released with full or partial support of the USWBSI. List the release notice or publication. Briefly describe the level of FHB resistance. If this is not applicable (i.e. no VDHR-related project) to your FY08 grant, please insert 'Not Applicable' below.

Not Applicable