

**U.S. Wheat and Barley Scab Initiative
 FY02 Final Performance Report (approx. May 02 – April 03)
 July 15, 2003**

Cover Page

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Year:	FY2002 (approx. May 02 – April 03)
Grant Number:	58-3640-2-139 (SCA)
Grant Title:	Fusarium Head Blight Research
FY02 ARS Award Amount:	\$ 39,731

Project

Program Area	Project Title	USWBSI Recommended Amount
EDM	Use of gene expression analysis to study pathogenicity in <i>Gibberella zeae</i> .	\$40,750
	Total Amount Recommended	\$40,750

Principal Investigator

Date

Project 1: Use of gene expression analysis to study pathogenicity in *Gibberella zeae*.

1. What major problem or issue is being resolved and how are you resolving it?

F. graminearum is an important pathogen suitable for studying many different aspects of fungal pathogenicity. Our studies aimed at improving basic understanding of molecular mechanisms of fungal pathogenesis in *F. graminearum*. In 2002, additional EST (expressed sequence tags) clones were sequenced and posted at <http://www.genomics.purdue.edu/~jxu/Fgr/S4>. Our major effort, however, was on functional analyses of candidate pathogenicity genes identified in ESTs. We have generated gene replacement mutants of *FMK1* and *FST12*, homologs of *Magnaporthe grisea* *PMK1* and *MST12* genes, respectively. The *fmk1* deletion mutant has normal vegetative growth, but is nonpathogenic on wheat, sexually sterile, and reduced in conidiation. We also have constructed gene disruption vectors for *F. graminearum* homologs of the *Colletotrichum gloeosporioides* *CAP20*, *Candida tropicalis* secreted aspartic proteinase *SAP2*, *Neurospora crassa* *CPC-1*, and *Aspergillus fumigatus* *ALP2* genes. For the *CAP20* and *SAP2*, we have transformed linearized vectors into PH-1 and identified putative knockout mutants by PCR screening of transformants. Preliminary data indicated that these genes are dispensable for fungal pathogenicity in corn silk assays. Currently, we are generating gene replacement mutant constructs for three polyketide synthase genes identified the *F. graminearum* genome.

We have also generated over 7000 REMI (restriction-enzyme mediated integration) mutants. A few REMI mutants displaying a range of pathogenesis defects have been identified. Mutant 222 shows no ability to induce plant cell death and cause necrotic symptoms on the plant. Re-introduction of the wild-type *HCR1* all into 222 fully restores its defects. The 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase gene (*HCR1*), a key enzyme involved in isoprenoid biosynthesis, is disrupted in this mutant. The aconitase gene (*ACO1*) is disrupted in mutant 25C3 that is significantly reduced in wheat head infection.

2. What were the most significant accomplishments?

We have identified at least three more genes that play important roles in plant infection processes and fungal development. The *HCR1* and *ACO1* genes are identified as novel fungal pathogenicity factors.

In addition to accomplish the objectives proposed in 2002, we have generated about 10X coverage of the *F. graminearum* genome sequence in collaboration with the Whitehead Institute/MIT Center for Genome Research (WI-CGR) (available at www.genome.wi.mit.edu/annotation/fungi/fusarium/index.html).

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.

Hou, Z., Xue, C., Katan, T., Peng, Y., Kistler, H. C., and **Xu, J. -R.** 2002. A MAP kinase gene (*MGVI*) for hyphal growth and plant infection in *Fusarium graminearum*. *Molecular Plant-Microbe Interactions* 15: 1119-1127.

Trail, F., **Xu, J. -R.**, San Miguel, P., Halgren, R. G., and Kistler, H. C. 2003. Analysis of Expressed Sequence Tags from *Gibberella zeae* (anamorph *Fusarium graminearum*). *Fungal Genetics and Biology*. 38: 187-197.

Gyungsoon Park, and **Jin-Rong Xu**. 2003. Mechanisms of Infection-Imperfect Fungi. The Encyclopedia of Plant and Crop Science. Ed. Robert Goodman, Marcel Dekker, Inc. 270 Madison Ave. New York, USA. Accepted.

Miles Trace, Zhanming Hou, H. Corby Kistler, and **Jin-Rong Xu**. 2002. REMI mutagenesis in the wheat scab fungus *Fusarium graminearum*. Abstract presented at the 2002 APS meeting.

Goswami, R. S., Trail, F., **Xu, J. R.**, and Kistler, H. C. 2003. Fungal genes expressed during plant disease development in the *Fusarium graminearum*/wheat interaction. Abstract 292 presented at the 22nd Asilomar Fungal Genetics Conference, Pacific Grove, CA. March 18-23, 2003.