

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY06 Final Performance Report (approx. May 06 – April 07)  
July 16, 2007**

**Cover Page**

<b>PI:</b>	Robert Bowden
<b>Institution:</b>	USDA-ARS
<b>Address:</b>	4008Throckmorton Hall Kansas State University Manhattan, KS 66506
<b>E-mail:</b>	rbowden@plantpath.ksu.edu
<b>Phone:</b>	(785) 532-2368
<b>Fax:</b>	(785) 532-6167
<b>Fiscal Year:</b>	2006
<b>USDA-ARS Agreement ID:</b>	NA
<b>USDA-ARS Agreement Title:</b>	Fusarium Head Blight Research.
<b>FY06 ARS Award Amount:</b>	\$ 32,754

**USWBSI Individual Project(s)**

<b>USWBSI Research Area*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
PGG	Function of Pheromones in Gibberella zeae.	\$ 32,754
	<b>Total Award Amount</b>	<b>\$ 32,754</b>

\_\_\_\_Robert L. Bowden /s/\_\_\_\_ July 16, 2007\_\_\_\_  
Principal Investigator Date

\* CBCC – Chemical, Biological & Cultural Control  
EEDF – Etiology, Epidemiology & Disease Forecasting  
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain  
GET – Genetic Engineering & Transformation  
HGR – Host Genetics Resources  
HGG – Host Genetics & Genomics  
PGG – Pathogen Genetics & Genomics  
VDUN – Variety Development & Uniform Nurseries

**Project 1:** *Function of Pheromones in Gibberella zeae.*

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

*Gibberella zeae* is the main causal agent of Fusarium head blight (FHB) in wheat and barley. The most economical and efficient method of control should be development of resistant cultivars, but current sources of resistance are not sufficient to give complete control. We are studying the fungal sex pheromones as a potentially novel control method. Fungal sex pheromones are an interesting target because they can affect intercellular communication, fungal germination, filamentous growth, chemotaxis, and sexual development. If we could use pheromones to interrupt these processes, it could result in disease control. The objectives of this study were to identify the genes for pheromones and pheromone receptors in *G. zeae* and to determine their function.

**2. List the most important accomplishment and its impact (how is it being used?).  
Complete all three sections (repeat sections for each major accomplishment):**

**Accomplishment:** We identified two sex pheromone genes (*ppg1* and *ppg2*) and two pheromone receptor genes (*pre1* and *pre2*) in *G. zeae*. Only one pheromone/receptor pair (*ppg1* and *pre2*) played a role in self-fertilization and outcrossing, and the other pair (*ppg1* and *pre1*) had no discernible function. Using fluorescent reporter gene constructs, we found that *ppg1* and *pre2*, but not *ppg2* or *pre1*, were strongly expressed during sexual reproduction. In addition, we found that pheromone peptides of *G. zeae* and *Neurospora crassa* inhibit spore germination of *G. zeae*. Interestingly, the *N. crassa* peptide inhibited spore germination much more efficiently than did the *G. zeae* pheromone peptides.

**Impact:** One pheromone/receptor pathway that enhances sexual reproduction and outcrossing is now known to be functional in *G. zeae*. The inhibitory effect of the pheromone on spore germination could be used as a novel control method for this fungus.

**As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?**

The scientific community has a new understanding of the function of pheromones in an important plant pathogen. We have submitted a patent disclosure statement at Kansas State University entitled, "Use of fungal sex pheromones and their derivatives to inhibit germination of fungal conidia and ascospores for disease control". Development of this concept is continuing.

**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.**

**Abstract and meeting presentation**

Jungkwan Lee, Robert L. Bowden, and John F. Leslie. 2007. Pheromone functions of *Gibberella zeae*. The 24<sup>th</sup> Fungal genetics and conference (Asilomar, California): 399.

**Peer-reviewed article**

Jungkwan Lee, John F. Leslie, and Robert L. Bowden. 2007. Expression and function of sex pheromones and receptors in the homothallic Ascomycete *Gibberella zeae* (submitted)