USDA-ARS / USWBSI
FY04 Final Performance Report
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Cover Page

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Year:	**FY2004**
FY04 ARS Agreement ID:	**NA**
FY04 ARS Agreement Title:	**Biotechnology, Epidemiology and Host Resistance to Wheat Scab.**
FY04 ARS Award Amount:	**$ 60,517**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
BIO	Function of Secreted Proteins from *Gibberella zeae*.	$ 26,341
EDM	Genetic Mapping in *Gibberella zeae.*	$ 34,176
	Total ARS Award Amount	**$ 60,517**

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Principal Investigator Date

* BIO – Biotechnology
CBC – Chemical & Biological Control
EDM – Epidemiology & Disease Management
FSTU – Food Safety, Toxicology, & Utilization
GIE – Germplasm Introduction & Enhancement
VDUN – Variety Development & Uniform Nurseries

(Form – FPR04)

Project 1: ***Function of Secreted Proteins from Gibberella zeae.***

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

Fungal sex pheromones have been reported to affect intercellular communication, germination, filamentous growth, chemotaxis, sexual development, and pathogenicity. The pheromones interact with G-protein coupled receptors, which in turn interact with a complex signal transduction pathway to produce various fungal behaviors. The pheromone signal transduction pathway is a potential target for novel disease control strategies.

In related Ascomycete fungi, there are two mating type-specific pheromone precursor genes (ppg). They have different names in different species, so we will call them *ppg1* and *ppg2* for simplicity. *ppg1* encodes a large peptide that is cleaved to produce multiple copies of a short peptide. *ppg2* encodes a single copy of a short lipopeptide with a CAAX motif at the C-terminus.

Sex pheromones in related heterothallic (i.e. not self-fertile) fungi function in attraction of members of the opposite mating type for sexual reproduction. Heterothallism is presumed to be the ancestral state in this group of fungi. However, *G. zeae* is homothallic (i.e. self fertile) and it is unclear why pheromones might still be needed. Although few details are known about mating behavior in *G. zeae*, knockouts of one mating type gene (*MAT1-2-1*) are no longer self-fertile, but they can function as females. This suggests that at least part of the ancestral heterothallic physiology and control of the mating system are still functional.

Our goal is to identify and determine the function of the secreted sex pheromones and their receptors in *G. zeae*. How can we assay for sex pheromones? Does *G. zeae* actually produce sex pheromones? What is their effect on the behavior of *G. zeae*?

2. What were the most significant accomplishments?

We identified both pheromone precursor genes and both receptor genes. In preliminary experiments, *ppg1* was expressed in conidia, ascospores, and germ tubes, but not vegetative hyphae. Furthermore, knock-out mutants of *ppg1* had more than a 50% reduction in production of mature perithecia. This suggests that *ppg1* still retains its ancestral role in initiation or maturation of perithecia. Further work is needed to clarify the role of the sex pheromones and to identity novel strategies to exploit them.

Project 2: *Genetic Mapping in Gibberella zeae.*

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

Jurgenson et al. (2002) previously published a genetic map of *Gibberella zeae* (*Fusarium graminearum*) based on a cross between Kansas strain Z-3639 (lineage 7) and Japanese strain R-5470 (lineage 6). The genetic map was based on 1048 AFLP markers and consisted of nine linkage groups. The objective of this research was to align the genetic map with the first assembly of the genomic sequence of strain PH-1 (lineage 7) that was released by The Broad Institute (Cambridge, MA).

2. What were the most significant accomplishments?

We used 7 sequenced structural genes and 129 sequenced AFLP markers from all nine linkage groups (LG) of the genetic map. One hundred and fourteen markers were associated with nine supercontigs (SC) of the genomic sequence. LG1, LG7, LG8 and LG9 aligned with SC2 and SC5; LG2 aligned with SC3, SC8 and SC9; LG 3 aligned with SC4 and SC6; and LG4, LG5 and LG6 aligned with SC1 and SC7. The alignments grouped the linkage groups and supercontigs into four sets, suggesting that there are four chromosomes in this fungus. Approximately 99% of the sequence was anchored to the genetic map, indicating the high quality of the sequence assembly and the relative completeness and validity of the genetic map.

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 you grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

1. Bowden, R. L., J. E. Jurgenson, J.-K. Lee, Y.-W. Lee, S. H. Hun, K. A. Zeller & J. F. Leslie. 2004. A second generation genetic map of *Gibberella zeae*. *Proceedings of the 15th International Plant Protection Congress*: p. 355.
2. Bowden , R.L., J.F. Leslie , Jungkwan Lee , and Yin-Won Lee .Cross fertility of lineages of *Gibberella zeae*. XXIII Fungal Genetics Conference. Fungal Genetics Newsletter Vol. 52-Supplement. p. 60.
3. Bowden, R. L., J. F. Leslie, J. E. Jurgenson & J. Lee. 2004. Genetic mapping in *Gibberella zeae*. *Proceedings of the 2nd International Symposium on Fusarium Head Blight (Orlando, Florida)*. p. 555-556.
4. Bowden, R. L., J. F. Leslie, J. Lee & Y.-W. Lee. 2004. Cross fertility of *Gibberella zeae*. *Proceedings of the 2nd International Symposium on Fusarium Head Blight (Orlando, Florida)*. p. 554.
5. Cumagun, C. J. R., R. L. Bowden, J. E. Jurgenson, J. F. Leslie & T. Miedaner. 2004. Genetic mapping of pathogenicity and aggressiveness of *Gibberella zeae* (*Fusarium graminearum*) towards wheat. *Phytopathology* **94:** 520-526.
6. Lee, J., J. E. Jurgenson, J. F. Leslie & R. L. Bowden. 2004. The alignment between physical and genetic maps of *Gibberella zeae*. *Proceedings of the 2nd International Symposium on Fusarium Head Blight (Orlando, Florida)*. p. 569.