**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:** | 59-0790-6-063 |
| **USDA-ARS Agreement Title:** | A Rapid Assay System for Trangenes that Confer Resistance to DON and FHB. |
| **FY08 USDA-ARS Award Amount:** | $ 54,252 |

**USWBSI Individual Project(s)**

| USWBSI Research Category* | Project Title | ARS Adjusted Award Amount |
|---|---|---|
| GDER | A Rapid Assay System for Transgenes that confer Resistance to DON and FHB. | $54,252 |
| | **Total Award Amount** | **$ 54,252** |

July 10th, 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:** *A Rapid Assay System for Transgenes that confer Resistance to DON and FHB.*

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

   The lack of natural sources of FHB resistance in wheat and barley germplasm has focused attention on exploiting a broader range of plants to identify novel mechanisms and genes involved in conferring FHB-resistance. One of these, the recombinogenic plant *Physcomitrella patens*, is uniquely amenable to genetic manipulation and allows gene function to be determined through the creation of gene knockout or overexpression mutant lines. We have used this system to (i), identify genes whose deletion confers resistance to FHB (these genes are therefore required for susceptibility to FHB); and (ii), characterize genes whose overexpression enhances resistance to FHB (these genes are involved in the inducible resistance response to FHB). These genes provide the means to identify and assay corresponding wheat and barley genes for their ability to confer resistance to FHB in both model plants and in grain crops.

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:**

   Previous work supported by USWBSI allowed us to identify a collection of Physcomitrella genes whose deletion or overexpression conferred resistance to FHB and/or FHB. We have now identified wheat homologs of these genes and showed that, with one exception, wheat homologs genes are equally effective as their Physcomitrella counterparts in conferring resistance to FHB. In cases where wheat contains a family of genes that exist as only a single copy gene in Physcomitrella, we have been able to use Physcomitrella to identify the most effective member of the wheat gene family in conferring FHB resistance. These wheat homologs form the basis for the direct assay of these genes in wheat using a viral-induced gene suppression assay (VIGS). Our studies have also shown that mutants that are compromised in the induced immune response are fully susceptible to FHB, consistent with a role for this pathway in the expression of FHB resistance.

   **Impact:**

   These studies validate the use of the Physcomitrella rapid assay system as a useful tool for FHB-resistance gene discovery and provide a set of functionally validated anti-FHB genes for introduction into transgenic wheat plants or for improvement in existing germplasm by marker-assisted selection. They also establish an R&D pipeline for the discovery and deployment of additional genes as these are uncovered from ongoing screens.

   **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 before?:**

   Our studies have defined genes whose manipulation confers resistance to FHB. These genes form the basis for the direct improvement of wheat and barley though the construction of transgenic plants and for the indirect improvement of wheat and barley through marker assisted selection of endogenous genes. These genes also define specific disease resistance

and disease susceptibility targets, whose respective enhancement and inhibition by chemical treatments can now be investigated to develop new strategies for the chemical control of FHB.

**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.**

**Publications:**

Lawton, M and Saidasan, H. Physcomitrella Pathogenesis. In The Moss, Physcomitrella, C, Knight, D. Cove and P.-F. Perroud, Eds. Annual Plant Reviews, Wiley-Blackwell, Oxford. (In Press)

**Presentations:**

H. Saidasan and M. Lawton. *Physcomitrella patens*: a genetically tractable system for plant pathogen interactions. New York Area Plant molecular biology meeting, Adelphi University, June, 7, 2008, New York City, NY.

H. Saidasan and M. Lawton. *Physcomitrella patens*: a genetically tractable system for studying plant pathogen interactions and the plant cell wall. FAPESP Workshop: Cellulose Biofuels, Sept 10, 2008, Sao Paulo-SP, Brazil

M. Lawton and H Saidasan. The genetic and molecular basis of disease susceptibility of *Physcomitrella patens* to *Fusarium gramineaum*. 54th Congress, SBG genetics meeting, Salvador, Sep 16-19, 2008, , Bahia, Brazil.

H. Saidasan and M. Lawton. Physcomitrella patens: a model system for studying biotic stress and the plant cell wall. Sugarcane Engineering workshop, Douglas college center, Rutgers University, Oct 8, 2008, New Brunswick, NJ.

H. Saidasan and M. Lawton. *Physcomitrella* – a novel system for studying plant: pathogen interactions. 25 Years of Plant Biology, Salk Institute, Oct 13, 2008, La Jolla, CA.

H. Saidasan and M. Lawton Rapid gene assay in *Physcomitrella patens* reveals multiple mechanisms and approaches for controlling FHB. 2008 National Fusarium Head Blight Forum, Dec 2-4, 2008, Indianapolis, IN.

M. Lawton and H. Saidasan. Gene discovery in *Physcomitrella patens*. 1st Biofuels Cluster Meeting, Dec 11-17, 2008. Seminar presented at University of Sao Paulo, Sao Paulo Brazil.

H. Saidasan and M. Lawton. Multiple mechanisms for resistance to *Fusarium graminearum* revealed by functional assays in *Physcomitrella patens.* Rutgers 3rd Annual Microbiology Symposium, Jan 29-30, 2009, New Brunswick, NJ.

**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