USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY07 Final Performance Report (approx. May 07 – April 08)  
July 15, 2008

Cover Page

<table>
<thead>
<tr>
<th>PI:</th>
<th>David Schmale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institution:</td>
<td>Virginia Polytechnic Institute and State University</td>
</tr>
</tbody>
</table>
| Address:   | Dept. of Plant Pathology, Physiology, Weed Science  
410 Price Hall  
Blacksburg, VA  24061 |
| E-mail:    | dschmale@vt.edu |
| Phone:     | 540-231-6943 |
| Fax:       | 540-231-7477 |
| Fiscal Year: | 2007 |
| USDA-ARS Agreement ID: | 59-0790-7-078 |
| USDA-ARS Agreement Title: | Contribution of Local Inoculum Sources to Regional Atmospheric Populations of G. zeae. |
| FY07 ARS Award Amount: | $ 24,390 |

USWBSI Individual Project(s)

<table>
<thead>
<tr>
<th>USWBSI Research Area*</th>
<th>Project Title</th>
<th>ARS Adjusted Award Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEDF</td>
<td>Contribution of Local Inoculum Sources to Regional Atmospheric Populations of G. zeae.</td>
<td>$24,390</td>
</tr>
<tr>
<td></td>
<td><strong>Total Award Amount</strong></td>
<td><strong>$ 24,390</strong></td>
</tr>
</tbody>
</table>

* 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  
IIR – Integrated/Interdisciplinary Research  
PGG – Pathogen Genetics & Genomics  
VDUN – Variety Development & Uniform Nurseries

Principal Investigator ___________________________ Date ____________
Project 1: Contribution of Local Inoculum Sources to Regional Atmospheric Populations of G. zeae.

1. What major problem or issue is being resolved and how are you resolving it? Epidemics of FHB may be initiated by regional atmospheric sources of inoculum of G. zeae, but little is known about the contribution of local inoculum sources to regional atmospheric populations of the pathogen and how far inoculum may travel from its source. The ability to predict the regional transport of G. zeae from local inoculum sources may help refine risk models for FHB. The ultimate goals of our research efforts are to determine where inoculum for FHB comes from and how far it travels. We used unmanned aerial vehicles (UAVs), DNA fingerprinting, and the atmospheric transport model HYSPLIT to predict and track the movement of G. zeae in the atmosphere.

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: Little is known about the contribution of local inoculum sources to regional atmospheric populations of the G. zeae and how far inoculum may travel from its source. We inoculated a portion of a tilled field with corn kernels colonized with a single clonal isolate of G. zeae, and we conducted 35 autonomous UAV sampling flights for the G. zeae 100 m above our inoculum source. Isolates of G. zeae were cultured from the sampling plates, and a DNA fingerprinting technique known as Amplified Fragment Length Polymorphisms (AFLPs) was used to track the released isolate in our atmospheric collections. The atmospheric transport model HYSPLIT was used to forecast the long-distance transport of G. zeae from our inoculum source. Thirty three percent of our isolates were collected on two different flights on May 1, 2007. Runs with HYSPLIT for these collection times suggested that our inoculum source was transported at least a kilometer away from the ground surface within an hour. The high number of colonies recovered during this time period, coupled with data from AFLP analyses, is consistent with HYSPLIT model predictions of spore transport.

Impact: This is the first study to track the movement of G. zeae in the atmosphere from a clonal inoculum source, and the first body of work to predict the long-distance transport of G. zeae over broad geographical regions. This project has developed new and improved tools (e.g., autonomous UAVs) necessary for studying regional atmospheric populations of G. zeae, and has assisted in predicting the distribution and spread of G. zeae in the atmosphere. Our work continues to aid in developing and/or excluding strategies for managing FHB, and should help researchers refine forecasting/risk assessment models for regional FHB epidemics.

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?: Knowledge of the long-distance transport of G. zeae from local inoculum sources is an important step toward developing an early warning system for FHB and practical management strategies for FHB epidemics. Since spores of G. zeae may move over kilometer distances in the atmosphere, management strategies for FHB should be considered on a regional (i.e. county or state) basis. Forecasting and risk assessment models for FHB epidemics could benefit from the inclusion of information on atmospheric inoculum dynamics.
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.

Presentations


Peer-reviewed articles


Non peer-reviewed articles
