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9SWXNXYXNTS/	USDA-ARS Cereal Disease Laboratory 1551 Lindig Street St. Paul, MN 55108
5$RFNQ/	corby.kistler@usda.gov
>MTSJ/	612-625-9974
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B@41$1?@ 1LVJJRJSX ANXQJ/	Pathogen Genes for Enhanced Resistance to FHB
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PBG	Pathogen Transporters for Enhanced Resistance to FHB	$ 36,856
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July 24, 2020
Principal Investigator Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
GDER – Gene Discovery & Engineering Resistance
PBG – Pathogen Biology & Genetics
EC-HQ – Executive Committee-Headquarters
BAR-CP – Barley Coordinated Project
DUR-CP – Durum Coordinated Project
HWW-CP – Hard Winter Wheat Coordinated Project
VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
SPR – Spring Wheat Region
NWW – Northern Soft Winter Wheat Region
SWW – Southern Soft Red Winter Wheat Region

Project 1: *Pathogen Transporters for Enhanced Resistance to FHB*

1. What are the major goals and objectives of the research project?

Examine several candidate multidrug transporters in *Fusarium graminearum* for their potential role in trichothecene export and virulence.

2. What was accomplished under these goals or objectives? *(For each major goal/objective, address items a-b) below.)*

a) What were the major activities?
Each of five *Fusarium graminearum* genes were individually deleted and the mutant alleles combined by sexual recombination to create strains with deletions in combinations of two and three per strain. Additionally, the five genes were individually expressed in yeast to determine their ability to allow for DON resistance.

b) What were the significant results?
Single deletion mutants for three ABC and MFS transporters showed reduced mycotoxin accumulation *in vitro* and/or *in planta* and reduced virulence. Certain mutation combinations resulted in additive effects in reducing mycotoxin accumulation and virulence. Disrupting multiple mycotoxin export mechanisms simultaneously nearly eliminated mycotoxin accumulation and virulence *in planta*. When expressed in yeast, one ABC transporter (*Abc1*) greatly increased its tolerance to 15ADON and DON, while one MFS transporter (*Tri12*) increased the sensitivity of the recipient strain to 15ADON and DON.

c) List key outcomes or other achievements.
These results may be helpful in providing targets for designing new, more effective, management strategies for FHB. Introducing certain transporters into wheat or barley may allow for plant resistance to DON and 15ADON.

3. Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.

Members of the lab are limited in their ability to do laboratory work. Only one person is allowed to work in the lab at a time. The lab manager has been on telework status since March, 2020. This has slowed all laboratory work considerably across the board.

4. What opportunities for training and professional development has the project provided?

The funded graduate student, Sean O'Mara, participated in the 2020 FHB forum in Milwaukee and presented a poster. The poster, titled "The *Fusarium graminearum* T-SNARE

Sso1 is involved in growth, defense and DON accumulation and virulence" garnered second prize in the graduate student poster competition.

5. How have the results been disseminated to communities of interest?

The results have been published in a peer reviewed journal and presented at the 2019 FHB Forum.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY19 award period (N/A). The term "support" below includes any level of benefit to the student, ranging from full stipend plus tuition to the situation where the student's stipend was paid from other funds, but who learned how to rate scab in a misted nursery paid for by the USWBSI, and anything in between.

1. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their MS degree during the FY19 award period?**
   No

   If yes, how many?

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY19 award period?**
   No

   If yes, how many?

3. **Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**
   N/A

   If yes, how many?

4. **Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**
   N/A

   If yes, how many?

Release of Germplasm/Cultivars

Instructions: In the table below, list all germplasm and/or cultivars released with full or partial support through the USWBSI during the FY19 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations.

NOTE: Leave blank if you have nothing to report or if your grant did NOT include any VDHR-related projects.

Name of Germplasm/Cultivar	**Grain Class**	**FHB Resistance** (S, MS, MR, R, where R represents your most resistant check)	**FHB Rating** (0-9)	**Year Released**

Add rows if needed.

NOTE: List the associated release notice or publication under the appropriate sub-section in the 'Publications' section of the FPR.

Abbreviations for Grain Classes

Barley - BAR
Durum - DUR
Hard Red Winter - HRW
Hard White Winter - HWW
Hard Red Spring - HRS
Soft Red Winter - SRW
Soft White Winter - SWW

Publications, Conference Papers, and Presentations

Instructions: Refer to the FY19-FPR_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY19 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (N/A**) should be included. If you did not publish/submit or present anything, state 'Nothing to Report' directly above the Journal publications section.

NOTE: Directly below each citation, you **must** indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in the publication/ presentation. See example below for a poster presentation with an abstract:

De Wolf, E., D. Shah, P. Paul, L. Madden, S. Crawford, D. Hane, S. Canty, R. Dill-Macky, D. Van Sanford, K. Imhoff and D. Miller. 2019. "Impact of Prediction Tools for Fusarium Head Blight in the US, 2009-2019." In: S. Canty, A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (p. 12), Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Journal publications.

O'Mara, S. P., Broz, K., Boenisch, M., Zhong, Z., Dong, Y., Kistler, H.C. 2020. The *Fusarium graminearum* t-SNARE Sso2 is involved in growth, defense, and DON accumulation and virulence. Molecular Plant-Microbe Interactions. https://doi.org/10.1094/MPMI-01-20-0012-R
Status: published
Acknowledgement of Federal Support: YES

Books or other non-periodical, one-time publications.

Other publications, conference papers and presentations.

O'Mara, S. P., Broz, K., Boenisch, M., Zhong, Z., Dong, Y., Kistler, H.C. 2020. The *Fusarium graminearum* t-SNARE Sso2 is involved in growth, defense, and DON accumulation and virulence." In: Canty, S., A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (p. 75), Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY.
Status: published
Acknowledgement of Federal Support: YES for poster and abstract