

Washington Grain Commission

Wheat and Barley Research Annual Progress Reports and Final Reports

Project #: 3019 5234

Progress Report Year: 3 of 3 (*maximum of 3 year funding cycle*)

Title: **Evaluation of WSU wheat breeding lines for management of Hessian fly and development of DNA markers for resistance breeding**

Cooperators: Mike Pumphrey, Nilsa A. Bosque-Pérez

Executive summary:

Hessian fly (HF) infestations continue to cause significant annual yield losses in spring wheat production areas of Washington and neighboring regions of Oregon and Idaho. Hessian fly is in many ways a silent problem. Moderate infestations are not visually striking, and their occurrence is somewhat variable over space and time. Nonetheless, significant reductions in grain yield and grain quality are observed across spring wheat production areas. Factors such as climate change, crop rotation, variety selection, and tillage or conservation practices can impact HF pressure. Infestation may also be a significant barrier to increased conservation tillage practices in the Palouse.

Forty-eight advanced breeding lines along with 300 mapping population progeny were screened for Hessian fly resistance in 2014. Among elite breeding lines, 19 were resistant to Hessian fly, while 29 were susceptible. The HT080158LU/WA8076 doubled haploid mapping population was completed, and 300 progeny were produced. Esraa Alalwan, the PhD student working on this project, worked with Dr. Bosque-Perez at U of I to complete Hessian fly phenotyping from June-August 2014. Single gene Hessian fly resistance from WA8076 was determined in the DH population by 1:1 segregation. Genetic map construction is underway.

Impact:

Inventories of HF resistance in PNW spring wheat will be useful for strategically designing the breeding program. The development of tightly linked DNA markers will improve the effectiveness and efficiency of spring wheat breeding by eliminating susceptible lines earlier in the breeding process, prior to expensive yield testing and making crosses. A conservative state-wide loss estimate of 2% translates to over \$4,000,000 per year; yield loss due to HF in moderately to heavily infested areas often exceeds 25% and may be 100% in localized areas. In addition to protecting from \$45-\$104 per acre via HF resistance, improved variety development can translate to \$Millions/year in WA spring wheat farm gate value. Three 2014 spring wheat variety releases are Hessian fly resistant based on selection data from this project.

Outputs and Outcomes:

WGC project number: 5234
 Evaluation of WSU wheat breeding lines for management of Hessian fly and development of DNA markers for resistance breeding
Project PI(s): Pumphrey
Project initiation date: 2012
Project year: 3

Objective	Deliverable	Progress	Timeline	Communication
Screen WSU Spring Wheat breeding populations and advanced breeding lines for resistance to Hessian fly in the laboratory	Information on resistance of elite breeding lines on an annual basis	48 elite breeding lines were screened in 2014. 19 were resistant to Hessian fly. 300 progeny of a mapping population were also phenotyped.	Annually	<p>Progress will be presented by M. Pumphrey, K. Garland Campbell and N. Bosque-Pérez at field days, plot tours, at Wheat Research Reviews for individual states. Presentations will be made to the Washington Wheat Commission and WAWG conferences upon invitation. Progress will be reported in Wheat Life magazine and data will be recorded with nursery data.</p>
Continue to incorporate "new" Hessian fly resistance genes into breeding lines	Improved germplasm with useful sources of Hessian fly resistance	Several backcrosses have been made to known HF donors, and additional stocks were recently received for Hessian fly testing and future crossing	Annually	
Use association mapping to identify SNP-based DNA markers for routine selection of Hessian fly resistance	DNA markers and genetic information on PNW sources of Hessian fly resistance	A doubled haploid population was phenotyped and genotyped in 2014, which showed 1:1 segregation and will validate and tag one resistance gene detected by association mapping	Genetic map construction will be completed by Summer 2015	