Washington Grain Commission

Wheat and Barley Research Annual Progress Reports and Final Reports

Project #: **3019 3574**

Progress Report Year: *_2___ 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 weather patterns, 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. Advanced breeding lines, new sources of resistance genes H13, H26, and two unknown resistances source, along with mapping population progeny were screened for Hessian fly resistance in 2016. Backcross populations were developed with four new sources of resistance, and progeny selfed to select homozygous resistant lines this winter. The HT080158LU/WA8076 doubled haploid mapping population was used to map a newly discovered Hessian fly resistance gene on chromosome 6A. Winter wheat populations were screened for the first time in many years, to introgress HF resistance into winter wheat.

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. Spring wheat production has averaged ~30 million bushels in WA in recent years. 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.

Outputs and Outcomes:
Excel file attached

WGC project number: 3574
WGC project title: 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: 2015
Project year: 3 of 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	Over 60 spring wheat lines, 12 winter wheat breeding populations, and new entries into the WSU Wheat Variety Testing Program were screened in 2016.	Annually	Progress will be presented by M. Pumphrey 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.
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 (H13, H26) and unknown resistance gene donors, using susceptible elite line "Dayn" as the initial recipient parent. BC3 populations were self pollinated, selected for Hessian fly resistance, and Doubled-haploid progeny were developed from resistant plants. A new resistance gene on chromosome 6A was mapped in an elite doubled haploid population, and DNA marker validation is underway. With these new Hessian fly resistance sources in elite genetic backgrounds, we can now use them more effectively in breeding efforts.	Annually	