

## Washington Grain Commission

### Wheat and Barley Research Annual Progress Reports and Final Reports

**Project #:** 3019 3674

**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, Arash Rashed

#### **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. 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 Washington. Advanced breeding lines, new sources of resistance genes *H13*, *H26*, and two unknown resistance sources, along with winter wheat varieties were screened for Hessian fly resistance in 2019. Backcross populations were developed with four new sources of resistance, and progeny advanced to select homozygous resistant lines. Winter wheat populations and varieties were screened to introgress HF resistance into winter wheat. This project supported the screening of all new entries in WSU Variety Testing Program spring wheat trials.

#### **Impact:**

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. Our recent emphasis on winter wheat is due to infestations increasingly observed in winter wheat in the region. While not as severe as spring wheat infestations, we believe the value of Hessian fly resistance in winter wheat is underestimated, and increasing.

Our most recently released soft white spring wheat varieties Seahawk, Tekoa, and Ryan, and hard red spring wheat varieties Net Cl+, Glee, Alum, and Chet, are resistant to Hessian fly because of selection activities carried out by this collaborative project. Given their broad acreage in Washington State, this represents a major economic impact to Washington farmers.

**Outputs and Outcomes:** attached

**WGC project number:** 3674  
**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:** 2018  
**Project year:** 2 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 300 spring wheat lines, 40 winter wheat varieties, numerous spring wheat breeding populations, and new entries into the WSU Wheat Variety Testing Program were screened in 2019.	Annually	<p>Progress was presented by M. Pumphrey 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 (H13, H26) and unknown resistance gene donors, using susceptible elite line "Dayn" as the initial recipient parent. BC4 populations were self pollinated, selected for Hessian fly resistance, and Doubled-haploid progeny were developed from resistant plants. These Dayn-Hessian fly resistant introgression lines were evaluated in yield plots and for grain quality in 2019, and elite performers used in routine breeding crosses in fall 2019. Also, JD and Melba were used to introduce four new resistance sources through backcrossing with phenotypic selection.	Annually	