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 \textit{H13}, \textit{H26}, and two unknown resistance sources, along with winter wheat varieties were screened for Hessian fly resistance in 2022. 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 and winter wheat variety trials. NEW DNA markers that allow diagnostic tracking of the previously unknown spring wheat resistance source that is in most spring wheat varieties were validated and fully implemented in 2021 and markers for “Louise” resistance source in 2022.

\textbf{Impact:} Spring wheat production has averaged \textasciitilde30 million bushels in WA in recent years. A conservative state-wide Hessian fly 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 $\text{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, new club release WA8325 (Roger) and hard red spring wheat varieties Hale, 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.

\textbf{Outputs and Outcomes:} attached
**Objective**

| Screen WSU Spring Wheat breeding populations and advanced breeding lines for resistance to Hessian fly in the laboratory | Information on Hessian fly resistance of >100 elite breeding lines and variety trial entries on an annual basis; updated Variety Selection Tool and Seed Guide data | Newly released varieties and elite variety candidates are Hessian fly resistant. Variety Testing Program including and Winter Wheat varieties and breeding lines screened. Data has been shared with Extension personnel, through the Variety Selection Tool, WSCIA | Annually | 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. |
| Continue to incorporate "new" Hessian fly resistance genes into breeding lines | Improved germplasm with useful sources of Hessian fly resistance. Backcross derived elite lines with H13, H22, H26, H52, an unknown gene, and combinations with HKelse | New DNA markers developed through this effort in routine use. Peer reviewed article published in 2022. DNA markers for Louise resistance source validated and new markers developed to track now both primary sources of resistance in spring wheat. | Annually |  |