WASHINGTON STATE UNIVERSITY

WSU PLANT PATHOLOGY SEMINAR

November 3, 2025, 4:10 PM (Pacific)

Challenges and Opportunities Faced by Phloem-Limited Plant Pathogens

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Attend in Person

November 3, 2025 @ 4:10 pm
Clark 149, Pullman, WA

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ABOUT THE PRESENTER

Mary Steele is a Ph.D. candidate in the Department of Plant Pathology at Washington State University, where she is co-advised by Dr. Chakradhar Mattupalli and Dr. Lindsey du Toit. Her research focuses on improving management of Botrytis blight and fruit rot in highbush blueberry. Specifically, Mary is developing efficient detection methods for mutations in *Botrytis cinerea* that confer fungicide resistance and improving understanding of *B. cinerea* infection timing of flowers and fruits. Mary is also involved with the department outside of research and is the 2025-2026 president of the Plant Pathology Graduate Student Organization.

ABSTRACT

Although a unique group, phloem-limited plant pathogens cause some of the most economically important plant diseases today. This includes phloem-inhabiting walled bacteria (e.g., *Candidatus* Liberibacter spp. which include the causal agent of Huanglongbing disease of citrus), wall-less bacteria (mollicutes, e.g., *Candidatus* Phytoplasma spp. which include the causal agents of X disease of cherry and aster yellows), and viruses (e.g., potato leafroll virus and citrus tristeza virus). The symptoms caused by phloem-limited pathogens usually manifest slowly and vary across pathosystems but often include leaf chlorosis and small, bitter fruit for fruit-bearing plant species. Phloem serves as a unique environment for plant pathogens as it is microaerophilic (1) and can support bidirectional movement of pathogens through plant tissues (2,3). Phloem is composed of sieve elements, which have limited cellular activity but are structurally sophisticated, and companion cells that act as metabolic supplements (4). Phloem presents advantages to pathogens in some ways by providing macronutrients, such as sugar, as well as micronutrients (5), which facilitates smaller genomes and more primitive cellular machinery in cellular phloem-limited pathogens (4). The phloem also provides an "escape" for pathogens from some pesticides, as there is a limited number of phloem-translocated pesticides (6). Plant immune responses, i.e., microbe-associated molecular pattern- and effector-triggered immunity, are also somewhat restricted from the phloem, although this remains the subject of ongoing debate (7).

Conversely, phloem tissue has evolved a toolkit to defend against phloem-inhabiting pathogens. This primarily includes mechanisms for blocking flow of pathogens and phloem-translocated molecules through a combination of callose deposition (8), sieve element P-protein activity (9), and electrochemical signaling such as calcium ion signaling (10). This disruption of phloem flow is complex in terms of disease outcomes. In some cases, this blocks pathogen movement and/or survival, but in other cases disrupted phloem flow presents challenges to normal plant functions (11). The phloem also has some inherent protection due to the location inside plants; without being mechanically introduced, phloem-inhabiting pathogens usually cannot infect plants (7). Phloem-feeding insects, primarily in the order Hemiptera, play a key role in the transmission of phloem-limited plant pathogens and add a layer of complexity to these tritrophic interactions. Three categories have been used commonly to describe the nature of insect-vectored plant pathogens: circulative, persistent (or semi-persistent), and propagative (7). The type of transmission for a particular plant pathogen significantly impacts appropriate disease management strategies for the pathogen. Despite the complexity of diseases caused by phloem-limited plant pathogens, there are some promising areas for future research. For example, the unique structure of sieve elements is the subject of ongoing study, as well as better simulating the phloem environment for studying these pathogens in vitro. These opportunities, and the resulting implications for disease management, will be discussed in the seminar.

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