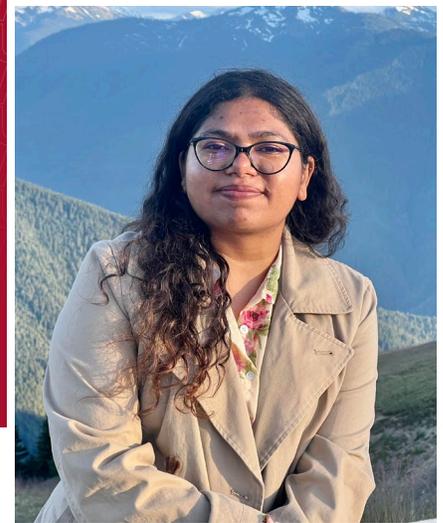




WASHINGTON STATE  
UNIVERSITY

WSU PLANT PATHOLOGY SEMINAR  
October 6, 2025, 4:10 PM



# Turning Foes into Allies: Plant Pathogens as Tools for Weed Biocontrol

## ABOUT THE PRESENTER

Harpreet Kaur is a Ph.D. student in the Department of Plant Pathology at Washington State University, advised by Dr. Youfu Zhao. Originally from Punjab, India, she developed her passion for agriculture and plant health while growing up in her village. She earned her bachelor's degree in agriculture from Punjab Agricultural University, India, and went on to complete her master's degree at Tennessee State University. Her master's research focused on identifying pathogenicity factors of *Erwinia tracheiphila* using transposon mutagenesis. Her doctoral research investigates the effects of large chromosomal inversions on populations of *E. amylovora*, the bacterial pathogen responsible for fire blight in apple and pear.

**Harpreet Kaur**

*PhD student*

*Washington State University, Prosser*

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## ABSTRACT

Weeds, insect pests and plant diseases are major yield-limiting factors negatively impacting crop production. Weeds are plants out of place that compete with crops for essential resources such as water, nutrients, and light, resulting in yield losses of about 25 to 40%. Traditional weed management depend heavily on mechanical, cultural, and chemical methods, with the global use of herbicides projected to rise by 6.3% in 2025 [1]. Continuous dependence on herbicides has imposed strong selection pressure on weed populations, leading to resistance development at 22 of the 25 known molecular target sites of herbicides. In addition, excessive use of herbicides contributes to soil degradation, environmental pollution, and risks to human health [2].

Biological weed control using plant pathogens is a sustainable alternative, with the bioherbicide market rapidly expanding due to globalization and demand for organic farming. It includes use of natural enemies for long-term suppression and application of microbial propagules like fungal spores or bacterial cells to directly suppress weeds [1-2]. My goal for this seminar is to review the principles of bioherbicide development, highlight major successes, identify current limitations, and discuss future opportunities for integrating microbial weed management into sustainable agricultural systems.

The development of bioherbicides begins with selecting suitable pathogens by reviewing literature, analyzing genetic structure and population dynamics of weed plants and pathogens, and conducting preliminary performance assessments. Host range studies are crucial to ensure specificity and avoid non-target impacts [2-3]. Once promising candidates are identified, their mode of action needs to be understood. Fungi and bacteria often suppress weeds through production of phytotoxic metabolites. Pathogens can trigger various physiological effects resulting in leaf necrosis, chlorosis, premature leaf drop, dark sunken spots on leaves, and reduced plant growth. Their action mechanisms include producing cell wall degrading enzymes, disrupting photosynthesis, releasing toxins that block biosynthetic pathways, and suppressing plant defense responses [4-5].

Examples of successful agents include *Colletotrichum gloeosporioides* strain BWH-1, which produces dirhamnolipid metabolites with strong herbicidal activity against dicot weeds, and *C. gloeosporioides* f. sp. *aeschynomene*, causing anthracnose on *Sesbania exaltata*, an invasive weed affecting rice and soybean. So far, 15 biocontrol agents have been registered, the majority being fungal, along with a single bacterial and one virus-based product. Notable commercial examples of fungal based products include BioMal (*C. gloeosporioides* f. sp. *malvae*) against *Malva pusilla* [6], Phoma (*Phoma macrostoma*) for broadleaf weeds such as dandelion [5], and a bacterial formulation, Camperico, containing *Xanthomonas campestris* registered in Japan against annual bluegrass [7]. Although viruses are generally considered less suitable due to their variable efficacy and narrow host ranges, certain strains such as tobacco mild green mosaic virus have shown potential as a biocontrol agent against tropical soda apple in Florida [8]. However, there are only a few commercial products available on the market as the success of bioherbicides is largely dependent on environmental factors, such as moisture and temperature [9]. Future research should focus on understanding the mechanisms behind weed suppression and on biotechnological improvements to enhance the efficacy of the biocontrol agent for inclusion in integrated weed management practices [10].

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