WASHINGTON STATE UNIVERSITY

Department of Plant Pathology

WSU Plant Pathology Seminar

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Sensing the rhizosphere: microbial transcriptome responses to root exudates and redox-active metabolites

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Abstract: Soil bacteria that produce antimicrobial metabolites called phenazines are abundant in the rhizosphere of wheat grown in the low-precipitation regions of the Pacific Northwest, where they help control soilborne fungal pathogens. However, the molecular mechanisms that underlie the adaptation of these and other rhizobacteria to dryland conditions remain poorly understood. To address this gap, we analyzed root exudates from wheat grown under both water-replete and water-stressed conditions, demonstrating that water-stressed exudates contain higher levels of quaternary ammonium compounds (QACs), which protect the phenazine-producing strain *Pseudomonas synxantha* 2-79 from osmotic stress. RNA-seq analysis revealed that exposure of 2-79 to these exudates led to the upregulation of QAC uptake and catabolism genes. We then inactivated genes involved in QAC uptake to assess how these mutations influenced the ability of 2-79 to catabolize these metabolites and use them as osmoprotectants. A multiple QAC transporter mutant of 2-79 exhibited reduced competitiveness in rhizosphere colonization compared to the wild-type parental strain. In a separate study, we focused on phenazine biosynthesis in *Burkholderia*, another group of phenazine-producing rhizobacteria. Through a combination of mutagenesis, genetic complementation, RNA-seq, and analytical techniques, we characterized the genes associated with phenazine biosynthesis, regulation, and self-resistance in *Burkholderia lata* 383, underscoring their importance to the organism's biology. Collectively, these studies indicate that the exchange of metabolites between plant roots and microbes, as well as among different microbial species, plays an important role in shaping the rhizosphere microbiome.

WSU Plant Pathology Seminar Series – Spring 2025 | Mondays 4:10 pm | Clark Hall 151 in Pullman campus
Zoom Link: [insert URL without https://]
Meeting ID: 935 5851 3144 | **Passcode:** 1824 | **Call in Number:** 1 646 558 8656

Short biography of Dr. Mavrodi

Dmitri Mavrodi received his Ph.D. in Molecular Biology from the Engelhardt Institute of Molecular Biology (EIMB) in Moscow, Russia. From 2001 to 2013, he worked as a postdoctoral associate and assistant research professor in the Department of Plant Pathology at Washington State University. In 2013, he moved to the University of Southern Mississippi (USM), where he held the positions of Assistant and later Associate Professor in the Department of Biological Sciences. His research at USM focused on interactions between plants and rhizosphere microorganisms under environmental stress, as well as plant-derived antimicrobials and redox-active metabolites known as phenazines.

In 2025, he joined the USDA-ARS Wheat Health, Genetics, and Quality Research Unit as a Research Microbiologist, where he will focus on how the plant microbiome, microbial genes, and metabolites influence plant growth, development, resistance to abiotic stress and diseases, and specific physiological and biochemical processes.