From Insect–Pathogen–Plant Interactions to RNAi-Based Pest Management: Molecular Insights and Emerging Technologies

Junepyo Oh, Ph.D.
Department of Entomology, Kansas State University

Insect pests pose significant challenges to agricultural production through direct feeding damage and the transmission of plant pathogens. Understanding the molecular mechanisms underlying insect–pathogen–plant interactions and developing innovative pest management strategies are essential for sustainable agriculture. This seminar will highlight research conducted during my doctoral and postdoctoral training, focusing on the molecular interactions among insects, pathogens, and plants, as well as emerging RNA interference (RNAi)-based technologies for insect pest management.

The first part will focus on the interactions among the potato psyllid (*Bactericera cockerelli*), the bacterial plant pathogen '*Candidatus* Liberibacter solanacearum' (Lso), and host plants. Specifically, I will discuss haplotype-specific differences in pathogen transmission, molecular mechanisms underlying pathogen interactions with insect vectors, and the roles of bacterial effectors in modulating plant defense responses. These studies provide insights into the complex molecular interactions that influence pathogen transmission and disease development.

The second part will explore RNAi-based approaches for sustainable insect pest management. Although RNAi offers a promising strategy for species-specific pest control, its efficiency varies considerably among insect species. To better understand these differences, I investigated species-specific dsRNA processing and siRNA production using small RNA sequencing, revealing distinct siRNA profiles and discrepancies between experimentally generated siRNAs and computational predictions. Building on these findings, I will discuss ongoing research aimed at improving RNAi efficiency through rational RNA design and innovative delivery strategies.

Together, these studies demonstrate how fundamental research in insect molecular biology can advance our understanding of insect–pathogen–plant interactions and contribute to the development of next-generation, sustainable pest management technologies.