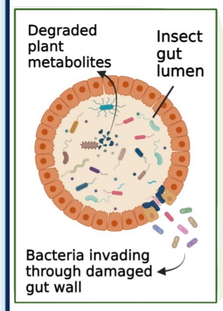
Elucidating the effects of plant defenses on insect gut-associated bacterial communities

Syed Turab Hasan[1], Andreea Bosorogan[1,2], and Eliana Gonzales-Vigil[1,2]

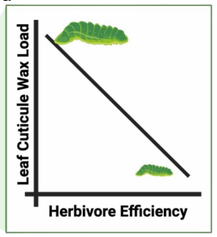
[1]Department of Biological Sciences, University of Toronto Scarborough

[2]Department of Cell & Systems Biology, University of Toronto

Introduction



Bacteria impact success of both plants and insects, yet are often overlooked when studying plant-insect interactions.[1]



The cuticle, a wax coating plant surfaces reduces insect growth and feeding.[2,3]

↑JA ↔ ↑ET → Defences against insects

Plant defences are regulated by three hormones: Jasmonic Acid (JA), Ethylene (ET) and Salicylic Acid (SA).[4,5]

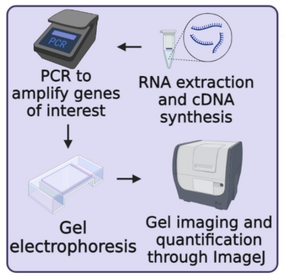
↑SA ⊣ JA → Defences against pathogenic bacteria

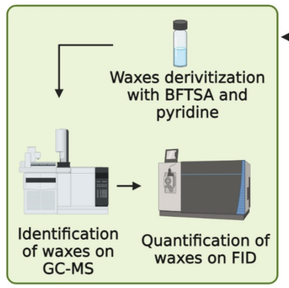
Methods

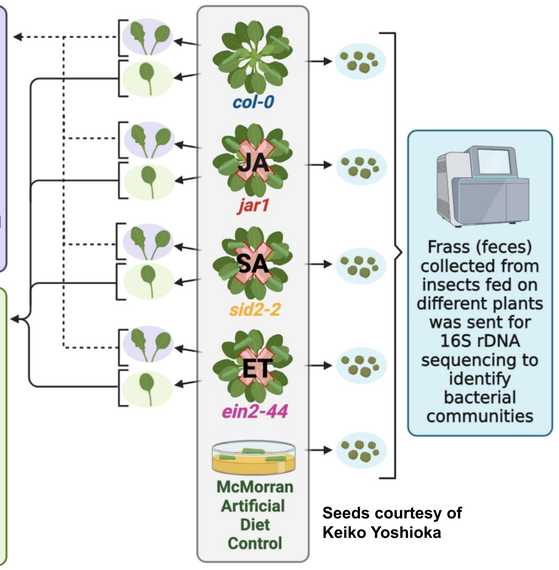
1st OBJECTIVE : Assess the effects of plant defence pathways on insect gut bacterial communities

2nd OBJECTIVE : Characterize the composition of leaf cuticular waxes to identify differences in mutants

3rd OBJECTIVE : Evaluate the induction of SA, JA and ET signaling pathways in wild-type and mutant plants





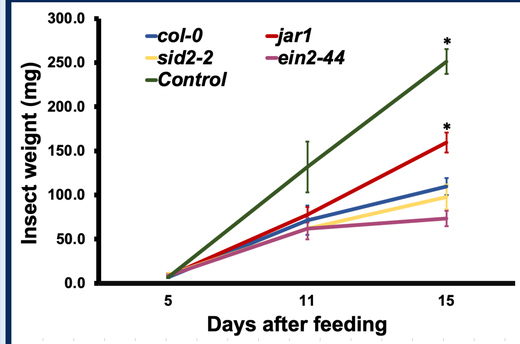


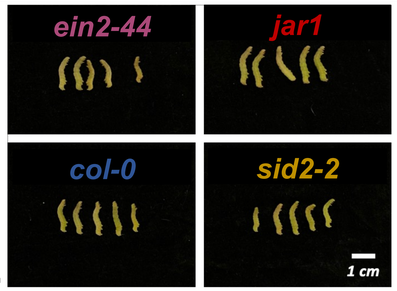
Frass (feces) collected from insects fed on different plants was sent for 16S rDNA sequencing to identify bacterial communities

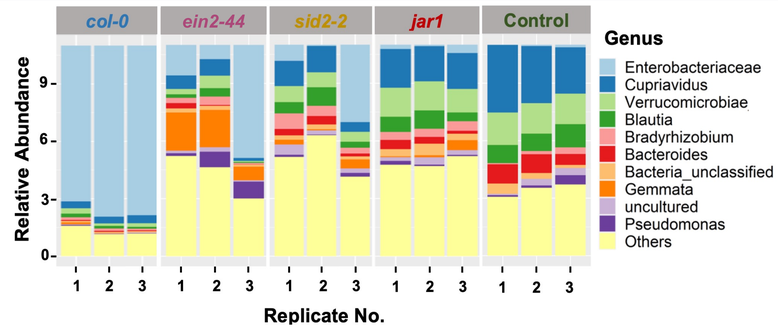
Seeds courtesy of Keiko Yoshioka

Analysis will aid the development of microbiome-mediated solutions for sustainable crop management by targeting insect-gut bacterial communities

1. Insect Performance & Gut Bacterial Community Composition





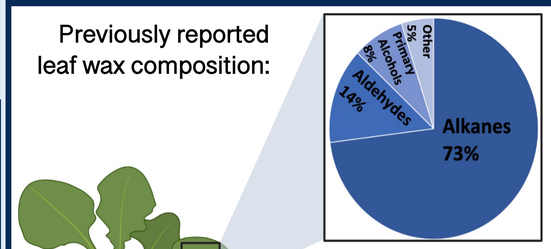


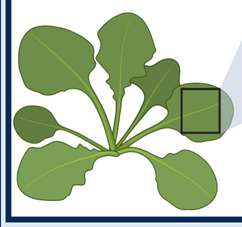
Optimal performance was observed in insects fed on control diet, followed by those fed on JA-deficient plants → JA has a key role in modulating anti-herbivory defences

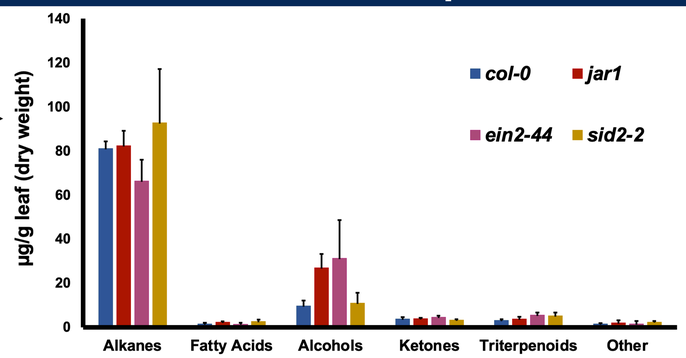
Plant defences alter insect gut bacterial communities as observed by the variation in abundances of *Enterobacteriaceae* and *Cupravidus* in insects fed on resistant and susceptible diets

2. Leaf Cuticular Wax Composition

Previously reported leaf wax composition:



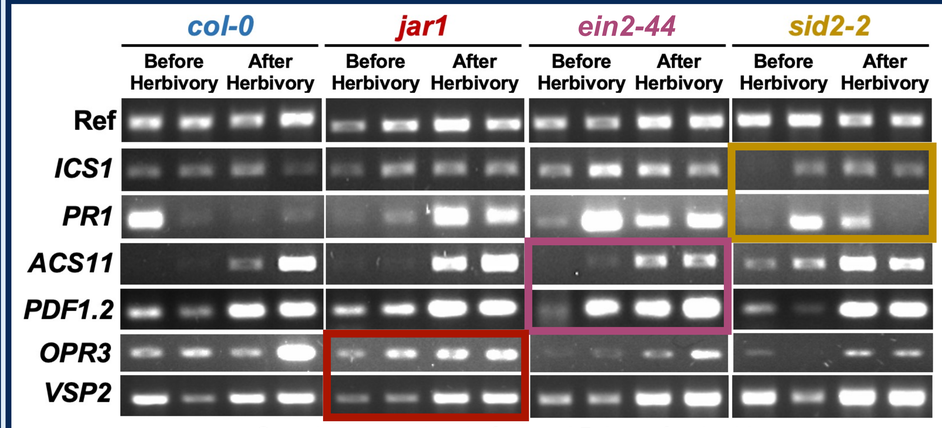




Mutants impaired in JA and ET have higher amounts of alcohols compared to wild-type leaves

The three signaling pathways do not impact wax accumulation as observed by the lack of significant difference in wax composition among mutant and wild-type plants

3. Phytohormone Pathway Induction



Samples were taken before and 5 days after herbivory

Gene	Protein	Pathway	Role
PP2A-A3	Protein Phosphatase 2A Subunit A3	N/A	Reference
ICS1	Isochorismate Synthase 1	SA	Biosynthesis
PR1	Pathogenesis-Related Gene 1	SA	Signaling Cascade
ACS11	1-aminocyclopropane-1-carboxylate synthase 11	ET	Biosynthesis
PDF1.2	Plant Defensin 1.2	ET	Signaling Cascade
OPR3	12-Oxophytodienoate Reductase 3	JA	Biosynthesis
VSP2	Vegetative Storage Protein 2	JA	Signaling Cascade

Antagonistic relationship between JA and SA pathways evident in the induction patterns of PR1 and VSP2

References

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