CITRUS ADVANCED TECHNOLOGY PROGRAM

QUARTERLY & FINAL REPORTS: Control of Citrus Greening, Canker & Emerging Diseases of Citrus

SELECT PERIOD September 2015

(●) *Quarterly Report* ( ) *Final*

Proposal Title

Why is Poncirus trifoliata resistant to colonization by Asian citrus psyllid?

Today's Date	Sponsoring Organization (drop-down)	Category (drop down)
2/1/16	Citrus Research and Development Foundation	Vector Management

REPORT UPDATE (500 words-It is not necessary in this public report to disclose your institution's proprietary information or intellectual property.)

Host plant resistance can be expected to provide the foundation for successful management of Asian citrus psyllid (ACP) in the future. We performed choice assays to assess antixenosis and no-choice assays to identify antibiosis effects of Poncirus trifoliata on host selection behavior of ACP to preferred and non-preferred hosts and studied how the chemical constituents of host plants affect oviposition and nymphal development. Some trifoliate accessions exhibited reduced larval and adult development (antibiosis) and reduced colonization (antixenosis). Experiments were performed to explore these aspects of decreased oviposition and nymphal development in trifoliates and the concurrent reduced feeding by ACP. Electrical penetration graph (EPG) studies were performed on resistant and susceptible accessions to characterize feeding from xylem and phloem and to provide insight into physical barriers in plant vascular elements that reduce phloem ingestion.

EPG is used to characterize feeding behavior of piercing-sucking insects such as aphids, psyllids, whiteflies etc. While the insect probes, ingests, and salivates within the food source, characteristic voltage waveforms are produced that, in conjunction with histological studies, allow researchers to determine feeding patterns associated with acquisition and inoculation of pathogens. A primary limitation to this method is data analysis. Recordings of multiple insects for >3 hours generate gigabytes of data. Classification of data into insect feeding states representing ingestion, salivation, or other activities is typically accomplished through visual inspection of waveforms and manual annotation by comparison to published standards. Analysis is time consuming, requires expert training and manual annotation that precludes high-throughput analysis. We removed the data analysis bottleneck through application of machine learning algorithms designed to teach a computer to recognize and learn from minimal human coding. Machine learning algorithms can transform raw EPG data to feeding states with little or no human input. We used supervised and semi-supervised machine learning models to annotate ACP feeding waveforms and discovered previously unrecognized feeding states. With minimal (5%) human annotation of EPG recordings, machine learning models classified the remainder with >95% accuracy. A manuscript has been submitted for publication. Further analysis of feeding states should provide insight into the nature of pathogen transmission and allow identification of characteristics that render certain plant varieties more resistant to pathogen infection.

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Organization USDA, ARS

Project Number 853

Project Duration (years) 2 *Year of Project* 2

Total Funds (current year) $93,478.00

Form PR-12 Quarterly Reports **SUBMIT REPORT**

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