ROLE OF ALFALFA IN THE EPIDEMIOLOGY OF *XYLELLA FASTIDIOSA* IN CALIFORNIA

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ABSTRACT
Alfalfa occurs widely throughout the Central Valley, often adjacent to grape and other plants susceptible to *Xylella fastidiosa (Xf)*. A previous epidemic of Pierce's disease in the Central Valley was associated with migration of infective insects from alfalfa fields to vineyards. We will determine the importance of alfalfa as a host of different strains of *Xf* and its role as a source of the pathogen for vector transmission. These studies provide basic information on these interactions, which would be incorporated in disease management strategies that include alfalfa as a host of *Xf* and sharpshooter vectors.

INTRODUCTION
The role of alfalfa in the maintenance and spread of *Xylella fastidiosa (Xf)* in California is poorly understood, despite the fact that the epidemic of Pierce's disease (PD) in the Central Valley during the 1940s was linked to alfalfa fields. We will conduct studies aimed to understand the importance of alfalfa in the epidemiology of *Xf* in California in relation to grape and almond hosts, and native and invasive insect vectors. We will conduct transmission experiments with different *Xf* strains and different vector species to determine what factors are of important in the spread of this bacterium among different host plants. Recent research on *Xf* has also examined its biology within alfalfa plants. Our work will also study the movement and multiplication of *Xf* in alfalfa and the potential role of this crop as a reservoir of *Xf* for vector acquisition. Information gathered in this project will lead to determination of the importance of alfalfa in the epidemiology of *Xf*.

OBJECTIVES
1. Determine the fate and role of *Xf* in alfalfa.
2. Determine the transmission efficiency of *Xf* strains to/from alfalfa to grape and almond by three sharpshooter vector species.

RESULTS
This project is being initiated. We have no results to report at this point.

FUNDING AGENCIES
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WHERE, WHEN AND HOW DO INGESTION AND OTHER FEEDING BEHAVIORS OF THE GLASSY-WINGED SHARPSHOOTER ALLOW INOCULATION OF *XYLELLA FASTIDIOSA*?

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ABSTRACT

This year, we completed the laboratory portion of work that identified an aspect of electrical penetration graph (EPG) ingestion waveform (C) of glassy-winged sharpshooter (GWSS) that definitively represents xylem ingestion. We also demonstrated that extravasation is correlated with the B1 waveform. Both B1 and C waveforms may play a role in the behavior that facilitates inoculation of *Xylella fastidiosa* (*Xf*). Results this year support that both amount and location of *Xf* binding in the foregut of GWSS ("vector load") are critical for success of subsequent inoculation. The precibarium is the first area colonized during acquisition, and also may be the most important location for subsequent inoculation. If insects become "maximally loaded" with *Xf*, preliminary results suggest that a single probe by a single vector can cause a lethal infection. These results will help solve the PD/GWSS problem by providing powerful new tools for future studies, answers to numerous questions about how vector transmission works, and new potential targets for host plant resistance.

INTRODUCTION

The behaviors comprising within-plant feeding (a.k.a. stylet penetration) of hemipteran vectors are intricate and complex, and vary enormously among species. Yet, a deep understanding of stylet penetration is particularly important for sharpshooter vectors because behavior plays a crucial role in transmission of non-circulatively transmitted pathogens like *Xylella fastidiosa (Xf)*. Thanks to EPG monitoring, sharpshooter stylet penetration can now be observed in detail, in real-time. Two stylet penetration behaviors emphasized in this project likely control *Xf* inoculation. They are uptake of plant fluids into the gut (ingestion) and expulsion of bacteria-laden fluids (egestion or extravasation).

OBJECTIVES

1. Characterize ingestion behavior, especially to: (a) identify in which cell types various durations of ingestion (C) are occurring, and (b) how to recognize that by EPG alone.
2. Characterize extravasation behavior, especially to: (a) correlate the B1 waveform with fluid flow in and out of the stylets, and (b) determine in which plant cells this behavior occurs.
3. Characterize behavior-*Xf* interactions that permit inoculation, especially to (a) identify the behaviors (i.e. ingestion, extravasation or both) during which bacteria are expelled, and (b) whether bacterial expulsion is into xylem, or any plant cell type penetrated, or both.

RESULTS

Insect Availability

Last year's progress report announced that we had solved all problems with availability of experimental plants, insects and bacteria. Unfortunately, one month after writing that report, our source for clean glassy-winged sharpshooters (GWSS), D. Morgan of CDFA, told us he could no longer provide insects due to unforeseen colony issues. For most of this year, we have attempted to use GWSS lab-reared from egg masses laid by adults that we field-collected from ornamental plants in Bakersfield (for *Xf* inoculation studies) or we have substituted smoketree sharpshooter (STSS) (for waveform correlation studies without *Xf*). These attempts were partially successful, but consequences were severe for one experiment. As of this writing (late September 2006), we have been promised a few clean insects from Morgan, to re-do key experiments.