SPATIAL AND TEMPORAL RELATIONS BETWEEN GLASSY-WINGED SHARPSHOOTER SURVIVAL AND MOVEMENT, XYLEM FLUX PATTERNS, AND XYLEM CHEMISTRY IN DIFFERENT HOST PLANTS

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INTRODUCTION

The glassy-winged sharpshooter (GWSS), *Homalodisca coagulata* (Say) (Homoptera: Cicadellidae), has been identified as the main vector for the xylem restricted bacterium *Xylella fastidiosa*, the causal agent of Pierce's disease. Our project aims to identify those aspects in the GWSS-host plants interaction that may explain variations in GWSS performance and population dynamics of this vector. Following the field population dynamics of a species requires a reliable method for accurately estimating real field densities. Current methods used to estimate GWSS densities in the field, rely mainly on yellow sticky traps or net beatings and insect counts. We have developed a method to take absolute samples of the GWSS to recover all the GWSS stadia except eggs. We will then explore possible correlations between GWSS changes in population densities and performance, with xylem physical and chemical parameters in different host plants.

OBJECTIVES

1. Quantify xylem flux patterns and to characterize xylem fluid chemistry to determine potential correlations with GWSS movement from surrounding alternate host plants into vineyards.
2. Quantify egg production, nymphal survival, and adult production and movements in different host plants and to correlate GWSS demographic statistics with xylem flux and chemistry.

METHODOLOGY

Our sampling system uses military parachutes to cover entire trees and then, by fogging the trees, we recover all the insects. To estimate accurately the recovery rate, we collect adult GWSS in trees surrounding the ones to be sampled and mark the GWSS with a dye. After the randomly selected sample trees are tented, we release 100 marked GWSS in each of them. The amount of marked insects recovered is an estimate of the recovery rate of the population on each of the trees. We then use this number as a correction factor for each tree. The average recovery rate of marked GWSS on these commercially sized citrus trees is 89%. We count all the adult and nymph GWSS in the sample. We also use a specially designed Schölander bomb to measure xylem fluid pressure and to extract xylem fluid for chemical analyses.

RESULTS AND CONCLUSIONS

At this point, the method is being used in orange and lemon trees at three different locations. One is a mixed orange/lemon grove at Agricultural Operations, UC Riverside, and the other two consist of an orange and a lemon grove, in Temecula, California. We also did some limited work at an orange grove in Kern County, and in the Coachella Valley, California. We intend to use this method to follow GWSS population dynamics for two complete years, and to correlate changing GWSS densities over time in different host plants with xylem flux and xylem chemistry over the same time period with the same trees. Our results show that several thousand glassy-winged sharpshooter adults occur per tree too (Figure 1). We also found that adult GWSS densities differ between lemon and Valencia trees at certain times of the year whereas they are similar significantly between Valencia oranges and lemon over the entire year, adult GWSS switch from Valencia to lemon trees starting in mid-January. By the end of February, when the first egg-masses appear, 99.51% of the adult GWSS population can be found on lemon trees.

The results shown here are in agreement with indirect density measurements in the same and other areas. Data from a mark-recapture method used in our other studies, allowed us to use the Lincoln index to estimate GWSS adult population densities. Summer estimations for adult GWSS ranged between 6,000 to more than 8,000 adult GWSS per tree (ca. 600,000 to 800,000/acre) in both Agricultural Operations, UC Riverside and a non-treated orange grove in the Bena Road area of Kern County. We are also counting all nymphal stages and estimating nymph densities. These results for this first year of sampling will also be presented.

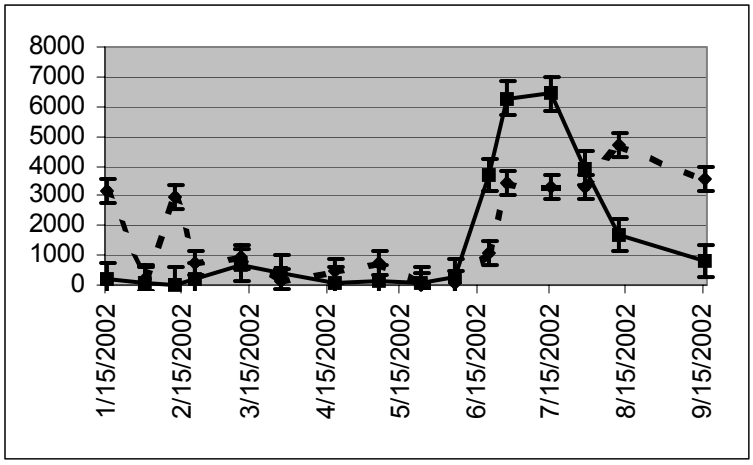

Figure 1. Monthly mean of adult GWSS on lemon trees (dotted line) and orange trees (solid line).

With these data, we have also estimated GWSS sex ratios. Based on the coloration of newly emerged adult GWSS, we estimated the proportion of new adults per sampling date. All these data will be used to calculate recruitment, and mortality for each age and for each generation on both citrus host plants, and therefore, to build a picture of the GWSS population dynamics over time. We are using the Scholander bomb for xylem fluid extraction on the same trees that are sampled for GWSS for subsequent chemical analyses. We are in the process of collecting the samples in both places at UC Riverside and Bakersfield area. We intend to expand this xylem studies to different host plants, namely grapefruit, tangerines, and grapevines during the second year of the project. The chemistry of the xylem samples for the first year is being analyzed, and we will test for possible correlations between fluctuations in xylem chemistry and in GWSS performance that might explain changes in GWSS densities over time.

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