THE EPIDEMIOLOGY OF PIERCE'S DISEASE

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INTRODUCTION

The epidemiology of Pierce's disease (PD) changed dramatically in California with the arrival of the glassy-winged sharpshooter (GWSS) about 15 years ago. Before that time infections that persisted and resulted in vine death were the result of primary spread, i.e. from inoculum sources outside the vineyard. The disease caused losses, but the spread was linear, not logarithmic, and the damage was a gradual linear accumulation resulting in the loss of a small percentage of vines. With the exception of some traditional "hotspot" areas, losses from PD were important but not severe enough to preclude grape production. With the arrival of the GWSS, however, the transmission of the causal bacterium appears to be both primary and secondary (from vine to vine) and subsequent disease spread has become logarithmic, such that entire vineyards can be destroyed in as little as 3 to 5 years (Perring et al. 2001; Blua, Phillips et al. 1999; Purcell and Saunders 1999). To cope with this development there have been extensive field studies to determine methods to control the glassy-winged sharpshooter. However characterization of the changes in the epidemiology of PD when the causal bacterium is transmitted by GWSS has been based largely on anecdotal information and general observations with limited actual field data. These two coordinated projects propose to use field data from large numbers of vineyards to assess the impact of the glassy-winged sharpshooter on the epidemiology of Pierce's disease. This is the first year of a proposed 5 year project. The resulting improved understanding of PD epidemiology may also enable UC Cooperative Extension to propose some preliminary recommendations for disease-based control strategies that growers can implement.

Two critical issues are how much economic loss can be expected where GWSS occurs or when the insect moves into new viticulture areas, and what disease-based control methods can be employed in areas already infested with GWSS. The current economic loss models for GWSS are not based on empirical data but on arbitrary projections. Empirical mapping and disease tracking data that enables the comparison of various epidemiological factors (such as cultivar and susceptibility, vineyard age, proximity to GWSS hosts, cultural and control practices in grapes and other crops, etc.) are needed to make better informed projections. Current epidemiological models based on other native sharpshooter vectors (Purcell 1981) are not adequate to account for vine-to-vine spread when GWSS is the vector. Historically, mapping the incidence and vine locations of PD and tracking the spread over a few consecutive years has led to key conclusions regarding the sources of PD spread (Hewitt and Houston 1941, Purcell 1974) and the effectiveness of various control methods (Purcell 1979, Hewitt, Frazier et al. 1949). For example, these previous efforts paid off in identifying the highest risk areas to be avoided with new grape plantings.

OBJECTIVES

1. Develop a model for PD epidemiology when *Xylella fastidiosa* is vectored by GWSS, that evaluates the importance of epidemiological factors such as GWSS population size, vine age, cultivar susceptibility, control practices, and GWSS control treatments in vineyards and nearby GWSS hosts or habitat.
2. Develop PD identification and management strategies for use by growers to reduce risk and damage. Update and provide educational materials to assist vineyard managers, pest control advisors, and county, state, and federal staff involved in advising growers and area-wide management plans.
3. Create a central data processing facility to compile the data from these projects in a GIS format. Share the resulting data, maps, and information with collaborating plant pathologists, statistical analysts, agricultural economists, and other legitimate researchers.

RESULTS AND CONCLUSIONS

Two projects with shared methods and objectives were pursued cooperatively to avoid duplication and make the most efficient use of management and field personnel, equipment and other resources. Field surveys were conducted between early August and November 18, 2002, after which the data compilation began. A field crew composed of CDFA and UC people was trained, and the surveys were done using all terrain vehicles. Another project using identical methods and funded by private sources was conducted by Gisela Wittenborn, and her data were made available to the overall project. Every vine

displaying possible PD symptoms was identified, tagged, mapped, and a sample was taken and sent to the CDFA diagnostic laboratory in Sacramento and tested by ELISA for *X. fastidiosa*. In all more than 250 blocks (> 6000 acres total) in Kern County and more than 60 blocks (>3000 acres total) in Tulare County were surveyed and mapped. More than 30 growers participated in the project. As the data are compiled these participants will be provided with mapped survey results for their vineyards to assist in disease control. The following cultivars were included in the study: Red varieties include Christmas Rose, Crimson Seedless, Flame Seedless, Redglobe, Ruby Seedless. White varieties include Calmeria, French Columbard (wine), Jade Seedless, Muscat, Perlette, Thompson Seedless, Superior Seedless. Purple varieties include Autumn Royal, Black Emerald, Fantasy Seedless. A data center at the Center for the Assessment and Monitoring of Forest and Environmental Resources (CAMFER) at University of California, Berkeley is beginning to compile the data and create a GIS based data set that will be used in these projects and made available to other legitimate researchers. The sites that were surveyed were selected to enable a wide range of comparisons within the data set to enable the evaluation of epidemiological variables, projection of disease progression over time, and the effectiveness of disease control practices.

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Biological Control of the Glassy-winged Sharpshooter