FINDING PIERCE'S DISEASE INFECTED VINES IN LARGE VINEYARDS: A PROPOSED PIERCE'S DISEASE SAMPLING PROGRAM

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ABSTRACT
The goal of this project is to evaluate a sampling method for rapidly identifying vineyards to sample for Pierce's disease (PD) infection. Using aerial imagery to locate large "PD signature areas" we have searched 30,353 vineyard acres, identifying 76 vineyards for sampling. We have sampled 17 of these vineyards, finding PD in 8 of them. It is important to note that these infected sites had never been identified prior to our research. This is the first step toward sampling large areas for PD and it is the foundation for developing a sampling program for PD in California.

INTRODUCTION
Pierce's disease (PD), a disease of grapes caused by the bacteria, *Xylella fastidiosa* Wells et al., was described in California in the 1880s during an epidemic in Orange County (Pierce 1882). A second epidemic occurred in Tulare County in the 1930s (Hewitt et al. 1949), and until the mid-1990's, it was considered only a minor problem in vineyards close to riparian areas. In the early 1990s a new vector, the glassy-winged sharpshooter (GWSS), *Homalodisca vitripennis* (Germar) (formerly *Homalodisca coagulata* Say), was introduced into the state (Sorenson and Gill 1996), and this species was associated with a devastating epidemic of PD in the Temecula Valley. Since 1994, at least 1,500 acres of vineyards have been lost to the disease in California; in the Temecula Valley alone, losses have been estimated at $13 million (Wine Institute 2002).

Locating infected vines also is the most important component behind vineyard-level management strategies implemented by individual growers. For example, vineyards with high PD incidence would logically require more aggressive vector management than vineyards with little or no PD in the field. This does not mean that growers should relax their vigilance in areas or vineyards with low PD incidence, but by knowing the distribution of PD in their field, growers could prioritize the areas needing the most immediate attention. Also, knowing the location of infected vines is necessary for growers to implement roguing strategies to reduce *Xf* inoculum in vineyards.

Presently, the only proposed strategy for finding PD is to census vineyards in search for symptomatic vines; infection is verified by ELISA. This type of census was evaluated in Kern County, and it provided a cost-effective strategy for identifying infected vines when incidence was low (Hashim and Hill 2003). However, it becomes prohibitively expensive to sample and test every symptomatic vine when the percentage of vines with PD-like symptoms exceeds 1% in the vineyard (Perring et al. 2005). It is especially difficult to use a symptom-based survey when other stress factors (e.g. drought and salt damage) that express PD-like symptoms exist in vineyards (Krell et al. 2006).

While many growers are fastidious and have been diligent in conducting field censuses and roguing infected vines, the majority of large vineyards in California have never been surveyed for PD. Even vineyards in close proximity to citrus which represent putative high risk areas have not been sampled. In this project, we will develop PD sampling strategies that are not biased by variable symptom expression, that are economical so they can be applied to large geographic areas, and that have sufficient detail so they can be used to locate diseased vines within vineyards.

OBJECTIVE

1) To evaluate the use of "PD-signatures areas," visualized with aerial photography, for prioritizing vineyards for more intensive PD sampling. While this project focuses on table grapes in Kern and Tulare County (due to the funding source), the protocol is adaptable to vineyards of all types throughout the state.

RESULTS

The goal of an area-wide-level PD sampling plan is to assess PD distribution over large geographic areas. Clearly it is impractical to visit every vineyard in California and search for PD infection, so a method is needed for prioritizing fields to sample. In previous studies, we found that 82% of the diseased vines in the Coachella Valley were adjacent to two to six consecutive missing, dead, or replanted grapevines in a row. We hypothesized that these holes were created by PD infection, and putatively termed them "PD signature areas," (Perring et al. 2005, Park et al. 2006). We learned that these signature areas can be seen in aerial photographs (Figure 1), and we evaluated the feasibility of using aerial images to identify fields with PD. In previous studies in the Coachella Valley, we identified 15 vineyards with putative signature areas and sampling revealed 7 of them were infected with PD. These vineyards represented new finds for our area-wide survey that had not been identified in the previous 4 years of surveying by vehicle. A subsequent study in September 2006 in Kern County identified nine vineyards that had not been sampled previously; all nine were selected because they had PD signature areas visible in aerial images. Tissue collected around the signature areas confirmed PD in seven of the fields.

Currently, we are in the process of sampling table grape vineyards in Kern and Tulare County (Figure 2). Using aerial imagery, we have searched 163 vineyard sites representing 12,584 acres in Kern County and 363 sites representing 17,769 acres in Tulare County. In Kern County, we identified 20 vineyards with large signature areas and to date, we have sampled 17 of these vineyards, collecting samples for ELISA analyses. Eight of these fields were positive. We are continuing to search the aerial imagery in Kern County for additional sampling sites. In Tulare County we have identified 56 sites for sampling, and we are in the process of contacting growers to gain access to their vineyards for sampling.

CONCLUSIONS

The CDFA Research Scientific Advisory Committee (2007) noted that adding Pierce's disease data to the current CDFA GIS database is an "important and highly desirable objective." With over 790,000 acres of grapes in the state, this is a sizeable goal. Our lab has been working for several years on sampling strategies for PD at the grapevine (Krell et al. 2006), vineyard (Park et al. 2006), and area-wide scales. Our results in the current study suggest that aerial imagery can provide a rapid and efficient method for surveying large land areas and prioritizing vineyards for PD sampling. This season, we have identified 76 vineyards for priority sampling out of 526 sites representing 30,353 acres. We have collected samples from 17 of the 76 sites and have verified PD in 8 of the vineyards that had not been identified previously. This area-wide sampling is the first step toward adding PD data to the CDFA database.

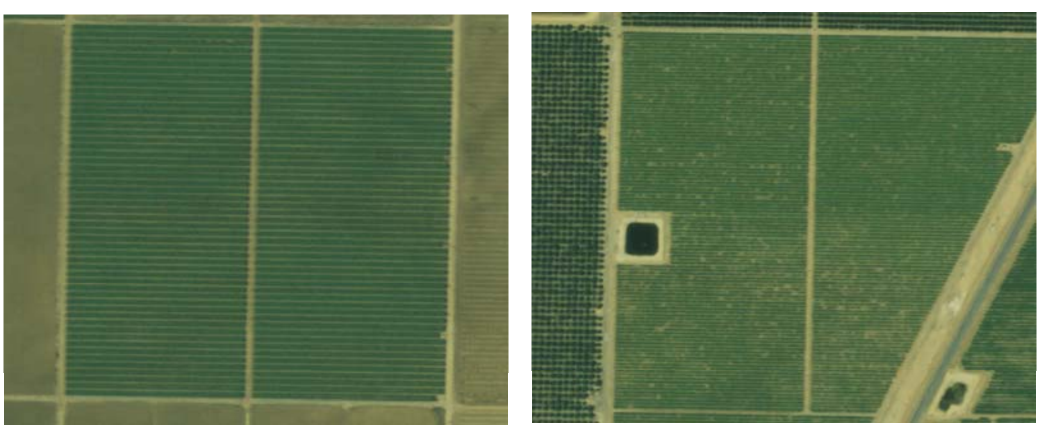

Figure 1. Aerial images of two vineyards in Kern County. The left side image was categorized as "healthy", meaning that it had a low priority for sampling while the right side image was categorized as having "PD signature areas", thus qualifying the vineyard for sampling.

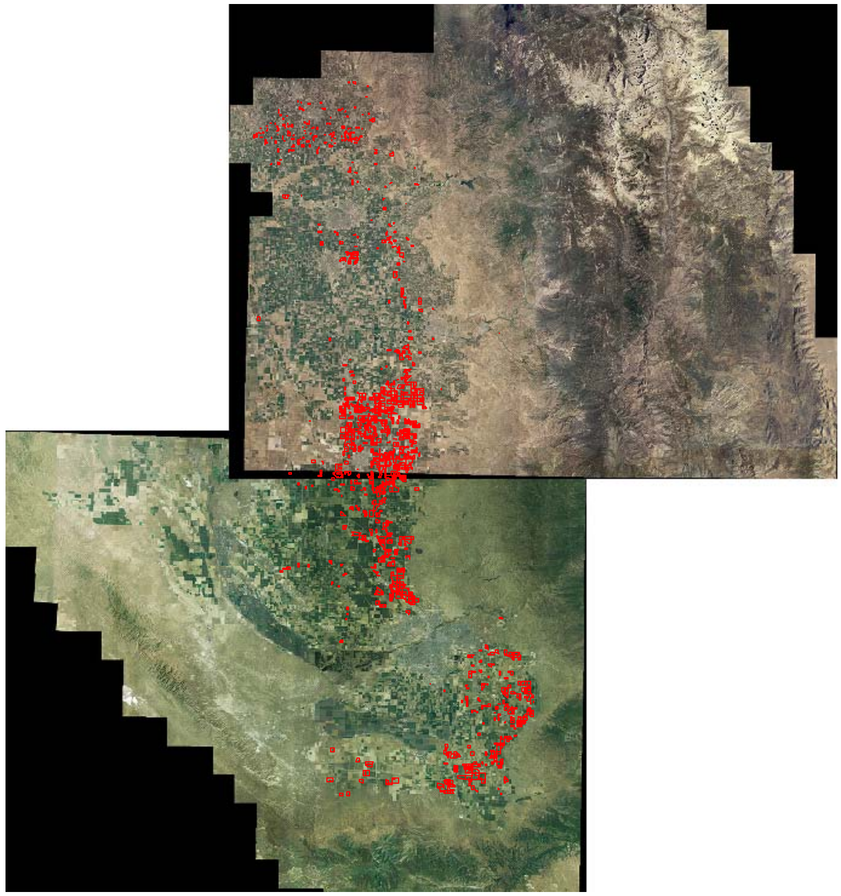

Figure 2. Aerial images of Tulare (top) and Kern (bottom) Counties showing the table grape vineyards (red areas).

REFERENCES

CDFA Research Scientific Advisory Committee. 2007. PD/GWSS Research Scientific Review Final Report. http://www.cdfa.ca.gov/pdcp/Documents/RSAP_Final_Report_08302007.pdf.

Hashim, J. M., and B. L. Hill. 2003. Monitoring and control measures for Pierce's disease in Kern County, and epidemiological assessment of Pierce's disease, pp. 95-98. *In* M. A. Tariq, S. Oswalt, Pl. Blincoe, A. Ba, T. Lorick, and T. Esser (Eds.), Proceedings of Pierce's disease research symposium. Coronado, CA. California Department of Food and Agriculture, Sacramento, CA.

Hewitt, W. B., Frazier, N. W., Freitag, J. H., and Winkler, A. J. 1949. Pierce's disease investigations. Hilgardia 19:207-264.

Krell, R. K., T. M. Perring, C. A. Farrar, Y. L. Park, and C. Gispert. 2006. Intraplant sampling of grapevines for Pierce's disease diagnosis. Plant Disease 90: 351-357.

Park, Y. L., T. M. Perring, R. K. Krell, C. A. Farrar, and C. Gispert. 2006a. Spatial distribution of Pierce's disease in the Coachella Valley: Implications for sampling. Am. J. Enol. Vitic. 57: 220-224.

Perring, T.M., J. Hashim, C. Gispert, Y. L. Park, C. A. Farrar, and R. K. Krell. 2005. Development of a field sampling plan for glassy-winged sharpshooter-vectored Pierce's disease, pp. 269-272. *In* M. A. Tariq, S. Oswalt, Pl. Blincoe, A. Ba, T. Lorick, and T. Esser (eds.), Proceedings of Pierce's disease research symposium. Coronado, CA. California Department of Food and Agriculture, Sacramento, CA.

Pierce, N. B. 1882. The California vine disease. U. S. Div. Vegetable Phys. and Pathology. Bulletin No. 2.

Sorensen, J. T., and Gill, R. J. 1996. A range extension of *Homalodisca coagulata* (Say) (Hemiptera: Clypeorrhyncha: Cicadellidae) to southern California. Pan-Pac. Entomol. 72:160–161.

Wine Institute. 2002. Pierce's disease update. .http://www.wineinstitute.org/communications/pierces_disease/pierces_disease_update.htm

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