

## **Risk assessment, economic analysis, and extension education for Asian citrus psyllid and huanglongbing disease management in California**

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**Short summary:** Asian citrus psyllid is a vector of a bacterial pathogen that causes an incurable and deadly disease of citrus called huanglongbing. This project will provide a web-based GIS view of urban and commercial citrus infestations of Asian citrus psyllid and infections of huanglongbing for California. The maps will be linked with a risk assessment and the economics of various control tactics to provide users with decision-making information. Statewide education will be provided to users (commercial growers, plant nurseries, landscapers, and the general public) to facilitate management of Asian citrus psyllid and huanglongbing.

**Project Summary:** The Asian citrus psyllid (ACP), *Diaphorina citri* was first found in the US in Florida in 1998, in Texas in 2001, in Mexico and California in 2008, and in Arizona in 2009. This pest readily feeds on citrus and close relatives in the Rutaceae family, where it can achieve extremely high population growth rates. Damage from *D. citri* occurs due to preferential feeding by the nymphal stages on developing citrus shoots, which causes sooty mold production, shoot deformation, and plant stunting. More importantly, *D. citri* is also an efficient vector of the bacterial pathogen *Candidatus Liberibacter asiaticus* that causes the deadly citrus disease huanglongbing (HLB). This disease produces progressive mottling of leaves, deformed and off-flavor fruit, plant stunting, and eventual plant death. Currently there is no known cure for infected trees. Control is to ameliorate the potential impact of this invasive pest and pathogen in California. We will collaborate with state and citrus industry scientists to connect *D. citri* geographical databases, conduct spatial risk analysis for commercial citrus growers as a function of proximity to controlled or uncontrolled urban areas. Mapping the spatial distribution of *D. citri* over time will allow us to quantify rates of spread and the efficacy of intervention methods. The economic analysis will provide the expected costs of *D. citri* and HLB management in backyard citrus and commercial orchards. The risk assessment and economics will be furnished as an online resource linked with the GIS database so that individual stakeholders will be limited to removal of infected trees to curb pathogen spread, and vector management via chemicals or, to a limited extent, biological control. HLB was first identified in Florida in 2005 and has spread into nearby states. It is found currently in Central America, Belize and Mexico, but not California, Arizona or Texas. Areas affected by HLB have incurred significant economic losses associated with reductions in fruit quality and extensive tree mortality, coupled with increasing costs associated with vector and disease management. Since 2005, total citrus acreage in Florida has declined by 200,000 acres and an additional 40,000 acres have been abandoned because of a combination of two diseases, bacterial canker and HLB. Psyllid and disease management programs in Florida currently cost \$500-600/acre. ACP monitoring programs are in place in both commercial citrus and urban areas of California. Up to this point, 99% of ACP finds have been in the urban areas. Thus, comprehensive vector control recommendations have not been fully developed or implemented

in commercial citrus. To date, HLB has not been detected in any insect or plant samples in the western United States, but its arrival in the next 5 years is likely because it is spreading northward from Mexico. The coordinated development of exhaustive monitoring, large-scale extension activities, and aggressive management programs are necessary to stave off devastating losses from this disease in California. An intensive management program in Brazil, consisting of extensive field surveys, removal of infected trees, *D. citri* control, and shifting of nursery operations into protected screenhouses has been attributed with substantial reductions in disease. We propose to leverage the knowledge of ANR scientists, economists, and industry have "one-stop" access to decision-making information. Then we will conduct statewide education of commercial growers, plant nurseries, landscapers, and the general public to facilitate management of *D. citri* and HLB disease. We will evaluate the efficacy of the extension program in reaching stakeholders and promoting adoption of appropriate management techniques. The proposed work will facilitate a transfer of knowledge regarding *D. citri* and HLB management from ANR researchers and extension personnel to stakeholder groups, building on ANR strengths in invasive species ecology, agricultural economics, and extension education. We expect this project also has excellent potential to generate additional funding, since a similar proposal that included area-wide management of *D. citri* and HLB in CA, AZ, and TX received a high funding priority rating by a recent USDA-NIFA grant panel.