University of California
Agriculture and Natural Resources

Thousand cankers disease and the walnut twig beetle: a rapidly emerging invasive threat to walnuts in California

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Project dates: July 1, 2011 – June 30, 2014

Short summary: Thousand cankers disease is an emerging disease responsible for serious decline and death of ornamental eastern black walnut in Colorado and other western states, and the walnut species *J. californica* and *J. hindsii* in California. The fungal pathogen, *Geosmithia morbida*, that causes the disease is vectored by the walnut twig beetle, now found in California. The anticipated outcomes of this research project are a clear assessment of the susceptibility to TCD of *Juglans*species important to walnut breeding, rootstock production, and the walnut nut production industry; an understanding of stress factors that may influence host selection by WTB and symptom severity of TCD; and the distribution pattern of TCD in California orchards for understanding disease risk in relation to potential vector/inoculum sources.

Program Summary: Thousand cankers disease (TCD) is an emerging disease responsible for serious decline and death of ornamental eastern black walnut (*J. nigra*) in Colorado and other western states, and *J. californica* and *J. hindsii* in California. In July 2010 TCD was reported for the first time in the native range of eastern black walnut, where both the walnut twig beetle vector (*Pityophthorus juglandis*, WTB) and the fungal pathogen (*Geosmithia morbida*) were identified in symptomatic trees near Knoxville, Tennessee. There is great concern over the further spread of TCD throughout the native range of *J. nigra*, and uncertainty about the potential impact on *Juglans*species of agricultural and ecological importance in the western U.S. as well. Both the pathogen and beetle vector were identified in July 2008 from symptomatic *J. californica*, *J. hindsii*, and *J. regia*, and more recently from *J. major*, within the National Clonal Germplasm Repository's (NCGR) *Juglans*collection at Winters, CA. We have also identified TCD frequently in native and ornamental stands of *J. californica* and *J. hindsii*, in black walnut seed trees for rootstock production, and in commercial orchards in both English scions and Paradox rootstocks in the heart of the California walnut industry, which generates nearly three quarters of a billion dollars in annual sales. Given the concerns expressed by regulatory officials, scientists, land managers, and other stakeholders, there is a need to consider other pathways of spread at both local and regional levels, as well as the management and regulatory implications. Also unclear is the variation in the population of *G. morbida* as there may be local or regional differences among isolates in virulence and, possibly, other fungal species that contribute to TCD symptom severity. Because the initiation of *G. morbida*infection beneath the bark is completely dependent on the activity of WTB as a vector, it will be necessary to understand the degree to which WTB discriminates among its potential hosts and their condition in the lab and in the field. Thus, research on the etiology, epidemiology, and management of TCD, as well as the relative resistance or susceptibility of *Juglans* species under California conditions is critically important and urgent. With this background, we propose to i) evaluate *Juglans* species susceptibility to TCD under field conditions, ii) evaluate the influence of bark moisture status and other stressors on host susceptibility to *G.*

morbida and WTB host selection, and iii) assess disease and vector distribution in orchards and the diversity of California isolates of *G. morbida*. The anticipated outcomes of this research are a clear assessment of the susceptibility to TCD of *Juglans* species important to walnut breeding, rootstock production, and the walnut nut production industry; an understanding of stress factors that may influence host selection by WTB and symptom severity of TCD; and the distribution pattern of TCD in California orchards for understanding disease risk in relation to potential vector/inoculum sources.