MONITORING WALNUT TWIG BEETLE ACTIVITY IN THE SOUTHERN SAN JOAQUIN VALLEY DURING: OCTOBER 2012-DECEMBER 2014

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ABSTRACT

Walnut twig beetle (WTB), *Pityophthorus juglandis*, is the vector of thousand cankers disease, an emerging disease on walnut caused by the fungus *Geosmithia morbida*. Thousand cankers disease was originally reported in declining black walnut in Colorado, but the disease was confirmed in California in 2008 and has since been reported in the major commercial walnut-growing areas in the state. In 2013, the beetle and the disease were also found on walnut in Italy. Since 2009, numerous cases of thousand cankers disease have been documented in commercial walnut orchards in the southern San Joaquin Valley (SSJV). In an effort to better understand the seasonality of activity of the WTB, weekly monitoring of beetle flight activity was initiated in 2010. The 2010 survey was conducted in two commercial orchards and relied exclusively on random trap catches of walnut twig beetle on yellow sticky traps. The availability of a new, male-produced aggregation pheromone, 3-methyl-2-buten-1-ol, enhances the probability of detecting WTB. In 2011, the pheromone was utilized in conjunction with sticky traps, to assess WTB activity in three orchards in the SSJV. In October 2011, sticky traps were replaced with funnel traps, also baited with the pheromone, to capture beetles. Trap catches from 2011-2012 were published in the 2012 Walnut Research Reports. Here we report on trap catches at one commercial orchard site in Tulare County the first week of each month from October 2012 through December 2014.

OBJECTIVE

Assess the seasonal activity of walnut twig beetle in a commercial walnut orchard in Tulare County.

SIGNIFICANT FINDINGS

Minimal WTB activity was detected between early December 2012 and mid-February 2013. Conversely, WTB activity was detected through the winter months of December 2013 through February 2014. These results suggest the potential for thousand cankers disease transmission during winter months in the SSJV.

PROCEDURES

Site Description: From October 2012-December 2014, WTB activity was monitored at a commercial walnut orchard in Farmersville, CA. The Farmersville, CA orchard was originally planted as 'Chico' on black walnut rootstock. The orchard now contains 9 black walnut trees (2.0% of total) that grew from stump sprouts. All 9 black walnut trees exhibited galleries of WTB. One tree (0.2% of total) was a replant on 'Paradox' rootstock. Walnut twig beetle-infested trees have not been removed from this orchard over time.

Trapping Strategy: Two poles containing traps were placed in the orchard, one pole on the orchard perimeter and one in the center of the orchard. Each pole contained two traps, one placed at approximately 4.5 ft above ground and one at approximately 9 ft above ground. The walnut twig beetle pheromone was placed in a permeable plastic bottle associated with the funnel trap at each height. The four traps (2 heights x 2 locations) were checked and emptied at 4- to 10-day intervals (generally weekly) from October 2011 through December 2014. After trap catches were collected, samples were returned to the laboratory and frozen until they were processed.

Beetle Quantification. Beetles were collected each week by straining them out of a propylene glycol antifreeze solution in the trap cup attached to the bottom funnel of each trap. Filters containing the beetles were stored frozen, and periodically transported to the Seybold Laboratory, USDA Forest Service, for species-level verification and for determination of sex ratio of beetles trapped. The number of each sex caught during each trapping period was normalized to a 7-d period. At the time of report submission, the trap catches from the first week of each month were tabulated for inclusion in this report. The trapping procedures are similar to those described in the WTB trapping guidelines (Seybold et al., 2013).

RESULTS

Trap catch data from the Farmersville site in Tulare County were available from November 2012 through December 2014, and are broken down into two periods: November 2012-November 2013 (Figure 1A) and November 2013-December 2014 (Figure 1B). Female WTB generally exceeded males in the trap catches throughout both periods.

During the winter of 2012-2013, WTB trap catches were minimal from early December through early February (Figure 1A). No WTB trap catches were observed during the month of January 2013 (Figure 1A). During spring 2013, trap catches were minimal, though constant (generally <10 beetles/trap/week). In mid-July 2013-late October 2013, trap catches approximated 40-80 WTB/trap/week (Figure 1A).

A generally constant source of WTB was observed in traps between November 2013 and December 2014 (Figure 1B). In contrast to the winter 2012/2013 season, WTB activity was documented in December, January, and February trap catches during the winter of 2013/2014. Peak trap catches were observed in early September 2014, with over 100 WTB/trap/week (Figure 1B).

Neither *Xyleborinus saxeseni* (ambrosia beetle) nor *Hypothenemus* (probably) *eruditus* were observed in traps from October 2012-December 2014. In contrast, both were observed in prior trapping periods as reported in the December 2012 Walnut Research Reports.

DISCUSSION

Since our first finding of thousand cankers disease in Tulare Co. in October 2009, both the documented incidence and the known geographic distribution of the disease have increased gradually over time. The disease has been detected in commercial English walnut orchards in Tulare, Fresno, and Kings Cos. In the southern valley, the pathogen has been isolated from Tulare, Chico, and Chandler varieties, as well as from both black and Paradox rootstocks. Initially, thousand cankers disease was observed only on stressed trees exhibiting prior infection

by *Phytophthora* or *Agrobacterium tumefaciens*, or larval predation of roots by tenlined June beetle. In 2010, 2011, and 2012, however, WTB activity and thousand cankers disease have been observed on trees with no evidence of prior stress or decline. Additionally, local surveys conducted in 2012 suggest an extensive amount of beetle activity in several orchards, though most trees exhibiting beetle activity did not exhibit symptoms of thousand cankers disease. For example, in 2012, a survey was conducted in the Tulare, CA orchard where the disease was first observed and confirmed in Tulare County. The survey results suggested that 69 of the 124 trees surveyed (56%) exhibited evidence of WTB activity; however, only one tree exhibited the characteristic bleeding symptomatic of infection by *G. morbida*.

In the SSJV, we have observed WTB activity in orchards with no history of thousand cankers disease. In the absence of symptomatic trees, the beetle has been detected on sticky traps and in funnel traps, as well as in insect galleries on productive trees and on discarded wood in burn piles. Because bleeding cankers are not always associated with infection, the frequency of disease incidence has likely been underestimated. Walnut twig beetle galleries have been associated with every documented case of thousand cankers disease. The number of documented incidences of thousand cankers disease in Tulare County continues to grow; however, many growers remove symptomatic trees from the orchard and retain only one for formal diagnosis. Consequently, as grower awareness of the disease increases, the number of documented new incidents of disease is expected to decrease.

The overall goal of our WTB monitoring program is to enhance understanding of the life cycle of the thousand cankers disease vector. In past seasons, winter (December-February) trap catches were minimal to non-detectable; however, the current data demonstrate WTB activity in Tulare County during the winter 2013/2014 season. Further studies are necessary to model WTB activity with respect to climatic conditions for establishment of temperature thresholds for flight activity in the SSJV. Research in northern California has suggested WTB flight thresholds at approx. 52 to 54 °F (Chen and Seybold, 2014) or 63 to 64 °F (Seybold et al., 2012).

Given that growers' most common question concerns the ideal timing of removal of infected trees, these data suggest that removal of infested wood from orchards should be completed year round, particularly during warm winters. Wood debris (primarily larger branches and stems) should be removed from the orchard soon after pruning or felling of declining trees.

A more comprehensive report of walnut twig beetle flight activity from statewide surveys will be compiled after another year of data collection, and will include comparisons between walnut growing regions within the state as well as the influence of trap location (i.e., low vs. high and interior vs. orchard perimeter) on detection of WTB populations

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Figure 1A.

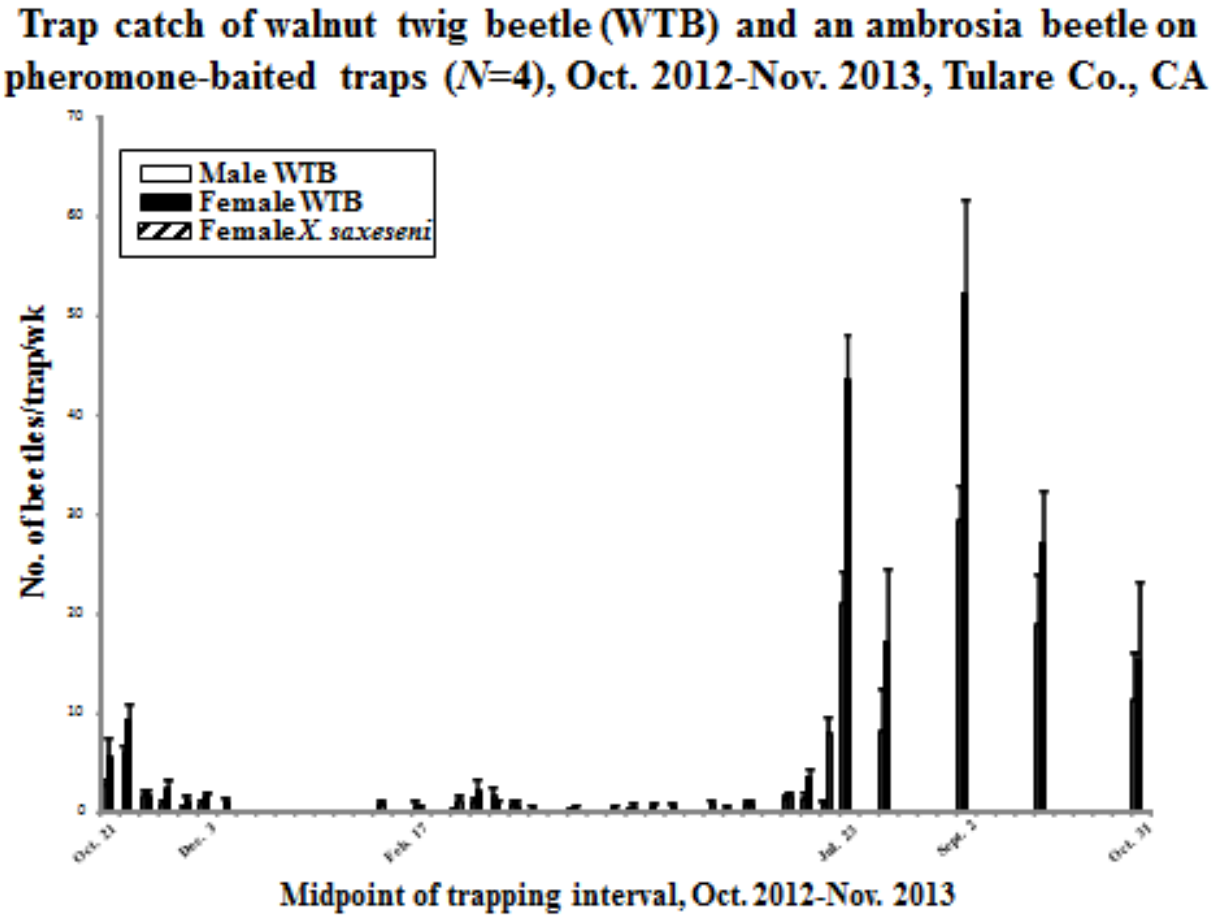
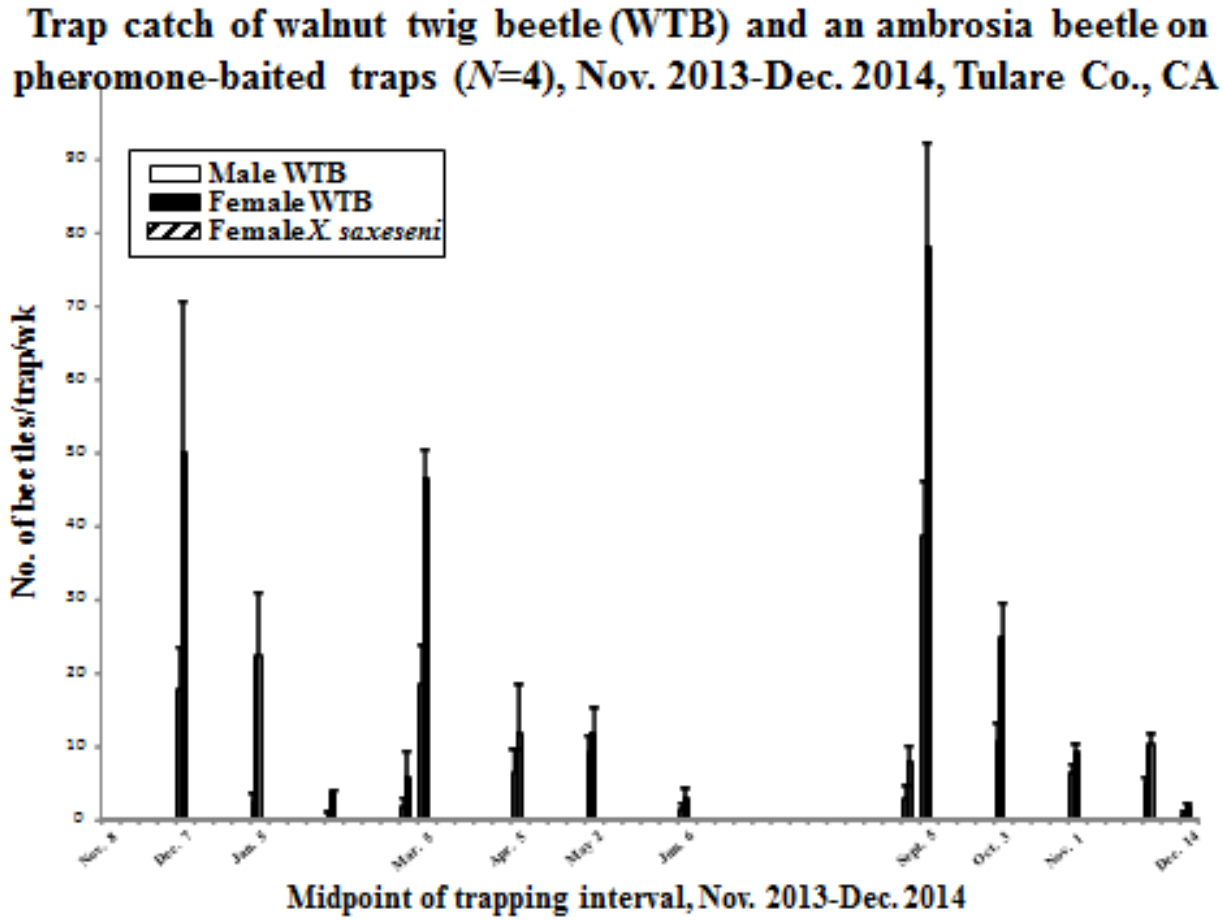

Trap catch of walnut twig beetle (WTB) and an ambrosia beetle on pheromone-baited traps (N=4), Oct. 2012-Nov. 2013, Tulare Co., CA
Male WTB
Female WTB
Female X. saxeseni
No. of beetles/trap/wk
70
60
50
40
30
20
10
0
Oct. 21
Dec. 3
Feb. 17
Jul. 23
Sept. 2
Oct. 31
Midpoint of trapping interval, Oct. 2012-Nov. 2013

Figure 1B.


Trap catch of walnut twig beetle (WTB) and an ambrosia beetle on pheromone-baited traps (N=4), Nov. 2013-Dec. 2014, Tulare Co., CA
Male WTB
Female WTB
Female X. saxeseni
No. of beetles/trap/wk
0
10
20
30
40
50
60
70
80
90
Nov. 8
Dec. 7
Jan. 5
Mar. 8
Apr. 5
May 2
Jun. 6
Sept. 5
Oct. 3
Nov. 1
Dec. 14
Midpoint of trapping interval, Nov. 2013-Dec. 2014