Investigation and Survey for unknown flatheaded borer infesting Pear fruits in Lake County Pear Orchards

Cindy Kron, UCCE North Coast IPM Advisor, Sonoma County
Clebson Goncalves, UC Cooperative Extension Advisor
Broc Zoller, Pest Control Advisor

ABSTRACT

The family Buprestidae comprises over 15,500 species of metallic wood-boring beetles. The genus *Chrysobothris* includes over 690 species with at least 69 of those species found in California. One behavioral trait that buprestids have in common are that their larvae are wood boring. In August 2023, flatheaded borer larvae of an unknown species were found feeding in numerous Bartlett pear fruits in four orchards in Lake County, CA. Larvae were collected and placed on an artificial diet to rear out to adults. A larval sample sent to the California Department of Food and Agriculture was identified as a *Chrysobothris* species based upon morphological characteristics. Nondestructive DNA extraction of four larvae identified the buprestid as the Pacific flatheaded borer, *Chrysobothris mali* using CoxI barcoding which was later supported by morphological identification of reared adults. The Pacific flatheaded borer has a wide host range of at least 70 host species belonging to 40 genera in 21 different plant families. This is the first reported detection of any species of Buprestid attacking fruit indicating a new larval host and a possible behavioral shift by this species.

INTRODUCTION

In August 2023, flatheaded borer larvae of an unknown species were found feeding in numerous Bartlett Pear fruits in four orchards in Lake County, CA. The initial finding was close to harvest which prevented a more extensive survey of incidence and distribution from being performed in 2023.

Pacific flatheaded borer larvae appear to enter the pear through the calyx and tunnel through the pear flesh to the sunny side of the fruit (Figure 1). The presence of the flatheaded borer larvae in pear fruit is noticeable by a small, blackened spot near the calyx and a larger blackened spot that begins to appear on the sunny side of the fruit (Figure 2). Inside the pear, the larva creates a dry pocket filled with frass and leathery layers of pear flesh (Figure 3) creating a suitable microenvironment for development.

The Pacific flatheaded borer (PFHB) has a wide host range of at least 70 host species belonging to 40 genera in 21 different plant families. This is the first detection of any species of Buprestid attacking fruit indicating a possible behavioral shift by this species and a possible new insect pest of European pear fruit.

OBJECTIVES

- Monitor for adult flatheaded borers in Lake County.
- Survey orchards for flatheaded borer in pear fruit to determine the extent and distribution of this pest in pears.
- Disseminate the findings to growers, Pear Board, and pest control advisors.

PROCEDURES

Larvae were dissected out of the fruit and placed on prepared artificial diet to rear out to adults (Figure 4) since the larvae lack definitive features to ID to species. In the flatheaded borer life cycle, the larvae overwinter, pupate in spring, and emerge as adults in summer. Six weeks post autumnal equinox larvae were placed in the fridge to mimic winter for 10-12 weeks. They were then removed, placed on a heating pad under grow lights and allowed to pupate and emerge as adults.

Nine pear fruits containing flatheaded borer larvae were placed in a plastic jar that had been cut on the sides and sealed with a screen for air flow. The jar was placed in a work shed with ambient temperatures ranging from 35 ºF to 103ºF. The infested pear fruits were monitored weekly from September 2023 to July 2024.

Visual surveys for presence/absence were conducted in 2024 in a subset of orchards: 19.3 acres in Upper Lake (Figure 5), 23.8 acres in Scott's Valley (Figure 6), and 69.6 acres in Kelseyville (Figure 7).

RESULTS

A larval sample sent to CDFA was returned with a genus ID of *Chrysobothris* based upon morphological characteristics. DNA from four larval samples sent to the University of Tennessee were found to be consistent with Pacific flatheaded borer, *Chrysobothris mali.* Larvae taken from infested pear fruits were allowed to complete development on artificial diet in the laboratory. Eight out of the 42 larvae pupated and emerged as adults. The first adult male was sent to The University of Tennessee-Knoxville (UTK) for morphological identification. Traditional morphological examination of a lab reared male adult corroborated results of larval molecular identification. In addition, one adult emerged from the nine infested pear fruits in late June 2024 (Figure 8).

No flatheaded borer damage to pear fruits were found in the 43.1 acres surveyed in Upper Lake and Scott's Valley pear growing regions. Flatheaded borer damage to pear fruit in 2024 was found in 5 organic orchard blocks within a 0.62-mile radius of the epicenter (39° 0′ 14.303′′ N, 122° 50′ 24.374′′ W) in Kelseyville, CA.

DISCUSSION

Pacific flatheaded borer larvae were found in pear fruit in 2023 and 2024 demonstrating that use of pear fruit as a larval host is repeated anomaly. Only one larva was found in a pear fruit on the edge of a conventional orchard in 2023 but not in 2024, with all remaining detections in organic orchards. This occurrence can plausibly be explained in that edge trees of an orchard often receive insufficient coverage of pesticides when the spray rig is turning around.

One adult emerged from the nine infested pear fruits showing that PFHB can complete their life cycle in pear fruit and that the dry pocket filled with frass created by the larva is an acceptable microenvironment for larval and pupal development. The field implications are that adult PFHB are capable of emerging from infested pear fruits and that pear fruits are not a dead-end host.

A first-find publication titled "DNA barcoding helps establish a novel host-plant interaction for *Chrysobothris mali* (Horn, 1886) (Coleoptera: Buprestidae) larvae found infesting *Pyrus communis* 'Bartlett' fruit in Lake County, California orchards" has been submitted to Pan-Pacific Entomologist and is currently under review. In 2024, findings were presented at the Orchard Pest and Disease Management Conference (OPDMC) and the Pacific Branch of Entomological Society of America conference and updated findings will be reported at the 2025 OPDMC. An in-person and virtual presentation of these findings to the pear growers was conducted in October and November 2023 respectively and a virtual update of findings in November 2024.

Further investigation is needed into the differences between pesticides applied in conventional versus organic pear orchards in Lake County. In addition, exploration into any differences in products used or timing of applications between organic orchards that have PFHB in pear fruit and organic orchards that do not have PFHB in pear fruit. Future DNA studies are also needed to look for genetic differences between PFHB found in pear fruit and PFHB from other woody hosts in California to explore possible changes in genetics that could explain the change in larval host behavior.

Figure 1. Larvae enter the pear through the calyx and tunnel through the pear flesh to the sunny side of the fruit.

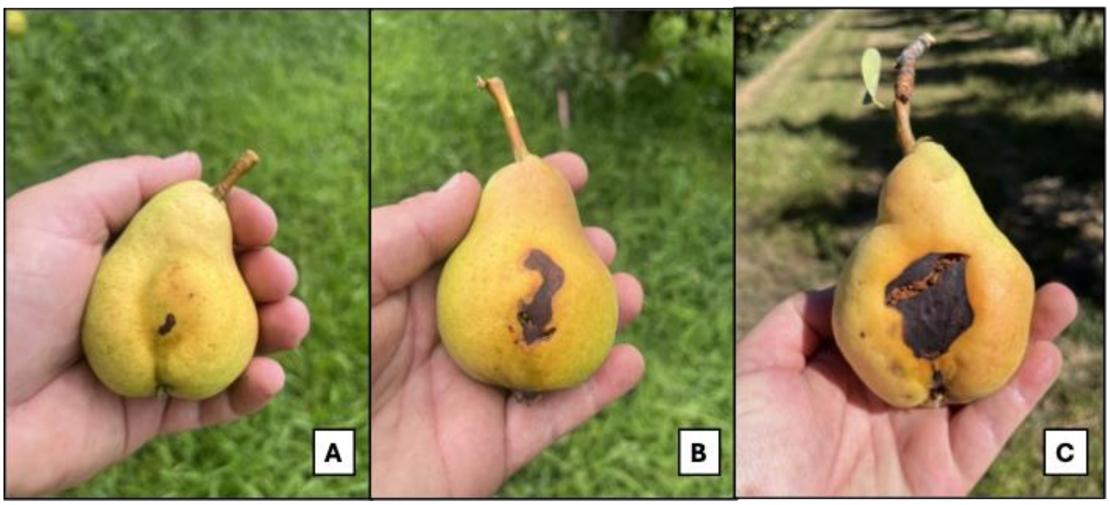

Figure 2. The presence of the flatheaded borer larvae in pear fruit is noticeable by a small, blackened spot near the calyx and a larger blackened spot that begins to appear on the sunny side of the fruit (A) which grows larger (B) and hardens over time (C).

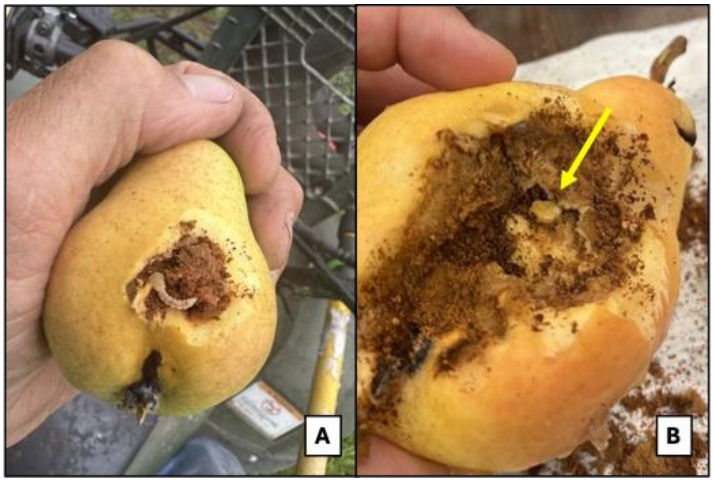

Figure 3. The larva creates a dry pocket filled with frass (A) and leathery layers of pear flesh (B) indicated by the yellow arrow.

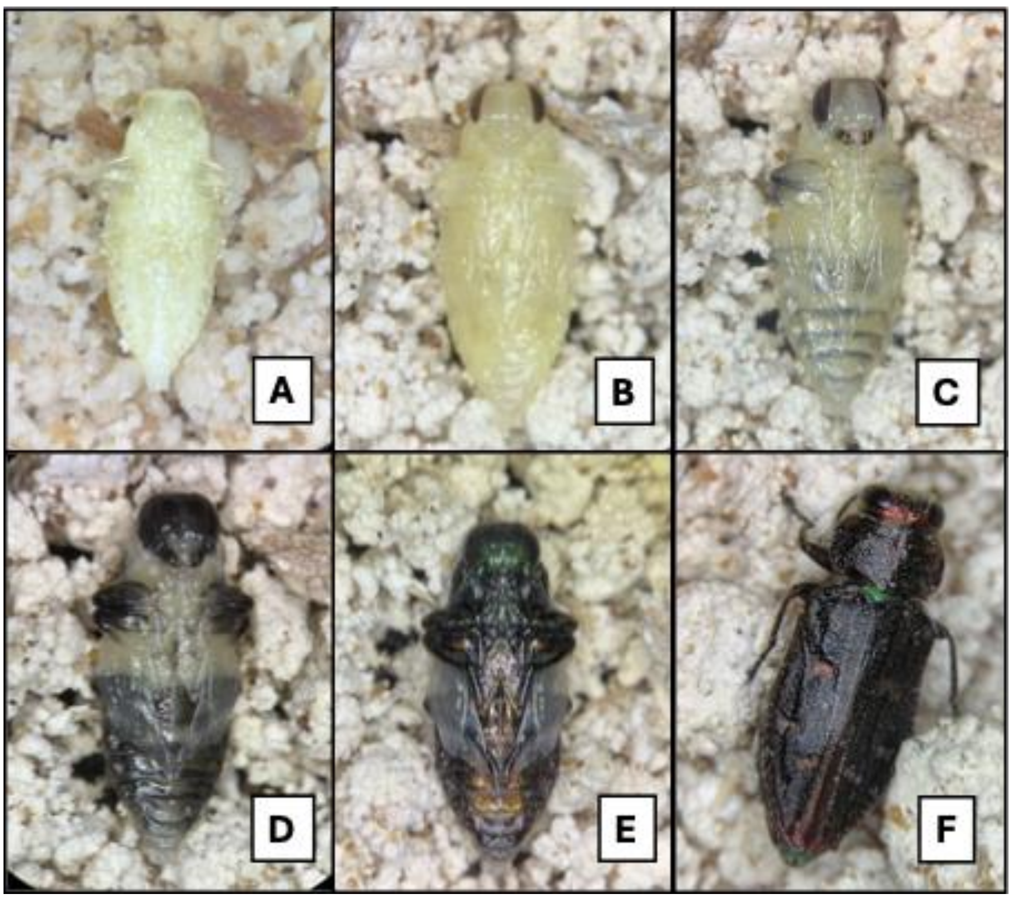

Figure 4. Progression of pupal development to adult (A-F) of a male Pacific flatheaded borer reared on artificial diet from larva recovered from infested pear fruit.

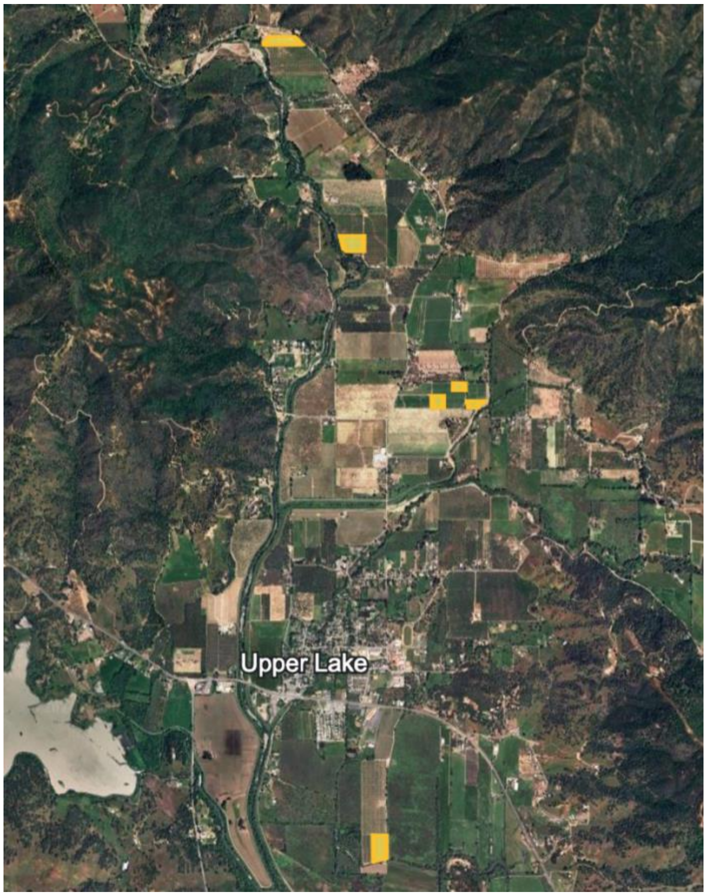

Figure 5. Upper lake pear orchards surveyed for presence/absence of Pacific flatheaded borer in pear fruit in 2024 highlighted in yellow.

Figure 6. Scott's Valley pear orchards surveyed for presence/absence of Pacific flatheaded borer in pear fruit in 2024 highlighted in yellow.

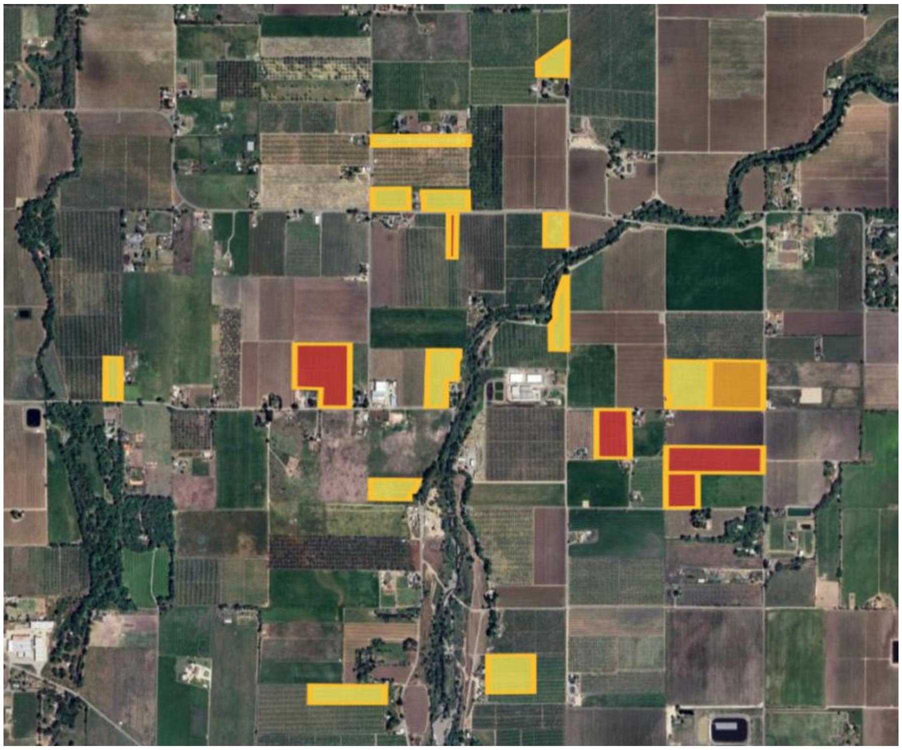

Figure 7. Kelseyville pear orchards surveyed for presence/absence of Pacific flatheaded borer in pear fruit in 2024 (yellow = no PFHB, orange = PFHB found in 2023 but not 2024, red = PFHB found).

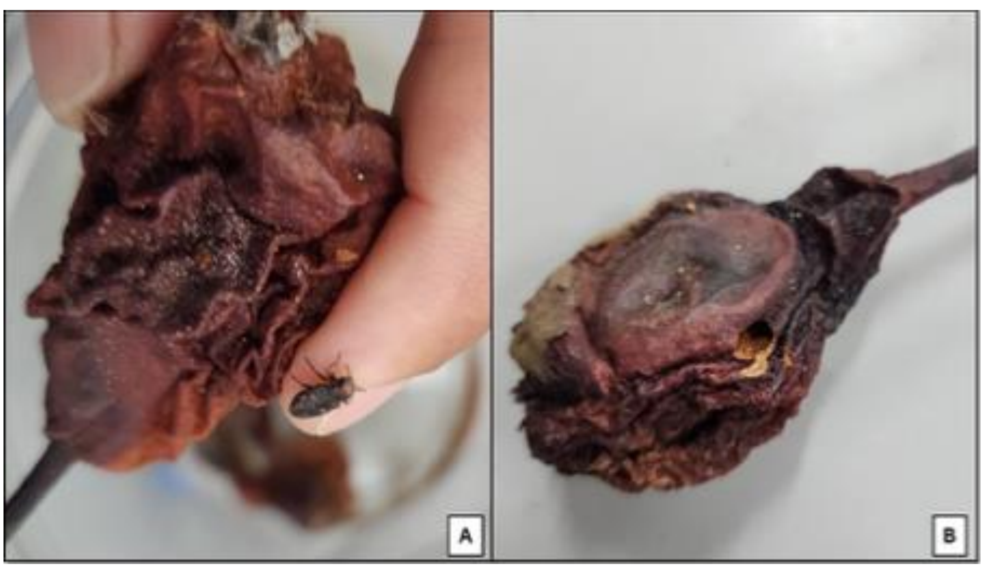

Figure 8. Adult *Chrysobothris mali* (A) reared from infested pear fruit with exit hole (B).