



Shot Hole Borer Update

By Tim Spann
Research Program Director

A lot has been happening with the shot hole borer since the last issue of *From the Grove* came out just a few short months ago. There has been very significant movement of the polyphagous shot hole borer (PSHB) both in the south and north, with it now being present in the Temecula area of Riverside County and the Santa Paula area of Ventura County. Not to be outdone, the Kuroshio shot hole borer (KSHB; San Diego beetle) moved significantly north into Orange County. Despite a tremendous amount of research, there are still more unanswered questions than answered ones.

Temecula PSHB Finds

In late October, the California Avocado Commission (CAC) learned that beetle specimens collected from traps located near two packinghouses in Temecula were identified as PSHB. These finds were the first near the avocado growing area of Riverside County, and were about 30 miles from the closest known location of PSHB. The Commission immediately deployed additional traps in the area to increase the trap density and try to determine the extent of the apparent infestation. Since then, only two additional beetles have been captured in the traps — one in a new trap and one from one of the previously positive traps.



Drs. Joe Morse and Frank Byrne conduct shot hole borer injection trials at Pine Tree Ranch

There is still no certainty about how the beetles moved to the Temecula area. Surveys of the area did not find any infested trees, avocado or other hosts. The working hypothesis is that they had infested trees lining Temecula Creek, which the Army Corp of Engineers is working on clearing to prepare for El Niño. This may have caused the beetles to disperse and subsequently become caught in the traps. This would in part explain why, after the initial captures, there have not been continuing trap finds.

Orange County KSHB Finds

In early November, a PCA found a beetle suspect in a trap located in an Orange County commercial grove. DNA analysis by Dr. Richard Stouthamer's lab at University of California, Riverside (UCR) determined that the beetle was a KSHB specimen and not a PSHB specimen. This find marked the first time that KSHB had been positively identified outside of San Diego County and, like the PSHB find in Temecula, was nearly 30 miles from the previously known infested area.

Ground surveys of the area did not find any apparently infested avocado trees, and no additional specimens have been captured. Initially, the presence of a nearby firewood yard was of concern, but an inspection of that location found that no new wood had been brought onto the property in about a year. At this time, there's no theory concerning how the beetle may have moved into Orange County and there is no evidence that a population of KSHB has been established in the county.

Since the two beetle species appear to now be sharing the same territory, it is important to mention what could happen. The sibling mating habit of these beetles — brothers mate with sisters in the gallery — makes outcrossing between the two species virtually impossible under natural circumstances. Unfortunately, the same cannot be said of the fungi associated with these beetles. If a beetle of one species picks up the fungi from the other species — by reusing an old gallery or attacking the same tree — the possibility exists for the fungi to hybridize. Fungal hybridization could lead to adaptation to new hosts or an increase or decrease in virulence. Researchers will keep a close eye on this situation.

Ventura County PSHB Finds

When the last issue of *From the Grove* was released, we knew that PSHB was knocking on the door of Ventura County. The Commission had been funding the maintenance and monitoring of a network of early detection traps in Ventura County since early 2015. In early November, two of those traps — one in Ojai and one near Santa Paula — were found to have PSHB specimens in them. Soon after those finds, infested avocado trees were found in two groves near the original trap find on the western edge of Santa Paula. The Commission immediately retooled our detection trapping grid in Ventura County in response to these finds.

On December 2, more trap samples from six additional avocado groves to the west of Santa Paula were confirmed as PSHB. One of these traps had 20 PSHB specimens in it and another had 10, indicating that a significant population has established in the area. No additional specimens have been found in the Ojai valley.

Growers in the area should routinely survey their groves for any symptoms of PSHB attack. The Commission, in cooperation with UCR, UC Cooperative Extension and OC Parks has developed a handout to help growers recognize the symptoms of PSHB attack. This handout can be found, in both English and Spanish, as a tear-away insert to this article. Growers may also wish to install lured traps in their groves to aid in early detection. Information on where to purchase traps and lures accompanies this article on page 25.

Researchers Working Hard

Since the first identification of the shot hole borers as a potential threat to avocados in early 2012, the Commission has been working closely with the researchers at UCR, especially Drs. Akif Eskalen, Richard Stouthamer, Joe Morse and Frank Byrne. Together this team has been focused on understanding the biology of the beetles and their fungal symbionts, and searching for and testing control strategies. They recently presented updates on their work to the CAC Production Research Committee and their accomplish-

ments are impressive.

Early on, Richard Stouthamer was focused on the correct identification of the beetles. As we've shared in previous update articles, we now know that there are two different, but closely related, species of shot hole borers, both of which originate from Southeast Asia. He then shifted his efforts to beetle trapping and biocontrol studies.

Dr. Stouthamer's lab has found that the beetles are highly attracted to the compound quercivorol, which is a chemical component produced by their fungal symbionts. His lab has tested various formulations of lures containing quercivorol from different companies and found two that are very good (see details in call out box below). They also discovered that these ambrosia beetles, unlike others, are repelled by alcohol, which is commonly used in ambrosia beetle traps. They are continuing to work to determine the ideal concentration of quercivorol to maximize effectiveness.

Drs. Stouthamer and Eskalen have been working on identifying potential biological control agents for the shot hole borers and their fungal symbionts. Two trips to Southeast Asia have yielded several potential biocontrol agents for the beetles — a parasitic wasp, a nematode and a fly. Because of its greatest potential for specificity to our beetle species,

the parasitic wasp has been prioritized. Likewise, potential biocontrol agents for the fungal symbionts have also been found and are being pursued. Dr. Eskalen has identified species of *Bacillus* bacteria that are found naturally on avocado trees in California that show high antagonism toward the *Fusarium* fungi. He is working on developing methods for applying these bacteria in high enough concentrations to be effective in the field. Since these bacteria were cultured from avocado trees, the hope is that there will be fewer regulatory hurdles to clear in order to use them.

Lastly, Drs. Joe Morse and Frank Byrne have been spearheading our efforts to obtain efficacy data for pesticides against the shot hole borers. They developed efficacy data for Hero® that was used to submit a Section 18 Emergency Exemption Application to the California Department of Pesticide Registration (CDPR) on September 1. That application has cleared the CDPR review process and was forwarded to EPA the first week of December. We remain optimistic that we will receive that Section 18 in early 2016. In addition, trials continue with what we believe will be more effective systemic pesticides for future registrations. Unfortunately, those products require the full EPA registration process and are likely several years out. 🍌

PSHB/KSHB Traps and Lures

Lindgren funnel traps are currently the trap of choice for PSHB/KSHB. These traps come in different configurations with varying numbers of funnels. The 12-funnel version with a wet collection cup is recommended. The wet cup should be filled with about one inch of soapy water. Antifreeze can be used, but is more hazardous and you must make sure the antifreeze does not contain alcohol, which will repel the beetles. The cups will need to be checked every three to four days (up to one week if using antifreeze).

Both beetles are attracted to a quercivorol lure. There are two companies currently producing this lure for sale in the United States and both work equally well, but there is a significant cost difference between the two. Lures last approximately 60 days and old lures should be removed when a new one is installed on the trap. Lures should be installed about mid-way along the length of the funnel trap.

Lures and Traps

Synergy Semiochemicals Corp (Canada)

604-454-1122

synergy@semiochemical.com

Lure item # 3361 — \$12

Trap item # 4021 — \$60

ChemTica Internacional (Costa Rica)

506-22615396

cam@chemtica.com

Lure item # P548-Lure — \$6

Trap item # P218-Trap — no price info

Traps Only

BioQuip Products

<https://www.bioquip.com/>

2321 Gladwick Street

Rancho Dominguez, CA 90220

(310) 667-8800

Trap item # 2854 — \$72