

## Avocado Lace Bug is Continuing to Spread in California

**A**vocado Lace Bug was first described based on specimens collected from avocados growing in Florida in 1908. Adult bugs (Fig. 1) and immature stages, referred to as nymphs, live and feed on the undersides of leaves. Lace bugs have needle-like mouthparts that are used to puncture leaf tissue, which enables feeding bugs to suck up the juice contained within perforated cells. This feeding damage results in necrotic brown islands (Fig. 2) that typically form within the central regions of the leaf. It's possible that feeding damage is exacerbated by opportunistic pathogenic fungi, like *Colletotrichum* spp., which may enter the leaf through feeding wounds and then proliferate thereby causing more damage.

Female ALB lay eggs (Fig. 3) on the undersides of leaves, often in clusters or trails that are usually covered in a black "tar" like substance, which could be an excretory waste product. This covering may help protect eggs from desiccation or attacks by natural enemies.



Figure 1. An adult avocado lace bug on a U.S. penny.  
Photo credit: Mike Lewis, UC Riverside

### Where Did California's ALB Come From?

In 2004, reports of unusual damage to avocado leaves on backyard trees in the Chula Vista and National City areas of San Diego County were being

reported. In response to these phone calls and emails, Dave Kellum (San Diego County Entomologist with the Agricultural Commissioner's Office), Guy Witney (California Avocado Commission), Gary Bender (UCCE Farm

Advisor), and Mark Hoddle (UCR Entomology) got together to investigate. This field trip resulted in the first collections of avocado lace bug, *Pseudocysta perseae* (Hemiptera: Tingidae), in California. A significant concern was that this pest, which is very destructive in parts of México and the Caribbean, would invade commercial Hass avocado orchards, cause substantial damage, and require management. Curiously, in urban areas in San Diego, this pest preferred infesting the avocado variety Bacon and reports of infestations on Hass were rare. ALB colonies used for experiments described below were maintained on Bacon as we couldn't rear ALB on Hass.

Where and how ALB got to California in 2004 was a mystery that needed investigating, and molecular analyses — similar to those seen in TV programs like CSI — were used to figure out where the invading ALB population may have originated. Phil Phillips (UCCE Ventura County) and Mark Hoddle undertook foreign exploration efforts throughout the presumed native range of ALB (i.e., Southeastern U.S. states, the Caribbean, and México). There were two goals to these collecting trips: (1) collect ALB eggs to rear out parasitoids for possible use in a biological control program in California, and (2) collect adult ALB for DNA analyses to figure out where the population in California had come from. Phillips and Hoddle made extensive collections of ALB throughout México, the Caribbean, and parts of Central America. Colleagues provided additional specimens from Florida, Texas, and South America for use in DNA analyses.

The molecular work was done by Paul Rugman-Jones in Richard Stouthamer's Lab at UC Riverside and the results strongly suggested that the invading ALB population in San Diego County had likely originated from



Figure 2. Avocado lace bug feeding damage on a Hass avocado leaf. ALB feed on the undersides of leaves.  
Photo credit: Mark Hoddle, UC Riverside



Figure 3. Avocado lace bug eggs are often covered with a black protective substance. Photo credit: Mark Hoddle, UC Riverside

Nayarit in México, and more specifically, possibly Las Vivasas, which is part of the Mexican “Riviera,” a popular destination for tourists. We speculated that a small ALB-infested avocado tree may have been purchased at one of the commonly seen roadside stalls, put in the back of an RV, and driven approximately 1,300 miles up the Pacific Coast to San Diego County where the tree was planted in a residential backyard and its associated ALB hitch hikers were unintentionally cared for.

Another interesting find from the molecular work was the possibility that ALB was not native to the Southeastern portion of the U.S., eastern México (e.g., Yucatán), and the Caribbean as originally thought. ALB may be invasive in these areas too, possibly having originated from native populations in western parts of México. As for the biological control program, unfortunately it didn't get off the ground, as no natural enemies, specifically egg parasitoids, were found attacking ALB eggs in the areas surveyed.

## Management of Avocado Lace Bug

Research by Eduardo Humeres, Frank Byrne, and Joseph Morse in the Entomology Department at UC Riverside indicated that several insecticides were effective at killing ALB. Imidacloprid, for example, applied through chemigation to the soil, provided good control of this pest. Small scale trials indicated that contact insecticides like fenprothrin, a pyrethrin mixture, petroleum oil, and potash also killed ALB. Interestingly, abamectin and spinosad did not appear to have significant negative impacts on ALB. Natural enemies associated with ALB in California avocado orchards include predatory adult and larval thrips, primarily *Frankliniethrips orizabensis* (Thysanoptera: Aeolothripidae), and lacewing larvae,

*Chrysoperla* sp. (Neuroptera: Chrysopidae). Laboratory trials indicated that these natural enemies would attack and feed on ALB nymphs. However, their impacts in orchards have not been studied and it's unknown if natural enemies can provide sufficient levels of biological control for suppressing damaging pest levels. Another group of natural enemies, predatory phytoseiid mites, should be studied to determine if they can attack and feed on ALB eggs.

## What's Happening with Avocado Lace Bug Now?

There is a standing joke amongst applied entomologists that the best way to quickly solve an invasive pest problem is to get grant money to research control solutions. Sometimes, after going to a lot of trouble to get research funds, the pest problem unexpectedly fizzles out, and as the joke goes, voilà, problem solved! This is what happened with ALB in San Diego County. As research into management options was being conducted in anticipation of the pest moving out of urban areas, it turned out that ALB didn't spread rapidly and there were no reports of infestations in commercial Hass orchards. Consequently, the ALB program ended when the grants finished as there was no urgency to continue this work.

This situation changed in 2017 when reports of ALB damage in commercial Hass orchards was being reported by growers and Pest Control Advisors in the Oceanside-Bonsall-Fallbrook (San Diego County)-Temecula (Riverside County) area. Emails with photos supported observations that ALB was causing leaf damage and field collections confirmed this. Around the same time, reports of ALB infestations of backyard avocados in Culver City and Long Beach in Los Angeles County were received and confirmed by field inspection.

So, the questions now were, “Where did these new infestations come from?” “Had the San Diego population finally started moving after about 13 years or so of doing nothing?” “Why was ALB now infesting Hass?”

Molecular analyses by Rugman-Jones and Stouthamer indicated that these 2017 ALB infestations had a different genetic fingerprint to the original San Diego infestation from 2004. The new populations were genetically more similar to ALB from the eastern areas of the pest's distribution (i.e., Southeastern U.S., eastern México and the Caribbean). We currently think these new more aggressive ALB populations infesting Hass may have originated from Florida. So, it looks like California has been invaded twice by ALB, the first time was around 2004 with bugs from México and the second time was around 2017 with bugs from Florida.

## And the Spread Continues ...

In 2019, the first reports of ALB infesting avocados were reported from Oahu Hawaii, a significant range expansion for this pest. It is unknown how ALB made it to Hawaii. The most obvious explanation would be an accidental introduction, most likely via infested avocado cuttings or plants.

In May 2021, the first active ALB infestation in a commercial Hass orchard in Carpintera, Santa Barbara County, was reported. The spread of ALB northwards out of Los Angeles County into Santa Barbara County also may have occurred via the movement of infested plant material. Additionally, research by Paloma Dadlani, an M.S. student in the Hoddle lab at UC Riverside, has resulted in some preliminary evidence from sticky card monitoring in commercial Hass orchards, which indicates that ALB adults may engage in “flight” and have the potential to disperse aerially.



## What's Being Done Now for Avocado Lace Bug in California?

With support from the California Avocado Commission, the research program into ALB has been resurrected. Work is currently investigating the phenology of this pest in commercial Hass orchards in Oceanside-Bonsall and surveys for natural enemies associated with pest populations are underway. In the lab, we are investigating the effects of temperature on ALB egg

and nymph development and survivorship rates, and adult longevity and egg laying by females. These data may help us understand if heat waves and Santa Ana winds can knock back ALB populations, which we should be able to corroborate via the phenology studies in orchards. Also of interest is understanding what has happened to the original ALB population in Chula Vista-National City. Has this population been replaced by the more aggressive Florida strain of ALB? Also we want to

figure out what is going on in Hawaii. Was Hawaii invaded by the original San Diego ALB population from México? Did California accidentally export the more aggressive Florida strain to Hawaii? Or, importantly, from California's perspective, did the Hawaii population come from somewhere else and does it now pose an invasion risk to California avocado growers? Molecular studies are planned to answer these questions and as our research progresses there will be a lot more to report and to read about. 🍌

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