California AvoTech

By Mark S. Hoddle
Department of Entomology
University of California Riverside

New Things to Know About Avocado Lace Bug

Figure 1

Background Information

In 2004, avocado lace bug (ALB), *Pseudacysta perseae* (Hemiptera: Tingidae), was found infesting non-Hass varieties of avocados (e.g., Bacon) in Chula Vista and National City in southern San Diego County. This leaf feeding pest, first described in 1908 from Florida, is quite destructive in parts of the southeast United States, Caribbean and eastern Mexico. Understandably, there was considerable concern that ALB would cause similar levels of damage in California as populations would not remain in backyard gardens for long. In response to this potential threat, foreign exploration for ALB natural enemies was undertaken in what was presumed to be the native range of this pest, the southeastern portion of the U.S., eastern Mexico and the Caribbean. Surveys also were conducted in western Mexico. In all areas surveyed, adult ALB were collected for genetic analyses to determine two different things. First, to figure out if ALB was indeed one true species or instead a collection of cryptic species spread across all these widely distributed collection areas that couldn't be separated based on morphology. Second, to determine, if possible, where the invading ALB population in California had originated.

Unfortunately, foreign exploration efforts failed to find natural enemies, especially egg parasitoids, which could be effective against ALB in California. The molecular work determined that ALB is one species throughout the entire geographic region it is found. Further, it was determined the evolutionary area of origin for ALB is probably western Mexico and not eastern Mexico, the southeastern U.S. or the Caribbean as originally thought. California's original invading population likely originated from the state of Nayarit on the Pacific Coast of Mexico.

As it turned out, initial concerns about massive ALB outbreaks and rapid spread into commercial Hass orchards didn't eventuate. Reports of outbreaks in the backyards of southern San Diego diminished as well, and ALB pretty much dropped off the radar. Curiously, this situation changed abruptly in 2017 when reports of ALB outbreaks were reported in commercial Hass orchards in Oceanside and Bonsall in northern San Diego County, and Temecula and Riverside in Riverside County. By 2019, reports of infestations in backyard trees were coming in from homeowners in Los Angeles County, and Hawaii was invaded as well. Infestations in Orange County and commercial orchards in Santa Barbara were reported in 2022 and 2023, respectively.

Molecular Analyses to Determine Source Populations of ALB

Molecular studies using specimens collected from these new outbreaks demonstrated that a new haplotype, not previously recorded from California, had established itself and was associated with spreading ALB populations that were causing damage to Hass trees in backyards and commercial orchards. This new haplotype was the same as that found in Florida and the Caribbean. Despite its rapid spread, the Florida haplotype has not, at least yet, replaced the original Mexican haplotype that established in southern San Diego County in 2004. The Hawaiian ALB population has the same genetic signature as the spreading damaging populations in California. Based on these findings, we have tentatively concluded that the new ALB population infesting Hass in California may have originated from Florida, and California may have been the source of the population that invaded Hawaii.

These molecular studies were conducted by Paloma Dadlani, a M.S. student in the Hoddle Lab at UCR. Marco Gebiola, in the Kerry Mauck Lab in the Department of Entomology at UCR, and Paul Rugman-Jones, also in the Entomology Department at UCR, assisted with this work. Ivan Milosalvjević, formerly in the Hoddle Lab, and now working for the Citrus Research Board, helped with statistical analyses that fitted non-linear models to data sets.

Assessing the Effects of Temperature on ALB Development and Survivorship

Another part of Paloma's Master's work was to investigate the effects different temperatures have on ALB development and survivorship rates. These studies were conducted in temperature cabinets that were programmed to simulate six fluctuating temperature profiles that averaged 15°C (59ºF), 20ºC (68ºF), 25ºC (77ºF), 30ºC (86ºF), 32ºC (90ºF) and 35ºC (95ºF) over a 24-hour period. These fluctuating temperature cycles oscillate over a 24-hour period and are representative of climatic conditions across ALB-infested areas in southern California. To determine what these hourly temperature cycles looked like, five years of weather data were downloaded from various weather stations and the hourly mean temperatures were calculated and used to program the 24-hour temperature steps in the cabinets. When these hourly temperatures were averaged over the 24-hour period they hit the desired overall 24-hour temperature average (e.g., 32ºC [90ºF]).

Statistical analyses of developmental data for ALB eggs and each of the four nymphal instars indicated that the optimal temperature range for development and reproduction was 25-32ºC (77–90ºF). The minimum temperature above which ALB can develop is around 9-10ºC (48-50ºF), and it takes about 476 days with temperatures above the minimum threshold for ALB to complete development. The upper lethal temperature range predicted for ALB by statistical models ranges from 34-39ºC (93-102ºF). The high mortality rates observed among eggs, nymphs and adult ALB at the upper threshold temperature — that averaged 35°C during a 24-hour period — underscores the negative impact of upper-level temperature extremes on survivorships rates. This finding may support in part why ALB tends to be more problematic in cooler Oceanside orchards when compared to inland Bonsall orchards that tend to have higher summer temperatures.

Unusual temperature peaks over summer caused by heat domes or intensive heat waves of short duration — such as Santa Ana winds — may have significant and deleterious impacts on ALB populations.


Figure 2