PSHB and Fusarium Dieback Update

INFESTATION SITE UPDATES

According to Dr. Akif Eskalen, UC Riverside, as of August 2014, confirmed infestation sites of polyphagous shot hole borer beetles (PSHB) are located in Los Angeles, Orange, San Bernardino, Riverside, San Diego, and Santa Cruz counties. Los Angeles County and Orange County contain the highest density of known infestation sites, with Los Angeles County containing the northernmost and westernmost infestation sites in Southern California. The easternmost infestation site is located in the city of Corona in Riverside County. A single heavily infested location exists west of Cleveland National Forest in San Diego County, but no other infestation sites have been found in San Diego County thus far. An infestation has also been found west of San Jose in Santa Cruz County, and it is currently the only known infestation site in Northern California.

Fig. 1: Distribution of known infestation sites in California.

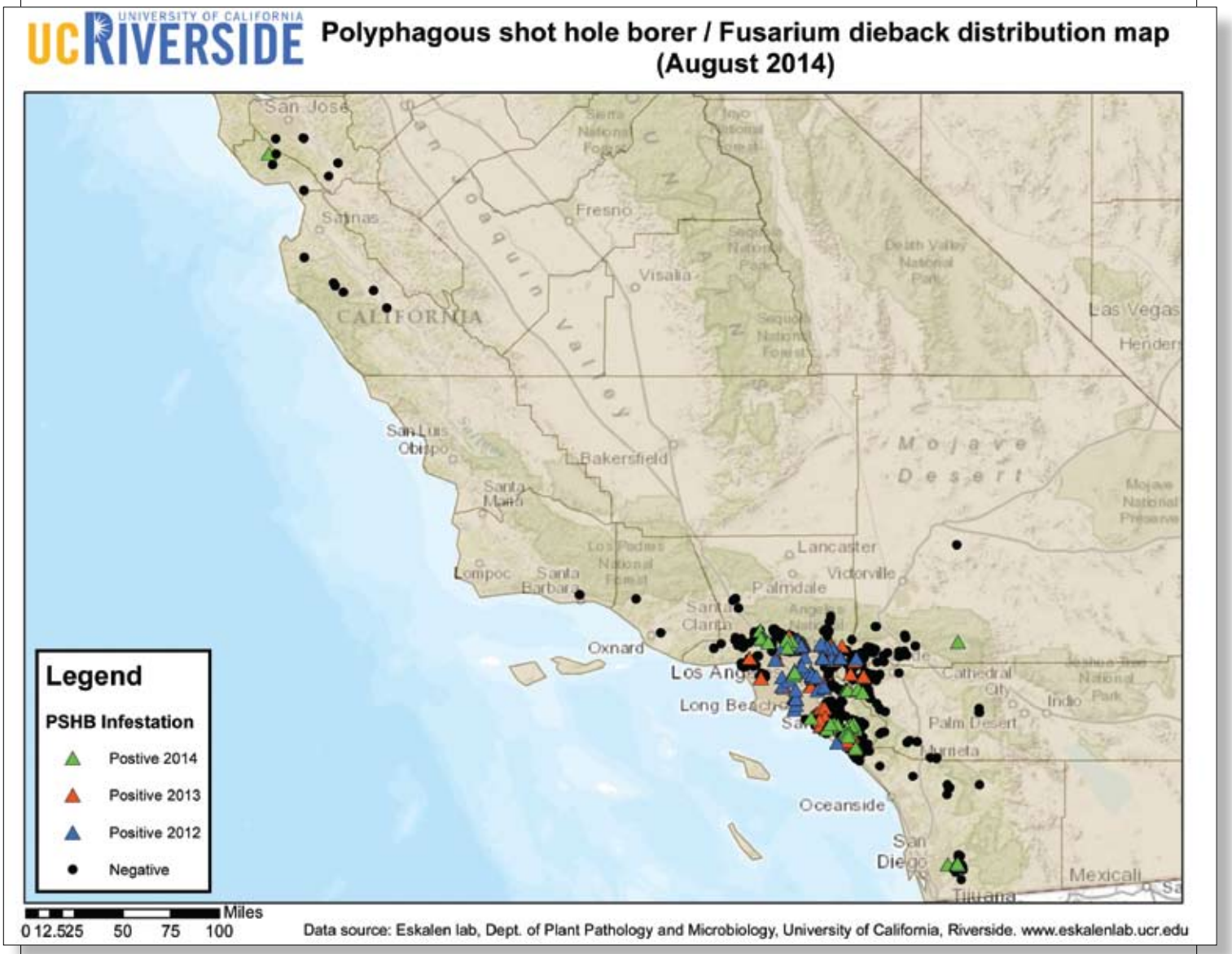
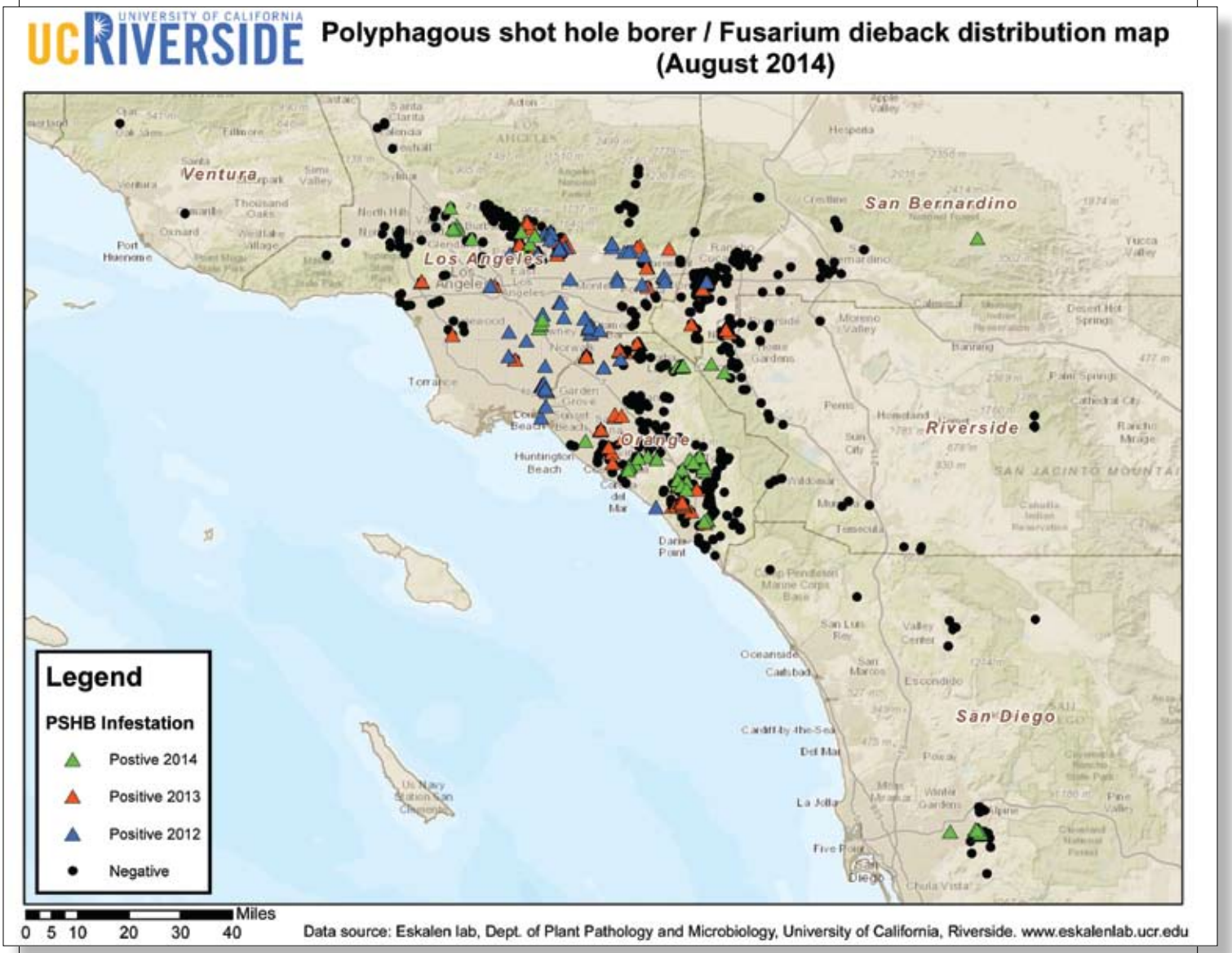


Fig. 2: Distribution of known infestation sites in Southern California.



TESTING PSHB MANAGEMENT TACTICS

According to Dr. Timothy Paine, UC Riverside, management of PSHB will require a range of effective tactics, noted below, for control of the insect.

Chipping and solarization of infested wood

Chipping and solarization of infested wood may reduce the number of beetles that could colonize new trees. While chipping, as a sanitation treatment, has significant potential to reduce the population of emerging beetle, Dr. Paine's research indicates that the chipping process of heavily infested wood must be conducted very carefully.

In an experiment to test beetle survival in chips, wood was chipped and sorted into three size classes: coarse (greater than 2 inches), medium (1-2 inches), and fine (less than 1 inch). Unchipped sections of log were also monitored as an untreated control.

Chips were placed in five-gallon buckets with emergence chambers. Since beetles often remain in host material rather than emerging, a six-inch section of clean trap log (castor bean) was placed in each bucket to survey survival and activity in the bucket. Buckets were checked every two weeks for emergence and activity on the trap log. A new trap log was then placed in the bucket. Buckets were monitored for a total of 11 weeks.

While a few beetles from coarse and medium chips attacked trap logs, the number of attacks was always significantly lower than for trunk sections. There was no beetle

activity on trap logs from buckets of fine chips.

These results, as well as results from previous trials, demonstrate that while chipping is very effective at reducing beetle survival, some beetles will survive in medium and coarse chips and beetle larvae may complete development. Therefore, unless the chipping is conducted very carefully so that the wood is chipped to a fine consistency, material should not be moved from the infestation zone. Covering chipped material will likely prevent any surviving beetles from emerging.

Insecticide application

Dr. Paine is also investigating whether applications of insecticides to uninfested trees may create a barrier protecting the trees from colonization. The insecticides Safari 20 SG (dinotefuran), Danitol (fenpropathrin), and Arena 50 WDG (clothianidin), with and without the use of the bark penetrating surfactant Pentra-bark were compared to Onyx (bifenthrin). All pesticides were applied at the high label rate. During the two weeks of beetle exposure, none of the pesticides performed better than Onyx. However, all insecticides did provide trunk protection, particularly when used with the penetrating agent.

Varietal susceptibility

In addition to direct control, Dr. Paine notes that understanding varietal susceptibility will provide a baseline for risk assessment in future insect management plans because different varieties of avocado appear to have different levels of susceptibility to PSHB.

Dr. Paine's team acquired freshly pruned branches from nine avocado cultivars located within UC Riverside groves. The branch samples were divided into 12 – 15-inch segments and placed in five-gallon buckets with beetle-infested branches for a five-week time period. For a choice test trial, five buckets contained one branch from each of the nine cultivars. Each cultivar was also placed singly in a bucket for a no-choice trial.

Data collected from buckets with branches from all avocado cultivars during the weeks while beetle source logs were present showed attack rates were highest for Zutano and lowest for Bacon, Gem and Gwen. Preliminary data comparing gallery formation among the cultivars indicates that Lamb-Hass may be most susceptible to beetles, having a high rate of gallery formation to attacks. While Feurte and Zutano had higher rates of attack, they had relatively low gallery formation, indicating these cultivars may be more resistant.

Avocado trees with an average stem diameter of 18 mm also were planted at CalPoly Pomona in April and exposed to beetles using infested box elder logs wrapped next to each tree trunk with burlap. Source logs were left in place for six weeks. Cultivars included Ettinger, Hass, Lamb-Hass, Pinkerton and Zutano. At the end of the infestation period Ettinger, Pinkerton and Zutano were more heavily attacked than Hass.

LURE TESTING

Dr. Richard Stouthamer continues to investigate PSHB lure testing at groves in Huntington. While the testing is still in the preliminary stages, one of the lures being tested indicates that the beetles are attracted to the lure. In the upcoming year, Stouthamer will test an orange oil lure at the Huntington avocado collection.

IDENTIFYING BEETLES

A recent PSHB find in a Durban, South Africa park is also considered significant because this region is an important port in South Africa. The Durban find was discovered by one of Stouthamer's team members, Paul Rugman-Jones, as he was querying the Bar Code of Life database (BOLD). This database contains a large number of DNA sequences for the mitochondrial COI gene. Each species has a unique sequence for the COI gene, and this database helps researchers identify species by comparing COI sequences within the database to determine what genus or species a specimen belongs to.

In this case the South African specimen was an unknown ambrosia beetle, but the BOLD sequence was identical to one of the three COI sequences found in the PSHB from California, to one in Israel, and to one of the many COI sequences found in Vietnam.

It has also been determined that the beetles from Sycuan have a different genetic fingerprint than those found in the greater Los Angeles infestation. While beetles with an identical genetic fingerprint for the Los Angeles infestation have been found in Vietnam, the infestation in Sycuan has a genetic fingerprint identical to beetles from Taiwan.

Stouthamer's lab will run tests to determine if the Sycuan and Los Angeles/Vietnam beetles are compatible by mating Sycuan females with Los Angeles males and Los Angeles females with Sycuan males to determine if they are the same species.

SEARCHING FOR NATURAL PREDATORS

In January 2015, Drs. Eskalen and Stouthamer will travel to Taiwan to collect beetles and fungus. Researchers will also collect nematodes that Taiwanese scientists have indicated are natural enemies of PSHB. The nematodes will then be tested against PSHB in the California quarantine facility.