DETECTION SURVEYS AND POPULATION MONITORING FOR *PSEUDACYSTA PERSEAE* ON AVOCADOS IN SOUTHERN CALIFORNIA

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The avocado lace bug, *Pseudacysta perseae* (Heidemann) (Hemiptera: Tingidae), is a foliar pest of avocados, and the known distribution of *P. perseae* includes the Caribbean, the southeastern USA, Mexico, Guatemala, Venezuela and French Guyana (Humeres et al. 2009).

Pseudacysta perseae was detected for the first time in California (USA) in Sep 2004 from 2 residential avocado trees in Chula Vista and San Diego in San Diego County (Hoddle et al. 2005). We present surveys that delineate the range of *P. perseae* in California, selected monitoring sites, and long-term monitoring studies to determine population growth trends from 3 years of population data.

Two detection surveys for *P. perseae* with a pest detection grid system established by the California Department of Food and Agriculture (CDFA) were performed in San Diego County during spring (Mar 20-Jun 30) and fall (Sep 20-Oct 30) of 2006 to delineate the geographic distribution of this pest. The CDFA grid square used for surveys was 2.6 km^2. If *P. perseae* was present, or if avocado trees exhibited possible symptoms characteristic of *P. perseae* feeding (e.g., large necrotic areas on mature leaves, or trees were defoliated), samples were collected and sent to the San Diego County Department of Agriculture, Weights and Measures' Entomology Laboratory for official determination.

For the spring 2006 survey, avocado trees on 966 selected properties within the grid square pattern were inspected every 6 weeks to determine the presence or absence of *P. perseae*. Of these sites, 891 were private residences with 5 or fewer avocado trees, 67 sites had 50-500 trees, and 8 sites had 501-2000 trees. The spring 2006 survey for *P. perseae* in San Diego County delimited the distribution of this pest south of the Interstate 8 freeway to the USA-Mexico border (Fig. 1). The survey covered important commercial avocado production regions such as Fallbrook, Bonsall, Vista, and Escondido where no *P. perseae* were found. *Pseudacysta perseae* detected were exclusively restricted to avocado trees growing in residential areas (Fig. 1).

The survey area in fall 2006 was limited to the area enclosed by 2 major freeways, Interstate 8 and California State Route 78 (Fig. 1). A total of 78 sites were inspected in this region of northern San Diego County. During the fall 2006 survey, 2 new sites near La Jolla were detected north of the Interstate 8 freeway indicating a slight (~16 km) movement north (Fig. 1). Again, no detections were made in commercial orchards. Survey results indicated that areas infested with *P. perseae* were restricted to the southern coastal region of San Diego County and were within 50 km of the coast.

For population monitoring studies, *P. perseae* sampling sites were selected from residential areas that had moderate to high pest infestations on trees that were 5 to 7 years old. All sampling sites were within 15 km of the coast (Fig. 1). A total of 5 sampling sites in San Diego County were monitored monthly for long term population surveys. The study sites used were: Division, 47th Street, Del Sol (City of San Diego), Margaret, Bonita, and Naples (City of Chula Vista). For each sampling event, 25 avocado leaves were randomly collected around the tree from ~1 to 1.5 m above the ground. The number of *P. perseae* nymphs (collected from Apr 2006 to Oct 2008), and adults (collected from Jun 2005 to Oct 2008) on leaves were counted in the laboratory with aid of a dissecting microscope.

Avocado trees at monitoring sites were unknown varieties, which could affect *P. perseae* population growth. Molecular studies were conducted to determine tree heritage. DNA was extracted from spring flush leaves collected from each sampling site (Margaret was not tested due to lack of suitable foliage), and subsequent analysis followed protocols developed by Ashworth & Clegg (2003) and Ashworth et al. (2004) for ascertaining avocado parentage. Two methods were used to infer the most likely parentage of the study trees based on variation in fragment sizes at 7 SSR loci: (1) a manual parentage exclusion method, and (2) an automated method involving parentage assignment software (Marshall et al. 1998).

Both analysis methods indicated that the Division site is synonymous with the avocado variety Bacon. The 47th Street site is a Hass × Bacon variety, the tree at the Naples site originated from a Hass × Zutano cross, and the Del Sol site is a cross between Bacon with an unknown avocado variety. Although avocado varieties at each of the *P. perseae* phenology sites showed different parentage, this did not appear to have a significant effect on

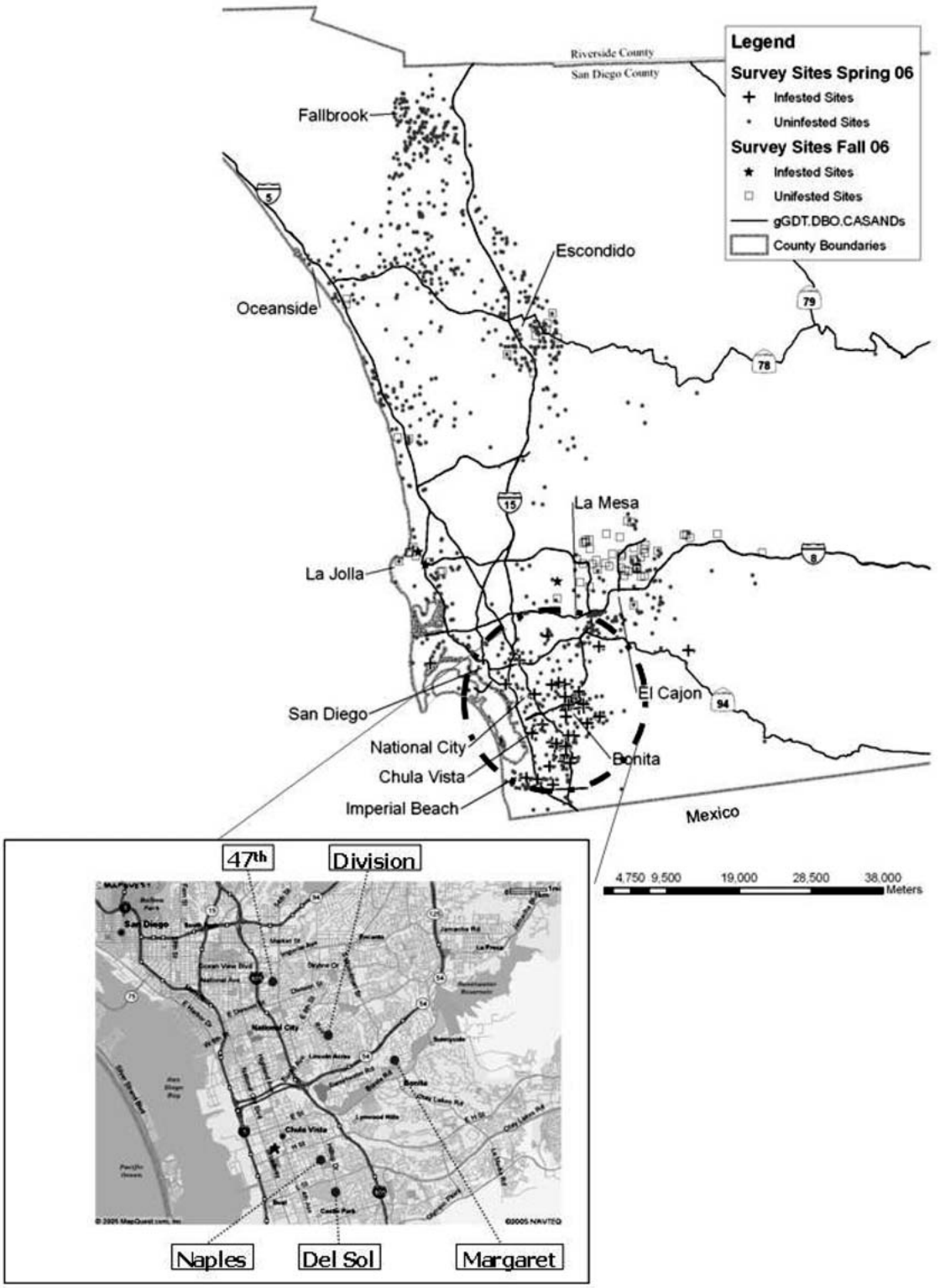

Fig. 1. Detection survey results for *Pseudacysta perseae* on avocados in San Diego County during 2006.

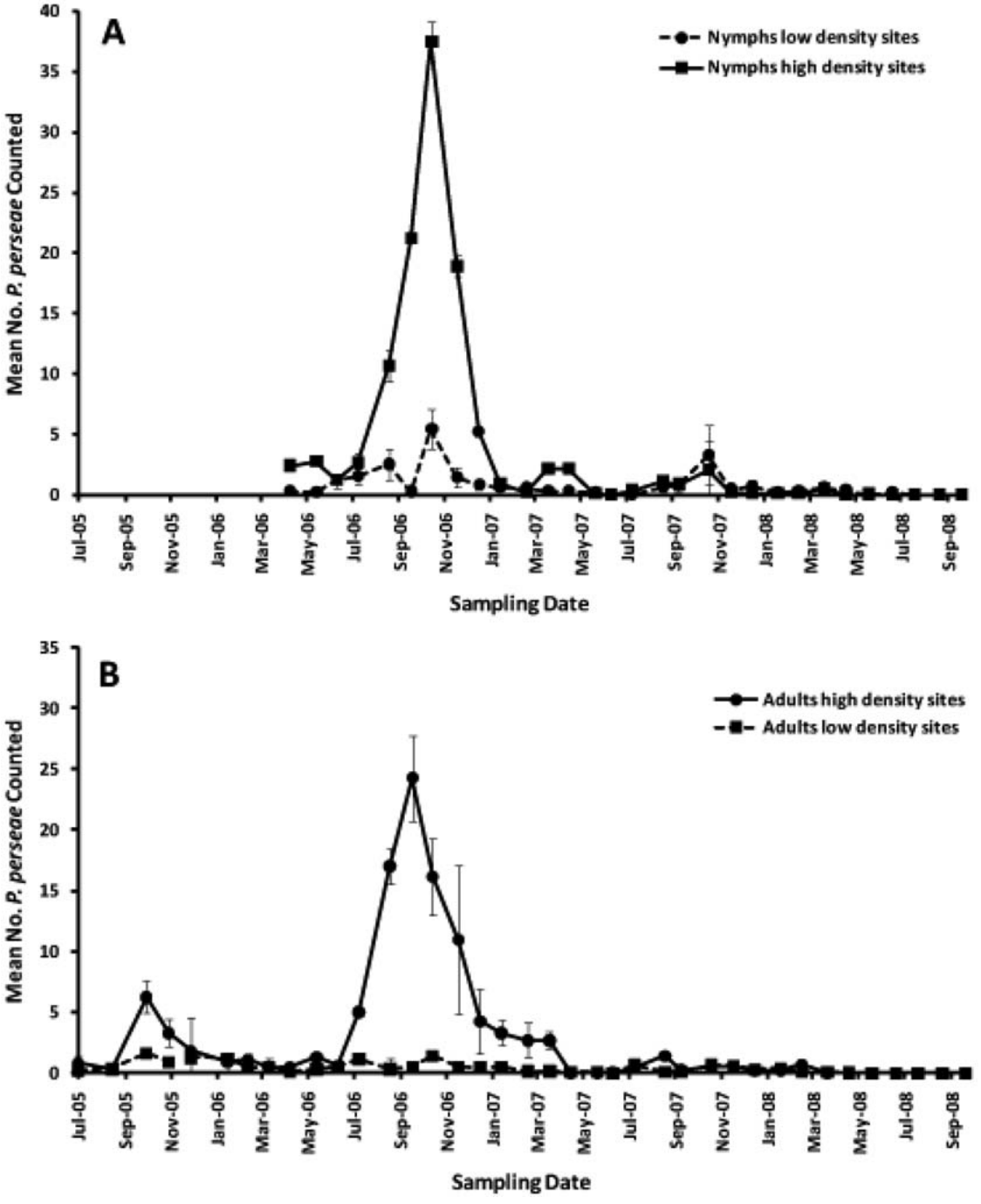

Fig. 2. Number of adults and nymphs of *Pseudacysta perseae* per leaf in San Diego Co., 2005-08 at selected study sites. (A) Average number of nymphs from low *P. perseae* density sites (Division, 47th Street, and Margaret) and high *P. perseae* density sites (Naples and Del Sol). (B) Average number of adult *P. perseae* from low density sites (Division, 47th Street, and Margaret) and high *P. perseae* density sites (Naples and Del Sol).

the long-term population trends of *P. perseae* across the different sites.

The first year of the *P. perseae* monitoring showed that nymphs and adults increased in numbers in early summer (Jun) and decreased during fall (Sep) in 2006. During the same time period for 2007 and 2008, *P. perseae* populations remained low with no outbreaks observed across all sampling sites used. Despite the high *P. perseae* infestations at the Naples and Del Sol sites that originally caused heavy leaf damage and defoliation during 2006, these populations did not display similar population trends in 2007-08 (Fig. 2) and natural enemy (i.e., egg parasitism and presence of predators) activity did not differ significantly over the course of this study (data not shown).

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