State-Wide Monitoring Study to Determine Relationship between Navel Orangeworm Egg and Male Moth Capture

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Introduction

Presently, egg traps provide the primary navel orangeworm (NOW) monitoring tool in almond. Egg capture then is used to establish a biofix defined as: the first date, of two consecutive dates, on which 50% of the egg traps in a given area have an increase in egg numbers. Growers and pest control advisors can use a degree-day (DD) model, available through the University of California, Statewide Integrated Pest Management Program, to strategically time insecticide applications.

In 2013, Suterra LLC, Bend OR, began marketing an NOW lure containing female synthetic sex pheromone. The lure when placed in a sticky trap, provides an effective and efficient method for monitoring male moth flights within orchards. Given this, the new technology could soon replace standard egg traps as the method of choice. However, we do not have a sufficient understanding of the relationship between egg capture and male moth capture and therefore cannot fully utilize male capture data for making treatment decisions.

Objectives

1. Evaluate NOW population dynamics over the almond-production region of California from the southern San Joaquin Valley (Kern County) to the Sacramento Valley region (Glenn / Tehama counties).
   a. Determine biofix dates for egg-laying and male-moth capture at sites throughout the almond-producing regions.
      i. Determine the relationship between egg-capture and male-moth capture biofixes.
      ii. Determine relationship between intra-season male-moth and egg-laying data.
   b. Evaluate applicability of the UC IPM navel orange worm degree-day model using a male-moth capture biofix.

Procedure

A. We selected two to five orchards in each of four growing regions, southern, central, and northern San Joaquin Valley; and Sacramento Valley region for monitoring NOW using egg traps (ET) and pheromone traps (PT) (Fig. 1).
   a. ETs consisted of Trécé black NOW egg traps.
   b. PTs white-top wing traps baited with the Suterra NOW sex pheromone lure.
   c. Three monitoring sets were placed in each orchard consisting of four ET and a single PT.

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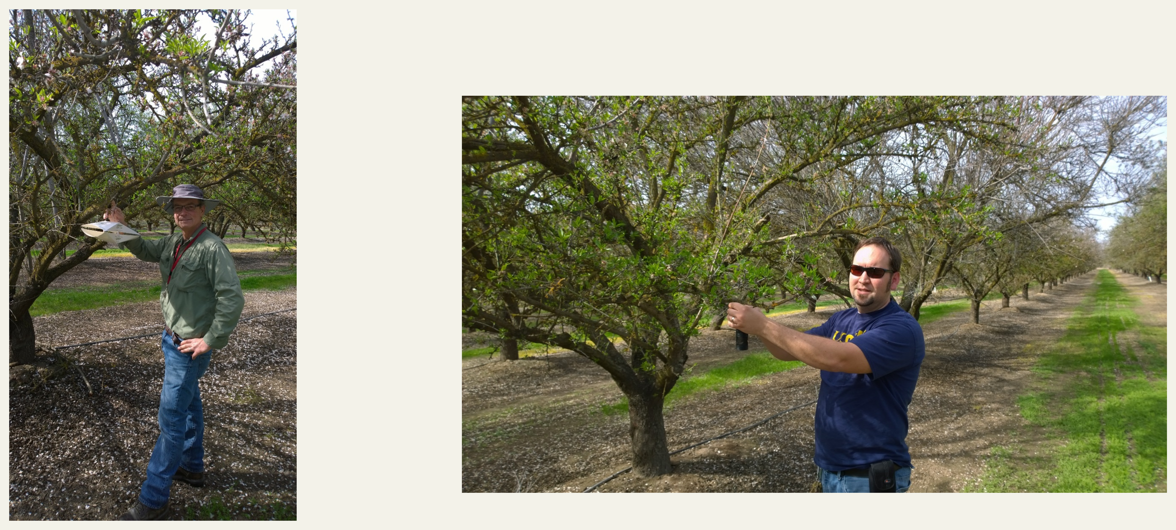

Fig. 1. Wing sticky trap (left), and standard egg trap (right).

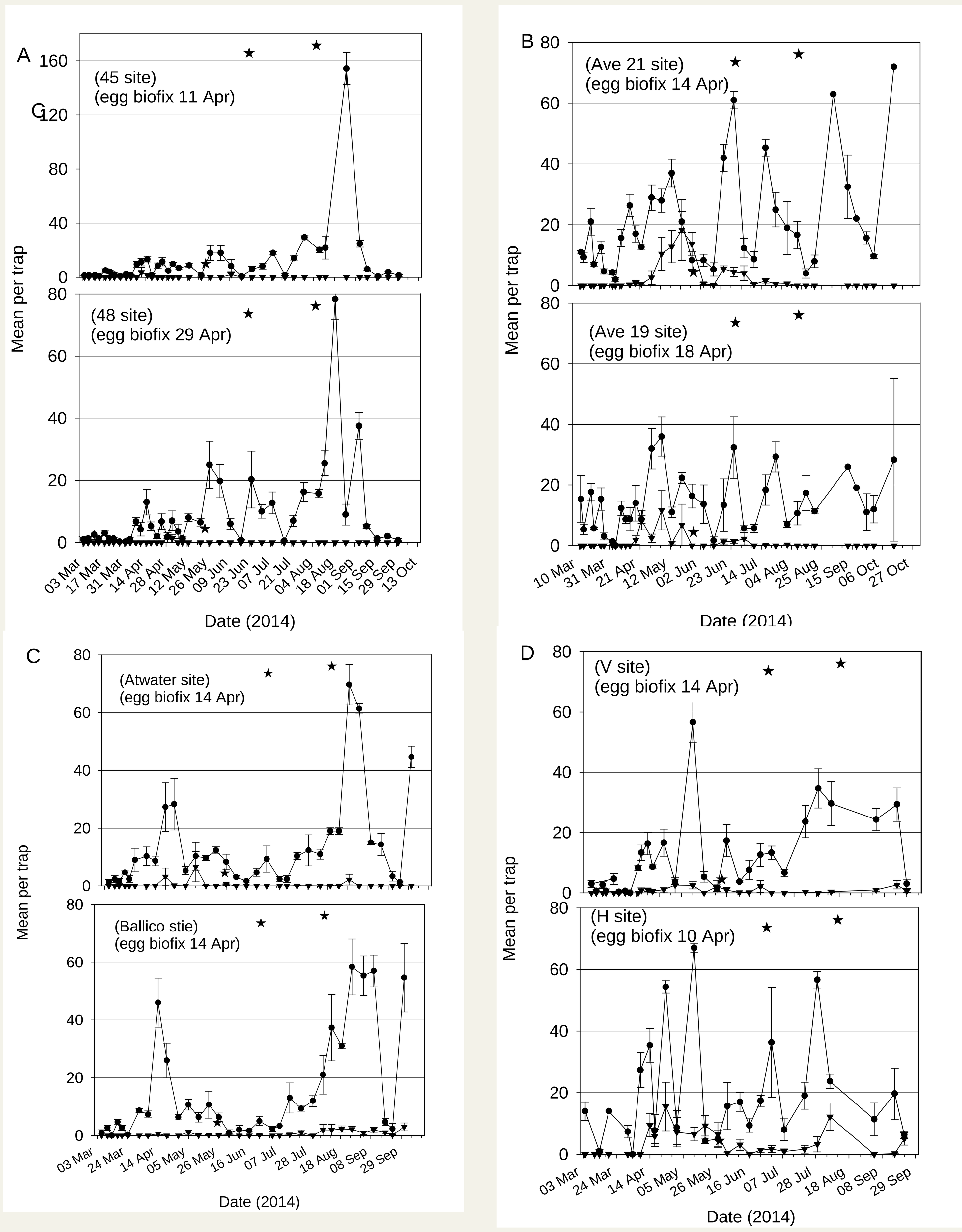

Fig. 2. Mean (± SEM) egg and male navel orangeworm capture for eight sample sites (south (A), central (B), and northern (C) San Joaquin Valley; and upper Sacramento Valley Region (D). Circle = male moth, triangle = egg capture, and stars = degree days at approximately 500, 1056, and 2112 respectively.

Procedure (cont)

1. Spacing within-trap set was 100 ft between traps and approximately 5 -6 feet above the soil surface in an (ET ET PT ET ET) configuration. Monitoring sets were placed within tree-rows.
2. Monitoring sets were separated by 1000 ft and at least 5 tree-rows from the orchard edge.

d. Monitoring sets were placed in orchards by mid-March; egg and moth numbers were counted from mid-March through September. Trap sets were checked twice weekly until egg biofix, then once weekly.
   1. White-top wing trap bottoms were replaced as needed.
   2. Almond meal and pheromone lures were replaced every four weeks.

Results and Discussion

At all 18 sites, pheromone traps began capturing male moths within the first week of being placed in orchards, therefore, we could not establish a biofix based on male moth capture. Egg capture biofix occurred from mid to late April; however, was the biofix was established at just 10 of the 18 orchards sampled. For this report, male moth and egg capture data from two orchards from each of the four growing regions (Fig. 2, A, B, C, and D) shown. Unless otherwise stated, the following results refer to those data.

With a few exceptions, male capture was moderate; over the season mean capture did not exceed 70 per week and generally remained below 60 per week (Fig. 2).

With the exception of the more northern sites in (Fig. 2, D), males of the overwintering generation (first flight) were capture up to mid-June. The subsequent second flight (first generation) tended to occur at approximately the same period (Fig. 2). Other than degree days accumulating more rapidly than in previous seasons, no degree day anomalies occurred (Fig. 2).

The initiation of egg laying in relationship to male flight was relatively consistent across sites. Tentative results suggest that eggs are more likely to be captured when orchard populations reach some threshold; in this case, indicated via male capture exceeding approximately 15 – 20 moths per trap. Additionally, egg capture tended to lag slightly behind upswings of male capture (Fig. 2).

At this early stage in the study, data are not complete enough to determine a relationship between male moth and egg capture. However, to this stage in the study, the data suggest that a population threshold in the orchard must be exceeded and egg capture has a predictable lag period once the threshold is exceeded. A logistic model is one possible option that can provide a predictive tool. The benefit of this model is that several independent categorical variables can be employed, for instance, level of sanitation, proximity to pistachio... can be added. As this project progresses, we will explore how a logistic and or other models can be used to best used.