
Sampling Methods and Development of Thresholds for Use Under Conventional and Mating Disruption-Based Management of Navel Orangeworm (NOW)

Project No.: 15-ENTO15-Rosenheim
(Progress Report)

Project Leader: Jay Rosenheim
Department of Entomology and Nematology
UC Davis
One Shields Ave.
Davis, CA 95616
530.752.4395
jarsenheim@ucdavis.edu

Project Cooperators and Personnel:
Bradley S. Higbee, Wonderful Orchards
Jonathan Ackerman and George Livingston, UC Davis
Matthew Meisner, Farmers Business Network

Objectives:

1. Prepare a series of datasets, all collected previously in commercial almond orchards using either conventional management or mating disruption methods between 2009-2014, that relate estimates of navel orangeworm population density made using different sampling methods to nut infestation and damage at harvest. Integrate the datasets and prepare them for analysis.
2. Using a variety of statistical modeling techniques that incorporate information on trap catches across a 'landscape' of adjacent almond blocks, determine which sampling method is the most accurate predictor of nut infestation and damage.
3. Develop thresholds for applying insecticides to control navel orangeworm populations under conventional and mating disruption-based management programs.

Interpretive Summary:

The goal of this study is to use data from commercial almond orchards to improve the management of the navel orangeworm. By using data from the real commercial setting, rather than from small experimental plots maintained at a research farm, we hope to provide insights that will be ready for implementation. The project is now scheduled to be completed December 31, 2016; thus, this is a progress report, rather than a final report. During this reporting period, our primary efforts were directed to preparing datasets for analysis. Data collected from commercial production orchards are often somewhat variable in the exact variables measured and procedures followed across different years. Thus, a major task is to ensure that the data are prepared so that the final dataset is internally consistent. Also, many different datasets (for example, data on use of pesticides and mating disruption techniques; estimates of mummy nut numbers and infestation; estimates of navel orangeworm numbers based on pheromone traps, egg traps, kairomone lures; infestation of nuts that are early for hull-split; and final infestation of the harvested nuts) must be integrated into a single large

dataset that is error-checked and ready for analysis. This task has now nearly been completed. We also expanded the datasets to include data for the 2015 crop.

Materials and Methods:

Preparing data for analysis involved the following steps. First, it was critical that the procedures used to gather the data in the commercial setting were fully understood, so that the data can be properly interpreted. With this in mind, we held a series of meetings to clarify sampling procedures. Second, we checked all data sets for completeness and to detect and correct errors. Third, differences in methods that emerged across sites or across years were identified; when possible, measurements were transformed to achieve data uniformity. Fourth, it was necessary to develop strategies for ‘data binning’. That is, for variables that were measured repeatedly over the course of a field season (e.g., measures of moths caught in pheromone traps that were collected and checked once or twice per week for the entire spring and summer), we needed to decide how to group observations into successive time periods (e.g., mean captures for every two weeks). Fifth, all the different datasets were merged into a single file that is ready for import into a software package for statistical analysis. These steps, which collectively are called “data munging” by data scientists, required considerable programming. All of the programming was written in the statistical computing language R.

Results and Discussion:

Data files that have been readied for analysis include the following, for two ranches and seven years (2009-2015):

- navel orangeworm damage at harvest: 12 datasets
- pesticide applications targeting navel orangeworm: 12 datasets
- planting date for the almond blocks studied: 1 dataset
- pre-harvest samples of nut infestation for nuts with early hull-split: 12 datasets
- sanitation samples (mummy nuts on tree and ground): 12 datasets
- navel orangeworm captures in traps (traps baited with virgin female moths; traps baited with synthetic sex pheromone lures; traps baited with almond meal cake; traps baited with host plant volatile chemical lures): 12 datasets

The plan for data analysis was developed and refined.

Research Effort Recent Publications:

Written reporting will be done in the fall of 2016, after the analyses are completed.

References Cited:

None.