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MOVEMENT AND MONITORING OF NAVEL ORANGEWORM (*AMYELOIS TRANSITELLA*) IN WALNUTS

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Objectives

1. Compare navel orangeworm (NOW) source and seasonality in walnuts based on the relative prevalence of almond and walnut in the surrounding landscape.
2. Compare monitoring using previously examined attractants (pheromone, ovipositional bait) with PPO.
3. Examine correlation of moth counts in the different trap types with damage to walnuts.

Background

Navel orangeworm damage to walnuts at harvest has been of increasing concern over the past decade. Prior to husk-split, intact walnuts (those not damaged by codling moth, blight, or sunburn) are generally resistant to infestation by navel orangeworm. However, husk-split generally occurs after most almond harvest has been completed and as pistachio harvest is beginning. The potential importance of movement between nut crops has increased as the overall acreage of walnuts, almonds, and pistachios in California has increased.

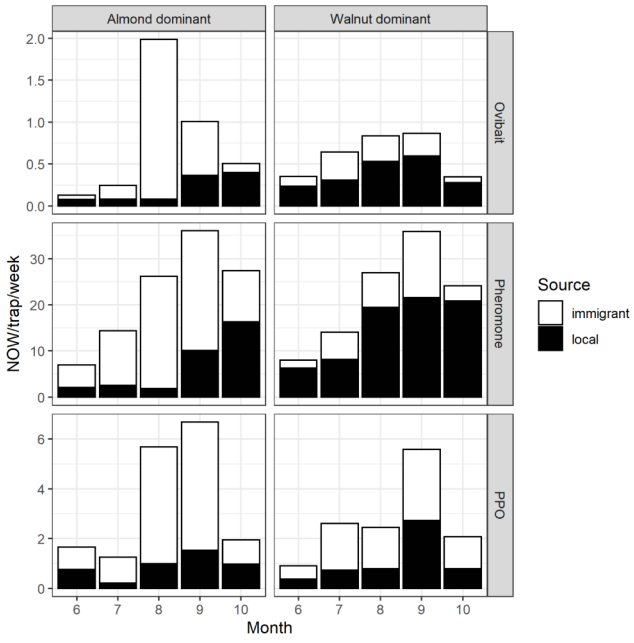
Different attractants have different advantages and disadvantages for monitoring navel orangeworm and potentially for predicting risk of harvest damage. In almonds, studies indicate that counts on traps that attract females (egg traps, or bait traps attracting gravid females) correlate better with damage than pheromone traps (which capture only males). A study in walnuts also found that females in bait traps were more likely to have developed as larvae in walnut compared to males in pheromone traps, consistent with the idea that the female traps capture more locally. Therefore, in the absence of navel orangeworm mating disruption, female bait traps are more associated with damage while pheromone traps for males provide more sensitive detection of navel orangeworm. However, mating disruption suppresses pheromone traps in orchards outside those under treatment, so pheromone traps for mating disruption are less reliable when mating disruption is used in the region. Phenyl propionate (PPO) is a chemical attractant of navel orangeworm that attracts both sexes in either the presence or absence of mating disruption, and generally in higher numbers compared to bait traps for females. The physiology and ecology of navel orangeworm attraction to PPO is unclear, but PPO offers a third alternative to egg bait and pheromone as attractants, and potentially with advantages over either of the other two.

The life history of the navel orangeworm and differences in fatty acids between walnut and other tree nuts provide a way to reliably distinguish navel orangeworm adults that developed on walnuts from those that developed on almonds or pistachios. Fatty acids extracted from moths reared in the laboratory on known nut hosts show distinct differences that can be used to determine whether moths captured in the field developed as larvae on walnut or a different nut crop.

This project is using the fatty acid profile technique to compare the origin of navel orangeworm captured in traps baited with ovipositional bait, pheromone, and PPO in walnut orchards. This comparison is made in areas where walnuts are the predominant nut crop and areas in which almonds are the predominant nut crop. Correlation between navel orangeworm damage at harvest and counts of navel orangeworm captured with ovipositional bait, pheromone, and PPO at harvest are used to compare the usefulness of these attractants for informing husk-split treatment decisions.

Results

Weekly trapping profiles were different between the three trap types, and similar between the two years. The number of NOW captured in August increased in all three trap types, but the increase was proportionately greater in ovibait and PPO traps compared to pheromone traps. PPO traps captured more NOW than ovibait traps but fewer than pheromone traps. Use of fatty acid profiles to determine larval host found greater immigration to walnut from almond orchards in August compared to earlier months (see figure at right). Correlation with NOW damage to walnuts at harvest was marginally significant ($P < 0.1$) with PPO traps, nonsignificant with pheromone and ovibait traps, but much stronger between damage in 2020 and damage at the same site in 2019.



Discussion

Findings to date indicate greater movement of NOW from almond into walnut in August, near the time of husk-split. This trend is, of course, more in the areas where the landscape is predominantly almond. The data also indicate a slightly greater association of counts in PPO with damage compared to pheromone or ovibait. Preliminary data from other sources suggest that PPO is more attractive than the other baits to older or more fat-depleted moths, which could make it more sensitive to NOW immigrating from other orchards and other crops. Damage was more associated with previous damage history than with any of the monitoring methods tested here. It may, however, be possible to use the monitoring method along with orchard history to identify which years have higher potential for damage.

NOW is a highly mobile pest that makes use of multiple tree nut crops and, as such, likely requires management that takes into account the composition of crops surrounding a given orchard block. With multiple orchard sites in different geographic locations, many growers are in need of better ways to prioritize trapping and control efforts. Here, the goal of this study is to provide additional tools to improve the predictability of orchard colonization events and identify the best trap to reflect local NOW populations and their potential for crop damage.