

MATING DISRUPTION FOR CONTROL OF NAVEL ORANGEWORM IN CENTRAL CALIFORNIA

Charles S. Burks*, USDA/ARS, Commodity Protection and Quality, San Joaquin Valley Agricultural Sciences Center, 9611 South Riverbend Avenue, Parlier, CA 93648

The navel orangeworm, *Amyelois transitella* (Walker) (NOW), is the most important insect pest of almonds in California. Previous research has demonstrated that mating disruption can significantly reduce damage in almonds. Most research, however, has been done in the southern Central Valley of California, with almonds of the varieties Nonpareil and Monterey. The present research examines the effect of mating disruption on reduction of NOW reproduction, damage, and abundance in a different region and under different production conditions.

The demonstration site for the Central Region located in western Fresno County, a few miles southwest of the town of Mendota, and comprises 2300 acres of almonds, with some additional interspersed areas of grapes, non-bearing pistachios, and fallow ground. Within this area we have established three observation blocks total 846 acres. Around 60% of each of these blocks is interplantings of the varieties Nonpareil and Monterey (in some cases also with Wood Colony), and around 40% is interplantings of Butte and Padre. Distinctive features of this site include a very hard soil (high clay content), modest levels of sanitation attained at very high price, high insecticide use, and high yield of almonds. It also shares with other western San Joaquin Valley locations recent limitations in delivery of irrigation water, and concern about an increasing reliance on well water and accompanying problems with salinity. These three blocks represent management by several different owners and pest control advisors, and data from 2008 indicated that a variety of different levels of mummy carryover and navel orangeworm abundance are represented in the three blocks.

The observation blocks were monitored in the absence of mating disruption throughout the 2008 growing season. In the 2009 growing season mating disruption was applied to $\approx 60\%$ of the observation blocks, and the remainder was used as a comparison. Nonpareil-Monterey and Butte-Padre blocks were equally represented in the treatment and comparison blocks. Mating disruption began \approx May 1, 2009. CheckMateNOW Puffers were placed in orchard blocks by grower crews, with researcher observation. Effects of mating disruption were examined using winter sampling (population density estimates), early June sanitation surveys (census of mummies only), season-long monitoring with virgin female-baited traps (1 per 40 acres) and egg traps (1 per 2.5 acres), and harvest sampling.

Winter sampling indicated variable but generally high mummy loads. Estimates of navel orangeworm abundance also varied substantially. The June sanitation survey indicated a substantial reduction of mummies, although the number of mummies per tree was still slightly greater than current recommendations.

Numbers of males captured in virgin female-baited traps were similar in 2009 compared to 2008 in March and April; i.e., prior to Puffer activation. After Puffer activation, in the final days of April, the number of males captured in virgin-baited traps was substantially suppressed in both treatment plots and adjacent comparison plots (Fig. 1). Overall numbers of eggs in egg traps were similar to 2008 (pre-mating disruption), but there was a trend of reducing egg counts over the season in treated than in comparison areas (e.g., Fig. 2). Harvest damage in 2008 was under 1% in all varieties and sections, and under 0.5% in most. This continues to be the case in 2009, based on evaluations of Nonpareil Padre varieties (the first two varieties harvested). In the one block there was significantly less damage in Nonpareil almonds in the treated area than in the comparison area, and in the other blocks and varieties there is a non-significant trend of less damage in treated than in comparison areas. These data suggests that mating disruption has in impact in this demonstration site, as previously demonstrated in Kern County.

Advantages of mating disruption for control of NOW in almonds include:

- No effect on non-target organisms
- Potential reduction of insecticides and fumigants targeting NOW
- Potential reduction of NOW population abundance and NOW-associated aflatoxin

Barriers to adaptation include:

- **Price.** The cooperators at this site are interesting in this technology at the current price (\$110 per acre, or \$272 per ha) because their high yield and concern about NOW. This price may be more of a barrier for other growers.
- **Ability to predict NOW damage.** Economic and stewardship advantages from mating disruption depend on reduction of insecticides targeted at NOW. This reduction depends on grower confidence in timely detection of increasing NOW infestation in their crop. The current monitoring tools—egg traps and direct sampling—do not provide this confidence as they are now implemented. The current status of monitoring for this pest thus constitutes a barrier to adaption.

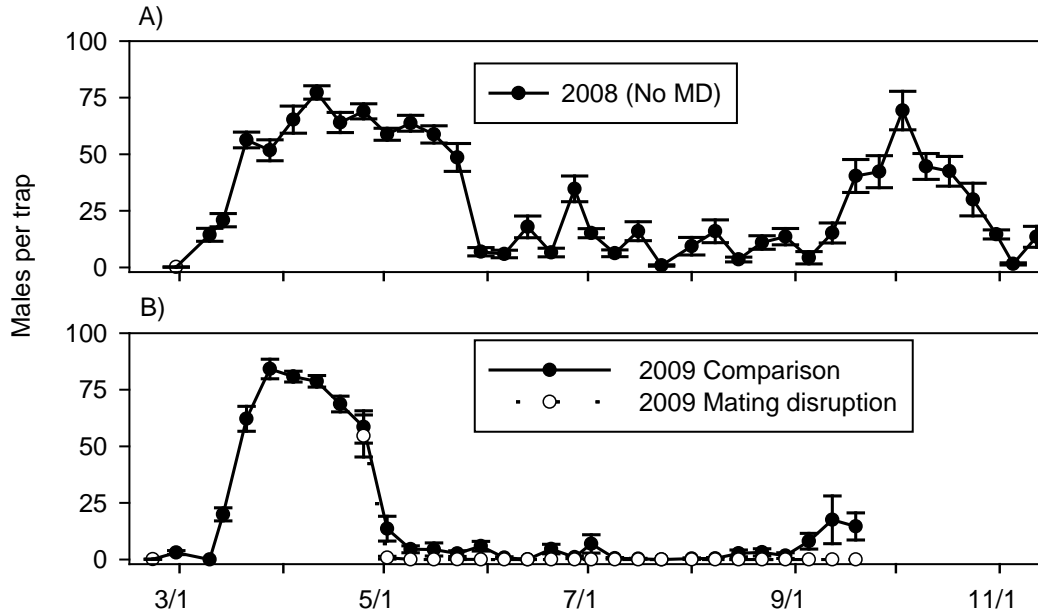


Fig. 1. Navel orangeworm males (mean and SE) captured weekly in wing traps baited with virgin females in A) 2008 and B) 2009. Mating disruption treatments resulted in complete elimination of males captured in virgin-baited traps in treatment plots, and a high degree of suppression of males captured in adjacent comparison blocks.

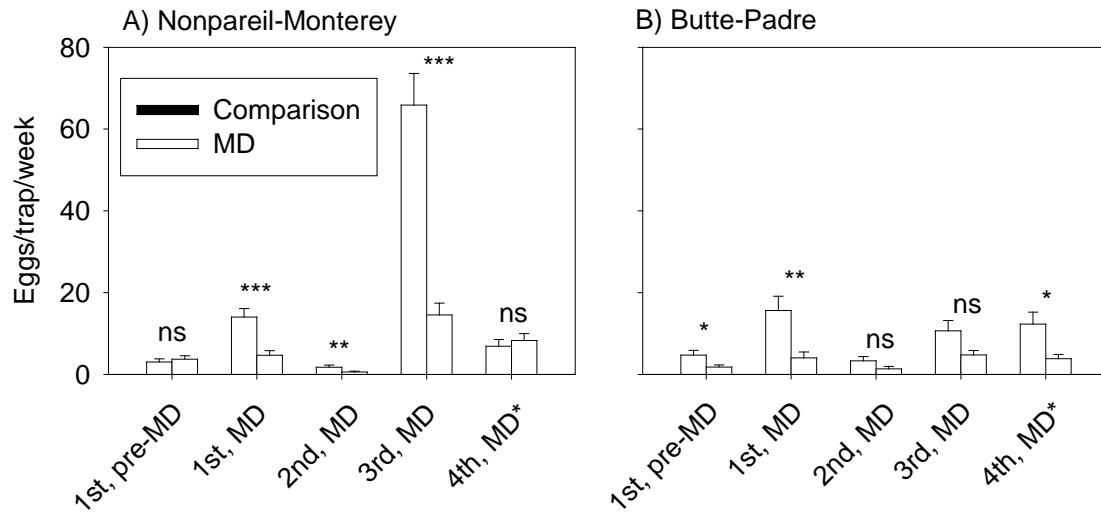


Fig. 2. Navel orangeworm eggs per trap per week (mean and SE) on standard egg traps in A) Nonpareil-Monterey and B) Butte-Padre portions of blocks treated with mating disruption (MD) or in adjacent comparison plots in Block 3. Periods are flight 1 (pre-MD), ; flight 2, ; flight 3, ; and flight 4, . Paired means indicated with ns, *, **, and *** had P values of >0.05 , <0.05 , <0.01 , and <0.001 , respectively.

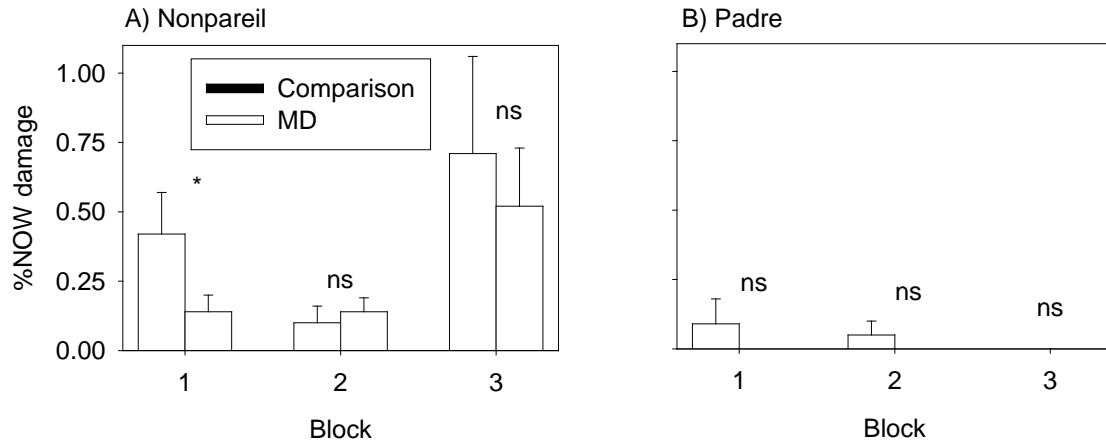


Fig. 3. Percent insect damage (mean and SE) to A) Nonpareil and B) Padre almonds sampled at harvest from the three blocks. Means separation is as described for Fig. 3. Damage represents 3-8 samples of 250-500 almonds each.