PROBLEMS IMPLEMENTING A SYSTEMS APPROACH FOR NAVEL ORANGEWORM IN CALIFORNIA

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One of the challenges in implementing a systems approach to controlling the navel orangeworm is a limited understanding of the population dynamics of this insect. In order for new technologies such as mating disruption to succeed within an orchard, the local population of this insect must first be reduced. Almonds pose a unique challenge because there are many varieties grown in California, and the varieties differ in susceptibility to navel orangeworm, which in turn affects the population dynamics of this pest. Growers commonly believe that varieties of almonds with hard shells are not affected by navel orangeworm, and as a consequence do not spend the same effort sanitizing these almonds as they do the most valuable variety of almonds,Nonpareil, which has a soft shell.

We have conducted studies since 2003 in Madera County evaluating the pattern of infestation and adult emergence from unharvested almonds and pistachios, in order to better understand the population dynamics of this pest. Emergence is prolonged and typically begins in late February and continues through June. During the period November 2009 through March 2010, the prevalence of navel orangeworm in unharvested almonds (mummies) belonging to the hard shell Padre variety was determined, Table 1. In this study intact nuts (Nut +Hull) were collected, but some of these samples lost their hulls during the sorting process. We calculated the infestation of intact nuts, separate hulls, and separate nuts, and also determined the overall infestation. With the exception of a collection on January 7, infestation ranged between 9.6-18.33% in early February, and then fell. This was consistent with previous observations that most of the population reduction occurred between January and mid February. These data were compared to the levels of infestation in other varieties, Table 2. The prevalence of navel orangeworm declined sooner in the Nonpareil variety than it did in Padre, and the prevalence of navel orangeworm in the Butte variety was lower than in Nonpareil and Padre nuts. However, once the winter mortality occurred, the prevalence of navel orangeworm in Butte, Nonpareil and Padre nuts was similar from mid February through March 4. The experiment was terminated at that date because the grower knocked down and destroyed the remaining unharvested nuts.

We conclude that in our study area, almonds belonging to a hard shell variety, Padre, served as a substantial reservoir for the local population and that sanitation standards must be uniformly employed for all varieties, in order to decrease the resident population. This in turn will increase the efficiency of mating disruption as a control technique, and allow growers to reduce their use of insecticides.

Table 1. Prevalence of navel orangeworm in unharvested Padre variety almonds, collected between November 23 and March 4, 2009-2010. The total number of nuts examined is reported in brackets.

Padre	Nov 23	Dec 21	Jan 7	Jan 22	Feb 2	Feb 11	Feb 25*	Mar 4*
Nut + Hull	**9.62%** (1,196)	**9.96%** (1,723)	**5.30%** (3,998)	**18.34%** (1,679)	**18.33%** (1,533)	**15.13%** (1,428)	**3.60%** (389)	**5.81%** (430)
Hull Only	•	•	•	**7.38%** (298)	**2.19%** (732)	**3.21%** (780)	**0** (354)	**0.75%** (1,194)
Nut Only	•	•	•	**0.49%** (1,020)	**2.15%** (1,397)	**3.94%** (1,217)	**0.67%** (902)	**1.69%** (1,185)
Overall	**9.62%** (1,196)	**9.96%** (1,723)	**5.30%** (3,998)	**12.99%** (2,694)	**14.50%** (2,255)	**10.93%** (2,645)	**1.55%** (1,291)	**3.33%** (1,624)

Table 2. Overall prevalence of navel orangeworm in unharvested Monterey, Nonpareil, Fritz, Butte and Padre variety almonds, collected between November 23 and March 4, 2009-2010. The total number of nuts examined is reported in brackets.

Variety	Nov 23	Dec 21	Jan 7	Jan 22	Feb 2	Feb 11	Feb 25*	Mar 4*
Monterey	**1.15%** (871)	**0.18%** (1,117)	ND	ND	ND	ND	ND	ND
Nonpareil	**13.56%** (3,325)	**9.67%** (993)	**11.12%** (4,253)	**8.34%** (2,255)	**2.89%** (1,279)	ND	ND	ND
Fritz	**2.23%** (1,392)	**3.61%** (2,246)	ND	ND	ND	ND	ND	ND
Butte	**1.02%** (1,962)	**0.81%** (1,356)	ND	ND	ND	**6.28%** (1,958)	**2.03%** (1,331)	**1.71%** (3,167)
Padre	**9.62%** (1,196)	**9.96%** (723)	**5.30%** (3,998)	**12.99%** (2,694)	**14.50%** (2,255)	**10.93%** (2,645)	**1.55%** (1,291)	**3.33%** (1,624)