

Research Advances on the Application of Pheromone Mating Disruption for Management of Navel Orangeworm on Walnut

Elizabeth J. Fichtner, UCCE Farm Advisor, Tulare County

Katherine Wilson, UC ANR Staff Research Associate, and Chuck Burks, USDA-ARS, Parlier

Navel orangeworm (NOW), *Amyelois transitella*, is well known as a primary pest of almond and pistachio in California; however, it also attacks walnuts, particularly in the southern San Joaquin Valley. Other hosts include fig and pomegranate. Early in the growing season (April-mid-May), the first generation of adults may lay eggs on blight-infected walnuts or on nuts infested with codling moth (CM). In late summer, emerging females prefer to lay eggs on the open husk or on the exposed nutshell. Growers are familiar with monitoring for and managing CM in walnut; therefore, NOW incidence in walnut may be underestimated and grouped with CM damage under the general classification of “worm damage.” Because CM damage predisposes walnut to NOW infestation, effective management of CM additionally protects the crop from NOW. Strategies for NOW management vary by crop. For example, sanitation is the primary strategy for management of NOW in almond, but is less effective for mitigating NOW damage in pistachio. Pheromone mating disruption (PMD) has been successfully utilized for management of NOW in almond and pistachio, and may similarly have application in walnut. It is estimated that over 15,000 acres of nuts in California are treated with PMD for NOW.



Figure 1. Frass and webbing are diagnostic signs of NOW infestation in walnut. Photo: Elizabeth Fichtner

Differentiating between CM and NOW damage in walnut

One can easily differentiate between NOW and CM damage on walnut when larvae are present in the nut. NOW infestation is associated with extensive webbing and frass (Figure 1). Additionally, NOW larvae have a crescent-shaped marking on each side of the body, behind the head (Figure 2).

Management of NOW in walnut

Orchard sanitation is the first consideration for management of NOW. Similar to almonds, removal of mummy nuts from the orchard will reduce overwintering sites. Overwintering populations can generally be reduced by flailing or burning all crop debris containing nuts before mid-March. During the 2012 growing season, however, NOW emergence was documented prior to March 15 and populations of NOW were present in some orchards despite rigorous sanitation efforts. Additionally, practices utilized to manage CM infestation, walnut blight, and sunburn indirectly protect nuts from NOW because NOW only attacks walnuts with damaged or split husks. Prompt harvest of walnuts also reduces NOW infestation because it may prevent the cycle of a 4th generation of the insect in orchards.



Figure 2. The crescent-shaped mark behind the head is a diagnostic feature of NOW. Photo: Jack Kelly Clark

New studies are currently being conducted to investigate the use of PMD for management of NOW in walnut orchards. Use of PMD is not a new concept for some walnut growers who are already using the technology to control CM, with the result of reducing or even eliminating the need for CM insecticide treatments in early, more susceptible varieties. PMD is already implemented for management of NOW in over 15,000 acres of almond and pistachio in California.

What are the benefits of Pheromone Mating Disruption (PMD)?

Broad-spectrum insecticides have historically been the primary method of control for CM and NOW in walnut. More recently, commitment to environmental stewardship and reductions in pesticide use have become primary goals worldwide. Water and air quality issues have caused the Department of Pesticide Regulation (DPR) to re-evaluate pyrethroids and chlorpyrifos as well as pesticides that contain volatile organic compounds, possibly leading to use restrictions and cancellations. In addition, many insecticides harm beneficial insects in the orchard, which can lead to outbreaks of secondary pests, requiring additional insecticide and miticide applications. The need has become crucial for reliable, environmentally and economically sustainable pest management technologies such as PMD. The most widely used system for dispensing pheromone into a walnut orchard is the aerosol pheromone puffer.

What is PMD?

Mating disruption is a relatively new method of control which uses insect specific pheromones released throughout an orchard to confuse and prevent males from finding females to mate with. One of the methods of PMD that has been developed is a timed-release aerosol pheromone dispenser (TRAPD). TRAPDs house a pressurized canister (Figure 3) containing insect-specific pheromones that release a puff of the pheromone at timed intervals. These TRAPDs are hung on branches within the orchard and are fully automated. It is important to remember that pheromones are insect-specific; thus, TRAPDs used for CM control will not disrupt the mating of NOW.

Because TRAPDs are fully automated, they require little human maintenance after the initial installation. Some growers have reported leaving TRAPDs in orchards over winter, only physically handling them in spring to insert a new pheromone canister.



Figure 3. Puffers®, a TRAPD marketed by Suterra®, were utilized in the current study. Photo: Elizabeth Fichtner

Recent advances on use of PMD for NOW in walnut. A current research study led by Dr. C. Burks, USDA in cooperation with Dr. E. Fichtner, UCCE Tulare County, is designed to compare the phenology and damage between NOW and CM in walnut and to examine the impact of PMD on reproduction and damage by NOW on walnut. Grower cooperators in Tulare and Kings Counties have worked with our research team to allow for weekly insect monitoring using egg traps and female-baited pheromone traps at 10 sites. Additionally, Puffers®* were installed in 4 commercial walnut orchards in Tulare County to experimentally test the efficacy of PMD for NOW management (Figure 4).

Preliminary results from the 2012 field season indicate that overwintering populations of NOW are present at most sites. The number of males captured in mating disruption plots comprised 79% of those captured in non-mating disruption sites before treatment started, but 0.1% of those in non-mating disruption sites after treatment began. The findings to date indicate walnuts can support high abundance of NOW independent of other crops, and NOW



Figure 4. Puffer® suspended in Tulare Co. walnut orchard. Photo: E. Fichtner

has potential for damage independent of CM in some walnut orchards, depending on management. The impact of PMD on rate of NOW infestation on walnut will be determined at harvest, and the results will be summarized in future newsletters as well as in the Walnut Research Reports which are searchable online through the Fruit and Nuts Research and Information Center: <http://fruitsandnuts.ucdavis.edu/>. For more information on pest management in orchards, please visit the UC IPM Website: <http://www.ipm.ucdavis.edu/index.html>. Always read the label of the product being used, and note that all registered pesticides are not necessarily listed on the UC IPM Online website or in this newsletter. Always check with the certifier to determine which products are organically acceptable. Mention of trade names or commercial products in this article is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the University of California.

*Puffer® is a registered trademark of Sutterra®.

Acknowledgements

This project was made possible with funding from the Walnut Board of California.

Thousand Cankers Disease Now in Three East Coast States

Elizabeth Fichtner, UCCE Farm Advisor, Tulare County

As the known geographic range of thousand cankers disease continues to expand in California, the disease has also emerged in three East Coast states, now threatening eastern black walnut (*Juglans nigra*) in its native range. The disease, caused by the fungus *Geosmithia morbida*, is vectored by the walnut twig beetle (wtb) (*Pityophthorus juglandis*). The association between *Geosmithia* species and bark beetles is a worldwide phenomenon; however, *G. morbida* has only been observed in the USA, and is specific to *Juglans* (walnut) species.



Walnut twig beetles bore through tree flagging upon emergence. Holes in flagging are an excellent initial indicator of possible wtb colonization. Photo: E. Fichtner

Thousand cankers disease timeline

Over the past decade, thousand cankers disease has been associated with decline and mortality of eastern black walnut in several western states. Although eastern black walnut is native to the eastern United States, it is planted extensively in landscapes in western states and serves as a rootstock for commercial production of English walnut (*Juglans regia*) in California. In 2008, the disease was first observed in California on northern California black walnut (*Juglans hindsii*) in Yolo County. By the close of 2009, however, the disease was known to affect commercial walnut orchards throughout the state, with infections documented on both black and Paradox rootstocks and on several varieties of English walnut.

Since 2010, thousand cankers disease has been reported in three East Coast states: Tennessee, Virginia, and Pennsylvania. Although the pathogen and insect vector are native to North America, they are still exotics when introduced to eastern landscapes. In eastern landscapes, the pathogen and wtb vector are introduced, exotic species attacking eastern black walnut in its native range.

Active Quarantines

In Tennessee six counties are currently under quarantine in the Knoxville area, and ten surrounding counties serve as a buffer zone. In Virginia seven counties are quarantined around the Richmond area. Bucks County, Pennsylvania is also under quarantine. In these situations, the quarantine prevents the movement of walnut wood, and associated materials (ie. stumps, roots, mulch, etc) out of quarantined counties. The success of

quarantine activities in preventing the spread of thousand cankers disease is challenged by the fact that spores may be transmitted over some distance by wtb flight.

Ohio is considering implementation of an exterior quarantine for thousand cankers disease, which would restrict movement of walnut materials from infected counties in the 11 states known to have thousand cankers disease, including California. Nuts, nut meats, hulls, processed lumber and finished wood products (ie. furniture or gunstocks) would be exempt from quarantine.

The take-home-message for California walnut growers is that the pathogen and wtb are not moved in walnut meats or hulls; therefore, these commercial products do not pose a risk of disease transmission. To prevent the spread of the disease to uninfested regions of the state and country, however, infected, untreated wood should not be moved.

Where did thousand cankers disease come from?

The current dominant hypothesis purported by the scientific community is that both the wtb and pathogen are native to the southwestern United States. The wtb has a long-term association with Arizona walnut (*Juglans major*), with the first report of the beetle made in New Mexico in 1929. The beetle tends to exhibit limited colonization of Arizona walnut, and cankers induced by the pathogen are smaller on Arizona walnut than on black walnut. The limited affect of both the pathogen and insect on Arizona walnut suggest the potential for a long-term coexistence of host, pathogen, and vector. Similarly, wtb were reported in the Los Angeles area in 1959 in the native range of California walnut (*Juglans californica*), another host exhibiting some level of resistance to the disease.

Over the next few years, genetic analyses of the wtb and *G. morbida* will likely elucidate the origin and distribution pattern of the disease within North America.

California walnut growers have facilitated nationwide research and monitoring efforts

Numerous walnut growers in California have cooperated with UCCE Farm Advisors to participate in a statewide wtb trapping program led by US Forest Service Entomologist, Dr. Steve Seybold. Since 2009, in Tulare County alone, five growers have permitted weekly trapping of wtb in orchards. The year-round monitoring of wtb activity provides valuable insight into the epidemiology of the disease in diverse walnut growing regions in California, and has provided a framework for the guidelines now utilized nationwide for early detection of new forest infestations. Early results of the wtb monitoring program demonstrate that the beetles are active in winter, particularly after a period of mild temperatures. Consequently, infected trees remaining in orchards over the dormant season may serve as primary inoculum for disease transmission by winter beetle flight.

Upcoming UCCE research efforts

With support from the UC ANR Competitive Grants program and the Specialty Crops Research Initiative (SCRI), collaborating Farm Advisors throughout the state will be conducting extensive local surveys for the disease in commercial orchards. Upcoming surveys will be conducted in September and October 2012. Orchards in both Tulare and Kings Counties will be included in the statewide survey, with the goal of understanding the distribution of the disease in diverse geographic orchard systems.



The latest design in walnut twig beetle traps employs a patent-pending pheromone to enhance beetle detection. Photo: E. Fichtner

2012 Advances in Pistachio Production Short Course

Tuesday, November 13, 2012 - Thursday, November 15, 2012



This 3-day short course will be held at the [Visalia Convention Center](#), and will include presentations by UCCE Farm Advisors and Specialists, covering pistachio production topics such as field preparation, planting, pruning, economics, IPM, and harvesting.

This will be a course for orchard decision makers, which will cover the basic science, not as experimental data, but as accepted science, that supports current and developing production practices, including regional differences.

Early registration fee is \$750; \$900 after September 30, 2012; \$950 at the door.

<http://ucanr.org/sites/Nov2012ShortCourse>

SAVE THE DATE!

Statewide Pistachio Day

Wednesday, January 16, 2013

Tri-County Walnut Day

Wednesday, February 6, 2013

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In-A-Nutshell

September 2012

Elizabeth Fichtner
Farm Advisor