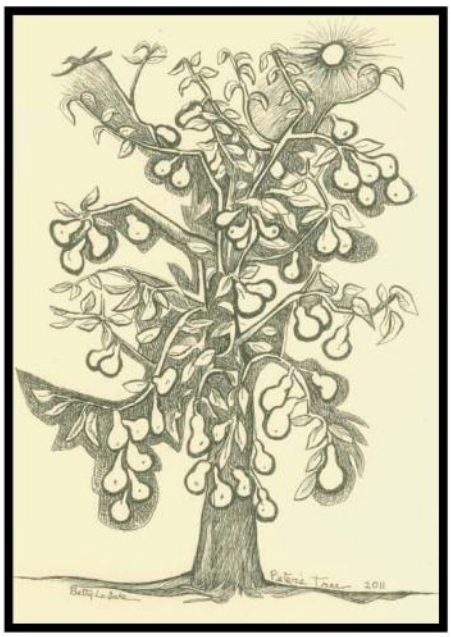

Abstracts from the 86th

Orchard Pest Management Conference

2012

The 86th Conference is pleased to announce our keynote speaker

Dr. Claudio Ioriatti

Instituto Agrario di San Michele All'Adige, Italy

Keynote Address:

"Integrated Fruit Production (IFP) in Italy, Past, Present and Future: Examples from Apple and Grape"

Hilton Portland, Portland, Oregon
January 11-13, 2012

In Memoriam

Peter Hughes Westigard

1933-2011

Peter Westigard began his career at Oregon State University's Southern Oregon Experiment Station in 1962 and continued there until his retirement in 1997. He had a passion for his work, as his many accomplishments attest, but will be remembered as well for his interaction with colleagues and students. He had a tremendous generosity of spirit which embodied the camaraderie that has been a hallmark of the IPM tradition in Pacific Northwest tree fruit research.

Peter was California born and bred. He grew up in San Mateo in the Bay Area, but also spent time on the family farm in the central valley. He got a Bachelor's degree from San Jose State before moving to the entomological hothouse at Cal Berkeley and obtaining his doctorate in 1961. The concept of IPM was being developed and UC Berkeley was at the center of this new way of approaching pest management.

Peter's many research topics included original work on a wide array of pear pests: aphids, pear rust mite, grape mealybug, San Jose scale, pear psylla, spider mites and codling moth. He also studied natural enemies, particularly the biological control agents of pear psylla such as *Trechnites* and *Deraeocoris*. Peter's contributions to the basic biology of pear pests and natural enemies are seen throughout our key reference, the "Orchard Pest Management" resource book.

Peter Westigard

Multi-species holistic studies were Peter's research passion. His seven year study of a pear orchard in the absence of chemical controls for arthropod pests clearly identified induced pests and allowed him to evaluate the extent of biological control. This multi-species work culminated with Larry Gut's dissertation on Arthropod Community Organization and Development in Pear that attempted to look at all the arthropod species in the pear orchard and identify the major interactions and key factors involved.

Peter was committed to supporting growers by providing tools they could successfully implement to increase profitability and stay in business. Making pest management economical was a central objective and is seen in Peter's work with Hal Moffitt on mating disruption for codling moth and testing the codling moth granulosis virus with Stan Hoyt well before either of those technologies were marketable. Working with his good friend and grower, Ed Earnest, a selective program based on the use of the IGR Dimilin was implemented on 800 acres. Peter's groundwork helped form the basis for the Codling Moth Areawide Program, with southern Oregon serving as one of the five original sites. The CAMP project clearly demonstrated the effectiveness of mating disruption as a central tactic for managing codling moth.

Peter loved wine, both cheap and expensive, conversation and laughter. The Portland meeting was always a favorite of his, as it combined his passion for work with his love of a good time shared with colleagues, who were also his friends.

In Memoriam

Richard E. (Dick) Rice

1937-2011

Dick Rice was Professor Emeritus at UC Davis and one of the faculty members located at the Kearney Agriculture and Research Center in Parlier. Dick was raised on a tree and vine farm in Sultana, CA and spent much of his career in the San Joaquin Valley. He served in the US Army as a medical entomologist in the mid 1960's at Fort Sam Houston, Texas where he trained new recruits in preventative medicine. He received his PhD at UC Davis in 1967 under the gifted agricultural entomologist Frank Strong.

His specialty became pest management in tree fruit and nut crops. He worked closely with the tree fruit and nut industries in California studying a number of significant insect and mite pests over his career. He is most noted for his research on navel orangeworm, oriental fruit moth, codling moth, omnivorous leafroller, San Jose scale and a number of Hemipterans attacking pistachio and almonds. He was an excellent entomologist, contributing much to our knowledge of the biology of these pest species. His research helped to make California farmers of fruit and nut crops dominant in world markets today. It also set the foundation for management approaches for these pests that is still in use.

Of particular import ance was the implementation of mating disruption for Oriental fruit moth and codling moth in California. His development of the navel orangeworm egg trap for monitoring is still used by farmers in the pistachio and almond industry. He was an early innovator in using management approaches that solved regulatory and quarantine problems. He focused on developing acceptable programs for exporting California's fruit to other countries through cultural management and monitoring while minimizing the use of disruptive and environmentally harsh approaches.

Dick was an active member of the Entomological Society of America where he served as both President and Secretary-Treasurer of the Pacific Branch. He was also an active member and participant of the Western Orchard Pest and Disease Management Conference for 33 years. Dick was the keynote speaker for the 2008 Conference, speaking on a favorite theme "35 Years of Watching Chemical Ecology at Work".

Dick served as a mentor to so many of us on the West Coast. He took the time to patiently guide his students and younger faculty. He worked closely with industry to help develop and implement technological advances. He will always be remembered not only for knowledge and experience but also as a gentleman who made time to help and nurture others. He was very accomplished but he was always interested in the personal and professional lives of others. He was a true entomologist who loved the study of insects. He used that knowledge to the benefit of the agricultural industry that he loved and served. He will be greatly missed and fondly remembered. We lost a great friend and colleague.

WESTERN ORCHARD PEST AND DISEASE MANAGEMENT CONFERENCE
"The Portland Spray Conference"
(1926 - 2012)

Our History: One of the oldest and most appreciated Entomology-Plant Pathology meetings in the Pacific Northwest is the Portland Spray Conference. It dates back to 1926. It was on June 30 of that year at the suggestion of J. R. Parker, Associate Entomologist, Montana Agricultural Experiment Station, that the first meeting was held in Tacoma, Washington. The "Western Cooperative Oil Spray Project" as it was formally named was organized at that meeting. Participants included representatives of Idaho, Montana together with representatives of the USDA and the Canada Department of Agriculture. Mr. Parker was named Chairman. Another meeting was held in Spokane, Washington on December 5, 1926 and thereafter, over the past 80 years, this has been an annual gathering. The meeting continues to grow and we now have participants from all fruit growing areas of North America and other countries including Argentina, Chile, and Switzerland.

Our Focus: The meeting has always been one focused on research, without any emphases on the commercial aspects of the applications of the research. Not so long ago (thirty or so years ago), the meeting was small, forty or fifty people, and limited to only research scientists from public institutions. Then extension agents were invited in, then one representative from each chemical company (about twenty years ago), then opened to everyone. Now the meeting participants include researchers, extension personnel, manufacturing reps, fieldmen from agricultural chemical companies, private consultants, and growers. Everyone is invited to give presentations and there is a strong commitment amongst all members to keep presentations scientific not only out of a respect to the origins of the meeting but also to ensure that the meeting is a valuable experience to all participants.

Rubber Chicken Award: In an effort to ensure that presenters and participants maintain the highest standards of conduct and etiquette, WOPDMC members annually award the prestigious but unwelcome "Rubber Chicken Award". Recipients of this high distinction (awarded at the conclusion of the meeting) receive a featherless, rubber chicken appropriately hung by its feet.

'Winners' in the Modern Era (following about a 15 year hiatus, the award was revived during the 75th anniversary meeting)

Rachel Elkins (2001), Univ. of Calif., Clear Lake, for using an overhead projector in a digital age.
Jay Brunner (2002), Wash. St. Univ., Wenatchee, for giving one of the looooongest talks in the history of the WOPDMC.
Doug Light (2003), USDA, Albany, California, for showing incomprehensible data slides again and again and again.
Stephen Welter (2004), Univ. of Calif., Berkeley, for inappropriate behavior by leaving the meeting prior to giving his presentation.
Andy Kahn (2007), Wenatchee, Washington, for giving a much too long presentation and refusing to yield the podium - Andy subsequently decapitated our alopeciate friend.
Jim Miller (2008), Mich. St. Univ., for attempting to coerce the entire membership into his cult of the pheromone - and Jim was responsible for the demise of yet another unfeathered friend.
Peter Shearer (2009), Ore. St. Univ., Hood River, for forgetting, like Dorothy, that he was not in Rutgers anymore.

Orchard Pest and Disease Management Conference
Agenda for 2012 Conference

Note that the agenda is NOT a fixed time schedule and the actual time at which you are called to give your talk may vary. Below is the order in which the sessions will be given and the projected time slot which that will occur.

Talks within a session will be in the order in which they are listed in the agenda found on the following pages.

Wednesday, January 11		
9:00am	Opening Business	Tom Unruh, WOPDMC Chair
10:00am	Mating Disruption / SIR	Alan Knight, Moderator
12:00pm	Lunch	
1:30pm	Mating Disruption / SIR (cont.)	Alan Knight, Moderator
3:00pm	Coffee	
3:30pm	*Keynote Address:* **Implementation of Integrated Fruit Production (IFP) in Italy: Past, Present and Future with Examples from Apple and Grape.** Claudio Ioriatti, Istituto Agrario San Michele	
5:00pm	Mixer (Lobby)	
Thursday, January 12		
8:00am	Implementation	Rick Hilton, Moderator
9:00am	Thresholds / Monitoring	Don Thomson, Moderator
10:00am	Poster Session / Coffee Break	
11:00am	Biological Control	Tom Unruh, Moderator
12:00pm	Lunch	
1:30pm	Invasive Species	Angela Gadino, Moderator
3:30pm	Break	
4:00pm	Invasive Species (cont.)	Angela Gadino, Moderator
Friday, January 13		
8:00am	Chemical Control	Ron Britt, Moderator
11:00am	Closing Business	Tom Unruh, WOPDMC Chair David Epstein, Chair-elect
12:00pm	Adjourn	

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Western Orchard Pest and Disease Management Conference

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Order of Presentations
FROM THE 86th ANNUAL
ORCHARD PEST AND DISEASE MANAGEMENT CONFERENCE
January 11, 12 & 13, 2012

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MATING DISRUPTION/SIR—

Moderator: Alan Knight, USDA-ARS, Wapato

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Mating Disruption/SIR

Successes with Area-wide Use of Mating Disruption: Moving from Crisis Management to Long Term Pheromone-based Pest Management

Don Thomson, and Jack Jenkins
Pacific Biocontrol Corporation, Vancouver, WA

Keywords: sex pheromones, mating disruption, *Pectinophora gossypiella*, area-wide, crisis, resistance, secondary pests, reduced risk insecticides, environmental awareness, health concerns

Abstract: The potential of using sex pheromones to control insect pests was first demonstrated over 40 years ago. The first mating disruption product for control of an insect pest *Pectinophora gossypiella* was registered in 1978. Now more than 30 years later, mating disruption technology is used worldwide to control many insect pests in both agriculture and forestry. The deployment of mating disruption technology has often been precipitated by crises, for example the loss of control due to insecticide resistance, outbreaks of secondary pests due to the overuse of insecticides for key pests, regulations restricting or banning insecticides and outbreaks of invasive species. The incorporation of area-wide mating disruption into pest management systems has been instrumental in the resolution of crises by re-establishing control. This allows the end-user to harvest marketable crops and improve profitability. Examples of success stories whereby the area-wide use of mating disruption has helped to resolve crises will be presented. With the resolution of the crises, end-users have sometimes abandoned the use of mating disruption and returned to a reliance on conventional insecticide control programs as they are viewed as easier and cheaper to deploy. Environmental and health concerns have led to increased restrictions or the phase-out of many of the "older" insecticides. Although the US EPA and other regulatory agencies have registered many "reduced risk insecticides", these new products are more expensive, difficult to use and can negatively impact natural enemies resulting in outbreaks of secondary pests. Together these factors have resulted in mating disruption technology becoming a standard practice in some pest management systems around the world. Reasons why mating disruption continues to be used in some pest management systems following resolution of a crisis but not others will be discussed. As environmental awareness increases and countries become increasingly interdependent on trade, harmonization of regulations and restrictions will help to promote greater use of mating disruption technology.

Mating Disruption/SIR

Evaluating Mating Disruption Technologies in Commercial Orchards

Jay F. Brunner and Nick Wiman
Washington State University Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: Codling moth, *Cydia pomonella*, sterile moth release, mating disruption

Abstract: Last year we reported on use of sterile codling moth (CM) releases to compare mating disruption technologies. Release of SIR moths allowed us to evaluated different pheromone technologies in large plots located in grower orchards and provided a consistent and repeatable result. In 2011 we evaluated three pheromone technologies in large replicated plots located in commercial orchards. The commercial orchards were selected because they had low CM populations and growers were willing to allow the release of sterile CM. The pheromone technologies evaluated were: CheckMate CM-O Puffers (PUFFER) compared to Isomate Flex (FLEX), Isomate RING compared to Isomate Flex, and CideTrak CM, with and without pear ester (PE), compared to Isomate Flex.

In a direct comparison of the PUFFER (1 unit per acre) and FLEX (400 dispensers per acre) technologies in large plots (≈ 40 acres) there was no difference in capture of released sterile moths measured by monitoring traps baited with 0.1 mg lures or Trécé L2 lures, both were different from the untreated control (UTC = no pheromone), $P < 0.0001$.

In second study a direct comparison was made between the RING technology at 20, 30 and 40 dispensers per acre and the FLEX (400 dispensers per acre) technology in moderate sized plots (≈ 5 to 10 acres) replicated five times. There were only two UTC plots and one was compromised by other pheromone treatments so statistical comparisons were only made between the pheromone treatments. There were no differences between treatments in moth capture in monitoring traps baited with 0.1 mg lures or Trécé L2 lures.

In third study a direct comparison was made between the Trécé CIDETRAK, with and without pear ester, at 320 and 400 dispensers per acre and the FLEX (400 dispensers per acre) technology in moderate sized plots (≈ 5 to 10 acres) replicated four times. There were two UTC plots, one at each site where two replicates of pheromone treatments were located. Moth capture in monitoring traps baited with 0.03 mg, 0.1 mg, or Trécé L2 lures were used to assess differences in treatments. All pheromone treatments capture far fewer moths than the UTC. There were no differences in the average moth capture between treatments in any of the traps baited with different lures.

Mating Disruption/SIR

Studies on Aerosol Puffers for Mating Disruption of Codling Moth: Pheromone Load and Male Upwind Attraction

Daniel Casado, Frances Cave and Steve Welter
Department of Environmental Science, Policy and Management. University of California, Berkeley, CA

Keywords: mating disruption, aerosol puffers, walnut, pear, codling moth, pheromone dose, upwind attraction.

Abstract: Aerosol puffers are increasingly used for mating disruption of codling moth. However, the implementation protocols are not yet optimized, and the mechanisms involved in their performance are not fully understood. Previous studies suggested that the current deployment rate and pheromone load of the puffers might result in pheromone redundancy due to their large area of influence. On the other hand, some studies have suggested that codling moth males may be displaced upwind due to long distance attraction to the puffers. We conducted an assay on the effect of reducing pheromone load in puffers in their area of influence using releases of sterile males. Uniform grids of pheromone-baited traps were set in walnut, and pear orchards. The effect of puffers emitting 100, 50, 25 and 10 percent of the standard amount of pheromone on trap suppression was recorded. Furthermore, the effect of the aerosol emission was compared to that of a cluster of passive dispensers emitting a similar amount of pheromone. In a second assay we evaluated the attraction of males towards a puffer placed 150 meters upwind. We found areas of influence of large dimensions for all the rates assayed, supporting the hypothesis of pheromone redundancy. Areas of influence of the passive devices were also recorded, but tended to be smaller than those of the puffers. This suggests different dispersion patterns for pheromone emissions from passive and aerosol devices. Finally, our movement assay showed that males move upwind regardless the presence of a puffer. This is also supported by our observations in the control replicates of the area of influence assay.

Mating Disruption/SIR

Field Evaluations Of Isomate CM Mist Pheromone Mating Disruption

Peter McGhee[1], Larry Gut[1], Don Thomson[2], Jack Jenkins[2]
[1]Michigan State University East Lansing, MI
[2]Pacific Biocontrol Corporation, Vancouver, WA

Keywords: Cydia pomonella, codling moth, puffer, mating disruption, pheromone

Abstract: Mating disruption of codling moth in apple is primarily achieved using hand applied, high-point source dispensers. Mechanical "puffers" (Suterra - Checkmate Puffer) deployed at low point sources, (0.5 – 2 units/ac) that emit high quantities of pheromone are increasingly being adopted by fruit growers. These devices release timed pulses of pheromone by a mechanical device connected to a pressurized canister. The advantage is pheromone is protected from degradation until released, and time and costs associated with using fewer point sources are reduced. A new pheromone emitter, Pacific Biocontrol Company, was evaluated during the 2011 field season in Michigan for control of codling moth.

A direct comparison was conducted using Isomate CM Flex, Isomate CM Mist, and a no MD check. The experiment was replicated on three farms near Sparta, MI. Treatments were 10 ac apple blocks. Flex dispensers were applied at 400/ac and emitters were deployed at 1 unit/ac. A grid of 15, L2 baited LPD traps was used to evaluate male moth captures throughout the season. Sterile codling moths obtained from the Okanagan-Kootenay Sterile Insect Release (SIR) program in British Columbia, Canada were released several times during the season across treatments. The addition of SIR moths provided an evaluation using a known and equal pest density across treatments.

Captures of wild male CM were very low in both the Flex and Mist plots compared to the No Mating disruption orchards. Disruption of wild CM was not significantly different between Flex and Mist treatments. Recaptures of SIR moths followed a similar pattern compared to the wild male captures with the lowest catches in the Flex and Mist treatments. The Mist devices were easily transported, programmed and deployed in the field.

Mating Disruption/SIR

Evaluation Of Puffer® CM: A Release Device Of Pheromone to Control Codling Moth on Apple and Walnut in Italy

Mario Baldessari[1], Claudio Ioriatti[1], Martin Thomann[2], Gino Angeli[1]
[1]FEM- IASMA, Center for Technology Transfer, TN, Italy
[2]Südtiroler Beratungsring, BZ, Italy

Keywords: puffer, apple, walnut, codling moth, *Cydia pomonella* L.

Abstract: Different techniques have been developed to achieve pheromone-mediated mating disruption (MD) of Codling moth (CM), by treating orchards with hand-applied product or by sprayable formulations. In Trentino Alto Adige (north/east Italy), MD has been applied successfully (22,500 Ha, i.e. 81% of the apple area) to control CM in heavily infested areas; on the contrary in areas with low pressure of the pest (hilly areas), usually less pesticides are applied and pheromone applications were considered economically not convenient. Inconsistent results were obtained when either hand-applied or sprayable mating disruption pheromones were applied in high canopy (6 meter) walnut. A new pheromone-based control technique, called Puffers® CM, has been recently proposed and it is under evaluation by FEM-IASMA. Nine experimental trials, five on apple and four on walnut have been carried out over two years in order to evaluate the performance of Puffer® in an wide growing areas (20-100 Ha/plot). Puffers® performed extremely well, leading to an almost high codling moth catch inhibition and to a low fruit damage situation both on apple and walnut.

Mating Disruption/SIR

Evaluating Low-Density High-Load "Meso" Dispensers for Mating Disruption of Codling Moth in Walnuts and Apple Comparing Pheromone-Alone and Pheromone with Pear Ester Kairomone Dispensers

Douglas Light, James Baker, and Alan Knight
USDA, ARS, Western Regional Research Center, Albany, CA

Keywords: kairomone, pear ester, hand-applied dispensers, *Cydia pomonella,*

Abstract: The effect of the pear ester kairomone (PE) [ethyl (2*E*, 4*Z*)-2,4-decadienoate] on the efficacy of sex pheromone-based mating disruption (MD) was tested using low-density high-load "Meso" dispensers in trials in Californian walnut orchards and Washington apple orchards. CIDETRAK polymeric matrix dispensers (Trécé, Inc.) experimentally formulated as long straps (51 cm) were applied at densities of 10 and 20 (walnut), and 32 (apple) per acre. Studies were replicated in 1 – 4 acre plots. Two Meso treatments were evaluated in California including a pheromone-alone and a combo-dispenser with both PE and sex pheromone. In Washington only the combo Meso was evaluated; however, this was compared with high-density hand-applied dispensers loaded with codlemone alone or combo dispensers applied at 320 per acre. MD control efficacy was evaluated by the relative suppression of male moth catch in traps and nut and fruit injury at harvest. In addition, the level of virginity in field-trapped female moths was assessed in each treatment. Results show that deployment of low-density combo dispensers emitting both PE and sex pheromone were more effective than those emitting pheromone-alone in suppressing male attraction to sex pheromone-baited traps and reducing fruit and nut injury. The higher levels of virginity of female moths and reductions in multiple matings found in plots treated with combo dispensers suggests that these differences were due to improved disruption of codling moth mating when pear ester is combined with sex pheromone.

Mating Disruption/SIR

Taking a FLEXible Approach to Mating Disruption in British Columbia

Gary Judd and Donald Thomson
Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre,
Summerland, British Columbia, Canada

Keywords: *Cydia pomonella*, codling moth, leafrollers, eye-spotted budmoth, mating disruption, sterile insect release

Abstract: Under area-wide management, populations of codling moth in British Columbia (1994-2009) have been reduced to extremely low levels. In 2009, 37.4% of the acreage was free of codling moth and fewer than 10 wild moths were caught per season (1 trap / 2.5 acres) on 85% of the acreage. Maintaining these levels with area-wide mating disruption is straightforward, so the challenge has become doing it for the lowest cost and adding value to this pheromone treatment by making it applicable to multiple species. In 2009, three 100+acre multi-year pilot projects were established to test and compare the efficacy of Isomate-CM FLEX 80, Isomate-CM/LR and Isomate-CM/LR/ESBM as codling moth treatments, but with each targeting increasing numbers of pest species (1, 5, and 6, respectively). In this three-year summary (2009-2011) pheromone release-rate characteristics of each dispenser type and levels of disruption achieved in six tortricid species are compared. Overall, CM/LR/ESBM twin-tube dispensers released the greatest amounts of pheromone, regardless of the component measured, and resulted in the highest levels of disruption, as measured by trap catches, averaging 89% across all species. Disruption of secondary species ranged from a low of 86% for *Archips rosanus* with CM/LR, to a high of 99% for *Spilonota ocellana* with CM/LR/ESBM. Disruption of wild codling moth populations appeared quite variable and potential reasons for this will be discussed. Studies were augmented by delivering sterile codling moths to each pheromone-treated plot enabling a unique comparison of sterile:wild ratios, rates of recapture and disruption of equivalent populations of codling moth as dispensers aged. In these controlled population comparisons, FLEX 80, which released the least codlemone, consistently caused the greatest disruption of sterile codling moth. Simultaneous disruption of codling moth and secondary pests from a single dispenser may require different and competing dispenser design characteristics.

Mating Disruption/SIR

Field Evaluations Of Isomate Flex CM And Cidetrak CM "MESO" Hand Applied Mating Disruption

Peter McGhee, Larry Gut, Mike Haas, Jim Miller, Juan Huang
Michigan State University East Lansing, MI

Keywords: Cydia pomonella, codling moth, Isomate, Cidetrak, mating disruption, pheromone

Abstract: The high cost of mating disruption is often cited as a major impediment to broader adoption of the tactic. The economics of reservoir dispensers could be improved through more efficient use of the active ingredient. Very similar disruption profiles and impacts were generated using dispensers that released pheromone at much lower rates than the standard dispenser. Shin-Etsu (Tokyo, Japan) has produced Isomate CM Flex dispensers that have substantially lower loading and subsequently lower release rates than the standard Isomate C+ dispenser. Equivalent levels of disruption (>90%) have been achieved using low-releasing Flex dispensers and standard dispensers in both small-plot and on-farm experiments.

Trécé Cidetrak® CM and CM + pear ester (PE) were evaluated using two different dispenser designs; traditional "puzzle" shaped Cidetrak and a larger "MESO" Cidetrak® dispenser were applied at 320 or 32 per acre respectively in Michigan apple orchards. Larger "MESO" dispensers placed at lower densities could possible reduce application time and labor. High levels of disruption (>94%) was achieved using Cidetrak® CM, CM+PE "puzzle", and CM+PE "MESO" dispensers while the CM "MESO" dispenser provided 85% disruption of male moth captures in baited (L2) delta traps. The addition of PE to CM "puzzle" dispensers did not increase overall efficacy, but did for CM "MESO".

Mating Disruption/SIR

Evaluating SIR Technology as Spot Treatments in Commercial Orchards

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Keywords: Codling moth, *Cydia pomonella*, sterile moth release

Abstract: This project was established to evaluate the potential of releasing sterile codling moth in commercial orchards to mitigate "hot spots" primarily associated with borders. Moving insects across international boundaries for the Okanogan Kootenay SIRP facility in Osoyoos was found to be fraught with difficulty. The personnel at the Okanogan Kootenay SIRP facility were excellent to work with and they produced a very good product. We, therefore, relied on the existing USDA-APHIS permit to bring moths across the border on a weekly schedule. If there is interest from the industry in accessing sterile CM for commercial purposes a different method of transport would need to be worked out.

We did not achieve a high sterile to wild moth ratio, 40:1 being the target, in traps at most of our SIR release sites. Only four of eleven achieved this ratio and two of these were sites where no mating disruption was used. Most of the sites selected were good tests of border problems of orchards dealing with immigrating codling moth. Fruit injury data at harvest was highly variable and on average more injury occurred in blocks where SIR moths were released than the "control" blocks at the same location. While these results were likely influenced by how we set up our study sites it is not a very encouraging result.

There was no difference in moth activity, number of moths recaptured, at different distances when we released moths using different methods, release cup, dumped on ground and placed in the crotch of a tree. These results would allow SIR moths to be more rapidly distributed in the orchard should this technique be developed into a commercial venture.

Mating Disruption/SIR

Tangler® Mating Disruption Technology for Control of Codling Moth in Apple

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[3]RidgeQuest, Sparta, MI

Keywords: Cydia pomonella, mating disruption, pheromone, delivery system

Abstract: MSU and WSU researchers have partnered with a Michigan based company, RidgeQuest, to develop a new pheromone delivery system that is effective, less expensive and easily applied at high point source densities. This new technology, called the Tangler®, is comprised of a plastic module loaded with pheromone and a launcher that enables the grower to rapidly apply numerous modules to the upper tree canopy. The module consists of a plastic cap that is attached to a plastic base by a 30 cm length of cotton string. A pheromone-release system is placed in the cap. As a result of the bola design, the propelled modules readily become tangled in the tree branches. Capsules are clipped together in a fashion that allows them to be fed into a mechanical launcher operated by compressed gas. Field trials to determine the efficacy of the Tangler system were conducted at four Michigan sites and three Washington sites in 2011. The experimental Tangler formulation provided disruption equivalent to the hand-applied dispensing system, Isomate CM Flex®. Both pheromone treatments provided approximately 85% disruption of wild populations. No fruit injury was recorded in any of the plots. Inhibition of catch of released sterile moth was also equivalent in the Tangler and Flex plots. In-season codlemone release rates from the two dispensing systems were very similar. Week 12 release rates for Flex and Tangler dispensers averaged 1.6 and 1.4 µg/hour, respectively. Emission rates for the Tangler were within the optimum range we had hoped to achieve, and believe was needed to obtain a high level of disruption. Automated deployment of the Tangler modules was five times faster than hand application of Flex tubes.

Mating Disruption/SIR

Attract-and-Remove for Control of Codling Moth and Obliquebanded Leafroller

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Keywords: Cydia pomonella, *Choristoneura rosaceana*, mating disruption, pheromone, competitive attraction

Abstract: Recent caged plot studies have shown that removal of codling moths from an apple orchard using high-density trapping is more effective at reducing capture in monitoring traps than a mating disruption regime. Studies in 2010, using open orchard 0.2-hectare plots comparing an attract-and-remove scenario to mating disruption for codling moth and obliquebanded leafroller, confirmed those results. The open orchard studies were repeated on a larger scale during the summer of 2011. Commercial orchards were divided into 1.0-hectare plots, each receiving either hand-applied mating disruption, traps at high density, or a no pheromone control. Isomate OBLR/PLR+ and Pherocon IIB traps baited with Trécé OBLR lures, both applied at 500/ha, reduced male OBLR capture in monitoring traps by 96% and 93%, respectively, compared to a no pheromone control. Fruit damage at harvest was 0.4% in the control treatment and 0.3% in both disruption treatments. Isomate CM FLEX applied at 1000/ha and novel microtraps baited with Trécé CM lures applied at 500/ha reduced male CM capture in monitoring traps by 97% and 66%, respectively, compared to the no pheromone control. In another set of studies, several microtrap designs were directly compared with the goal of improving the efficiency of the microtraps used when controlling codling moth via an attract-and-remove strategy. Here we report on the relative performance of the various designs.

Mating Disruption/SIR

Examining the Pattern of Pheromone Dispersal in Almonds

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Keywords: Amyelois transitella, navel orangeworm, mating disruption, sex pheromone, almond, puffers, air movement

Abstract: In past nighttime studies using titanium tetrachloride sources positioned from a meter above ground level to the top of the tree canopy indicated that pheromone plumes might have considerable vertical movement. This past field season we documented wind flow in 3-D with a sonic anemometer at six heights from 2.08 to 6.65 meters above the ground level, monitoring the speed, turbulence and direction of airflow for five minutes at each height every three hours over four days. These records show that the net flow of air during the time when NOW mate (late night to dawn) is upward and not simply planar as has been generally assumed. One practical implication of these observations for mating disruption is that when pheromone puffers are deployed at the top of the orchard canopy, as is current practice, much of their output may be carried upwards beyond the canopy. This suggests that much of the output of puffers so deployed would be unavailable to disrupt NOW mate finding—that it would be "wasted". We suggest that puffers would be just as efficacious if deployed at mid or lower canopy levels. As a result of these observations, we have evaluated male capture in female-baited traps positioned at several canopy heights and the effect of the height of puffers on the efficacy of mating disruption.

Mating Disruption/SIR

Management of the Sessiid Borer, Synanthedon Scitula (HARR.) with Mating Disruption and Mass Trapping in Michigan Apple Orchards

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Key words: pheromones, *Synanthedon scitula (Harr.*), mating disruption, mass trapping

Abstract: Dogwood Borer (DWB) (*Synanthedon scitula (Harr.*)) principally attacks burr knot and vascular tissue on the trunks of apple trees, reducing tree vigor and potentially killing young trees. Trunk sprays with organophosphorous insecticides (OP's) have been the main control method for borers over the past half-century in eastern North America, but the cancellation and/or restriction of several OP's is driving the development of alternative methods for managing borer pests. We will report on field trials being conducted to develop mating disruption and mass trapping of DWB. Dose–response experiments with a new Isomate®-DWB pheromone dispenser conducted in 2009 (four replicated 0.1 ha plots at rates of 0, 10, 20, 63, 188 and 375 dispensers per ha) and 2010-2011. (four replicated 2.0 ha plots at rates of 0, 75, 225 and 375 dispensers per ha) showed increasing orientation disruption of male moths to pheromone-baited traps with increasing numbers of uniformly distributed pheromone dispensers. These results along with video recordings of moth attraction to dispensers in disrupted and non-disrupted orchards show the mechanism of disruption to be competitive attraction. We will also report on DWB mass trapping studies conducted in 2010-2011 in four replicated 0.4 ha plots at densities of 0, 75, and 225 traps per ha and one treatment of 75 traps plus 150 dispensers per ha. In addition, to address the question of whether mating disruption or mass trapping is more efficacious for insect control, we will present relative dispenser activity (*Relative* D_a) from the competitive attraction equation to compare the disruptive activity of the devices used in mating disruption and mass trapping. Moth catch in each plot is determined using a centrally placed, pheromone-baited monitoring trap. The *Relative* D_a measurement is important for an informed decision when choosing a method for management of Pyralidae and Sesiidae tree-boring pests. *Relative* D_a can be used to compare devices for pheromone-based behavioral manipulation of these and other species that are competitively attracted to artificial pheromone sources.

Mating Disruption/SIR

Mating Disruption Plus Novel Barriers for Dogwood Borer Control

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Cornell University, NYS Agricultural Experiment Station, Geneva, NY

Keywords: apple, dogwood borer, *Synanthedon scitula*, control, mating disruption, trunk barriers, elastomer, ethylene vinyl acetate, EVA

Abstract: Current management approaches for apple trunk damage by pests including dogwood borer (DWB) and rodents rely on insecticide trunk sprays for borers and trapping/exclusion plus rodenticides for rodents. We are evaluating pheromone mating disruption, alone or in combination with novel barrier materials: fibrous barriers made of non-woven ethylene vinyl acetate (EVA) generated by a hot melt adhesive unit fitted with a hand-held spray head, and elastomeric compounds (rubberized acrylic paint) used in commercial building coatings. A newly available DWB sex pheromone was deployed in the orchard blocks, and incidence of trunk damage was compared. In the 2011 trials, trap shutdown was 100% in all treated plots. In trunk inspections to determine crop infestation, the pheromone MD treatment was comparable to a Lorsban trunk spray standard in two of the three sites. For the barrier treatments, the EVA formulation in combination with pheromone MD had the lowest infestation readings, although values were statistically significant at only one site. Without pheromone MD, the EVA treatment resulted in significantly lower infestation than the untreated Check at one site, and lower than the elastomer treatment at one site. Early observations of barrier weathering status indicated that the elastomer might not be holding up as well as the EVA, as some cracks and openings were found on some tree trunk sites.

Mating Disruption/SIR

Prionus californicus Mating Disruption and Trap Capture in Sweet Cherry

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Keywords: Coleoptera, Cerambycidae, root-borer, pheromone, mating disruption, mass-trapping

Abstract: Injury from the root-boring larvae of *Prionus californicus* can cause substantial fruit tree decline and mortality. Mating disruption (MD) and mass-trapping of adult males were studied. Trap capture in two sweet cherry orchards treated with Isomate *P. californicus* pheromone dispensers (Pacific Biocontrol Corp., Vancouver, WA; 100 dispensers per acre) was compared to that in two untreated orchards in northern Utah from late June to mid September, 2011. Bucket traps sunk into the ground and baited with either 0.1 mg (research) or 30 mg (Contech Enterprises, Victoria, BC, Canada) (3*R*,5*S*)-3,5-dimethyldodecanoic acid were used to measure adult male activity. Significantly more male *P. californicus* were caught in untreated than MD-treated orchards (90% trap shutdown). In MD-treated orchards, trap capture was greater with 30 mg than 0.1 mg lures in seven of eight weeks when males were active. In two additional non-MD-treated sweet cherry orchards, Contech 30 mg lures were equally attractive to males after 4 weeks deployment as compared to two weeks. Across the four non-MD orchards, Contech 30 mg lures caught a mean of 31.0 males per trap for the season vs. 8.1 males per trap for 0.1 mg lures. Prospects for MD and mass-trapping of *P. californicus* in orchards are promising.

Mating Disruption/SIR
POSTER

Pheromones: Biological Pest Prevention in Modern IPM

Veronelli, V., Waldner, W., Varner, M., Mattedi, L., Marani, G., Melandri, M., Pradolesi, G.
CBC (EUROPE) Ltd., Nova Milanese, Italy

Keywords: mating disruption, grapes, apples, peaches, South Tyrol, Trentino, Emilia Romagna

Abstract: In Europe, mating disruption (MD) has received increased attention over the last decade. In 2011 MD was applied to approximately 1,000,000 hectares of fruits, vines and other crops worldwide. Europe accounted for approximately 200,000 ha with most of the use in grapes, apples and peaches. Italy, Switzerland, Germany, France and Spain began experimenting with MD in the late 1980's. Since the mid 1990's the use of MD has expanded substantially in the fruit production regions of northern Italy (grapes and apples in the Trentino and South Tyrol and peaches and pome fruits in Emilia Romagna and Piedmond). Local technical advisory teams began integrating pheromones into their IPM strategies to solve problems associated with insecticide resistance. The use of MD helped to manage insecticide resistance particularly with *Cydia pomonella* (CM) in pome fruits and *Grapholita molesta* (OFM) in stone fruits. It soon became clear that the deployment of MD could also help reduce the use of insecticides to comply with EU standards for maximum residue levels (MRLs) and consumer demand for safer food. The reduction in the availability of insecticides due to revisions in the EU registration process and the increased concerns for workers and public health, confirmed the importance of a pheromone-based IPM approach. Our poster presents data collected by several advisory teams in important fruit production regions of Italy. The data illustrate the achievements of pheromone-based IPM approach.

South Tyrol - Apple: The area-wide use of MD to control *Cydia pomonella* (CM), *Grapholita molesta* (OFM) and various species of leafrollers resulted in average damage levels at harvest below 1% with less than 1 insecticide spray per hectare per season. In 2010, random samples confirmed that 82% of harvested fruits had zero residues of insecticides, 16,5% of samples had residues of 1 insecticide active ingredient (range of 0,01 ppm to 0,12 ppm) and 1,5% of samples had residues of 2 insecticides active ingredients (range of 0,01 ppm to 0,12 ppm). All of these residues were well below the limits allowed by EU regulations and the retail food industry.

Trentino - Grape: The application of MD to control grape berry moths (*Lobesia botrana* and *Eupoecilia ambiguella*) on 2,400 ha of grapes located between the cities of S. Michele and Mezzocorona permitted the reduction in seasonal insecticide use from an average of 5 kg/ha in the 1990's to 0,1 kg/ha in each of the last 3 seasons. Insecticide residues on grapes decreased on average from 0,15-0,25 ppm to 0,01 ppm and residues in wine became non-detectable.

Emilia Romagna - Peaches: Surveys conducted in conjunction with cooperatives and provincial advisors showed that insecticide use by growers using MD for OFM and *Anarsia lineatella* (PTwB) decreased from 4-6 applications in the first season of MD use to 1 or no sprays after 4 years of consecutive MD application. The reduction in insecticide resulted from lower insect populations (OFM and PTwB) and increased grower confidence in the ability of MD to control these pests.

IMPLEMENTATION—

Moderator: Rick Hilton, OSU-SOES, Medford

Notes:

Implementation

Seven Years of Implementing "Reduced Risk" Tart Cherry IPM: What We Learned

Mark Whalon[1], Larry Gut[1], Diane Alston[2], and Nikki Rothwell[1], Jean Haley[3], Barb Dartt[4]
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Salisbury Management Services[4]

Keywords: Reduced risk, AZM, IPM, cherry fruit fly, plum curculio

Abstract: Two production strategies, organophosphate (OP) and Reduced Risk (RR) Integrated Pest Management (IPM) were compared side by side in tart cherry blocks from 2004-10. RR IPM systems reduced functional ecology, yielded more larva detections, increased costs, produced MRL issues and greater ecological impacts.

Federal Pesticide Update

David Epstein
USDA Office of Pest Management Policy, Washington, DC

Keywords: National Pollution Discharge Elimination System (NPDES), Pesticides General Permit, Endangered Species Act (ESA), USEPA Registration Review

Abstract: A brief review of federal regulatory activities concerning the Pesticides General Permit, the Endangered Species Act (ESA) in relation to biological opinions issued from consultation between NOAA Fisheries, US Fish and Wildlife Service and the USEPA, and USEPA registration review will be presented.

Implementation

Meeting Pesticide Maximum Residue Limit Requirements in Export Markets for Pacific Northwest Tree Fruit

Mike Willett and Deborah Carter
Northwest Horticultural Council, Yakima, WA

Keywords: tree fruit, plant protection, pesticide, export, tolerances, maximum residue limit, MRL, good agricultural practice, GAP

Abstract: Compliance with new or enhanced food safety regulatory schemes is increasingly a fact of life in major markets worldwide for fresh fruit exporters. Over the last half-decade, enforcement of regulations related to maximum residue limits (MRLs or tolerances in the United States) for plant protection products has become a significant factor for Pacific Northwest fruit exporters when calculating the suitability of product for certain markets. In meeting this challenge it is critical to understand the scope of these potential restrictions; the variability of MRL rules in key fruit export markets; the potential impact of specific MRL regulations on trade and; the roles of industry associations, U.S. government organizations, registrants and foreign governments in working together to minimize, where possible, negative trade impacts. Sources of information regarding MRL standards range from the U.S. government to trade associations to registrants. In determining whether pesticide applications result in acceptable residues, a number of novel sources beyond standard registrant-generated residue decline curves, such as good agricultural practices (GAPs) as found on labels registered in foreign markets or as noted in international publications can be used.

Implementation

Continued Development of IPM on Oregon Hazelnuts

Vaughn M. Walton, Chris Hedstrom, Ute Chambers, Jeff Olsen
Department of Horticulture, Oregon State University, Corvallis, Oregon

Keywords: Integrated pest management, Hazelnut, Filbert, Filbertworm, *Cydia latiferreana*, pheromone mating disruption, entomopathogenic nematodes

Abstract: Hazelnut production in the United States is centered in Oregon and is mainly found in the Willamette Valley. Key pests on hazelnut include hazelnut and filbert aphids, leafrollers and filbertworm (FBW). Filbertworm, *Cydia latiferreana*, is a direct key pest that needs management on a yearly basis. Management methods for this pest include monitoring with pheromone-baited sticky traps, a degree-day model, flailing of the orchard floor and well-timed pesticide applications. Here we will focus on optimization of trapping, pesticide use including soft pesticides, entomopathogenic nematodes and a three-year report on mating disruption.

Pheromone traps need to be placed in the orchard earlier than previously recommended. Traps should also be placed near surrounding oaks, an alternative host of FBW. Our data show that soft pesticides have very little impact on biocontrol agents associated with aphids found on hazelnuts. Entomopathogenic nematodes can be effective to control FBW, but cost is prohibitive. Orchards under mating disruption displayed significantly lower FBW pheromone-baited counts in two of six cases. Trap shutdown levels were low compared to successful cases of mating disruption of other pests. Fewer pesticide applications for FBW control were necessary in mating disruption treated blocks compared to control blocks.

Implementation

Evaluation of Environmental Data Used for IPM Models

Ute Chambers[1], Vincent P. Jones[1] and Gary Grove[2]
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[2]Washington State University, Irrigated Agriculture Research and Extension Center, Prosser, WA

Keywords: IPM, Decision Aid System, temperature, degree-day accumulation, codling moth, models

Abstract: The WSU Decision Aid System (DAS) uses WSU-AgWeatherNet (AWN) data and forecasts for these AWN stations provided by the National Digital Forecast Database (NDFD) to run insect and disease models. The quality of temperature input data in relation to an organism's actual experienced temperature greatly affects the accuracy of such model predictions. Typically, AWN stations are placed outside of agricultural land to avoid impact of agricultural practices on environmental measurements. The ambient temperature an insect experiences, however, can vary significantly between different habitats. The purpose of our study is to evaluate the differences in environmental parameters depending on sensor placement and horticultural practices and how these differences affect model accuracy. We are comparing data from AWN stations vs. orchard interior, high-density vs. low-density orchards, as well as the impact of overhead cooling. The accuracy of NDFD forecast data was also tested against actual temperature data from AWN.

For the analysis, we calculated degree-day (DD) accumulations with data from all different scenarios using parameters for codling moth (CM) and six other insect models. Degree-day accumulations using data from the orchard interior vs. AWN differed but were strongly correlated, and this linear relationship remained fairly constant between 2010 and 2011. On average, AWN data predicted key insect events to be 2.7 ± 1.9 (S.D.) days later than with data collected inside the orchard. For most sites and models, the difference in model predictions between adjacent high- and low-density orchards was below three days, the maximum deviation we suggest is tolerable for IPM purposes. Only later in the season did these differences exceed three days and key insect events were predicted to occur later in low-density plantings than in the neighboring high-density plots. Overhead cooling in late summer at temperatures of 85°F and above reduced the daily maximum ambient temperature by 2.2 ± 1.4°F. However, within the high-density orchard setting, this temperature reduction had no significant effect on model predictions (difference ≤ 1d).

Finally, DD accumulations using AWN and NDFD data were not identical and, in some cases, differed dramatically. However, due to their strong linear relationship the resulting differences in projected key insect events between AWN and NDFD degree-days can be sufficiently corrected below the three-day threshold for the majority of stations and models using linear regression. The consistency of the linear relationship between 2009 and 2011 indicates that, with sufficient data to derive the necessary correction factors, virtual weather station can be a valuable resource, particularly in areas underserved by WSU-AWN.

Implementation
POSTER

WSU Apple IPM Transition Project – A Four-year Summary

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Washington State University Tree Fruit Research & Extension Center, Wenatchee, WA

Keywords: Codling moth, *Cydia pomonella*, apple, azinphos-methyl, Guthion, op-alternative, Integrated Pest Management (IPM), Apple IPM Transition Project (AIPMTP), Pest Management Transition Project (PMTP)

Abstract: The Apple IPM Transition Project (AIPMTP) was formed to address pest management concerns of the Washington apple industry as national regulatory action limited use of, or eliminated, certain pesticides that were deemed high risk to human health, particularly farm workers, and the environment. A primary issue was the EPA's decision to phase-out the use of azinphosmethyl (AZM, Guthion) in tree fruit production. WSU had been conducting research on OP-alternatives for several years. The AIPMTP was an education effort to help the apple industry implement best practices using OP-alternatives. In addition, AIPMTP connected with farm workers and environmental groups to help them understand the benefits derived from tree fruit growers transitioning to OP-alternative insecticides. The first two years of this project were funded by the Washington State legislature through an allocation to the Washington Tree Fruit Research Commission, which in turn funded the Pest Management Transition Project (PMTP). In the last two years the Apple IPM Transition Project (AIPMTP) was supported by the Specialty Crop Block Grant Program (SCBGP) through funding of two one-year projects. More information about the AIPMTP project can be found on the project website: http://pmtp.wsu.edu.

THRESHOLDS/MONITORING—

Don Thomson, DJS Consulting Services, Seattle

Notes:

Thresholds/Monitoring

An Electronic Insect Trap for Automated Monitoring of Lepidoptera in Orchards: Year 3 Results

Larry Hull[1], Johnny Park[2,3], Vincent Jones[4], Germán Holguin[2], Henry Medeiros[3], Anderson Nacsimento[3], Brian Lehman[1], Callie Baker[4]
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Keywords: *Cydia pomonella*, codling moth, *Grapholita molesta*, oriental fruit moth, monitoring, electronic pheromone traps, apple

Abstract: An electronic sex pheromone trap was developed and evaluated in both Pennsylvania and Washington state apple orchards to automate the monitoring of both codling moth (CM) and oriental fruit moth (OFM) adults. The electronic trap or "Z-Trap" was based on a bio-impedance operation that used an electronically charged coil system. The high-voltage electric grid consisted of a pair of intertwined metallic coils spaced approximately 5 mm apart. The traps were equipped with a custom rechargeable battery pack to power the microcontroller, coil and the wireless technology. When an insect contacted the coil, current would flow and the insect was stunned and fell into a collector below the coil. Each time an electrical discharge occurred, the microcontroller recorded the time of the event. The traps were also equipped with wireless technology that allowed data to be transmitted from the orchard to a base station. In 2011, four Z-Traps were deployed at WSU to monitor CM and eight Z-Traps were deployed at PSU (four for CM, four for OFM). The Z-Traps achieved comparable and higher capture rates for CM and OFM, respectively, to that of the industry standard – the large plastic delta traps. During the 2011 field tests, the signals generated by the bio-impedance sensor (i.e., the amplitude and duration of the electric current pulse) were analyzed to distinguish target insects (e.g., CM and OFM adults) from non-target insects (e.g., flies, gnats, etc.) and other environmental events (i.e., rainfall).

Thresholds/Monitoring

Monitoring Multiple Pests in One Trap with Combined Lures

Alan Knight
USDA, ARS, Wapato, WA

Keywords: Cydia pomonella, Cydia molesta, Pandemis, Choristoneura

Abstract: Previous studies have examined the idea of combining sex pheromone lures within a single trap to monitor the key moth pests of tree fruits. While feasible, these approaches were not always useful either because moth catches in pheromone-baited traps are either disrupted (*Cydia molesta*) or not well correlated with local population densities (tortricid leafrollers). A new approach has recently been investigated that uses a combination of host plant volatiles, food lures, and sex pheromones to track both male and female moth populations of multiple species with one trap. Two research studies are underway. The first one is monitoring *Cydia pomonella*, and two species of tortricid leafrollers, *Choristoneura rosaceana* and *Pandemis pyrusana* (*limitata*) in apple and pear orchards in Washington and Oregon. The second one is monitoring *C. molesta* and *C. pomone*lla with or without leafrollers present in the orchards. This study is ongoing in South America and will be expanded to California next season.

Functional Ecology: Measuring Beneficial's in Organophosphate and Reduced Risk Orchards

Mark Whalon
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Keywords: organophosphate, Integrated Pest Management, IPM, apple, cherry

Abstract: Yellow sticky trap monitoring and scoring yield ecological insight into transition from organophosphate (OP) to reduced risk (RR) insecticide integrated pest management (IPM) programs in apples and cherries.

Thresholds/Monitoring

Using HIPVs to Monitor Natural Enemies in Western Apple, Pear and Walnut Orchards

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Keywords: Herbivore-Induced Plant Volatiles, natural enemies, sampling, formulation, attractive blends, indicator species

Abstract: We have developed monitoring traps for natural enemies using herbivore-induced plant volatiles (HIPV) and floral attractants. Lures are constructed by applying the attractants onto dental wicks and placing the wicks in heat-sealed polyethylene tubing of different thicknesses. We have determined the release rates for 14 different attractants under laboratory and field conditions, and constructed lures with a minimum longevity of 30 days. Our studies on attractant blends have allowed us to identify both specific and general attractants, which can be used to monitor a broad range of natural enemies in deciduous fruit and nut orchards. In general, we find only minor differences between crops in monitoring a particular natural enemy, but relatively large differences between different natural enemy species. Lacewings and syrphid flies are some of the most commonly collected species and we suggest that these would be excellent candidates to act as indicator species for evaluating pesticide effects on the natural enemy community.

Thresholds/Monitoring

Evaluation of Stink Bug Pheromones as Monitoring Tools

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Keywords: Stink bug, *Euschistus conspersus*, *Chlorochroa ligata*, pheromone, release rate, trapping

Abstract: The aggregation pheromone for *Chlorochroa ligata* was shown to be attractive and selective but it was difficult to synthesize economically, which will likely limit its commercial availability due to high cost of synthesis. The *C. ligata* pheromone is a large molecule, having a slow release rate from different lures tested. Efforts to optimize capture of *C. ligata* by using lures with different release rates were not successful, as all lures attracted roughly the same number of bugs. Using multiple lures in a trap did increase capture of *C. ligata* but using multiple lures seems impractical because of their expected cost.

We were able to show that the optimized release rate for the *Euschistus conspersus* aggregation pheromone was different for the spring, overwintered adults, compared to the summer generation. The good news is that the best commercially available *E. conspersus* lure (AlphaScents™) has an optimal release rate and works well in late summer to detect adults moving into orchards from native habitats. We also showed that putting lures of two stink bug species, *E. conspersus* and *C. ligata*, in the same trap did not inhibit capture of either species. Monitoring *E. conspersus* adults in late summer and fall appeared to be a good indicator of risk of fruit injury, with higher numbers of *E. conspersus* adults captured correlating with increasing fruit injury on the orchard border.

Laboratory screening showed that the carbamates Lannate (methomyl) and Carzol (formetanate hydrochloride), the chlorinated hydrocarbon Thiodan (endosulfan), and the synthetic pyrethroids Danitol (fenpropathrin) and Warrior (lambda-cyhalothrin) caused highest mortality of *E. conspersus* adults. Treating the panels of pyramid traps with toxicants did not prove to be a good method for attract and kill because bugs tended to crawl up the edges of the panels and were exposed to very little toxicant. Bugs entering traps were able to escape, but putting a Vaportape II kill strip in the trap or coating the inside of the trap with a toxicant reduced or eliminated bugs escaping from traps. A mass trapping study provided some encouragement that this approach could provide some protection from orchards at high risk from immigrating stink bug adults in late summer and fall.

Thresholds/Monitoring

Preferences by Western Cherry Fruit Fly for Different Yellow Rectangles

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Keywords: *Rhagoletis indifferens*, trapping, color preference, fluorescence, muscoid flies

Abstract: Seven sticky rectangle traps of various yellow colors and fluorescence made of cardboard were tested against western cherry fruit fly. Traps were paired to test the preference of flies for different traps. Results suggest that sticky rectangle traps painted semi-gloss enamel Saffron Thread or Citrus Splash with low fluorescence could be highly useful for detecting cherry fruit flies.

Trapping Spotted Wing Drosophila with Wine and Vinegar

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[2]Yakima Agricultural Research Laboratory, Wapato, WA

Keywords: spotted wing drosophila, trapping, bait, wine, vinegar

Abstract: In 2010, experiments were conducted that showed vinegar with wine exhibited a synergistic affect in attraction of spotted wing drosophila compared with wine or vinegar alone. This year experiments were conducted to determine if the increase in spotted wing drosophila attraction was due to the wine or vinegar. A series of trapping experiments were conducted to evaluate spotted winged drosophila response to different types of wine and different types of vinegars.

BIOLOGICAL CONTROL—

Moderator: Tom Unruh, USDA-ARS, Wapato

Notes:

Biological Control

Nontarget Effects of Pesticides on Natural Enemies: Woolly Apple Aphid as a Case Study

Elizabeth H. Beers, Lessando Gontijo, Bruce Greenfield, Peter Smytheman
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: Intrepid, methoxyfenozide, Rimon, novaluron, Altacor, chlorantraniliprole, Delegate, spinetoram, Warrior, lambda-cyhalothrin, Kumulus, sulfur, woolly apple aphid, *Eriosoma lanigerum*

Abstract: The nontarget effects of pesticides on disruption of biological control of woolly apple aphid was studied in Petri dish (acute toxicity) bioassays, mesocosm (sublethal) bioassays, and replicated large-plot field trials. The bioassays of *Aphelinus mali*, a specialist endoparasitoid, indicated that the spinosyns (spinetoram, spinosad), as well as the older pesticides (azinphosmethyl, chlorpyrifos, carbaryl) were acutely toxic. The neonicotinoids (acetamiprid, thiacloprid) and a pyrethroids (lambda-cyhalothrin were moderately to highly toxic; the diamides (chlorantraniliprole, cyantraniliprole) were moderately toxic, and fungicides (sulfur, mancozeb, copper hydroxide) and spirotetramat were non-toxic on contact. Spinetoram was consistently the most disruptive codling moth material used in the large-plot field trial, although novaluron also appeared to be disruptive in some cases. Methoxyfenozide and chlorantraniloprole appeared to be neutral materials in terms of woolly apple aphid disruption. Lambda-cyhalothrin provided direct control of aphids, thus its effect on nontarget organisms was difficult to assess in the field.

Evaluating Codling Moth Spray Impacts on Biological Control in Pear

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Keywords: Codling Moth, *Cydia pomonella*, Lepidoptera, Tortricidae, chemical control, Altacor, rynaxypyr, Delegate, spinetoram, cyazypyr, biological control, *Deraeocoris brevis*, green lacewing, *Chrysoplerla plorabunda*, *Trechnites* spp., herbivore induced plant volatiles, sampling

Abstract: Field and laboratory studies were initiated to investigate impacts that several insecticides used to control codling moth may have on key natural enemies in pear orchards. Results indicate that various insecticides can negatively impact biological control arthropods. The use of lab assays to predict effects in the field will be discussed.

Biological Control

Evolution toward Softer IPM for Tree Fruits may Enhance Biological Control of Codling Moth

Thomas R. Unruh
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Keywords: Cydia pomonella, carabids, spiders, earwigs, ground covers, windbreaks, rynaxypyr, spinetoram

Abstract: Codling moth has been the major pest of apples in the US for 200 years. Classical biological control importations have spanned 90 years, most recently with releases of three parasitoids by Nick Mills and me. The transfer of the egg parasitoid, *Ascogaster quadridentata*, from the eastern USA to the West in the 1920's was successful and the wasp can produce up to 30% parasitism in unsprayed orchards in some years. Augmentative biological control using Trichogramma releases have not been successful, but the broad availability of high quality codling moth granulovirus has contributed greatly in stabilizing codling moth management in organic production together with mating disruption. The third type of biological control, conservation, has seen little research for codling moth since the advent of synthetic insecticides, but newer, more specific, synthetic insecticides may support conservation of generalist predators and contribute to codling moth management. I will present preliminary data on the frequency of feeding by ground dwelling and tree dwelling arthropod predators and estimate their potential impact based on measures of predator abundance.

Biological Control

Enhancing Biological Control to Stabilize Western Orchard IPM Programs

Angela N. Gadino[1], Vince P. Jones[1], Jay F. Brunner[1], Elizabeth H. Beers[1], Karina Gallardo[1], Jessica Goldberger[1], Nick Mills[2], Peter W. Shearer[3], Steve Castagnoli[3], David R. Horton[4], Thomas R. Unruh[4]
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[4]USDA-Agricultural Research Service, Wapato, WA

Keywords: natural enemies, predators, parasitoids, monitoring, phenology, acute pesticide effects, sub-lethal pesticide effects, codling moth, secondary pests, educational resources

Abstract: In western apple, pear and walnut orchards twenty-three new pesticide chemistries have recently been introduced to replace the loss of OP insecticides. The shift to alternative materials has created instability in orchard IPM programs in this region. While this shift is associated with the addition of new pesticides, it is also clear that our lack of knowledge of natural enemies, particularly predators, reduces our ability to use conservation biological control. A regional project, including a team of ten scientists from Washington, Oregon and California have focused on six different objectives to enhance biological control in these orchards and improve the long-term sustainability of the apple, pear and walnut industries in the western United States. Research goals for this project include: (1) evaluating the acute and sub-lethal effects of new insecticides on key natural enemies; (2) characterizing natural enemy phenology and develop models to better predict their presence in orchards; (3) evaluate the potential for attractants to improve natural enemy monitoring; (4) develop molecular techniques to determine which predators are most important in controlling codling moth, the key pest of apple, pear and walnut; (5) the use of economic models to show the advantage of enhancing biological control; and (6) synthesize the information and survey users to determine optimal methods to transfer information for rapid adoption. In the past three years, significant progress has been accomplished for each of these goals and results from completed research will be summarized. The new knowledge gained through this project will assist pest control decision-makers with timing and selection of pesticides to reduce natural enemy disruption and the use of more effective monitoring tools for key natural enemies that will aid in enhancing biological control.

Biological Control
POSTER

Effects of Newer Insecticides on the Green Lacewing *Chrysoperla carnea* (Neuroptera: Chrysopidae)

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Oregon State University, Mid-Columbia Agricultural Research and Extension Center, Hood River, OR

Keywords: cyazypyr, rynaxypyr (Altacor®), spinetoram (Delegate®), novaluron (Rimon®), lambda-cyhalothrin (Warrior II®), *Chrysoperla carnea*, pears, natural enemies, predator

Abstract: Our laboratory study focused on lethal and sublethal effects of cyazypyr, rynaxypyr, spinetoram, novaluron, lambda-cyhalothrin tested against adults and second-instars of the green lacewing *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae). Products were tested using concentrations that were equivalent to the high label rate (1x) and 1/10th of that amount (0.1x) dissolved in 100 gallons of water. High rates of rynaxypyr, spinetoram and lambda-cyhalothrin and both rates of cyazypyr were highly toxic to adults. Both rates of novaluron appeared to be toxic to larvae with no larva to adult survival. Larva to adult survival was lower for high rates of rynaxypyr and spinetoram and both rates of cyazypyr and lambda-cyhalothrin. Viability of eggs was low when females were treated with either rates of novaluron.

INVASIVE SPECIES—

Moderator: Angela Gadino, WSU TFREC, Wenatchee

Notes:

Invasive Species

Drosophila suzukii, A Revolution for Soft Fruits in Trentino, North of Italy

Alberto Grassi and Marica Pallaoro
Edmund Mach Foundation, Technology Transfer Centre, S.Michele all'Adige, Trento, IT

Keywords: Drosophila suzukii, spotted wing drosophila, soft fruits, sweet cherries, monitoring, alternative control methods

Abstract: Drosophila suzukii infestation on soft fruits was reported for the first time in Trentino, North of Italy, in 2009. This was the first record of this pest in Italy and Europe. Two years after, the spotted wing drosophila reached an extraordinary development of population, causing serious damages on soft fruits and cherries. An important infestation was also observed for the first time on wine grape. Conventional insecticides, even if applied many times, were ineffective in reducing fruits damage, due to the very high pressure of the pest. Interesting results were obtained with alternative control methods (anti-insect nets, mass trapping, attract and kill, etc.). A multi-method approach seems to be the best to manage *D.suzukii* infestations in a sustainable way in Trentino.

Distribution and Control of Spotted Wing Drosophila in Michigan Blueberries

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Berry Crops Entomology Laboratory, Michigan State University, East Lansing, MI

Keywords: Phenology, management program, wild host, bioassay, field trial, Imidan, phosmet, Delegate, Malation, Sevin, carbaryl,spinetoram, Entrust, spinosad, Assail, acetamiprid, Lannate, methomyl, Mustang Max, zeta-cypermethrin, Pyganic, pyrethrum.

Abstract: During the first full year of investigation of spotted wing drosophila (SWD) in Michigan, we monitored across the blueberry production regions of Michigan finding fly activity in most regions. First detection was in early July, with increased activity coinciding with the later-ripening blueberry cultivars. SWD larvae were also reared from the fruit of many wild hosts growing in natural habitats. Studies to compare insecticide toxicity in the laboratory and field support previously-reported west coast assays highlighting the performance of organophosphate and pyrethroid classes, as well as the activity of the spinosyns. Neonicotinoids were variably active and many organic insecticides had little to no activity. We will discuss the implications of our findings for managing SWD when blueberry maggot and Japanese beetle control is also required during the blueberry ripening period.

Invasive Species

Spotted Wing Drosophila in Eastern Washington: 2011 Update

Elizabeth H. Beers, Peter Smytheman and Bruce Greenfield
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: Monitoring, phenology, spinosad, spinetoram, thiamethoxam, lambda-cyhalothrin

Abstract: Spotted wing drosophila (SWD) was monitored throughout the primary commercial cherry-growing regions of eastern Washington in 2011. The overall results of the trapping program indicated that populations were 90% lower than in 2010; while the reasons for this can only be speculative, the Thanksgiving freeze of November 2010 is highly suspect. A number of growers were able to harvest their crop before SWD was found in their area. Trap designs and baits were tested in the field; a set of six traps from different programs was deployed in six replicate cherry orchards in eastern WA. The Haviland trap (named for Dave Haviland) caught about twice as many SWD as the two next highest traps (Van Steenwyk, Deli cup). This trap also appears to catch slightly earlier than the other traps, also. The mesh-top design may be a factor in either the diffusion of the bait odor, or the preference of the adults to enter or be retained by the trap. The "superbait" mixture of wine, apple cider vinegar and molasses caught the most SWD, followed by apple cider vinegar and a sugar-yeast mixture; however, having a larger trap influenced the catch more than the bait. Most of the treatments tested (Success, Entrust, Warrior, Endigo) provided high levels of fruit protection in a field-lab bioassay; control with Delegate was slightly less so.

Invasive Species

Spotted Wing Drosophila in the Southern Interior Valleys of British Columbia, 2010 - 2011

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Duane Holder, Gayle Krahn, Molly Thurston
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Keywords: Spotted wing drosophila, monitoring, apple cider vinegar traps, new hosts

Abstract: Spotted wing drosophila, *Drosophila suzukii*, was first detected in the interior of British Columbia in September 2009. Adults were monitored in numerous traps baited with apple cider vinegar during 2010 and 2011. In 2010, *D. suzukii* was widespread in the Okanagan and Similkameen valleys, found in the Creston Valley, and damage was recorded near harvest or post-harvest from cherry, peach, nectarine, apricot, and some berries, in commercial and domestic sites. In 2011, significantly fewer *D. suzukii* were found in the Okanagan and Similkameen valleys than in 2010. Also, no *D. suzukii* were trapped in the Creston region, and there were no reports of economic damage in commercial fruits. Fruit was collected season-long and flies were reared each year from important non-commercial plants in the southern interior valleys of B.C. Known hosts to date are *Mahonia* sp., *Sambucus cerulea*, *Sambucus* sp., *Ribes hudsonianum*, *Lonicera* sp., and *Prunus mahaleb*.

Invasive Species

An Update on the Monitoring and Management of Spotted Wing Drosophila, *Drosophila suzukii* (Diptera: Drosophilidae), in the Mid-Columbia Region of Oregon

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Keywords: Spotted wing drosophila, *Drosophila suzukii*, monitoring, invasive, sweet cherry, Mid-Columbia region, apple cider vinegar, lure, attractant, abundance, trapping, overwintering, dimethoate, Couraze, imidacloprid, Cyazypyr, cyantraniliprole, Danitol, fenpropathrin, Lambda-Cy, lambda-cyhalothrin, Perm-UP, permethrin, Delegate, spinoteram, Entrust, spinosad, malathion, Lannate LV, methomyl, carbaryl, Belay, clothianidin, Lorsban, chlorpyrifos, Belt, flubendiamide

Abstract: A variety of trapping and monitoring methods were used for spotted wing drosophila (SWD) in the Mid-Columbia region in 2011. A pre-bloom insecticide trial, soil emergence cages and soil and duff samples were used to determine where SWD overwinters. No SWD were collected from the soil emergence cages or duff samples and results from the insecticide trial were inconclusive at determining if SWD overwinter in local cherry orchards.

In 2011, the first SWD were captured in apple cider vinegar (ACV) baited traps on 4 May in Hood River County and on 21 July in Wasco County. First catches in traps were female SWD. The abundance of SWD collected from ACV traps increased throughout the year well into Nov.

One trapping study compared six different trap designs baited with ACV. Traps with wire-mesh lids captured more adult SWD than did other trap designs. We also demonstrated that a 10% solution of ACV and salt would allow for monitoring of SWD during the winter by preventing freezing of the bait.

Field-laboratory assays were performed to evaluate insecticide efficacy and confirmed that organophosphorus insecticides, pyrethroids and spinosad/spinetoram-based products were the most efficacious. Dimethoate provided the longest lasting systemic activity.

Invasive Species

Seasonal Phenology, Trap Comparisons, and Damage Observations for Spotted Wing Drosophila in California Cherries

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Keywords: Spotted wing drosophila, *Drosophila suzukii*, SWD, Van Steenwyk trap, Yogurt trap, monitoring, phenology, cherry

Abstract: The flight patterns of *Drosophila suzukii* (SWD) were tracked in unsprayed and sprayed cherry orchards in the Northern San Joaquin Valley (NSJV) and the Santa Clara Valley (SCV) using standard "yogurt" style traps baited with apple cider vinegar. SWD damage was assessed in the NSJV. Seasonal flight patterns varied between regions but were similar within each region for 2010 and 2011. The NSJV flight began in late April, peaked in early June during harvest, had a second peak in November and was very low during summer and winter months. Damage in unsprayed orchards ranged from 0.5-77%. In sprayed orchards, flight was suppressed during harvest and damage varied with spray program. The SCV flight began in mid-April and continued through fall, dropping to very low levels in winter. In sprayed orchards, flights were suppressed from mid May to early August. Populations were higher in the moderate SCV climate than in the NSJV. The SWD gender distribution varied from orchard to orchard and over the season. An additional trial in the NSJV compared the standard yogurt traps with the same container using a screen top instead of side holes (the Van Steenwyk trap). Captures began, ended and peaked on the same dates for both traps. The screen top traps caught more SWD but also had greater contamination from non-target species.

Invasive Species

Infestation of Cherries by Spotted Wing Drosophila in Relation to Canopy Height and Evaluation of Cover/Trunk Applications of Malathion for Control of SWD

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Keywords: Spotted wing drosophila, *Drosophila suzukii,* Malathion 8 Aquamul, malathion, cover/trunk application, chemical control, insecticide, canopy height, cherry

Abstract: Spotted wing drosophila (SWD) was initially detected in California in 2008, first causing significant economic damage to sweet cherry crops in 2009. These studies were conducted to assess the distribution of SWD infestation within a cherry canopy, and the efficacy of cover/trunk applications of malathion in controlling SWD populations. The number of SWD larvae was determined per 100 fruit using the brown sugar floatation method. Cherries were sampled from the lower, mid and upper canopies of several cultivars in commercial orchards located in San Joaquin and Santa Clara Counties, CA. Larval infestation decreased with increased canopy height in both orchards. There were significantly lower rates of infestation in fruit from the high canopies than from the low canopies of the San Joaquin orchard. The cover/trunk application study was conducted in the inter-planted Burlat and Bing Santa Clara County orchard. Two treatments were replicated six times in a randomized, complete block design. Malathion 8 Aquamul was applied weekly to the bottom three feet of the trunk and ground cover, below fruit and foliage. Sprays began on 26 Apr and continued through harvest. A standard ACV trap in the center of each plot revealed little difference in adult SWD populations between treatments, perhaps due to small plot size. However, larval infestation did show a trend of lower rates of infestation in treated plots.

Invasive Species

Drosophila suzukii Degree-Day Modeling and Field Validation in the Willamette Valley

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Oregon State University Department of Horticulture, Corvallis, OR

Keywords: *Drosophila suzukii*, spotted wing drosophila, phenology, blueberry, trapping, Willamette Valley

Abstract: *Drosophila suzukii* was initially detected in the Willamette Valley during late summer 2009. Field monitoring of *Drosophila suzukii* in blueberries, using apple cider vinegar traps, has been on going since March 2010. Findings reflect the number of *D. suzukii* trapped in an organic and a conventional blueberry field in addition to growers' response to presence of *D. suzukii* and management thereof. Conjunctionally, *D. suzukii* was reared in a controlled setting to determine developmental parameters. From data recorded, degree-days are determined and extrapolated to field conditions in order to predict number of generations. Field data is used to corroborate these predictions.

SWD and MRLs: Controlling One While Complying with the Other

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Keywords: spotted wing drosophila, *Drosophila suzukii*, malathion, Warrior II, lambda-cyhalothrin, spinosad, Success, spinetoram, Delegate, zeta cypermethrin, Mustang Max, fenpropathrin, Danitol

Abstract: The recent introduction of spotted wing drosophila (SWD) into the major cherry-producing regions of the western US has elevated concerns regarding Maximum Residue Levels (MRLs) on exported sweet cherries. Pesticide labels granted by the US-EPA are designed to meet US tolerances, but each country has the ability to set its own tolerance for any given pesticide, some of which are considerably lower than that of the US. This has created a void in our knowledge of how to apply these materials so that they will produce fruit that meet export requirements. Residue degradation curves were developed for six of the most likely candidate pesticides to be used for SWD control. Of the six insecticides tested, three had a favorable profile for use on fruit destined for export, viz., spinosad, lambda-cyhalothrin, and malathion. With the exception of malathion on fruit destined for the EU, all could be used according to the US label with little projected concern about MRLs. Insecticides with similar tolerances between the US and other countries were more likely to be favorable; those with markedly dissimilar tolerances (e.g., 500- fold higher in the US) were deemed more likely lead to problems.

Invasive Species

Timing of Spotted Wing Drosophila Control in Cherry

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Keywords: Success, Entrust, spinosad, Warrior, lambda-cyhalothrin, Diazinon, Malathion, spotted wing drosophila, *Drosophila suzukii*, chemical control, insecticide, cherry

Abstract: The study was conducted in a commercial Bing cherry orchard in Santa Clara, CA. Six treatments were replicated three times in a RCB design. The application timing was based on fruit color, i.e. Diazinon at green fruit, Warrior at straw fruit, Malathion at pink fruit, Success at red fruit and Entrust three days before harvest. Each of the six treatments successively removed one insecticide: treatment 1 was Diazinon, Warrior, Malathion, Success and Entrust; treatment 2 was Warrior, Malathion, Success and Entrust; treatment 3 was Malathion, Success and Entrust; treatment 4 was Success and Entrust; treatment 5 was Entrust followed by Entrust and treatment 6 was a check. Treatments were applied with an air-blast speed sprayer. Treatment efficacy was evaluated with ACV bait traps. One hundred fruit from each replicate were sampled weekly starting with the first pink Bing fruit. The SWD were counted and sexed and all other drosophila species were counted. All larvae that were reared to adults were SWD until three wks after harvest. The number of females in the bait traps was significantly lower in all treatments compared to the untreated check but there was no significant difference among the insecticide treatments. The number of larvae per one hundred Bing fruit was significantly lower in all treatments compared to the check until two weeks after commercial harvest. At two and three weeks after commercial harvest the two applications of Entrust had increased counts and were not significantly different from the check.

Invasive Species

Pre-Harvest Control of Spotted Wing Drosophila in Cherry

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Keywords: Assail® 70WP, acetamiprid, Admire® Pro, imidacloprid, Belay® 2.13SC, clothianidin, Movento® 2SC, spirotetramat, HGW86 10SE, cyantraniliprole, Bexar 1.25SC, tolfenpyrad, Perm-Up® 3.2EC, permethrin, Baythroid® XL, β-cyfluthrin, Leverage® 360, Dyne-Amic®, spotted wing drosophila, *Drosophila suzukii*, cherry, chemical control, insecticide

Abstract: Spotted wing drosophila (SWD) has become a major pest of cherry since its appearance in California in 2008. It lays its eggs not only in ripening fruit, but other substrates suitable for drosophila development. As eliminating drosophila populations is unfeasible, control will emphasize reducing the number of eggs laid in ripening fruit. A field trial was conducted to assess the efficacy of various insecticides in reducing damage from larval infestation. Using a hand-held orchard sprayer treatments were applied on 27 May in a mixed fruit orchard pre-harvest. There were 10 treatments (including an untreated check) replicated six times in a RCB with each replicate consisting of a single tree. Treatment efficacy was assessed by collecting 100 fruit from each replicate on 24 May, 2 June and 9 June. Larval infestation was determined using brown sugar flotation method. At two weeks after treatment, approximately one SWD life cycle, there was significant difference between treatments in the number of larvae per 100 fruit between treatments. HGW86 10SE, Movento® 2SC, Leverage® 360, Perm-Up® 3.2EC and Baythroid® XL provided significantly more control of SWD larvae as compared to Bexar 1.25SC and the untreated check, reducing counts by half or more. Bexar 1.25SC, Assail® 70WP and Belay® 2.13SC treatments did not differ significantly from the untreated check.

Invasive Species

Control of Spotted Wing Drosophila in Cherry - Post-Harvest Applications

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Keywords: Assail, acetamiprid, HGW86, cyantraniliprole, Altacor, chlorantraniliprole, Delegate, spinetoram, Entrust, spinosad, Admire Pro, imidacloprid, Belay, clothianidin, Actara, thiamethoxam, Leverage, Perm-UP, permethrin, Baythroid, beta-cyfluthrin, Warrior, lambda-cyhalothrin, Mustang, zeta-cypermethrin, Bexar, tolfenpyrad, Diazinon, Malathion, Sevin, carbaryl, Nu-Lure, spotted wing drosophila, *Drosophila suzukii*, chemical control, insecticide, cherry

Abstract: Trials were conducted to evaluate a large number of registered and unregistered insecticides for control of spotted wing drosophila (SWD) in cherry. Since it was not possible to evaluate all materials in a single trial, a series of trials were conducted with the same experimental design. All treatments were replicated six times in a randomized, complete block design. Each replicate consisted of an individual tree. There was a minimum of one untreated buffer tree between each replicate. Experimental treatments were applied with a hand-held orchard sprayer. All materials were applied at the highest field rate unless noted. The mortality data was then transformed using Abbott's formula. Mortality at 1 DAT indicates that the OPs (diazinon and malathion) were the most effective, followed by the pyrethroids (Baythroid, Warrior, Mustang and Perm-Up) with Mustang and Perm-Up overlapping with Sevin, HGW86 applied at three rates, Delegate and Entrust. The neonicotinoid insecticides (Actara, Leverage, Belay, Assail and Admire Pro) along with Bexar provided little adult mortality. Mortality at 7 DAT was much lower than at 1 DAT and the pyrethroids (Baythroid and Warrior) were the most toxic materials followed by Delegate, Malathion, Mustang and Diazinon. The OPs were far less effective at 5 DAT compared to 1 DAT. Again the neonicotinoid insecticides provided little control.

Invasive Species

How Can We Control Brown Marmorated Stink Bug in Eastern U.S. Fruit Orchards?

Greg Krawczyk and Larry A. Hull
Pennsylvania State University, Department of Entomology, Fruit Research and Extension Center, Biglerville, PA

Keywords: *Halyomorpha halys,* brown marmorated stink bug, insecticide bioassays, pome fruit, stone fruit

Abstract: Brown marmorated stink bug (BMSB) *Halyomorpha halys* (Stäl) (Heteroptera- Pentatomidae), an exotic insect species introduced from Asia continues to challenge fruit growers in Eastern U.S. During the 2010 and 2011 seasons BMSB becomes established in Pennsylvania pome and stone fruit orchards causing severe losses. At this time, only frequent insecticide applications provide adequate control of this stink bug.

The efficacies of insecticides were tested in laboratory and field residual bioassays to assess the potential fit of each product for the control of BMSB. During BMSB adult direct contact bioassays a droplet of insecticide solution (2 µl) was applied dorsally to male and female bugs. Mortalities were evaluated at 24, 48, 72, 96 and 120 hours after the treatment. During field residual bioassays, the second instar BMSB nymphs were exposed to aged residue of various insecticides. Foliage was collected at various times after the treatment (1, 4, 6 and 12 days) and 2nd instar nymphs were placed on treated foliage. Mortalities were evaluated at 24 and 48 hours after placement. Overall, the insecticides active against adults were also active against BMSB nymphs. The strongest activity against BMSB were observed among products belonging to neonicotinoid (*e.g.,* thiametoxam, dinotefuran and clothianidin), pyrethroid (*e.g.,* fenpropathrin, λ-cyhalothrin, β-cyfluthrin and bifenthrin), carbamate (*e.g.,* methomyl) and cyclodiene organochlorin group of insecticides (*e.g.,* endosulfan).

Unfortunately, applications of above listed products already increased outbreaks of secondary pests such as mites, scales or wooly apple aphids.

Invasive Species

Year Two Update: Intensive Survey for *Pseudococcus maritimus* and GLRaV in Oregon Vineyards

Daniel Dalton[1], Vaughn Walton[1], Kent Daane[2], Rodrigo Almeida[2], and Bob Martin[3]
[1]Oregon State University Horticultural Entomology Lab, Corvallis, Oregon
[2]Department of Environmental Science, Policy and Management, University of California, Berkeley, CA
[3]USDA-ARS Horticultural Crops Research Unit, Corvallis, Oregon

Keywords: grape mealybug, *Pseudococcus maritimus*, GLRaV-3, pheromone monitoring, wine grapes

Abstract: The grape mealybug, *Pseudococcus maritimus*, is an insect pest that threatens grape vines, causing damage directly to plants through contamination of leaves and fruit with honeydew exudates, and indirectly as a vector of grape leafroll-associated viruses (GLRaVs). To gain a better understanding of the epidemiology of GLRaVs and associated mealybug vectors, intensive visual surveys for mealybugs and virus-symptomatic vines were conducted in seven Oregon vineyards monthly from April to October in 2010 and 2011. Proportion of vines with evidence of *P. maritimus* infestation varied between sites; however, differences were negligible for proportion of infested vines within sites from 2010 to 2011. Pheromone lures for male *P. maritimus* were deployed at the time of visual surveys. Males were captured at all sites in both years. Population distribution through time indicated one generation in 2011 in the Willamette Valley. Southern Oregon sites and the Mid-Columbia Gorge area appeared to have two generations in 2011. Walla Walla Valley sites produced at least one generation in 2011, with possibly a second generation at one or both sites. ELISA virus screening identified GLRaV-3 in many vines at one site in 2011; ELISA did not show GLRaV-3 infection at other sites despite visual symptoms of the disease, suggesting either the presence of another GLRaV or some other cause for the symptoms.

Invasive Species
POSTER

Update on the European Grapevine Moth, *Lobesia botrana* (Lepidoptera: Tortricidae) Control Program in California

Lucia G. Varela, Monica L. Cooper and Rhonda J. Smith
University of California Cooperative Extension, Santa Rosa, CA

Keywords: European grapevine moth, *Lobesia botrana*, invasive pest, grape, *Vitis*, tortricid, berry moth

Abstract: *Lobesia botrana*, European grapevine moth, was reported for the first time in North America in mid-September 2009 in vineyards in Napa County, California. Moths have since been detected in eleven California counties, as determined by a program deploying pheromone-baited traps at densities of 6 to 10 traps per square kilometer in all grape-growing regions of California. State and federal agencies mounted a rapid response to the detections, and implemented aggressive quarantine and treatment programs. Quarantined areas have been established in an 8-kilometer radius from a detection of 2 or more moths within 4.8 km or any other life stage are detected in a generation. As of August 2011, an area of approximately 6000 square kilometers in 10 California counties is under quarantine for European grapevine moth. A single moth was found in an 11th county that is not in quarantine. In 2010, the treatment programs targeted all vineyard acreage within 200 m (Napa) or 1000 m (all other counties) of moth detection. Insecticide applications were recommended for all three generations, and mating disruption dispensers were recommended in Napa County only. In 2011, recommendations were to treat the first two of the three generations on all vineyard acreage within 500 m of a life stage detection and to apply mating disruption, except in areas of the state that are attempting to be released from quarantine regulations.

The aggressive treatment programs reduced Napa County populations from 99,266 moths trapped during the first flight of 2010, to 1,329 and 281 in the second and third flights, respectively. As of August 2011, traps in Napa County have caught 96 and 16 moths during the first and second flights, respectively. Detected infestations in the other 10 counties are very low, with a total of 128 males caught in 2010 and 33 males in the 1st and 2nd generations of 2011. In field trials, we demonstrated the efficacy of various insecticide products used in the treatment programs. Ongoing surveys of host plants cited in the literature have not identified any alternate hosts of consequence in Napa County. Although we detected eggs and larvae in olive flowers during the first generation of 2010 only, the populations were three-fold lower than in adjacent vineyards, and subsequently we have not detected any life stages in olive. We collected and analyzed data on the treatment programs in Napa and Sonoma counties, where populations are the largest or most persistent. Given the aggressive treatment programs, the availability of very effective tools such as insecticides and mating disruption, the lack of alternate hosts of consequence, and the apparently high level of compliance with treatment and quarantine programs, the question remains: Have we temporarily lowered populations to undetectable levels or is eradication of *L. botrana* from California feasible?

Invasive Species
POSTER

Biology and Trapping of Spotted Wing Drosophila

Jana Lee, Denny Bruck, and Dave Edwards
USDA ARS Horticultural Crops Research Unit, Corvallis, Oregon

Keywords: alternative hosts, color preference, *Drosophila suzukii*, host preference, standard trap

Abstract: The spotted wing drosophila (SWD) is a serious invasive pest of small and stone fruits. With a serrated ovipositor, the female lays eggs inside ripening and ripe fruit hanging on the plant. A survey of field-collected fruit at different ripeness stages indicated that SWD attacks the ripe stage, and the color-changing stage was less preferred. Laboratory assays that exposed SWD to various wild and ornamental fruit, suggest that cherry laurel, dogwood, gooseberry, hardy kiwi, huckleberry, lingonberry, mountain ash, and salal may potentially be susceptible to SWD. A large-scale trapping study done by cooperators in British Columbia and six U.S. states showed that traps with mesh openings seemed to collect many flies. A two-year field study showed that red traps were generally higher in fly catches, although not always statistically different.

Feeding Damage on Hazelnuts by *Halyomorpha halys,* Brown Marmorated Stink Bug (Hemiptera: Pentatomidae)

Chris Hedstrom, Vaughn Walton, Jeff Miller, Peter Shearer, Jeff Olsen
Department of Horticulture, Oregon State University, Corvallis, OR

Keywords: Hazelnut, filbert, BMSB, stink bug, *Halyomorpha halys*, feeding damage, Pentatomidae, brown marmorated stink bug

Abstract: Halyomorpha halys (Hemiptera: Pentatomidae), commonly known as brown marmorated stink bug (BMSB), is a pest on a wide range of crops in the eastern United States. BMSB has been established in Oregon since 2003 and poses a serious threat to Oregon agriculture. A preliminary study was done to characterize feeding damage that BMSB could inflict on hazelnuts, one of Oregon's main specialty crops. Mesh sleeves were placed over hazelnuts branches when the nuts began developing. Adult BMSB males were placed in each sleeve. The insects were left to feed for two weeks before being moved to more mature clusters of nuts. This was repeated every two weeks until harvest. The nuts remained bagged until harvest after insects were removed. At the end of the season nuts were collected and examined for damage. Damage was found to occur at all hazelnut developmental stages in this study. Early nuts had aborted or stunted development while later nuts showed high percentages of corking, including those with mature shells. Nuts not exposed to BMSB had higher percentages of healthy nuts than those exposed. The study will be continued for two more seasons to confirm these initial trends.

CHEMICAL CONTROL—

Moderator: Ron Britt, Ron Britt & Associates, Yakima

Notes:

Chemical Control

Tolfenpyrad (Bexar 15SC, Apta 15SC): A New Insecticide from Nichino America

Allison Walston and Pedro Hernandez
Nichino America, Wilmington, DE

Keywords: tolfenpyrad, Bexar 15SC, Apta 15SC, pome fruit, stone fruit, citrus, insecticide

Abstract: Tolfenpyrad (Bexar 15SC, Apta 15SC) is a new broad-spectrum contact insecticide from Nichino America. The active ingredient, tolfenpyrad, has been in development since 2004 and registration is planned for August 2012. Tolfenpyrad has broad-spectrum activity against several economically important insect pests on vegetables, fruits, nuts, vines and row crops. Tolfenpyrad is active on Hemiptera, Thysanoptera, Lepidoptera, Coleoptera, Diptera, Orthoptera, and Eriophyid mites. Tolfenpyrad also has fungicidal activity against certain species of powdery mildew and downy mildew.

Tolfenpyrad has been classified by the Insecticide Resistance Action Committee (IRAC) under Group 21A, the Mitochondrial Complex I Electron Transport Inhibitors (METI). Tolfenpyrad works by inhibiting cellular respiration in the mitochondria. Tolfenpyrad causes rapid feeding cessation and death of the pest usually within 24-48 hours.

An overview of tolfenpyrad as well as efficacy trial results in tree fruit will be presented.

Chemical Control

DuPont™ Cyazypyr™: A New Cross-Spectrum Insecticide for Tree Fruit Insect Management Programs

J.M. Alvarez, N. McKinley, H. Portillo, B. Annan
DuPont Crop Protection, Stine-Haskell Research Center, Newark, DE

Keywords: Cyazypyr™, cyantraniliprole, ryanodine receptor, codling moth, *Cydia pomonella*, Western cherry fruitfly, *Rhagoletis indifferens*, rosy apple aphid, *Rhagoletis indifferens*, spotted winged drosophila, *Drosophila suzukii,* obliquebanded leafroller, *Choristoneura rosaceana.*

Abstract: Cyazypyr™ (DPX-HGW86, cyantraniliprole), is a novel cross-spectrum second generation anthranilic diamide insecticide that was discovered by the DuPont Company, and has proven to be effective at controlling many economic insect pests in tree fruit and other crops. Field and laboratory tests in the Pacific Northwest have shown excellent activity on codling moth (*Cydia pomonella*), obliquebanded leafroller (*Choristoneura rosaceana*), Western Cherry Fruit fly (*Rhagoletis indifferens*), rosy apple aphid (*Dysaphis plantaginea*), and spotted winged drosophila (*Drosophila suzukii*). Cyazypyr™ is the second molecule in the anthranilic diamide class of chemistry to be commercialized, but is the first with significant efficacy on sucking pests. It exhibits a novel mode of action, by selectively activating the ryanodine receptor in insect muscles, resulting in rapid cessation of feeding in affected pest insects. Cyazypyr™ has very low mammalian toxicity and presents a favorable eco-toxicological and environmental fate profile. The EPA recently granted Cyazypyr™ the Reduced Risk status. Cyazypyr™ conserves many beneficial arthropods and will be an excellent fit in IPM programs.

Chemical Control

Rosy Apple Aphid Control with Flupyradifurone

Diane Alston and Thor Lindstrom
Utah State University, Logan, UT

Keywords: Dysaphis plantaginea, Aphis pomi, apple, chemical control, systemicity, butenolide, nicotine acetylcholine receptor, flupyradifurone, BYI02960, Sivanto, stemofoline

Abstract: Flupyradifurone (Sivanto), a new butenolide insecticide from Bayer CropScience, was compared against two neonicotinoids for control of rosy apple aphid (RAA) (*Dysaphis plantaginea*) and green apple aphid (GAA) (*Aphis pomi*) in 'Gala' and 'Fuji' apple trees. Higher rates of flupyradifurone (5.2 and 7.0 oz per acre) performed best in reducing RAA infestation (numbers of infested shoots per tree and aphids per shoot). Imidacloprid (Admire Pro at 2.8 oz per acre) performed similarly to lower rates of flupyradifurone (1.8 and 3.5 oz per acre) while thiacloprid (Calypso at 4.0 oz per acre) reduced RAA densities the least, but still significantly better than the untreated control. All the insecticides evaluated performed well against GAA for up to 25-days-post-treatment. Insect predator densities were relatively low during the trial, and none of the insecticides reduced their densities as compared to the untreated plots.

Control of Wooly Apple Aphid in Gala Apples

Caroline Wise, Robert Van Steenwyk, Lauren Novotny, Anthony Miller
Department of Environmental Science, Policy and Management, University of California, Berkeley, CA

Keywords: Wooly apple aphid, *Eriosoma lanigerum*, Movento, spirotetramat, Diazinon, HGW86, cyantraniliprole, chemical control, insecticide*, Aphelinus mali*, apple

Abstract: Wooly apple aphid (WAA), found both on the roots and foliage of apple trees throughout many North American apple growing regions, can pose a significant threat to trees by causing the formation of root galls. Fruit damage can also occur in the case of heavy aerial infestation. In this study seven treatments (two rates of Movento, Diazinon, and three rates of HGW86) were replicated four times in a randomized, complete block design in a commercial Gala orchard in San Joaquin County, CA. Treatments were applied on 28 May and 1 Sep. WAA populations were assessed on 9 Jun, 23 Jun, 7 Jul, 22 Aug and 17 Sep. At every assessment each tree was given an overall infestation rating and sample colonies were collected when present. Colony composition was determined in the laboratory by counting the number of live or dead adult and nymph WAA and either unemerged or emerged *Aphelinus mali* parasitized WAA. Both rates of Movento and Diazion ultimately controlled WAA so effectively that many replicates had insufficient colonies to permit sampling for composition analysis. HGW86 did not show significant control of WAA populations in this trial.

Chemical Control

Mixtures for Managing Arthropod Pests in Deciduous Orchards: Your Recipe or Ours?

Peter W. Shearer[1] and Jay F. Brunner[2]
[1]Oregon State University, Mid-Columba Agricultural Research and Extension Center, Hood River, OR
[2]Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: Pre-mix, tank-mix, IPM, biological control, resistance management, Agri-Flex, abamectin, thiamethoxam, Leverage, imidacloprid, cyfluthrin, Endigo, lambda-cyhalothrin, Voliam-flexi, chlorantraniliprole, Voliam-express, Tourismo, flubendiamide, buprofezin,

Abstract: A new trend in the agro-chemical business is manufacturing and selling pre-mixes. These are essentially pre-packaged containers with two or more active ingredients. The manufactures of these products indicate these products can provide broad-spectrum pest control, be used for resistance management, are convenient, can reduce warehousing of various individual products and offer cost benefits because some of the a.i.s are "essentially" free. Conversely, there are several disadvantages for using pre-mixes in deciduous orchard IPM systems because they remove flexibility of IPM programs, reduce selectivity, can promote resistance, add confusion to resistance management plans, MRLs and seasonal use rates, increase warehousing, negatively impact natural enemies and are more likely to cause secondary pest outbreaks. Additional arguments from industry indicating that the competition is doing it and that end-users want them do not appear valid in the PNW. We conclude that pre-mixes for orchard crops are based on corporate marketing decisions that are not scientifically based and that the limited justifications for their application are far outweighed by their lack of usefulness.

Chemical Control

Field Test and Laboratory Bioassays of Residues of Newer Insecticides against Apple Maggot

Harvey Reissig, David Combs, and Cynthia Smith
Department of Entomology, Cornell University, Geneva, NY

Keywords: Apple maggot, insecticides, residual laboratory bioassays

Abstract: Field plots were set up along the edge of commercial block of apples in New York that was heavily infested with apple maggots (AM). Treatments of newer insecticides, Calypso, Assail, Delegate, and Altacor were compared with a Guthion standard and an unsprayed check. Sprays were applied weekly with an airblast sprayer starting on 19 July and continuing until 23 August. Each week, apples were brought into the laboratory after residues had aged for 1, 7, or 15 days and placed in a clear, quart plastic container with two gravid AM females. Mortality and oviposition punctures were counted after 48 hours. One hundred apples/replication were examined for AM puncture, stings (<5mm deep) and internal tunnels on 20 August and 23 September. All insecticides except Altacor significantly reduced AM damage below that in the check plots (51.3% damaged fruit at harvest). Calypso and Assail were slightly more effective in preventing damage than the Guthion standard. In laboratory bioassays, Guthion residues killed more flies and usually reduced punctures better than most other materials. Calypso residues reduced AM oviposition as effectively as Guthion, but rarely killed more than 50% of the flies. One-day old Assail residues also effectively killed flies and reduced oviposition, but 7 and 15-day residues were not as effective as Guthion. Delegate and Altacor residues were less effective than Guthion and Calypso. There was considerable variability in the effects of residues of the same age in the 2 laboratory bioassays that were conducted at different times during the season. This variability was apparently not caused by rainfall differences.

Chemical Control

Not the Usual Suspects: Effects on Rust Mite, San Jose Scale, and Earwigs

Richard Hilton
Oregon State University, Southern Oregon Research & Extension Center, Central Point, OR

Keywords: apple rust mite, *Aculus schlechtendali*, *Encarsia* sp., European earwig, *Forficula auricularia*, pear rust mite, *Epitrimerus pyri*, San Jose scale, *Quadrapidiotus perniciosus*, Altacor, chlorantraniliprole, Avaunt, indoxacarb, Delegate, spinetoram, Envidor, spirodiclofen, tolfenpyrad, Ultor, spirotetramat, apple, pear

Abstract: Various products were evaluated in pears for their effects on pest and beneficial species. In one evaluation Delegate and Altacor were alternated by codling moth generation and tested with and without the addition of mineral oil, in one treatment Rimon was used for the intial cover spray. Other products tested in spray trials included Ultor, Envidor, tolfenpyrad, FujiMite, Zeal, Acramite, and AgriMek. A test was conducted in apples where Ultor or diazinon was used for in-season control of woolly apple aphid and compared to delayed dormant treatments of diazinon or chlorpyrifos. In a laboratory assay, Avaunt and Delegate were tested on European earwig. The use of Delegate without oil for first generation codling moth control resulted in a significantly higher level of scale marking on the harvested fruit. The numbers of the parasitic wasp *Encarsia* were lower in the treatments where Delegate (with or without oil) was used in the first codling moth generation. A number of products demonstrated consistent activity on pear rust mites: Envidor, Ultor, tolfenpyrad, AgriMek, and FujiMite. In the trial conducted in apples, treatments where Ultor was applied had significantly lower populations of apple rust mite and all the treatments had lower levels of scale crawlers than the untreated check. In the laboratory assay, both Avaunt and Delegate had significant activity on earwigs.

Chemical Control

Control of Codling Moth using New Products in Orchards under Pheromone Mating Disruption

Lauren Novotny and Robert Van Steenwyk
Department of Environmental Science, Policy and Management, University of California, Berkeley, CA

Keywords: Altacor™, Chlorantraniliprole, Delegate®, Spinetoram, codling moth, *Cydia pomonella*, walnut, chemical control, insecticide

Abstract: Codling moth (CM) is a major pest of early-maturing walnut cultivars. Though pheromone mating disruption (PMD) is used for controlling low CM populations it must be supplemented by chemical control for high populations. As CM has developed resistance to some pesticides, control programs using new products are of interest. A field trial was conducted in a 101 ac orchard under PMD with 18% infestation at commercial harvest the prior year. There were four treatments replicated three times in a RCB design. Treatments were applied aerially and by ground at selected times during the 1st and 2nd CM flights. CM infestation was monitored during the first flight. Secondary pests (aphids, mites) were monitored from the start of the first flight until harvest. Infestation at harvest was determined by collecting 100 nuts from each of nine designated sample trees per replicate. Experimental treatments using Delegate and Altacor were significantly more effective in reducing total infestation (≤1.5%) than the grower's standard (4.3%). Grower and experimental treatments were significantly less infested than the treated check (8.4%). There was no flare up of secondary pests associated with any treatment. The success of the experimental treatments demonstrates that judicious use of low-risk pesticides is sufficient to bring high populations of CM to acceptable levels within a single season.

Chemical Control

Chemical Control of Codling Moth in Pear

Robert Van Steenwyk, Lauren Novotny, Caroline Wise, Lesley Thayer
Department of Environmental Science, Policy and Management, University of California, Berkeley, CA

Keywords: Codling moth, *Cydia pomonella*, pear psylla*, Cacopsylla pyricola,* Pear rust mite, *Epitrimerus pyri,* Twospotted spider mite, *Tetranychus urticae*, HGW86, cyantraniliprole, Altacor, chlorantraniliprole, Agri-Mek, abamectin, Agri-Flex, Guthion, azinphos-methyl, Imidan, phosmet, PureSpray Green horticultural oil, pear, chemical control, insecticide

Abstract: A study was conducted in a commercial 'Bartlett' pear orchard in Fairfield, CA to evaluate Agri-Mek SC and Agri-Flex, which are volatile organic compound (VOC) compliant formulations compared to Agri-Mek EC, a non-compliant VOC formulation, for control of pear psylla (PP) and mites. In addition HGW86 was compared to Altacor, a grower standard and check for codling moth (CM) control. Eight treatments were replicated four times in a RCB design. Each replicate was an individual tree. Sprays were applied with a handgun. Control of the CM was evaluated at harvest on 16 Aug by inspecting 100 fruit per replicate. Control of PP nymphs, motile twospotted spider mites (TSSM) and pear rust mites (PRM) was evaluated by sampling 10 exterior and 10 interior leaves per replicate weekly from 21 Jun through 8 Aug. Agri-Mek SC and Agri-Flex were as efficacious as Agri-Mek 0.15 EC in control of TSSM, PRM and PP and both Agri-Mek formulations as well as Agri-Flex treatment had significantly lower mite and pear psylla compared to the grower standard and the check. HGW86 was as efficacious as Altacor in control of CM with both HGW86 and Altacor having CM infestation lower than the grower standard and significantly lower than the check. Both HGW86 and Altacor did not flare WSM, PRM or PP populations; however, HGW86 and Altacor did not provide control of WSM, PRM or PP.

Chemical Control

Efficacy of Reduced Risk Insecticides in Almonds – Is Spray Coverage Limiting?

Bradley S. Higbee and Ray Kaczmarczyk
Paramount Farming Company, Bakersfield, CA

Keywords: Amyelois transitella, navel orangeworm, insecticides, spray coverage, almond, reduced risk

Abstract: Pyrethroids in the 3rd and 4th generation classes have been very effective against Navel Orangeworm (NOW) and other pests in almonds since they have become registered, starting in 2007. We have demonstrated NOW damage reductions of 75-95% in large-scale field trials over the past five years. However, potential resistance and regulatory scrutiny combine to jeopardize the long-term sustainability of this class of insecticides. In field trials, we have only been able to achieve 40-60% damage reductions with the suite of reduced risk insecticides available in almonds (methoxyfenozide, flubendiamide, chlorantraniliprole and others), in single and multiple application treatments. We used water sensitive papers, residue analyses, and crop damage to compare vertical distributions of spray coverage and damage among different sprayers, speeds and manifold nozzling. Results of percent coverage and residue deposition correlated well with observed damage. NOW infestation was 3-4 fold higher in the top half of the tree, while coverage of the top half of the tree was reduced 4-6 fold relative to the lower half of the tree with ground based sprayers. Tower sprayers had more consistent coverage among the elevations observed, but overall coverage was similar to ground based rigs. The highest observed coverage overall in this two year study was in the range of 45-55% and was achieved by a number of sprayer-speed- nozzle configurations.

Minutes of the 85th Annual Meeting
Orchard Pest & Disease Management Conference
Hilton Hotel, Portland, Oregon
January 12 -14, 2011

I. Call to Order

The **85**th Annual Meeting was called to order by the President Peter Shearer at 9:00 AM. President Shearer announced that there were approximately 200 registered attendees, asked speakers to not exceed 15 min per presentation to maintain the meeting schedule, asked for each attendee to introduce themselves, and introduced session leaders. They were:

Biology/Phenology	- Art Agnello
Mating Disruption/SIR	- Jeff Olson
Implementation	- Tim Smith
Thresholds/Monitoring	- Chris Nobbs
Biological Control	- Dave Biddinger
Invasive Species	- Bob Van Steenwyk
Chemical Control/New Products	- Dan Skoczylas

II. Old Business

A. Reading of 2010 Minutes: Secretary Alston announced that the 2010 minutes are posted on the OPDMC website. It was moved and seconded to approve the minutes.

President Shearer called for any other old business. There was none.

III. New Business

A. Board of Directors Meeting

President Shearer announced that the Board of Directors will hold their annual meeting at 12:15 pm on Wednesday, January 12, and that all members were welcome to attend. The Board consisted of Past President Lerry Lacey, President Peter Shearer, President-Elect Tom Unruh, Executive Director Donald Thomson, Program Co-Chairs John Dunley and Betsy Beers, Secretary Diane Alston, and Treasurer Nancy Hays.

B. Committee Assignments

President Shearer called for volunteers for committee positions. The following committee assignments were made:

Nominations: Larry Gut (Chair), Alan Knight, and Harvey Reisig
Audit: David Epstein (Chair), Peter McGhee, and Phil Van Buskirk
Resolutions: Tom Unruh (Chair), Rick Hilton, and Bob Van Steenwyk

C. Pesticide License Credit Sign Up Sheets

Sign up sheets will be available for AZ, CA, OR, and WA at the registration desk.

D. Call for Further New Business

There was no further new business. The business meeting was then adjourned until 11:00 AM, Friday, January 14.

IV. Closing Business Meeting

The closing business meeting was called to order by Peter Shearer on January 14.

A. Board Meeting Report

President Shearer called upon Secretary Alston for a report on the Board Meeting. The following information items were presented:

- The board voted to keep "Disease " in the conference name, but "Western" has been dropped to reflect the national scope of the meeting
- Executive Director Thomson will add information on the PNW Insect Management Conference to the OPDMC website to facilitate dissemination of meeting information
- Pre-registration using ACTEVA worked very well
- The drop-box for submitting talks was a great improvement over the past
    - Eliminated previous problems with lost abstracts
    - There were a few issues with determining which author was presenting the paper
- The 2012 keynote speaker will be Claudio Ioriatti from Italy
- We will continue the Invasive Species session as it was highly popular this year
- Acknowledge Program Co-Chair Dunley for creating the rubber chicken award history that was provided on the front page of this year's proceedings
- The board voted to allow the rubber chicken awardees to keep their chicken. OPDMC will invest in a bulk purchase of chickens to give out a new chicken each year.

B. Committee Reports

President Shearer called for the committee reports.

1. Nominations

Chair Larry Gut made the following recommendations:
President-Elect: David Epstein (Michigan State University)
Secretary: Diane Alston (Utah State University)
Treasurer: Nancy Hays (Pacific Biocontrol Corp.)
Executive Director: Donald Thomson (DJS Consulting Services)
Program Co-Chairs: Betsy Beers (Washington State University) and John Dunley (Wilbur Ellis)
A motion was made and seconded to accept the recommendations of the nominations committee. The motion was passed unanimously.

2. Audit

Chair David Epstein reported that the committee examined the Report of the Treasurer and recommended that the membership accept the report. It was moved, seconded, and approved.

3. Resolutions

Chair Tom Unruh read the proposed resolutions:
1. Be it resolved that this conference extend written appreciation to the management and staff of the Hilton Hotel for the courteous service and fine accommodations provided. (The Hilton staff recognized the group with a 10^{th} anniversary cake at one coffee break).
2. Be it resolved that the members of the conference express their appreciation to the Past President Lerry Lacey, President Peter Shearer, President Elect Tom Unruh, Secretary Diane Alston, Treasurer Nancy Hays, and Program Co-Chairs John Dunley and Betsy Beers for their leadership and dedication in organizing the 2011 meeting.
3. Be it resolved that the members of the conference extend their appreciation to the Tree Fruit Research and Extension Center, Washington State University, and in particular, Christina Mayer, for applying for pesticide applicator credits for the various states and preparing the proceedings abstracts.

4. Be it resolved that the members of the conference extend their appreciation to the Tree Fruit Research and Extension Center, Washington State University, and Jerry Tangren, in particular, for organizing and maintaining the OPDMC website.
5. Be it resolved that the members of the conference extend their appreciation to the session leaders: Art Agnello, Jeff Olson, Tim Smith, Chris Nobbs, Bob Van Steenwyk, and Dan Skoczylas.
6. Be it resolved that the Secretary write letters of condolences to families of members who passed away the past year. Angus Howitt was recognized as a deceased member in 2010.
7. Be it resolved that the members of the conference extend their appreciation to Don Thomson for his 12th successful year as our Executive Director!
8. Be it resolved that the members of the conference extend their appreciation to Jay Pscheidt, Oregon State University, for ably overseeing the disease management session of the conference.

It was moved, seconded, and approved to accept the resolutions.

C. Treasurer Report

Beginning balance	$3,914.58
Income	$9,487.25
Expenses	$8,526.18
Net cash inflow	$961.07
Ending balance	$4,875.65

D. New Business

1. Discussion to invite Christina Mayer to meeting for a day/night and take her out to dinner to show our appreciation for all her efforts on behalf of OPDMC. John Dunley will speak to Jay Brunner about whether WSU would allow us to do this.

2. Rubber chicken award

President Shearer called for nominations:

A. Broc Zoller nominate John Dunley for sleeping past the 8:00 am meeting start-time and not passing along his laptop password; and for a mix-up in the CA CEUs
B. Pat Weddle nominated Broc Zoller for using 1950s slide technology (taking photos of slides) in 2011; PowerPoint software only costs about $50!
C. Pat Weddle nominated Larry Hull for being the most audacious speaker of the meeting. Larry spoke about how peach and apple growers in PA sprayed 16 times for brown marmorated stink bug, and still had 60% fruit injury. When asked if IPM was dead, he replied that it isn't!

President Shearer called for a vote from the membership based on loudness of applause for each name. John Dunley won. President Shearer awarded John the rubber chicken by passing it to him upside down, hanging by the legs.

The 2012 meeting will be held January 11-13, 2012.

President Shearer passed the gavel to the New President, Tom Unruh. New President Unruh adjourned the meeting.

Respectfully Submitted,

Diane Alston
Secretary
2011 Orchard Pest and Disease Management Conference

Claudio Ioriatti - Biographical Information

Claudio was born in Baselga di Piné, a small town (5,000 inhabitants) in the Alps, 20 km from Trento. Claudio still lives in Baselga di Piné with his family. The family roots in Baselga di Piné go back 4 centuries, and Claudio has been deeply involved in the life of his community, serving as a member of the town council and as the mayor. Claudio is married to Silvia Cristina Zangrando and they have 3 children: a son Pema (14), and two daughters, Ningsalmaya (10) and Pooja (9). Claudio and his family love outdoors activities including hiking, skiing and mountain biking. He has travelled extensively with visits to destinations in North and South America, India and Nepal.

Claudio works for the Instituto Agrario (Fondazione Edmund Mach) di San Michele all'Adige. The institute is located in the rugged mountains of northern Italy in a beautiful valley located in the Trentino region. Over 90% of the Trentino region is above 1,650 feet and 50% of the surface is covered by forest. The region is famous for the production of apples and grapes. There are over 10,000 apple and 10,500 vineyards, occupying approximately 72,000 and 25,000 acres, respectively. The mountain splendor also makes the region a popular place for tourists to enjoy many outdoor activities. The institute is committed to promoting agricultural practices that minimize environmental impact but in ways that enhance agricultural innovation and cost effectiveness.

Claudio is a Senior Scientist and Head of the Applied Research Department at the Institute. During his career, Claudio has conducted extensive research on integrated controls of apple and grape pests. He has focused his research on area-wide application of semiochemicals and the management of insecticide resistance. Claudio also lectures on Viticultural Entomology at the University of Trento. He has authored 45 publications in international peer-reviewed journals and he has more than 200 publications (scientific papers, popular articles, book chapters, conference communications). Claudio is well known to many of our members from his sabbatical in the eastern USA in 2010 and his involvement with the Technical Working Group for the European Grape Vine Moth program in California in 2010 and 2011.

Claudio has spent time as a visiting scientist at Cornell University (2010) with Art Agnello and Harvey Reissig, the Horticulture and Food Research Institute in New Zealand (1995) with Max Suckling, the Instituut vorr Plantenziektenkunding Onderzoek in the Netherlands with Leo Blommers (1998) and the Station de Recherches Agronomiques de Changins with Pierre-Joseph Charmillot (1985 to 1986), a distinguished and familiar list of collaborators.