2016
Orchard Pest and Disease Management Conference

The 90th Conference is pleased to announce our keynote speakers:

Steve Sheppard

Thurber Professor of Apiculture and Chair of the Dept of Entomology, Washington State University

Keynote Address 1:

The Queen and I: History and Future of Honey Bee Breeding

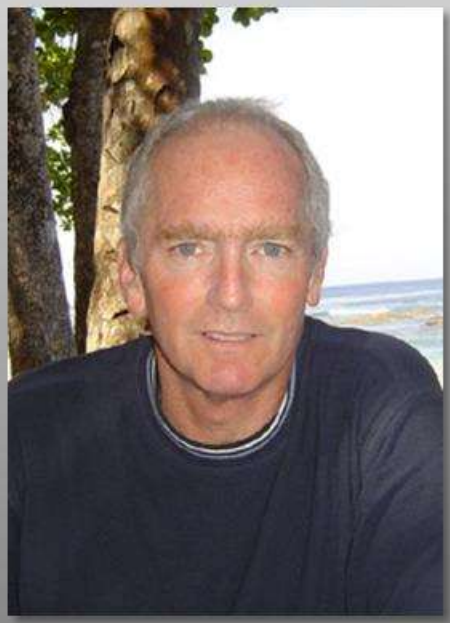
Hilton Portland, Portland, Oregon
January 13-15

Tom Baker

Distinguished Professor of Entomology and Chemical Ecology, Penn State University

Keynote Address 2:

Love at First Sniff: Harry Shorey and the Dawn of the Age of Pheromones



Dr. Steve Sheppard

Steve Sheppard is the Thurber Professor of Apiculture and Chair of the Department of Entomology at Washington State University. His interest in honey bees derives from early childhood days spent with beekeeping equipment and bee books in the workshop of his great grandfather, a beekeeper from Savannah Georgia. Steve's MSc research at the University of Illinois was on pollination biology and his PhD project shifted to investigation of population genetics and evolution in honey bees.

Prior to joining the faculty at WSU, Steve worked as a research scientist for USDA-ARS, conducting studies on Africanized honey bees and the genetic processes that accompany insect range expansions. Since 1996, Steve, his students, postdocs and research collaborators at WSU have continued basic work on honey bee population genetics and evolution and conducted a long term breeding program to select honey bees adapted for PNW conditions that exhibit improved tolerance of mites and diseases. In collaboration with US queen producers, the lab has been involved in the importation and distribution of novel honey bee genetics from Old World source populations since 2008.

Development of practical methods of honey bee semen cryopreservation in Steve's laboratory enabled WSU to establish the world's first honey bee germplasm repository. This repository currently houses samples of numerous Old World honey bee subspecies and current domestic breeding stocks. Additional research on honey bee health issues includes: the use of metabolic gases for indoor wintering and mite control, the use of fungal mycelium as a biocontrol agent for parasitic mites and fungal extracts as antivirals for use in bees.

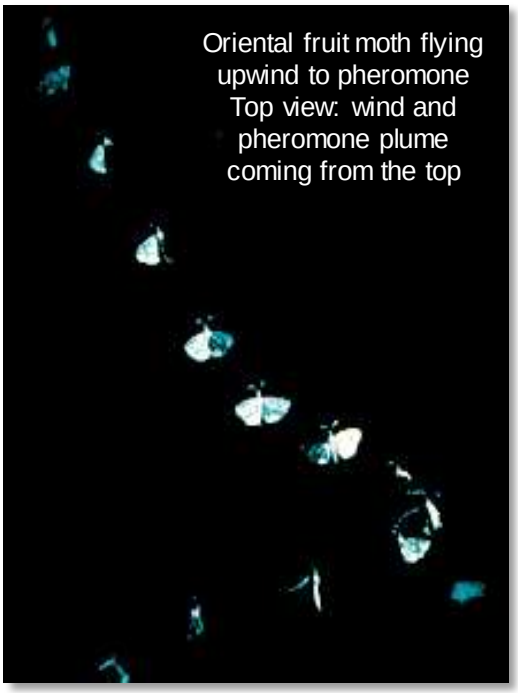
Dr. Tom Baker

Dr. Tom Baker is the Distinguished Professor of Entomology and Chemical Ecology at Penn State University.

Tom recently gave the Annual Founders' Memorial Lecture at the ESA meetings in Minneapolis, Minnesota. Tom's Memorial Lecture honored the late Dr. Harry Shorey for his pioneering research in the area of insect pheromones. Tom also provided a great overview of how Harry Shorey and his colleagues developed mating disruption technology for the management of insects in agricultural systems. OPDMC is delighted that Tom will give his excellent presentation in January 2016.

Tom received his PhD in Entomology from Michigan State University in 1979. He joined the faculty at UC Riverside in 1979 where he served as Head of the Division of Toxicology and Physiology from 1986-1988, and Chair of the Department from 1988-1992. He relocated to Iowa State University in 1992 where he served as Chair of the Department of Entomology. Tom currently holds the Distinguished Professor of Entomology and Chemical Ecology at Penn State University.

During his career, Tom and his colleagues made pioneering advances in the field of insect pheromone research that have earned him international recognition and stature. Tom's research helped to elucidate the mechanisms used by flying insects to locate odor sources. Tom's research also helped identify the olfactory pathways insects use to discriminate among odors. Tom's contributions to pheromone research aided our understanding of the mechanisms of mating disruption leading to better deployment strategies and commercial successes. Tom's pioneering research in these areas was cited in his being elected Fellow of the Entomological Society of America and Fellow of the American Association for the Advancement of Science.



The International Society of Chemical Ecology presented Tom with both the Silverstein-Simeone Award and the Silver Medal Award for his career achievements. Tom has over 175 research publications and he has published 30 review articles and book chapters.

90th Annual Orchard Pest and Disease Management Conference

Orchard Pest and Disease Management Conference
2016 Agenda

Below is the order in which the sessions will be given and the projected time slot in which they will occur. 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.

Talks within each session are listed in order in the Table of Contents.

Wednesday, January 13th	
8:30 am	Opening Business—Steve Ela, OPDMC Chair, Janet Caprile, Chair-elect
9:15 am	**Invasive Species—Peter McGhee**
12:00 pm	*Lunch*
1:30 pm	**Invasive Species—Peter McGhee (cont'd)**
2:15 pm	**Chemical Control/New Products—Tim Ksander**
3:00 pm	*Coffee*
3:30 pm	Keynote Address 1: **The Queen and I: History and Future of Honey Bee Breeding,** *Steve Sheppard, Entomology Department Chair Professor, Graduate Faculty Apiculturist, Thurber Memorial Chair, Washington State University*
5:00 pm	*Mixer (Lobby)*
Thursday, January 14th	
8:30 am	**Chemical Control/New Products— Tim Ksander (cont'd)**
9:30 am	**Biology/Phenology—Mike Devencenzi**
9:45 am	*Poster Session/Coffee (Lobby)*
10:45 am	**Biology/Phenology—Mike Devencenzi (cont'd)**
12:00 pm	*Lunch*
1:30 pm	**Mating Disruption/SIR— Alan Knight**
1:30 pm	Keynote Address 2: **Love at First Sniff: Harry Shorey and the Dawn of the Age of Pheromones***, Tom Baker, Distinguished Professor of Entomology and Chemical Ecology, Penn State University*
3:00 pm	*Coffee*
3:15 pm	**Mating Disruption/SIR—Alan Knight (cont'd)**
5:00 pm	*Adjourn*
Friday, January 15th	
8:00 am	**Implementation—Glenn Thayer**
8:15 am	**Biology/Phenology—Mike Devencenzi (cont'd)**
8:45 am	**Thresholds/Monitoring—Glenn Thayer**
9:45 am	**Biological Control—Betsy Beers**
10:15 am	Closing Business—Steve Ela, OPDMC Chair, Janet Caprile, Chair-elect
11:15 am	*Adjourn*

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For information, see: http://opdmc.org/

Order of Presentations
FROM THE 90th ANNUAL

ORCHARD PEST AND DISEASE MANAGEMENT CONFERENCE

January 13, 14 & 15, 2016

Keynote Presentation 1: Wednesday, 3:30pm – 5:00pm

The Queen and I: History and Future of Honey Bee Breeding, Steve Sheppard, Entomology Department Chair Professor, Graduate Faculty Apiculturist, Thurber Memorial Chair, Washington State University

Keynote Presentation 2: Thursday, 1:30pm – 2:30pm

Love at First Sniff: Harry Shorey and the Dawn of the Age of Pheromones, Tom Baker, Distinguished Professor of Entomology and Chemical Ecology, Penn State University

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Invasive Species—

Moderator: Peter McGhee

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Invasive Species

Brown Marmorated Stink Bug in Washington: A Growing Problem

Elizabeth Beers[1], Joshua Milnes[1], Mike Bush[2], Gwen Hoheisel[3], Todd Murray[4], Mike Klaus[5], Peter Landolt[6], Katie Buckley[5], Doug Walsh[7], and Jay Brunner[1]

[1]Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA; [2]WSU Extension, Union Gap, WA; [3]WSU Extension, Prosser, WA; [4]WSU Extension, Stevenson, WA; [5]WSDA, Yakima WA; [6]USDA, Wapato, WA; [7]WSU-IAREC, Prosser, WA

Keywords: brown marmorated stink bug, *Halyomorpha halys*, survey, cultural control

Abstract: Brown marmorated stink bug is a new, invasive pest of the western United States, following its detection and establishment in the mid-Atlantic area in the mid-1990s. In Washington, at least 14 counties have had one or more specimens reported to date. It is well established in the Vancouver area, across the Columbia River from Portland. It has been found up the I-5 corridor on the west side of the state, and is most common along the Columbia from Vancouver to Walla Walla. Detections in central Washington are confined to urban/suburban landscapes, with the exception of a few fruit orchard and vineyard detections near the Columbia. Future pest management strategies studied will include biological control with an exotic parasitoid and physical exclusion.

Invasive Species

Distribution and Phenology of Brown Marmorated Stink Bugs in Sacramento, Lake, and Mendocino Counties

Chuck A. Ingels, Lucia G. Varela, and Rachel B. Elkins
University of California Cooperative Extension, Sacramento County

Keywords: Brown marmorated stink bug, BMSB, *Halyomorpha halys*, monitoring, trapping, phenology, host species

Abstract: In the midtown Sacramento infestation area, 21 brown marmorated stink bug (BMSB) traps were placed and checked weekly to help evaluate BMSB phenology. Approximately half were standing 4-ft pyramid traps and half were double cone traps secured to tree branches. AgBio Combo lures were used (replaced every 4 weeks) along with insecticide strips (replaced every 8 weeks). Traps were placed 24 Feb and checked weekly through 26 Oct. Late February and early March were unusually warm, and the first adults were caught in traps on 3 Mar. Intense searching for eggs was conducted early to mid-April, and the first eggs were found on 14 Apr (20 d earlier than 2014). The first nymph was trapped on 19 May. Eight traps caught >100 BMSB each in 2015. An average of 14 nymphs/trap/week was found in these traps through most of June, and 45-50 nymphs/trap/week were found in early to mid-September. Few adults were found in traps until the last 2 weeks of September, when an average of 10-15 adults/trap/week was found. Two generations were found in both 2014 and 2015, which agrees with the BMSB model based on Sacramento temperatures. In addition to BMSB, over 200 *Astata occidentalis* (a large, solitary, predatory wasp that feeds on stink bug adults and nymphs) were found in the traps through the season. The ratio of nymphs:adults trapped in 2015 was 4:1, and in 2014 was 3:1. Overall, pyramid traps caught 14% more BMSB than double cone traps. Plant species found to host the largest numbers of BMSB were sunflower (Helianthus annuus), tree of heaven (*Ailanthus altissima*), trident maple (*Acer buergerianum*), Chinese pistache (*Pistacia chinensis*) and waxleaf privet (*Ligustrum japonicum*). Extensive trunk feeding and resulting oozing of sap was seen on sweet cherry (Prunus avium), sweet orange (*Citrus sinensis*), sawleaf Zelkova (*Zelkova serrata*), and Shamel ash (*Fraxinus uhdei*). In addition 20 pyramid traps, baited with Sterling Rescue BMSB lures, were monitored bi-weekly south of Sacramento to Walnut Grove from March-October; one male adult BMSB was found in a trap in Freeport, which borders farms along the Sacramento River. Eighteen 4-ft pyramid traps baited with Sterling Rescue BMSB lures were placed in agriculture/urban interface areas in Lake and Mendocino counties and checked weekly to determine if BMSB are present in these areas, and none were found.

Invasive Species

A Potpourri of BMSB Data from Virginia

J. Christopher Bergh and Angelita Acebes-Doria
Virginia Tech, Alson H. Smith, Jr. Agricultural Research and Extension Center, Winchester, VA

Keywords: Brown marmorated stink bug, *Halyomorpha halys*, injury, dispersal, monitoring, development

Abstract: Summary results from a selection of research projects on brown marmorated stink bug (BMSB) in Virginia are presented, including host suitability and developmental studies, seasonal patterns of nymphal dispersal among selected cultivated and wild hosts, nymphal feeding injury to tree fruits, and overwintering biology.

Re-Development of Effective IPM Programs in Pennsylvania Orchards Despite the Presence of Brown Marmorated Stink Bug

Greg Krawczyk, L. A. Hull and Lauren Shaak
Pennsylvania State University, Department of Entomology, Fruit Research &Extension Center, Biglerville, PA

Keywords: *Halyomorpha halys*, brown marmorated stink bug, BMSB monitoring, pome fruit, stone fruit

Abstract: Introduction and rapid population growth of brown marmorated stink bug (BMSB) *Halyomorpha halys* (Stäl) (Heteroptera: Pentatomidae) in the Mid-Atlantic region of United States created additional pressure on fruit growers to continue utilizing Integrated Pest Management (IPM) principles to manage orchard pests. Limitations in the practical monitoring of BMSB combined with tapered assortment of available effective tools to manage BMSB, frequently forced growers to disproportionate use of broad-spectrum insecticides. The addition of BMSB-specific treatments negatively impacted the presence of beneficial organisms resulting in the re-emergence of secondary pests such as woolly apple aphids and scale insects. Also, the increased usage of insecticides against BMSB indirectly reduced the use of mating disruption materials and other selective tools previously used to manage the "old" pest complex in the orchards.

During the 2013-2015 seasons we evaluated the effectiveness of BMSB management programs based on monitoring data provided by traps organized in a grid scheme in apple and cherry orchards. Commercially available BMSB traps from Ag-Bio Inc. (pyramid trap) and Sterling International (Rescue trap) were deployed on the orchard borders and inside the block. The BMSB adult and nymph populations were monitored using 13 traps per block while the cherry orchard was monitored by 9 traps. The BMSB directed insecticide treatments were triggered exclusively by the capture of BMSB nymphs in the monitoring traps. Codling moth (CM) and oriental fruit moth (OFM) mating disruption was deployed in the apple orchard during the 2014 (CheckMate Puffer CM/OFM, Suterra, Inc.) and 2015 (CideTrak CM/OFM products, Trécé, Inc.) seasons. Additionally, during the 2014 and 2015 seasons the effectiveness of pyramid and Rescue traps was compared with the effectiveness of the 12 in2 clear plastic sticky trap baited with the same BMSB attractants.

The insecticide applications against BMSB based on the provisional threshold of presence/absence of BMSB nymphs in the monitoring traps resulted in nearly 40% yearly reduction in the number of insecticide applications during each of the 2014 and 2015 seasons. Combined with mating disruption programs against CM and OFM, the BMSB nymphal presence treatment decision threshold allowed the return to the level of insecticide applications from the 2009 season, the year before the BMSB outbreak.

Invasive Species

Survey of *Halyomorpha halys* Natural Enemies in Virginia, 2015

J. Christopher Bergh[1], Angelita Acebes-Doria[1], and Elijah Talamas[2]
[1]Virginia Tech, Alson H. Smith Jr. Agricultural Research and Extension Center, Winchester, VA
[2]USDA ARS Systematics Entomology Laboratory, Washington, DC

Keywords: Brown marmorated stink bug, *Trissolcus japonicus*, parasitoids

Abstract: A survey of *Halyomorpha halys* natural enemies was conducted in Northern Virginia during the summer of 2015, using sentinel H. halys egg masses from a laboratory colony. Between June and September, egg masses were deployed on known hosts of *H. halys* growing at the edge of unmanaged woodland habitats at six locations along a west-to-east transect extending from Winchester, VA. Egg masses were found to have been parasitized by several native parasitoids and by the recently detected and invasive Asian parasitoid, *Trissolcus japonicus*.

Can We Make a Better BMSB Trap?

Nik G Wiman[1], Peter W Shearer[2], Elizabeth Tomasino[3] and Josh Milnes[4]
[1]Oregon State University, North Willamette Research and Extension Center, Aurora OR;
[2]Oregon State University, Mid-Columbia Agricultural Research and Extension Center, Hood River, OR;
[3]Oregon State University, Department of Food Science and Technology, Corvallis, OR;
[4]Washington State University, Tree Fruit Research and Extension Center, Wenatchee WA

Keywords: *Halyomorpha halys*, brown marmorated stink bug, aggregation pheromone, monitoring, plant volatiles

Abstract: Now that the aggregation pheromone for Halyomorpha halys has been described along with a synergistic attractant, more effective monitoring is possible. A number of commercial traps and lures are available but many of the current options are unlikely to be widely used by growers. Traps can be unwieldy and expensive, and there is potential that lures could be further enhanced. We report on field trials examining different traps and potential use of host plant volatiles as attractants.

Invasive Species

Continued Development of IPM on Oregon Hazelnuts in the Context of the Invasive Pest, Brown Marmorated Stink Bug

Vaughn M. Walton, Betsey Miller and Daniel T. Dalton
Oregon State University, Department of Horticulture, Corvallis, OR

Keywords: Integrated pest management, Hazelnut, Filbert, Filbertworm, *Cydia latiferreana*, pheromone mating disruption, entomopathogenic nematodes, Brown Marmorated Stink Bug, BMSB, *Halyomorpha halys*, commercial hazelnut

Abstract: Hazelnut production in the United States is centered in Oregon with most of the acreage cultivated in the Willamette Valley. Historically, key pests on hazelnut have included hazelnut and filbert aphids, leafrollers filbertworm (FBW), *Cydia latiferreana*, and since 2013 brown marmorated stinkbug (BMSB), *Halyomorpha halys*. FBW is a direct pest that needs management on a yearly basis. Aphids are indirect pests that need management less frequently. Management methods for FBW include monitoring with pheromone-baited sticky traps, a degree-day model, flailing of the orchard floor and well-timed pesticide applications. More recently, mating disruption has developed as an alternative for management of FBW. Here we will focus on the integration of mating disruption against FBW in relation to the seasonal phenology of BMSB, the new invasive pest.

Characterizing Defensive Secretions of BMSB

Nik G Wiman[1], Elizabeth Tomasino2
[1]Oregon State University, North Willamette Research and Extension Center, Aurora OR;
[2]Oregon State University, Department of Food Science and Technology, Corvallis, OR

Keywords: *Halyomorpha halys*, brown marmorated stink bug, dorsal abdominal gland, ventral abdominal gland

Abstract: The volatile compounds produced from *H. halys* at different development stages (1st instar – adult) were evaluated using gas chromatography mass spectrometry (GCMS). Over 39 compounds were identified. The number of compounds that contributed more than 1% of the total chromatogram peak area decreased, as the insects moved from 1st instar to adult, due to the increase of tridecane production as H. halys matured. The main compounds produced from both female and male adult BMSB include dodecane, (E)-2-decenal, and (E)-2-undecen-1-ol, and tridecane. Secretions from nymphs comprising 1% or greater of total peak area contained more compounds relative to adults, and only tridecane and (E)-2-decenal were conserved among all life stages. Tridecane comprised the largest proportion of peak area relative to any other compound produced in any life stage. These compounds are responsible for the cilantro-like odor associated with *H. halys* and have behavioral significance.

Invasive Species

Overwintering and Seasonal Dynamics of Spotted Wing Drosophila, *D. suzukii*, in the Okanagan-Columbia River Basins, 2010-2014

Howard Thistlewood, Paramjit Gill, Elizabeth Beers, Peter Shearer, Doug Walsh, Brigitte Rozema, Susanna Acheampong, Steve Castagnoli, Wee Yee
Agriculture and Agri-Food Canada, Summerland, BC, Canada

Keywords: spotted wing drosophila, *Drosophila suzukii*, monitoring, trap, apple cider vinegar, yeast, non-crop plants, berry, cherry, stone fruit, grape, alternate hosts, temperature, pesticide use, GIS, spatial ecology, elevation, latitude, Topographic Wetness Index

Abstract: Adults of the vinegar fly, spotted wing Drosophila*, Drosophila suzukii*, were monitored at 367-686 trap sites per year, 2010-2014, using traps with lures of apple cider vinegar or yeast. The traps were placed in a great variety of crops and non-crop locations, across 137,500 km^2 of the Okanagan and Columbia River Basins in Oregon, Washington, and British Columbia. Some 71,000 weekly trap records were subjected to a spatially explicit analysis using a geographic information system (GIS). First analyses of consolidated results (mean per trap day) are presented for berry, cherry, stone fruit, grape, non-crop host plants, and non-host sites and for conventional, organic, backyard, and feral sites by region and year. After removal of duplicate traps, at each site we calculated Daymet daily weather (from NOAA), 25 geomorphometric layers (SAGA software), and the distances to water, and other spatial variables for each site using Spatial Analyst toolbox (ESRI). Emergence from overwintering (the week of first catch of *D. suzukii*) in 2010-14 was highly related (R^2=0.49) to the year, pesticide treatment at the site, and the number of winter days with temperatures <-5 °C, in 1505 site-years of records from cherry trees, using a spatially explicit statistical analysis. Similarly, emergence from overwintering in 2011-14 was significantly related (R^2=0.42) to the year, pesticide treatment at the site, logarithm of the prior year population of *D. suzukii* during the Fall, latitude, elevation, and topographic wetness index, in 1136 site-years of records from berry, cherry, stone fruit and grape habitats. The results are leading to improved understanding of the ecology of this invasive insect and to improved strategies for future management.

Improving Trap Efficiency and Retention for Spotted Wing Drosophila

Danielle M. Kirkpatrick, James R. Miller, and Larry J. Gut
Michigan State University, East Lansing, MI

Keywords: spotted wing drosophila, *Drosophila suzukii*, SWD, pest, trap color, insect color vision, efficiency, retention, trap, invasive species, small fruit, stone fruit, lure, bait, attractant, detection

Abstract: Methods for trapping spotted wing drosophila, *Drosophila suzukii*, have not yet been optimized for detecting this devastating pest of small and stone fruits. Laboratory bioassays quantifying rates of spotted wing drosophila alightment on odorless sticky disks of various colors showed that red, purple, and black disks captured the most spotted wing drosophila. Similar patterns of captures were seen in a field study with ball traps of various colors. Red and fluorescent red are the best candidates for trap color, while clear and white are the least desirable. When the standard deli cup trap that is currently used for spotted wing drosophila monitoring was compared to the sticky ball trap in the field, both baited with the same lure, trap efficiency was greatly increased.

Invasive Species

Spotted Wing Drosophila Monitoring

Elizabeth Beers, Alix Whitener and Peter Smytheman
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: spotted wing drosophila, *Drosophila suzukii*, monitoring, trapping, lure, bait

Abstract: Three experiments were performed testing traps and lures/baits for spotted wing drosophila (SWD). The first compared lures/baits (using a standard trap, the PBJ) during June and September. In June, the Scentry lure caught the highest number of SWD, but had poor selectivity (0.3% SWD). The two Trécé lures caught the fewest SWD, but were the most selective of the lures tested. In September, the Scentry lure again caught the highest numbers, and the Trécé lures the lowest numbers of SWD. The proportion of all Drosophila captured that were SWD increased substantially for all lures tested, but selectivity was still the greatest with the Trécé lures. In general, the proportion of SWD was negatively related to the average numbers of SWD. Traps were deployed during the same two periods as the lure test (June and September). In the early deployment, the PBJ and Scentry traps captured the highest numbers of the SWD, the TrapView the lowest, and the others (Trappit Dome, AlphaScents sticky cards [white and yellow]) were intermediate. Selectivity was poor overall (<1% of all Drosophila captured were SWD), but best in the AlphaScents cards (≈0.6%). In the late deployment, the AlphaScents yellow card and the PBJ caught the highest numbers of SWD (77-82 flies/trap/week); the TrapView caught <3 flies/trap/week. The sex ratio for most traps at this time of year was about 50% female; however, the AlphaScents traps percentage of females was 16-21%. Females were also the most difficult to identify on these traps (males were easily identifiable because of the spots on their wings); and correct identification of the female required manipulating them on the sticky surface until the ovipositor could be seen. Traps and lures from AlphaScents, Scentry, and Trécé were tested in a 3x3 factorial design. The Scentry lure and the Scentry trap caught the greatest number of SWD regardless of which trap or lure they were paired with, and the same was true when the Scentry trap and lure were used in combination. The sex ratio of SWD on the AlphaScents trap was highly skewed toward males, but also had the best selectivity for SWD.

Insecticide Trial for Spotted Wing Drosophila in Sweet Cherries: 2014 and 2015

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

Keywords: Drosophila suzukii, Cyclaniliprole, Danitol, fenpropathrin, Delegate, spinetoram, Entrust, spinosad, Exirel, cyantraniliprole, PFR-97, Sevin, carbaryl, Dimilin, diflubenzuron, Double Take, diflubenzuron and lambda-cyhalothrin, Warrior II, lambda-cyhalothrin

Abstract: Treatments were applied with an airblast sprayer to mature 'Bing' cherry trees. Leaves and fruit were collected the following day and exposed to adult female spotted wing drosophila (SWD) in the laboratory. In 2014, all treatments except PFR-97 provided some level of control when SWD were exposed to treated leaves. The highest mortality occurred when SWD were exposed to fruit treated with Entrust and Delegate. All treatments except PFR-97 reduce oviposition relative to the control. In 2015 general, all treatments except Dimilin provided some level of control when SWD were exposed to treated leaves.

Chemical Control/New Products—

Moderator: Tim Ksander

Notes:

Chemical Control/New Products

Ambrosia Beetle (*Xylosandrus germanus*) Infestations and Management Trials in High-Density Apple Orchards

Arthur Agnello, Deborah Breth and John Vandenberg
Cornell University, Department of Entomology, NYS Agric. Expt. Station, Geneva, NY

Keywords: black stem borer, *Xylosandrus germanus*, apples, adult trapping, trunk sprays

Abstract: Black stem borer (BSB), *Xylosandrus germanus*, an ambrosia beetle established in the US for over 80 years, is causing increasing damage in NY and other northeastern states. Normally a pest of hardwood trees, BSB has been documented in dozens of NY apple orchards since 2013, causing tree death and decline in mostly young dwarf plantings of trees ranging from 5–25 cm in trunk diameter. Although these borers are known to attack physiologically stressed trees (e.g., from flood, drought, or cold injury) that are emitting ethanol volatiles, they also have been reported to attack apparently healthy trees. We used ethanol traps to document their occurrence and timing in over 50 NY orchards, and also tested different trunk insecticide sprays for BSB control in waterlogged potted apple trees placed in the orchard to stress them enough to produce ethanol. Trunk and tree damage was assessed among the different treatments; overall, there was a reduction in trunk infestation holes and galleries in the treated tress compared with untreated checks, but results were variable between the two commercial orchard sites. In one site, chlorpyrifos (Lorsban) handgun treatment resulted in lower damage than using the pyrethroids lambda-cyhalothrin (Warrior) or gamma-cyhalothrin (Declare). At the other site, all handgun treatments resulted in generally lower damage than in the checks, but there was no separation among the products tested.

Chemical Control/New Products

Managing the Vectors of Little Cherry Disease

Andrea Bixby Brosi and Elizabeth Beers
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Keywords: Little cherry disease, Little Cherry Virus, apple mealybug, *Phenacoccus aceris*, grape mealybug, *Pseudococcus maritime*, insect vector control, cherry

Abstract: Little cherry disease (LCD) is a serious viral disease of sweet cherry caused by three viral pathogens, Little Cherry Virus 2 (LChV2), Little Cherry Virus 1 (LChV1), and Western X phytoplasma. Trees with LCD produce cherries of small size and poor flavor making the fruit unmarketable and results in unpicked limbs/trees and tree/orchard removal. Little Cherry Virus 2 is transmitted via insect vectors, apple mealybug (AMB), *Phenacoccus aceris*, and, grape mealybug, *Pseudococcus maritimus.*

In 2014 and 2015, a large, naturally occurring AMB population was monitored weekly in a conventional apple orchard, at WSU's Sunrise orchard. During both growing seasons, a field experiment was conducted to determine the effects of chemical insecticides on AMB populations. Delayed dormant treatments included Lorsban+oil, Diazinon+oil, and oil targeting overwintering females. Lorsban+oil (2.0 ± 0.4 crawlers/leaf) was the only compound that had a significant lower crawler population compared to the check (15.2 ± 5.2 crawlers/leaf). Two systemic compounds, Ultor+oil (foliar) and Admire Pro (soil drench), were applied 14 d after petal fall, but seasonal crawler averages using these two treatments were similar to the control. Finally, we applied Admire Pro (foliar), Centaur, Diazinon, and Actara to target active crawlers on leaves. Trees treated with Diazinon (2.1 ± 0.5 crawlers/leaf) had significantly lower crawler numbers, while all other treatments targeting crawlers had crawler averages similar to the control. The experiment was repeated in 2015 with a few additional compounds. In 2015, delayed dormant applications of Lorsban+oil, (1.4 ± 0.1 crawlers/leaf) and Centaur+oil (1.0 ± 0.2 crawlers/leaf) did show some reduction in AMB population compared to the check (2.8 ± 0.75 crawlers/leaf). The addition of Centaur (insect growth regulator) to delayed dormant treatments was aimed to target molting female nymphs emerging during their second instar. Centaur showed promising results especially compared to Lorsban, the most effective treatment in 2014 and 2015. These results suggest that a delayed dormant spray in combination with a spray targeting the crawler stage will provide the best control of AMB.

In 2015, GMB was monitored weekly in a commercial 'Bing' orchard, located in E. Wenatchee, with a high density of GMB. A field experiment was conducted to determine the effects of chemical insecticides on GMB. Compounds applied at petal fall included Centaur, and systemic compounds, Ultor +oil, and Admire Pro (soil drench). Both systemic compounds showed a reduction in GMB populations (0.2 ± 0.05 and 0.1 ± 0.05 GMB/spur, respectively). Of the compounds targeting summer crawlers, Centaur (0.4 ± 0.14) had the lowest number of GMB/spur compared to the check (1.1 ± 0.43). This experimental site was discovered too late in the season to test compounds at delayed dormant. Results show that systemic treatments applied at petal fall had the most effect on GMB populations.

Chemical Control/New Products

Spray Coverage of Insecticides in Almonds – The Machine Might Matter

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

Abstract: The tolerance for navel orangeworm (NOW) damage in almonds continues to hover at about 1%. Crop values and acres planted are at all-time highs. Available registered insecticides for NOW target eggs and larvae, with the exception of the pyrethroid class. But that insecticide class is losing effectiveness due to resistance development. We suspected spray coverage as a limiting factor for ovi-larvicidal products because of the dense canopies relative to most other tree crops. In addition, the spatio-temporal pattern of nut susceptibility to NOW adds another layer of complexity when placing residues on the nuts. The reduction in damage typically observed in trials comparing these "reduced risk" products and programs is 30-50%. In a series of experiments from 2010 through 2014, we examined vertical distribution of coverage, residues and damage as a result of treating trees with various sprayers, speeds, and nozzling arrangements. We found that 50% overall coverage (mean of 5.3 µg/nut of chlorantraniliprole) was not surpassed. However, as much as 70% coverage (8.5 µg/nut) was achieved in the lower half of the tree with ground rigs using flat fan, full cone and hollow cone nozzles employing one or two manifold booms. In 2015, we compared engine driven and shaft driven (PTO) sprayers in the categories of coverage, residue deposition and NOW infestation levels at four levels in almond trees. These results will be compared to previous results and discussed in the context of reduced risk chemical applications.

Chemical Control/New Products

Control of Walnut Husk Fly in English Walnuts

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University of California, Cooperative Extension, Hollister, CA

Keywords: Walnut husk fly; *Rhagoletis completa*; Assail; acetamiprid; Cyclaniliprole; Intrepid Edge, a 1:2 mixture of 2.5 lb ai/gal methoxyfenozide and 0.5 lbs ai/gal spinetoram; Termitry, a mixture of 7.1 lb ai/gal malathion to 0.1068 lb ai/gal gamma-cyhalothrin; walnut, chemical control, insecticides

Abstract: A field trial was conducted to evaluate the efficacy of Assail, Cyclaniliprole, Intrepid Edge, Termitry and untreated check for control of walnut husk fly (WHF). The trial was conducted on mature walnut trees near Hollister, CA. Eight treatments were replicated four times in an RCB design. Adult WHF population was monitored in two locations in the orchard with Alpha Scents WHF traps and ammonia carbonate lures. The traps were monitored weekly. The traps and lures were replaced weekly. Treatments were applied 3 Jul, one week after substantial fly captures in the adult traps, and at 3-week intervals on 28 Jul and 12 Aug. Foliar sprays were applied with a handgun orchard sprayer operating at 250 psi with a finished spray volume of approximately 300 gal/acre. The WHF damage was evaluated mid-season on 6 Aug by visually inspecting 100 nuts per replicate for stings, larvae and exits. The nuts were not removed from the trees. Prior to anticipated harvest, WHF damage was evaluated on 9 Sep by inspecting 100 nuts per replicate. The nuts were removed from the trees and dissected to determine the number of stings, larvae and exits. The mid-season inspection showed no significant difference in the percent stings, larvae, exits or total infested nuts in any experimental treatment as compared to the untreated check. The harvest evaluation showed that there was a significantly lower infestation in all experimental treatments compared to the untreated check with excellent control with Assail, the middle and high rate of Termitry and moderate control with Intrepid Edge and the low rate of Termitry. All treatments included NuLure and Latron B-1956.

Chemical Control/New Products

Ovicidal and Larvicidal Activity of Three Neonicotinoids on Walnut Husk Fly

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Keywords: Rhagoletis completa, walnut husk fly, Assail 30SG, acetamiprid, Admire Pro, imidacloprid, Belay 2.13SC, clothianidin, *Juglans regia,* English walnut, insecticide, infestation, chemical control

Abstract: Two replicated laboratory studies were conducted to determine the susceptibility of walnut husk fly eggs and larvae in walnuts to three registered neonicotinoids. Untreated walnuts were collected from Davis, CA and returned to the lab in Berkeley, CA. Each nut had two inches of stem left intact and was submerged into a flask containing sugar/water solution to maintain turgor pressure. The walnuts were then exposed to gravid walnut husk flies and removed when two or more stings were observed. Solutions of the maximum field rate of Assail 30SG, Belay 2.13SC, Admire Pro diluted to 100 gallon per acre, and an untreated check were prepared, all containing 0.125% v/v methylated seed oil. For the ovicidal trial, 20 stung walnuts per treatment were held for 24 h then dipped into these solutions. For the larvacidal trial, 17 stung walnuts per treatment were held for 7-10 days until larval feeding was observed, and then dipped into the experimental solutions. For both trials, walnuts were held at 23 °C for 10 d after treatment, then dissected to determine if living larvae were present. All materials demonstrated significantly increased egg mortality versus the untreated check, with Admire Pro exhibiting significantly higher egg mortality than Assail 30SG and Belay exhibiting intermediate results. No material exhibited any control of larvae.

Chemical Control/New Products

Life Cycle and Management of Walnut Scale (*Quadraspidiotus juglansregiae*) in English Walnuts

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Keywords: Assail, acetamiprid, Bridagier, bifenthrin, imidacloprid, Centaur, buprofezin, Movento, spirotetramat, Seize, pyriproxyfen, Sequoia, sulfoxaflor, Sivanto, flupyradifurone, phenology, Botryosphaeria

Abstract: Scale infestation has increased in commercial California walnut orchards in recent years, and the reported association of scale pests with *Botryosphaeria* (Bot) infection has led to greater focus on scale pest management. Minimal research has been conducted on walnut scale (*Quadraspidiotus juglansregiae*) in the past, as parasitoids have historically kept scale populations below economically damaging levels. However, given the threat of Bot to the walnut industry, treatments for walnut scale are increasingly common. The life cycle of walnut scale was examined in 2015 in nine orchards across six California counties. The current study supported previous research indicating that walnut scale has two generations per year based on two distinct crawler activity periods evident in all locations. The efficacy of various materials and application timings were tested against walnut scale populations infesting commercial walnut orchards in Yuba County, California between beginning in 2014. Treatments included delayed dormant applications of Centaur 70WDG and Seize 35WP, and crawler applications of Assail 30SG (high and low rate), Brigadier 2EC, Centaur 70WDG, Movento 2SC, and Sequoia 2SC. In spring 2014, Centaur 70WDG applied at the delayed dormant timing provided best control of walnut scale crawler populations directly after application. Follow-up evaluations in winter 2015 indicated that delayed dormant applications of Centaur 70WDG and Seize 35WP, and crawler applications of Movento 2SC, Brigadier 2EC, and Centaur 70WDG all had significantly lower live walnut scale than the untreated check. In the final evaluation of the spring 2014 applications, all experimental treatments except Sequoia 2SC had significantly fewer walnut scale crawlers in spring 2015 than the untreated check.

Chemical Control/New Products

Insecticide Evaluations for Control of Codling Moth in Walnut

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Keywords: Cydia pomonella, codling moth, *Amyelois transitella*, navel orangeworm, walnut, *Chromaphis juglanicola*, walnut aphid, *Trioxys pallidus*, walnut aphid parasitoid, *Tetranychus urticae*, twospotted spider mite, *Eotetranychus willamettei*, Willamette spider mite, *Galendromus occidentalis*, western predatory mite, chemical control, insecticide, infestation, Dimilin 2L, diflubenzuron, Double Take, Warrior II, lambda-cyhalothrin, Assail 30SG, acetamiprid, Exirel 0.83SE, cyantraniliprole, Delegate 25WG, spinetoram, Altacor 35WDG, chlorantraniliprole, Voliam Xpress, Proclaim 5SG, emamectin benzoate

Abstract: A study was conducted in a commercial walnut orchard near Tracy, CA for control of codling moth (CM). Twelve treatments were replicated four times in an RCB design. Each replicate was an individual tree. The CM adult population was monitored weekly from 17 Mar through 20 Jul by placing two pheromone traps high in the tree canopy. The CM-infested dropped nuts were monitored weekly from 7 May through 22 Jun. Aphid infestation was determined by inspecting 5 terminal leaflets per replicate weekly from 9 Jun through 8 Jul. Mites were evaluated weekly by sampling 10 leaflets per replicate weekly from 30 Jun through 21 Jul. The CM and navel orangeworm infestation was determined based on 125 nuts per replicate at commercial harvest on 20 Sep. There were no significant differences among treatments in the mean number of mites. Treatments including Dimilin 2L displayed elevated walnut aphid and walnut aphid parasitoid populations compared to the untreated check. Assail 30SG followed by Delegate 25WG and the untreated check had significantly higher cumulative dropped nuts than all other treatments. At harvest, Dimilin 2L followed by Double Take, Dimilin 2L followed by Warrior II, Double Take, Altacor 35WDG, and Assail 30SG followed by Delegate 25WG did not provide significant CM or navel orangeworm control compared to an untreated check.

Chemical Control/New Products

Evaluation of a Novel Attract-and-Kill Device for Critical Insect Pests of Fruit

Juan Huang, Larry Gut, Tony Lienert, Michael Mueller, and Matthew Grieshop
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Keywords: sex pheromone, deltamethrin, forced contact, wind tunnel, codling moth, oriental fruit moth, obliquebanded leafroller, Japanese beetle, spotted wing drosophila

Abstract: Fruit crops are important to the United States economy, generating billions of dollars each year. Pest management is consistently listed as a prime concern for growers, and insecticides alone can account for as much as 13% of yearly production expenses. Insect pest management in U.S. fruit production systems has faced unprecedented challenges such as: the loss of insecticides through revised EPA regulations, rapid development of pest resistance to key insecticides, increasing public concerns about negative impacts associated with insecticides, the promulgation of international Maximum Residue Limits, and an influx of invasive insect pests. Attract-and-kill tactics are behaviorally mediated pest management approaches that can provide an alternative to broadly applied insecticide sprays for tree fruit insect pests. This technology bridges the insect control tactics of insecticides and mating disruption by employing sex pheromones or other attractants to lure insect pests to a killing device, typically consisting of either a sticky trap or a contact active insecticide. Attract and kill tactics provide high pest selectivity, low rates of active ingredients, reduced selection pressure, and do not contribute to insecticide residues on fruit. Our research team has developed a simple, inexpensive, and long lasting attract-and-kill device—a fabric device treated with deltamethrin and containing semiochemical attractants inside. This device provides a large insecticide treated surface for insects to interact with. We evaluated this new device for its effectiveness of control of oriental fruit moth, codling moth, obliquebanded leafroller, and Japanese beetle. Its potential application to spotted wind drosophila and brown marmorated stink bug will be discussed.

Insecticide and Miticide Evaluations on Pear in Southern Oregon

Richard J. Hilton
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Keywords: bifenazate, codling moth, cyclaniliprole, *Cydia pomonella*, cyflumetofen, diflubenzuron, lambda-cyhalothrin, *Tetranychus urticae*, twospotted spider mite

Abstract: A number of insecticides were evaluated for control of codling moth in Bartlett pear: cyclaniliprole (a new anthranilic diamide), diflubenzuron (Dimilin), lambda-cyhalothrin (Warrior II), and a combination of diflubenzuron and lambda-cyhalothrin (DoubleTake). With the exception of diflubenzuron, the materials tested provided a high level of codling moth control equivalent to industry standards. The activity of the combination product, DoubleTake, on codling moth was not significantly different from the pyrethroid component alone.

Bifenazate (Acramite) and cyflumetofen (Nealta) were tested against a high population of twospotted spider mite in Red Anjou pears. Both products significantly reduced the levels of twospotted spider mite but bifenazate was more effective than cyflumetofen in this study. Additionally, two sprayer setups were compared in the miticide test, both delivering a spray gallonage of 99 gpa but in one case the tractor speed was 1.5 mph and in the other the speed was 2.7 mph. No difference in the level of mite control between the two sprayer setups was observed.

Chemical Control/New Products

Pacific Flatheaded Borer in Young Apple Trees in the Southern Interior of British Columbia

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Ministry of Agriculture, British Columbia, Canada

Keywords: Pacific flatheaded borer, *Chrysobothris mali*, apple, surveillance

Abstract: The Pacific flatheaded borer, *Chrysobothris mali* Horn (Coleoptera: Buprestidae), is not normally a pest of fruit trees in the Southern interior of British Columbia (B.C.). Stem damage, frass and yellowed growth in a block of 1- to 2-year-old apple trees in Kelowna, B.C., was reported by a grower in July 2015. DNA analysis (barcode sequencing by Dr. Robert Foottit, Agriculture and Agri-Food Canada, Ottawa, Ontario) of extricated larvae turned out to be that of *C. mali*. Follow-up surveys of young apple plantings and nurseries in the Okanagan and Similkameen Valleys were conducted during July - October, 2015. *C. mali* larvae were detected at low infestation levels in 15 of the 19 survey sites. The Pacific flatheaded borer normally attacks weakened or injured trees. Newly planted and grafted trees are particularly susceptible because of the stress caused by grafting and the possibility of sunburn on the bark and at the bud union. Pest presence and damage in 2015 was likely related to record breaking temperature and drought conditions experienced throughout the Pacific Northwest. Incidence of this pest in B.C. was last reported in 2003, a previous record breaking weather year. Further surveys and adult trapping are planned for 2016.

Biology/Phenology—

Moderator: Mike Devencenzi

Notes:

Biology/Phenology

Development of Stable Isotopes and new Biochemical Tools for Identification of Sterile Insects and Determination of Pest Origin

Gregory Simmons[1], Rebecca Hood-Nowotny[2], Goggy Davidowitz[3], Heather Costa[3], Brittany Munoz[1] and Tom Greene[1]

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Keywords: Stable isotopes, fatty acid signature analysis, insect marking techniques, regulatory entomology, pest detection, biosurveillance, pest provenance, sterile insect technique

Abstract: More robust and reliable identification tools for the Animal and Plant Health Inspection Service-Plant Protection and Quarantine (APHIS-PPQ) Sterile Insect Technology (SIT) programs are needed because mistaking sterile released insects for wild-target pests can trigger costly response measures or delay eradication declarations in programs that use SIT as a primary control measure. New isotopic and fatty acid analysis methods can be used to provide more reliable markers in SIT programs and can also be used to determine location of origin (local vs. foreign) for new pest detections and to determine host plant origin in cases where an invasive plant pest may be using multiple hosts.

Transfer of the well-established and documented stable isotope technology to make it an operational tool will provide immediate benefits to APHIS-PPQ's fruit fly and pink bollworm sterile insect release programs.

Biology/Phenology

Life History of *Rhagoletis pomonella* (Diptera: Tephritidae) in Western Washington: Repeated Ecological Speciation?

Monte Mattsson[1], Glen Hood[2] and Jeffrey Feder[2]
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Keywords: Adaptive radiation, allochronic speciation, apple maggot, degree day model, diapause, eclosion, phenology, reproductive isolation

Abstract: The apple maggot, *Rhagoletis pomonella* (Diptera: Tephritidae), is a host-specialist fruit fly endemic to the eastern United States known for its propensity to form host races in sympatry. The fly was introduced to the Pacific Northwestern United States <65 years ago via larval-infested apples. There, its host range expanded from apple (*Malus domestica*) to early-fruiting native black hawthorn (*Crataegus douglasii*), and late-fruiting, introduced ornamental hawthorn (*C. monogyna*). In the field, we recently found seasonal distributions of *R. pomonella* populations are offset: eclosion times mirror host fruits' ripening, despite spatial overlap among host species. Thus, adaptive shifts in diapause timing appeared rapidly, repeating patterns observed in eastern populations. It is not known if divergent phenologies among populations are maintained by environmental or genetic mechanisms in western Washington. We manipulated the pre-winter (= pre-diapause) environment under standardized laboratory conditions to test two hypotheses: (1) pre-winter thermal accumulation modulates post-winter eclosion timing and (2) mortality increases when pre-winters are longer or shorter than host-specific intervals in nature. Pupae were subjected to 15, 30, 45, or 60 days of 22 °C "pre-winter" followed by 25-weeks of 5 °C "winter". Mean days to eclosion were unaffected by pre-winter treatments and appear to have a genetic basis, remaining fixed within all host populations (45.3, 49.2, 54.1, and 64.8 for black hawthorn-, early-apple-, late-apple-, and ornamental hawthorn-associated flies, respectively). If heritable, divergent eclosion phenologies might lead to reproductive isolation and potentially cladogenesis. Mortality rates were also unaffected by treatments, though consistently lower for hawthorn-origin (~32%) than apple-origin (~50%) flies. Local hawthorn hosts may engender greater survivorship than apple hosts.

Biology/Phenology

Influence of Temperature, Humidity and Photoperiod on Western Cherry Fruit Fly Diapause and Metabolism

Lisa G. Neven
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Keywords: Rhagoletis indifferens, diapause, metabolism, quarantine pest

Abstract: The ability of an insect to establish and spread in a new environment is dependent on a number of biotic and abiotic factors. Climate and photoperiod are among the most important abiotic factors that may affect invasive pest species establishment. Much work has been published on the ability of tropical and sub-tropical Tephritid fruit flies to establish and spread in new locations around the world. However, little is known of the invasive potential of temperate fruit flies, specifically species within the genus *Rhagoletis*. The most important difference of the life cycle of temperate *Rhagoletis* species as opposed to tropical fruit flies is the ability and/or necessity to diapause. As part of a five year study to determine the invasive potential of western cherry fruit fly, *Rhagoletis indifferens* (Curan) to countries importing sweet cherries from the Pacific Northwest, we studied the influence of chilling duration, rearing temperature, and humidity on diapausing pupae. We measured whole body supercooling points, post-diapause emergence, metabolic heat rates, lipid, carbohydrate, and protein content over the span of 18 months post-pupation. We also measured metabolic heat rate in relation to temperature in adult flies from 1 to 28 d in age. We found that for diapausing pupae photoperiod, rearing temperature, and relative humidity are less important than the duration of chilling in respect to post-diapause emergence numbers and synchronization. We also found that pupae maintain a low metabolic hear rate until a few days before adult emergence. Adult flies exhibit a contraction of optimal thermal tolerance as a function of age. We will discuss the relationship of these results with previous studies and field observations.

Diel Flight Periodicity of the Peach Twig Borer in California Almonds

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Keywords: peach twig borer, diel periodicity, almond, *Anarsia lineatella, PTB*

Abstract: The peach twig borer (PTB), *Anarsia lineatella* is a key pest of California almonds, especially in the northern section of the state. In order to better understand peak mating times, automated traps were constructed to determine season-long trap captures organized by the hour of the day. Six of these traps were placed in almond orchards near Durham, California on 3 Apr, 2014 and checked daily until 31 Jul, 2014. A temperature logger was also installed at each trap location. 68.2% of the total trap captures were recorded between 2400 hours and 0600 hours. Peak trap captures in April occurred at 0100 hours, while peak trap captures in July occurred at 0400 hours. 91% of all moths trapped were caught when temperatures were between 11.7 °C and 25.6 °C. Recent improvements in mating disruption technology have led to the ability to release pheromone via aerosol dispensers during specific times and temperatures. These results provide a starting point to manipulating the time and temperature programming of aerosol emitters for PTB mating disruption.

Mating Disruption/SIR—

Moderator: Alan Knight

Notes:

Mating Disruption/SIR

Love at First Sniff: Harry Shorey and the Dawn of the Age of Pheromones

Tom Baker
Distinguished Professor of Entomology and Chemical Ecology, Penn State University

Keywords: pheromone, mating disruption, integrated pest management, gypsy moth, pink bollworm

Abstract: The presentation will focus on Dr. Harry Shorey, a pioneer of sex pheromone research and applications. Dr. Shorey's discovery of mating disruption was an important contribution to integrated pest management and environmental protection. His research led to the use of synthetic pheromones for reducing the damage caused by many destructive moth species in North America, particularly the gypsy moth and the pink bollworm.

Aerosol Mating Disruption for the Navel Orangeworm: Characterization and Optimization

Charles S. Burks[1], Donald Thomson[2], and Jack Jenkins[3]
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[2]Pacific Biocontrol Corporation, Seattle, WA;
[3]Pacific Biocontrol Corporation, Litchfield Park, AZ

Keywords: navel orangeworm, mating disruption, almonds, pistachios, mode of action

Abstract: The navel orangeworm *Amyelois transitella* (Walker) (Lepidoptera: Pyralidae) is the principal insect pest of almonds and pistachios in California, and an important pest of walnuts and figs. Currently, control of this pest by mating disruption is accomplished with a timed aerosol mega-dispenser, using a single, non-attractive component of the sex pheromone. Discussion will be presented of experiments and data that relate field observations with predictions from the current theoretical framework, and seek to increase cost-effectiveness of aerosol mating disruption for this pest.

A New Sprayable Product for Mating Disruption of Codling Moth

Alan. L. Knight
USDA-ARS, Yakima Agricultural Research Laboratory, Wapato, WA

Keywords: *Cydia pomonella*, codling moth, sex pheromone

Abstract: Apple and pear growers have adopted the use of sex pheromones for mating disruption of their key pest, codling moth, *Cydia pomonella*. Hand-applied dispensers and aerosol units are the two most widely-adopted technologies. Research has continued to develop new improved technologies, including combined applications of sex pheromone and pear ester. Now, a new sprayable formulation for codling moth has been developed that follows the successful development of the microencapsulated pear ester product, DA-MEC by Trécé Inc. Studies conducted in 2015 found that the efficacy of this new formulation for codling moth compared with the one existing sprayable product is significantly longer-lasting under field conditions and under overhead watering for sunburn protection. The efficacy of this new product when applied with pear ester was demonstrated to be comparable to sex pheromone dispensers in a small field trial.

Mating Disruption /SIR

Mating Disruption for Leafrollers

Alan. L. Knight
USDA-ARS Yakima Agricultural Research Laboratory, Wapato, WA

Keywords: Obliquebanded leafroller, sex pheromones, Meso dispensers

Abstract: Apple and pear growers have adopted the use of sex pheromones for mating disruption of their key pest, codling moth, *Cydia pomonella*. Technology has evolved to the use of fewer dispensers and the development of Meso dispensers that are applied at a 10% rate. The addition of pear ester in these dispensers (Cidetrak) have been shown to be effective and further reduce female mating compared with dispensers loaded only with sex pheromone. The tortricid leafrollers, *Choristoneura rosaceana* and *Pandemi*s spp. have remained a problem in some orchards, especially under certified-organic management practices. Research conducted in 2015 evaluated both standard and Meso dispensers loaded with codlemone and pear ester plus the sex pheromone for leafrollers. Disruption of moth catches were nearly 100% in orchard blocks treated with these two types of dispensers. The possibility of using Meso dispensers for both codling moth and leafrollers is an exciting development. Further testing will be conducted during 2016.

A "Mass Trapping" Approach To Protecting Apples against Codling Moth

Peter Landolt
USDA, ARS, Yakima Agricultural Research Laboratory, Wapato, WA

Keywords: Codling moth, *Laspeyresia pomonella*, apple, pear, attractant, mass trapping, attract-and-kill.

Abstract: A three-chemical lure for male and female codling moth (CM) was used as a bait in sticky traps for reducing CM populations and larval infestation levels in plots of commercial apple orchards. Orchards were selected based on heavy CM populations. Three pairs of treated versus control plots were compared, with 50 traps per acre in treated plots for 30 days during the height of the moth flight. Apples were surveyed for CM damage to determine differences between the plots, and in all three cases, control plots suffered higher damage levels than treated plots.

Mating Disruption/SIR

Trial by Fire: Commercialization of Filbertworm Mating Disruption in a High Pressure Year

Betsey Miller and Vaughn Walton
Oregon State University, Horticulture Department, Corvallis, OR

Keywords: Mating disruption, filbertworm, *Cydia latiferreana*, hazelnut, filbert, pheromone

Abstract: Pheromone dispensers for mating disruption (MD) of filbertworm (FBW) became available as a commercial product for hazelnut growers in 2015. We evaluated MD as an effective strategy for the fourth consecutive growing season, and began evaluation of intensive monitoring (IM) as a low-cost alternative to MD. The 2015 trial was expanded to include 1,200 acres and an additional growing region. Due, in part, to optimal environmental conditions, FBW populations were earlier and greater than usual in all areas under study. The majority of growers involved in the trial applied chemical insecticides in addition to the pheromone treatment. At harvest, mean percent infestation of nuts by FBW in control, MD and IM plots was 0.0, 0.48 and 0.50, respectively. Despite the application of insecticides in MD and IM plots, the number of acres sprayed was reduced by 50 to 81%, compared with control plots. We will discuss results of the 2015 trial season and implications for the future of MD in hazelnuts.

Development of Mass Rearing Methods for Release of Sterile Navel Orangeworm over Pistachio Orchards

Michelle Walters for the Mass Rearing Team
USDA APHIS, Plant Protection and Quarantine, Phoenix, AZ

Keywords: Amyelois transitella, pistachio, almond, walnut, sterile insect release, mass rearing, artificial diet

Abstract: The mass rearing facility for pink bollworm is now modifying its methods to rear navel orangeworm. The goal is to rear millions per day, sexually sterilize them with Cobalt 60 radiation and release them over pistachio orchards. The sterile moths (male and female) will mate with wild moths and produce no offspring. This will reduce damage to the crop and reduce the next generation of moths.

Mating Disruption/SIR

Mating Disruption for the 21st Century: Matching Technology with Mechanism

Larry Gut and James R. Miller
Michigan State University, East Lansing, MI

Keywords: mating disruption, competitive, non-competitive, pheromone, dose-response

Abstract: Improvements in the efficacy and economics of mating disruption are possible and will be catalyzed by: 1) progress toward differentiating among mating disruption mechanisms and identification of the causal actions of given products and 2) understanding how to deliver the optimal dose of pheromone to effect the identified critical action while minimizing costs of disruption products and labor for application. We offer a dichotomous key for eight distinct categories of mating disruption and detail criteria and methodologies for differentiating among them. Mechanisms of mating disruption fall into two major categories – competitive and non-competitive. Under competitive disruption, no impairments are experienced by males, females, or the signal of females. Therefore, males can respond to females and traps. Competitive disruption is entirely a numbers game where the ratio of dispensers to females and traps is highly consequential and renders the control pest-density-dependent. Under non-competitive disruption, males, females, or the signal from females are already impaired when sexual activity commences. The control achieved non-competitively offers the advantage of being pest-density-independent. Mating disruption products of the 21st century must be characterized as to whether they operate competitively or non-competitively. The best way to do so is via dosage-response profiles. Key traits of purely competitive disruption are smoothly concave profiles when untransformed capture data are plotted against density of dispensers and a straight line with negative slope when catch is plotted against dispenser density * catch. Key traits of purely non-competitive disruption profiles include an initial linear disruption profile on untransformed axes and a re-curving complex plot. Hybrid profiles are possible when some males begin the activity period already incapacitated, while those not pre-exposed are able to respond to traps or pheromone dispensers. Examples of disruption within the two categories and suggested tactics for differentiating among them are offered through analysis of the disruption of important pests using various formulations. Once the principal and contributory causes of disruption are understood, different paths present themselves with respect to optimizing: 1) loads of pheromone in the formulation and release rates, 2) dispenser spacing in the field, and 3) costs of the product and its application.

Implementation—

Moderator: Glenn Thayer

Notes:

Implementation

Management of Apple Maggot Pupae in Solid Organic Yard Waste

Wee L. Yee and Peter S. Chapman
USDA-ARS, Yakima Agricultural Research Laboratory, Wapato, WA

Keywords: Apple maggot fly, *Rhagoletis pomonella*, compost, heat, moisture, oxygen levels, organic waste, apple industry, compost industry, regulations

Abstract: The effectiveness of using tarps placed over piles of ground organic yard waste on killing pupae of apple maggot fly at various depths was tested from October to November 2015. Pupae were placed on the surface and 2 and 18 in. below the surface of 30 yd^3 piles. Tarps were then placed over the piles, and pupal mortality evaluated at 3 and 7 d. After 7 d, all pupae at 18 in. were killed, but kill of pupae at the surface and 2 in. varied depending on the test.

Thresholds/Monitoring—

Moderator: Glenn Thayer

Notes:

Thresholds/Monitoring

Interpreting Catch of Codling Moth (*Cydia pomonella*) in Sex Pheromone Baited Monitoring Traps

Christopher G. Adams, Larry J. Gut, Jeffery H. Schenker, Jim R. Miller
Michigan State University, East Lansing, MI

Keywords: Codling moth, *Cydia pomonella,* monitoring, population estimation, trapping area, plume reach, T_{fer}

Abstract: Codling moth, *Cydia pomonella* (CM), is a key pest of apple in Michigan and around the world. Management decisions are made using catch data from sex pheromone-baited monitoring traps. Because absolute pest density in not known, these decisions are made based on relative population numbers. More accurate measures of pest density per unit area can equate to more precise management decisions. Three years of field data, recently published in a Springer Brief book, are presented that validate novel methods of data interpretations for trapping. Using a central-trap-multiple-release experimental design, it is possible to quantify; 1) the trap findability (T_{fer}), 2) the dispersive distance for a population of insects, 3) the plume reach, and 4) trapping area. For codling moth responding to a phercon CM L2 baited Delta trap in MI the T_{fer} was .01, the dispersive distance was 260 m, the plume reach was 2 m, and the trapping area was 53 acres.

Long-Line Trapping of Codling Moth: A Novel Approach to Increasing the Precision of Insect Captures is Monitoring Traps

James Miller, Christopher Adams, Peter McGhee and Larry Gut,
Michigan State University, East Lansing, MI

Keywords: codling moth, *Cydia pomonella*, monitoring, plume reach, trapping radius

Abstract: Monitoring traps baited with sex pheromones play a critical role in revealing where and when codling moth adults are active. However, translating the number of moths captured in a monitoring trap into an accurate estimate of the actual pest density in an orchard has remained elusive. Rather, pest managers rely on relative action-thresholds developed from years of experience keeping careful track of trapping results, pest management programs and injury records. Unfortunately, growers are often reluctant to risk withholding a spray until a threshold is reached, due to a general lack of confidence in moth captures as an accurate measure of pest pressure. Recognizing the inherent weakness of using a single trap for codling moth (CM) pest management decisions while seeking to minimize the time and labor required to visit multiple traps distributed throughout a large apple block, we conducted field experiments to quantify the benefits of a novel approach to monitoring that we have termed long-line trapping. The approach entails deploying 5 standard CM traps on 5 adjacent trees at the center of a large (25-40 acre) orchard block. By so doing the total plume generated by the 5 traps will be substantially increased, as will the sampling power of the trapping system. Field experiments directly comparing the precision of a single trap versus long-line trapping for codling moth revealed that mean catch in a long-line of 5 traps was very similar to that for a single trap. Furthermore, variation in mean catch in the long-line was substantially reduced over that for a single trap. We conclude that long-line trapping will substantially increase the resolution of inferences about actual population density and allow growers to confidently make spray decisions, while the time required to service a 5-trap station will increase only slightly over a 1-trap station.

Thresholds/Monitoring

Developing Practical Use of Phenyl Propionate (PPO) for Monitoring Navel Orangeworm Mating Disruption in the Presence of Mating Disruption

Charles S. Burks
USDA ARS, San Joaquin Valley Agricultural Sciences Center, Parlier, CA

Keywords: navel orangeworm, monitoring, mating disruption, almond, pistachio, kairomone

Abstract: Previous experiments demonstrated that phenyl propionate (PPO) can detect navel orangeworm males and females under mating disruption treatments that suppress pheromone traps, and that pheromone lures also synergize the response to PPO in the presence of mating disruption. The present study examined release devices, age effects, and the effect of mating disruption intensity on adults captured. The previously-used vials and a new, more convenient dispenser system were both efficacious for at least six weeks. In the presence of mating disruption, pheromone/PPO combination lures attracted more adults while PPO by itself showed more consistency across various levels of mating disruption intensity, as well as less variability within these levels. These finding will facilitate practical use of PPO for monitoring navel orangeworm.

Factors Affecting Effectiveness of Commercial Pheromone Lures for Monitoring Navel Orangeworm

Charles S. Burks[1], Cristofer Wilk[2], and Bradley S. Higbee[3]
[1]USDA ARS, San Joaquin Valley Agricultural Sciences Center, Parlier, CA

[2]Scientific Methods Inc., Durham, CA; [3]Wonderful Orchards, Shafter, CA

Keywords: navel orangeworm, monitoring, pheromone lure, almond, pistachio

Abstract: Pest control managers now have several models of synthetic pheromone lures for navel orangeworm from which to choose; experiments were therefore performed in 2015 examining comparative performance of these lures. These experiments demonstrated effects on lure attractiveness due to the model, the time in end-user storage, and the crop in which the lure was used. Comparison of traps baited with synthetic pheromone and traps baited with unmated females indicates seasonal failure to detect males in pheromone traps in pistachios, but not in almonds. Pest managers should be away of the potential for crop type to affect trap captures, and future research should examine different pheromone lure formulations and or different combinations of attractants in order to better detect changes in navel orangeworm population throughout the season in pistachio blocks.

Biological Control—

Moderator: Betsy Beers

Notes:

Biological Control

Efficacy and Non-Target Effects of Net Enclosures in Apple Orchards

Adrian Marshall and Elizabeth Beers
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: Cage exclusion, biological control, brown marmorated stink bug, *Halyomorpha halys*, consperse stink bug, *Euchistus conspersus*, woolly apple aphid, *Eriosoma lanigerum*, *Aphelinus mali*, parasitoid, lacewings spider mites, Tetranychidae, predatory mites, Phytoseiidae

Abstract: Building shade netting structures over Washington orchards has become increasingly popular as a method to reduce sun damage to fruit. If netting material is used to enclose the orchard, it can be used to exclude larger arthropod pests such as brown marmorated stink bug, *Halyomorpha halys*. However, exclusion cages may exclude both pests and natural enemies, disrupting biological control in the case of the latter. We used the native consperse stink bug, *Euchistus conspersus*, as a surrogate for the exotic pest, *H. halys,* to test the hypothesis that net cages would exclude/prevent damage by stink bugs. Preliminary experiments were unsuccessful in that no damage occurred in either the caged or uncaged trees, despite the release of captured stink bugs in close proximity to the plots. We also studied the non-target effects of the cages on secondary pests and natural enemies. Woolly apple aphid densities were significantly higher (≈73×) in the caged plots, although no treatment differences in density of the parasitoid *Aphelinus mali* were noted. Earwigs, an important aphid predator, were significantly higher in caged plots, whereas lacewings caught in plant-volatile baited Delta traps were ≈85× higher in uncaged plots. Spider mites were significantly higher, and predatory mites significantly lower, in the caged plots. The hypothesis that only larger, winged predators would be excluded by the nets was only partially supported by these results.

Discovery of an Exotic Egg Parasitoid of the Brown Marmorated Stink Bug and Its Potential for Biocontrol in Washington State

Joshua Milnes and Elizabeth Beers
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: *Halyomorpha halys*, brown marmorated stink bug, *Trissolcus japonicus*, egg parasitoid, biocontrol

Abstract: Trissolcus japonicus (Ashmead) is widely distributed throughout Eastern Asia and is the primary egg parasitoid of the brown marmorated stink bug, *Halyomorpha halys* (Stål) (BMSB). Typically, BMSB will lay their eggs on the underside of leaves, deposited in masses averaging ≈28 eggs. *T. japonicus* attacks and emerges successfully from 90-100% of the BMSB eggs, a much higher rate than native Nearctic parasitoids. *T. japonicus* has been under investigation in quarantine facilities in the Unites States as a potential biocontrol agent since 2007 in order to evaluate its efficacy and non-target effects on native stink bugs. The first discoveries of *T. japonicus* in the wild in the U.S. occurred in 2014 and 2015 in Maryland and Virginia. In fall of 2015, *T. japonicus* was discovered in the wild in Vancouver, Washington near the Columbia River as part of a parasitoid survey, ca. 2,300 miles from the mid-Atlantic finds. *T. japonicus* was collected from a BMSB egg mass on the underside of a vine maple leaf, and the species verified by the Smithsonian Institution National Museum of Natural History by E. Talamas. Plans for future research include a more extensive survey for this parasitoid, and mass rearing and release in areas affected by BMSB.

Poster Session

Notes:

POSTER
Chemical Control/New Products

Minecto™ Pro: A New Insecticide for Control of Pear Psylla

Joshua Adkins, Jess Holcomb, John Koenig, Elijah Meck
Syngenta Crop Protection, LLC

Keywords: pear psylla, cyantraniliprole, abamectin, chemical control, diamide, pome fruit, Minecto Pro, insecticide

Abstract: Minecto Pro is a broad-spectrum insecticide currently under development, which contains cyantraniliprole (a second generation diamide) and abamectin. Foliar applications will be positioned to control a wide range of lepidopteran pests as well as difficult to control sucking pests such as psylla, mites, whiteflies, leafminers, and thrips. Minecto Pro is targeted for registration in citrus, pome fruit, stone fruit, tree nuts, vegetables, potatoes, and onions. Trials were conducted in 2015 to evaluate Minecto Pro for control of pear psylla in Hood River, Oregon and Wapato, Washington. Two applications of Minecto Pro applied at 97, 122, and 146 grams active ingredient per hectare (ga/ha) provided excellent control of pear psylla at both locations. At 5 d after the second application in Hood River, Minecto Pro applied at 146 ga/ha resulted in an average of 1.0 pear psylla nymphs per leaf compared to 8.3 in the untreated control. At 7 d after the first application in Wapato, Minecto Pro applied at 146 ga/ha resulted in an average of 1.1 pear psylla nymphs per leaf compared to 9.6 in the untreated control. Mites and codling moth will be among the other primary pests of pome fruit controlled by Minecto Pro. Submission of the Minecto Pro registration package to the EPA is anticipated by the end of 2015.

POSTER
Thresholds/Monitoring

Kairomones for Monitoring and Control of Native and Invasive Tortricid Pests

Ashraf El-Sayed[1], Alan. L. Knight[2], Gary Judd[3], and Esteban Basoalto[4]
[1] NZ Institute Plant and Food Research, Agriculture & Science Centre, Auckland, NZ
[2] USDA ARS Yakima Agricultural Research Laboratory, Wapato, WA
[3] Agriculture and Agri-Food Canada, Summerland, BC
[4] Instituto de Producción y Sanidad Vegetal, Universidad Austral de Chile

Keywords: Pandemis, Eyespotted budmoth, obliquebanded leafroller

Abstract: New plant-derived compounds have been identified that are highly attractive to the suite of leafrollers and eyespotted budmoth that are pests of fruit crops in North America. The lures catch both sexes of moths and appear to have the potential to be used in mass trapping efforts. Studies conducted in 2015 evaluated lures for three species including *Pandemis pyrusana*, *Choristoneura rosaceana*, and *Spilonota ocellana*. The new lure catches both sexes and outperformed the sex pheromone lure for *Pandemis* and caught nearly 30% as many total moths as the sex pheromone lures for the latter two species. Also, in orchards treated with sex pheromones for the latter two species the new lures were effective in tracking both the phenology and population density of these pests. In comparison, traps baited with sex pheromone lures caught almost no moths. Research is continuing on the use of these lures for monitoring and mass trapping for the next two years. Tortricid pests of crops other than tree fruits should be evaluated.

POSTER
Biology/Phenology

Survey of Leafroller Species in Utah Orchards

Marion Murray and Diane Alston
Utah State University, Logan, UT

Keywords: obliquebanded, fruittree, European, pandemis, omnivorous, leafroller, survey

Abstract: A survey for five leafroller species (Lepidoptera: Tortricidae) of economic importance in western North American orchards was conducted in five counties of northern Utah from late spring through early fall in 2014 and 2015. The need for this project was prompted by an outbreak of leafroller larvae in tart cherry orchards in 2012. The survey was conducted in 20 orchards using pheromone traps, as well as symptom inspections and beating tray sampling for larvae. Obliquebanded leafroller (OBLR) was the primary species caught in the traps, followed distantly by fruittree leafroller. A small number of European leafroller moths were captured and no omnivorous or pandemis leafroller moths were captured. The larval sampling did not yield any specimens, likely due to increased pesticide applications to prevent an infestation similar to 2012. The OBLR moth flight was compared to the predictive model developed by Brunner and Lampson (1997). The emergence of the 2nd generation moths in the Utah orchards was earlier than predicted for each year. And interestingly, the flight pattern of OBLR reversed from 2014 to 2015, with a large 1st and small 2nd generation in 2014, and a small 1st and large 2nd generation in 2015. An unanticipated outcome of this project was that the lure used for European leafroller was equal to or more effective than the OBLR lure in capturing OBLR (with similar results reported elsewhere). In addition, the trap results using the lure recommended for western North American OBLR were similar to the results from the standard OBLR lure, with slight variation between generations. Finally, the species of moth by-catch were identified, with no significant findings.

POSTER
Invasive Species

New Pests on the Horizon

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

Keywords: American plum borer, *Euzophera semifuneralis*, Pyralidae

Abstract: Two instances of American plum borer, *Euzophera semifuneralis*, were found in the greater Wenatchee area in 2014-2015. While its range has included Washington State, this is the first record of infestation. In both cases, larvae were found attacking the graft union of cherry trees; the literature suggests that wounding is necessary for the larvae to attack successfully. Its host plant range is quite broad, and includes the rosaceous tree fruits, but the most common problems have been on plum and cherry. A pheromone was discovered in the mid-1980s, and is available for monitoring.

POSTER
Chemical Control/New Products

Required No-Spray Buffers for the Benefit of Pacific Salmon and Steelhead

Sharon Selvaggio and Kim Leval
Northwest Center for Alternatives to Pesticides, Eugene, OR

Keywords: buffer, pesticide, salmon

Abstract: Under the Endangered Species Act (ESA), EPA must ensure that its registration of a pesticide is not likely to jeopardize the continued existence of federally listed threatened or endangered species or destroy or adversely modify their designated critical habitat. In 2002, the U.S. District Court for the Western District of Washington found that EPA had failed to complete required such analyses (consultations) on the effects of 54 pesticides to Endangered Species Act (ESA) listed salmonids. The court imposed interim no-spray buffers along salmon-bearing streams in Washington, Oregon and California until the EPA completes consultation procedures for the pesticides in question. Of the 37 pesticides subsequently acknowledged by EPA as likely to adversely affect ESA-listed salmonids, the National Marine Fisheries Service (NMFS) has completed Biological Opinions on 31 of the 37 pesticides. NMFS has determined that the current legal uses of 77% of these 31 pesticides - including several commonly used on orchard crops- jeopardize the survival and/or poses adverse modification of critical habitat for multiple runs of listed salmonids. As the EPA has completed these analyses, most of the required buffers have expired. However, buffers were re-imposed in 2014 for five insecticides, including chlorpyrifos, diazinon, malathion, carbaryl, and methomyl. In addition, buffers remain in place for bromoxynil, metolachlor, prometryn, and 1,3-dichloropropene. Buffers for these active ingredients will remain in place until EPA implements any necessary protections for Pacific salmon and steelhead based on reinitiated consultations with the National Marine Fisheries Services. These measures are not enforced by EPA (i.e. labels do not speak of these buffers) therefore there is widespread misunderstanding about the buffer requirements. This poster describes key reasons some pesticides pose sobering risks to salmon and their habitat, summarizes NMFS conclusions from biological opinions completed on 31 pesticides so far, presents some recommended measures to keep pesticides out of salmon waters, and provide updates on current required court-ordered buffers.

POSTER
Invasive Species

Brown Marmorated Stink Bug: Washington State Update

Joshua Milnes[1], Mike Bush[2], Gwen Hoheisel[3], Todd Murray[4], Mike Klaus[5], Peter Landolt[6], Katie Buckley[5], Doug Walsh[7], Jay Brunner[1] and Elizabeth H. Beers[1]
[1]WSU-TFREC, Wenatchee, WA; [2]WSU Extension, Union Gap, WA; [3]WSU Extension, Prosser, WA; [4]WSU Extension, Stevenson, WA; [5]WSDA, Yakima WA; [6]USDA, Wapato, WA,[7]WSU-IAREC, Prosser, WA

Keywords: *Halyomorpha halys*, brown marmorated stink bug, *Trissolcus japonicus*, egg parasitoid, biocontrol, outreach, monitoring, pheromone

Abstract: Brown marmorated stink bug (BMSB) *Halyomorpha halys* (Stål) establishment has been increasing steadily in the past five years. It is well established in the Vancouver area, and in the Seattle-Tacoma metropolitan area. Finds have been common along the Columbia River as it borders Oregon, with a significant population as far east as Walla Walla. There have also been multiple finds in Yakima and the Tri-Cities areas, and in the fall of 2015, multiple finds in northcentral Washington. Sampling methods have included a newly available pheromone, and beating tray sampling of favored tree hosts. The ecology of BMSB in the arid shrub-steppe environment of eastern Washington may be very different than the mid-Atlantic states, but given the success of many species of native stink bugs to thrive here, we can also expect BMSB to establish. Preliminary tests with net enclosures were performed in 2015 to determine if physical exclusion could provide protection from BMSB fruit damage; this work will continue in 2016. Outreach efforts have included presentations at meetings, online and print literature on identification and biology, and training county pest boards in sampling and recognition. The most significant progress in the future management of BMSB was made in the fall of 2015 with the discovery of an exotic scelionid egg parasitoid, *Trissolcus japonicus* (Ashmead), which unlike native parasitoids, is well adapted to BMSB. The discovery of two parasitized egg masses in Vancouver, WA, was the first record of this species on the west coast of North America.

Entomology for Fun

Notes:

Entomology for Fun

Insect Collecting in Central America

Peter Landolt
USDA, ARS, Yakima Agricultural Research Laboratory, Wapato, WA

Keywords: Guatemala, collecting, moths, wasps, camping, vacation.

Abstract: There is no better way to get a break from the office than camping in the forest, far from the rat race of civilization. Couple this with collecting, which is one of our most popular and relaxing types of hobby, and you get a sure fire way to reduce your blood pressure and a way to quickly drop ten pounds. For many years I have been making nearly annual trips to Central America, with the goals of getting as far from people and as close to nature as possible, and to survey the diversity of the entomofauna. This has included what I call meso-moths and stinging wasps, with a few other odds and ends thrown in. It provides a serious distraction, as well as entertainment, great stories, good friends, and repeated reconnections to the real world of insects.

"Vinsectos: A Survey of Insects Depicted on Wine Labels."

Jack W. Jenkins
Pacific Biocontrol Corporation, Phoenix, AZ

Keywords: Insects, wine, labels, hobby

Abstract: There is a remarkable array of animals depicted on the labels of wine bottles. This includes insects. Vinsectos, over the last 5 years, has attempted to survey and identify insects on wine labels. Vinsectos includes labels collected from wine bottles produced in 15 countries. Vinsectos has labels from bottles produced in 11 states in the USA. The collection includes insects from 10 orders and 17 families. Over 20 insects have been identified to species. Vinsectos is interested in soliciting the help of OPDMC members in furthering this entomological pursuit.

Minutes of the 89th Annual Meeting

Orchard Pest & Disease Management Conference
Hilton Hotel, Portland, Oregon
January 14 -16, 2015

I. Call to Order

The 89th Annual Meeting was called to order by the Chair Jack Jenkins at 9:00 am on January 14, 2015. Chair Jenkins welcomed the approx. 200 attendees who are presenting 47 papers and posters, asked for each attendee to make a brief self-introduction, and then introduced session moderators. They were:

Biological Control	Jeannine Lowrimore
Invasive Species	Peter McGhee
Chemical Control/New Products	Chris Nobbs
Biology/Phenology	Brad Higbee
Mating Disruption/SIR	Larry Gut
Implementation	Joe Grant
Thresholds/Monitoring	Reed Britt

II. Old Business

A. Approval of 2014 Minutes: Secretary Alston announced that the 2014 minutes are posted on the OPDMC website and printed in the back of the abstract booklet. She asked for amendments. There were none. It was moved, seconded, and voted to approve the 2014 minutes.

Chair Jenkins called for other old business. There was none.

III. New Business

A. Board of Directors' Report

Secretary Alston gave the Board of Directors' report.

- The board voted to increase meeting registration fees by $10: pre-registration will be $50/60 (with and without program abstracts); on-site registration will be $60/70.
- Discussion to shorten the conference in future years if there are fewer presentations, and end Thursday evening
- Put out a call for keynote speaker suggestions.

B. Treasurer Report

Treasurer Hays gave the treasurer report.

Total Cash & PayPal Balance as of 12/31/13	$13,491.18
Total Income	$10,343.64
Total Expenses	$12,411.33
Total Cash & PayPal Balance as of 12/31/14	$11,423.49

There was a motion, second, and unanimous vote to approve the treasurer report.

C. Other Items

Don led a discussion about shortening the meeting. There was concern expressed about losing 2-3 hr of certification credit. It was suggested to leave the length the same for 2016 and see how many papers are submitted. We will revisit this topic next year.

There was a motion, second, and vote to close new business.

IV. Committee Assignments
Chair Jenkins called for volunteers for committee positions. The following committee assignments were made:

Audit: Rick Hilton (Chair), Bruce Greenfield, and Betsey Miller
Nominations: Larry Gut (Chair), Randy Hansen, and Bob Van Steenwyk
Resolutions: Art Agnello (Chair), Peter McGhee, and Mike Lees

V. In Memoriam
Three members were remembered:

- Michael J. Smirle (presented by Gary Judd)
- Barry M. Wilk (presented by Cris Wilk)
- Tom M. Burlando (presented by Pat Weddle)

Chair Jenkins called for the names of other deceased members; there were none. He then called for a moment of silence to recognize our deceased members.

Chair Jenkins called for a motion, second, and vote to adjourn the opening business meeting at 10:04 am, which was concluded until the closing business meeting on Friday.

VI. Closing Business Meeting
The closing business meeting was called to order by Chair Jenkins at 10:20 am on January 16, 2015.

A. Further New Business
Chair Jenkins called for further new business.

- Meeting dates for 2016 will be January 13-15. It will be the 90th meeting of OPDMC.
- Don announced there were almost 200 pre-registrants for the 2015 meeting, plus on-site registrants totaled about 220.
- Don asked for all members to consider submitting presentations next year, including those who haven't presented before, such as consultants, industry, etc.

B. Committee Reports
Chair Jenkins called for the committee reports.

1. Audit
Chair Rick Hilton reported that the committee examined the Report of the Treasurer and recommended that the membership accept the report. It was moved, seconded, and approved.

2. Nominations
Chair Larry Gut made the following nominations:

- President-Elect: Janet Caprile (University of California Cooperative Extension, CA)
- Secretary: Diane Alston (Utah State University, UT)
- Treasurer: Nancy Hays (Pacific Biocontrol Corp., WA)
- Executive Director: Donald Thomson (Pacific Biocontrol Corp., Canada)
- Program Co-Chairs: Betsy Beers (Washington State University, WA) & John Dunley (Wilbur Ellis, WA)
- Steve Ela (Ela Family Farms, CO) will serve as Chair in 2016

A motion was made and seconded to accept the recommendations of the nominations committee. The motion was passed.

3. Resolutions

Chair Art Agnello (playing samba drum music on his iPhone and through his iSpeakers) and Committee Member Peter McGhee (playing the glass-tapping cow bell) proposed the following resolutions with flawless timing to the music (except the cow bell got behind a few times…):

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.
2. Be it resolved that the members of the conference express their appreciation to Executive Director Don Thomson, the Past Chair Lucia Varela, Chair Jack Jenkins, Chair-Elect Steve Ela, Secretary Diane Alston, Treasurer Nancy Hays, and Program Co-Chairs John Dunley and Betsy Beers for their leadership and dedication in organizing the 2015 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, Chris Sater, for applying for pesticide applicator credits from participating states and preparing the meeting abstracts, and Jerry Tangren for maintaining the OPDMC website.
4. Be it resolved that the members of the conference extend their appreciation to the session moderators Jeannine Lowrimore, Peter McGhee, Chris Nobbs, Brad Higbee, Larry Gut, Joe Grant, and Reed Britt for ably overseeing the entomology sessions of the 2015 conference.
5. Be it resolved that the members of the conference extend their appreciation to Tamla Blunt, Colorado State University, for ably overseeing the disease management session of the 2015 conference.
6. Be it resolved that the Secretary write letters of condolences to family of members who passed away during the past year: Michael J. Smirle, Barry M. Wilk, and Tom M. Burlando.

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

C. Call for Nominations for the Rubber Chicken Award

Chair Jenkins called for nominations:

1. Jay Brunner was nominated for running a black market in sterile codling moths and smuggling them across the Canadian border.
2. Peter Witzgall was nominated for drinking contaminated water even after being told not to do it.
3. Brad Higbee was nominated for delivering an extended talk under false pretenses, breaking the new OPDMC computer, and bragging about his 40 acre research plots.
4. Larry Gut was nominated for giving his own slideshow while introducing the keynote speaker, and re-using his same slideshow from ESA.

Chair Jenkins called for a vote from the membership by a show of hands. Brad Higbee won his first rubber chicken which was presented to him at the podium by Chair Jenkins.

Chair Jenkins presented Executive Director Thomson with two bottles of wine with entomological themes for his meritorious service to the conference.

Chair Jenkins passed the gavel to the 2016 Chair Steve Ela, who adjourned the meeting at 10:41 am.

Conference dates for next year are January 13-15, 2016. It will be held once again at the Portland Hilton.

Respectfully Submitted,
Diane Alston
Secretary
2015 Orchard Pest and Disease Management Conference

The Rubber Chicken Award

An enduring tradition of informality is the nomination, voting, and awarding of the Rubber Chicken to one of the presenter during the closing business meeting. The Rubber Chicken may be awarded for a variety of reasons, but egregious behavior in some aspect of presenting a scientific talk is the underlying theme: too long, too short, poor organization, illegible slides, and over-spinning research results are frequently cited.

Notables who have received the award include:

- **Clancy Davis**, Berkeley, California for his quiet, sober, professional demeanor on all occasions.
- **Stan Hoyt**, Wenatchee, Washington for failing to enliven methods of presentation of papers.
- **Don Berry**, Medford, Oregon for never having made a single comment over 20 years.
- **Pete Westigard**, Medford, Oregon for returning from a sabbatical with 400 color slides (all failures) and a new child (a success).

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

- **Rachel Elkins (2001)**, University of Calif., Clear Lake, for using an overhead projector in a digital age.
- **Jay Brunner (2002)**, Washington State University, Wenatchee, for giving one of the looooongest talks in the history of the WOPDMC (Seriously. His 10-minute talk was an hour).
- **Doug Light (2003)**, USDA, Albany, California, for showing incomprehensible data slides again and again and again. (Chemists….)
- **Stephen Welter (2004)**, University of California, Berkeley, for inappropriate behavior by leaving the meeting prior to giving his presentation.
- **Bob Van Steenwyk (2005)**, University of California, Berkeley, Bob suffered at the hands of technology and he could have been forgiven for these technical glitches; however the membership was in a surly mood after the prolonged business meeting. Bob graciously accepted the award.
- **Alan Knight (2006)**, USDA-ARS, Wapato, Washington, for not submitting a talk.
- **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)**, Michigan State University, for attempting to coerce the entire membership into his cult of the pheromone, and for admitting to having intimate relations with codling moths; Jim was responsible for the demise of yet another unfeathered friend.
- **Peter Shearer (2009)**, Oregon State University, Hood River, for forgetting, like Dorothy, that he was not in Rutgers anymore (For those of you not present, he gave his talk as the new director of the Hood River Station MACAREC, using the Rutgers template).

- **Harvey Reissig (2010)**, Cornell University, Geneva, for his presentation that introduced a new web-based IPM decision support system for NY apple growers that was actually a chemical spray calendar disguised as an IPM program (well played, Harvey, well played…).
- **John Dunley (2011)**, Wilbur-Ellis, Cashmere, Washington, for not being present each morning to turn on the lights, the projector, and the laptop computer before the meeting began. He also assumed that at least one of the many well-educated members of the Conference (ahem, Broc Zoller), most of whom were lugging their own laptops, would be able to find the correct button to turn on the conference laptop, and that labels on the two (!) cords would make the connections between the laptop and projector clear. He was proven to be incorrect.
- **Larry Gut (2012)**, Michigan State University, for now conducting research on pheromone puffers (and finding them effective) after 'pooh-poohing' them for many years.
- **Don Thomson (2013)**, DJS Consulting Services, for delivering the keynote speaker's address in his introduction of Camille before she had a chance to deliver her own presentation. Also, Don temporarily lost the rubber chicken in the foyer, but he did later recover it.
- **Doug Light (2014)**, USDA ARS, Albany, California, for blatantly promoting his own product during his presentation.
- **Brad Higbee (2015)**, Paramount Farms, CA, for delivering an extended talk under false pretenses, breaking the new OPDMC computer, and bragging about his 40 acre research plots.

Adult pear psylla

Brown marmorated stink bug

Woolly apple aphid

Western cherry fruit fly

Walnut husk fly

Apple maggot

Navel orangeworm

Spotted wing drosophila

Codling moth