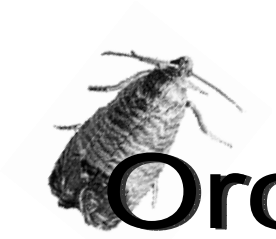

Orchard Pest & Disease Management Conference

Conference Abstracts

81st Annual Conference

Hilton Portland, Portland, Oregon

January 10-12, 2007

WESTERN ORCHARD PEST AND DISEASE MANAGEMENT CONFERENCE
"The Portland Spray Conference"
(1926 - 2007)

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

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

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

Notables who have received the award include:

1. **Clancy Davis**, Berkeley, California for his quiet, sober, professional demeanor on all occasions;
2. **Stan Hoyt**, Wenatchee, Washington for failing to enliven methods of presentation of papers,
3. **Don Berry**, Medford, Oregon for never having made a single comment over 20 years.
4**. Pete Westigard**, Medford, Oregon for returning from a sabbatical with 400 color slides (all failures) and a new child.
5. **Jay Brunner**, Wenatchee, Washington for giving one of the looooongest talks in the history of WOPDMC
6. **Doug Light**, Albany, California for showing incomprehensible data slides again and again and again.
7. **Stephen Welter**, Berkeley, California for inappropriate behavior by leaving the meeting prior to giving his presentation.

Orchard Pest and Disease Management Conference

Agenda for 2007 Conference

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

Talks within a session will be in the order in which they are listed in the Conference Abstracts, which will be picked up when you pay your registration fee at the beginning of the conference, or can be viewed at http://entomology.tfrec.wsu.edu/wopdmc/index.html

See the section on "Presenters' Checklist" for more information.

Time	Session	Moderator
	Wednesday, January 10	
10:00am	Opening Business	Walt Bentley, WOPDMC President
10:30am	Thresholds/Monitoring	Lucia Varela
11:30am	Biocontrol	Tom Unruh
12:00pm	Lunch	
1:30pm	Resistance Management	Bob Van Steenwyk
2:00pm	Chemical Control/New Products	Joe Grant
3:00pm	Coffee	
3:30pm	Life Histories	Pat Weddle
	Thursday, January 11	
8:00am	Chemical Control/New Products	Joe Grant
8:15am	*Tree Fruit Diseases*	*Gary Grove - in Broadway III*
10:00am	Poster Session	Authors to be at posters
12:00pm	Lunch	
1:30pm	Biology/Phenology	Pat Weddle
4:00pm	Mating Disruption/SIR	Carolyn Pickel
	Friday, January 12	
8:00am	Mating Disruption/SIR	Carolyn Pickel
9:00am	Implementation	Walt Bentley
10:00am	Closing Business	Walt Bentley, WOPDMC President Harvey Reissig, WOPDMC President Elect
11:00am	Adjourn	

Washington State University
Tree Fruit Research and Extension Center
1100 N. Western Avenue
Wenatchee, WA 98801
Phone: 509-663-8181

Content queries to Dr. John Dunley
dunleyj@wsu.edu

Western Orchard Pest and Disease Management Conference

Officers for the 2007 Conference

Chair
Walt Bentley
University of California
Kearney Research and Extension Center
9240 S. Riverbend Ave.
Parlier, CA 93648
Phone: 559-646-6527
FAX: 559-646-6593
Email: walt@uckac.edu

Chair-Elect
Harvey Reissig
Cornell University
New York State Agricultural Experiment Station
Geneva, NY 14456
Phone: 315-787-2336
FAX: 315-787-2326
Email: whr1@cornell.edu

Secretary/Treasurer
Nancy Hays
Pacific Biocontrol Corporation
14615 N.E. 13th Court, Ste. A
Vancouver, WA 98685
Phone: 360-571-2247
FAX: 360-571-2248
Email: nhays@pacifier.com

Program Chair
John Dunley
Washington State University
Tree Fruit Research and Extension Center
Wenatchee, WA 98801
Phone: 509-663-8181, ext 236
Fax: 509-662-8714
Email: dunleyj@wsu.edu

Executive Director
Don Thomson
DJS Consulting Services, LLC
3015 S.W. 109 Street
Seattle, WA 98146
Phone: 206-444-5770
FAX: 206-444-0255
Email: dthomson@pobox.com

Proceedings
Christina Mayer
Washington State University
Tree Fruit Research and Extension Center
Wenatchee, WA 98801
Phone: 509-663-8181, ext 0
Fax: 509-662-8714
Email: wopdmc@wsu.edu

For information, see: http://entomology.tfrec.wsu.edu/wopdmc/index.html

AGENDA
FROM THE 81ST ANNUAL WESTERN ORCHARD PEST AND DISEASE MANAGEMENT CONFERENCE
January 10, 11 & 12, 2007

		Convene **Business Meeting** **Walt Bentley, WOPDMC President**
Page		**Life History 3:30 – 5:00pm, Wednesday, January 10** **Pat Weddle, Moderator**
10		Pierre-Joseph Charmillot - Management of Susceptible and Resistant Codling Moth in Switzerland Using Chemical Insecticides, Mating Disruption, and Granulosis Virus
11		Helmut Riedl – The Entomological Journey of Dr. Helmut Riedl: An Almost True Story
	1.	**Thresholds/Monitoring** **Lucia Varela, Moderator**
13		Use of the Pear Ester Kairomone in the Monitoring and Management of Codling Moth (Hilton et al.)
13		Comparison of Consperse Stink Bug Trap Catches Inside and Outside Pear Orchards to Investigate a Means of Reducing Fruit Damage (Elkins)
14		Navel Orangeworm Sanitation, Trap Data, and Damage in Almonds and Pistachios (Burks et al.) **POSTER**
	2.	**Biocontrol** **Tom Unruh, Moderator**
16		Why Biocontrol Agents Go Bad: A Search for Competitor-free Space (Messing and Wang)
16		Improving the Activity of the Granulovirus of the Codling Moth with Sunlight Screens (Arthurs et al.)
17		Potential for Managing the Obliquebanded Leafroller, *Choristoneura rosaceana*, with an Integrated Management Program of Biological Control and Reduced Risk Insecticides (Reissig et al.)
17		Biological Control of Oriental Fruit Moth, *Grapholitha molesta* (Mallek and Bentley)
18		Hover Flies as Biocontrol Agents of Woolly Apple Aphid: Whodunnit? (Bergh)
	3.	**Resistance Management** **Bob VanSteenwyk, Moderator**
20		Good News? Codling Moth Exhibits Negative Cross Resistance Between Guthion and Rimon (Knight)
20		Status of Insecticide Resistance in Pear psylla, *Cacopsylla pyricola*, in Washington (Dunley)

Page	**7.**	**Implementation** **Walt Bentley, Moderator**
51		Mating Disruption in Italy's South Tyrol Apple Orchards: 15 years of Experience (Iodice et al)
52		Whole-Farm Biopesticide Based Codling Moth Management in Diverse Agricultural Environments (McGhee et al.)
53		Management of CM and OFM Through the Implementation of an Area-Wide Mating Disruption Program in Pennsylvania (Hull et al.)
54		The Use of Drift Reduction Technologies and Vegetative Barriers to Manage Pesticide Spray Drift in Cherry, Pear, and Apple Orchards (Wallis et al.)
	8.	**Tree Fruit Diseases** ***8:15am, Thursday, Jan 11 in Broadway III*** **Gary Grove, Moderator**
56		Comparison of Capture of Ascospores of *Venturia pirina* with the Temperature of Wetness of Rain in Mendocino County, California 2006 (Zoller)
56		Efficacy of Fungicides for Control of Brown Rot and Shot Hole of Almond (Holtz and Martin-Duvall) **POSTER**
10 am		**Business Meeting** **Walt Bentley, WOPDMC President** **Harvey Reissig, WOPDMC President-Elect**
11 am		**Adjourn**

Life History

Notes

Management of Susceptible and Resistant Codling Moth in Switzerland Using Chemical Insecticides, Mating Disruption and Granulosis Virus

Pierre-Joseph Charmillot
Station de Recherche Agroscope Changins-Wädenswil, Nyon, Switzerland

Keywords: Codling moth, *Cydia pomonella*, insecticide, resistance, mating disruption, granulosis virus

Abstract: In Switzerland, the codling moth, *Cydia pomonella* (CM), evolves in two annual generations whose flights proceed from the beginning of May to the end of August. During the last two decades, the control of this pest generally consisted of two, possibly three, treatments with insect growth regulators (IGR) such as chitin synthesis inhibitors, juvenile hormone analogue or moulting accelerator compounds.

Since 1996, cases of resistance, often crossed to several groups of insecticides, have appeared. A test of resistance detection by topical application of insecticides on diapausing larvae was developed. Curves of dosage efficiency were established for 14 active ingredients on a susceptible reference strain in order to choose discriminating dosage to test on diapausing larvae, collected using corrugated band traps in orchards with potentially resistant CM population. In the most serious cases, resistance relates to the majority of the tested products. In order to avoid a spiral of treatments, a specific biological control using mating disruption (MD) or granulosis virus (CpGV) was recommended against resistant CM. When the population pressure is important, i.e., when the damage at harvest exceeds 1-2% and when the over-wintering population is above one diapausing larva per tree, a combined control with MD and CpGV is recommended. In the first year, the damage may remain at high levels due to stopped penetrations but the density of population decreases appreciably. After one or two years of combined control, it is generally possible to continue with either MD or virus. MD is carried out primarily by means of Isomate-C Plus dispensers, generally applied at 1000 units per ha. Three formulations of CpGV are available in Switzerland: Madex, Carpovirusine and Granupom. Some cases of resistance of CM to CpGV have been reported lately in Germany and France. The new Madex-Plus product was selected for a better effectiveness on CM strains resistant to CpGV.

The Entomological Journey of Dr. Helmut Riedl: An Almost True Story

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

Keywords: Jan, Feb, March, April, May, June….retirement!

Abstract: Trained in forestry at the University of Vienna, Austria, and in entomology at Michigan State University, Helmut spent his entire career as a tree fruit entomologist. Helmut was a restless wanderer. He began his working life in Michigan as a postdoctoral research associate with Dr. Brian Croft. After faculty appointments at the University of California Berkeley (1976-1981) and at the New York Agricultural Experiment Station (1981-85), he finally settled down at Oregon State University's Mid-Columbia Agricultural Research and Extension Center where he spent the last 21 years. Helmut will review some of the highlights of his research career which included, as might be expected, both successes and failures. Initially, codling moth was a major focus of his work. This included studies on the use of the newly discovered sex pheromone for monitoring, studies on codling moth phenology, diapause, egg-laying behavior, as well as control investigations with new insecticide chemistries. While in California, he continued to work on codling moth, but began to broaden his research to other pests of pome fruits and walnuts. Projects included: walnut husk fly behavior, monitoring and control; impact of pyrethroid insecticides on target and non-target pests on pear; and orange tortrix biology and control on apples. While in New York and serving the fruit industry as an extension entomologist, Helmut worked on dogwood borer, a pest on size-controlling apple rootstocks. In Oregon, Helmut's work continued with a strong commodity orientation and a focus on pests of pears, apples, and sweet cherries. As control problems with OPs and other pesticides began to surface during the 1980s, Helmut got involved in resistance studies of codling moth, pear psylla, tentiform leafminer, and mites. Grower and tree fruit industry concerns as well as the need to secure adequate funding to support a research program determined to a large extent Helmut's research activities during his Oregon years. Responding to leafminer and leafroller outbreaks on cherries was a high priority during the 1980s and early 1990s. Fine-tuning of phenology models for cherry fruit fly and codling moth helped growers to improve timing of spray applications. Studies on the impact of new and old pesticide chemistries on key natural enemies in tree fruits provided the underpinning for the development of pest management programs which minimized impacts on biological control. More recently, Helmut has begun a project to reduce spray drift and prevent orchard pesticides from contaminating fish-bearing streams. Over the last 15 years, Helmut has spent considerable time and effort to demonstrate to fruit growers in northern Oregon that pest management without broad-spectrum pesticides is feasible and, in the long run, economically advantageous. This has led to the (partial) adoption of Integrated Fruit Production (IFP) programs by the local tree fruit industry. As the sun sets on Helmut's career, he would like to thank co-workers, former students, professional friends on various continents, field men and growers for accompanying him along the way and making his entomological journey so enjoyable.

Thresholds

Monitoring

Lucia Varela, moderator

Notes

Thresholds/Monitoring

Use of the Pear Ester Kairomone in the Monitoring and Management of Codling Moth

Richard J. Hilton, Alan L. Knight, and Philip VanBuskirk
OSU-Southern Oregon Research and Extension Center, Central Point, OR

Keywords: Pear ester, codling moth, *Cydia pomonella*, earwig domicile

Abstract: A combination pear ester kairomone and pheromone lure for monitoring codling moth was compared to the pear ester and pheromone components by themselves under a variety of field settings, including high and low codling moth pressure, and with or without mating disruption. A dispenser with both pear ester and pheromone was compared to a standard application of Isomate TT in replicated five-acre blocks. A microencapsulated sprayable form of the pear ester was also tested to determine the effect on codling moth. The use of a rolled corrugated cardboard earwig domicile to provide additional information on codling moth will be discussed.

Comparison of Consperse Stink Bug Trap Catches Inside and Outside Pear Orchards to Investigate a Means of Reducing Fruit Damage

Rachel B. Elkins
University of California Cooperative Extension, Lakeport, CA

Keywords: Consperse stink bug, *Euschistus conspersus*, monitoring, pear

Abstract: Consperse stink bug (*Euschistus conspersus*) (CSB) is the most commonly noted stink bug pest of pears in California. Though considered a localized pest, it can cause great damage to fruit if unmanaged, and is of major concern in fruit destined for canning. Like other true bug pests, its presence has increased since the advent of mating disruption for codling moth control due to reduced organophosphate use. Management is generally accomplished by visually monitoring the presence of CSB in vegetation outside the orchard in the spring, and then CSB presence and damage within the orchard during the summer, followed by treatment with broad-spectrum materials is necessary. Timing applications can be problematic due to the uncertainty of determining the timing of nymphal hatch and development and insect movement from external weed hosts into the orchard. In 2003, research was initiated in one orchard in the northern Sacramento Valley to test a degree day model developed for tomatoes. The model appeared to accurately predict the hatch of the first summer generation in the orchard. In 2005 research continued to test the degree day model as well as four trap and lure combinations (two traps and two lure types) to determine which best tracked seasonal CSB phenology. Aldrich traps used in tomato research combined with a lure developed by Applied Plant Technologies (APT) attracted the most CSB adults at the lowest cost. In 2006 Aldrich/APT were placed both outside and inside five orchards to determine if enough CSB could be lured outside the orchard to reduce damage significantly. Results suggest that the lures strongly attract CSB regardless of placement but that damage level dramatically declines even a short distance from the trap.

Thresholds/Monitoring

Navel Orangeworm Sanitation, Trap Data, and Damage in Almonds and Pistachios

Charles S. Burks, Bradley S. Higbee, and David G. Brandl
USDA-ARS, San Joaquin Valley Agricultural Sciences Center, Parlier, CA

Keywords: Navel orangeworm, *Amyelois transitella*, pheromone trap, egg trap, sanitation, almond, pistachio

Abstract: The navel orangeworm, *Amyelois transitella* (Walker), has a wide host range and is a primary insect pest of almonds and pistachios in California. Sanitation, removal of unharvested nuts prior to the beginning of the spring navel orangeworm flight, is a key part of navel orangeworm pest management in almonds and is recommended in pistachios. Assessments of the success of sanitation can also serve as an estimate of the abundance of navel orangeworm at the start of the growing season. In anticipation of availability of a navel orangeworm synthetic pheromone lure, we examined counts of eggs in egg traps and males in pheromone traps (baited with virgin females) along with sanitation and harvest data in pistachios and almonds. We compared these data in paired plots of pistachios and almonds with rigorous and minimal sanitation, and in 41 almond plots throughout a 259,000 ha area. Withholding sanitation resulted in a 1.3-fold increase in infestation in pistachios and a 3.4-fold increase in infestation in Nonpareil almonds. In pistachios, far fewer eggs were found on egg traps in first flight in unsanitized compared to sanitized plots, even though sanitation assessments indicated that navel orangeworm was more abundant in the unsanitized than that sanitized plots. From March to early August pheromone traps in the pistachio sanitation plots had the same high level of male captures suggesting that, under these conditions, trap saturation effects prevented pheromone traps from reflecting spatial and seasonal variation in abundance. In almonds with a history of high navel orangeworm damage, seasonal variation was discernable in males captured in pheromone traps in both sanitized and unsanitized plots and differences in males captured in flight traps and eggs on egg traps were consistent with sanitation census and harvest sampling data. However, data from 41 almond plots indicated that there was no significant association of sums of eggs on egg traps over a first and second flight with each other, with sums of males in pheromone traps in first, or second flights, or with subsequent harvest damage to Nonpareil almonds. In contrast, there was significant association of sums of males captured in pheromone traps between first, second, and third flights, and first and second flight were significantly associated with subsequent harvest damage. Weekly averages of eggs in egg traps and males in pheromone traps were highly correlated. We conclude that egg traps and pheromone traps are both suitable for determining navel orangeworm phenology and optimal application time for pesticides in almonds, but that pheromone traps data also have potential to predict damage in almonds, whereas this is not true of egg traps.

Biocontrol

Tom Unruh, moderator

Notes

Biocontrol

Why Biocontrol Agents Go Bad: A Search for Competitor-free Space

Russell H. Messing[1] and Xin-geng Wang[2]
[1] University of Hawaii at Manoa, Kauai Agricultural Research Station
[2] University of California at Riverside, Kearney Ag. Research Station

Keywords: Biological control, parasitoid, tephritid fruit fly, medfly, *Ceratitis capitata*, non-target effects, host shift, enemy-free space

Abstract: The Mediterranean fruit fly is both a direct and a quarantine pest of a wide variety of orchard crops in Hawaii, including citrus, mango, guava, coffee, and many other fruits and vegetables. A parasitoid of medfly, *Diachasmimorpha tryoni*, that was previously reported to be an effective biological control agent in Hawaii is now rarely found on the target pest, but is commonly found on a non-target tephritid host: the weed biocontrol agent *Eutreta xanthochaeta* (lantana gall fly). We tested the hypothesis that the non-target host is serving as a refuge from competition with other medfly parasitoids. All three conditions matching the ecological definition of "enemy free space" were demonstrated experimentally, indicating that the non-target impact of this biocontrol agent is driven, at least in part, by intra-guild competition.

Improving the Activity of the Granulovirus of the Codling Moth with Sunlight Screens

S. P. Arthurs[1], L. A. Lacey[1], A. Knight[1] and R. Hilton[2]

[1]USDA-ARS, Yakima Agricultural Research Laboratory, Wapato, WA, [2]Oregon State University, Southern Oregon Research and Extension Center, Medford, OR

Keywords: Codling moth, *Cydia pomonella*, apple, feeding stimulant, pear ester, lignin formulations, UV stability

Abstract: Insecticides based the codling moth, *Cydia pomonella* L., granulovirus (CpGV) are used by orchardists to selectively control codling moth larvae. However, current commercial formulations have a short residual activity under orchard conditions in the Pacific Northwest, because the activity of the virus is reduced through sunlight (ultraviolet) exposure. We have been experimenting with methods to extend the activity of the virus through the use of various spray adjuvants, particle films and spray-dried lignin-encapsulated formulations for improved solar stability of CpGV and use of the larval kairomone pear ester to increase virus uptake.

Biocontrol

Potential for Managing the Obliquebanded leafroller, *Choristoneura rosaceana,* with an Integrated Management Program of Biological Control and Reduced Risk Insecticides

Harvey Reissig, Mark Sarvary, and Jan Nyrop
Entomology Department, NYSAES, Geneva, NY

Keywords: Obliquebanded leafroller, *Choristoneura rosaceana*, biological control, Intrepid, Spinosad

Abstract: Studies in NY apple orchards showed that prophylactic sprays of Intrepid against overwintering OBLR larvae followed by Spintor sprays targeting the summer generation provided excellent control (<1.5% damage). When prophylactic sprays were discontinued and monitoring programs were initiated, overwintering populations were low, but subsequent summer populations in most orchards exceeded thresholds and fruit damage averaged 3.5% even after summer Spintor sprays. A 2-year test was set up to compare natural enemies of OBLR in unsprayed hedgerows, plots treated with reduced-risk insecticide programs for multiple seasons, and growers' orchards treated with standard insecticides, using outsourced larvae. Parasitism and predation levels were similar throughout the season in all three locations. Another 3-year study in apple trees receiving normal horticultural care and fungicide sprays, but not insecticides showed that populations of leafrollers persist and fruit injury is substantial These studies suggest that natural enemies can reduce levels of the summer generation of OBLR to low levels in unsprayed apple trees, but substantial fruit injury still occurs. There is no evidence that reduced risk insecticides are less toxic to natural enemies than conventional materials. Therefore, it may be difficult to manage OBLR without prophylactic insecticide sprays in outbreak areas.

Biological Control of Oriental Fruit Moth, *Grapholitha molesta* (Busck)

Walter Bentley and Susan B. Mallek
University of California Kearney Agricultural Center

Key words: Oriental fruit moth, biological control, *Macrocentrus ancylivorus*

Abstract: Homeosoma electellum (Hulst), the sunflower moth, was established at Kearney Agricultural Center (KAC) in Parlier, California as an alternate host for *Macrocentrus ancylivorus* (Roh.) a parasitoid of the Oriental fruit moth (OFM), *Grapholitha molesta* (Busck). Because *Macrocentrus* does not overwinter on OFM, sunflowers were planted adjacent to an orchard of Crimson Lady peaches at KAC. Three consecutive plantings of sunflowers infested with *H. electellum* were exposed to adult *Macrocentrus* in 2003 and 2004. Sunflower heads were caged before and after parasitoid release to monitor parasitism by *M. ancylivorus*. No *Macrocentrus* releases were done in 2005 and 2006. Results indicated a steady increase in parasitism of sample populations through late season. As the plantings were consecutive, so were the *Macrocentrus* releases, resulting in a high degree of parasitism even in our control population. *Macrocentrus* in sample populations declined in 2005 without releases but rose again in 2006. Heads collected in late fall to detect overwintering survival of the parasitoid resulted in emergence of *Macrocentrus* from sunflower moth larvae in spring of 2005 and 2006. OFM populations in the Crimson Lady peaches were monitored with pheromone traps and shoot strikes. Parasitism by *Macrocentrus* occurred in every year of the study and fruit samples revealed no damage from OFM.

Biocontrol

Hover Flies as Biocontrol Agents of Woolly Apple Aphid: Whodunnit?

Chris Bergh
Virginia Tech, AHS-AREC, Winchester, VA

Keywords: Aphidophagous hover flies, woolly apple aphid, *Eupeodes americanus*, *Syrphus rectus*, *Heringia calcarata*, biological control

Abstract: Three species of aphidophagous hover flies are the most common and abundant predators of woolly apple aphid in Virginia apple orchards. Larvae of *Eupeodes americanus* and *Syrphus rectus* are generalist aphid predators, while *Heringia calcarata* larvae are specialized predators of woolly apple aphid. Eggs of these species can be differentiated based on the sculpturing of the exochorion. Arboreal colonies of woolly apple aphid on potted apple trees deployed in an orchard in Virginia were used as sentinels to measure the phenology of the hover flies, based on the number of unhatched eggs deposited during weekly, 48-h exposure intervals from April to October, 2003-2005. Similar trends in the relative abundance of each species were recorded across all years. *E. americanus* was recorded first, showing a pronounced peak between mid-April and mid-May, followed by a prolonged period during which it was absent or present in very low numbers, and then a much smaller peak in September and October. First records of *H. calcarata* occurred slightly later than for *E. americanus*. Early peaks of *H. calcarata* abundance typically occurred in May and June and tended to be smaller those of *E. americanus*. *H. calcarata* eggs were recovered throughout most of each season. Eggs of *S. rectus* were least abundant and occurred sporadically each year. Exclusion cage and colony fate studies in 2006 examined temporal changes in the number and fate of arboreal woolly apple aphid colonies on potted apple trees and revealed that aphidophagous hover flies likely play an important role in suppressing woolly apple populations during the early part of each growing season.

Resistance Management

Bob VanSteenwyk, moderator

Notes

Resistance Management

Good News? Codling Moth Exhibits Negative Cross Resistance Between Guthion and Rimon

Alan Knight
USDA, ARS, YARL, Wapato, WA

Keywords: *Cydia pomonella*, apple, insecticides, fecundity

Abstract: The responses of adult codling moth from several field-collected populations and a laboratory-reared colony to residues of Rimon were evaluated in plastic cup adult bioassays. Both fecundity and successful egg hatch varied among populations. Populations of codling moth that exhibited the highest LC_{50}'s in previous topical and residual adult bioassays with Guthion had the lowest fecundity and egg hatch in the Rimon tests. The highest fecundity and levels of egg hatch were seen in the laboratory colony and a field population at the USDA experimental Farm that was created in 2002 by releasing 1,000's of laboratory moths. The potential significance of these results will be discussed.

Status of Insecticide Resistance in Pear psylla, *Cacopsylla pyricola,* in Washington

John E. Dunley
Tree Fruit Research and Extension Center, Washington State University, Wenatchee, WA

Keywords: pear psylla, resistance, pyrethroid, neonicotinyl, abamectin

Abstract: Pear psylla, *Cacopsylla pyricola (*Foerster), is a key insect pest of pear throughout the US, and infestations are particularly severe in the western US. Damage from pear psylla feeding is both indirect, with the honeydew product of feeding leading to russeting from sooty mold, and direct, including pear decline and 'psylla shock'. Total insecticide costs for controlling pear psylla in Washington range from $300 to $700 per acre, and reach as high $1000. With the high degree of insecticide use, pesticide resistance has long been a concern.

Pyrethroids were widely used for pear psylla control through the 1980s, and have not been used since the evolution of resistance in the early 1990s. The pyrethroid resistance that developed has been stable, and remains at high levels. Abamectin was introduced in the late 1980s, and while evidence of decreased field performance exists, only one resistant population has been documented. Several new insecticides with different modes of action have been introduced over the last decade, for which baseline levels of tolerance of been developed. Of these, the neonicotinyls have been found to have increased levels of tolerance. Resistance monitoring will continue.

Chemical Control

New Products

Joe Grant, moderator

Notes

Chemical Control/New Products

Phase Out of Azinphos Methyl on Deciduous Tree Fruit

Mike Willett[1] and Jim Cranney[2]
[1]Northwest Horticultural Council, Yakima, WA and [2]USApple, Vienna, VA

Keywords: Azinphos methyl, AZM, Environmental Protection Agency, EPA, apples, pears, cherries, almonds, walnuts, phase out

Abstract: On November 16, 2006, the U.S. Environmental Protection Agency (EPA) announced its final decision regarding azinphos methyl (AZM). The announcement can be found at EPA's Web site at the following address: http://www.epa.gov/oppsrrd1/op/azm/ phaseout_fs.htm. As expected, EPA announced that uses of AZM on almonds and walnuts would be phased out in 2009 and use on apples, pears, cherries, blueberries and parsley would be phased out in 2012, because of alleged risks to farm workers and the environment. In the weeks leading up to the November decision a broad cross section of commodity groups were in negotiations with the EPA to minimize the impact of the phase out on growers.

EPA has agreed to form, within the next six months, a transition working group comprised of members of its Pesticide Policy Dialogue Committee along with commodity specialists to evaluate the efficacy of assumed pest management alternatives and the availability of maximum residue levels in major export markets. EPA has also agreed to consider the use of Section 18 requests if the phase out of AZM creates a need for targeted use after the scheduled phase out date as determined by the transition work group.

The drivers behind the decision to phase out AZM, the specifics of the phase out schedule for deciduous tree fruit and industry thoughts on the composition of the transition work group will be discussed.

Manipulation with Codling Moth Neonate Behavior: A Potential Tool for this Pest Control

Maciej A. Pszczolkowski[1] and John J. Brown[2]

[1] Missouri State Fruit Experiment Station, Mountain Grove, MO,
[2] Washington State University, Pullman, WA

Keyword: Codling moth, fruit choice, feeding, neonate behavior, glutamate, *Ginkgo*

Abstract: Codling moth enters the fruit as a newly hatched larva (a neonate). A window of opportunity to control the pest, ranging from several hours to a day elapses between hatch and fruit infestation, depending on the kind of the fruit and abiotic conditions. Only during this period of time, can the grower effectively control codling moth neonates, because once the larva has entered the fruit, a loss in revenue has occurred.

Manipulation of neonate behavior can increase the pest's wandering and maximize its exposure to contact insecticides, increase efficacy of newer compounds that target the alimentary canal and are more toxic if ingested, or discourage the neonate from entering the fruit.

This paper reports how a researcher can manipulate post-hatch and fruit infestation behavior of codling moth neonates to a potential benefit of the grower. Several physiological mechanisms that influence fruit selection and infestation by codling moth neonates will be presented: single experience learning (one can teach neonate codling moth), fruit preference (one can teach the neonate to select a given fruit), fruit avoidance (one can teach the neonate to avoid a given fruit for weeks), feeding stimulation (one can extend probing the foliage by the neonate with over-counter human diet additives, e.g. monosodium glutamate), and feeding deterrence (extracts from *Ginkgo*, the ancient tree which has no insect pests seem to prevent fruit infestation).

Development of Micro-Encapsulated Pear Ester Kairomone Spray Adjuvant

Douglas Light
USDA, ARS, Western Regional Research Center, Albany, CA

Keywords: Kairomone, pear ester, micro-encapsulated, insecticide adjuvant, codling moth, *Cydia pomonella*, walnut, apple, pear, Cyd-X, Dipel, Dimilin, Intrepid, Guthion, Imidan, Lorsban

Abstract: Food Quality Protection Act 1996 is banning the use of most organophosphate (OP) insecticides and limitations on VOC-based products are being considered. Thus, there is a need for alternative insecticides to be made more effective and affordable. Knight and Light (2001) reported that the pear ester (PE), ethyl (2*E*, 4*Z*)-2,4-decadienoate, kairomone was highly attractive to neonate codling moth larvae. Field trials and demonstrations using a micro-encapsulated formulation of the pear ester kairomone (PE-MEC) (CIDETRAK DA-MEC, Trécé, Inc.) have expanded over the last four years testing its efficacy as a bait-spray adjuvant with various insecticides, including OPs, IGRs, and microbials. These spray adjuvant trials have been conducted in Californian walnut orchards and more broadly in apple and pear orchards of Argentina, Italy, Spain and the US Pacific Northwest. Treatments were reduce-rate insecticide alone *vs*. reduce-rate insecticide + PE-MEC, and treatments without insecticides were PE-MEC alone and a "blank-MEC." Trial designs have been both hand-gun sprays applied to replicate single trees and air-blast sprays applied to 1 - 10 acre plots, either replicated or singular for demonstration purposes. Resolution of improved insecticide efficacy has best been achieved in high-pressure orchards using both low-label or reduced-rates (50% or lower than label) of insecticides and low rates of adjuvant ($\leq$ 0.6 grams PE a.i./acre).

Chemical Control/New Products

Control of Codling Moth with Battalion and Assessment of Effects on Non-target Species

Geralyn West
Arysta LifeScience Corporation, Liberty Lake, WA

Keywords: Battalion, Deltamethrin, Codling moth, *Cydia pomonella,* apple, pear, apple rust mite, *Aculus schlechtendali,* European red mite, *Panonychus ulmi*, chemical control, insecticide

Abstract: Battalion (Deltamethrin) was tested for efficacy against Codling moth and also compared to existing chemistries regarding potential to flare mites. Battalion was highly effective for Codling moth control and appears to have less potential to flare mites compared to earlier generations of pyrethroids or neonicotinoid chemistries.

Rynaxypyr™: Novel Anthranilic Diamide Insecticide in a New Class of Potent and Selective Ryanodine Receptor Activators

Paula G. Marçon
DuPont Crop Protection, Stine-Haskell Research Center, Newark, DE

Keywords: Rynaxypyr™, anthranilic diamide, insecticide, new mode of action, residual activity, selectivity, integrated pest management, resistance management

Abstract: Rynaxypyr™ is a new insecticide from the anthranilic diamide class of chemistry with exceptional activity on a broad spectrum of economically important pest species. The mode of action of Rynaxypyr™ is activation of insect ryanodine receptors. Activation stimulates release of stored calcium from the sarcoplasmic reticulum of muscle cells, causing impaired muscle regulation, paralysis and ultimately insect death. Differential selectivity toward insect ryanodine receptors over mammalian receptors has been extensively demonstrated. Rynaxypyr™ presents low toxicity to birds, fish, and mammals. Rynaxypyr™ is very effective and shows good residual activity against target pest species at low use rates. This new insecticide is being evaluated on a wide range of food, feed, and fiber crops. The novel mode of action and unique selectivity against pollinators and beneficial arthropods are key attributes of Rynaxypyr™ making it a suitable pest management tool with an excellent fit in integrated pest management and insect resistance management programs.

Chemical Control/ New Products

Field Characterization of Spinetoram[1], A New Spinosyn Insecticide for Control of Key Pests in Western U.S. Tree Crops

Harvey Yoshida, Barat Bisabri, and Jim Dripps
Dow AgroSciences, LLC, Indianapolis, IN

Keywords: Codling moth, *Cydia pomonella*, pear psylla, *Psylla pyricola,* navel orangeworm, *Amyelois transitella,* oriental fruit moth, *Grapholitha molesta,* western flower thrips, *Frankliniella occidentalis,* citrus thrips, *Scirtothrips citri,* spinosyn, spinetoram, chemical control, insecticide

Abstract: Spineotram is a new broad-spectrum spinosyn insecticide under development by Dow AgroSciences, LLC. Field trials were conducted in California, Oregon, and Washington to evaluate the performance of spinetoram against key pests of tree crops including codling moth (*Cydia pomonella*), pear psylla (*Psylla pyricola*), navel orangeworm (*Amyelois transitella*), oriental fruit moth (*Grapholitha molesta*), western flower thrips (*Frankliniella occidentalis*), and citrus thrips (*Scirtothrips citri*). Performance of spinetoram was compared to commercial standards such as abamectin, acetamiprid, thiacloprid, phosmet and azinphos-methyl. Results of these field trials indicate that spinetoram is effective in controlling key pests of tree crops and offers an alternative tool for use in integrated management programs.

[1]*Spinetoram has not yet received federal registration; registration is pending. The technical information in this presentation is not an offer for sale.*

Baseline Sensitivity of Various Populations of Codling Moth and Obliquebanded Leafroller to Selected New Insecticide Chemistries

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

Keywords: Rynaxypyr, spinetoram, ovaluron, baseline sensitivity, laboratory bioassays

Abstract: Laboratory reared and field collected populations of codling moth (CM), *Cydia pomonella* L., and obliquebanded leafroller (OBLR), *Choristoneura rosaceana* (Harris) were evaluated for their sensitivity to newly introduced insecticides: Rynaxypyr, spinetoram and novaluron. Spinetoram and novaluron bioassays were conducted using lima bean diet surface topical bioassays while the sensitivity of CM populations to Rynaxypyr was evaluated using a stonefly diet incorporated bioassay method. The CM and OBLR populations were collected from commercial and/or abandoned orchards located in Pennsylvania, New York, North Carolina, Virginia and Michigan. All bioassays were conducted using neonate larvae from the earliest available generation of the pest, and in most cases were conducted no later than on *f2* generation. When possible, additional bioassays were conducted to assess if there was detectable cross-resistance between the newly introduced insecticides and other, older insecticides such as azinphos-methyl. No cross-resistance was detected between Rynaxypyr and azinphos-methyl for CM even though up to twofold differences was observed at the LC50 and up to 4 fold differences at the LC90 level were found among samples collected from various fruit growing regions. Differences in CM sensitivity to spinetoram were observed between one- and four-day readings, but the differences at the LC50 and LC 90 levels within each mortality reading period were no larger than 2.4 and 3.1 fold, respectively.

Chemical Control/New Products

Efficacy of New Insecticide Chemistries Against Internal Feeding Lepidoptera and Leafrollers on Apples in Pennsylvania

L. Hull, G. Krawczyk and D. Biddinger
Penn State University, Fruit Research and Extension Center, Biglerville, PA

Keywords: *Cydia pomonella*, codling moth, *Grapholitha molesta*, oriental fruit moth, obliquebanded leafroller, *Choristoneura rosaceana*, tufted apple bud moth, *Platynota idaeusalis*, insecticides, apple

Abstract: A series of orchard studies on apple were conducted over three years to determine the efficacy of three novel insecticide chemistries against both the codling moth (CM), *Cydia pomonella*, and the oriental fruit moth (OFM), *Grapholitha molesta*, and two leafrollers - obliquebanded leafroller, *Choristoneura rosaceana*, and tufted apple bud moth, *Platynota idaeusalis*. In addition, the relative toxicity of the compounds against various natural enemy populations was measured. The three novel chemistries were Flubendiamide (NNI-0001), Rynaxypyr (DPX-E2Y45) and Spinetoram (XDE-175). These three compounds were compared to a number of registered insecticides in all studies. All treatments were applied to either replicated single tree or 12-15 tree plots using an air-blast sprayer calibrated to deliver 100 gallons per acre. Data on pest and natural enemy populations and fruit injury were collected in all studies. All three products were as effective, and in most studies more effective, than any standard products for all lepidopteran pests. Rynaxypyr provided outstanding control of CM and OFM and the leafroller complex on a 21-day application interval. Spinetoram appeared to be somewhat toxic to the mite predator, *Typhlodromus pyri*.

Chemical Control/New Products

Reduced Risk Insecticide Evaluations for Apples in California

J.L. Caprile[1], R.A. Van Steenwyk[2]
[1] University of California Cooperative Extension, Contra Costa Co., Pleasant Hill, CA
[2] University of California, Dept. of ESPM, Berkeley, CA

Keywords: Apple, chemical control, insecticide, codling moth, *Cydia pomonella*, Assail 30SG, acetamiprid, Alatcor 35WG, rynaxypyr, Baythroid 2, cyfluthrin, Battalion 0.2EC, deltamethrin, Calypso 4F, thiacloprid, Delegate 25 WDG, spinetoram, Guthion 50WP, azinphos-methyl, Imidan 70WP, phosmet, Intrepid 80WP, methoxyfenozide, PureSpray Green oil, Rimon 0.83 EC, novaluron, Warrior 1CS, Lambda-cyhalothrin

Abstract: Ten reduced risk materials were compared alone and/or in combination to a grower standard (GS) program and an untreated control (UTC) in 14 randomized, replicated treatments in 'Gala' apples in the North San Joaquin Valley of California. All treatments were applied with a hand gun to three 15 tree replicates at 250 and 650 degree days (DD) for the first and second flights except for one treatment with a 50 DD Rimon application.

The grower standard consisted of Imidan followed by three Guthion sprays. The four treatments using the same material all season included Altacor, Delegate, oil , and Delegate + oil. The five combination treatments included Delegate + oil alternating with Calypso + oil by flight, Calypso for the first flight followed by Assail for the second flight, 50 DD Rimon followed by Calypso + Rimon + oil at 250 DD and Intrepid + oil at 650 DD, and Calypso for the first flight followed by Guthion for the second flight. Three other treatments used a pyrethroid, either Warrior, Battalion, or Baythroid, for the 250 DD spray and Guthion for the 650 DD spray.

Under extreme CM pressure (UTC=93.1% damage), all treatments performed significantly better than the UTC except for the Altacor and the oil treatments. All other treatments were not significantly different than the grower standard although the Battalion followed by Guthion and the Warrior followed by Guthion treatments had numerically lower codling moth damage than the GS.

Chemical Control/New Products

Insecticide Evaluations for Codling Moth Control in Pears

R. A. Van Steenwyk
Dept. of E.S.P.M., University of California, Berkley, CA

Keywords: Codling moth, *Cydia pomonella,* pear psylla, *Cacopsylla pyricola,* European mite, *Panonychus ulmi,* Twospotted spider mite, *Tetranychus urticae,* Pear rust mite (PRM), *Epitrimerus pyri*, Delegate, spinetoram, Calypso thiacloprid, Altacor, rynaxypyr, PureSpray Green horticultural oil, Guthion, azinphos-methyl, Imidan, Phosmet, Rimon, novaluron, Intrepid, methoxyfenozide, Agri-Mek, Battalion, deltamethrin, clutch, clothianidin, Warrior, lambdacyhalothrin, Proclaim, emamecin benzoate, abamectin, pear, chemical control, insecticide

Abstract: A single tree crop destruct field trial was conducted to evaluate new experimental insecticides for codling moth (CM) control. Delegate, a new promising experimental insecticide, provided excellent control when combined with horticultural oil. Delegate combined with horticultural oil and proceeding or following Calypso also provided excellent control of CM. Delegate provided some measure of pear psylla (PP) control. However, Delegate caused an increase in pear rust mite (PRM) compared to the untreated check and grower standard. The other promising treatments were Warrior combined with Proclaim and Rimon combined with Calypso followed by Calypso and Intrepid. The use of Warrior and Proclaim alone was not as effective as the combination of both products. Altacor that showed considerable promise last year did not perform as well this year. The drop-off in Altacor performance may be due to the use of lower rates and deleting the horticultural oil from this year's study. PP was suppressed in all treatments containing Calypso. Twospotted spider mite and European red mite were significantly increased in Altacor and Battalion treatments compared to the untreated check. Damaging levels of PRM were observed in the Warrior, Battalion and Altacor treatments

Chemical Control/New Products

Performance of Reduced Risk Insecticides Targeting Oriental Fruit Moth in Integrated Pest Management Programs

Walt Bentley and Brian Ribeiro
University of California, Kearney Agricultural Research and Extension Center, Parlier, CA

Keywords: Oriental fruit moth, peach pest management, reduced risk insecticides, integrated pest management in peaches.

Abstract: Insecticide control trials for Oriental fruit moth management have bee performed for 4 years. These trials have focused on the comparative efficacy of various reduced risk products now, or soon to be available, for peach and nectarine farmers. They have been compared to standard broad-spectrum materials that are problematic to the environment.

The general design of these trials has been to use 4 to 6 single tree replications where treatments are applied in either 268 (2004 and 2006) or 400 (2005) gallons per acre. This was dependent upon the variety used in the studies. Treatments were applied at the preferred timing of 500 to 600 degree days after first moth detected from the second flight (first generation adults but second generation larvae). In general, all of the newer products performed equally or were superior to the broad-spectrum insecticides. In particular, Intrepid 2F, E2Y WG 35 and Avaunt provided excellent Oriental fruit moth control. Tables 1-3 summarize the results of these trials.

Table 1. Effect of various insecticide application (6/21, 2006) on Oriental fruit moth twig strikes. Sprayed at 268 gallons per acre

Pesticide	**Rate/Acre**	**Strikes/tree 7/03**	**Strikes/tree 7/10**	**Strikes/tree 7/21**
Avaunt	6 oz	1.25 (± .95) ab	.5 (± .5) a	20(±1.35)
Calypso SC	8 oz	1.25 (± .63) ab	1.25 (± .48) ab	4.25 (± .95)
XDE 175	6 oz	1.75 (± .85) ab	1.5 (± 2.65) ab	6.75(± 1.55)
Intrepid 2F+ Latron	16 fl oz .10 lb	.50 (± 2.9) a	.5 (± .5) a	4.25(± 1.49)
Asana	12 oz	2.75 (± 4.8) bc	2.75 (± .48) b	0(± .5)
Success	7 oz	1.25(± .48) ab	1 (± .71) ab	6.5 (± .96)
E2Y WG 35	3 oz	.75 (± .48) ab	1 (± .58) ab	5.25(± 1.65)
Untreated		4 (± 1.23) c	5.5 (± 1.32) c	7.25 (± .59)

Table 2. Effect of various insecticide application (6/23, 2005) on Oriental fruit moth twig strikes. Treatments applied at the equivalent rate of 400 gallons per acre, four singletree replications.

Pesticide	Rate/Acre	Strikes/tree 7/29	Strikes/tree 8/10.	Infested Fruit
Avaunt	6 oz	9.25 (± 3.43) ab	10 (± 3.19) ab	0
Calypso SC	6 oz (6/4 and 6/23)	5.75 (± 2.75) ab	8.25 (± 3.47) ab	0
Calypso SC	8 oz	7.5 (± 1.19) ab	13.75 (± 1.03) bc	0
XDE	3 oz	6.75 (± 1.80) ab	7.25 (± 1.38) ab	0
XDE	4.5 oz	10.75 (±1.84 b	8.50 (± 2.06) ab	0
XDE	6 oz	9.75 (± 1.79) ab	12.75 (± 2.29) bc	0
Intrepid + Latron	16 fl oz .10 lb	3.75 (± 1.32) a	4.75 (± 1.80) ab	0
Imidan 70WP	4 lb	9.25 (± 2.10) ab	11.25(± 2.98). ab	0
Success	6 oz	11 (± 1.47) b	16 (± 2.16) bc	0
E2Y + Latron	.7 oz .10 lb	8.25 (± 1.87) ab	12.25 (± 3.59) bc	0
E2Y + Latron	1 oz .10 lb	3.5 (± 1.32) a	3.75 (± 1.49) a	0
E2Y + Latron	1.4 oz .10	4 (± 1.47) a	6.0 (± 1.47) ab	0
Untreated		23.75(± 1.84) c	19.5 (± 5.25) c	0

Table 3. Effect of various insecticide application (May 27, 2004) on Oriental fruit moth twig strikes.

Pesticide	Rate/Acre	Strikes/tree 6/9	Strikes/tree 7/22	Infested Fruit
Avaunt	6 oz	0.2 (± .2) a	31.4 (± 5.8)	0
Calypso SC	4 oz	0.6 (± .4) abc	36.2 (± 5.8)	0
Calypso SC	6 oz	1.4 (± .4) abcd	32.4 (± 4.6)	0
Diamond (2 apps)	1.6 lb	2.8 (± .58) cde	23.2 (± 3.2)	0
Diamond	1.6 lb	1.6 (± .51) abcde	30.0 (± 1.7)	0
Diamond	2.5 lb	0.4 (± .25) ab	20.8 (± 3.6)	0
Entrust	2.5 lb	2.2 (± .58) bcde	35.2 (± 5.5)	0
Imidan 70WP	4 lb	0.6 (± .40) abc	32.4 (± 4.2)	0
Success	8 oz	1.0 (± .63) abcd	23.0 (± 3.6)	0
Water		2.4 (± 1.12) cde	34.8 (± 6.6)	1
Untreated		3.0 (± 1.45) e	25.8 (± 3.5)	0

Chemical Control/New Products

MOVENTO®, BELT® and SYNAPSE®; New Products from Bayer CropScience with Novel Modes of Action for Broad-spectrum Sucking and Chewing Insect Control

R. Warner, J. Bell, S. Krueger, and R. Steffens
Bayer CropScience, Research Triangle Park, NC

Abstract: MOVENTO® contains a novel active ingredient, spirotetramat, from the new chemical class of tetramic acids. When applied to the foliage, this highly systemic insecticide is translocated within phloem vascular tissues, resulting in effective pest control on shoots, leaves and roots. MOVENTO is active via ingestion and provides excellent initial and long-lasting residual control of a broad range of economically important sucking pests infesting perennial and annual crops, including aphids, whiteflies, scales, mealybugs, psylla, and *Phylloxera*.

BELT® and SYNAPSE® are two new products containing the active ingredient, flubendiamide, for broad-spectrum Lepidoptera control on perennial and annual crops. Flubendiamide is the first member of a new chemical class, the phthalic acid diamides with a novel mode of action; disruption of cellular Ca^{2+} balance. Upon ingestion, flubendiamide produces rapid cessation of feeding resulting in excellent pest control and superior plant protection.

As new modes of action, spirotetramat and flubendiamide exhibit no cross-resistance to currently available chemical classes. In addition, MOVENTO, BELT and SYNAPSE have minimal impact on beneficial organisms. These new product offerings from Bayer CropScience provide outstanding pest control and will serve as powerful tools in Resistance and Integrated Pest Management programs.

New Approaches to Chemical Control of Woolly Apple Aphid: Soil and Foliar Applications to Kill Root Colonies

Elizabeth H. Beers and Stephen D. Cockfield
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: Woolly apple aphid, *Eriosoma lanigerum*, sticky bands, imidacloprid, Admire Pro, dinotefuran, Venom, oxamyl, Vydate, spirotetramat, Movento

Abstract: Several field and greenhouse experiments were performed to investigate the possibility of controlling the root colonies of woolly apple aphid. Control of shoot colonies, either through systemic activity or direct contact, was also studied. Two potted-tree bioassays with imidacloprid and spirotetramat indicated that both materials had efficacy against shoot and root colonies when applied to the soil (imidacloprid) or the foliage (spirotetramat); however, imidacloprid appeared to be faster acting than spirotetramat against aerial colonies. Venom applied to the soil suppressed shoot and root populations. Success of treatments in field trials was more variable. Admire Pro provided suppression of either root or shoot colonies in two field trials. Spirotetramat applied in May showed a (non-significant) trend to suppress crawlers and aerial colonies. NNP-515 provided good control in one orchard, but had no measurable effect in another. Vydate was not significantly different from the check in all 2006 field trials, although it showed good activity in 2005 potted tree bioassays.

Chemical Control/New Products

Materials and Methods for Control of Cherry Fruit Fly

Timothy J. Smith and Esteban Gutierrez
Washington State University Extension, Wenatchee, WA

Keywords: Acetamiprid, assail, imidacloprid, Provado, rynaxypyr, entrust, spinetoram, Delegate, pyrethrum, PyGanic, novaluron, Rimon, cherry fruit fly, control, GF-120NF bait, larvae

Abstract: Products included in this project during the 2006 trials included acetamiprid (Assail), imidacloprid (Provado), Rynaxypyr (an "anthranilic diamide,") Entrust, GF-120NF Bait, spinetoram (Delegate/DE-175), pyrethrum (PyGanic), novaluron (Rimon) (applied as a full cover spray and as a toxicant component in a bait), and an unmentionable numbered product. All products, rates and timings were tested under pest pressure conditions far in excess of what would be expected in commercial orchards.

- Entrust was effective when applied at 10-day intervals (the commonly recommended application interval is seven days.) These results have been consistent on 12 sites for two seasons.
- PyGanic (pyrethrum), even with relatively moderate pest pressure compared to the conditions of this set of trials, failed to completely control CFF in five of the six treated trees. The product was applied in both buffered and unbuffered water.
- Rimon appeared to prevent the infestation of cherries, both as a spray and as a toxicant in bait.
- Rynaxypyr and Delegate (and secret product "Z") at all tested rates were effective at preventing larval infestation of fruit, and did not damage the fruit or foliage.
- In trials evaluating effect of materials on larvae inside fruit, dimethoate, at the currently recommended after-harvest rate of 1.33 lb. ai/a was effective, but when the rate was reduced to the EPA-suggested 1.0 lb. ai/a, some larvae survived. In the same trial, imidacloprid and acetamiprid performed as well as the full rate dimethoate.
- Acetamiprid controlled CFF when applied at 7- or 10-day intervals, but did not completely prevent fruit infestation when applied at 14-day intervals. These results are consistent over the past four seasons.
- GF-120 bait treatment was applied to four new sites in 2006, and 10 sites previously treated from two to four seasons. All sites were well infested prior to initiation of GF-120 application, and no other control method or material has been applied during the 49 "treatment years." (Treatment year = one site treated for one season.) During the past five years, two larvae were found in 35,400 cherries crushed from these 49 treatment-year sites. No larvae were found after treatment of the four new infested 2006 sites. Use in the first three years of registration has saved Washington cherry growers over $2,750,000 in reduced labor, machinery and material costs, and economic benefits will continue at about $1.5 million per season at current use levels. Adoption of this new technology has essentially eliminated a serious and increasing problem with cherry fruit fly in Washington organic orchards. Due to use of this product, applicator exposure to products with potential to inhibit cholinesterase was reduced by about 8,000 hours during May, June and July of 2006.

Chemical Control/New Products

Organic Control of Oleander Scale on Kiwifruit

Janine Hasey, Kent Brocker, and Tim Ksander
University of California Cooperative Extension, Yuba City, CA

Keywords: Kiwifruit, *Actinida deliciosa*, Oleander scale, *Aspidiotus nerii*, Omni Supreme Spray Oil, PureSpray Green, Crocker's Fish Oil, organic control, organically acceptable horticultural oil, phytotoxic

Abstract: Three organically acceptable horticultural oils were tested for efficacy against armored scale and for phytotoxic effects on kiwifruit. Single vine replicates were sprayed at 100 gpa with a backpack sprayer for the dormant application and a solo mist blower for the in season application. Percent bud break and percent fruit infestation at harvest were evaluated. There were no phytotoxic effects on bud break. Oils applied as a dormant application suppressed scale-infested fruit. Fish oil applied in season when crawlers were active had the least infested fruit.

Promising Products for Peach Arthropod Management

Peter W. Shearer and Ann Rucker
Rutgers University Agricultural Research and Extension Center, Bridgeton, NJ

Keywords: Peach, Oriental fruit moth, *Grapholitha molesta*, stink bugs, *Euschistus* spp., DPX-E2Y45, XDE-175, Rimon, Danitol, Baythroid

Abstract: DPX-E2Y45, XDE-175, and Rimon were applied to peach trees with an air-blast sprayer and were then evaluated for their efficacy in separate season-long programs targeted against oriental fruit moth. These products provided excellent control against this pest. Various products were also applied with an air-blast sprayer to peach trees and then evaluated for their efficacy against stink bugs. Both Danitol and Baythroid provided the best protection against stink bugs.

Phytotoxicity of GF-120 NF Naturalyte Fruit Bait on Sweet Cherry Foliage

Naomi C. DeLury and Howard M.A. Thistlewood
Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre, Summerland, BC

Keywords: GF-120 NF Naturalyte Fruit Bait, phytotoxicity, necrotic lesions, sweet cherry, *Prunus avium* L., foliage, leaves, *Rhagoletis*, cherry fruit fly, SPAD, abaxial, adaxial

Abstract: Research was conducted in the summer of 2006 to investigate observations of necrotic lesions appearing on sweet cherry (*Prunus avium* L.) leaves within 24 hours of GF-120 NF Naturalyte Fruit Bait field application, for control of *Rhagoletis indifferens*. We examined the effects of: 1) concentration, within the recommended range given on the label; 2) cherry cultivar; and 3) adaxial vs. abaxial application of GF-120 NF Naturalyte Fruit Bait at 24 and 168 hours post treatment, for relative phytotoxicity to leaves. A formulation without spinosad was used in order to assess the bait in isolation of the active ingredient. We present a summary of the results, and recommendations for application so as to reduce any phytotoxicity to sweet cherry foliage that may be linked with this product.

Chemical Control/New Products

Baseline Toxicity of Altacor Against Codling Moth and Obliquebanded Leafroller

Michael D. Doerr, Jay F. Brunner, and Keith R. Granger,
Washington State University Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: Codling moth, *Cydia pomonella*, obliquebanded leafroller, *Choristoneura rosaceana*, apple, chemical control, insecticide, anthranilimide, rynaxypyr, altacor

Abstract: A novel anthranilimide insecticide, Rynaxypyr (Altacor 35WG, DuPont), was evaluated in a series of laboratory bioassays for its effect on codling moth and obliquebanded leafroller at WSU Tree Fruit Research and Extension Center in Wenatchee, WA. Altacor was evaluated for baseline toxicity against codling moth eggs and larvae using an apple-dip technique. A series of tests were run with laboratory and field collected populations of codling moth using a diet-incorporation technique to develop a method for screening for insecticide resistance. Baseline toxicity and resistance screenings were done with laboratory and field-collected populations of obliquebanded leafroller using a leaf-dip technique. Further, field-aged residues of Altacor were evaluated for their effect on codling moth and obliquebanded leafroller larvae.

Chemical Control/New Products

New Insecticide Alternatives for Codling Moth Control in Apple

Keith R. Granger, Jay F. Brunner, and Michael D. Doerr
Washington State University Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: Codling moth, *Cydia pomonella*, apple, chemical control, insecticide, anthranilimide, rynaxypyr, altacor, spinosyn, spinetoram, delegate

Abstract: Two new insecticides currently under review by EPA for registration were evaluated in 2006 field trials for efficacy against codling moth (CM). Delegate 25WG (spinetoram), a new spinosyn insecticide by Dow Agro Sciences and Altacor 35WG (rynaxypyr), a novel anthranilimide insecticide by DuPont, both provided CM control that was comparable to Guthion 50WP (azinphos-methyl) in field trials conducted at the WSU Tree Fruit Research and Extension center test orchards located in Wenatchee, WA. Trials with each product were conducted in 5-tree plots replicated three times in a randomized complete block design. All treatments were applied with an air-blast applicator calibrated to deliver 100 gpa at 1.5 mph. Applications began ca 250/1250DD for first and second CM generations and were repeated based on anticipated residue life of the product being applied. Degree-days (DD) were accumulated after first moth capture in pheromone baited traps (biofix), and calculated from daily maximum and minimum temperatures. Data were analyzed using a one-way analysis of variance and mean separation was by Student's t (p=0.05).

Delegate, applied three times per CM generation for a total of six applications, provided CM control that was statistically equivalent to Assail (six applications) and Guthion (four applications). Numerically, Delegate had fewer entries per fruit than Assail or Guthion. San Jose scale (SJS) infested approximately 50% of the fruit sampled in the untreated check (UTC) in this test plot. Delegate did not appear to have any effect on SJS when applied at these timings against CM. Mite samples in July and August revealed a slight suppression in the number of predatory mites in the Delegate treatment, which resulted in a slight increase in the number of spider mites.

Three rates of Altacor (2, 3 and 4 oz/acre) were tested. Altacor treatments were applied twice per CM generation for a total of four applications. The 3 and 4 oz rate of Altacor provided CM control that was statistically equivalent to Guthion, which was also applied twice per CM generation. SJS infested approximately 25% of the fruit sampled in the UTC in this test plot. There was a significant rate effect noted in the percentage of SJS injured fruit in the Altacor treatments. The 4 oz rate provided suppression of SJS that was similar to the Guthion comparison. There were no apparent effects on spider mites or predatory mites in any of the three Altacor treatments.

Chemical Control/New Products

Katydid Damage, Biology and Control in California Pear Orchard

Lucia G. Varela
University of California Cooperative Extension and Statewide IPM Program, Santa Rosa, CA

Keywords: Success, spinosad, Avaunt, indoxacarb, Danitol, fenpropathrin, Asana, esvenvalerate, Warrior, lambda-cyhalothrin, Brigade, bifenthrin, Dimilin, diflubenzuron, Intrepid, methoxyfenozide, Assail, acetamiprid, Imidan, phosmet, Guthion, azinphos-methyl, Katydid, orthoptera, pear, chemical control, insecticide, phenology

Abstract: The efficacy of pear registered insect growth regulator, neonicotinoid, organophosphate and pyrethroid insecticides were tested against katydid nymphs. A residue bioassay was developed in which a treated branch was placed in a cage with one katydid nymph and mortality accessed every other day from day 1 to 14 and replicated 10 to 30 times per rate. The bioassay was performed with branches sprayed at different rates to obtain an LD50. The bioassay was also performed with branches collected 1, 7 and 14 days after a grower spray and compared against untreated branches. All treatments gave control. Avaunt, Warrior, Brigade, Guthion and Imidan were the most effective, followed by Success and Dimilin. Asana, Danitol and Assail gave partial control. Katydid phenology was followed: eggs are laid in the bark in grapevines, nymphs begin to emerge in the first week of May, then molt through 5 instar stages; adults begin mid-July. Migration and damage in pears are observed beginning in mid-July.

Biology

Phenology

Pat Weddle, moderator

Notes

Biology/Phenology

Movement of Codling Moth between Abandoned and Commercial Orchards

Vincent P. Jones, Callie C. Baker, Tawnee D. Wilburn
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: Codling moth, *Cydia pomonella*, dispersal

Abstract: Our protein marking technique was used to quantify the movement of codling moth adults from abandoned orchards to conventionally treated commercial apple blocks. We assessed movement by placing a grid of traps in the commercial blocks (60 delta traps baited with Trécé's combo/DA lures) and 8-12 traps in the abandoned blocks. In addition, we performed high-density samples that were geo-coded so that we could reconstruct damage patterns in the orchards. In the first orchard, we found trap catch of marked moths was greatest in the rows closest to the abandoned block, but both males and females were captured throughout the commercial block. Fruit damage in the abandoned block was 25%, but 60 feet away in the first row of the commercial orchard it was ≈6% and 2.1% in the second row of the orchard. Fruit damage was found throughout the commercial orchard at each distance surveyed at roughly 1-2% depending on the distance from the abandoned block. In the second orchard, the population levels were lower overall, and the orchard was treated with Surround® for sunburn protection 3 days after we applied our markers in the abandoned areas. In this case, we collected only 42 marked moths in the commercial orchard, again heaviest in the traps closest to the abandoned area. Our damage survey showed 18.8% damaged fruit in the abandoned area and 36 feet away in the first row of the commercial orchard it was only 0.2% and 1.2% in the second row. Although low level damage was found in the other rows surveyed, it only average only 0.4%. The decreased damage and penetration of moths from the abandoned areas is likely a result of behavioral effects caused by the application of Surround® and suggests a method to reduce movement patterns from high density areas such as bin piles or abandoned orchards into commercial production areas.

Frequency Distribution of Larval Codling Moth Aggregations in Apple Orchards and Characterization of Larval Aggregation Pheromone as an Attractant

Zaid Jumean, Charlene Wood, and Gerhard Gries
Department of Biological Sciences, Simon Fraser University, Burnaby, BC

Keywords: Codling moth, *Cydia pomonella*, larval aggregation, pheromone, attraction, arrestment

Abstract: Pupation-site-seeking larvae of the codling moth (CM), *Cydia pomonella*, aggregate in response to aggregation pheromone emitted from the silk of male and female larvae spinning cocoons. Whether such aggregations occur frequently in nature and whether the pheromone arrests or attracts foraging larvae was unknown. We conducted field surveys of overwintering CM larvae in apple orchards to determine the frequency distribution of larval aggregations. The incidence of a male or female larva cocooning in solitude was twice as frequent as that of larvae cocooning in aggregations. The frequency of aggregations was inversely proportional to the number of individuals therein. In no-choice, straight tube laboratory experiments, 5th instar larvae moved upwind towards cocooning conspecifics faster and farther than towards a control stimulus. In two-choice cage experiments, foraging 5th instar larvae significantly more often responded first to cocooned conspecifics than to a control stimulus. Our results demonstrate that aggregations of CM larvae do occur in nature and that the pheromone mediating larval aggregation has attractive rather than merely arrestment characteristics.

Biology/Phenology

Comparison of Field Observations to the Current Degree Day Model for Codling Moth

Allison Walston and Helmut Riedl
Oregon State University, Mid-Columbia Agricultural Research and Extension Center, Hood River

Keywords: Codling moth, degree days, model

Abstract: Monitoring codling moth in apple and pear orchards with pheromone traps has become a widely used practice to determine whether codling moth is present in an orchard, to track flights through the season, time sprays accordingly, and to assess the potential for fruit damage. The objective of this research was to determine when both male and female moths were active and when eggs were being laid in the field. To find codling moth eggs in the field, fruit clusters from unsprayed apple blocks were collected weekly and examined for all egg stages. Eggs that were found were placed in an environmental chamber to estimate egg hatch in the field. By observing codling moth oviposition in the field, we estimated the beginning of egg hatch in early season and progression of egg hatch in each generation. Information from a three-year field study was then compared to our current codling moth degree day model and used to adjust the model accordingly.

Resetting the CM Clock: Targeting Peak Pest Periods

Alan Knight
USDA, ARS, YARL, Wapato, WA

Keywords: *Cydia pomonella*, apple, phenology, pest control

Abstract: Studies were conducted in 10 apple orchards in Washington State from 2003-2006 to characterize the seasonal cumulative curves of codling moth flight and the occurrence of fruit injury. Data from each generation were fit to logistic curves and these data were compared to a current widely used model. The only significant difference found was for the cumulative curve of egg hatch during the first moth generation. Data from the four-year study found that the peak in egg hatch occurred much later than previously predicted. Comparing several hypothetical pest management scenarios using either the old or new model emphasizes the importance of knowing the correct shape of the cumulative curve of egg hatch. Several modifications in the current pest control program for codling moth are suggested.

Biology/Phenology

An Evaluation of the Likelihood of Codling Moth Establishment and Spread in Taiwan Through the Importation of Fresh U.S. Apples.

Mike Willett[1], Lisa Neven[2] and Helmut Riedl[3]
[1]Northwest Horticultural Council, Yakima, WA
[2]USDA/ARS/YARL, Wapato, WA
[3]OSU Mid-Columbia Research and Extension Center, Hood River, OR

Keywords: Apple, Taiwan, codling moth, *Cydia pomonella*, diapause, day length, temperature, quantitative risk assessment, systems approach, exports

Abstract: Historically, Taiwan has been the apple industry's second or third most important foreign market, with exports averaging approximately 200 million apples per year. The authorities in Taiwan are concerned about the possible presence of codling moth on imported U.S. apples. After pest detections in 2002, Taiwan closed its market to U.S. apples until a new, more stringent apple export work plan was negotiated based on a systems approach. Under the terms of the revised work plan, Taiwan is permitted to suspend the importation of all U.S. apples following three separate detections of codling moth. In December 20, 2004 Taiwan again closed its market to U.S. apple imports following a third-strike. The resulting four-month closure cost U.S apple growers at least $15 million in lost sales to Taiwan. The diversion of apples originally destined for Taiwan to the U.S. market resulted in $10 million to $20 million in additional losses as this extra supply of product placed downward pressure on domestic apple prices.

The U.S. apple industry believes that either U.S. apple export procedures mitigate the risk to levels below quarantine concern or codling moth cannot survive in Taiwan, or a combination of the two. In particular, codling moth diapause triggers and requirements appear to appear to limit its ability to complete its life cycle in sub tropical and tropical regions under short day lengths and warm daily temperatures. This limits the distribution of this insect to areas above approximately 30 degrees latitude in each hemisphere. In November 2006 USDA/APHIS/PPQ's Center for Plant Health Science and Technology (CPHST) completed a quantitative risk assessment on the possibility of codling moth being introduced to Taiwan through U.S. apples. The draft assessment estimates that, given the biology of the insect and the prevailing climate and day length in Taiwan, there is a 99 percent chance that it would take at least 10,091 years before a mating pair of codling moths would occur in Taiwan, from apples imported from the Pacific United States.

The conditions of the systems approach, codling moth diapause biology, the climate of Taiwan and the assumptions used in the quantitative risk assessment and the future use of the risk assessment will be discussed .

Biology/Phenology

Resistance of Rootstock Selections to a Washington Strain of Woolly Apple Aphid

Elizabeth H. Beers[1], Stephen D. Cockfield[1] and Gennaro Fazio[2]
[1]Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA
[2]USDA-ARS, NY State Agric. Res. Station, Geneva, NY

Keywords: Woolly apple aphid, *Eriosoma lanigerum*, host plant resistance, Robusta 5 gene

Abstract: Ten rootstock selections were tested for their ability to host woolly apple aphid aerial colonies. Differences among the various rootstocks were apparent within a few weeks of artificial infestation. After 4 weeks, the susceptible rootstocks (including M.9, M.26, Bud 9, Bud 118, and seedlings from New York and Washington) were heavily infested. On MM.111 (whose resistance is derived from 'Northern Spy'), colonies established successfully, but were small and poorly developed. The majority of the replicates of the Geneva 'Robusta 5' derived resistant rootstocks (G.202, G41, and 4210) were free from infestation; but some replicates had a few very small colonies.

Phenology of Woolly Apple Aphid in Washington

Elizabeth H. Beers and Stephen D. Cockfield
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: Woolly apple aphid, *Eriosoma lanigerum*, sticky band, shoots colonies

Abstract: Peak upward woolly apple aphid crawler movement as evidenced by sticky bands occurred from late June to late July 2006 depending on the site. Peak movement at the site, which was sampled for 2 years, was nearly 7 weeks later in 2006 (late July) than in 2005 (early June). These data indicate substantial year-to-year variation in crawler movement. Captures in the lower band (presumably upward movement) were generally much higher than captures in the upper band (presumably downward movement). Shoot colony development appeared to be bimodal in the study orchards in 2006, with a small peak in mid- to late June, and a second, usually larger, peak in mid- to late August. Immature aphids were the most prevalent form in the shoot colonies throughout the season; apterous adults were present in lower numbers in most samples. Alate adults were found at only one site (Vantage) and only in mid-September through early October. Mummies (aphids parasitized by *Aphelinus mali*) were present starting in mid-June for as long as active colonies were present in the orchard (late October in one study site).

Biology/Phenology

Phenology of the Spotted Cutworm, *Xestia c-nigrum*, in Central Washington

Robert Brown, Peter J. Landolt, Daryl Green, and Connie Smithhisler
USDA-ARS, Wapato, WA

Keywords: *Xestia c-nigrum*, spotted cutworm, monitoring, phenology

Abstract: The seasonal response of the spotted cutworm to sex pheromone, to a feeding attractant, and to blacklight was monitored from April to November 2003 to 2006. Sex pheromone trap catches indicates there are two flights of spotted cutworm. The first flight peaks in late May into early June, and the other peaks in October. Blacklight trapping also indicates two flights of spotted cutworm, but not entirely coincident with the pheromone trap results. The spring light trap catches coincide with the pheromone trap catches, but there is a flight in August captured with the light trap that is not detected with pheromone traps. The moths in the August flight do not respond to the sex pheromone. They may be non-reproductive at that time, or it may be a different species of spotted cutworm with a different pheromone. We suggest that there are at least two spotted cutworm species in the area. The extremely late flights of spotted cutworm caught in sex pheromone traps indicate that one of the spotted cutworm species overwinters as an adult, not as a larva.

Acoustic Signals in the Sexual Communication of Peach Twig Borers

Melanie Hart, Stephen Takàcs, Gary Judd and Gerhard Gries
Simon Fraser University, Insect Communication Ecology Lab, Burnaby, BC

Keywords: *Anarsia lineatella*, peach twig borer, multimodal communication, mate finding

Abstract: Female peach twig borers, *Anarsia lineatella* (Zeller) (Lepidoptera: Gelechiidae), reportedly attract more males than synthetic pheromone. The hypothesis that females use acoustic and pheromonal signals for sexual communication was tested. A digital system was employed to record and play back sound. Males, flying on a tether, emitted signals of 12 dB above ambient sound intensity with wingbeats of 60 Hz and upper signal components at 2.5 and 10 kHz. Females produced sonic reply signals [50 Hz (wingbeat), 2 and 14 kHz) when exposed either to playback recordings of the males' signals or to signals from live males. The males' sonic signals provoked females to reduce pheromone emission. In field experiments, traps baited with sex pheromone and playback recordings of female sonic signals captured significantly more males than traps baited with pheromone alone. The data support the hypothesis that female and male *A. lineatella* also use bioacoustic signals during sexual communication.

Mating Disruption

SIR

Carolyn Pickel, moderator

Notes

Mating Disruption/SIR

Estimated Worldwide Acreage Under Mating Disruption – 2006

Jack W. Jenkins[1] and Hiroyuki Senoh[2]
[1]Pacific Biocontrol Corporation, Litchfield Park, AZ; [2]Shin-Etsu Chemical Co., Tokyo, Japan

Keywords: Mating disruption, acreage.

Abstract: It has been almost 50 years since the first publication about an insect sex pheromone. Forty years have past since the first publication demonstrating the potential of using sex pheromones for insect pest control and 30 years since the first mating disruption product received US EPA registration. Now there are more than 2,000 insect pheromones and scores of pheromone-based mating disruption products commercially used in cropping systems including for the control of Lepidopteran pests in pome fruit and stone fruit, grapes, tomatoes and cotton. Insect pheromones are also used extensively to control gypsy moth in deciduous forests. At present approximately 1.5 million acres are treated with various types of mating disruption formulations throughout the world. Estimates of treated acres are given for various pests in specific crops and countries.

New Insights Into Codling Moth, *Cydia pomonella* (L.), Distribution and Implications For Mating Disruption

D.L. Epstein, L.J. Gut, J. Miller, and L. Stelinski
Department of Entomology, Michigan State University, East Lansing, MI

Keywords: *Cydia pomonella*, canopy distribution, diel behaviour

Abstract: A study aimed at determining the location of searching codling moth (*Cydia pomonella* [L.]) (Lepidoptera, Tortricidae) males and calling females in mating disrupted and non-disrupted plots was conducted in Michigan, USA in 2005 and 2006. A leaf blower, converted into a vacuum for sampling codling moth adults on branches and in the tree canopy, had a 70-80% success in recovering released moths on potted trees in a greenhouse and 20% - 25% of marked/released moths in a 20-year-old Red Delicious orchard. A series of four collections were made during the hours of 09:00-18:00 from May 25, 2005 through June 15, 2005 and a second series of four collections were completed during the hours of 18:00-22:00 from July 20, 2005 to August 22, 2005. Only eight codling moth adults were collected during the four daylight samples; one female and two male moths were sampled from the top third of the tree canopy, four males were sampled from the middle third of the tree canopy, and one male was sampled from the lower third of the tree canopy. Canopy distributions of adults during daytime hours (09:00-18:00) were also assessed by fogging trees with various pyrethroid insecticides. No codling moth adults were collected in any of these samples. In contrast to the paucity of moths collected in the daytime samples, 94 moths were collected during four evening samples, with equal numbers sampled in disrupted and non-disrupted plots. In mating disruption plots, 42% of females were found in the top third of the tree canopy, 46% were found in the middle third, and 12% were recovered in the lower third. The 22 females sampled from non-disrupted plots were more evenly distributed, with 36.4% in the top third, 36.4% in the middle third, and 27.2% in the lower third of the tree canopy. Releases of marked moths were conducted in 2006 in screened tents to identify the daytime (09:00-18:00) habitats for adult moths within the orchard. Of males released, 11.2% were recovered from the tree canopy and 6.2% were recovered from the ground (drive row grass and vegetation under the tree). Of females released, 18.6 % were recovered from the tree and 8.2% from the ground.

Mating Disruption/SIR

Spraying Codling Moth Sex Pheromone With and Without Insecticides: "Allowing Growers to Concentrate"

Alan Knight
USDA-ARS, YARL, Wapato, WA

Keywords: *Cydia pomonella*, apple, insecticides, fecundity

Abstract: Studies were conducted in replicated small plots of apple comparing the efficacy of ULV sprays of Checkmate CM-F alone and in combination with Asana, Assail, or Imidan. A five-spray program of pheromone + insecticides using half rates of Assail or Asana were significantly more effective than spraying pheromone alone and equivalent to a four-spray, air blast insecticide program using full rates. Imidan at 1.0 lb per acre plus pheromone gave intermediate results. All ULV programs had lower phytophagous mite: predator mite ratios compared with plots treated with air blast applications of each insecticide. Interestingly, this ratio in both the Assail and Imidan treatments was not different than in the pheromone-only or untreated plots. ULV Assail applications were also very effective for control of white apple leafhopper. A new technique coined PULSV (Pulsating Ultra Low Spray Volume) was developed in 2006 for applying the microencapsulated pheromone formulation. PULSV allows growers to concentrate the deposition of microcapsules in the canopy to create thousands of attractive point sources in the orchard. Future studies will examine the effectiveness of the PULSV approach.

Commercial-scale Trials of New Mating Disruption Products, 2006

Andrew Kahn, Jay Brunner and Mike Doerr
Washington State University Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: Codling moth, *Cydia pomonella*, Suterra CheckMate CM-F, Scentry NoMate Fiber, Hercon Disrupt CM MicroFlake, apple, pear, mating disruption, pheromone

Abstract: CheckMate CM-F approached but never exceeded the efficiency of Isomate C+ in suppressing CM trap capture in L2 (1X) or Biolure (10X) traps. First generation, efficiency relative to Isomate was 75% for 1X and 66% for 10X traps. Second generation, CM-F was only about 23% as efficient as Isomate. Scentry NoMate CM Fiber again showed a significant rate effect between the 100 g/acre and 200 g/acre rates. The 100 g/acre rate was never statistically equivalent to the Isomate C+ standard. The 200 g/acre rate was often statistically equivalent, but never numerically. Hercon Disrupt-CM MicroFlake approached but never exceeded the efficiency of Isomate C+ in suppressing CM trap capture in L2 traps. A separate rate study indicated the potential in the technology if adequate numbers of flakes could be placed in the tree. Deposition studies showed that about 60% of Fibers and 35% of Flakes were being intercepted by canopy foliage. Retention studies showed that Fibers were only 24% retained after 6 weeks, while Flakes were 81% retained. Net, roughly equivalent numbers (13-18 per tree) were present in the canopy. Trécé Cidetrak dispensers showed promise as an alternative hand-applied technology for CMMD. Cidetrak products at minimum appear to be competitive with Isomate C+, and have the potential to exceed it.

Mating Disruption/SIR

Update on Mating Disruption in Walnuts: Puffers and Flakes

Carolyn Pickel, Joseph Grant and Stephen Welter
University of California IPM, Sutter/Yuba UCCE

Keywords: Pheromone mating disruption, codling moth, Suterra puffers, area-wide, Hercon flakes

Abstract: Two "areawide" puffer demonstration sites in walnuts were established in 2005. The Glenn Co. puffer site is 160 acres and the San Joaquin site is 564 acres. Puffers were deployed at one puffer per two acres with a cost around $50.00 per acre. Sites were evaluated with 1x traps low in the tree and combo lures high in the tree canopy. Damage was evaluated with ground canopy counts at 1000 nuts per block or variety. Damage at harvest was evaluated with a 500-nut sample and evaluated for codling moth and navel orangeworm damage. A full spray program was used to lower codling moth population in the first year. In 2006, codling moth management is based on DA combo trap catches to lower the resident population in the area and not the potential for damage.

Aerial Hercon flakes were applied to 20-25 acre blocks at 3 sites in the Sacramento Valley. Two applications were made May 5 and July 10. This treatment was compared to a grower standard and a two-acre check that was more than 1000 feet away from the pheromone treatment in the same variety. The same procedure described for puffers was used to evaluate the Hercon treatments. Black plastic was placed under the tree canopy in the weed strip treatment on 5 trees to evaluate if the flakes stuck to the canopy and if they dropped over time. Dropped flakes on the plastic were counted the day of application removed and counted at weekly intervals.

Results from both show a future potential for implementation of pheromone based IPM programs with application technology that can work in the large tree canopy and economically comparable to current walnut pest management programs.

Toward "High-performance" Mating Disruption of Oriental Fruit Moth and Codling Moth

Larry Gut, Lukasz Stelinski, Peter McGhee and James Miller

Keywords: Grapholitha molesta, *Cydia pomonella*, mating disruption, false-plume-following, competitive attraction, kairomone, pear ester, wax

Abstract: Recently, we have explored approaches of achieving "high-performance" mating disruption, defined as few, if any, males captured in monitoring traps or mate even under high population densities and without the need for companion insecticides. This work has been grounded in earlier investigations of disruption mechanisms, which indicated that competitive attraction between calling females and synthetic pheromone sources is an important component of effective disruption. For Oriental fruit moth (OFM) we have developed a mechanized applicator for high-speed deployment of pheromone dispensers made of wax to tree fruit. In on-farm trials in 2006, we achieved high-performance disruption of OFM for more than 100 days with a single application of wax. For codling moth (CM) we are investigating "Cidetrak" dispensers (Trécé Co.) intended to better protect the active ingredient and to co-release both codlemone and pear ester. In 2006, disruption of male CM with Cidetrak dispensers loaded with pear ester and codlemone was not superior to Cidetrak dispensers loaded with codlemone only; however, Cidetrak treatments were superior or equivalent to Isomate treatments. Deploying high densities (3,600—18,500 pieces/ha) of Cidetrak CM pieces ca. 1/7th the size of the original dispenser resulted in "high performance" disruption, and thus superior efficacy compared to that achieved using a standard application of dispensers.

Mating Disruption/SIR

Disruption of Internal Feeding Lepidoptera in Apples Using the Exosex System

Arthur Agnello and Harvey Reissig
Deptartment of Entomology, NYS Agricultural Experiment Station, Geneva, NY

Keywords: Oriental fruit moth, *Grapholitha molesta*, codling moth, *Cydia pomonella*, lesser appleworm, *Grapholitha prunivora*, mating disruption, pheromone, apple, Exosex

Abstract: A novel pheromone dispensing technology was evaluated against oriental fruit moth (OFM), codling moth (CM), and lesser appleworm in one high-risk and one low-risk apple block. The Exosex method used trap-like dispensers containing a pheromone lure plus a tray of fine natural wax powder that contains pheromone lure and is electrostatically attracted to the insect's body. The intent is for the male moth to become covered with the powder, which prevents it from being able to detect the natural pheromone of calling females. Separate dispensers for CM and OFM were placed, in 5-acre plots, at a rate of 10/acre in late April, before the first adult flights. All three species were monitored in test plots, in conventional mating disruption plots, and in nondisrupted check plots throughout the season. Additionally, weekly on-tree fruit inspections were conducted from mid-July through August to check for larval fruit infestations and an evaluation of fruit damage was made at harvest. Treatments were fairly effective at shutting down trap catch of moths, but not completely, particularly OFM at the end of August. No differences in fruit damage were seen between the Exosex and growers' standard plots at either site. The commercial practicality of this system is uncertain given these results and the high time and labor requirement to deploy and maintain the dispensers.

Developing “Meso-emitters” with Intermediate Release Rates for Control of Codling Moth

Stephen Welter and Frances Cave
University of California, Berkeley, CA

Keywords: Pheromone mating disruption, codling moth, meso-emitters, pears, walnuts

Abstract: Difficulties applying hand-applied dispensers for implementing mating disruption of codling moth in mature walnut trees has limited its adoption as well as concerns about labor availability and costs.

Ranges of codling moth pressures were challenged in three walnut and three pear orchards in 2006 using meso-emitters at ca. 12 dispensers per acre in a single hanging of the dispensers. A modified CheckMate membrane dispenser and a newly developed wax-matrix emitter were evaluated. Seasonal totals ranged from less than 10 moths for the season to >700 moths in 1X baited traps in the conventional comparison plots. Treatments included membrane emitters plus insecticides, matrix plus insecticide, conventional (same insecticide program), plus untreated controls in two orchards.

Effective trap suppression was observed in all plots regardless of codling moth densities ranging from 93-100% trap suppression. Low levels of consistent trap breakthrough were observed in the high-pressure orchards such that damage was both expected and realized at harvest. Additional damage suppression from the addition of the meso-emitters was observed early in the season, but late season breakthroughs were also observed. While promising, the low levels of damage in the conventional comparison plots (0-1%) precluded any meaningful conclusions as to the overall efficacy of the treatments. Significant problems with the wax matrix arose with the high summer temperatures experienced in 2006. Similarly, preliminary estimates of the release rates suggest that the emitters were providing ca. 1/3 of the desired emission rate.

Mating Disruption/SIR

Development of Mating Disruption for Navel Orangeworm in Almonds

Bradley S. Higbee and Charles S. Burks
Paramount Farming Company, Bakersfield, CA

Keywords: Amyelois transitella, navel orangeworm, mating disruption, pheromone, puffer, almond

Abstract: Control of navel orangeworm (NOW) and other lepidopteran pests using mating disruption (MD) alone or supplemented with selective, non-organophosphate insecticides were compared to "conventional" programs consisting of multiple applications consisting of organophosphate (OP), non-OP, and/or pyrethroid based insecticides. "Puffers" (Suterra) at the rate of two per acre containing (*Z*, *Z*)-11,13 - hexadecadienal, the major component of the NOW sex pheromone, combined with one early season (directed at the first flight of NOW) application of methoxyfenozide (Intrepid) and insecticide treatments were evaluated for disruption of mating and damage reduction in three, paired 160 acre plots. In addition, MD alone or in combination with two insecticide applications was compared to the insecticide applications only in a 2500-acre area-wide demonstration. All mating disruption plots resulted in nearly complete shutdown of male capture in traps baited with unmated females, however the temporal pattern of trap captures was unique at each site. The treatment of relatively large areas resulted in much more consistent damage reduction in MD treatments compared to previous work in 40-acre plots. Damage levels in MD plots compared favorably with insecticide based programs. Edge effects were characterized and were generally much more pronounced in MD plots relative to insecticide only plots and were of greater magnitude in the smaller plots. Data from concurrent work in identifying the "active space" of an individual puffer will enable us to begin to construct optimized configurations for puffer deployment.

Mark, Release, and Recapture of Codling Moth in the Presence and Absence of Mating Disruption

Matthew J. Grieshop, Jay F. Brunner, Vince P. Jones, and Mike D. Doerr
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Keywords: Mating disruption, codling moth, *Cydia pomonella*, female analog, trap active space, mark, release, recapture

Abstract: Marked, laboratory-reared codling moth (CM) were released at four distances from single traps in experiments comparing 0.1 mg, L2, or Biolure10x lures in an orchard lacking pheromone or 0.1 mg lures in orchard blocks, with zero, half, or full rates of Isomate® C+ dispensers. Similar numbers of moths were recaptured with the three lure types at each of the distances. Most of the moths captured from within 10 m of the trap were captured within three days, while moths released farther than 10 m, were typically recaptured after three days. Both pheromone treatments greatly reduced trap capture, and almost all of the moths recaptured under a full rate were from less than 10 m and within three days. These results support the hypothesis that lures, including the 0.1 mg female CM analog, have an attractive range of between 10 and 30 m in orchards lacking pheromone. Furthermore, the addition of pheromone constrains the attractive range of the 0.1mg female analog to less than 10 m.

Mating Disruption/SIR

SPLAT: Mechanical Application of a Flowable Pheromone Dispenser

Agenor Mafra-Neto, Leandro Ernesto Jost Mafra, Carmem Bernardi, Diego Zeni, Rafael Borges, Walter Boger, and Reginald Coler

ISCA Technologies, Inc., Riverside, CA, USA

Keywords: mating disruption, pheromones, mechanical application, gypsy moth, oriental fruit moth, pink bollworm, codling moth, *Grapholitha molesta*, *Lymantria dispar*, *Cydia pomonella Pectinophora gossypiella*

Abstract: SPLAT (ISCA Technologies, Inc. Riverside CA, U.S.A.), formulated with pheromones is a new product for mating disruption of lepidopteran pests. SPLAT (Specialized Pheromone & Lure Application Technology) is a flowable biodegradable semiochemical dispenser which provides a controlled and sustained release pheromones for the entire season. If formulated with small percentage of insecticide together with or without other attractants and phagostimulants, SPLAT will act first as a mating disruptant and will then double as an Attract & Kill bait station. Adaptable to most spray equipment, SPLAT is easy to apply, and highly effective in controlling Lepidoptera populations pests of row crops, orchards and forests. A single application of SPLAT promotes sustained, frequently season long, population suppression to a level well below economic threshold.

SPLAT: Use of Flowable Pheromone Dispenser, SPLAT OFM for "High Performance" Mating Disruption

Anna Getchell, Lukasz Stelinski, Larry Gut, Jim Miller, Leandro Ernesto Jost Mafra, Carmem Bernardi, Diego Zeni, Rafael Borges, Walter Boger, Agenor Mafra-Neto and Reginald Coler

ISCA Technologies, Inc., Riverside, CA, USA

Keywords: mating disruption, pheromones, mechanical application, oriental fruit moth, *Grapholitha molesta*, apples,

Abstract: SPLAT OFM (ISCA Technologies, Inc. Riverside CA, U.S.A.), is a new product for mating disruption of the oriental fruit moth *Grapholitha molesta*. SPLAT (Specialized Pheromone & Lure Application Technology) is a flowable biodegradable semiochemical dispenser which provides a controlled and sustained release pheromones for the entire season. Adaptable to most spray equipment, SPLAT is easy to apply, and highly effective in controlling the oriental fruit moth in orchards. A single application of SPLAT promotes sustained, frequently season long, population suppression to a level well below the economic threshold.

Implementation

Walt Bentley, moderator

Notes

Implementation

Mating Disruption in Italy's South Tyrol Apple Orchards: 15 Years of Experience

Andrea Iodice[1], Walther Waldner[2], Vittorio Veroneli[1], and Francesco Savino[1]
[1]CBC (EUROPE) Ltd. www.cbc-europe.it
[2]South Tyrolean Advisory Service for Fruit and Winegrowing www.beratungsring.org

Keywords: Codling moth, *Cydia pomonella*, oriental fruit moth, *Cydia molesta*, mating disruption, pheromones, IPM

Abstract: In Italy, the apple production surface is more than 58,000 hectares and almost 28,000 of these hectares are located in one region, named Trentino Alto Adige. This area partly belongs to the prefecture of Trento (Trentino) located in the southern part and partly to the prefecture of Bolzano (Alto Adige or South Tyrol) located in the northern part, close to the Italian-Austrian border. In both areas, there is a strong presence of producer cooperatives and many organizations are involved in all aspects of apple production, from the field advisory and extension services to the marketing. Two organizations have primarily contributed to the adoption of mating disruption (MD) IPM: the South Tyrolean Advisory Service for Fruit and Winegrowing (STASFW) in South Tyrol and the San Michele Institute in Trentino.

In 1977, the chitin synthesis inhibitor (CSI), diflubenzuron was registered in Italy. Until 1982 this active ingredient was used exclusively for the control of leaf miners in South Tyrolean apple orchards. In 1983, STASFW increasingly recommended it for codling moth (CM) control. At the end of the 1980s, other chitin synthesis inhibitors (teflubenzuron, triflumuron, exaflumuron) were registered in Italy. In 1990, it became apparent that codling moth populations were increasing in orchards treated with diflubenzuron. In 1991, orchards treating with 3-5 sprays of CSIs, sustained between 10-40% fruit injury at harvest. In 1992, codling moth resistance to CSIs was documented and the problem became more widespread, increasing from 1,200 ha to 15,000 ha. There were two possible options: a return to the application of organophosphates or the introduction of mating disruption (MD) technology. STASFW chose the second option.

In 1991, the program started with the BASF RAK 3+4 dispenser on 110 ha. In 1993, Isomate C was applied on 232 ha and thereafter, the apple-growing surface covered with MD increased annually. MD was successfully applied even in hillside orchards and small plots. During the season, four fruit assessments were conduced and the actions thresholds for treatment were as follows: 0.3% fruits with fresh entry holes in June, 0.52% fresh entry holes from July to mid-August, 0.8% fresh entries from mid-August to harvest, and 0.1% wormy fruits at harvest. If harvest damage exceeded 1% in the previous year or was unknown, supplementary treatments were recommended. After several years of MD, oriental fruit moth (OFM) damage showed up at harvest in some orchards. For this reason, the application of a double purpose MD strategy utilizing Isomate C Plus and Isomate OFM Rosso was implemented. Once populations were lowered, the areas affected by CM and OFM were treated with the dual dispenser Isomate C/OFM.

The current status of CM/OFM control with pheromones in the South Tyrol will be discussed.

Implementation

Whole-Farm Biopesticide Based Codling Moth Management In Diverse Agricultural Environments

Peter McGhee, David Epstein, Larry Gut, Heidi Noordijk, Nikki Rothwell[1], Bill Shane[1]
Michigan State University, Tree Fruit Entomology Lab, East Lansing, MI
[1]Michigan State University Extension

Keywords: codling moth, *Cydia pomonella,* apple, mating disruption, areawide, granulosis virus, pheromone

Abstract: The whole-farm or areawide management of codling moth approach to disruption directly addresses key concerns regarding orchard perimeters in smaller, individualized mating disruption programs, the immigration of mated females, and lower pheromone concentrations along the perimeters. The overall experimental design is a direct comparison of a biopesticide-based areawide approach to managing codling moth versus programs being implemented on other apple blocks not in the areawide project and not contiguous with the areawide apple blocks. Biopesticide-based management programs were tested in over 800 contiguous acres of commercial apple comprised of 12 individually owned farms in 2004 (Fruit Ridge area only), 2100 acres on 18 farms in 2005 (Fruit Ridge area only), and 2,800 acres on 28 farms in 2006 (Fruit Ridge, Berrien County, and Old Mission Peninsula). Pheromone baited traps were deployed at all project sites at the rate of one CM trap per every 2.5 acres of orchard. Traps were also deployed in at least four non-project comparison orchards in each year of the project. Fruit injury evaluations were performed twice annually, once at the end of first generation CM egg hatch, and again at pre-harvest by visually inspecting fruit throughout each farm for larval injury.

The results of the first two years of this project have been quite encouraging. In year 1, captures of male codling moth in pheromone-baited traps were significantly reduced from first to second generation. Codling moth injury to fruit was 76% lower in area-wide orchards at harvest compared to non-disrupted orchards outside of the project area. Area-wide orchards incorporating codling moth virus sustained 0.5% fruit injury compared to 2% injury in non-disrupted orchards outside of the project. Fruit injury at harvest was about 0.5% in the plots relying on virus and Calypso to supplement the disruption program, and 2.0% in plots treated with pheromone and standard insecticides. In year 2, captures of male codling moth in pheromone-baited traps were significantly reduced from the first year. Codling moth injury to fruit was 87% lower in area-wide orchards at harvest compared to non-disrupted orchards outside of the project area. Area-wide orchards incorporating codling moth virus sustained 95% less fruit injury non-disrupted orchards outside of the project. Codling moth catch was reduced 74% from 2004 to 2006 in the original areawide farms and catch for 7-mile, North, and Wilson farms was reduced 43% from 2005 to 2006. Overall fruit injury was reduced 70% from 2005 to 2006 in all AW MD blocks.

Implementation

Management of CM and OFM Through the Implementation of an Area-Wide Mating Disruption Program in Pennsylvania

L. Hull, G. Krawczyk, E. Bohnenblust, D. Biddinger
Penn State University, Fruit Research and Extension Center, Biglerville, PA

Keywords: Areawide, mating disruption, *Grapholitha molesta*, oriental fruit moth, *Cydia pomonella*, codling moth, pheromone dispensers

Abstract: An areawide (AW) mating disruption program was implemented across 900 acres of various deciduous fruit crops in Adams County, PA during 2006 to control internal fruit damage from both the codling moth (CM), *Cydia pomonella*, and oriental fruit moth (OFM), *Grapholitha molesta*. The AW program was organized into four large and fairly contiguous sites with each site ranging in size from 180 to 240 acres of tree fruits. Isomate CM/OFM TT combo pheromone dispensers were hung at a density of 200/acre in apples and 100/acre in pears. In peaches, Isomate Rosso dispensers were placed at a density of 150/acre; however, some growers hung Isomate M-100 dispensers at 100/acre. CM and OFM populations were monitored at weekly intervals from early May to mid-September using various types of monitoring lures (1X, 10X and CM-DA Combo) in sex pheromone traps. Fruit was assessed *in situ* for the presence of frass during mid-July and again in September on apples and in August on peaches. OFM shoot injury counts were taken on peaches in mid-June and again during the August fruit evaluation. There was considerable variation in pest pressure among sites with Site 4 having the highest CM pressure and Site 1 having the least pest pressure. Captures of CM adults in pheromone traps declined under the mating disruption program, especially during the second and partial third brood flights, while OFM adult captures were minimal once mating disruption was applied. Fruit injury levels from the CM/OFM complex varied among sites, Site 1 had almost no damage on apples; while Site 4 averaged 1.7% damaged fruit under AW mating disruption. The proportion of live worms collected from all injured apples across all sites at harvest was 90% CM and 10% OFM; whereas, only OFM larvae were collected from the peaches. The majority of growers in the AW program continued to apply their normal insecticide program in most blocks during this first year of the program.

Implementation

The Use of Drift Reduction Technologies and Vegetative Barriers to Manage Pesticide Spray Drift in Cherry, Pear, and Apple Orchards

Kelly Wallis, Helmut Riedl and Jeffrey Jenkins
Oregon State University, Mid-Columbia Agricultural Research and Extension Center, Hood River, OR

Keywords: Drift reduction technology, spray drift, vegetative barriers, vegetative buffers, malathion, malathion ULV, Lorsban, organophosphates, chlorpyrifos, salmon, pollution, riparian, air induction nozzles, tower sprayers, Proptec, Hardi, Accutech, air-blast sprayers, electrostatic sprayers

Abstract: There are many approaches that attempt to reduce the amount of pesticide spray drift from reaching off-target areas. Various spray drift reduction technologies were tested to determine which were the most effective at reducing drift and how coverage was affected. These included air induction nozzles, tower sprayers, electrostatic sprayers, and modifications of air-blast sprayers. It was found that the traditional air-blast sprayer had better spray coverage but higher drift potential than the other sprayers that were tested. The Proptec and Hardi tower sprayers and the modified air-blast sprayer using air-induction nozzles and low cost plywood donuts to restrict airflow were better in terms of drift reduction. Air-blast sprayers have low profile and are inefficient. However, spray drift from air-blast sprayers can be substantially reduced by proper calibration, new nozzle technologies and spraying in appropriate weather conditions.

Spray drift reduction technologies were also tested to determine the effectiveness of vegetative barriers to reduce organophosphate levels in salmon bearing streams. Levels of pesticide interception were tested in sites with a barrier strip of native riparian vegetation and compared to sites with little or no vegetation. Preliminary results for ground applications of pesticide are favorable, indicating vegetative barriers tend to intercept much of the spray drift, thus reducing stream loading of harmful chemicals. Aerial applications of Malathion ULV were tested with and without the barriers. Results from this trial are not yet available.

Tree Fruit Diseases

Gary Grove, moderator

Notes

Tree Fruit Diseases

Comparison of Capture of Ascospores of *Venturia pirina* with the Temperature of Wetness Of Rain in Mendocino County, California 2006

Broc G. Zoller
The Pear Doctor, Inc., Kelseyville, CA 95451

Keywords: *Venturia pirina,* pear scab, ascospores, temperature, wetness

Abstract: Ascospores of *Venturia pirina* were trapped during rain periods using roto-rod samplers as part of a disease management program in Mendocino County pear orchards. Data of spores trapped for the season vs. degree days above 0°C were compared. It was possible to judge the effect of wetness temperature on apparent pseudothecial productivity as measured by ascospore capture. There were captures with rain periods of 6 hour wetness at least 45°F. Capture often rose with increasing temperature. Rains beginning at night or early AM were judged to have spore discharge started at 7AM the next morning for the beginning of the 6 hours unless a warmer 6 hour period occurred later. Rains occurring before 5% and after 95% of the seasonal spore total had been captured were ignored, since a shortage of ascospores in the pseudothecia would lower productivity as measured by spore capture data. Regression analyses of rainfall temperature vs. the square root of the fraction of the seasonal spore total captured during the wetness yielded R square values of 0.20 (P=0.147) for total wetness period temperature, for example. Thus approximately 20% of the variation in the data may be attributable to the rainfall temperature differences. This and the absence of capture data for dew periods may help explain deviations in discharge from maturation curve models for pear scab ascospores.

Efficacy of Fungicides for Control of Brown Rot and Shothole of Almond

Brent Holtz and Tomé Martin-Duvall
University of California Cooperative Extension, Madera CA

Key words: brown rot (*Monilinia laxa*), shothole (*Wilsonomyces carpophilus*), almond, fungicides, Abound, azoxystrobin, BreakThru, silicone surfactant, Captan, Cuprofix Ultra, mancozeb/basic copper sulfate, Echo, chlorothalonil, Echo Ultimate, Enable, fenbuconazole, Gem, trifloxystrobin, Laredo, myclobutanil, Liquid Lime Sulfur, calcium polysulfide, Microthiol Disperss, sulfur, Orbit, propiconazole, Oxidate, hydrogen dioxide, PropiMax, Rovral, iprodione, Saf-T-Side, petroleum oil, Serenade, *Bacillus subtilis* Strain QST 713, Sonata, *bacillus pumilis* strain QST 2808, Sporan, rosemary oil + clove oil + thyme oil, Stylet Oil, paraffinic oil, Surfix, crop oil, Topsin, thiophanate-methyl, Trilogy, neem oil, USF 2010, V10116, V10135, Vangard, cyprodinil, ziram.

Abstract: An almond orchard, with a history of brown rot and shothole diseases, was divided into single tree plots of 36 treatments with 5 replications in a randomized complete block design. Treatments were applied with a handgun containing a 0.90 disk delivering 4 gallons of spray solution per tree at 200 psi. Applications were made on February 23 (pink bud), March 7 (full bloom) and March 25 (petal fall). High rainfall (3.79 inches) was recorded in March that coincided with both full bloom (most susceptible period for brown rot) and petal fall (most susceptible period for shothole). Strikes per tree were counted on May 3, 2006. Twenty-five nuts were evaluated for incidence and severity of shothole on May 17. Abound, Echo, Echo Ultimate, Gem, Laredo, Orbit, Rovral, Topsin WP, USF 2010, V10116, and Ziram provided excellent control of both brown rot strikes and shothole incidence and severity.

Appendix

Minutes of the 80th Annual Meeting
Western Orchard Pest and Disease Management Conference
Hilton Hotel, Portland, Oregon
January 11 - 13, 2006

I. Call to Order

The **80**th Annual Meeting was called to order by the Chair Vince Jones at 10:00 AM. Chair Jones extended an official welcome to everyone. Chair Jones then called for the participants to introduce themselves.

Chair Jones introduced section leaders. They were:

Mating Disruption/SIR	- Lukasz Stelinski
Implementation	- Walt Bentley
Thresholds/monitoring;	- Matt Grieshop
Biological Control	- Marshall Johnson
Resistance Management	- Rick Hilton
Chemical Control/New Products	- Harvey Yoshida
Biology/Phenology	- Diane Alston
Tree Fruit Diseases	-

Following the introductions, Chair Jones reminded the presenters to keep their talks to the 10 to 15 minute time limit.

II. Old Business

A. Issues Arising from the Meeting of the Board of Directors

Chair Jones announced that the Board of Directors held their annual meeting at 7:00 AM on Wednesday, January 11. The Board consisted of Past Chair Phil VanBuskirk, Chair Vince Jones, Chair Elect Walt Bentley and the Secretary/Treasurer Don Thomson. The Board of Directors approved the creation of a new position, Program Chair. The Program Chair would also be an officer of the Corporation as such would sit on the Board of Directors.

The Board appointed Don Thomson to the position of Executive Director. The Board of Directors also recommended to the membership that the position of Executive Director be compensated $800 per year for his or her services. A motion was made to compensate the position of Executive Director the sum of $800 per year. The motion was approved by the membership.

B. Reading of 2005 Minutes: It was moved and seconded that the reading of the minutes be dispensed with and that the minutes be approved as written. Secretary Thomson indicated that the minutes would be posted at the registration desk and that members could also review them on the organization's web site.

C. Miscellaneous

Chair Jones called for a report of the officers. There were no reports.

Chair Jones called for any other old business. There was none.

III. New Business

A. Committee Assignments

The following committee assignments were made:

Nominations: Nick Stephens, Mike Doerr, and John Dunley
Audit: Jay Brunner, Larry Gut and Peter McGhee
Resolutions: Dave Epstein, Art Agnello and Betsy Beers

B. PCA Sign Up Sheets

Sign up sheets will be available at the registration desk by afternoon coffee.

C. Call for Further New Business

There was no further new business. The business meeting was then adjourned until 11:00 AM, Friday, January 13.

IV. Closing Business Meeting

The closing business meeting was called to order by Chair Jones at 10:30 AM on January 13.

Chair Jones called for further new business.

A member mentioned that not having water on for 3 days was a problem with the Hilton. Don will talk with the Hilton.

Another member asked for coffee to be served earlier. Don said it was brought in at 9:30 and 2:30. A member asked that we have 2 urns of coffee and skip the decaf. It was also suggested that we have a pitcher of water for the speakers.

A member mentioned that the abstracts were too rudimentary. He asked to have more reports. Don mentioned only 6 people submitted reports last year.

Secretary Thomson raised the issue of loading the presentations onto the computer. The meeting had to be interrupted several times to load talks. This created an unnecessary delay. A suggestion was made that WOPDMC purchase its own computer. The computer would be kept at the WSU facility in Wenatchee. Presenters would be asked (but not required) to email their presentations to WSU prior to the meeting to be pre-loaded onto the computer. Presenters who prefer to bring their presentations to the meeting could still do so. Presenters would be asked to submit their presentations on a stick drive (preferably) or CD to the registration desk. The registration desk would be opened starting at 8:00 AM to facilitate the loading of talks onto the computer. Another member suggested using two computers with a wireless connection. Chair Elect Walt Bentley motioned for WOPDMC to buy a computer. It was seconded and passed unanimously.

It was also suggested that the members put their power point presentations in "Show" mode to reduce the launch time. Chair Jones then called for the committee reports.

A. Committee Reports:

1. Nominations:

The nominating committee nominated Harvey Reissig, Cornell University, Geneva, New York, 14456 as Chair Elect, Nancy Hays, Pacific Biocontrol Corp, 16010 NE 36th Avenue, Ridgefield, WA, 98642 as Secretary/Treasurer and John Dunley, Washington State University, 1100 N. Western Avenue, Wenatchee, WA 98801 as Program Chair for the 2007 meeting. A motion was made and seconded to accept the recommendations of the nominations committee. The motion passed unanimously. Walt Bentley, University of California, 9240 S. Riverbend Ave, Parlier, CA, 93648 will be the Chair for the 2007 meeting.

2. Audit

Jay Brunner, Chair of the Audit Committee, reported that the committee had met with Treasurer Thomson to review the account. The committee reported that the books were in good order and recommended that the membership accept the report of the Treasurer. It was moved, seconded and approved.

Secretary Thomson then gave the Treasurers report. He reported that the balance forward from December 31, 2004 was $3,328.08. The 2005 meeting took in $3,370.00. Expenses in 2005 were approximately $2,947.94 including coffee, audiovisual services and corporate fees and taxes. The balance as of December 31, 2005 was $3,750.14.

3. Resolutions

a. Be it resolved that this conference extend written appreciation to the management and staff of the Hilton Hotel for the courteous service and the fine accommodations provided.

b. Be it resolved that the members of the conference express their appreciation to Past Chairperson Phil VanBuskirk, Chairperson Vince Jones and Secretary/Treasure Don Thompson for their leadership and dedication in organizing the 2004 meeting.

c. 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 Bette Brattain for applying for pesticide applicator credits from the various states.

d. Be it resolved that the members of the conference extend their appreciation to the Tree Fruit Research and Extension Center, Washington State University, Wenatchee and in particular Bette Brattain and John Dunley, for preparing the research report abstracts.

e. Be it resolved that the members of the conference extend their appreciation to the Tree Fruit Research and Extension Center, Washington State University, Wenatchee and in particular, Jerry Tangren, Bette Brattain and John Dunley, for organizing and maintaining the WOPDMC web site.

f. Be it resolved that the members of the conference extend their appreciation to the section leaders: Lukasz Stelinski, Walt Bentley, Matt Grieshop, Marshall Johnson, Rick Hilton, Harvey Yoshida and Diane Alston.

g. Be it resolved that the Secretary write letters of condolences to the family of members who passed away the past year.

h. Be it resolved that the members of the conference extend their appreciation to Lukasz Stelinski for his willingness to provide computer technical support during the 2006 conference.

Chair Jones called for nominations for the Rubber Chicken Award. The membership voted to give the infamous Rubber Chicken Award to Alan Knight for not submitting a talk.

Chair Jones expressed thanks to the Section Leaders, Don Thomson, Secretary/Treasurer, Phil VanBuskirk, Past Chair, Bette Brattain, Washington State University, and Jerry Tangren, Washington State University.

The dates for the 2007 meeting will be January 10 to 12. The meeting will be held at the Hilton Hotel.

Chair Jones introduced the 2005 Chair Elect Walt Bentley. Chair Jones turned over the gavel to Chair Elect Bentley who adjourned the meeting.

Notes