Western Orchard Pest & Disease Management Conference

Conference Abstracts

77th Annual Conference
Hilton Portland, Portland, Oregon
January 15-17, 2003
Western Orchard Pest and Disease Management Conference

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For information, see: http://entomology.tfrec.wsu.edu/wopdmc/format.html
Agenda for 2003 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 at 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/wopdm/index.html.

See the section on "Information for Presenters/Report format" for more information.

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Content queries to Dr. John Dunley
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**Appendix**

Minutes of 2002 meeting
Biology/Phenology

Maciej Pszczolkowski, moderator
Abstracts of the 77th Annual Western Orchard Pest & Disease Management Conference

Biology/Phenology

Old and new pest problems on tree fruits in the Mid-Columbia area

Helmut Riedl
Oregon State University, Mid-Columbia Ag. Research & Ext. Ctr., Hood River, OR

Abstract: New pest problems are emerging and some old ones are gaining in importance as pest control programs on tree fruits are undergoing major changes and organophosphate and other broad-spectrum insecticides are being replaced. Codling moth has again risen to the top as the major pest of apples and pears. The reasons for the growing codling moth problem are not entirely clear yet but may be due to a combination of factors including changing seasonal emergence patterns, inadequate control programs and possibly resistance. Pear psylla, once the most feared pest of pears, has become more manageable thanks to improved biological control. On the other hand, a number of species have become more noticeable in recent years including pear thrips, a potentially very destructive pest just before bloom on pears, apples and cherries. In the "new pest category" is the snail case bagworm which caused heavy leaf damage in 2002 in a high-density apple orchard but did not infest an adjacent cherry block. Tentiform leafminer has diminished as a problem on cherries while obliquebanded leafroller larvae continue to pose a threat, particularly as contaminants in harvested fruit. A major outbreak of twospotted spider mites was observed in 2002 in an old cherry orchard and was likely related to use of disruptive sprays. Western flower thrips has caused some minor scarring from egg-laying punctures on cherries and has also been implicated as the cause of silvery surface blemishes close to harvest (first seen during the 2002 season). Additional cherry problems observed during the last two years have been redhumped caterpillar, shothole borers in orchards with stressed trees and poor sanitation and, for the second year in a row, cherry lacebug.

Biology/Phenology

Weevils attacking tree fruits in Washington

Elizabeth H. Beers, Mike Klaus¹, Astrid Gebhard², Steve Cockfield³, Rich Zack, and C. W. O'Brien⁴
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA
¹Washington State Department of Agriculture, Yakima, WA
²AG IPM, Benton City, WA
³Okanogan Valley IPM, Brewster, WA
⁴Center for Biological Control, Florida A&M University, Tallahassee, FL

Abstract: Weevils are not currently considered tree fruit pests in Washington State, but attacks by weevils have been mentioned as early as 1911. The advent of modern synthetic organic pesticides may have virtually eliminated weevils in commercial orchards in the intervening period. Recently several cases of weevil attacks have occurred on apple and cherry in several fruit growing regions in Washington and Oregon. The first case (in April 2000) occurred in a newly planted cherry orchard in Arlington, Oregon. The buds were heavily attacked by adult weevils shortly after planting, and could have caused substantial growth reduction or distortion. The weevil was identified as Lepesomatus=Dyslobus] n. sp. Reports of bud-feeding were made and investigated on two additional cherry orchards in Washington State in 2001. In one orchard (Quincy area) the predominant species was Ophryastes cinarescens, and in the other (Brays Landing area) the predominant species was Stammodes cimagei, with some O. cinarescens present. Sagebrush (Artemisia tridentata) is probably the native host of all three weevil species, and the common thread of the attacks was cherry orchards planted into uncultivated ground in or near sagebrush. In 2002, a severe infestation of a leaf-notching weevil species (tentatively identified as Otiorhynchus meridionalis) was found in an apple orchard on Bench Rd., ca. 5 miles west of Othello. This same species was subsequently found at three other apple orchards, one in East Wenatchee near Pangborn Airport in an organic orchard; one in the Brewster-Bridgeport area; and one near Vantage, WA. At the latter orchard, an isolated 600-acre apple ranch on the west side of the Columbia River, two additional weevil species have been problematic for a number of years. These species, tentatively identified as the strawberry root weevil (O. ovatus L.) and the black vine weevil (O. sulcatus F.), girdle the stems of developing fruit in late spring and summer.

Biology/Phenology

Susceptibility of apple cultivars to damage by *Campylomma verbasci*

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

Abstract: Campylomma nymphs were caged on king bloom flowers of seven apple cultivars. 'Golden Delicious', 'Delicious', 'Gala', 'Fuji', 'Cameo', and 'Granny Smith' showed some damage by campylomma feeding. The symptoms were visible at petal fall. 'Braeburn' did not show any damage symptoms under the experimental conditions. 'Gala', 'Granny Smith', 'Fuji', and 'Cameo' susceptibility was similar to that of 'Delicious'. All five were less susceptible than 'Golden Delicious'.

Biology/Phenology

Ecology of western flower thrips in intra- and near-orchard habitats

S. D. Cockfield¹, D. G. Johnson², E. H. Beers¹, and R. S. Zack²
¹Tree Fruit Research and Extension Center, Washington State University, Wenatchee, WA
²Dept. of Entomology, Washington State University, Pullman, WA

Abstract: Apple shoots harbored adult and immature thrips throughout the season until frost. Adult thrips appeared on dandelion flowers before apple flowers developed and first appeared on apple buds at delayed dormant. On the orchard floor, dandelion flowers, as well as other flowers sampled, harbored thrips until frost, sustaining a resident population in the orchard. Thrips fed and reproduced throughout the year in near-orchard habitats by switching hosts that produce new leaves and flowers in different seasons. Some plants, such as arrowleaf balsamroot, *Balsamorhiza sagittata*, bloomed in spring and then were dormant until the next year. Others, such as gray rabbitbrush, *Chrysothamnus nauseosus*, provided growing shoots throughout the spring and summer and flowers in the fall. The dominant climax woody species of the steppe, big sagebrush, *Artemisia tridentata*, attracted great numbers of thrips when in bloom in the fall. Native grass species attracted some thrips when in flower, but in general samples contained very few thrips. All native grass species sampled were dormant in the summer and fall and could not serve as a continuous food source for immature thrips. The great majority of thrips on apple and other host plants in Washington appeared to be western flower thrips.
Biology/Phenology

Effects of sanitation practices on almond mummies infested with navel orangeworm

Bradley S. Higbee
Paramount Farming Company, Bakersfield, CA

Abstract: Lab and field evaluations were conducted in order to assess the effect of mowing and disking treatments on the survival of immature stages of the navel orangeworm (NOW) infesting almond mummies. Flail mower treatments, which included mowing single layers of mummies once or twice and mowing mummies in windrows, resulted in 95 to 99 percent mortality relative to controls. For the field disking treatments, one or two passes of a disk resulted in 41 and 89.5 percent mortality, respectively. In addition, flight peaks in disking treatments were delayed up to 2 weeks relative to controls. Field disking treatments were imitated in lab studies by covering infested nuts with 1 or 3 inches of soil, resulting in 9.5 and 43 percent mortality. These studies indicate that mowing is vastly superior to disking for destroying overwintering NOW populations and disking may alter flight dynamics in surviving populations.

Biology/Phenology

Polyphagy in codling moth neonates

Maciej A. Pszczolkowski and John J. Brown
Washington State University, Department of Entomology, Pullman, WA

Abstract: Previously we reported that codling moth neonates are capable of feeding and development on apple leaves solely (Pszczolkowski et al. 2002. Annals of Entomological Society of Amer. 95:603-607). Recently we investigated codling moth potential for oviposition, feeding, and development on foliage of 10 other species. Foliage of sweet cherry, pear, plum, American walnut, hawthorn, English walnut, maple, birch, oak, and linden was used in experiments. In general, codling moth females laid eggs on foliage of each species, even if given apple foliage as optional oviposition substrate. Codling moth neonates successfully molted to second instar when fed leaves of all tested species, except for maple. Percentage of mortality, duration of the first instar, and maximum larval body weight varied depending on the foliage tested. Our findings contribute to better knowledge of codling moth neonates' biology and raise issue of potential codling moth hosts that would be an alternative to apple.
Biology/Phenology

Without those 'damn' apples!

J. J. Brown, N. Kittelson, G. Hannon, and D. Walsh
Washington State University, Department of Entomology, Pullman, WA

Abstract: Consider how much fun orchard pest management research could be if you did not have to worry about damage to the fruit and you were protecting only the trees themselves. We are using pest management strategies developed in Pacific Northwest orchard systems to protect hybrid poplars in eastern Oregon and Washington that are being attacked by wood burrowing lepidopteran and coleopteran pests. Here we report on the biology/phenology of three pests: Western Poplar Clearwing Moth, *Paranthrene robiae* (Sessidae), Carpenterworm moth, *Prionoxystus robiniae* (Cossidae), and the Poplar Willow Borer, *Cryptorrhynchus lapathi* (Curculionidae). We share two years of pheromone trap data, mercury-vapor light and pit-fall trapping. We have registered Dimilin® and Nolo® for use against two species of hoppers, *Camnula pellucida*, the smaller of the two, and the Two-striped Grasshopper, *Melanoplus bivittatus*, and demonstrated the successful use of Admire® against *Phylloxerina popularia* (Pergande).

Biology/Phenology

Effect of *Bt* on phenology of obliquebanded leafroller and pandemis leafroller

Callie C. Eastburn and Vincent P. Jones
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Abstract: The effect of *Bt* on the developmental rates of OBLR and PLR was investigated. We found that PLR were more sensitive to *Bt* and showed reduced growth rate at 1% of the field rate. OBLR were less sensitive, and the effects were about the same at 1, 2, or 4% of the field rate. For both species, the instar following the ingestion of *Bt* had the slowest developmental rate, and the effect decreased as caterpillars aged. PLR developmental time to adult was slowed 23-30% for caterpillars treated as 3rd instars and 6-36% for 4th instars. OBLR treated as 3rd instars had a developmental time about the same as control insects except for the 4% field rate treatment, where developmental time to adult was increased by about 8.5%. When treated as 4th instars, developmental time to adult was 13-23% longer than control caterpillars.
Biology/Phenology

The growth and development of the consperse stink bug, *Euschistus conspersus*, on selected potential host plants present in orchard ground cover

Christian H. Krupke, Jay F. Brunner and Vincent P. Jones
Washington State University, WSU Tree Fruit Research and Extension Center, Wenatchee, WA

Abstract: The consperse stink bug, *Euschistus conspersus* Uhler, has emerged as an important pest of pome fruit production in north central Washington in the past decade. Fruit damage is primarily caused by the feeding of adult *E. conspersus* in late summer and early fall, often within a few days of harvest. Crop losses of greater than 10% have been reported from many orchards. While some fruit packing facilities have rated stink bug damage as being a more serious problem than codling moth, relatively little is known about the habits of this insect and as a result management has been difficult. We have developed information on host plants used by *E. conspersus* outside the orchard; however, there is little information on the role that plants present in the orchard ground cover might play in supporting populations that could contribute to damage of apple. We conducted a study to compare the development of *E. conspersus* from the egg stage to adult on the most common plants found in the cover crop of Washington orchards. This information is presented in conjunction with data documenting patterns of fruit damage within orchards and the significance of these findings to grower practices such as insecticide and herbicide treatment regimes is discussed.
Mating Disruption/SIR

Jay Brunner, moderator
Predicting the success of mating disruption

Larry Gut1, Lukasz Stelinski1, Don Thomson2 and James Miller1
1Michigan State University, East Lansing, MI
2DJS Consulting, Seattle, WA

Abstract: Examining the many successes and failures of mating disruption reveals there is a great deal of variability in the susceptibility of species to this control tactic. For some species, such as redbanded leafroller and oriental fruit moth, treatment with pheromone alone is often sufficient to mitigate crop damage. Other pests, such as the codling moth and certain leafrollers, appear to be more 'difficult' to control using only mating disruption. Over the past few years we have been conducting studies to determine the factors that may allow the more resilient species to operate in environments permeated with synthetic pheromone. It appears there are fundamental differences in the capacities of species to become adapted and/or habituated when exposed to high doses of synthetic pheromone. In addition, pheromones vary considerably with respect to rates of evaporation, dispersion in air, and adsorption onto solid surfaces. Collectively, differences in these physico-chemical properties can have profound effects on the longevity and movement of pheromones in the environment. Finally, it is well known that species differ in their dispersal and reproductive capabilities. We propose that it is these basic differences in the properties of moths and their pheromone that make some species highly susceptible to mating disruption while others are capable of averting the effects of this control technique.

Codling moth behavior – our last and best chance to understand MD

Alan Knight
U.S.D.A., A.R.S., Wapato, WA

Abstract: The use of sex pheromones to disrupt mating (MD) of codling moth (CM) has been rapidly adopted since 1991 and its use now includes 60% of the tree fruit acreage in WA. A large number of studies have been conducted in my laboratory, during the past 10 years, to examine how MD works in an effort to improve its effectiveness. Our major findings have included demonstrations that dispensers need to be placed in the tops of trees to be most effective, demonstrating the success of monitoring orchards with high-load pheromone lures placed in the tops of trees away from dispensers and near the borders of orchards, the relative importance of dispenser density and emission rate on the level of disruption, the importance of false-trail following versus habituation as the major mechanism for MD, revealing that most CM females in MD orchards are mated but that multiple mating of females during the second flight are significantly reduced, demonstrating that delay of mating under MD is an important mechanism affecting population growth of CM, showing that the three component pheromone blend is not more effective than using the single major component, codlemone, and that dispensers emitting a blend of codlemone and its three geometrical isomers are more effective than similar dispensers emitting codlemone in shutting down male catch by virgin female-baited traps.
Mating Disruption/SIR

Effect of delayed mating on obliquebanded leafroller reproductive rate: Implications for mating disruption

Nik G. Wiman and Vincent P. Jones
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Abstract: The importance of delayed mating in OBLR was examined in laboratory studies. We delayed mating for 0, 2, 4, or 6 days and developed fertility tables to determine the effect on female reproduction. The net reproductive rate of females mated at 2, 4, and 6 days after emergence was 67, 50, and 13% of females mated on the day of emergence. In addition, population doubling time increased 12, 26, and 106% for females mated 2, 4, or 6 days after emergence compared to control females. Our studies also found that a greater percentage of females that experienced a delay before being paired with a male were either infertile or chose not to mate.

Mating Disruption/SIR

Codling moth and leafroller mating disruption evaluated using sprayable pheromones

Betsy Valdez and Jay F. Brunner
Washington State University, Tree Fruit Research & Extension Center, Wenatchee, WA

Abstract: The effect of sprayable pheromones (Suterra, Inc. and 3M Corp.) was evaluated for codling moth and obliquebanded leafroller in commercial orchards. Codling moth sprayable treatments were applied at varying rates (5, 10, 20 and 40 grams AI per acre) and compared with either a non-pheromone treated area or one treated with hand-applied dispensers (Isomate C+, 200 and 400 dpa, Pacific Biocontrol Corp.). Leafroller sprayable treatments were applied at four rates (1, 2.5, 10 and 20 grams AI per acre) and compared to a non-pheromone treated area at each location. Each treatment block was monitored with large delta-style traps baited with a standard load pheromone lure and/or a high-load (10X) pheromone lure. To determine female and male activity, the “DA” lure was used for codling moth and the acetic acid lure for leafroller. Females collected from the “DA” and acetic acid baited traps were dissected in the laboratory to determine mating status. Leafroller larval densities were evaluated throughout the season and fruit injury was evaluated at harvest. Codling moth fruit injury was evaluated after 1st and 2nd generations. Although codling moth and leafroller sprayable pheromone did reduce capture in most pheromone-baited traps, no consistent pattern of decreased larval populations or fruit injury was noted. Mating success for both codling moth and leafroller was not significantly different between treatments.
Mating Disruption/SIR

New uses for an old technology: Scentry fiber-pheromone formulations for codling moth and leafroller mating disruption

Michael D. Doerr, Jay F. Brunner and Betsy Valdez
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Abstract: Scentry Biologicals provided NoMate Fibers loaded with codling moth or obliquebanded leafroller pheromone. CM fibers were attractive for up to 60 days in both generations. Fibers were only slightly less attractive than a fresh 1 mg lure. A very similar pattern was observed with fibers loaded with OBLR pheromone. These were not as attractive as a fresh 1 mg lure but were as or more attractive than a fresh 0.05 mg lure. Scentry Biologicals contracted with Blue Line Manufacturing (Moxee, WA) to develop a prototype fiber applicator. This applicator was field tested for fiber distribution, retention and ability to suppress CM and OBLR moth captures in pheromone-baited traps in 2002. Suppression of CM capture was reasonably good in most plots that were treated and the effect lasted for up to 35 days. A high level of reduction in OBLR captures was noted in two replicated sites and the effect lasted the entire generation.

Mating Disruption/SIR

Evaluation of new mating disruption formulations

David Epstein, Larry Gut, Peter McGhee and Mike Haas
Michigan State University, East Lansing, MI

Abstract: Mating disruption is a novel technique that has been used successfully by many apple growers for control of one or more of these pest species. However, this approach has not been widely adopted in some apple production regions, including Michigan. Among the factors that contribute to the relatively low adoption of mating disruption in some areas is the high cost of the technique and the presence of several pests that growers may have to contend with, including oriental fruit moth and leafrollers. Sprayable disruption formulations, hand-applied delivery systems that target multiple pest species, or widely spaced devices may have a better fit under these conditions. Sprayable pheromones could be readily incorporated into current programs that include a number of sprays for diseases, insects and mites. A sprayable product could be used on an as-needed basis rather than as an expensive preventive control. Formulations targeting different pest species could be tank-mixed. Trials conducted in Michigan in 2002 demonstrated that frequent application of very low rates of sprayable pheromones was a highly economical and effective tactic for control of OFM and showed promise for other pests as well. The performance of OFM sprayable pheromone was significantly improved by adding Nu-Film 17. Under low-moderate pest pressure, hand-applied delivery systems that target multiple pest species also were found to be efficacious and may fit well in apple IPM programs in Michigan and elsewhere where several lepidopteran pests are a problem in apple.
Mating Disruption/SIR

Comparison of sprayable mating disruption to conventional pesticide program for codling moth management in walnuts

J. Stewart-Leslie
Pest Management Associates, Inc., Exeter, CA

Abstract: This field study was one segment of the California Walnut IPM Expansion Project for the Center for Ag Partnerships. In this particular study, performance of a sprayable pheromone (3M) program was compared to the grower standard pesticide control (Chlorpyrifos, Tebufenozide) in large block trials in the southern San Joaquin Valley of California. The ranch has three varieties of early and mid-season walnuts with a drive dividing each in half providing the project with conventional and mating disruption blocks for each of the varieties. Pheromone traps, DA traps, dropped nut counts and canopy nut counts were used to monitor CM populations. Harvest data and pesticide cost analysis were also used to evaluate the performance of each program. Pheromone traps indicated a moderate to high population initially, therefore a Chlorpyrifos treatment was applied to most blocks before the sprayable pheromone was available. Conventional blocks received between one and three treatments of Chlorpyrifos and/or Tebufenozide (Confirm). Once the pheromone was applied to the mating disruption half of the ranch (downwind of the conventional half) the pheromone trap catches were nearly zero in mating disruption blocks and were severely inhibited in the conventional blocks. DA traps showed some indication of flight activity. Dropped nut counts indicated infestation levels were low in previously Chlorpyrifos treated areas while the untreated conventional blocks showed a higher level of nut infestation. Canopy nut counts were used to monitor second generation CM activity. Those numbers indicated little difference between conventional and mating disruption blocks except for one conventional block that did not receive a first generation Chlorpyrifos treatment. Harvest data showed that the mating disruption program had at least the same or lower total worm damage than the conventional. After separating Navel Orangeworm and codling moth damage, the mating disruption blocks had higher NOW levels especially in the early variety (Ashley). Although the sprayable mating disruption looked comparable to the conventional blocks for codling moth damage, the cost analysis showed that the total cost of the application and pesticides to be between 1.5 to five times higher in the mating disruption blocks.

Mating Disruption/SIR

Effects of sunlight on encapsulated sprayable codling moth pheromone

Jessica A. Eng, Elizabeth Holmes, Tom Larsen, Steve Stadlmann and Kristin Ketner
Suterra LLC, Research and Development, Bend, OR

Abstract: The UV protective qualities of several formulations of encapsulated sprayable codling moth pheromone were compared qualitatively using high intensity UV light in a sealed chamber. The most effective formulation was quantitatively evaluated using sunlight (visible and UV) in simulated field conditions over time. The most effective formulation proved to be Suterra's current registered formulation. Results indicate that the current Suterra sprayable formulation prevents codlemone degradation in the shade and significantly reduces degradation in direct sunlight over 30 days.
Mating Disruption/SIR

Effect of rainfall on encapsulated codling moth pheromone

Kristin Ketner, Jessica Eng, Elizabeth Holmes and Tom Larsen
Suterra LLC, Bend, OR

Abstract: Laboratory tests were performed to demonstrate adherence of encapsulated codlemone to apple leaves after exposure to rain. Microcapsule adhesion differences between the top and bottom of apple leaves were also tested. Various commercial stickers were evaluated for improved adhesion of codlemone microcapsules to leaf surfaces during rain. Results indicate that increased rainfall is inversely proportional to microcapsule adherence, more microcapsules adhere to the bottom of leaves when overhead rain is applied and a latex-based product appears to be the most efficient sticker for increasing microcapsule adherence.

Mating disruption/SIR

Last Call CM: Effective codling moth control in apple orchards in British Columbia

Philipp Kirsch, Ken Shukin and Gerhard Gries
IPM Tech, Portland, OR

Abstract: Last Call CM was evaluated in several different apple orchards in 2001 in British Columbia. Last Call supplied excellent protection from CM attack equal to that of conventional OP programs and the alternative SIR programs. Last Call CM proved to be very complementary to other tactics deployed within the SIR program.
Mating disruption/SIR

Control of codling moth with attract and kill

Philipp Kirsch, John McLaughlin and Darek Czokajlo
IPM Tech, Portland, OR

Abstract: Last Call CM attract and kill was tested for codling moth control in apple and pear orchards in California, Oregon, Washington and British Columbia. Results are presented from 1999-2002 field trials. Options are presented for use of this technology as a stand-alone program, integrated with mating disruption or insecticide programs, or as a supplement to manage hot spots, bin piles or edge effects.

Mating disruption/SIR

Pheromone dose response of attract and kill formulations targeting leafrollers

Philipp Kirsch, Gerhard Booysen, Darek Czokajlo and John McLaughlin
IPM Tech, Portland, OR

Abstract: Attract and kill tactics are proven successful in management of several tortricid moths. Initial research trials targeting leafrollers suggest that considerably higher pheromone dosages than those used against codling moth may be required to achieve leafroller orientation and point source contact. Results are presented from research trials targeting obliquebanded and pandemis leafrollers in Oregon and Washington and pear leafroller in South Africa.
Mating Disruption/SIR

Evaluation of three consecutive years of mating disruption for control of greater peachtree borer (Synanthedon exitiosa) in peach

Diane G. Alston
Utah State University, Department of Biology, Logan, UT

Abstract: Placement of Isomate-P (rope-style) dispensers (Biocontrol Limited, Vancouver, WA) in one to four approximately one-acre peach orchards in 2000-2002 resulted in complete trap shutdown of greater peachtree borer (GPTB) moths. In contrast, low to moderate densities of GPTB moths (0.05-2 moths per trap per day) were captured in insecticide-treated comparison peach orchards. There were no untreated comparison orchards. Lower peach tree trunks were inspected for borer injury in September or October of each year. No GPTB injury was detected in any orchard in any year. Mating disruption provided complete control of GPTB in small peach blocks (one acre), comparable to a standard insecticide program (single application of Lorsban to lower trunks each year).

Mating disruption/SIR

New trap and lure formulations for Rhagoletis species and olive fruit fly

Darek Czokajlo and Philipp Kirsch
IPM Tech, Portland, OR

Abstract: IPM Tech has developed and tested novel controlled release formulations for known attractants and tested these in novel yellow sticky trap designs, targeting cherry fruit fly in Montana, apple maggot in Washington and Oregon and olive fruit fly in California. Results will be presented from the 2002 trapping season.
Mating Disruption/SIR

Ridding orchards of codling moth – one female at a time

Alan Knight
U.S.D.A., A.R.S., Wapato, WA

Abstract: Following the discovery that ethyl (2E, 4Z)-2,4-decadienoate (DA) was a potent attractant for both sexes of codling moth (CM) we initiated studies to develop adult control strategies. This work has shown that the use of traps baited with a DA lure is a fairly expensive approach and reduces fruit injury by CM ca. 50% in MD-treated apple orchards. Parallel studies using insecticide-treated bait stations, however, have been more effective. Grids of esfenvalerate-treated delta-shaped stations at densities of 24-50 per acre have reduced fruit injury up to 98% at mid-season in MD-treated orchards. However, fruit injury in these studies at harvest was only reduced 30-40%. The reduction in efficacy of this approach toward the end of the season was likely impacted by several factors. All plots were 0.6-2.0 ac and surrounded by orchards heavily infested with CM (60-100% fruit injury). The influx of mated females from these areas into our plots likely overwhelmed the bait stations. The DA lure appears to be less attractive in the second versus the first CM flight. In addition, the presence of infested fruit is thought to contribute to the production of much higher levels of competing fruit volatiles that may further decrease the attraction of the DA lure. Unfortunately, CM emerges as an adult capable of mating their first night and subsequently laying eggs. Typically >75% of females trapped with the DA lure in MD-treated orchards are mated. This situation is made worse due to a bias of the DA lure for mated females.

Mating disruption/SIR

New lure formulations maximize Anastrepha fruit fly captures

Darek Czokajlo, David Robacher, John McLaughlin and Philipp Kirsch
IPM Tech, Portland, OR

Abstract: New attractants and novel controlled release formulations demonstrate considerably increased Mexican and South American fruit fly captures in citrus and subtropical fruit orchards. These formulations are based on ammonia and related chemistries. It is very likely that these new ammonia formulations will show increased efficacy against Rhagoletis species such as apple maggot and walnut huskfly.
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Mating disruption/SIR

New formulations for *Ceratitis* fruit fly trapping and control

Gerhard Booysen, John McLaughlin, Darek Czokajlo and Philipp Kirsch
Insect Science South Africa, Tzaneen, South Africa

Abstract: Effective, selective and residue-free control of mediterranean, marula and natal fruit flies has been demonstrated with plant-based extracts formulated in the Last Call attract and kill matrix that was applied to commercial citrus, mango, grape and other subtropical fruit orchards. Formulations have also been developed for trapping these species in detection and monitoring programs.

Mating disruption/SIR

Last Call CM: Effective codling moth control in Canadian Maritime apple orchards

Robert Smith, Michelle Larsen and Philipp Kirsch
Atlantic Food and Horticulture Center, Kentville, Nova Scotia, Canada

Abstract: Last Call CM was evaluated in 30 different apple orchards in 2001 in the Canadian Maritime provinces (Nova Scotia, New Brunswick and Prince Edward Island). Last Call supplied excellent protection from CM attack equal to that of conventional OP programs. It is a proven alternative that eliminates pesticide residue on fruit and does not disrupt native predators/parasites. One late May application provided control of both the first and a partial second generation in our region.
Mating disruption/SIR

Last Call attract and kill: Effective control of *Cryptophlebia* in citrus and macadamia in South Africa

Christopher V. Sack, Gerhard Booysen, John McLaughlin, Darek Czokajlo and Philipp Kirsch
Department of Chemistry, State University of New York, Syracuse, NY

Abstract: False codling moth is the key lepidopteran pest of citrus and other subtropical fruits in South Africa. Macadamia nut borer is a key pest in macadamia production in South Africa, Hawaii and Australia. Novel synthetic pathways were developed to obtain economically viable high purity pheromone components for these species. Results of Last Call attract and kill field trials are presented, proving multi-year efficacy of this technology in managing these pest species in commercial farming operations in South Africa.

Mating disruption/SIR

Last Call in Syria: Effective codling moth control under extreme pressure

M. Mansour, John McLaughlin and Philipp Kirsch
Department of Molecular Biology and Biotechnology, Syrian Atomic Energy Commission, Damascus, Syria

Abstract: Last Call CM was evaluated in several different apple orchards in Syria in 2001 and 2002 following the breakdown of other CM management tactics in these orchards. Results are presented on pheromone trap catch, mating of tethered females, and fruit damage. Codling moth was controlled very effectively with the attract and kill tactic.
Mating disruption/SIR

Initial development of attract and kill technology against the oriental fruit moth

Maya Evenden, Adriane Orsatti, John McLaughlin, and Philipp Kirsch
West Chester University, Dept. Biology, West Chester, PA

Abstract: Oriental fruit moth is a key pest of stone fruit throughout the world and key pest of apples in eastern North America. Preliminary wind tunnel and field trapping trials were established to explore the attract and kill concept in management of this species. Last Call OFM formulation should be competitive against calling females under field conditions as formulations containing 0.16 and 0.016% OFM pheromone with 6% permethrin were statistically as attractive as calling virgin females in the wind tunnel.
Implementation Programs

Peter McGhee, moderator
Implementation

Reduced-risk pest management programs for MI apple, Year 1

Peter McGhee, Larry Gut, and Mike Haas
Michigan State University, East Lansing, MI

Abstract: The goal of this 4-year project is to design and evaluate pest management systems utilizing reduced-risk tactics that are effective, sustainable, economically viable, and lead to enhanced biological control for eastern apple growers. The overall experimental design was a direct comparison of the effectiveness of an organophosphate-free vs. OP-based grower standard pest management program. In commercial orchards 10 acres were managed under the soft vs. standard pest management regime. OP free programs relied on IGRs, neonicotinoids, oxadiazines, naturalyles, biopesticides, and pheromone mating disruption. Grower standard programs relied on OPs, carbamates, and pyrethroids. Pheromone mating disruption was excluded from all grower standard programs. Each program was evaluated in three regions of MI and replicated on three farms within each region. Pest management programs without OPs were 2-3x more expensive than OP standard programs. Fruit injury at harvest caused by codling moth, obliquebanded leafroller and oriental fruit moth varied in these two programs. Some of the most promising results were obtained in trials evaluating apple maggot and plum curculio control.

Implementation

Eastern RAMP: Successes and impediments to implementing non-OP peach IPM programs in the East; Year 1

Peter W. Shearer and Atanas Atanassov
Rutgers, the State University of NJ, Rutgers Ag. Res. & Ext. Ctr., Bridgeton, NJ

Abstract: Eastern peach growers manage a multitude of pests during the growing season. Most insect and mites have adequate reduced-risk control measures. However, some pests such as plum curculio and greater and lesser peachtree borers do not have registered or effective non-OP controls. We compared reduced risk peach arthropod management programs with side-by-side conventional peach pest management programs. All 8 study sites, comprising approximately 70 acres, required azinphosmethyl rescue treatments for plum curculio. However, sprayable OFM pheromone provided excellent Oriental fruit moth control.
Implementation

Reduced-risk pest management programs for North Carolina apples

James F. Walgenbach and Charles L. Thayer
NC State University, Mountain Horticultural Crops Research & Extension Center, Fletcher, NC

Abstract: An apple pest management program that relied heavily on reduced-risk pesticides and mating disruption was evaluated on approximately 800 acres in North Carolina over a three-year period from 2000 to 2002. Before initiation of the project, tufted apple bud moth, codling moth and Oriental fruit moth were the primary insect pests of apples in this region. The use of insect growth regulators and mating disruption provided excellent control of lepidopterous pests, but insects that were sporadic or of minor importance under organophosphate-based systems increased in importance, including San Jose scale, Comstock mealybug, plum curculio, and apple maggot. The recent registrations of new insecticides (Esteem, Actara and Avaunt) have helped to solve these initial problems. However, the cost of alternative pest management programs was higher than conventional organophosphate-based programs.

Implementation

Areawide II implementation project in apple, Year 2 results

Jay F. Brunner, Ted Alway, Betsy Beers, John Dunley and Vince Jones
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Abstract: The Areawide II project completed its second year. Fifteen locations compared conventional and non-OP programs that supplemented codling moth mating disruption. There were lower levels of damage by all pests in 2002 compared to 2001 in both programs. Results of trapping and cost of programs will be discussed. The project report can be found on the web site at http://entomology.tfrec.wsu.edu/stableipm/current.html.
Implementation

Areawide organic pest management in pear

John Dunley and Bruce Greenfield
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Abstract: Areawide management programs for insect pests of apple and pear in the western US have been successful since their inception a decade ago. Most projects have been targeted at codling moth, primarily through the use of mating disruption to replace organophosphate insecticides. Pear psylla, another important pest of pear, is amenable to areawide management, in that it is highly dispersive and has a number of potential natural enemies in surrounding native woodland. Establishing organic orchards or orchards using soft management practices among conventional orchards has often been difficult in that pests readily migrate in from the conventional orchards, yet natural enemy immigration is limited by the pesticide use in those same conventional programs. Organic pest management on an areawide basis could provide more opportunities for immigration of biocontrol agents. In 2002, an Areawide Organic Management Program was established on 310 ac of contiguous pear, surrounded by native vegetation. Organic pest management practices were implemented for insect and mite control throughout the project, however other organic practices were not required (e.g., nutrient, rodent, and weed management were often by conventional practices). Overall, there was a reduction in pesticide use and an associated reduction in insecticide costs. This program will be expanded in 2003. See http://entomology.tfrec.wsu.edu/pearent/pcg.htm for more information.

Implementation

Implementing arthropod pest management in stone fruits without broad-spectrum insecticides

Walter Bentley, Shawn Steffan, Carlos Hernandez, and Richard Coviello
University of California Cooperative Extension, Kearney Agricultural Research and Extension Center, Parlier, CA

Abstract: California’s Stone Fruit Pest Management Alliance has four objectives. The first is to implement arthropod management without the use of organophosphate and carbamate insecticides. The second is to achieve pest control equal to or better than the standard approach used during the past 30 years. The third is to keep pest control cost equal to or lower than the standard broad-spectrum insecticide approach. Fourth, grower adoption is necessary for success. The program has involved 7 farmers with 11 farms over 4 San Joaquin Valley counties. The 3-year comparison of insect damage has resulted in an average of 7.4% and 9.5% between the Alliance Program and the Standard Program, respectively. The average cost for pesticides in the Alliance Program is $183. The average cost for pesticides in the Standard Program is $190. Only one orchard utilizing the Alliance program has required supplemental use of broad-spectrum insecticides in 2002. We are now concentrating on helping stone fruit farmers adopt this program.
Implementation

The California walnut IPM expansion project

Patrick Weddle and Larry Elworth
Center for Agricultural Partnerships, Asheville, NC

Abstract: The Center for Agricultural Partnerships (CAP) in cooperation with growers and their organizations, crop consultants, researchers and farm advisors has developed a project to implement sprayable mating disruption and other new technologies on 25% of the walnut acreage susceptible to codling moth (CM) infestation (approximately 25,000 acres by the end of the fourth year). During year 1 (2001) the project’s potential for success was researched, project objectives were developed, the project architecture was designed and cooperators were identified. In year 2 (2002) baseline surveys of cooperators were conducted, work plans were formulated and the pilot field project was initiated with regional coordinators, 3 key pest management consultants and 8 grower cooperators on 900 commercial walnut acres statewide. 2002 results showed that cooperators have a continuing commitment to testing the target technologies under commercial field conditions, that mating disruption, though more expensive than conventional spray technologies, does have potential as a tool for CM management in walnuts, that the DA lure significantly out-captures pheromone baited traps in mating disrupted walnuts and that there is continued interest in expanding the project into 2003. Discussion of the problems and pitfalls of this approach to wide-scale commercial implementation will also be provided. Codling moth is one of the key pests of walnuts, infesting 60% of the more than 200,000 acres in California. Uncontrolled codling moth can lead to economic damage of up to 40% of the crop. The walnut crop in California was valued at $346 million in 2001.

Implementation

Development of Palm Pilot based spray recommendation databases for deciduous fruits

Vincent P. Jones and Gary Grove
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Abstract: Palm OS databases were developed to help agricultural consultants make decisions for IPM programs in deciduous fruits and grapes. The databases allow the user to view the recommendations by time of season and pest or disease. Each record for a pesticide includes rates, information on other pests controlled, effects on natural enemies, re-entry interval, pre-harvest interval, bee toxicity and any use restrictions. The disease databases are similar, but also include cross-resistance factors that are a serious concern with disease management programs. The inclusion of this information in a small, inexpensive, and easy-to-use hand-held computer allows the user to compare pesticides to maximize control while considering other use factors.
Thresholds, Monitoring
and Sampling

Mike Omeg, moderator
Abstracts of the 77th Annual Western Orchard Pest & Disease Management Conference

Thresholds, Monitoring, and Sampling

Geostatistical analysis of pandemis and obliquebanded leafroller distribution in apple

Vincent P. Jones and Callie C. Eastburn
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Abstract: Geostatistical analysis of PLR and OBLR distribution in apple shows that populations start out clumped and expand outward from hot spots over the course of the season. The analysis also shows that samples spaced more than 150 m apart are statistically independent, which allows us to take fewer samples per acre and still achieve an accurate representation of the population. However, application of Bt resulted in a fragmented distribution with statistical dependence extending less than 10 m. The fragmentation is probably an indication of poor spray coverage, but the effects would drastically affect sampling programs.

Thresholds, Monitoring, and Sampling

Implementing an IFP weather station network

Michael Omeg
Wy’East Resource Conservation & Development Area, The Dalles, OR

Abstract: The Integrated Fruit Production Network, or IFPnet, seeks to assist Mid-Columbia area orchardists to implement IFP practices. Using data collected from the weather stations, growers are able to view insect, pest and irrigation models specific to their orchard via the internet. The growers can then apply environmentally safe pesticides, implement irrigation water management and monitor frost and spray conditions. Currently, 46 weather stations make up IFPnet. Each station collects ambient air temperature, relative humidity, precipitation, leaf wetness, wind speed and direction, soil moisture and temperature, solar radiation and barometric pressure data. The stations transmit these data via radio telemetry to a central computer server. From the server, the data are then posted to an internet web site where they can be accessed by growers, orchard managers, pesticide applicators and crop consultants. Data and modeling information from the network are available to the public at: www.ifpnet.com.
Thresholds, Monitoring, and Sampling

Plum curculio monitoring in the Midwest: Implications for the Pacific Northwest

Mark E. Whalon and Andrea B. Coombs
Center for Integrated Plant Systems, Department of Entomology, Michigan State University, East Lansing, MI

Abstract: Trap types were evaluated for monitoring plum curculio in both apple and cherry research plots during the 2002 growing season. Trap types included screen, intercept, standard pyramid, plastic pyramid, and kill traps. All trap types were baited with aggregation pheromone, plum essence, and enhanced volatile blend lures. Traps were deployed during the second week of April and were checked once or twice weekly through fall. Plastic pyramid, screen, and wood pyramid traps were the first to capture plum curculio [DD(50) = 100]. Plastic pyramids traps, enhanced with white borders, capture more plum curculio than any other trap type evaluated. When averaged over habitat, plastic pyramid traps capture 3-fold more plum curculio than the next best trap. In the woods, plastic pyramid traps capture 10-fold more plum curculio than any other trap type. On the other hand, plastic pyramid traps do not capture statistically more plum curculio than screen, wood pyramid and unbaited plastic pyramids in the border and orchard. The orchard border, adjacent to plum curculio overwintering habitats, is the best location and the plastic pyramid trap is the best trap for capturing high numbers of plum curculio. However, plastic pyramid traps are not compatible with many tree fruit orchard practices. In addition, growers and scouts have preferred screen traps over pyramid traps.

Thresholds, Monitoring, and Sampling

Comparison of Kairomone DA 2313 and pheromone lure trapping for codling moth with oviposition monitoring

B.G. Zoller and A.M. Zoller
The Pear Doctor, Inc., Kelseyville, CA

Abstract: A kairomone-based codling moth (CM) adult trapping system was paired with a pheromone-based male trapping system in 137 interior locations of 836 hectares of pear orchards utilizing mating disruption for control in 4 California northcoast geographic areas. To monitor oviposition during June and July, 1.3 cutfruit/hectare/week were located in the trap locations; in perimeter locations of the same blocks there were 3.0 cutfruit/hectare/week. The ratio of DA capture to pheromone capture (by field age of the pheromone lure) suggested greater stability of the DA lure response compared with the pheromone lures in the highest population area. A comparison of the fraction of the season total ovae counted with the accumulated CM/trap at the time of oviposition showed that 92% of the ovae were detected with 1 or more adults/DA trap vs 79% of ovae detected with 1 or more males/pheromone trap. However, 83% were detected with 4 or more accumulated DA captures vs only 44% detected with 4 or more males/pheromone trap. The experiences indicated that DA action thresholds may be utilized at levels below detection of CM using pheromone traps; however, more frequent lure changes could increase the sensitivity of the latter.
Thresholds, Monitoring, and Sampling

Using kairomone lures to monitor codling moth in California apple orchards under mating disruption

Janet Caprile
UC Cooperative Extension, Contra Costa County, Pleasant Hill, CA

Abstract: Kairomone lures were compared to supercharged (Megalure and/or Biolure 10X) and standard (L2) pheromone lures in apple orchards using mating disruption in the northern San Joaquin Valley of California. Weekly trap catch and gender data were collected from 29 sets of traps in 16 orchards over a 3-year period. The kairomone lures caught consistently more moths during the 1st and 2nd flights and a similar number during the 3rd flight in comparison to the pheromone lures. Male and female moths caught in the kairomone traps had similar seasonal flight patterns and numbers except during the spring flight when males predominated in 2 out of 3 years. Both mated and virgin females were attracted to the kairomone traps with more mated females caught in high population orchards and more virgins caught in low population orchards. In orchards NOT using mating disruption, the kairomone lures caught significantly fewer moths than the standard pheromone lure.

Thresholds, Monitoring, and Sampling

Effectively monitoring codling moth with the DA lure

Alan Knight
U.S.D.A., A.R.S., Wapato, WA

Abstract: Codling moth (CM) continues to be managed with a suite of tools including the use of sex pheromones for mating disruption (MD) and a limited arsenal of insecticides. The growers' abilities to predict the beginning of moth activity, egg laying and egg hatch are important measures used to target the population with sprays. The current model in conjunction with the use of Guthion cover sprays has served the industry well for nearly 25 years. The model was developed by matching the accumulation of degree-days from first male captures in a sex pheromone-baited trap (Biofix) with the observed timing of egg hatch. Over many years it was found that the accumulation of 250 degree-days after Biofix successfully predicted the beginning of egg hatch.
Biological Control

Tom Unruh, moderator
Biological Control

Assessing the biologies of key indigenous leafroller parasitoids

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Abstract: In organic orchards in the southern interior of British Columbia, obliquebanded Choristoneura rosaceana (Harris) and three-lined leafrollers, Pandemis limitata (Robinson) (Lepidoptera: Tortricidae), are hosts to a rich complex of parasitoid species. There is a significant inverse correlation between the density of leafrollers in the organic orchards studied and the percent parasitism within generation and therefore parasitoids appear to be playing a major role in controlling leafroller density. Key parasitoid species have been colonized. Attributes of the parasitoids are being evaluated as to their potential to effectively decrease leafroller populations before field releases of a single or complex of species are carried out. Evaluated attributes include the parasitoid's fecundity and longevity, host specificity, impact on host's food consumption and host feeding.

Biological Control

Rose plantings increase leafroller parasitism in orchards: A story for the Rose City

Tom Unruh
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Abstract: In 1999-2002 parasitism of leafrollers was measured in multiple orchards embedded in a 1000-hectare landscape mosaic in Wapato, Washington. Using field exposure of lab-reared, larval Pandemis pyrusana we found parasitism was very low in spring and modest in summer generations. Roughly half of the parasitism was caused by 2 tachinids and the remaining half by 3 wasp parasitoids. Parasitism by the exotic wasp, Colpoclypeus florus, was found most reliably in sites near riparian habitats and almost exclusively in summer. In late summer of 2000 we planted 4 gardens of wild rose, Rosa woodsii, next to orchards at sites distant from riparian habitats with no previous history of parasitism by C. florus. Gardens were infested with the Strawberry leafroller, Ancy lis comptana, which is an important overwintering host of C. florus in some riparian settings. Ancy lis larvae subsequently became parasitized by C. florus in the fall of 2000. In the spring of 2001, sentinel Pandemis in both gardens and nearby apple orchards showed high parasitism by C. florus and much higher parasitism overall than observed in 1999-2000. Gardens acted as foci of C. florus parasitism in orchards through the 3 subsequent leafroller generations in 2001 and 2002. These manipulations demonstrate that the rose/Strawberry leafroller community produces significant orchard leafroller parasitism in the spring when it is usually very low and that spring parasitism grows into even higher parasitism in the summer generation.
Biological Control

Efficacy of two entomopathogenic nematodes for control of plum curculio in lab and field bioassays

Diane G. Alston
Utah State University, Department of Biology, Logan, UT

Abstract: Steinernema feltiae and an unidentified nematode species collected from plum curculio-infested field soil were both efficacious in killing plum curculio (PC) prepupae in lab soil bioassays. Percentage mortality of PC prepupae corrected for control mortality increased from 46 to 89% at inoculum concentrations of 250,000 to 4 million S. feltiae infective juveniles (IJJs) per m² soil. PC pupae and teneral adults were not very susceptible to S. feltiae (corrected mortality=6-21% at same nematode concentrations as for prepupae). Delays of 0 to 7 days in adding PC prepupae to nematode treated soil resulted in a decline in corrected mortality from 75 to 51% at 2 million S. feltiae IJJs per m² soil. Mortality of PC prepupae was the same to slightly greater for the same concentration levels of the field collected nematode species in lab bioassays. Insect cadavers killed by the Utah nematode were red in color suggesting that it may be in the genus Heterorhabditis. Mortality of PC prepupae in field microplots was less and more variable than in lab bioassays, likely because of drier and hotter conditions.

Biological Control

Carpovirusine granulosis virus formulation: Control of resistant strain of codling moth and study of the vertical transmission of the virus

Hervé Quénin, Pierre Laur
Calliope SAS – Arysta Life Science Group

Abstract: Carpovirusine is a biological larvicide based on Cydia pomonella granulosis virus. This product is formulated in a specially dedicated plant in the southwest of France where the virus production is obtained by natural mass rearing of codling moth infected by the virus. Carpovirusine has been developed in western Europe since 1993. After 10 years experimental trials and studies, conducted with scientific researchers and apple growers, key data have been generated. With these results we can promote the product as a tool for managing resistance to existing insecticide and for controlling existing codling moth population. A comparative efficacy study has been conducted on codling moth strain resistance in comparison with regular chemical insecticide. No change in the efficacy level was recorded during this study. Another study has been conducted in laboratory on codling moth larvae treated with a sublethal dose rate of Carpovirusine. The surviving larvae are bred under favorable conditions. Repetition of Carpovirusine sublethal treatments on 9 generations of codling moth never induced any resistant strain selection into the population. A comparative efficacy study has been conducted on codling moth strain resistance in comparison with regular chemical insecticide. No change in the efficacy level was recorded during this study. Another study has been conducted in laboratory on codling moth larvae treated with a sublethal dose rate of Carpovirusine. The surviving larvae are bred under favorable conditions. Repetition of Carpovirusine sublethal treatments on 9 generations of codling moth never induced any resistant strain selection into the population. A comparative efficacy study has been conducted on codling moth strain resistance in comparison with regular chemical insecticide. No change in the efficacy level was recorded during this study. Another study has been conducted in laboratory on codling moth larvae treated with a sublethal dose rate of Carpovirusine. The surviving larvae are bred under favorable conditions. Repetition of Carpovirusine sublethal treatments on 9 generations of codling moth never induced any resistant strain selection into the population. A comparative efficacy study has been conducted on codling moth strain resistance in comparison with regular chemical insecticide. No change in the efficacy level was recorded during this study. Another study has been conducted in laboratory on codling moth larvae treated with a sublethal dose rate of Carpovirusine. The surviving larvae are bred under favorable conditions. Repetition of Carpovirusine sublethal treatments on 9 generations of codling moth never induced any resistant strain selection into the population. A comparative efficacy study has been conducted on codling moth strain resistance in comparison with regular chemical insecticide. No change in the efficacy level was recorded during this study. Another study has been conducted in laboratory on codling moth larvae treated with a sublethal dose rate of Carpovirusine. The surviving larvae are bred under favorable conditions. Repetition of Carpovirusine sublethal treatments on 9 generations of codling moth never induced any resistant strain selection into the population. A comparative efficacy study has been conducted on codling moth strain resistance in comparison with regular chemical insecticide. No change in the efficacy level was recorded during this study. Another study has been conducted in laboratory on codling moth larvae treated with a sublethal dose rate of Carpovirusine. The surviving larvae are bred under favorable conditions. Repetition of Carpovirusine sublethal treatments on 9 generations of codling moth never induced any resistant strain selection into the population.
Biological Control

Augmentation of pear psylla natural enemies with selective insecticides, habitat modification, and hedgerow monitoring

Deborah J. Brooks, Alison T. Walston and Helmut Riedl
Oregon State University, Mid-Columbia Ag. Research & Ext. Center, Hood River, OR

Abstract: Field tests were conducted in a 15-year-old Anjou pear block to evaluate summer applications of various insecticides on pear psylla and its natural enemies. Field trials suggest that AgriMek and the chloronicotinyl insecticides Actara, Provado and Assail are more disruptive to *Deraeocoris brevis* and other hemipteran predators than Mitac and possibly Pyramite. Disruption may last as long or longer than four weeks. Surveys suggest that arboreal natural habitat along orchard borders can serve as an insectary and source for natural enemies. *D. brevis* was commonly found on native hazelnut, elderberry and, at times, also on conifers. Studies are under way to enhance biological control in orchards with four feet by twenty feet islands of flowering plants (nectar sources for hymenopteran parasitoids) and with hedgerows of elderberry and hazelnuts.
Pesticide Resistance

Roger Willemsen, moderator
Resistance Management

Natural variation in baseline data - when do we call a new sample "resistant"?

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¹Federal Research Station for Plant Production, Changins, Nyon, Switzerland
²Federal Institute of Technology, Lausanne, Switzerland
³Federal Institute of Public Health, Bern, Switzerland

Abstract: Mortality of pear psylla Cacopsylla pyri to amitraz was studied by means of bioassays. Variation between samples, temporal variation within the season in one orchard, and spatial variation between Swiss regions were considered. Variation between samples was large enough to produce different Probit functions and \( LC_{50} \) values. Temporal and spatial variations were too small to indicate resistance. Prediction intervals of the pooled functions using bootstrapping were calculated to determine if future samples would come from a population with decreased sensitivity. Probabilistic criteria on the population level were proposed for resistance.

Resistance Management

The OP-MD connection in effectively managing codling moth

Alan Knight
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Abstract: The organophosphate insecticide azinphosmethyl (Guthion) has been the backbone of our management program for codling moth (CM) for more than 40 years. Despite documentation of elevated tolerance to this insecticide in the early 1990s in WA and other western states, this insecticide continues to be widely used. Concurrent with the rapid adoption of sex pheromones for mating disruption (MD) the use of Guthion remained an important supplemental tool to manage CM. More recently as the population density of CM in many of our orchards has dramatically increased, the use of Guthion has remained strong. Use of Guthion has recently increased in Europe following the development of high levels of resistance to synthetic pyrethroids (SP) and some insect growth regulators (IGR). Cross-resistance in CM populations exposed to long-term use of Guthion has been reported to a range of other new and old insecticides that are its possible replacements. Certainly, the legacy of 40 years of Guthion use in WA orchards will be significant in the development of future pest management programs.
Chemical Control/

New Products

Christian Krupke, moderator
Chemical Control/New Products

Control of pear psylla with chloronicotinyl insecticides

Allison T. Walston, Deborah J. Brooks and Helmut Riedl
Oregon State University, Mid-Columbia Ag. Research & Ext. Center, Hood River, OR

Abstract: Two field trials were conducted to evaluate several insecticides for control of pear psylla in mid-summer. Each treatment had four single-tree replicates and applications were made with a handgun sprayer. In the first trial, the chloronicotinyl insecticides Actara, Assail, and Provado were examined as well as Mitac and Pyramite. Pear psylla nymph counts showed populations were significantly reduced on lower spur leaves after the application of all tested insecticides. Insecticide treatments significantly suppressed pear psylla nymph populations on upper terminal leaves for three weeks. Mitac had the lowest populations of pear psylla adults over the entire sample period. In the second trial, the chloronicotinyl insecticides examined were Actara, Assail, and Calypso. AgriMek and Mitac were also included. Counts from lower spur leaves showed Mitac and Calypso to significantly reduce pear psylla nymphs. Pear psylla nymph populations on upper terminal leaves were significantly reduced by all treatments compared to the control for up to three weeks. Mitac and AgriMek provided more immediate knock-down of pear psylla adults than other treatments. In addition, laboratory tests were conducted to evaluate ovicidal and nymph activity of various insecticides. Esteem and Pyramite had greater ovicidal activity than Provado, Mitac or AgriMek.

Chemical Control/New Products

Control of San Jose scale with different application timings of Esteem (pyriproxifen)

Allison T. Walston, Deborah J. Brooks and Helmut Riedl
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Abstract: Esteem (pyriproxifen) with and without HMO (horticultural mineral oil) was evaluated at different application timings for control of San Jose scale and compared to delayed-dormant applications of Lorsban (chlorpyrifos) and Supracide (methidathion). The application timings evaluated were delayed dormant (green tip), pink, petal fall, 100 degree days (DD) from codling moth Biofix, and first emergence of San Jose scale crawlers. Fruit evaluation of Red Delicious apples indicated that all treatments provided commercial control of San Jose scale compared to the untreated check. The treatment 100 DD after codling moth Biofix and the summer treatment of Esteem allowed some survival of San Jose scale crawlers compared to the other chemical treatments. In summary, delayed-dormant and bloom timings of Esteem resulted in season-long control of San Jose scale while applications in late May to early June (beginning of crawler emergence) were less effective.
Chemical Control/New Products

Pear psylla control—New materials, new prospects

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

Abstract: Four different trials were conducted to evaluate various materials at different rates and timings to control PP on pears. Treatments were applied to single-tree plots replicated four times in a randomized complete block design. Treatments were applied with a handgun sprayer at 400 psi to the point of drip, at a spray volume of approximately 200 gpa.

Trial 1: Nine different compounds were applied at three different timings: Delayed dormant (DD), Clusterbud (CB) and Petal fall (PF).

Trial 2: Seven different compounds were applied at two different timings: CB and PF.

Trial 3: Nine different compounds were applied in a single late summer application.

Trial 4: Four compounds were tested with a single application at different rates.

All plots were sampled on a weekly basis. Trials were evaluated by counting eggs and nymphs on 5 spurs per tree in early season and using standard mite brushing techniques to count the number of eggs and nymphs on 25 leaves per each treatment in late season.

Trial 1. GP 317 appeared to stimulate the adult population.

Trial 2. The PF applications Calypso® with and without oil had the best initial response. The combination of Actara®/Agri-Mek® provided the best overall long-term control. After 2 weeks all were comparable.

Trial 3. GWN-1708 at 24 and 16 oz had the best initial response while Agri-Mek® w/oil had best long-term control.

Trial 4. All of the materials tested appeared to provide good control for the first 6 weeks, with the higher rates of each formulation seeming to work more effectively.

Chemical Control/New Products

Control of grape mealybug on pear: An investigation of rates and timings

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

Abstract: This test examined several timings and rates of four chloronicotinyl compounds for control of grape mealybug. These compounds were used in combinations of clusterbud (first-generation GMB) plus mid-summer (second generation GMB) applications and Petal fall plus mid-summer applications. This was a single-tree, RCB design with four replicates. Sampling consisted of counting GMB crawlers/spur until 8 May, when we converted to doing timed counts of foliage as # of GMB seen /min. The Petal fall plus summer applications appeared to be more effective on GMB populations in the upper canopy than clusterbud applications. In the lower canopy all compounds tested provided similar control late in the season.
Abstract: The efficacy of Actara 25WG and an unregistered compound under development by Bayer Corp., USU02, was compared with three codling moth control materials (Guthion, Calypso and Novaluron) and an untreated control for control of green and woolly apple aphids in apple. USU02 was highly efficacious for control of both green (likely a mixture of Aphis pomi and A. spiraecola) and woolly (Eriosoma lanigerum) apple aphids for at least four weeks after treatment. Actara also kept green apple aphid incidence and densities relatively low but was significantly greater than USU02 by four weeks. Actara did not suppress woolly apple aphid densities. A high rate of Calypso and Guthion was moderately to highly suppressive of green and woolly aphids. Novaluron significantly increased green apple aphid incidence and densities on apple shoots and did not suppress woolly apple aphid densities as compared to untreated trees and other treatments. Densities of predaceous insects and parasitized aphids were low until four weeks after treatment when they were significantly greater in Novaluron plots than all others, likely because of high availability of aphid prey and low toxicity of Novaluron to natural enemies.

Chemical Control/New Products

Codling moth control in apple – 2002

Diane G. Alston
Utah State University, Department of Biology, Logan, UT

Abstract: The efficacy of two new, unregistered insecticides (Calypso and Novaluron) was evaluated for codling moth control in apple as compared to a conventional grower standard (Guthion) and untreated check. Numbers of male codling moths caught in pheromone traps were moderate (0.5-4 moths per trap per day) and there were two complete generations and a partial third. Calypso 4SC (thiacloprid) was applied at two rates (4 and 6 fl oz/acre) and three times per complete codling moth generation. Novaluron 7.5WG (chitin synthesis inhibitor IGR) was applied three times and Guthion 50WP (azinphosmethyl) twice per complete generation. Percentage of fruit injury was higher than expected following the first generation of codling moth in all insecticide treatments (6.3-9.5% stings and 0.3-0.8% larval entries). Following second generation, both Calypso and Novaluron were just as effective (0.8-1.8% fruit injury) as Guthion (0.9%) and significantly better than the untreated (7.3%). Spider mite and predaceous mite densities were generally not affected by any treatment. Calypso at 6 oz and Guthion showed some aphicidal activity to green apple aphid. Novaluron treated trees had excessively high aphid infestation levels in late June. Aphid predator densities were low in all treatments.
Chemical Control/New Products

Managing codling moth with new insecticides: Assail, Intrepid and Success

Keith R. Granger, Jay F. Brunner and Michael D. Doerr
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Abstract: The implementation of the Food Quality Protection Act in 1996 and the subsequent review of OP insecticides by the EPA have resulted in a reduction of broad spectrum insecticides and an increase in more selective alternatives for use in tree fruit production. These alternatives often necessitate a more intense level of management but, in turn, are safer to use and generally softer on orchard beneficials. Acetamiprid (Assail), a new chloronicotinyl; methoxyfenozide (Intrepid), an insect growth regulator; and spinosad (Success), a natural product of microbial fermentation, represent three new chemistries categorized by the EPA as “reduced risk” alternatives to OP insecticides. Each of these chemicals is now registered for use in Washington apple orchards. Tests conducted with Assail in 2002 focused on application rate and potential benefits of applying Assail in combination with horticultural mineral oil. Intrepid tests in 2002 compared water volume (25 and 100 gpa) and application timing (oviposition and traditional egg hatch). Success was not tested against codling moth in 2002; however, a recent ruling by the National Organic Standards Board makes revisiting past years’ tests of interest. Specifics and test results will be discussed.

Chemical Control/New products

New insecticides for control of codling moth on pear

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

Abstract: This test was conducted on a block of Bartlett pear trees at the Tree Fruit Research and Extension Center Smith Tract near Orondo, WA, to determine the best rates and timings for the control of codling moth. Individual plots consisted of single trees replicated four times in a randomized complete block design. Treatments were applied using a handgun sprayer operating at 400 psi. The trees were sprayed to drip, simulating a dilute application of 400 gpa. Dimilin and Novaluron at a high rate and a low rate were applied 14 May (112 degree days (DD) 1 and repeated on 24 May (209 DD) and 6 Jun. (248 DD) for the 1st generation CM, with a subsequent applications on 11 July (1005 DD), 17 July (1178 DD), and 26 July (1462 DD) for the 2nd generation. Novaluron at the high rate was applied 14 May (119 DD) and 4 Jun. (360 DD) for the 1st generation, and 11 Jul (1005 DD) and 19 July (1241 DD) for the 2nd generation. Novaluron + Assail was applied 28 May (248 DD) for the 1st generation, and 19 July (1241 DD) for the 2nd generation. Guthion was applied 28 May (248 DD) and 18 Jun. (248 DD+21days) for the 1st generation and 17 July (1178 DD) and 8 Aug. (1178DD +22 days) for the 2nd generation. Danitol was applied on the second generation only, on 26 July (1462 DD) and 15 Aug. (1434DD+20days). All compounds tested gave good control of codling moth at the first evaluation. There were no significant differences among any of the compounds tested. For the second generation, Guthion provided the greatest degree of control. Novaluron, at several rates and timings, provided the next best protection.

Abstract: Several different programs for the control of codling moth were used in southern Oregon pear orchards during the 2002 season. Programs using mating disruption generally achieved high levels of codling moth control, although elevated levels of pear psylla required supplemental applications of materials such as Assail and Danitol in some instances. Field trials conducted at the Research Center compared Imidan to other materials, including Assail, Avaunt, Dimilin, and novaluron. Novaluron in combination with 0.25% horticultural mineral oil resulted in control of codling moth equal to Imidan and better than Dimilin.

Abstract: A trial was conducted in Fairfield, CA, to evaluate the efficacy of reduced risk insecticides for control of codling moth (CM) in pears. Each experimental treatment was replicated four times in a RCB. The CM infestation in all experimental treatments was significantly lower than in the untreated control. All experimental treatments except for Dimilin without Omni Supreme oil and Omni Supreme oil alone provided acceptable control that was very similar to the grower standard of Imidan and Guthion. However Dimilin without oil and Omni Supreme oil significantly suppressed CM populations compared to the untreated control. A flare-up in both twospotted spider mite and European red mite was observed with the grower standard without Agri-Mek and with Calypso without Omni Supreme oil compared to the untreated control. The grower standard without Agri-Mek had significantly greater pear psylla than all the other treatments. Assail combined with Omni Supreme oil with or without Dimilin continues to be a very promising combination for total pest control in pears.
Abstracts of the 77th Annual Western Orchard Pest & Disease Management Conference

Chemical Control/New Products

Control of codling moth in organic pear orchards

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Abstract: A replicated single-tree trial was carried out in a mature Bartlett pear orchard in the third year of transition to becoming certified organic. Treatments were each applied using a hand-gun at dilute (about 300 gpa) rates to five trees in a randomized complete block design down the most upwind row in the orchard, bordered by walnuts. Codling moth (CM) pressure was high in 2001, thus likely assuring measurable results. The entire orchard was treated with the Suterra CM Puffer for CM mating disruption (MD). Chemical treatments included Surround® (kaolin clay), Surround® to June 19 followed by 415 oil, 415 oil, two rates of Pyganic 1.4 EC® plus Nufilm P (pyrethrin), two rates of GF-773 (spinosad) plus 1% 415 oil, and untreated control (MD only). Treatments were applied 6-9 times and timed for each CM flight through July 12. CM eggs and damage were sampled through the season and percent control vs. untreated calculated. Ten leaves per tree were sampled biweekly for the presence of other arthropods. Results were significant, untreated controls averaged 5.6% CM damage just prior to harvest on July 29. Both Surround® treatment regimes and the oil program had 0% damage (100% control). GF-773-treated trees averaged 95% control, Pyganic 1.4 EC® averaged 57% (2 pints) and 82% (4 pints), respectively. Damage on August 20, after the 2B flight, increased to 16% in untreated controls, but control remained at 100% in Surround®, oil, and GF773 (73 gms.) treatments, and 94% for GF773 (109 gms.), indicating the longevity of these treatments. Damage in the Pyganic 1.4 EC® (2 pint)-treated trees was higher than in untreated controls and gave only 44% control at the 4 pint rate, indicating the very short residual of this material. These results indicate that integrated programs of CM MD combined with various combinations of Surround®, oil, and spinosad can effectively control CM in organic pear orchards, but this hypothesis must be tested on a wider scale using grower equipment.

Chemical Control/New Products

Feeding stimulant that mimics monosodium glutamate and has improved rain-fastness

Maciej A. Pszczolkowski and John. J. Brown
Washington State University, Department of Entomology, Pullman, WA

Abstract: Recently we showed that monosodium glutamate (MSG) enhances spinosad’s activity through stimulation of feeding and pesticide intake by neonates of codling moth. However, because of its moderate rain-fastness, MSG was persistent in the field only in no-rain conditions. In order to propose rain-fast alternatives for MSG we investigated glutamate related pharmacology of taste perception by codling moth neonates. On the basis of this study we choose trans-1-aminocyclobutane 1,3 dicarboxylate (trans-ACBD) as a candidate for feeding stimulant with improved rain-fastness. trans-ACBD stimulates feeding in codling moth neonates, its feeding stimulatory properties are maintained in presence of spinosad, and addition of trans-ACBD to spinosad significantly increases its efficacy.
New acaricides for control of spider mites on pear

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

Abstract: A late season trial near Entiat, WA, was performed to evaluate some new miticides. Applications were made by handgun to single trees, replicated four times for each treatment. The plots were sprayed with a handgun sprayer operating at 400 psi, in a dilute spray of approximately 400 gallons per acre. The treatments were applied on 31 July. Spider mite counts were made just prior to the applications and at weekly intervals after application. The counts were made by collecting 25 leaves per tree, taking them to the lab and brushing them onto a glass plate covered with a thin film of soap solution using a standard mite brushing machine. The numbers of spider mite eggs and motile spider mites were counted on half of the area on the plate using a binocular dissecting scope. Initial examination of the test plot showed a level of infestation above tolerable levels (>0.5 mites/leaf). Two days post-application all samples showed a decrease in numbers of eggs and motiles. At one week, samplings showed a significant reduction in the number of eggs and motiles with the exception of the 2 lower rates of Fujimite®. By the last sampling, all products tested had made a significant impact on population size, while the untreated check continued to increase in number.

Spider mite control in apple and tart cherry – 2002

Diane G. Alston
Utah State University, Department of Biology, Logan, UT

Abstract: The efficacy of a new registered acaricide, Acramite 50W (bifenazate), was compared to standard acaricides (Agri-Mek, Pyramite, and Vendex), horticultural oils (JMS Stylet and Supreme oils) and an untreated control for control of spider mites in apple and tart cherry. Phytophagous mite (twospotted spider mite, European red mite, and brown mite) densities were low in the apple trial and did not differ among treatments. In tart cherry, both rates of Acramite (0.75 and 1.0 lb/acre) and Vendex (2 lb/acre + 0.25% oil) significantly lowered phytophagous mite densities for two weeks post-treatment. The oil alone treatments (1.5% JMS Stylet oil and 1.5% Supreme oil) were not effective in lowering phytophagous mite densities below untreated levels. All acaricides tested lowered predacious mite (Galendromus occidentalis and Zetzellia mali) densities for up to six weeks after treatment.
Chemical Control/New Products

True bug control with neonicotinoids on sweet cheery

Dept. of E.S.P.M., University of California, Berkeley, CA

Abstract: A trial was conducted in Stockton, CA, to evaluate the efficacy of three neonicotinoid insecticides (Provado, Actara and V-10112) for the control of mountain leafhopper (ML). ML were caged on cherry foliage at 0, 3, 7, 14 and 21 days after treatment (DAT), and mortality was assessed at 1/2, 1 and 2 days of exposure (DOE). At 1/2 DOE, Asana, the grower standard, provided significantly greater ML mortality compared to all other treatments through 21 DAT except Actara at 21 DAT. At 1 DOE Asana provided significantly greater ML mortality compared to all other treatments through 21 DAT except Actara at 0 and 21 DAT. Asana provided superior ML mortality compared to all of the neonicotinoid insecticides, while Actara provided consistently greater ML mortality than Provado or V-10112. Based on this and past years’ research, Actara would be the most effective neonicotinoid replacement for Asana, Sevin, Diazinon or Guthion.

Chemical Control/New Products

In-orchard management of the consperse stink bug, Euschistus conspersus, and associated non-target effects

Christian H. Krupke and Jay F. Brunner
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Abstract: The consperse stink bug, Euschistus conspersus Uhler, has emerged as an important pest of pome fruit production in north central Washington in the past decade. Growers have struggled to manage this pest, with limited effective chemical control options near harvest. Application of the synthetic pyrethroid fenpropathrin (Danitol®) resulted in high mortality in laboratory tests. We assessed the field efficacy of Danitol as an in-orchard treatment for stink bug damage. To quantify some of the possible non-target effects of Danitol, we followed both pest and beneficial mite populations before and after insecticide application. We found a significant increase in the populations of pest mite species in treated areas relative to controls, with a concurrent depression in populations of beneficial mite species. In light of this information, we present data from field testing of border-only applications of Danitol as an in-orchard treatment.
Chemical Control/New Products

Control of walnut huskfly with a spinosad plus bait (GF-120)

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Abstract: A trial was conducted in the San Joaquin valley, CA, to evaluate the efficacy of spinosad plus fruit fly bait (GF-120) for control of walnut huskfly (WHF) in walnuts. The trial was conducted in two orchards. GF-120 applications were initiated on July 10 in orchard No. 1 and July 17 in orchard No. 2, using a modified weed sprayer mounted on an ATV. Applications were terminated on September 19 at the beginning of husk-split in both orchards. GF-120 was diluted 1:4. In orchard No. 1, applications of GF-120 at 20 and 40 oz/ac applied weekly and 40 oz/ac applied every other week resulted in a significant reduction in fruit infestation compared to the blank bait or grower standard, but there was no significant difference among the GF-120 treatments. Despite the large reduction in fruit infestation, there was not a corresponding reduction in adult fly captures. In orchard No. 2, GF-120 10 oz/ac applied weekly and blank bait at 10 oz/ac applied every other week resulted in a significant increase in fruit infestation compared to the grower standard while GF-120 at 20 oz/ac applied weekly or every other week was not significantly different than the grower standard. It appears that 10 oz/ac was not sufficient to suppress this moderate population. GF-120 provided effective control of WHF. The amount of GF-120 per acre and/or the number of applications needed to suppress a population are dependent on the WHF density. GF-120 is slow-acting and has limited field longevity in the San Joaquin valley.

Chemical Control/New Products

Research results of Messenger (a.i. Harpin Protein) in apple, pear and cherry

Sean Musser
EDEN Bioscience Corporation, Bothell, WA

Abstract: The efficacy of Harpin Protein (Messenger) was tested to determine effect on fruit size and quality in apple, pear and cherry. Commercial size trials were conducted throughout the WA tree fruit growing area with WSU and WTFRC. Additionally commercial packouts were gathered from treated areas versus untreated as well as hand harvesting and subsequent evaluation. Messenger had a consistent positive impact on size in cherry and pear. Results in apple are mixed and therefore apple will remain a crop in development for EDEN in 2003 with expected commercialization in limited amounts.
Biological Control

Development of kairomone-based mass-trapping control of codling moths in Californian walnuts and apples

Douglas M. Light, Alan L. Knight, Katherine M. Reynolds and Michelle Brewer
USDA-ARS, Western Regional Research Center, Albany, CA

Abstract: The mass-trapping technique to control codling moth populations was investigated using a dual lure, a combination of the pear-ester kairomone and codlemone pheromone. The goals of the mass-trapping studies were to: 1) to simulate the potential of other kairomone-based controls (e.g., attract and kill), 2) demonstrate a control strategy for small acreage organically managed orchards, and 3) demonstrate a control strategy for orchard borders to eliminate immigration of mated-gravid CM females. Number-placement of traps in orchards was studied to increase mass-trapping efficacy. Occurrence-degree of nut damage was evaluated by nut drop, canopy infestation, and harvest injury/damage. Seven replicated three acre plots of walnuts (three organic, two conventional, and two mating disruption) and two apple plots were set up to evaluate the use of mass trapping as a population control measure over the entire season.

Thresholds

Progress in use of the ‘DA’ kairomone for monitoring codling moth populations in Californian walnuts

Douglas M. Light, Alan L. Knight, Katherine M. Reynolds and Michelle Brewer
USDA-ARS, Western Regional Research Center, Albany, CA

Abstract: The standard ‘DA’ kairomone lure (ethyl (2E, 4Z)-2,4-decadienoate) was used in its fourth year of population monitoring in California walnut orchards. Monitoring studies were conducted in 54 walnut orchards, both conventionally managed and mating disruption control orchards. Replicated pairs of pheromone-baited and kairomone-baited traps were used to compare the detection and resolution of codling moth biofix, flight initiation-emergence, flight duration, peak and periodicity, population intensity, and the mating status of captured female moths. The population monitoring parameters are being correlated with the occurrence and degree of orchard nut injury and damage.
Biological Control

Conservation biological control in California stone fruit: A case study of San Jose scale and its aphelinid parasitoids

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Abstract: The aphelinid parasitoids of San Jose scale, Diaspidiotus perniciosus (Comstock), were monitored using pheromone-baited traps for three growing seasons (2000-2002) throughout the central San Joaquin Valley of California. The fields monitored were commercial blocks of peach, plum, and nectarine under two insecticide regimes: reduced-risk materials (low mammalian toxicity, low persistence) and conventional materials (neurotoxins). Trapping data suggest D. perniciosus populations were suppressed primarily by dormant-season insecticide applications and spring parasitism. Acreage using reduced-risk insecticides tended to have higher San Jose scale populations, although several blocks that had been using reduced-risk materials for many years had very low San Jose scale populations.
Appendix
Minutes of the 76th Annual Meeting  
Western Orchard Pest and Disease Management Conference  
Hilton Hotel, Portland, Oregon  
January 9-11, 2002

I. Call to Order: The 76th Annual Meeting was called to order by the Chair Barat Bisabri at 10:00 AM. Chair Bisabri extended an official welcome to everyone. Chair Bisabri introduced section leaders. They were:

- Chemical Control/New Pesticides  
- Biology/Phenology  
- Mating Disruption/SIR  
- Implementation  
- Thresholds/monitoring  
- Biological Control  
- Pesticide Resistance  
- Tree Fruit Diseases  

   - Harvey Yoshida  
   - Vince Jones  
   - Bob Van Steenwyk  
   - Ted Alway  
   - Tony Duttle  
   - Rick Hilton  
   - No Reports  
   - Lorianne Fought

II. Old Business

A. Reading of 2001 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.

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

III. New Business

A. Committee Assignments: The following committee assignments were made:

- Nominations: Ted Alway, Joe Grant, Alan Knight  
- Audit: Douglas Light, Robert Van Steenwyk, Janet Caprile  
- Resolutions: Tim Smith, Bob McClain, Jim Stewart

B. Venue 2003

It was agreed that the WOPDMC would cancel its contract with the Benson Hotel and meet again at the Hilton Hotel. It was agreed that Secretary Thomson would make the arrangements with Hilton Hotel.

C. Structure of the WOPDMC

Secretary Thomson reported on the incorporation of the WOPDMC as a non-profit organization in the State of Oregon.

IV. Closing Business Meeting:

The closing business meeting was called to order by Chair Bisabri at 11:30 AM on January 11.

A. Committee Reports:

1. Nominations:

   The nominating committee nominated Broe Zoller as chair elect for the 2003 meeting and Don Thomson as Secretary/Treasurer for the 2002 meeting. A motion was made and seconded to accept the recommendations of the nominations committee. The motion passed unanimously. John Dunley will be the Chair for the 2003 meeting.

2. Audit:

   Chair Bisabri asked for the report of the auditing committee. The report from Treasurer Thomson was audited by the committee and they reported it to be in good order. A motion was made and seconded to accept the treasurer's report. The motion passed. Don Thomson then read the Treasurer's Report.
3. Resolutions:
The report of the resolution committee was requested by Chair Bisabri. The committee proposed the following:

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. The membership would like to especially thank the Hilton Hotel for the organization of the reception on Wednesday, January 9.

b. Be it resolved that the members of the conference express their appreciation to Chair Betsy Bisabri, and Secretary/Treasurer Don Thomson for their leadership and dedication in organizing the 2002 meeting.

c. Be it resolved that the members of the conference extend their appreciation to Glenn Fisher and Deanna Watkins for preparing the research report abstracts as well as to the section leaders: Harvey Yoshida, Vince Jones, Rick Hilton, Tony Dudie, Loriance Fought, Ted Alway, Bob Van Steenwyk

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

e. Be it resolved that the members of this conference recognize the long-term benefits the organization will receive from the development of the web-based communication made possible through the efforts of Betsy Beers and Jerry Tangren, WSU-TFREC, Wenatchee, Washington.

f. Be it resolved that special thanks and recognition should be afforded Secretary/Treasurer Thomson for recognizing the need (after 75 years) for the WOPDMC to organize into a form that gives us official standing with the US government and simplifies the transfer of the duties of Secretary/Treasurer if we even wish to do so.

A motion was made and seconded to accept the resolutions as read. The motion passed.

It was announced that the meeting dates for the 2003 meeting will be January 15, 16 and 17. The meeting will start at 10:00 AM on Wednesday, January 15th.

Chair Bisabri thanked those who had attended and helped in various capacities to make the 76th Pest and Disease Management Conference a success. Chair Bisabri turned over the proceedings to Chair Elect John Dunley. He adjourned the meeting.

Respectfully Submitted,

Donald R. Thomson
Secretary/Treasurer
Notes
Western Orchard Pest & Disease Management Conference

77th Annual Conference
Hilton Portland, Portland, Oregon
January 15-17, 2003