RESEARCH REPORTS:
76th ANNUAL WESTERN ORCHARD PEST
& DISEASE MANAGEMENT CONFERENCE

Imperial Hotel, Portland, Oregon
January 9, 10 & 11, 2002

These are research reports only, NOT recommendations of the conference.
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MEETING NOTICE

76th ANNUAL WESTERN ORCHARD PEST & DISEASE MANAGEMENT CONFERENCE

January 9, 10 & 11, 2002

Hilton Portland
921 SW 6th Ave.
Portland, OR 97204

Barat Bisabri, Chairman
John Dunley, Chair Elect
Don Thomson, Sec./Treas.
Elizabeth Beers-Peryea, Proceedings Editor

Website: http://entomology.tfrec.wsu.edu/wopdmc
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PEST AND DISEASE MANAGEMENT CONFERENCE
January 9, 10, & 11, 2002

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no reports

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no reports

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**9-11 January, 2002**  
Portland Hilton, Portland, OR

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- **poster**  
  - Bruner, J. F. and M. D. Doer  
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- **poster**  
  - Beers, E. H. and P. D. Himmel  
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    - Control of *Taphrina pruni* with registered and non-registered pesticides
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  - Beers, E. H. and P. D. Himmel  
    - The effect of Esteem on San Jose scale
- **poster**  
  - Beers, E. H. and P. D. Himmel  
    - Effects of various insecticides on first and second generation white apple leafhopper nymphs
- **poster**  
  - Beers, E. H. and P. D. Himmel  
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    - Neonicotinyls and IGRs for control of codling moth in pears
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  - Dunley, J. E., B. M. Greenfield and L. H. Bennett  
    - Control of two spotted spider mites - handicap trial
- **poster**  
  - Dunley, J. E., B. M. Greenfield and L. H. Bennett  
    - Use of new and registered compounds for control of grape mealybug in pears
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- **poster**  
  - VanBuskirk, P. D. and R. J. Hilton  
    - Evaluation of registered scardicides in late season foliar applications in pear, 2001
- **poster**  
  - Hilborn, R. and P. VanBuskirk  
    - Prew bloom use of Esteem (EC and WP formulations) and Pyramis for control of pear psylla

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**Lunch on Your Own**

- **poster**  
  - Hilborn, R. and P. VanBuskirk  
    - Evaluation of codling moth controls: Dimilin, Novacure, and Avantage
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    - Control of Western cherry fruit fly in tart cherry with neonicotinoid insecticides
- **poster**  
  - Alston, D. G.  
    - Control of spider mites in apple and tart cherry with acaricides
- **poster**  
  - Grodnik-Carwell, E. and Y. Guay  
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- **poster**  
  - Chesters, D. H. Reising and C. Smith  
    - Evaluation of apple maggot control and an organic insecticide program
- **poster**  
  - VanSteenwyk, R. A.  
    - Tree bug control with neonicotinoids in pears
- **poster**  
  - VanSteenwyk, R. A.  
    - Control of walnut huskfly with a Spinosad plus bait (GF-120)
- **poster**  
  - VanSteenwyk, R. A.  
    - Control of codling moth with reduced risk insecticides in pears
- **poster**  
  - McKinley, N., S. Kijima, E. Cook and D. Sherrod  
    - "Avantage" indoxacarb insecticide: A new mode-of-action insecticide for control of several key orchard pests
- **poster**  
  - Paczkowski, M. A. and J. J. Brown  
    - Feeding enhancements for insecticide targeting novel Lepidoptera larvae
- **poster**  
  - Knight, A. L.  
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### 5:00-7:00 PM

**Wine/Cheese Reception**
### Thursday, 10 January 2002

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| 8:00 AM    | Michael D. Dome and Jay F. Brunner
Development of a temperature-dependent predictive model for *Lasemola rubens* |
|           | Whalen, M. E.                                                                        |
|           | *Pom Carollor: Headed West* Phenomones, traps and trapping transects 2001           |
|           | Dunley, J. E., E. H. Beer, V. P. Jones and B. M. Greenfield                           |
|           | Effect of treatments on sympatric spider mite reproduction                         |
|           | Bredveld, K. and L. Tanigoshi                                                        |
|           | Status of cherry bark tortrix in Washington state                                 |
|           | Light, D., K. Reynolds, A. Knight and S. Welser                                     |
|           | Development of kairomone-based sex-trapping and other control tactics targeting both sexes of codling moth in California walnuts |

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<tr>
<td></td>
<td>Brunner, J. F., C. Cockfield and A. D. Kahn</td>
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<td>Evaluating new technologies for codling moth and leafroller mating disruption</td>
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<td>Valente, B. and J. Brunner</td>
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<td>Leafroller mating disruption and its use in commercial orchards</td>
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<td>McGhee, P. M., Haas, D. Epstein and L. Gut</td>
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<td>Efficacy of mating disruption formulations that contain pheromone blends</td>
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<td>Field studies with encapsulated sprayable codling moth pheromone</td>
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<td>Gut, L., D. Walston, M. Haas and P. McGhee</td>
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<td>Performance of sprayable mating disruption formulations</td>
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<td>Effect of clay particle film on encapsulated sprayable codling moth pheromone release rate</td>
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<td>Agnello, A. M.</td>
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<td>Evaluation of different pheromone dispensing technologies for mating disruption of Oriental fruit moth in peach orchards</td>
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<td>Knight, A. L.</td>
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<td>Integrated high emission low point (I. H.E.L.P) mating disruption systems for codling moth and leafrollers</td>
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### Noon-1:30 PM

**Lunch on Your Own**

### Friday, 11 January 2002

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<tr>
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<td>Brunner, J. F., J. Danley</td>
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<td>Closing Business Meeting</td>
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CHEMICAL CONTROL/NEW PRODUCTS

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Section Leader
Harvey Yoshida
NEW INSECTICIDE CHEMISTRIES FOR THE MANAGEMENT OF CODLING MOTH AND LEAFROLLER

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

Abstract: Several new insecticide chemistries have recently been approved or are in the registration process for use in Washington apple orchards. This list includes chloronicotinils (Assail, acetamiprid; Calypso, thiacloprid), growth regulators (Intrepid, methoxyfenozide; Esteem, pyriproxyfen) and novel chemistries (Proclaim, emamectin benzoate; Avaunt, indoxacarb). These insecticides have been evaluated in field and laboratory trials for the control of many pests including codling moth and leafrollers. Potential implementation of these new insecticides to manage lepidopteran pests in Washington will be discussed.

- Delayed Iapp of Guthion @ CM
  - Proclaim Microcyclic Lactone GABA Inhibitor
  - Intrepid Field Rate APM

EFFECT OF CHLORONICOTINYL INSECTICIDES ON PHYTOPHAGOUS AND PREDATORY MITE POPULATIONS IN A COVER SPRAY PROGRAM

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

Abstract: This study provides a reasonably clear indication that the use of Assail for codling moth may be problematic in terms of integrated mite control. This product is currently the most likely non-IGR OP replacement for control of Washington's key apple pest. While the mechanism is not clear from this field trial, both toxicity to predatory mites and stimulation of tetranychid mite reproduction may be contributory. The pest mite populations resulting from a 4-spray Assail program were moderate, although the small scale of these plots may influence the degree of immigration, and the effect may be more severe in larger plots. The other chloronicotinyls Calypso and Actara appear to have some effect on either predatory or tetranychid mites, but not to the same extent as Assail. Provado was not statistically different from either Imidan or the check in this regard. Asana suppressed predatory mites, but did not cause a mite flareup during the current growing season. Imidan has no apparent effect on either predatory or phytophagous mites. Assail, Calypso, Asana and Imidan provided the best codling moth control; Assail also appears to suppress San Jose scale. All the chloronicotinyls controlled white apple leafhopper, as did Imidan and Asana in 4-spray cover programs.
FIELD AND LABORATORY TRIALS AGAINST WESTERN TENTIFORM LEAFMINER

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

Abstract: Various insecticides were tested against leafminer in a heavily infested apple orchard near Brewster, Washington. Of the treatments tested, only Success + oil (peak sapfeeder) and Agri-Mek+oil (early tissuefeeder) were effective in reducing leafminer populations. There is some evidence to support changing the recommended timing to somewhat earlier than the traditional 10% tissuefeeder stage. Two greenhouse bioassays were performed by releasing 500-700 adult leafminers into cages containing 24 potted apple seedlings (4 treatments x 6 reps). Treatments were applied either prior to introduction, or at various times throughout the larval development period. Surround, Raynox and Intrepid when applied pre-exposure to adults gave ≈50% suppression of the numbers of total and live mines. In the Intrepid treatment, it appeared that if the larvae survived until the tissue feeder stage, they survived the treatment; most of the mortality occurred at the sapfeeder stage. Avaunt, applied either during the egg or sapfeeder stage, did not reduce leafminer populations in relation to the check. The standard treatment, Success plus oil targeting sapfeeders, reduced the the resulting population to a very low level.
Chemical Control/New Products

THE EFFECT OF ESTEEM ON SAN JOSE SCALE

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

Abstract: The efficacy of Esteem and several other widely used insecticides on a heavy infestation of San Jose Scale was tested in a 'Braeburn' apple block. Applications were made by handgun to the point of drip. Treatments were a combination of materials at three possible timings: delayed dormant timing (DD) only, or DD plus an application aimed at 1st generation crawlers in mid-summer. The 2nd spray targeting crawlers was timed using sticky tapes applied on limbs proximal to visible scale colonies. Fruit damage samples were done in mid-summer and pre-harvest. All treatments, either single (DD) or double (DD & Gen. 1) applications successfully reduced fruit infestation by scale compared to the check. Single applications of oil plus either Esteem or Supracide should be successful, although high populations may take several years to completely suppress.

Chemical Control/New Products

EFFECT OF VARIOUS INSECTICIDES ON FIRST AND SECOND GENERATION WHITE APPLE LEAFHOPPER NYMPHS

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

Abstract: This test was part of a series to establish the spectrum of activity of the nicotinoid insecticides against the white apple leafhopper. Secondarily, the miticide spirodiclofen was tested against the first generation and a neem product (Aza-Direct) against the second. First generation treatments were applied 7 d after petal fall (17 May) using a multiple tank airblast sprayer calibrated to deliver 200 gpa. The second-generation test was conducted in the same block, with treatments applied on 9 Aug 2001 (primarily instars 1-3 of the second generation) using the same spray equipment. In the first generation, Actara, Calypso, Assail and Sevin c controlled leafhopper nymphs throughout the nymphal period. Avault also reduced nymph populations to a low level, although the effect was delayed by about a week compared to the other materials. Spirodiclofen did not cause significant nymph mortality. In the second generation, all treatments reduced nymph populations in relation to the check, however the Aza-Direct population was low initially, and essentially caused no change in the population, making the probable effect difficult to interpret.
WOOLLY APPLE APHID CONTROL
Elizabeth H. Beers and Peter D. Himmel
Washington State University, Tree Fruit Research and Extension Center, Wenatchee, WA

Abstract: The efficacy of Actara and several other widely used insecticides against woolly apple aphid was tested in a 'Pink Lady' apple block near West Richland, WA. Four replicates consisting of 20 trees each were sprayed using an airblast sprayer at 100 gpa on 25 July. Counts of live aphids per colony were done both before application as well as at 6 and 21 d post-treatment. The evaluation done 1 wk after treatment showed a marked mortality in those colonies treated with Thiodan and Diazinon. The other materials (Actara, Dimethoate, Provado and Aza-Direct) all showed a significant decrease in populations when compared to the control, but not to the extent of the Thiodan and Diazinon treated trees. Two weeks later, all above-ground colony size was greatly reduced and not significantly different from the control.

NEONICOTINILS AND IGRs FOR CONTROL OF CODLING MOTH IN PEARS
John E. Dunley, Bruce M. Greenfield and Larry H. Bennett
Washington State University, Tree Fruit Research & Extension Center, Wenatchee, WA

Abstract: Individual plots consisted of single trees replicated four times in a randomized complete block design. Treatments were applied using a handgun sprayer at 400 gpa. The insect growth regulator (IGR) compounds were applied twice for each generation starting 1-3 weeks earlier than the other compounds which were applied on a more typical codling timing. Calypso was applied 4 times/generation, Imidan 3 times/generation, and Assail & Guthion 2 times/generation on a 10, 14, 21-day schedule, respectively. Codling moth (CM) injury was evaluated after each generation by examining 50 fruit per tree for CM stings and entries. All compounds gave good control of codling moth at the first evaluation, although CM injury was only 10% in the check. At the second evaluation, Dimilin 25WP had more CM stings than the other compounds and was not significantly different from the check. All compounds had significantly fewer CM entries than the check, but the differences between the compounds tested were not statistically significant.
CONTROL OF TWOSPOTTED SPIDER MITES – HANDGUN TRIAL

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

Abstract: This test was applied to d’Anjou pear trees at a commercial orchard near Dryden, WA. 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. The treatments were applied 16 Aug. Mites were counted by collecting 25 leaves per plot and brushing them with a standard mite brushing machine onto a glass plate covered with a thin film of soap solution. Plates were examined under magnification and the number of mite eggs and motile stages recorded. All compounds worked well on the motile forms. Savey had a lag in efficacy when compared to the other materials used but did finally compare favorably. Acramite at the high and low rate, Mesa with oil, BAJ 2740 at both rates, and Agri Mek with oil had the greatest initial impact on the egg populations.

USE OF NEW AND REGISTERED COMPOUNDS FOR CONTROL OF GRAPE MEALYBUG ON PEARS

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

Abstract: This test examined various timings and rates of four neonicotinil compounds compared to Imidan and Applaud. These compounds were used in combinations of clusterbud plus mid summer applications and petal fall plus mid summer applications. This was a single tree, RCB design with four replicates. Sampling consisted of counting grape mealybug (GMB) crawlers/spur till 8 May when we converted to doing timed counts of foliage as number of GMB observed/min as described by C. A. Geiger & K. M. Daane, J.Econ.Entomol. 94(1): 291-301(2001). The petal fall plus summer applications of Assail, Actara, Applaud, Calypso and Provado appeared to have the most effect on GMB populations in the upper canopy. The clusterbud plus summer applications were not as effective. In the lower canopy all compounds tested provided similar control late in the season.
CONTROL OF PEAR PSYLLA NYMPHS

John E. Dunley, Bruce M. Greenfield and Larry H. Bennett
Washington State University, Tree Fruit Research & 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 used combinations of prebloom + summer and petal fall + summer applications for season long pear psylla control. Application dates for this trial were 16 Apr cluster bud (CB), 7 May (PF), 2 Jul (Sum 1), and 26 Jul (Sum 2). Trial 2 compared pre bloom materials for PP control. Application dates were, 19 Mar delayed dormant (DD), 12 Apr cluster bud (CB), and 17 Apr popcorn (PC). Trial 3 compared post bloom materials for PP control. Applications were made on 7 May petal fall (PF). Trial 4 was a single late season application comparing full, half rates and combinations of various materials. All were applied on 2 Jul. PP nymph counts up through 1 May were made by collecting 5 spurs per tree and examining them under magnification and counting the number of eggs and nymphs. Starting on 9 May, 25 leaves were collected from each tree, and were brushed with a standard mite-brushing machine onto a glass plate. Plates were examined under magnification and the number of nymphs recorded. Trial 1: Clusterbud and petal fall applications provided control of nymphs for approx. 6 weeks. Summer applications of half rates of Provado + Actara did not provide as good of control as the half rate applications of Assail + Actara. The summer application of a half rate of Actara by itself gave very little control. Summer applications of full rates of Pyramite, Applaud, Provado and Agri Mek provided the best control of nymphs. Trial 2: Control of nymphs began to appear 3 weeks after CB and PC applications. All CB and PC applications provided short-term control with the high rate of Actara providing the best overall control. Trial 3: All compounds tested provided a significant decrease in PP nymphs and adults for over 6 weeks. Trial 4: The full Rate of Provado provided the best control of nymphs. The half rate of Provado provided the least control. All other treatments were comparable.
EVALUATION OF REGISTERED ACARICIDES IN LATE SEASON FOLIAR APPLICATIONS IN PEAR, 2001

Philip D. VanBuskirk and Richard J. Hilton
Oregon State University
Southern Oregon Research & Extension Center, Medford, Oregon

Keywords: Agr-imek, abamectin, Pyramite, pyridaben, Apollo, clofentezine, Savey, hexythiazox, Vendex, fenbutatin-oxide, Vydate, oxamyl, Kelthane, dicofol, Acramite, bifenazate, twospotted spider mite, *Tetranychus urticae*, chemical control, acaricides, miticides, pear.

Abstract: Acaricides registered for use on pear to control twospotted spider mites (TSM) were evaluated for their efficacy when used during the foliar season. Single tree replicates were sprayed by air blast sprayer, and pre and post-treatment counts were made to determine the performance of the materials applied. Acramite, registered in 2001 for the first time under a Section 18 in Oregon, provided the best control of TSM in this test.

Acreamte-best for mite
Savey next best alternative

PREBLOOM USE OF ESTEEM (EC AND WP FORMULATIONS) AND PYRAMITE FOR CONTROL OF PEAR PSYLLA

Richard J. Hilton and Philip VanBuskirk
Oregon State University, Southern Oregon Research & Extension Center, Medford, OR

Abstract: Two trials were conducted to evaluate the effect of Esteem, both the EC and WP formulations, and Pyramite applied at the pink stage for control of pear psylla. Plots were at approx. 0.1 A in size and applications were made with an airblast sprayer. Leaf counts of pear psylla immatures showed that populations of pear psylla were reduced in all treatments when compared to the check, but few significant differences were seen among the treatments tested. In one of the trials the effect of Pyramite on reducing populations of pear rust mite and twospotted spider mite was also examined.
EVALUATION OF CODLING MOTH CONTROLS: DIMILIN, NOVALURON AND AVAUNT

Richard J. Hilton and Philip VanBuskirk
Oregon State University, Southern Oregon Research & Extension Center, Medford, OR

Abstract: Two formulations of Dimilin and novaluron, both chitin synthesis inhibitors, were tested for control of codling moth on pear in a full season program consisting of four applications. Single tree replicates were sprayed with an airblast sprayer. All treatments along with a standard program using Imidan resulted in significant reduction of codling moth damage. The greatest reduction in fruit injury at harvest was seen in the novaluron treatment. In another trial three applications of Avaunt plus oil for control of first generation codling moth were made in an orchard using puffers for codling moth mating disruption. Plot size was 1 acre or greater. In comparing plots where a combination of Avaunt and oil was used to plots where only oil was applied, the addition of Avaunt reduced codling moth injury at harvest by 50% or more.

CONTROL OF WESTERN CHERRY FRUIT FLY IN TART CHERRY WITH NEONICOTINOID INSECTICIDES

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

Abstract: The efficacy of two neonicotinoid insecticides, thiacloprid (Calypso) and imidacloprid (Provado), were tested for control of western cherry fruit fly (Rhagoletis indifferens) in tart cherry as compared to an industry standard program (azinphosmethyl (Guthion) and carbaryl (Sevin)) and an untreated control. Insecticides were applied with an airblast sprayer (70-80 gpa) to 3-row-wide by 5-tree-long (60 ft x 60 ft) plots. First treatments were applied 6 days after first adult fly catch (26 May) on ammonium carbonate-baited yellow sticky traps. Subsequent treatments were applied at 14 d intervals for a total of three applications per treatment. In fruit harvest samples collected on 16 July, there was no fruit injury in Provado and Guthion/Sevin treatments, 0.08% injury in the Calypso treatment, and 2.75% injury in the untreated plots. Adult fly densities were monitored with a trap in each plot. Adult densities were high in all treatments (ranged from 195-272 cumulative flies per trap per treatment from 1 June to 26 July) with no differences among treatments. Fruit injury at harvest in untreated plots was lower than expected (2.75%) given the high number of adults caught on traps. The small plot size and relatively small area of untreated trees in the orchard are likely explanations. One untreated buffer row was left between each tier of plots to minimize insecticide drift and create a greater reservoir of untreated fruit.
CONTROL OF SPIDER MITES IN APPLE AND TART CHERRY WITH ACARICIDES

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

Abstract: The efficacy of a new (unregistered) acaricide, Acramite (bifenazate) was compared with two registered acaricides, Pyramite (pyridaben) and Agri-Mek (abamectin) for control of two spotted and European red mite in apple and tart cherry. The toxicity of the acaricides to two predaceous mites, Galendromus occidentalis and Zetzellia mali, was also evaluated. Treatments were applied on 19 July to single-tree replicates with a handgun sprayer (400 gpa). Spider mite densities were reduced by all acaricides as compared to untreated trees on 7 and 17 days after treatment (DAT). However, spider mite densities in all acaricide treatments rebounded by 21 or 22 DAT, and cumulative mite days for the 42-day study period were not different among treatments, with the exception of lower mite days in Pyramite than untreated trees in the apple study. Pyramite was more effective in reducing densities of European red mite than two spotted spider mite. All acaricide treatments initially lowered predaceous mite densities (7-14 DAT) below those in untreated trees, but predator populations generally recovered and were no different than in untreated trees by 21 or 22 DAT.

LABORATORY STUDY OF THE EFFECTS OF VOLCK OIL ON SAN JOSE SCALE STAGES

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Abstract: Plum twigs infested with various stages of San Jose scale were either dipped or sprayed with concentrations of Volck oil ranging from 1-6%. The survival of 1st instar, 2nd instar, 3rd instar scale and the fecundity of females was evaluated after 8 days. Dipping scales with 1, 2, 4, or 6% oil killed all stages equally well. When oil was sprayed on the twigs, concentrations of 4 and 6% oil were significantly better in killing scale and reducing fecundity of females than 1 or 2% oil. First and 2nd instar scales were easier to kill with oil than older instars. These results confirm that greater coverage and higher percentage of oil more effectively control of San Jose scale. When organophosphates were added to the dormant application for San Jose scale, California stone fruit growers reduced water volume and the concentration of oil in the mix. As organophosphate resistance builds and growers return to treatments of oil alone, they need to return to higher volumes of water and maintain the oil concentration high.
The objectives of this study were to determine the efficacy of current organic insecticides, while also evaluating organic and standard materials against apple maggot. Treatments were 1) Surround (50 lb/A) starting at petal fall applied weekly until last cover; 2) Surround (50 lb/A) starting at petal fall applied weekly five times, followed by weekly sprays of AZA-Direct (32.0 oz/A). Both treatments provided similar levels of control, but the seasonal program of Surround had a slightly higher percentage of clean fruit due to better control of internal lepidoptera and plum curculio.

Two rows in this orchard were set up to conduct apple maggot trials. Hand applications were applied (450 psi) either weekly or bi-weekly depending on material. Bi-weekly treatments were: Avaunt (1.9 oz/100), Calypso (1.0 oz/100), Actara (0.46 oz/100) and Guthion (8.0 oz/100). Weekly applications were Surround (25 lb/100), AZA-Direct (11.0 oz/100), Spintor (2.5 oz/100) and a volatile bait containing spinosad (32.0 ml/tree). The poison bait was applied using a backpack CO$_2$ sprayer. Surround gave complete control, while the standard Guthion had less than 0.5%. Calypso also gave good control, but the remainder of the materials tested were similar in damage to that of the untreated control.

Chemical Control/ New Products

TRUE BUG CONTROL WITH NICOTINOIDS IN PEARS

R. A. Van Steenwyk
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Abstract: A trial was conducted to evaluate the efficacy of five neonicotinoid insecticides (Actara, Provado, Calypso, Assail and V-10066) for control of Lygus in pears. Lygus was caged on pear foliage at 0, 7, 14 and 21 days after treatment (DAT) for 1, 4 and 7 day of exposure (DOE). All insecticides provided excellent control at 0 DAT. V-10066 provided excellent control at 14 DAT and 4 DOE and give consistently greater Lygus mortality than the other neonicotinoid insecticides. Based on this and past years’ research, V-10066 would be the most effective replacement for Carzol or Dimethoate.
Chemical Control/ New Products

CONTROL OF WALNUT HUSKFLY WITH A SPINOSAD PLUS BAIT (GF-120)

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Abstract: A trial was conducted to evaluate the efficacy of spinosad plus bait (GF-120) for control of walnut huskfly in walnuts. The trial was conducted in an orchard with an extremely large WHF population. The number of infested nuts was significantly reduced by spinosad plus bait compared to bait without spinosad or an untreated control. Adult flies were reduced by the spinosad plus bait treatment and the bait appears to be a powerful attractant to adult flies.

Chemical Control/ New Products

CONTROL OF CODLING MOTH WITH REDUCED RISK INSECTICIDES IN Pears

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Abstract: A trial was conducted to evaluate the efficacy of reduced risk insecticides for control of CM in pears. Assail with or without horticultural oil and Calypso preceding or following Intrepid plus horticultural oil provided acceptable CM control that was very similar to the grower standard of Imidan and Guthion. Intrepid alone, Novaluron and Dimilin significantly suppressed CM populations compared to the untreated control but are not adequate for stand-alone control of CM. These insecticides will need to combined with other insecticides in a season long program. Avaunt, V-10066 and horticultural oil suppressed CM compared to the untreated control. V-10066 and Assail caused significantly population increases of TSSM and ERM populations. However, Assail combined with horticultural oil maintained TSSM, ERM, and PP populations within acceptable levels. Assail combined with horticultural oil is a very promising combination for total insect pest control in pears.
Abstract: Indoxacarb is a new mode-of-action and new class of chemistry insecticide now registered for use in apples and pears. Indoxacarb is in the oxadiazine class of chemistry and it works as a sodium channel blocker. Indoxacarb was registered in the U.S. for use on apples, pears and many other crops in May of 2001. It is a reduced risk pesticide with very low mammalian toxicity and a benign profile for avian and aquatic toxicity. Indoxacarb is a broadspectrum insecticide with activity on codling moth, white apple leafhopper, pandemis leafroller, western tentiform leafminer, and laccanobia fruitworm.

FEEDING ENHANCEMENTS FOR INSECTICIDE TARGETING NEONATE LEPIDOPTERAN LARVAE

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

We show that neonates of the codling moth Cydia pomonella (L.) are capable of feeding and development on apple leaves, and identify granulated sugar substitute, Sweet'n Low® (1%, w/v), and monosodium glutamate (0.0025%, w/v) as substances that increase leaf feeding in codling moth neonates. In laboratory trials, addition of Sweet'n Low® or monosodium glutamate to standard concentrations of Success®, a pesticide formulation containing Spinosad, significantly increased its efficacy without increasing the amounts of toxic component. However, our field experiments indicate that a better formulation of feeding stimulant/pesticide combination is needed to protect both from being washed off from leaves by rain.

We also have preliminary data on spatial characteristics of leaf exploratory behavior, and on glutamate-dependent pharmacology of feeding in codling moth neonates. These data could help to design a proper spray delivery system, and improve field persistence of identified feeding stimulators.

Our data suggest a new strategy for rational pesticide reduction in control of lepidopteran pests. Our formulation increased the amounts of pesticide ingested by stimulation of feeding, thereby showing prospects of decreasing the amounts of toxic ingredients needed in pesticide formulation without affecting its efficacy.
MANAGING CODLING MOTH WITH KAIROMONE / SEX PHEROMONE-BAITED STATIONS IN APPLE

Alan L. Knight
USDA, ARS, Wapato, WA

Abstract: Four replicated plots were established in May with either 24 or 40 bait stations per acre in several heavily infested orchards under mating disruption for codling moth. Initially we baited 25% of the traps with both DA2313 and L2 pheromone lures and the remainder with only DA2313. Bait stations were treated with esfenvalerate at a rate of 0.18 mg A.I./cm². The insecticide residue was renewed ca. every two weeks through 9 August. Plots were rearranged in June to include only four 1-2 acre plots treated with 24 stations per acre. All stations were baited with both lures for the remainder of the season. Two of these plots received 11 oil applications during the season. Fruit injury compared with untreated plots was dramatically reduced at mid-season (95% in the MD+DA and 99% in the MD+DA+oil). However, this success deteriorated during August and September. Possible factors affecting the performance of the bait stations will be discussed.
BIOLOGY/PHENOLOGY

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Section Leader
Vince Jones
DEVELOPMENT OF A TEMPERATURE-DEPENDENT PREDICTIVE MODEL FOR LACANOBIA SUBJUNCTA

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

Abstract: A temperature-dependent predictive model was developed for Lacanobia subjuncta. Constant temperature rearing under laboratory conditions was used to establish a minimum threshold for development of 44°F. Using a linear modeling system, the mean degree-days (°F) required for complete development of eggs, larvae and pupae were 137.3, 874.5, and 535.8 respectively. These data were validated using fluctuating temperatures under field conditions. Extensive sampling of overwintering emergence, preoviposition and oviposition periods, as well as larval population distributions were used to complete the predictive model.

Biology

PLUM CURCULIO: HEADED WEST? PHEROMONES, KAIROMONES, TRAPS AND TRAPPING TRANSECS 2001

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Abstract: Two plum curculio, Conotrachelus nenuphar (Herbst), transects were established in May and June, 2001. The first transect included 25 sites and was placed with cooperators in a north to south orientation from Walla Walla, WA to Winnemucca, NV through eastern Oregon. The second was located from Kalispell, MT to Pocatello, ID. Sites were chosen based on the availability of a compliant cooperator, the insecticide use history, tree species and tree fruit density. Plum curculio larvae or adults were detected at 3 sites. Five trap designs; six pheromone/kairomone baits and two management strategies were evaluated in Michigan cherry and apple orchards. Two trap-bait formulations significantly outperformed the other combinations tested.
EFFECT OF CHLORONICOTINYLS ON REPRODUCTION OF TWO-SPOTTED SPIDER MITES

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

A study was initiated to determine the effects of chloronicotinyl insecticides on reproduction of the two-spotted spider mite (TSSM), *Tetranychus urticae*. Two chloronicotinyls (imidacloprid, Provado®, Bayer; and thiamethoxam, Actara®, Syngenta) are currently registered for use in pear, and two are in development (acetamiprid, Assail®, Aventis; and thiacloprid, Calypso®, Bayer). These insecticides are used for control of pear psylla, and do not appear to cause mortality in spider mites. Moreover, field observations have detected an association of increased spider mite populations and the use of imidacloprid. Chemically-enhanced reproduction was reported by James (1997) for a predatory phytoseiid mite, *Amblyseius victoriensis*, in Australia.

Pear leaf discs were treated topically using a Potter spray tower with 2 ml of an appropriate concentration of insecticide. Four replicates at each of five concentrations, plus a control treatment using water only, were established in each trial. Twenty female TSSM were placed on pear leaf discs on wet cotton in a portion cup. Ten males were also added to the treated disc to ensure adequate mating. The numbers of eggs laid by the 20 females were counted under a dissection microscope. Each trial was run for seven days, and eggs were removed from the leaf disc. The numbers of females on each disc were also recorded, and eggs laid per female per day were calculated.

Cumulative oviposition by spider mites over seven days was significantly affected by exposure to chloronicotinyls. Daily patterns were variable, but the trends of chemcial-enhanced reproduction were consisant.
THE STATUS OF CHERRY BARK TORTRIX IN WASHINGTON STATE

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In 1991, the first U.S. record was made on the establishment of *Enarmonia formosana* (Scopoli) (Lepidoptera; Tortricidae), cherry bark tortrix (CBT), in Washington State. Originally from Eurasia, CBT larvae feed on the cambium of cherry (*Prunus spp.*) trees and other plants in the family Rosaceae. Their feeding activity causes girdling of the tree trunk, resulting in canopy dieback and tree death in several years under high infestation pressure. CBT has the potential to be a serious problem, which has been recognized by USDA APHIS PPQ, who placed it on their NBCI biological control target list for 2001.

Pheromone traps have been used to monitor the status of CBT in Washington for several years. In 2000, collaboration between Washington State University, the University of Washington, and Washington Park Arboretum provided valuable biological data about CBT’s population dynamics in Seattle. In the summer of 2001, the Seattle Pesticide Reduction Commission and the Seattle City Parks and Recreation joined the collaboration to facilitate aspects of on-going research management tactics. Another collaborator was the USDA APHIS PPQ laboratory in Niles, Michigan, which agreed to utilize their Biological Control Laboratory to mass-produce the CBT egg parasitoid, *Trichogramma cacoeciae* Marchal.

The city of Seattle proves a great habitat for CBT and their population is well established in the plethora of ornamental cherry trees. To determine the status, spread and control of CBT in Washington, several areas in Seattle were observed for CBT damage, population size and CBT egg parasitism. In total, 26 CBT pheromone trap sites provided data on CBT seasonal flight patterns and population dynamics (Fig.1). Laboratory experiments will provide data about CBT egg survival at low relative humidity. The potential exists for CBT to migrate over the Cascade Mountain Range and to infest the tree fruit regions of eastern Washington. *T. cacoeciae* releases provided valuable information on their population dynamics, dispersal dynamics, CBT egg parasitism (Fig.2) and its potential as a biological control agent.
The impact of killing both female and male codling moths was investigated in field trials using the mass-trapping control tactic with the pear-derived kairomone lure. Evaluation of the kairomone, ethyl (2E, 4Z)-2,4-decadienoate, as an attractant-lure verses the pheromone, codlemone, were conducted in mass-trapping field studies in Californian walnut orchards. Moth capture rates and efficacy, and walnut damage rates were compared for the kairomone and pheromone lure plots (four replicated one-acre plots for each lure). The mass-trapping plots with kairomone-baited traps captured far greater numbers of total moths and male moths, let alone female moths, than the plots with pheromone-baited traps. Also, mid-season nut damage was lower in kairomone plots than pheromone or control plots.
MATING DISRUPTION/SIR

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Section Leader
Bob Van Steenwyk
Abstract: Aerial applications of Sentry's fiber pheromone formulation showed promise as a control of leafrollers (obliquebanded leafroller-OBLR, pandemis leafroller-PLR) based on reduction in trap captures throughout the entire first flight. Two formulations of sprayable CM pheromone were tested and showed varying degrees of promise as a technology for managing this pest. A formulation developed by Consep provided suppression of CM captures and equivalent fruit damage at harvest in a 4-spray program when paired with Isomate-C+ applications in a low-pressure site. Additional large plot trials are required before it can be recommended for growers use. An attract-and-kill (A&K) formulation using the Last Call (IPM Technologies) base formulation and different concentrations of PLR or OBLR pheromone were evaluated. Attraction of moths to the A&K formulation was proportional to pheromone concentration. It appears that higher pheromone concentrations are required in the A&K formulation than currently is being used. The evaluation of five different hand-applied codling moth pheromone dispensers showed variable pheromone release behaviors when analyzed using three different methods.
Abstract: The effect of hand-applied pheromone dispensers (Pacific Biocontrol) and sprayable pheromone (3M Corporation) was evaluated for obliquebanded and pandemis leafroller in 12 commercial orchards. Sprayable experiments consisted of approximately 30 acres divided into three ten-acre blocks with two treatments (20 and 40 grams AI per acre) and a non-pheromone treated comparison. Hand applied dispenser experiments consisted of approximately 30 acres divided into three ten-acre blocks with two treatments (80mg dispensers x 400 dpa and 250mg dispensers x 200 dpa) and non-pheromone treated comparison. Another experiment was conducted using the same criteria for the hand applied dispensers but added a fourth treatment (80mg dispensers x 200 dpa). Each block was monitored with large delta-style traps baited with a standard load pheromone lure, a high-load pheromone lure or an acetic acid food-based lure that monitored both female and male activity. Females collected from the acetic acid baited traps were dissected in the laboratory for mating success. Larval densities were evaluated throughout the season and fruit injury was monitored at harvest.

Although both sprayable and hand applied dispensers reduced capture in pheromone-baited traps, no consistent pattern of decreased larval populations was noted. Mating success was reduced in the hand-applied dispenser blocks at all locations, however the same pattern was not observed in the sprayable pheromone blocks.
Mating Disruption/SIR

EFFICACY OF MATING DISRUPTION FORMULATIONS THAT COMBINE PHEROMONE BLENDS

Peter McGhee, Mike Haas, David Epstein and Larry Gut
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Abstract: Mating disruption (MD) using multi-species pheromones released from a single Microsprayer and two Shin-Etsu hand applied dispensers was evaluated in apples. The spatial distribution and behavior of codling moth (CM), Oriental fruit moth (OFM), and obliquebanded leafroller (OBLR) was examined by turning "on" and "off" the Microsprayer for periods of 7-8 days, mating disruption and time to recovery was monitored with grids of 25-30 pheromone traps in 1.2 to 2.0 acre apple blocks. Microsprayers were efficient pheromone-broadcasting devices with an active space of 0.450 ha generating pheromone plumes reaching more than 100 m downwind. Moth communication disruption occurred 1-3 days following the release of pheromone, but a rapid sensory recovery occurred after 3-6 days of continuous exposure. Percent trap "shutdown" was not related to percentage of protection from insect damage. In fact, the size of the disrupted area for CM & OFM combined was 40.7% and 43.5% respectively in the pheromone treatment and control. However, the area with less than 1% fruit damage was 78.0% in the pheromone treatment, but only 27.4% in the control

Evaluation of two Shin-Etsu hand applied multi-species pheromone dispensers (C/OFM and CD/LR/OFM) were tested against CM, OFM, and OBLR. Effectiveness of each dispenser type was directly compared to non-pheromone grower standard management program at four orchards. Dispensers were applied at a rate of 275-300 per acre in 5-10 acre bearing apple orchards. Pheromone baited traps were checked weekly and fruit injury data was collected in June and at pre-harvest. Each dispenser type suppressed OFM captures in traps for 12 weeks. The CD/LR/OFM dispensers effectively shutdown OBLR captures for 15 weeks. The effectiveness of these two products against CM was erratic and did not significantly reduce male captures under high pressure. Fruit injury was comparable in orchards treated with or without pheromone dispensers, however, a reduced number of chemical applications resulted in the MD vs. non-MD programs.
FIELD STUDIES WITH ENCAPSULATED SPRAYABLE CODLING MOTH PHEROMONE

Thomas E. Larsen
Suterra LLC, Bend, Oregon

Abstract: Field studies were carried out comparing encapsulated sprayable codling moth pheromone treatments against hand-applied pheromone dispensers and conventional codling moth control practices. The effect of rates, and overhead irrigation on efficacy was also evaluated. In general, the encapsulated sprayable pheromone provided crop protection equal to that of hand-applied dispensers and conventional control practices in low to moderate codling moth pressure orchards. Overhead irrigation had a negative impact on efficacy in orchards treated with the encapsulated sprayable pheromone.

PERFORMANCE OF SPRAYABLE MATING DISRUPTION FORMULATIONS

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

Abstract: The performances of experimental formulations of sprayable pheromone were evaluated in small-plot and large block trials in Michigan. Formulations manufactured by 3M, Consep or Thies Technologies were evaluated for efficacy against codling moth, oriental fruit moth or leafrollers. Male captures in pheromone traps and larval feeding on foliage or fruit were used to evaluate the performance of pheromone treatments. Pheromone treatments provided 40-100% inhibition of moth captures in traps for periods of 2-7 weeks. Substantial variation in the performance of treatments was attributed to differences in the formulations, as well as the likely dislodging of capsules by rain. The potential effect of rain on the number of oriental fruit moth pheromone microcapsules (MEC) was further examined in a series of laboratory and field studies. Leaves on 2 m tall 'Golden Delicious' trees were treated with 3M Phase I, III, or V oriental fruit moth MEC and exposed to natural rain events. Rainfall greater than 10 mm significantly decreased the number of microcapsules on field exposed leaves relative to controls. Over 70% of the capsules were lost during heavy rains.
Mating Disruption/SIR

EFFECT OF CLAY PARTICLE FILM ON ENCAPSULATED SPRAYABLE CODLING MOTH PHEROMONE RELEASE RATE

Kristin C. Ketner
Suterra LLC, Bend, Oregon

Abstract: Laboratory studies were performed to test possible effects of a clay particle film (Surround) on the release rate of encapsulated sprayable codling moth (CM) pheromone. Samples of moderate- and slow-releasing CM pheromone microcapsules were tested in conjunction with manufacturer suggested concentrations of Surround. In general, the Surround product reduced the release rate of encapsulated sprayable CM pheromone.

Mating Disruption/SIR

EVALUATION OF DIFFERENT PHEROMONE DISPENSING TECHNOLOGIES FOR MATING DISRUPTION OF ORIENTAL FRUIT MOTH IN PEACHES

Arthur M. Agnello, Dept. of Entomology, N.Y.S. Agric. Expt. Station, Geneva, NY

Abstract: Mating disruption was evaluated as a control tactic against oriental fruit moth in peaches using twist-ties (Isomate-M), paraffin-based liquid (Confuse-OFM) and sprayable pheromone (3M) formulations in commercial orchards. Pheromone trap catches of male moths were low in the disrupted plots throughout the entire season, remaining essentially at or near zero in most cases, despite considerable population pressure. In one case, however, there was breakthrough in the traps of a Confuse plot that was directly adjacent to an apple planting, which likely had its own population of OFM that was being attracted into the peach plots. Pre-harvest fruit inspection showed fruit damage from OFM feeding and infestation to be quite low in most of the treatments, except in the aforementioned Confuse site, where it surpassed 10%. In summary, all treatments appear to have the potential for acceptable control within plot interiors, but border sprays may need to be incorporated to forestall infestations by moths immigrating from non-disrupted areas when these products are used in typical commercial production areas in western N.Y.
INTEGRATED HIGH EMISSION LOW POINT (I.-H.E.L.P.) MATING DISRUPTION SYSTEMS FOR CODLING MOTH AND LEAFROLLERS

Alan L. Knight
USDA, ARS, Wapato, WA

Abstract: Twenty-five 40-acre apple orchards (1,000 acres) were treated with one of five integrated, high emission low point density approaches (I.-H.E.L.P) in the Brewster, Washington area. All puffer-treated orchards received 16 mechanical devices spaced in an internal 100 x 100 m grid beginning 50 m from the edge of the orchard. MBA orchards were treated with 64 screened cages each containing 100 Isomate-C+ dispensers spaced in a 50 x 50 m grid starting 25 m from the orchard’s edge. All orchards were also treated with a 10 m wide band of Isomate C+ dispensers around its’ perimeter. Comparison orchards were established for each of the twenty-five orchards. These were paired based on similar size, location, pest pressures, cultivar, ownership, and spray practices. All comparison orchards were treated with Isomate C+ dispensers applied at 200 dispensers per acre. Fruit injury was assessed just prior to harvest by sampling thirty fruit from twenty trees within each quadrant of the orchard (2,400 fruit sampled per orchard). All five variants of the I.-H.E.L.P. approach outperformed the standard use of Isomate C+. Growers preferred the use of these I.-H.E.L.P. approaches over the standard hand-applied system in all cases.
IMPLEMENTATION PROGRAMS

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Section Leader
Ted Alway
Implementation

FINAL YEAR OF AN IPM DEMONSTRATION PROGRAM USING "SOFT INSECTICIDES" TO MANAGE INSECTICIDE RESISTANCE AND DAMAGE FROM THE OBLIQUEBANDED LEAFROLLER IN NY APPLE ORCHARDS.

H. Reissig, C. Smith, and D. Combs,
Entomology Department, NYSAES, Geneva, NY 14456

Abstract: This study was conducted from 1999-2001 to compare organophosphate (OP) resistance and control of OBLR in plots treated with soft insecticides. OP resistance remained stable in field populations of OBLR during the 3 years of the study. OBLR control in the soft plots was better than that obtained with standard treatments. Plum curculio (PC) control was not adequate in most of the soft blocks and in 2001, damage was observed even in blocks that had no PC damage during the first year of the study. This soft insecticide program did not provide adequate control of internal lepidoptera in some of the blocks for multiple seasons, although control of the apple maggot was acceptable. Foliar pests such as tentiform leafminers, green apple aphids, white apple leafhoppers, and mites were not serious problems in the soft pesticide blocks. Tarnished plant bug damage was generally similar in grower's standard programs and the soft pesticide blocks. Secondary pests, such as rosy apple aphids and the San Jose Scale were problems in some of the soft pesticide blocks. The overall insect damage in the standard and soft pesticide was fairly similar during all seasons of the 3 year study, except in one orchard, which suffered severe damage from curculio and internal lepidoptera. The costs of insecticides applied in the standard and soft pesticide programs were similar.

Implementation


Ted Alway
T.C. Alway Consulting, Peshastin, WA

Abstract: The WVPP demonstrated that biological control of key pests in Wenatchee Valley pear orchards could be increased, developing pest management programs that are equally or more effective and economical than the chemically intensive programs commonly used. Sixteen D’Anjou pear growers participated over the three-year period, with over half of the orchards each year using a soft program (no or very limited use of broad-spectrum insecticides). Pear psylla populations were higher in the soft blocks in the first year, but declined in subsequent years to levels similar to the conventional blocks. Grape mealybug and spider mites were lesser problems in the soft blocks. Pear rust mite increased in many soft blocks. Other pests were at similar levels between the two treatment regimes. Natural enemies were far higher in the soft blocks; the principal ones found were Deraeocoris brevis, Campylomma verbasci, lacewings, earwigs and Trechnites sp. Fruit marking was higher in the first year in the soft blocks, due to pear psylla, but damage levels were similar in later years. Pest control costs averaged $150-$200/ac less each year in the soft blocks.
Implementation

BUILDING A MULTI-TACTIC PHEROMONE-BASED PEST MANAGEMENT SYSTEM IN THE WESTERN UNITED STATES—AREAWIDE II APPLE PROJECT

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

Abstract: This Areawide II-Apple project compares a pheromone-based no-OP with pheromone-based OP pest management program in apple. This follow-up to the highly successful Areawide Codling Moth Management Program is supported by the USDA-CSREES and funded through the Initiative for Future Agriculture and Food Systems (IFAFS) and FQPA Risk Mitigation for Major Food Crop Systems (RAMP) programs. Fifteen paired apple sites of 20 to 40 acres have been established throughout WA. Orchards were monitored for codling moth, leafrollers and lacanobia fruitworm, as well as secondary pests and natural enemies.

Pest populations at different apple sites have varied from low to high based on monitoring results. At harvest there was no difference in the level of fruit injury from codling moth and lacanobia fruitworm (cutworm) in the OP (0.11%±0.06%) or no-OP (0.05%±0.02%) pheromone-based management programs. However, there was less damage from leafrollers in the no-OP (0.09%±0.03%) compared to the OP (0.28%±0.11%) pheromone-based program. Secondary pests were monitored in all apple blocks at regular intervals during the growing season. There were no differences between the OP and no-OP pheromone-based programs for any of the secondary pests or their natural enemies. There was variability between sites, and sprays were applied for aphid and mite control in a few instances. The extensive counts made this year provide baseline information as we evaluate changes that may occur in secondary pest populations in subsequent years. There was no statistical difference in the number of pesticides applications made in the OP (8.7±1.0) and no-OP (9.3±1.3) pheromone-based programs and also no difference in the cost of these programs (OP - $223±23 versus no-OP - $253±28).

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 is developing a project to implement sprayable mating disruption and other new technologies on 25% of the walnut acreage susceptible to codling moth infestation (approximately 25,000 acres by the end of the third year).

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 $278 million in 2000.
THRESHOLDS/MONITORING/SAMPLING
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Section Leader
Tony Duttle
Thresholds and Monitoring

USING THE KAIROMONE LURE, DA2313 TO MONITOR CODLING MOTH IN APPLE AND PEAR

Alan L. Knight
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Abstract: Lures loaded with the pear ester (DA2313) were used to monitor > 100 apple and pear orchards under both conventional and mating disruption-based (MD) pest control programs. Catches of codling moth was similar or higher in MD apple orchards than in sex pheromone-baited traps. DA2313-baited traps performed similarly in conventional apple orchards during the first flight but captured only 30% the number of moths as in pheromone-baited traps during the second flight. DA2313-baited traps caught only 10% as many moths as pheromone-baited traps in pear orchards. First sustained capture of moths in DA-2313-baited traps plus 155 degree-days was an excellent predictor of egg hatch. Moth catch thresholds of > 4 moths or > 2 female moths in DA2313-baited traps appeared to be a reasonable threshold for applying supplemental sprays in pheromone-treated orchards during the first flight. A similar threshold can be used for second flight.

DEVELOPMENT OF KAIROMONE-BASED MONITORING FOR BOTH SEXES OF CODLING MOTH IN CALIFORNIA WALNUTS

Doug Light, Kathy Reynolds, Alan Knight, Carolyn Pickel and Joe Grant
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The ability of the kairomonal attractant to monitor the phenology of female and male codling moths was investigated for the fourth year in Californian walnut orchards under either conventional or mating disruption controls. The pear-derived volatile, ethyl (2E, 4Z)-2,4-decadienoate, and certain other host-plant volatiles have been optimized in composition, delivery rate, and formulation to create lures with enhanced population monitoring and prediction capability. Replicated pairs of pheromone-baited and kairomone-baited traps are being 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. These population monitoring parameters are being correlated with the occurrence and degree of orchard nut damage (nut drop, canopy infestation, and harvest damage). With this data, a female-based 'biofix' model is being developed to predict egg hatch based upon the trap capture and monitoring of female emergence.
Thresholds and Monitoring

MONITORING CODLING MOTH WITH A NEW PEAR-KAIROMONE ATTRACTANT ("DA LURE", TRÉCÉ, INC.) IN NON-PHEROMONE TREATED ORCHARDS

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Abstract: The use of a new, pear-kairomone ("DA lure", Trécé, Inc.) attractant that monitors both male and female codling moth activity was evaluated in non-pheromone treated orchards. The attractant was compared to a standard load pheromone lure in replicated trials in orchards with high codling moth pressure. Females captured in traps baited with the DA lure were dissected in the laboratory for mating success. Female flight activity and oviposition monitoring were used to validate the current degree-day model in use extensively throughout Washington orchards. The DA lure system was also compared to the standard pheromone lure for its ability to predict fruit injury in untreated orchards.

DA-trap captures in non-mating disruption orchards during the first and second generation were about 17% and 10%, respectively. In lure aging studies, the DA lure appeared to maintain its relative attractancy through an entire codling moth generation. DA-trap captures in untreated orchards did not show a high correlation with observed fruit injury in high-pressure orchards during the first or second generation.

Thresholds, Monitoring and Sampling

SPATIAL DISTRIBUTION OF LEAFROLLERS ATTACKING APPLE AND IMPLICATIONS FOR SAMPLING PROGRAMS

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Abstract: The spatial distribution of leafrollers attacking apples in Washington was examined using isotropic variograms. The analysis showed that significant autocorrelation existed in all situations except when populations were only found in one small portion of a field. The percentage of the variance associated with spatial components was related to the area covered by the sampling grid. The closer together samples were taken, the greater the importance of the spatial component. The range of autocorrelation was 5-9 meters when every tree within an area was sampled, but varied from \( \approx 22-210 \) meters at the larger scales. These data suggest that infestations within a field start as a number of small foci that expand over time to cover relatively large areas. The spatial distributions observed suggest that sampling sites within a block could be separated by 100 meters or more to reduce statistical dependence in the data, but sampling units within a site should draw from a number of trees within \( \approx 9 \) meters. These conclusions will be tested this coming year in large-scale validation plots.
Thresholds and Monitoring

SEASONAL OVIPOSITION PREFERENCE OF CODLING MOTH BETWEEN CUT AND INTACT FRUIT OF BARTLETT AND BOSC PEAR CULTIVARS

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Keywords: codling moth, *Cydia pomonella*, pears, oviposition preference

Abstract: Oviposition was monitored weekly comparing intact and cutfruit cluster samples in an orchard with adjacent Bartlett and Bosc cultivars in the Sacramento Valley. In six weekly samples prior to May 23 (965 degree days, 53 days before first Bartlett harvest), oviposition was slightly more frequent in the intact fruit clusters compared with the cutfruit clusters. Beginning May 23 through July 18 (2461 degree days, 3 days after first Bartlett harvest), cutfruit clusters became much preferred oviposition sites over intact fruit clusters. Intact Bosc were preferred over Bartlett in the late season, also.

<table>
<thead>
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<th>Ratio, % Oviposition</th>
<th>Early Season</th>
<th>Late Season</th>
<th>P</th>
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<tr>
<td></td>
<td>Mean</td>
<td>SE</td>
<td>Mean</td>
</tr>
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</table>

Thresholds and Monitoring

SEASONAL COMPARISON OF MONITORING TECHNIQUES FOR CODLING MOTH IN MATING DISRUPTED PEAR ORCHARDS

B. G. Zoller and A. M. Zoller
The Pear Doctor, Inc., P. O. Box 335, Kelseyville, California 95451

Keywords: codling moth, *Cydia pomonella*, pears, oviposition monitoring

Abstract: A season long weekly comparison of monitoring techniques for codling moth was made in a Bartlett orchard undergoing mating disruption in the Sacramento Valley. The methods compared were (1) 10 mg high pheromone trapping for males, (2) sampling intact fruit clusters for oviposition, and (3) sampling cutfruit clusters for oviposition. Prior to May 23 (965 degree days), 53 days before harvest, one male was present in two of three traps, while all cutfruit cluster samples were negative and intact clusters reached 8% oviposition in a perimeter sample next to untreated walnuts. However, after June 6 (1320 degree days), 39 days before harvest, no male codling moths were trapped while cutfruit cluster samples on the same trees as the moth traps reached 122% oviposition. Intact cluster samples reached 8% oviposition and cutfruit cluster samples reached 220% oviposition levels in perimeter samples next to the untreated walnuts.
ESTIMATING SUMMER LEAFMINER OUTBREAKS FROM SPRING SAMPLES

Stephen D. Cockfield
Okanogan Valley IPM, LLC, Brewster, WA

Abstract: Western tentiform leafminers were sampled for five years in an orchard of 20-year-old Red Delicious trees. Samples of the first and second new generations were gathered. Between the two generations, leafminers increased by a factor of 5.7-11.3 in four of the years, but increased by a factor of 29.9 in one of the years. The increase depended on fecundity and growth of new leaves between leafminer generations. Measurements of leaf growth helped determine estimates of fecundity, which agreed with previous laboratory estimates. Leafminers can be occasional but serious pests and need control action at oviposition. Therefore, advanced warning of outbreaks is necessary for IPM decisions.

ARE MULLEIN BUG TRAPS WORTH USING?

Stephen D. Cockfield
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Abstract: Mullein bug (Campylomma) traps baited with pheromone were set out during egg lay at harvest and the results were compared with beating tray samples during egg hatch. An action threshold was estimated based on one season and results of three years were used to evaluate the thresholds. Although thresholds were very low, especially in Golden Delicious, the procedure was used to sort potential problem orchards. The utility of the sampling depended on many factors which will be discussed.
BIOLOGICAL CONTROL

Section Leader
Rick Hilton
Biological Control

EARLY-SEASON RELEASE OF *GALENDROMUS OCCIDENTALIS* ONTO APPLE ORCHARD GROUND COVER FOR CONTROL OF SPIDER MITES IN TREES

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Abstract: Despite the occurrence of *Galendromus occidentalis* in northern Utah orchards, economically damaging populations of spider mites still occur. To evaluate whether early-season suppression of spider mites on ground cover by supplementation of predaceous mites bears merit, insectary purchased *G. occidentalis* were released onto the ground cover of a ‘Ginger Gold’ apple orchard at a rate of 19,000 predaceous mites per acre on 17 April, 17 May and 20 June. The experimental design was completely randomized with 4 treatments (3 release timings and untreated control) and 4 replications. Plot size was 2 row-middles (28 ft) by 40 ft. long with buffers of 40 ft within rows and 5 row-middles between rows left between all plots. Two spotted spider mite densities on ground vegetation (predominantly fescue with some broadleaf weeds (common mallow, field bindweed, dandelion)), on sticky trunk bands and in trees were low from April through early June. In late June and July, spider mite densities on trunk bands and in trees were greater in untreated and June release plots than in April and May release plots. However, spider mite densities in trees never exceeded five motile stages per leaf in any treatment on any date and by August spider mite densities in trees were very low in all plots. *G. occidentalis* densities were low in ground vegetation samples and very low in trees during the study. Low spider mite densities and arid conditions in the orchard likely reduced establishment of predaceous mite on ground vegetation. Although spider mites didn’t exceed an economic threshold in the orchard, release of *G. occidentalis* onto ground vegetation in April and May did reduce densities of two spotted spider mites on trunks and in trees in late June and July.
Section III
Biological & Cultural Control

TRICHOGRAMMA CACOECIAE, AN EGG PARASITOID TO CONTROL CHERRY BARK TORTRIX

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Naturally occurring *Trichogramma cacoeciae* Marchal (Hymenoptera; Trichogrammatidae) populations occur as an egg parasitoid on *Enarmonia formosana* (Scopoli), cherry bark tortrix (CBT) in Bellingham, Anacortes and Seattle. In July 2000, 50 parasitized CBT eggs were collected from Cherry trees in Anacortes, Washington to establish a colony at Washington State University, Pullman. Mass production of this species is straightforward due to their genetically thelytokous nature. In 2001, field studies were conducted in Seattle, Washington to look at the dispersal, parasitism rates, and the overall efficacy of *T. cacoeciae* as a biological control agent for CBT. Our release program was greatly aided by the USDA APHIS PPQ laboratory in Niles, Michigan, which agreed to utilize their Biological Control Laboratory to mass-produce *T. cacoeciae*.

In 2001, field experiments in Seattle included weekly releases of *T. cacoeciae* to acquire data on their intra- and inter-tree dispersal dynamics. Sentinel traps baited with irradiated eggs of the Mediterranean flour moth, *Ephestia kuehniella*, were placed at certain distances from the point of release to see how far *T. cacoeciae* disperses. The releases also provided data on CBT egg parasitism, which ranged from an average of 55% to as much as 95% at certain sites (Fig. 1).

Laboratory experiments with the *T. cacoeciae* colony will provide data on longevity, fecundity and storage capabilities at 5°C (Fig. 2) for different life stages. Storage capabilities are important for the potential use of *T. cacoeciae* to commercially control CBT. Longevity is greatly increased with the presence of a food source, which consequently results in continued egg laying. These field and laboratory experiments provide valuable data in our effort to combat the continuous spread of CBT from northwestern Washington, south into Oregon’s urban forests and potentially, east across the Cascade Mountain Range into Washington tree fruit regions.
PESTICIDE RESISTANCE

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Section Leader
TREE FRUIT DISEASES

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Section Leader
registration and the reception.
http://entomology.tfrec.wsu.edu/wopdmc/index.html

5. The meeting starts at 10:00 AM, Wednesday, January 9, and closes approximately noon on Friday, January 11. For a more specific agenda, check the website after December 17th.
http://entomology.tfrec.wsu.edu/wopdmc/agenda.html

On behalf of the WOPDMC membership, I would like to extend sincere thanks to Jerry Tangren (Web Master, WSU, Wenatchee) and Betsy Beers for their work on the web site. I would also like to recognize the efforts of Barat Bisabri, John Dunley and Betsy Beers for organizing the survey. Over 100 people responded!!! I would also like to thank Deanna Watkins and Glenn Fisher of Oregon State University for their help with the abstracts and PCA credits.

Look forward to seeing everyone in January.

Best regards,
Don

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Hi Everyone!

All the information regarding the **2002 WOPDMC** meeting is now available on the web. Please click on the following link for further information.
https://entomology.tfrec.wsu.edu/wopdmc/index.html

**Please note the following:**

1. Titles and abstracts must be sent to Deanna Watkins, Oregon State University by **November 15, 2001.** The earlier date for submission of titles and abstracts is now required in order to apply for pesticide applicator credits. Please see the web site for further details.
https://entomology.tfrec.wsu.edu/wopdmc/checklist.html

2. Complete reports must be sent by **December 15.** Reports will be placed on the web site and will hopefully be available for download prior to the meeting. In addition, the titles and abstracts will be available at the time of registration. Please see the following link for more information:
https://entomology.tfrec.wsu.edu/wopdmc/checklist.html

3. The meeting will be held at the Hilton Hotel in downtown Portland. You need to book your hotel room by December 15 to get the WOPDMC rate. We encourage everyone to stay at the Hilton Hotel. If we do not meet our minimum room obligations, we will have to raise our registration fees to pay for the use of the meeting rooms. Please the following link for more information on the Hilton Hotel
https://entomology.tfrec.wsu.edu/wopdmc/hotel.html

4. We will have a wine and cheese reception on Wednesday, January 9, 2002. Tickets can be purchased at the time of registration. Registration costs will be $20 to $30 per person unless we do not meet our hotel obligations. See the following link for further information on