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# 67TH ANNUAL PACIFIC NORTHWEST

# INSECT MANAGEMENT CONFERENCE

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# SECTION I

## SURVEYS OF INVASIVE & EMERGING PESTS

**SECTION LEADER**

**BEN SIMKO**

*Jatropha curcas,* is projected for biofuel source considering the limitation of using edible oils in India. At present it seems to be less prone to pest damage, perhaps due to use of wild varieties as live fence in scattered patches. Out of many insects found to occur, leaf webber cum fruit borer, *Pampelia* ( *Salebria) morosalis* (SaalmUller) (Pyralidae: Lepidopter), tailed mealy bugs *Ferrisia ( Ferrisiana)virgata* (Ckll.) (Pseudococcidae: Hemiptera), Scutellarid bugs, *Scutellera nobilis* (Fabricious)and *Chrysocoris purpureus* (Westw.) (Scutelleridae: Hemiptera) occur throughout the year under tropical conditions and causes serious damage to the capsules. The greenish brown/brownish green *P.morasalis* caterpillar webs the leaves and feeds on leaves remaining in the leaf web. At flowering bores into peduncle and capsule which show galleries made of silk and frass. *F.virgata* remains clustering upon the terminal shoots, leaves , flowers and fruits and sucks the sap causing crinkling of foliage and ill development of capsules. *S.nobilis and C.purpureous* desap the leaves,flowers and unripe fruits and causes flower fall, premature abortion and development of malformed hollow seeds.With taking up Jatropha as regular monocrop in continuous stretches recently with high yielding cultivars, outbreak of pests can be anticipated.

Section I

Surveys of Invasive and Emerging Pests

OCCURRENCE OF CAPSULE PEST COMPLEX ON BIOFUEL , JATROPHA IN INDIA:PEST RISK ASSESSMENT

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A one time roving survey was undertaken in 30 selected locations in Tamil Nadu and one location in Kerala states. Five sites were selected in each field. In each site ten plants selected at random were observed for the incidence of the pests. The incidence of *P.morasalis, sutellarid bugs* and *F.virgata* was observed in 8, 26 and 10 locations respectively.The level of incidence was 0.2-30.2,0.2-1.4 and 0.2- 0.8 per cent respectively. The sporadic and low level of incidence is due to scattered nature of plants in hedges and early stage of extensive upcoming plantations. Out of 146 million hectares of wasteland , it is proposed to reclaim 33 million hectares for Jatropha cultivation, apart from the arable land that will be used for Jatropha cultivation as sole or intercrop.

The Planning Commission recommended allocation of INR 1400 crores (US $ 3,000 million) for the promotionof Jatropha cultivation for three years. Any major intervention like extension of area, cultivation as sole crop, use of high yielding cultivar, application of fertilizers, and irrigation is likely to cause pest build up. Use of synthetic pyrethroids on other crops is likely to cause outbreak of *F.virgata.* Considering the various options available for the management of these pests like, biocontrol agents, effective chemistries, scope for behavioural

manipulations, these pests pose low risk at present. However the cost benefit ratio is an important factor is to be reckoned.

Table 1. Surveillance for the incidence of pests affecting capsule in Jatropha.- incidence ( %)

| 1. | Location | District | Species | Crop | *P.morasalis* | *Sutellarid bugs* | *F.virgata* |
|---|---|---|---|---|---|---|---|
| 1. | Vandi peiryar | Idukki, Kerala | *J.curcas* | Observational plot- 30 cents | Nil | 0.2 | Nil |
| 2. | Lower camp | Theni | *J.curcas* | Continuous Hedge | Nil | 0.6 | 0.2 |
| 3. | Gudalur | Theni | *J.curcas* | Discontinuo-us Hedge | Nil | 0.4 | Nil |
| 4. | Cumbum | Theni | *J.curcas J.gosspifolia* | Discontinuo-us Hedge | Nil | 0.2 | 0.2 |
| 5. | Palayam | Theni | *J.curcas J.gosspifolia* | Discontinuous hedge | Nil | 0.2 | Nil |
| 6. | Chinnamanur | Theni | *J.curcas J.gosspifolia* | Discontinuo-us Hedge | Nil | 0.4 | Nil |
| 7. | Sippalakottai | Theni | *J.curcas J.gosspifolia* | 8 holdings– one year old 18 acres | Nil | Nil | Nil |
| 8. | Devaram | Theni | *J.curcas* | 18 holdings- one year old- 110 acres | Nil | 1.2 | Nil |
| 9. | Theni | Theni | *J.curcas* | Discontinuous Hedge | Nil | 0.2 | Nil |
| 10 | Periyakulam | Theni | *J.curcas J.gosspifolia* | Discontinuous Hedge | Nil | 0.2 | 0.2 |
| 11 | Gengu varpatty | Dindigul | *J.curcas* | Single holding- 100acres | 2.2 | Nil - | - Nil |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 12 | Batlagundu | Dindigul | *J.curcas, J.gosspifolia* | Hedge-sparse | Nil | Nil | Nil |
| 13 | Sempatty | Dindigul | *J.curcas* | Hedge-sparse | Nil | 0.2 | Nil |
| 14 | Kannivadi | Dindigul | *J.curcas* | Hedge-sparse | Nil | Nil | 0.2 |
| 15 | Oddanchatram | Dindigul | *J.curcas J.gosspifolia* | Hedge-sparse | Nil | 0.2 | Nil |
| 16 | Dharapuram | Erode | *J.curcas J.gosspifolia* | Hedge-sparse | Nil | 0.2 | Nil |
| 17 | Mettukadai | Coimbatore | *J.curcas* | Continuous Hedge | 3.2 | 0.6 | Nil |
| 18 | Chemmipalayam | Coimbatore | *J.curcas* | Abandoned nursey | 1.2 | 0.4 | Nil |
| 19 | Palladam | Coimbatore | *J.curcas J.gosspifolia* | Hedge-sparse | Nil | 0.2 | 0.2 |
| 20 | Coimbatore | Coimbatore | *J.curcas J.gosspifolia* | Continuous Hedge | 0.6 | 1.4 | 1.0 |
| 21 | Thondamuthur | Coimbatore | *J.curcas* | Continuous Hedge | 0.4 | 0.8 | 0.4 |
| 22 | Alandurai | Coimbatore | *J.curcas* | Continuous Hedge | 0.2 | 0.2 | 0.6 |
| 23 | Poluvampatty | Coimbatore | *J.curcas* | Continuous Hedge | 0.2 | 0.8 | 0.4 |
| 24 | Thennamanallur | Coimbatore | *J.curcas* | Continuous Hedge | Nil | Nil | 0.2 |
| 25 | Thudiyalur | Coimbatore | *J.curcas* | Continuous Hedge | Nil | 0.4-pl; | 0.8 |
| 26 | Devipattanam | Thirunelveli Dt | *J.curcas* | One holding- 2 acres | Nil | Nil | 0.2 |
| 27 | Kovilur | Virudhunagar | *J.curcas* | School boundary | Nil | Nil | Nil |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 28 | Muhavoor | Virudhu nagar | *J.curcas* | Continuous Hedge | Nil | 0.2 | Nil |
| 29 | Dhalavaipuram | Virudhu nagar | *J.curcas* | Tank bund | Nil | 0.2 | Nil |
| 30 | Solaiseri | Virudhu nagar | *J.curcas* | Tank bund/ Mini plant lot | Nil | 0.2 | 0.2 |
| 31 | Moovaraivendran | Virudhu nagar | *J.curcas* | Single holding-5 acres- rain fed-two years old | 0.4 | 0.8 | 0.2 |
| *J.gosspifolia*- No pest incidence- Voluntary crop / self spread | | | | | | | |

Section I Surveys of Invasive and Emerging

## New Information on the Management of Potato Tuberworm in Columbia Basin Potatoes

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Despite its wide spread presence in Washington and Oregon, and local detections of adults moths in Idaho, potato tuberworm (PTW) as a pest of potatoes appears to have declined as a threat in potatoes in the Pacific Northwest. The commonly accepted basis for this was the minimum winter temperatures in January of 2006. PTW was detected in only lower numbers in 2006. In 2007, the insect was considered moderate in abundance, but higher than in 2006. At least one field in Washington was rejected for the fresh market due to presence of PTW. Potatoes from a research farm in Washington were rejected for use as processing potatoes due to presence of PTW. Dave Bragg complained that Columbia Basin potatoes he purchased in Pomeroy were infested with PTW.

Following conventional wisdom, it is thought that PTW will continue to be a pest of PNW potatoes barring an unusually cold winter. If minimum winter time temperatures are high, PTW could become a more serious pest of potatoes. The potato industry is still facing the management of insect pest for which little is known about its biology and management. Following are the results from two studies conducted on PTW north of Pasco, WA in 2007.

Overall PTW pressure was relatively low. As of August 17, no PTW were detected in our trial, however shortly thereafter the insect become more commonly detectable. One month later, the untreated check had an average of 3.0 mines per plant.

Efficacy of Foliarly Applied Insecticides for Control of Potato Tuberworm in Potatoes
Ranked by decreasing number of larvae per plant on September 17

| Trt | Name | Rate | 8/17 115 DAP mines/ plant | 9/17 146 DAP mines/ plant | 9/17 146 DAP larvae/ plant | 10/1 160 DAP larvae/ tuber | 10/1 160 DAP larvae/ tuber | 10/15 174 DAP larvae/ tuber | 10/15 174 DAP larvae/ tuber |
|---|---|---|---|---|---|---|---|---|---|
| 1 | UNTREATED CHECK | | 0 a | 15 a | 7 a | 0.3 a | 0 a | 0.8 a | 0.8 a |
| 8 | DIPEL DF | 1 lb/a | 0 a | 9 b | 1.5 b | 1.5 a | 1.8 a | 2.3 a | 2.3 a |
| 12 | MONITOR | 2 pt/a | 0 a | 1.3 b | 1.5 b | 1.5 a | 2 a | 0.8 a | 1 a |
| 17 | AZA DIRECT | 2 pt/a | 0 a | 4.8 b | 0.8 b | 1.8 a | 2.3 a | 1.8 a | 2 a |
| 2 | ALVERDE | 16 fl oz/a | 0 a | 1.8 b | 0.5 b | 1 a | 0.8 a | 2 a | 2.5 a |
| 13 | FURADAN | 2 pt/a | 0 a | 1 b | 0.5 b | 1.3 a | 2.3 a | 1 a | 1.5 a |
| 3 | ALVERDE | 16 fl oz/a | 0 a | 3.8 b | 0.3 b | 0.5 a | 0 a | 1.5 a | 2.5 a |
| 6 | ULTOR | 8 fl oz/a | 0 a | 1 b | 0.3 b | 0 a | 0 a | 0.5 a | 0.5 a |
| 15 | ASSAIL | 1.7 oz/a | 0 a | 3.3 b | 0.3 b | 1.8 a | 2 a | 0 a | 0 a |
| 18 | BATTALION | 12.8 fl oz/a | 0 a | 0.5 b | 0.3 b | 2 a | 2.3 a | 0.5 a | 0.5 a |
| 4 | RYNAXYPYR | 3.4 fl oz/a | 0 a | 0 b | 0 b | 0 a | 0 a | 1.5 a | 1.5 a |
| 5 | RYNAXYPYR | 5.1 fl oz/a | 0 a | 0 b | 0 b | 0.3 a | 0 a | 0.5 a | 0.8 a |
| 7 | BELT | 3 fl oz/a | 0 a | 0 b | 0 b | 1.5 a | 0.8 a | 1.3 a | 1.8 a |
| 9 | F6550 | 4.8 fl oz/a | 0 a | 0 b | 0 b | 1 a | 1.3 a | 2.5 a | 4.8 a |
| 10 | F6550 | 6.14 fl oz/a | 0 a | 0.3 b | 0 b | 0 a | 0 a | 0.8 a | 0.8 a |
| 11 | F6550 | 6.14 fl oz/a | 0 a | 0 b | 0 b | 0.5 a | 0 a | 0.3 a | 0.3 a |
| 14 | ASANA | 8 fl oz/a | 0 a | 0 b | 0 b | 0 a | 0 a | 1.5 a | 2 a |
| 16 | ENTRUST | 2 oz/a | 0 a | 0.3 b | 0 b | 0.5 a | 0.8 a | 2 a | 3 a |
| 19 | BATTALION | 12.8 fl oz/a | 0 a | 2.8 b | 0 b | 1.5 a | 0 a | 1 a | 1.3 a |
| 20 | HERO | 10.3 fl oz/a | 0 a | 0 b | 0 b | 0.8 a | 0.8 a | 0.8 a | 1 a |

Impacts of Desiccants on Late Season PTW Infestation in Potatoes
Ranked by decreasing number of larvae per plant on September 17

| Trt | Name | Rate | 9/17 146 DAP mines/ plant | 9/17 146 DAP larvae/ plant | 10/1 160 DAP larvae/ tuber | 10/1 160 DAP larvae/ tuber | 10/15 174 DAP larvae/ tuber | 10/15 174 DAP larvae/ tuber |
|---|---|---|---|---|---|---|---|---|
| 1 | UNTREATED CHECK | | 8.8 a | 2.3 a | 1 a | 1.5 a | 1 a | 1.3 a |
| 3 | REGLONE | 2 pt/a | 7.8 ab | 2 a | 2.5 a | 4 a | 2.3 a | 2.5 a |
| 4 | ENQUICK | | 7.3 ab | 1.5 a | 0.5 a | 1 a | 2.3 a | 2.8 a |
| 6 | AIM | 5.8 fl oz/a | 6.3 b | 1.3 a | 0.8 a | 0 a | 1.8 a | 3 a |
| 2 | RELY | 3 pt/a | 4.3 c | 0.5 b | 0.5 a | 1 a | 1.3 a | 1.3 a |
| 5 | RELY/Monitor | 3 +2 pt/a | 2.5 d | 0.3 b | 2.5 a | 2.5 a | 1.8 a | 2.3 a |

**Following are the 2007 recommendations for controlling PTW in potatoes in the Pacific Northwest.**

**Products that have been found to be effective for control of PTW in Washington and Oregon** – based on one season of testing. All rates are in formulated product per acre. Unless otherwise noted, the products discussed in this section were found to reduce the incidence of PTW larvae in the foliage to close to zero in a moderate pressure situation or significantly reduce larval populations in a high pressure situation. All treatments began approximately four to six weeks before desiccation.

**Monitor.** Monitor applied by ground and chemigation at 32 ounces (2 pints) was effective when applied at a 7-day interval.

**Rimon 0.83EC.** Rimon applied at 9 and 12 ounces provided effective control of PTW when applied at a 10 day interval by ground and chemigation.

**Avaunt.** Avaunt was effective when applied by ground and chemigation at 7 day intervals at 3 and 5 ounces. Avaunt applied by chemigation at desiccation and 7 days after desiccation was effective at reducing tuber infestation.

**Agri-Mek.** Agri-Mek was effective when applied by ground at 7 day intervals at 10 ounces.

**Asana.** Asana was effective at 4 and 8 ounces when applied by ground and chemigation at 7 to 10 day intervals. There is no indication that the higher rate is more effective.

**Lannate.** Lannate applied by ground and chemigation at 1 and 2 pints at 5-day intervals was effective at controlling PTW.

**Imidan**. Imidan at 1.3 and 2.5 pints applied by ground at 10-day intervals was effective against PTW.

**Success**. Success was effective at 6 ounces when applied by ground at a 7-day interval.

**Furadan**. Furadan was effective at a 7-day interval at 2 pints when applied by ground.

**Leverage**. Leverage applied by ground and chemigation at 10-day intervals at 3.75 ounces was effective against PTW.

**Baythroid**. Baythroid at 1.5 ounces was effective when applied by chemigation at 10-day intervals.

**Assail**. Based on the results of research trials in 2005, Assail is not recommended for PTW; however use of the product against other insect pests may reduce PTW populations.

**Penncap M.** Penncap M applied at 4 pints at 10 day intervals by ground was effective against PTW.

**Dipel (Bacillus thuringiensis).** Dipel at 1 pound per acre applied by ground in rotation with Entrust at 3 ounces per acre at 10-day intervals was effective in controlling PTW. Entrust was applied first and third and Dipel was applied second and fourth.

**Products Considered Ineffective Against PTW.** No planting time treatments are known to be effective against PTW including Gaucho, Admire Pro, Cruiser, Platinum, Venom, Temik and Thimet/Phorate.

**Foliar Insecticides Considered Ineffective Against PTW.** Sevin, Provado, Actara, dimethoate, Fulfill, Beleaf, Acramite, Comite and Oberon have not demonstrated efficacy against PTW.

**Products of Unknown Efficacy Against PTW.** Research has not yet determined the efficacy of Thiodan against PTW.

**Chart for activity by life stage.** This information is based on research data, information provided by registrations and our knowledge of the products listed.

| Product | Egg | Larvae | Adult | Activity against larvae in leaf tissue |
|---|---|---|---|---|
| Monitor | | x | x | x |
| Imidan | | x | x | |
| Penncap M | | x | x | x |
| Rimon | x | x | | |
| Avaunt | x | x | | x |
| Agri-Mek | | x | | |
| Asana | | x | x | |
| Leverage | | x | x | |
| Baythroid | | x | x | |
| Success, Entrust | | x | | |

| | | | |
|---|---|---|---|
| **Furadan** | x | x | x |
| **Lannate** | x | x | x |
| **Bacillus thuringiensis** | x | | |
| **Assail** | x | | |

# RESULTS OF 2007 IDAHO SURVEYS FOR EXOTIC LEPIDOPTERA: LIGHT BROWN APPLE MOTH, *EPIPHYAS POSTVITTANA* (TORTRICIDAE) (LBAM); POTATO TUBERWORM, *PHTHORIMAEA OPERCULELLA*, (GELICHIIDAE) (PTW); AND SILVER Y MOTH, *AUTOGRAPHA GAMMA*, (NOCTUIDAE) (SYM)

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## LBAM

LBAM infestations in northern California counties have made survey and detection for this species a national priority. Larvae of this species have a plant host range in excess of 150 plant genera in over 70 families. Potential hosts in Idaho include: nursery stock, cut flowers, stone fruit (peaches, plums, nectarines, cherries, and apricots), pome fruit (apples and pears), and grapes. Information from regions where LBAM is reported (England, New Zealand, Australia) was analyzed by USDA, Plant Protection and Quarantine (PPQ). LBAM has only been reported in USDA Plant Hardiness zones 7 and above. In Idaho areas in the Treasure Valley and around Lewiston ID are classified zone 7. In 2007 ISDA initiated a pheromone trap survey in SW Idaho commercial apple orchards and some selected retail nursery outlets. One hundred and fourteen, 114, Pherocon VI traps were deployed in SW Idaho (Ada, Canyon, Gem Payette, Owyhee, Washington Counties). Lures were provided by the USDA PPQ Otis Methods Lab. No LBAM were captured in this preliminary survey. Some prominent non target species captured included: *Choristoneura sp.*, *Sparganothis sp.* - family Tortricidae and *Achyra occidentalis, Pyralis orphisalis* - family Pyralidae. Determinations of the non target microlep species were made by WSDA entomologist Dr. Eric LaGasa.

## PTW

There have been infrequent but notable invasions of this pest into Idaho over the last 60 years. The first incident recorded was in July of 1946 when infested potatoes shipped from California to a Burley processing plant threatened the industry in that area of the state. Using area wide treatments of DDT, the infestation was successfully eradicated. The Unversity of Idaho, W.F. Barr Entomology Museum in Moscow recorded a catch of PTW on March 4, 1959 in Boise. The infestation was found in stored potatoes and the collector was R. Portman. That infestation was successfully thwarted. No PTW infestations have been reported since 1959. In 2002 this species emerged as a serious economic pest of

potatoes in Umatilla County, Oregon and in the Columbia Basin of south central Washington. In 2005 in response to this growing threat, the U.I. initiated a limited survey under the direction of Dr. Juan Alvarez, and funded through a grant from the Idaho Potato Commission. ISDA implemented a more extensive statewide detection surveys of all potato growing areas after a single male PTW was trapped in August of 2005 near Parma. ISDA has run a detection survey for this insect for the last three seasons and results are summarized in the table below. Preliminary screening of suspect gelechiids and final species confirmation was carried out by the authors. Only five adult male PTW were captured in 2007.

| **Year** | **Detection Traps (Potato Production Counties)** | **Total Male PTW Captured** | **Counties with Positives** |
|---|---|---|---|
| 2005 | 461 | 19 | Canyon, Payette, Elmore |
| 2006 | 468 | 6 | Canyon |
| 2007 | 491 | 5 | Canyon, Owyhee |

Also, USDA, Idaho Agricultural Statistical Service (IASS) conducts a yield survey covering all potato production areas of the state. Fifteen pound sample of tubers were dug from a statistical sample of all potato fields within the state. The sample size was 288 field samples from over 20 potato production counties. IASS staff involved with this yield survey received special training, conducted by ISDA, on recognizing PTW tuber damage signs. No damaged or infested tubers or live larvae have been have been observed or reported thus far. ISDA plans to reduce its statewide survey and do a limited follow-up detection survey in the Parma area of Canyon County in 2008.

SYM

This exotic moth is native to Europe. A single record of this species in North American is reported from location in Greenland. Adult moths have been reported coming in on cargo and passenger aircraft originating from Europe. The larval stage feeds on more than 200 host plants. USDA, PPQ places the species on the national pest priority list. Potential crop host plants of importance to Idaho include: alfalfa, corn, grapes, dry beans, potato, sugar beets and wheat. ISDA staff placed 211 pheromone traps in 30 southern Idaho counties. A very similar native moth, the alfalfa looper, *Autographa californica,* was captured in high numbers in the survey traps. Dissection of the male genitalia is required to separate the native non-target from the target species. Dissections and species determinations were conducted by the authors. Six hundred and eighty-four (684) individual specimens required dissections in the course of the survey. None of the moths captured were the target species *A. gamma.* The second most common non target species captured in the traps was the celery looper, *Anagrapha falcifera.*

**Section I.**
**Surveys of Invasive and Emerging Pests**

## New Detections by the OSU Insect Clinic

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This year the OSU Insect Clinic returned to normal operations and began to advertize its services. The country extension agents, general public and commercial industries of Oregon responded with an 88% increase in the number of specimens submitted for identification (223 in 2006 and a projected 420+ for 2007). The Insect clinic now has a web page with submission suggestions, forms and soon will have pictures and description of new and commonly submitted pests.

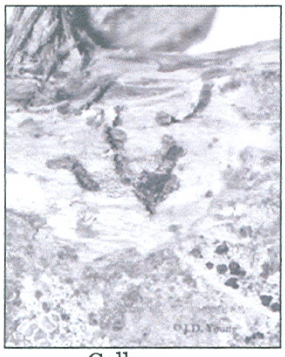
This year new state records, new host records for established pests and some sporadic pests were submitted to the Clinic for Identification.

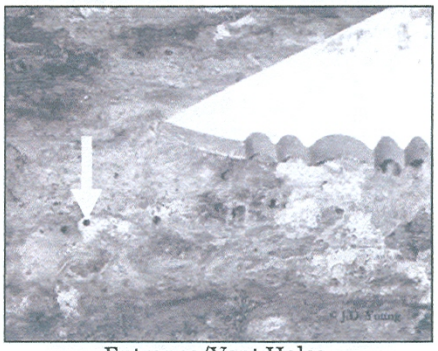
## New Introductions/Detections:

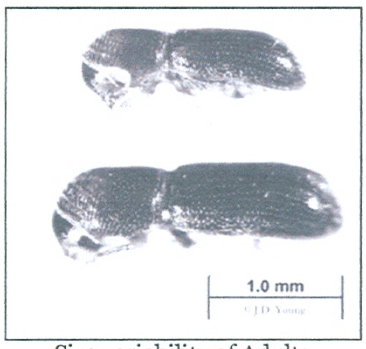
**Walnut twig beetle** (*Pityophthorus juglandis* Blackman, 1928)

Historic range: Arizonia & Southern California
Recent Expansion: Colorado 2004, Oregon 2007
Hosts: *Juglans nigra* (primary) other *Juglans* sp.?

This species is being investigated as a vector of a pathogen that is causing a decline in walnuts growing the city limits of Boulder. Extension specialists in Colorado have isolated a *Fusarium sp.* from the galleries however, it has not been determined if the *Fusarium* is the primary cause of the decline or simply contributing to it. Symptoms include yellow/brown leaves, death of large branches and the presence of large black cankers under the bark of both the branches and the main stem. Info on the Colorado decline can be found at:
http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=3859&Itemid=900


Gallery


Entrance/Vent Holes

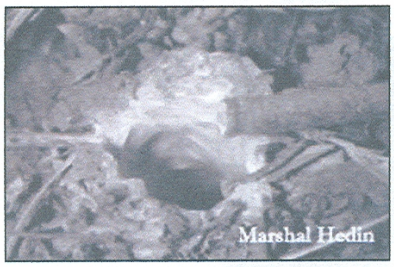


Size variability of Adults

**Wafer Trap Door Spiders** (*Apomastus* & *Neoapachella rothi*)

Historic range: California
Possible seasonal introduction

This large Mygalomorphae spider is visually and behavioral (aggressive) similar to the Hobo spider. Due to its large fangs it can cause a very painful bite. This spider is likely to be an annual hitchhiker that will not survive Oregon's winter. However, because 5 specimens representing 2 genera were submitted this year from 4 locations and the absence of specimens in the OSU Extension Collection, I felt that this Family should be noted.



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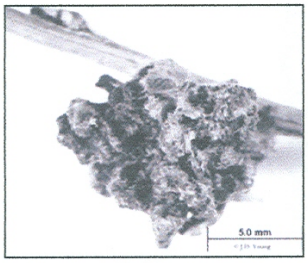
**Broom Erophyid Mite** *Aceria genistae*

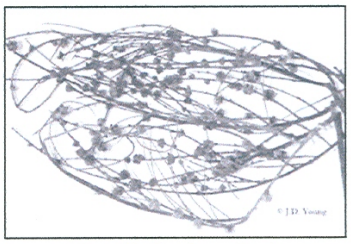
Historic range: Europe
Recent Expansion: California 2000
Hosts: French broom (*Genista monspessulana*), Scotch broom (*Cytisus scoparius*) and other brooms

This Eriophid mite has been considered for the control of Scotch Broom and other invasive brooms worldwide. Initial trials found that this mite did decrease overall vigor however it will not kill its host. This mite was first reported in the US in Albany, California occurring on escaped French broom. This past November several plants were found with galls in Multnomah County. As previously stated this mite does not kill its host however it can drastically reduce seed production by stunting shoots that would otherwise flower and produce seed.



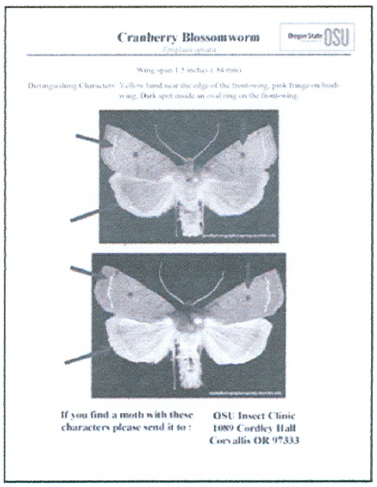
Gall

Large & sparse


Small & abundant

## Potential New Introduction:

**Cranberry Blossomworm** (*Epiglaea apiata*)




Historic range: Eastern USA
Hosts: *Vaccinium* sp.

Several hundred caterpillars were found in Coos Co. when the cranberry fields were flooded for harvest. The caterpillars visually match the Cranberry Blossomworm which is primarily an indirect pest on that feeds on the leaves and occasionally the fruit of cranberries grown in monoculture. Currently no larval keys exist that contain both the Cranberry Blossomworm and western natives. A "Pest Watch" sheet with images of the adult was distributed to the county agent for dispersal to local growers. At this time the pest has not been confirmed

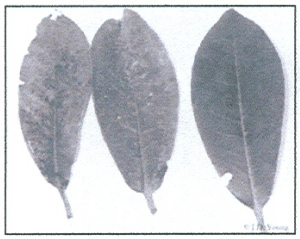
## New Hosts:

**Green House Thrips** (*Heliothrips haemorrhoidalis*)

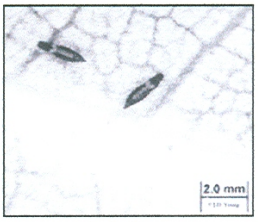
Historic range: Subtropical regions of South America
Expansion: Greenhouses worldwide, Established in the wild in Florida and Southern California
Hosts: Prefers evergreen, thick/leathery, glabrous leaves, (Shrubs, trees & ferns)

Samples of Salal (*Gaultheria shallon*, Ericaceae) with typical thrips damage (leaf silvering) were brought in late this year from an unheated or covered courtyard. All life stages of the Green House Thrips were found on the foliage. When the courtyard was visited Green House Thrips were found feeding and reproducing on rhododendron and at least 1 species of native fern (*Polystichum imbricans imbricans*). Adults were also found on common ground ivy. However, due to the lack of immature stages I do not believe it to be a host. Oregon Grape (*Mahonia aquifolium*) was growing within 12 inches of infested material and was found to be free of this pest. These specimens were brought in as an example of damage that has been observed for the last 3 years on Salal growing south of Newport on US Route 101.

Salal


Rhododendron

Fern

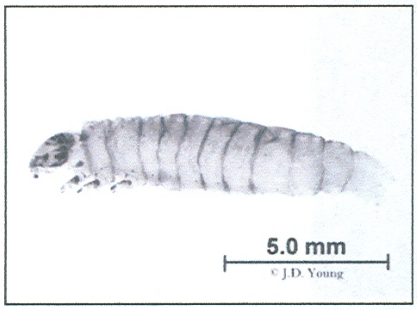


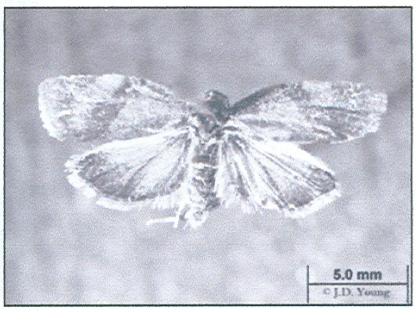
Adults

**Mediterranean Carnation Leafroller** (*Cacoecimorpha pronubana*)

Historic range: Mediterranean region of Europe
Expansion: Willamette Valley, Oregon
Hosts: principal host carnations. Other ornamental hosts include: *Acacia*, *Acer*, *Chrysanthemum*, *Coriaria*, *Coronilla*, *Euphorbia*, *Ilex*, *Jasminum*, *Laurus*, *Mahonia*, *Pelargonium*, *Populus*, *Rhododendron*, *Rosa*, *Syringa*. Fruit crop hosts include: *Citrus*, *Malus*, *Olea*, *Prunus*, *Rubus*. Vegetable hosts include: *Brassica* spp., carrots, peas, potatoes, tomatoes, *Trifolium* and *Vicia*.

This pest has been established in Oregon for a few years and can be a serious pest in flower production and nurseries. This year Robin Rossetta of NWREC found Tortricid larvae causing substantial damage to Deodar cedar (*Cedrus deodara*) and Dwarf Alberta Spruce, (*Picea glauca conica*). Robin collected and the larvae are reared out adults that were positively identified as the Mediterranean Carnation Leafroller. The larva of this species closely resembles several native Tortricid conifer pests and is not included in Peterson's or Stehr's larval keys. In Stehr's key to common Tortricid Larvae on Pinaceae the larvae of this species identifies to the genus *Argyrotaenia*. The larvae form a small feeding shelter by webbing together needles much like *A. occultana*.

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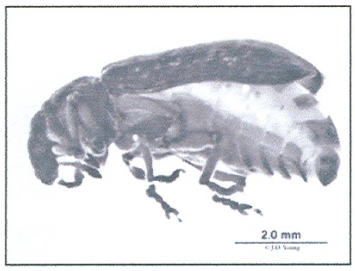
**Thistle Head Weevil** (*Rhinocyllus conicus*)

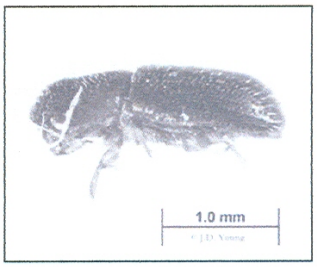



Native range: Europe
Introduced as a Biological control Agent in US beginning in 1969

This biological control agent was introduced to help control/eliminate exotic thistles that out compete native thistles. Unfortunately, it appears that it jumped hosts to at least one native thistle in Oregon. The shift to native species has been observed in other states over the last decade and now poses an additional threat to several threatened native Oregon species.

## Newer Pests that were Detected

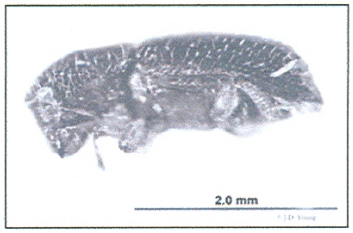
***Xyleborus pfeili***




Historic range: Europe and Asia
Expansion: Africa, North America, & Pacific Ocean Isl.
Hosts: *Acer* sp, *Alnus* sp., *Castanea* sp., *Populus* sp., *Quercus* sp., & *Ulmus* sp.

This pest was first detected in the US in 1992 in Maryland. It was first detected in Oregon by ODA in 1997. It is believed that this pest is widespread in Oregon but does not appear to be causing substantial damage. This pest targets small to medium sized branches of healthy trees.

**Asian Ambrosia Beetle** *Xyleborinus saxeseni*
(aka: Fruit tree Pinhole Borer)

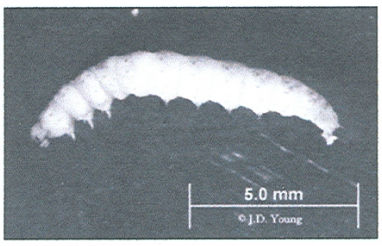



Historic range: Asia
Expansion: North America, Europe & Australia .
Hosts: almost all deciduous trees

This pest is well established in Oregon and very abundant throughout its range. In Oregon the species apparently prefers maples and takes advantage of nursery growing conditions. Like *X. pfeili* this pest typically infests small to medium sized branches of healthy trees.

## Oldies but Goodies

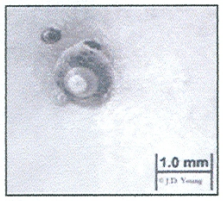
**Strawberry Crownminer** (*Aristotelia fragariae*)

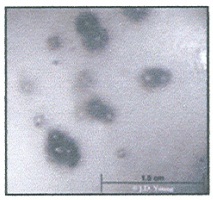



Native Range: Oregon & Washington
Hosts: Wild and cultivated strawberry

This pest is rarely encountered. In fact the only adult specimens in OSAC are from collections made in 1955, 1957 and 1960. Caterpillar bores in to top of the crown and in the leaf petioles. The larvae overwinter in the soil and pupate before the spring. Adults emerge in June & July. As many as 12 larvae have been found in a single crown.

**San Jose Scale** (*Diaspidiotus perniciosus*)



From personal observations it seems that this pest was very abundant this year but remained below damage thresholds.

# SECTION II

## BEE POISONING, ENVIRONMENTAL TOXICOLOGY, REGULATORY ISSUES

**SECTION LEADER**

**CHAD DOBIE**

Section II.
Bee Poisoning, Environmental Toxicology, Regulatory Issues

# BEE PESTICIDE SAFETY TRIALS ON ALFALFA SEED, 2007

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The alkali bee, *Nomia melanderi*, and the alfalfa leafcutter bee, *Megachile rotundata*, are significant pollinators of the alfalfa seed crop in Washington State. It is imperative that we know whether the pesticides used on alfalfa seed to control Lygus bug, aphids, and mites are toxic to these pollinating bees. Dan Mayer of Washington State University was one of very few entomologists who conducted safety trials on these bees. Since his retirement in 2000, there had been no studies on the newly registered and registration-pending pesticides until 2005, when we developed a protocol to conduct pollinator safety bioassays to enable resumption of this important research.

Preliminary trials were conducted in 2005 with fenpyroximate (Fujimite) and bifenthrin (Capture 2EC) to develop the experimental protocol. Bifenthrin is known to be very toxic to bees. Fenpyroximate along with 13 other compounds were tested in 2006 (reported last year). In 2007, spinosad was added to the list of tested compounds against leafcutter bees and abamectin and thiacloprid were dropped. Products were applied at either the maximum label rate or the maximum recommended rate for control of certain insects or mites on alfalfa seed using a $CO_2$ pressurized sprayer with a hand-held boom at a rate of 26 gallons per acre over 0.01 acre plots of first- or second-growth alfalfa. Alfalfa samples were collected at 1 hour and 8 hours after treatment for the bee bioassays, with treatment and age of residue replicated four times. For each sample, about 400 cm of alfalfa foliage were placed into a 15-cm Petri dish cage with tops and bottoms separated by a wire screen insert. In 2007, leafcutter bee pupae were emerged in specially designed boxes; this method allowed for a large number of similarly young-aged, healthy bees to be available for testing. Approximately 20 leafcutter bees were placed into each cage; they were fed 50% sucrose solution in a wad of cotton. Leafcutter bees were exposed to the aged residues for 24 hours at which time mortality was scored. In addition, acetamiprid, flonicamid, and novaluron were tested against

field-collected alkali bees using a slightly different protocol. Scores were corrected for control mortality using Abbott's formula.

When the leafcutter bees were exposed to 1-hour residues, only four compounds showed reasonably low toxicity (10% and lower): bifenazate, flonicamid, novaluron, and etoxazole (Table 1). When bees were exposed to 8-hour residues, all the pesticide treatments but thiamethoxam, spiromesifen, and spinosad caused less than 25% mortality to bees (Table 1). Dan Mayer had concluded from his research that rates of materials that cause less than 25% mortality with 2-hour residues can probably be applied during the early morning with little or no hazard to bees, and those materials that cause less than 25% mortality with 8-hour residues can probably be applied during late evening with little or no hazard to bees.

Alkali bees were evaluated about an hour after exposure to 8-hour residues, and low mortalities were recorded (Table 1). However, we noted that some of the bees in the acetamiprid treatments were exhibiting neuro-intoxication; no bees behaving like that were found in the flonicamid, novaluron, and control chambers.

Table 1. Mortalities (%)* of alfalfa leafcutter bees and alkali bees exposed to field-aged residues of pesticides applied to 0.01 acre plots of alfalfa seed, Prosser, WA, 2007.

| Treatment | | | Leafcutter Bees | | Alkali Bees |
|---|---|---|---|---|---|
| | | | Age of Residue | | Age of residue |
| **Formulation** | **Active Ingredient** | **Rate/acre** | **1 hr** | **8 hr** | **8 hr** |
| **Acramite 4SC** | **bifenazate** | **1.5 pt** | **0.00** | **3.17** | |
| **Actara** | **thiamethoxam** | **4 oz** | **81.42** | **100** | |
| **Assail 70WP** | **acetamiprid** | **1.1 oz** | **14.47** | **0.00** | **9.82** |
| **Beleaf** | **flonicamid** | **3 fl oz** | **3.56** | **0.65** | **2.29** |
| **Comite** | **propargite** | **1.25 pt** | **33.94** | **0.00** | |
| **Dibrom** | **naled** | **1 pt** | **93.77** | **0.90** | |
| **Fujimite** | **fenpyroximate** | **3 pt** | **55.64** | **0.00** | |
| **Oberon** | **spiromesifen** | **1 pt** | **87.30** | **40.37** | |
| **Provado** | **imidacloprid** | **3.8 fl oz** | **20.30** | **0.00** | |
| **Rimon** | **novaluron** | **12 fl oz** | **0.00** | **0.00** | **2.99** |
| **Success** | **spinosad** | **8 fl oz** | **72.17** | **67.18** | |
| **Zeal** | **etoxazole** | **3 oz** | **10.16** | **4.05** | |

*Corrected for control mortality using Abbott's formula.

Section II
Bee Poisoning, Environmental Toxicology, Regulatory Issues

## DETERRENCE OF SHOOT AND CAPSULE BORER *CONOGETHES PUNCTIFERALIS* GUENEE AND THRIPS *SCIOTHRIPS CARDAMOMI* RAMK. OF SMALL CARDAMOM BY CERTAIN NEEM FORMULATIONS

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Considerable damage is done to cardamom by thrips *Sciothrips cardamomi* Ramk. and shoot and capsule borer *Conogethes punctiferalis* Guenee) in India.For management of insect pests, major focus falls on chemical insecticides. Effect of pesticides on bees assumes special significance in cardamom where pollination by bees is of tremendous importance. For effective use of ecofriendly neem , feeding and ovipositional deterrence effects of neem were evaluated against *C. punctiferalis* and *S. cardamomi.*

The settling response of *C. punctiferalis* and *S. cardamomi* ,oviposition deterrence of different neem formulations were assessed by multiple and dual choice tests . Cardamom capsules (50 gram) treated with different neem formulations (Nimbecidine containing 0.03 % azadirachtin and Nimbecidine containing 0.15 % azadirachtin of T.Stanes Pvt.India Ltd , NeemAzal containing 1.0 % azadirachtin and NeemAzal containing 5.0 % azadirachtin of EID Parry Pvt.India Ltd.and TNAU neem EC containing 0.03 % azadirachtin developed by Tamil Nadu Agricultural University) diluting @ 2ml/litre of water .Batches of 50 and 25 pre-starved *C. punctiferalis* larvae for three hours and batches 25 and 10 *S. cardamomi* nymphs were used in multi and dual choice tests respectively. The number of larva/ nymphs settled 24hr after release were recorded. Two plastic tea strainers put in a juxta position (8cm dia.) containing cardamom capsule as odor source wrapped with cotton cloth was used as oviposition substrate. Ten pairs of moths were allowed and caged for four days The number of eggs laid on treated and untreated ovipositional substrates were recorded.

The TNAU neem affected settling behaviour of *C. punctiferalis* larvae to the extent of 72.37 – 77.03 per cent and that of *Sciothrips cardamomi* Ramk. nymph to the extent of 80.07 – 85.12 per cent as against 87.24 – 92.84 and 92.93 – 92.84 per cent repulsion by the NeemAzal five per cent respectively. The order of repellency was NeemAzal (5%) $\geq$ NeemAzal (1%) > TNAU neem (0.03EC) $\geq$ Nimbecidine (0.15%) > Nimbecidine (0.03%)(Tables1-2).

The oviposition of *C. punctiferalis* was reduced by neem formulations; the extent of reduction being 71.76 – 94.98 per cent. The order of ovipositional deterrence was NeemAzal

(5%)> NeemAzal (1%) ≥ TNAU neem ≥ Nimbecidine (0.15%) > Nimbecidine (0.03%)(Table 3).

**Table: 1.Effect of neem formulations on settling behaviour of *S.cardamom* - Multi & dual choice tests.**

| | Treatments | Multi choice | | Dual choice-Treated | | Dual choice -Untreated | | Dual choice |
|---|---|---|---|---|---|---|---|---|
| | | Number | Settling index | Number | Per cent | Number | Per cent | Settling index |
| 1 | Nimbecidine 0.03% | 3.67b | 22.02 | 3.00 | 30.00 (33.21)f | 7.00 | 70.00 (56.79)f | 30.00 |
| 2 | TNAU neem 0.03 EC | 2.33c | 15.20 | 1.66 | 16.60 (24.03)d | 8.33 | 83.33 (65.91)d | 16.60 |
| 3 | Nimbecidine 0.15% | 4.33b | 24.99 | 2.33 | 23.3 (28.86)e | 7.66 | 76.60 (61.08)e | 23.00 |
| 4 | NeemAzal 1% | 1.33de | 9.28 | 1.33 | 13.30 (21.38)c | 8.66 | 86.60 (68.54)c | 13.30 |
| 5 | NeemAzal 5% | 1.00e | 7.14 | 0.66 | 6.60 (14.85)a | 9.33 | 93.30 (75.04)a | 6.60 |
| 6 | Untreated check | 15.67a | - | - | - | - | - | - |

Figures in the parantheses are arc sine ; where P is per cent of larvae settled

Means followed by same letter (s) in a column are not significantly different by DMRT (P=0.05)

**Table: 2.Effect of neem formulations on settling behaviour of *C. punctiferalis* – Multi and dual choice tests.**

| | Treatments | Multi choice | | Dual choice- Treated | | Dual choice -Untreated | | Dual choice |
|---|---|---|---|---|---|---|---|---|
| | | Number | Settling index | Number | Per cent | Number | Per cent | Settling index |
| 1 | Nimbecidine 0.03% | 5.33c | 24.29 | 5.83 | 29.32 (32.78)e | 19.17 | 70.68 (13.06)a | 23.32 |
| 2 | TNAU neem 0.03 EC | 4.33c | 15.20 | 4.67 | 18.68 (25.59)c | 20.33 | 81.32 (13.46)c | 18.68 |
| 3 | Nimbecidine 0.15% | 4.67c | 22.02 | 5.33 | 21.32 (27.49)d | 19.67 | 78.68 (13.36)b | 21.32 |
| 4 | NeemAzal 1% | 2.33c | 9.28 | 2.67 | 10.68 (19.05)b | 22.33 | 89.32 (13.75)d | 10.68 |
| 5 | NeemAzal 5% | 2.00c | 7.14 | 1.67 | 6.68 (14.93)a | 23.33 | 93.32 (13.90)e | 6.68 |
| 6 | Untreated check | 15.67c | - | - | - | - | - | - |

Figures in the parantheses are arc sine $\sqrt{P}$ ; where P is per cent of larvae settled

Means followed by same letter (s) in a column are not significantly different by DMRT (P=0.05)

**Table: 3.Effect of neem formulations on oviposition of *C. punctiferalis* (dual choice test)**

| | Treatments | Multi choice | | Dual choice -Treated | | Dual choice-Untreated | |
|---|---|---|---|---|---|---|---|
| | | Number of eggs | % over check | Number of eggs laid | Per cent | Number of eggs laid | Per cent |
| 1 | Nimbecidine 0.03% | 45.33 | 14.11 (22.05)e | 45.67 | 37.95 (38.02)e | 120.33 | 62.05 (51.97)e |
| 2 | TNAU neem 0.03 EC | 29.33 | 9.19 (17.62)c | 27.00 | 21.25 (27.44)c | 127.00 | 78.75 (62.56)c |
| 3 | Nimbecidine 0.15% | 35.33 | 11.08 (19.42)d | 42.33 | 29.88 (33.13)d | 141.67 | 70.12 (56.87)d |
| 4 | NeemAzal 1% | 21.70 | 6.80 (15.07)b | 21.67 | 16.97 (24.31)b | 127.67 | 16.97 (24.32)b |
| 5 | NeemAzal 5% | 16.00 | 5.02 (12.88)a | 17.33 | 14.17 (22.10)a | 122.33 | 85.83 (67.90)a |
| 6 | Untreated check | 319.00 | | | | | |

Figures in the parantheses are arc sine $\sqrt{P}$ ; where P is per cent of egg laid
Means followed by same letter (s) in a column are not significantly different by DMRT (P=0.05)

Section II
Bee Poisoning, Environmental Toxicology, Regulatory Issues

## Registration Status of New and Old Insecticides

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Most pesticides have passed their review under The Food Quality Protection Act of 1996. Two products of importance to the PNW are still undergoing reregistration. One product, aldicarb (Temik), appears to be surviving the review with only changes being required to the label. For example, it is no longer a question of whether aldicarb will be registered on potatoes, but rather what will be the tolerance will be. EPA has proposed to reduce the tolerance from 1.0 ppm to 0.2. The registrant and the potato industry have proposed a tolerance of 0.6. Once this issue is resolved, the industry will request a shorter PHI and additional states be allowed use of this product. Fairing more poorly is carbofuran (Furadan). EPA has proposed to cancel all uses of this product, including field corn, potatoes, alfalfa and sugar beet. The registrant has mounted a vigorous defense of the product. An Administrative Law Hearing has been scheduled for the first week of February. The outcome of this hearing will be pivotal toward the continued availability of the product.

A large number of active ingredients are now available generically. A recent and important example of the generification of a product is imidacloprid, the insecticide with the highest sales in the United States and which recently became generically available. In the state of Washington 12 different companies hold registrations on 29 different products on potatoes alone. Two years ago, one company held four registrations. Most insecticides in Washington are available generically. The benefit to growers is direct and obvious, cheaper insect control costs. However, widely available generic insecticides, which tend to be broader in spectrum and cheaper than newer, patented products are having a detrimental impact on delivery of IPM programs.

In part in response to the wide availability of generic insecticides, companies have started launching package mixes of insecticides as part of their post patent protection strategies. Package mixes offer growers a broader spectrum of control. Registrants like to package a cheap, broad spectrum generic product with a newer patented product. Since the PNW potato industry has suffered from one new or reemerging insect pest per year for the last 5 years, growers are now more commonly facing the need to control multiple arthropod pests at time.

Growers will find package mixes attractive as the face the specter of new mixes of insect pests. In 2007, there was a single prominent insecticide package mix used in potatoes. In the subsequent year, growers will have access to at least six package mixes, and in excess of a dozen such mixes the following year. Package mixes on potatoes will include

Leverage (cyfluthrin + imidacloprid)
Endigo (lambda-cyhalothrin + thiamethoxam)
FMC (flonicamid + zeta cypermethrin)
MANA (lambda-cyhalothrin + imidacloprid), expect several others
(bifenthrin + imidacloprid)
Arysta LifeSciences (deltamethrin + clothiniadin)

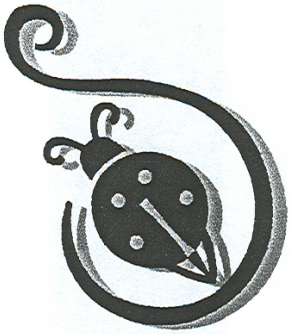
There are several other combinations being tested and other consideration.

Another interesting package mix that is currently available (just not on potatoes) is Dow AgroScience's Cobalt, which is a combination of chlorpyrifos and gamma-cyhalothrin.

While package mixes offer convenience, broader spectrum and efficacy, they do have at least two negative consequences. Combination of insecticides are often considered to be either a poor option for resistance management or actually a detriment to resistance management. The broader spectrum of a package mix can often have negative impact on beneficial organisms. Most often package mixes of insecticides include pyrethroid insecticides that are well known to flare aphids and mites. The widespread registration and use of package mixes may have some deleterious consequences on development of resistance and implementation of IPM programs.

# SECTION III

## BIOLOGICAL & CULTURAL CONTROL



**SECTION LEADER**

**DAVID BRAGG**

Section III
Biological & Cultural Control

# CEREAL LEAF BEETLE BIOLOGICAL CONTROL PROGRAM IN OREGON, 2007

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## Introduction

Cereal leaf beetle (CLB), *Oulema melanopus*, was previously detected in 19 counties: Baker, Benton, Clackamas, Columbia, Crook, Deschutes, Jefferson, Lane, Linn, Malheur, Marion, Multnomah, Polk, Tillamook, Umatilla, Union, Wallowa, Washington, and Yamhill. Surveys in 2007 did not detect CLB in any new counties.

In 2007, ODA, USDA, and OSU continued cooperation on the CLB biocontrol program to monitor, release, and redistribute the two parasitoid wasp species, *Anaphes flavipes* and *Tetrastichus julis*, within the CLB infested counties in Oregon.

## Egg parasitoid – *Anaphes flavipes*

Releases of the egg parasitoid, *Anaphes flavipes,* have been made in Oregon since 2000. Two field insectaries in Washington Co., at Banks and Scholls, one in Union Co., and various growers' fields in Washington and Linn counties, have been utilized as release sites since 2000. After releases in 2002 and 2003, recovery efforts in Banks in 2004 and 2005 showed approximately a 30% parasitism rate (PR) which decreased to zero in 2006 and 2007. The Banks insectary was not funded in 2007, but some samples were still taken from there and surrounding fields within half a mile. Releases were made at the Scholls insectary during 2004 and 2005. Monitoring during 2006 yielded the first overwintering recovery there, but only from one collection in mid-June with a PR of approximately 5%. Recovery rates dropped to zero in 2007. Releases were also made at the OSU Agricultural Research Center insectary site in Union County in 2005. However, due to very low CLB levels in Union County, the insectary was discontinued, and there was no release or recovery activity there in 2006 and 2007. Recovery efforts will be a priority in Union County in 2008. All releases of *A. flavipes* in 2006 were made, with a grower's permission, at two fields in Scio, Linn County. Those fields were monitored and found negative for *A. flavipes* in 2007. To date no wasps have become permanently established at detectable levels at any of the sites. It may take many years for populations to increase and stabilize.

The source for *A. flavipes* release material has been the Colorado Department of Agriculture's biocontrol facility in Palisade, Colorado. Unfortunately the lab suffered a colony collapse during the winter of 2006-07. Oregon sent 15,827 adult CLB to Colorado to help re-establish the lab colony. Due to the time involved to rebuild the colony, only one release of approximately 4,285 *A. flavipes* was made in Oregon at the Scholls insectary in Washington County in 2007. Releases were made there so as not to interfere with recovery efforts at the Scio release sites. CLB adults were also sent to the WSU's quarantine lab for use in rearing *Anaphes nipponicus* shipped from China. (See report by Barry Bai regarding foreign exploration in China for *A. nipponicus*.)

**Larval parasitoid – *Tetrastichus julis***

The goals for the *T. julis* program in 2007 were to determine the distribution and parasitism in central Oregon and Umatilla and Wallowa counties, and to collect and redistribute *T. julis* within the state. To determine *T. julis* distribution and parasitism rate, CLB-positive field sites were located for sampling. Collected larvae were routinely dissected for parasitism assessment. Widespread recovery of *T. julis* was found in 2006 with exceptionally high PRs, including locations where it had not been previously released. In 2007, the peak PRs of *T. julis* found in each county tested were as follows: Baker (85%), Crook (24%), Jefferson (5%), Linn (100%), Marion (100%), Multnomah (100%), Umatilla (80%), Washington (68%). A few sites were also tested in Deschutes and Wallowa counties but were found negative for *T. julis*.

For the second year, in 2007 *T. julis* releases were made entirely from materials collected within Oregon. The OSU insectary fields in Benton and Union counties were discontinued in 2007 as those areas have high *T. julis* and low CLB populations in recent years. In fact, it has become difficult to find CLB in collectable numbers in Union County. The OSU insectary field at the Central Oregon Agricultural Research Center in Madras, Jefferson County, was the only one that received *T. julis*, and additional adult CLB were released to increase CLB numbers there. Larvae parasitized with *T. julis* were also released in growers' fields in central, eastern and northwest Oregon. The numbers of CLB larvae (and estimated number of *T. julis*) released in each county in 2007 are: Crook, 745 (2,581); Deschutes, 200 (600); Jefferson, 7,300 (10,461); Marion, 250 (525); Wallowa, 700 (2,040). The parasitism rates among CLB release material from all areas ranged from 18 to 100%. This year was the first release of *T. julis* in Wallowa County. *T. julis* continues to establish well in release areas. Samples from a 2006 Umatilla County release site showed an 80% PR in 2007. Crook County had a 24% PR in one field after only a small release in 2002. Jefferson County yielded a 5% PR after initial releases in 2006.

A 2007 pesticide usage survey by USDA is pending. The same survey in 2006 suggested that possibly due to our biological control effort and perhaps other factors, the acres treated with pesticides continued to decrease in 2006 to 20,554 acres.

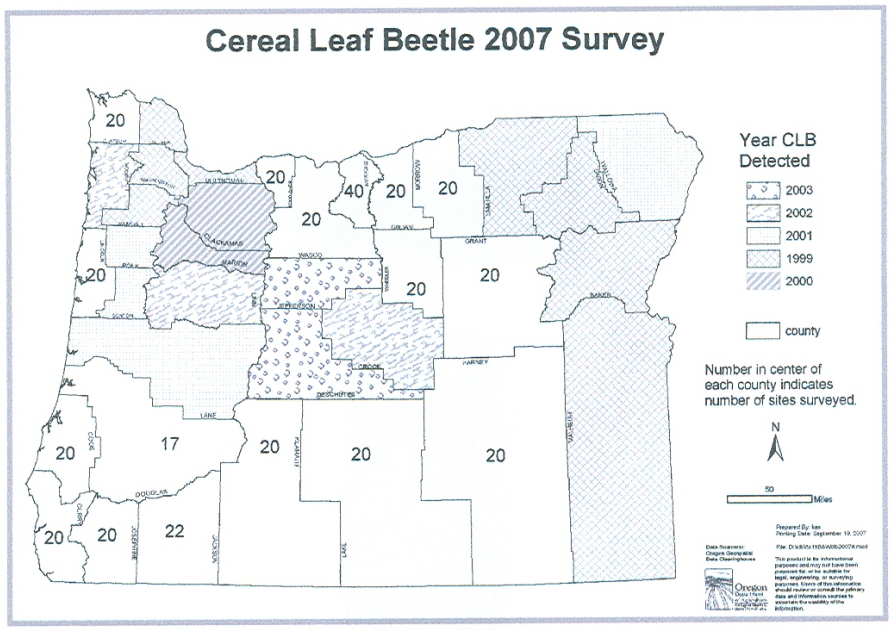



Figure 1

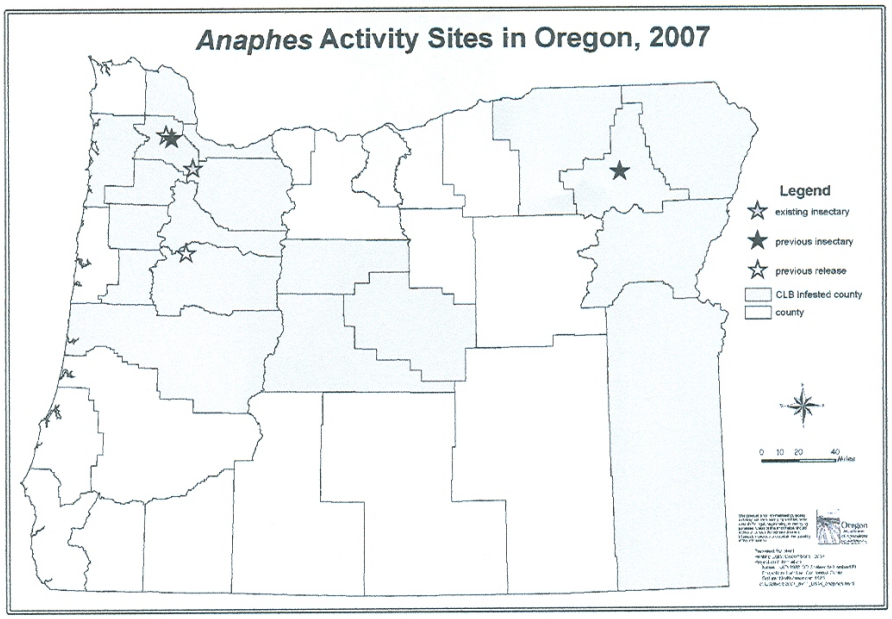



Figure 2

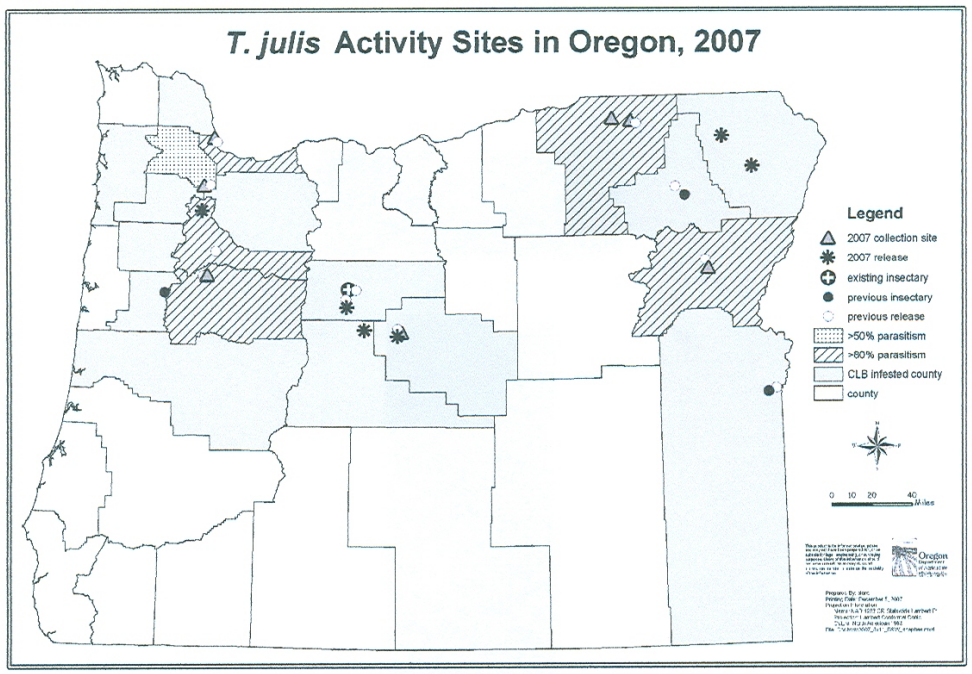



**Figure 3**

| Year | *A. flavipes* | *T. julis* |
|---|---|---|
| 2000 | 263 | 12,310 |
| 2001 | 434 | 18,905 |
| 2002 | 6,200 | 107,566 |
| 2003 | 28,111 | 108,949 |
| 2004 | 26,213 | 51,000 |
| 2005 | 31,904 | 23,160 |
| 2006 | 16,750 | 41,965 |
| 2007 | 4,285 | 16,207 |
| **Total** | **114,160** | **380,062** |

**Table 1. Number (estimated) of parasitoids released in Oregon during 2000-2007.**

Section III
Biological & Cultural Control

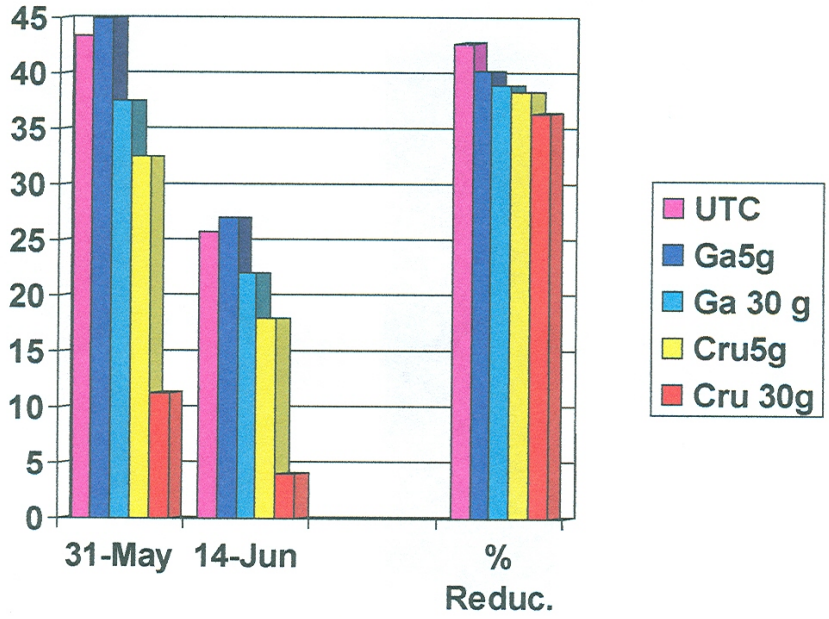
## Predator and Parasitoid Management of Cereal Leaf Beetle (Oulema melanoplus) in Spring Wheat 2007

**By David E Bragg WSU Extension Entomology**
**Patti Carr**
**Diana Roberts**
**WSU Extension**
**Kurt Tetrick, USDA-ARS Farm Manager**

**Protocol** for seed treatment insecticides plus UTC:
RCBD replicates of 5 treatments of seed treatment insecticides were seeded on 5 April 2007 in the established
cereal leaf beetle insectary located at Central Ferry WA. Treatments for evaluation were UTC, Gaucho 600 FS
(5 g/chg, Gaucho 30 grams, Cruiser 5 FS 5 grams, Cruiser 30 grams. ***Hippodamia convergens*** adults a common
predator at CFRF appeared on 24 May 2007 in the spring wheat before the arrival of CLB adults from adjacent
winter wheat fields.

Surviving 3rd instar and prepupae were sampled for T. julius parasitoids on 14 June by Terry Miller, Manger of the
WSU Entomology Department Insectary. An overall mean of 93% CLB larvae surviving the predators feeding had
93% parsitoidism by *Tetrastichus julius*. Thus 40% mean predation of eggs and up to smaller 3rd instar larvae were
eaten by ladybird beetle adults occurs, followed by parasitoid attack. No seed treatment affected either predator or
parasitoid populations.

**Populations of Cereal Leaf Beetle per Meter/2 on 2 dates before and after arrival of *Hippodamia convergens* adults in early June – <u>mean Hc per meter was 4 for entire trial</u> period until CLB finished the cycle. Hc then fed on aphids and other small arthropods.**



Section III.
Biological & Cultural Control

# Susceptibility of the Strawberry Crown Moth, *Synanthedon bibionipennis* (Lepidoptera: Sesiidae) to Entomopathogenic Nematodes

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The objective of this study was to determine the susceptibility of the strawberry crown moth, *Synanthedon bibionipennis* (Lepidoptera: Sesiidae) larvae to two species of entomopathogenic nematodes. The entomopathogenic nematodes (*Steinernema carpocapsae* (Weiser) Agriotos and *Heterorhabditis bacteriophora* (Steiner) Oswego) were evaluated in laboratory soil bioassays and the field. Both nematode species were highly infective in the laboratory bioassays. Larvae were extremely susceptible to nematode infection in the laboratory, even in the protected environment inside the strawberry crown (Table 1). Infectivity in the laboratory was 96 and 94% for *S. carpocapsae* and *H. bacteriophora*, respectively. Field applications in late fall (October) were less effective with *S. carpocapsae* and *H. bacteriophora* resulting in 51 and 33% infection, respectively. Larval mortality in the field from both nematode treatments were significantly greater than the control but were substantially less efficacious than in the laboratory. Soil temperature post nematode application in the field was below optimum for both nematode species for a majority of the post application period (Fig. 1). It is clear from laboratory data, that strawberry crown moth larvae are extremely susceptible to nematode infection. Improved

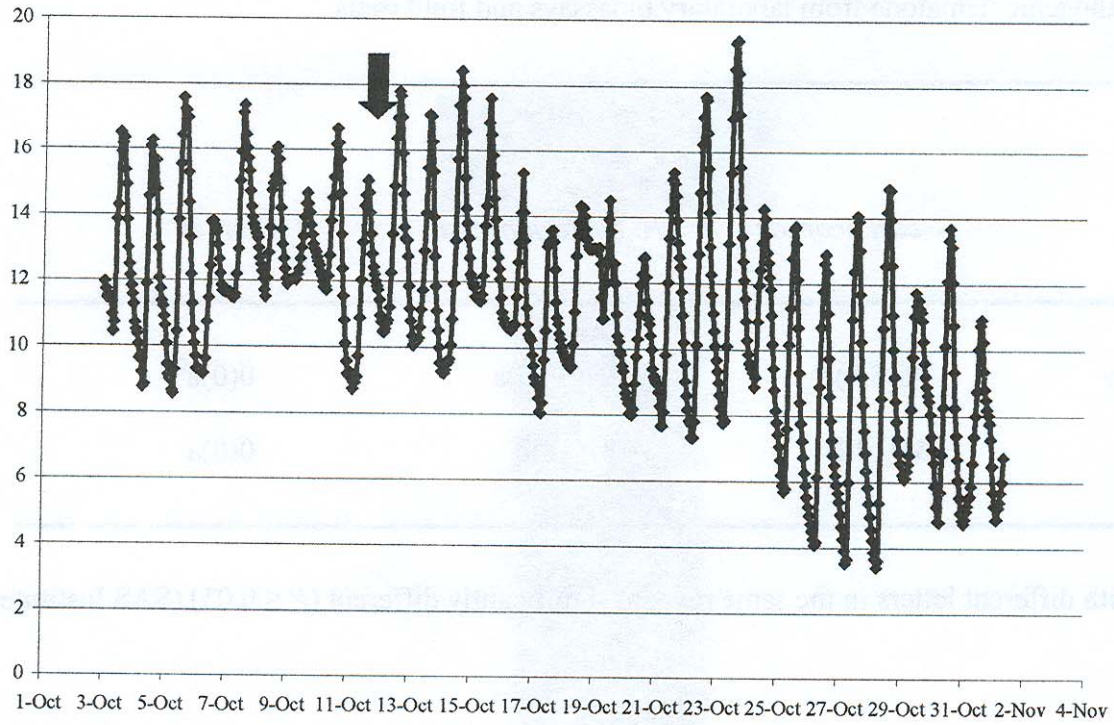
control in the field is likely if nematode applications are made in late summer to early fall when larvae are present in the soil and soil temperatures are more favorable for nematode infection.

Table 1. Mean percentage (±SD) of strawberry crown moth larvae infected with each species of entomopathogenic nematode from laboratory bioassays and field trials.

| | Treatment | | |
|---|---|---|---|
| | *S. carpocapsae* | *H. bacteriophora* | Control |
| Laboratory | 96(5.9)b | 94(5.25)a | 0(0)a[1] |
| Field | 51(19)b | 33(18)b | 0(0)a |

[1]Means with different letters in the same row are significantly different ($P \leq 0.05$) (SAS Institute, 1999).

Fig. 1




Soil temperatures (°C) in field experiments performed to determine the efficacy of entomopathogenic nematodes against strawberry crown moth larvae. Downward arrow indicates when nematodes were applied.

Section III
Biological & Cultural Control

# NEEM: EFFECTIVE TOOL FOR PUSH-PULL STRATEGY OF PEST MANAGEMENT IN CONJUNCTION WITH TRAP CROP AND BIOCONTROL AGENTS

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The neem tree ( *Azadirachta indica* A.Juss) (Syn.*Melia azadirachta* L., *Melia indica* Brandilis) known for its legendary insect-repellent and medicinal properties. Azadirachtin together with other constituents of neem seeds such as salanin, nimbin, nimbidin, and meliantriol exhibit insect repellant, antifeedant and insect growth regulator properties. Though neem and biocontrol agents, *Bt* ,NPV *Trichogramma* spp and *Chrysopa* are very promising, they are not popular among the farmers as sole method of pest management due to several deficiencies viz. inactivation of HaNPV due to high pH values of dew on cotton foliage, specific activity and less cost benefit ratio of NPV and Bt formulations, NPV and Bt being stomach poisons necessitating thorough coverage and repeated applications, inability of *Trichogramma* to disperse in larger areas and slow action of neem when compared to synthetic insecticides .

The above difficulties could be overcome through a concept called push-pull strategy or stimulo-deterrent diversionary strategy (SDDS). Neem, as host-masking agents, repellents, phago- and oviposition deterrents is deployed to "push" colonizing insects away from the harvestable crop and also to attract predators or parasitoids into the area. At the same time, the pests are aggregated on a sacrificial /ecofeast/ trap crop so that a selective control agents, *eg.* biocontrol agents such as NPV, Bt, *Trichogramma* sp. can be used directly to reduce the pest population .

The concept of this strategy includes:

- The palatability of the trap crop is increased by application of neem confined to main crop leaving trap crop untreated. Repellent, feeding and oviposition deterrence of neem products had been used for diverting pests to trap crop by selective application.

- The efficacy of biocontrol is improved when the pest density is more. Diversification of pest by neem application results in congregation of pest in less area.
- The area of treatment with biocontrol is reduced. This will facilitate more frequent use of biocontrol agents on restricted crop (trap crop).

Push-pull strategy with conjunctive use of neem + trap crop/variety in cotton and rice and three components such as neem +trap crops (bhendi/redgram) + biocontrol agents (NPV / Bt / *T. chilonis* ) in cotton was validated in field conditions.

Rice - Neem+ Trap variety : Application of neem on rice cultivar CO47 leaving susceptible TN1(S) as a trap variety enhanced the diversion of leaf folder, *Cnaphalocrocis medinalis* ( Gueen) to TN1(S) for egg laying. The preference ratio increased from 1.18 - 1.43 in both untreated to 1.47 - 1.77 in both treated and 1.99 - 2.84 in TN1(S) untreated - CO 47 treated under in house conditions. The neem formulations, neem seed kernel extract (NSKE5%) and TNAU neem 0.03 EC were effective in repelling the leaf folder from treated CO47 to untreated TN1(S); the increase in preference ratio was from 1.48 - 1.55 at pre-count to 2.36 - 2.48, 3.98 - 4.17 and 3.81 - 3.92 after first, second and third applications respectively.

Cotton- Neem+ Trap crop okra : Use of okra as trap crop and neem dust formulations on cotton enhanced the diversion of cotton leafhopper, A*mrasca devastans* Distant(1 : 1.5 to 1: 3.4), cotton aphid *Aphis gossypii* Glover (1 : 1.4 to 1: 3.6), whitefly, *Bemisia tabaci* Gennadius (1 : 1.2 to 1: 1.9) and semiloopers, *Anomis flava* F. (1 : 0.7 to 1 : 1.9) towards bhendi. Cotton- Neem+ Trap crop okra /pigeon pea: The oviposition preference of moths and feeding preference of larvae of *Helicoverpa armigera* Hub. was towards trap crops bhendi and redgram compared to cotton. Application of NSKE on cotton leaving trap crops enhanced the diversion of *H. armigera* to trap crops. The preference of *A. devastans*, *A. gossypii* Glover, *Spodoptera litura* F., *Anomis flava* F. and *Earias vittella* F. was towards bhendi compared to cotton. The *B. tabaci* preferred cotton compared to bhendi. Application of NSKE on cotton increased the preference ratio in favour of untreated bhendi as a trap crop. Restricted application of NPV/Bt/tagging *Tichogramma* ( egg cards) on trap crops (from 53 DAS to 81 DAS at weekly interval) significantly reduced the incidence and per cent damage to fruiting bodies, boll, locule and inter locule by *H. armigera* compared to cotton sole crop under untreated check. The recovery of NPV infected larvae on bhendi, redgram and cotton varied from 34.2 - 47.5, 32.8 - 39.2 and 14.2-20.2 per cent in the respective treated plots. The percent parasitisation of cotton bollworm *Helicoverpa armigera* Hub. eggs by *Trichogramma chilonis* Ishii varied from 10.4 to 12.0, 14.5 to 15.5 and 14.8 to 16.4 per cent on bhendi, redgram and cotton respectively. The recovery of Btk infected larvae on bhendi, redgram and cotton varied from 43.3 – 48.8, 40.0 – 48.3 and 32.7 -38.6 per cent in the respective treated plots. Application of NSKE on cotton diverted the population of Coccinellids species such as *Menochilus sexmaculatus* Fabr., *Coccinella transversalis* Fabricius and *Alesia discolor* Muls. and the spider species such as *Oxyopes* sp., *Argiope* sp., *Araneus* sp., *Neoscona* sp., *Plexippus* sp., of coccinellids and spiders to trap crops and increased the occurrence ratio towards trap crops.

# IDAHO CEREAL LEAF BEETLE (*Oulema melanopus*) (CLB) BIOCONTROL PROJECT UPDATE

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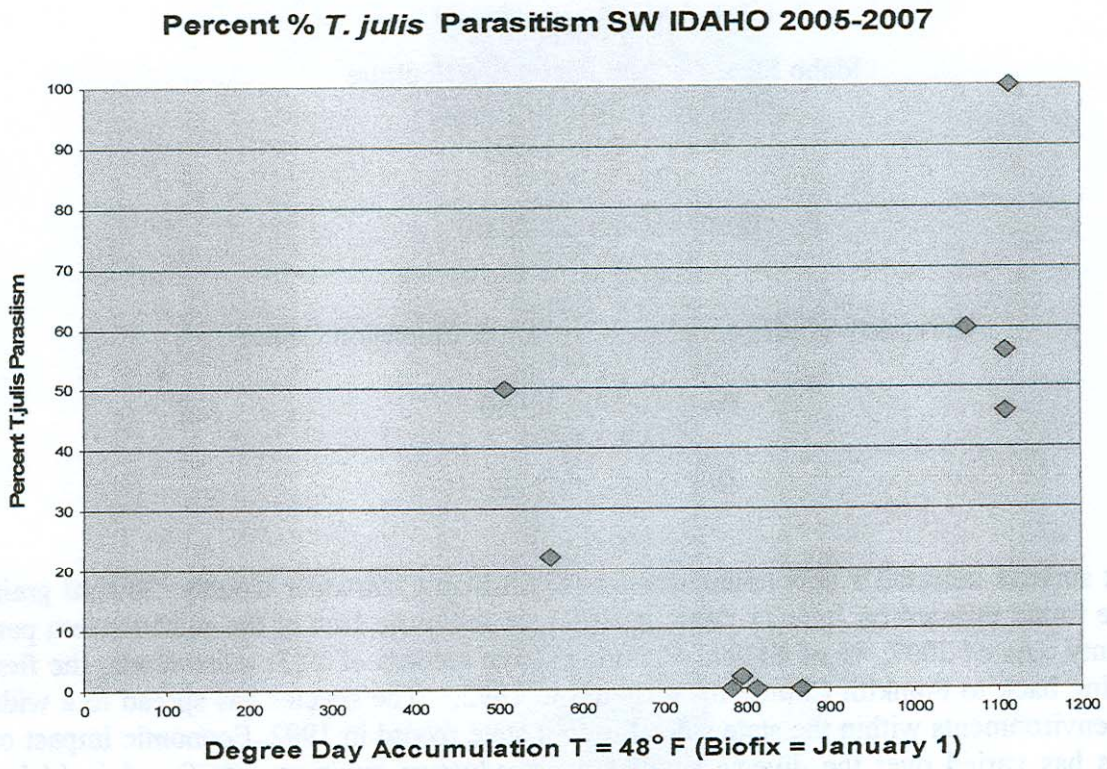
Sweep net surveys detected a new county record for CLB in Clearwater County. Several grain fields were found infested on June 21, 2007 in the Weippe Prairie area of the southwestern part of the county. As of 2007, 43 of 44 Idaho counties have records of CLB infestations; the first record dating back to Franklin County in SE Idaho in 1992. The species has spread to a wide variety of environments within the state since the first state record in 1992. Economic impact of the species has varied over the diverse small grain production environments found in Idaho. Generally CLB has the status of an occasional pest problem in most counties were it occurs, with declining crop damage or economic impact being reported in recent years. Recent record high wheat prices has been a factor in the practice of SW Idaho growers applying prophylactic insecticide treatments tanked mixed with a broadleaf herbicide in early to mid spring. Insecticide applications targeting CLB and aphids are in some cases applied to sub economic populations of CLB.

ISDA cooperating with University of Idaho has had a multi-year effort of biological control agent releases and recovery surveys. In 2007, CLB larval parasite (*Tetrastichus julis*) surveys were conducted in grain fields at the University of Idaho, Parma Experiment Station on May 29 and on June 13. On each date 25 larvae were collected and dissected. *T. julis* parasite levels were 0% on May 29 and 60% on June 13. W.S.U. extension educator, Diana Roberts dissected a sample of CLB larvae collected June 18, 2007, from an oat field near Princeton, ID in Latah County. The sample was found to have a 72% *T. julis* parasitism level. This was a new county record for this biological control agent and is a result of a natural migration of *T. julis* to this area

of the state. Recent research conducted by Evans, E. et al. documented seasonal patterns of larval parasitism in Utah*. CLB larval dissections over three years in SW Idaho show a similar seasonal pattern of *T. julis* parasite levels as observed in Utah.




A field insectary for the egg parasite, *Anaphes flavipes,* was initiated in the spring of 2004 at the University of Idaho, Southwest Idaho Research and Extension Center in Parma, ID. Several egg parasite releases have been made during the 2004 to 2006 field seasons in cooperation with USDA, Plant Protection and Quarantine and Colorado Department of Agriculture Insectary in Palisades CO. *Anaphes flavipes* egg parasite recovery surveys were conducted on April 26, May 3, May 17, and May 29 in 2007. A total of 310 CLB eggs were collected and rear out. No *A. flavipes* were recovered and no evidence of overwintering and establishment of this biological control agent have been observed after three years of releases and follow up recovery surveys. ISDA plans to discontinue efforts to release the egg parasite *A. flavipes* within the state.

***Evans, E. W., J.B Karren and C. E. Israelsen. 2006.** Interactions over time between cereal leaf beetle (Coleoptera: Chrysomelidae) and larval parasitoid *Tetrastichus julis* (Hyemoptera: Eulophidae) in Utah. J. Economic Entomology 99(6) 1967-1973.

# SECTION IV

## CEREAL CROP PESTS

**SECTION LEADER**

**DAVID BRAGG**

Section IV
Cereal Crop Pests

## Spring Wheat – Valent, Bayer, Syngenta Products

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RCBD replicates of 4 replicates per treatment were seeded by Hegi Cone Seeder on 7 x 6 inch rows x 4 feet wide by 20 feet long at Central Ferry WA. Alpowa swsw was seeded at 70 lbs per acre into 48 F soil on 4/5/2007. Seedling emergence occurred 0n 4/13/2007. The trial was rated for plant stand (wire worm damage) on 5/10/2007 by counting ¼ meter square. The trial was harvested by Winter Steiger Plot Combine on 8/10/2007.

| Treatments under Trial | Rate grams/Ha |
|---|---|
| 1 UTC | ---------- |
| 2 Gaucho 600 FS A | 5.0 |
| 3 Gaucho 600 FS B | 31.56 |
| 4 V-10170 (VA) | 5.0 |
| 5 V-10170 (VB) | 10.0 |
| 6 V-10170 (VC) | 30.0 |
| 7 V-10170 (VD ) | 50.0 |
| 8 Cruiser 5 FS (CruA) | 10.0 |
| 9 Cruiser 5 FS (CruB) | 30.0 |

LSD All-Pairwise Comparisons Test for Plant Stand (wire worm stand reduction)

| Treatment | Mean plant stand 1/4 meter |
|---|---|
| 3 Gaucho B | 17.50 A |
| 7 V-10170 D | 17.00 A |
| 9 Cruiser B | 16.25 A |
| 6 V-10170 C | 16.00 A |
| 8 Cruiser A | 10.75 B |
| 2 Gaucho A | 12.75 B |
| 5 V-10170 B | 12.75 B |
| UTC | 12.25 B |
| V-101770 A | 10.75 B |

Alpha 0.05

Standard Error for Comparison 1.2729
Critical T Value 2.052 Critical Value for Comparison 2.6119
There are 2 groups (A and B) in which the means
are not significantly different from one another.

**LSD All-Pairwise Comparisons Test for yield**

| Treatment | Mean Yield bu/ac | |
|---|---|---|
| VB | 44.500 | A |
| VC | 44.250 | A |
| VD | 44.250 | A |
| GaB | 43.750 | A |
| VA | 43.500 | A |
| CruB | 42.500 | A |
| CruA | 41.000 | A |
| GaA | 29.000 | B |
| UTC | 27.250 | B |

```
Alpha 0.05 Standard Error for Comparison 1.8257
Critical T Value 2.052 Critical Value for Comparison 3.7461
There are 2 groups (A and B) in which the means
are not significantly different from one another.
```

Differences between treatment variables were decreased due to grain fill in secondary (sucker) tillers following a timely rain in early August in a late crop maturity season. In terms of yield all treatments were similar except for the low rate of Gaucho 600 5 grams/Ha and the UTC. Often early stand reduction will result in increased tillering by the thinned plants. Spring wheat will average 4 tillers per plant in average ppt. years but extra moisture will allow up to 7 tillers to fill with grain. The number of plants left by wireworm feeding remains the same. This would not occur in spring crops w/o June rains.

**Section IV**

## WIRE WORM STUDIES 2007 WINTER WHEAT – BASF PRODUCTS
## (Submitted to J. Irreproducible Results)

**David Bragg, WSU Extension Entomologist**
**Patti Carr, Technician**
**Kurt Tetrick, USDA-ARS Farm Manager**

Trial Seeded 10/10/2006 at CFRF using a Hegi Cone Seeder set at 60 lbs seed per acre in 4 replicates per treatment in a RCBD – each replicate 8 x 80 feet. DPE = 10/18/2006. Winter wheat varieties were Rod/Madsen 50/50 mix. Usual plant stand evaluation made 10 DPE. All BASF treatments with Charter/Apron fungicide.

**One-Way AOV for: 1 2 3 4 5 6 7 plant stand 1/4th Meter square**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Between | 6 | 178.429 | 29.7381 | 6.86 | 0.0004 |
| Within | 21 | 91.000 | 4.3333 | | |
| Total | 27 | 269.429 | | | |

Grand Mean 20.857 CV 9.98 Chi-Sq DF P
Bartlett's Test of Equal Variances 6.82 6 0.3380
Cochran's Q 0.2940
Largest Var / Smallest Var 8.9167
Component of variance for between groups 6.35119
Effective cell size 4.0

| Treatment | Mean Stand ¼ m2 |
|---|---|
| 1 Charter + Apron | 24.25 |
| 2 Regent 500A + Charter + Apron | 23.25 |
| 3 Regent 500A + Charter + Apron | 18.00 |
| 4 BAS 320001 + Charter + Apron | 23.25 |
| 5 Gaucho 480 + Charter + Apron | 19.50 |
| 6 U T Check | 20.25 |
| 7 Gaucho 600 FS + RXT | 17.50 |

Observations per Mean 4
Standard Error of a Mean 1.0408
Std Error (Diff of 2 Means) 1.4720

**LSD All-Pairwise Comparisons LSD Test for plant stand count - BASF winter wheat trial 2006-2007**

| Treatment | Rate Fl Oz/cwt | Mean Plant stand ¼ meter sq |
|---|---|---|
| 1. Charter 3.07 + Apron XL 0.0853 | | 24.25 A |
| 2. Regent 500 37.5 + Charter 3.07 + Apron XL 0.0853 | | 23.25 A |
| 4. BAS32001 12.8 + Charter 3.07 + Apron XL 0.0853 | | 23.25 A |
| 6. Check in trial | | 20.25 B |
| 5. Gaucho 480 2.0 + Charter 3.07 + Apron XL 0.0853 | | 19.50 C |
| 3. Regent 500 1.563 + Charter 3.07 + Apron XL 0.0853 | | 18.00 C |
| 7. Gaucho 600 FS 0.32 + RXT 2.0 (standard) | | 17.50 C |

Alpha 0.05 Standard Error for Comparison 1.4720

Critical T Value 2.080 Critical Value for Comparison 3.0611

There are 3 groups (A, B, etc.) in which the means
are not significantly different from one another.
While the statistics show SD separation of groups for plant stand I feel uncertain about fungicide treatment 1 being paired with insecticide treatments 2 and 4. I think there is a "strong equalizer" present that confounds the common variable of wire worm activity in this trial = probably no real reduction in plant stand coupled with a plant stimulant. Notice that the in-trial UTC check is comparable to the other treatments, but the outside Raxil XT check 7 is SD. Could this mean that the "equalizer effect" is a block effect that influences all replicates grown together?

**One-Way AOV for: yield in bushels per acre**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Between | 6 | 19947.7 | 3324.62 | 33.9 | 0.0000 |
| Within | 21 | 2059.2 | 98.06 | | |
| Total | 27 | 22007.0 | | | |

Grand Mean 149.54 CV 6.62
Chi-Sq DF Bartlett's Test of Equal Variances 13.1 6 0.0415
Cochran's Q 0.3506
Largest Var / Smallest Var 51.571
Component of variance for between groups 806.640
Effective cell size 4.0

| Treatment | Mean Bu/Ac |
|---|---|
| 1 Charter/Apron | 158.75 |
| 2 Regent + 37.6 | 156.00 |
| 3 Regent + 1.53 | 168.50 |
| 4 BAS32001 | 166.75 |
| 6 UTC in trial | 144.00 |
| 7 Gaucho 600 FS 0.32 standard outside trial | 87.00 |

Observations per Mean 4
Standard Error of a Mean 4.9513
Std Error (Diff of 2 Means) 7.0021

**LSD All-Pairwise Comparisons Test for yields in bu/ac**

| Treatment | Mean Bushels | |
|---|---|---|
| 3 Regent + 37.5 | 168.50 | A |
| 5 Gaucho 480 + 2.0 | 166.75 | A |
| 4 BAS32001 + | 165.75 | A |
| 1 Charter/Apron | 158.75 | B |
| 2 Regent + 37.5 | 156.00 | B |
| 6 UTC | 144.00 | B |
| G Gaucho 600 FS 0.32 + RXT | 87.00 | C |

Alpha 0.01 Standard Error for Comparison 7.0021
Critical T Value 2.831 Critical Value for Comparison 19.826
There are 3 groups (A, B, etc.) in which the means
are significantly different from one another.
Yield is SD and reflects all factors that stress the wheat. Some late Cereal Leaf Beetle damage appeared at anthesis/boot stage but was less than 10% tillers infested at less than 20% damage to the flag leaf. NSD.

## Section IV.

# 2006-2007 Bayer Crop Science Winter Wheat Rate Study Trial

**Dr. David Bragg, WSU Extension Entomologist**

Location Central Ferry Research Farm Garfield County WA
Seeding Date October 30, 2006
Variety Rod/Madsen 50/50
Seeded by Hegi Cone Plot Seeder on 7 rows x 48 Inches x 20 feet replicates with 4 replicates per treatment.
Emergence date was November 09, 2006.
Plant stand per ¼ meter square counted November 16, 2006 (wire worm injury).
Harvest by Winter Steiger Plot Combine on July 12, 2007. No aphids were found throughout the trial period.

**One-Way AOV for: Plant Stand**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Between | 11 | 1098.92 | 99.9015 | 59.0 | 0.0000 |
| Within | 36 | 61.00 | 1.6944 | | |
| Total | 47 | 1159.92 | | | |

Grand Mean 20.542 CV 6.34

| | Chi-Sq | DF | P |
|---|---|---|---|
| Bartlett's Test of Equal Variances | 9.69 | 11 | 0.5581 |

Cochran's Q 0.3730
Largest Var / Smallest Var 11.375
Component of variance for between groups 24.5518
Effective cell size 4.0
Observations per Mean 4
Standard Error of a Mean 0.6509
Std Error (Diff of 2 Means) 0.9204

**LSD All-Pairwise Comparisons Test for Plant Stand (0.05)**

| Treatment (fl oz cwt) | Mean Plant Stand | |
|---|---|---|
| Gaucho XT 1.00/Cyfluthrin 2.10 | 29.000 | A |
| Gaucho 600 FS 1.44 | 27.500 | AB |
| Poncho 600 FS 0.128 | 26.750 | B |
| Poncho 600 FS 0.790 | 23.250 | C |
| Cruiser 5 S 0.790 | 20.750 | D |
| Poncho 600 FS 0.320 | 19.250 | DE |
| Gaucho XT 1.00 | 18.750 | E |
| Gaucho 600 FS 0.320 | 18.250 | E |
| Gaucho 600 FS 0.128 | 18.000 | E |
| Raxil XT | 15.250 | F |
| Poncho 600 FS 0.128 | 15.000 | F |
| Cyfluthrin XL 2.10 | 14.750 | F |

Alpha 0.05 Standard Error for Comparison 0.9204
Critical T Value 2.028 Critical Value for Comparison 1.8668
There are 6 groups (A, B, etc.) in which the means are not significantly different from one another.

**Significant differences in plant stand from wire worm (*Limonius canus* and *L. californicus*) occurred. The treatments followed by A, AB, and B are not SD. C, D, and E are SD from each other but all have stands suitable for winter wheat. The F group stands are significantly lower than those of the other groups. Cyfluthrin alone seems to be equal to the fungicide check and the lowest rate of Poncho 600.**

**One-Way AOV for yield (Bushels/Acre):**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Between | 11 | 6509.9 | 591.811 | 2.61 | 0.0149 |
| Within | 36 | 8170.5 | 226.957 | | |
| Total | 47 | 14680.4 | | | |

Grand Mean 160.60 CV 9.38

| | Chi-Sq | DF | P |
|---|---|---|---|
| Bartlett's Test of Equal Variances | 20.0 | 11 | 0.0447 |

Cochran's Q 0.2271
Largest Var / Smallest Var 46.018
Component of variance for between groups 91.2136
Effective cell size 4.0

**LSD (0.01) All-Pairwise Comparisons Test for Yield Bu/Ac Bayer WW 2006-2007**

| Variable fl oz cwt | Mean Bu/AC | |
|---|---|---|
| Poncho 0.790 | 177.65 | A |
| Cruiser 0.790 | 175.33 | AB |
| Gaucho 1.44 | 171.06 | AB |
| Gaucho XT/Cyfluthrin | 170.16 | AB |
| Gaucho XT 1.00 | 169.43 | B |
| Gaucho 0.320 | 163.92 | BC |
| Poncho 0.128 | 159.95 | BC |
| Poncho 0.510 | 151.44 | C |
| Poncho 0.256 | 150.19 | C |
| Gaucho 0.128 | 146.85 | D |
| Raxil XT (check) | 146.06 | D |
| Cyfluthrin XL 2.10 | 145.20 | D |

Alpha 0.01 Standard Error for Comparison 10.653
Critical T Value 2.719 Critical Value for Comparison 28.970
There are 3 groups (A, B, etc.) in which the means
are not significantly different from one another.

**It appears that yield is variable similar to that of plant stand. Poncho 600 treatments are variable but in most trials NSD.**

Section IV.

## Winter Wheat Rate Study Trial For Cereal Leaf Beetle 2007 – Bayer Products

David Bragg, WS U Extension Entomologist
Patti Carr, Technician
Kurt Tetrick. USDA ARS Farm Manager

Location Central Ferry WA
Seeding Date October 30, 2006
Variety Rod/Madsen 50/50 mix
Seeded by Hegi Cone Plot Seeder on 7 rows x 48 Inches x 20 feet replicates with 4 replicates per treatment.
Emergence date was November 09, 2006.
Cereal Leaf Beetle percent counted June 24, 2007 at early boot stage.
Harvest by Winter Steiger Plot Combine on July 12, 2007. No aphids were found throughout the trial.
***Hippodamia convergens*** were present in large numbers from February to boot stage and fed on CLB larvae/eggs in all treatments.

**One-Way AOV for: CLB%**

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Between | 11 | 1688.61 | 153.510 | 11.2 | 0.0000 |
| Within | 36 | 493.55 | 13.710 | | |
| Total | 47 | 2182.16 | | | |

Grand Mean 10.938 CV 33.85
Component of variance for between groups 34.9500
Effective cell size 4.0

Observations per Mean 4
Standard Error of a Mean 1.8513
Std Error (Diff of 2 Means) 2.6182

LSD All-Pairwise Comparisons Test CLB%

| Treatment | Rate Fl/Oz | Mean CLB% | |
|---|---|---|---|
| Raxil XT | check | 25.00 | A |
| Cyfluthrin XL | seed treatment | 20.00 | A |
| Gaucho XT/Cyfluthrin | | 13.75 | B |
| Gaucho 600 FS | 0.128 | 10.00 | C |
| Gaucho 600 FS | 0.320 | 10.00 | C |
| Poncho 600FS | 0.128 | 10.00 | C |
| Poncho 600 FS | 0.256 | 10.00 | C |
| Poncho 600 FS | 0.510 | 10.00 | C |
| Gaucho XT | 1.00 | 7.500 | D |
| Poncho 600 FS | 0.790 | 7.500 | D |
| Cruiser 5 S | 0.790 | 5.025 | D |
| Gaucho 600 FS | 0.1.44 | 2.505 | E |

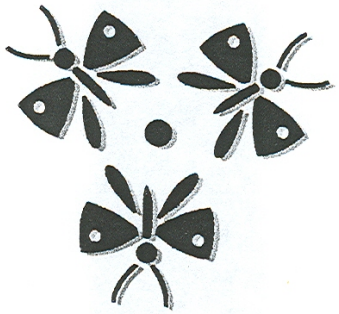
Alpha 0.05 Standard Error for Comparison 2.6182
Critical T Value 2.028 Critical Value for Comparison 5.3099
There are 4 groups (A, B, etc.) in which the means
are not significantly different from one another.

In this lagniappe trial, sampled for activity against Cereal Leaf Beetle larvae 204 days after emergence, CLB were actively feeding on emerging flag leaves at early boot stage. The seed treatment insecticides all

showed some degree of CLB percent reduction except for those in Group A. These treatments were effective in reducing CLB populations until late boot/anthesis stage at which time the CLB adults began emigrating to adjacent spring wheat. How ever CLB economic injury thresholds are 20% + leaf damage with 40% of plants infested.

# SECTION V

## SOIL ARTHROPODS



**SECTION LEADER**

**MICHAEL HUBBARD**

Section V.
Soil Arthropods

# Efficacy of Altacor® 35 WDG, (chlorantraniliprole) for Control of Mint Root Borer Larvae (*Fumibotys fumalis*) in Sprinkle Irrigated Peppermint at Different Rates and on Different Soil Types, located in Idaho

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**OBJECTIVE 2:** Efficacy of Altacor in controlling mint root bore larvae when sprayed on and overhead irrigated in later, on different soil types, and at four rates.

## INTRODUCTION

Lorsban (chlorpyrifos) is the only chemical insecticide that is registered for control of mint root borer larvae. Lorsban can be effective only if it is chemigated however, sometimes Lorsban appears ineffective. It is assumed that one problem with chemigating Lorsban is that the sprinklers do not deliver the Lorsban evenly on the field, or that wind effects the distribution of the Lorsban. If an effective insecticide could be applied uniformly with a ground applicator and then later watered in, control could possibly be more consistent. Studies done in 2004 and 2005 in the La Grande Oregon area, found that the new DuPont Crop Protection insecticide, registered with the name of, Altacor® 35 WDG (chlorantraniliprole), formerly known as DPX-E2Y45, controlled MRB as well as Lorsban when applied by chemigation.
In 2006 Altacor® 35 WDG was tested for MRB control in Idaho, in sprinkle and furrow irrigated mint. Altacor® was applied with a sprayer, at the rate of 4 oz/ac, on dry soil. Later the Altacor was incorporated into the soil with overhead irrigation or rain. All experiments done in 2006 showed Altacor controlled most of the MRB larvae even when it was incorporated by rain thirteen days after being broadcast applied.

It has been speculated that when Altacor is applied to dry soil that the soil type could affect the efficacy of Altacor in controlling the MRB larvae. This trial in 2007 was designed to test Altacor on two different soil types as well as test it at a range of rates.
The Altacor rates varied from a high rate of 4 oz/a (0.12 lb ai/ac) to a low rate of 1 oz/a (0.03 lb ai/ac).

## MATERIALS AND METHODS

These two experiments were each located in production peppermint fields. Experiment one was located in a field in the Dry Lake, Idaho area, on a Scism Silt loam soil with 3-7% slopes. Experiment two was located in the Kuna Idaho area on a Power-McCain Slit loam soil with 2-4 % slopes. Both soils have similar texture according to the soil maps but the Scism soil is derived from calcareous mixed mineral material while the Power McCain Silt loam is formed in loess or silty alluvium. The actual soils in the plot areas appeared different from each other. The soil in experiment three (Dry Lake) appeared very siltly while the Power-McCain soil (Kuna) appeared to have some clay and some sand mixed with the silt.

In both experiments the plots were 12 ft by 20 ft sections of peppermint fields containing a natural infestation of MRB larvae. The following treatments were arranged in a randomized block design and replicated six times: (1) Untreated check, (2) Lorsban 4E chlorpyrifos, 2 qt/ac (2.0 lb ai/ac), (3) Altacor 35 WDG, 4 oz/ac (0.88 lb ai/ac), (4), Altacor 35 WDG, 3 oz/ac (0.066 lb ai/ac), (5) Altacor 35 WDG, 2 oz/ac (0.044 lb ai/ac) , (6) Altacor 35WDG, 1 oz/ac (0.022 lb ai/ac)

All treatments were broadcast applied with a $CO_2$ backpack sprayer (20 GPA at 15 psi). Spray water was buffered to an approximate pH of 5.5.

Evaluations of all treatments were made by taking six, 0.75-$ft^2$ soil / rhizome samples in each plot. The samples were taken to the depth of the rhizomes which averaged four inches deep. The soil was shaken off the mint rhizomes and sifted though a 0.25" screen while the rhizomes were placed in Berlese funnels until dry. The number of MRB larvae recovered from soil sifting was combined with that from Berlese funnel extraction and recorded.

### Experiment 1 (Dry Lake area)

For experiment one, the field was swathed approximately August 11 and then irrigated once before the all the treatments were applied on August 22. The soil surface was dry when the applications were made and there was approximately 0.5 inch of regrowth on the mint. Solid set irrigation sprinklers watered in all the treatments approximately 24 hours after they were applied.

Experiment one was evaluated October 1, 40 days after treating (DAT)

### Experiment 2 (Kuna area)

The field was swathed approximately August 19. All treatments were applied on August 25 before the first post-harvest irrigation. The plot area was irrigated with wheelines approximately seven days after the applications were made but, approximately six days after applying the treatments, it rained approximately 0.3 inch. This experiment was evaluated on October 10, 44 DAT.

## RESULTS AND DISCUSSION

The application of 2 qt. /ac Lorsban did not significantly reduce the MRB larvae levels compared to the untreated check in either experiment but there were exact opposite trends in both experiments with the Lorsban treatment. In experiment one the Lorsban application slightly lowered the mean number of MRB larvae, but in experiment two the Lorsban application slightly increased the mean MRB larvae level. A possible explanation for this difference could be that in experiment one, the Lorsban was washed into the soil with solid set irrigation just one day after being applied while in experiment two there was no rain or irrigation for at least six days after the Lorsban application. It is possible that the Lorsban was slightly effective in experiment one when irrigation occurred one day after the application, while in experiment two it was totally ineffective because it was not watered for six days.

All rates of Altacor provided significantly more control of the MRB larvae than the untreated check; however not all the treatments lowered the MRB levels below the treatment threshold. In both experiments, the rate of 1 oz/ac Altacor did not lower the MRB level below one per sq. ft. In addition the 3 oz/ac rate, in experiment two did not lower the MRB level below the treatment threshold either. There is a clear trend in experiment one that shows a decreasing amount of MRB control with decreasing the rate of Altacor. The same trend occurs in experiment two except for the 3 oz/ac rate of Altacor provided less control than the 2 oz/ac rate. This is unusual but is most likely caused by variation in the MRB population.

There were no apparent differences in the total amount of control of the MRB larvae between the two types of soil.

No phytotoxicity was observed on any mint plants at anytime.

**Table 1. Experiments on and two**

Results of field efficacy trials for mint root borer larvae control in sprinkle irrigated by applying Altacor 35 WDG before overhead irrigating

| | | Experiment 1<br>40 DAT | Experiment 2<br>39 DAT |
|---|---|---|---|
| Treatment | Rate<br>(lb ai/a) | Mean number live mint root borers per $ft^2$.* | Mean number live mint root borers per $ft^2$.* |
| UTC | | 10.7 c | 10.7 c |
| Lorsban (2 qt/a) | 2.0 | 8.7 c | 13.3 c |
| Altacor 35 WDG 4 oz/a | 0.088 | 0.2 a | 0.3 a |
| Altacor 35 WDG (3 oz/a) | 0.066 | 0.6 a | 1.5 ab |
| Altacor 35 WDG (2 oz/a) | 0.044 | 1.4 a | 0.9 ab |
| Altacor 35 WDG (1 oz/a) | 0.022 | 4.2 b | 3.6 b |

Sample means were compared with Fisher's Protected LSD ($p=0.05$). Means with the same letter are not significantly different (Petersen 1985).

Experiment 1: LSD = 2.3, $p<0.05$

Experiment 2: LSD = 3.3, $p<0.05$

* Includes live mint root borer larvae found in the rhizomes, soil and hibernaculum.

Secton V.
Soil Arthropods

# Efficacy of Altacor® 35 WDG, (chlorantraniliprole) for Control of Mint Root Borer Larvae (*Fumibotys fumalis*) in Furrow Irrigated Peppermint located in Idaho

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**ABSTRACT**
In the furrow irrigated mint experiments the Lorsban application appeared to control some of the mint Root borer larvae but did not lower the levels below the treatment threshold. Mid to late August, broadcast applications of 4 oz/ac Altacor 35 WDG® were highly effective when rain of over 0.25 inch washed the Altacor in to the soil in late August. Early September applications of 4oz/ac Altacor 35 WDG were only partly effective in controlling the Mint Root borer larvae. The treatments that knifed 4oz/ac Altacor35 WDG into the soil in mid to late August, after the first irrigation, were not effective in controlling the Mint Root borer larvae.

**OBJECTIVE:** Control of mint root borer larvae in furrow irrigated mint
Using Altacor® 35WDG and Lorsban

**MATERIALS AND METHODS**
Two nearly identical experiments were conduced for this first objective. Both were located in harvested, 2nd year, furrow irrigated, production peppermint fields infested with natural populations of MRB larvae. The first experiment was located in the Nampa area, and the second was located in the Wilder area. All experimental plots were 12 ft by 20 ft, arranged in a randomized block design, with six replications. Evaluations were made by taking six, 0.75-$ft^2$ soil / rhizome samples in each plot. The samples were taken to the depth of the rhizomes which averaged four inches deep. Samples were taken in narrow strips that went across the full width of the row. The row width for both experiments was 30 inches.
The soil was shaken off the mint rhizomes and sifted though a 0.25" screen while the rhizomes were placed in Berlese funnels until dry. The number of MRB larvae recovered from soil sifting was combined with that from Berlese funnel extraction and recorded. Both fields that these experiments were placed in were swathed approximately August 9, 2007.
In experiment one the grower corrugated the field after harvest but before the first post-harvest irrigation. This corrugation cleaned out the furrows or small ditches that irrigate the mint, using small shovels attached to a three point hitch tool bar. This implement scraped the soil out of the

furrows and scattered it onto the rows containing the mint plants. Experiment two was not corrugated after harvest by the grower, but for treatment three only; corrugation was done by hand shoveling the soil out of the furrow and scattering it on the rows in the plot area.

**Experiment 1**

The following post-harvest treatments were applied: (1) untreated check, (2) Lorsban 4E 2 qt/ac (2 lb ai/ac) broadcast applied before corrugating and irrigating for the first time after harvest, (3) Altacor 35 WDG broadcast applied at 4 oz/ac (0.087 lb ai/a) before corrugating and irrigating for the first time after harvest, (4) Altacor 35 WDG at 4 oz/ac (0.087 lb ai/ac) broadcast applied after corrugating and irrigating for the first time, (5) Altacor 35 WDG 4 oz/ac knifed in each side of the row, after the first irrigation. (6) Altacor 35 WDG 4 oz/ac knifed in the center of the furrow after the first irrigation, (7) Altacor 35 WDG 4 oz/ac broadcast applied with 4 qt. /ac crop oil (Herbimax) at a later date than all the other treatments (see table one for timeline of events). Treatments two three, four and seven were broadcast applied with a $CO^2$ powered backpack sprayer. A four nozzle boom was used with 80003XR flat fan nozzles at 15 PSI in 20 GPA water. Treatments two and three were applied on August 11, before the field was corrugated and furrow irrigated. Treatments four five, and six, were applied after the field had been irrigated at least once. Treatment four was applied on August 23 and treatments five and six were applied on August 25. Treatments five and six were applied by knifing 4 oz/ac of Altacor into the soil 3 to 4 inches deep with the knife cuts being placed approximately 4.5 inches on each side of the center of the furrow giving a spacing of 21 inches between the knife cuts in the row, The Altacor was mixed with water and pressurized with $CO^2$ gas. For treatment five the Altacor was knifed in with 55 gallons of water per acre, and for treatment six the Altacor was knifed in with 22.2 gallons of water per acre. The injection was done with a knife that had a spray nozzle attached to the end. The knife was placed behind a straight coulter with the knife and coulter being mounted on a four wheel cart that was pushed by hand. The coulter cut the soil and stubble and allowed the injector knife to pass thought the soil with minimal soil disturbance. Treatment seven was broadcast applied September 5. All treatments had the water acidified to a pH of approximately 5.5. No other surfactant or adjuvant was added to treatments two through six. Treatment seven had 4 qt/ac of crop oil added to it in an attempt to get the Altacor to be taken up by the mint foliage.

On August 31 it rained approximately 0.25 to 0.5 inch. This rain apparently washed the Altacor into the soil from treatments two and three. On September 24 it rained over 1 inch and this second rain apparently washed treatment seven into the soil. It rained again on October 19 approximately 0.3 inch.

**Experiment 2**

The same post-harvest treatments were made in experiment two as in experiment one

The field containing this experiment did not have the furrows corrugated (cleaned out) after harvest however, for treatment number three only, corrugation was done by hand. This

corrugation was accomplished by shoveling soil out of the furrow, by hand, and scattering it on the row. The attempt was to simulate the corrugation that was done in experiment one.

## RESULTS AND DISCUSSION

### Experiment 1

Treatment two (2 qt/ac Lorsban) which was applied to dry soil and then had the furrows corrugated and irrigated within two days, slightly lowered the MRB levels but not significantly compared to the untreated check (table 1). The two early broadcast applications of Altacor (treatments three and four) provided nearly complete control of the MRB larvae and were very significant compared to the untreated check.

Treatment number seven (Sept. 5 application of 4 oz/ac Altacor) lowered the MRB level but did not significantly reduce it compared to the untreated check. Treatment seven was applied on September 5 when the MRB larvae should have been active, but the Altacor was not washed into the soil until September 24. Even after the Altacor was washed into the soil it had to be taken up by the plants. At this time of the year the plants were growing slower and may have taken up the Altacor at a slower rate. In addition, by September 24, some of the MRB could have stopped feeding and started to form a hibernaculum.

Treatment five was not significantly lower than the untreated check and the MRB levels were significantly higher than the untreated check for treatment six. This unusual result could be caused by variation in the MRB population.

Knifing the Altacor into the soil was clearly not effective in controlling the MRB larvae.

No phytotoxicity was observed on the mint plants at anytime from any treatment.

**Table 1** Experiment one

Results of field efficacy trials for mint root borer larvae control in furrow irrigated mint with Altacor® 35 WDG and Lorsban (Evaluated October 19, 2007)

| Treatment number | Treatments | Rate (lb ai/a) | Application time | Mean number live mint root borers per $ft^2$.* |
|---|---|---|---|---|
| 1 | UTC | | | 2.1 c |
| 2 | Lorsban | 2.0 | 8/11 | 1.8 bc |
| 3 | Broadcast application of Altacor / corrugate | 0.087 | 8/11 | 0.1 a |
| 4 | Broadcast Altacor | 0.087 | 8/23 | 0.1a |
| 5 | Knife in Altacor on sides of row | 0.087 | 8/25 | 2.4 c |
| 6 | Knife in Altacor in furrow | 0.087 | 8/25 | 5.8 d |
| 7 | Broadcast Altacor | 0.087 | 9/5 | 1.4 abc |

Experiment 1: LSD = 1.31, $p<0.05$

* Includes live mint root borer larvae found in the rhizomes, soil and hibernaculum.

**Experiment 2**

Applying 2 qt/ac Lorsban to dry soil after the first irrigation did significantly reduce the MRB larvae levels compared to the untreated check; however it did not lower the levels below the treatment threshold of 1 per. $ft^2$ (table 2) All three of the treatments of broadcast applied 4 oz/ac Altacor significantly lowered the MRB larvae level below the untreated check level but only one of the treatments lowered the MRB larvae level below the treatment threshold of one MRB larvae per sq. ft. Treatment number three had the Altacor broadcast applied and then hand corrugated immediately. Treatment number four was applied in the same way and on the same day but did not have the soil scattered onto the row. Although the treatment that had the hand corrugation provided the most control of the MRB larvae, all of the broadcast applications of Altacor had statistically similar results. The late broadcast application of Altacor (September 5 application) did not lower the MRB larvae level below the treatment threshold but this may be due to the late application date, and a later rain event, as explained in experiment one.

The two treatments that had the Altacor knifed into the soil did not provide significantly more control of the MRB larvae than the untreated check.

No phytotoxicity was observed on the mint plants at anytime from any treatment.

**Table 2.** Experiment two

Results of field efficacy trials for mint root borer larvae control in furrow irrigated mint with Altacor® 35 WDG and Lorsban. (Evaluated October 24, 2007)

| Treatment number | Treatments | Rate (lb ai/a) | Application time | Mean number live mint root borers per $ft^2$.* |
|---|---|---|---|---|
| 1 | UTC | | | 4.2 c |
| 2 | Lorsban | 2.0 | 8/21 | 2.8 b |
| 3 | Broadcast application of Altacor / corrugate | 0.087 | 8/21 | 0.7 a |
| 4 | Broadcast Altacor | 0.087 | 8/21 | 1.4 a |
| 5 | Knife in Altacor on sides of row | 0.087 | 8/21 | 3.0 c |
| 6 | Knife in Altacor in furrow | 0.087 | 8/21 | 4.4 c |
| 7 | Broadcast Altacor | 0.087 | 9/5 | 1.3 a |

Experiment 2, LSD = 1.12, $p<0.05$

* Includes live mint root borer larvae found in the rhizomes, soil and hibernaculum.

Section V
Soil Arthropods

## CLAY COLORED ROOT WEEVIL CONTROL ON RED RASPBERRY, 2007

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**Clay colored root weevil, *Otiorhynchus singularus* (L.).** Clay colored weevils (CCW) were collected from the Lynden area on 'Meeker' red raspberry in mid-May, 2007. Individual red raspberry trifoliate leaves were placed in water-filled vials capped with a cotton roll plug. Each treatment consisted of 25 weevils placed on 5 individual leaf arenas held in 5 inch diameter Petri dishes held at room temperature. These leaf arenas were each dipped in respective deionized water-insecticide solutions for approximately 4 seconds and air dried for a couple of hours (Table 1). After 4 days Capture™ (bifenthrin) and Malathion provided complete mortality of CCW through contact and ingestion under lab conditions. Under these ideal lab conditions, the results provided no evidence for the onset of resistance to Capture as suggested from last year's results from a field population collected at the same location. Though the knockdown for the high rate of 4 oz/acre for Actara™ (thiamethoxam) was intermediate after 4 days posttreatment, cessation of feeding, metabolic stress and uncoordinated movements results in prolonged morbidity and death beyond 4 days. These post exposure responses are similar for the other species of root weevils when exposed to Actara. Though the target site of Capture differs from the neonicotinoids, population mortality upon exposure often is variably prolonged for 3-5 days as well in adult root weevils.

Table 1.

| | | Percent Mortality | | | |
|---|---|---|---|---|---|
| Treatment | lb(AI)/acre | 1DAT | 2DAT | 3DAT | 4DAT |
| Actara 25WG | 0.06 | 44ab | 52b | 60bc | 64b |
| Capture 2EC | 0.10 | 46ab | 64ab | 80ab | 100a |
| Malathion 8EC | 2.00 | 72a | 88a | 92a | 100a |
| Success 2SC | 0.09 | 34b | 38b | 38c | 40c |
| Untreated check | | 0c | 0c | 0d | 0d |

Mean within columns followed by the same letter are not significantly different (Fisher's protected LSD, $P<0.05$), PRC ANOVA SAS.

Other than spotty clay colored weevil infestations in the north Lynden area, the black vine, strawberry and rough strawberry root weevils were generally economically managed throughout the Whatcom county red raspberry growing regions. These empirical observations suggested the root weevil complex still remains highly susceptible to Brigade/Capture and Malathion, especially if timed for evening application when the adults are known to be actively feeding during their pre-egg laying period.

Section V Soil Arthropods

# MAGGOT CONTROL IN CARROT AND ONION

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Seedcorn maggot (SCM) *Delia platura* can significantly reduce field stand establishment in several crops in the Columbia Basin. Seed treatments were tested with several insecticides for control of SCM in carrot and onion.

The trial on carrots was established on 30 April 2007 near Alderdale, Washington State USA. For the carrot trial, seeds were planted by the grower in a complete random block design using a commercial vacuum planter. The number of carrot seedlings in ten 1 meter segments per plot was counted on 23 May and June 8 2007 to evaluate efficacy. A significant increase in seedling stand was achieved in the plots where the seed was treated with Entrust (spinosad) and in the plots where Diazinon was applied over the top compared to the untreated seeds (Figure 1).

| Treatment | Rate | Seedlings per meter +/- SE | |
|---|---|---|---|
| | | 24 May | 8 June |
| Entrust (spinosad) | 50 g. ai/A | 61.6 +/- 2.4* | 63.3 +/- 1.6* |
| Diazinon | 2 lbs. ai/A | 60.3 +/- 2.8* | 65.6 +/- 1.6* |
| Untreated Check | NA | 50.5 +/- 3.9 | 50.0 +/- 2.4 |

Figure 1. Carrot seed stand establishment with different treatments. * Denotes treatments with significantly more seedlings per meter in a pair-wise t-test compared to the untreated check ($p<0.05$)

The trial on onions was established on 30 April 2007 near Alderdale, Washington State USA. For the onion trial, seeds were planted using a Graymore push planter in a complete random block design with four replications. Seeds from ten different seed pelleting companies with three different insecticide treatments including Entrust (spinosad), Mundial (fipronil), and Poncho (clothianidin) were evaluated. The number of onion seedlings in three 1 meter segments per plot was counted on 23 May and June 8 2007 to evaluate efficacy. Maggot pressure was extremely high at the test site and results provided no statistically significant differences comparing the untreated check to the different seed treatments.

| Company | Treatment | Stand per meter ± SE 5/23/07 | 6/8/07 |
|---|---|---|---|
| Agricoat | Entrust | 8.75±0.48 | 9.00±0.82 |
| Agricoat | Mundial | 7.75±0.63 | 7.50±0.65 |
| Agricoat | Poncho | 9.25±1.44 | 8.75±3.01 |
| Eastern Seed Services | Entrust | 8.25±1.32 | 8.00±1.47 |
| Eastern Seed Services | Mundial | 6.25±2.14 | 9.75±1.38 |
| Eastern Seed Services | Poncho | 2.50±1.56 | 4.00±1.41 |
| GTG | Entrust | 9.75±0.95 | 8.75±0.25 |
| GTG | Mundial | 4.50±2.72 | 6.00±2.12 |
| GTG | Poncho | 7.25±2.29 | 7.25±1.65 |
| Inotec | Entrust | 10.25±1.80 | 9.75±1.44 |
| Inotec | Mundial | 14.75±1.32 | 13.25±1.25 |
| Inotec | Non-treated | 7.25±2.39 | 5.00±2.04 |
| Inotec | Poncho | 12.25±1.65 | 13.00±0.71 |
| Inotec | Trigard | 7.00±1.08 | 6.00±2.35 |
| Kamterer | Entrust | 5.75±1.80 | 5.00±1.73 |
| Kamterer | Mundial | 6.75±1.10 | 7.00±1.23 |
| Kamterer | Poncho | 9.25±2.46 | 9.25±2.84 |
| Nunhems | Entrust | 12.00±0.91 | 11.75±0.95 |
| Nunhems | Mundial | 11.50±1.56 | 7.75±1.44 |
| Nunhems | Poncho | 15.75±1.10 | 11.25±2.66 |
| Seed Dynamics | Entrust | 9.00±0.58 | 9.75±1.32 |
| Seed Dynamics | Mundial | 8.50±1.85 | 7.75±1.11 |
| Seed Dynamics | Poncho | 11.00±1.58 | 8.25±1.49 |
| Seminis | Entrust | 10.75±1.32 | 9.75±1.32 |
| Seminis | Mundial | 7.25±3.04 | 9.00±1.58 |
| Seminis | Poncho | 7.25±2.40 | 9.50±1.89 |
| Seteco | Entrust | 5.50±2.10 | 4.50±2.40 |
| Seteco | Mundial | 7.50±1.66 | 10.00±2.04 |
| Seteco | Poncho | 12.75±1.38 | 9.50±1.85 |
| Skagit Seed Services | Entrust | 5.50±2.66 | 4.75±1.97 |
| Skagit Seed Services | Mundial | 8.50±3.01 | 6.50±1.85 |
| Skagit Seed Services | Poncho | 9.50±2.02 | 7.25±2.56 |

Figure 2. Onion seed stand establishment with different treatments. * Denotes treatments with significantly more seedlings per meter in a pair-wise t-test compared to the untreated check ($p<0.05$)

# SECTION VI

## VECTORS OF PLANT PATHOGENS

**SECTION LEADER**

**JOE DEFRANCESCO**

Section VI.
Vectors of Plant Pathogens

## Wheat Streak Mosaic Virus Management

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Wheat Streak Mosaic Virus (also High Plains Disease of Sweet Corn) is vectored by an Eriophyidae mite, *Aceria tosciella* Keifer, known as the Wheat Leaf Curl Mite. The host range has been well researched by University of Kentucky Entomologists since 1987. Many cereal/grass species are potential host for this mite disease complex. A recent appearance of WSM and HPD in Washington State in recent months indicates an elimination of the brown period between cereal crops. A simple management strategy is to make a crop free period between cereal crops expressing economic injury from the virus. For example in counties where vibrant crop presence is required over the winter make sure the harvested crop is brown for at least 2 weeks before fall seed emergence occurs. Do not over winter green fallow. Make sure that spring wheat or seeding of sweet corn is done after winter fallow volunteers are removed by herbicides or tillage. Rotation to non cereal crops may help in done regionally. Research on HPD Resistant sweet corn varieties is being done. No wheat resistance is available at this time.

Section VI.
Vectors of Plant Pathogens

## Management of PVY and Vectors in Idaho Potatoes

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*Potato Virus Y* (PVY including strains O and all new N variants) is the most economically important virus affecting potato production in the US and causes severe economic losses to seed and commercial potato growers in North America. Increasing levels of PVY infection have been observed in the Pacific Northwest (PNW) potato fields in spite of the use of high-grade, virus-free planting material. PVY can be transmitted in a non-persistent manner by at least 50 different species of aphids. Since acquisition and inoculation occur in minutes following epidermal probes by the aphid, vectors do not need to colonize potatoes to transmit PVY. Some growers in the PNW claim that they can manage PVY by controlling aphids with insecticides. Because of the virus-transmission mode, it is difficult to believe that insecticide applications for aphid control would effectively decrease the disease transmission. Therefore, we conducted an insecticide efficacy trial at the University of Idaho Kimberly R&E Center to test whether the disease incidence could be reduced with insecticide applications. Eleven insecticide treatments were evaluated. Potato leafroll virus infection was also evaluated. The lowest cumulative number of aphids during the 12 weeks of sampling was present in the SPT/Provado treatment. This treatment was especially efficient at eliminating green peach aphids during the week of the highest peak of aphids (July 17). Four other treatments had low cumulative numbers of green peach aphids: Monitor, SPT/Provado/Baythroid, Fulfill, and Platinum. None of the insecticides seem to prevent transmission of PVY. Combination of SPT with Provado resulted in less PLRV-infection than in combination with Bathyroid. SPT, Fulfill, Vydate, and Platinum kept the PLRV infection at 0% in the last sampling. The highest yield was produced in the Monitor treatment and the lowest in the untreated control. Also, winter tests on harvested tubers will be conducted early in 2008.

# SECTION VII

## FOLIAGE & SEED FEEDING PESTS

**SECTION LEADER**

**LARRY WRIGHT**

Section VII
Foliage and seed-feeding pests

# BIOLOGY AND CONTROL OF THE HOP LOOPER (*HYPENA HUMULI*)

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## Introduction

Hop looper (*Hypena humuli* (Harris)) is a Noctuid moth widely distributed across the continental USA and Canada. It appears to be restricted to hops and stinging nettles (*Urtica* spp.), which are its only recorded host plants. It was first reported as a pest of hops in the late 1800s, but has generally been regarded as a relatively minor and sporadic problem. However, recently it has become a more frequent and damaging pest, probably as a result of the gradual shift away from broad-spectrum organophosphate compounds for the routine control of aphids and mites to more selective products that provide no incidental control of loopers. As a first step toward developing an integrated management strategy for hop looper, the following studies were conducted to clarify the basic life history and phenology of *H. humuli* and its natural enemies, and to test the efficacy of two commercial formulations of the bacterial larvicide *Bacillus thuringiensis*.

## Materials and Methods

### 1. Life history and phenology

The seasonal phenology of the looper was determined in a variety of ways from 2005 to 2007 in the vicinity of Prosser, WA. Each year, the flight activity of adult loopers was followed from late March to the end of October by means of either two (2007) or three (2005 and 2006) walk-in light traps, which were checked and emptied three times per week. Seasonal oviposition patterns (and incidence of egg parasitism) were determined by taking random samples of 50 leaves per week throughout each growing season from each of two unsprayed hop yards. Larval development patterns and number of generations were investigated by collecting weekly samples of larvae (40-60 each week from each of two hop yards). The larvae were sorted by instar (based on head capsule measurements) and reared in a temperature-controlled cabinet at 26 °C (15 hr photoperiod) until all pupated or died. Any parasitoids emerging from dead larvae or pupae were recorded and identified.

### 2. Impact of predation

Exclusion cage studies were conducted to determine the net impact on looper larvae of various natural enemies (including birds). Eggs were obtained from captive adult loopers, and 50 newly-

hatched larvae were placed on individual potted hop plants assigned to one of three treatments. In each experiment, five plants were left uncaged (exposed to all potential predators), five were caged with mesh large enough to admit insect predators (but exclude birds), and five were caged with very fine mesh (to exclude all predators). The experiments were conducted next to an unsprayed hop yard to ensure adequate exposure to natural enemies. After 18 days, any surviving larvae were counted and reared to adulthood to determine if any had been parasitized. The data were analyzed by one-way ANOVA and means separated by Tukey's test.

**3. Efficacy of the bacterial pesticide *Bacillus thuringiensis***

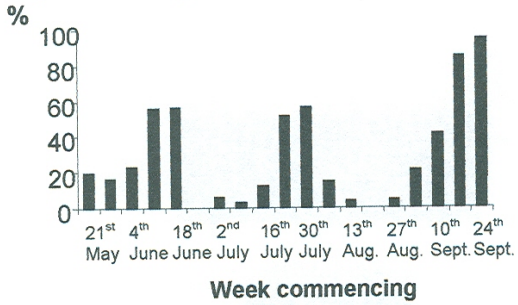
Towards the end of the season, there is considerable overlap between successive generations of loopers, so that in the final (most damaging) generation, virtually all stages of larvae may be present together, making it difficult for growers to target insecticide treatments against the smaller, more vulnerable stages. For an integrated control program, a lepidopteran-specific pesticide such as *Bacillus thuringiensis* ('Bt') would be the product of choice. However, some growers have expressed concerns that Bt products may not be effective against the larger larvae that are inevitably present when treatment is required. A trial was therefore conducted in August, 2007, to test the efficacy of two strains of Bt (*Bacillus thuringiensis* subsp. *aizawai* Strain ABTS-1857 (marketed as XenTari®) and *Bacillus thuringiensis* subsp. *kurstaki* Strain ABTS-351 (marketed as Dipel®)(both from Valent Corporation) against the final generation of hop looper larvae. XenTari® was applied at three rates (0.5, 1.0 and 2.0 lbs/acre (representing the label range for hop loopers)), while Dipel® was applied at the label rate of 1.0 lb/acre. Bifenthrin (Capture®, at 6.4 oz/acre) and water were included as positive and negative controls, respectively. All treatments were applied with a backpack sprayer at 10 psi. The trial was conducted using a randomized complete block design with four replications and larval density as the blocking factor. Larval numbers were assessed by beating tray samples (two per plot) both before treatment and 7 days after treatment. At the time of application, 22% of the looper population consisted of large ($4^{th}$ and $5^{th}$ instar) larvae. The data were analyzed by means of Kruskal-Wallis non-parametric ANOVA followed by Dunn's post test.

**Results**

**1. Life history and phenology**

Contrary to previous reports, the hop looper appears to complete three generations per year (rather than two), with the final generation being the most numerous and most damaging. Overwintered adult moths first appear in the hop yards at the beginning of April while adults of the final generation may be actively flying well into October. Oviposition patterns and larval instar distribution clearly indicated the occurrence of three generations (e.g. Fig. 1).

Fig. 1 Percentage of larvae in final instar (2007)



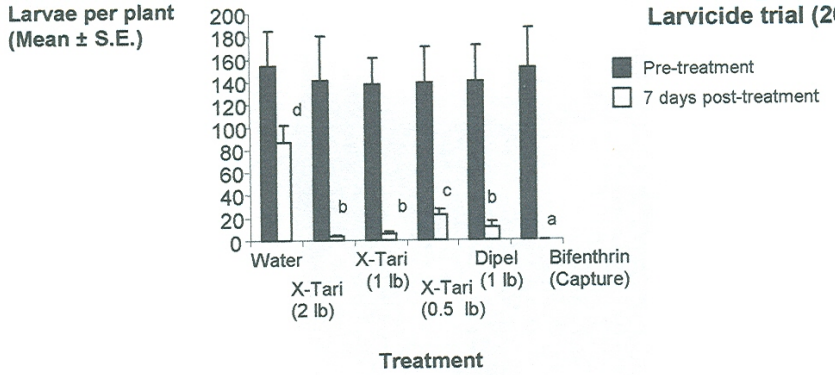

## 2. Impact of Predation

Exclusion cage studies conducted from 2005 to 2007 consistently showed a highly significant difference between treatments (e.g. 2006: $F_{2,12}$=34.41, P<0.001), with survivorship being significantly higher in the cages that excluded all predators ('total exclusion' cages)(2006: mean no. of larvae surviving: 35.0 ± 3.7) than in either the bird mesh cages (mean no. surviving: 10.2 ± 3.0) or open treatments (mean no. surviving: 3.6 ± 1.1). In general, predation seems to be a much more important mortality factor than is parasitism, with the most abundant larval parasitoid (a tachinid fly) rarely parasitizing more than 20% of larvae in any one week.

## 3. Efficacy of the bacterial pesticide *Bacillus thuringiensis*

Statistically, bifenthrin produced the highest level of mortality, but XenTari® at the two highest rates (2 and 1 lb/acre) also provided good control with the added benefit of preserving important natural enemies of both the hop looper and other pests of hops such as mites and aphids. The level of control provided by the lowest rate of XenTari® (0.5 lb/acre) was probably not sufficient to satisfy growers, while Dipel® at 1 lb/acre gave results intermediate between the lowest rate of XenTari® and the two higher rates (Fig. 2). (N.B. Larval populations are shown as means (for ease of interpretation), although the statistical tests shown are based on medians.)

Fig. 2
Larvicide trial (2007)



Section VII
Foliage & Seed Feeding Pests

## WESTERN RASPBERRY FRUITWORM ON RED RASPBERRY, 2007

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**Western raspberry fruitworm, *Byturus unicolor* Say.** Two neonicotinoids, Provado™ 1.6F (imidacloprid) and experimental Assail™ 30SG (acetamiprid) were compared with our Diazinon standard for efficacy and labeling/registration to control the adult western raspberry fruitworm. Residual leaf dip bioassays were conducted using raspberry florets whose stems were inserted into water-filled vials, plugged with cotton. Florets were dipped in respective deionized water-insecticide solutions for approximately 4 seconds, air dried and placed in 5 inch diameter Petri dishes. Each treatment was replicated four times. Four adult western raspberry fruitworm adults collected in mid-June, were placed into each arena and maintained at room temperature. Adult mortality was assessed every 24 hours (Table 1). Within 24 hours, 100% mortality was observed for the Diazinon standard. No significant differences were observed between the neonicotinoids Assail 30SG and Provado 1.6F and that of the standard, Diazinon. Similar results were reported from earlier performed lab and field-tests using Actara™ (thiamethoxam), another neonicotinoid. We conclude, that multiple insecticides currently labeled for caneberries, effectively control western raspberry fruitworm.

Table 1. Adult western raspberry fruitworm bioassay, 2007.

| | | Percent Mortality | | |
|---|---|---|---|---|
| Treatment | lb(AI)/acre | 1DAT | 2DAT | 3DAT |
| Assail 30SG | 0.09 | 66.6b | 95.8a | 95.8a |
| Assail 30SG | 0.10 | 83.3ab | 100a | |
| Provado 1.6F | 0.05 | 87.5a | 91.7a | 95.8a |
| Diazinon 4E | 1.00 | 100a | | |
| Untreated check | | 7.5c | 15.8b | 24.2b |

Mean within columns followed by the same letter are not significantly different (Fisher's protected LSD, $P<0.05$), PRC ANOVA SAS.

# THRIPS CONTROL ON DRY BULB ONIONS

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Onion thrips *Thrips tabaci* Lindeman are the key pest for dry bulb onion production in Washington State. Trials were conducted at two different locations during the 2007 growing season each implementing a complete random block design with four replicates. Plots were evaluated for efficacy by counting the number of adult and immature thrips on the central onion leaf.

Broadcast spray plots were two double rows wide and twenty feet long. Applications were made with a $C0_2$ backpack sprayer applying 30 gallons per acre water at 30 psi. The trail was conducted on 18 June 2007 in Othello, Washington State in a yellow onion field grown under rill irrigation. Data were subjected to ANOVA and means were separated from the untreated check using Fisher's PLSD ($p<0.05$). None of the chemistries tested provided thrips control that was significantly different from the untreated check. Thrips abundance was reduced the greatest in the Lannate and Carzol treatments (Figure 1). Trends in the data will be discussed during the oral presentation.

The second trial was conducted three times throughout the growing season in Othello, Washington State in a yellow onion field under drip irrigation. The products were applied through the drip irrigation system using a piston powered pump to inject the pesticide. Applications were made on 14 June, 25 June, and 8 July 2007. Data were subjected to ANOVA and means were separated from the untreated check using Fisher's PLSD ($p<0.05$). In the first and second applications of the treatments, none of the chemistries tested provided thrips control that was significantly different from the untreated check (Figure 2). For the third application, the Lannate treatment provided a level of control that was significantly better than the untreated check (Figure 2). Other trends in the data will be discussed during the oral presentation.

| Treatment and Rate | Mean +/- St Dev |
|---|---|
| Untreated Check | 57.00 +/- 27.66 |
| Agrimek 1 pint/A | 39.25 +/- 15.80 |
| Assail 30SG 5 oz/A | 58.00 +/- 17.09 |
| Aza-DIRECT 1.2 EC 24 oz./A | 58.38 +/- 27.80 |
| Carzol 1 lb/ A | 36.25 +/- 19.60 |
| Carzol 1.25 lb/ A | 37.00 +/- 12.94 |
| Champ 1.5 liters/A | 70.50 +/- 46.03 |
| GF 1587 XDE175 12 oz./A | 47.00 +/- 17.47 |
| Hachihachi 14 oz/A | 65.00 +/- 25.92 |
| Hachihachi 24 oz/A | 72.50 +/- 26.08 |
| Lannate LV 3.0 pts/A | 26.75 +/- 4.72 |
| Movento 240 SC 5 oz/A MSO | 89.75 +/- 22.95 |
| Movento 240 SC 5 oz/A NIS | 62.50 +/- 11.56 |
| Movento 240 SC 8 oz/A | 77.25 +/- 32.77 |
| QRD 400 25 EC 1 qt/A | 70.75 +/- 39.38 |
| QRD 400 25 EC 2 qts/A | 62.75 +/- 35.89 |
| QRD 400 25 EC 3 qts/A | 42.75 +/- 9.46 |
| Success 6 fl. Oz/A | 40.75 +/- 5.19 |
| V-10170 50WG 1 oz/A | 112.50+/- 145.46 |
| V-10170 50WG 2 oz/A | 45.75 +/- 12.84 |
| V-10170 50WG 3 oz/A | 51.75 +/- 33.82 |
| Venom 70SG 4 oz/A | 79.75 +/- 36.40 |

Figure 1. Thrips counts 6 days post treatment. * Denotes treatments with significantly fewer thrips in a pair-wise t-test compared to the untreated check ($p<0.05$).

| Treatment and Rate | Application | Days Post treatment | Mean +/- St Dev |
|---|---|---|---|
| Untreated Check | First | 8 | 43.17 +/- 22.17 |
| Aza-Direct 24 oz./A | First | 8 | 42.17 +/- 17.42 |
| Aza-Direct 48 oz./A | First | 8 | 40.17 +/- 22.11 |
| Lannate 3 pints/A | First | 8 | 27.33 +/- 11.72 |
| Vydate 2 qts./A | First | 8 | 35.92 +/- 15.62 |
| Untreated Check | Second | 8 | 116.63 +/- 24.92 |
| Aza-Direct 24 oz./A | Second | 8 | 115.67 +/- 23.28 |
| Aza-Direct 48 oz./A | Second | 8 | 101.00 +/- 24.70 |
| Lannate 3 pints/A | Second | 8 | 69.25 +/- 20.78 |
| Vydate 2 qts./A | Second | 8 | 84.42 +/- 29.27 |
| Untreated Check | Third | 10 | 239.83 +/- 47.13 |
| Aza-Direct 24 oz./A | Third | 10 | 265.83 +/- 34.31 |
| Aza-Direct 48 oz./A | Third | 10 | 229.00 +/- 57.78 |
| Lannate 3 pints/A | Third | 10 | 112.17 +/- 17.26* |
| Vydate 2 qts./A | Third | 10 | 187.08 +/- 23.32 |

Figure 2. Thrips counts. * Denotes treatments with significantly fewer thrips in a pair-wise t-test compared to the untreated check ($p<0.05$).

Section VII
Foliage & Seed Feeding Pests

# IDENTIFICATION OF CUTWORMS ON GRAPEVINES AND A FIELD TRIAL OF SYNTHETIC *ABAGROTIS ORBIS* PHEROMONE

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Cutworms feed on grape buds at night during the spring causing a reduction in yield. In a previous study, 1% to 5% bud loss resulted in economic damage to Concord grape. The spotted cutworm, *Xestia c-nigrum* (L.), and the redbacked cutworm, *Euxoa ochrogaster* (Guenee) were believed to be the most important cutworms causing damage to grapes. In 2003 and 2004, we sampled vineyard floors to determine the cutworm species present in south central Washington vineyards. We began sampling vines during the night in 2004 to determine the species that were actually on the vines. This work continued through 2007. The results of the nocturnal sampling are reported here.

We identified a pheromone produced by *Abagrotis orbis* (Grote), a cutworm found feeding on grape, and tested the pheromone in a field trial.

## Materials and Methods

**Cutworm identification.** Sampling during the four years of the study started and ended on the following dates: 7 April to 20 April 2004, 7 March to 27 April 2005, 27 March to 3 May 2006, and 13 March to 25 April 2007. The number of vineyard samples (many vineyards were sampled more than once within a year) per year were: 5 in 2004, 51 in 2005, 36 in 2006, and 34 in 2007. Sampling was centered on the Yakima Valley but vineyards were also sampled in the grape-growing regions near Walla Walla in the east, Paterson in the south, and Mattawa to the north. Sampling started about an hour after sundown. Each vineyard was searched for one person-hour using flashlights. Cutworms were collected and taken to the lab for rearing. Cutworms are difficult or impossible to identify as larvae, so they must be reared to adults. They were reared in 135 ml plastic cups with about 2 cm coconut fiber (Coco Life Brik, Coconut Palm Resources, Inc. Hillsboro, Oregon) and a piece of artificial diet (Multiple Species Diet, Southland Products Inc., Lake Village, AR). Nylon screen covered the cups. The temperature was 27°C with 24 h light. The adult moths were pinned and identified using published descriptions and comparisons with identified specimens.

**Pheromone trial.** Four wine grape vineyards were selected for the study: BD, 2 mi S of Richland; EE, 7 mi NE of Prosser; HQ, 4 mi NE of Prosser; and PA, 3 mi N of Paterson. One Universal Moth Trap (Great

Lakes IPM, Inc. Vestaburg, MI) baited with synthetic *Abagrotis orbis* pheromone and a toxicant strip (Vaportape II, Hercon Laboratories Corp. Emigsville, PA) was hung from the upper trellis wire in each vineyard. The traps were deployed on 13 and 14 April 2006. The trap catches were removed weekly and taken to the lab for counting and identification. The pheromone lures and toxicant strips were replaced monthly. Trapping ended on 29 Oct 2006.

## Results and Discussion

**Cutworm identification.** A total of 563 cutworms were collected in the four years of the study, 444 (78.9%) were reared to adults and identified to species, 56 (9.9%) were parasitized (mostly by Hymenoptera); 50 (8.9%) died as larvae (cause unknown); and 18 (3.2%) died as pupae (cause unknown). Almost 90% of the non-parasitized cutworms were reared to the adult stage. Parasitism per year ranged from 4.2% to 14.7%.

Nine cutworm species were found (Table 1). *Abagrotis orbis* [previously known as *A. barnesi* (Benjamin)] was the most common, accounting for almost three-fourths of the cutworms collected. *Agrotis vetusta* Walker was second, making up almost 20% of the cutworms. All the other species together comprised only 6.6 % of the total. *Abagrotis orbis* ranges over most of North America but it has been reported as a pest only in southeastern Washington, southwestern Idaho, southwestern Michigan, northern Indiana, and New York. It prefers sandy soils. Recorded host plants are apple, peach, cherry, cottonwood, serviceberry, boxelder, and grape. The older larvae have dark elongate spots on each segment, one on either side of the dorsal line. The larvae pupated about two weeks after collection and spent about three weeks in the pupal stage followed by adult emergence from mid-April to early June. The adults live through the summer but do not oviposit until mid-September. There is one generation per year.

*Agrotis vetusta* occurs across the United States and probably southern Canada and northern Mexico. It apparently has not been reported to be a pest although the moths can be common. The adult has a common name, 'the old man dart', but the caterpillar does not. *Agrotis vetusta* larvae appeared about two weeks later than *Abagrotis orbis* (Table 1). The mature *Agrotis vetusta* larvae go into diapause that lasts about three months. Pupation occurred in the lab in mid-July. The adults fly in late summer and fall, mate, and lay eggs. The eggs soon hatch, the larvae feed for a few weeks, and overwinter It has one generation per year. The larva doesn't have any prominent markings like the spots on *Abagrotis orbis*, but it does have a series of cream-colored and brownish stripes running from the head to the posterior end. The larvae of the two species easily can be separated by the markings on the head capsules: *Abagrotis orbis* has a network of lines and *Agrotis vetusta* has spots.

*Noctua comes* Hubner was the third most numerous cutworm in our collection but all specimens came from one vineyard over a span of three years. It is a Eurasian species that was first discovered in North America near Vancouver, BC in 1982. A related species, *Noctua pronuba* (L), apparently was first found in Washington in a light trap near Prosser in 2004. We found it feeding on weeds in a vineyard at night, but have not found it on vines.

Only three spotted cutworms and no redbacked cutworms were found. Possibly these species were more numerous in years past (But see the pheromone trial results for *X. c-nigrum* below.) or they were misidentified by earlier workers.

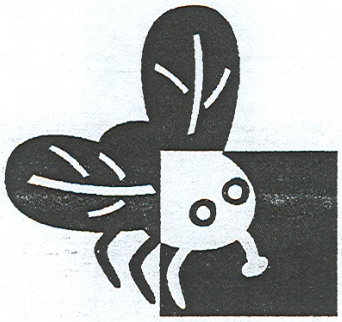
**Pheromone trial.** A total of 70 *Abagrotis orbis* males were caught in the synthetic pheromone traps. The flight period of the moths was from early September to mid October. There was one generation per year. The traps also caught 153 *X. c-nigrum* moths, 169 *Mamestra configurata* Walker (bertha armyworm) adults, and 109 *Feltia jaculifera* Guenée (dingy cutworm) moths. All four species have at least one pheromone component in common. Only males were captured in the traps. Recent work indicates that the pheromone has only one component, which was the one tested here. We plan to continue this work with the long-range goal of developing the pheromone for population monitoring and control.

**Table 1. Species of cutworms found in on grape vines at night, 2004 to 2007.**

| Cutworm Species | Reported Food Plants | Number reared to adult | Percent of total | Earliest and latest Collection dates (all years) |
|---|---|---|---|---|
| *Abagrotis orbis* (=*A. barnesi*) | Fruit trees, grape | 331 | 74.5 | 13 March to 26 April |
| *Agrotis vetusta* | Unknown | 84 | 18.9 | 4 to 26 April |
| *Noctua comes* (introduced) | Foxglove, strawberry, tobacco, grape, weeds | 9 | 2.0 | 13 March to 26 April |
| *Abagrotis reedi* | Willow, cotton-wood, ocean-spray, boxelder | 6 | 1.4 | 13 March to 18 April |
| *Spaelotis clandestina*, W-marked cutworm | Blueberry, maple, pine, beans, cabbage, corn, apple, strawberry | 5 | 1.1 | 13 to 21 April |
| *Xestia c-nigrum* Spotted cutworm | Apple, barley, corn, clover, maple, tobacco | 3 | 0.7 | 11 to 17 April |
| *Euxoa atomaris* | Unknown | 2 | 0.5 | 11 to 13 April |
| *Euxoa messoria,* Darksided cutworm | Trees, herbs, grasses | 2 | 0.5 | 17 March to 13 April |
| *Euxoa olivia* | Strawberry, corn | 2 | 0.5 | 13 to 13 April |

# SECTION VIII

## MITES & SAP SUCKING PESTS



**SECTION LEADER**

**CHRISTOPHER ISHIDA**

# 2007 RESULTS FROM GREEN PEACH APHID TRIALS ON POTATOES IN WASHINGTON

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This trial was established at ADG research station in Eltopia, WA in order to evaluate the efficacy of various insecticides on green peach aphid populations in potatoes. The variety of potato was russet Burbank with plot sizes of 4 (34" centers) rows by 20 feet and four replications for each treatment.

All treatments were applied using CO2 on a spider sprayer with 24 ft booms. Applications were made with 8003VS nozzles at 40 psi and 20 gallons/acre. Equipment speed was 3.2 mph. Two applications were made, the first was on July 5, the second application on July 12.

Aphid evaluations were made by sampling 2 plants per plot, twice a week during the course of the trial. A 17" X 17" beat sheet was used for each evaluation date and the number of winged and wingless aphid were counted.

Ultor (spirotetramat) is a new systemic foliar insecticide registered by Bayer Cropscience. Ultor inhibits lipid synthesis, which causes incomplete molting. Plant leaves absorb Ultor, and once inside the plant tissue the active ingredient is hydrolyzed into the weak acid spirotetramat-enol. This acid moves in the phloem as well as the xylem, although on a more limited basis.

In this trial, all insecticides were statistically better than the untreated check. All insecticides reduced wingless aphid numbers by 50% or more over a 28 day period. All insecticides in this study were statistically similar although some numerical differences existed. Battalion/Dimethoate was the least effective treatment in the trial with over 60% control as opposed to the untreated check. Ultor applied alone, at both rates, was numerically similar to Ultor/Baythroid and Battalion/Provado, all exhibiting better than 75% control compared to the untreated check. Industry standards, Monitor, Fulfill (high rate), and Leverage controlled aphid populations by 80% or better. The trend held true for Provado, also. Interestingly, Nufarm imidacloprid and Etigra imidacloprid were among the better treatments numerically at 88% and 94% control, respectively and were similar to Fulfill (low rate) and Battalion/Provado. The best treatment, in this trial, was Ultor/Provado, which had nearly 100% control as compared to the untreated check.

Efficacy of Foliarly Applied Insecticides on GPA in Potatoes
Ranked by number of wingless aphids

| Trt. No. | Treatment | Rate | 28 day cumulative aphid totals (DAT) wingless | winged |
|---|---|---|---|---|
| 1 | UNTREATED CHECK | | 88.8 a | 134 a |
| 11 | BATTALION/DIMETHOATE | 12 1 fl oz/pt/a | 34.5 b | 143 a |
| 6 | BAYTHROID XL | 2.8 fl oz/a | 25.0 b | 106 a |
| 15 | LEVERAGE | 3.75 fl oz/a | 21.3 b | 119 a |
| 4 | ULTOR | 8 fl oz/a | 20.8 b | 105 a |
| 2 | ULTOR | 6 fl oz/a | 20.5 b | 154 a |
| 16 | BATTALION - PROVADO | 2.8 - 3.8 fl oz/a | 19.0 b | 69 a |
| 8 | ULTOR/BAYTHROID XL | 6/2.8 fl oz/a | 16.5 b | 132 a |
| 3 | MONITOR | 2 pt/a | 13.8 b | 61.3 a |
| 10 | FULFILL | 5.5 oz/a | 10.3 b | 97.5 a |
| 14 | BATTALION/DIMETHOATE | 12.8 - 1 fl oz/a | 10.3 b | 94.8 a |
| 5 | PROVADO | 3.8 fl oz/a | 9.8 b | 97.8 a |
| 12 | LEVERAGE | 3.75 fl oz/a | 9.0 b | 104 a |
| 17 | NUFARM IMIDACLOPRID | 3.8 fl oz/a | 7.8 b | 58.5 a |
| 13 | BATTALION/PROVADO | 12 - 3.8 fl oz/a | 7.3 b | 79.8 a |
| 9 | FULFILL | 2.75 oz/a | 5.5 b | 75.3 a |
| 18 | ETIGRA IMIDACLOPRID | 3.8 fl oz/a | 5.3 b | 68.3 a |
| 7 | ULTOR/PROVADO | 6/3.8 fl oz/a | 3.8 b | 65.5 a |

LSD (P=.10)

Means followed by same letter do not significantly differ (P=.10, Student-Newman-Keuls)

# EFFICACY OF NEEM FORMULATIONS AGAINST PINK MITE, *ACAPHYLLA THEA* WATT INFESTING TEA IN INDIA.

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The perennial tea (*Camellia sinensis* L.) plantation is affected by an array of pests round the year. Among them the pink mite, *Acaphylla thea* (Watt) causes damage to the leaves thereby reducing the briskness and flavor of the tea. Chemical control continues to play a vital role in reducing the damage caused by *A. thea*. In an attempt to scale down the ill effects caused by chemical pesticides to this beverage crop and to facilitate production of organic tea, the neem formulations viz., TNAU neem 0.03 EC (containing 0.03% azadirachtin,developed by Tamil Nadu Agricultural University ) and Neem Gold 0.15 EC (containing 0.15% azadirachtin from Southern Petrochemical Industries (SPIC), Chennai, India) were evaluated for managing the pest. Neem oil, neem seed kernel extract( NSKE) and Ethion 50 EC were included as standard checks.

In the laboratory, the toxicity of neem formulations to *A. thea* adults was evaluated by leaf disc assay with five replications@ 20 adult mites per leaf disc. Mortality of the mites was recorded 1,2 and 3 days after treatment (DAT). Deterrence of neem formulations to tea mite was evaluated by dual choice test treating one half of the disc while the other untreated half served as check. Batches of twenty adult mites were placed at the centre of each disc and the orientation of mites towards treated or the control area was recorded 24 hours after. Five replicates were maintained per treatment.

Field experimental plots were established in the tea plantation at Coonoor, The Nilgiris (1600m above MSL), Tamil Nadu. with three replications; 100 bushes constituting one plot. Two rounds of application were given at 30 days interval. The population of the mites was counted on 50 leaves collected at random.

Azadirachtin residues in fresh tea leaf were extracted in methanol and partitioned into hexane The residues in mother liquor was extracted into dichloromethane layer. Final determination was done using HPLC after dissolving 10 ml HPLC grade methanol.

Survival rate of the *A. thea* adults in all the treatments tended to decrease with lapse of time after application. Ethion and NSKE caused the highest mortality of *A. thea* (100%) 3DAT. Neem Gold @ 0.2, 0.5 and TNAU neem @ 0.3 % caused more than 90 per cent mortality (Table 1). In the choice test neem formulations strongly prevented the orientation of *A. thea* to the treated surface. The per cent alightment of *A. thea* ranged from 30.0 – 42.0 per cent (Fig. 1).

The field population was reduced to a maximum level of 28.8- 38.5 per cent ,7 days after first application. The maximum per cent reduction due to neem formulations was 36.9 – 72.2 per cent 15 days after second application. (Table 2).

No phytotoxic symptoms were observed on tea bushes treated with the neem formulations. The residues of Neem Gold 0.15 EC and TNAU neem 0.03 EC were below detectable limit in made tea samples taken one day after treatment. Though the synthetic insecticide Ethion is more effective than neem formulations, considering the toxicity to non target organisms, residues and resistance development associated with it, the neem formulation is the best bet in the IPM schedule for the purple mite.

**Table 1. Acute toxicity of neem formulations to *Acaphylla thea* on tea.**

| Treatments | Concentration (%) | Per cent mortality after * (hrs) 24 | 48 | 72 |
|---|---|---|---|---|
| T1 Neem gold 0.15 EC | 0.02 | 35.20 (36.1)[b] | 41.80 (40.20)[a] | 90.00 (73.30)[b] |
| T2 Neem gold 0.15 EC | 0.05 | 41.6 (40.1)[bc] | 62.40 (52.30)[a] | 91.00 (72.90)[ab] |
| T3 Neem gold 0.15 EC | 0.1 | 48.6 (44.2)[c] | 93.30 (82.20)[b] | 100.00 (90.00)[c] |
| T4 TNAU neem 0.03EC | 0.1 | 24.6 (29.20)[a] | 46.40 (42.90)[a] | 83.00 (65.80)[a] |
| T5 TNAU neem 0.03EC | 0.3 | 43.6 (41.30)[bc] | 96.50 (82.70)[b] | 99.00 (86.60)[c] |
| T6 Neem oil 3 % | 3.0 | 21.7 (27.60)[a] | 76.20 (61.90)[ab] | 92.00 (75.30)[b] |
| T7 NSKE 5% | 5.0 | 38.40 (38.20)[bc] | 93.30 (80.30)[b] | 100.00 (90.00)[cb] |
| T8 Ethion 50 EC | .05 | 67.80 (55.40)[a] | 100.00 (90.00)[c] | 100.00 (90.00)[c] |

* Mean of four replications;
Means followed by same letter in a column are not significantly different by (p=0.05 ) DMRT

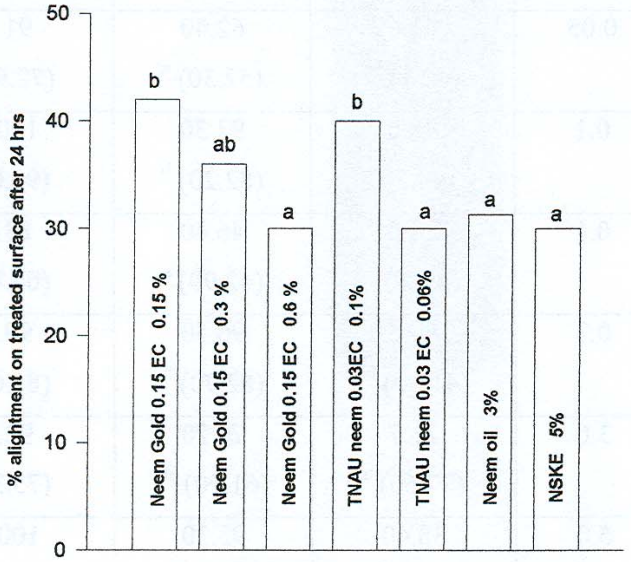


Fig .1. Deterrence of neem formulations to *A. thea*
Means followed by same letter in a column are not significantly different by (p=0.05) DMRT

**Table -3 . Bio efficacy of neem formulations applied against pink mite, *A. thea***

| Treatments | Dose ml/ha. | Pre treatment count * | Corrected per cent mortality | | | | Pre treatment count * | Corrected per cent mortality | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 DAIT | 3 DAIT | 7 DAIT | 15 DAIT | | 1 DAIIT | 3 DAIIT | 7 DAIIT | 15 DAIIT |
| T1 Neem gold 0.15 EC | 625 | 100.5 | 9.30 (17.60) [a] | 15.80 (23.30) [a] | 28.80 (32.40) [a] | 27.80 (31.70) [a] | 83.20 | 94.0 (17.80) [a] | 15.70 (23.30) [a] | 26.30 (30.70) [a] | 36.90 (37.30) [a] |
| T2 Neem gold 0.15 EC | 1250 | 99.70 | 10.80 (19.10) [a] | 20.50 (26.90) [ab] | 34.70 (36.0) [ab] | 33.30 (35.20) [ab] | 76.50 | 14.80 (22.30) [ab] | 25.70 (30.20) [b] | 40.80 (39.60) [bc] | 50.80 (45.50) [b] |
| T3 Neem gold 0.15 EC | 2500 | 100.50 | 15.60 (23.20) [bc] | 23.80 (29.10) [bc] | 38.50 (38.30) [b] | 36.60 (37.20) [b] | 74.50 | 19.10 (25.70) [b] | 33.30 (35.10) [b] | 52.00 (46.20) [d] | 72.20 (58.50) [c] |
| T4 TNAU neem 0.03EC | 250 | 105.20 | 10.00 (18.20) [a] | 15.0 (22.50) [a] | 29.90 (33.0) [ab] | 27.60 (31.60) [a] | 89.20 | 16.0 (23.40) [ab] | 26.00 (30.50) [b] | 30.50 (33.50) [ab] | 46.70 (43.10) [ab] |
| T5 TNAU neem 0.03EC | 500 | 106.7 | 13.40 (21.30) [ab] | 23.0 (28.60) [bc] | 37.30 (37.60) [ab] | 36.00 (36.80) [b] | 78.50 | 17.30 (24.60) [b] | 32.30 (34.60) [b] | 49.30 (44.60) [cd] | 62.90 (52.50) [c] |
| T6 Ethion 50 EC | 500 | 95.70 | 19.30 (25.90) [c] | 30.30 (33.20) [c] | 47.50 (43.50) [c] | 47.10 (43.30) [c] | 58.0 | 27.20 (31.20) [c] | 43.50 (41.20) [c] | 68.60 (56.00) [c] | 84.0 (66.50) [d] |
| T7 Control * | | 104.5 | 109.5 | 111.5 | 116.7 | 119.7 | 119.70 | 121.2 | 121.5 | 122.0 | 126.5 |

DAIT – Days after Ist treatment, DAIIT – Days after II treatment; * Number of mites per 50 leaves

Means followed by same letter in a column are not significantly different by (p=0.05) DMRT

Section VIII
Mites & Sap-Sucking Pests

## RASPBERRY APHID CONTROL ON RED RASPBERRY, 2007

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**Raspberry aphid, *Amphorophora agathonica* Hottes.** A population of alate raspberry aphids was collected on 17 August (Table 1) and 7 September (Table 2) from a two year-old 'Meeker' planting at the WSU Mount Vernon NWREC. The terminal leaflet of maturing primocane leaves were individually inserted into water-filled vials plugged with cotton. They were then dipped for 4 seconds in a deionized water-aphicide solution. Ten alate adults were then placed on each air-dried leaflet, replicated ten times for each treatment (n = 100)and placed in 5 inch diameter Petri dishes. Compared with the untreated check, all treatments (Tables 1-2) were significantly different at the 5% level through three days posttreatment. Malathion continues to provide quick knockdown of raspberry aphid within 24 hours posttreatment. The high rate of Assail™ (acetamiprid) provided equivalent control of mature raspberry aphid two days posttreatment. Cessation of feeding was observed on the first day but death of the aphids occurred by 48 hours for the high and 72 hours or longer for the 0.047 lb(AI)/acre rate of Assail. Both subclasses of neonicotinoids were comparable to Mustang Max™ (zeta cypermethrin) at 0.05 lb(AI)/acre (Table 2).

Table 1. Raspberry aphid bioassay, Mt. Vernon, WA. 2007.

| | | Percent Mortality | | |
|---|---|---|---|---|
| Treatment | lb(AI)/acre | 1DAT | 2DAT | 3DAT |
| Assail 30SG | 0.047 | 78b | 88a | 100a |
| Assail 30SG | 0.075 | 94ab | 100a | |
| Malathion 8EC | 2.00 | 100a | | |
| Untreated check | | 18c | 32b | 20b |

Mean within columns followed by the same letter are not significantly different (Fisher's protected LSD, $P<0.05$), PRC ANOVA SAS.

Table 2. Raspberry aphid bioassay, Mt. Vernon, WA. 2007.

| Treatment | lb(AI)/acre | Percent larval mortality 1 DAT | 2DAT | 3DAT | 4DAT |
|---|---|---|---|---|---|
| Actara | 0.047 | 83a | 100a | | |
| Assail 30SG | 0.047 | 47bc | 72b | 81b | 82ab |
| Assail 30SG | 0.075 | 75ab | 100a | | |
| Malathion 8EC | 2 | 100a | | | |
| Mustang Max | 0.05 | 72ab | 100a | | |
| Untreated check | | 0 | 11d | 39c | 60bc |

Mean within columns followed by the same letter are not significantly different (Fisher's protected LSD, $P<0.05$), PRC ANOVA SAS.

# SPIDER MITE CONTROL WITH ACRAMITE 50WS, 2007

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***Yellow spider mite field trial.***

Population levels of spider mites in Washington were generally non-economic ones for this season especially in northwestern Washington. Problematic mid-harvest populations of the yellow spider mite, *Eotetranychus carpini borealis,* never reach potential treatment levels of 25 per leaf until late August and early September. This period of intense primocane development, onset of leaf senescence, aggressive numerical response of the mite predator, *Neoseiulus fallacis,* when coupled with the difficulty of physically applying good coverage of an acaricide are all factors favoring late season biological control. Under these conditions we field tested 2 rates of the selective, soon to be registered acaricide, Acramite™ (bifenazate) with Vendex™ (fenbutatin-oxide) on a mature 'Meeker' site in Lynden, WA. Applications were made on 13 September 2007 with our plot spray equipped to deliver 133 gpa at 1.8 mph with 2 D4-45 Tee Jet nozzles on top of boom, with 2 D2-25 nozzles pointing up into the row while both vertical arms were equipped with 14 D3-25 Tee Jet nozzles. Treatments were replicated five times and plots measure 30 feet long by 10 feet wide. Twenty-five leaflets were taken at random from primocanes at chest height on both sides of the row. These samples were sampled with a mite brushing machine. Compared with the untreated check, Acramite at 0.38 and 0.50 lb(AI)/acre were significantly different at 7, 11 and 17 days posttreatment (Table 1). Though non-significant, the average motiles/leaf were numerically less than our standard Vendex, given the cooler field conditions for these comparisons. Most importantly, there were no significant differences in the numerically increasing phytoseiid predator densities on a spider mite population that was still increasing at 27 September. However, at this time, our samples revealed low, overwintering (orange-yellow-colored) females and very few spider mite eggs.

Table 1.

| Treatment | lb(AI)/acre | Ptrm | Motile YSM/leaf 7DAT | 11DAT | 17DAT |
|---|---|---|---|---|---|
| Acramite 50WS | 0.38 | 27.9b | 8.9b | 6.6c | 10.5b |
| Acramite 50WS | 0.50 | 48.7a | 9.4b | 8.7c | 9.3b |
| Vendex 50WP | 1.00 | 41.1ab | 16.5b | 21.8b | 12.8b |
| Untreated check | | 33.3ab | 27.4a | 30.7a | 55.7a |

Mean within columns followed by the same letter are not significantly different (Fisher's protected LSD, $P<0.05$), PRC ANOVA SAS.

***Twospotted spider mite field trial.***

A postharvest population of twospotted spider mite, *Tetranychus urticae,* was sampled and treated on 10 September 2007 in a 2 year-old 'Meeker' field at the WSU Mt. Vernon NWREC. Pretreatment densities for this late season infestation approximated 3 mite/leaf. Though non-economic, this numerically increasing population and cool/cloudy weather conditions were ideal to compare Acramite with Vendex on an incipient twospotted spider mite infestation on red raspberry. Rates and application methods were identical to those used for YSM above. Compared with the untreated check, the 0.05 lb(AI)/acre rate of Acramite was significantly different to 16 days posttreatment given the low levels of this last generation infestation (Table 2).

Table 2.

| Treatment | lb(AI)/acre | Ptrm | Motile TSSM/leaf 3DAT | 9DAT | 16DAT |
|---|---|---|---|---|---|
| Acramite 50WS | 0.38 | 3.5a | 0.6b | 1.5ab | 0.9bc |
| Acramite 50WS | 0.50 | 2.8a | 0.2b | 0.7b | 0.4c |
| Vendex 50WP | 1.00 | 2.8a | 0.8a | 1.6ab | 1.6b |
| Untreated check | | 3.9a | 1.7a | 3.1a | 5.3a |

Mean within columns followed by the same letter are not significantly different (Fisher's protected LSD, $P<0.05$), PRC ANOVA SAS.

The registration of Acramite for 2008 season will provide the red raspberry industry with an acaricide that is a very selective, possessing quick knockdown, long residual and exhibiting good activity under PNW weather conditions.

# SPIDER MITE CONTROL IN CARROTS

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In 2005 and 2006, Washington State carrot growers experienced economic injury from late-summer spider mite outbreaks. While several insecticides are registered for use against mites on carrots, they are not effective and are inappropriately broad in spectrum. At present no miticides are registered for spider mite control on carrots in Washington State. Acaricides were screened for ability to control two-spotted spider mite on carrots. Field plots were established near Othello, Washington State, USA. Plots were 6 ft. wide and 20 ft. long and were replicated four times in a complete random block design. Acaricide applications were made on August 31, 2007 using a $CO^2$ propelled backpack sprayer. To evaluate efficacy, ten carrot leaves per plot were collected ten days post application and transported to the laboratory where mites were counted under a stereoscope.

Data were subjected to ANOVA and means were separated from the untreated check using Fisher's PLSD ($p<0.05$). The plots treated with Oberon, Fujimite, and Zeal at the 3 oz. rate had significantly fewer mites than did the untreated check. Moderate levels of control were also achieved with Comite, Acramite, and Zeal at the 2 oz. rate.

| Treatment | Mites/5 leaves +/- SE |
|---|---|
| Untreated | 62.25 +/- 35.75 |
| Oberon 2SC | 15.38 +/- 9.58* |
| JMS Sylet Oil | 43.88 +/- 22.07 |
| Comite | 25.38 +/- 14.14 |
| Fujimite | 17.25 +/- 11.34* |
| Champ | 39.25 +/- 15.59 |
| Capture 2EC | 112.00 +/- 43.91 |
| Zeal 2 oz. | 23.50 +/- 19.83 |
| Zeal 3 oz. | 17.88 +/- 9.14* |
| Acramite 4SC | 34.50 +/- 13.98 |

Figure 1. Mite counts 10 days post treatment. * Denotes treatments with significantly fewer mites in a pair-wise t-test compared to the untreated check ($p<0.05$).

# SECTION IX

## NEW PRODUCT DEVELOPMENT

**SECTION LEADER**

**CHRISTOPHER ISHIDA**

# PNWIMC

## 2008 PNW Resource Guide

**Date:** **12/5/2007**

| *COMPANY NAME:* | *PRODUCT NAME* | *TYPE:* | *WEBSITE:* | *CONTACT:* | *TEL:* | *E-MAIL ADDRESS:* |
|---|---|---|---|---|---|---|
| **Arysta** | Azinphos-methyl, Battalion | Insecticide | www.arysta-na.com | Jeri West | 509-255-1052 | jeri.west@arystalifescience.com |
| | Kanemite | Miticide | | | | |
| **BASF** | Counter, Regent | Insecticide | www.agproducts.basf.com/ | Chuck Rice | 509-396-5283 | chuck.rice@basf.com |
| **Bayer** | Admire, Aztec Baythroid, Calypso, Decis, Di-syston, Lavin, Leverage, Monitor, Provado, Renounce, Sevin | Insecticide | www.bayercropscienceus.com | Dean Christie | | dean.christie@bayer.com |
| | Envidor, Oberon | Miticide | | | | |
| | Mocap | Nematicide | | | | |
| **Chemtura** | Dimilin, Rimon | Insecticide | www.chemtura.com/ | Scott Ockey | 509-453-8757 | scott.ockey@chemtura.com |
| | Acramite, Comite, Omite | Miticide | | | | |
| **Dow** | Confirm, Entrust, Lorsban, Radiant, Success | Insecticide | www.dowagro.com | Harvey Yoshida | 509-628-1368 | harvey.yoshida@dow.com |
| | Kelthane | Miticide | | | | |
| | Telone | Nematicide | | | | |
| **DuPont** | Altacor, Asana, Avaunt, Lannate, Vydate | Insecticide | http://www2.dupont.com/Production_Agriculture/en_US | Norm McKinley | 503-370-9976 | norman.d.mckinley@usa.dupont.com |
| | Vendex | Miticide | | | | |
| | Vydate | Nematicide | | | | |
| **Gowan** | Nexter | Insecticide | www.gowanco.com | Gary Melchior | 509-520-4779 | gmelchior@gowanco.com |
| **Syngenta** | Actara, Fulfill, Platinum, Proclaim | Insecticide | www.syngentacropprotection-us.com | Chris Clemens | 509-375-0666 | christopher.clemens@syngenta.com |
| | Agri-Mek, Zephyr | Miticide | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Valent BioSciences** | Biobit, DiPel, Novodor, Xentari | Insecticide | www.valentbiosciences.com | Chris Ishida | 360-834-4457 | christopher.ishida@valent.com |
| | DiTera | Nematicide | | | | |
| **Valent U.S.A.** | Danitol, Esteem, Knack, Seize, Venom | Insecticide | www.valent.com | Len Welch | 541-386-4557 | len.welch@valent.com |
| | Danitol, Zeal | Miticide | | | | |

Section IX
New Product Development

# VALENT BIOSCIENCES MICROBIAL PRODUCTS

C.A. Ishida
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An update will be presented on VBC insecticidal and nematicidal microbial products. The insecticidal products include the following: for coleopterous pests (Colorado Potato beetle), Novodor; and for lepidopterous pests, Biobit, DiPel and XenTari. VBC also has nonAg products active against fungus gnats (Gnatrol) and mosquitoes (Vectobac and Vectolex). The nematicidal product is DiTera. A number of these products are OMRI-certified, including DiPel DF, XenTari DF and DiTera DF. Additional microbial products are currently under development, targeting new pest groups (white grubs, etc.) as well as new formulation work is being pursued to enhance activity of current products.

For current VBC (& VUSA) product label/MSDS information, use the following website, www.valent.com.

# Business Meeting 2007 Minutes

Minutes of 2006 Meeting R & A after opening by Ben Simko
1 Treasurer's Report R & A
2 Committee Assignments
  Tumble Bug - Dave Bragg, Robin Rosetta, Benny Fouche'
  Resolutions – Ben Simko
  Nominations – Ben Simko, Sharon Collman
  Local Arrangements – Denny Bruck, Joe DeFrancesco, Jim Todd
3 Thank you's to 2007 Local Arrangements Committee given (Denny, Joe, and Robin)
4 Credit's for OSU issue discussed and tabled for Robin & Denny to investigate for 2008

NB Closing Meeting Tuesday PM

1 Committee Reports
  Nominations - suggested alternating industry and agency/university people Chris Ishida
  President 2008 with Sharon Collman 2009 President Elect
  Tumble Bug -Alan Schreiber by a furlong!!!
  Resolutions – Thanks to moderators; Denny, Jim and Joe; David and Patti Carr;
  all attendees; Denny the AV man.
2 Section I worked! So Section IX is on its way…
3 Moderators to encourage no more than 15 minutes per presentation…
4 Suggestion to reorganize all sections by specific crops e.g. "Potatoes" rather than current names used. Need more discussion and a formal vote on this idea…

**Treasurer's Report for 2008**
Beginning balance $3146.90 after paying al 2007 bills
$1304.06 Payment to Hilton Hotel to secure site for 2008 Mtg on 10/09/2007
Balance on hand $1852.84
$200 in change for 2008 registrations