By

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Table of Contents

Publications, Videos, and Other IPM Resources

Educational resources produced by the UMass fruit team, by other Universities in New England, and by Cornell University are presented below.

- **UMass** IPM Fact Sheets
- UMass IPM Fruit Loop Podcast
- **Healthy Fruit** is a timely newsletter that includes information on tree-fruit horticulture, pest management, and related topics. The primary reader is the commercial grower, but anyone growing fruit trees will benefit from this. Healthy Fruit is published weekly or biweekly from April through September and periodically throughout the rest of the year.

  The cost for a subscription to Healthy Fruit is $75 per year for the pdf version (available for purchase at the UMass Extension Bookstore or download the Fruit Publications Order Form and mail it in with your payment).

- **UMass Extension Fruit Team YouTube Channel**.
- **Fruit Notes** is distributed to growers and researchers in 35 states in the U.S. and 14 other countries. Most reports are from current research at the University of Massachusetts and other universities. Electronic versions are available for purchase at the UMass Extension Bookstore or you could download the 2023 Fruit Publications Order Form and mail it in with your payment. There are 4 issues per year. Cost: $35 (electronic copy only).
  - New England Tree Fruit Management Guide.
  - New England Small Fruit Management Guide.
  - University of Vermont Extension - Tree Fruit production.
  - University of Rhode Island IPM program.
  - The Jentsch Poma Lab.

Plant Growth Regulator Updates (Jon Clements)

ACCEDE reformulation (J. Clements)

Accede (Valent USA) has been reformulated as Accede SG (Soluble Granule). PPM rate remains the same, that is 200 to 400 PPM for apple thinning and 300 to 600 PPM for stone fruit. For the latter (stone fruit) that is equivalent to 10 to 20 ounces of Accede SG per acre; for apples it is 6.7 to 13.4 ounces of Accede SG. With apples, the recommended application timing is typically after the traditional chemical thinning window of 12 mm when additional fruit thinning is needed and the apples are in the 20 to 25 mm range. My experience suggests that Accede SG is a particularly effective "rescue" thinner on Gala and Golden Delicious. Accede SG application may also improve return bloom the year following application. Accede SG can be an effective stone fruit thinner too, although it is not intended to eliminate the need for some hand thinning. Accede SG application to peaches at bloom is kind of a no-brainer in my opinion. I would suggest starting at a modest rate, target bloom (although it can be applied from pink to petal fall), and apply under slow drying conditions if possible. Variety responses may differ. Temperature at the time of application is not critical. It seems to work OK at lower temperatures than might be expected from most PGR applications (to apples). Evening application is suggested as efficacy may be improved under dark skies. Use of a non-ionic surfactant with Accede SG will improve performance and response.

Branching advice for young apple trees (J. Clements)

Lack of or limited branching of young apple trees (newly planted 1st leaf, 2nd leaf, and maybe 3rd leaf) continues to be a headache. Key is knowing what age wood you are trying to branch:

- Current season's shoot growth, typically trees being grown in the nursery, or newly planted apple trees, use growing tip sprays of 6-BA (Maxcel) at 400 PPM where branching is desired; repeat at 7-14 day intervals or every 5 to 6 inches of growth for a total of 4 to 5 applications. For newly planted trees, it works best when trees are planted early and there are some root establishment (so it has some "punch"). Do not attempt on weak growing trees.
- 1-year old wood, "whip" trees at planting or with excessive leader growth, BEFORE bud break: apply 6-BA (Maxcel) at 5,000 PPM in latex paint to the area of 1-year old wood where branching is desired. If buds have broken and there is green tissue present, use 6-BA (Maxcel) at 400 PPM as a directed (backpack) spray to the area of 1-year old wood where branching is desired. Works best when it is warm. Do not add surfactant to Maxcel. In both cases, for newly planted trees, it works best when trees are planted early and there are some roots established (so it has some "punch"). Do not use it on weak growing trees. Note: Promalin may be substituted for 6-BA as described above, read the labels for more use recommendations in all cases! 1-year old wood may also be

successfully branched using double-notching at bud break, for more detail see: http://www.umassfruitnotes.com/v86n3/a1.pdf

- 2-year-old wood, where you have blind wood and "senescent" buds, you can try notching (use a utility knife to make a good divot) just above those quiescent buds and then spray (immediately) with 1500 PPM Maxcel. Do after bud break when trees are otherwise actively growing. Your results may vary!
- If you have older (3rd-, 4th-leaf trees) and you want to achieve a little more branching or "fullness" in the tops, a directed airblast application of 400 PPM Maxcel (still non-bearing trees only at that rate) when it is warm and the trees are actively growing has (anecdotally) been effective. If trees are bearing, Maxcel is limited to a thinning rate of 200 PPM, which will probably not work as well but might be worth a try (if you apply twice if the label allows).

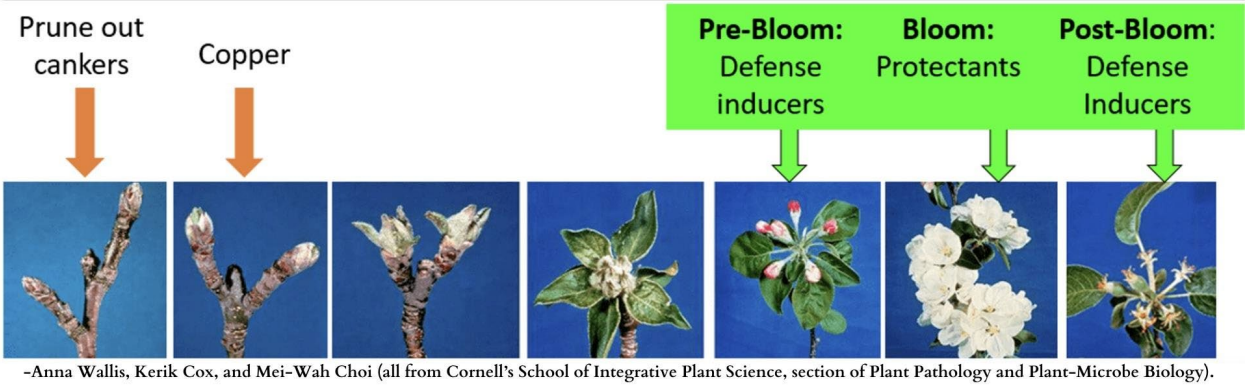
Oh wait, one more thing, directly from the Arrange (Fine Americas) label: "For increased branching of nursery stock and young trees, improve tree structure and floral reduction of the year following application. For nursery trees, make 3-4 applications of 400-600 ppm (4-6 gallons per 100 gallons of water) on a 28-day interval to trees that have at least 28-30 inches of growth. For young trees (young plantings not yet bearing), begin applications during petal fall timing. Up to 4 applications may be made during the growing season of 400-600 ppm (4-6 gallons per 100 gallons of water) on a 28-day interval." Interesting…and speaking of Fine Americas, they also have 6-BA (exilis 9.5 SC) and perlan which are essentially the same as Maxcel and Promalin respectively; however, exilis 9.5 SC is a more concentrated 6-BA formulation so you need to look at the respective labels to be sure you are using the right amount of active ingredients! PPM of active ingredient per above remains the same. Confused yet? Why you should absolutely read the label and use it according to label directions regardless of what I tell you! :-) Although this Fact Sheet needs updating, you may find it useful with more information: https://ag.umass.edu/sites/ag.umass.edu/files/fact-sheets/pdf/f-140_-_branching_young_apple_trees.pdf

Massachusetts Pests Overview

Diseases (Liz Garofalo)

Using biologicals to boost fireblight management. As fireblight becomes increasingly difficult to manage, implementing new tools can help reduce the pressure in your orchards. There are three general types; 1) Defense inducers, 2) The land grab (non-pathogenic microorganisms occupying floral parts, out competing *Erwinia amylovora*) and 3) Antibiotic metabolites (kill off the *Erwinia amylovora* before it can infect).

Timing matters.



-Anna Wallis, Kerik Cox, and Mei-Wah Choi (all from Cornell's School of Integrative Plant Science, section of Plant Pathology and Plant-Microbe Biology).

Think about defense inducers like sunblock, you put them on before the damage is done. In this case, materials like LifeGard (*Bacillus mycoides*), Regalia (extract of *Reynoutria sachalinensis* aka giant knotweed) or Actigard (acibenzolar-S-methyl, not a biological but still a defense inducer) go on prior to bloom in order to have time to do their work in the plant before any infection can occur. These defense inducers make the host plant think it is under attack causing them to turn on their natural immune systems.

-LifeGard LC
- -label indicates 3-5 days prior to infection is necessary to achieve best results.
- -label indicates protection lasts up to 18 days
- -application rate of 1 gallon LifeGard LC to 100 gallons water

-Regalia
- -watch tank mixing, the label has a number of warnings about this
- -label states apply from green tip through bloom
- - application rate of 1-2 quarts in 50-100 gallons water not to exceed 0.5% v/v

-Actigard
- -label indicates maximum activity 4 days after application
- -foliar applications have a 60 day PHI
- -label rate 1-2 oz/A beginning at 20% bloom

Land grab and microbial metabolites (MM) need to go on the plant immediately prior to *E. amylovora* colonizing the flowers. This allows the non-pathogenic microorganisms to colonize the flower parts or, the MM to be present to kill the *E. amylovora* before it colonizes.

The Land Grab
-Bloomtime Biological (*Pantoea agglomerans*)
- - label indicates an application rate of 0.33lbs/A at "early" bloom and again at full bloom
- - label indicates storage temperatures between 4 and 40 degrees F

-BlightBan (*Pseudomonas fluorescens*)
- -copper based materials are incompatible with BlightBan

-early bloom rates of 5.3oz concentrate (50-150 gallons water/A) or 7oz dilute (200-350 gallons water/A)

-a second application of the above rates is suggested for full bloom and a third for "rattail" bloom

Microbial Metabolites

-Serenade Opti (*Bacillus subtilis*)

-label states first application should be made at 1-5% bloom

-application rate of 14-20oz/A

-Double Nickel (*Bacillus amyloliquefaciens*)

-label states first application should be made at 1-5% bloom

-application rate of 0.25 to 3 lbs/A for high disease pressure

-application rate of 0.25-1 lbs/A for low disease pressure

This list of materials is not meant to be exhaustive. There is observational evidence that high temperatures decrease the efficacy of these materials. For regional temperature reference, the work Kerik Cox's lab has been doing showing the efficacy of biologics in fireblight management was done in the finger lakes region. Under current (4/12/24) conditions, Belchertown is roughly 5-10 degrees warmer. Check **NEWA** to compare your location's conditions to those where these materials were shown to be effective in a fireblight management program. Biologicals are not a replacement for strep but a potentially valuable tool at mitigating resistance development and increasing overall management.

Insects (J. Piñero)

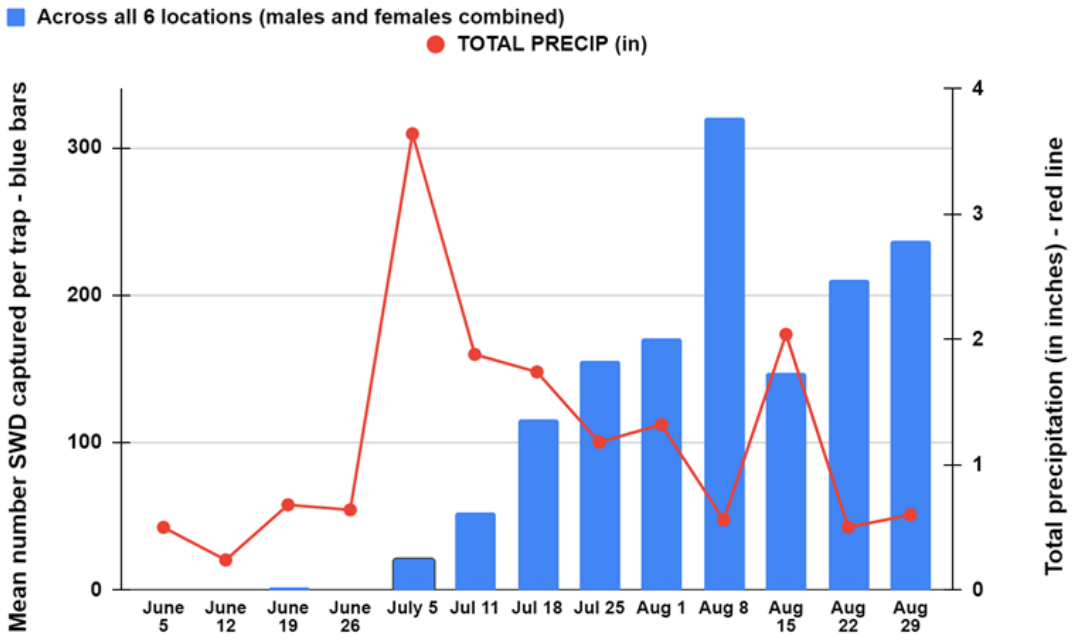
2023 levels of fruit injury by insect pests recorded at harvest. Overall, the levels of insect pest injury, in particular plum curculio and tarnished plant bug, were lower than those recorded in previous years. Damage by tortricid moths was very low for codling moth (0 - 0.17%) and obliquebanded leafroller (0 - 0.17%) and non-existent for Oriental fruit moth. *Note that table 1 presents the results of PERIMETER-ROW injury only.* The interior-row injury was lower, as expected. Apple maggot fly (AMF) was well controlled in most orchards.

Table 1. For each of nine commercial apple orchards in MA, perimeter-row fruit injury by nine insect species. Fruit assessments were conducted at harvest in 2023.

Orchard #	Plum curculio	Stink bug	Tarnished plant bug	Other (feeding)	Rollers	Oriental FM	Codling moth	European apple sawfly	Apple maggot	San Jose scale
1	0.71	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	4.28	0.23	2.48	0.00	0.00	0.00	0.00	1.13	0.45	1.35
3	0.72	0.00	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	2.52	0.00	1.54	0.00	0.11	0.00	0.00	0.00	1.54	0.00
5	1.39	0.00	1.56	0.09	0.17	0.00	0.17	0.35	0.52	0.00
6	7.07	0.00	2.02	0.00	0.00	0.00	0.00	1.01	0.00	0.00
7	4.27	0.00	1.71	0.43	0.00	0.00	0.00	0.43	6.41	0.00
8	4.22	0.15	2.26	0.60	0.00	0.00	0.00	0.00	1.66	0.00
9	0.51	0.00	1.69	0.34	0.00	0.00	0.17	0.00	1.69	0.17
AVERAGE (%)	2.86	0.04	1.59	0.16	0.03	0.00	0.04	0.32	1.36	0.17

Observations indicated that Japanese beetle (JB) pressure was moderate this year, with some feeding damage observed on Honeycrisp in 3-4 orchards. Research involving mass trapping was conducted in grape and blueberry blocks at the UMass Cold Spring Orchard (CSO) in Belchertown, MA. The results were published in the forthcoming Fall issue of Fruit Notes.

In 2023, SWD populations reached their peak (Figure 4) about 2 weeks earlier than observed in previous years. One grower reported SWD control failure in strawberry and blueberry due to excessive rain, which in addition to washing off the insecticide applications, also kept many customers away from the pick-your-own operation, resulting in a large portion of the crop not being harvested. In 2024, a monitoring system will be deployed at six farms starting in May.



Spotted-wing drosophila seasonal abundance measured using traps baited with diluted Concord grape juice fermented in the presence of 2% table salt, a bait that is very attractive to SWD, and total rainfall (in inches) – red line, for each trapping period.

Some Notes on Internal Lepidoptera. Longstanding trap-based treatment threshold levels for codling moth (CM) and Oriental fruit moth (OFM) coupled with degree day models have been the foundation of successful IPM program for decades. However, these thresholds simply represent a “long ago best guess” and temperature-based developmental models have not been re-verified under varying abiotic conditions, which demonstrates the need for substantive modifications.

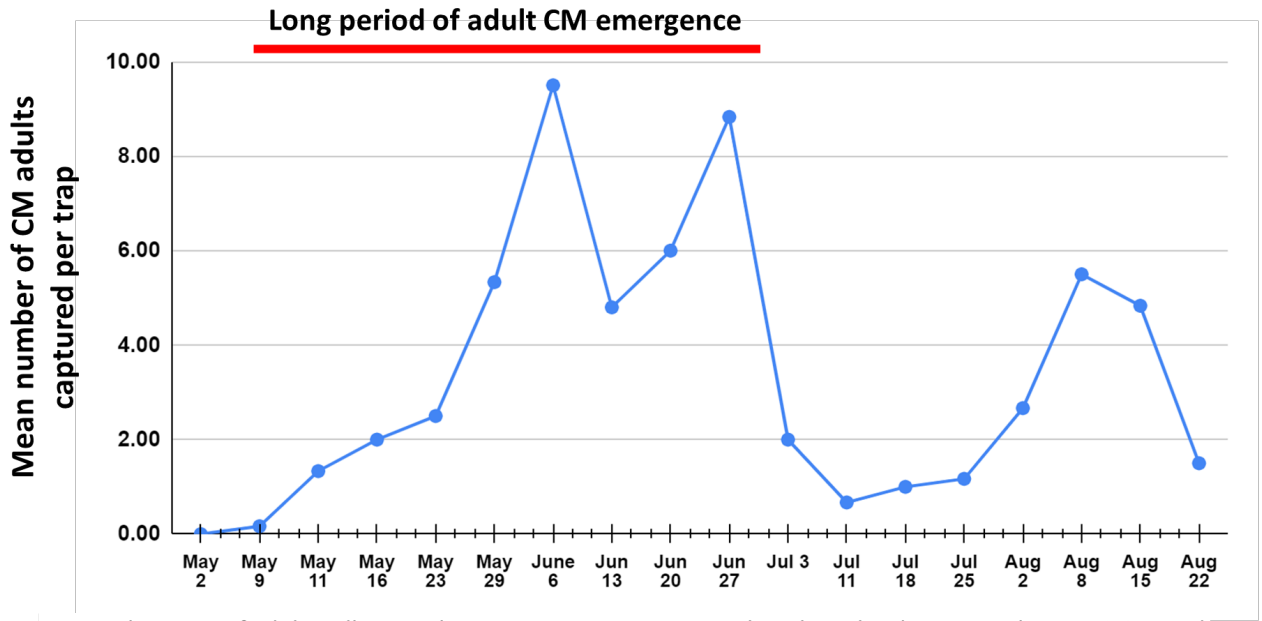
Research conducted in Europe and California has suggested that both CM and OFM are likely to undergo shifts in their geographical range, earlier initiation of key biological events, such as biofixes, and potentially an increase in the number of generations per year. Consequently, this may necessitate higher levels of insecticide applications. With abiotic factors becoming increasingly unpredictable, characterized by extreme temperature and rainfall fluctuations, it becomes imperative to verify the accuracy of phenological models for CM and OFM. Additionally, the validity of threshold levels needs reassessment under these current, less predictable conditions, especially in instances where emergence occurs earlier or when their phenology deviates from historical patterns. For the next three years, the UMass Extension fruit team will be participating in a number of studies aimed at examining the

Increasing tolerance and/or resistance among Lepidopteran pests have been observed in commonly used pyrethroids (10), newer Lepidopteran diamides (according to unpublished data from Krawczyk), and biopesticides such as the Cydia pomonella granulosis virus (CpGV). To mitigate these challenges, mating disruption has emerged as a viable strategy. In the case of CM, mating disruption implemented across neighboring apple orchards on a large scale as well as on individual farms, has demonstrated effectiveness, especially when combined with CM-specific insecticide treatments.

Despite promising outcomes even when used in blocks less than 5 acres, the adoption of mating disruption remains limited, as recent surveys of growers in various U.S. states indicate that most growers do not utilize this approach.

Oblique-banded leafroller (OBLR). Materials like rynaxypyr (Altacor) and spinetoram (Delegate) are known to provide good control when used in conjunction with pheromone trapping and degree-day modeling (available on the NEWA site). Scouting of terminals and fruit clusters from late June through mid-July is helpful in assessing the need for treatment. Control has been satisfactory when using the right materials and timing, but this is a pest that doesn't seem likely to go away -- we continue to find larvae in low numbers in orchards where we've been actively controlling them for several years.

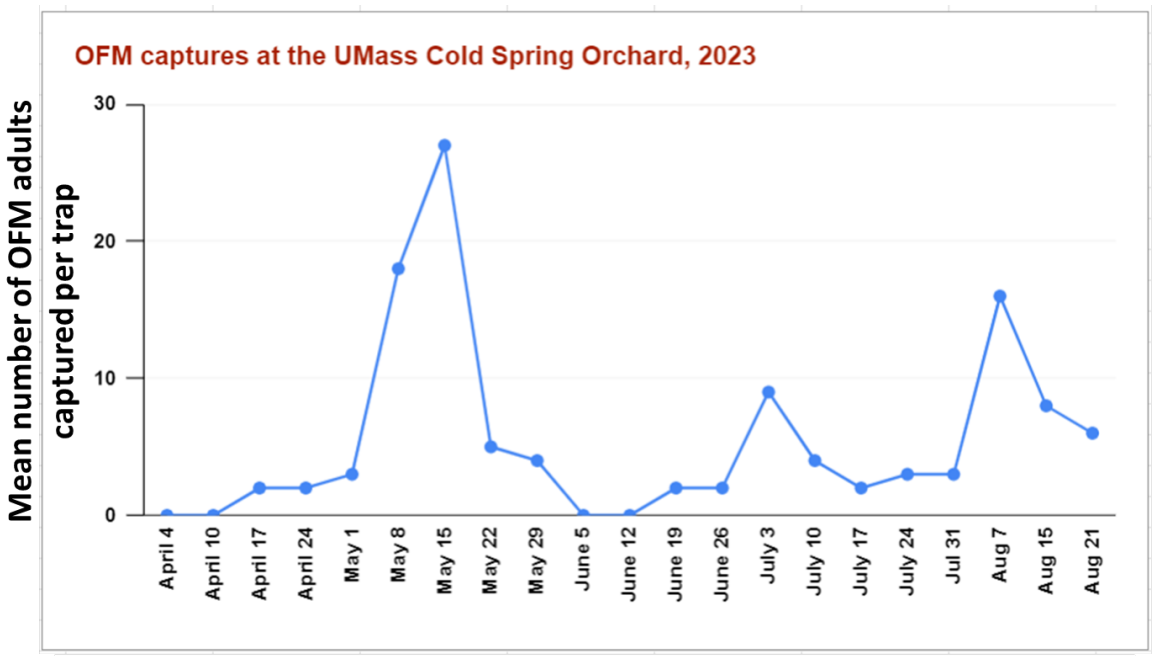
Codling Moth (CM). Degree-day models have been less useful here because of an extreme generational spread -- in 2018, first-generation larvae were still active in fruit when second-generation larvae were hatching, according to the degree-day model based on pheromone captures. A double peak of emergence (shown in the figure below) has been observed in Massachusetts as well as in other states such as North Carolina and Pennsylvania. Some growers and consultants reported seeing no distinct flight periods recorded by pheromone trapping, just a constant stream of new moths. This makes CM very difficult to manage and difficult to change modes of action between generations (that is, using one material against the first generation, and another against the second). Mating disruption may turn out to be a useful tool in this situation, in conjunction with a finely tuned insecticide program.



Seasonal pattern of adult codling moth emergence at a commercial apple orchard in Massachusetts, A second emergence of overwintering adults sometimes occurs between 500 and 800 degree days after biofix. This is often referred to as the "B peak" and may be associated with insecticide-resistant individuals in the population. Hence, pheromone trapping is important throughout the flight period.

Oriental Fruit Moth (OFM). Some growers have had good success with such a program with OFM on peaches (they can also infest apples, but so far, they seem to prefer peaches and sometimes pears in this region). Some growers in Massachusetts have successfully used mating disruption for season-long control of OFM. Chemical control of OFM can be improved by using pheromone trap data and a degree-day (DD) model to establish optimum timing of insecticide sprays targeting newly hatched larvae. No insecticides need to be applied until eggs begin to hatch. The normal petal fall spray should control OFM larvae hatching early in the season. After that, for first-generation OFM, one insecticide spray between 350 (base45°) and 375 (base45°) DD after biofix is recommended. Action threshold based on trap captures: If apples have > 30 OFM per trap per week for the first flight, and >10 moths per week for subsequent flights, there is a potentially treatable population.

In MA, there are 3 flights of OFM per year in apple orchards, as shown in the figure below. The larger peak is represented by the first flight. Successful OFM control at that time should result in easier OFM management throughout the season.



In Massachusetts, there are three generations of OFM in apple orchards.

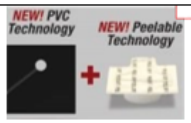
Effective Monitoring Tools for Tortricid Moths in Apple Orchards (by Ajay Giri, graduate student at Stockbridge). Sex pheromone lures in traps are used to monitor male populations of CM, OFM, RBLR and OBLR in conventional and mating disruption orchards. Monitoring female moth populations is crucial for refining predictive models and establishing precise action thresholds. Augmenting sex pheromone lures with plant volatiles, or kairomones, has shown promise in enhancing moth monitoring and mating disruption systems.

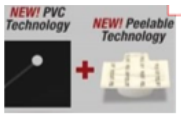
Numerous commercially available lures serve as effective tools for monitoring populations of CM, OFM, OBLR, and other moth species. These lures primarily utilize sex pheromones to attract male moths from the targeted populations. However, enhancing female moth captures can be achieved by incorporating plant volatiles or kairomones alongside the sex pheromones. For instance, traps baited with CM sex pheromone can be augmented with pear ester (ethyl (E,Z)-2,4-decadienoate) and acetic acid, resulting in increased attraction of female CM (Knight et al., 2019). Moreover, a synergistic blend of plant volatiles, known as "Megalure CM 4K dual," has been developed, which, even without sex pheromones, can effectively lure females of both CM and OFM.

Table 2 provides a comprehensive list of commercially available lures designed for monitoring CM, OFM, and OBLR populations. These lures typically utilize a rubber septum as the standard method for dispensing the sex pheromone, offering a longevity of 4 to 6 weeks in the field. Alternatively, a gray halo butyl rubber septum, referred to as OFM L2 or CM L2 in trade names, can extend this longevity to up to 8 weeks. Notably, Trécé has recently introduced a proprietary PVC matrix as a delivery medium, capable of sustaining the release of sex pheromones or kairomones for up to 12 weeks in field conditions. Combo lures, commonly packaged with two

components—sex pheromone and a kairomone—typically feature the sex pheromone loaded in either a rubber septum or PVC matrix, while the kairomone is housed in a membrane cup.

Table 2. List of lures for monitoring selected tortricid moths.

Moth species	Trade name	Attractant type	Replacement	Notes	Pictures
Oriental fruit moth	Trécé Pherocon OFM lure	Male only	4 weeks	Red rubber septa	
	Trécé Pherocon OFM L2 lure	Male only	8 weeks	Gray halo butyl rubber. L2 stands for long lasting. Can be loaded with higher rate of pheromone.	
	Trécé Pherocon OFM Combo Dual	Male and female	8 weeks	Comes with kairomone combo in a peelable membrane cup.	
	Scentry OFM lure	Male only	4-6 weeks	Black rubber septa	
Codling moth	Trécé Pherocon CM Standard 1X	Male only	4 weeks	Red rubber septa for standard monitoring	
	Trécé Pherocon CM Standard 10X	Male only	2-3 weeks	10X higher dose than standard for use in mating disrupted orchard	
	Trécé Pherocon CM L2	Male only	8 weeks	Gray halo butyl rubber. L2 stands for long lasting. Can be loaded with higher rate of pheromone.	
	Trécé Pherocon CM L2-P	Male only	12 weeks	Pheromone loaded in PVC material. L2 stands for Long lasting, and P stands for PVC.	
	Trécé Pherocon CMDA Combo-P	Male and Female.	12 weeks	The DA in CMDA is pear ester (a plant volatile/kairomone). The combo is Acetic acid (AA).	
	Trécé Pherocon CMDA Combo-S	Male and Female.	8 weeks	The DA in CMDA is pear ester (a plant volatile/kairomone). The combo is Acetic acid (AA). S stands for Rubber Septa.	

	Trécé Pherocon Megalure CM Dual 4K	Male and Female.	8 weeks	4K stands for 4 different Kairomones. Studies carried out in Massachusetts also showed its attraction to both sex of OFM.	
	Scentry CM Lure	Male only	4-6 weeks	Red rubber septa for standard monitoring	
Oblique banded leafroller	Trécé Pherocon OBLR lure	Male only	4 weeks	Red rubber septa. Due to overlapping of sex pheromone component in OBLR and RBLR, trap baited with OBLR lure can also attract significant number of RBLR.	
	Scentry OBLR lure	Male only	4-6 weeks	Red rubber septa. Also attractive to RBLR.	

Note: Information generated from Trécé Inc. and Scentry Biologicals Inc.

EPA's Endangered Species Protection Program - Understanding Bulletins Live! Two (J. Piñero)

Overall, the EPA's role in the Endangered Species Act is to ensure that its regulatory activities do not harm listed species or their habitats and to collaborate with other agencies to conserve biodiversity and promote the recovery of endangered and threatened species. This involves conducting consultations, integrating endangered species considerations into regulatory decisions, and collaborating with other stakeholders to address threats to listed species and their habitats.

FIFRA requires that EPA reevaluate every pesticide every 15 years, including the hundreds that affect species listed under the Endangered Species Act (ESA). ESA obligations also exist for many registrations of new pesticides, new uses of existing pesticides, and amendments to pesticide labels. In total, thousands of FIFRA actions will require an ESA review over the next decade alone.

If a geographically specific pesticide use limitation is necessary to protect a listed species or its designated critical habitat, the information appears as an Endangered Species Protection Bulletin and is referenced on the pesticide label. Since these pesticide labels refer to Bulletins, the Bulletins are enforceable as an extension of the label.

To implement the mitigations resulting from formal consultation, EPA may require changes to a pesticide's registration, label, or use instructions. When those changes are needed only in

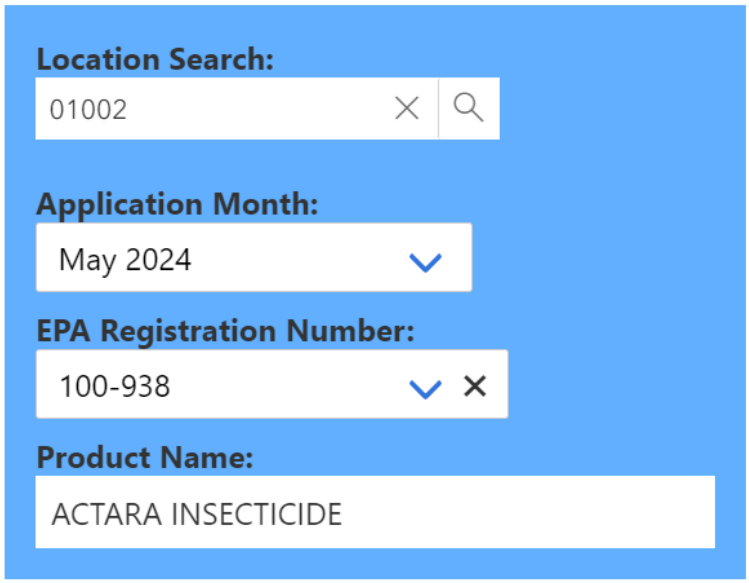
specific regions rather than nationwide, EPA may implement the changes through geographically specific Endangered Species Protection Bulletins. Bulletins Live! Two is EPA's current online endangered species bulletins system.

Bulletins Live! Two -- View the Bulletins

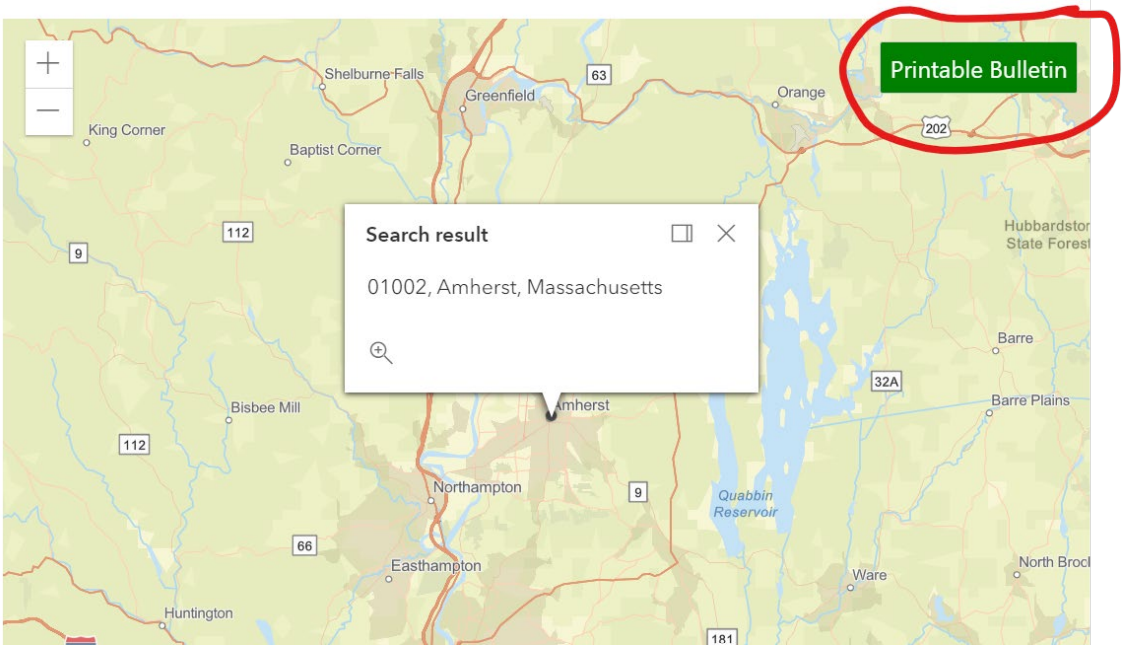
On November 9, 2023, EPA offered "Understanding Bulletins Live! Two: An Overview of The System," a webinar intended for state and tribal pesticide regulatory agencies, pesticide applicators, farmers, and others including academia and nongovernmental organizations. The webinar provided an overview of the Bulletins Live! Two web application, which is used to map Pesticide Use Limitation Areas (PULAs) for the protection of threatened and endangered (i.e., listed) species and their designated critical habitat.

- View webinar recording
- View webinar presentation slides (pdf) (2.1 MB)
- View webinar transcript (pdf) (194.7 KB)
- BLT Q&A Page.

Access the Bulletins Live! Two > You will need the EPA registration number of the product you intend to use.
As an exercise, I used 01002 as the application location, May 2024 as the application month, and the EPA registration number of ACTARA (100-938).



After populating the above box, you will see a change in the map (the red button that reads “PRINTABLE BULLETIN” will change from red to green.

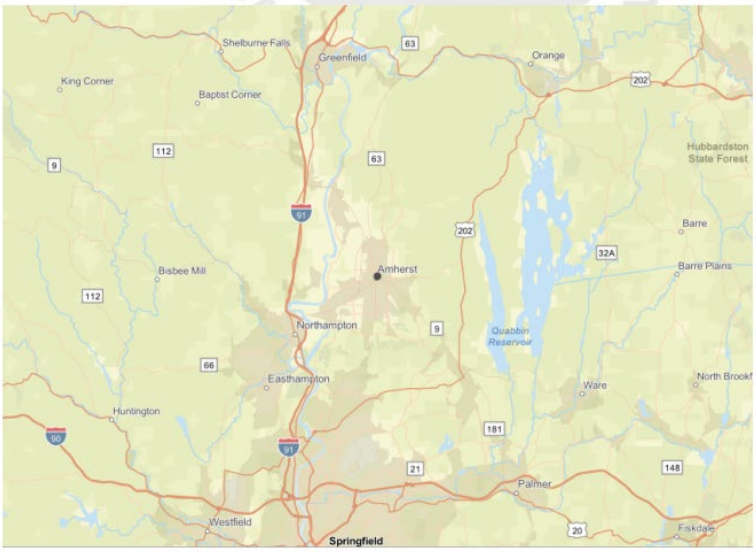


Click on the green button to generate the PDF file with the BULLETIN:

Endangered Species Protection Bulletin

Application Month: May 2024
Product: ACTARA INSECTICIDE (100-938)

1 Areas where pesticide use must be limited are identified on the map. A legend is located beside the map to help pinpoint these locations.

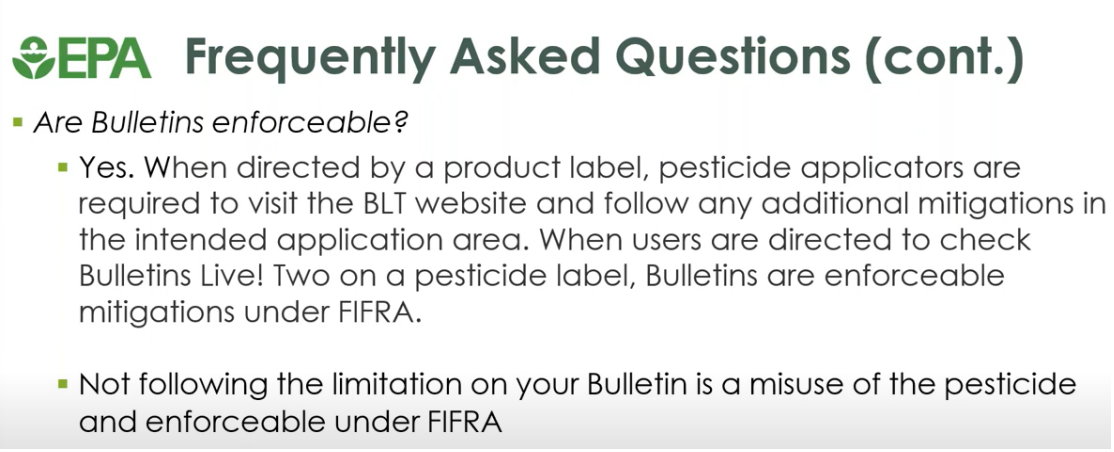


Legend
Limitation Area

Currently, no pesticide use limitations exist within the printed map view for the month/year and product you selected, beyond the instructions specified on the pesticide label.
Follow the use instructions on your label.

Ensure that your pesticide application area is within the printed map view. If it is not, follow the directions on the Instructions Tab to ensure that your pesticide application area is captured within the printed map view.

Please check back if you plan to apply your pesticide in an area outside the map view or in a month and year other than the one for which this Bulletin is valid.



Pesticides Update

Herbicide update (J. Clements)

Chateau herbicide (Valent USA) water soluble granules has been reformulated as Chateau EZ (hats off to their marketing department!) liquid flowable. Use recommendations/restrictions remain the same, those largely being for pome and stone fruit: rate is 6 to 12 fluid ounces per acre applied before silver tip (apples) and bud break (peaches); apply to berms only. I take that to mean in the herbicide treatment strip, not the whole ground acreage; avoid direct or indirect spray contact to foliage and green bark (may be used the year of planting IF trunks are shielded from spray contact): but "apply only to an apple block with an established (2 years or older) permanent cover crop that covers a minimum of 60% of the surface area of the block." I take that to mean row middles. Several other important application considerations: please read the label fully before using. The timing for spring application may have already run out by the time you read this. (Although it can be applied in the fall after harvest.) Chateau EZ gives effective pre-emergent and limited post-emergence control of many grasses and broadleaf weeds.

Zeus XC herbicide (FMC) was consolidated to Spartan 4F and Zeus Prime XC herbicide was consolidated to Spartan Charge.

Princep 4L and Princep (Syngenta): Updated Weeds Controlled section, expanded Apple and Pear uses to include entire Pome Fruit Crop Groupxpa, ended Peach, Nectarine, and Tart Cherry uses to include entire Stone Fruit Crop Group, revised Tank Mixtures for Weed Control in Perennial Fruit and Nut Crops.

Insecticide update (J. Pinero)

Altacor Insect Control (FMC) was discontinued and the transition to Altacor eVo Insect control was started. This should be in full effect this year. It went from a 35WG formulation to a 70 WG formulation, so the rates were halved, the new max rate is 2.2 oz/A with Altacor eVo.

Fungicide update (J. Pinero)

Miravis (Syngenta) added Caneberry Crop Subgroup 13-07A, a caneberry subgroup that includes blackberries and raspberries.

Miravis Prime (Syngenta) added Caneberry Crop Subgroup 13-07A. Changed rate in Grape and Small Fruit Vine Climbing subgroup (except Fuzzy Kiwifruit) Crop Subgroup 13-07F from 9.2 to 11.2 fl oz.

Many products updated their label to include Endangered Species Protection Requirements statement.

An update on the PFAS – Pesticide situation (G. Koheler)

Maine law states that beginning January 1, 2030, all products containing intentionally added PFAS will be prohibited from sale, unless the Maine Department of Environmental Protection (DEP) has determined that the use of PFAS in those products is currently unavoidable. Issuing an exemption requires approval by the Legislature. DEP may ban sale of PFAS prior to 2030 with legislative approval.

There are three ways that a pesticide could contain PFAS compounds:

a) The active ingredient is a PFAS.

b) An “inert” ingredient in the formulation, such as an adjuvant, is a PFAS.

c) Contamination. A compound not intended to be in the formulation can be introduced during the production process or as leachate from packaging materials.

The list of “Maine PFAS pesticides” shown below only includes those for which the active ingredient is defined as a PFAS by Maine statute. Those products are still registered by the EPA and by the state of Maine as legal products. The state of Minnesota also has a statewide ban on PFAS pesticides which begins in 2032. The Minnesota definition of PFAS is more inclusive than the Maine definition. Some prominent tree fruit pesticide active ingredients categorized as

being PFAS by Minnesota but not Maine are the insecticide/miticides Beta-cyfluthrin (e.g. Baythroid), Cyfluthrin (e.g. Tombstone), and Etoxazole (e.g. Zeal); the fungicides Fluazinam (e.g. Omega), and Fluxapyroxad (e.g. Merivon Xemium); and the herbicides Carfentrazone-ethyl (e.g. Aim), and Flumioxazin (e.g. Chateau).

The State of Maine has defined a PFAS as a compound with at least one fully fluorinated carbon. At least 10 other states, several other countries (including a proposal to the entire European Union), and the 38-member Organization for Economic Cooperation and Development (OECD) trade organization have also adopted a "single-carbon" definition. As of March 2024, only Maine and Minnesota have a date set for banning the sale of PFAS pesticides.

The EPA has been using a "working definition" that identifies PFAS as having two fully fluorinated carbon atoms (the actual chemical definition is more nuanced than that, but that is the gist of it.) EPA has no date specified for when a final determination will be made to replace the "working definition." The EPA definition only includes two pesticide active ingredients currently registered in Maine as being PFAS: pyrifluquinazon (e.g. PQZ insecticide), and broflanilide (an insecticide not labelled for use on tree fruit). The EPA has stated that it prefers to assess PFAS risk for individual compounds, not by a class-based definition such as put into state law by Maine and Minnesota.

The awareness and understanding of risks related to PFAS chemicals continues to evolve in many states, nationally, and internationally. Maine and Minnesota are not the only states with ongoing investigations into PFAS regulation. The current Maine law could be superseded by a new law before 2030. Or pesticides cleared for use by EPA could be granted an exemption by the Maine DEP.

Conversely, concerns about PFAS health and environmental effects could result in regulation at the national level before the Maine law takes effect in 2030. Consumer preference and marketing concerns could preclude the use of PFAS products even without government regulation. Orchard customers see a continuing stream of PFAS stories in the media. It may be useful for growers to be aware of which pesticides may be perceived as being implicated as part of the larger issues of PFAS pollution.

The list below only includes those pesticide active ingredients that are 1) categorized as a PFAS by Maine law, 2) are registered for sale in Maine, and 3) are labelled for use on tree fruit. There are other pesticides labelled for use on other crops not shown in the list. A Minnesota Department of Agriculture report published in February 2024 provides a readable discussion PFAS chemistry, sources of PFAS in pesticides, and the different definitions used by regulatory bodies to identify what is and what is not a PFAS. It is available at https://www.lrl.mn.gov/mndocs/mandates_detail?orderid=17604.

Tree fruit pesticides for which the active ingredient is categorized as a PFAS by Maine statute.		
Active Ingredient	Brand Name examples	Target crop examples (VERY incomplete)
Insecticides & Miticides		
Bifenthrin	Brigade, Sniper	Broccoli, Melon, Pumpkins, Rasp., Tree fruit.
Cyflumetofen	Nealta, Sultan	Grape, Strawberry, Tomato, Tree fruit.
Gamma-Cyhalothrin	Declare	Cabbage, Fid.& Swt. corn, Onion, Tree fruit.
Indoxacarb	Avaunt, Provaunt	Lettuce, Potato, Pumpkin, Swt. corn, Tree fruit.
Lambda-Cyhalothrin	Besiege, Crusader, Endigo, Silencer, Warrior	Bell pepper, Cabbage, Field & Sweet corn, Melon, Tree fruit.
Novaluron	Cormoran, Rimon	Brocc., Pot., Pumpk., Strawb., Swt.corn, Tree ft.
*Pyrifluquinazon	PQZ	Cabbage, Potato, Pumpkin, Spinach, Tree fruit.
Fungicides		
Cyflufenamid	Torino	Apple. Bell pepper, Cantaloupe, Pumpkin, Strawberry
Fludioxonil	Academy, Maxim, Scholar	Carrot, Cabbage, Sweet corn, Tree fruit.
Fluopyram	Luna Sensation, Luna Tranquility	Bell pepper, Pumpkin, Strawberry, Tree fruit.
Mefentrifluconazole	Cevya	Pumpkin, Sum. squash, Swiss chard, Tree fruit.
Penthiopyrad	Fontelis, Velista	Broccoli, Pumpkin, Strawberry, Tree fruit.
Trifloxystrobin	Flint, Gem	Pumpkin, Strawberry, Tomato, Tree fruit.
Triflumizole	Procure, Terraguard	Kale, Melon, Pumpkin, Strawberry, Tree fruit.
Herbicides		
Dithiopyr	Crew, Dimension	Christmas tree, Flowers, Nursery, Tree fruit.
Fluazifop-P-butyl	Fusilade	Carrot, Lettuce, Strawberry, Tree fruit (Stone fruit & Nonbearing pome), Wine grape
Norflurazon	Evital, Solicam	Cranberry, Tree fruit
Oxyfluorfen	Collide, Galigan, Goal, GoalTender, Oxystar	Onion, Potato, Pumpkin, Strawberry, Tree fruit
Penoxsulam	Pindar	Tree fruit
Trifluralin	Snapshot, + others.	Bell pepper, Carrot, Potato, Pumpkin, Tree fruit

IPM and other News Around the Country

Revisiting spring peach floral bud cold hardiness (J. Clements)

Just recently, I ran across the above titled Extension publication from Ioannis Minas at Colorado State University which I found interesting. ‘Quick Facts’ direct from the publication:

- ‘Cresthaven’ and ‘Suncrest’ are much less hardy from phenology stages 2-4 than classic cold hardiness charts would indicate.
- Most hardiness is lost by the beginning of stage 3-“red calyx”.
- ‘Suncrest’ reached stage 3-“red calyx”, two days earlier than ‘Cresthaven’.
- Moisture content is highly correlated with bud hardiness and phenology stage.
- At equal phenology stage ‘Suncrest’ is as hardy as ‘Cresthaven’ despite California heritage, showy petals and low chilling requirement.
- New updated cold hardiness charts per phenology stage were developed and presented herein for ‘Suncrest’ and ‘Cresthaven’.

I realize we don’t grow ‘Suncrest’ typically, nor Cresthaven necessarily, but there are some things to think about if you read the full article here: https://extension.colostate.edu/revisiting-spring-peach-floral-bud-cold-hardiness/ Most noteworthy is that the buds are less hardy in the early stages (through pink bud) than historical references suggest here: https://www.canr.msu.edu/resources/critical-spring-temperatures-for-tree-fruit-bud-development-stages Also, moisture content plays a role. Hmmm. Just goes to show how vulnerable we are — and how little we can predict — in the spring as to where we will be in August. Crop insurance is a no-brainer in this day and age, unless you want to be self-insured. People ask me all the time how the peach (and apple crop) is doing, I like to tell them “ask me again in August!”

Hail netting: an economically competitive IPM alternative to insecticides for Midwest apple production

Erica Laveaga, Kelli Hoover and Flor E. Acevedo (Department of Entomology, The Pennsylvania State University)

Exclusion netting has been shown to effectively control multiple insect pest species, limit fruit damage and reduce the use of insecticides while also conferring consumer and environmental benefits. In this study, partial budgeting was applied to explore the financial efficacy of using a hail netting (DrapeNet®) system as a sustainable pest management strategy for Midwest U.S. apple (Malus x domestica). The cost of the hail netting was compared to a common Midwest insecticide spray regimen for apples using yield and quality data from a field study at two Minnesota apple orchards in 2021-2022. The PB analysis indicated that the netting system was an economically competitive alternative to conventional insecticide applications. The economic results were robust across a range of apple prices and yields suggesting that Minnesota apple growers can benefit economically from the application of hail netting for sustainable pest management. Access the entire article **HERE.**

Turning a pest into a natural enemy: removing earwigs from stone fruit and releasing them in pome fruit enhances pest control

Aldo Hanel, Robert J. Orpet, Richard Hilton, Louis Nottingham, Tobin D. Northfield, and Rebecca Schmidt-Jeffris, C (Michigan State University)

Researchers from Washington State University, Oregon State University, and USDA ARS conducted field research aimed at developing mass-trapping and augmentation protocols for earwigs in Pacific Northwest stone fruit and pome fruit, respectively. In Washington State and Oregon, they conducted a two-year study to test (1) whether mass trapping was a reliable strategy to obtain large amounts of earwigs and (2) whether mass trapping reduced earwig populations and fruit damage in stone fruit. The researchers also examined whether earwig releases in pome fruit (3) helped establish and increase earwig abundance and (4) whether this had an effect on pest control.

While the European earwig is a generalist omnivore that can be a direct pest in stone fruit crops like cherries and peaches, it is a beneficial predator in apple and pear crops. In these crops, it feeds on two key pests, the woolly apple aphid and pear psylla, respectively, and rarely damages fruit. In the study, the researchers tested a two-way strategy to reduce fruit damage by removing earwigs from crops where they are pests and releasing earwigs into orchards where they can help control pest populations. They found that mass-trapping earwigs in stone fruit orchards did not significantly reduce earwig numbers or fruit injury; however, this was a relatively easy and practical method for collecting thousands of individuals for augmentative release in pome fruit orchards. Two mass releases (once annually) of earwigs helped control key pests in pears and apples, such as pear psylla and woolly apple aphids, by the second year. The researchers did not find evidence of a reduction in other pests, such as mites and other aphid species. Finally, they found that earwig releases can be useful in establishing their populations in orchards where they are absent or rarely found, potentially providing increased pest control over multiple seasons. Access the full article **HERE**.

Earwigs are effective at wiping out colonies of soft-bodied insects including woolly apple aphid

Original source: Katlyn Catron, Washington State University The Wenatchee Tree Fruit Research and Extension Center - June 1 2023

Earwigs get a lot of flak from humans – their name conjures unpleasant mental images, they're creepy and crawly as they move, and their cerci (or "pinchers," though they rarely pinch) look way more aggressive than any body part used for mating ought to. Some growers have good reason to dislike them, as earwigs can cause damage to soft fruits like peaches. However, for folks who grow firmer fruits like apples and pears, earwigs are incredibly useful allies in the fight against woolly apple aphid and pear psylla. Earwigs are so effective at wiping out colonies of soft-bodied pests in these systems that the Washington State University Tree Fruit Research

and Extension Center is distributing thousands of earwigs to growers who want to utilize them as a method of natural pest control. Despite their flaws, earwigs can be good additions to pome fruit pest management programs.

Figure 1. Woolly apple aphid colony during the day.

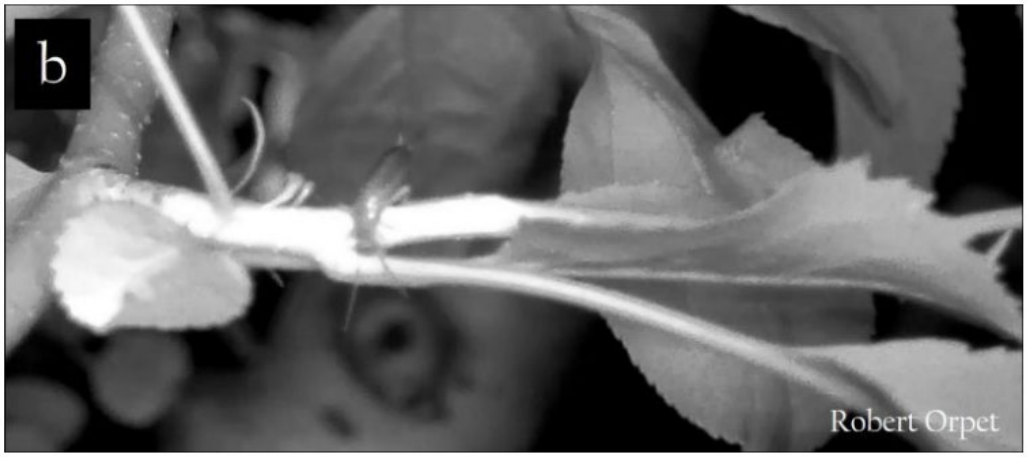


Figure 2. The same colony being consumed by an earwig at night.

Click on the picture below to watch a short movie

IPM Around the World (J. Piñero)

The benefits of integrated pest management for apple depend on pest type and production metrics

The development of integrated pest management (IPM) strategies, aimed at reducing pesticide use, has myriad ecological and agronomic benefits to terrestrial ecosystems and the environment, but can also lead to different biological and economic outcomes depending on the production system. The most common facet of IPM in apple is the reduction and/or alternative use of pesticides, but it also includes cultural, mechanical and biological controls. Using apple as a model system, we performed a meta-analysis* of 55 studies from 20 countries to quantify the effects of IPM on beneficial invertebrates, pest and disease pressure, and crop productivity (i.e., fruit yield and quality). We also explored different feeding guilds (i.e., tissue-chewing, sap-sucking or boring/mining herbivores, and beneficial natural enemy predators or parasitoids) to determine whether invertebrate responses to IPM differ between feeding strategies. By scoring IPM adoption based on the relative number of facets of IPM used in each study, we also determined whether the level of IPM implemented in apple farming systems alters the responses of invertebrates and pathogens. Our results demonstrate how IPM adoption increases the performance of natural enemies, while simultaneously reducing pest and disease pressure overall. However, the effects of IPM on disease pressure may depend on the level of IPM adoption because disease pressure increased when multiple facets of IPM were adopted (i.e., as the level of IPM adoption increased). Apple quality was not limited by IPM adoption, yet fruit yield decreased overall. While both natural enemy feeding guilds (predators and parasitoids) responded positively to IPM adoption, only two of the three pest feeding guilds (tissue-chewing

and sap-sucking herbivores) decreased under IPM, with boring/mining herbivores showing no response. These results demonstrate the complex benefits and limitations that can occur under IPM and call for economic risk assessments based on these differences. Effective IPM strategies rely on monitoring practices and pest/pathogen prevention but can provide real environmental value.

For the full article, click **HERE**.

*A meta-analysis combines data from multiple studies to increase statistical power, aiding in drawing reliable conclusions about the overall effect size or outcome. It offers a clearer picture of consistency and effects across studies, aiding in identifying patterns in research literature.

Side-effects of several insecticides on predatory mites in apple orchards

Valeria Malagnini and collaborators (Italy)

Background: *Amblyseius andersoni* is a common predatory mite occurring in fruit orchards located in Europe and North America. Its role in preventing spider mite outbreaks is widely recognized, in particular when selective pesticides are used. The compatibility between plant protection products and predatory mites is crucial to preserve their activity. There is a need to investigate the effects of pesticides on beneficials using multiple approaches. **Objectives**: Field and laboratory experiments were conducted to evaluate the effects of a number of insecticides on *A. andersoni*. **Methods**: The effects of neonicotinoids (i.e., acetamiprid, imidacloprid, thiacloprid, thiamethoxam) were compared with those of pyrethroids (i.e., tau-fluvalinate), well known for their negative impact on predatory mites. Insecticides were applied 1-3 times in an experimental fruit orchard located in Northern Italy. Laboratory trials focused on their effects on the survival and the fecundity of predatory mite females. **Results**: Field experiments showed a decline in predatory mite numbers in plots treated with neonicotinoids or tau-fluvalinate compared to the untreated control. However, predatory mites in neonicotinoid plots reached higher densities compared to those recorded in tau-fluvalinate plots. Spider mite (*Panonychus ulmi*) populations reached moderate to high densities in plots treated with taufluvalinate while their densities were negligible in the remaining plots. The survival of the predatory mite *Amblyseius andersoni* was moderately affected by some neonicotinoids in the laboratory while they significantly reduced predatory mite fecundity. In contrast, tau-fluvalinate exerted severe effects on survival and fecundity of predatory mites. Finally, the escape rate increased after pesticide exposure suggesting possible alterations in predatory mite behavior. **Conclusions**: Neonicotinoid applications significantly affected predatory mite densities in field conditions and this phenomenon appeared to be influenced by their impact on female fecundity. Their effects on survival were less severe. Implications of these results for IPM tactics in fruit orchards are discussed. Access the full article **HERE.**