

PMTP Newsletter – Enhancing Western Orchard Biological Control

What is Biocontrol?

Biological control occurs when pest populations are reduced by their natural enemies. All pest species have natural enemies. The effect of biocontrol can be enhanced by importing enemy species from the pest's native country, increasing the number of already existing natural enemies, or working to conserve the natural enemies that are already present. A research project, led by Vince Jones at the WSU Tree Fruit Research & Extension Center, is looking at ways to improve biocontrol and reduce the negative effects of pesticides on natural enemies.



Figure 1. The tachinid fly is a natural enemy of leafroller and other Lepidoptera that feed on foliage.

Terms used in biocontrol

Parasites - A parasite is an organism that lives on or in another species from which it derives sustenance or protection. It usually does not benefit the host, and often does it harm. It may complete its life cycle without killing the host.

Parasitoid - A parasitoid is an organism that requires and eats only one animal in its life span, but may be responsible for killing many (primarily as an adult). The immature stage is typically rigidly associated with the host insect.

Predator - A predator is an organism that kills and consumes many animal food items during its life span.

Enhancing Biocontrol in Western Orchards

A collaborative project between Washington State University, University of California at Berkeley, Oregon State University, and USDA-ARS Yakima Agricultural Research Laboratory is focused on ways to improve the stability of IPM programs in apple, pear, and walnut orchards, by enhancing biological control.

One of the key objectives of the project is to evaluate the lethal and sublethal effects of newer pesticides on key natural enemies. The sublethal and chronic effects of these materials may be less obvious at first, but can be very detrimental to the conservation of natural enemy populations. Another objective of the biocontrol project is to develop monitoring tools to help characterize natural enemy phenology. Information about when natural enemies emerge from overwintering areas, when they enter the orchard, and how they develop within the orchard can help in developing management programs that will reduce negative impacts on natural enemies.

Lab studies of pesticide effects

Initial lab bioassays revealed that in addition to acute mortality, some chemicals may alter sex ration, fecundity, prey consumption, or increase long-term (chronic) mortality. Some of the first results from lab studies are shown in the table below (Table 1).

Table 1. Acute and sublethal effects of pesticides on natural enemies. Cell color reflects the impact on the natural enemy: green (< 25% impact), yellow (25-75% impact), or red (≥ 75% impact); white – test not yet analyzed, grey – test not applicable.

	Altacor	Delegate	Rimon	Warrior
<i>D. brevis</i> (Fig. 2)				
acute 48h immature mortality	Green	Green	Red	Red
acute 48h adult mortality	Green	Green	Green	Green
fecundity	Green	Yellow	Red	Grey
<i>G. occidentalis</i> (Fig. 3)				
acute 48h immature mortality	Green	Green	Green	Red
acute 48h adult mortality	Green	Red	Yellow	Red
prey consumption	Green	Grey	Green	Grey
fecundity	Yellow	White	Red	White
<i>A. mali</i> (Fig. 4)				
acute 48h adult mortality	Yellow	Red	Yellow	Red

*100% field rate used



Figure 2. *Daraecoris brevis* prey on spider mites, aphids, scale crawlers, leafhoppers, pear psylla.



Figure 3. *Galandromus occidentalis* prey on spider mites of all stages.



Figure 4. *Aphelinus mali* attacks late instar aphids; adult parasitoids also puncture aphids and host feed to obtain nourishment for egg laying.

The information gained from these and other pesticide studies will help with creating IPM programs that enhance biological control by minimizing disruption of the natural enemies in the orchard. Results of the pesticide effects studies are updated regularly as experiments are completed on the project website found at: http://enhancedbiocontrol.org/P_effects.html. The final results of this research will be added to the WSU-DAS website.

Natural Enemy Phenology

Knowing when, where, and how many natural enemies are present at various times of the season will help us design management programs that minimize pesticide exposure to natural enemies. To get information about natural enemy phenology in our orchards, monitoring tools first need to be developed. In the first year of the project, a lure system was developed and three trap types, four release rates, and fourteen different herbivore-induced plant volatile (HIPV) attractants were tested.



Figure 5. Trap types tested for monitoring natural enemies.

The yellow sticky card (Fig. 5) was consistently one of the most sensitive for all natural enemies. The combination of visual and chemical lures allows monitoring several predatory and parasitoid groups that don't respond to normal delta traps. An effective attractant blend has been developed and future research will work towards optimizing lures to capture a range of natural enemies and reduce capture of those of less interest.



Figure 6. *Eupeodes volucris*, syrphid fly.



Figure 7. *Chrysoperla plorabunda*, lacewing.

The attractant blend that has been developed (geraniol + methyl calicylate + 2-phenylethanol or "GMP") brings in large numbers of syrphid flies (Fig. 6), which feed on aphids; and lacewings (Fig. 7), which feed on aphids, spider mites, small soft-bodied insects.

For more information about the Enhancing Western Orchard Biocontrol Project and reports of progress being made, visit the project website:

<http://enhancedbiocontrol.org/>

For more information about management programs and pesticide effects on natural enemies visit the WSU Decision Aid System (DAS) website at: <http://das.wsu.edu>

For access to newsletters and other educational material related to apple IPM, visit the Apple IPM Transition Project website at: <http://pmtip.wsu.edu>