

Project Title: Calibrating current NE action thresholds with lure-baited trap catch

Report Type: Final Project Report

Primary PI: Christopher Adams
Organization: OSU
Telephone: 248-850-0648
Email: chris.adams@oregonstate.edu
Address: 3005 experiment station drive
City/State/Zip: Hood River, OR 97031

Co-PI 2: Rebecca Schmidt-Jefferies
Organization: USDA-ARS
Telephone: 509-454-6556
Email: Rebecca.schmidt@usda.gov
Address: 5230 Kennowac Pass Rd.
City/State/Zip: Wapato, WA 98951

Co-PI 2: Robert Orpet
Organization: WSU
Telephone: 509-293-8756
Email: robert.orpet@wsu.edu
Address: 1100 N. Western Ave
City/State/Zip: Wenatchee, WA 98801

Cooperators: GS Long, Wilbur-Ellis, W. Ag. Improvement, Chamberlin

Project Duration: 3 Year

Total Project Request for Year 1 Funding: \$ 45,000
Total Project Request for Year 2 Funding: \$ 45,000
Total Project Request for Year 3 Funding: \$ 45,000

Other related/associated funding sources: Applied, and re-applying

Funding Duration: 2024 - 2027

Amount: \$339,668

Agency Name: WSARE

Notes: We applied for this grant last year and were highly rated but not funded. We are re submitting the grant this spring with more of an emphasis on on-farm outreach and extension.

WTFRC Collaborative Costs:

Item	2021	2022	2023
Salaries 1	\$13,000.00	\$13,000.00	\$13,000.00
Benefits			
Wages			
Benefits			
RCA Room Rental			
Shipping			
Supplies 2	\$6,000.00	\$6,000.00	\$6,000.00
Travel 3			
Plot Fees			
Miscellaneous			
Total	\$19,000.00	\$19,000.00	\$19,000.00

Footnotes:

¹Faculty Research Assistant at 0.15 FTE, with 3% increase in years 2 and 3; OPE 70%

²Research consumables

Budget 1

Primary PI: Christopher Adams

Organization Name: OSU

Contract Administrator: Charlene Wilkinson

Telephone: 541-737-3228

Contract administrator email address: Charlene.wilkinson@oregonstate.edu

Station Manager/Supervisor: Brian Pierson

Station manager/supervisor email address: brian.pierson@oregonstate.edu

Item	2021	2022	2023
Salaries ¹	\$13,000.00	\$13,000.00	\$13,000.00
Benefits			
Wages			
Benefits			
RCA Room Rental			
Shipping			
Supplies			
Travel ²			
Plot Fees			
Miscellaneous			
Total	\$13,000.00	\$13,000.00	\$13,000.00

Footnotes:

¹GS-4 technician for 4 months per year, 100% FTE at 8% benefits, Year 2 includes 2.5% COLA increase. Technician would conduct sampling in the Yakima area, process/count samples, and slide mount mites for identification (Schmidt-Jeffris will identify). This technician will also conduct surface sterilization and PCR for gut content analysis for all samples (Yakima, Wenatchee, and Hood River).

²Molecular supplies for gut content analysis, sticky cards for field sampling – to be purchased for entire project team.

³Fuel to field sites will be provided by USDA base funds and is not requested.

Budget 2

Co PI 2: Rebecca Schmidt-Jeffris

Organization Name: USDA-ARS

Contract Administrator: Mara Guttman

Telephone: 510-559-5619

Contract administrator email address: mara.guttman@usda.gov

Station Manager/Supervisor: Rodney Cooper

Station manager/supervisor email address: Rodney.cooper@usda.gov

Item	2021	2022	2023
Salaries ¹	\$13,000.00	\$13,000.00	\$13,000.00
Benefits			
Wages			
Benefits			
RCA Room Rental			
Shipping			
Supplies			
Travel ²			
Plot Fees			
Miscellaneous			
Total	\$13,000.00	\$13,000.00	\$13,000.00

Footnotes:

¹PhD student in Orpet lab at 0.15 FTE with 3% increase in years 2 and 3; OPE 30%

³Travel to field plots

Budget 3

Co PI 2: Rob Orpet

Organization Name: WSU

Contract Administrator: Shelli Tompkins

Telephone: 509-293-8803

Contract administrator email address: shelli.tompkins@wsu.edu

Station Manager/Supervisor: Chad Kruger

Station manager/supervisor email address: cekruger@wsu.edu

Objectives

1. Use plant volatile baited monitoring traps to describe NE communities in orchard ecosystems through the season.
2. Compare capture of several key species of NEs in lure-baited traps with numbers measured from standard scouting techniques.
3. Establish action (or in-action) thresholds for key NEs.

Significant Findings

- We have shown that lure baited monitoring traps can be used to attract and collect natural enemies in managed pear orchards. These traps are superior to beat trays because they collect data continually over the period of a week. Plant volatile baited traps collect unbiased data that is not influenced by differences in human collection technique.
- We have measured the abundance and timing of 12 natural enemies of pear psylla across the entire Hood River valley over three years.
- We provided weekly communication about natural enemy abundance and timing to stake holders through weekly extension emails, who said they used these numbers to make management decisions.

Methods

Natural enemy lures containing 4 compounds acetic acid, methyl salicylate, phenylacetaldehyde, and 2-phenylethanol, a combination that has been shown to attract key indicator groups of natural enemies, were made at the OSU MCAREC lab. These lures were hung on yellow sticky traps and placed at 20 pear orchards that were recommended by collaborative crop consultants. Traps were checked and replaced weekly from April to September. Captured insects were identified to family level, species complex (e.g. Lacewings), or to species when possible.

We hope to be able to correlate numbers of natural enemies with relative levels of pear psylla control, and supply crop consultants with reliable action thresholds. While this project will likely require years of refinement, I believe that this first step is critically important to setting the expectation that action threshold for natural enemies can be quantified. Additionally, we hope to direct private industry to manufacture specific lures according to our specifications that will target key natural enemies and be available for commercial use.

To evaluate the usefulness of natural enemies traps we will need to show that trapping can be as good or better at measuring the building natural enemy population, as scouting. Scouting for natural enemies only provides a snapshot in time of the pest and predator populations and may be negatively influenced by weather or sampling technique, which makes it difficult to know if you have an accurate picture of the insect community. Traps have the advantage of collecting data continually over the period between trap checking. Lure baited traps left in the field for a week provide a more consistent measure of the local arthropod community and is more consistent than a person tapping limbs. Catch data was shared with consultants in real

time during the study and reviewed retrospectively to see how recommendations and predictions of pest and natural enemy populations matched with catch data. Cooperating crop consultants have been asked to keep detailed notes of psylla and natural enemies counts made as part of their normal scouting routine, as well as recommendations they made for each week. At the end of the season, we compared crop consultant's management decisions and scouting counts with trap capture for that same period of time.

Weekly psylla counts were sampled by randomly collecting 10 pear shoots from each site and counting the number of eggs, young nymphs, and old nymphs from 5 leaves from each shoot. This method is regularly used by crop consultants to help guide management decisions. The addition of this data will give a clearer image of how psylla populations grew or decreased each week at each site.

We believe that lure baited monitoring will be the new standard for monitoring pear orchards for natural enemies. We have approached private industry (AlphaScents) to develop a commercial lure that can be used by crop consultants.

Results and Discussion

A total of 837 four-part plant volatile lures were manufactured in Hood River for the three trapping seasons. The traps placed at 20 pear orchards in Hood River Co (Fig 1.A.) yielded a total of 5,037 natural enemies in 2021. Of these the most common insects found were green lacewings (1,680), *Dereaocoris* (1,836), Yellow Jackets (809), and earwigs (232). In 2022 traps placed in the same 20 orchards yielded a total of 5,037 natural enemies. Of these the most common insects found were green lacewings (1,091), *Dereaocoris* (1,303), Yellow Jackets (1,040), Syrphidae (615), Trechnites (696), and earwigs (274) (Fig. 3 A and B). In 2023 traps placed in the same 20 orchards yielded a total of 4,522 natural enemies. Of these the most common insects found were green lacewings (1,861), Trechnites (1,038), Yellow Jackets (564), *Deraeocoris* (464), Campylomma (136), and earwigs (107)

In Chelan County, WA 9 traps placed along US route 2 near Cahsmere (Fig 1.B.) that yielded a total of 3,773 natural enemies. Of these the most common insects found were green lacewings (1,112), Trechnites (1,743), and *Dereaocoris* (462), in 2022 In 2023 these same sites had a total of 3,773 natural enemies. Of these the most common insects found were green lacewings (1,112), Trechnites (1,743), and *Dereaocoris* (462) (Fig. 3 D and E).

In Yakima County, WA 10 traps placed in pear orchards (Fig 1.C.) yielded a total of 1,602 natural enemies. Of these the most common insects found were green lacewings (994), *Dereaocoris* (409), Coccinellidae (322), and Yellow Jackets (320) in 2022. In 2023 these same sites had a total of 1,602 natural enemies. Of these the most common insects found were green lacewings (653), *Dereaocoris* (342), and Trechnites (142)

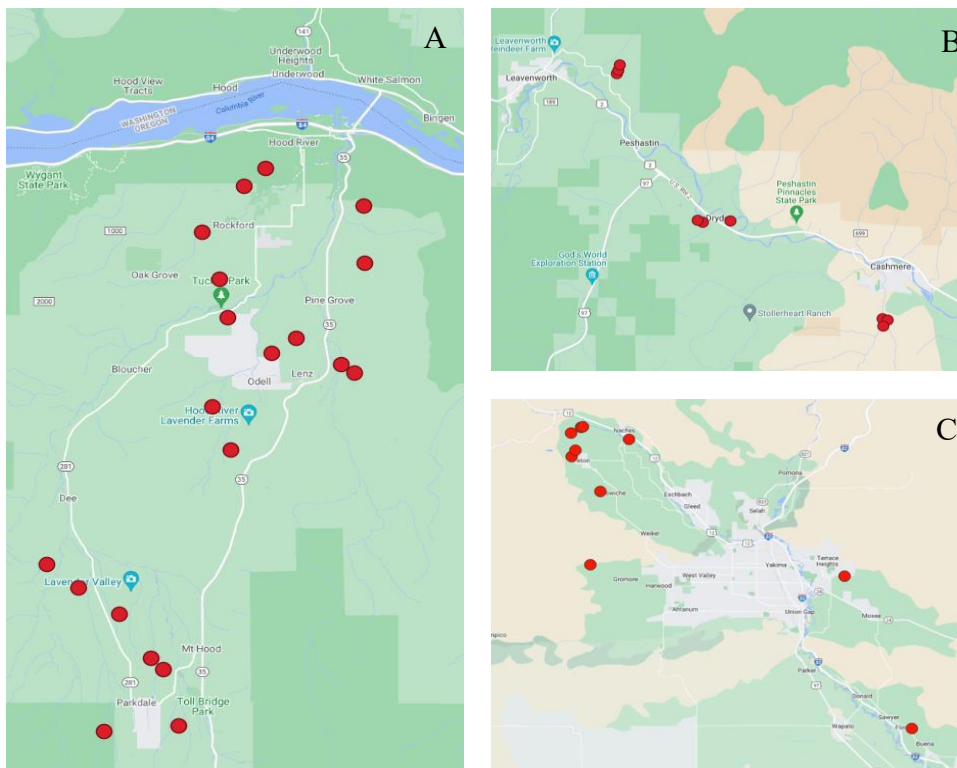
Lure baited yellow sticky cards effectively collected 12 key natural enemies season long and represent significant time savings over scouting the orchards with beat trays. In Addition, lure baited yellow sticky cards collected insects not typically collected in beat trays such as

yellow jackets, bald faced hornets, and adult syrphid flies. Lure baited yellow sticky card provided the additional benefit of collecting data all day long over an entire week (or more). This benefit addresses some of the limitations of beat trays which are impacted by the time of day the traps are checked or from the high wind conditions. Beat tray data can also be impacted by variation between people conducting the sample, or the limb of tree selected.

Earlier researchers have suggested that natural enemies need to be present in large numbers early in the season to be effective at rendering biological control against pear psylla. In Orchards identified by crop consultants as “easy” to control with natural enemies, we find large populations of natural enemies early in the season and at ratios of up to 100:1 (natural enemies to pear psylla). Where populations of natural enemies are not present early in the season or when ratios of natural enemies to pear psylla is not sufficient, we see lack of control. Tracking natural enemies with lure baited sticky cards also indicates where psylla sprays are impacting natural enemies and, in some cases, we can see where insecticide sprays were applied when no psylla were present. This tool will allow for improved management decisions and better-timed sprays.

Researchers have been working on this objective for fifty years. This same question was Larry Gut’s Master’s degree, his dissertation sits on my shelf. The last three seasons have been some of the most unusual in memory with snow during bloom, a heat dome in the summer, followed by an unusually wet spring. None of these past years can be average. One trend we have seen is that a steady drop in *deraeocoris* over three years that corresponded with a huge surge in pear psylla this past summer, despite huge numbers of lacewings being present all three years. We still have great variability between sites within each year, and we don’t find clear cause and effect. Despite this variability crop consultants can, for the first time, compare individual sites to area-wide averages to help make decisions. While the number of any one natural enemy has not correlated with control, we are encouraged by the high level of enthusiasm from our crop consultant collaborators, who feel that this data is informative to them.

Washington collaborators could not start work in the first year because of the off-set timing of funding. They will complete their final summer of collection this year. Rebecca Schmidt-Jeffris may need a no cost extension to manage the billing to her account. I did not make an extension request extension because I thought she would be able to move those funds into a spendable account. She is in the process of working out those details.



Figures 1 (A-C). Maps showing the sites where traps were placed in A. Hood River County, OR, B. Chelan Co., and C. Yakima Co.

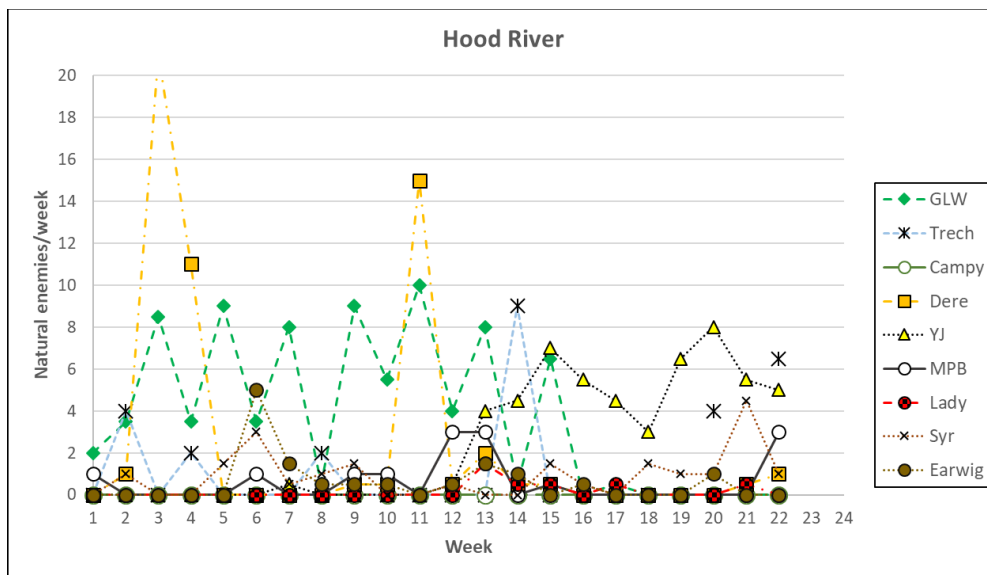


Figure 2. An example of the average natural enemy counts found in the Hood River region, sent out weekly to growers and crop consultants in 2021 - 2023. These area-wide averages were used by crop consultants, in conjunction with local trapping, to make decisions. Although crop consultants could not agree on a magic number of any one insect.

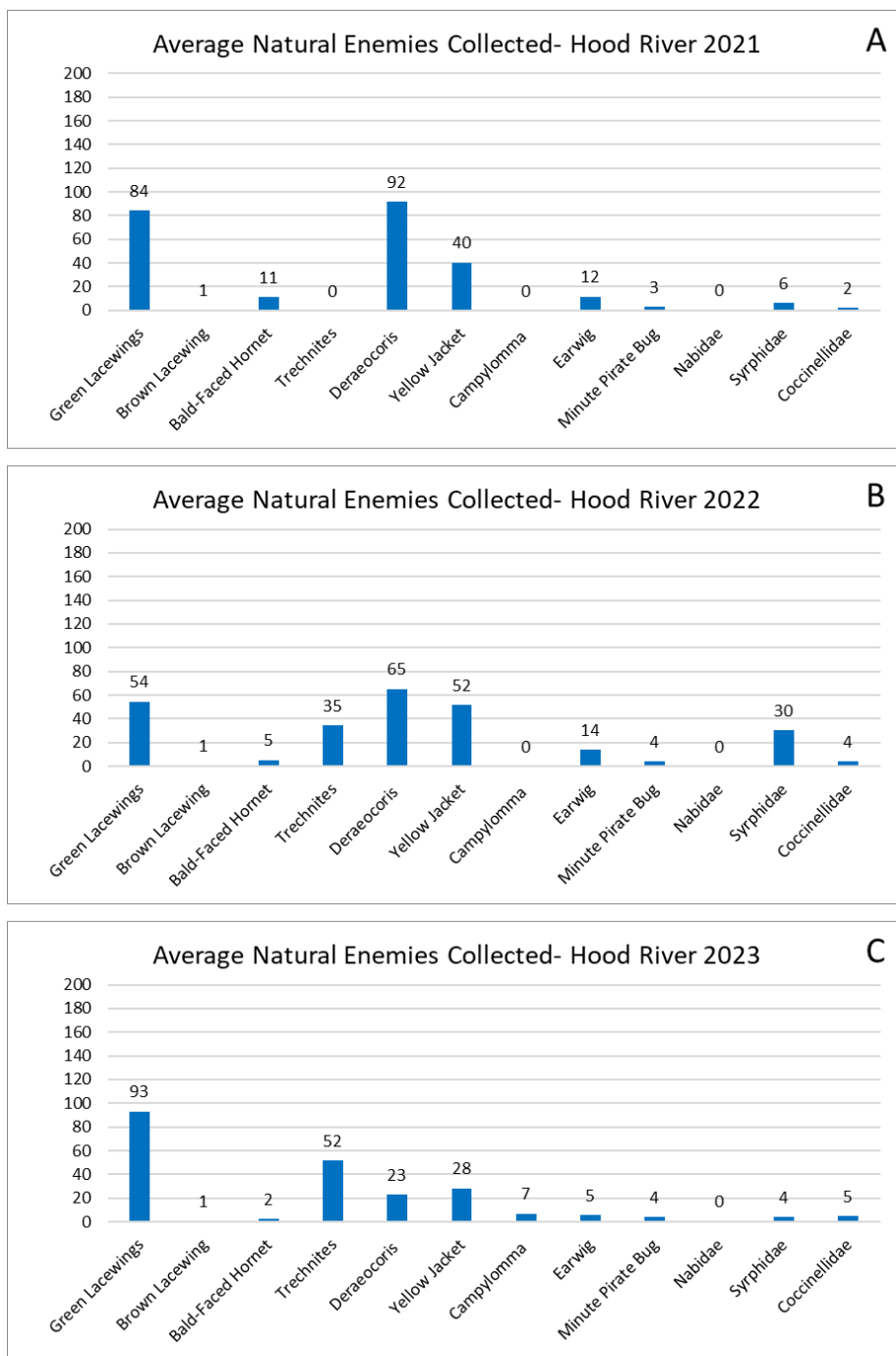


Figure 3 (A-C). Average natural enemy capture in Hood River by year shows a multi-year decreasing trend in deraeocoris that correlates with last high year's pear psylla counts. No other insect has shown a clear correlation.

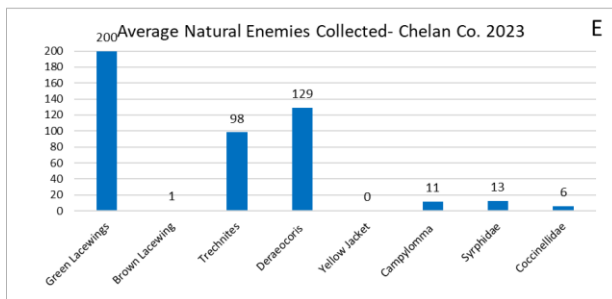
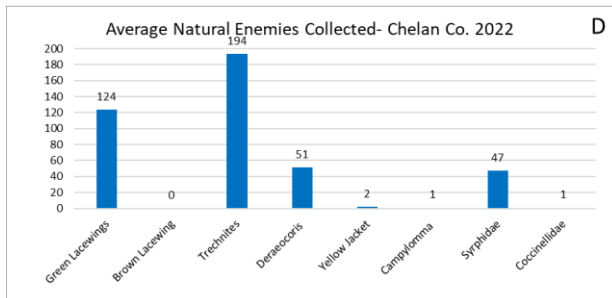


Figure 4 (D &E) Average natural enemies Chelan CO in 2022 (D) and 2023 (E).

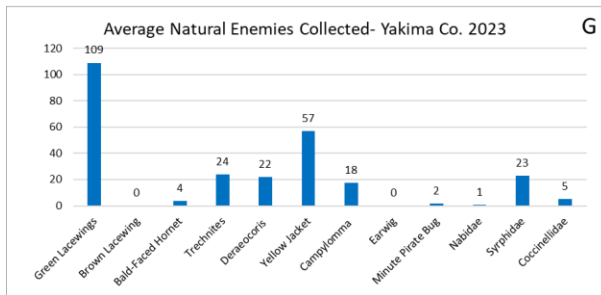
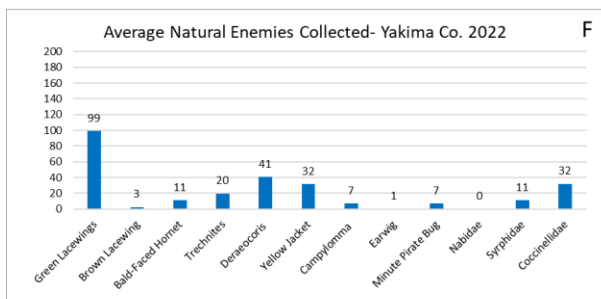


Figure 5 (F & G) Average number of natural enemies collected Yakima Co. in 2022 (F), 2023 (G).

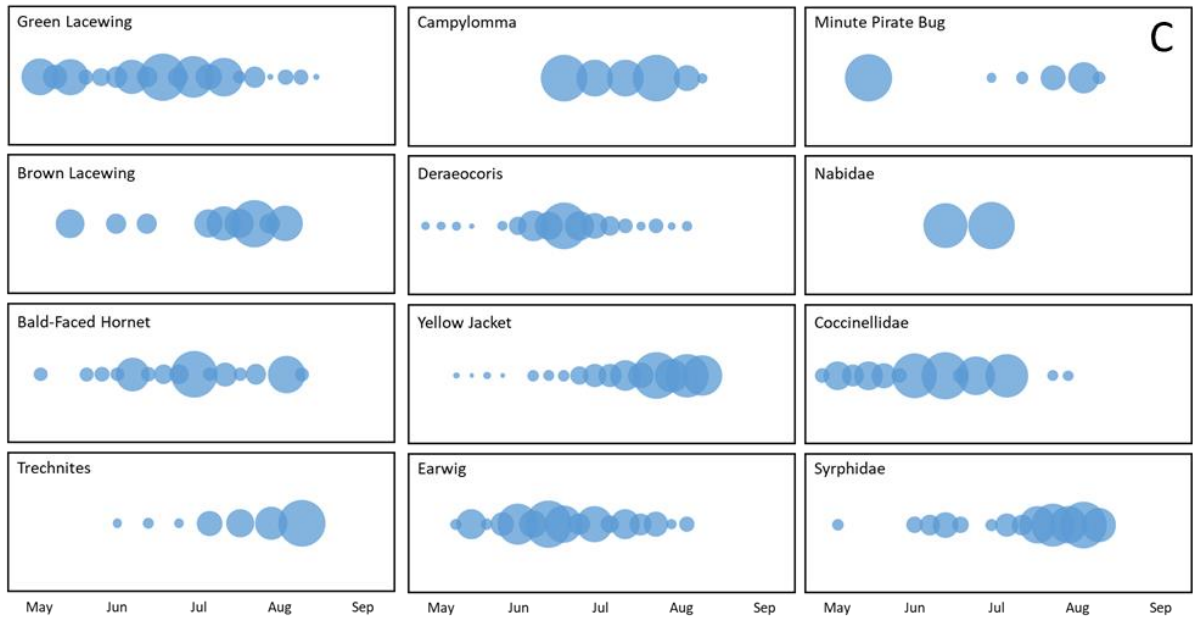


Figure 6. The relative abundance of natural enemies throughout the season in Hood River illustrates timing of natural enemy occurrence.

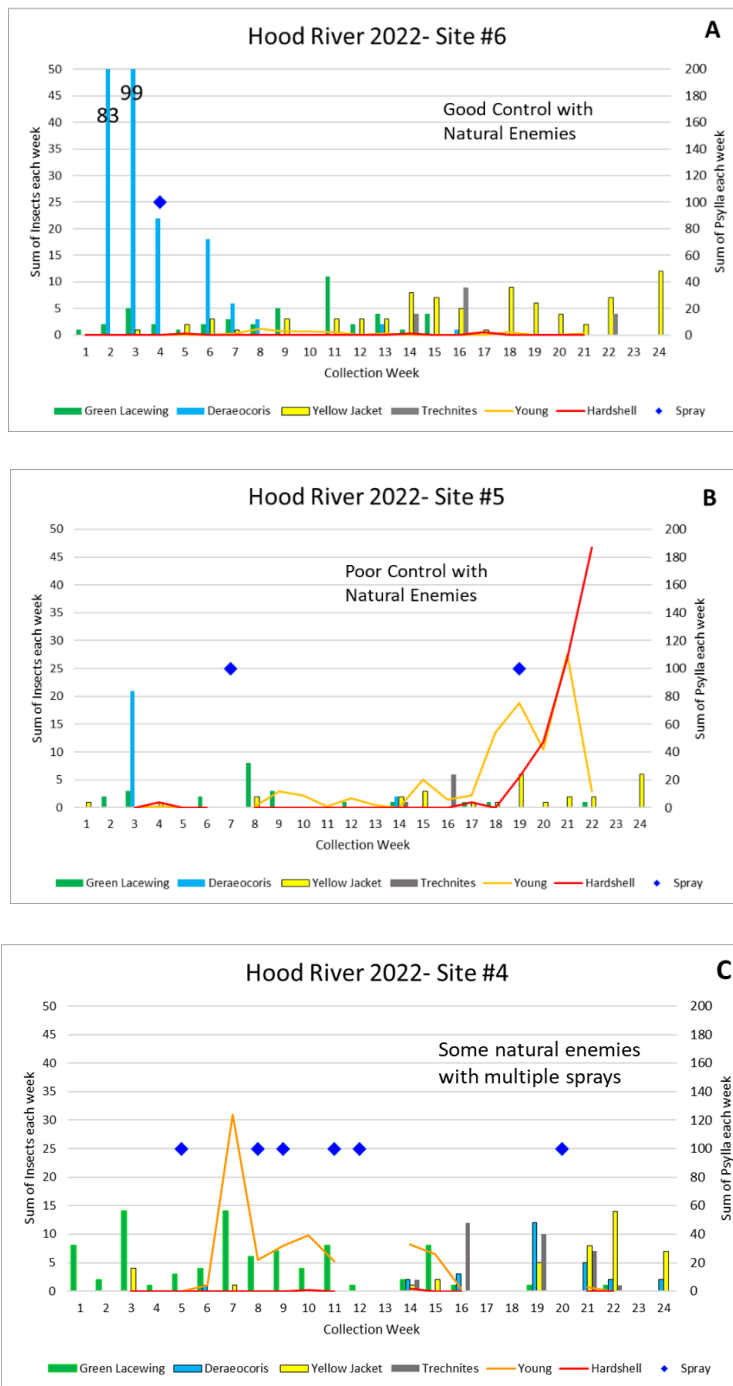


Figure 7. Representative orchards showing season long catch. Counts of natural enemies, young pear psylla nymphs (young), and mature psylla nymphs (hard-shell) at select sites in Hood River Co. Figure A shows ideal natural enemy control. Figure B shows lack of natural enemy control. And Figure C shows insufficient natural enemy control with multiple sprays.