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Managing the Vectors of Little Cherry Disease

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Little Cherry Disease (LCD)

- Symptoms
  - Produce cherries of small size and poor color and flavor

- Results
  - Economic losses
  - Tree and orchard removal

Bing Cherries

Pathogens and vectors associated with LCD

1. Little cherry virus 2 (LChV2) (pathogen)
   - Transmitted by
     - apple & grape mealybug (vectors)
     - Root grafting
2. Western X phytoplasma (WX) (pathogen)
   - Transmitted by
     - various leafhopper species (vectors)
     - Root grafting
   - Surprising resurgence discovered in 2014
3. Little cherry virus 1 (LChV1) (pathogen)
   - Mode of transmission unknown
   - Present at low level throughout WA State
   - Typically found in combination with LChV2 or WX

Apple Mealybug,
Phenacoccus aceris

Grape Mealybug,
Pseudococcus maritimus

Cherry leafhopper,
Fieberiella florii
Photo credit: Carol Davis

Mountain leafhopper,
Calladonus montanus
Photo credit: Carol Davis

Apple Mealybug Phenology

overwintering females

overwintering males

emerged females

emerged males

egg masses

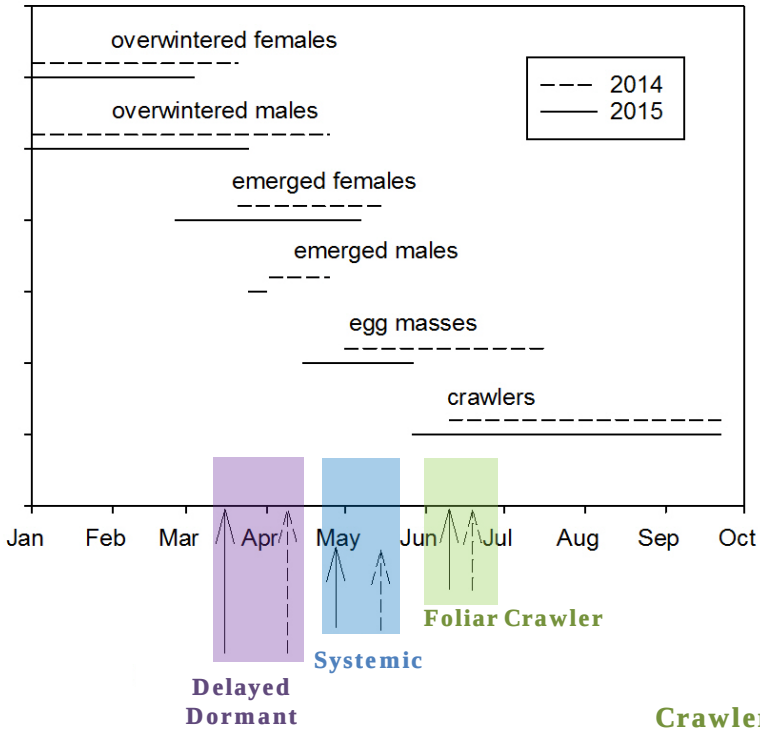
crawlers

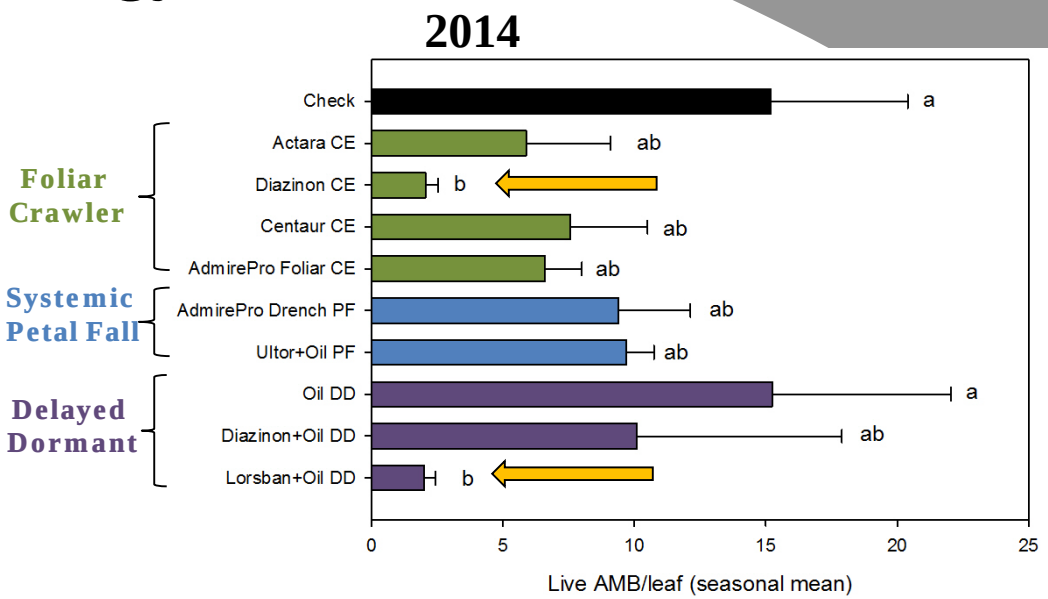
Jan Mar May Jul Sep

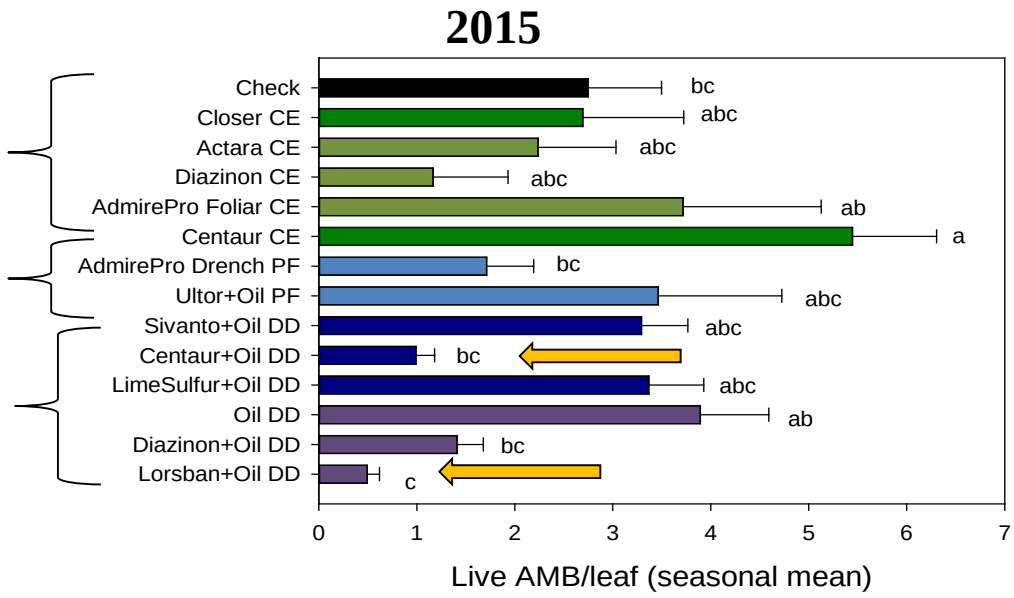
Delayed Dormant

Systemic Petal Fall

Apple mealybug phenology and control





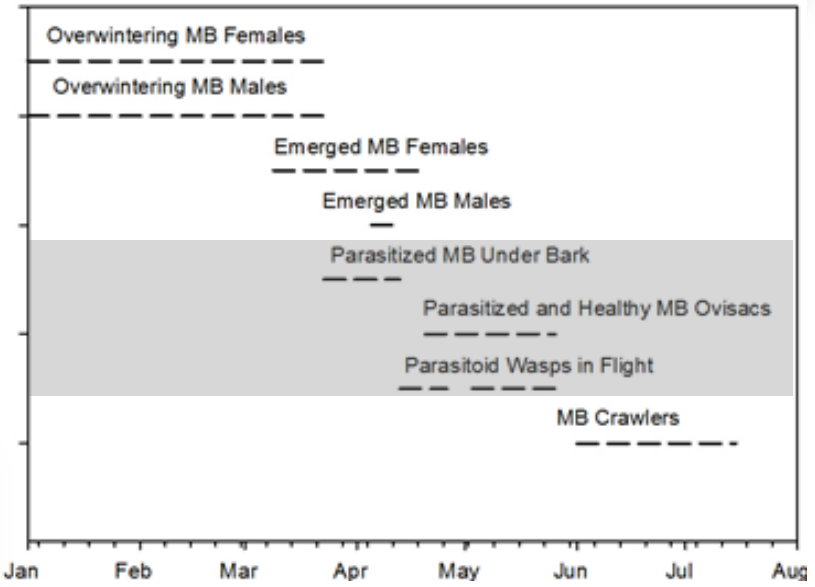


Control methods for apple mealybug 2016

- A field experiment was conducted to determine the effects of chemical insecticides, however, due to extreme parasitism, all trees/trt groups had low crawler numbers.

- Observed parasitism jumped from affecting approximately 20% of egg laying females in 2014, 70-80% in 2015, and to almost 100% in 2016.

- Parasitoid wasps were identified as *Anagyrus schoenherri*.



AMB phenology observed (2016). Parasitoid wasp, observed within AMB mummies and in flight (shaded area).

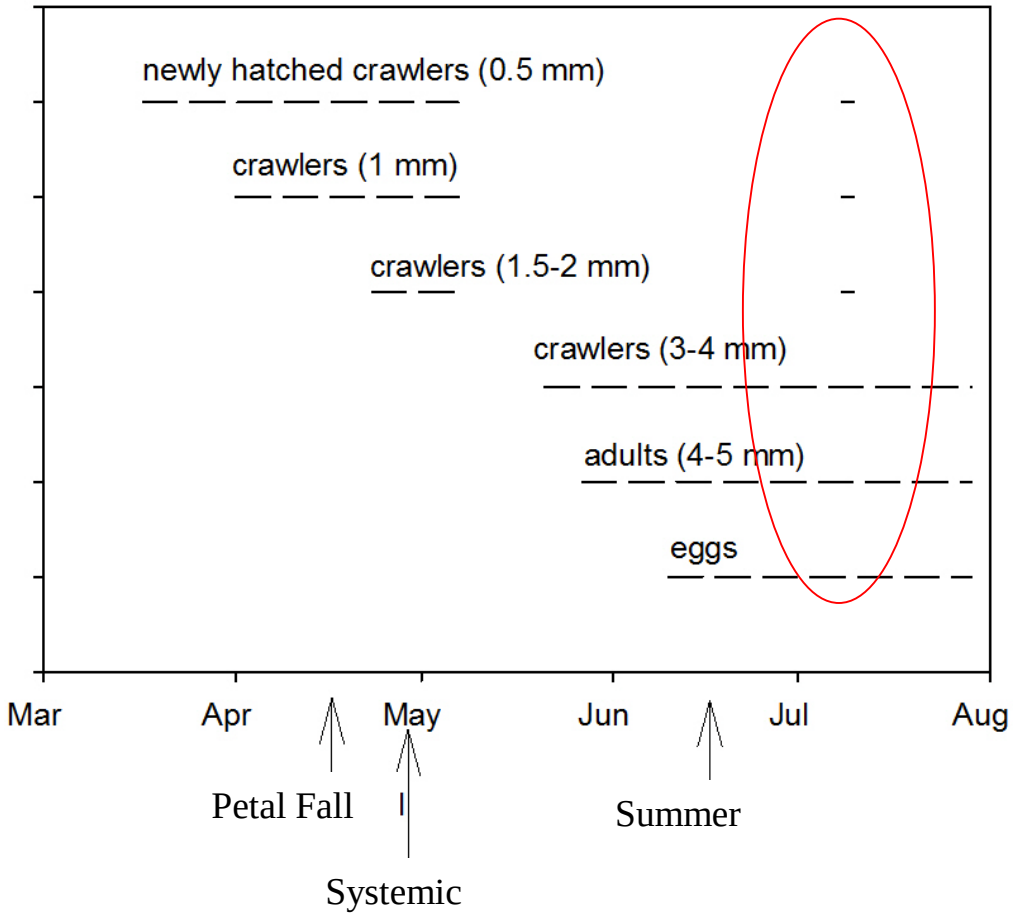
AMB biocontrol via parasitoid wasps

- ***Allotropus utilis* Muesbeck**
  - **Discovered in 1939 in Nova Scotia, was exported to British Columbia (in 1938), where it became well established.**
  - **Credited for reduction in AMB associated with LCD infected trees.**
- ***Anagyrus schoenherri* discovered in Washington state in 2015.**

Anagyrus schoenhherri, Female on top, male on bottom

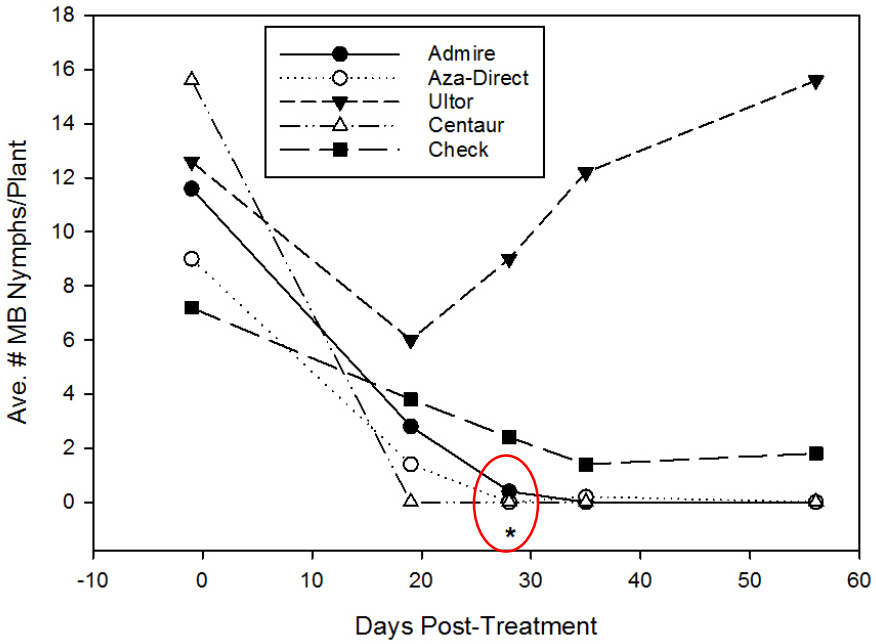
AMB egg masses with wasp exit holes

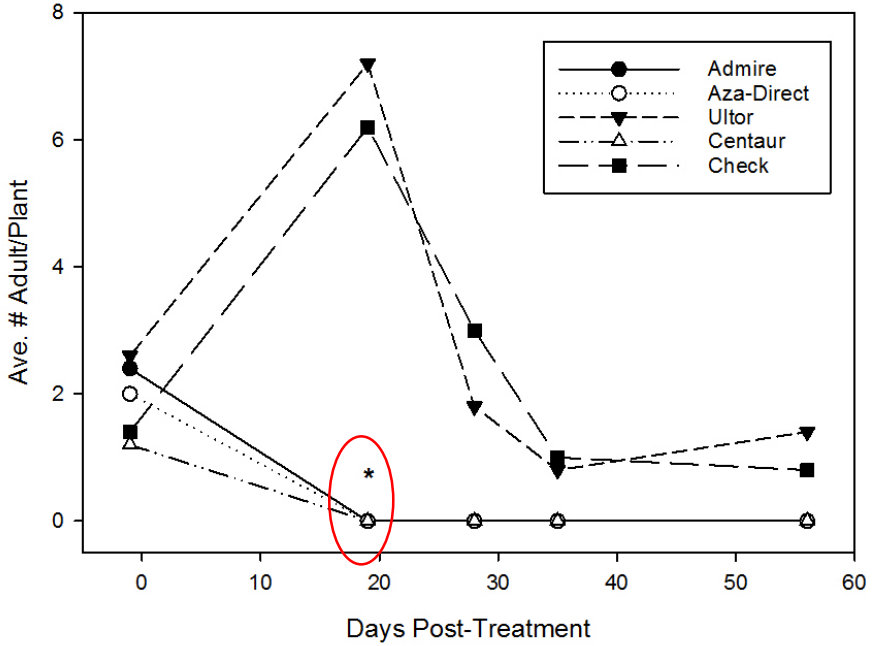
Grape mealybug phenology and control



Control methods for grape mealybug (GMB)

- Systemic control
  - GMB-infested 1-yr.-old potted “Bing” trees.
  - Treatments:
    - **Admire Pro and Aza-Direct** (soil drench systemic)
    - **Ultor** (foliar-systemic)
    - **Centaur** (insect growth regulator)
  - Average number of GMB crawlers, nymphs, adults/plant over time.

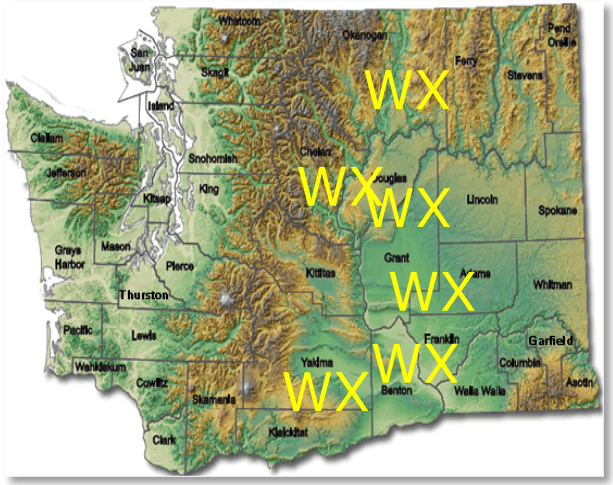




Significant findings for mealybug control

- AMB – Delayed dormant treatments targeting emerged females is most effective.
- AMB – *Anagyrus schoenherri* was found in WA state, and can reduce populations.
- GMB – Soil-drench systemic compounds and an IGR reduced the nymph and adult numbers on potted 'Bing' trees.

The Hunt for Leafhopper Vectors of Western X in Washington Cherries: Year One

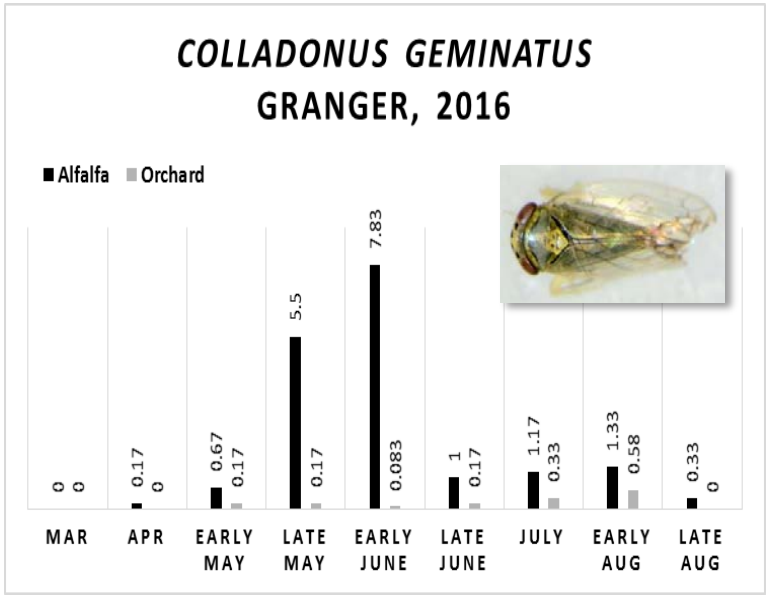


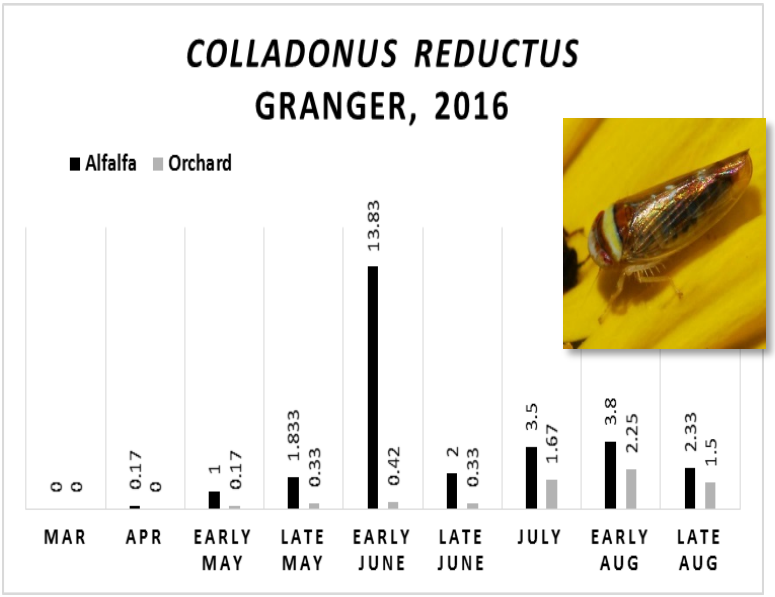
1. Conduct survey of leafhoppers in Western X affected orchards.

2. Conduct survey of host plants for leafhoppers and/or WX in affected orchards.

3. Examine the capability of selected leafhopper species to transmit WX phytoplasma.

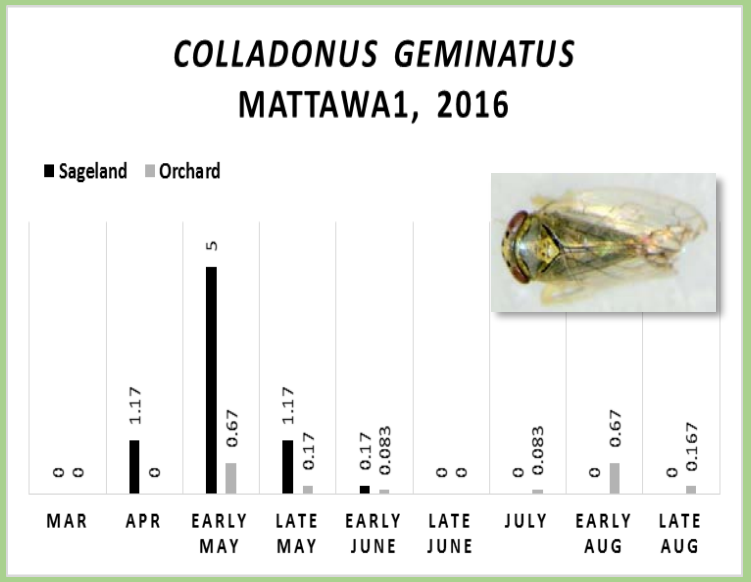
Seasonal incidence of *Colladonus* spp. on sticky cards in Granger cherry orchard and neighboring alfalfa field

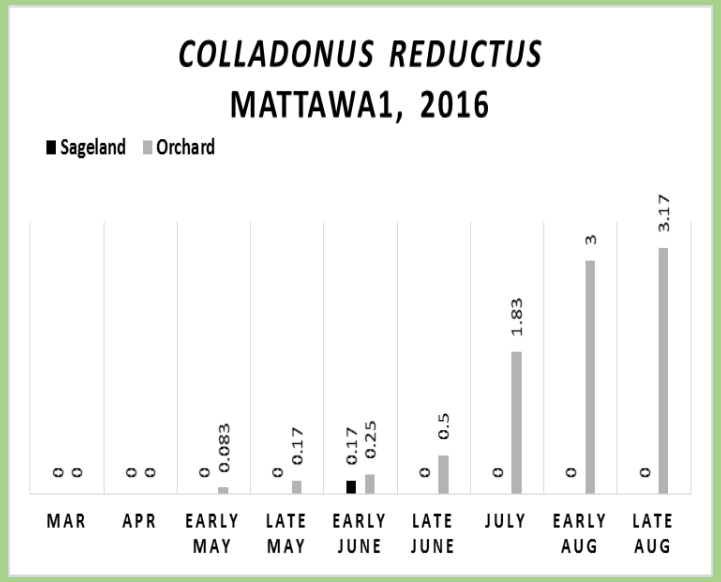


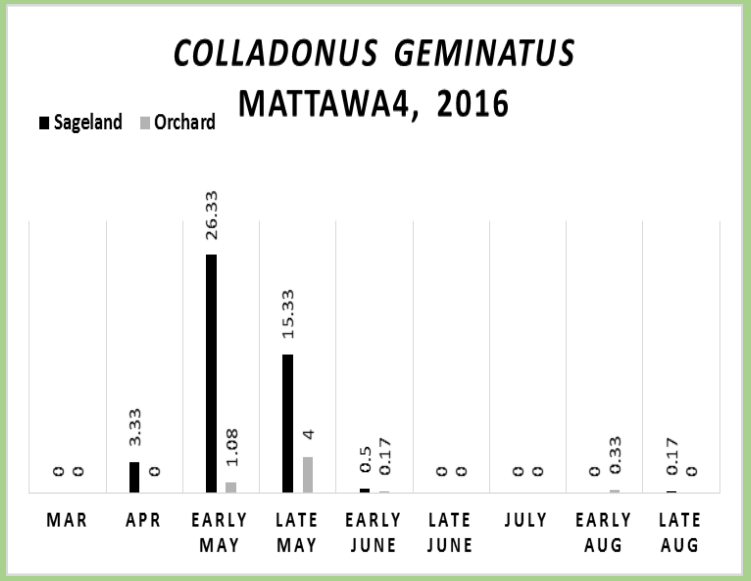


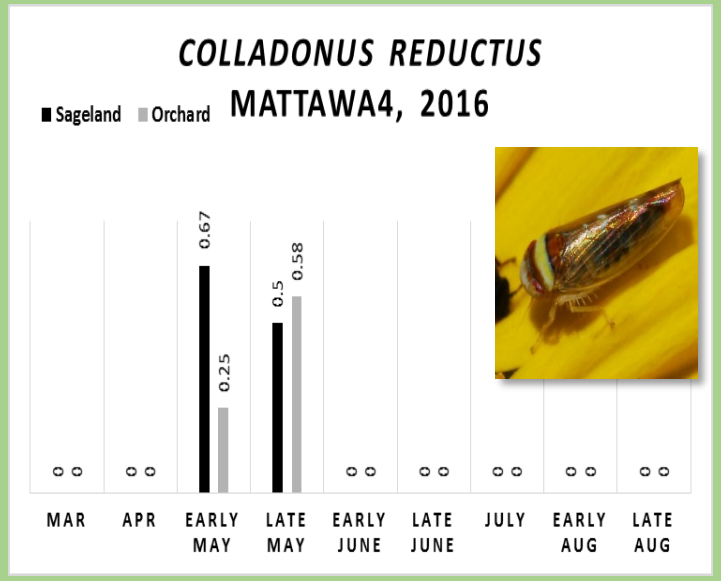
- Two most abundant leafhopper vector species were *Colladonus geminatus* and *reductus.*
- Greater incidence in neighboring alfalfa field than in orchard.
- Peak in alfalfa observed late May/early June for *C. geminatus*, early June for *C. reductus.*
- *C. reductus* increasing in orchard early August.

Seasonal incidence of *Colladonus* spp. on sticky cards in Mattawa cherry orchards and neighboring sageland









Incidence of Western X in *C. geminatus* collected in cherry orchard and extra-orchard habitats, 2016

Colladonus geminatus N=218						
	Cherry orchard			Extra-orchard habitat		
Period	# samples	# positive	%	# samples	# positive	%
Late April	0	--	--	28	22	79
Early May	22	5	23	59	37	63
Late May	34	1	4	21	1	5
Early June	6	0	0	8	0	0
Late June	2	0	0	4	0	0
Early July	5	1	20	1	0	0
Late July	8	1	13	5	2	40
Early Aug*	13	5	38	2	1	50

Incidence of Western X in *C. reductus* collected in cherry orchard and extra-orchard habitats, 2016.

Colladonus reductus	N=168				
	Cherry orchard			Extra-orchard habitat	
	# samples	# positive	%	# samples	# positive	%
Late April	0	--	--	1	1	100
Early May	9	3	33	9	7	78
Late May	15	0	0	9	0	0
Early June	5	0	0	11	0	0
Late June	6	0	0	11	0	0
Early July	7	2	29	4	0	0
Late July	38	16	42	6	4	67
Early Aug*	33	19	58	4	4	100

Leafhopper Project Significant Findings

- *Colladonus geminatus* and *C. reductus*, were the most abundant species on sticky cards in cherry trees and in habitats outside of orchards.

- Data from sticky cards placed in extra-orchard habitats (e.g., sageland, weeds, alfalfa) provided new information on alternative habitat/host plants and on seasonal movement patterns of leafhopper vectors.

- Molecular diagnostic testing results of 218 *C. geminatus* and 168 *C. reductus* DNA samples confirmed that both species can carry WX phytoplasma. Most of the WX-positive orchard samples for these species were collected during early May and late July/early Aug.