Psylla and Mite IPM

NCW Pear Day
18 January 2017
Wenatchee Convention Center, Wenatchee, WA

Elizabeth H. Beers
Tree Fruit Research & Extension Center
1100 N. Western Ave.
Wenatchee, Washington

Pear IPM – a broken system

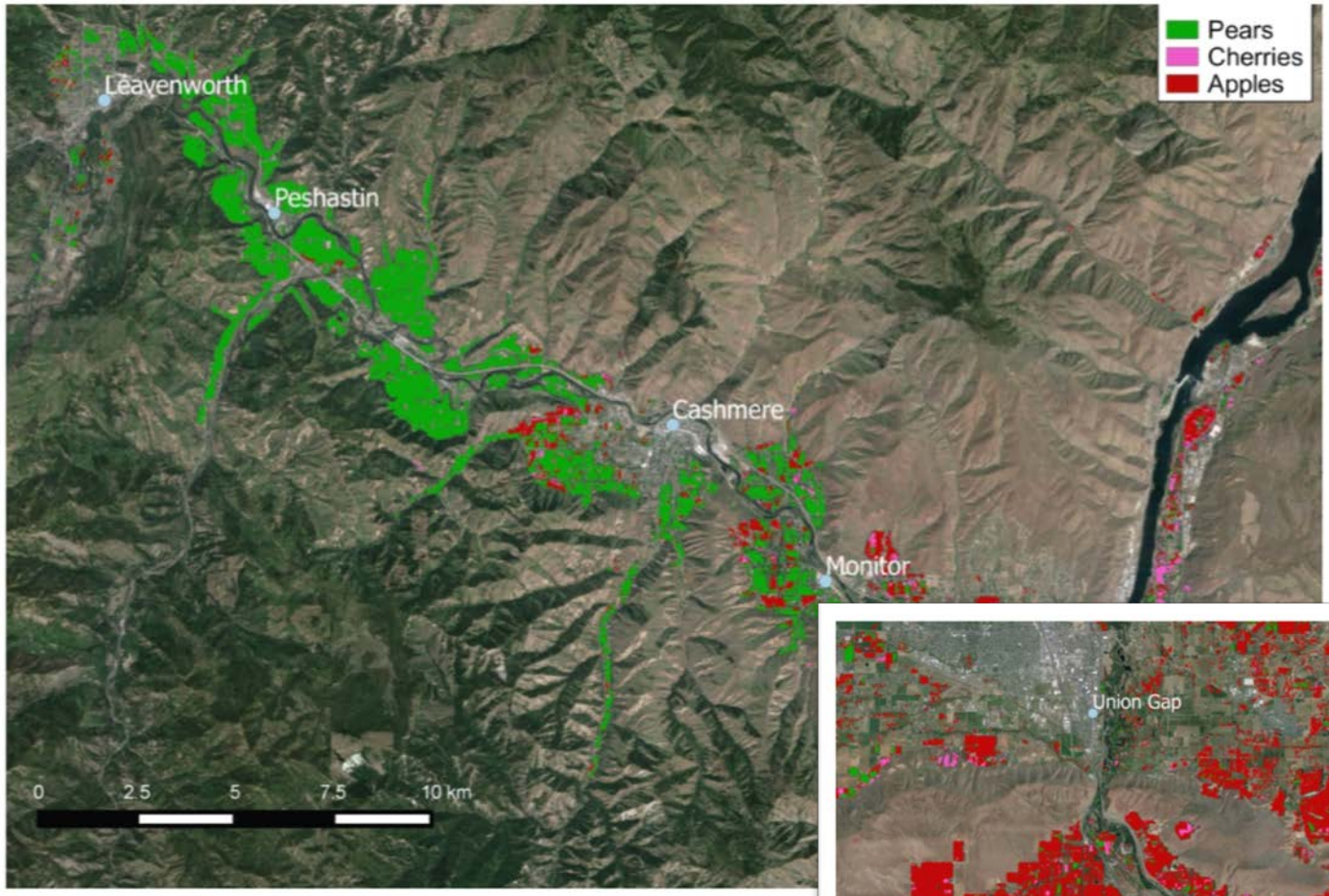
(More)

Insecticide Resistance

Pear IPM – if it IS broke, how do I fix it?

Against us:	*For us:*
No dwarfing rootstock	Induced pests (mites, psylla)
Excess vigor	MD for codling moth (and low susceptibility)
Highly susceptible cultivars	History of soft programs that work
Concentrated production areas	History of cooperation
Pesticide resistance	Adaptability
Non-selective pesticides	

A tale of two regions

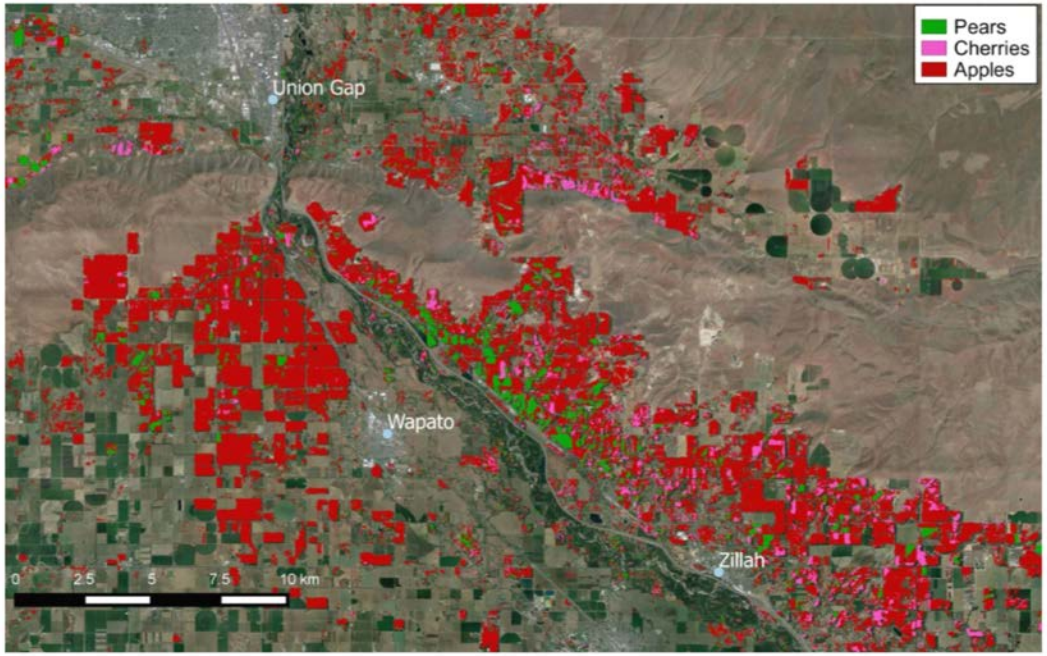


Wenatchee River Valley

Pears

Apples

Cherries



Yakima Valley

Key vs Induced Pests

Codling moth

Pear psylla

Spider mites

Key Pest

Induced Pest

How do we know it's induced? Kill its natural enemies, and an outbreak occurs

Importance of Psylla in the Pear Program

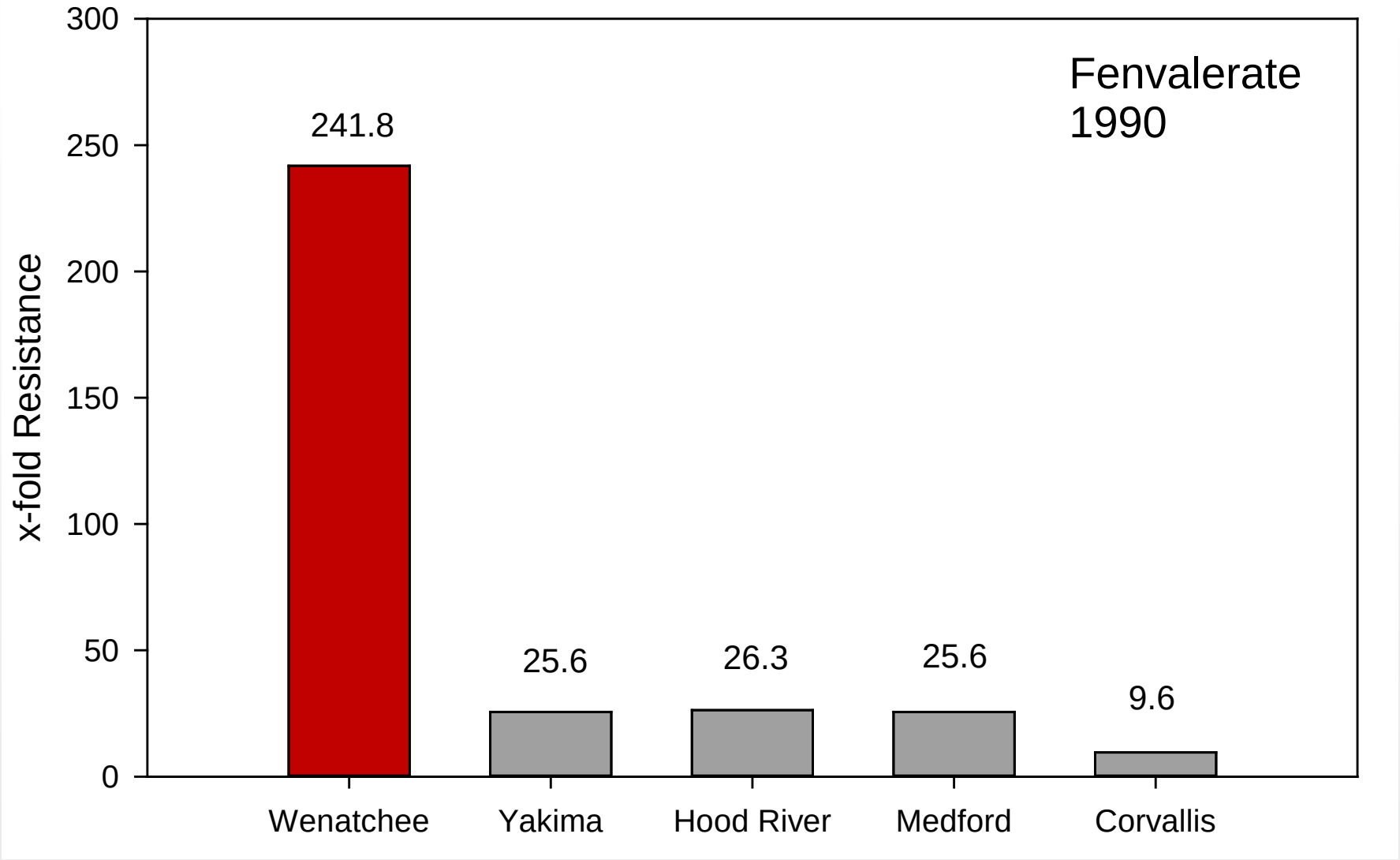
rust mites	rust mites		mealybug			codling moth		
scale	mealybug	psylla	rust mites		mites	mites	mites	
psylla	psylla	codling moth	psylla	codling moth	psylla	mealybug	psylla	psylla
Dormant/ DD	**Cluster Bud**	**Bloom**	**Petal Fall**	**250 DD (1st CM cover)**	**Late June/early July**	**Mid-summer**	**Preharvest**	**Postharvest**
Surround	Surround	Mating disr.	Neonicotinyl	Altacor	Delegate	(Miticide)	FujiMite	Surround
Oil	Neonicotinyl	Dithane/Manc	IGR		Neonicotinyl	Neonicotinyl	(Miticide)	Sulfur
Lime Sulfur	IGR		Agri-Mek		Centaur			
Pyrethroid?			METI		(Miticide)			
Thiodan?			Ultor					
			(Miticide)					

Resistance: Psylla

Resistance in Psylla - Historical

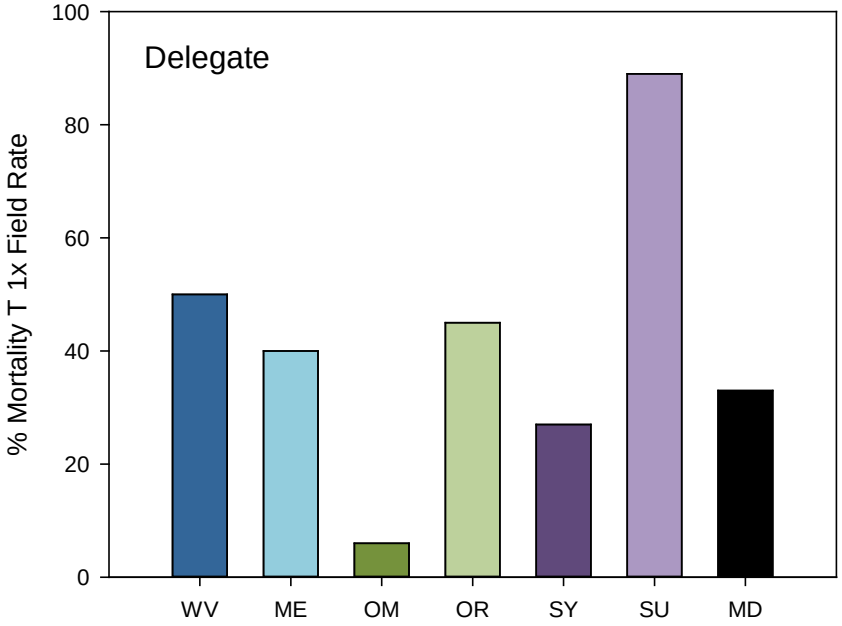
1965 – Burts – Morestan less effective
1965 – Dean– Guthion resistance noted
1965 – Madsen et al – malathion, parathion, dieldrin resistance
1965 – Westigard – signs of Guthion resistance
1967 – Burts – Perthane less effective than previous year
1967 – McMullen – DDT reduced predator complex, PP up 240%
1968 – Burts – Perthane resistance demonstrated 4-8x; Leavenworth
1968 - Batiste – Guthion resistance in San Jose CA
1970 – Burts – test population resistant to Guthion
1990 – van de Baan – widespread resistance to fenvalerate
2005 – Greenfield, Dunley, Madsen - Significant increase in resistance to imidacloprid and thiacloprid in pear psylla from Wenatchee River Valley – but, field rate still effective
2014/15 – Unruh et al.: high levels of resistance to pyrethroids, moderate to Agri-Mek/Admire, few problems with Nexter/Delegate

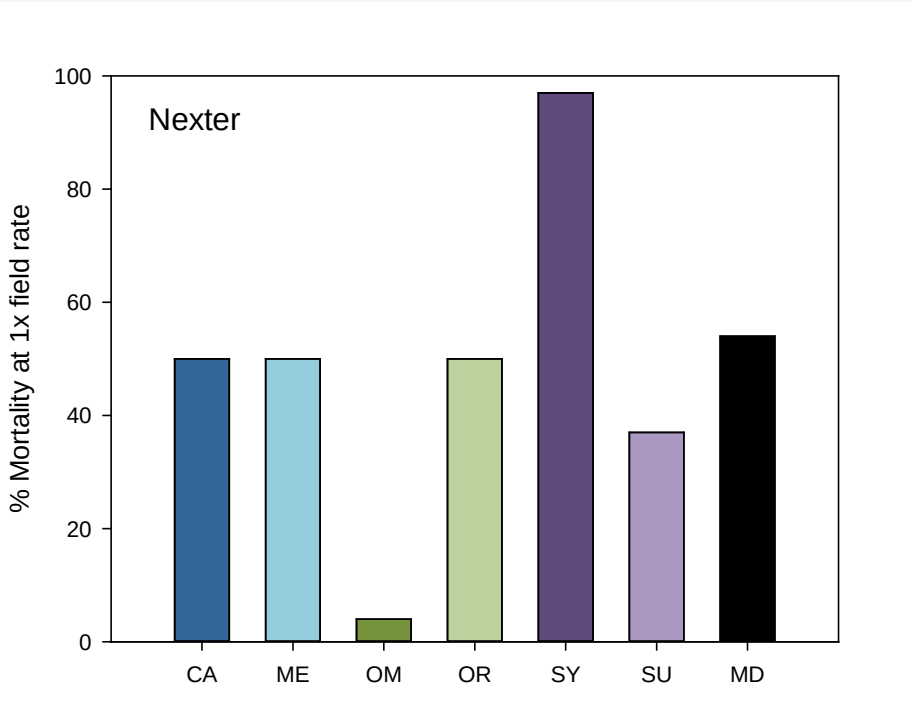
Resistance to Fenvalerate 1990



Van de Baan, H. E., B. A. Croft, and E. C. Burts. 1990. Resistance to the pyrethroid fenvalerate in pear psylla, *Psylla pyricola Foerster (Homoptera: Psyllidae), in the northwestern USA. Crop Prot. 9: 185-189.*

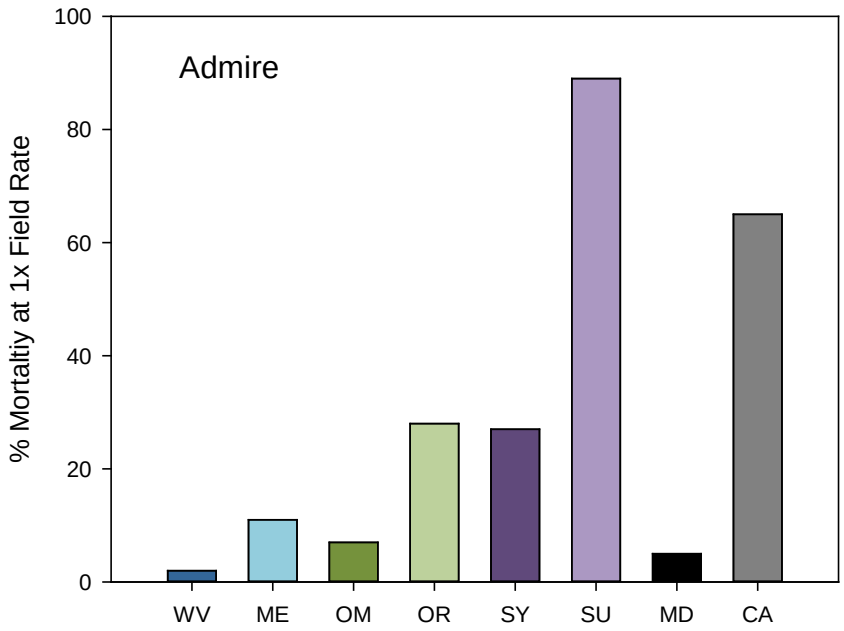
Resistance in Pear Psylla

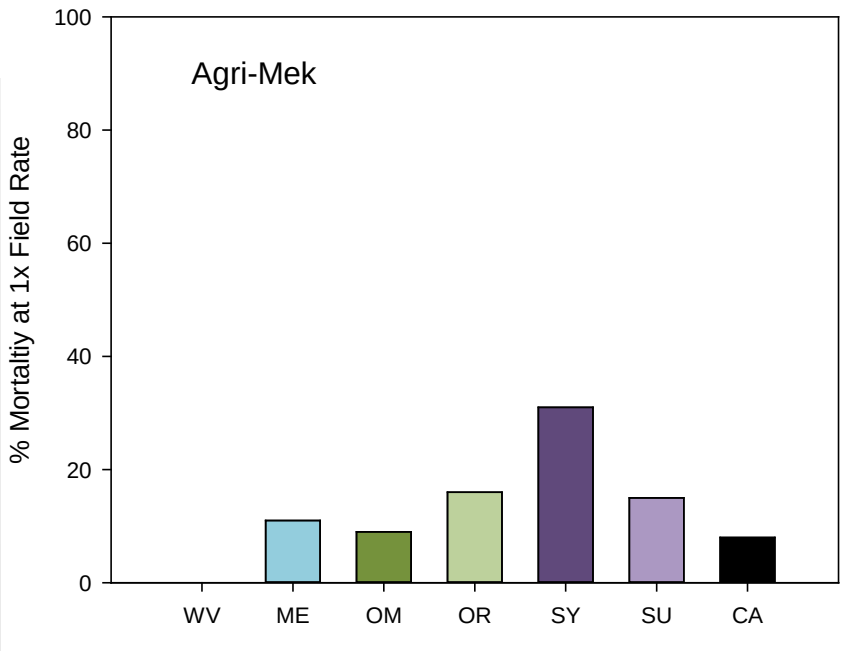




Unruh et al 2016

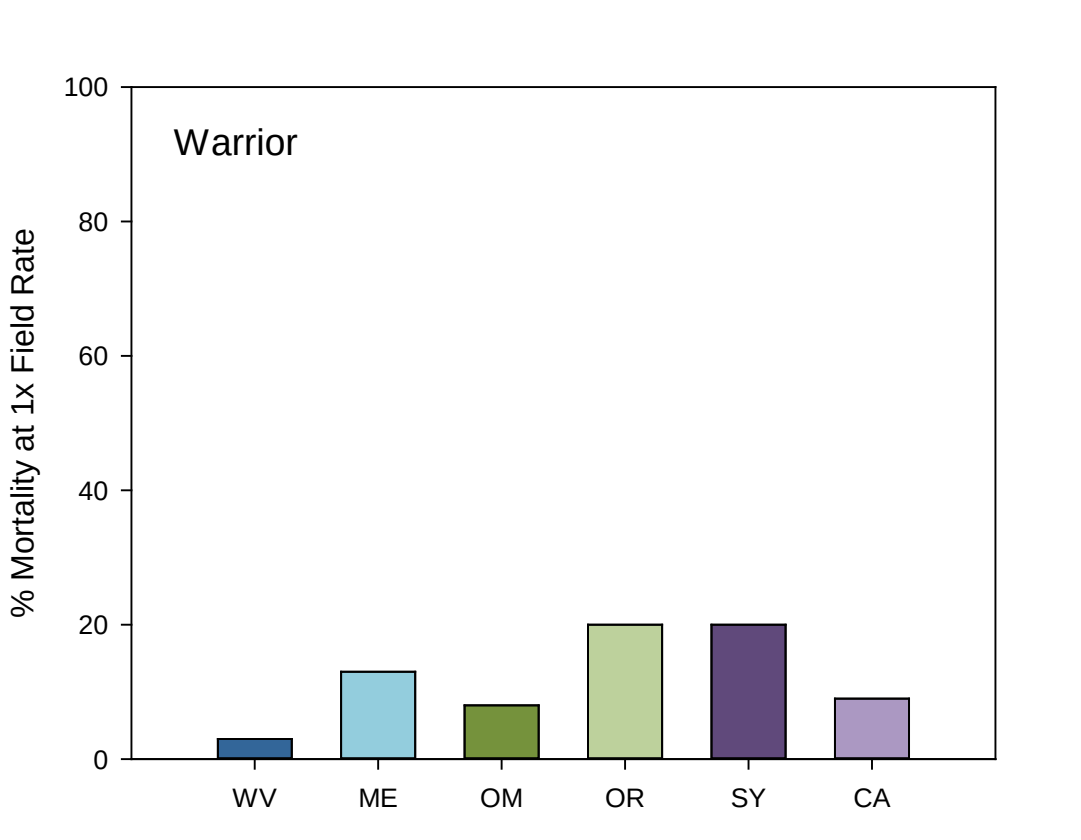
Resistance in Pear Psylla





Unruh et al 2016

Resistance in Pear Psylla



Unruh et al 2016

Resistance: Mites

Miticides screened for resistance

Trade name	Common name	Group	MOA	Bioassay type
Agri-Mek	abamectin	avermectins	6	adulticide
Acramite	bifenazate	NA	unknown	adulticide
FujiMite	fenpyroximate	METI	21A	adulticide
Envidor	spirodiclofen	tetronic/tetramic acid derivatives	23	ovicide
Onager	hexythiazox	mite growth inhibitors	10A	ovicide
Zeal	etoxazole	mite growth inhibitors	10B	ovicide

What is a Resistance Ratio (RR)?

$$RR = \frac{LC_{50}\ (R)}{LC_{50}\ (S)}$$

$$RR = \frac{10}{1} = 10$$

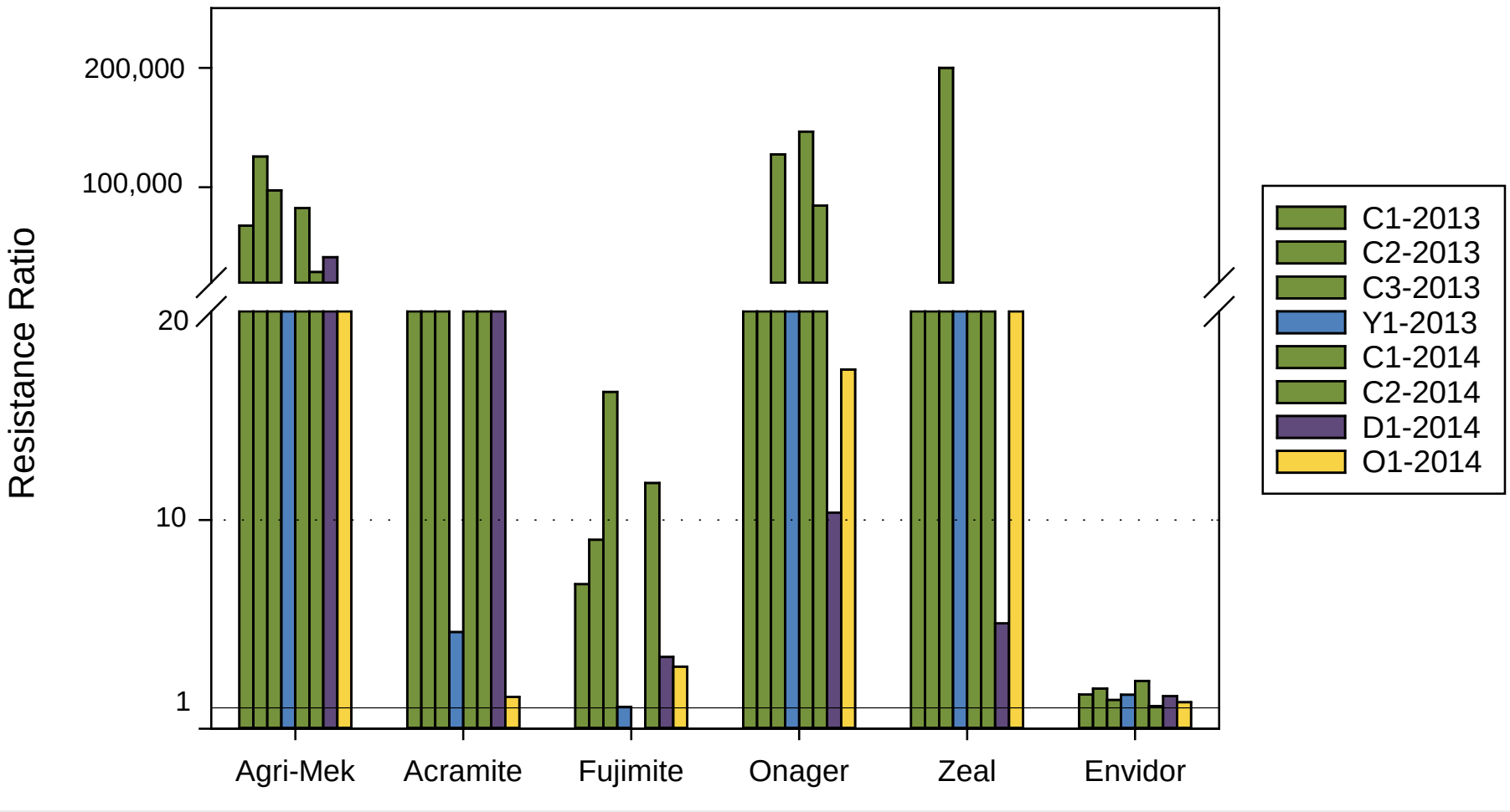
**The higher the RR, the more resistant the population

Resistance "Rule of Thumb"

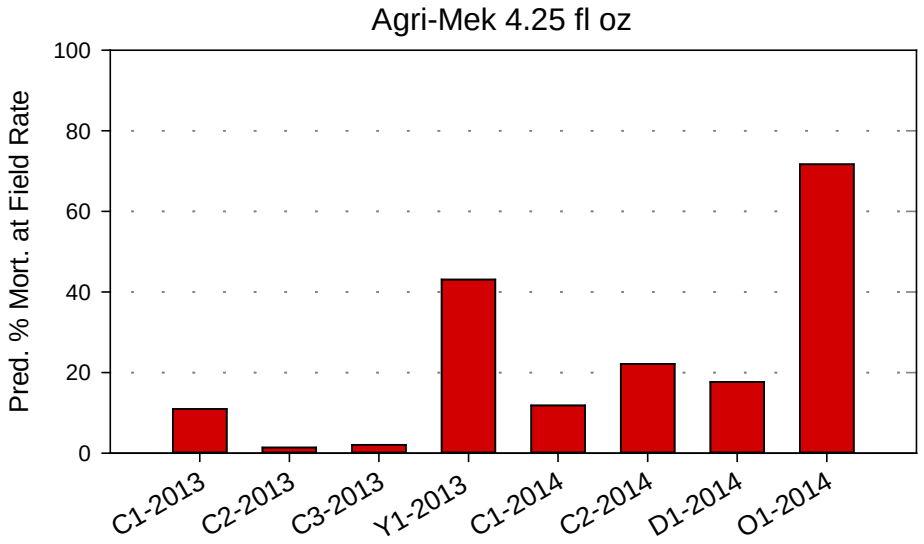
(Flexner et al 1988):

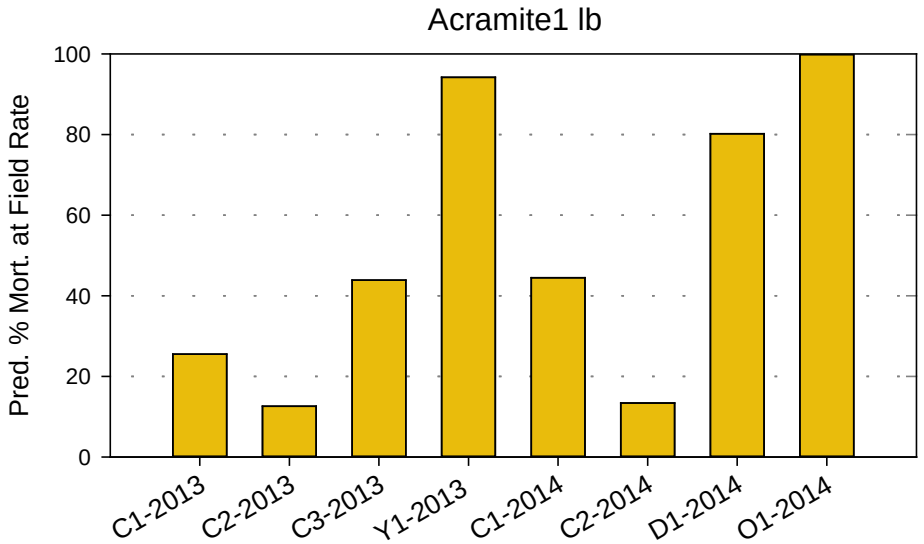
RR < 3	**Not Resistant**
RR 3-7	**Transitional**
RR > 7	**Resistant**

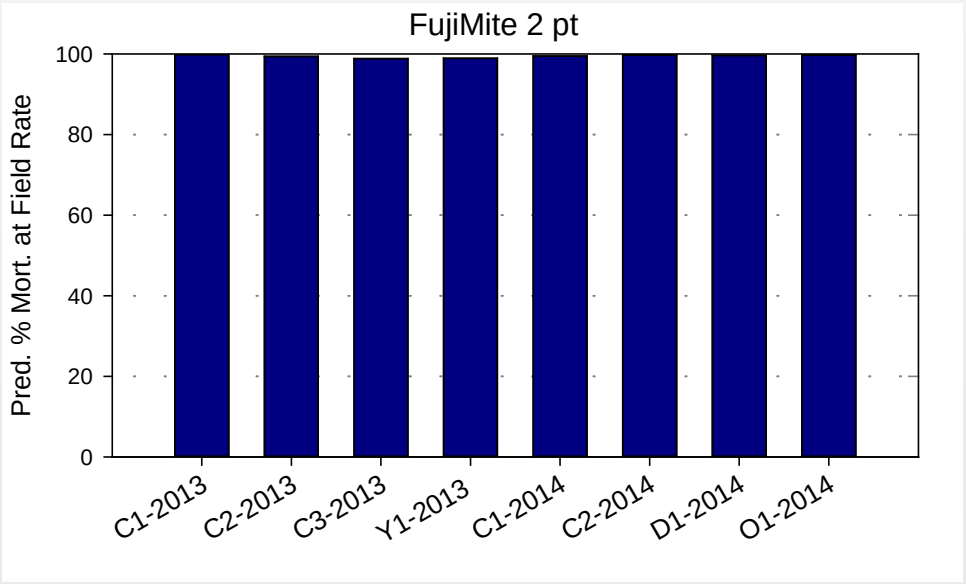
Miticide Resistance



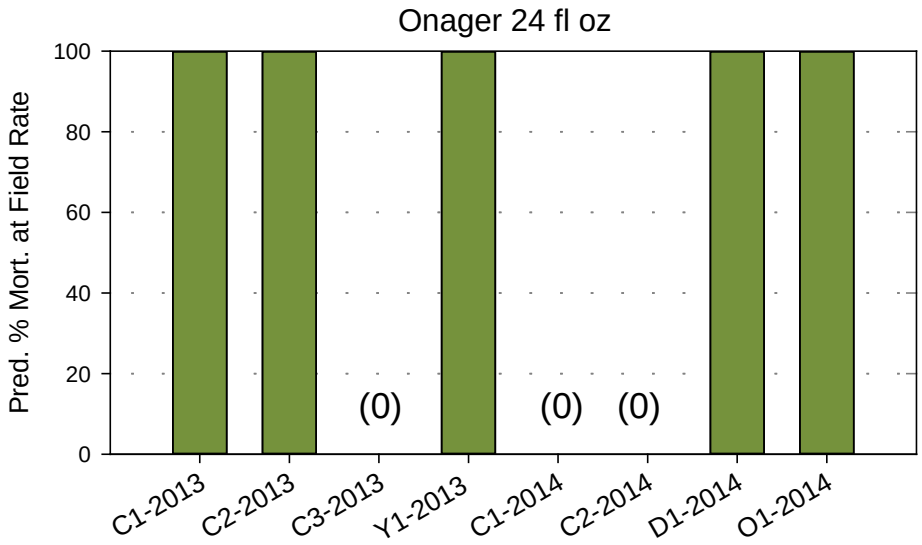
Miticides – Predicted % Mortality at the field rate (Adulticides)

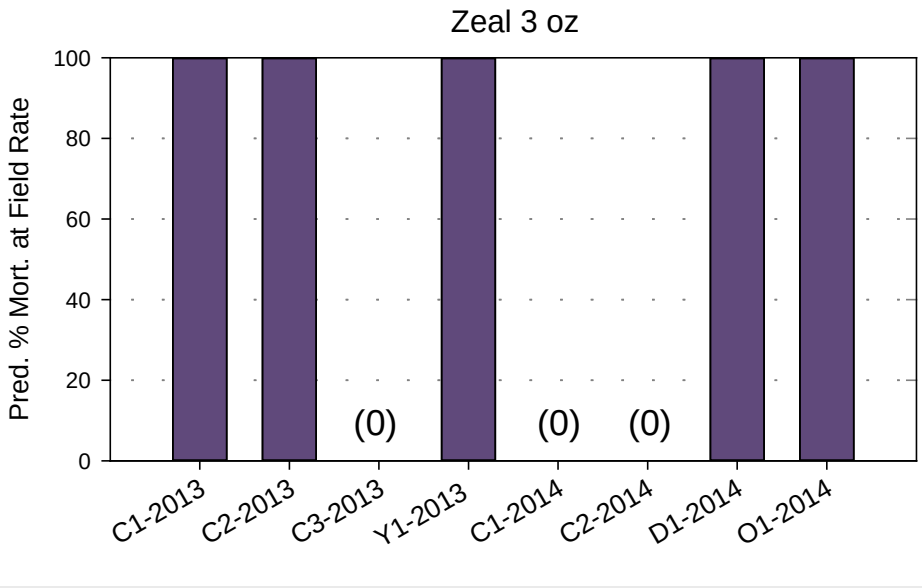


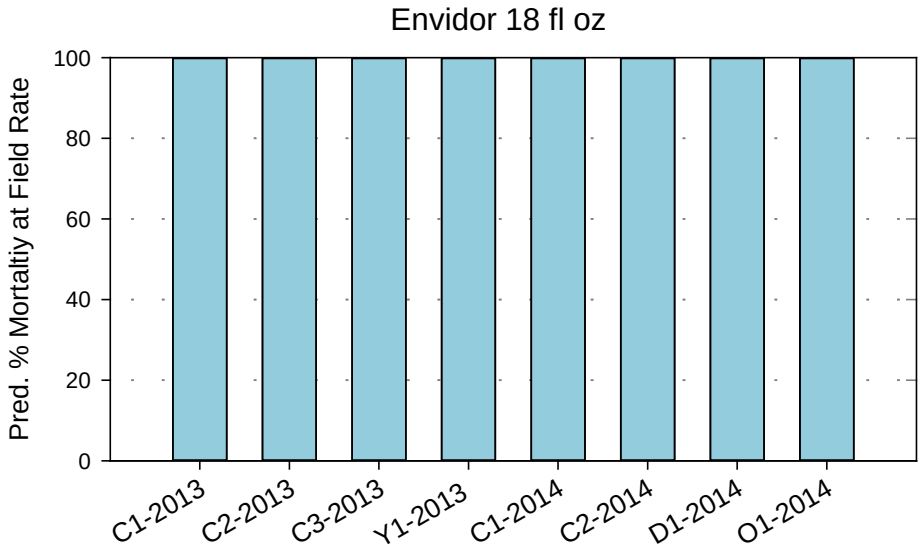




Miticides – Predicted % Mortality at the field rate (Ovicides)







Pesticide Magnagement: *Failure of a Strategy*

Natural Enemies are your Best Friends!

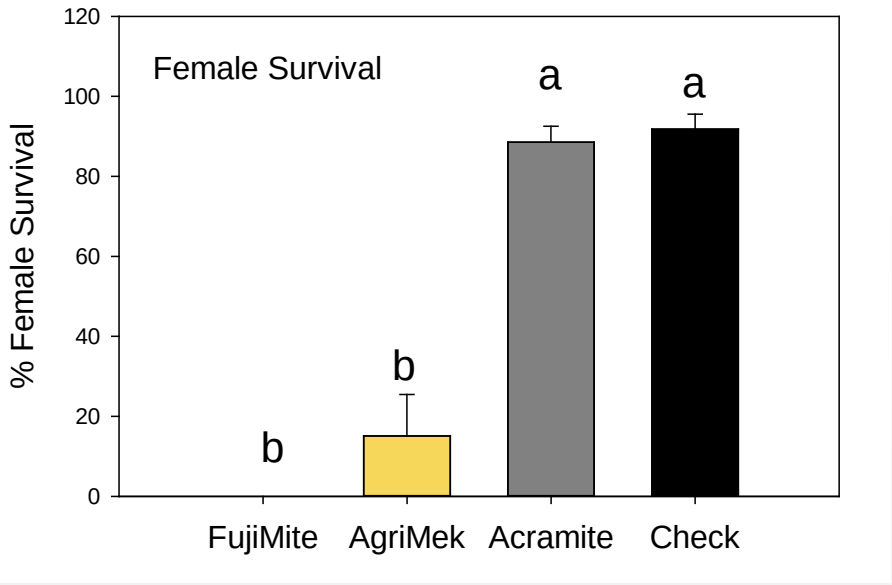
Nontarget Effects

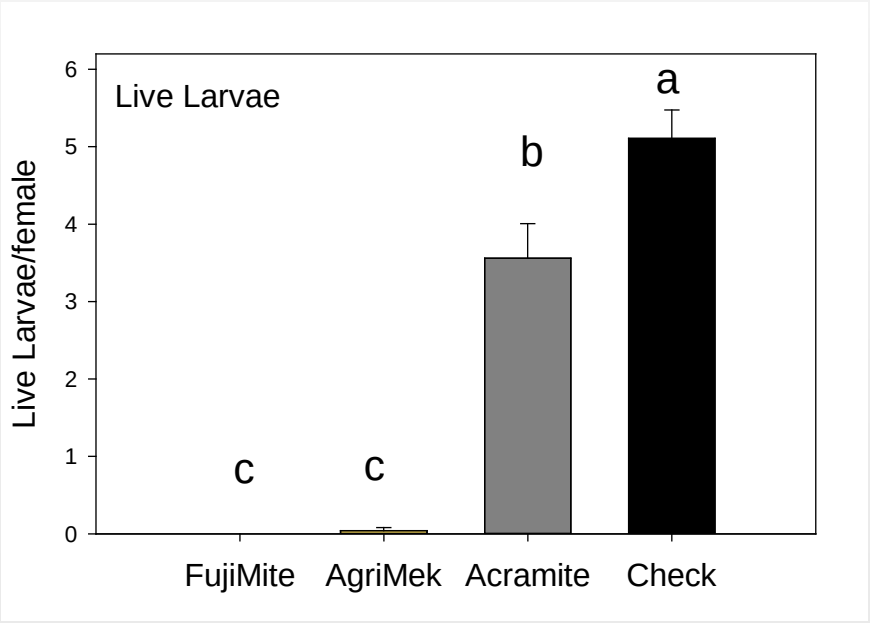
Nontarget Effects of Pesticides

...are the unintended (negative) consequences of a pesticide spray for a pest on beneficial insects

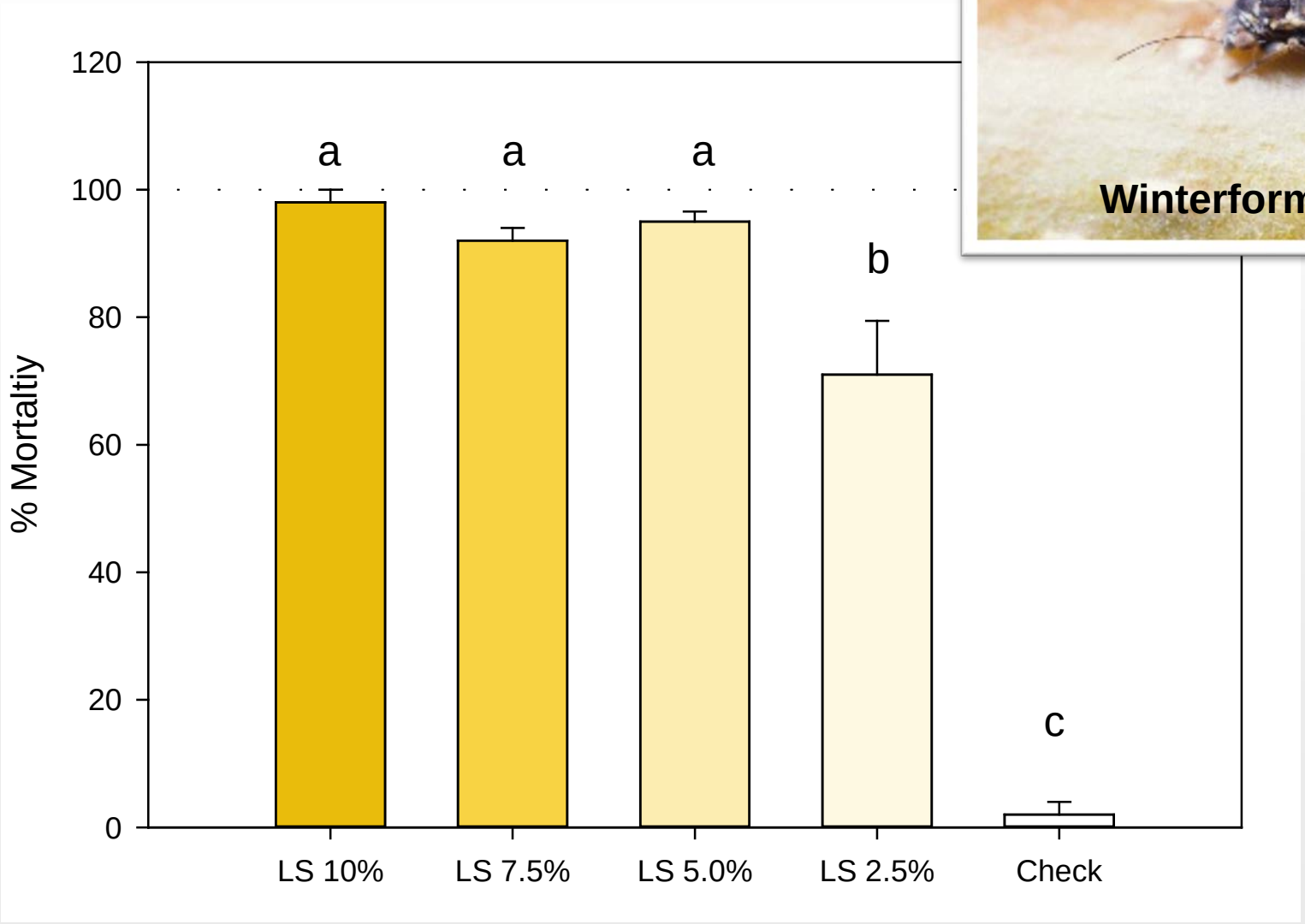
	Typhs	Lacewings	Deraeocoris	Lady Beetles	Earwig
Warrior					
Assail					
Imidacloprid					
Actara					
Agri-Mek					
Delegate					
Rimon					
Ultor					
Sulfur					
Altacor					
Esteem					

Nontarget Effects of *Acaricides*





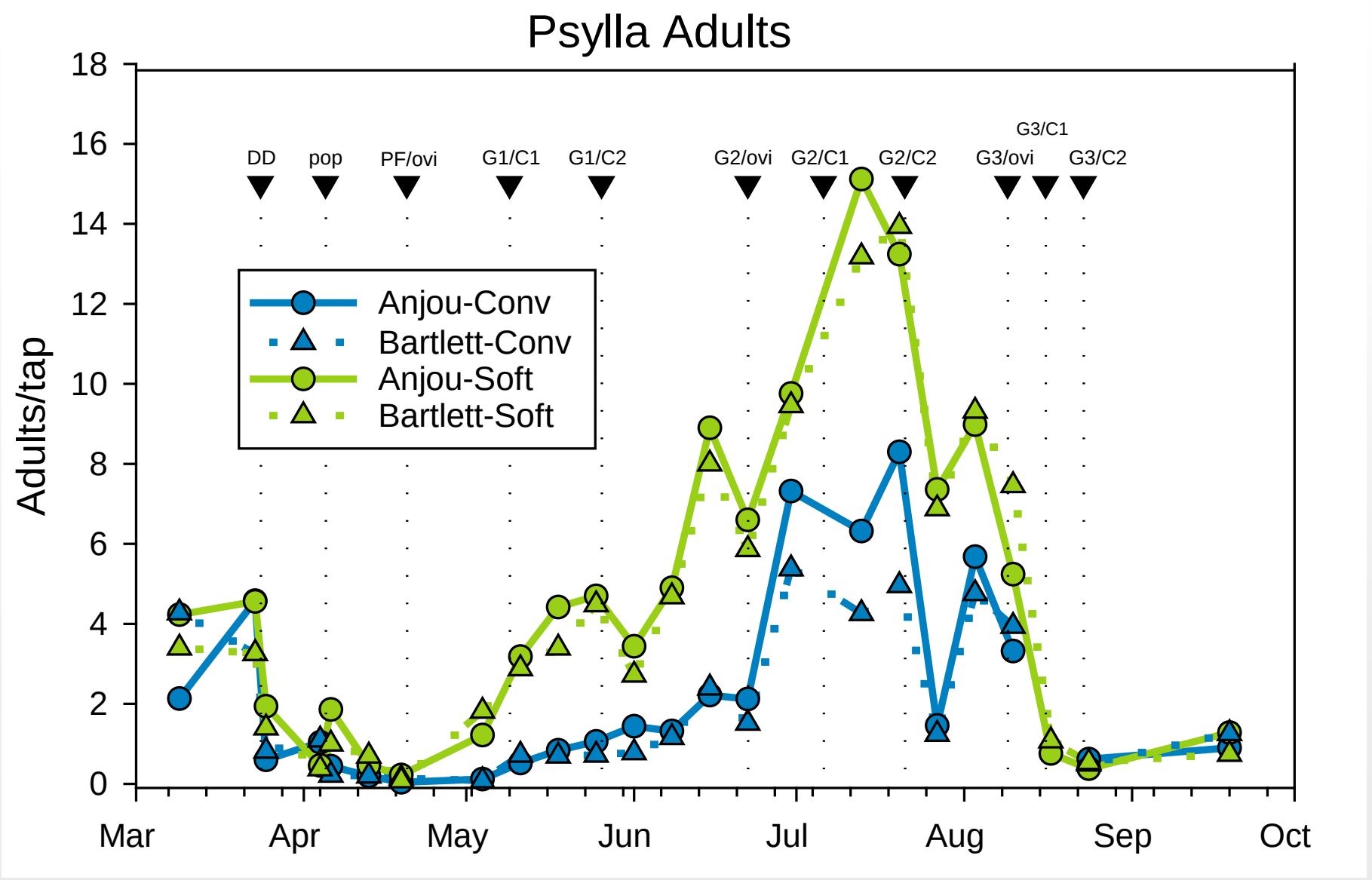
Lime Sulfur: Rates (bioassay)



Pear IPM Trial – 2016: Soft vs Conventional

Timing	Soft	Conventional
Delayed dormant Psylla	Surround Esteem Microthiol Oil	Cobalt Advanced Exponent Oil
Popcorn Psylla, rust mites	Centaur Esteem Vendex	Centaur Assail Rimon Agri-Mek
Petal fall Psylla + G1 ovicide	Centaur Vendex Intrepid	Ultor Rimon Agri-Flex
CM G1/C1	Altacor	Altacor
CM G1/C2	Altacor+Oil	Altacor+Oil
CM G2/ovicide	Intrepid+Oil	Oil
CM G2/C1	Altacor+Oil	Delegate+Oil
CM G2/C2	Altacor+Oil	Delegate+Oil
CM G3/ovicide	Oil	Oil
CM G3/C1	Cyd-X+Oil	Imidan
CM G3/C2	Cyd-X	

Pear IPM: Soft vs Conventional



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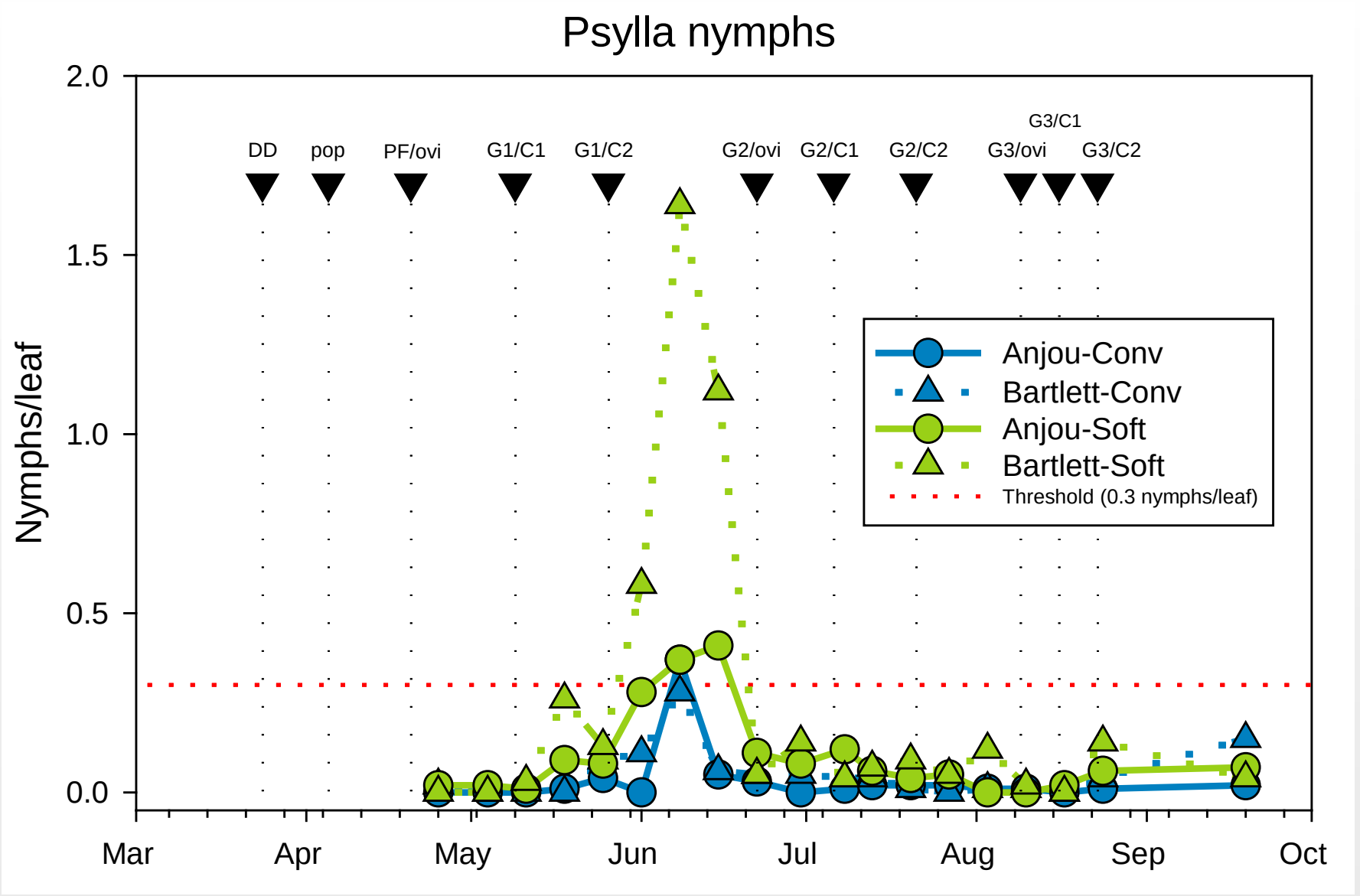

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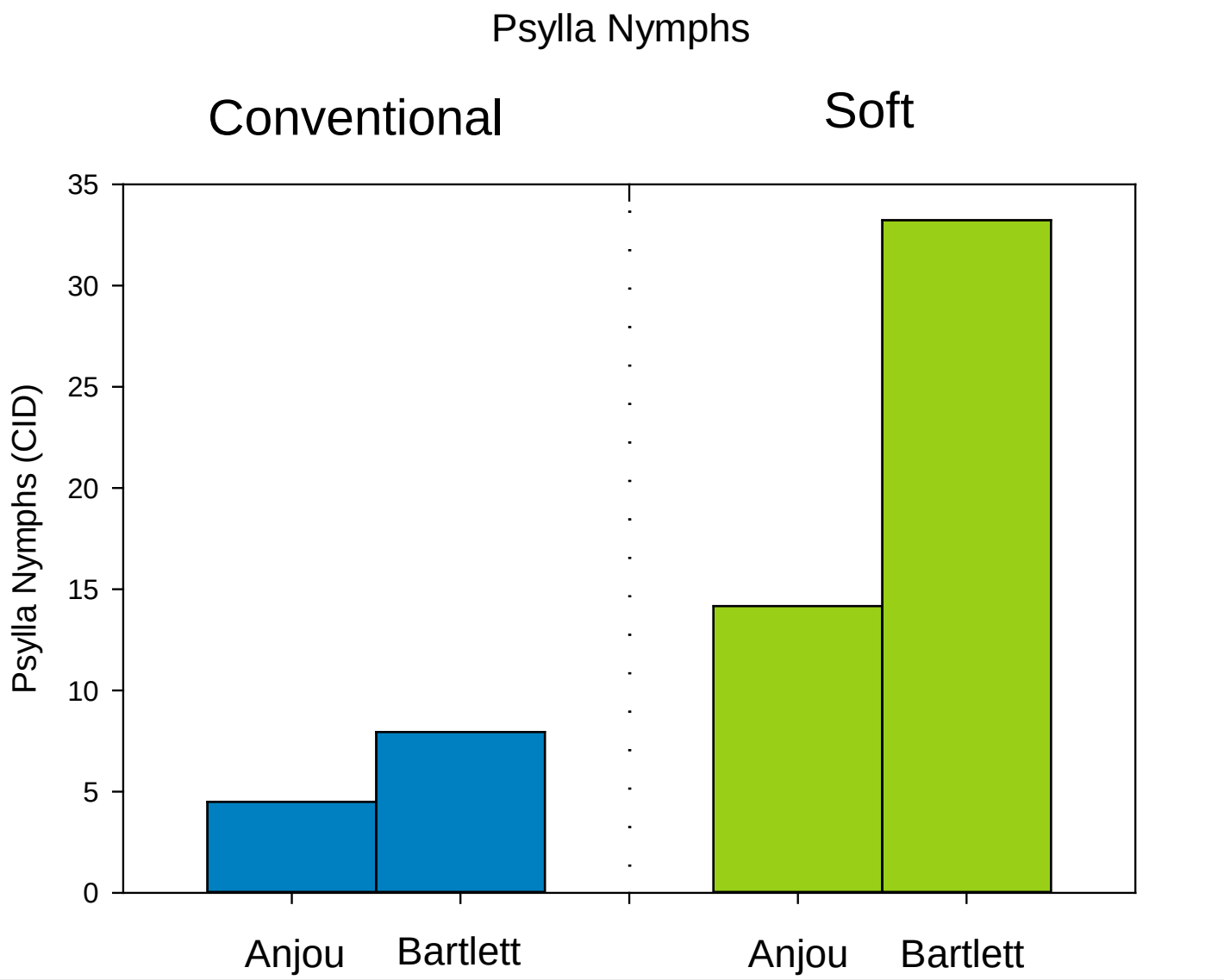
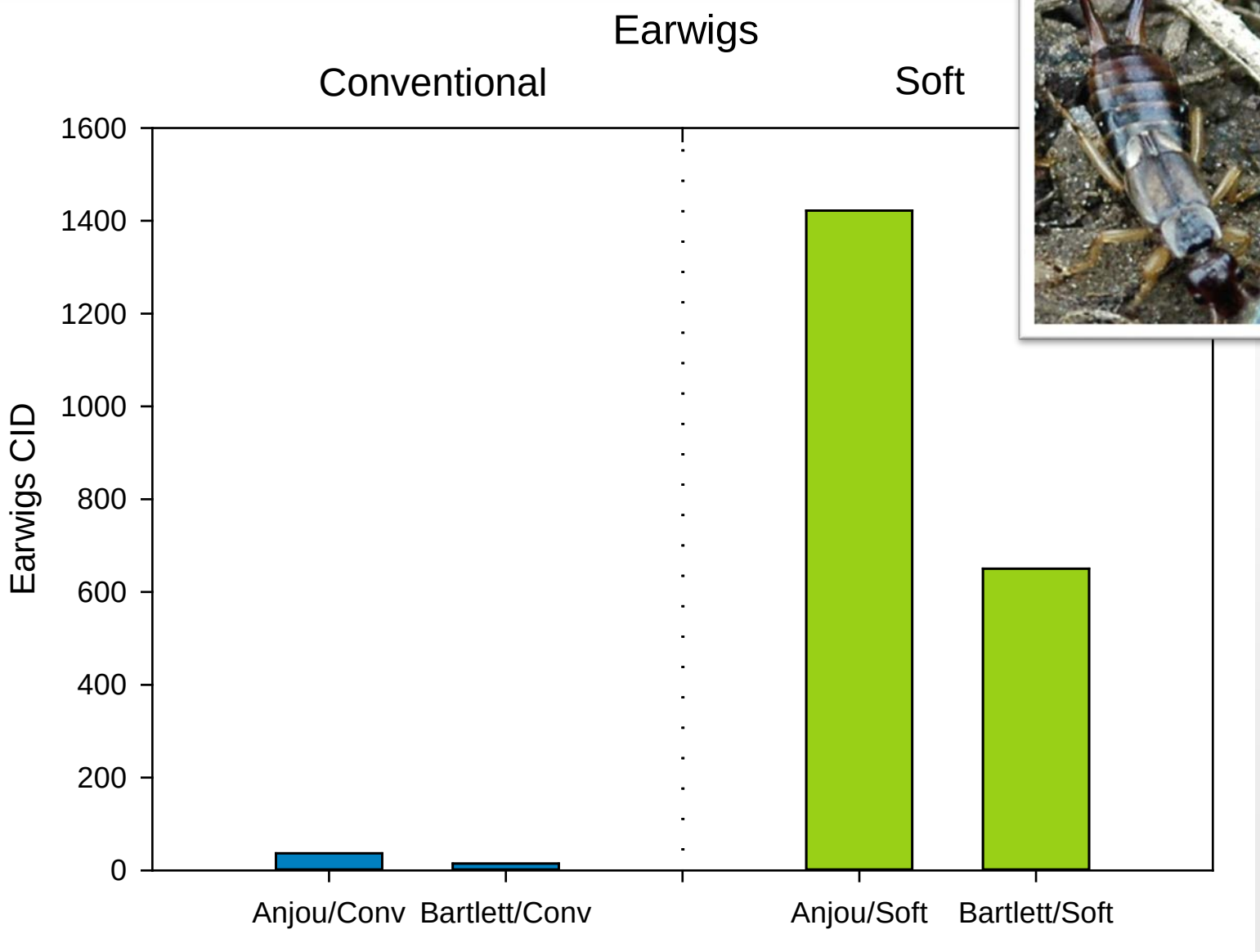
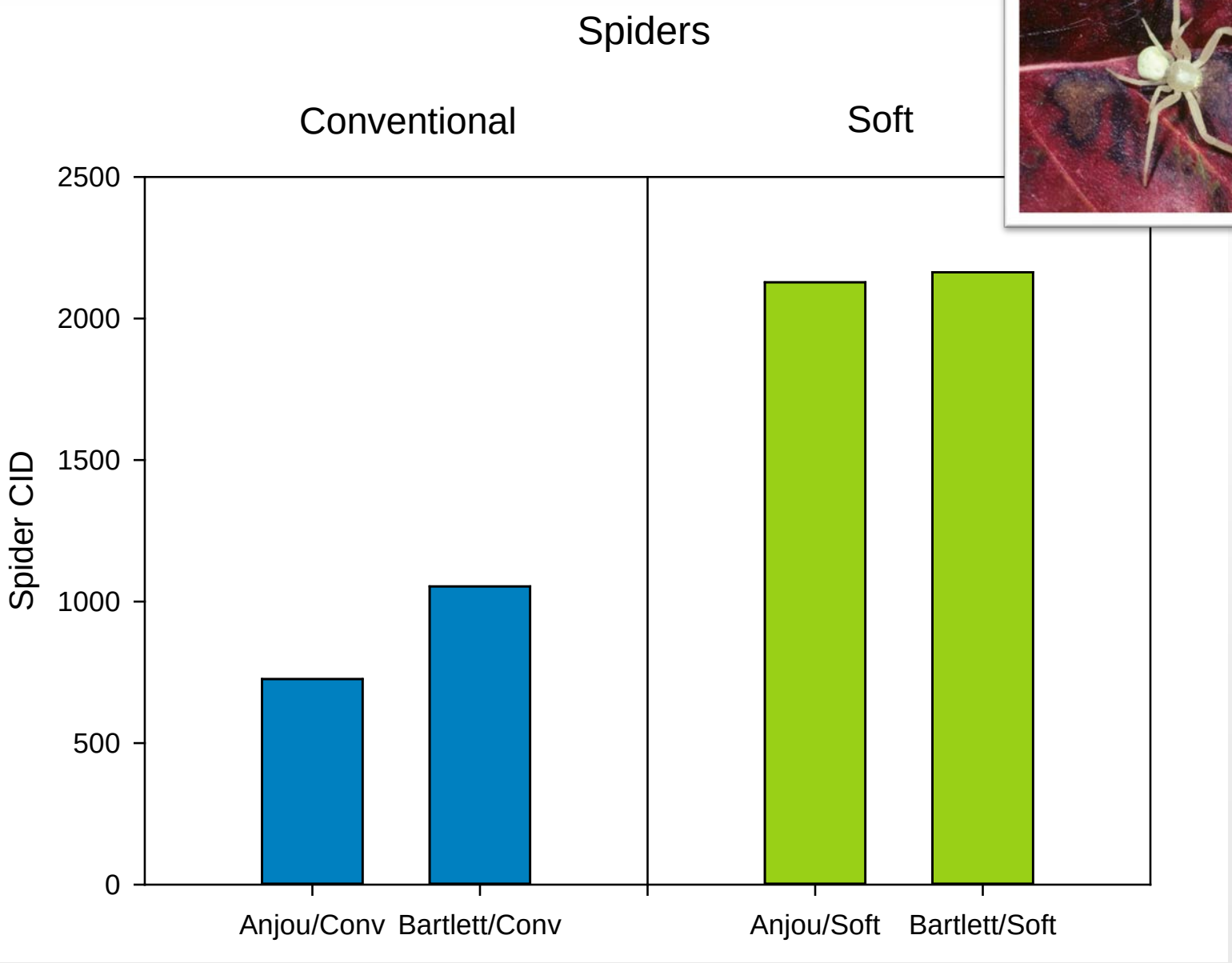


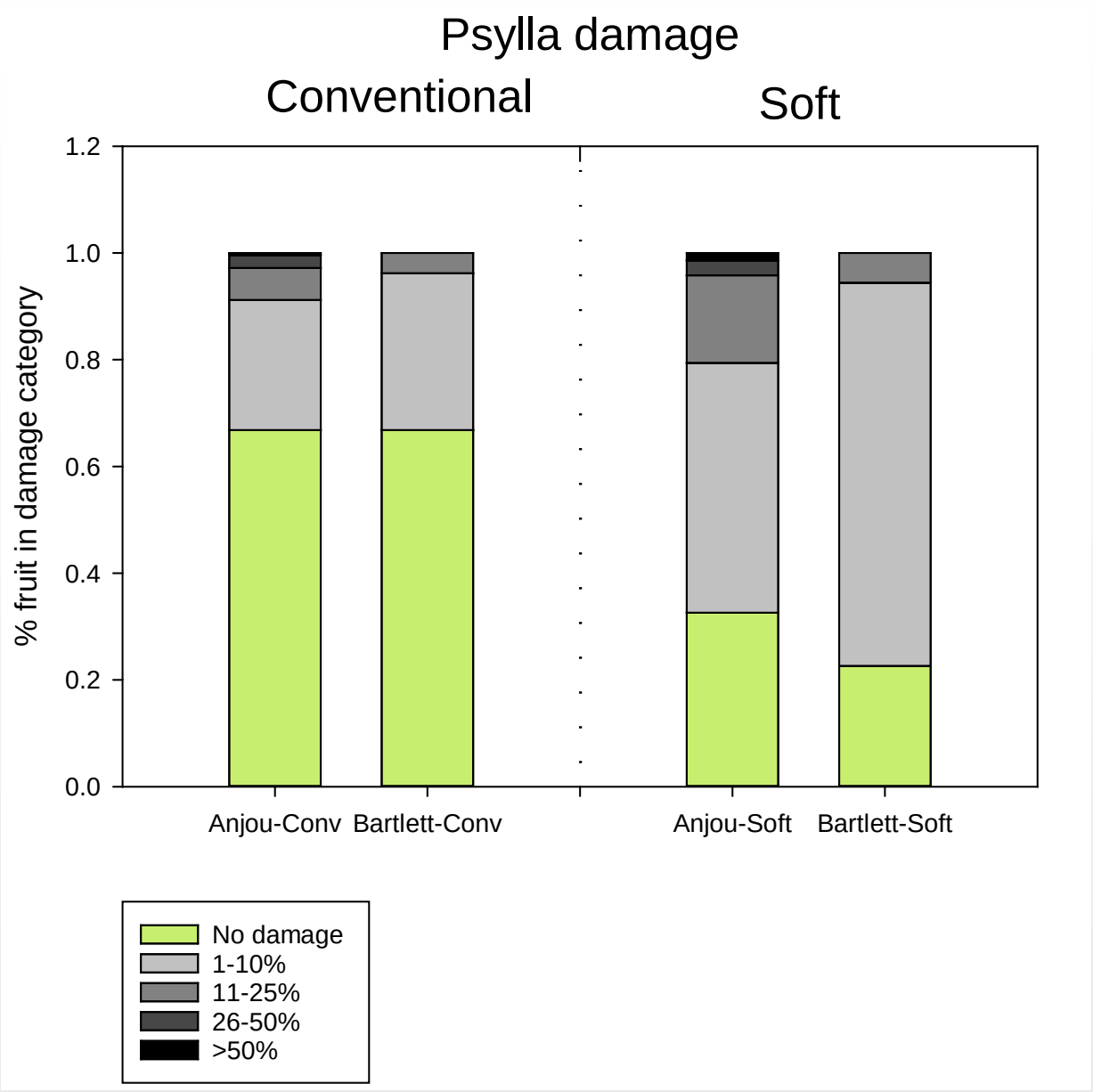
Natural Enemies



Natural Enemies

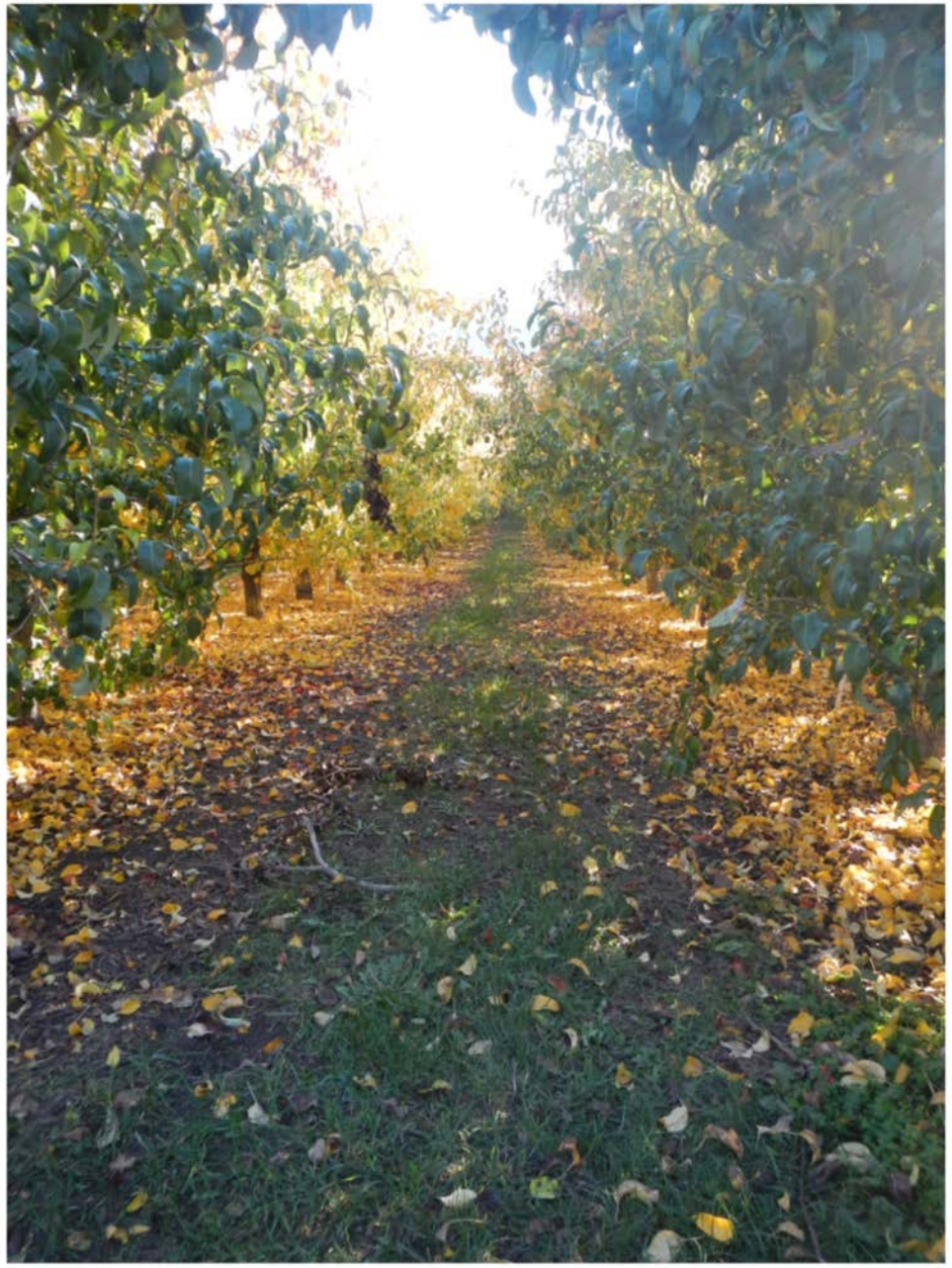


Soft vs Conventional: Fruit Damage (Psylla)



Pear Horticulture/Breeding

- Need for winter-hardy dwarfing rootstock
- Need for pruning/training systems to manage vigor
- Need for varieties that are less sensitive to insect damage



History of Soft Programs – Oregon, 1986

Selective Control Program for the Pear Pest Complex in Southern Oregon

P. H. WESTIGARD,[1] L. J. GUT,[1] AND W. J. LISS[2]

J. Econ. Entomol. 79: 250–257 (1986)

ABSTRACT Selective chemical control programs were evaluated in four southern Oregon pear orchards with the goal of maximizing effect of biological control agents for suppression of pear pests. The programs used prebloom oil sprays for control of San Jose scale, *Quadraspidiotus perniciosus* (Comstock), and for ovipositional delay of pear psylla, *Psylla pyricola* Foerster; diflubenzuron for codling moth, *Cydia pomonella* (L.), suppression; *Bacillus thuringiensis* Berliner for leafrollers; and, where needed, half the usual rate of cyhexatin for spider mite control. Organophosphates, carbamates, pyrethroids, and amitraz were deleted from selective programs. Predator density increased in all selective plots and was sufficiently high in two of the four orchards to give commercially acceptable control of pear psylla and to lower acaricide use by 75%. Control costs were ca. $300 per ha and $700 per ha in selective and standard programs, respectively. Density and period of colonization by pests and predators varied from site to site and appeared to depend on previous treatment history within the study area, and on the nature and management of surrounding vegetation.

- ✓Predators increased in selective plots
- ✓BC worked in 2 of 4 orchards
- ✓Pesticide costs cut in half

History of Soft Programs – Washington, 1983

Effectiveness of a Soft-Pesticide Program on Pear Pests[1]

EVERETT C. BURTS

Washington State University, Tree Fruit Research Center, Wenatchee, Washington 98801

J. Econ. Entomol. 76: 936–941 (1983)

ABSTRACT During 1980 and 1981, spray programs using soft pesticides were compared with programs using pesticides normally applied to commercial pear orchards in central Washington for the control of the insect-mite pest complex. In 1980, all pest species present except pear psylla, *Psylla pyricola* Foerster, were held below damaging densities by both soft and standard programs or by predators and parasites that survived. In the soft-pesticide plot, two prebloom sprays of petroleum oil and four postbloom tree washes failed to prevent serious fruit russetting by honeydew from pear psylla. In the standard program, fenvalerate and oxythioquinox sprays before bloom and three postbloom sprays of amitraz provided better control of this pest than did the oil sprays and tree washes. In 1981, both soft and standard programs controlled all pest species present. In the soft plot, pear psylla density was kept below damaging level by two prebloom petroleum oil sprays and four postbloom sprays of mancozeb. Codling moth, *Cydia pomonella* (L.), was controlled in the soft plot by four cover sprays each year of diflubenzuron in 1980 or Bay Sir 8514, 2-chloro-N-([L(4-trifluoromethoxy)phenyl]amino) carbonyl benzamide) in 1981. Azinphosmethyl applied on a similar schedule in the standard plot also provided good codling moth control. Densities of major predators of pear psylla were higher in the soft than in the standard plot, but not as high as those in the untreated check.

- ✓Soft program worked in one year of a 2-year study
- ✓Codling moth control with and IGR (Dimilin)

Wenatchee Valley Pear Project, 1999-2001

- Psylla populations higher in soft blocks Year 1, declined thereafter.
- GMB, mites less problems in soft blocks
- PRM increased in soft blocks
- NEs higher in soft blocks : *Deraeocoris , Campylomma,* lacewings, earwigs and *Trechnltes*
- Fruit marking (by psylla) was higher the first year in soft blocks, same as conventional in Years 2, 3
- Pest control costs $150-200/acre/year lower in soft blocks.
- Proximity to native habitat is important to pear orchards trying to attract and retain natural enemies.
- Soft IPM in pear limited by t
  - Lack of critical numbers for pests and natural enemies (low thresholds)
  - Limited people to sample
  - Greater risk of fruit damage.

The Benefits of a Cooperative Effort

“Pear Psylla Spray Signals To Be Given This Spring”

Wenatchee World,
9 March 1969

“A cooperative effort between TFREC, Coop. Extension, and the North Central Washington Fieldmen’s Association…”

“If all pear growers cooperate with their neighbors by applying a dormant spray for this insect, the population numbers can be reduced to a minimum before they get started”.

SPRAY TIME NEAR? -- Pear psylla overwintering adults are sought by Extension Agent F. A. (Bill) Rushmore, left, and Dr. Everett Burts of the Tree Fruit Research Center. When the flies reach the egg-laying stage, coordinated spraying will be signaled by field men making checks like this in all localities.