

Why Has Red Scale Been Such a Problem and What Can You Do to Improve Control?



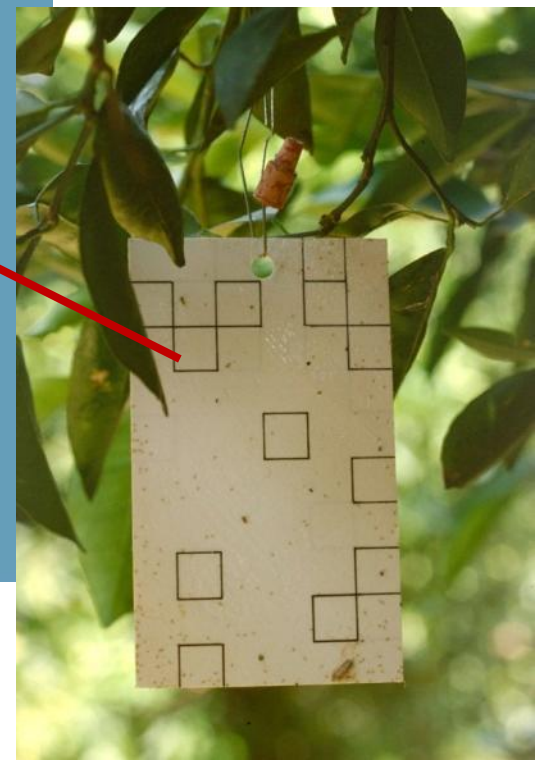
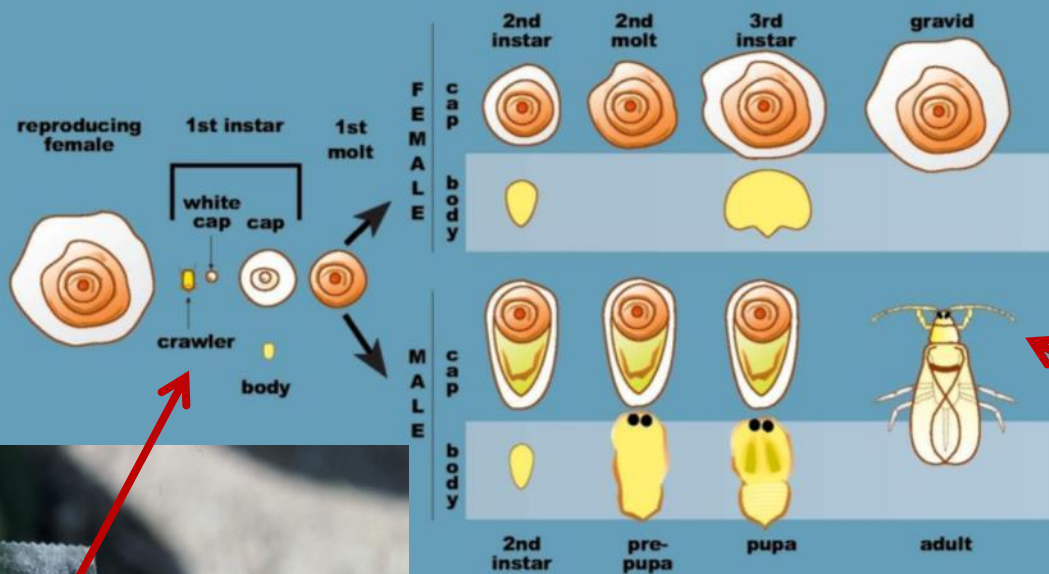
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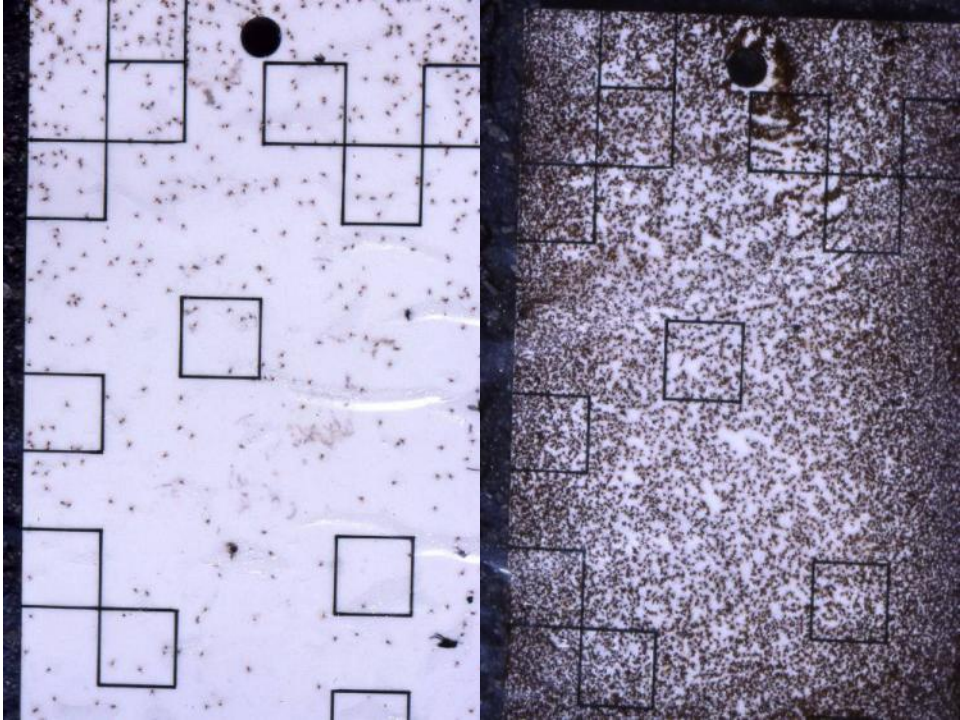


• You can monitor and know when events are happening:

- Pheromone traps
- Crawler tapes
- % infested fruits

California Red Scale Life Cycle



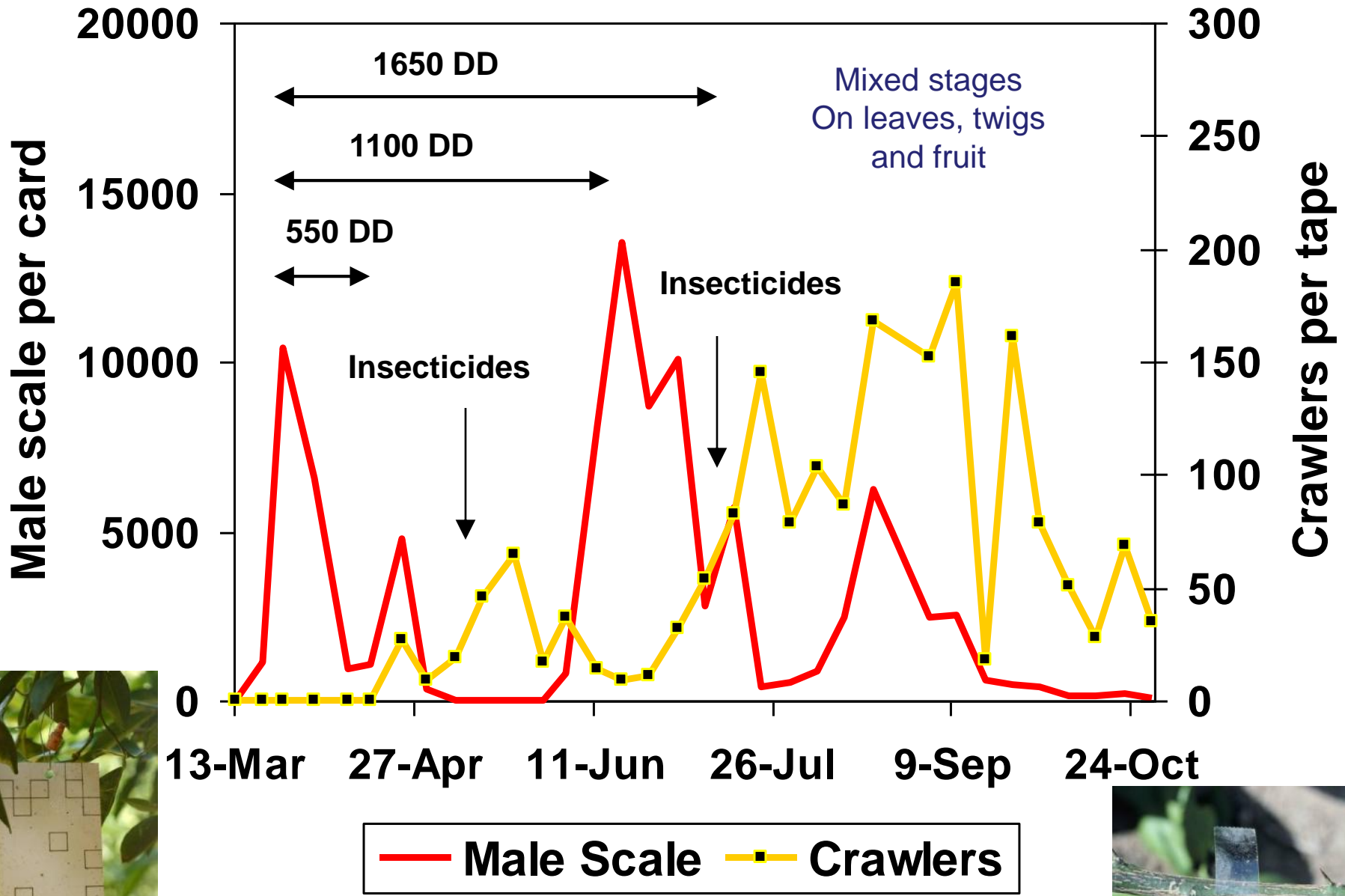


The squares represent 20% of the card and so you can count scale in the squares and multiply $\times 5$ to estimate the total number

Cards can be used two ways:

- 1. To follow the generations**
- 2. To estimate populations at the end of the season***

• First two generations of scales are synchronized and control works best on the first instars



Degree day units

Spring

High: 74

Low: 50

Average daily temperature = $(74+50)/2$ minus LDT 53

= 62-53

= **9 degree days/day**

(61 days from male flight to crawlers)

California red scale

lower developmental threshold

LDT=53°F

Summer

High: 103

Low: 81

Average daily temperature = $(103+81)/2$ minus LDT 53

= 92-53

= **39 degree days/day**

(15 days from male flight to crawlers)

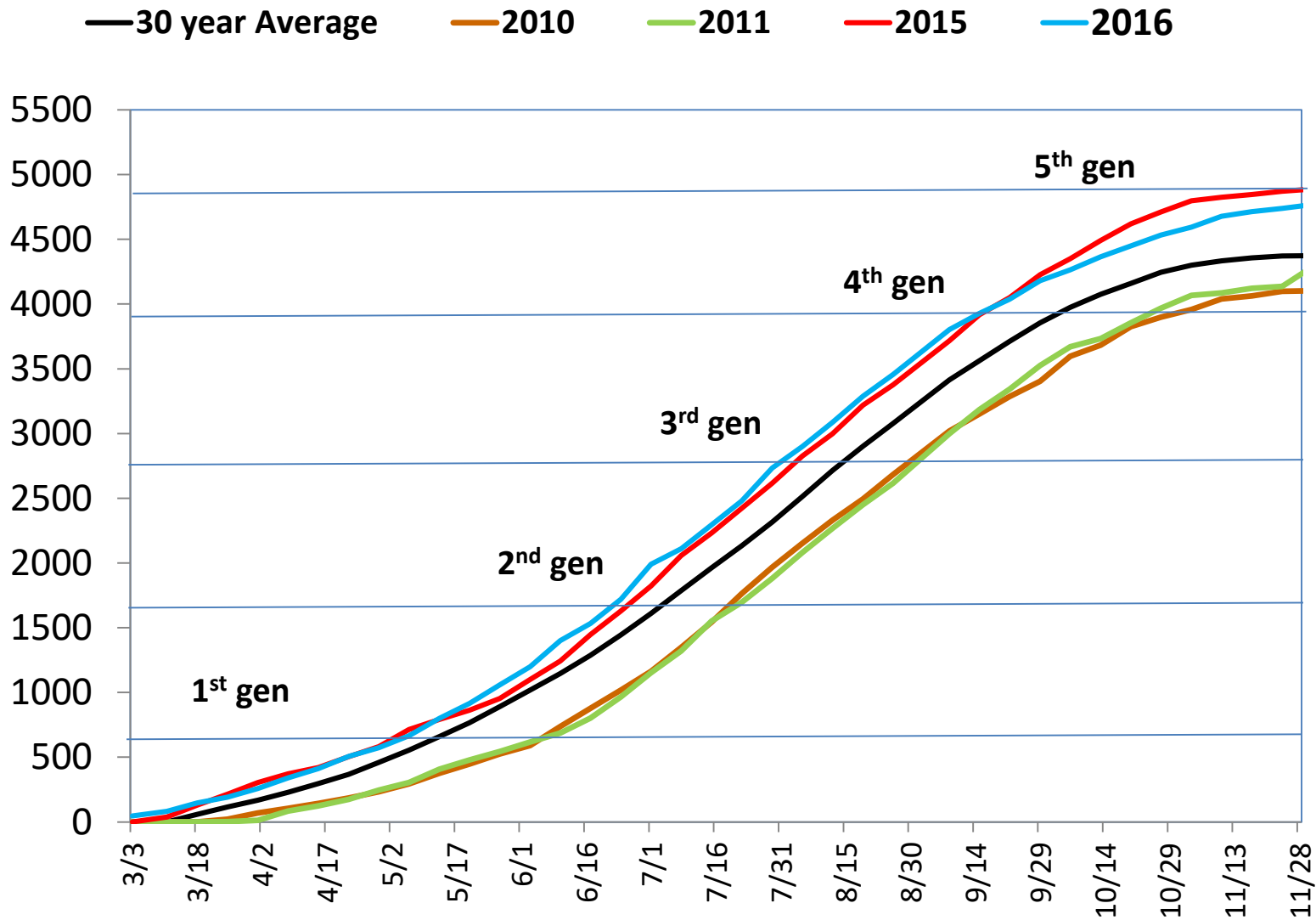


www.Avatel.com Harvest guard data loggers

www.onsetcomp.com Hobo data loggers

California Red Scale DD – Crawler emergence

Lindcove Research and Extension Center



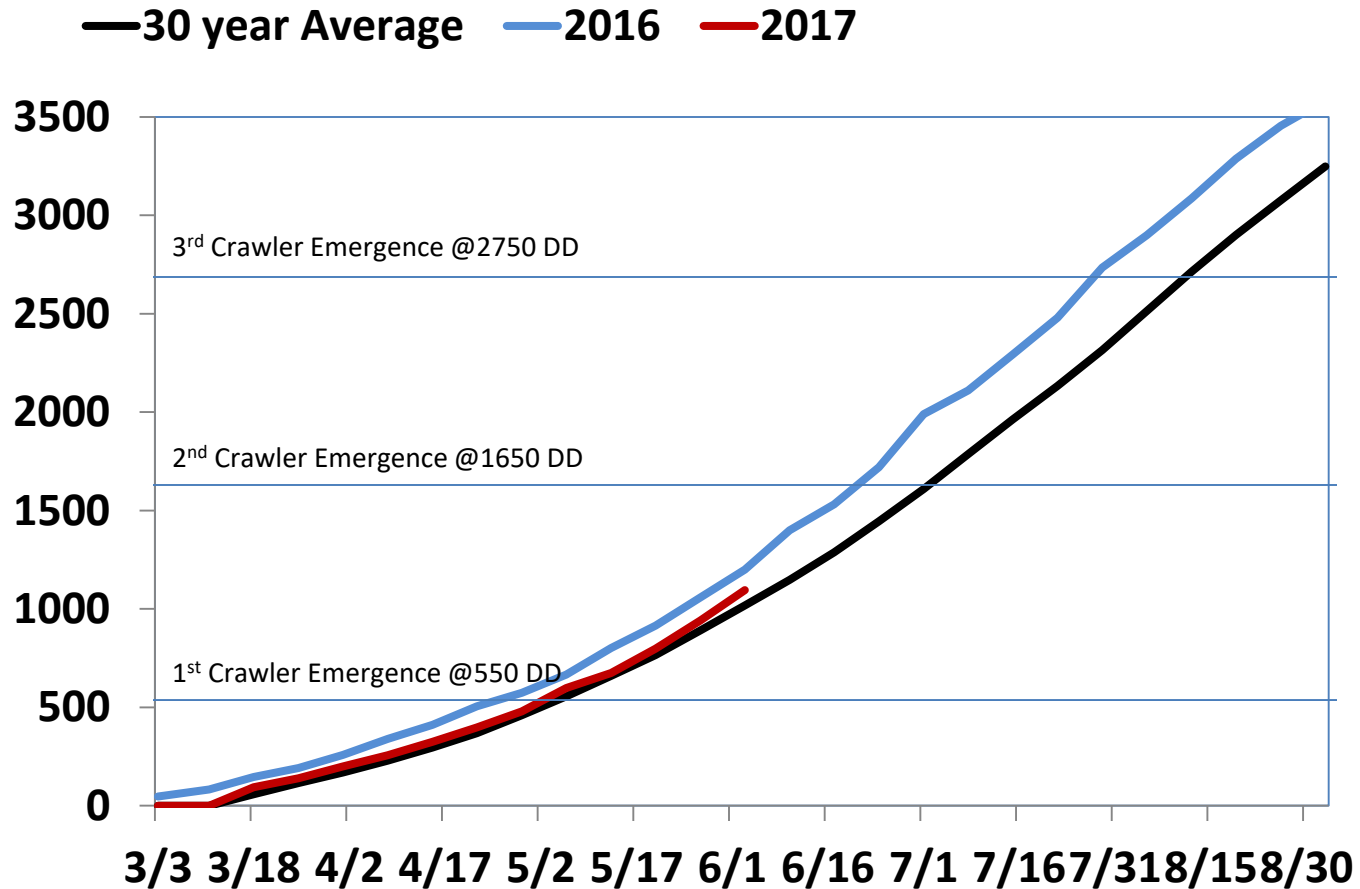
Why so much scale in 2012-16? Perfect storm

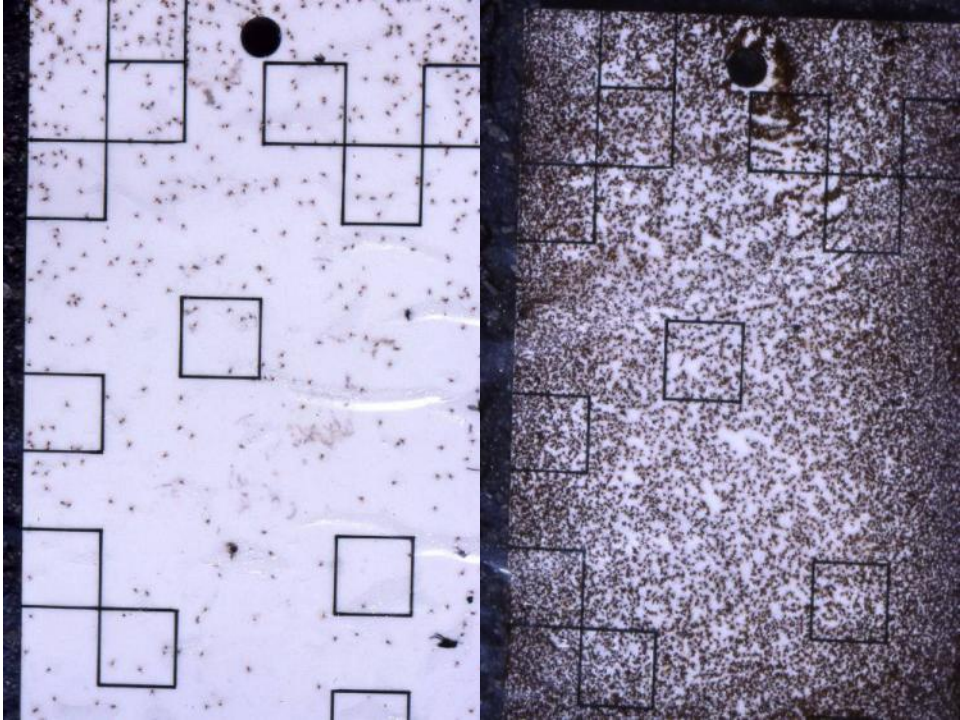
- 1. Warm winters (2014-16) allow young stages to survive and the generations are no longer synchronized in the spring, so the insecticides don't work as well**
- 2. Higher degree day units for the past 5 years allows the 4th generation to grow up and the parasites can't keep up with them**
- 3. Drought – dusty, stressed trees have more scale, parasites don't work as well when they have to get past the dust**

What is happening in 2017?

<http://ucanr.edu/sites/KACCitrusEntomology/>

California Red Scale Degree Days at Lindcove REC





The squares represent 20% of the card and so you can count scale in the squares and multiply x 5 to estimate the total number

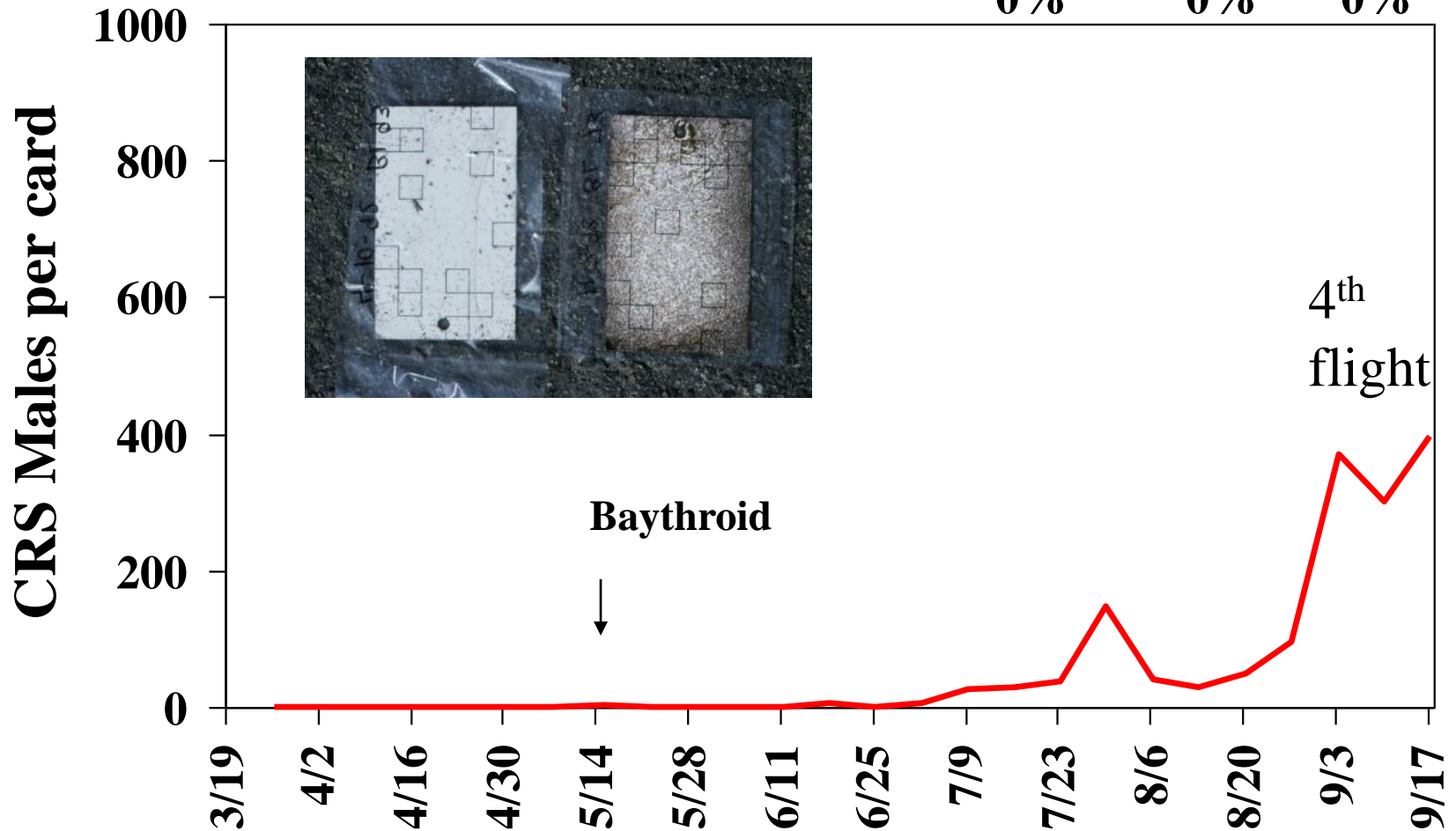
Cards can be used two ways:

- 1. To follow the generations**
- 2. To estimate populations at the end of the season***

Orchard 7

% fruit infested

0% 0% 0%

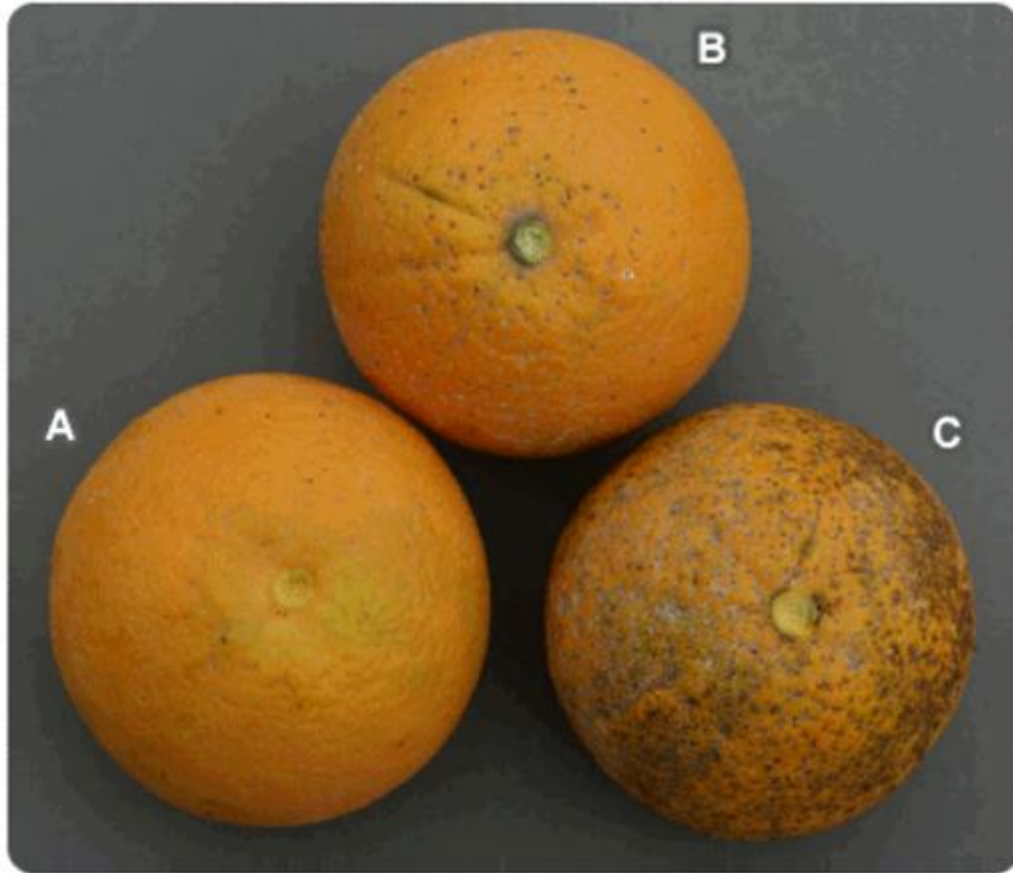


— CRS males

Based on the Organophosphate era
IGRs: lower male counts

Aphytis and Movento: higher male counts

At harvest check bins of fruit



Estimate the % of fruit with >10 scales

If you find more than 5% of fruit infested, the block likely needs a treatment next year

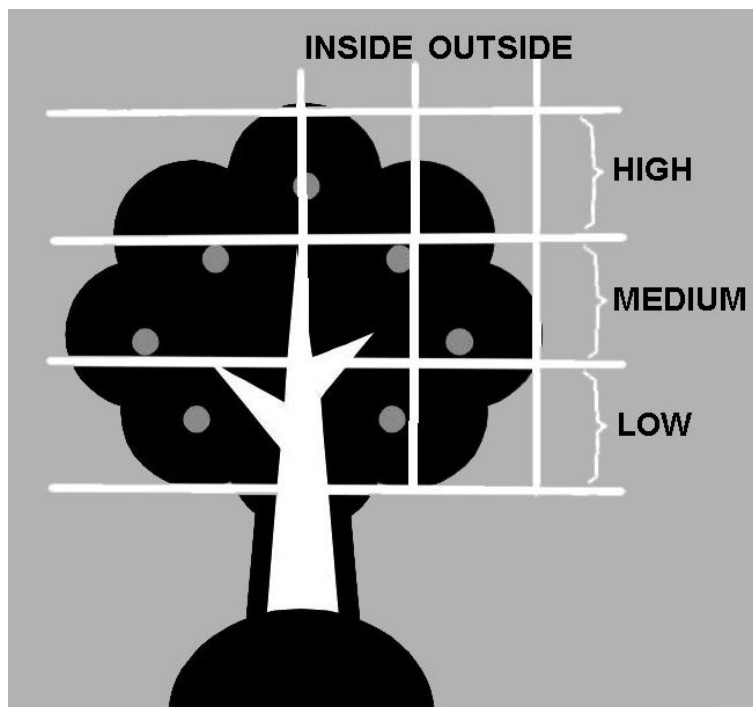


Spray coverage as measured by water sensitive paper

D2/40 Engine-powered Air-O-Fan Sprayer

15 foot 40 year old Atwood navel

Movento + 1% oil



500 gpa

	Inside	Outside
High	56%	62%
Medium	72%	72%
Low	83%	87%

250 gpa

	Inside	Outside
High	33%	34%
Medium	61%	74%
Low	72%	67%

Treatments for California red scale control

Aphytis releases

100,000/acre distributed from Mar-Oct

Oils

415, 440, 455

*OPs and Carbamates

Lorsban, Supracide, Sevin

Insect Growth Regulators

Esteem¹⁹⁹⁸

Applaud/Centaur¹⁹⁹⁷

Lipid synthesis inhibitor

Movento²⁰⁰⁸: foliar systemic

*Resistance

Aphytis wasp releases



Stage to Target: March-October 3rd instar scales

Efficacy: Works well on 2nd and 3rd instar scales, but not 1sts, molts or adults.

Resistance: None

Specificity: Only attacks California red scale

Natural enemies: other natural enemies such as *Comperiella* and *Rhyzobius* join in

Issues: Some years its more effective than other years.

- Hot dry years seem to be more difficult.
- Most citricola scale, Fuller rose beetle treatments (broad spectrum neonicotinoids) work against *Aphytis*.

Biological Red scale management



Cultural Control:

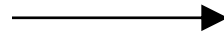
Reduce dust, prune trees, avoid broad spectrum pesticides, and have a high pressure washer available

Biological Control:

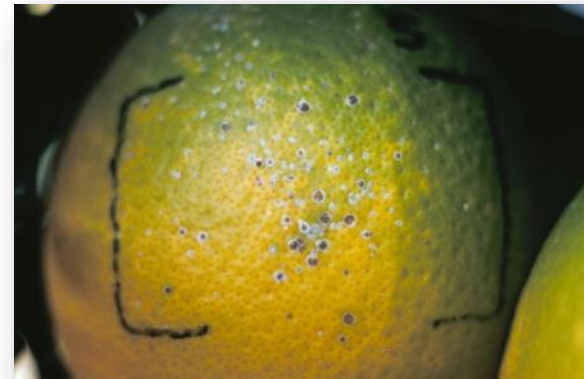
Aphytis melinus: Release 5,000/acre every two weeks from March 1 to October 31 = 100,000/acre

Cost: \$.85/1,000 wasps = \$85/acre

August



September



Parasitized scales flake off

Petroleum Oils

415, 435, 440, 455

Stage to Target: 1st or 2nd generation 1st instars

Efficacy: Works well on young stages, but allows enough to survive that it doesn't eliminate populations

Resistance: None

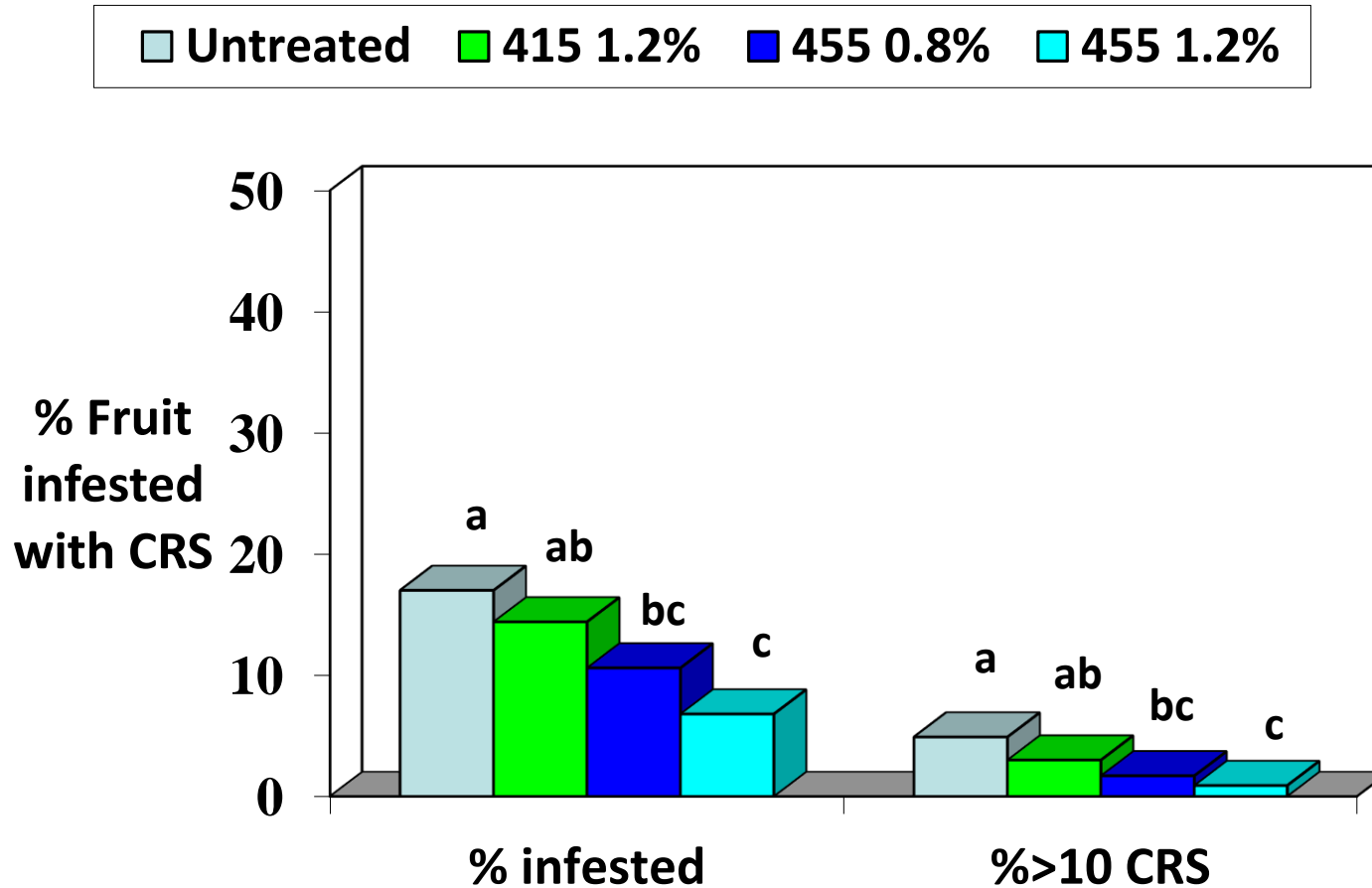
Specificity: Broad spectrum against both pests and natural enemies, smothering

Toxicity to natural enemies: kills what it directly contacts, but residues don't last too long. Exception is *Euseius* predatory mites are affected long-term.

Issues: During hot weather, the orchard must be well-irrigated and treatments applied at night/early morning

•Higher distillation point and higher concentration = greater scale kill, but be careful of phytotoxicity

Effects of PureSpray oil (10E and 15E) on California red scale



Organophosphates & Carbamates

***Lorsban, *Supracide, *Sevin**

Stage to Target: 1st or 2nd generation white caps

Efficacy: varies, depends on resistance

Resistance: *common in the San Joaquin Valley

Specificity: broad spectrum, killing pests and natural enemies unless they have resistance

Toxicity to natural enemies:

- High toxicity for Supracide and Sevin. Depends on the rate for Lorsban.
- Aphytis, predatory mites, vedalia beetle have some resistance in the San Joaquin Valley

Issues: worker safety (restricted use), drift, and pesticide resistance

Insect Growth Regulators

Esteem and Applaud/Centaur

Stage to Target: 1st or 2nd generation 1st instars as they start to molt.

Efficacy: Esteem was cheaper, shorter REI and perceived to be more efficacious than Applaud and so has been depended on for the past 15 years.

Resistance: Indications there is some Esteem resistance

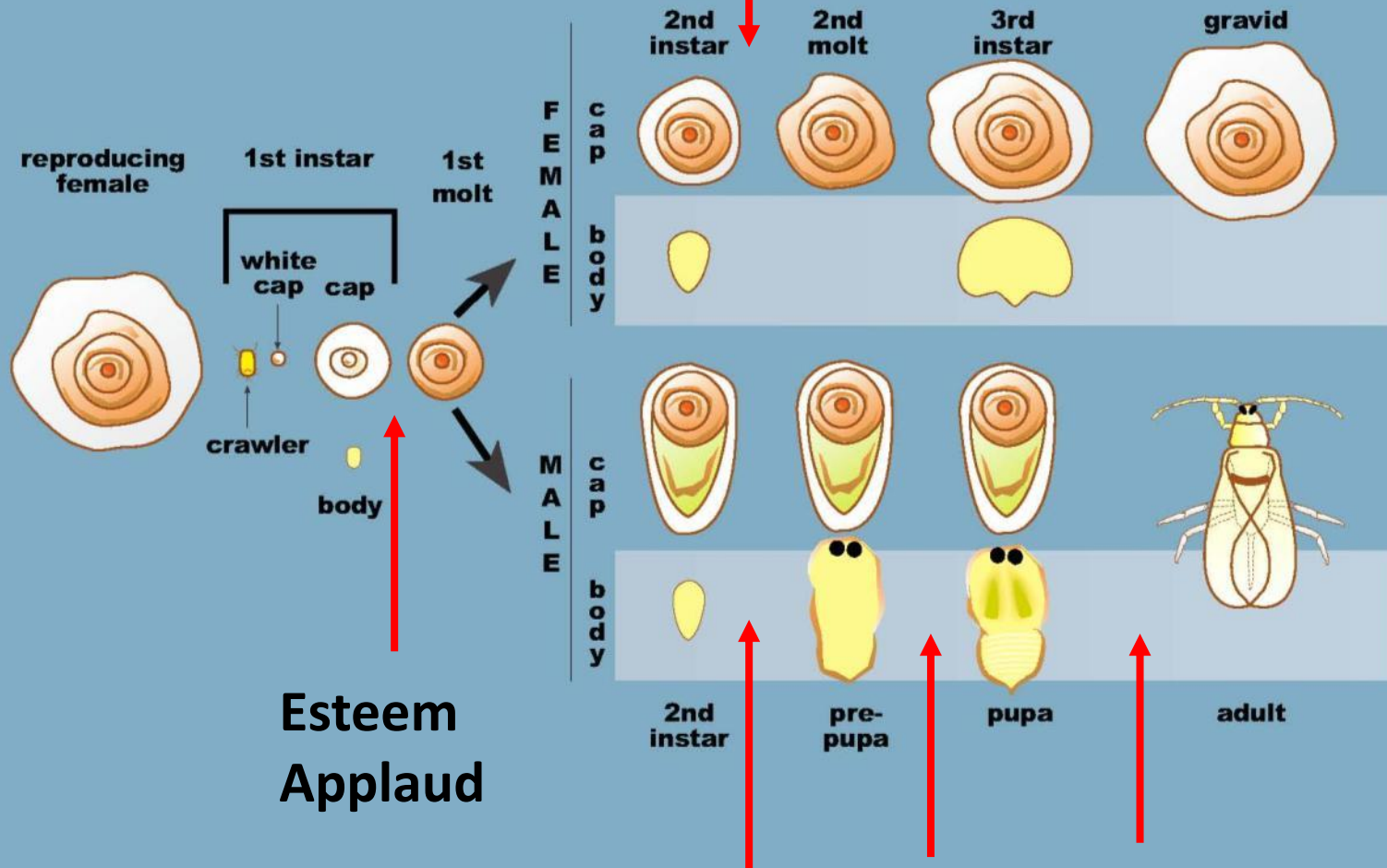
Specificity: Works better on California red scale than citricola scale or cottony cushion scale

Toxicity to natural enemies: Only toxic to coccinellid predatory beetles such as Vedalia beetle.

Issues: coverage, timing and they only work on developing stages (eggs and molts) – so they can't clean up a very heavy population

- Male scales molt more and so are more susceptible to IGRs = low pheromone trap counts

California Red Scale Life Cycle



Tetrone acid insecticide

Movento

Stage to Target: younger instars

Efficacy depends on

- Adjuvants
- Timing (tree has to move the product)
- Water volume

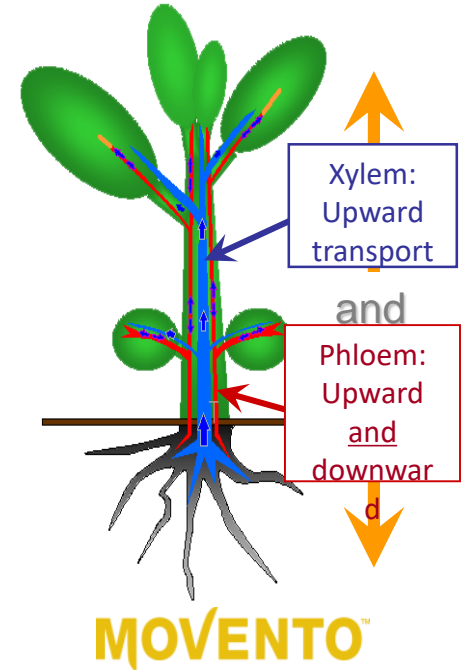
Resistance: None

Specificity: Toxic to California red scale, citrus red mite, citrus leafminer, citrus thrips

Toxicity to natural enemies: Affects predatory mites but not predatory beetles or parasitic wasps

Issues: Uptake and movement into leaves and fruit.

Does not control scales on twigs and trunk. Can not clean up a heavy population of red scale. Requires an adjuvant.



Pesticide screening



Insecticide group	Chem grp	Parasites	Predatory mites	Predatory beetles
OP and Carbamate	1a,b	Rate dependent	Resistant	resistant
Neonicotinoids	4a	Toxic (9 wk)	Rate & coverage dependent	Toxic
Insect growth regulators	7c, 16	Soft	Soft	Very toxic
Movento (spirotetramat)	23	Soft	Toxic	Soft
Oils		Synchronize	Reduce	soft

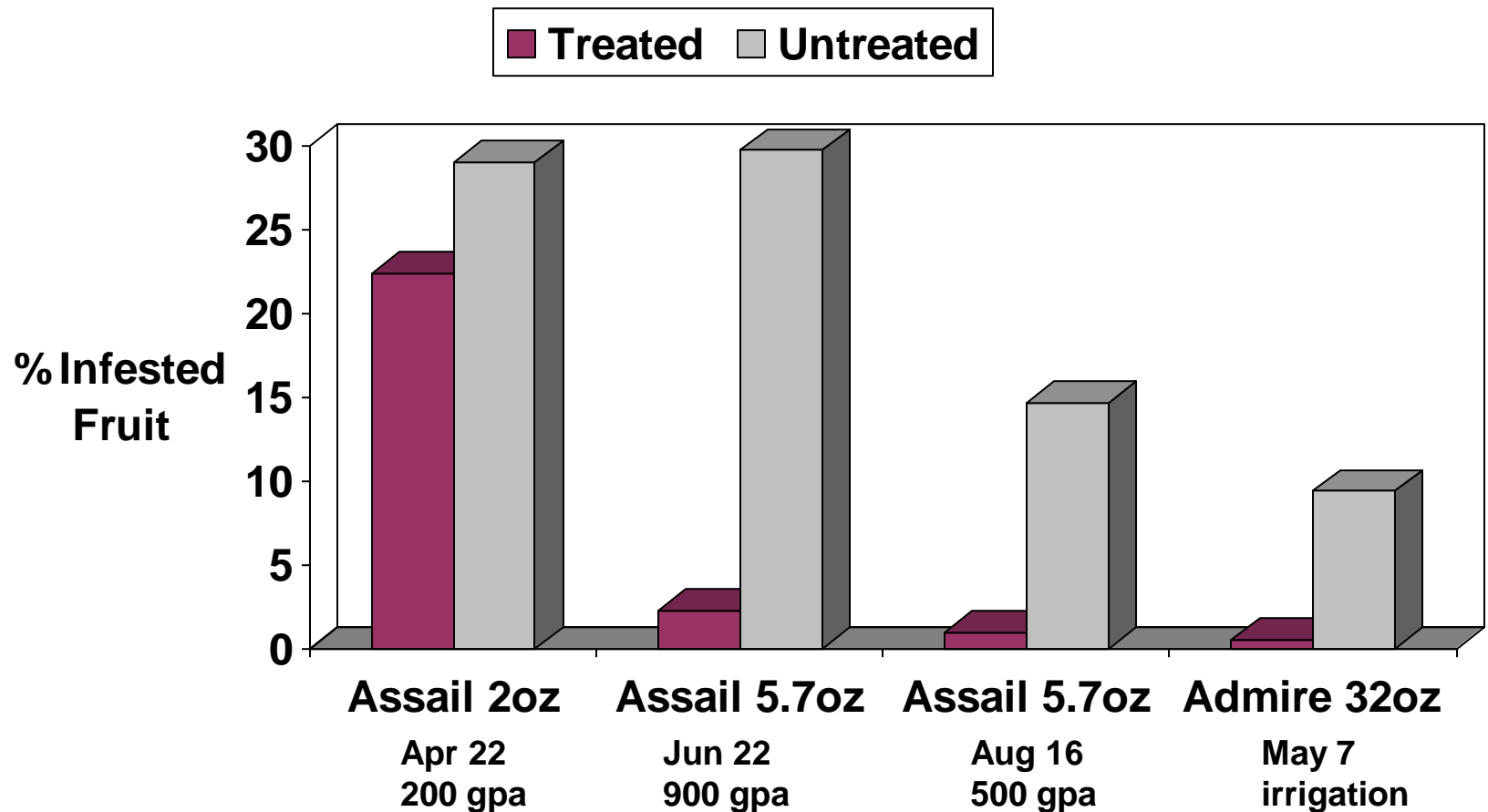
Why are the systemic neonicotinoids (Admire Pro and generics, Assail, Platinum, Actara) not good products for California red scale?

- Reduce natural enemies**
- Systemics control red scale on fruit but not wood**
- Build up scale that can not be controlled by oils, IGRs or Movento**

• **High rates of neonicotinoids reduce scale on fruit**

October 2004

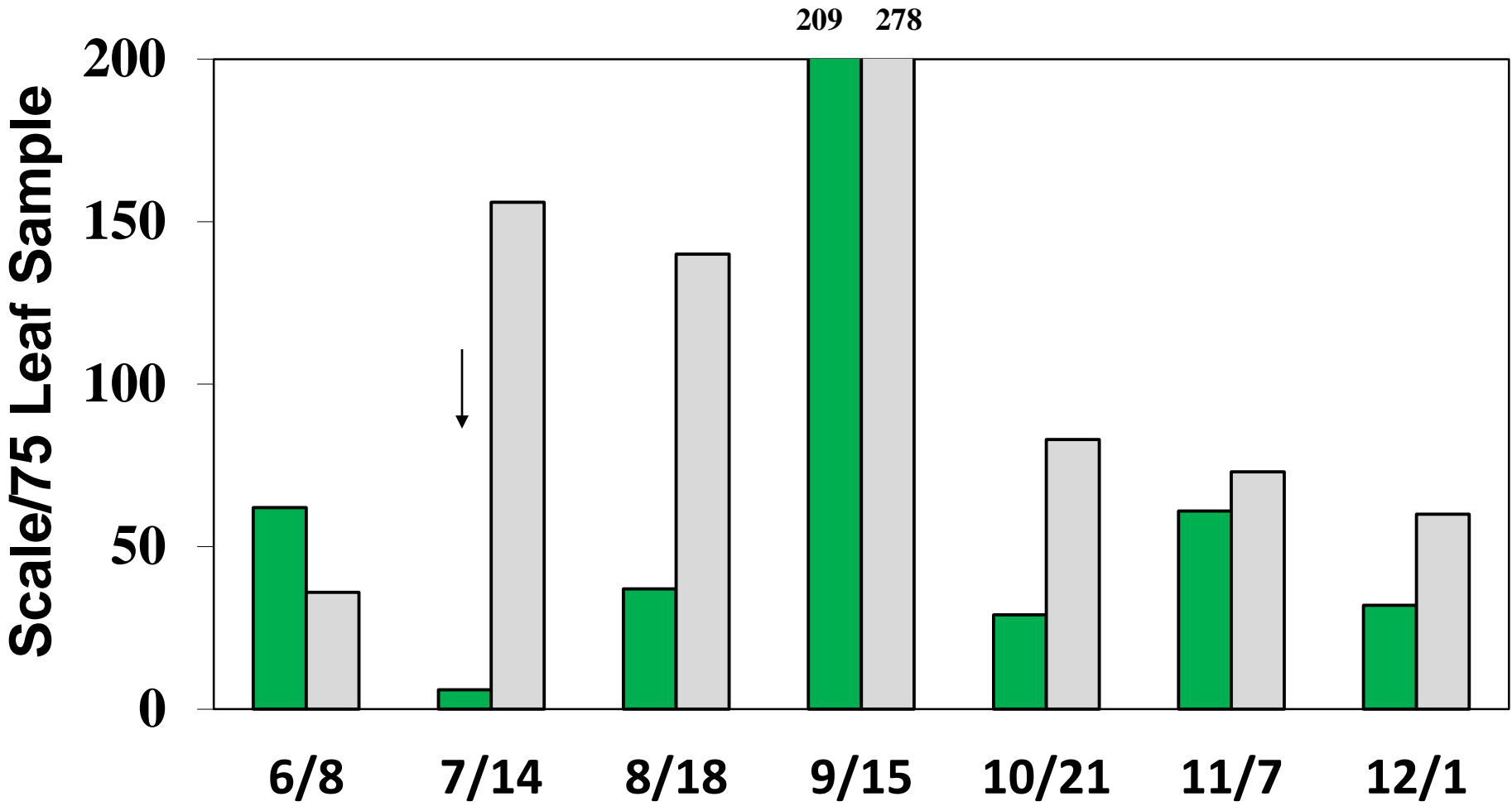
Neonicotinoid impact on red scale
Assail and Admire



•Neonicotinoids do not control scales on leaves or twigs

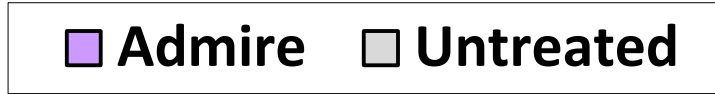


2004- Assail Trial

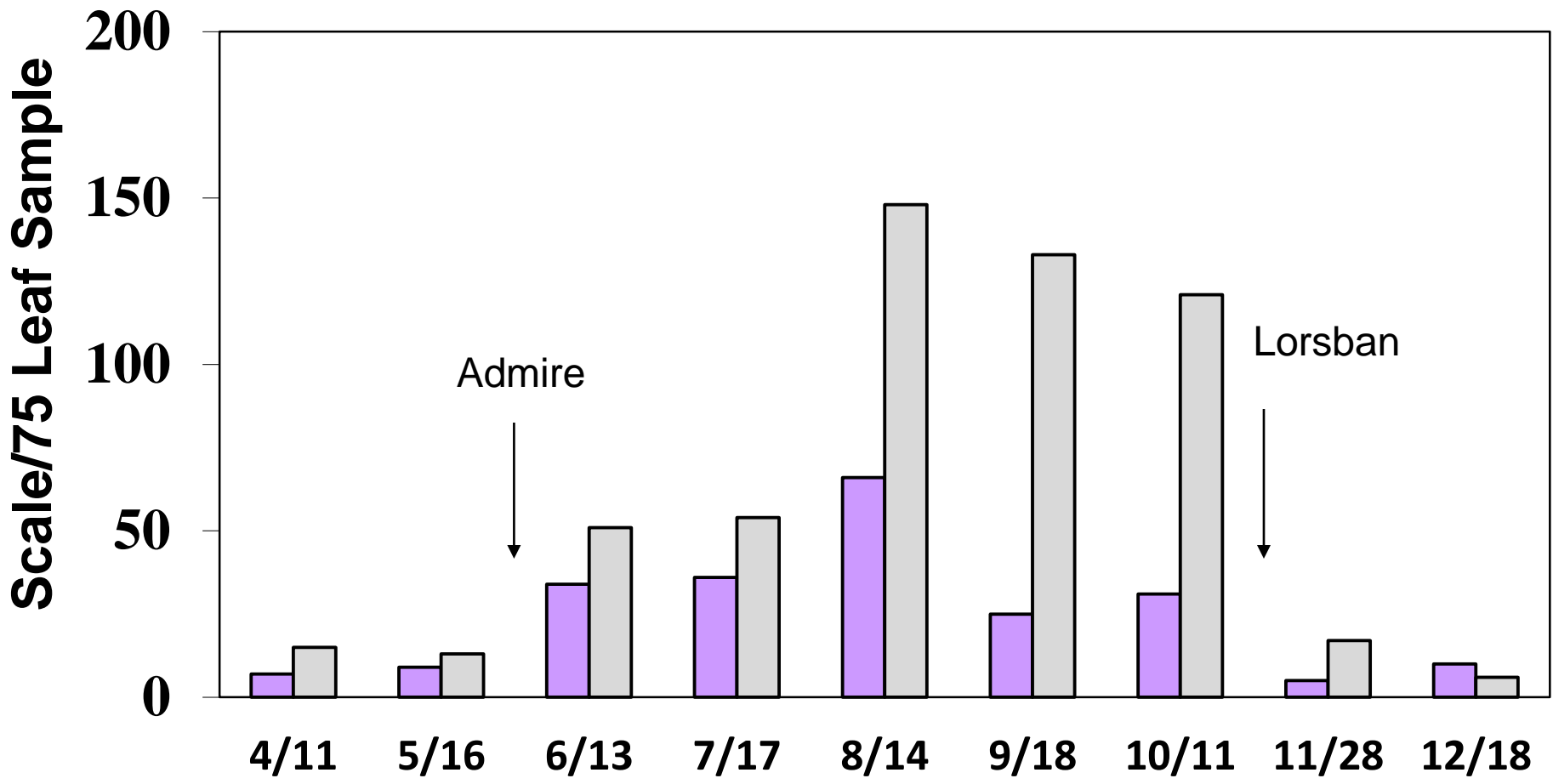


Treated on June 22, Assail 5.7 oz in 900 gpa

•Neonicotinoids do not control scales on leaves or twigs



2001 – Admire trial – Kern Co.



Admire applied May 21, Lorsban for citricola Oct 17

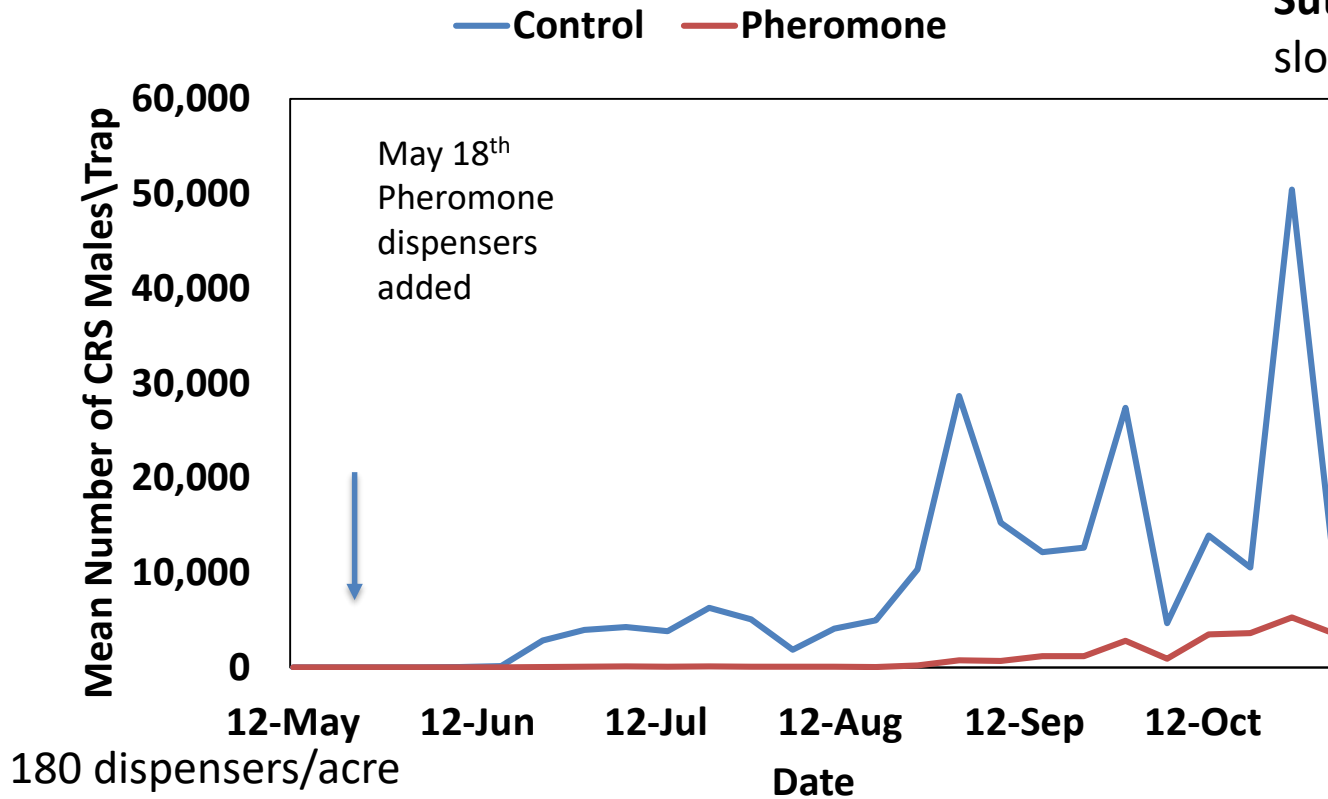
Why so much scale in 2012-16? Perfect storm

- 1. Warm winters (2014-16) allow young stages to survive and the generations are no longer synchronized in the spring, so the insecticides don't work as well**
- 2. Higher degree day units for the past 5 years adds another generation and the parasites can't keep up with them**
- 3. Drought – dusty, stressed trees have more scale, parasites don't work as well when they have to get past the dust**
- 4. Admire treatments and possibly Movento treatments are building scale on wood**
- 5. The registered insecticides only last about 1 generation: great for light scale years and tough for heavy scale years.**

Why don't we have more red scale insecticides coming down the pike?

- The insecticide rate has to be high because water volume is high to achieve good coverage.**
- This often makes the product too costly or raises registration concerns**

Suterra Checkmate CRS
slow release dispensers



	CRS/Twig (Aug)	% Fruit with > 10 CRS
Control	1.1/twig	13%
Pheromone dispensers	0.3/twig	7%

What are we going to do about red scale?

Timing: hit the stage that is most sensitive and in tough situations apply multiple treatments

Good coverage: 750-1500 gpa for most chemicals, 250 gpa for Movento

Calibrate your rig correctly and Drive slowly! ≤ 1.5 mph

Pheromone disruption: Suterra dispensers reduce scale about 50% in low to moderate populations

2017 should be better because we have had cold, wet winter weather (reduces dust, synchronizes scale, causes overwintering mortality of younger instars)