Management of Vine Mealybug and other New Pests in Lodi Vineyards Update

LUCIA G. VARELA
NORTH COAST IPM ADVISOR
UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION & STATEWIDE IPM PROGRAM

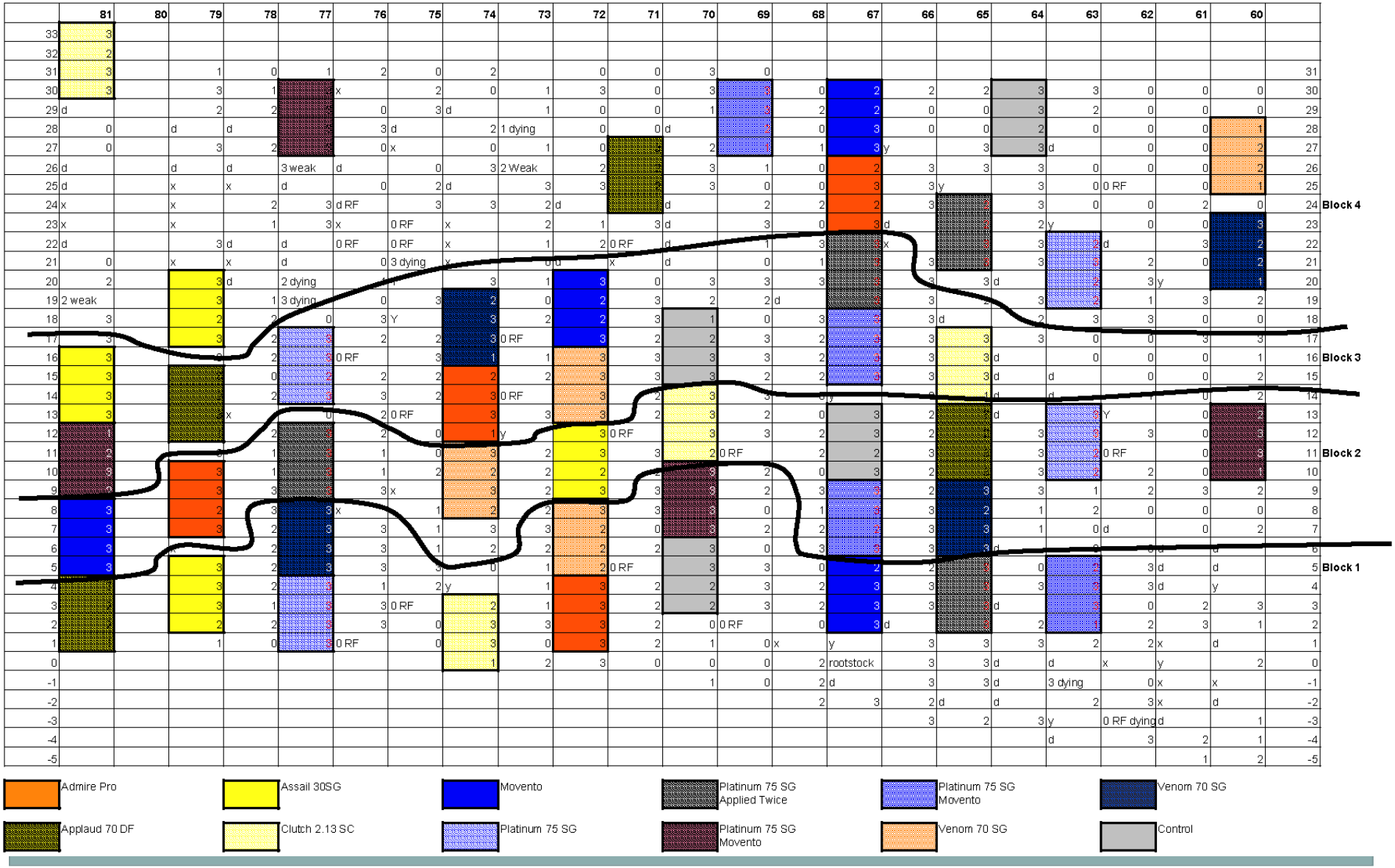
Vine Mealybug Trials

Photo: Jack Kelly Clark

2009 Vine Mealybug Trial

Blocks of 12 plots each were defined down the slope.

Treatments were randomly assigned to plots.



Product Chemistry

Product	Active Ingredient	IRAC Group	
Admire	Imidacloprid	4a	Neonicotinoid
Applaud	Buprofezin	17a	Moulting disruptor. Inhibits formation of chitin. Target protein unknown.
Assail	Acetamiprid	4a	Neonicotinoid
Clutch	Clothianidin	4a	Neonicotinoid
Movento	Spirotetramat	23	Lipid biosynthesis inhibitor. After ingestion pest cannot store energy
Platinum	Thiamethoxam	4a	Neonicotinoid
Venom	Dinotefuran	4a	Neonicotinoid

12 Treatments; 4 Replications

- Admire Pro 14 oz/ac Chemigation
- Applaud 70 DF 12 oz/ac Foliar Applied Twice
- Assail 30 SG 5 oz/ac Foliar
- Clutch 2.13 SC 5 oz/ac Foliar
- Movento 6 oz Foliar
- Platinum 75 SG 5.67 oz/ac Chemigation
- Platinum 75 SG 2.67 oz/ac Chemigation Applied Twice
- Platinum 75 SG 4 oz/ac Chemigation and Movento 6 oz/ac Foliar
- Platinum 75 SG 5.67 oz/ac Chemigation and Movento 6 oz ac Foliar
- Venom 6 oz/ac Chemigation
- Venom 3 oz/ac Foliar

12 Treatments; 4 Replications

Treatment	Product	Rate per Acre		Application Method	Application Date
1	Admire Pro	14	fl oz	Chemigation	May 13
2	Applaud 70 DF	12	dry oz	Foliar	May 18
	Applaud 70 DF	12	dry oz	Foliar	June 26
3	Assail 30SG	5	dry oz	Foliar	May 18
4	Clutch 2.13 SC	5	fl oz	Foliar	May 18
5	Movento	6	fl oz	Foliar	May 19
6	Platinum 75 SG	5.67	dry oz	Chemigation	May 13
7	Platinum 75 SG	2.67	dry oz	Chemigation	May 13
	Platinum 75 SG	2.67	dry oz	Chemigation	June 15
8	Platinum 75 SG	4	dry oz	Chemigation	May 13
	Movento	6	fl oz	Foliar	May 19
9	Platinum 75 SG	5.67	dry oz	Chemigation	May 13
	Movento	6	fl oz	Foliar	May 19
10	Venom 70 SG	6	oz dry	Chemigation	May 13
11	Venom 70 SG	3	oz dry	Foliar	May 18
12	Control				

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6	Platinum 75 SG	5.67	dry oz	Chemigation	May 13
7	Platinum 75 SG	2.67	dry oz	Chemigation	May 13
	Platinum 75 SG	2.67	dry oz	Chemigation	June 15
8	Platinum 75 SG	4	dry oz	Chemigation	May 13
	Movento	6	fl oz	Foliar	May 19
9	Platinum 75 SG	5.67	dry oz	Chemigation	May 13
	Movento	6	fl oz	Foliar	May 19
10	Venom 70 SG	6	oz dry	Chemigation	May 13
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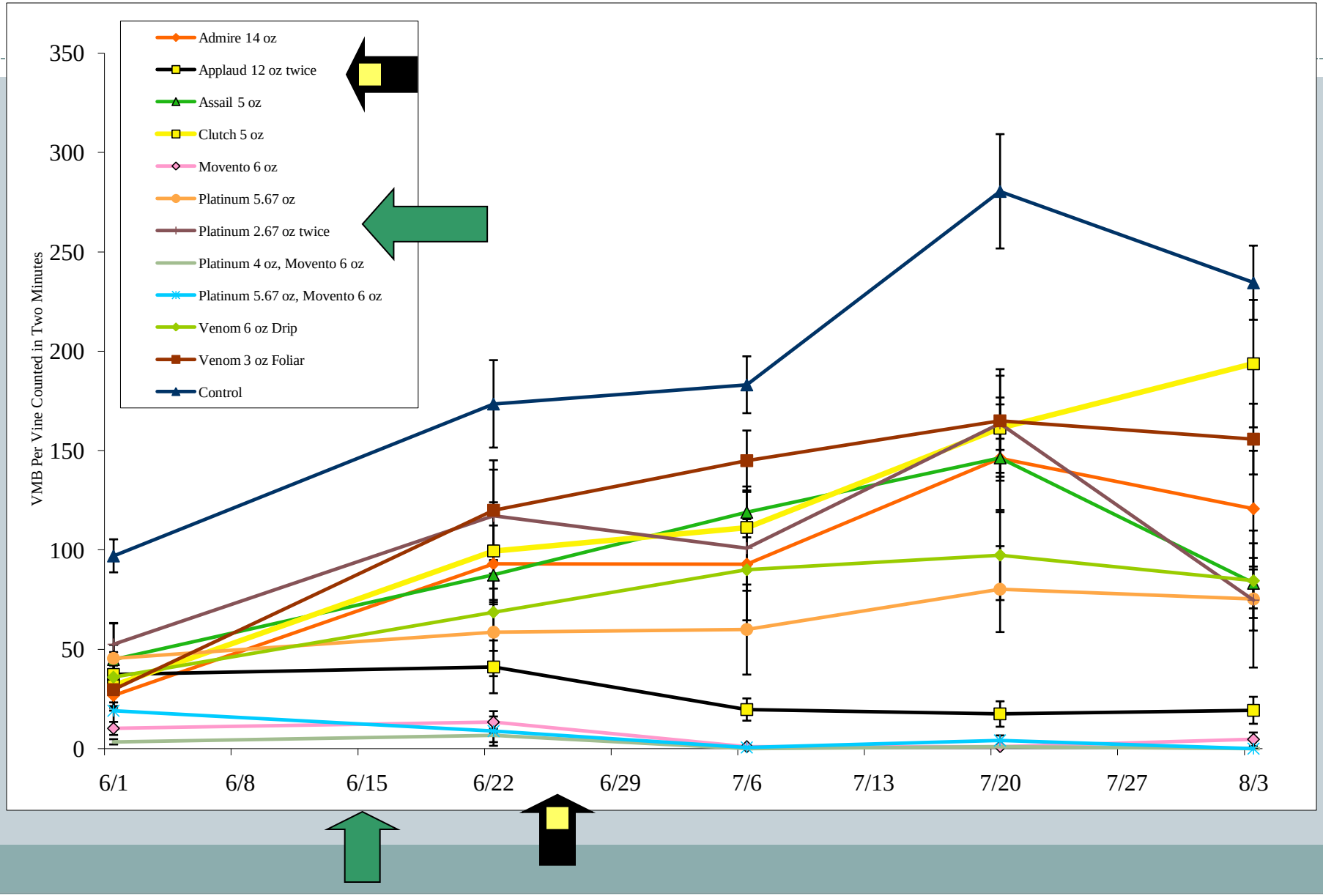
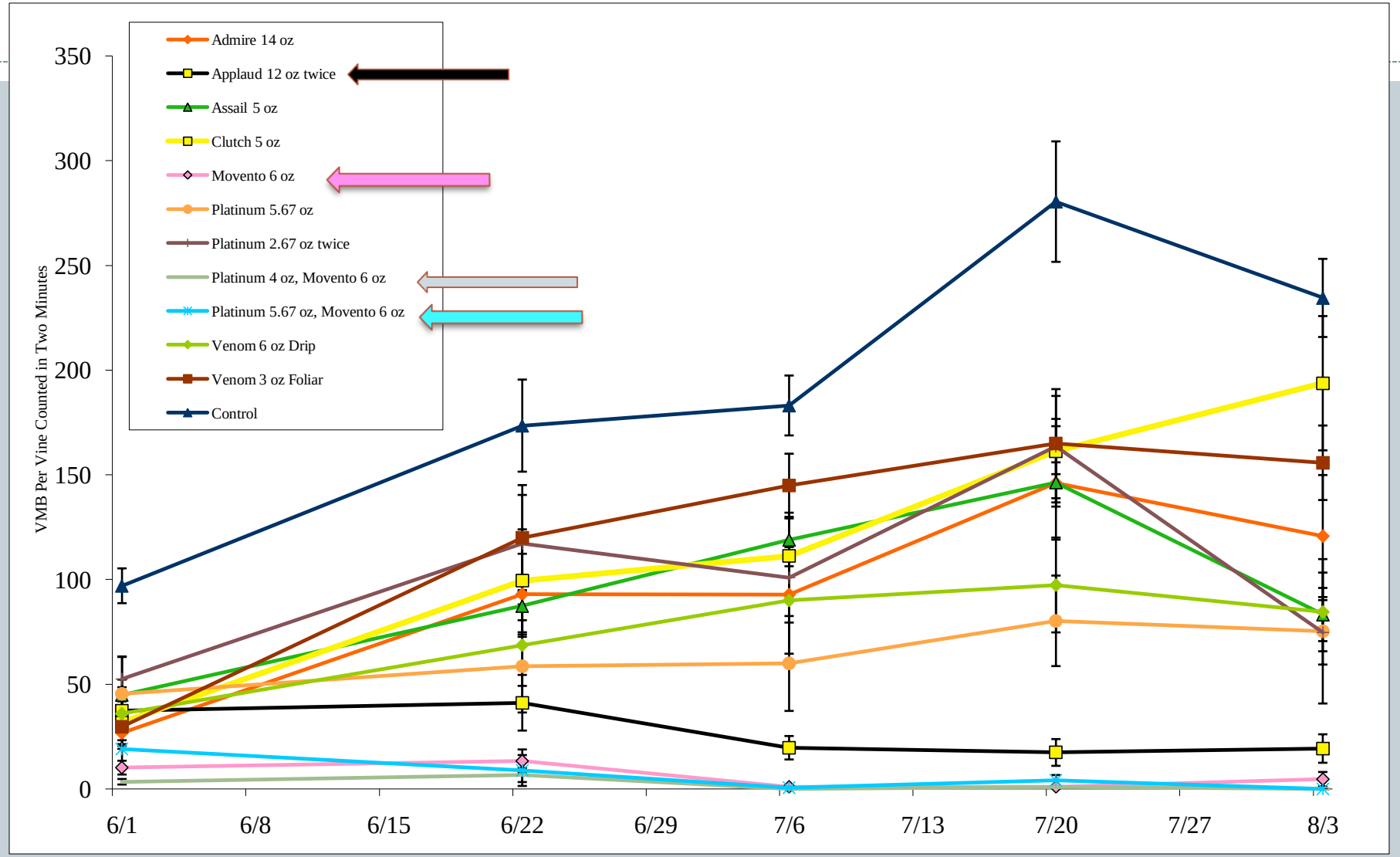
Two Minute VMB Counts



Two Minute VMB Counts



Two Minute Counts Throughout Growing Season

Treatment	June 1		June 22		July 6		July 20		August 3	
Admire 14 oz	26.8	abc	93.0	cde	92.9	cd	146.1	de	120.8	cd
Applaud 12 oz twice	37.4	bc	41.1	abcd	19.6	ab	17.4	bc	19.3	ab
Assail 5 oz	44.9	bc	87.4	bcde	119.0	cd	146.4	de	83.3	bc
Clutch 5 oz	31.6	bc	99.4	cde	111.3	cd	161.3	def	193.8	d
Movento 6 oz	10.1	ab	13.3	ab	1.0	a	1.0	a	4.6	a
Platinum 5.67 oz	45.4	bc	58.5	abcde	59.9	bc	80.3	def	75.3	bcd
Platinum 2.67 oz twice	52.5	bc	117.3	de	100.8	cd	163.5	def	74.8	bc
Platinum 4 oz, Movento 6 oz	3.4	a	6.6	a	0.0	a	1.0	ab	0.0	a
Platinum 5.67 oz, Movento 6 oz	19.0	abc	8.8	abc	0.5	a	4.0	ab	0.0	a
Venom 6 oz Drip	35.9	bc	68.6	bcde	90.0	c	97.4	cd	84.5	cd
Venom 3 oz Foliar	29.6	bc	120.0	cde	145.0	d	164.9	ef	155.8	d
Control	97.0	c	173.5	e	183.1	cd	280.5	f	234.5	d

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Clutch 5 oz	31.6	bc	99.4	cde	111.3	cd	161.3	def	193.8	d
Movento 6 oz	10.1	ab	13.3	ab	1.0	a	1.0	a	**4.6**	**a**
Platinum 5.67 oz	45.4	bc	58.5	abcde	59.9	bc	80.3	def	75.3	bcd
Platinum 2.67 oz twice	52.5	bc	117.3	de	100.8	cd	163.5	def	74.8	bc
Platinum 4 oz, Movento 6 oz	3.4	a	6.6	a	0.0	a	1.0	ab	**0.0**	**a**
Platinum 5.67 oz, Movento 6 oz	19.0	abc	8.8	abc	0.5	a	4.0	ab	**0.0**	**a**
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Platinum 5.67 oz	45.4	bc	58.5	abcde	59.9	bc	80.3	def	75.3	bcd
Platinum 2.67 oz twice	52.5	bc	117.3	de	100.8	cd	163.5	def	74.8	bc
Platinum 4 oz, Movento 6 oz	3.4	a	6.6	a	0.0	a	1.0	ab	0.0	a
Platinum 5.67 oz, Movento 6 oz	19.0	abc	8.8	abc	0.5	a	4.0	ab	0.0	a
Venom 6 oz Drip	35.9	bc	68.6	bcde	90.0	c	97.4	cd	84.5	cd
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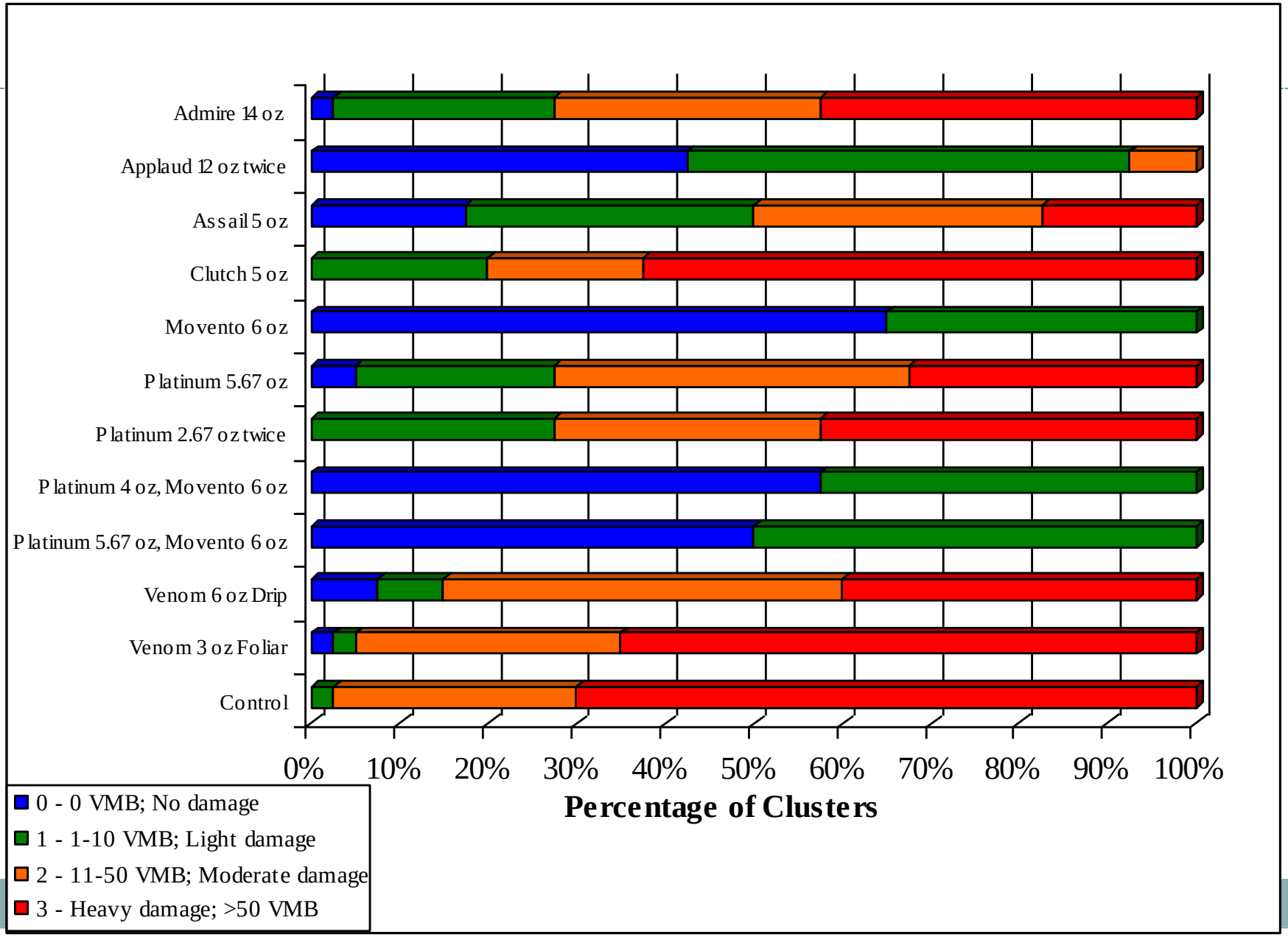
Counted vmb with dissecting scope

Cluster Damage Ratings - August 13 and 14



David Haviland's Post-harvest Trials

2007-8 Two trials

- •Arvin-1-year grafted over Summer royal
- •Edison-mature Thompsons

Sprayed late August (07)

2008-9 Two trials

- •Edison-Flame seedless

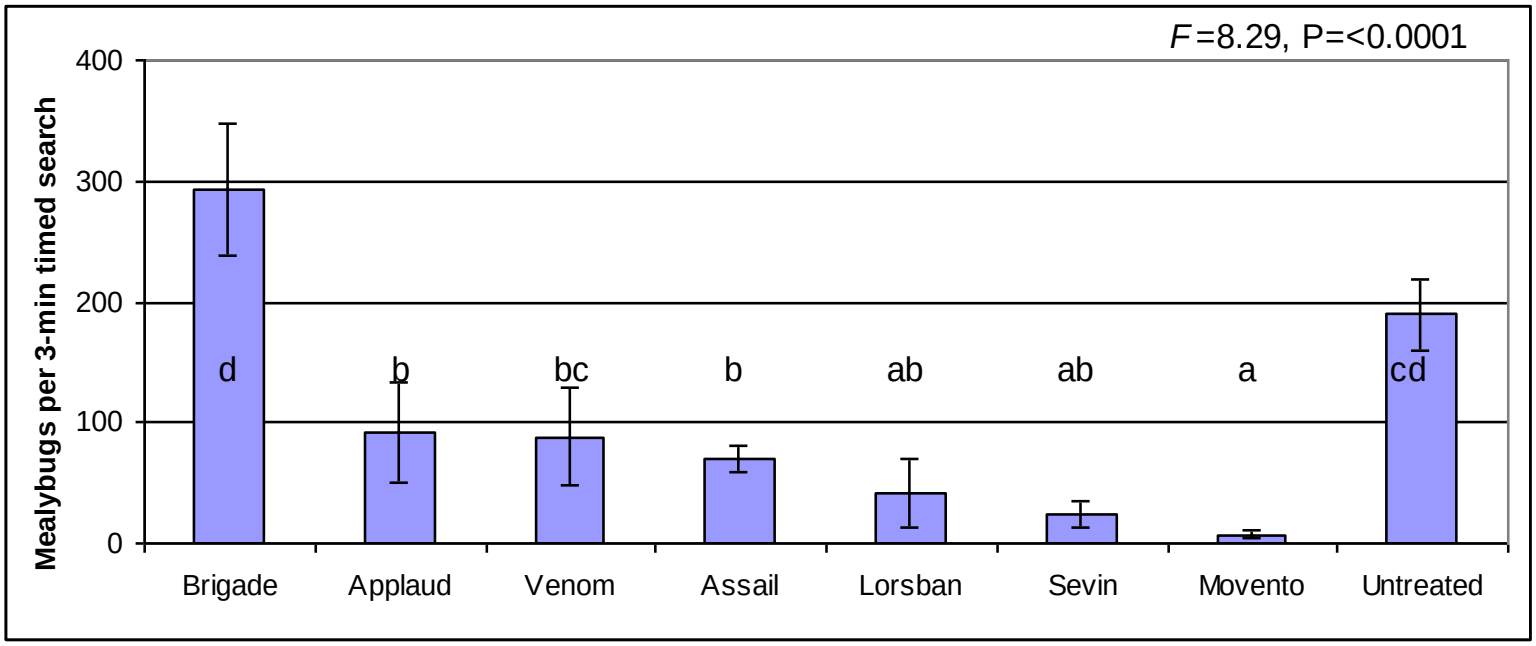
Sprayed Sept2/Oct1/Nov3 (08)

Evaluated in April/May

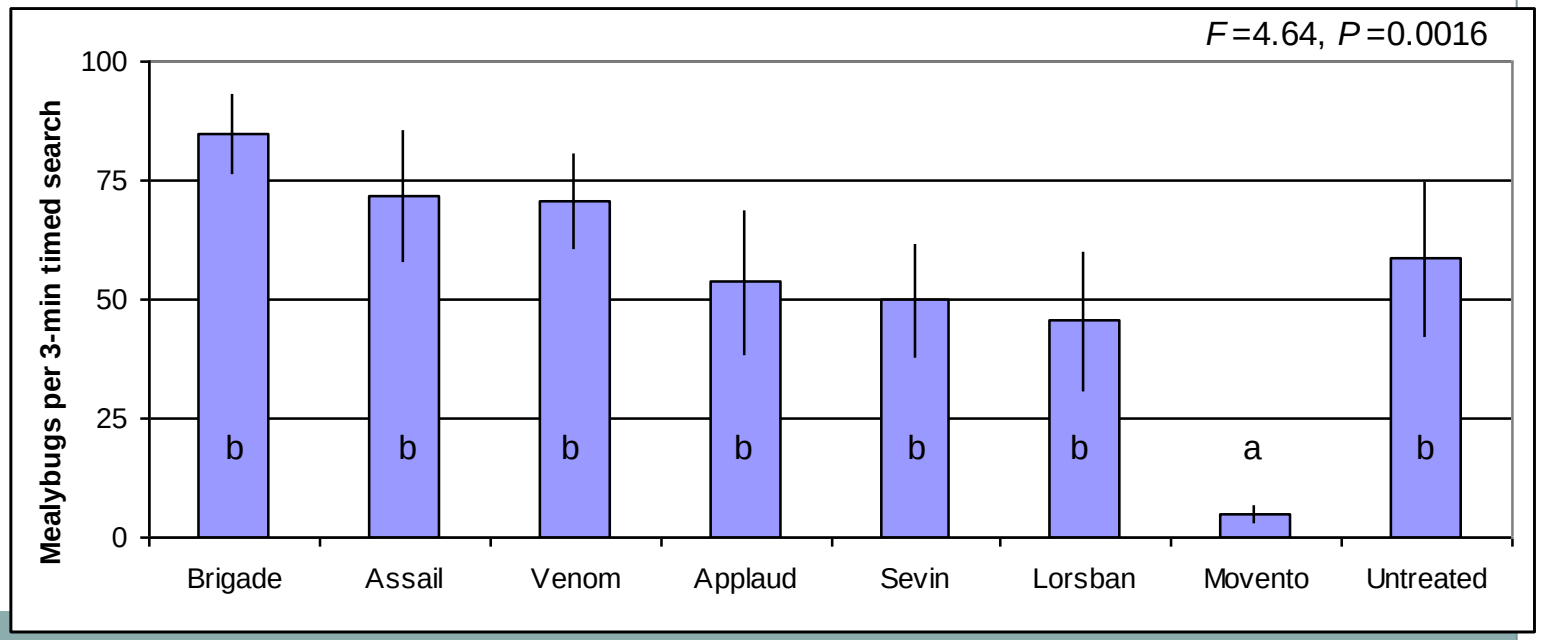
Lorsban	Sevin XLR
Assail	Brigade
Applaud	Movento
Venom	Untreated

2007/08

Postharvest
Summer
Royal
Young Vine
Appl: August
20-vine plots
Eval: in May



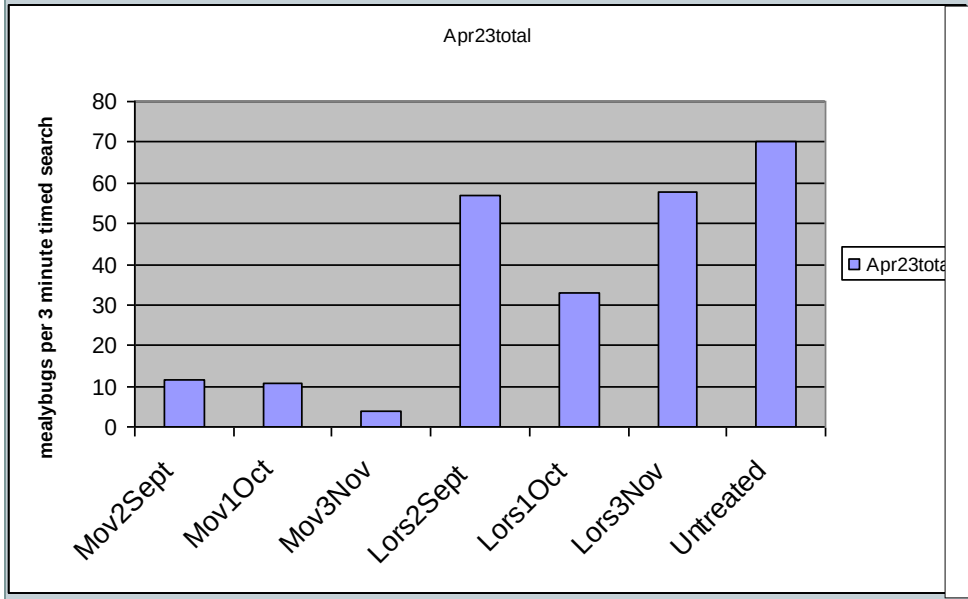
Postharvest
Thompsons
Mature Vine
Appl: August
20-vine plots
Eval: in May



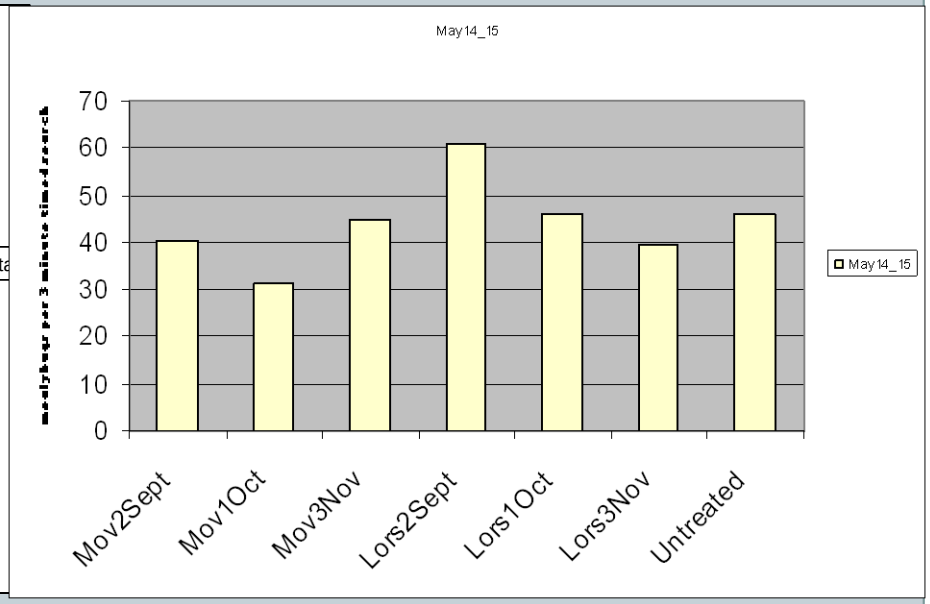
Post-harvest Trial 2008/09

Flame Seedless

April evaluation



May evaluation



What is Movento Doing?

- Applied foliar in fall
- Killing foliar mealybugs in the fall (as does Lorsban)
- Likely maintaining parasitoids
- Likely affecting mealybugs on the roots (that already migrated below ground prior to treatment)
- Benefits until May (when trials were terminated)

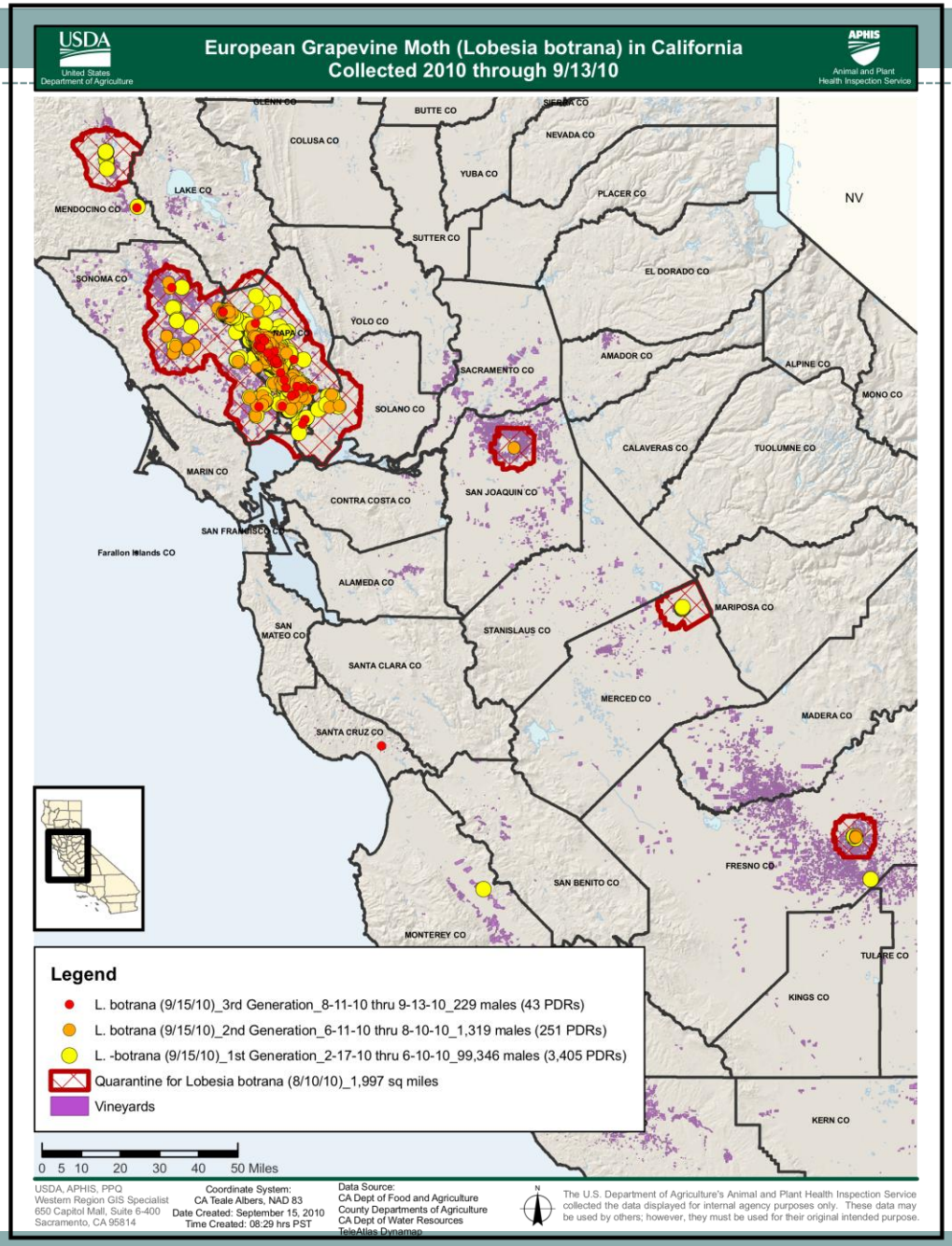
European Grapevine Moth

Quarantine Areas

&

Individual Moth Catches

As of 9/13/2010



Life cycle

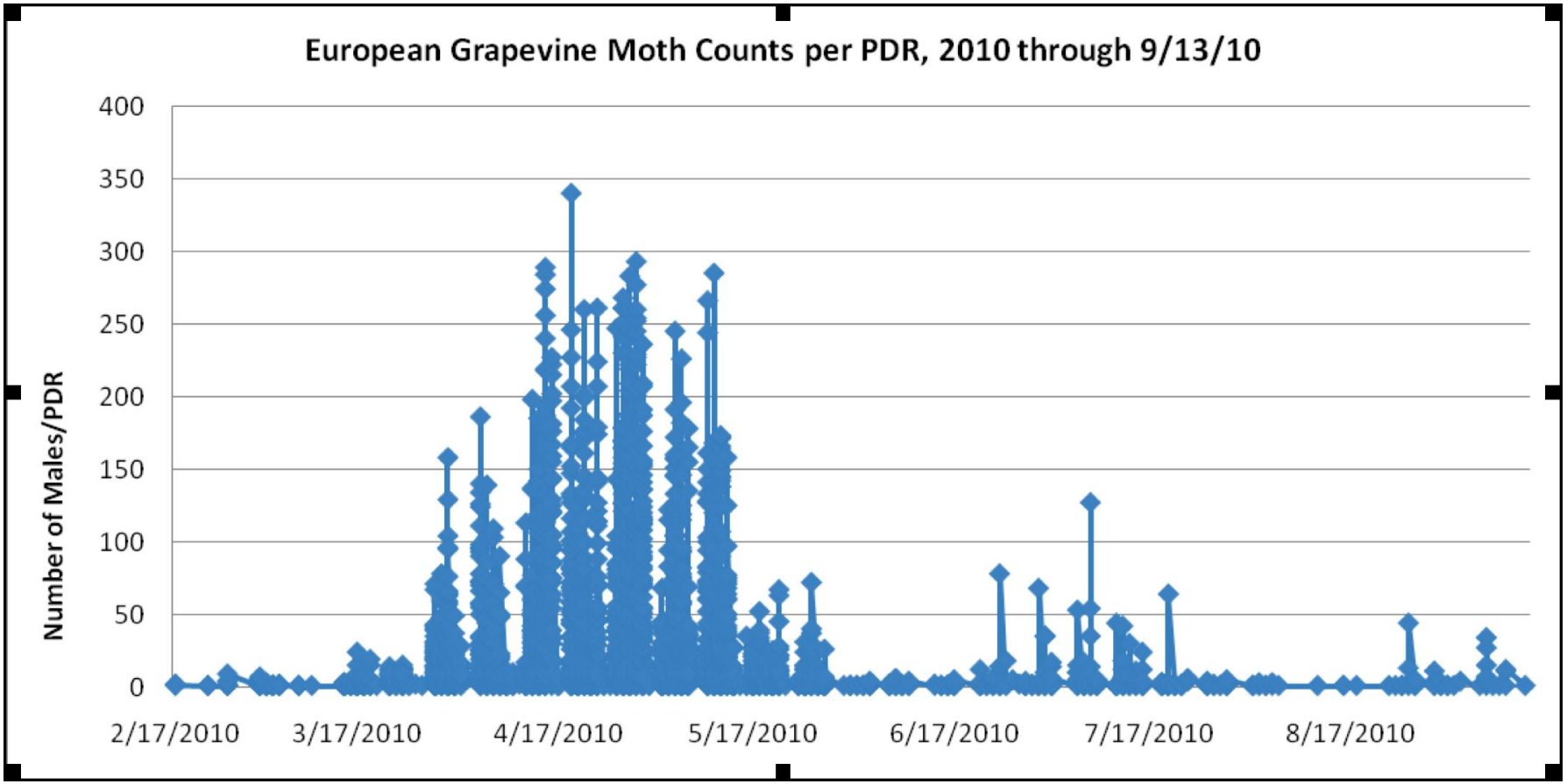
3 generations/year possible 4 in Southern California

Adult (Moth)

Egg

Larv

Pupa


European Grapevine Moth Counts per PDR, 2010 through 9/13/10
Number of Males/PDR
400
350
300
250
200
150
100
50
0
2/17/2010
3/17/2010
4/17/2010
5/17/2010
6/17/2010
7/17/2010
8/17/2010

Adults Emergence Mid February

Overwintering Pupae

Photos: Jack K. Clark

Development thresholds:

Upper: 86° F

Lower: 50° F

Optimal Temperature: 70-84° F

RH: 40-70%

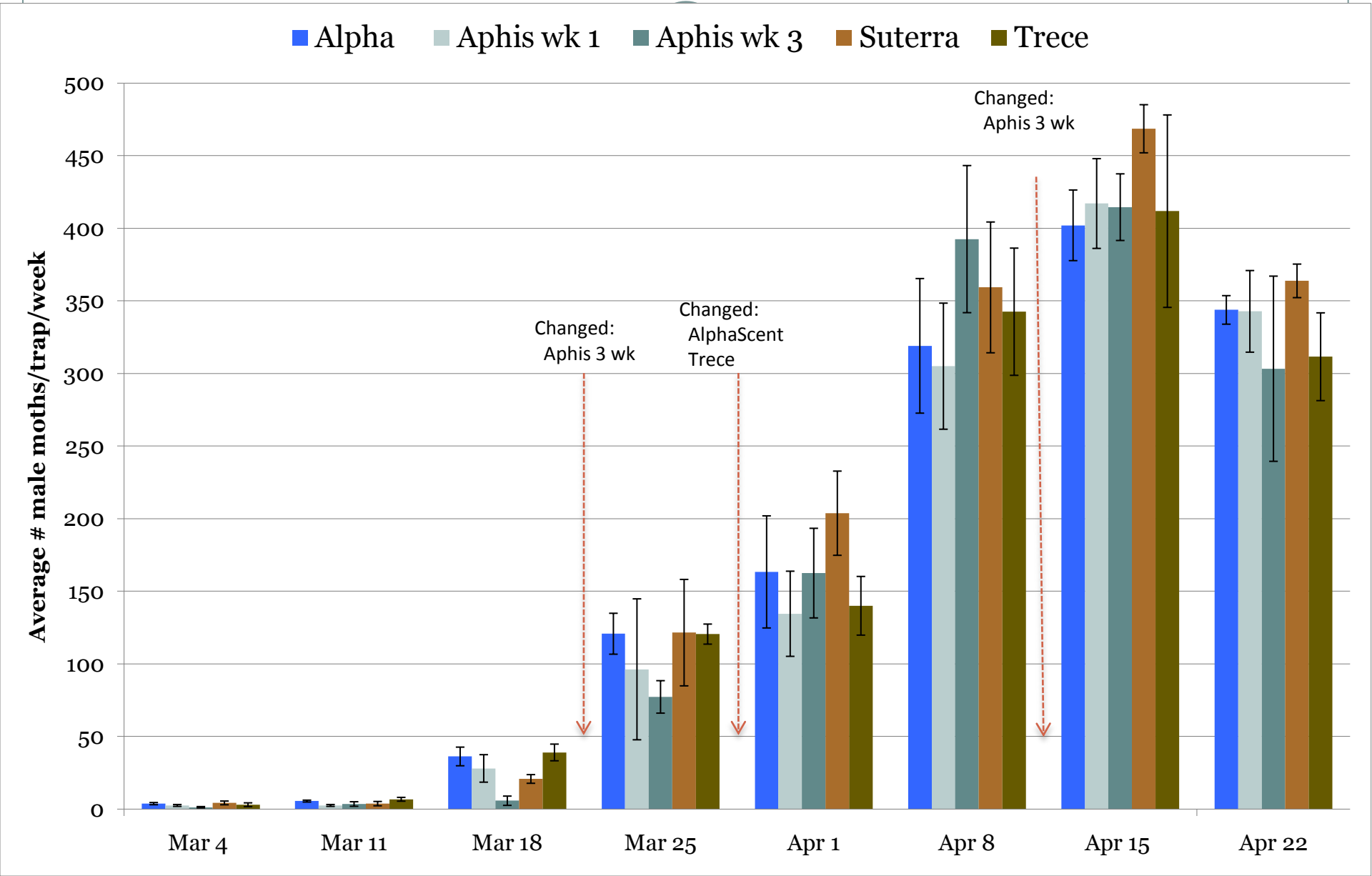
80-160 eggs per female per lifetime

Sticky traps used to monitor male moth populations

- Deploy traps 2 weeks before bud-break
- Monitor traps once per week from bud break to harvest

Males on trap bottom

1st Generation Lure Trial



1st Generation Egg Laying


Photo: Luis Sazo

From flower separation until bloom

- Laid on flat surfaces of cluster:
  - Cluster stem
  - Flower caps
  - Bracts


Photo: Monica Cooper


Photo: Bruno Bagnoli

1st genera females lay single eggs near flowers…

1st Generation Larval Development

Photos: Bruno Bagnoli

SPRING

- First generation larvae web and feed on the flower clusters
- Small larvae may penetrate pre-bloom flowers

Photos: Bruno Bagnoli

1st Generation Monitor: larvae nests (webbed flower parts)

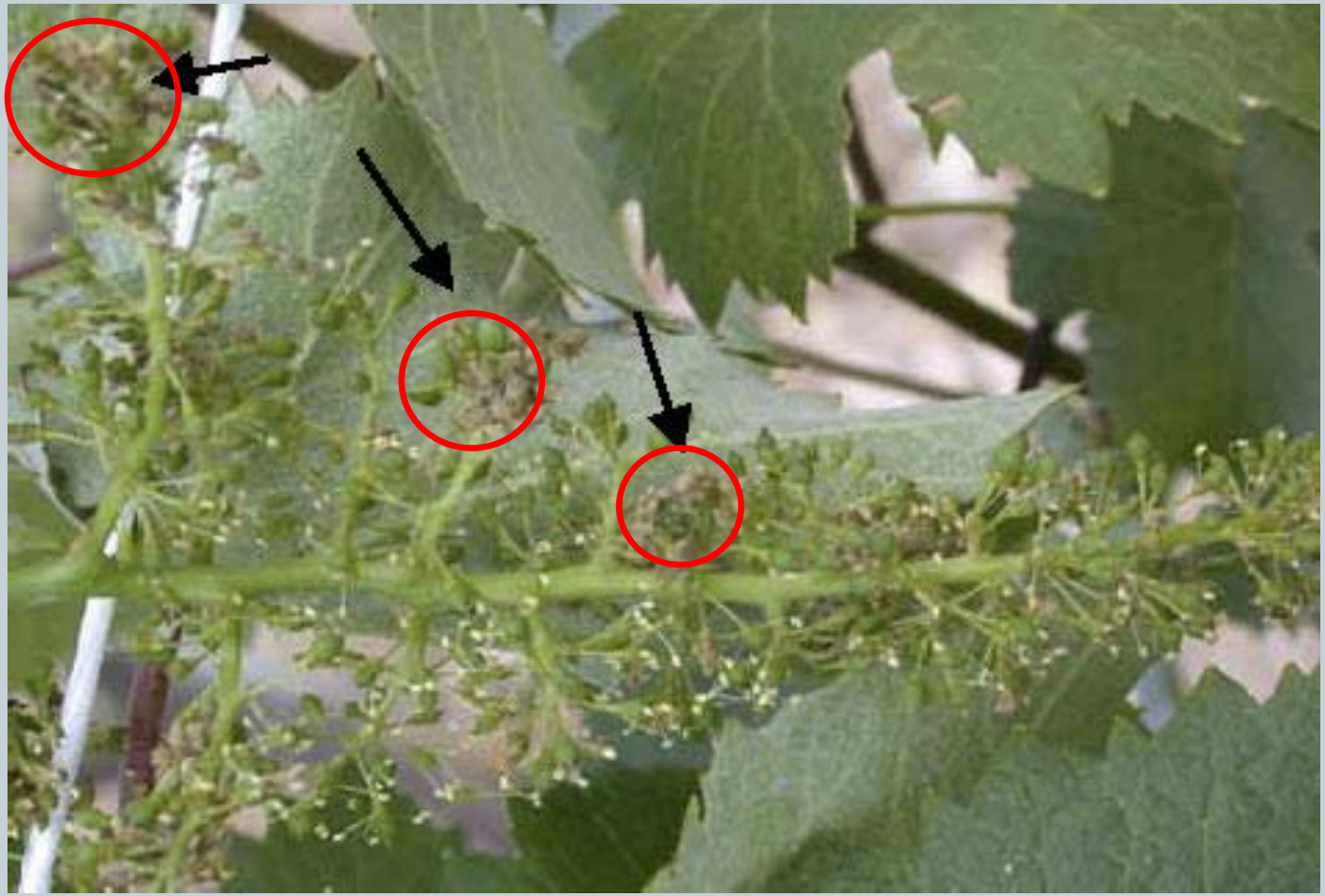
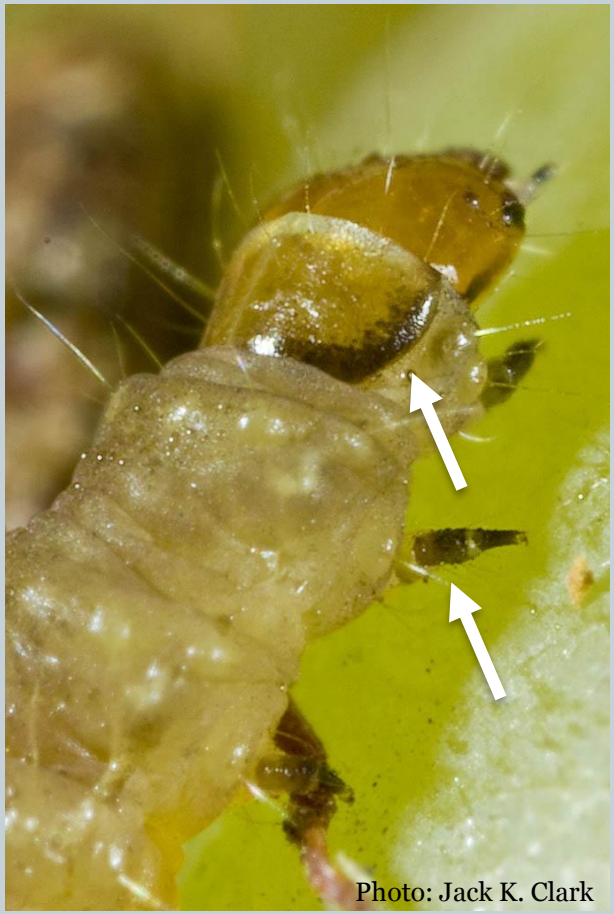


Photo: Andrea Lucchi

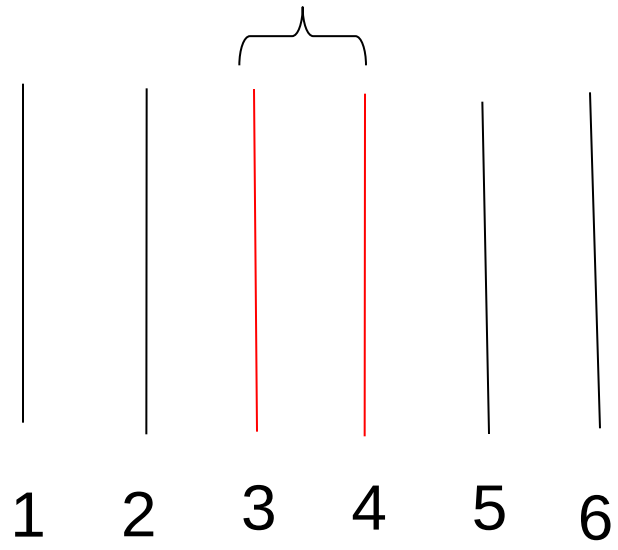
Larva



1st Generation Trial

Conventional:	Application Rate
• Altacor (chlorantraniliprole) 2-4.5 oz	3.25 oz
• Intrepid (methoxyfenozide) 8-16 oz	12 oz
Organic:	
• Dipel (*B. thuringiensis* Kurstaki) 0.5-1 lb	1 lb
• Entrust (spinosad) 1.25-2.5 oz	2 oz

Rows 3 & 4
Sampling



Cab Sauv (4, 7, 15, 337) 039-16
planted in 2000
Lyre/ Quad

Treatment: May 7, (14, 20)

Evaluation: May 26, 2010

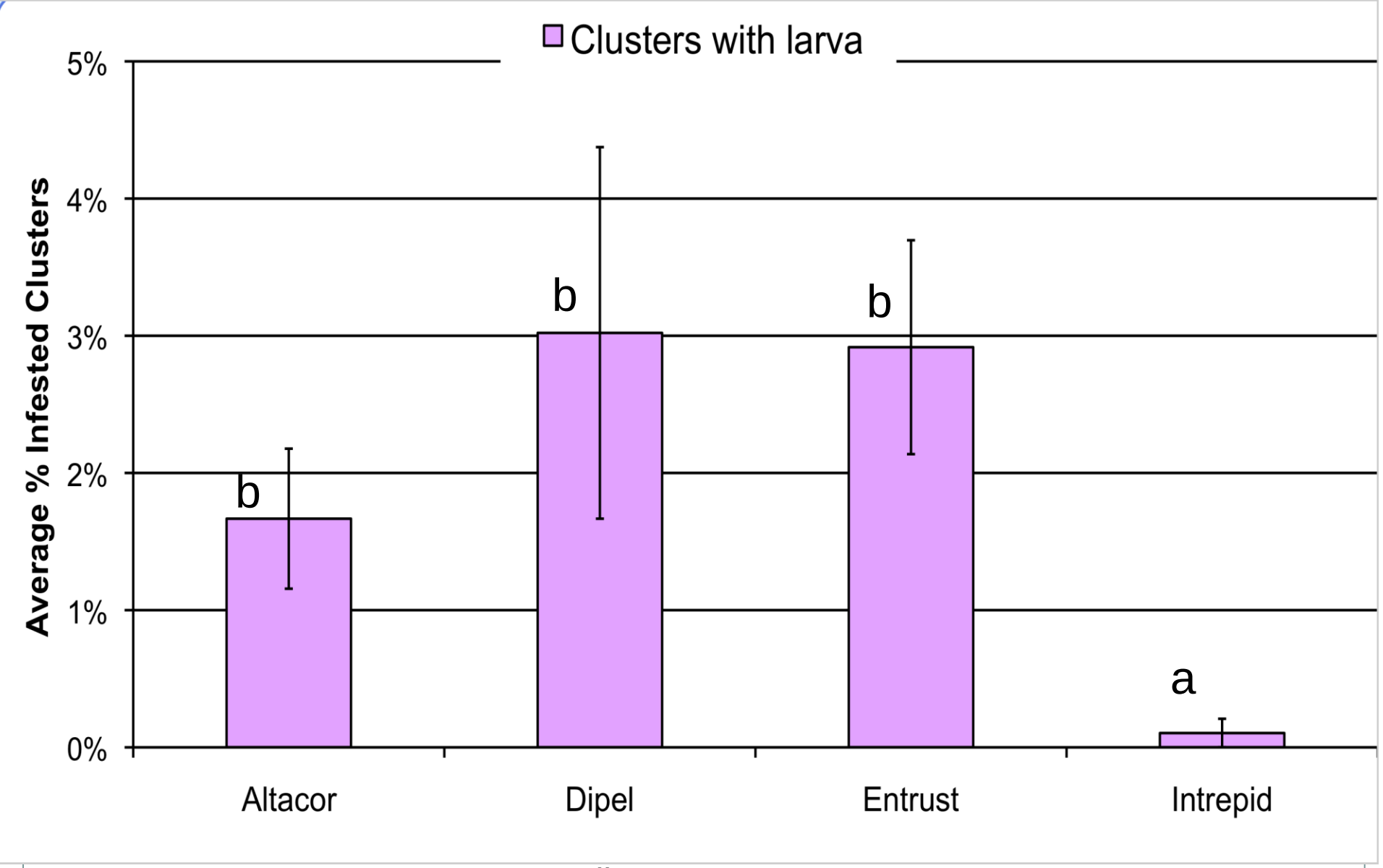
4 treatments

4 replications, RCB design

Each replicate (~2 ac)

Monitored:
- 60 vines
- 4 clusters per vine
- = 240 clusters

Each treatment:
- 960 clusters



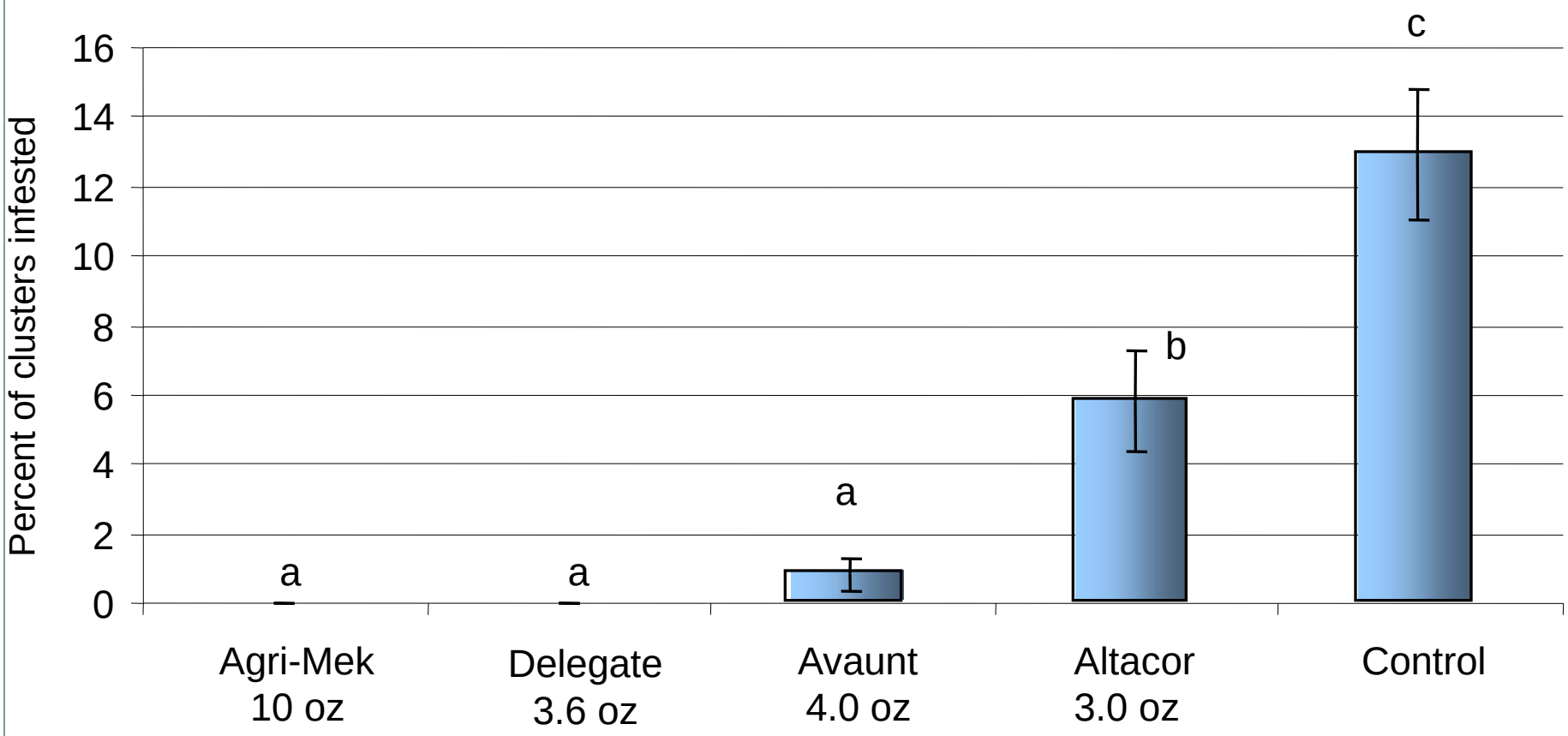
Rate:	3.25 oz	1 lb	2 oz	12 oz
# Applications:	1	3	2	1

Evaluated on May 26, 2010

Small plot trial – large larvae

- Location:
  - Oakville – Cabernet Sauvignon
  - Planted in 2000
- Application:
  - Back-pack on June 8, 2010
  - 5 treatments X 4 replications
  - 7 vine plots
- Evaluation
  - On June 10, 2010
  - 20 clusters in 3 center vines
  - (60 clusters/plot and 240 clusters/treatment)

Insecticide efficacy 5th instar
Lobesia botrana



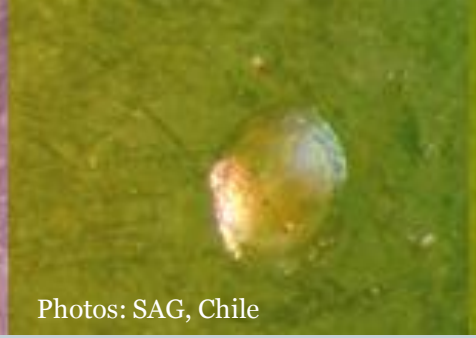
June 10, 2010

Insecticide Control

	IRAC* Group Number
INSECT GROWTH REGULATOR	
Intrepid® (methoxyfenozide)	18
MICROBIAL INSECTICIDE	
Bacillus thuringinsis (various products)	11
INSECTICIDES ACTING ON NERVE/MUSCLE TARGET	
Altacor® (chlorantraniliprole)	28
Avaunt® (indoxacarb)	22
Success® and Entrust® (spinosad)	5
Delegate® (spinetoram)	5
Agrimek® (abamectin)	6

For resistance management, rotate insecticides with a different mode-of-action group number

*http://www.irac-online.org



Photos: SAG, Chile


Photos: Jack K. Clark


Photo: Bruno Bagnoli

2nd Generation Egg Laying

- Eggs are laid on the berry
- In the summer eggs take about 6 days to emerge

2nd Generation Larval Development

Photo: Larry Strand

From pea size berries to early veraison

Photos: Zangheri et al. 1992

Photo: Francisco Javier Saénz

Summer (2nd generation)
Pea-sized berry to post-veraison

Larval feeding damage

Summer (2nd generation) Pea-sized berry to post-veraison Larval feeding damage

2nd Generation Pupation

- Pupae form inside a silken cocoon:
  - Inside cluster
  - In a folded lobe of a leaf blade close to the cluster
  - Under the bark on the arms, cordons or trunk

Photo: Larry Strand

3rd Generation Larval Development

Photo: Katey Taylor

From early veraison to harvest

Photo: Monica Cooper

EGVM stages present at harvest

Photos: Zangheri et al. 1992

Photo: Monica Cooper

Adults?

Diapausing Pupae

- As nights become longer than 11 hours during 3rd generation larval development, the resulting pupae will enter diapause (resting stage).
- Pupa forms inside a silken cocoon under the bark of cordons and trunks.

Photos: Jack K. Clark

Winter
Pupa
Under the bark


Jack K. Clark


Monica Cooper

Mating Disruption

Photo: Pacific Biocontrol

Isomate-EGVM dispensers

- Works best
  - At low population levels
  - Areas larger than 10 acres
- Application
  - 200 dispensers/acre
  - Twist on wire or shoot high inside the canopy

Isomate-EGVM

Photo: from 1999 Informatore Agrario #20, Italy

Information

- UCCE Sonoma – http://cesonoma.ucdavis.edu
  - IPM Program
    - Mealybugs
    - – European Grapevine Moth and Leafroller page
- UC IPM – http://www.ipm.ucdavis.edu
  - Exotic Page – European Grapevine Moth, Lobesia botrana
- UCCE Napa County - http://cenapa.ucdavis.edu
  - Newsletters - European Grapevine Moth Newsletter
- California Department of Food and Agriculture
  - http://www.cdfa.ca.gov