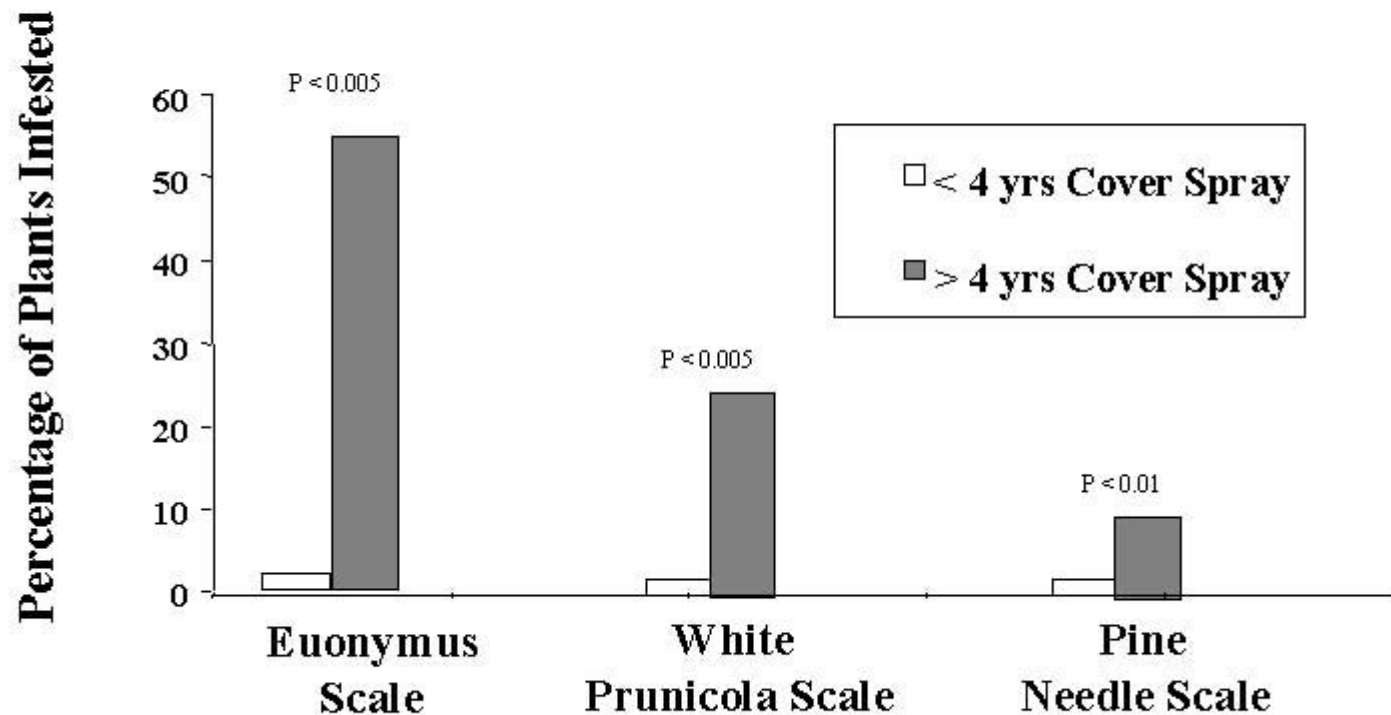


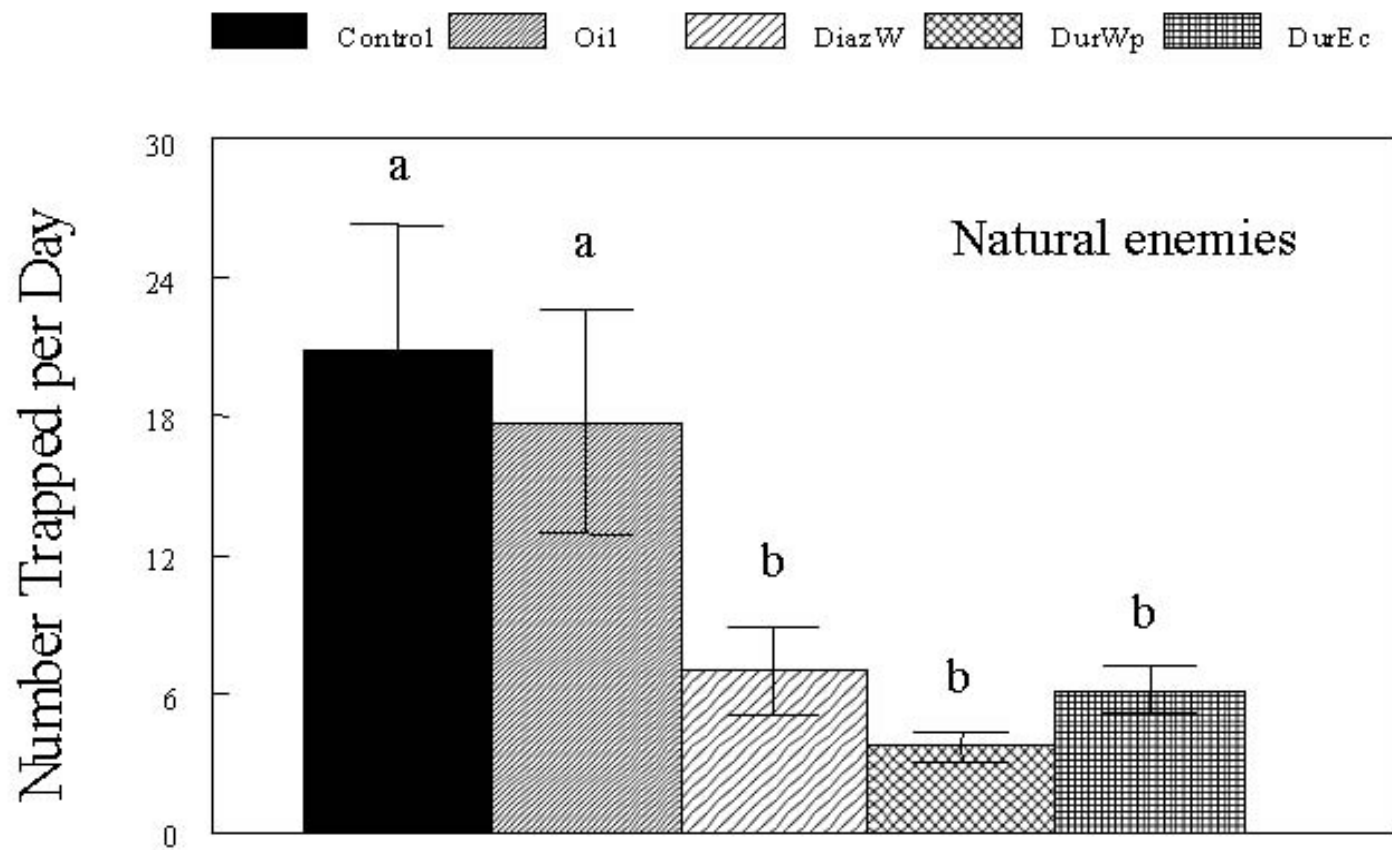
Relationship between Cover Sprays And Armored Scale Problems



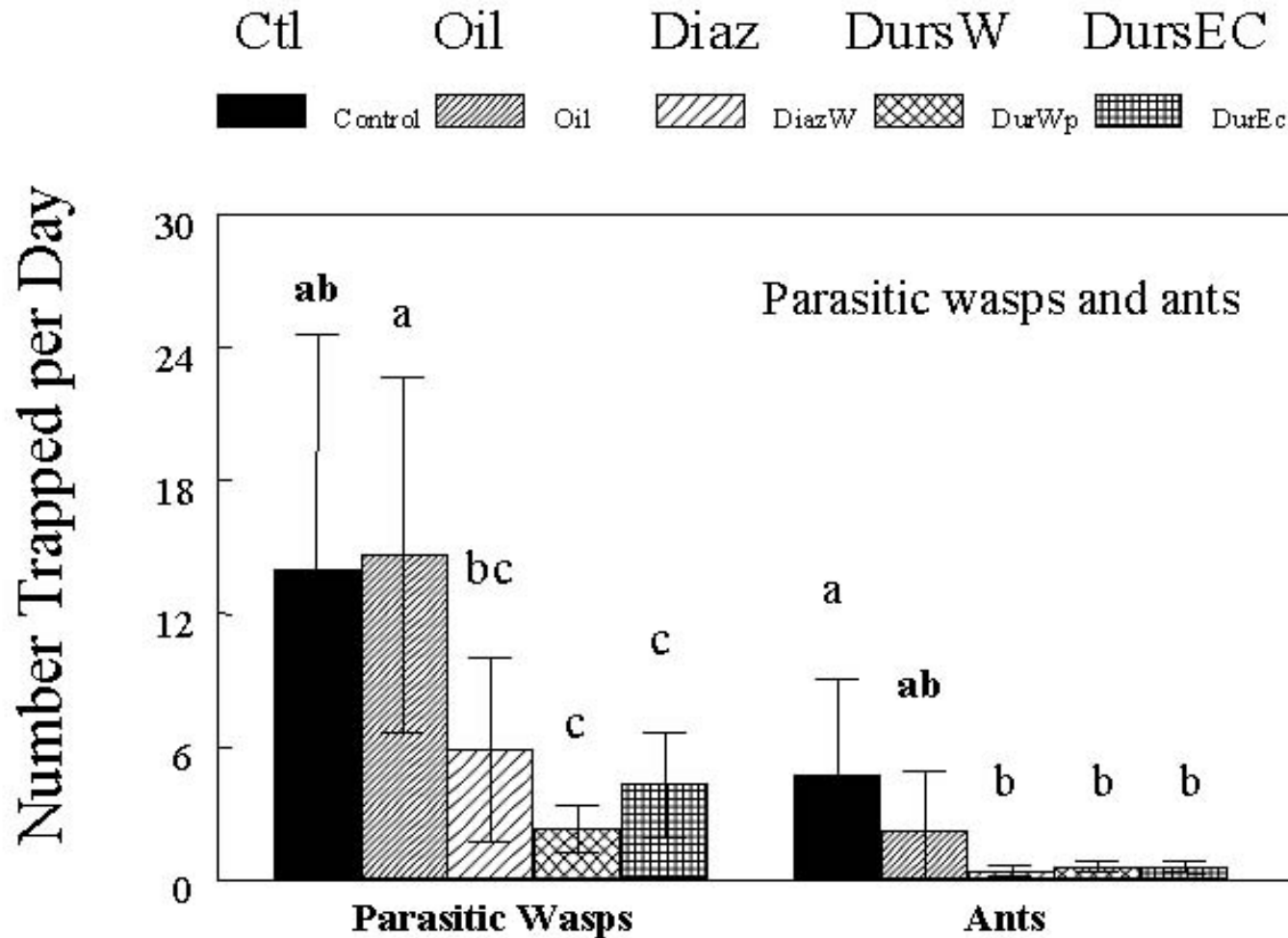
Obscure Scale on Pin Oak



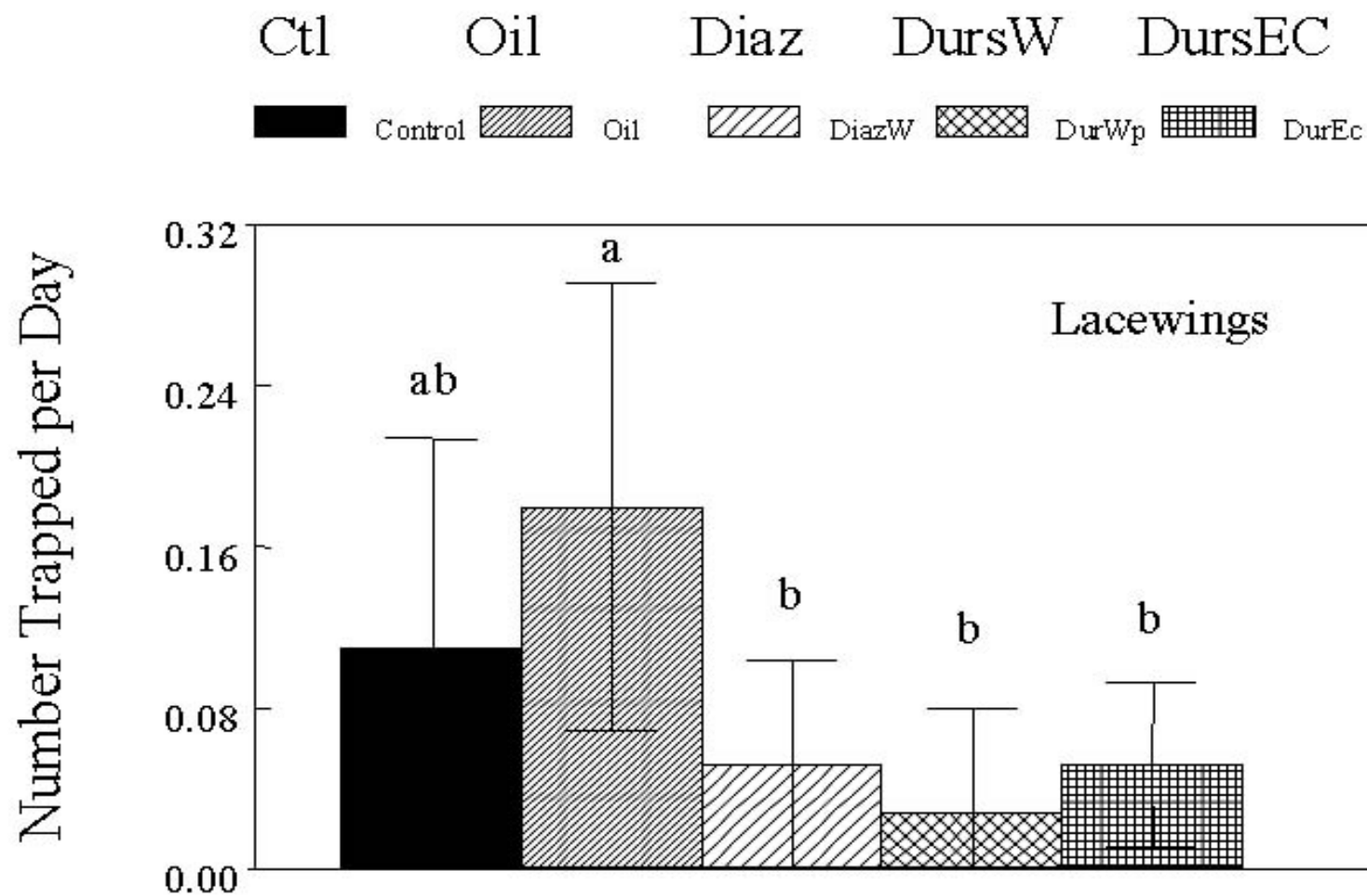
Effects of Treatments on Natural Enemies Of Obscure Scale Collected in 6 wk period



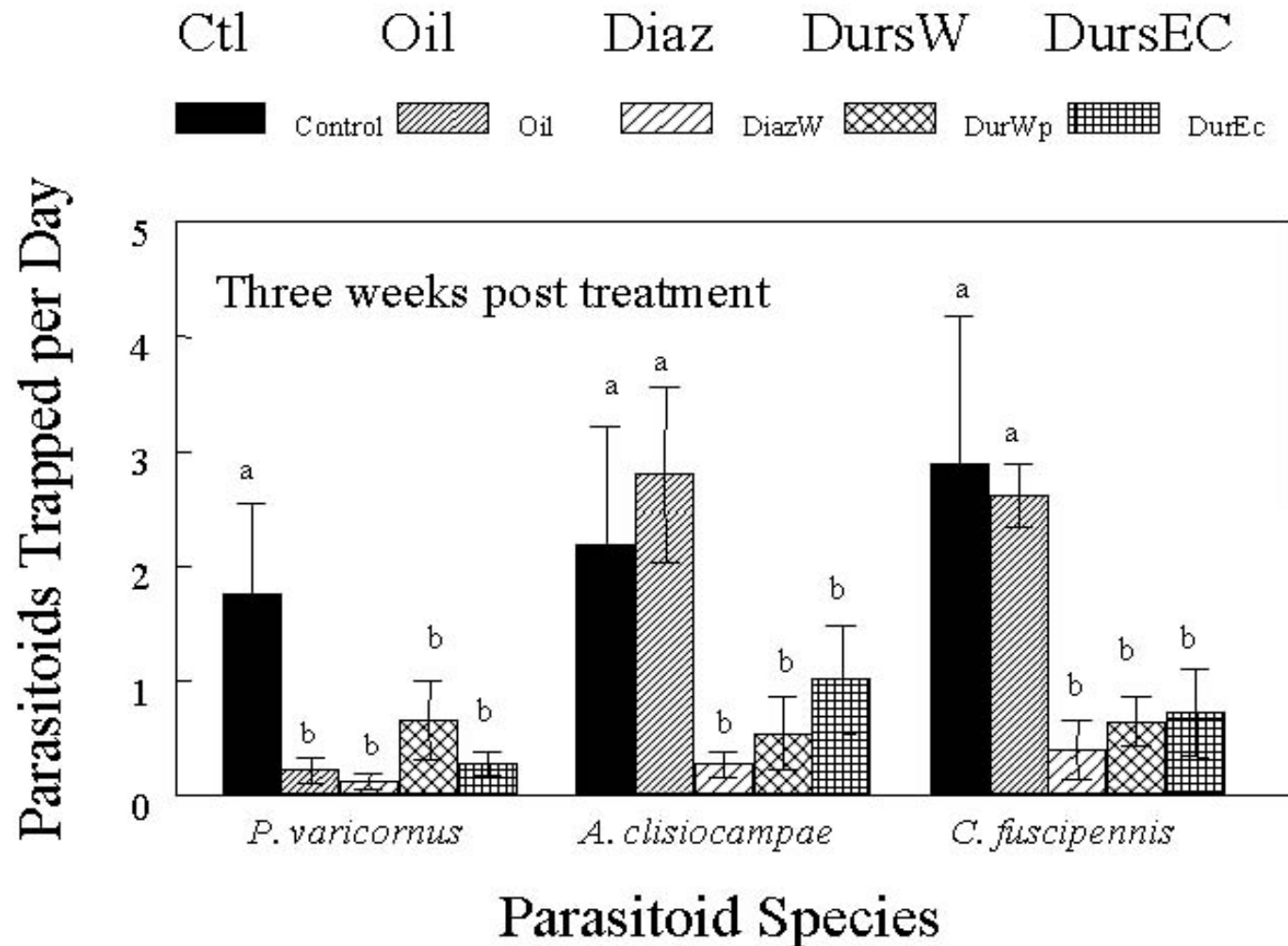
Effects of Treatments on Parasitic Wasps And Ants Collected in 6 wk period



Effects of Treatments on Green Lacewings Collected in 6 wk period



Effects of Treatments on 3 Scale Parasitoids Collected in 6 wk period



Obscure Scale Summary

- Dursban and Diazinon Kill Natural enemies of scale
- Dormant applications of oil does not kill scale natural enemies that winter in the pupal stage
- Dormant applied oil kills parasitoids that winter in the larval stage

Euonymus scale



Euonymus Scale:

- Abundant on *Pachysandra* and *Euonymus*
- Can cause chlorosis, dieback, and death of plant
- Two generations per year



Treatments:

- **4% horticultural oil (dormant rate)** applied on 27 March 1998 **and 2% (“summer” rate)** applied during crawler stage on 24 May 1998. (SunSpray Oil was used for this purpose)
- **Merit 75WP (imidacloprid)** applied on 27 March 1998 as a soil drench (rate = 0.2 oz. [4 tsp.] Merit per 1000 sq. ft.)
- **Orthene 75SP (acephate)** foliar applied on 24 May 1998 at crawler emergence (rate = 2/3 lb. per 100 gal.)
- **Untreated control**

Overwintering Distribution - 3/13/98

Location ¹	# of Adult Females \pm SE (% of shoot total)	
	Live	Parasitized
Upper	2.38 \pm 0.64 (14.1)	0.12 \pm 0.04 (12.9)
Middle	5.17 \pm 1.29 (30.6)	0.36 \pm 0.07 (38.7)
Basal	9.32 \pm 1.43 (55.3)	0.45 \pm 0.12 (48.4)
Total	16.87 \pm 2.68	0.93 \pm 0.14

¹ n=100 for each section. Upper section =1cm apical and 2 cm basal of the last flush growth. Middle section taken from similar area of next flush growth. Basal section taken from basal 3 cm of shoot.

Oil vs. Control - 4/14/98

Euonymus Scale Distribution

Location ¹	# of Live Adult Females \pm SE (% of shoot total)	
	Oil	Control
Upper	0.04 \pm 0.04 (1.9)	1.04 \pm 0.51 (16.6)
Middle	0.76 \pm 0.38 (35.2)	0.96 \pm 0.19 (15.3)
Basal	1.36 \pm 0.45 (63.0)	4.28 \pm 1.16 (68.1)
Total	2.16 \pm 0.81	6.28 \pm 1.79

¹ n=100 for each section. Upper section =1cm apical and 2 cm basal of the last flush growth. Middle section taken from similar area of next flush growth. Basal section taken from basal 3 cm of shoot.

Effects of 3 Treatments on Euonymus Scale - 7/13/98

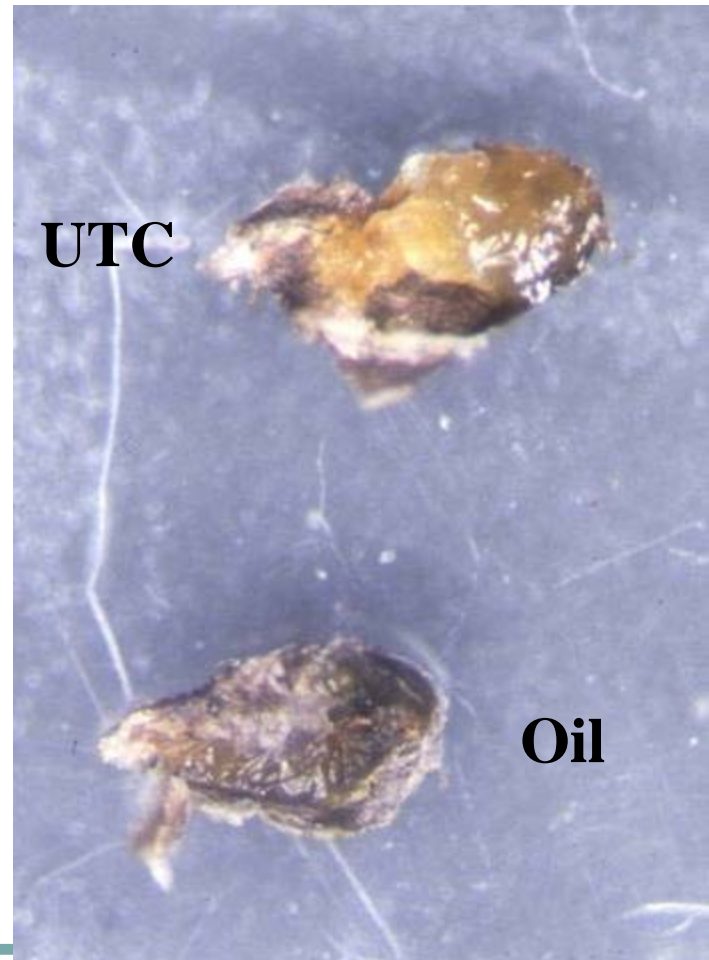
Location ¹	# of Live Adult Females Per Section			
	Merit	Orthene	Oil	Control
Upper	7.72	1.96	0.00	4.74
Middle	8.28	1.64	0.00	4.68
Basal	8.12	2.12	0.08	7.28
Total	24.12a	5.72bc	0.08c	16.68ab

Effects of 3 Treatments on Scale Parasitoid Abundance -

Location ¹	# of Parasitized Females			
	Merit	Orthene	Oil	Control
Upper	0.20	0.04	0.08	0.20
Middle	0.48	0.84	0.44	0.48
Basal	0.36	0.80	0.12	1.40
Total ²	1.04a	1.68a	0.64a	2.08a

Euonymus Scale Control: Results

- A dormant oil application (4%) followed by a timed crawler spray of oil (2%) significantly reduced scale populations (99.5%)
- Orthene (65.7%)
- Merit (- 44%)



Key Findings:

- Most euonymus scales were found in the middle and lower portions of the canopy
- Numbers of live and parasitized scales varied by treatment and time
- The differences in efficacy results are not due to observed differences in parasitism
 - Background rates of parasitism were variable in the 5 control plots
- Failure of Merit drench - due to where hard scales feed?

Scales (Homoptera: Coccoidea)

Soft Scales:

- Phloem feeders
- Excrete honeydew



Armored Scales:

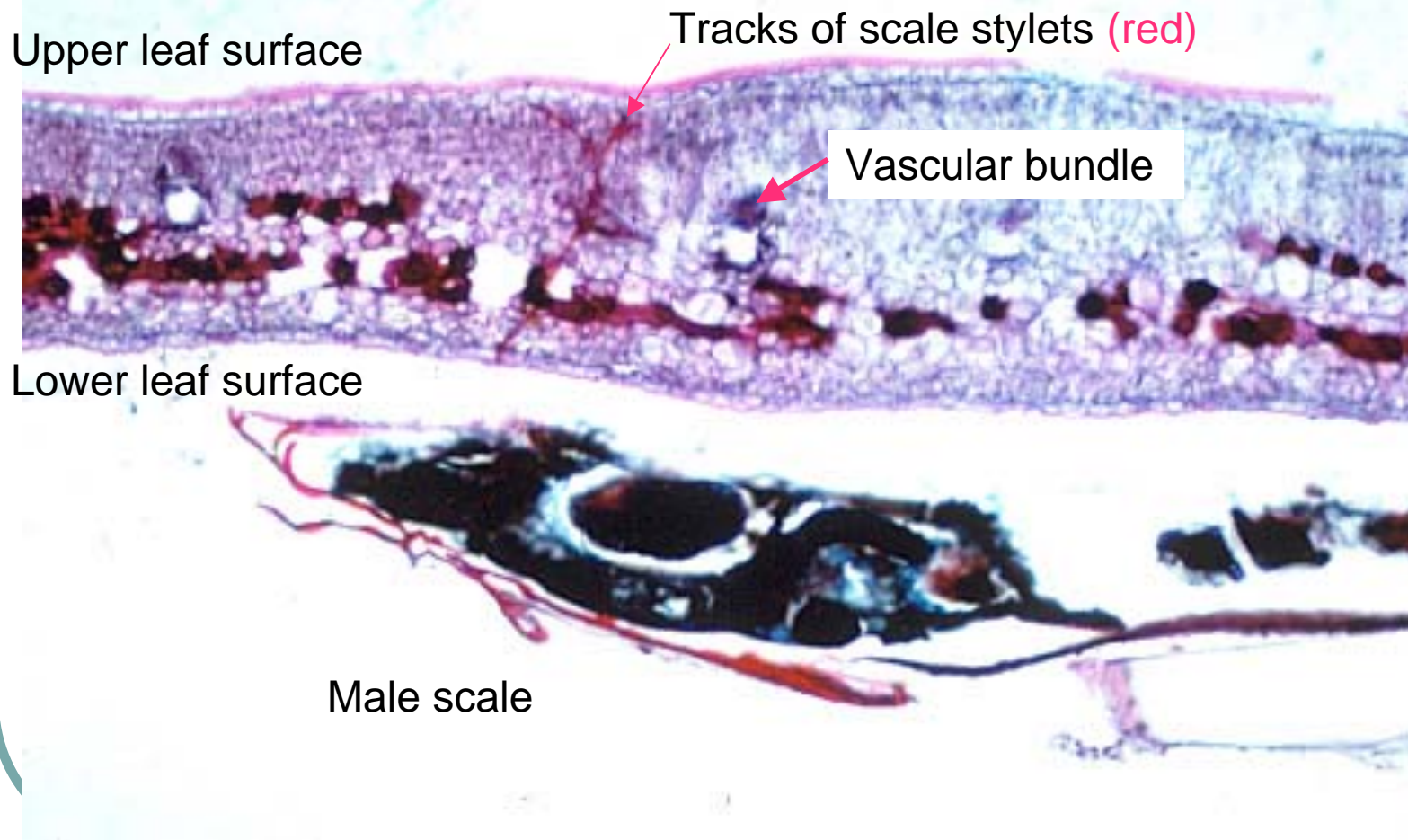
- Feed in palisade parenchyma and mesophyll cells
- Excretions are used to create a hard shell called a "test"



Euonymus scale – Leaf Chlorosis



How Armored Scales Feed



Cranshaw and Cooper (1995)¹:

Striped Pine Scale (Coccidae):

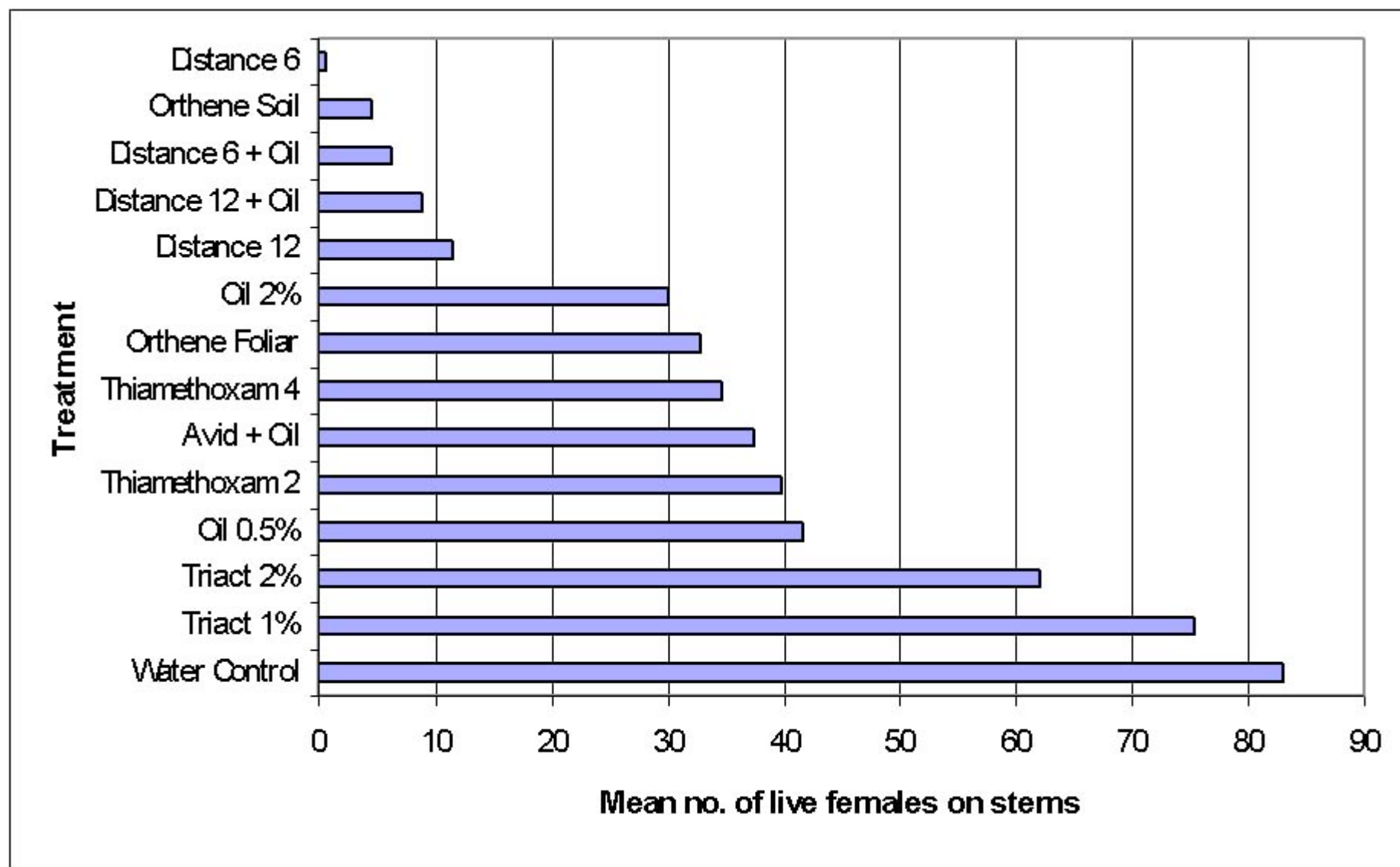
<u>Treatment</u>	<u># of Scales per 15 Needle Bunches</u>
Merit 75W (3.2 oz/100 gal)	5.8 a
Merit 75W (0.8 oz/100 gal)	7.2 a
Water Check	47.6 b

Pine Needle Scale (Diaspididae):

<u>Treatment</u>	<u>Percent Nymphal Mortality</u>
Merit 75W (1.6 oz/100 gal)	67.0 a
Water Check	51.5 a

¹ Data abridged from *Arthropod Management Tests - Volume 20:17H, 20H*. Numbers within columns followed by the same letter are not significantly different by SNK ($P < 0.05$). Five and four replications per study, respectively.

Euonymus Scale Trial (2000)



Newest Chemical Option: Safari

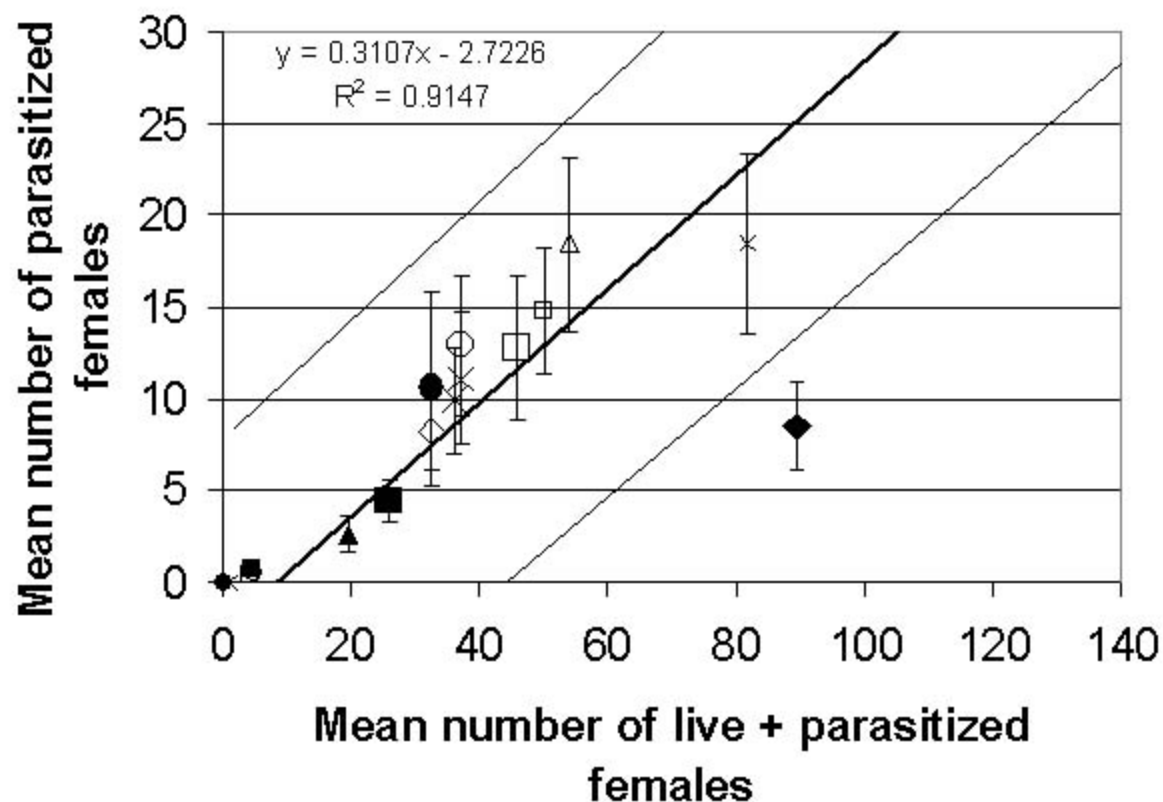
- Dinotefuran
- Systemic neonicotinoid
- Increased mobility allows it to kill armored scales
- Shorter residual in plants than imidacloprid.
- Labeled for nursery, greenhouse and landscape
- Produced by Valent Chemical

Parasitized Euonymus Scale



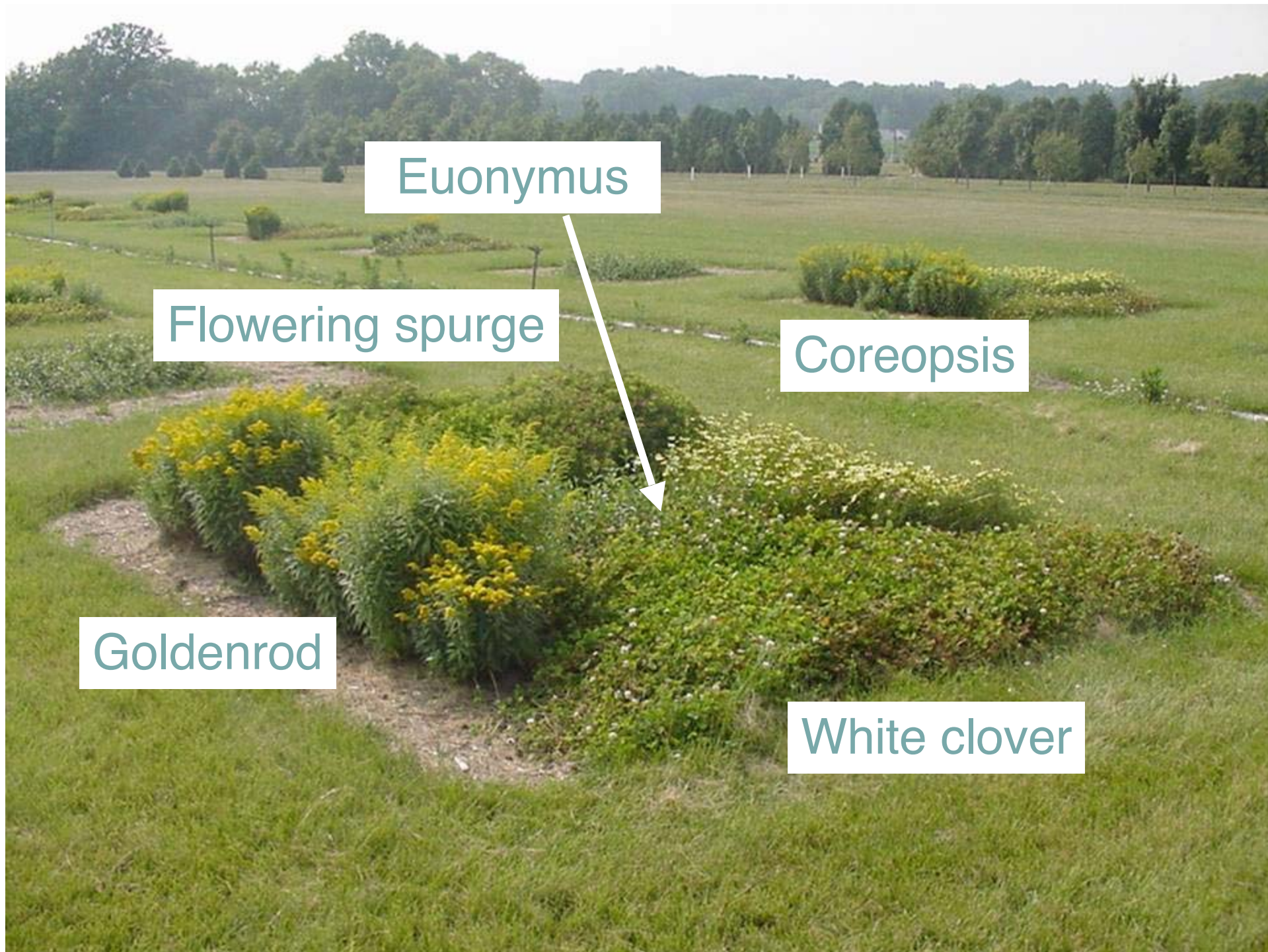
Euonymus Scale Trial (2001)

Mean Abundance of Total vs. Parasitized Females





Can conservation biological control
work against euonymus scale?



Euonymus

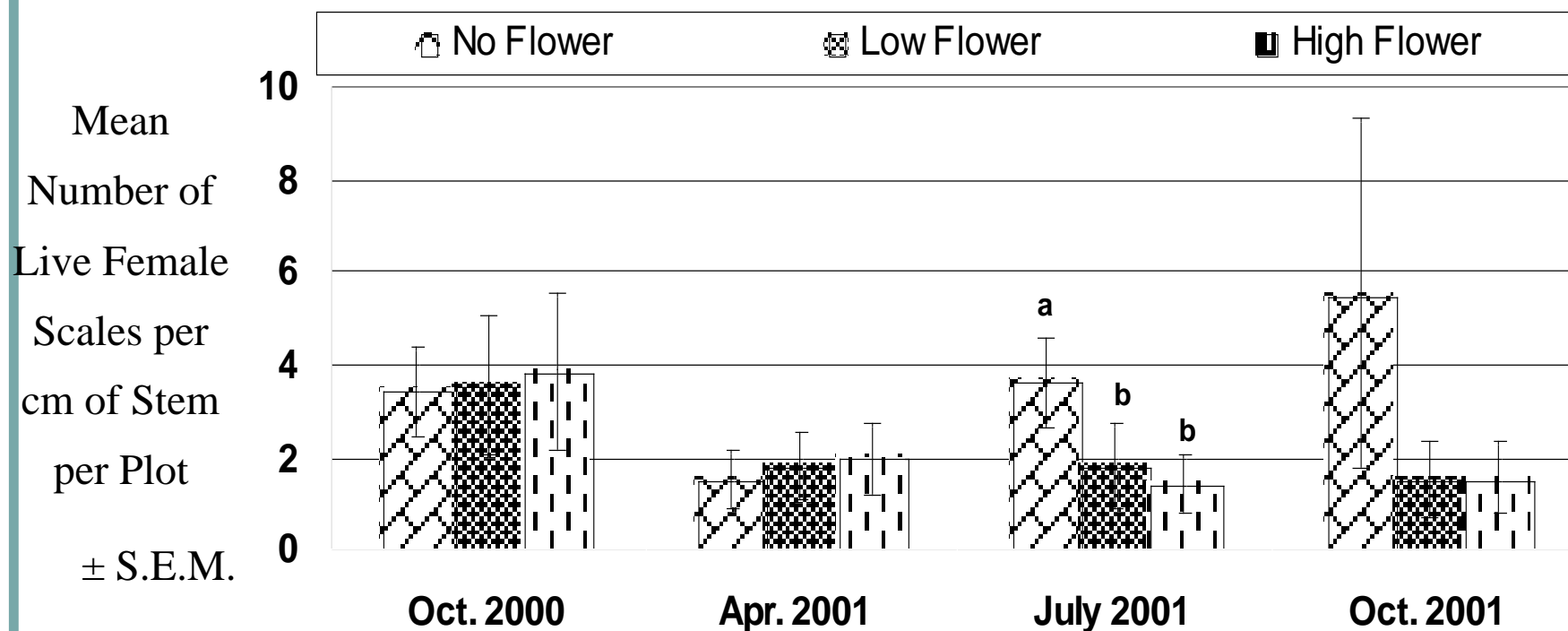
Flowering spurge

Coreopsis

Goldenrod

White clover

Density of live female euonymus scale



Means with the same letter are not significantly different (Fisher's Protected LSD, $p < 0.05$).

Scale Management Summary

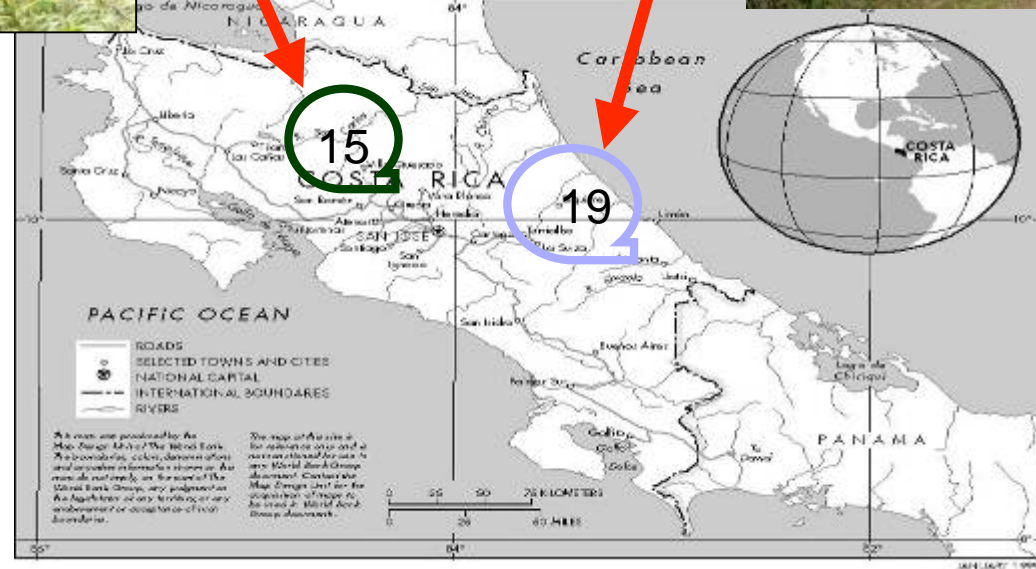
- Conserve Natural Enemies
 - Flowers, reduced or selective pesticides etc.
- Oils are effective in dormant season and in summer against crawlers
- Pyriproxifen more effective crawler spray
- Imidacloprid kills honeydew producing scales, but can flare armored scale populations
- Dinotefuran (Safari) new systemic that kills armored and soft scales

Costa Rica



La Tigra

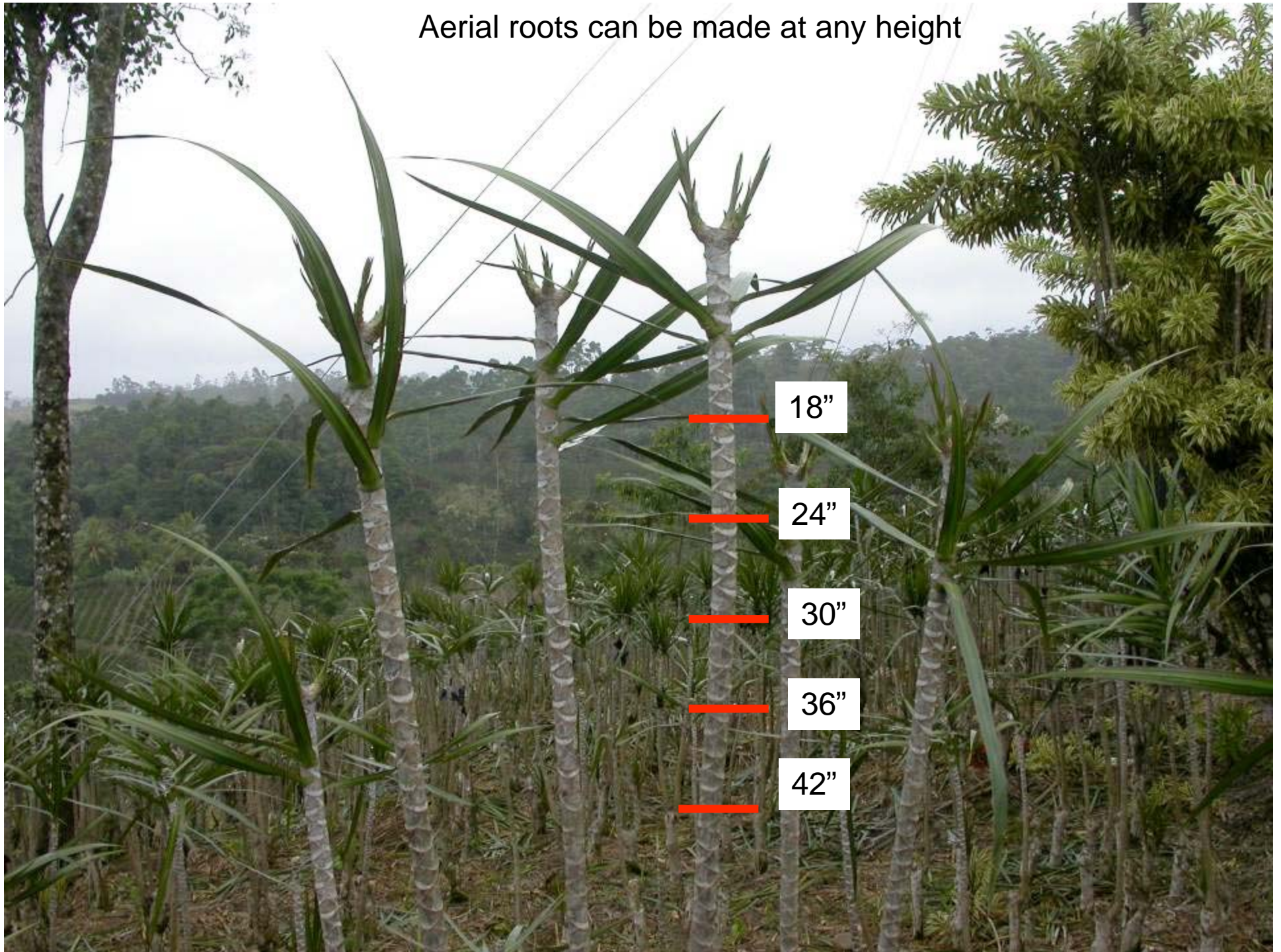
Atlantica







Aerial roots can be made at any height





Chrysomphalus aonidium
(Florida red scale) on Dracaena

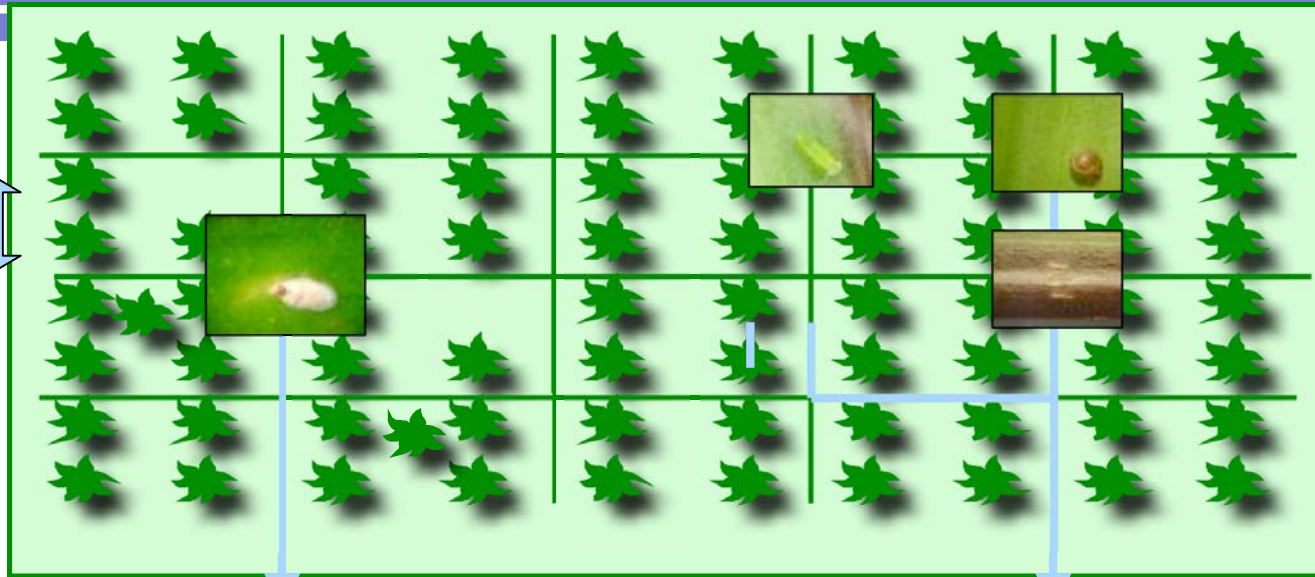






Systematic Sampling Program

10x10 m



8 leaves



8 tips

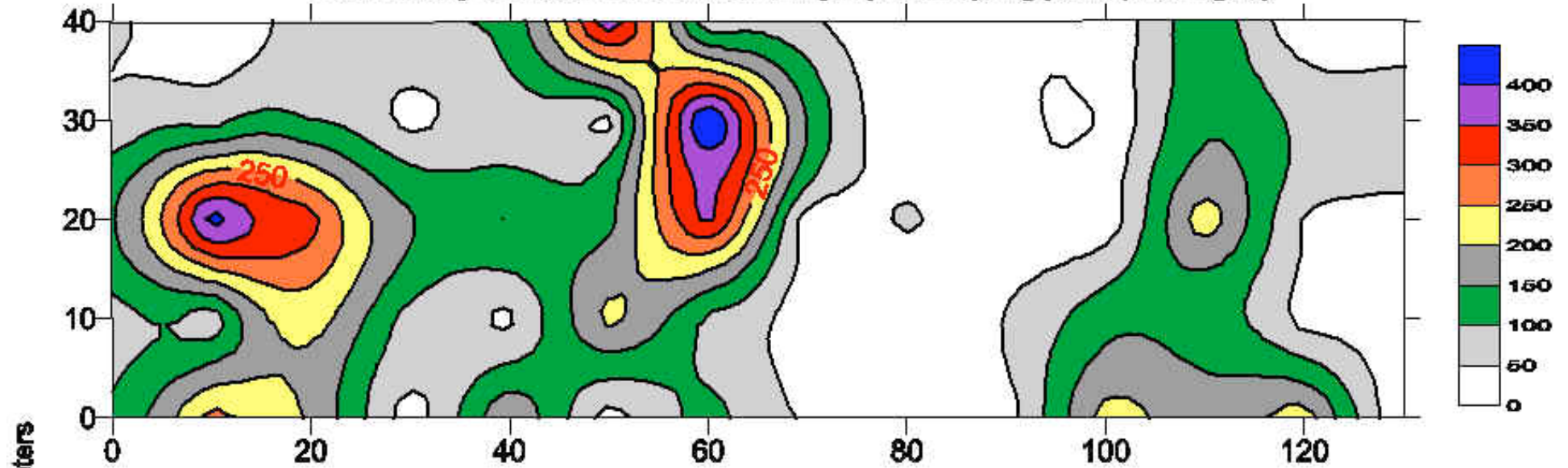
Thirds

Cane
Bud

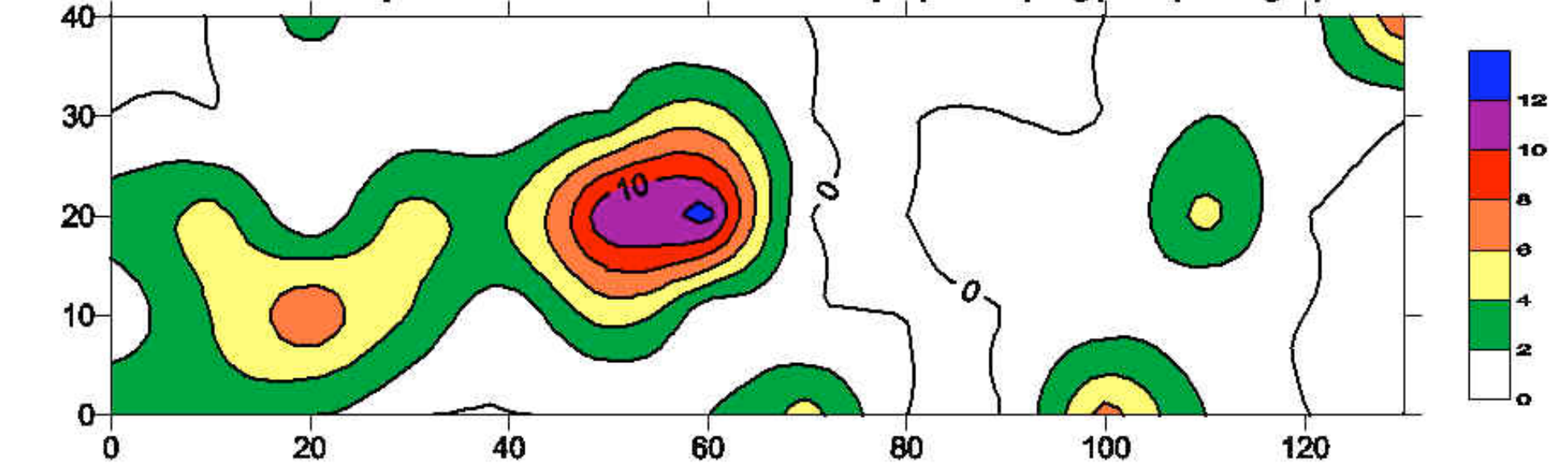


Sampling for scale distribution on Green Marginata, Plot 2

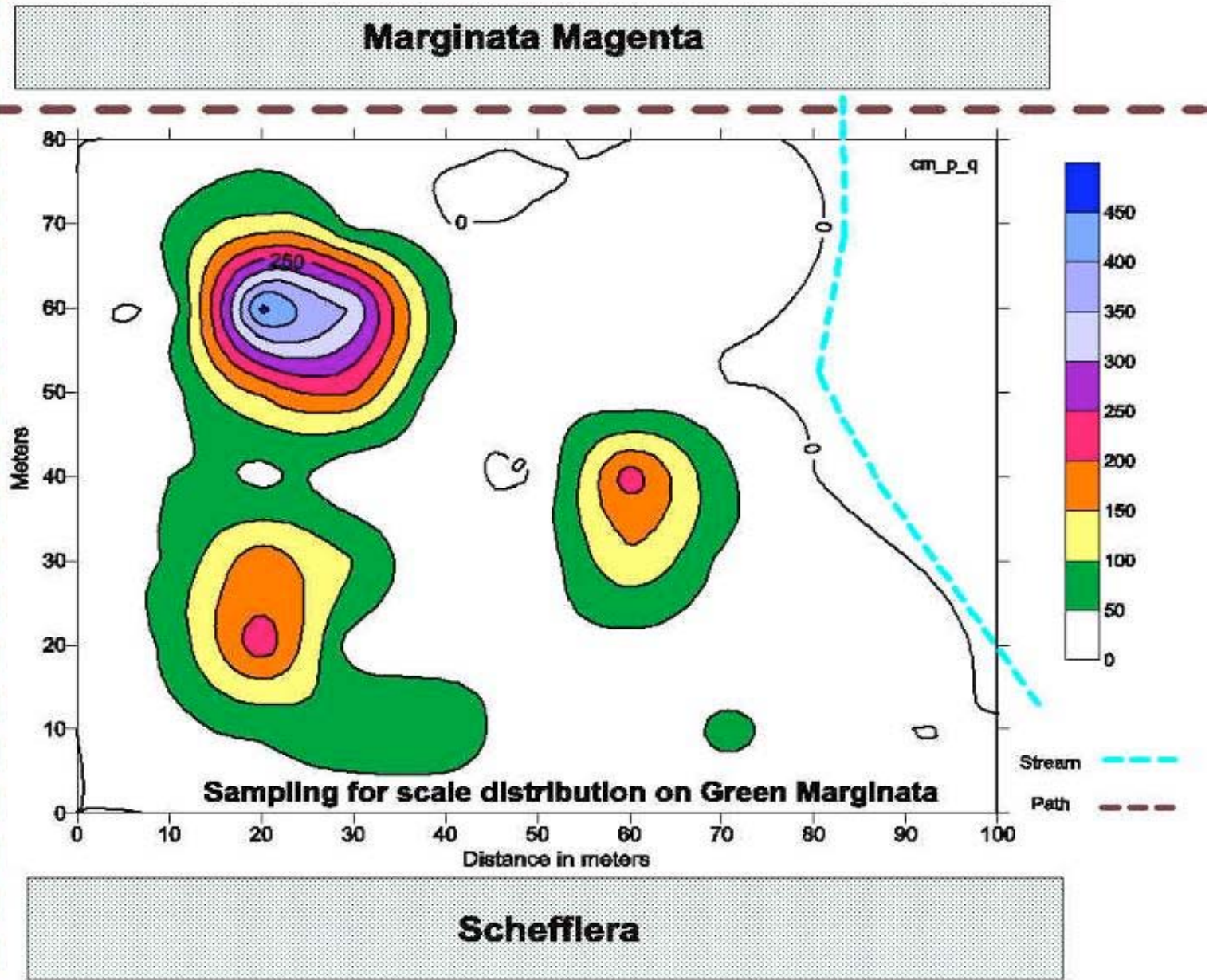
Total healthy scales on an 8 leaves sample per sampling point (10x10 grid)



Total parasitized scales on an 8 leaves sample per sampling point (10x10 grid)



Distance In meters





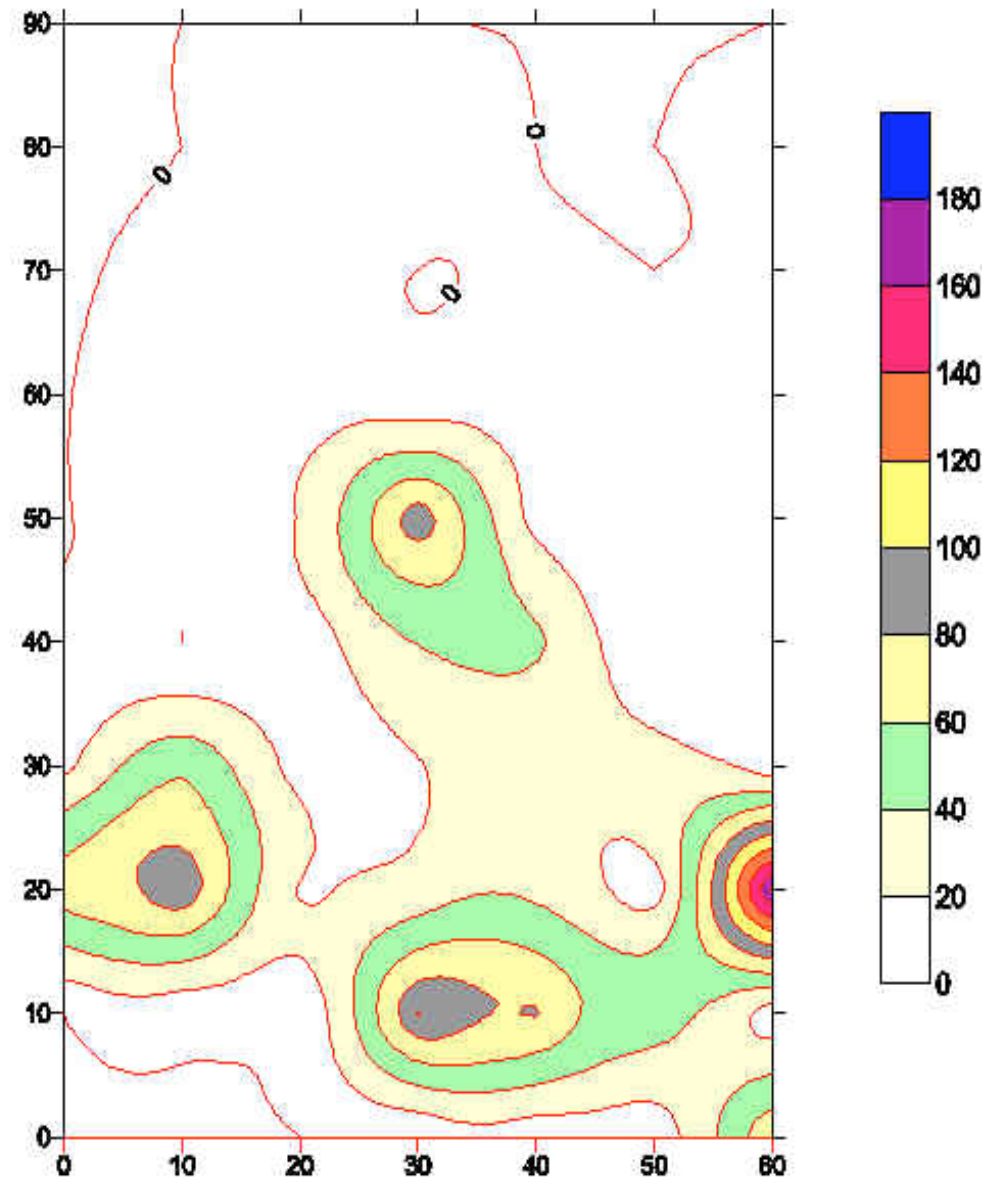
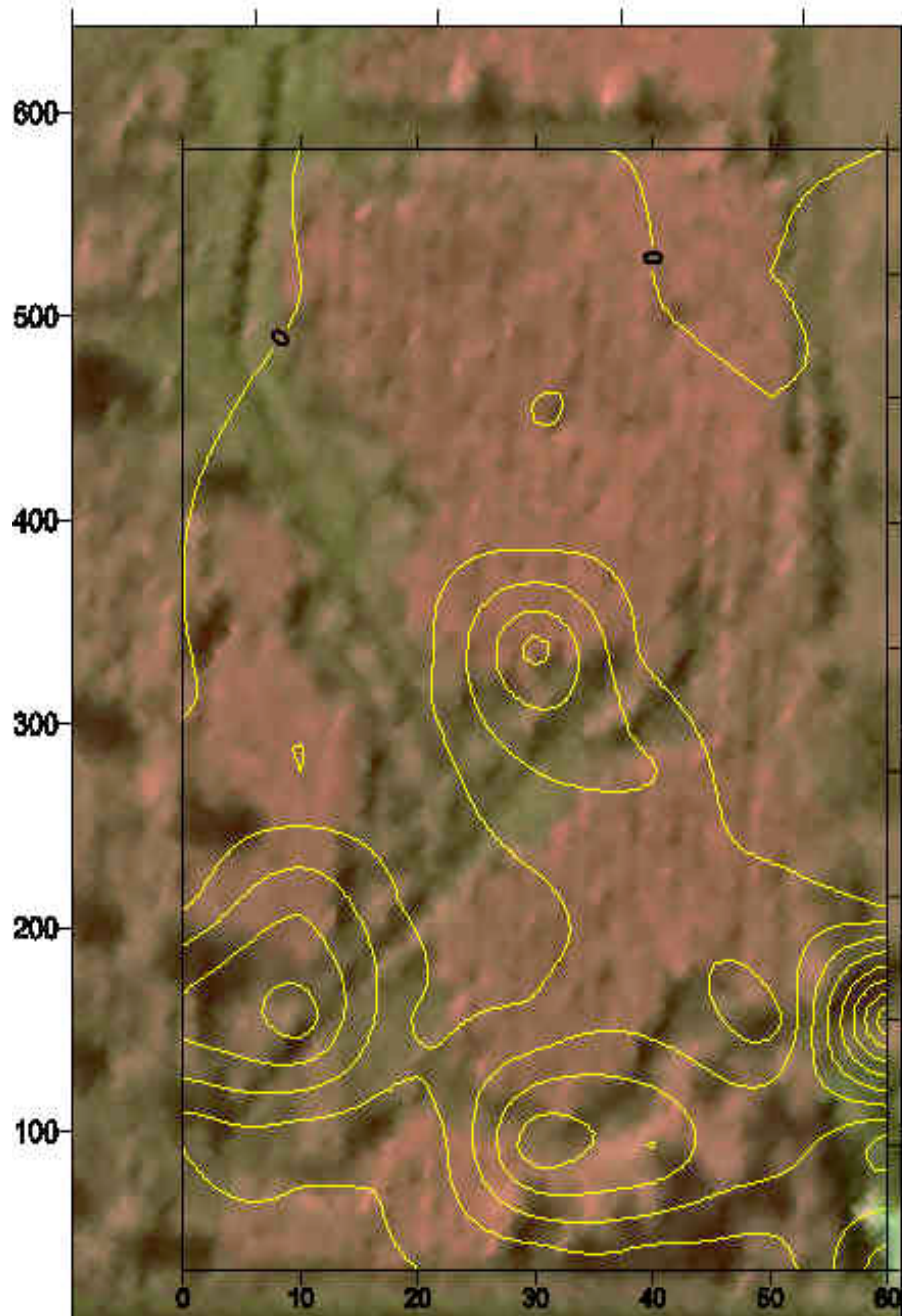








Mealybug nymph distribution on *Alpinia* field (Plot 2, La Carambola)



Use aerial photos to examine small scale landscape effects



