Black Scale and Olive Psyllid

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Black Scale

Saissetia oleae

Olive Psyllid

Euphyllura olivina

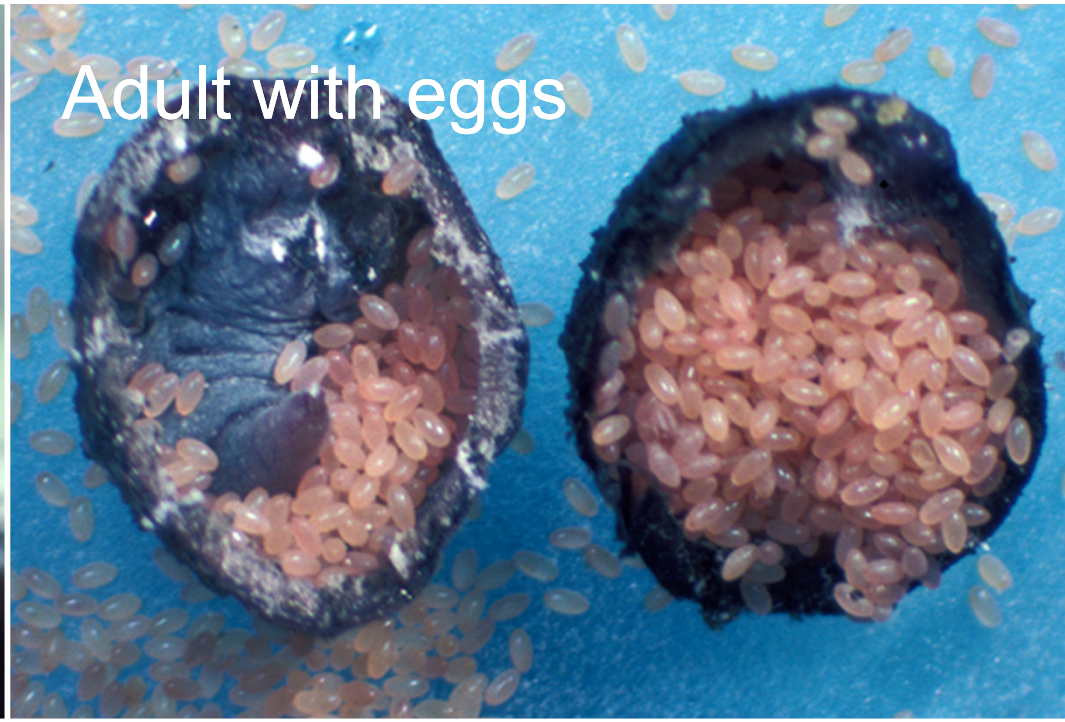
Presentation Topics

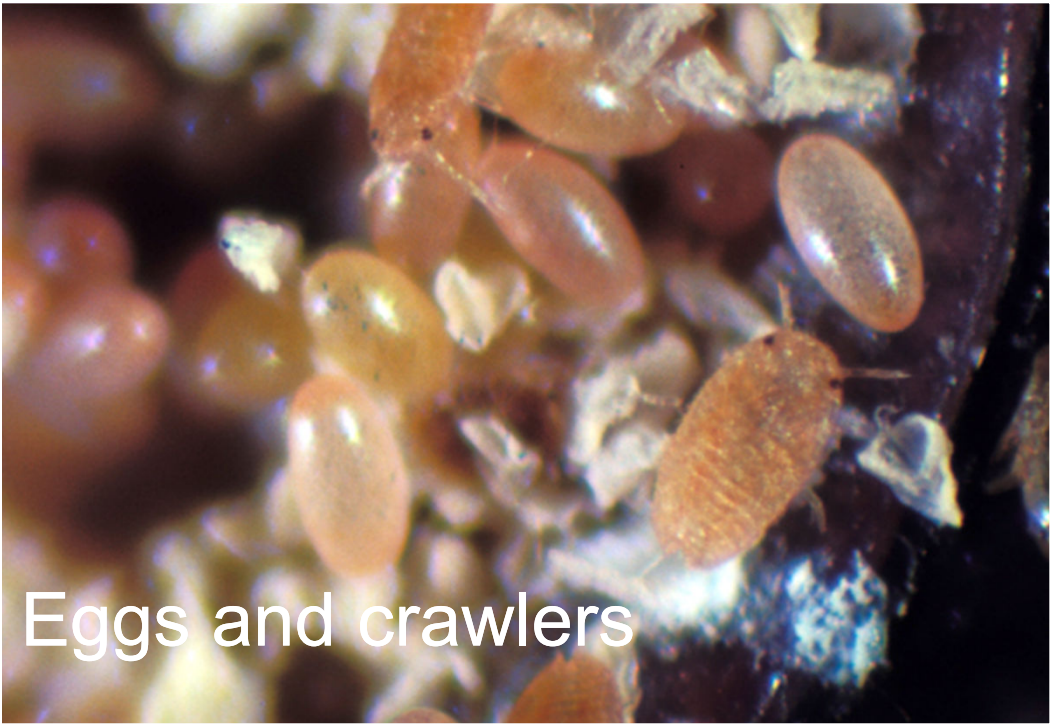
- Black scale and its management
- The relationship between black scale and olive fruit fly
- Status of the olive psyllid

Biology of Black Scale, *Saissetia oleae*

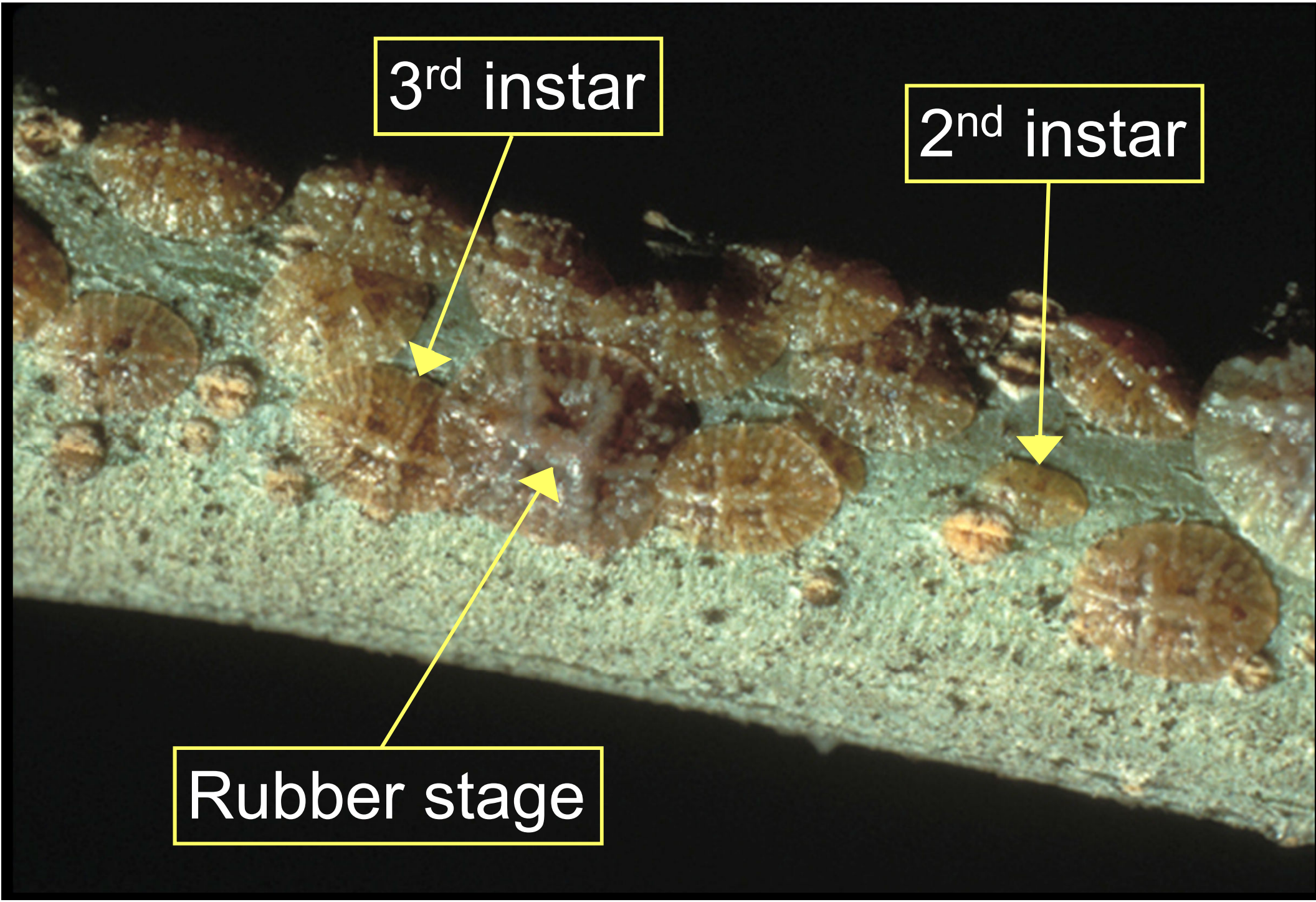
- Black scale adult females are about 0.2 inches (5 mm) in diameter
- They are dark brown or black with a prominent H-shaped ridge on the back
- First instars are yellow to orange crawlers and are found on leaves and twigs of trees
- A hand lens is usually needed to detect the crawlers □
- Black scales usually have one generation per year in the interior valley olive-growing districts
- In cooler, coastal regions multiple generations occur
- Black scale prefers dense, unpruned portions of trees
- Open, airy trees rarely support populations of black scale.


Black scale adult


Adult with eggs


Eggs and crawlers


Immature stages


3rd instar
2nd instar
Rubber stage

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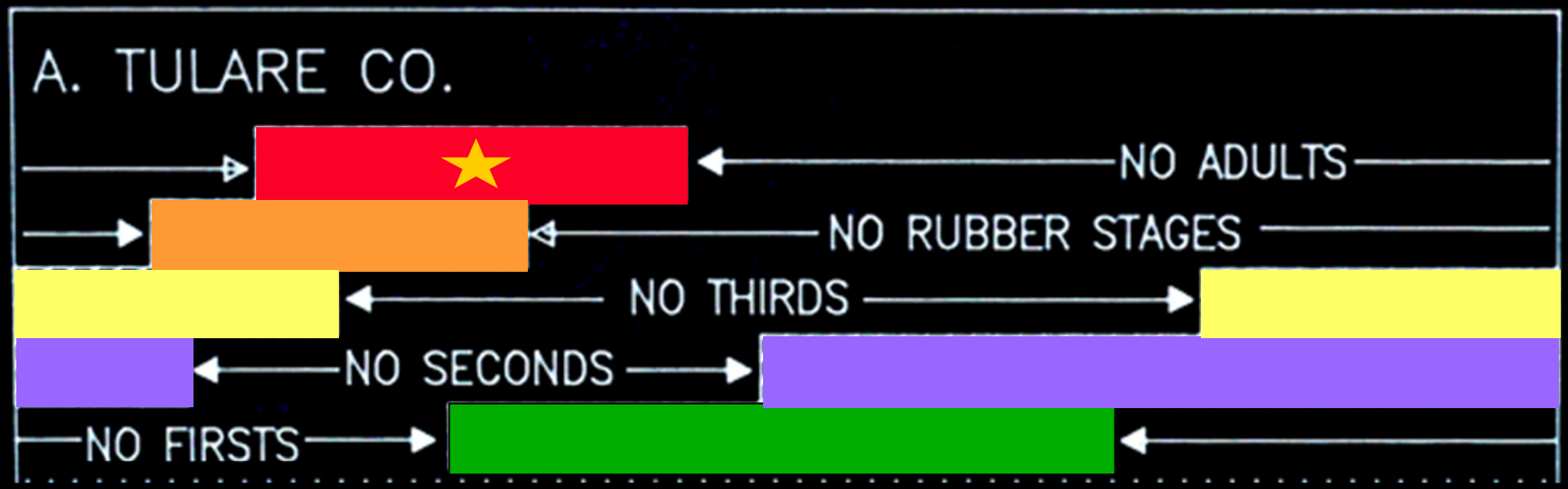
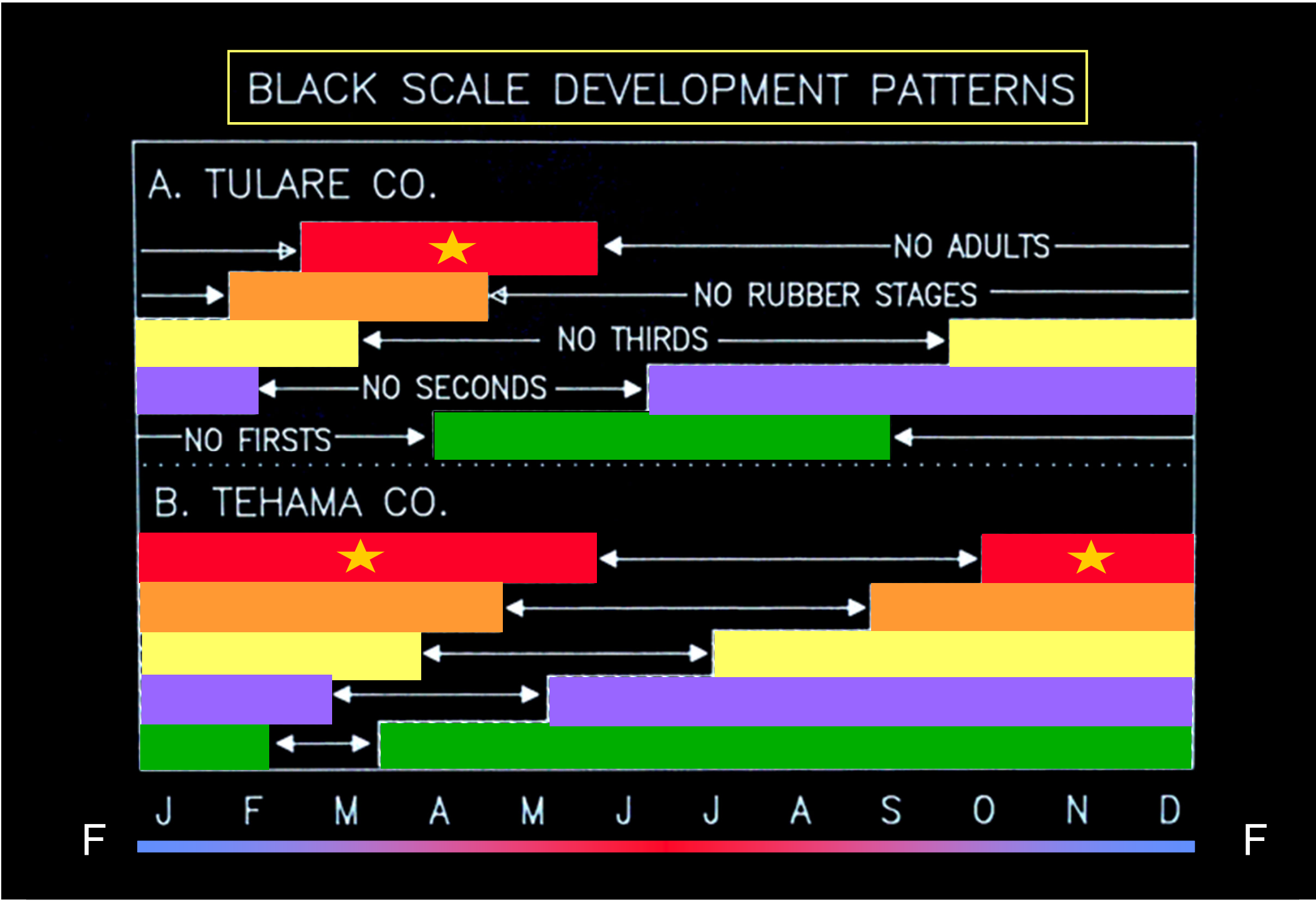
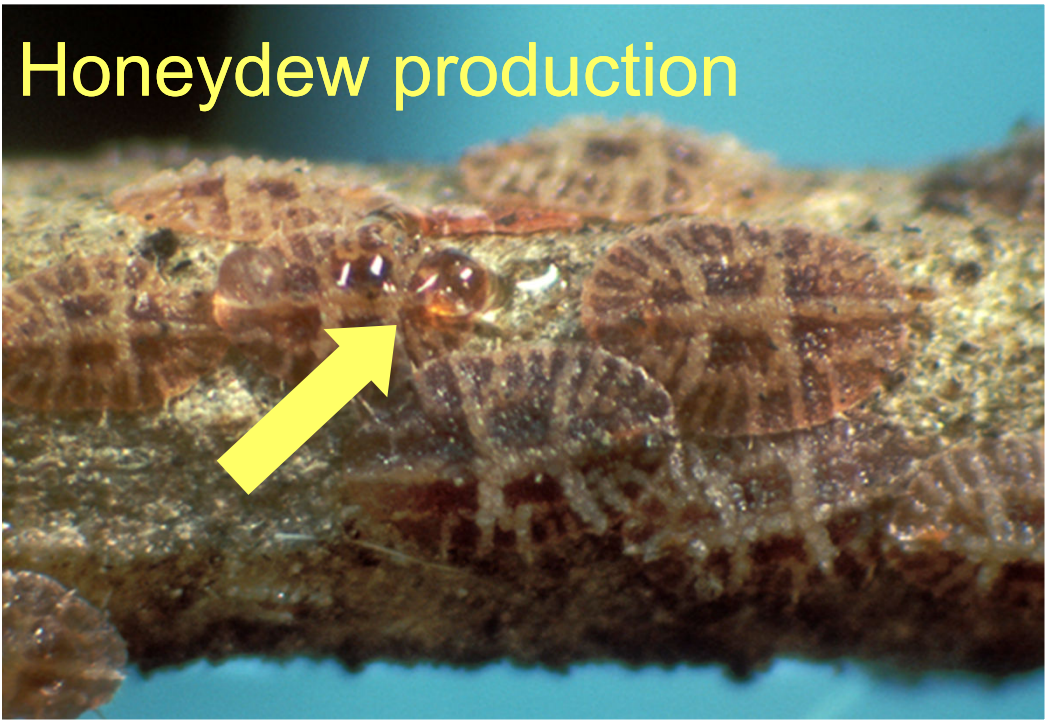
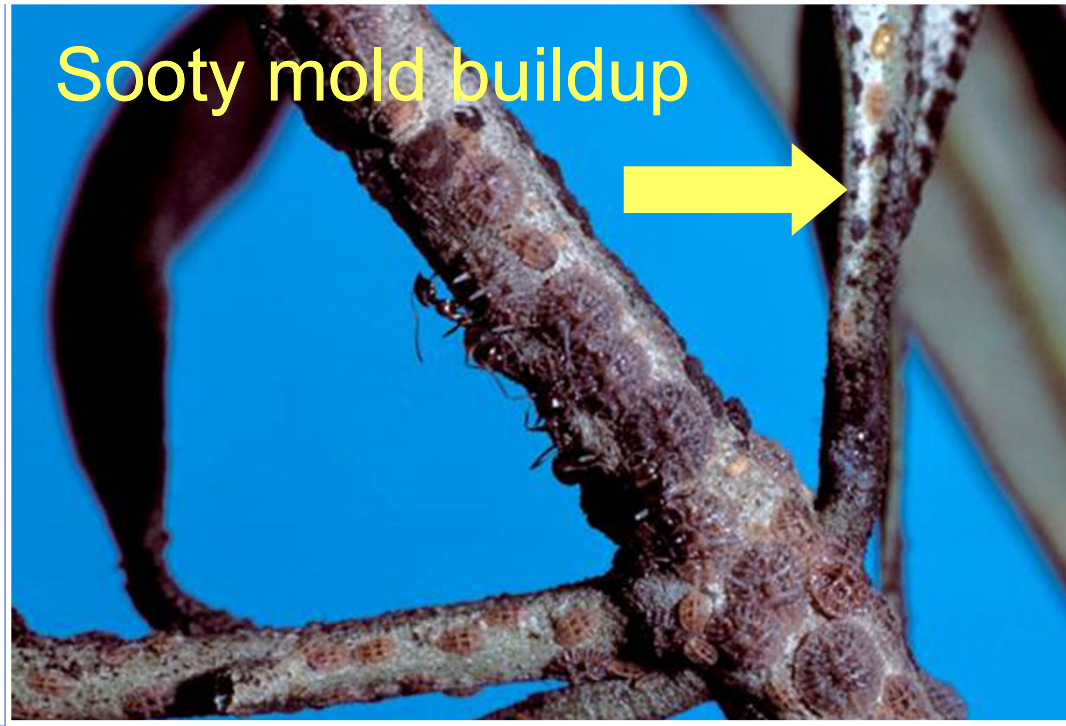
BLACK SCALE DEVELOPMENT PATTERNS



F J F M A M J J A S O N D F


BLACK SCALE DEVELOPMENT PATTERNS
A. TULARE CO.
NO ADULTS
NO RUBBER STAGES
NO THIRDS
NO SECONDS
NO FIRSTS
B. TEHAMA CO.
J F M A M J J A S O N D
F
F



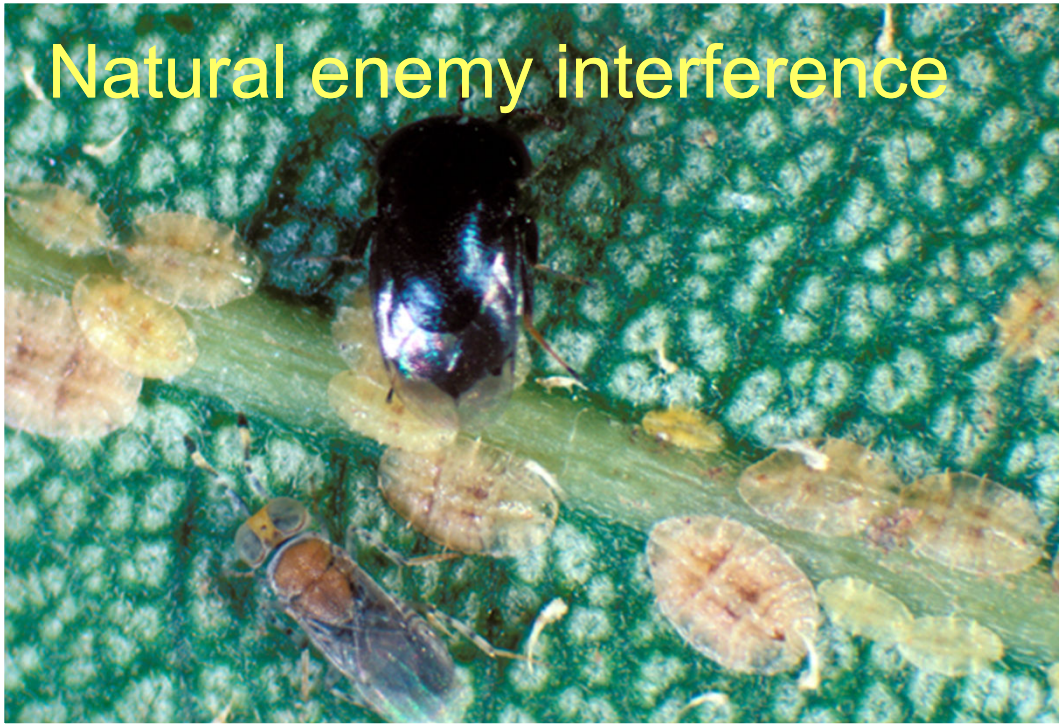


- Young scales excrete sticky, shiny honeydew on leaves
- At first, affected trees and leaves glisten; then they become sooty & black in appearance as sooty mold fungus grows on the honeydew
- Infestations reduce vigor and tree productivity
- Continued feeding reduces bloom the following year
- Olive pickers are reluctant to pick olive fruits covered with honeydew and sooty mold.

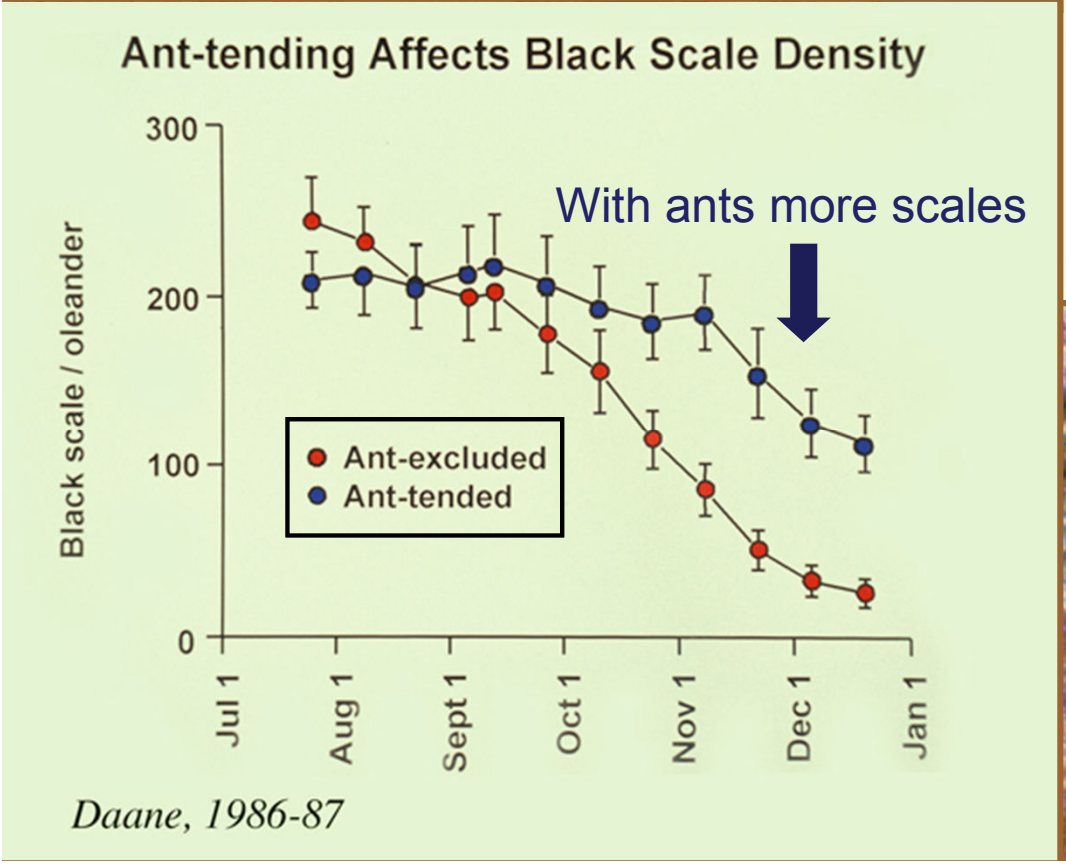

Honeydew production

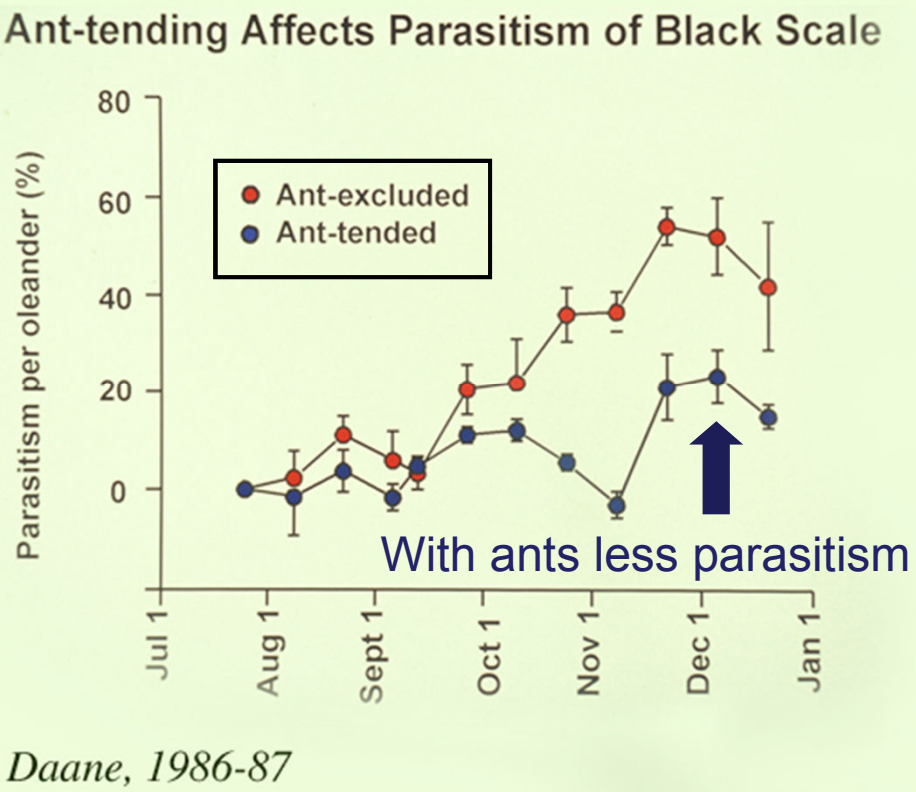

Sooty mold buildup


Argentine ants


Natural enemy interference


Ants tending black scale


Ant-tending Affects Black Scale Density
Black scale / oleander
300
200
100
0
Jul 1
Aug 1
Sept 1
Oct 1
Nov 1
Dec 1
Jan 1
Ant-excluded
Ant-tended
With ants more scales
Daane, 1986-87


Ant-tending Affects Parasitism of Black Scale
Parasitism per oleander (%)
80
60
40
20
0
Jul 1
Aug 1
Sept 1
Oct 1
Nov 1
Dec 1
Jan 1
Ant-excluded
Ant-tended
With ants less parasitism
Daane, 1986-87


Parasitoid emergence

Management of Black Scale

- **Biological control** & **Pruning** to open up closed canopies are key to managing black scale
- **Monitor to detect** the presence of honeydew on leaves and track black scale population levels in olive groves
- **Control ants** using bait stations in the orchard because they disrupt biological control

Management of Black Scale

Biological control

- A number of natural enemies attack black scale
- The most effective are parasitoids: *Metaphycus helvolus*, *M. lounsburyi*, and *Scutellista caerulea* (= *S. cyanea*)
- These parasitoids, combined with proper pruning, provide sufficient control in northern and coastal orchards
- In other regions, biological control is often ineffective because black scale development pattern hampers parasite establishment.

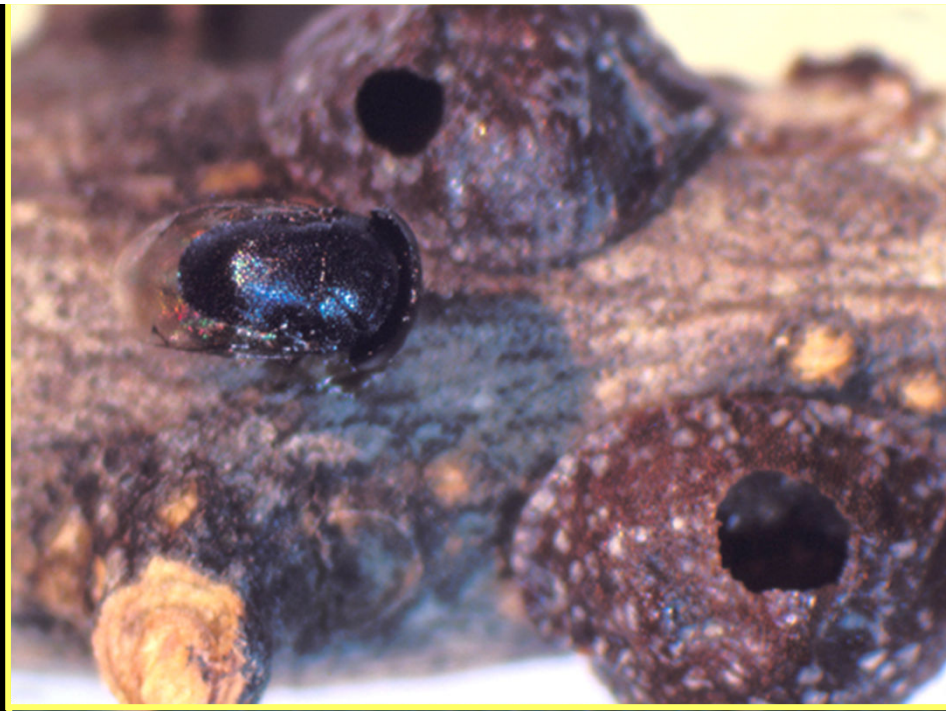
Parasitoids

Predators

Metaphycus lounsburyi

Feeds on scale body

Scutellista caerulea



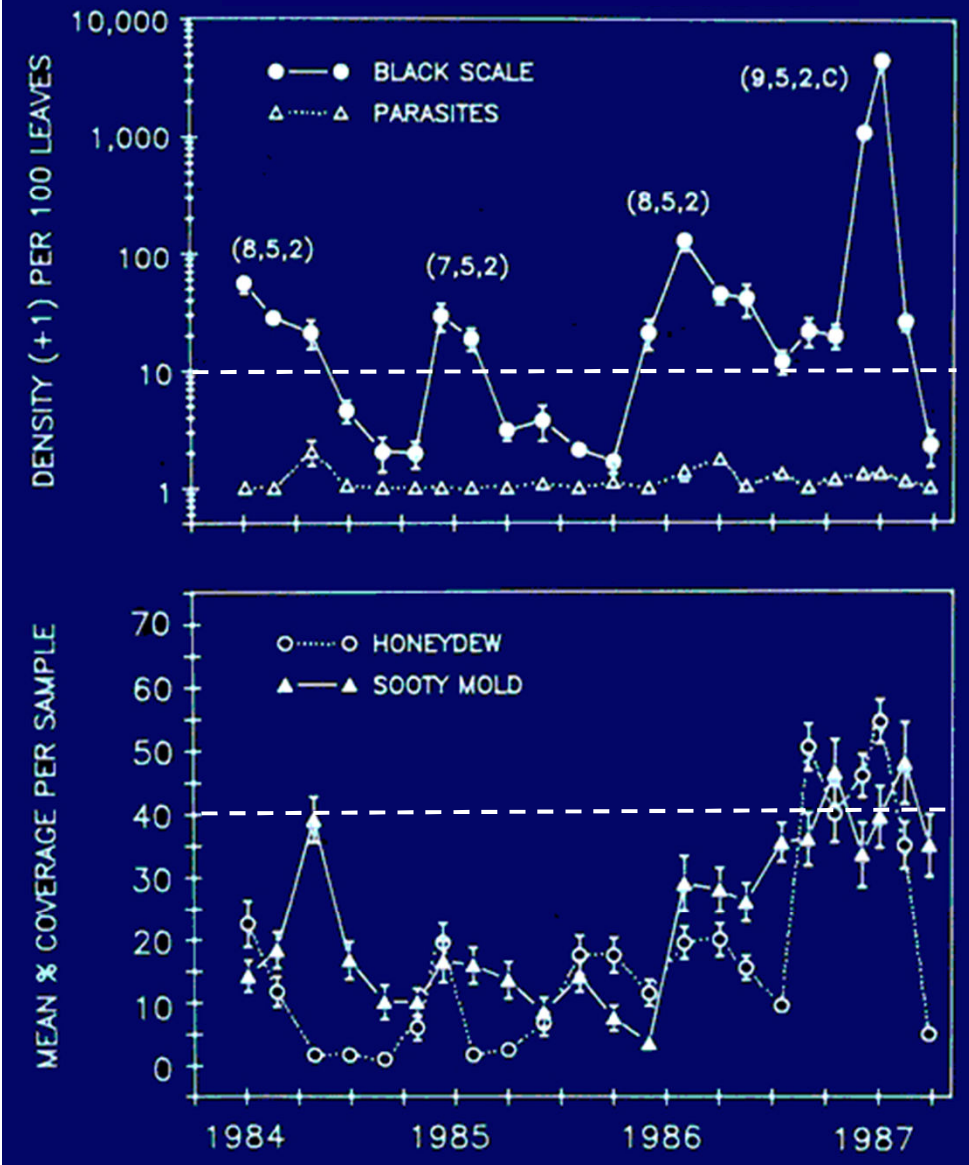
Feeds on scale eggs

Management of Black Scale

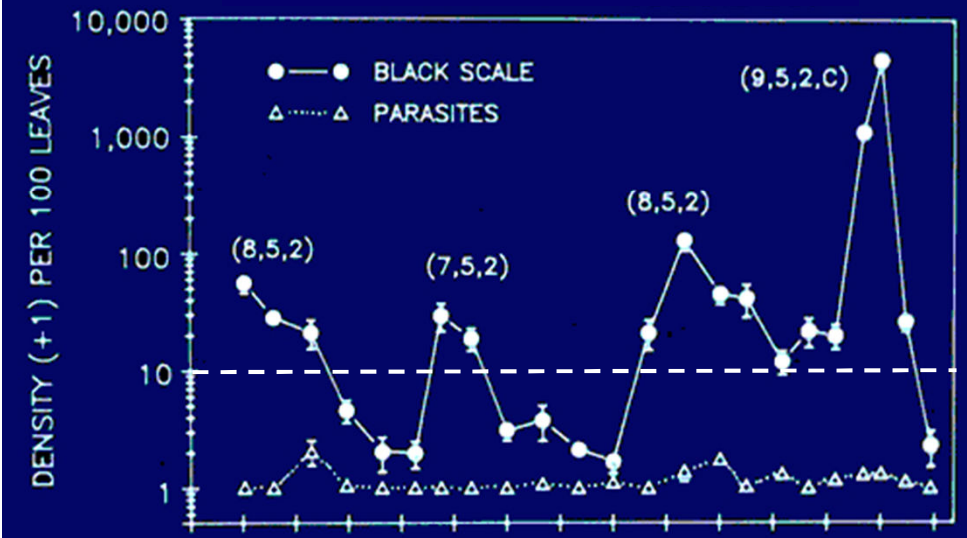
Prunning

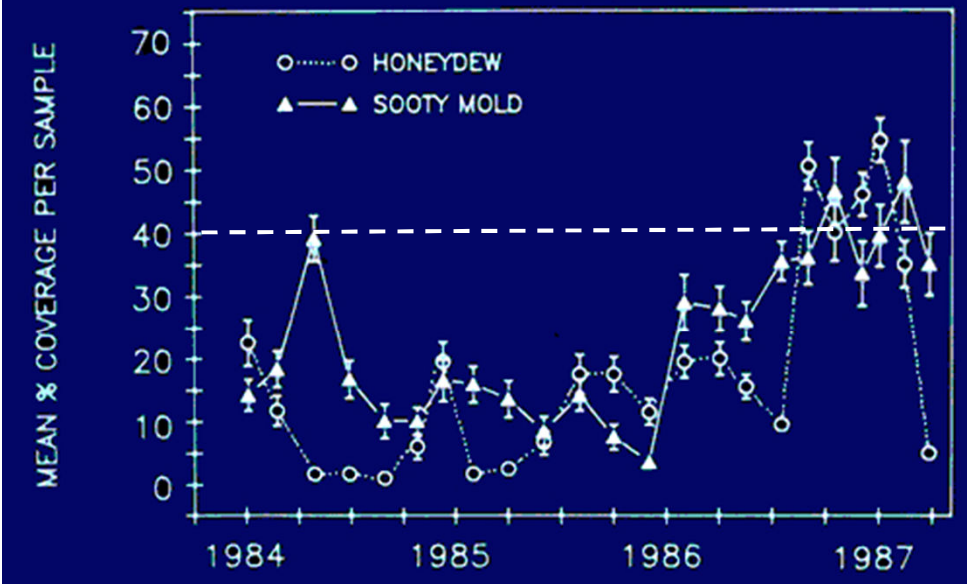
- Pruning to provide open, airy trees discourages black scale infestation and is preferred to chemical treatment.

CLOSED CANOPY

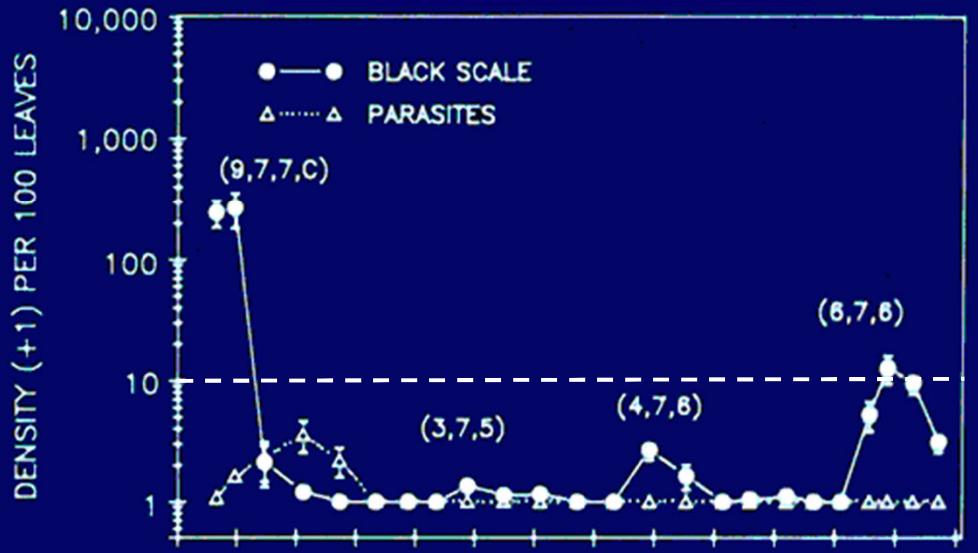


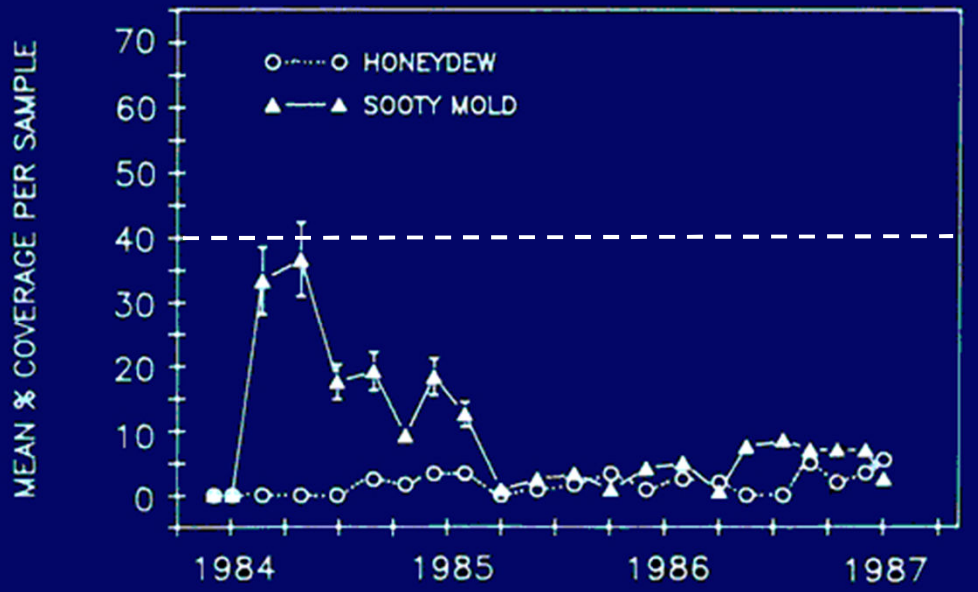
CLOSED CANOPY





OPEN CANOPY





Management of Black Scale

Monitoring

- The first black scale indicator is usually honeydew on the leaves
- Check 25 to 30 trees during April and October, the two periods of greatest honeydew accumulation, to estimate population levels
- Sample for adult scales in May, focusing on 2 to 3 areas in each block, particularly those that have had past problems
- First, select 10 trees in each area: count the number of adults on the terminal 18 inches of 10 branches on each tree
- Be sure to include the lower, inner, and outer sections of the tree
- Sum the numbers of black scale in each 10-branch sample and divide by the number of branches sampled (10) to determine the infestation level

Monitoring

- Infestations fall into one of four levels: *light (0 to fewer than an average of 1 per branch [PB] sampled), moderate (1 to 4 PB), heavy (4 to 10 PB), and severe (more than 10 PB)*
- ***Light infestations*** typically do not require treatment in **open-canopy** orchards, but **closed-canopy** orchards should be pruned and an application of a dormant oil considered
- ***Moderate infestations*** may occur following a cool summer or within a **closed orchard canopy**

  This level of scale infestation typically does not cause damage; however, it presents the potential for substantial damage and economic losses the next year. In trees with **open canopies**, the scale population should decrease or remain stable, depending on summer temperatures. If the summer is mild, apply a narrow range oil. If trees in the orchards have **closed canopies**, prune them and apply oil or an oil/insecticide combination treatment

Monitoring

- Infestations fall into one of four levels: *light (0 to fewer than an average of 1 per branch sampled), moderate (1 to 4), heavy (4 to 10), and severe (more than 10)*

- ***Heavy infestations*** can cause economic damage; if left untreated, the next generation will inflict substantial crop loss. Heavy infestations are rare in **open canopies**, but orchards with **closed canopies** must be pruned, chemically treated, or both

- ***Severe infestations*** occur in **closed-canopy** orchards in which treatment of moderate or heavy scale infestations is delayed. Economic loss can be extensive. Prune the orchard, removing severely damaged branches, and treat with an insecticide. The best application timing is after egg hatch to treat the crawlers (mid-July), but before August to avoid damage to the following year's crop

Management of Black Scale

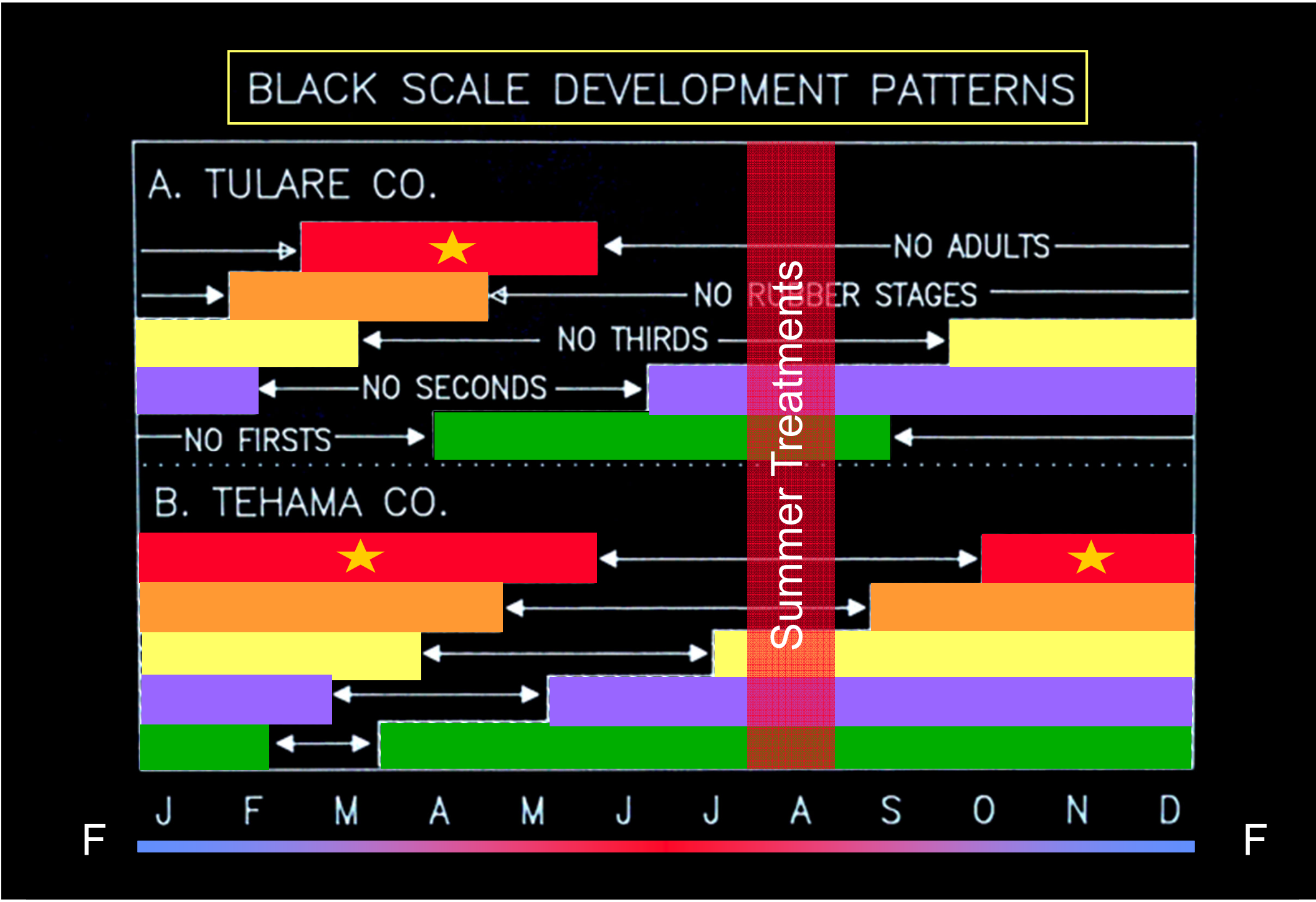
Chemical Control

Summer (July 15 – Harvest)

Narrow Range Oil: works by smothering scales
- Effective against light to moderate infestations, especially when combined with pruning
- Most effective against crawler stage

Narrow Range Oil + Carbaryl: Use for heavy to servere populations. Do not use more than twice per year
- Carbaryl is highly destructive to natural enemies

Consult UC IPM recommedations to see limitations and potential problems associated with use of these products


BLACK SCALE DEVELOPMENT PATTERNS
A. TULARE CO.
NO ADULTS
NO RUBBER STAGES
NO THIRDS
NO SECONDS
NO FIRSTS
B. TEHAMA CO.
Summer Treatments
J F M A M J J A S O N D
F
F

Management of Black Scale

Chemical Control

Post Harvest (Post Harvest until rubber stage appears)

Narrow Range Oil: works by smothering scales.
Effective against light to moderate infestations, especially when combined with pruning.
Most effective against crawler stage.

Narrow Range Oil + Supracide (methidathion): Use for heavy to servere populations. Do not use more than 12 lb/acre/ year. Supracide may be used alone.

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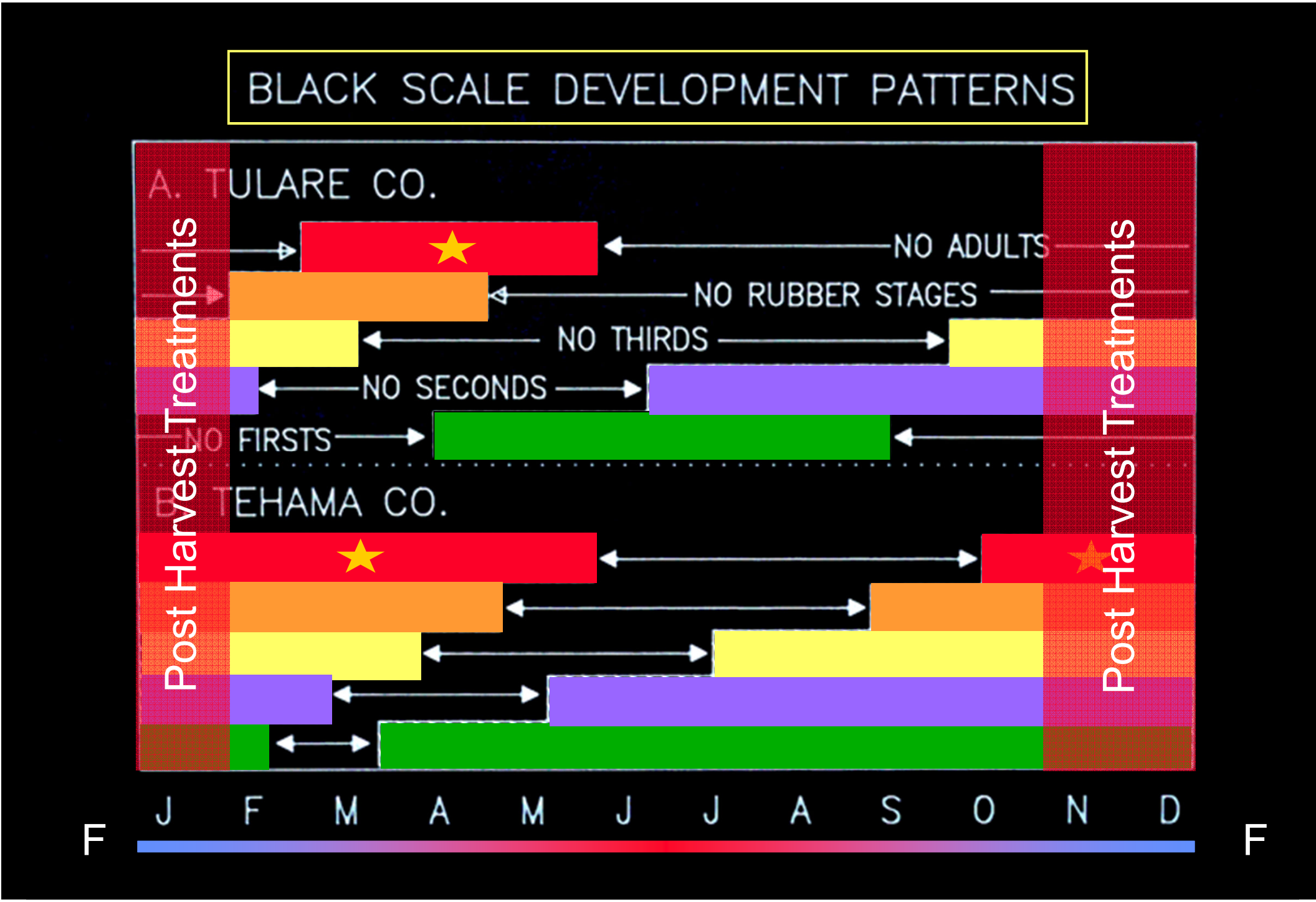
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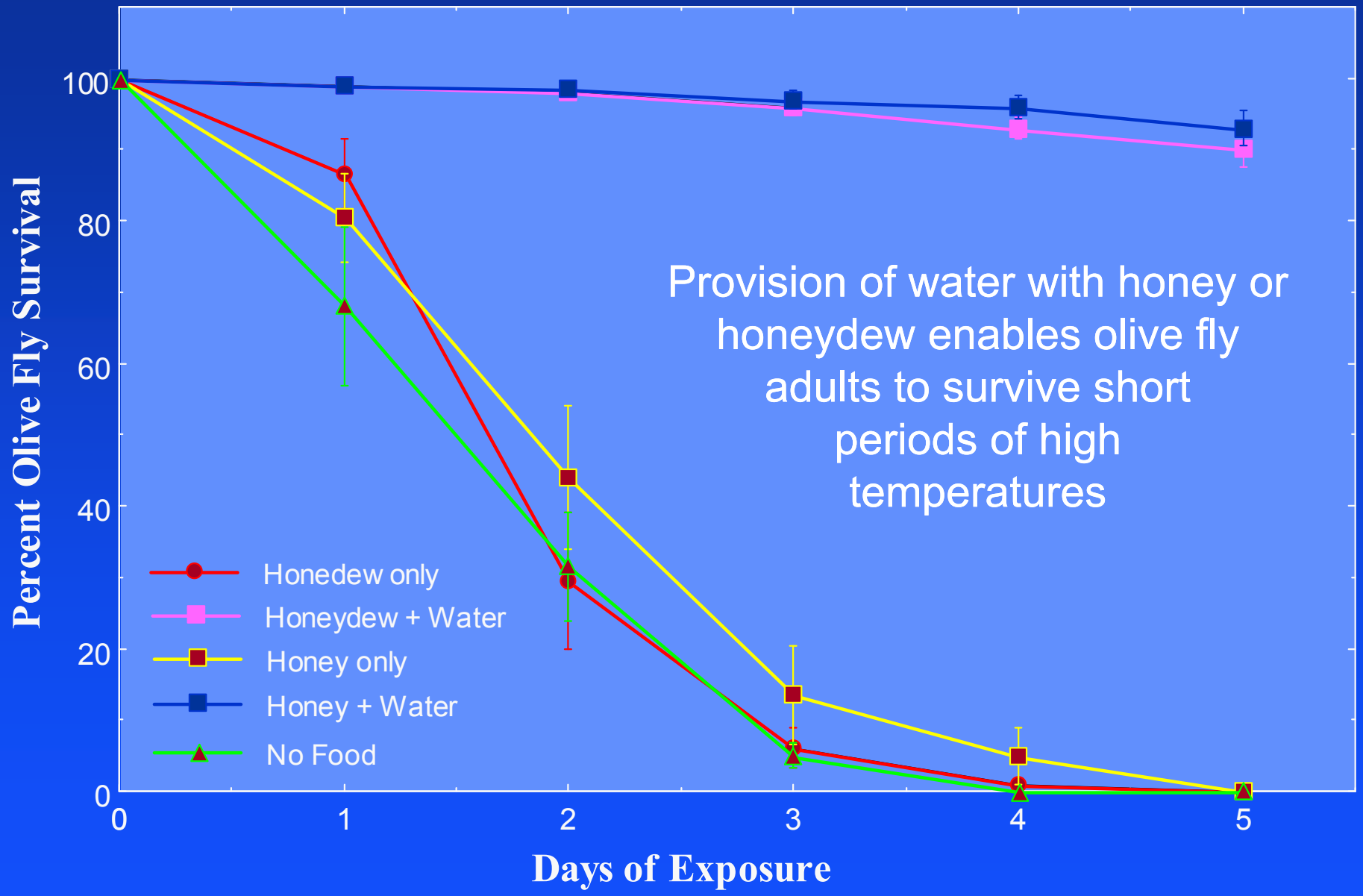
Post Harvest Treatments
Post Harvest Treatments
J F M A M J J A S O N D

Presentation Topics

- Black scale and its management
- The relationship between black scale and olive fruit fly
- Status of the olive psyllid

- Honeydew consumption enables flies to survive periods of extreme heat

Laboratory Data: High = 97.5 ºF; Low = 65 ºF

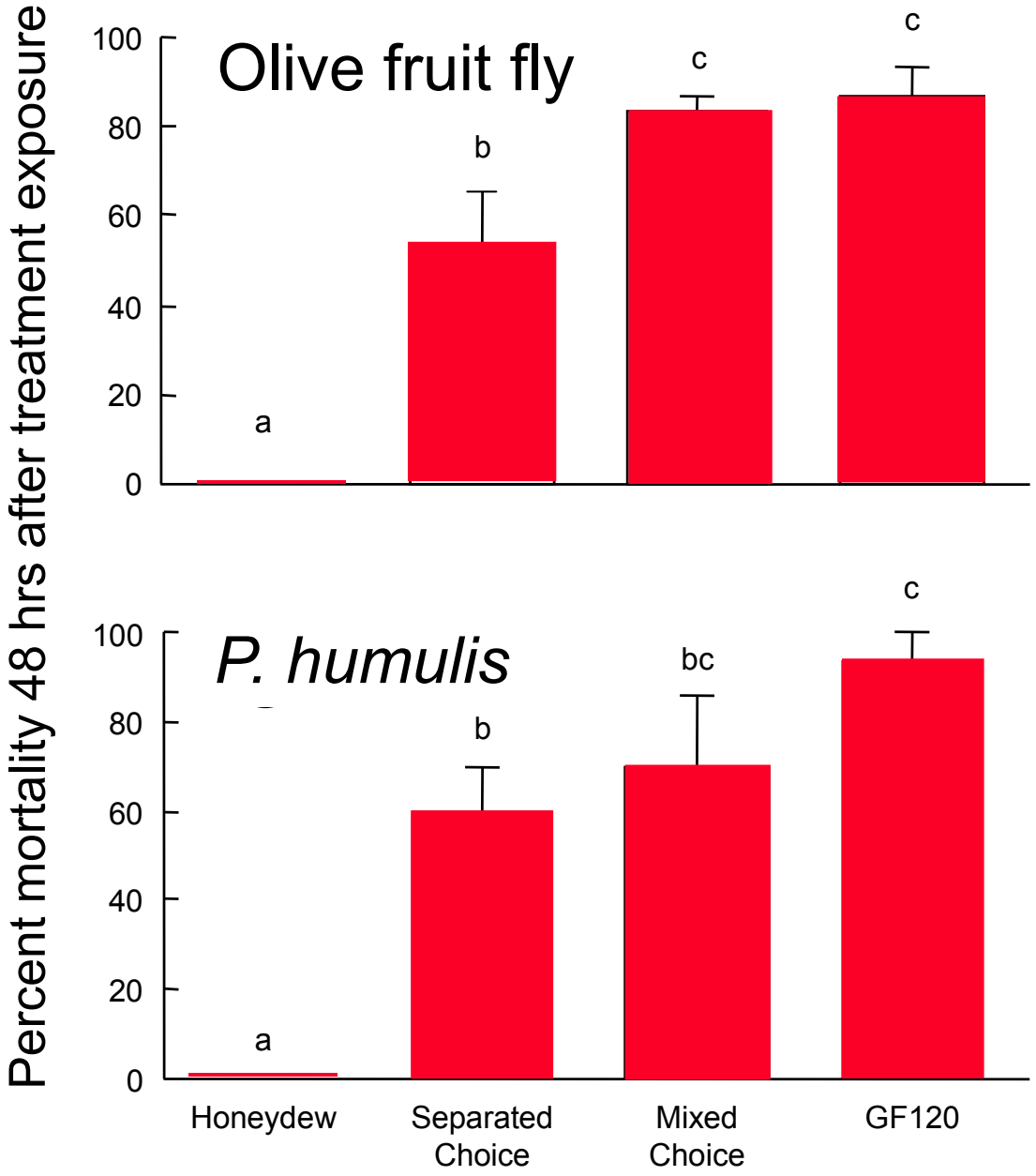



Does the presence of high quantities of honeydew in an orchard impact the affects on GF-120 residues?

When black scale honeydew is offered to adult olive flies or the parasitoid, they will eat it and survive. If offered GF-120, they eat it and they die at high levels (about 90%).

However, if droplets of honeydew and GF-120 are together on a surface, a lower than expected mortality will happen because each species will ingest some honeydew, which reduces the overall mortality.

Other studies show that *P. humulis* will not approach GF-120 if given a choice.



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Olive psyllid

Euphyllura olivina Costa

Adult

Adult with caste skins from small nymphs

Olive Psyllid: Potential Threat to California Olives

- Nymphs and adults feed by rupturing cells and ingesting sap, reducing nutrients essential for tree development and fruit production
- Plant parts attacked include buds, tender shoots, floral axes, inflorescences, and young fruits
- Nymphs secrete sticky wax that accumulates on the foliage and stimulates premature flower drop** □
- The wax can actually protect individuals from some insecticides so it is best to control the first generation when buds and flowers are not present
- Nymphs and adults produce honeydew (similar to aphids)
- When colonies are on inflorescences, the level of sap loss is directly proportional to psyllid numbers
- Yield reductions in some areas outside the USA have been as much as 40 to 60%. Populations > 20 nymphs per inflorescences can cause such losses.

The presence of psyllid-produced wax is a good indicator of the presence of nymphs. Adults do not produce wax.

The accumulation of waxy material can lead to aborted buds and flowers, thereby reducing yields.

Olive psyllid clusters increase in the spring just as the buds start to appear.

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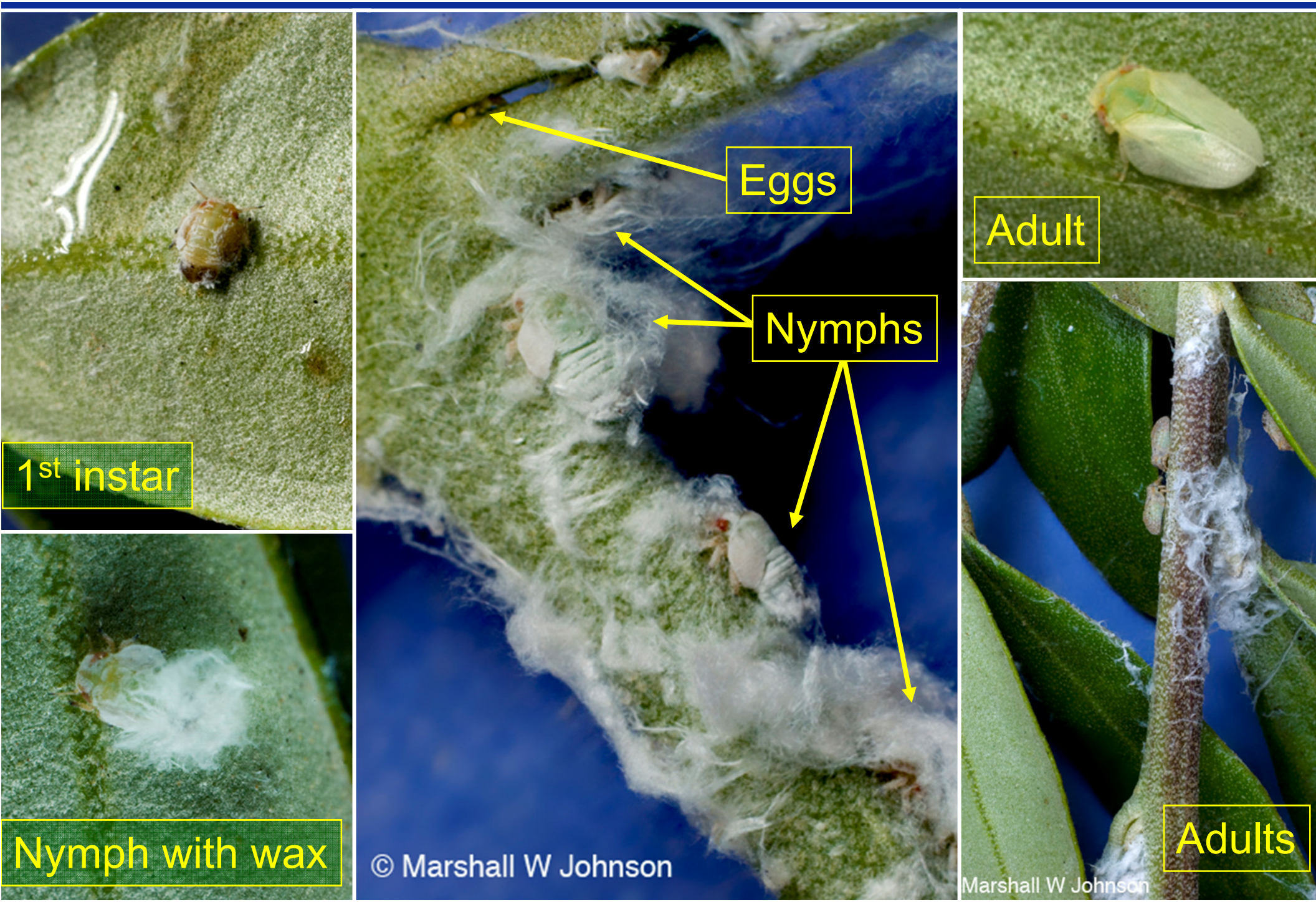
Biology of the Olive Psyllid

- Stages include an egg, 5 nymphal instars, and adults (both sexes)
- Immatures look like adults, but wings are non-functional) □
- It has 3 host plants: Olive, Russian olive (oleaster), *Elaeagnus angustifolia*, and mock privet, *Phillyrea latifolia*
- The life cycle is about 3 months long depending on temperature
- Females may lay more than 1,000 eggs
- Optimal growth conditions are between 68 to 77°F
- There are typically 3 generations. The first in early spring. The second generation becomes inactive when temperatures exceed 81°F, and active again when temperatures drop. The 3rd generation should overwinter.


1st instar
Eggs
Nymphs
Adult
Nymph with wax
© Marshall W Johnson
Adults
Marshall W Johnson

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RUSSIAN OLIVE

Survey Proceedures

- Surveys to detect olive psyllid in Southern California were conducted: July & Oct 2008; March, April, June, Aug, Oct & Dec 2009, and March, April, May, June, July, Sept & Dec 2010.
- Olive trees in residential (around apartment complexes, homes) and business areas (malls, shopping centers, parking lots, etc.) in Orange, San Diego, Riverside, and Los Angeles Counties were randomly selected and inspected for psyllid colonies and the wax they produce. □
- To date, more than 50 sites (i.e., locations with 3 or more olive trees) have been checked in Southern California and more than 40 sites have been checked on a periodic basis to establish seasonal trends of the psyllid.
- Initially, sites were categorized relative to psyllid presence or absence, but are now rated on a 0 to 4 scale.
- 0 = no psyllids; 1 = 1 to 3 clusters; 2 = 3 to 10 clusters; 3 = up to 10% of the branches infested; and 4 = > 10% infested branches

SURVEY SITES

Conditions similar to an olive grove

Near Rincon

San Diego

Newport Beach

SURVEY SITES

Newport Beach

Conditions less humid due to increased airflow

Santa Clarita

Newport Beach

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Rating system

0 = no psyllids
1 = 1 – 3 clusters
2 = 4 – 10 clusters
3 = > 10 clusters, < 10% branches infested
4 > 10% tree infested

Plants were visually inspected for about 2 minutes each. An average of about 13 plants were inspected at each site.

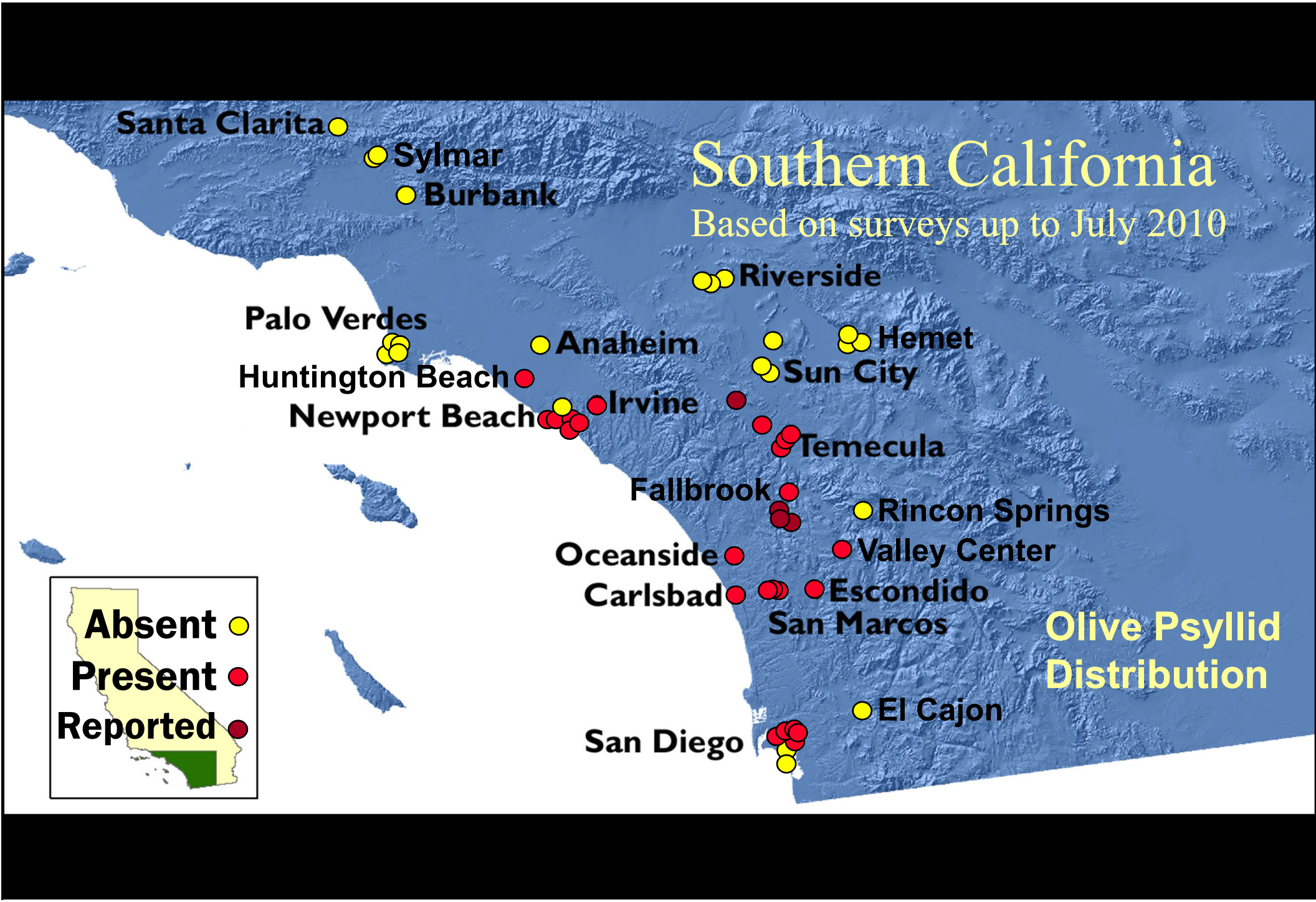
The easiest way to detect an infestation of olive psyllid is to examine the suckers at the base of the tree.

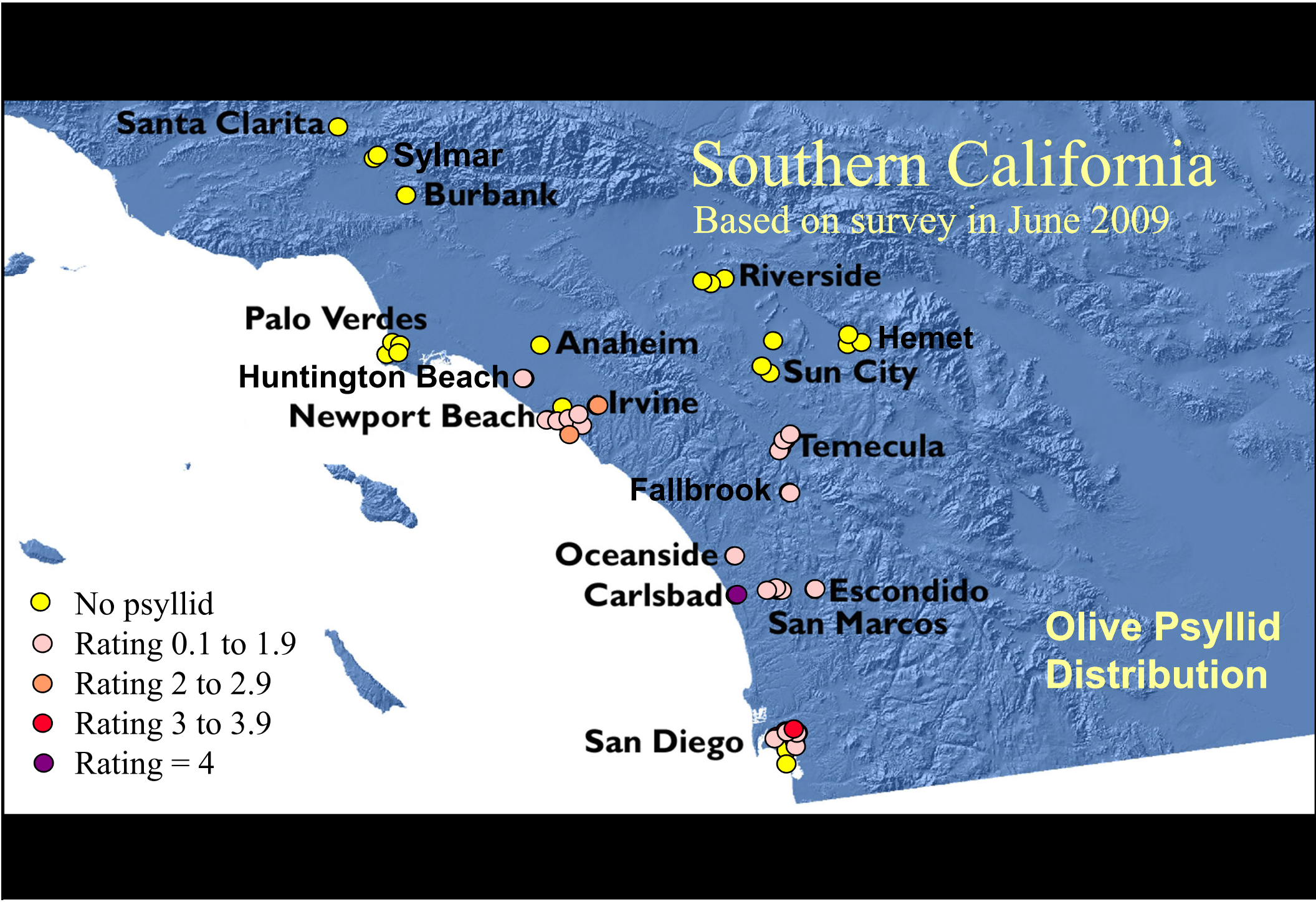
If there are no clusters on the suckers, then the plant is probably free of immature olive psyllids.

However, adult psyllids may be present in the canopy or within crevices in the bark of the tree.

Progress to Date

- The numbers of clusters at sites peaked in June 2009 and May-June 2010. The infested sites in Southern California had a tree infestation rate of ca. 60 and 75 % in 2009 and 2010, respectively. In Carlsbad and San Diego the infestations were considered damaging.
- In Southern California, as of July 2010, no infested trees were found north of Huntington Beach on the coast or the Temecula / Murrieta area in the inland valleys.
- No natural enemies have been identified as providing significant biological control. However, an *Orius* species (i.e., minute pirate bug) that was found at some sites may provide potential control. More information is needed.
- Around mid-June 2010, an infestation of olive psyllid was reported in Carmel Valley (Monterey County). That infestation may be limited to one location. There are also non-confirmed reports of infestations in Santa Clara and San Mateo.


Southern California
Based on surveys up to July 2010
Santa Clarita
Sylmar
Burbank
Riverside
Palo Verdes
Anaheim
Hemet
Sun City
Huntington Beach
Irvine
Newport Beach
Temecula
Fallbrook
Rincon Springs
Oceanside
Valley Center
Carlsbad
Escondido
San Marcos
El Cajon
San Diego
Absent
Present
Reported
Olive Psyllid Distribution


Southern California
Based on survey in June 2009
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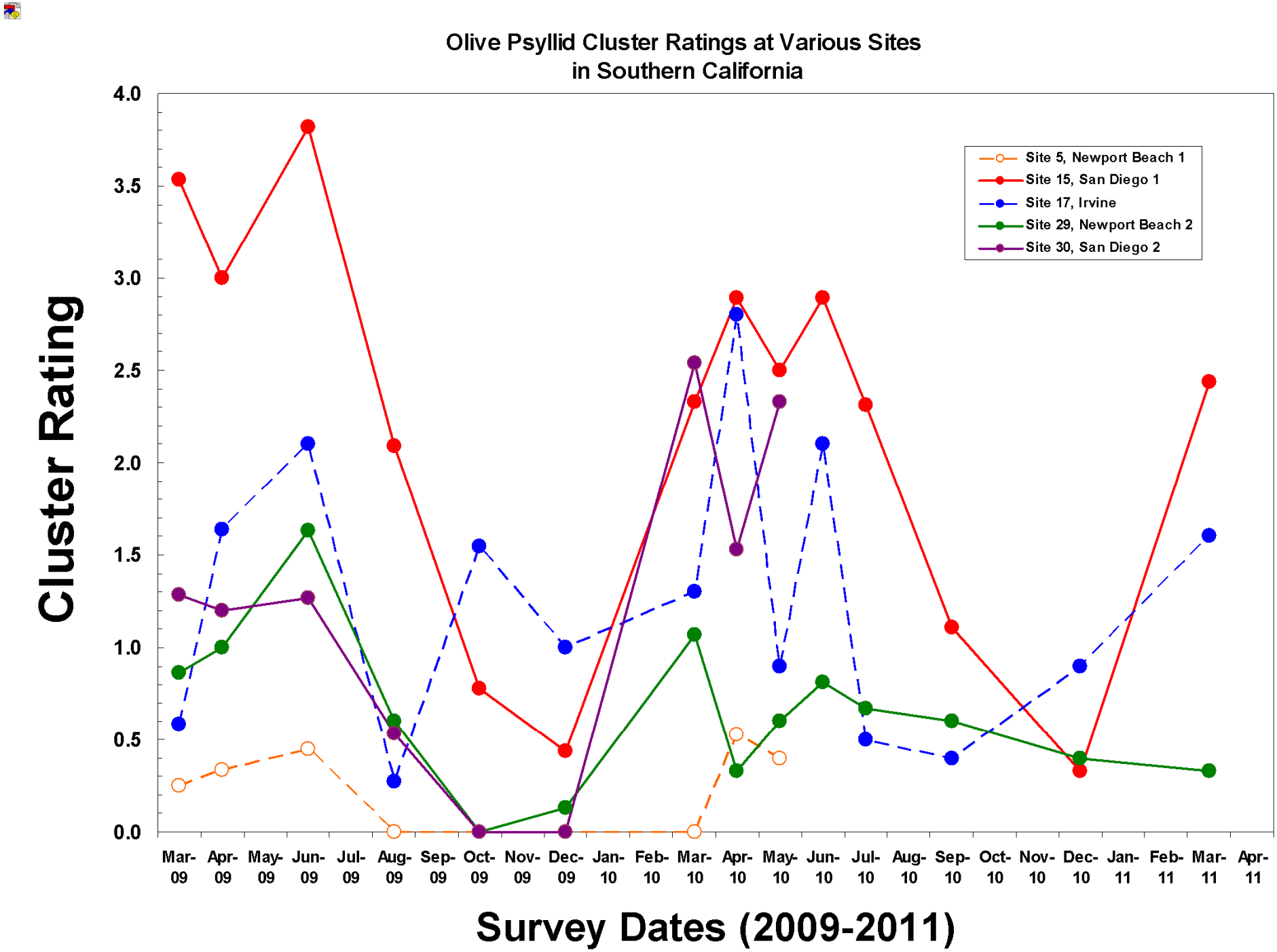
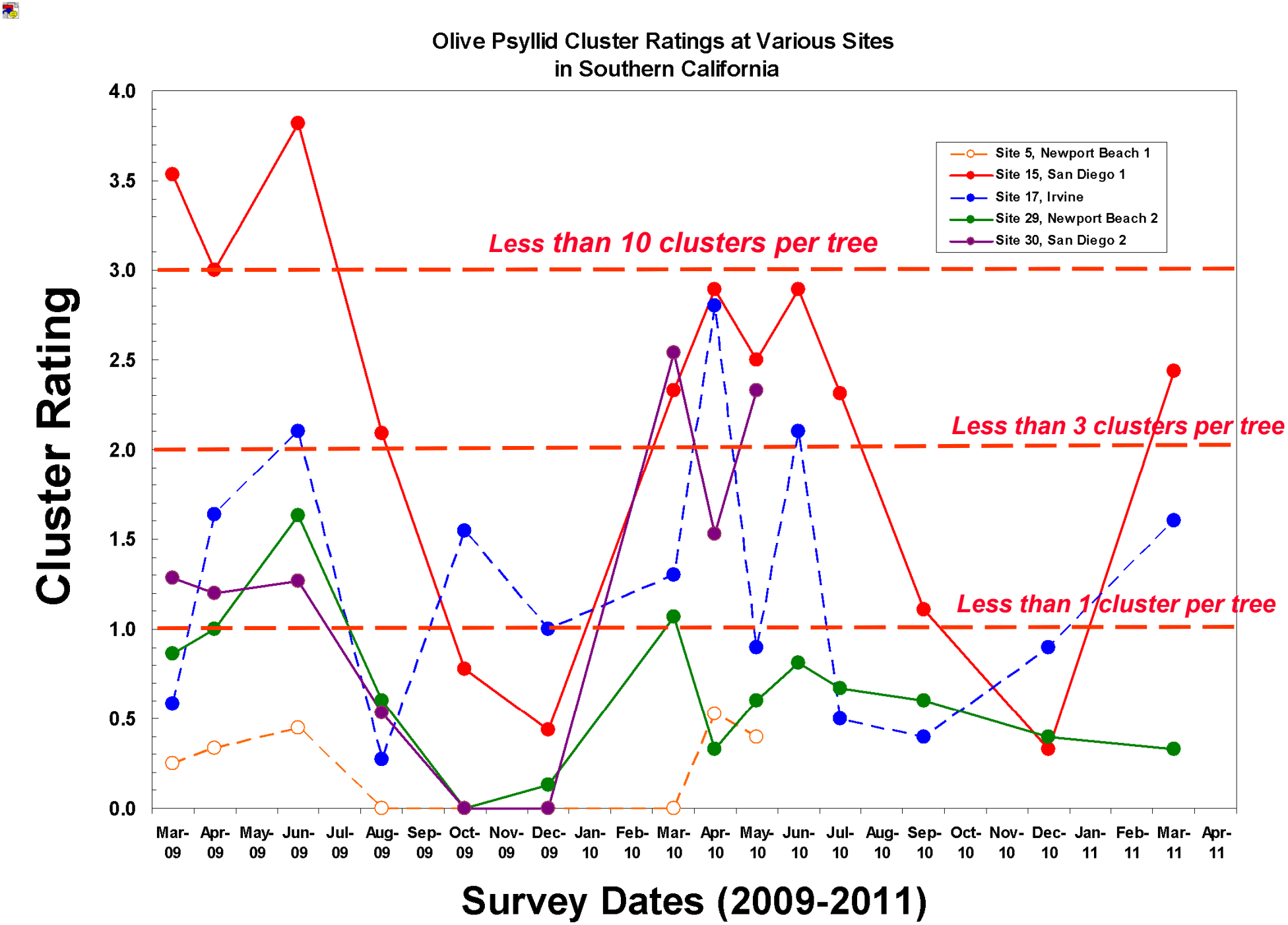
Irvine
Newport Beach
Temecula
Fallbrook
Oceanside
Carlsbad
Escondido
San Marcos
San Diego
No psyllid
Rating 0.1 to 1.9
Rating 2 to 2.9
Rating 3 to 3.9
Rating = 4
Olive Psyllid Distribution


Olive Psyllid Cluster Ratings at Various Sites
in Southern California
Cluster Rating
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Site 5, Newport Beach 1
Site 15, San Diego 1
Site 17, Irvine
Site 29, Newport Beach 2
Site 30, San Diego 2
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10
Dec-10
Jan-11
Feb-11
Mar-11
Apr-11
Survey Dates (2009-2011)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in Southern California
Cluster Rating
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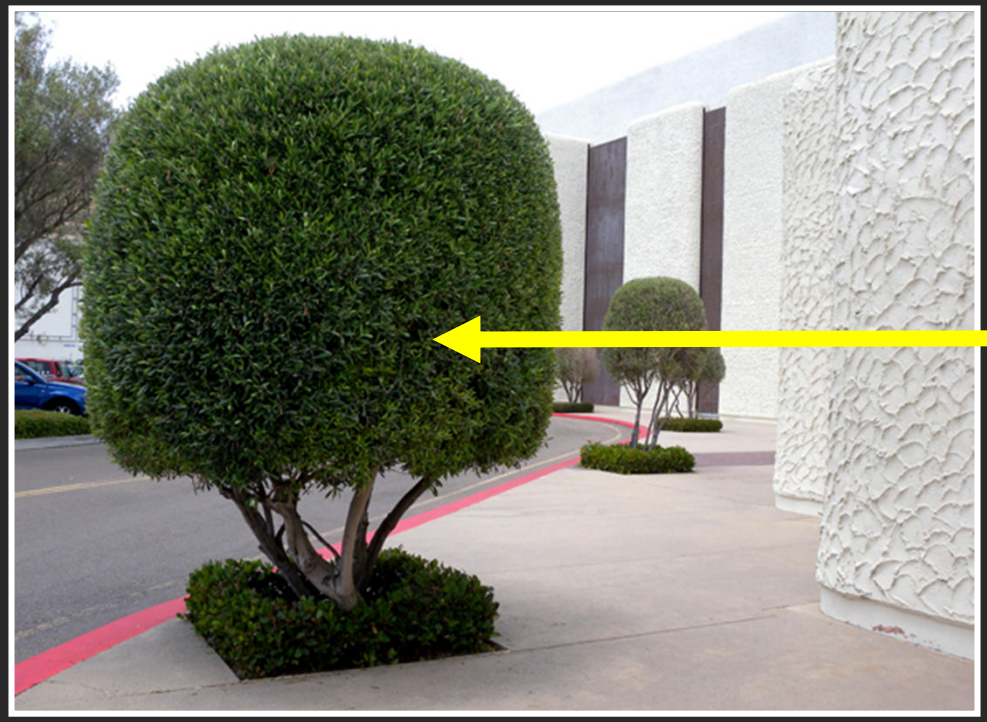
Site 5, Newport Beach 1
Site 15, San Diego 1
Site 17, Irvine
Site 29, Newport Beach 2
Site 30, San Diego 2
Less than 10 clusters per tree
Less than 3 clusters per tree
Less than 1 cluster per tree
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10
Dec-10
Jan-11
Feb-11
Mar-11
Apr-11
Survey Dates (2009-2011)

PROTECTED FROM SUNLIGHT

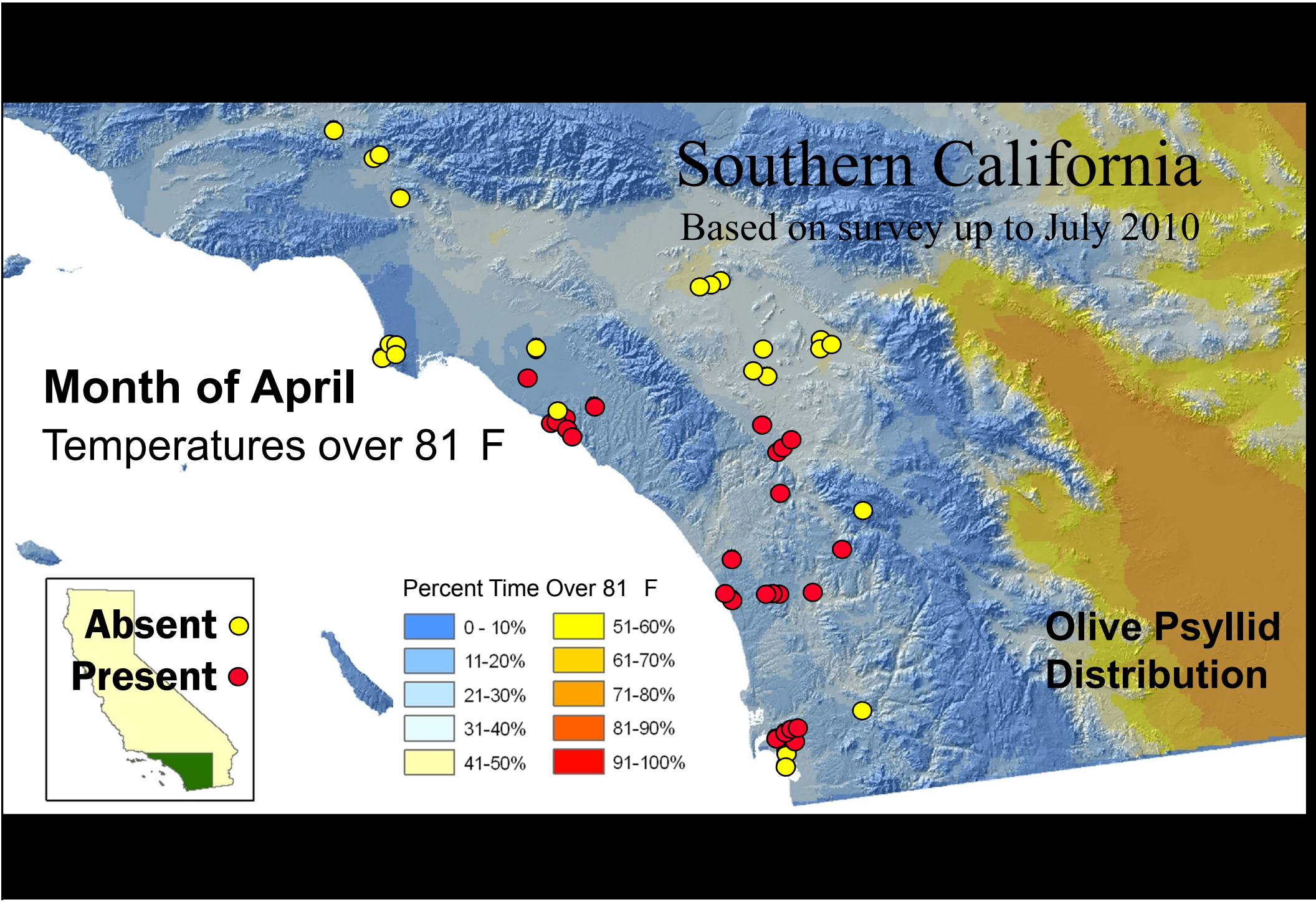
Adjacent to buildings that block direct sunlight

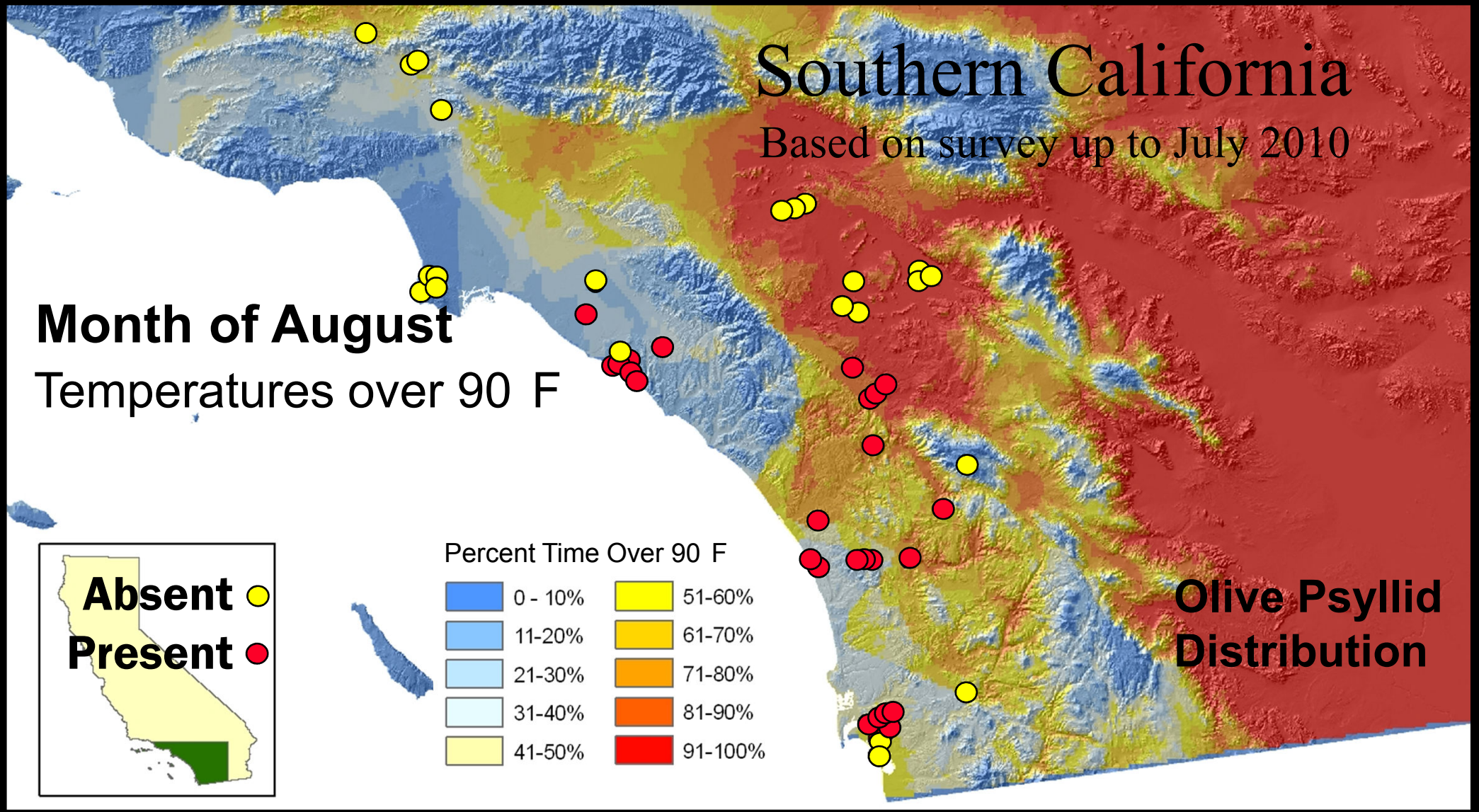
Airflow limited by canopy shape

Psyllids may be found deep within the canopy.
Push aside the branches to see within the canopy.

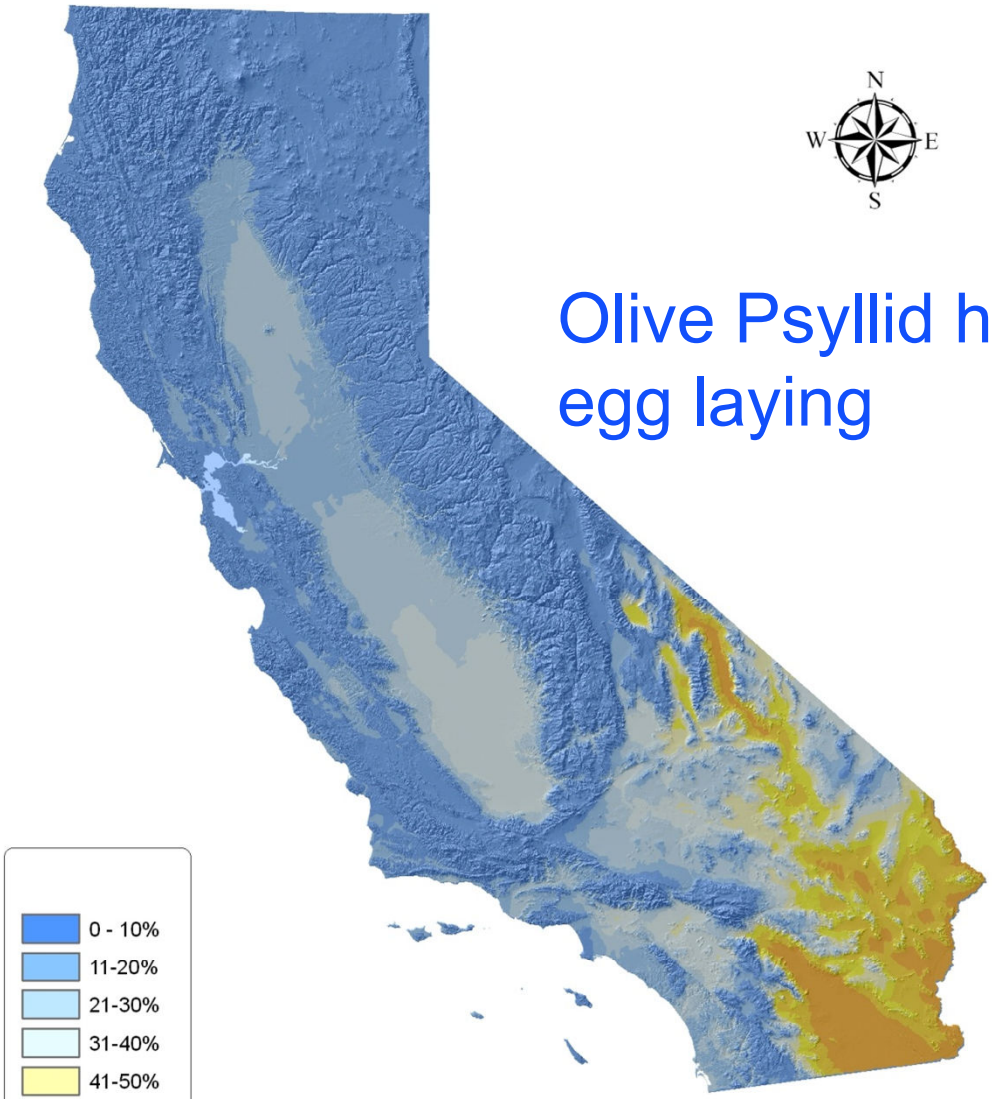


Heavy prunning has been employed at many urban sites to reduce olive psyllid populations

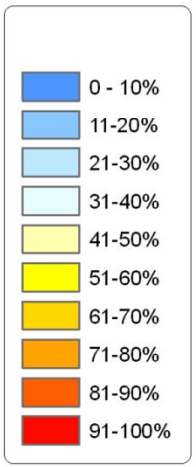

Southern California
Based on survey up to July 2010
Month of April
Temperatures over 81 F
Absent
Present
Percent Time Over 81 F
0 - 10%
11-20%
21-30%
31-40%
41-50%
51-60%
61-70%
71-80%
81-90%
91-100%
Olive Psyllid
Distribution


Southern California
Based on survey up to July 2010
Month of August
Temperatures over 90 F
Absent
Present
Percent Time Over 90 F
0 - 10%
11-20%
21-30%
31-40%
41-50%
51-60%
61-70%
71-80%
81-90%
91-100%
Olive Psyllid
Distribution

10 Year Average of Max Temperature Above 81°
April

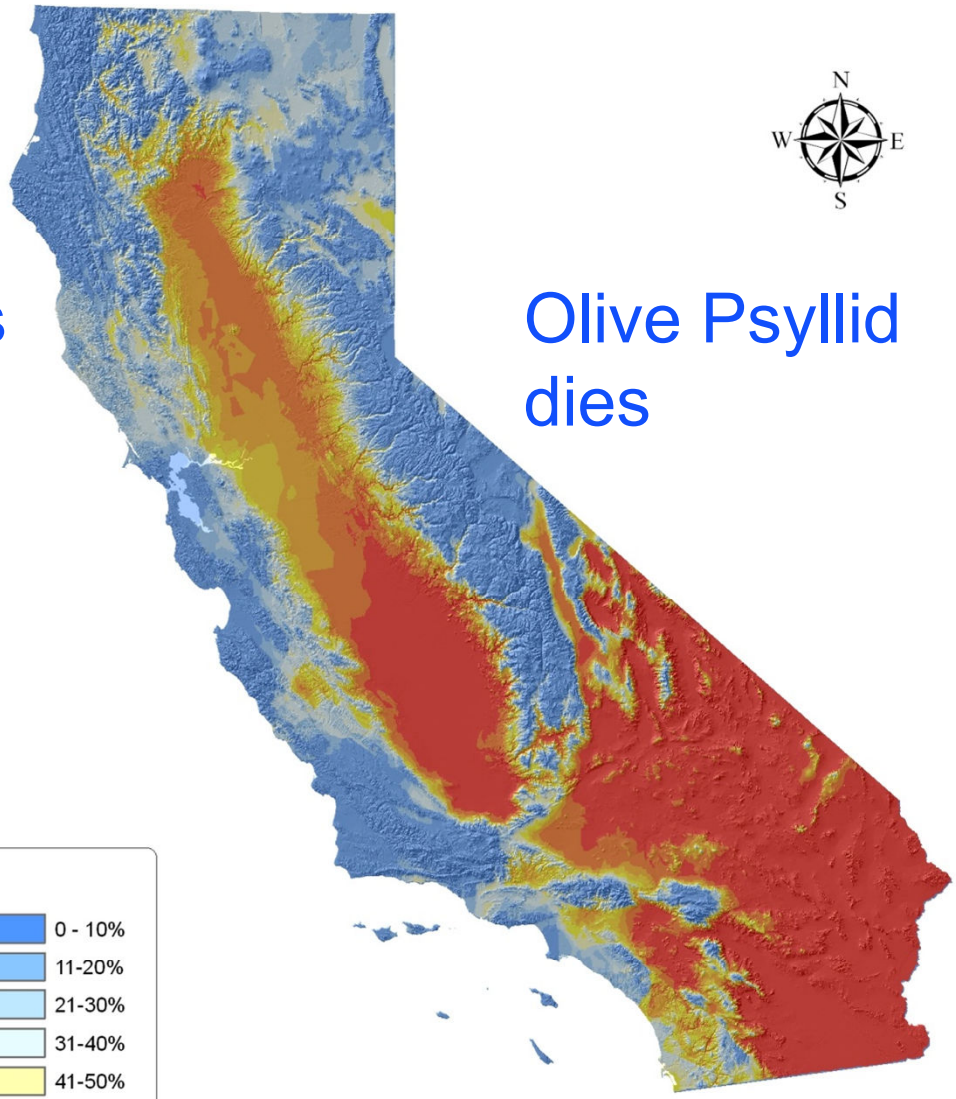


Olive Psyllid halts egg laying

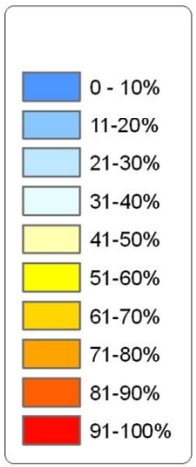


Temperature Data Analyzed and Map Prepared by the
UC Kearney Agricultural Center GIS Facility

10 Year Average of Max Temperature Above 90°
August



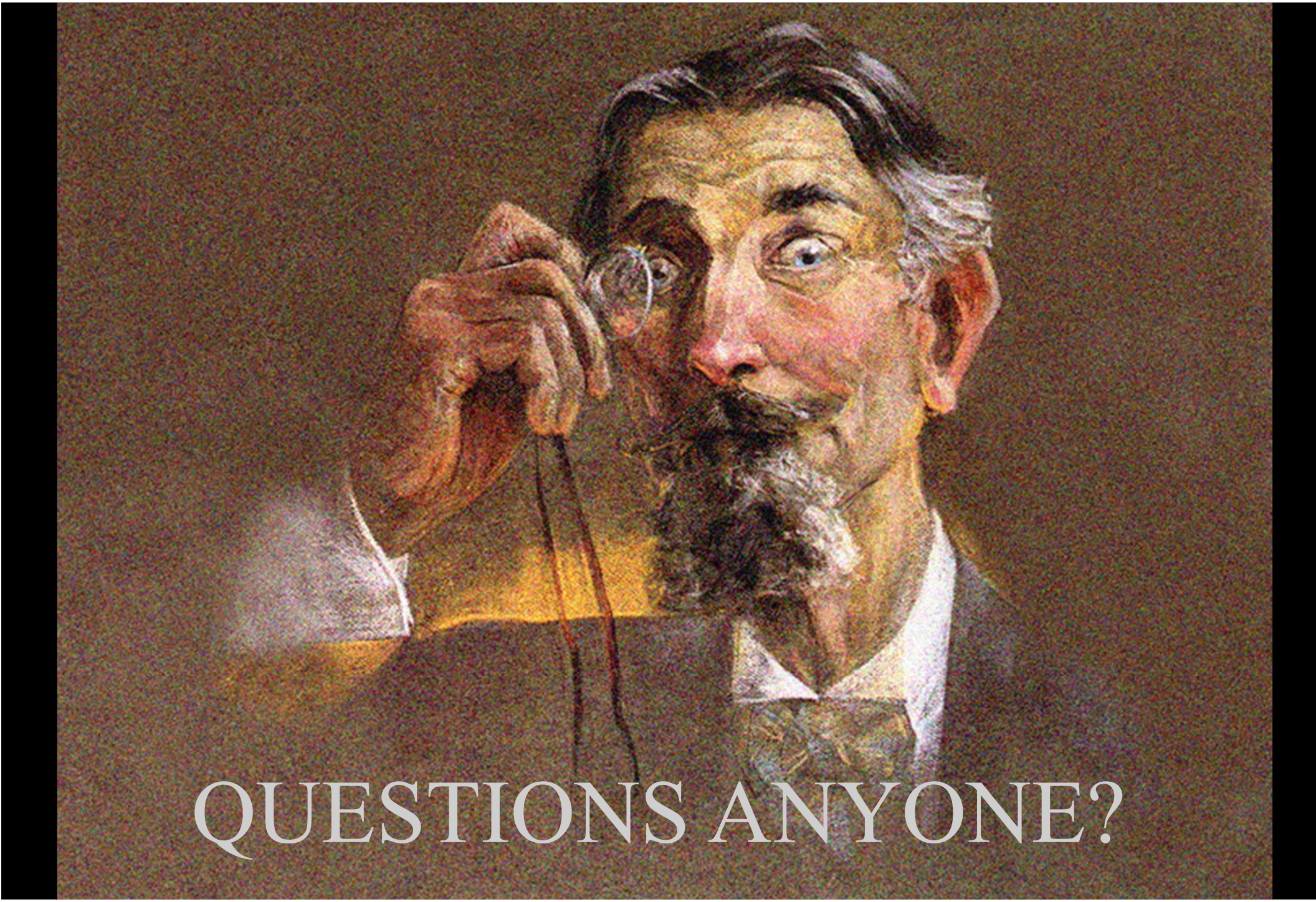
Olive Psyllid dies



Temperature Data Analyzed and Map Prepared by the
UC Kearney Agricultural Center GIS Facility

Summary

- Black scale is generally a greater problem in the Sacramento Valley and along the coast in contrast to the hotter San Joaquin Valley
- Olive trees with open canopies, presence of black scale natural enemies, and free of ants, typically have problem-free black scale populations
- Closed canopy olive trees set the environmental stage for high black scale densities and the presence of ants worsens the problem
- Control of black scale may reduce survival of olive fly adults due to removal of a potential food source for the fly
- The olive psyllid is now in San Diego, Orange, Riverside, and Monterey Counties, and may be able to survive in the Central Valley


QUESTIONS ANYONE?