INSECT PESTS OF THE GRAPEVINE

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Major Insect & Mite Pests

- Leafhoppers
  - Western Grape, Variegated and Virginia Creeper
- Spider Mites
  - Willamette & Pacific
- Mealybugs:
  - Grape, Vine, Obscure, Longtailed and Gill's
- Worms
  - Berry feeders, leafrollers, defoliators
- Pierce's disease vectors
  - Sharpshooters and spittlebugs
- Others:
  - Scale, phylloxera, thrips

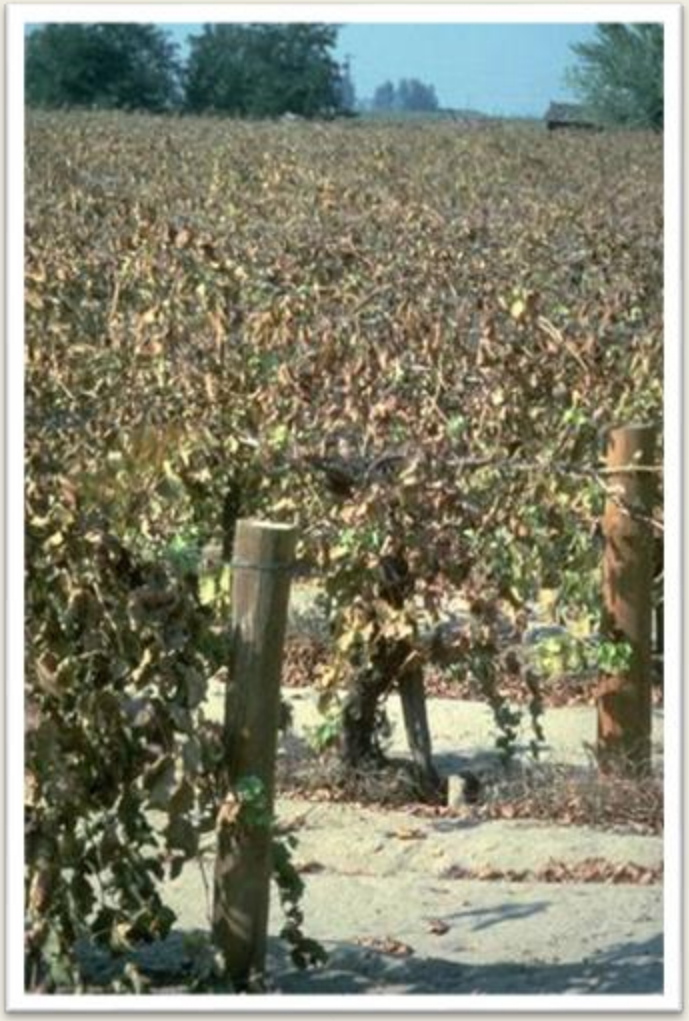
Leafhoppers in California Vineyards

Photos: Jack K. Clark

- Western grape leafhopper, *Erythroneura elegantula*, found throughout California, north of the Tehachapi Mountains.
  - Adults pale yellow with orange markings and two dark brown spots on thorax.
- Variegated leafhopper, *E. variabilis*, found in the Central Valley as far north as San Joaquin County and in southern California.
  - Adults have red, white, green, brown mottling.
- Virginia creeper leafhopper, *E. ziczac*, found in Northern California and Northern Sierra foothills.
  - Adults have reddish-brown zigzag markings on the wing.

All 3 species overwinter as adults

Leafhopper Leaf Damage



Photos: Jack K. Clark

Monitor for nymphs

Nymphs are small (~1/32 to 1/8”). Found primarily on under surface of leaf.

Photos: Jack K. Clark

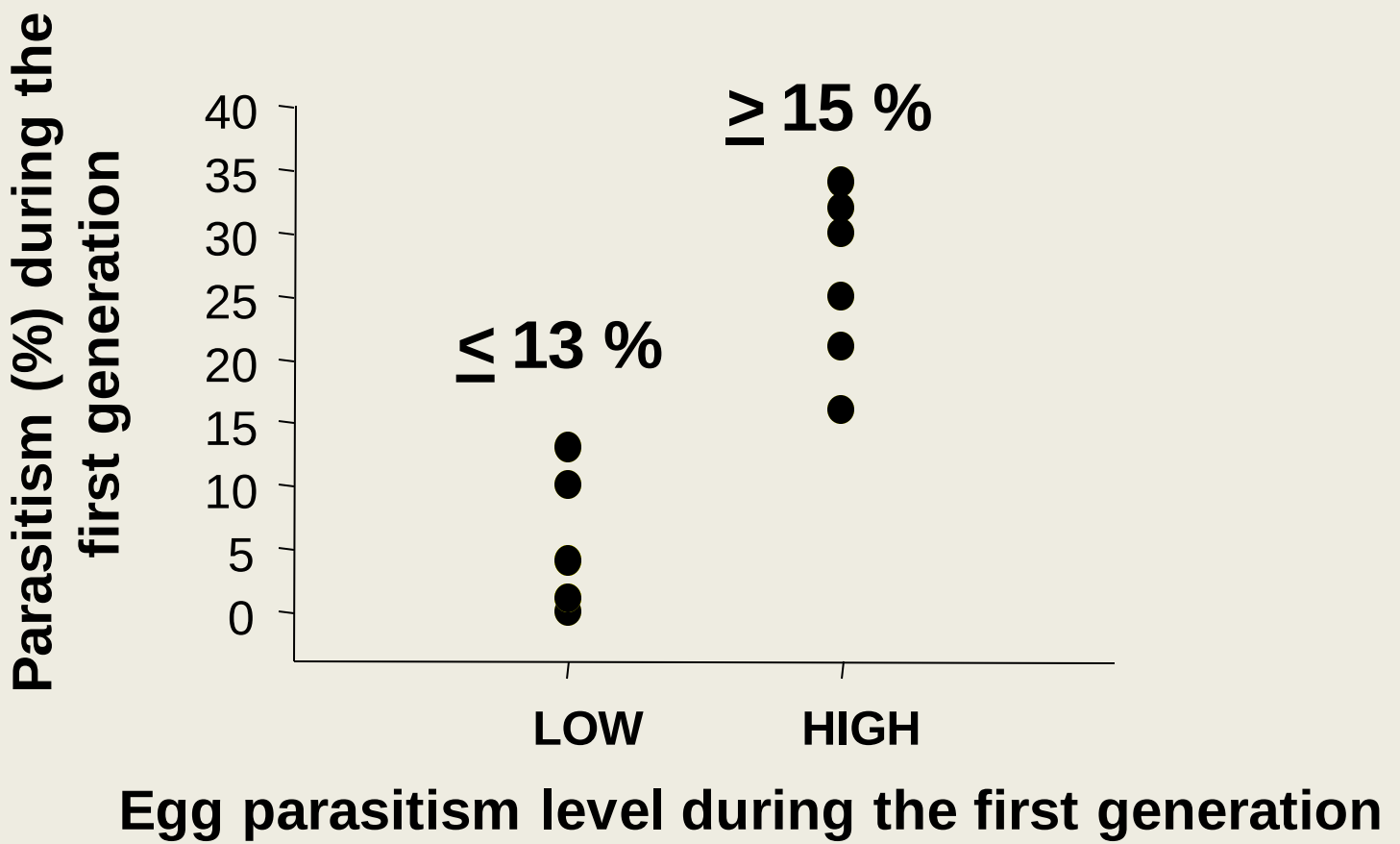
- Western grape leafhopper
  - Pale yellow marking on thorax only visible with a hand lens. Eyes appear white.
  - 2 to 3 broods a year
- Variegated leafhopper
  - Yellow-brown to orange-brown. 1st and 2nd stages primarily on the upper surface of the leaf.
  - 2 to 4 broods a year
- Virginia creeper leafhopper
  - First stage is colorless with dark reddish brown eyes.
  - 2nd and 3rd stage have 4 orange markings on the thorax and dark red eyes.
  - 4th and 5th stage nymphs have 4 reddish-brown markings on the thorax and dark red eyes.
  - Cast-off skin of fifth molt (with reddish-brown markings) sticks to leaf, signaling adult emergence.

Egg Parasitism by *Anagrus sp.*

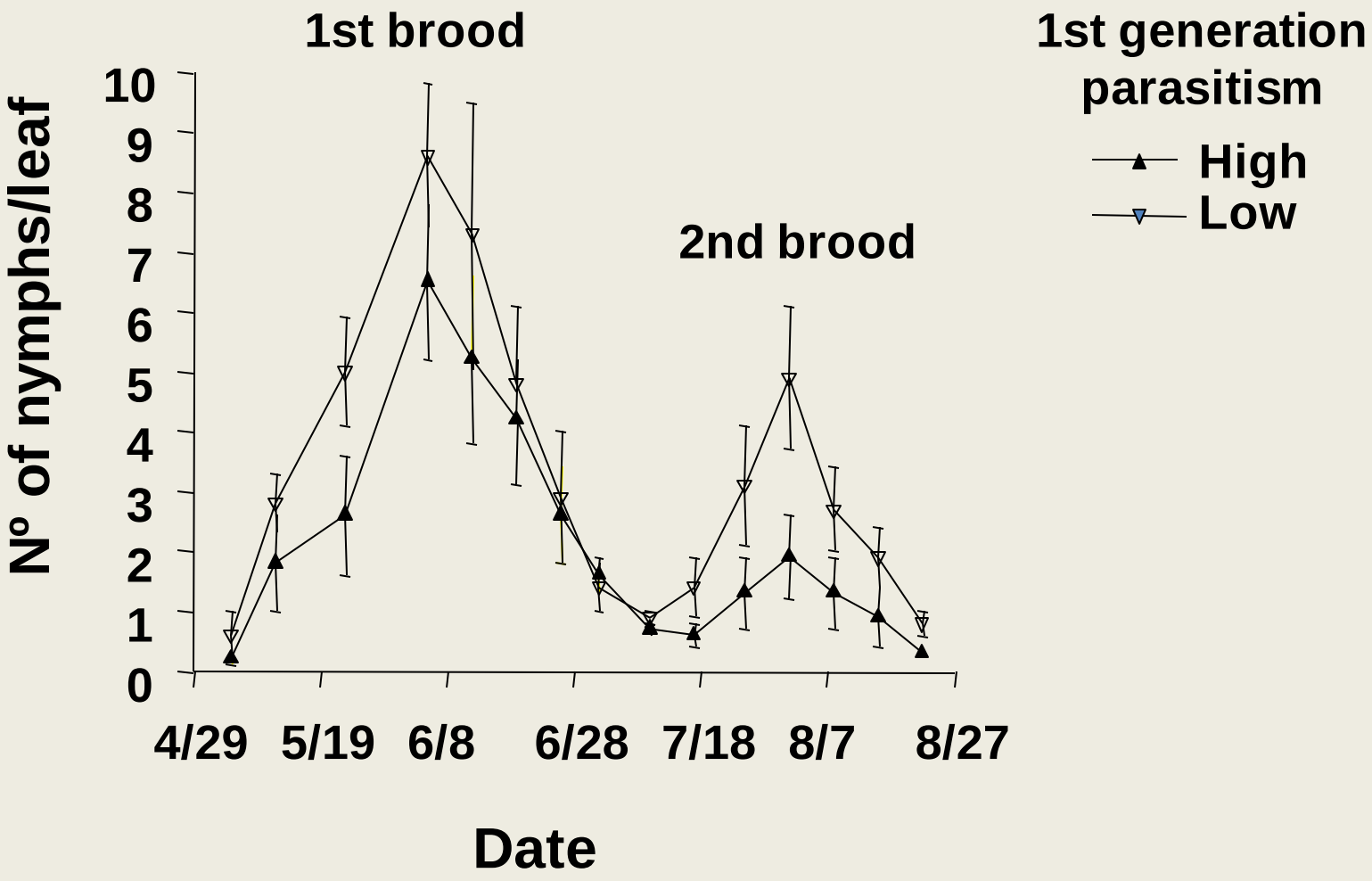
A. erythroneurae
A. daanei
A. tretiakovae

Photos: Jack K. Clark

Western grape leafhopper parasitism monitored in 25 vineyards. Vineyards divided into 2 groups:



Seasonal numbers of Leafhopper nymphs



Overwintering Refuges of the Parasite

Since all leafhopper species that feed on grapes overwinter as adults, *Anagrus* parasitoids overwinter inside eggs of alternate hosts

Photos: Jack K. Clark

Cayote bush, *Baccharis pilularis, as alternate host* (Wilson et al. 2016)

Leafhopper eggs

Female leafhopper lays minute bean-shaped egg under epidermis primarily on underside of expanded leaf.

- Western grape leafhopper:
  - Lays single eggs
- Variegated leafhopper
  - Single eggs embedded deeper in upper or lower surface of leaf, making it harder for the parasites to attack the eggs
- Virginia creeper leafhopper:
  - Lays eggs side-by-side in batches of 2 to 7 (sometimes singly)
  - Covers eggs with bluish-gray secretion.

Photos: Jack K. Clark

Leafhopper Predators

- Spiders are the most important predators

Photos: Jack K. Clark

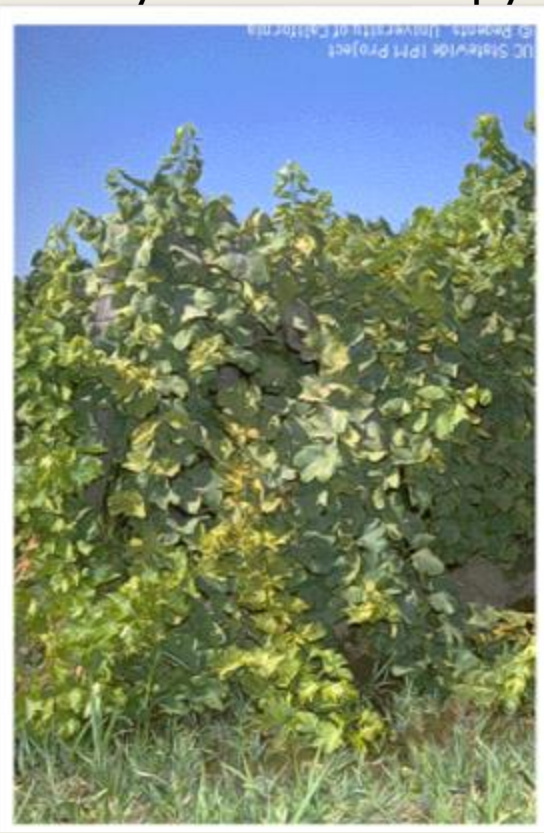
Spider Mites

Photos: Jack K. Clark

- Willamette spider mite, *Eotetranychus willamettei*
  - first pair of legs translucent.
- Pacific spider mite, *Tetranychus pacificus*,
  - first pair of legs yellow to reddish.

Willamette Spider Mite

On shady side of canopy



Form colonies and feed along the vein on the underside of the leaf

Photos: Jack K. Clark

Pacific Spider Mite

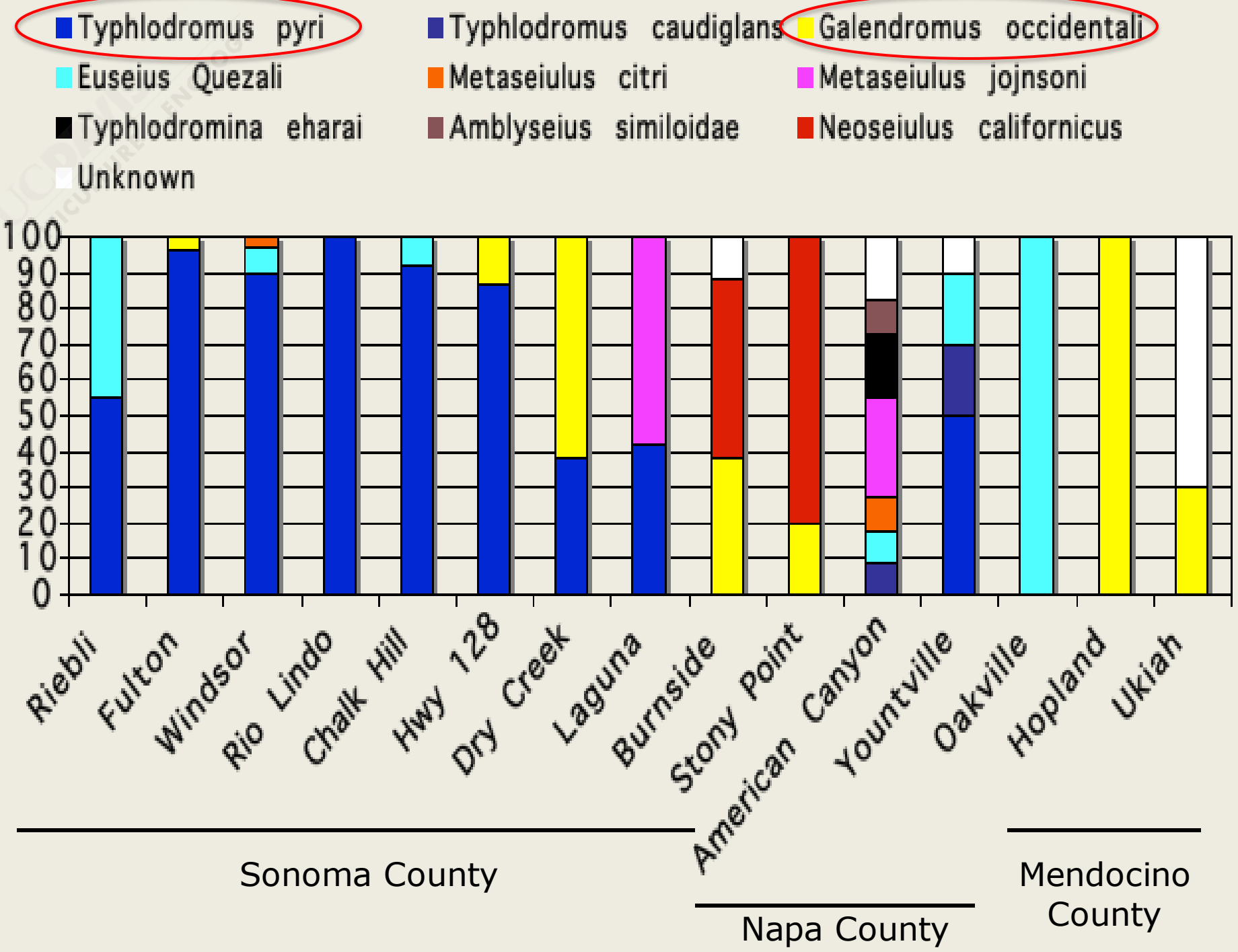
Clump distribution on underside of leaf

On the sun exposed side of the canopy

Photos: Jack K. Clark

Predatory Mites

- Pear shaped, slightly larger than spider mites
- Translucent to slightly reddish
- Moves fast searching
- Oval-shaped eggs


Typhlodromus pyri
Typhlodromus caudiglans
Galendromus occidentali
Euseius Quezali
Metaseiulus citri
Metaseiulus jojnsoni
Typhlodromina eharai
Amblyseius similoidae
Neoseiulus californicus
Unknown
100
90
80
70
60
50
40
30
20
10
0
Riebli
Fulton
Windsor
Rio Lindo
Chalk Hill
Hwy 128
Dry Creek
Laguna
Burnside
Stony Point
American Canyon
Yountville
Oakville
Hopland
Ukiah
Sonoma County
Napa County
Mendocino County

‘Life style’ types proposed by McMurtry and Croft (1997)

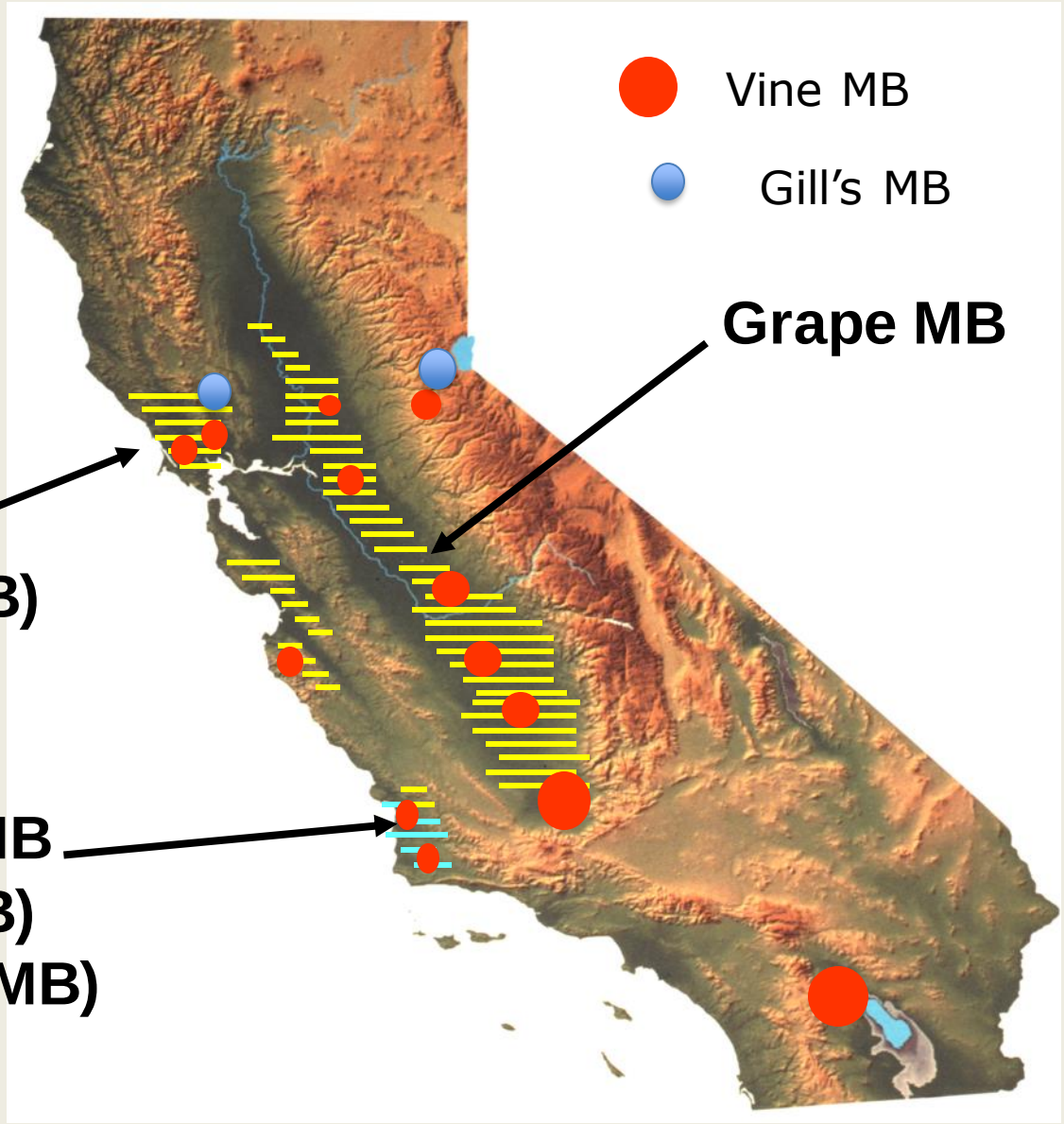
- Type I
  - Specialized predators of spider mites
  - Live in spider mite colonies with dense webbing
- Type II
  - Preference for but not limited to spider mites
  - Commonly live in spider mite colonies with moderate to dense webbing but also prey on other mites, e.g. eriophyids, tydeids
- Type III
  - Food habits include all types of mites, small insects, pollen, nectar
- Type IV
  - Food habits- pollen, spider mites (they don’t enter webbed colonies), other mites, thrips, etc.

Mealybugs in California Vineyards

Photos: Jack K. Clark

Photo: David Haviland

Mealybugs in California



From Kent Daane

Grape Mealybug,

Pseudococcus maritimus

Rectangular shaped
Edge filaments long & thin
Long tails

Defensive fluid deep orange

Obscure Mealybug,

Pseudococcus vibruni

Photos: Jack K. Clark

Rectangular shaped
Edge filaments long & thin
Long tails

Defensive fluid clear

Grape Mealybug,
Pseudococcus maritimus

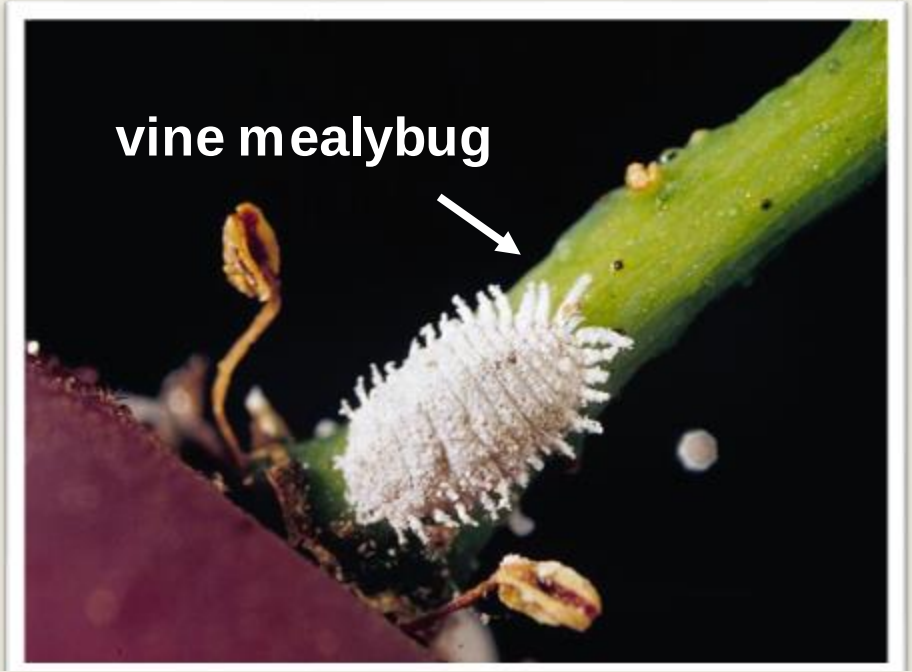
Rectangular shaped
Edge filaments long & thin
Long tails

Vine Mealybug,
Planococcus ficus

Photos: Jack K. Clark

Oval shaped
Edge filaments short & wide
Short tails

Photos: Kent Daane



Grape Mealybug "Complex"

- **long "tail"**

Grape

- **2 generations per year**
- **stages are synchronized**
- **moderate honeydew production**

Obscure

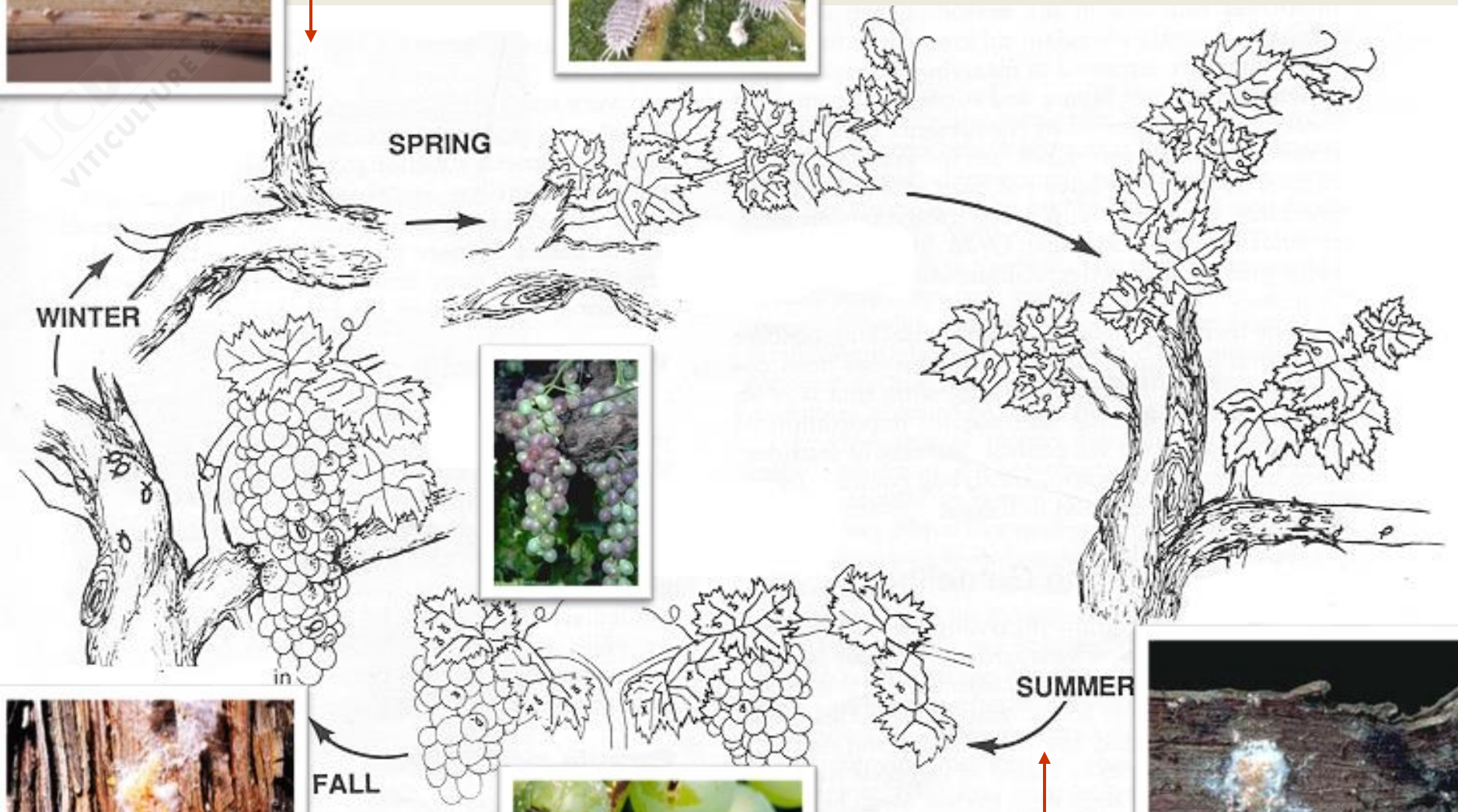
- **2-3 generations per year**
- **stages overlap throughout year**
- **moderate to high honeydew production**

Vine mealybug:

- **short tails**
- **3-7 generations per year**
- **stages overlap throughout year**
- **excessive honeydew production**
- **feeds throughout the canopy**
- **feeds on roots in light soils**

Grape mealybug lifecycle

Crawlers



Crawlers

Photos: Jack K. Clark

Monitoring Grape Mealybug at Delayed Dormant

Photos: Jack K. Clark

- In vineyard with a history of GMB
- Monitor spurs for crawlers

Grape mealybug parasitoids

Complex of several species

- *Pseudophycus angelicus*

Acerophagus notativentris

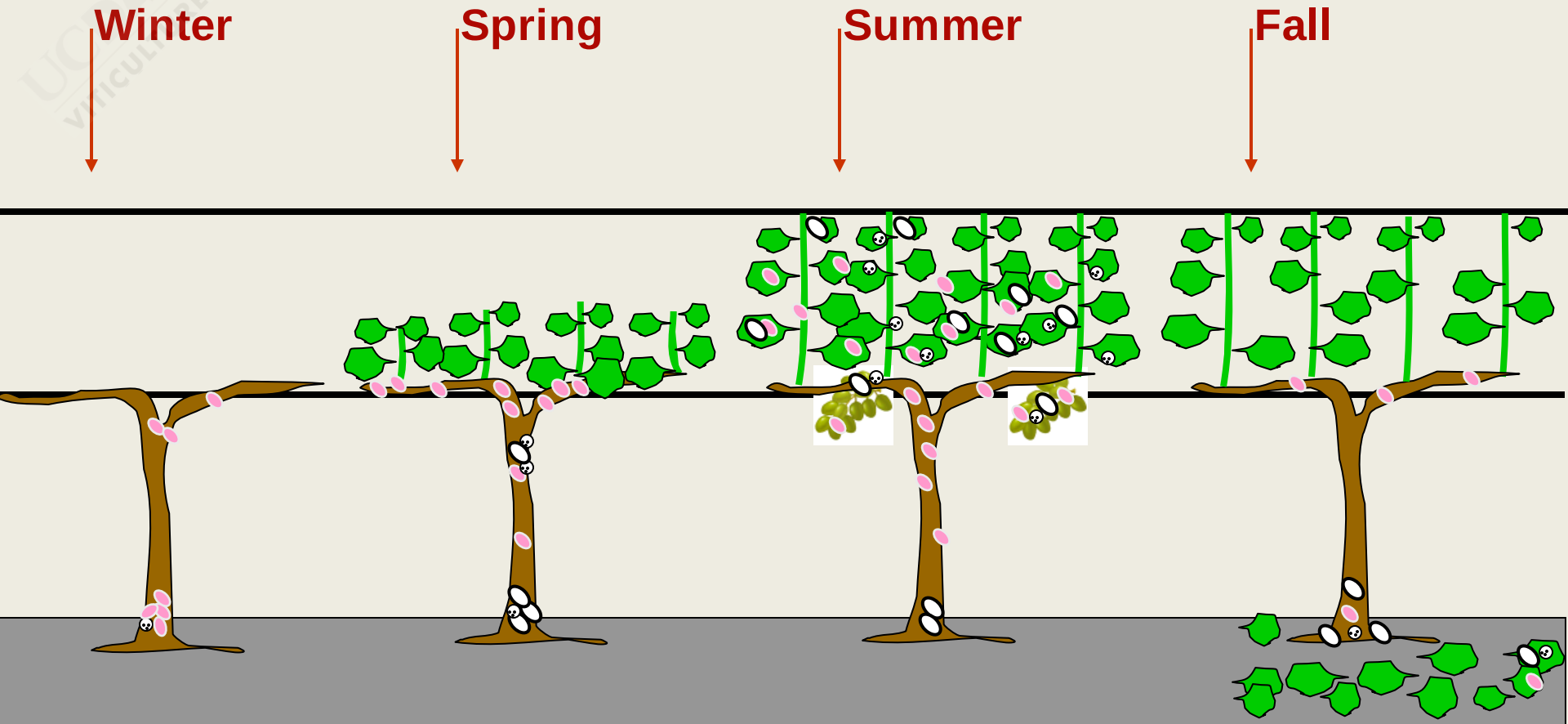
Photos: Jack K. Clark

Biological Control

- Mealybug destroyer (*Cryptolaemus montrouzieri*)

Photos: Jack K. Clark

Vine Mealybug Life Cycle



Drawing Mark Battany (modified)

VMB Infested green-growing vines

Photo: Rhonda Smith

Vine Mealybug Parasite

Anagyrus pseudococci

- **Prefers later vine mealybug stages**
- **In San Joaquin Valley parasitism rate reaches 80% in the summer generations**
- **Overwinters until May**

Photo: Kent Daane

Pheromones lures to monitor for GMB and VMB

Photo: Kent Daane

Gill's mealybug, *Ferrisia gilli*

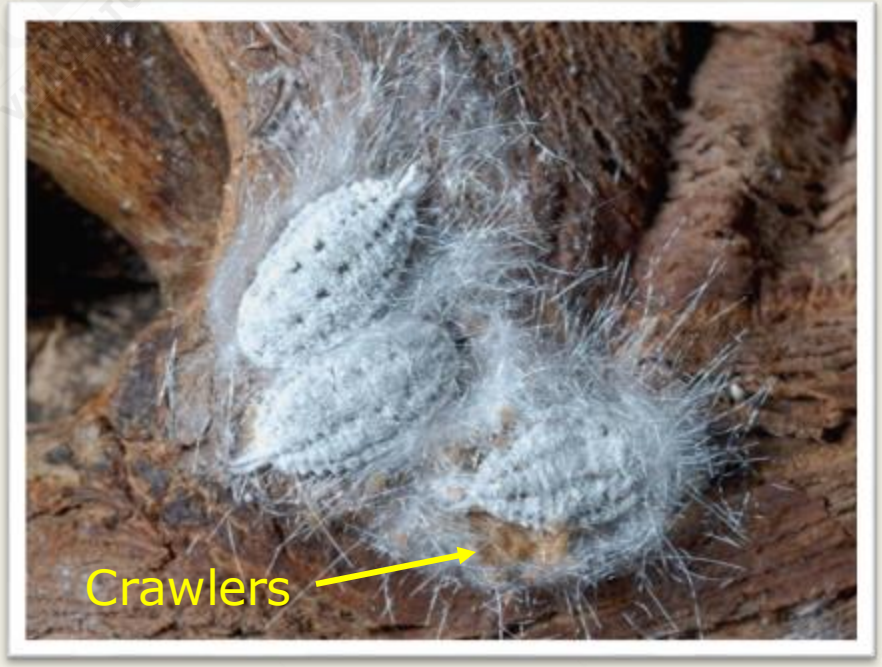


Photo: Kent Daane

- Adult females flat and oval; body faded pink and covered with white wax. Two broad white tails. Covered by white, crystalline filaments
- Give birth to crawlers

Adult male mealybug

Photo: David Haviland

- Two generations/year in Sierra foothills.
- Overwinter as nymphs

Key times for Gill's seasonal development:

- Spring (May): look for adults on young new spurs, shoots.
- Early Summer (late June in foothills): Treat first generation crawlers on leaves-before they enter clusters.
- July-August: Gill's entering clusters.
- Mid-Sept.: 2nd generation Honeydew and ants tending.
- Overwinter: as nymphs (2nds-3rds) under bark.

From Lynn Wunderlich

Parasitoid: *Acerophagus sp*.

Photo: David Haviland

- Parasitizes 2nd and 3rd nymphal stages
- Most commonly found under grapevine trunk bark in early spring and in clusters prior to harvest.

“The Worms”

In clusters:

- Berry feeders: European grapevine moth
- Leafrollers:
  - Omnivorous leafroller
  - Orange tortrix
  - Light brown apple moth

Defoliators:

- Grape leaffolder
- Western grapeleaf skeletonizer

European grapevine moth, *Lobesia botrana*

Photo: Monica Cooper

Three generations a year

First generation larvae feed on flower cluster. 2nd and 3rd generation larvae feed inside berries.

Damage in September 2009

Photo: Jack K. Clark

Photo: Katey Taylor

Leafrollers in California Vineyards

Orange Tortrix,
Argyrotaenia franciscana

Omnivorous Leafroller,
Platynota stultana

Photos: Jack K. Clark

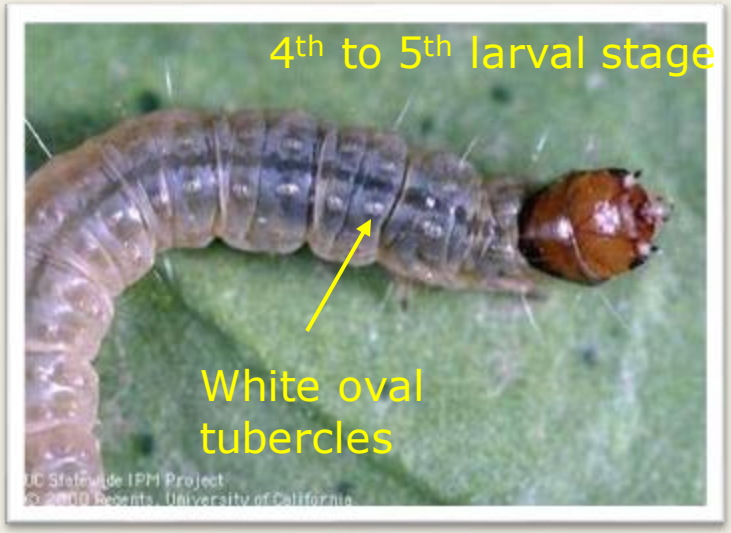
Light Brown Apple Moth,
Epiphyas postvittana

Leafroller Damage

Photos: Jack K. Clark

Leafroller larvae

Omnivorous leafroller

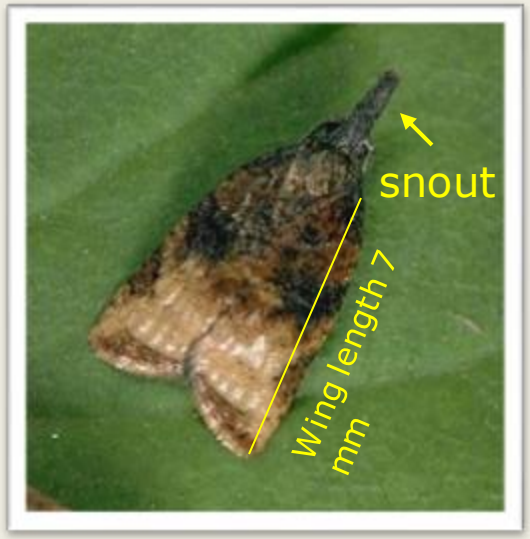


Photos: Jack K. Clark

Traps Catch Males

Orange tortrix

Omnivorous leafroller



Light brown apple moth

Photos: J. K. Clark

Light brown apple moth

MALES IN TRAPS

Photo: B. Oliver, Monterey Ag.Com. Office

Photos: J. K. Clark

Light Brown apple moth

Costal fold

An expanded outer edge of the forewing folds up over the edge of the wing as a flap

Photo: S. Kinnee & M. Epstein, CDFA

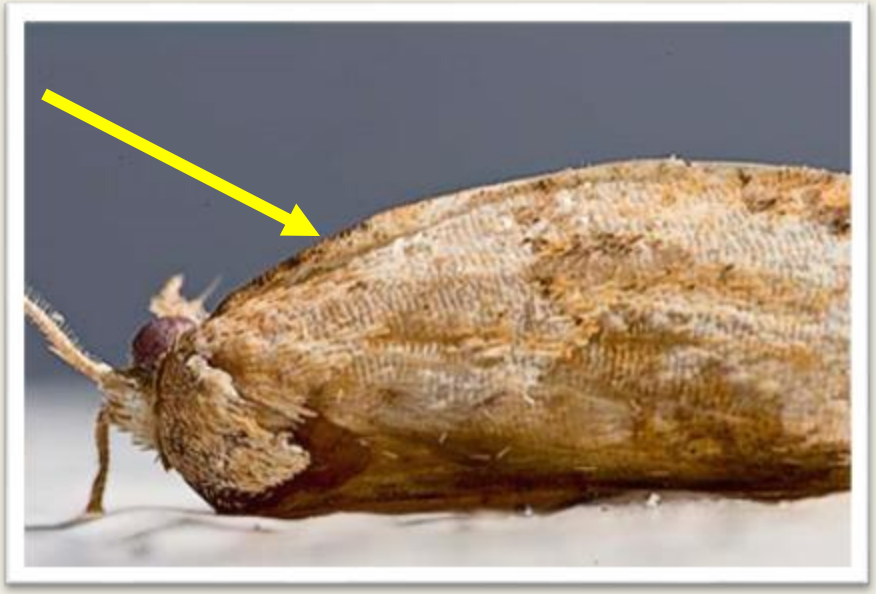


Photo: B. Oliver, Monterey Agricultural Com. Office

Grape Leaffolder, *Desmia funealis*

Photos: Jack K. Clark

- Overwinters in the pupal stage in the vineyard floor
- Three generations a year
- 3rd to 5th stage larvae with small black spots above second pair of legs.

Grape Leaffolder Damage

Young larvae feed in groups between overlapping leaves.

Photos: Jack K. Clark

DAMAGE

- Reduced leaf surface due to leaf roll; defoliation may occur by the third generation

MONITOR

- As larvae begin making rolls examine vineyard twice a week

Parasitoid *Bracon cushmani*

Photos: Jack K. Clark

Western Grapeleaf Skeletonizer

Three generations/year

Overwinters in pupal stage under the bark

Photos: Jack K. Clark

Damage caused by WGLS

Photos: Jack K. Clark

- Leaf damage may continue to increase through the season in uncontrolled populations
- Defoliation may occur by the second or third generation

Biological Control

Photos: Jack K. Clark

European Fruit Lecanium Scale,

Parthenolecanium corni

European Fruit Lecanium Scale

European Fruit Lecanium Parasitoids

Photos: Jack K. Clark

- ***Coccophagus lycimnia***
- ***Metaphycus luteolus***
- ***Metaphycus insidiosus***
- ***Blastothrix longipennis***

Sharpshooters

Photos: Jack K. Clark

Grape Phylloxera,
Daktulosphaira vitifoliae

Photos: Jack K. Clark

- Very small (0.02” wide).
- Lemon yellow.
- Overwinters as small nymphs on roots.
- Starts feeding when soil temperature exceed 60°F.
- 5 to 8 generations/year

Grape Phylloxera Damage

Photos: Jack K. Clark

- Saliva injected as they feed causes roots to swell.
- In the rootlets they cause nodosities.
- On larger roots they cause tuberosities.

Grape Phylloxera Damage

Photos: Jack K. Clark

- Root injuries impair absorption of nutrients and water causing decline of the plant.
- Clay or adobe soils are more favorable to infestation than lighter soils.

Western Flower Thrips, *Frankliniella occidentalis*
Grape Thrips, *Drepanothrips reuteri*

Photos: Jack K. Clark

RESOURCES

- **Grape Pest Management Manual** – 3rd edition, Larry Bettiga editor
  UC DANR Publication # 3343

- **Vineyard Pest Identification and Monitoring Cards:**
  UC DANR Publication #3532 - English
  UC DANR Publication #3538 - Spanish
  UC DANR Publication # 9012 ibook & #9016 – MOBI/kindle

- **UC Statewide Integrated Pest Management Program website:** http://ipm.ucanr.edu/PMG/selectnewpest.grapes.html