Biology and Management of Avocado Lace Bug in California

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What Will We Talk About?

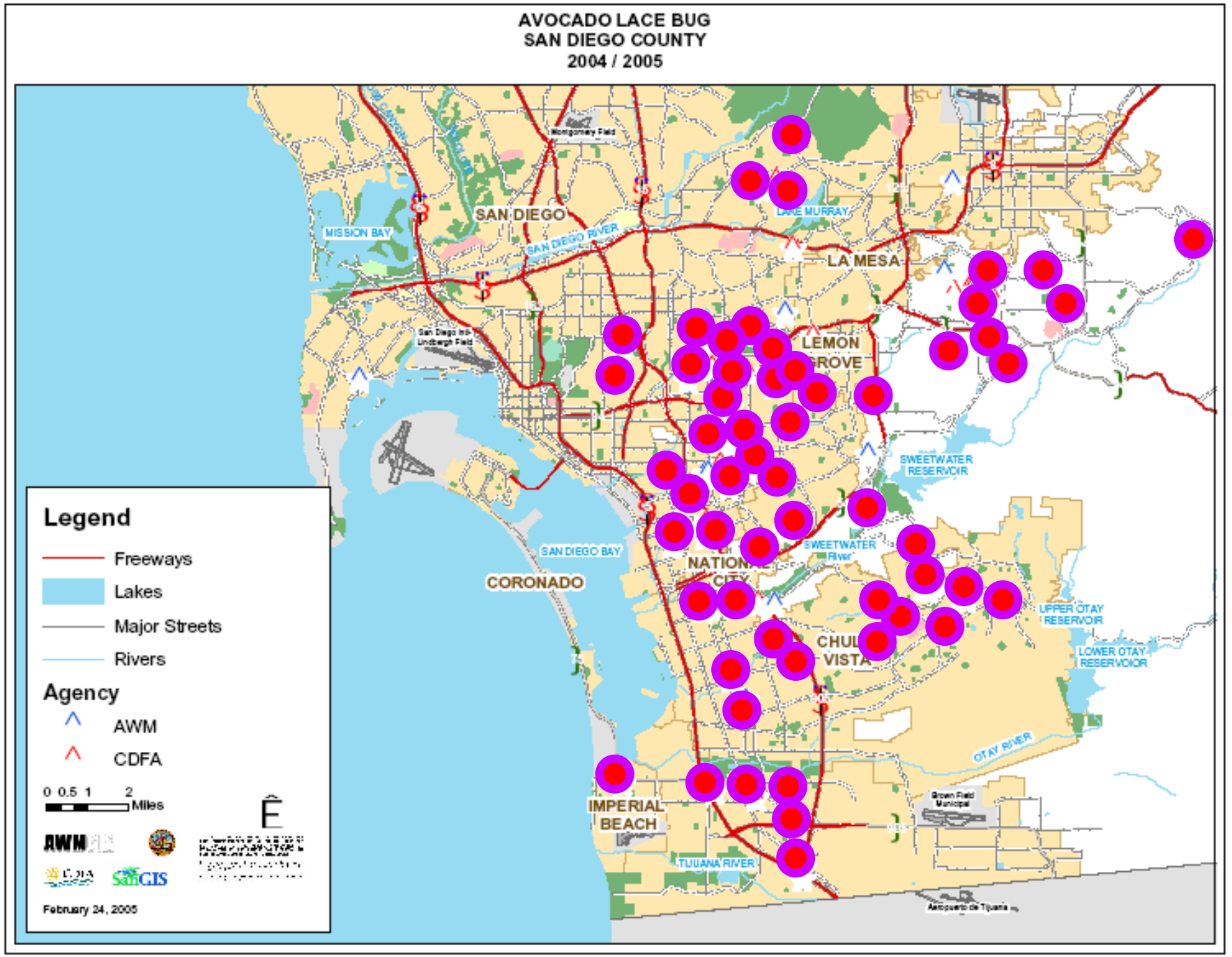
- Biology, damage, and distribution of ALB
- First invasion into California
- Response to this invasion
  - Phenology studies
  - Natural enemy & insecticide evaluations
- Second invasion into California?
  - Populations established in commercial Hass avocado orchards in Fallbrook, Bonsall, Oceanside

Avocado Lace Bug Overview

- *Pseudacysta perseae* (Hemiptera: Tingidae)
  - First described in 1908 from specimens collected in Florida
- Detected in National City San Diego in Sept. 2004
  - Outbreaks reported in Fallbrook-Bonsall-Oceanside-LA area in late 2017
- Adults & nymphs live on undersides of leaves
  - Feeding damages leaves
- Host plants – avocado, camphor, & red bay (all Lauraceae)

What Do We Know About ALB?

- Relatively little is known about avocado lace bug
  - Reported as a sporadic pest from Florida
    - Pesticide disruption of biocontrol?
  - Major pest in Dominican Republic & Puerto Rico
    - Hass avocados highly preferred
  - Outbreaks typically occur in hot dry periods
  - Avocado cultivars vary in susceptibility to attack
    - Bacon and Hass in California
  - Heavy attacks may reduce fruit yields due to defoliation and sunburn


AVOCADO LACE BUG
SAN DIEGO COUNTY
2004 / 2005
SAN DIEGO
MISSION BAY
SAN DIEGO RIVER
LAKE MURRAY
LA MESA
LEMON GROVE
SWEETWATER RESERVOIR
SWEETWATER River
SAN DIEGO BAY
CORONADO
NATION CITY
CHUL VISTA
UPPER OTAY RESERVOIR
LOWER OTAY RESERVOIR
OTAY RIVER
IMPERIAL BEACH
TIJUANA RIVER
Legend
Freeways
Lakes
Major Streets
Rivers
Agency
AWM
CDFA
0 0.5 1 2
Miles
February 24, 2005


Feeding damage may be amplified by pathogenic fungi, possibly *Colletotrichum* spp.

Tip Burn & ALB Feeding Damage

Pop Up Quiz - 1

- **Where and when was avocado lace bug first detected in California?**
  - **(A) Balboa Park, SD 2002**
  - **(B) National City, SD 2004**
  - **(C) El Cajon, SD 2005**
  - **(D) Oceanside, SD 2007**

Pop Up Quiz - 2

- **Avocado lace bug feeding damage may be confused with what other type of leaf problem?**

- **(A) Anthracnose infections**

- **(B) Zinc and phosphorus deficiencies**

- **(C) Rot root infections**

- **(D) Tip burn from salty irrigation water**

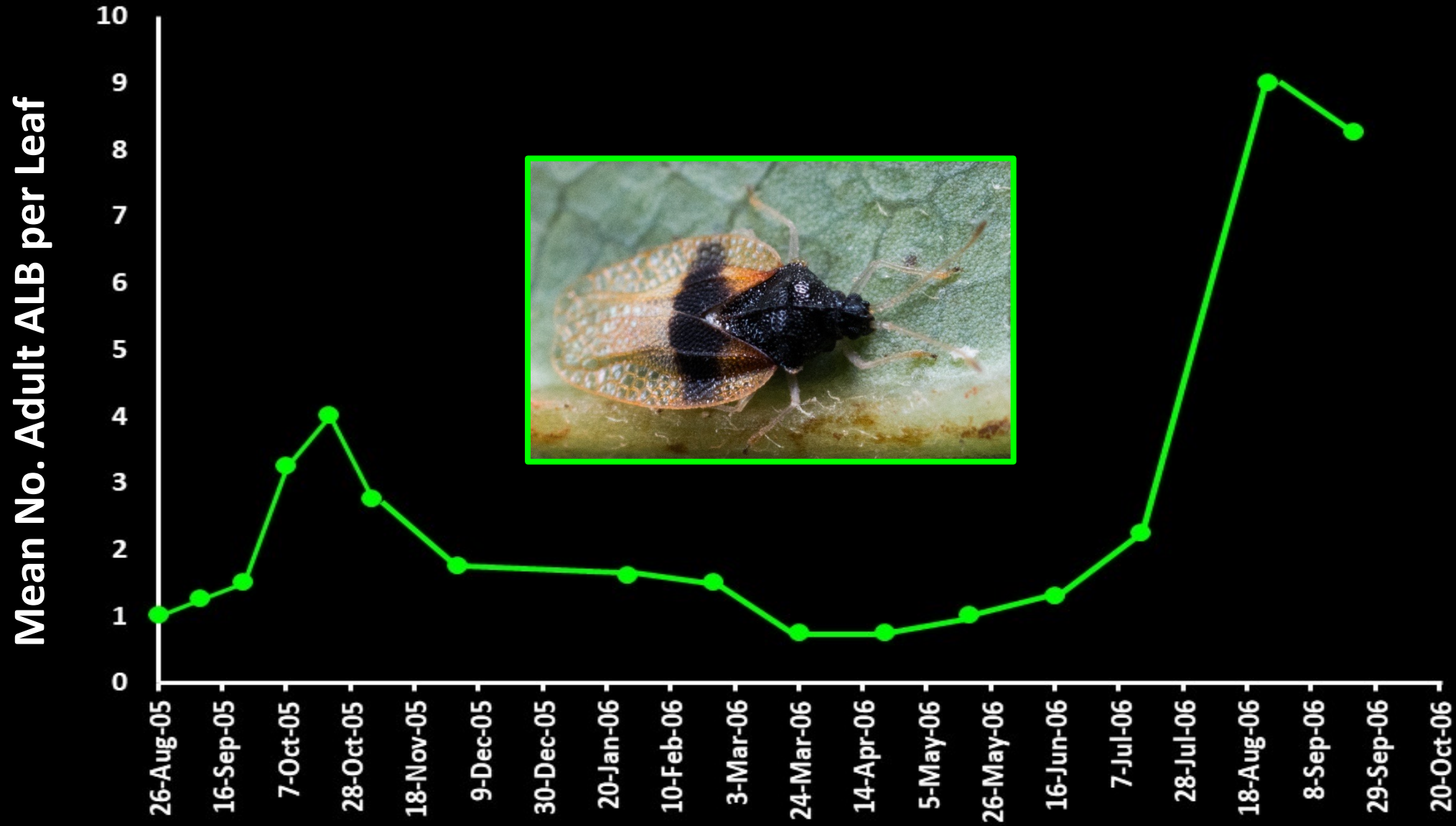
Threshold temperature for Egg-Adult Development is ~50°F (10°C)
435 Degree-Days (°C) to complete development (815 degree-days [°F])

14 Days

Life Cycle of Avocado Lace Bug at 77°F (25°C)

14 Days

Adult ALB Phenology Across Six Sites in Urban San Diego

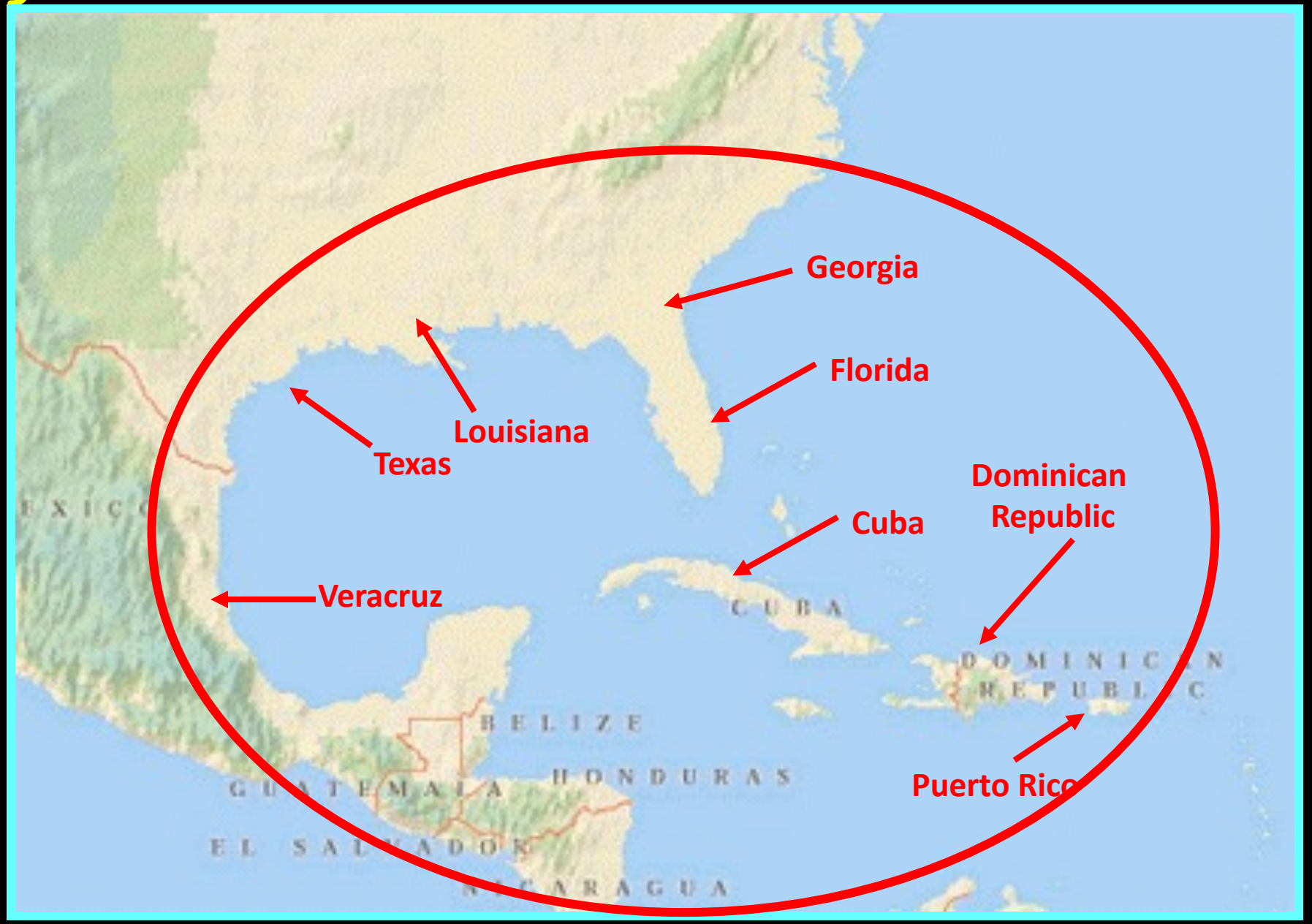


Pop Up Quiz - 3

- **Avocado lace bug life cycle has which of the following life stages?**

- **(A) Eggs, nymphs, adults**
- **(B) Eggs, larvae, adults**
- **(C) Eggs, larvae, pupae, adults**
- **(D) Eggs larvae, propupae, pupae, adults**

Presumed Native Range of Avocado Lace Bug?



Biological Control of ALB

- Natural Enemies
  - Natural enemies are known from Florida
    - Egg parasitoids
      Oligosita sp.
      Erythmelus sp.
    - Generalist predators
      Franklinothrips,
      lacewing larvae,
      mirids
- Unable to provide population level suppression of ALB?

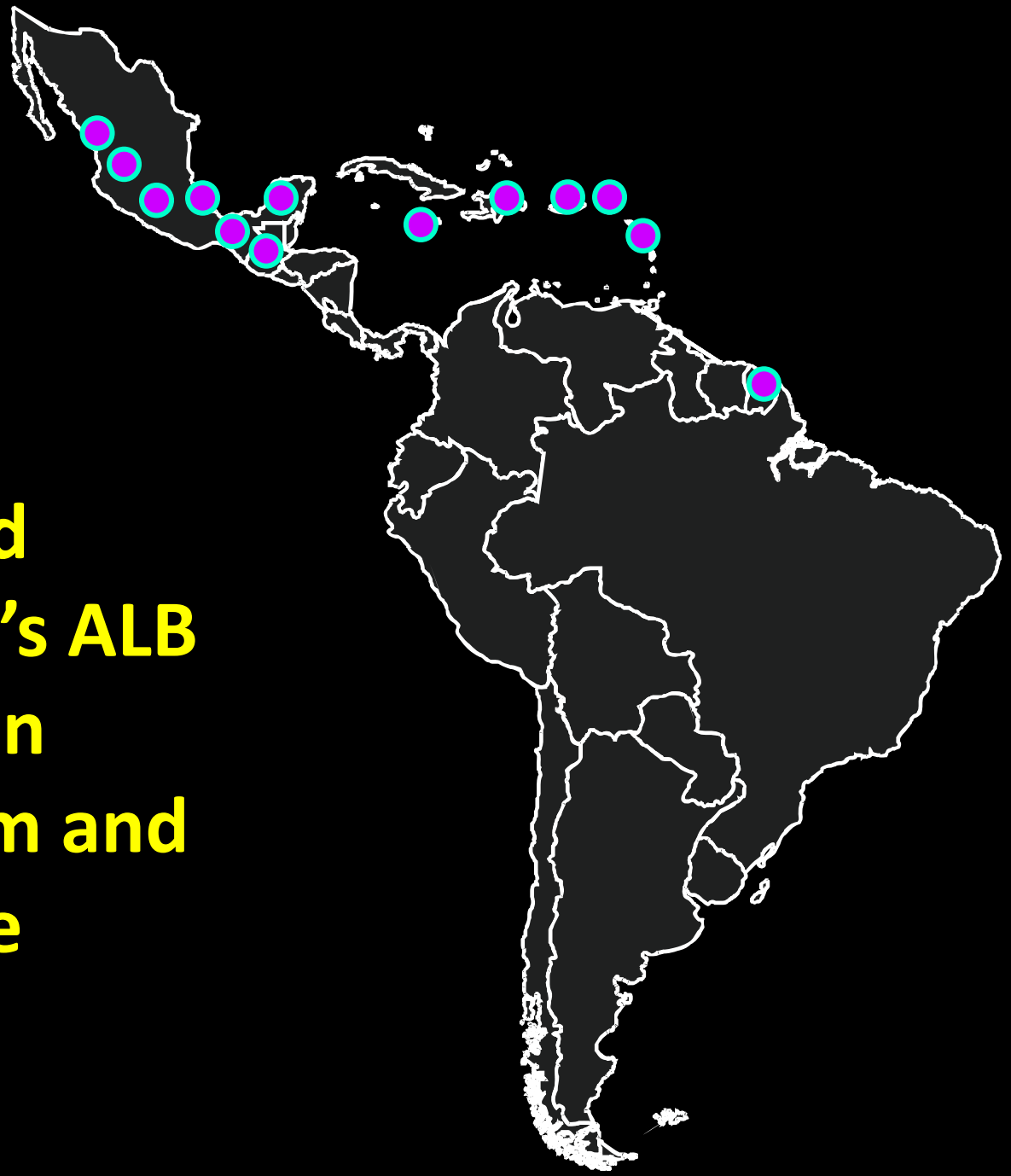
Foreign Exploration for ALB

- Two pronged approach
  - Genotyping project
    - Genotype the CA population and compare to specimens collected through out the home range of ALB
      - Determine if we have ALB or another species
      - Determine where the CA population originated
  - Natural enemy collections
    - Collect egg parasitoids for ALB in home range
    - Identify egg parasitoids – must be host specific
      - No keys to tingid egg parasitoids
      - Most species are undescribed

Collecting ALB in Jamaica in 2006

Phil Phillips Collecting ALB in St. Thomas in 2006

Where did California's ALB population come from and is ALB one species?



Mexico

- Yucatan
- Veracruz
- Michoacán
- Nayarit
- Jalisco
- Colima
- Guerrero
- Tabasco
- Chiapas

Central America

- Guatemala

Caribbean

- Dominican Republic
- Jamaica
- Puerto Rico
- St. Thomas
- St. John
- St. Lucia
- St. Kits

South America

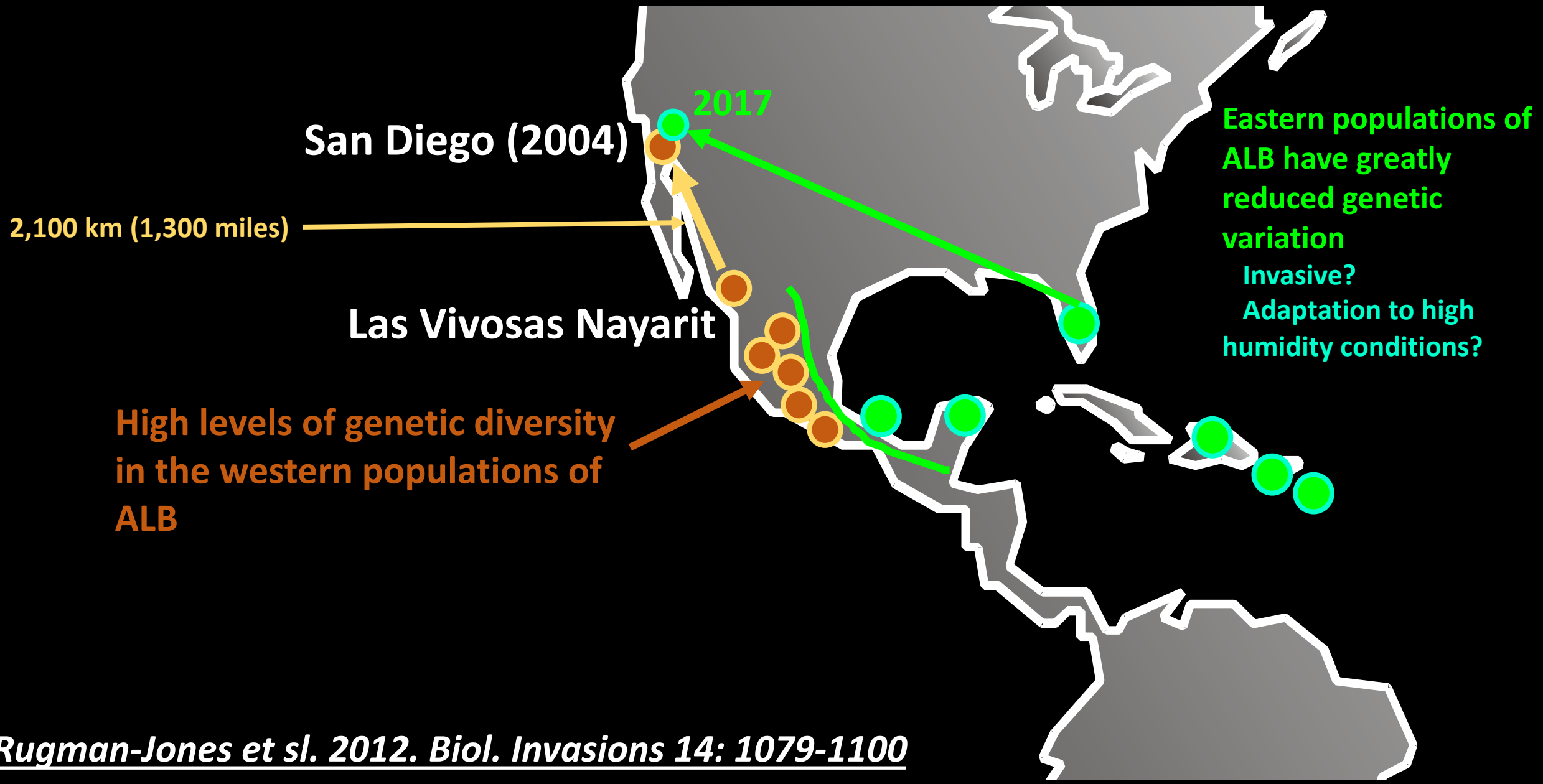
- French Guiana

What Did the Molecular Work Reveal?

- Mitochondrial and nuclear markers used to pin point the geographic origin of the ALB population that invaded California
  - Microsatellites from source populations compared to CA populations to refine relatedness
- Mitochondrial haplotypes indicated that California's population related to specimens collected from TX, Guerrero, Chiapas, Tabasco, Nayarit, Jalisco, and Michoacán (all Mexico)
- Microsatellites indicated that California's ALB population most similar to specimens collected in the State Nayarit, specifically Las Vivosas
  - Located in the tourist-popular Mexican Riviera
- ALB one species, no evidence of cryptic species

Road side stall selling small potted avocado plants in Las Vivosas, Nayarit

What Else Did the Molecular Work Reveal?



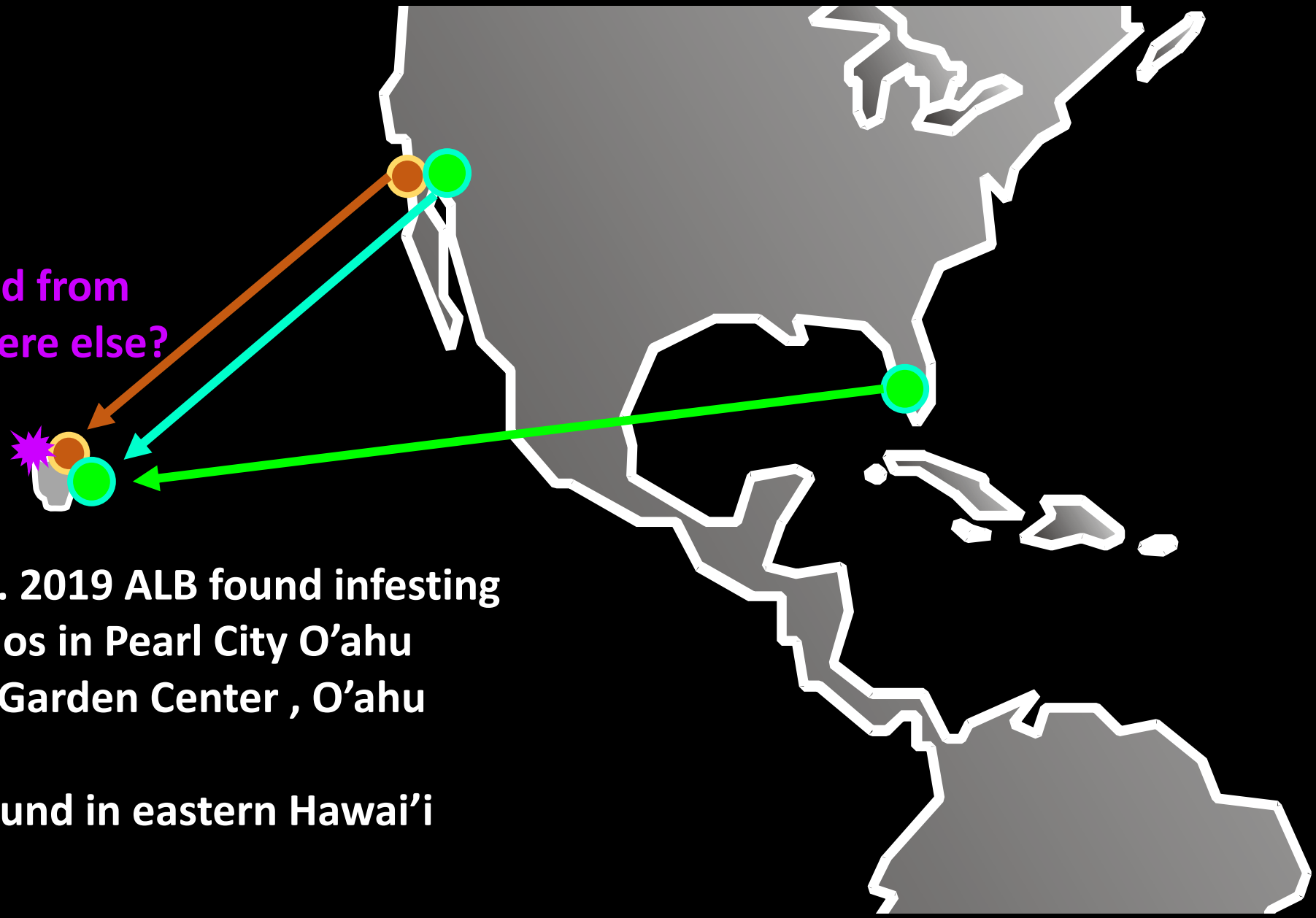
Rugman-Jones et sl. 2012. Biol. Invasions 14: 1079-1100

Pop Up Quiz - 4

- **Foreign exploration and molecular analyses of avocado lace bug DNA suggest that the founding population that first invaded San Diego in 2004 likely originated from……..**

- **(A) Fort Lauderdale, Florida USA**
- **(B) Las Vivosas, Nyarit Mexico**
- **(C) Escuintla, Santa Maria Guatemala**
- **(D) Santo Domingo, Distrito Nacional, Dominican Republic**

ALB Has Invaded Hawai'i



Invaded from somewhere else?

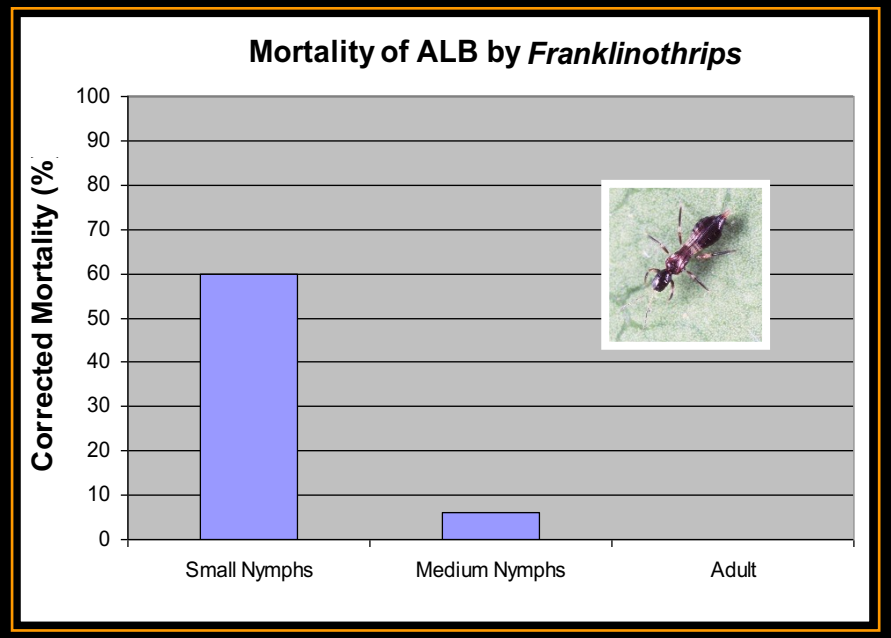
29 Dec. 2019 ALB found infesting avocados in Pearl City O'ahu Urban Garden Center , O'ahu

Also found in eastern Hawai'i Island

Did We Find Natural Enemies?

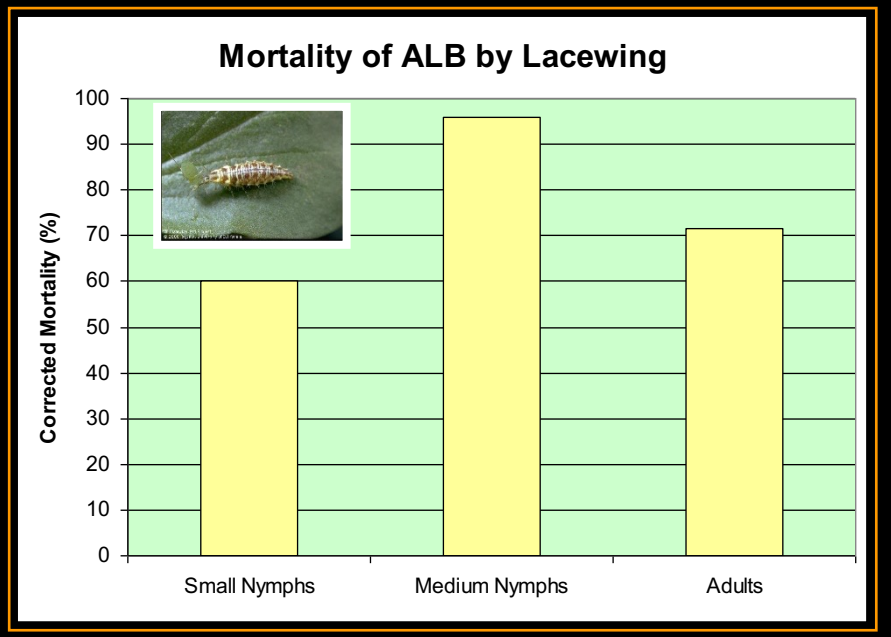
- **Extensive rearing of egg masses throughout Mexico and the Caribbean**
  - **Returned to UCR's Insectary and Quarantine Facility under USDA-APHIS permits**
  - **No natural enemies reared from eggs**
  - **Most populations when found were large and extremely damaging**
    - **When found generalist predators dominated**
      - ***Franklinothrips* sp. common in ALB outbreaks in Dominican Republic and Guatemala**
      - ***Franklinothrips orizabensis* already present in CA**

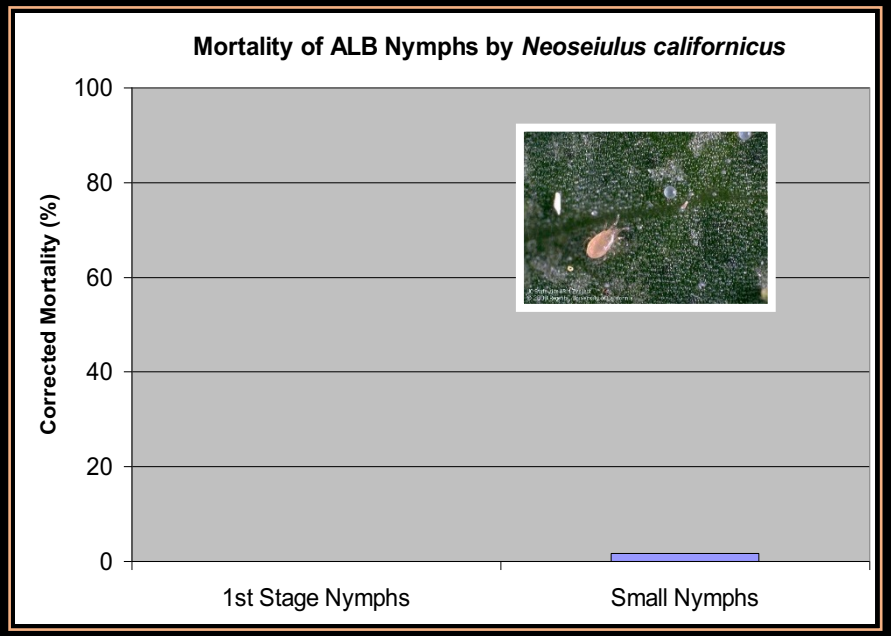
Commercially Available Natural Enemies



5-15 ALB prey, small, medium, or adults presented to predators for 24 hr

Paired controls used to correct for mortality



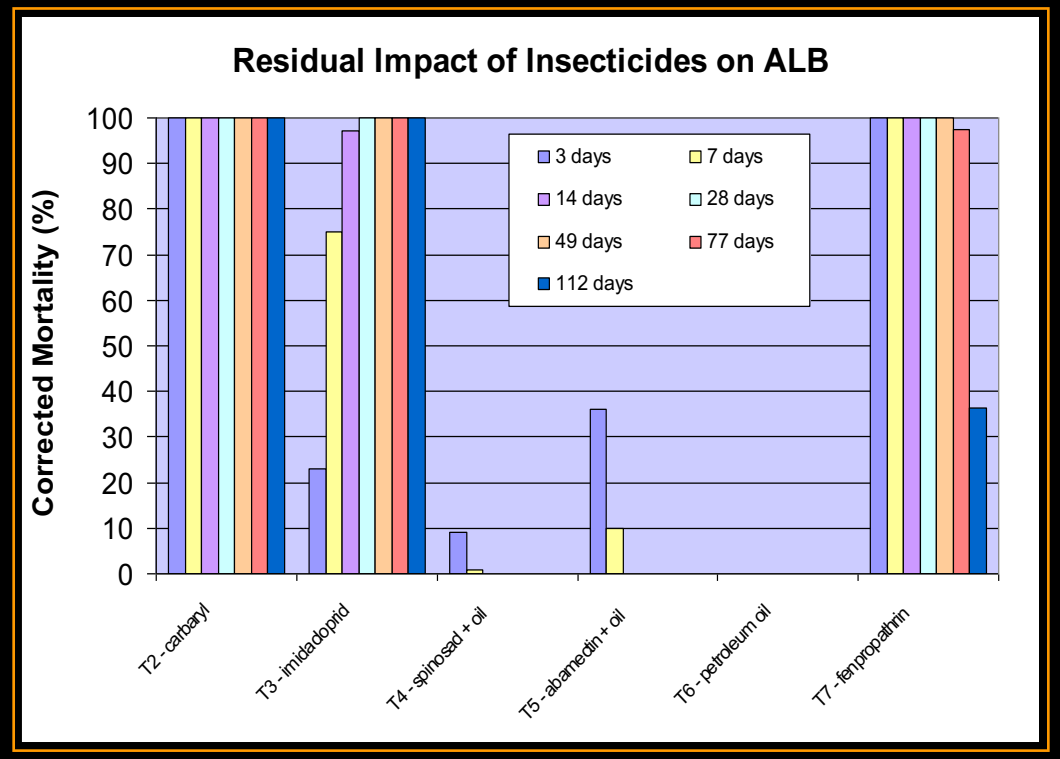


Chrysoperla rufilabris **larvae consumed all life stages presented**

Franklinothrips **preferred small nymphs**

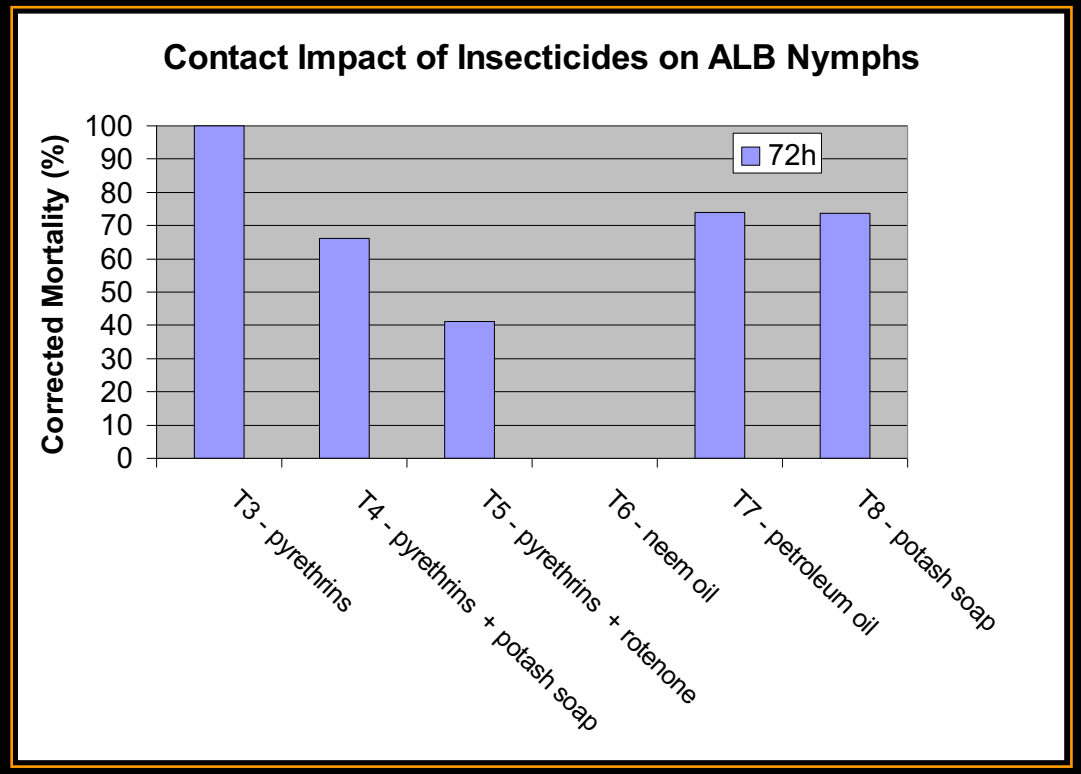
Neoseiulus californicus **not effective against ALB nymphs. Predation of ALB eggs not tested**

Insecticide Efficacy Trials - Lab



Carbaryl, imidacloprid, and fenpropathrin most effective

Spinosad/abamectin not recommended



Pyrethrin most effective contact tested

Chemigation of Avocado Trees with Imidacloprid

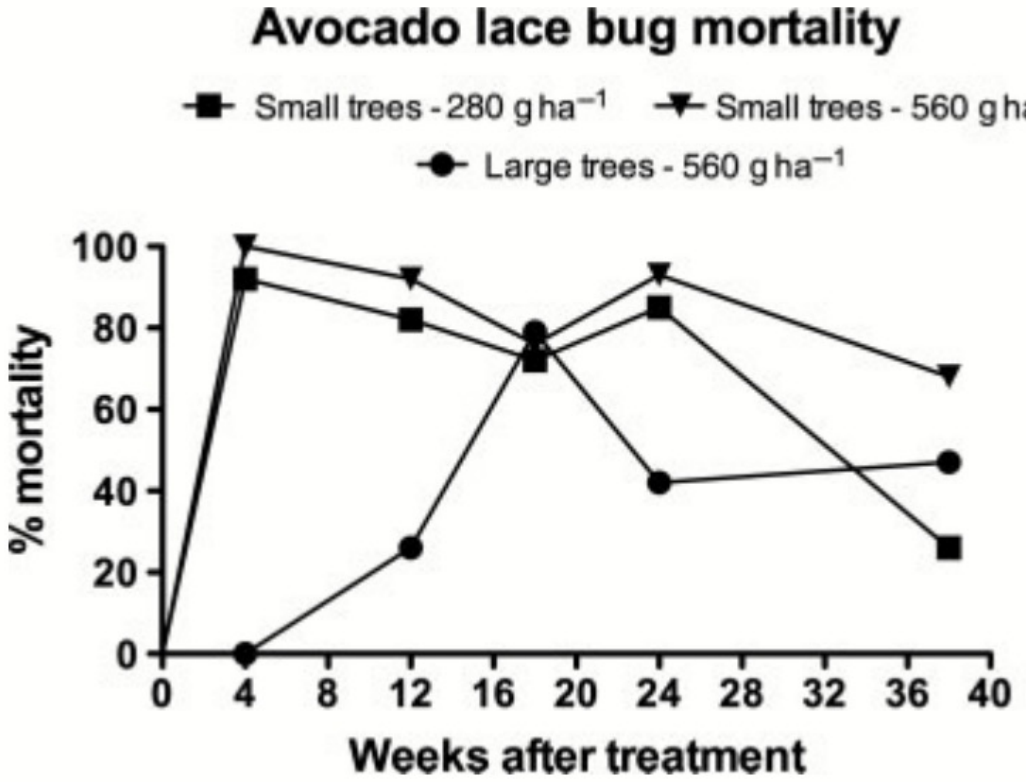


Figure 4. Avocado lace bug mortality in bioassays conducted using leaves sampled from avocado trees treated with imidacloprid. The small trees were treated at two rates of imidacloprid (280 and 560 g ha^{-1}) and the large trees were treated at the higher rate only. Each point is the mean % mortality for ten bioassay cells.

Trail run on Hass avocados in a commercial orchard in Fallbrook

Applications made in March (30th [2006]) or June (9th [2005)]

Large Trees = 9-12 m tall, 25 yr old

Small trees = 3-4 m tall, 6 yr old

Byrne et al. (2010) Pest Manag. Sci. 66: 1129-1136

Pop Up Quiz - 5

- **Lab trials suggest which type of natural enemy may be the most effective predator of avocado lace bug?**
- **(A) Spiders**
- **(B) *Franklinothrips orizabensis* (a predatory thrips)**
- **(C) *Neoseiulus californicus* (a predatory mite)**
- **(D) *Chrysoperla rufilabris* (predatory lace wing larvae)**

More Information?

www.biocontrol.ucr.edu/avocado-lace-bug

https://www2.ipm.ucanr.edu/agriculture/avocado/Avocado-lace-bug

Questions?