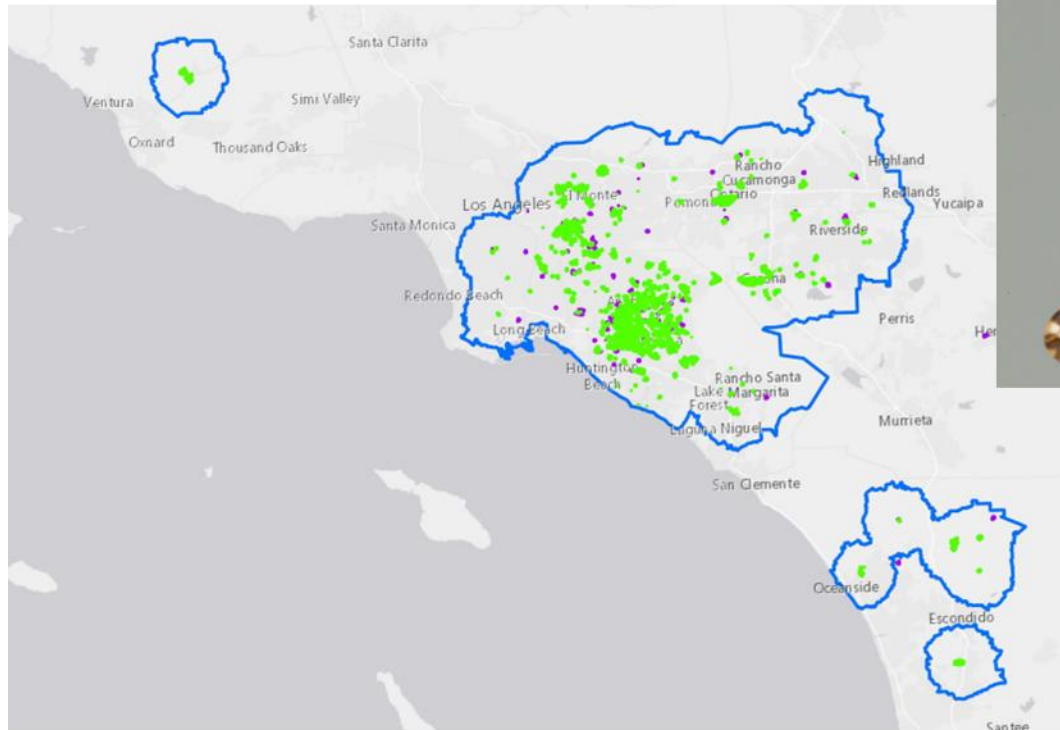


Effectiveness of Asian citrus psyllid management in huanglongbing quarantine zones



photos: Mike Lewis

Matt Daugherty, UC Riverside, mattd@ucr.edu



Asian citrus psyllid, *Diaphorina citri*

Native to Asia, highly invasive in the Americas

- strong preference for citrus
- dynamics tied to “flushing”

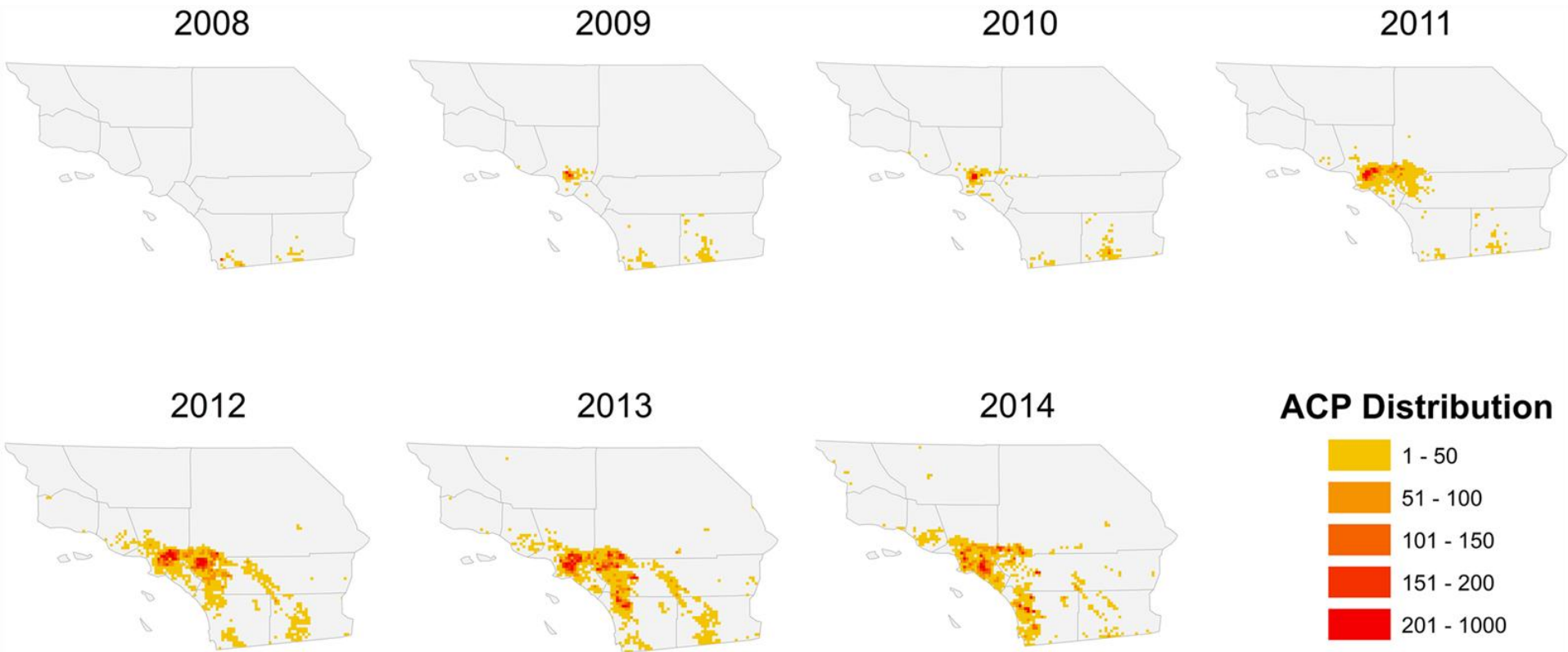
Vector of bacterium associated with huanglongbing

- yellowing leaves, improper fruit development, stunting, tree death

ACP first detected in CA in 2008, HLB in 2012

ACP first detected in 2008, rapidly spread in residential areas

First detected in commercial citrus in 2011



HLB first detected in residential LA County in 2012

Invasion of residential citrus

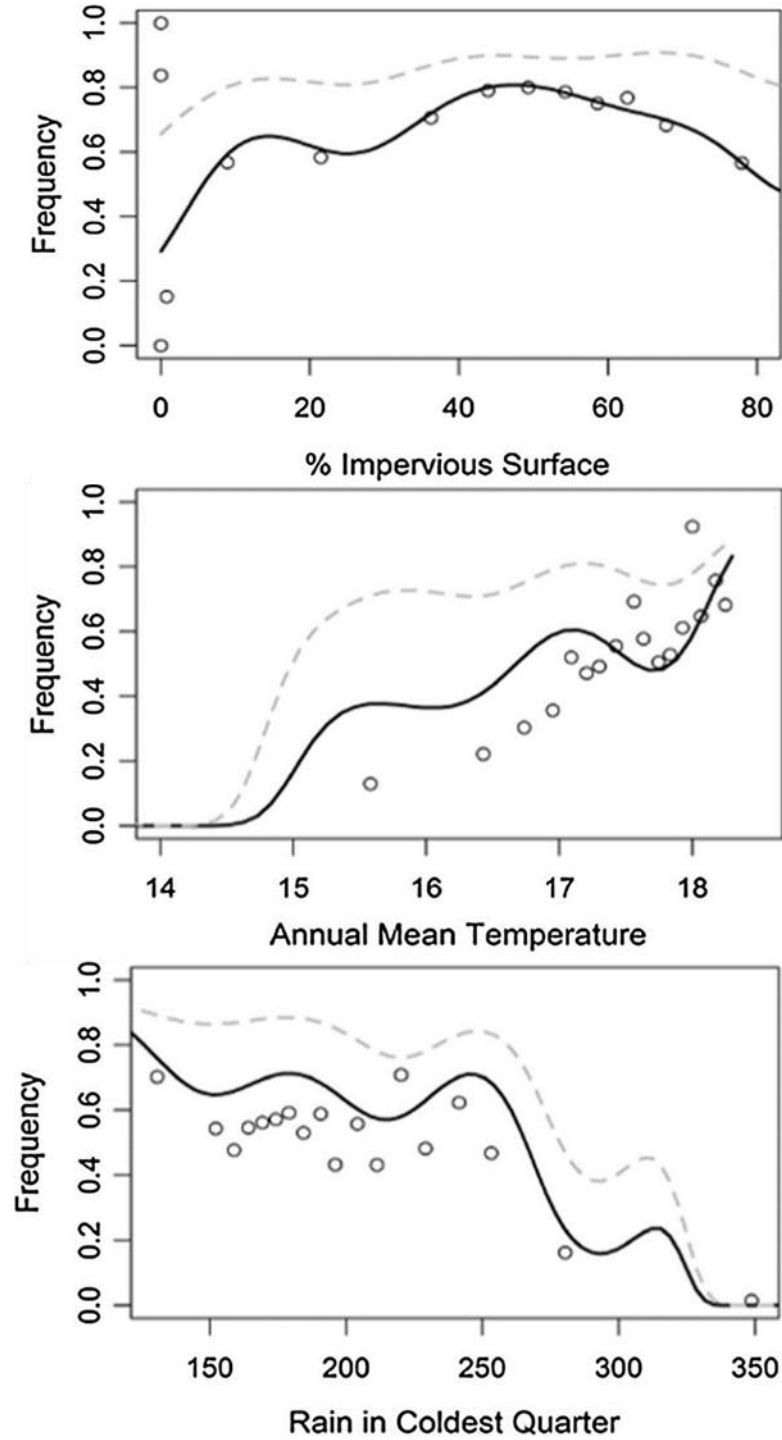
Evidence of human-assisted introduction

Establishment and spread favored by:

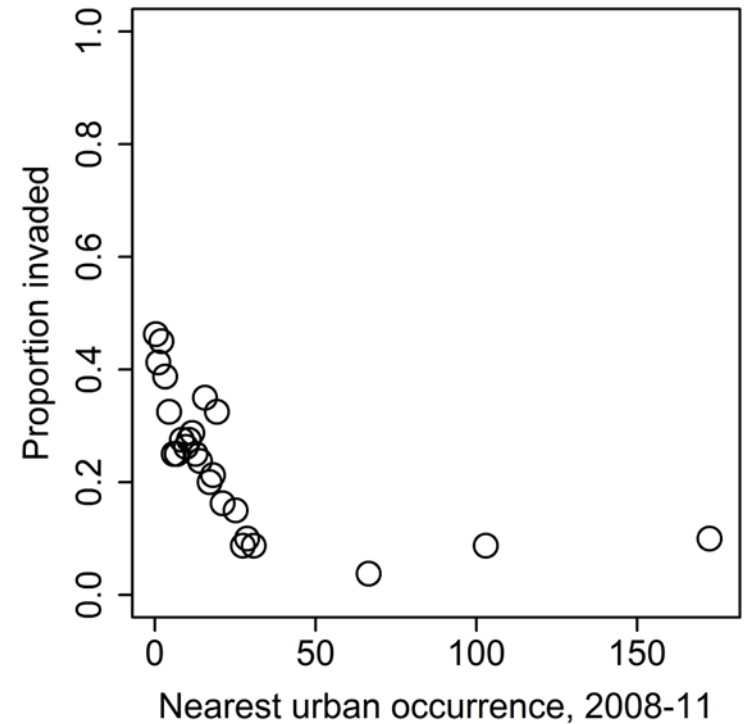
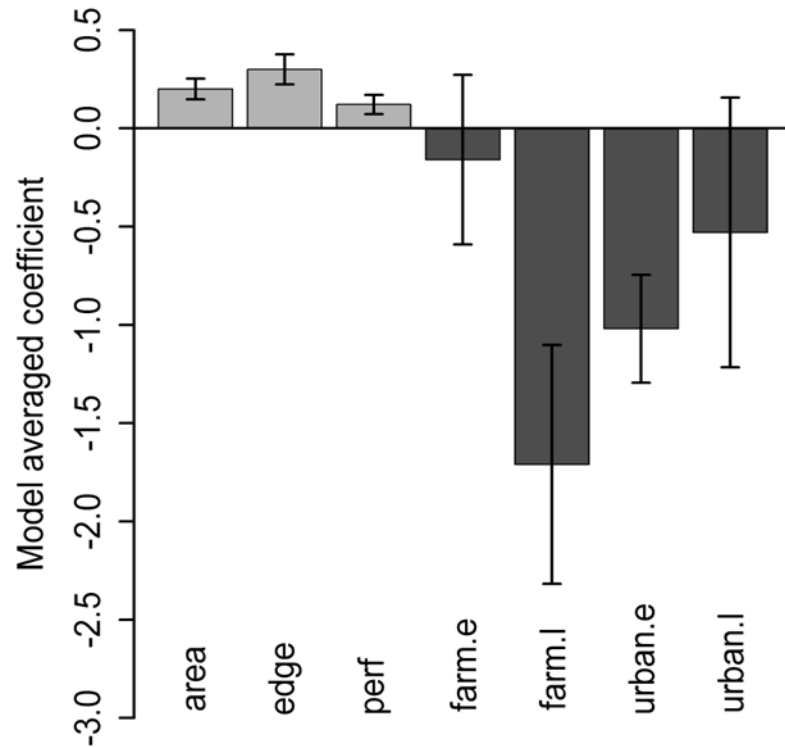
1. access to residential citrus

2. favorable climatic conditions

+ temperature, - rainfall



Spillover into commercial citrus



Bayles et al. 2022

- Invasion rate of groves largely driven by proximity to ACP detections in residential citrus

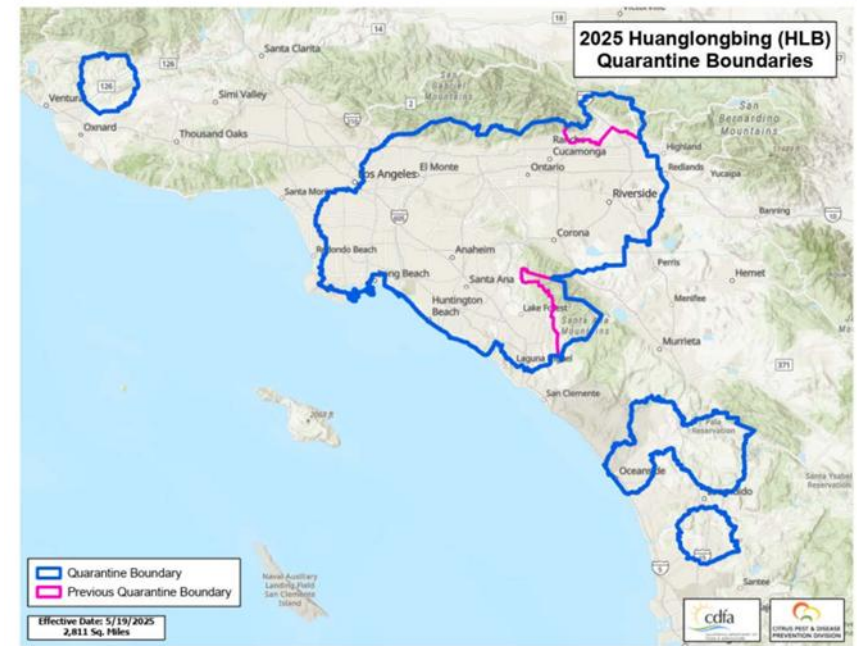
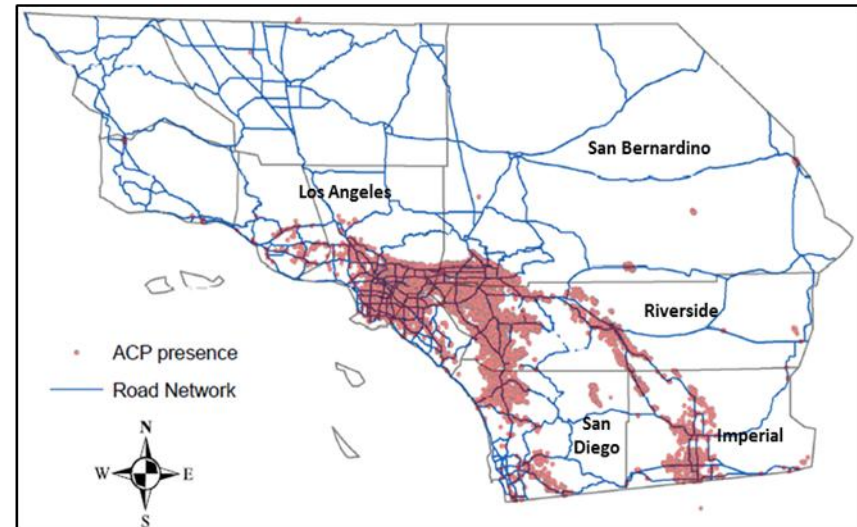
Current status of ACP, HLB in California

ACP is widespread in Southern California citrus

- present, but rare, as far north as Sacramento & Bay Area

More than 10,000 HLB cases detected to date

- 4 distinct quarantine areas
- thus far limited to non-commercial citrus



For more information on ACP and HLB

UC IPM Pest Management Guidelines (updated Nov 2024)

<https://ipm.ucanr.edu/agriculture/citrus/asian-citrus-psyllid/#gsc.tab=0>

ACP/HLB Distribution & Management (being updated)

<https://ucanr.edu/site/asian-citrus-psyllid-distribution-and-management>

ACP and HLB management in residential citrus

Sticky trap monitoring

Strategic surveys for diseased trees

- removal of infected trees
- insecticide treatments of neighboring citrus

“Buffer treatments” near commercial groves

Biological control releases in residential citrus

<https://www.cdfa.ca.gov/citruscommittee/docs/ActionPlan.pdf>

Huanglongbing (HLB)

 Regulation and Quarantine Boundaries

 Pest Hotline: 1-800-491-1899

The plant disease known as Huanglongbing (HLB) is believed to be caused by a phloem-restricted bacterium which is vectored by the Asian Citrus Psyllid (ACP).

Residential ACP treatments

Following CLas/HLB detection, tree treated, then removed

Inspection of neighboring properties, treatment of any ACP hosts

- formerly 800 m, then 400 m, now 250 m
- up to 2 years



Residential ACP treatments

Following CLas/HLB detection, tree treated, then removed

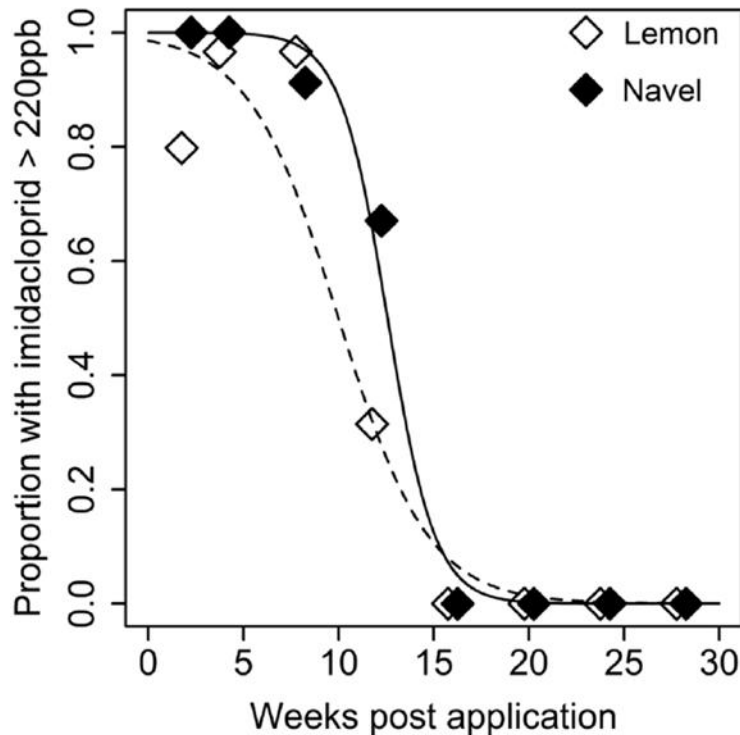
Inspection of neighboring properties, treatment of any ACP hosts

- cyfluthrin (Tempo) a foliar pyrethroid
- imidacloprid (Merit) a systemic neonicotinoid



Residential ACP treatments

Systemic neonicotinoids can provide long-term protection from ACP for nursery stock and mature commercial groves



Little information about effectiveness in residential citrus

Classical biological control of ACP

Tamarixia radiata

- nymphal ectoparasitoid
- preference for 4th, 5th instars
- prone to host-feeding

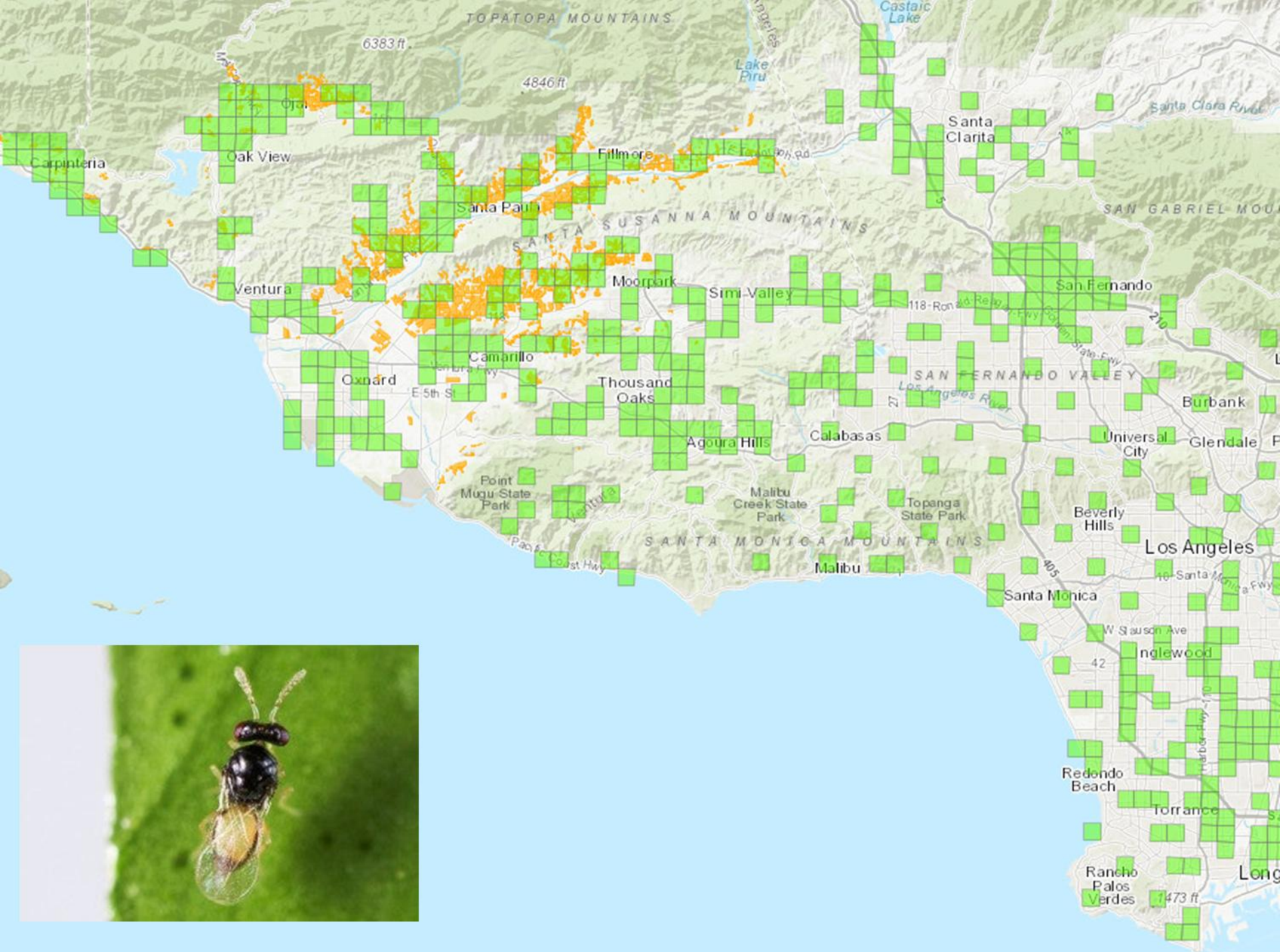
Imported from Pakistan

- host-range testing at UCR

First releases late 2011

> 30 M released to date

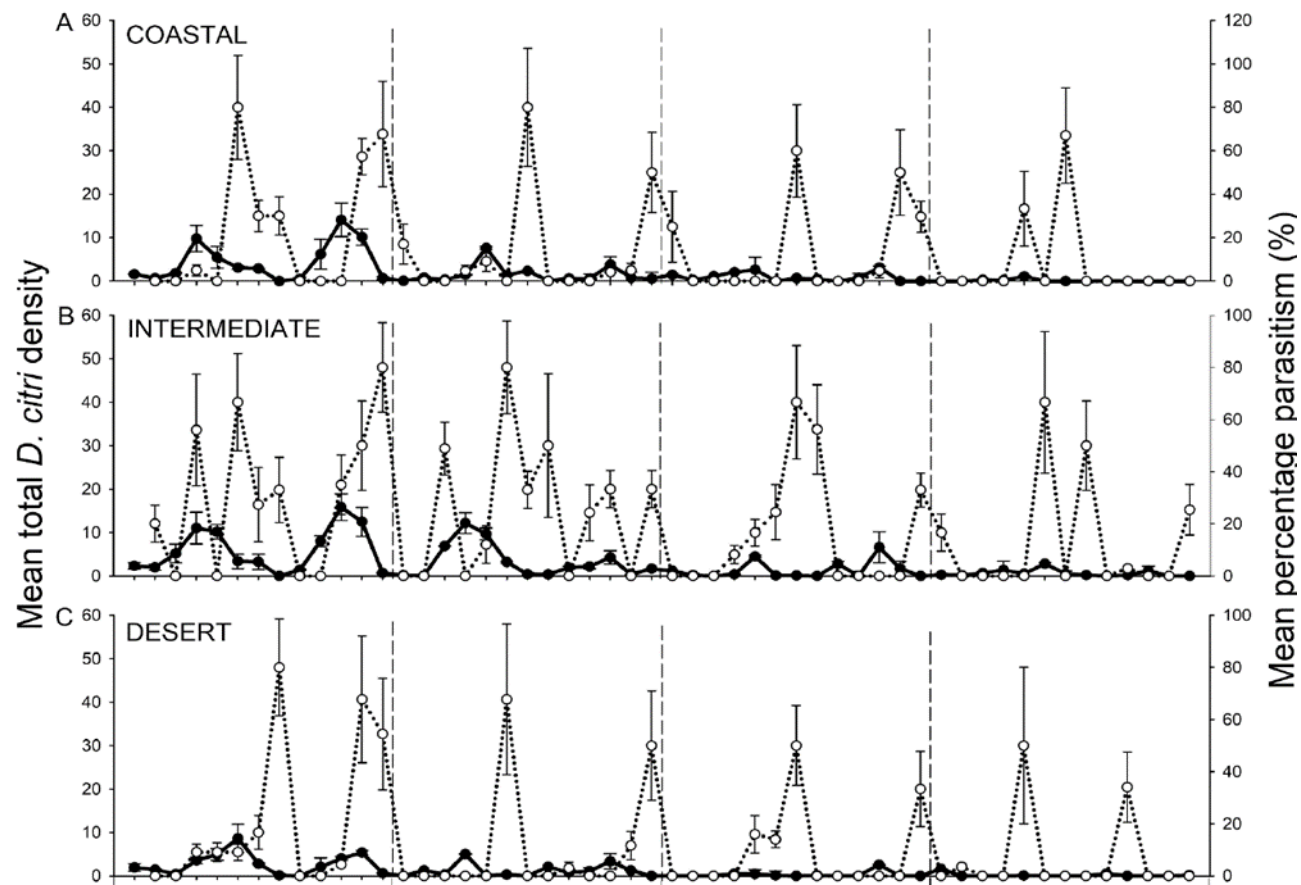


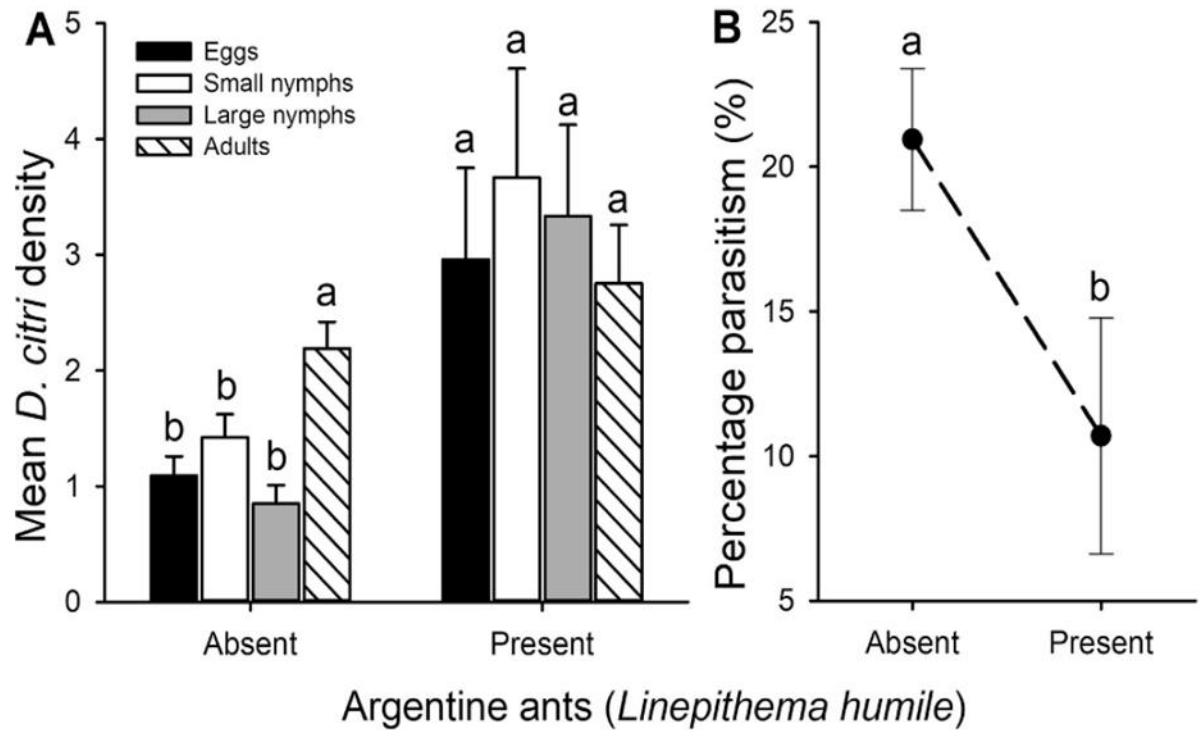


Tamarixia radiata readily establishes, spreads naturally

Seasonal parasitism up to 80%

- likely part of observed ACP declines of 75%





Milosavljevic et al. 2021

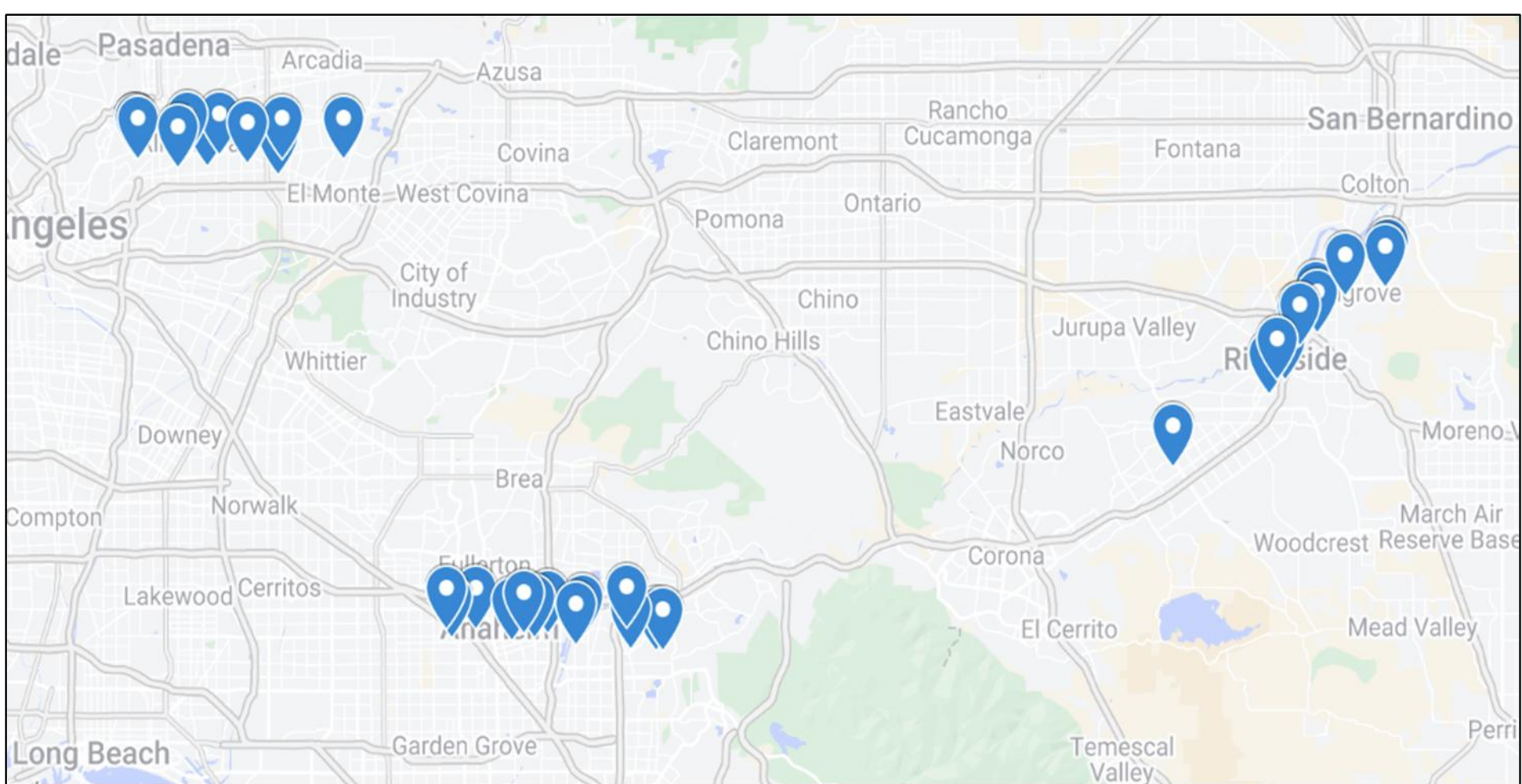
Argentine ant disrupts biocontrol

- presence reduces parasitism by 50% or more

How effective is ACP management in HLB quarantine zones?

1. Is there evidence that treatments are having an impact?
2. Are treatments and biocontrol compatible?

Monitoring at 35 sites in and around HLB treatment zones



What impact are treatments and biocontrol having on ACP?

Study design

5+ years of censuses, 2x per month (> 7500 observations)

- flush availability
- timed counts of ACP adults in tree canopy
- collected/inspected flush (ACP adults, eggs, nymphs, mummies, parasitoid emergence)
- quantified ant activity (disrupts biocontrol)
- sites within and outside of HLB treatment zones
- recorded *Tamarixia* releases in surrounding area

Monitoring at 35 sites in and around HLB treatment zones

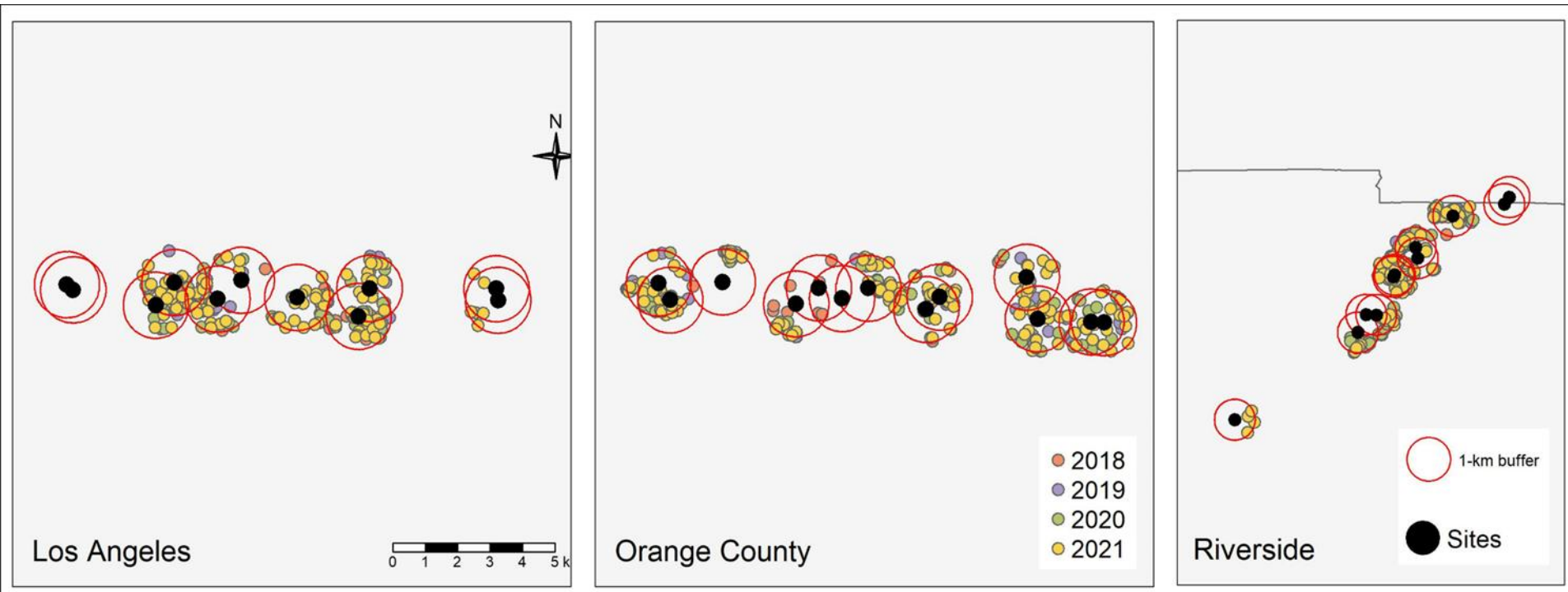
Treatment zones, Orange County



What impact are treatments and biocontrol having on ACP?

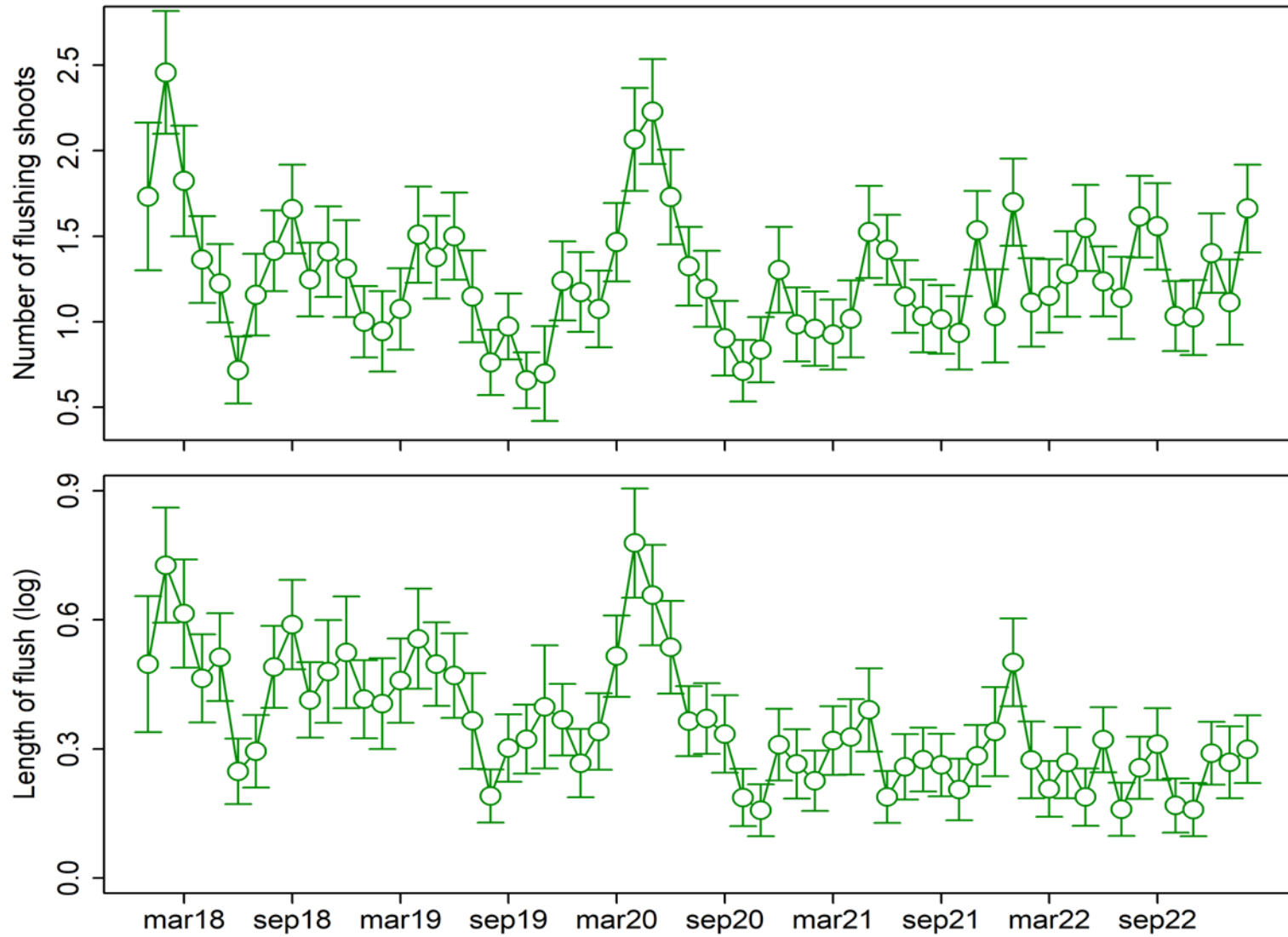
Monitoring at 35 sites in and around HLB treatment zones

Parasitoid releases near monitoring sites

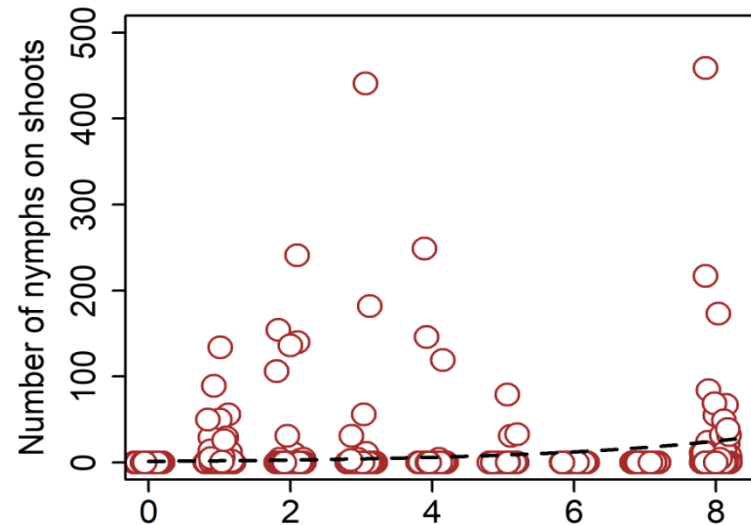
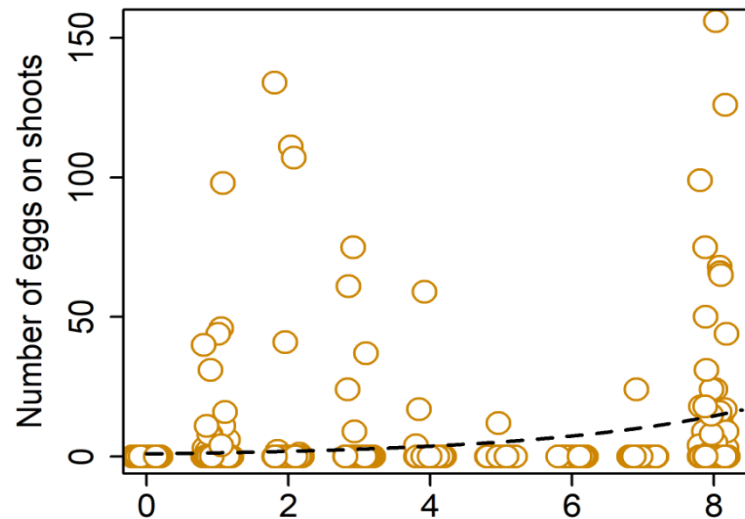
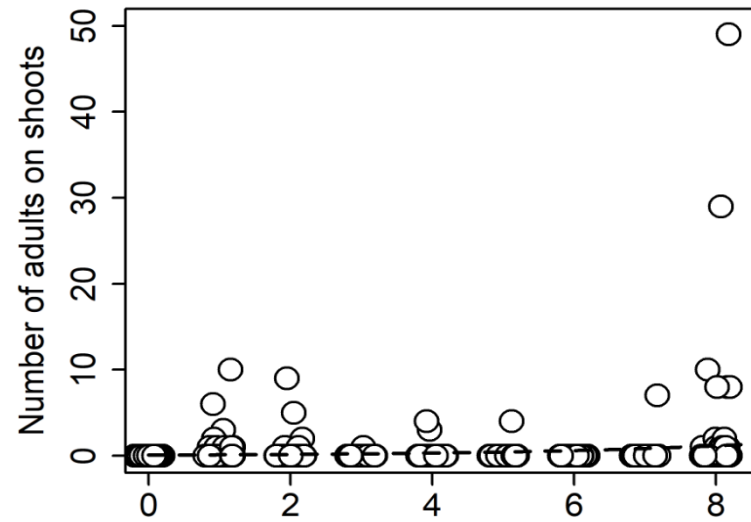
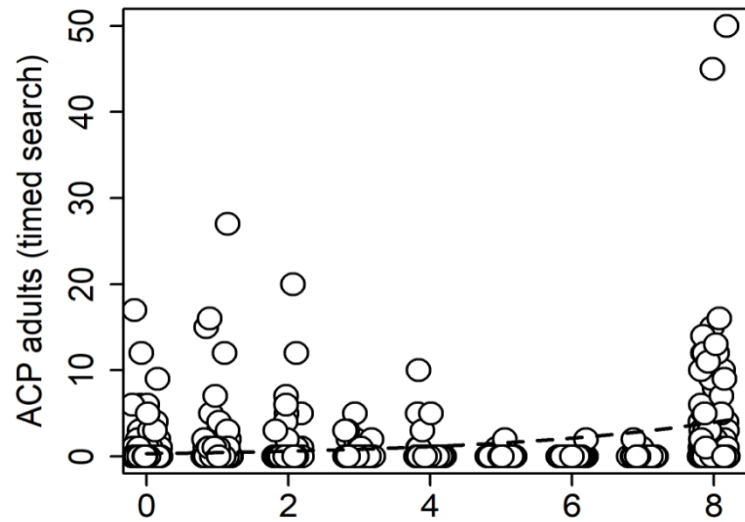


What impact are treatments and biocontrol having on ACP?

Flushing – significant effects of year and month



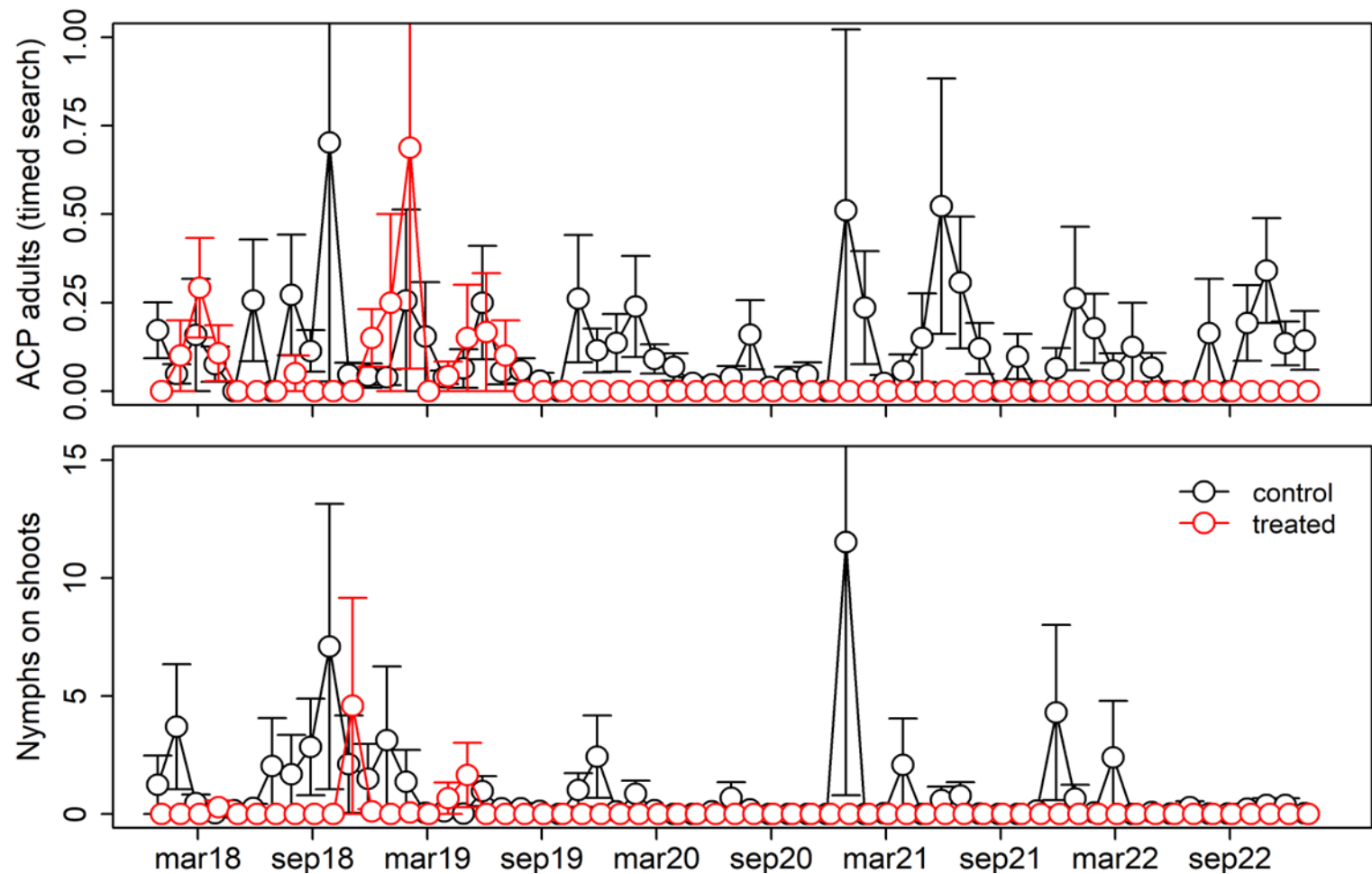
ACP – significant effects of flush availability



Number of shoots with flush

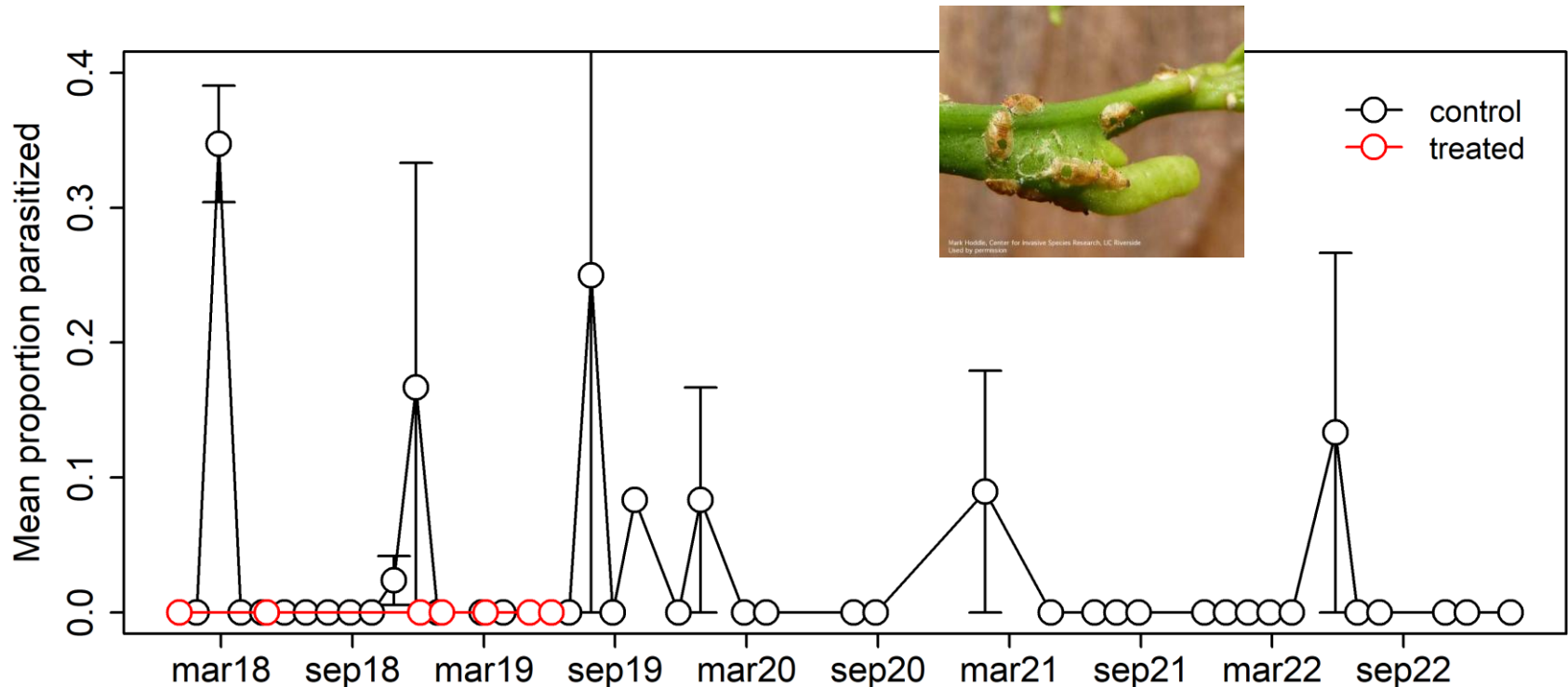
Number of shoots with flush

ACP – significant treatment-by-time interaction



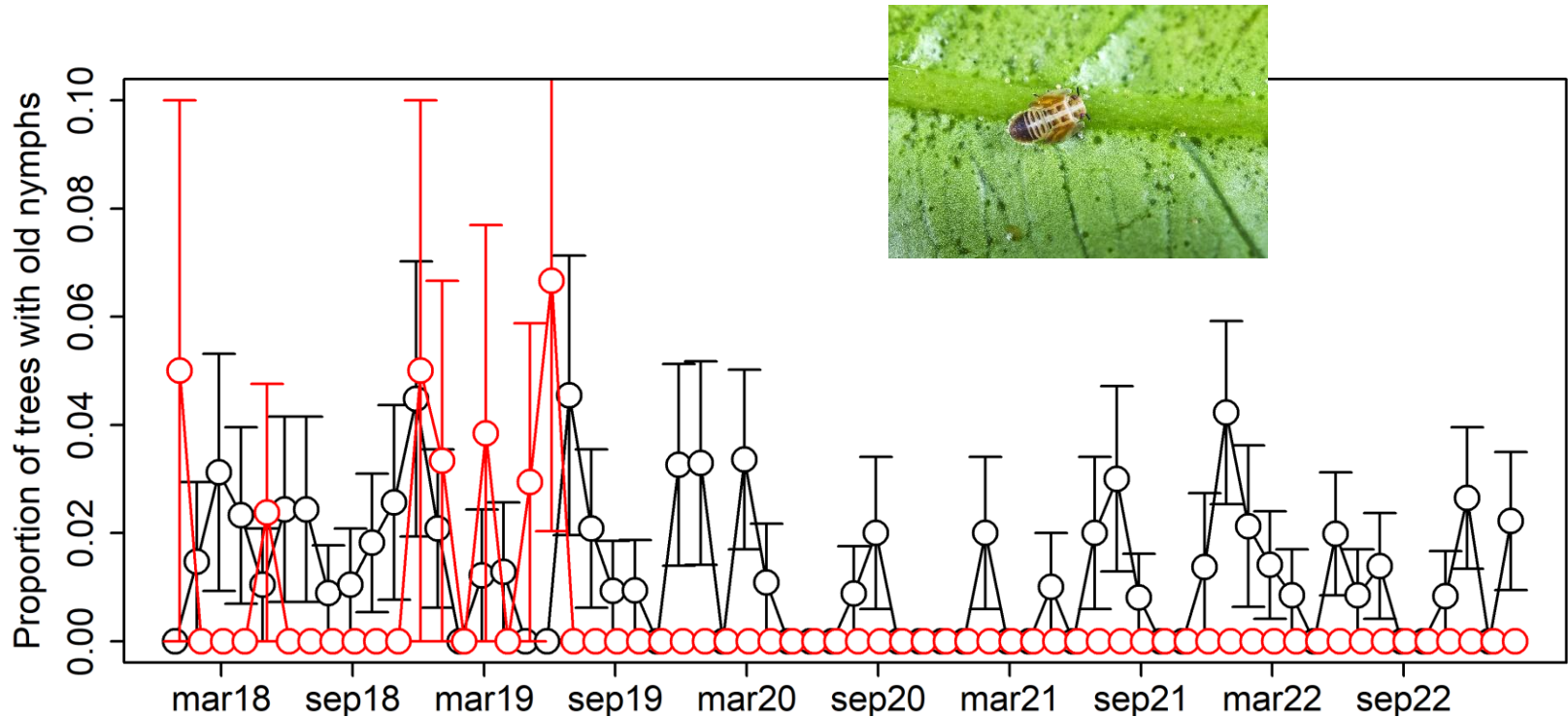
- ACP rare in treated sites after 2019

~13% parasitism overall, as high as 50%



- non-significant effects of treatment, # nymphs, flush, ants, cultivar, parasitoid releases

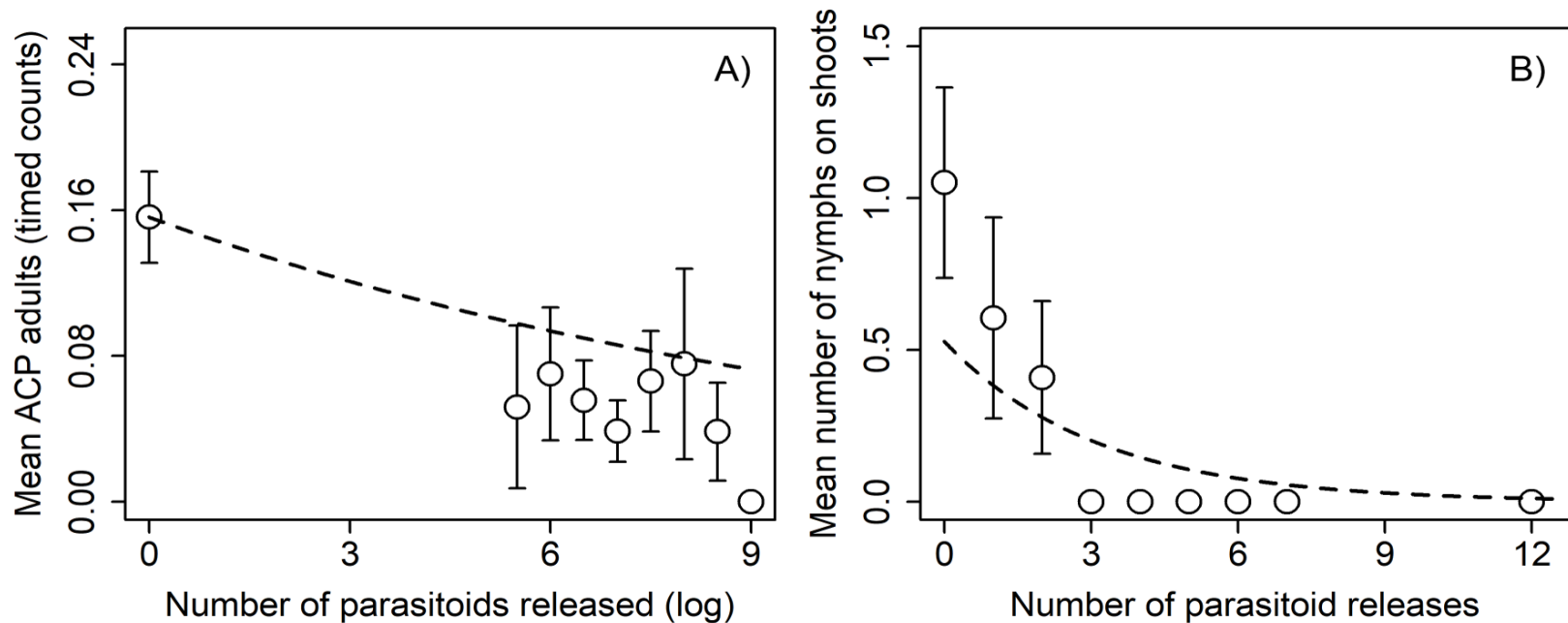
4th/5th instar nymphs rare in treated sites after 2019, limiting analysis of parasitism



- treatments indirectly limit parasitism by limiting available hosts, but can't rule out non-target impact on parasitoids

ACP – effects of *Tamarixia* releases

Even in the absence of much parasitism, effects of *Tamarixia* are apparent



- larger releases or more releases reduce ACP densities
- host feeding, or is parasitism being underestimated?

Effectiveness of ACP management in quarantine?

Insecticide treatments strongly reduce ACP densities

- cumulative, persistent declines in treated areas

Larger, more frequent *T. radiata* releases reduce ACP

- conservative estimate of the impact of biocontrol
- can't disentangle indirect (host availability) and direct (toxicity) effects of treatments on biocontrol
- need more separation between treatments and releases?

Effectiveness of ACP management in quarantine?

ACP population densities appear to be very low in Southern California residential areas

Low enough to halt pathogen/disease spread?

- threshold ACP density not known

David Morgan



Rachael Massie



David Phong

Hector Zumbado-Ulate



Greg Simmons