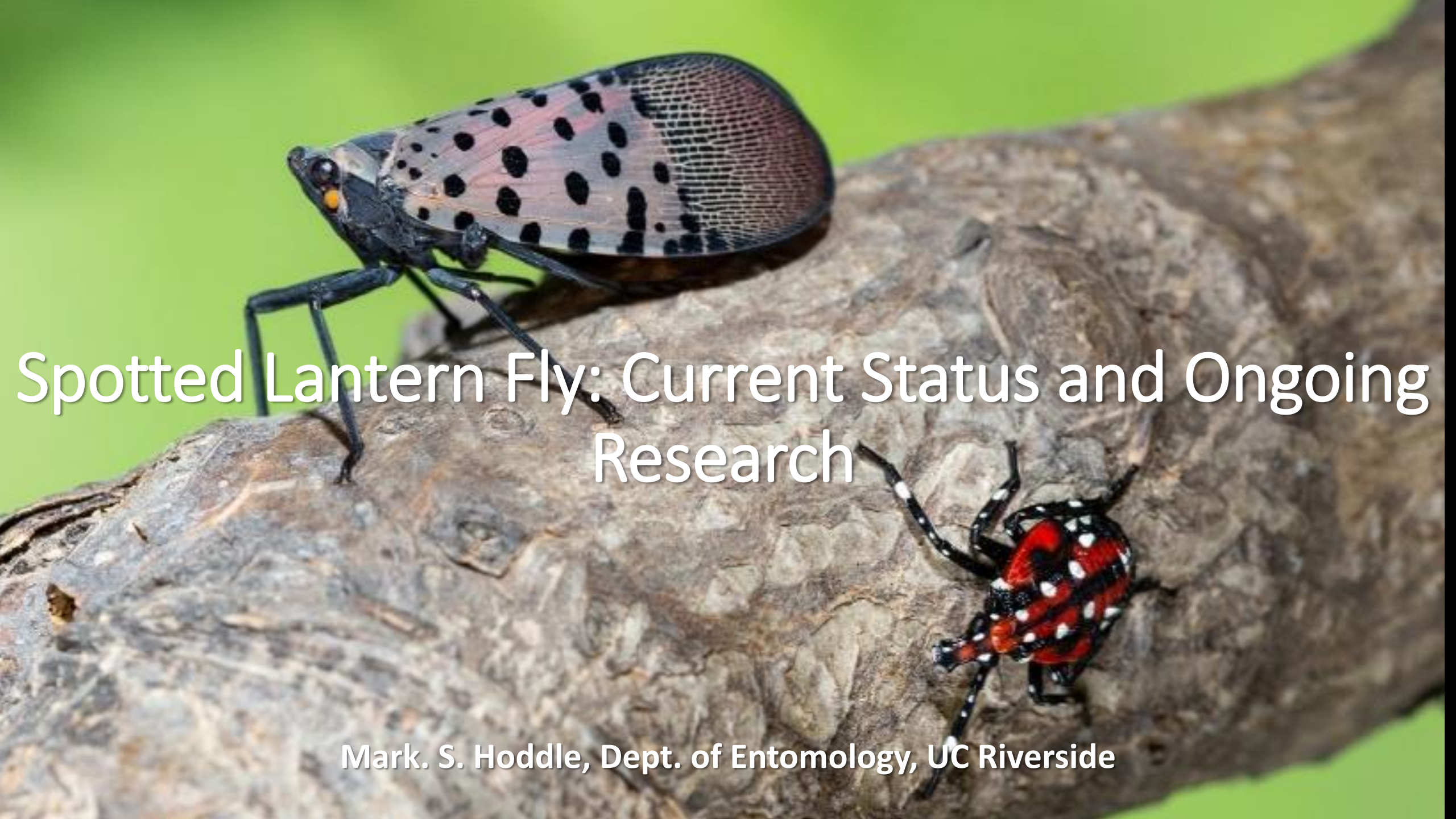


Spotted Lantern Fly: Current Status and Ongoing Research

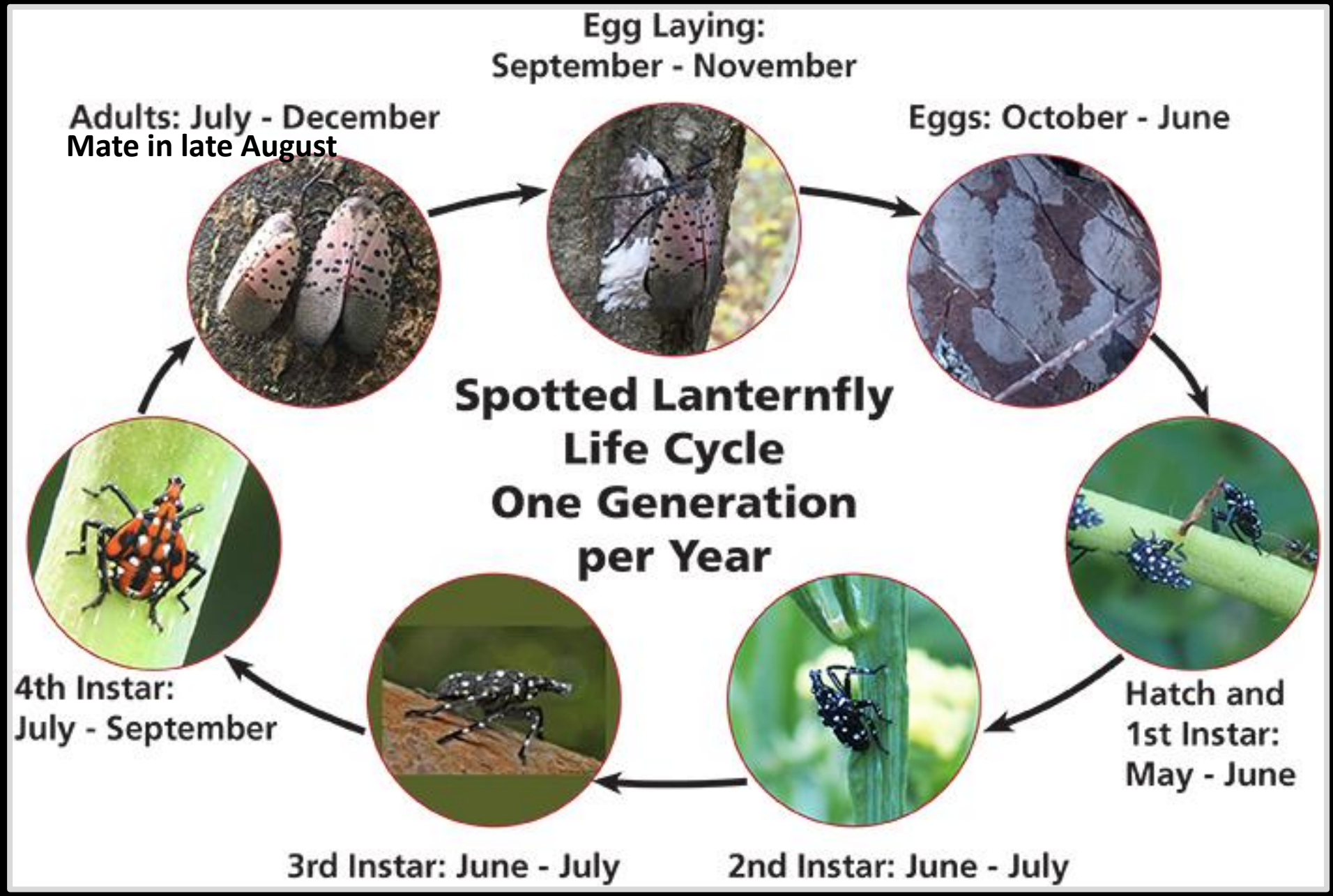
Mark. S. Hoddle, Dept. of Entomology, UC Riverside

Overview

- Taxonomy and biology
- Life cycle
- Invasion history
- Threat posed to California
  - Potential distribution in CA
  - Economic impacts
    - Potential host crops
- What's being done?
  - Proactive biocontrol in California

Taxonomy and Biology

- Spotted lanternfly (SLF)
  - *Lycorma delicatula* (Hemiptera: Fulgoridae)
  - Not a fly – it's a true bug!
  - Early biologists thought that the "lantern" emitted light (Asia)
  - Peanut headed lantern fly (Central and Sth America)
- SLF is a sap sucking bug
  - Eggs laid as an egg mass
    - Overwintering stage
  - Four nymphal stages, instars
  - Nymphs and adults are sap (phloem) feeders
    - Produce a lot of honeydew – sugary waste that is excreted as droplets
  - One generation per year



https://nysipm.cornell.edu/environment/invasive-species-exotic-pests/spotted-lanternfly/spotted-lanternfly-ipm/biology-life-cycle-identification-and-dispersion/

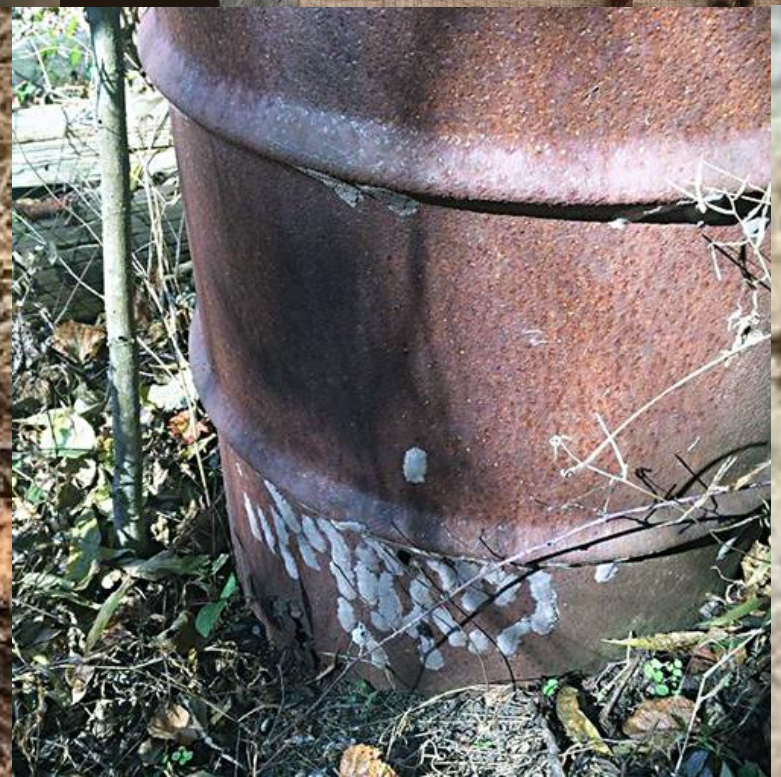
Invasion History

- SLF native to parts of China, India, and Vietnam
  - 2006 – invaded South Korea
  - 2008 - invaded/expanded (?) range in Japan
- USA
  - 2014 – PA (from China, Beijing area)
  - 2017 – NY & DE
  - 2018 – NJ, MD, & VA
  - 2023 – CT, IN, MA, MI, NC, OH, RI, WV
  - CA – not established, yet!
    - Adults (dead) intercepted in aircraft several times in SoCal in 2019
    - Establishment likely through accidental introduction of egg masses from NE USA

Lawrence Barringer, PA Dept. of Agriculture





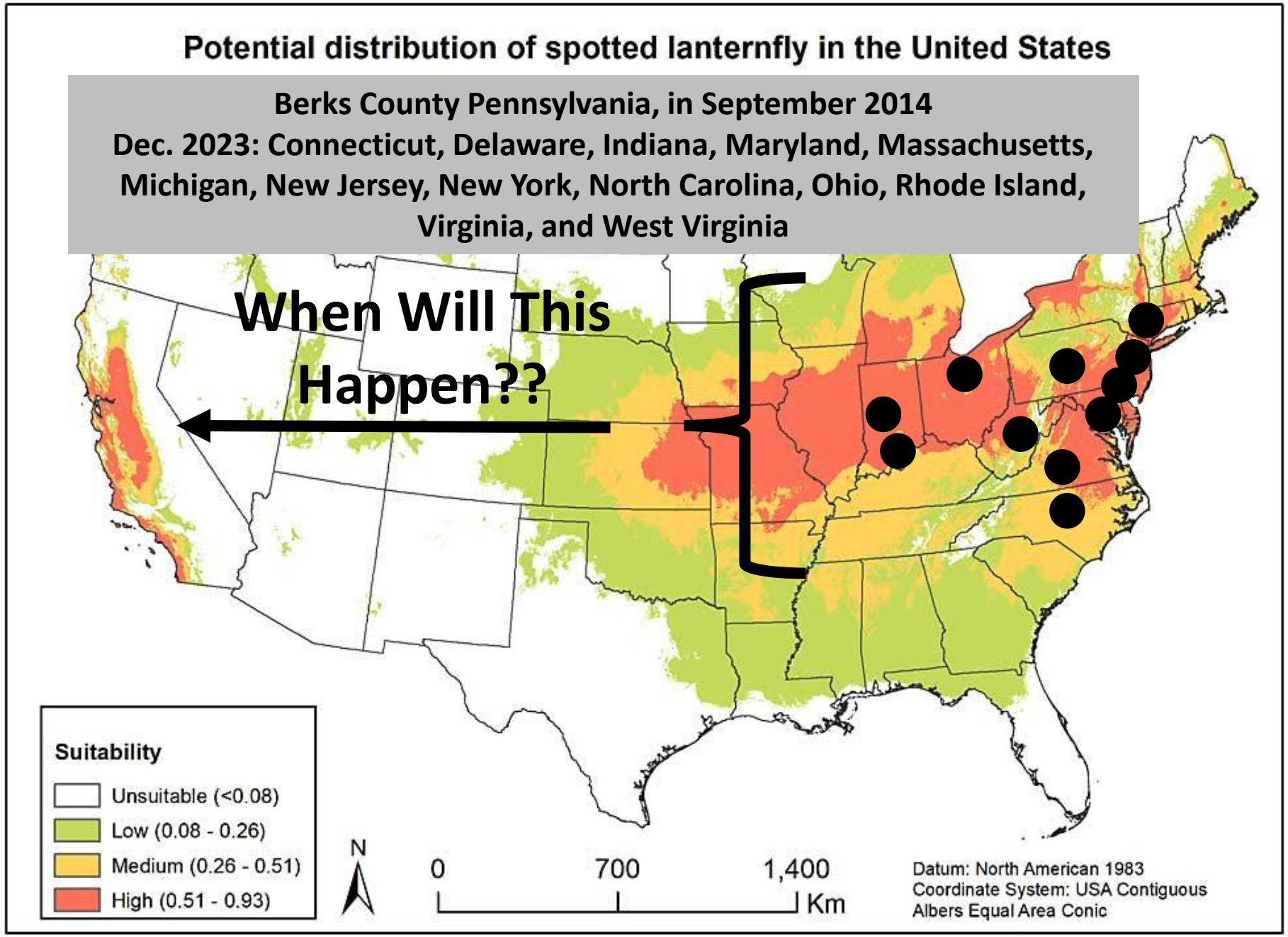



Tree of Heaven (*Ailanthus altissima*), native to China and invasive in the US, is a highly preferred host for SLF

Crops at Risk from SLF

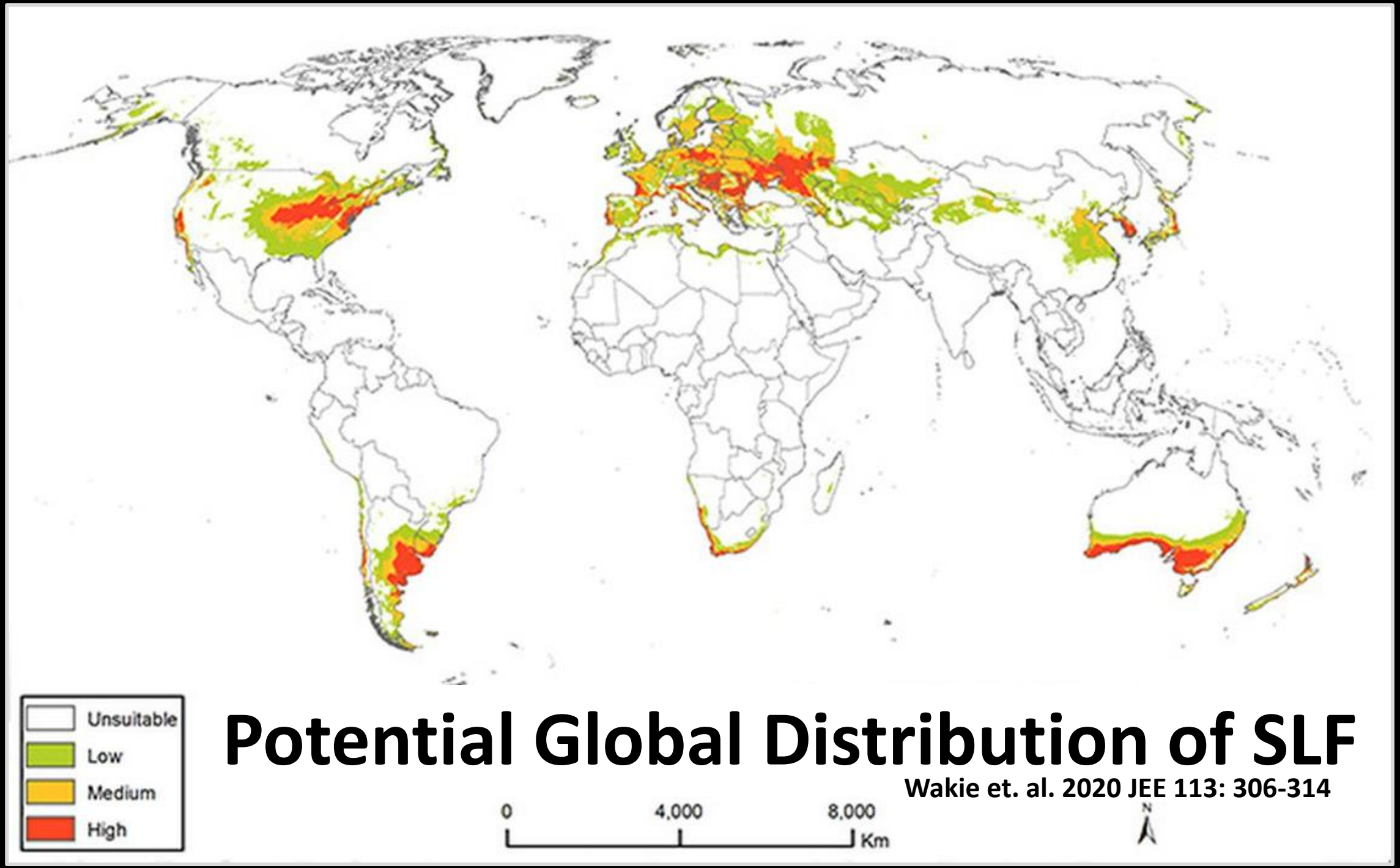
- More than 70 host plants recorded
  - Forest trees, black walnut, Chinese mahogany, pine (Christmas tree imports?)
  - South Korea – grapes and walnuts attacked
  - NE USA – grapes and apples attacked
  - USDA lists the following crops of concern
    - Hops
    - Peaches, plums, cherries, apricots (*Prunus* spp.)
    - Pears
  - California – probable crops at risk
    - Grapes
    - Nuts (walnuts, almonds, pistachios)
    - Apples and pears
    - Apricots, plums, cherries, peaches

https://www.growingproduce.com/fruits/apples-pears/new-finds-spotted-lanternfly-apple/



Ecological niche models (MAXENT and CLIMEX) suggest that SLF may do well where mean low temperatures range between −7°C and 7°C

Wakie et al. 2020 JEE 113: 306-314



Potential Global Distribution of SLF

Wakie et. al. 2020 JEE 113: 306-314

Leaning In: Proactive Biocontrol of SLF in California

- Biocontrol programs – **reactive** – initiated after the invasion and damage is underway
- SLF is an obvious threat – so let's be **PROACTIVE**
  - Start screening natural enemies **BEFORE** SLF establishes in CA
  - USDA has two parasitoids in quarantine in DE
  - UCR has obtained the egg parasitoid, *Anastatus orientalis*
  - **Safety testing completed in quarantine at UCR for the egg parasitoid**

OUTLOOK

Proactive biological control: A cost-effective management option for invasive pests

Proactive biocontrol could accelerate responses to invasive pests in urban areas — where pesticide use may be unpopular — before they spread to agricultural areas.

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Kevi Mace, Senior Environmental Scientist, Office of Pesticide Consultation and Analysis, California Department of Food and Agriculture, and Research Associate, UC Davis Department of Agricultural and Resource Economics

John Steggall, Senior Environmental Scientist, Office of Pesticide Consultation and Analysis, California Department of Food and Agriculture, and Research Associate, UC Davis Department of Land, Air and Water Resources

Invasive pests regularly threaten California agriculture as well as the state's diverse urban and wilderness areas. Approximately nine nonnative species of invertebrates (i.e., insects, mites, spiders, etc.) establish in the state each year, of which about three become pests (Dowell et al. 2016). These invasive species move globally through trade and tourism. Biological control programs are typically implemented as part of an integrated pest management (IPM) approach for some invasive species infestations in California. However, a proactive approach would be to screen a pest's natural enemies and approve them for release ahead of time, before the pest establishes in California. Such a project is just getting underway.

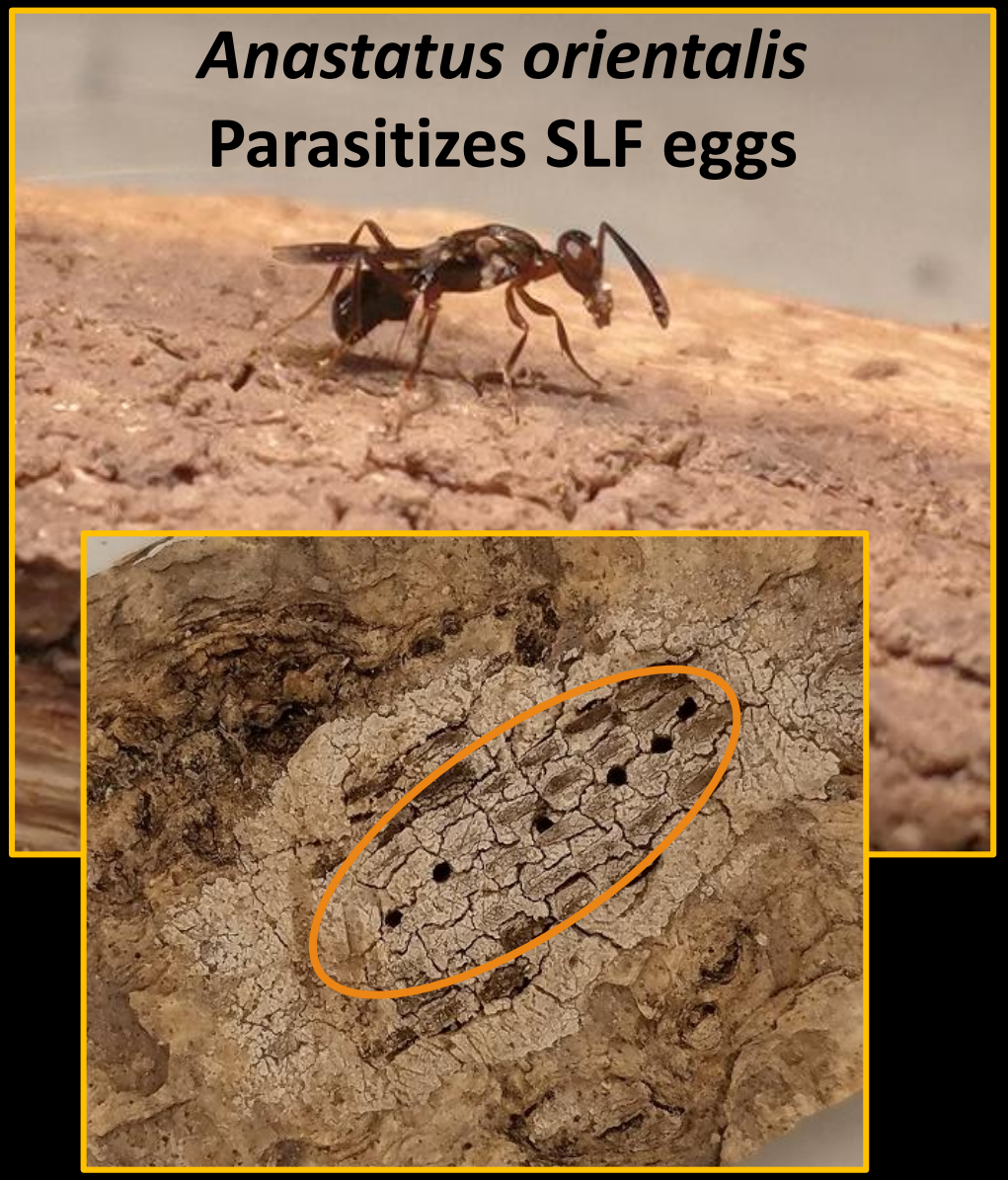
California's agricultural enterprises are vast (valued at $46 billion in 2015), and the state is a world leader in the development of science-based pest management solutions. Biological control and IPM originated here. IPM is a comprehensive approach to managing pests and combines plant and pest management practices, of which biological control is one, to reduce pest pressure, crop damage and pesticide use. Biological control is the intentional use of a pest's natural enemies for suppressing population densities to less damaging levels. When a nonnative species is introduced into a new area, its population may grow and spread rapidly because predators, parasitoids or pathogens that limited population growth in the native area are not present. Classical biological control programs import, screen for safety and establish safe natural enemy species from the invader's native area for pest control.

Biological control programs in California began 125 years ago, with numerous achievements over the years in agricultural crops (e.g., citrus, olives, grapes, alfalfa) and urban areas (e.g., ash and eucalyptus). In several cases, imported natural enemies have suppressed invasive pest populations so that they no longer require management, and in many instances they have contributed significantly to IPM programs by reducing the need to spray pesticides. When a new invasive pest becomes established, IPM programs that carefully manage insecticide use may be disrupted as spraying increases in response to pressure from the new pest. In urban areas, which can be hot spots for invasive species that threaten agriculture, pesticide use to eradicate or control an invasive pest can cause public resistance, which sometimes results in legal actions and the termination of pest control programs.

Asian citrus psyllid is arguably the most serious threat California citrus growers face, because it vectors a citrus-killing bacterium.

Hoddle et al. (2018) Cal. Ag.
https://doi.org/10.3733/ca.2018a0027

SLF Parasitoids



Anastatus orientalis

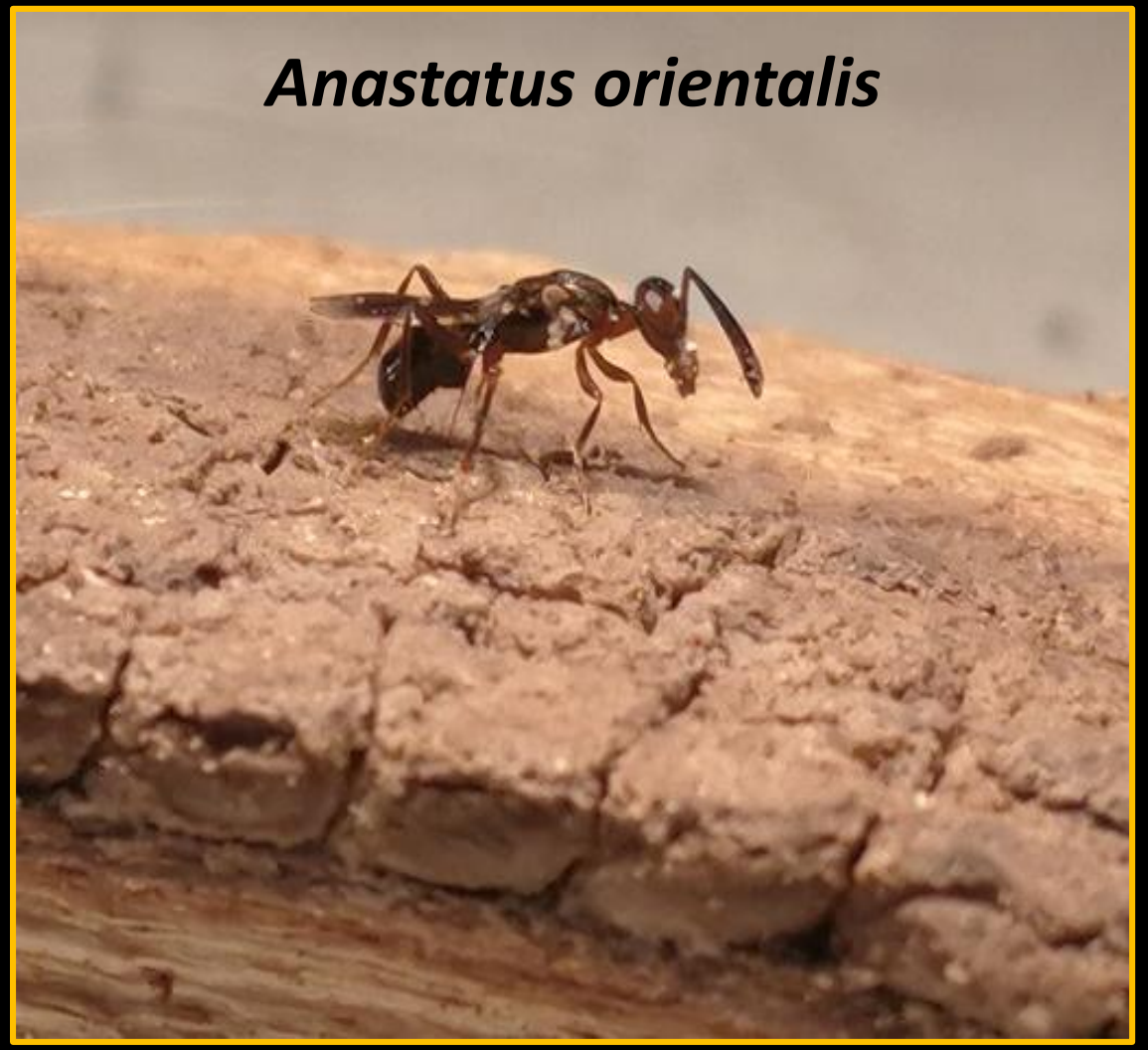
Parasitizes SLF eggs

Dryinus browni

Parasitizes SLF nymphs

Host Specificity Testing Results

- *Anastatus orientalis* is a generalist
- *A. orientalis* can successfully parasitize and develop in host species belonging to at least two different orders
  - Hemiptera and Lepidoptera
  - Seven families: Coreidae, Erebidae, Fulgoridae, Lasiocampidae, Pentatomidae, Saturniidae and Sphingidae
- *A. orientalis* will not be approved for release in the US for classical biocontrol of SLF!



What are We Doing Now at UC Riverside?



Questions?