Flatheaded Borer & Spotted Lanternfly Update

Cindy Kron
North Coast IPM Advisor
Sonoma, Napa, Mendocino
and Lake Counties

UC IPM | UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources | Integrated Pest Management Program

Flatheaded borer attacking pear fruit in Lake County

Cindy R. Kron[1], Clebson G. Gonçalves[2], Broc Zoller[3], Axel David Gonzalez Murillo[4], J. Kevin Moulton[4], Karla Addesso[5], William E. Klingeman[4]

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August 2023

Photos: Broc Zoller

Flatheaded borer infested fruit in the orchard

Flatheaded borer infested fruit in the orchard

Flatheaded borer damage

No frass at entrance hole

Codling Moth damage

One or more holes plugged with frass

Where we have found flatheaded borers in Pear fruit

- Four Pear orchards in Lake County

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But, this discovery was late in the season and areawide scouting to determine the extent of the flatheaded borer distribution was not conducted before harvest

Entomologist: Flatheaded borer in fruit?!?!

Phylum: Arthropoda

Class: Insecta (Insects)

Order: Coleoptera (Beetles)

(400,000+ species)

Family: Buprestidae (Metallic wood-boring beetles)

(15,500+ species)(larvae called flatheaded borers)

Genus: *Chrysobothris* (CDFA Identified)

(690+ species – at least 69 species in California)

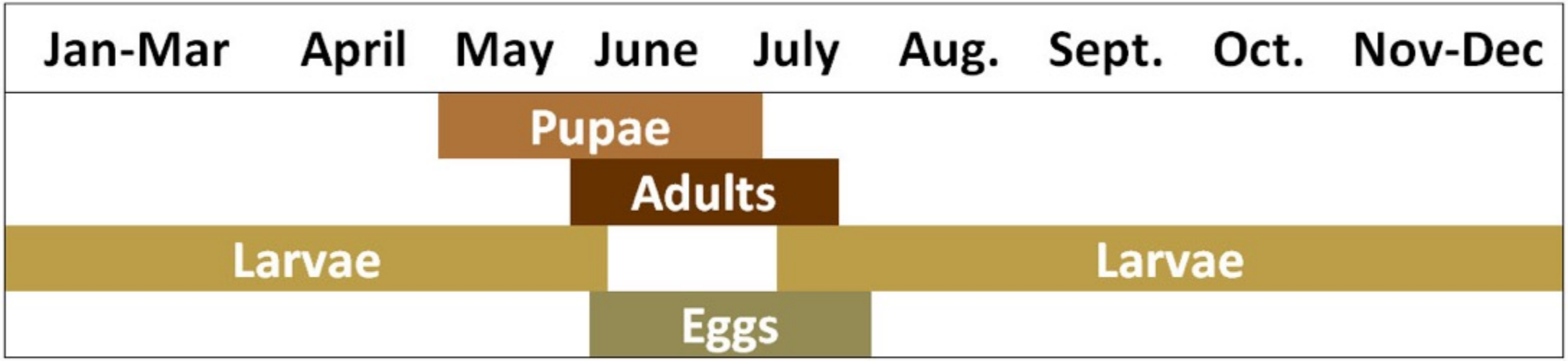
Species: ?

Rearing on artificial diet

- Spoke with Jhalendra Rijal, Area IPM Advisor working with flatheaded borer on walnut
- Received an artificial diet recipe from Karla Addesso, Associate Professor at Tennessee State University
- Sent sample to CDFA and received a *Chrysobothris* spp. ID
- Sent samples for DNA analysis to William Klingeman, Professor at University of Tennessee

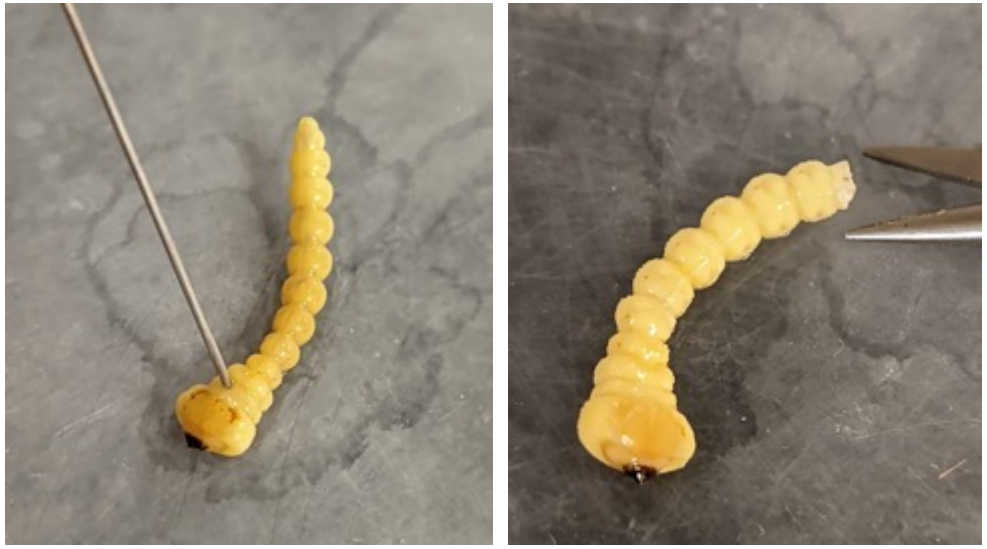
The process could take 5+ months to get an adult

Flatheaded Borer Life Cycle



Larvae were found in infested pear fruits that were collected in Kelseyville, CA

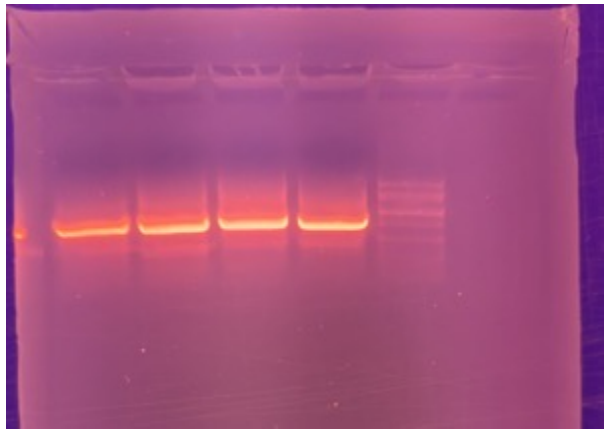
A subsample of larvae were preserved in molecular-grade, non-denatured ethanol

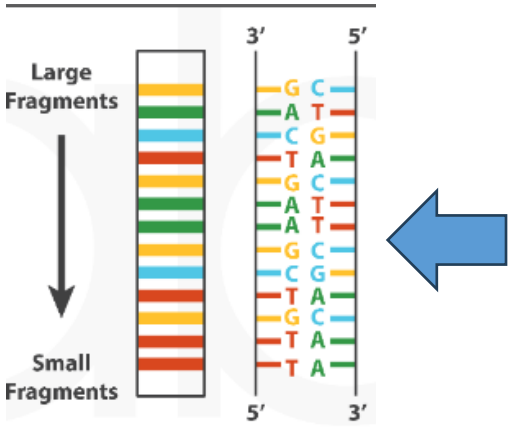


The last larval segment was removed & then a hole was made in the second thoracic segment to give access to soft tissue for better DNA extraction

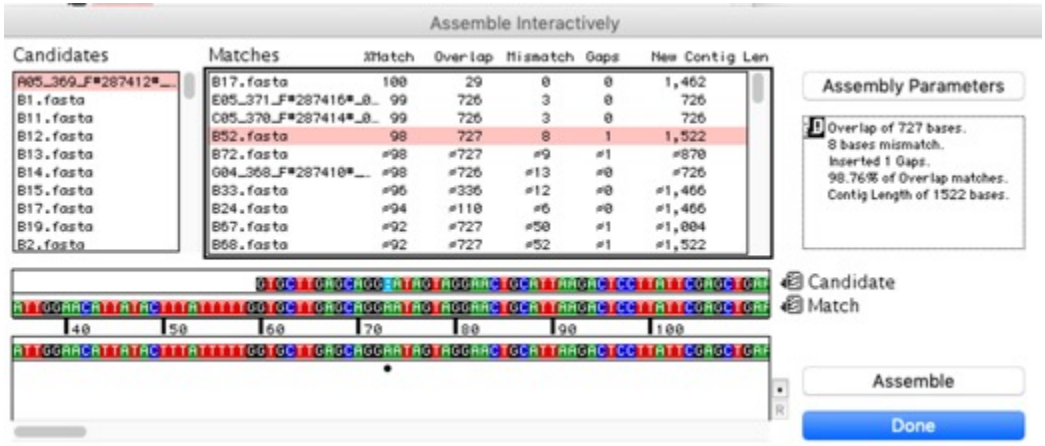
The whole larvae was exposed to lysis buffer & proteinase K for 4 hrs, and then placed in a heat block at ~52C°.

DNA was obtained using an extraction protocol designed by Dr. Kevin Moulton (University of Tennessee)





PCR was completed using a customized (730 bp) COX I primer that amplifies coding regions of *Chrysobothris* species. Finally, DNA samples were sent for DNA sanger sequencing



Analysis of returned Sanger Sequencing data were completed using Sequencher v.5.4

Annotated sequences were blasted against the National Institute of Health's NCBI GenBank database

Based on database resources, we determined that DNA extracted from the larva from pear fruit is *98.75% similar to (homologous with)* the **COX I** mitochondrial region for ***Chrysobothris mali*** (658 bp match)

Chrysobothris mali ♂

Distance tree of results MSA viewer

Descriptions | Graphic Summary | Alignments | Taxonomy

Sequences producing significant alignments Download Select columns Show 100

select all *100 sequences selected* GenBank Graphics Distance tree of results MSA Viewer

Description	Scientific Name	Max Score	Total Score	Query Cover	E value	Per. Ident	Acc. Len	Accession
Chrysobothris mali voucher RGF16610 cytochrome oxidase subunit 1 (COI) gene, partial c...	Chrysobothris...	1133	1133	87%	0.0	98.75%	658	KX283168.1
Chrysobothris inaequalis voucher BUP0166 cytochrome oxidase subunit 1 (COI) gene, par...	Chrysobothris...	992	992	100%	0.0	91.33%	1233	KM364358.1
Ectophasia rotundiventris voucher YSUW180401074 cytochrome c oxidase subunit I (COX...	Ectophasia ro...	902	902	98%	0.0	89.51%	806	MW392928.1
Ectophasia rotundiventris voucher YSUW180401073 cytochrome c oxidase subunit I (COX...	Ectophasia ro...	902	902	98%	0.0	89.51%	806	MW392927.1
Iotarphia australis voucher CNUIC656 cytochrome c oxidase subunit I (COX1) gene, partia...	Iotarphia aust...	900	900	99%	0.0	89.10%	1492	MT188367.1
Pterostichus fasciatopunctatus voucher hs907 cytochrome c oxidase subunit I (COI) gene, ...	Pterostichus f...	898	898	99%	0.0	89.18%	1444	JX535633.1
Ectophasia rotundiventris mitochondrion, complete genome	Ectophasia ro...	896	896	98%	0.0	89.37%	15792	NC_050938.1
Iotarphia australis isolate CNUIC0329 cytochrome oxidase subunit I (CO1) gene, partial cd...	Iotarphia aust...	885	885	98%	0.0	89.06%	1458	MK234522.1
Ochthebius uniformis voucher IBE<ESP>:AN437 mitochondrion, complete genome	Ochthebius u...	883	883	99%	0.0	88.71%	16212	NC_052905.1
Maoraxia auroimpressa voucher BUP0017 cytochrome oxidase subunit 1 (COI) gene, parti...	Maoraxia aur...	881	881	100%	0.0	88.61%	1257	KM364366.1

Isn’t pear fruit a dead-end host?

Isn’t pear fruit a dead-end host?

We’ve got a pupa!!!

February 29th, 2024

Pupal development

Feb 29: 9:00 am

March 4: 1:14 pm

March 5: 12:28 pm

March 5: 3:31 pm

March 6: 10:02 am

March 7

Pacific Flatheaded Borer
Chrysobothris mali

March 18

Funding provided by the Pear Pest Management Research Fund

CALIFORNIA PEARS

Pear Pest Management Research Fund

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The invasive Spotted Lanternfly

Why we need to remain vigilant

Cindy Kron, PhD
North Coast IPM Advisor
Serving Sonoma, Napa, Lake and Mendocino Counties

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SPOTTED LANTERNFLY (SLF)
(*Lycorma delicatula*)

- Planthopper (~1” x 0.5”) native to northern China
- Egg masses thought to have arrived on a stone shipment in 2012
- First found in the United States (Pennsylvania) in 2014
- Has since been documented in 14 states: Pennsylvania, New York, Delaware, New Jersey, Maryland, Virginia, West Virginia, Connecticut, Massachusetts, Rhode Island, North Carolina, Ohio, Michigan, Indiana,

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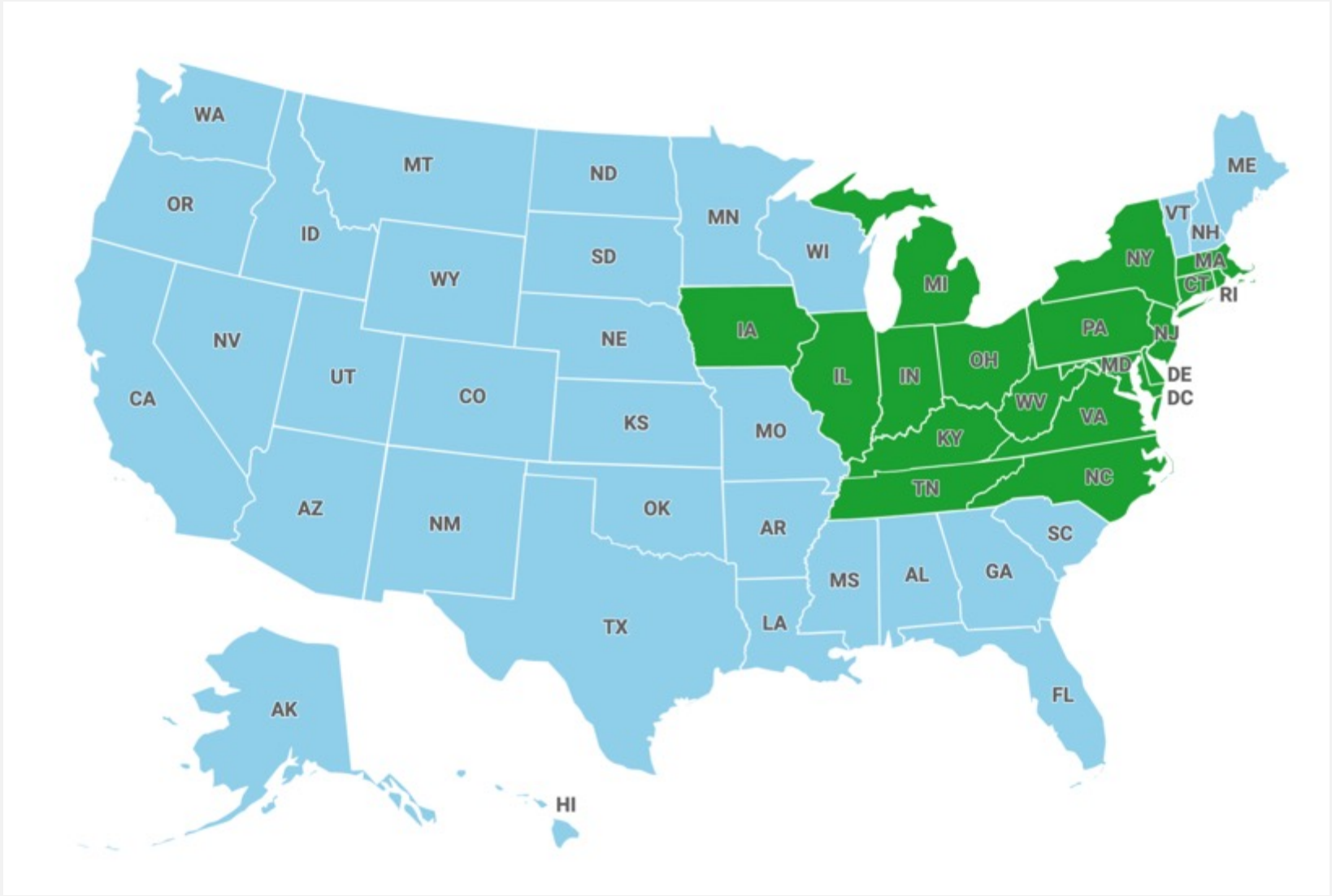
December 13th, 2023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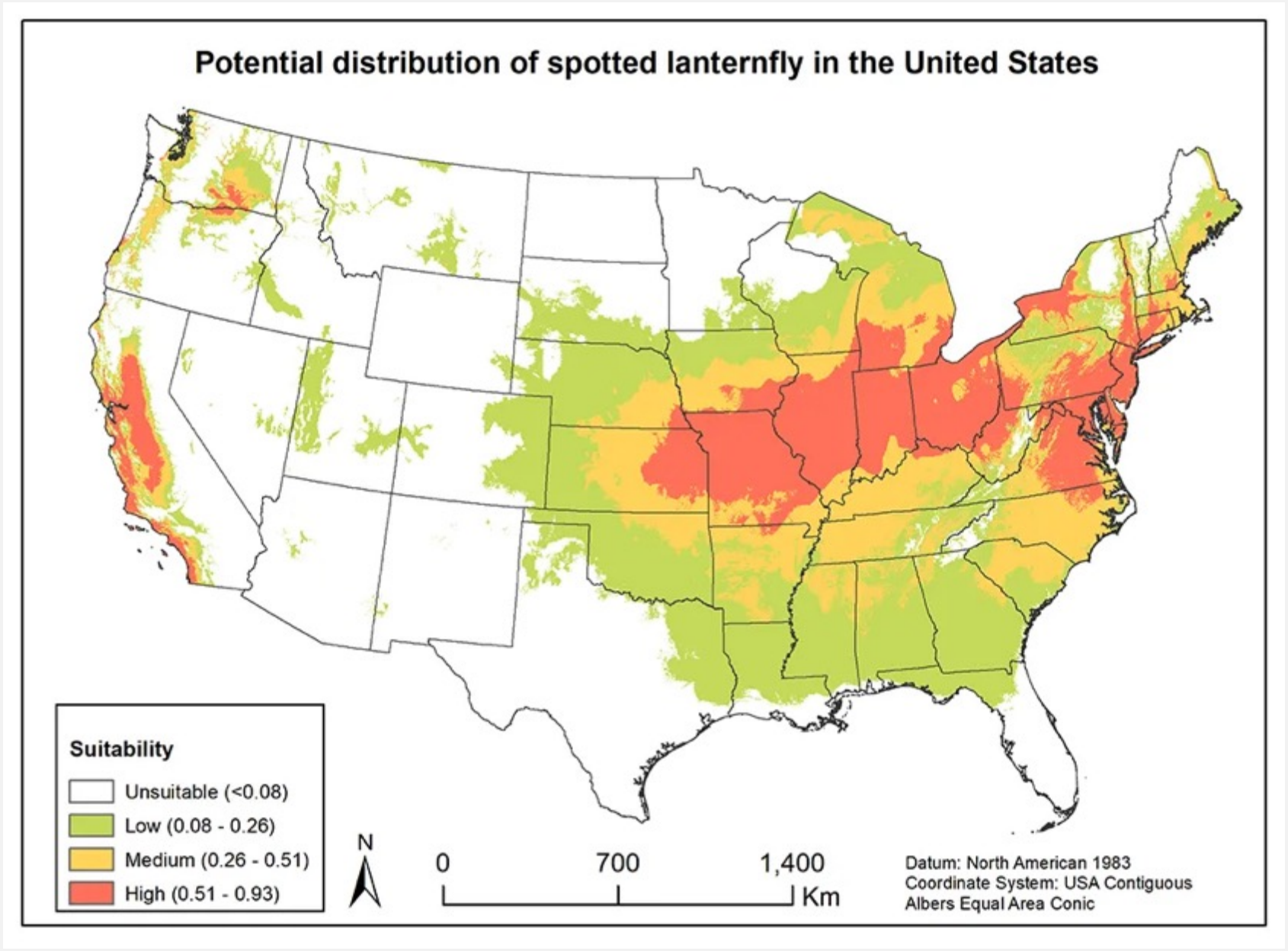
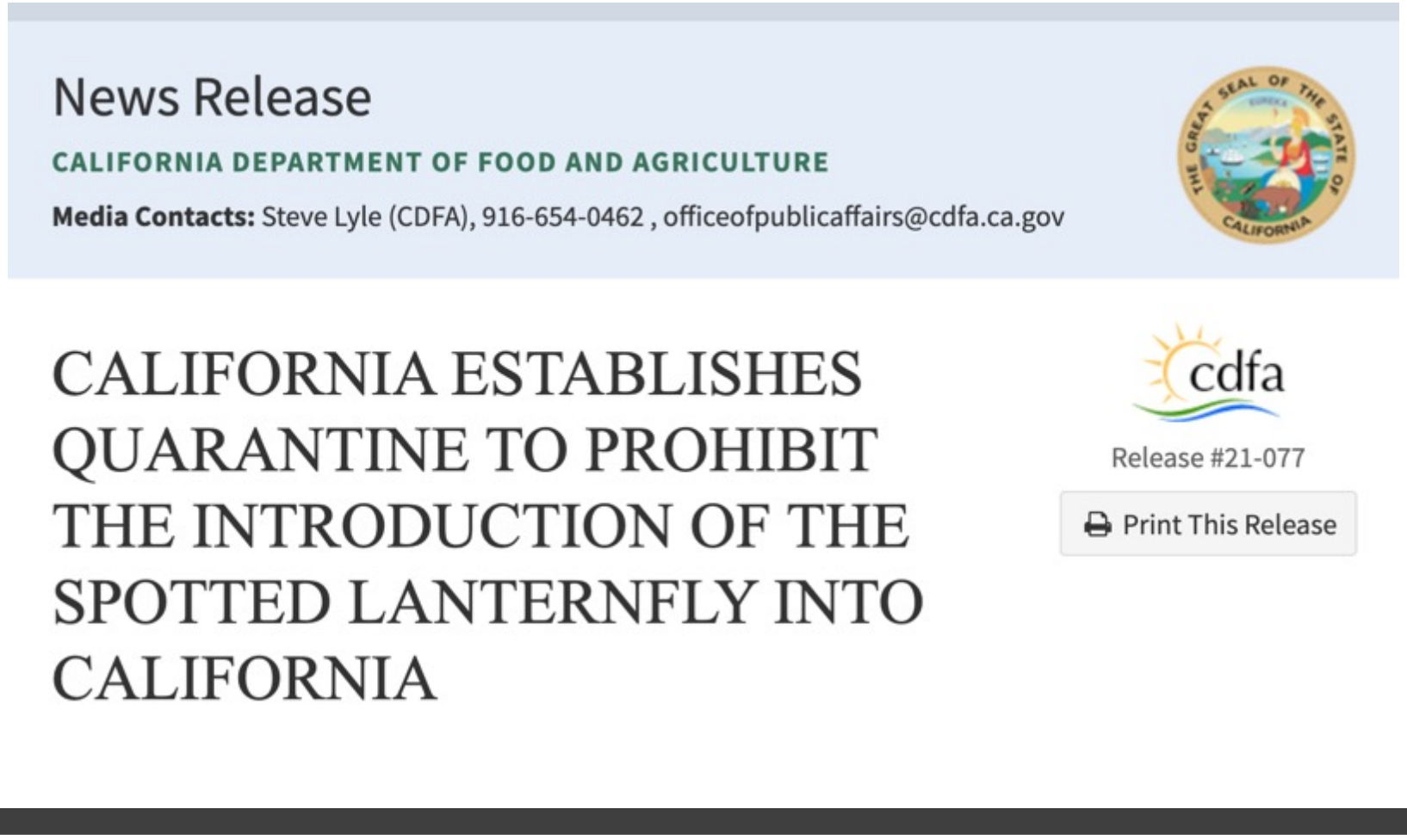


EntomologyToday.org



News Release

CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE

Media Contacts: Steve Lyle (CDFA), 916-654-0462 , officeofpublicaffairs@cdfa.ca.gov

CALIFORNIA ESTABLISHES QUARANTINE TO PROHIBIT THE INTRODUCTION OF THE SPOTTED LANTERNFLY INTO CALIFORNIA

cdfa

Release #21-077

Print This Release

July of 2021 - prohibits the entry into California of SLF, its host plants, and a variety of articles, including conveyances, originating from any area where an SLF infestation exists.

SPOTTED LANTERNFLY EGGS

- Each female lays one to two egg masses of 30 to 50 eggs each
- Eggs are laid in multiple successive rows and covered with a yellowish-brown waxy deposit

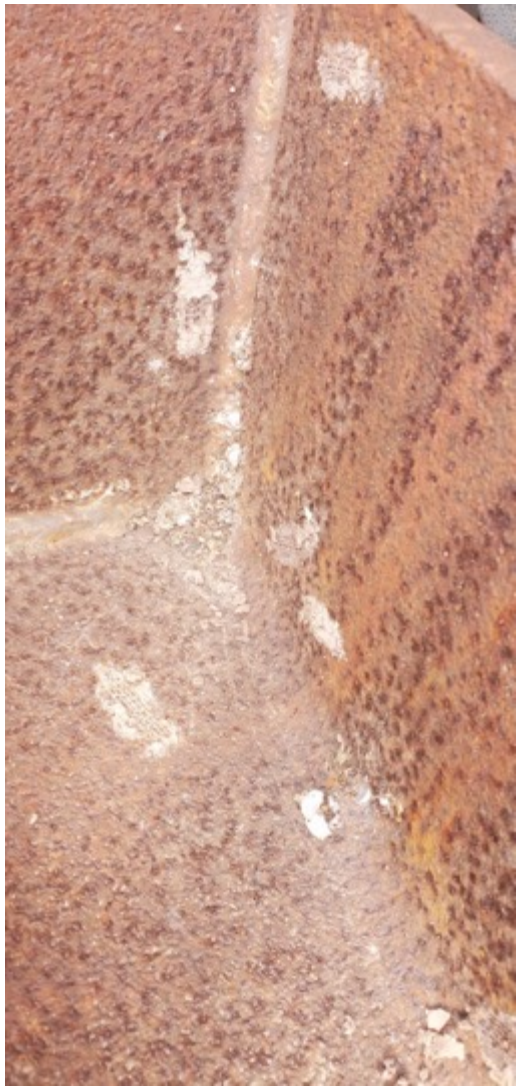


SPOTTED LANTERNFLY EGGS

- Eggs are laid on smooth tree surfaces and inanimate objects such as telephone poles, stones, pallets, outdoor furniture, railway cars, firewood, vehicles, etc.
- Laying eggs on non-plant items contributes to SLFs wide dispersal ability and likelihood of unintentional introduction into new areas

- Art structure stopped at Truckee CDFA station – March 27th, 2024
- Suspected SLF egg masses found
- Eggs sampled and were viable
- Entry was denied and truck returned to Sparks where ~30 SLF egg masses removed and destroyed, structure was powerwashed with soap and water, and cleared inspection by Nevada Department of Agriculture – April 2nd, 2024
- Allowed entry into California
- Instructions were not to offload until inspection by Sonoma Ag Commissioner's office, but structure was offloaded anyway
- Sonoma Ag Commissioner's office arrived, inspected structure and found 3 more egg masses

Egg masses are ~30 - 50 eggs each meaning
the structure had between 990– 1,650 SLF eggs!!!



SPOTTED LANTERNFLY (SLF)
(*Lycorma delicatula*)

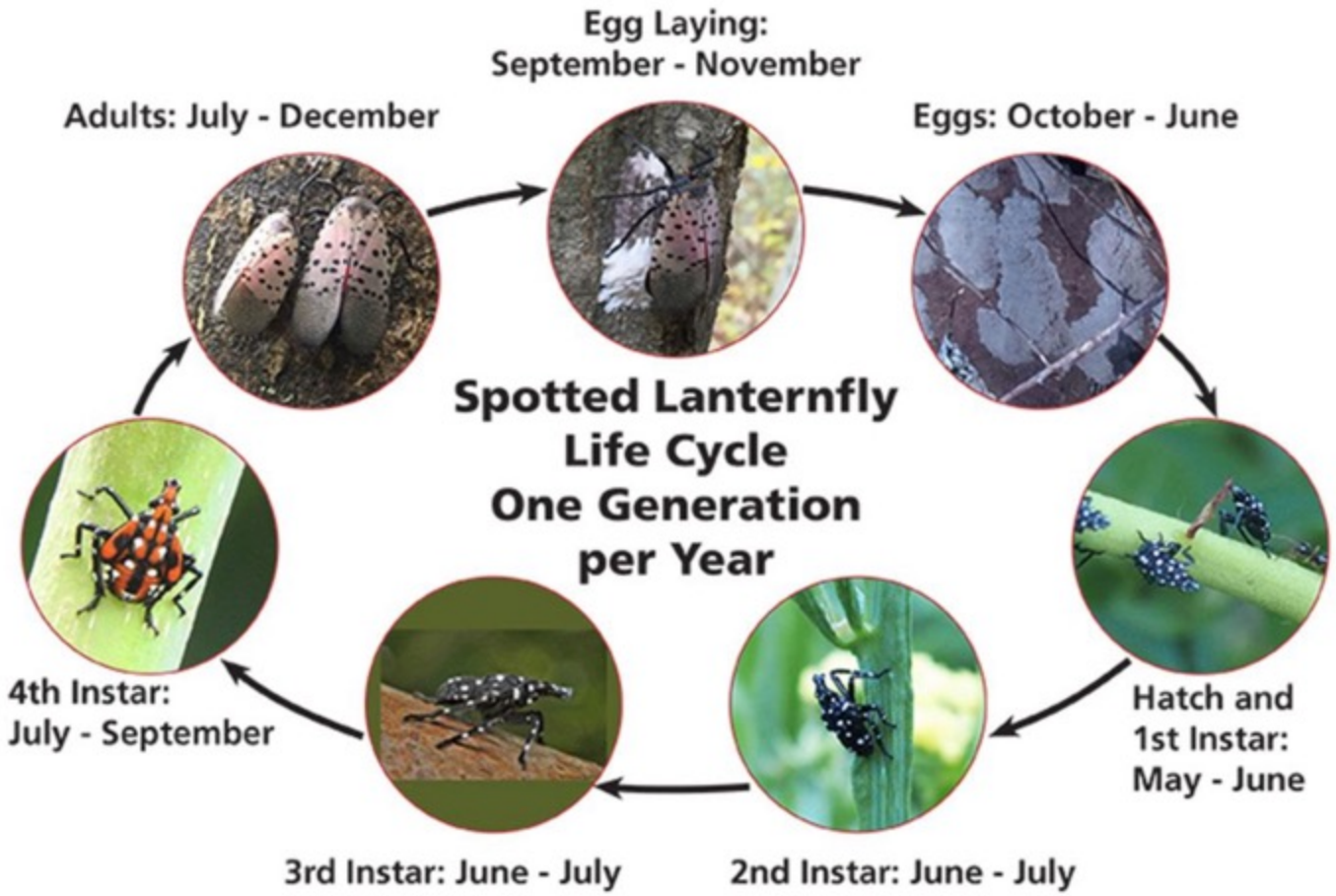
- Host range of 103+ plant species with at least 40 occurring in North America
- Preferred host is tree of heaven (*Ailanthus altissima*), grapevines, black walnut, maple
- Other hosts include stone fruits, apple, cherry, blueberry, fig, hops, oak, birch, sycamore, ash, beech, hickory, poplar, black cherry, willows and woody ornamentals

SPOTTED LANTERNFLY (SLF)
(*Lycorma delicatula*)

- Found in agricultural, wooded and urban areas and moves between different environments to feed
- Potential to severely harm grape, orchard and logging industries
- Can aggregate in large numbers

SPOTTED LANTERNFLY (SLF) (*LYCORMA DELICATULA*)

- May lower crop yields, increase production costs, lower cold hardiness, reduced or no return bloom or crop, cause vine death, and cause trade disruptions
- Produces large amounts of honeydew → sooty mold


Egg Laying:
September - November
Eggs: October - June
Hatch and
1st Instar:
May - June
2nd Instar: June - July
3rd Instar: June - July
4th Instar:
July - September
Adults: July - December
Spotted Lanternfly
Life Cycle
One Generation
per Year

Spotted Lanternfly nymphs

1st through 3rd instars

4th instar

Spotted lanternfly nymphs

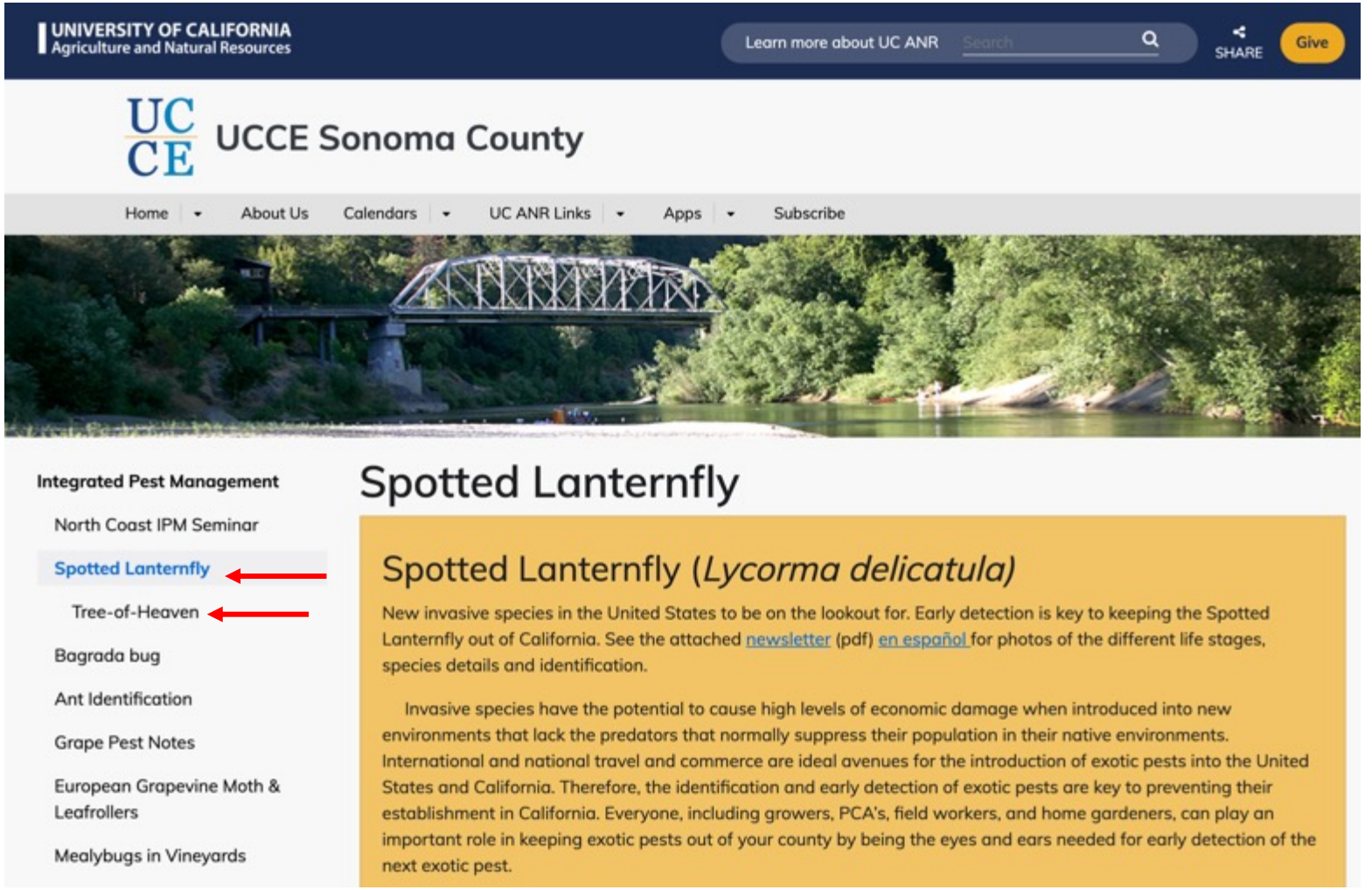
Spotted Lanternfly nymphs and adults

4th instars and adults

Adult with wings spread

UCANR.EDU/NCIPM

UCANR.EDU/SLF



UCANR.EDU/NCIPM

UCANR.EDU/TOH

Report any sightings

If you find what you believe to be any of these insects, collect it in a sealed container and document the location and date when found before taking it to your local county agricultural commissioner or UC Cooperative Extension office. Together with your help, we can help keep the spotted lanternfly out of California.

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