Hardwood tree pests and their management

The Grand Tree Pests Review
ISA Southern Annual Conference
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COOPERATIVE EXTENSION
College of Agriculture, Forestry and Life Sciences

Department of
FORESTRY AND ENVIRONMENTAL CONSERVATION

What is an invasive species?

Terms

Native = from here

Terms

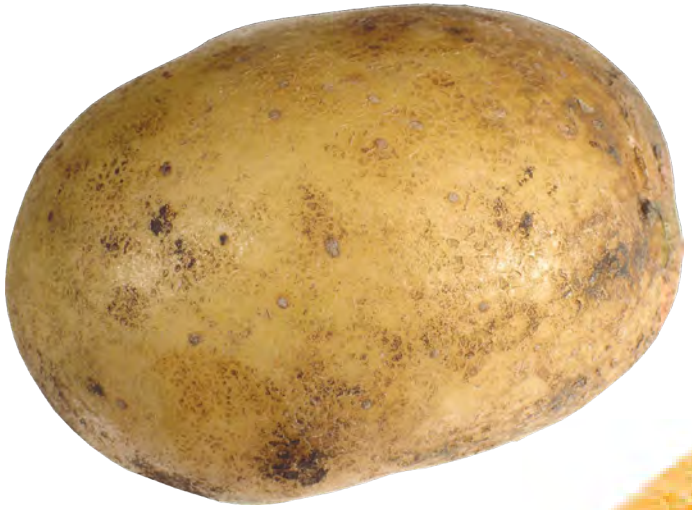
Native = from here

Non-native = not from here

Exotic = not from here

Alien = not from here

Are all non-native species bad?



Terms

Native = from here

Non-native = not from here

Exotic = not from here

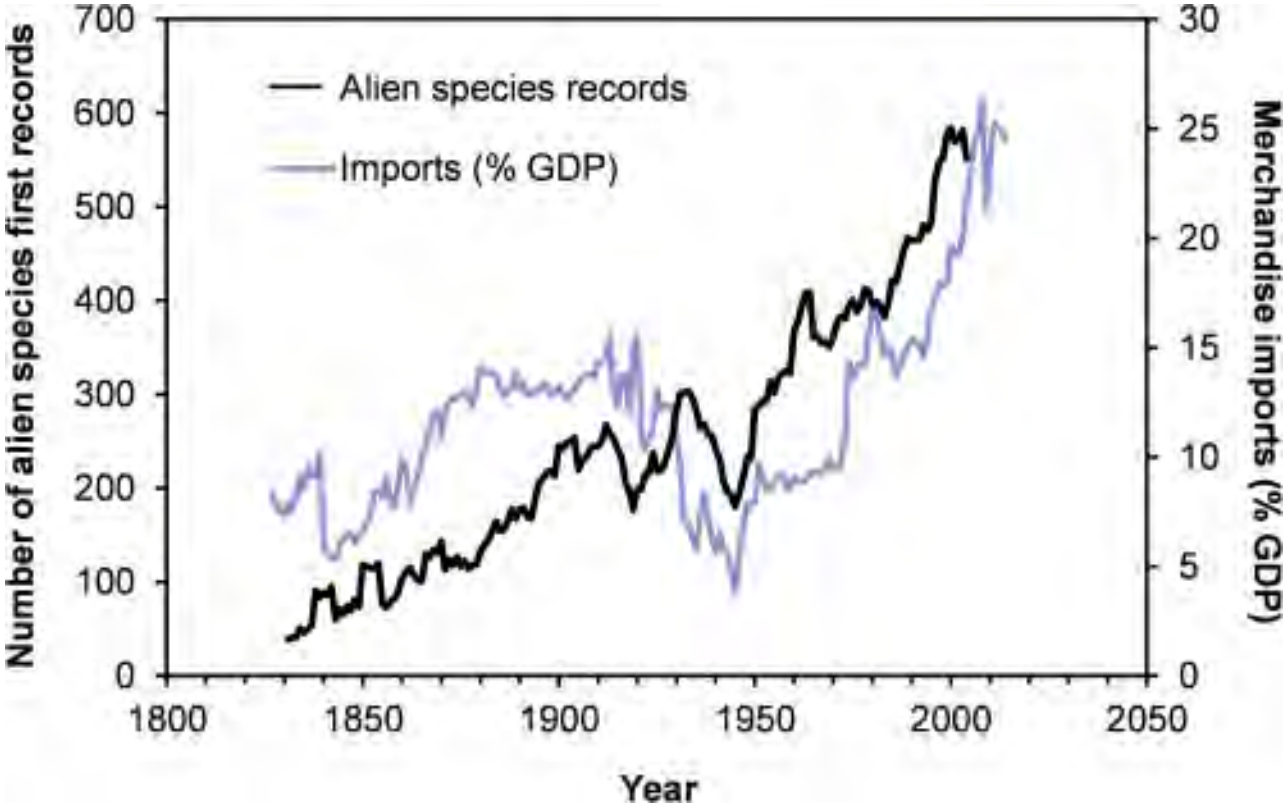
Alien = not from here

How do we get invasive species?

Short answer:
we buy stuff

How do invasive species get here?

More pests



More stuff

Hulme 2021. One Earth 4: 666-679.

U.S. imported **>$4.3 trillion** in goods in 2025!

https://www.bea.gov/news/2023/us-international-trade-goods-and-services-december-and-annual-2022

How do we get invasive pests?

Stuff gets shipped

Stuff gets inspected

Sometimes we find the pests

Good news! We find a lot of pests.

>54,000 insect interceptions/year from 1998-2018

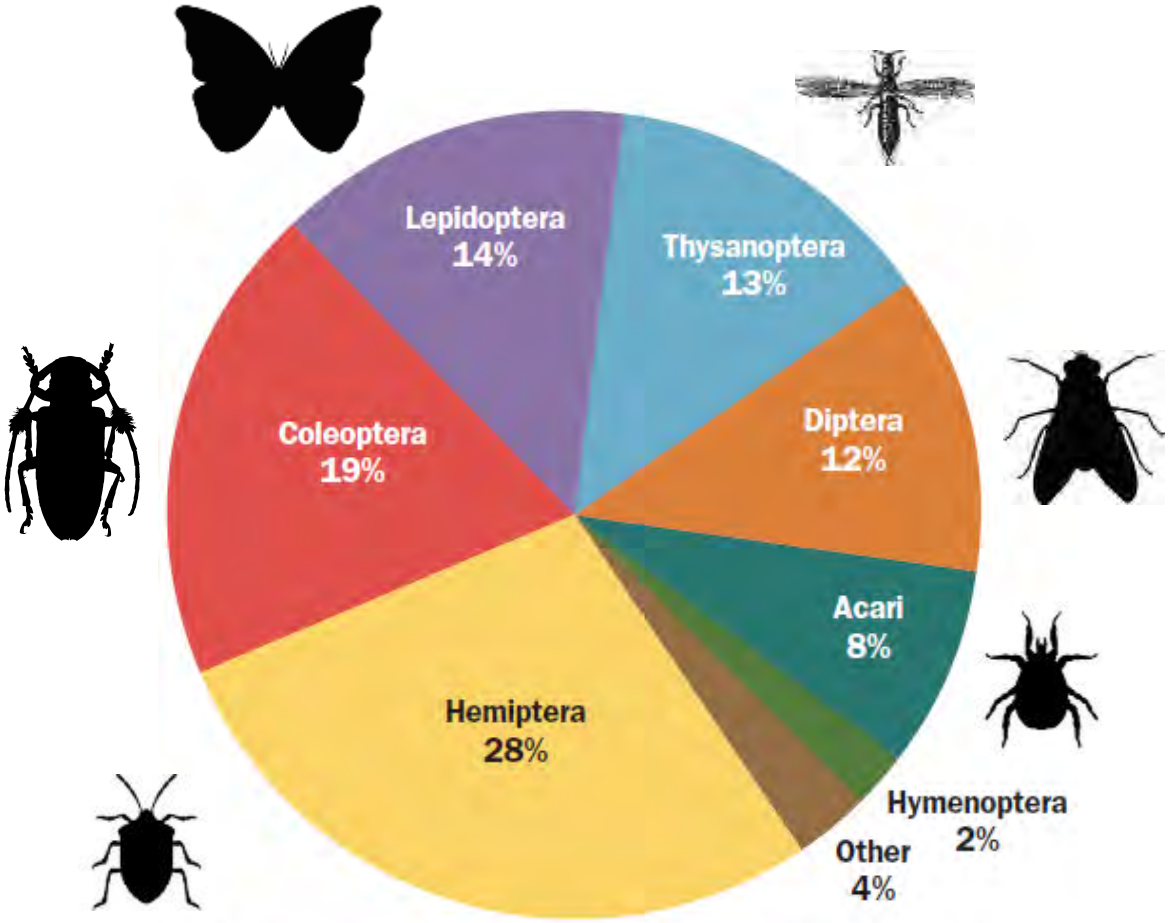
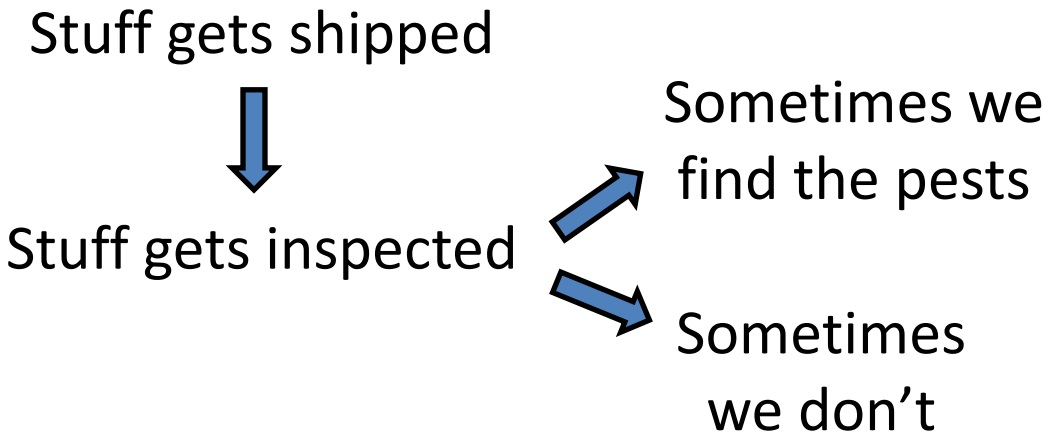


Fig. 2. Percentage of interceptions by Customs and Border Patrol, by Arthropod Order

Jenkins et al. 2014.; Turner et al. 2021.

How do we get invasive pests?

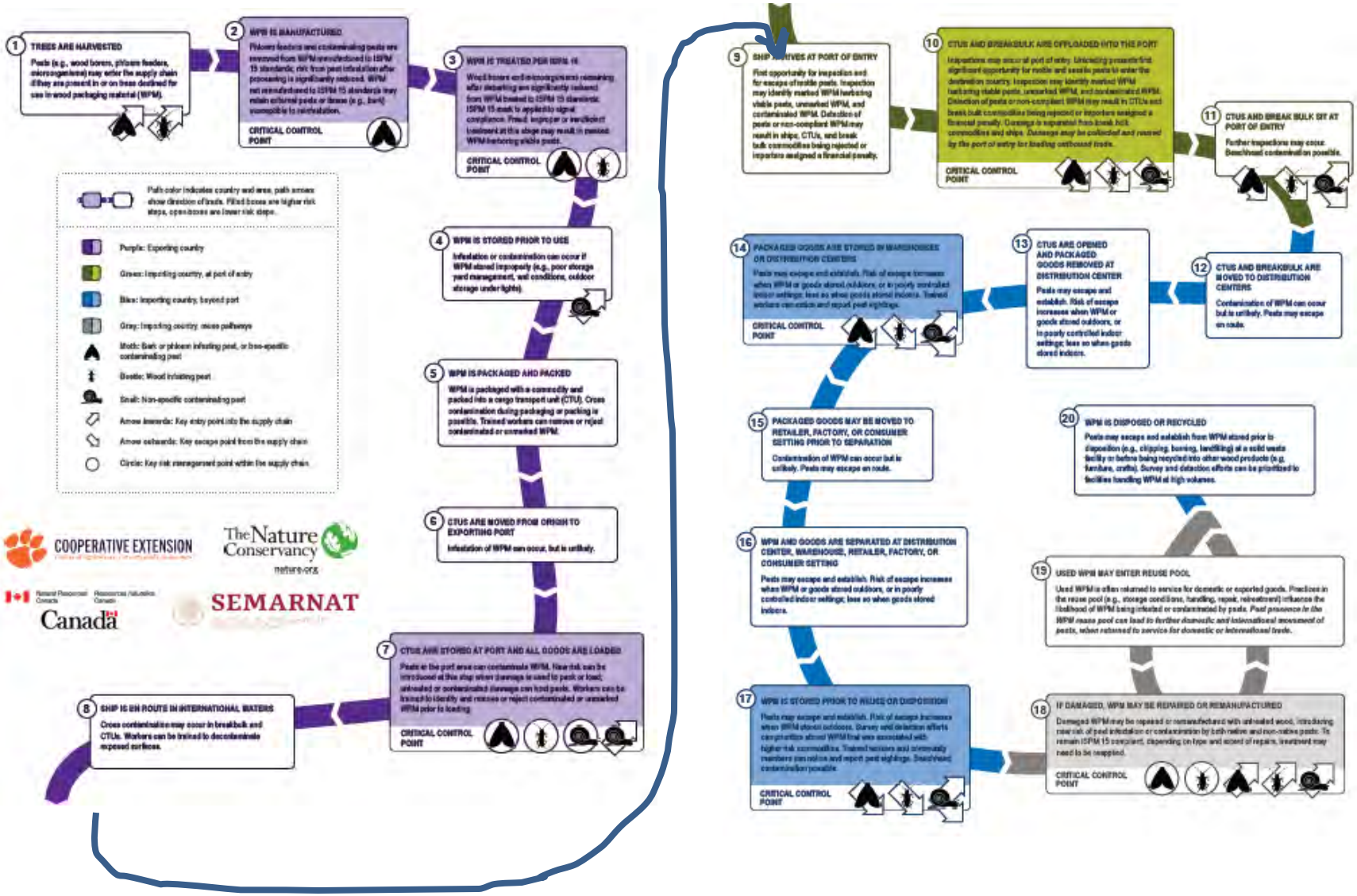


SWPM
(solid wood packing material)

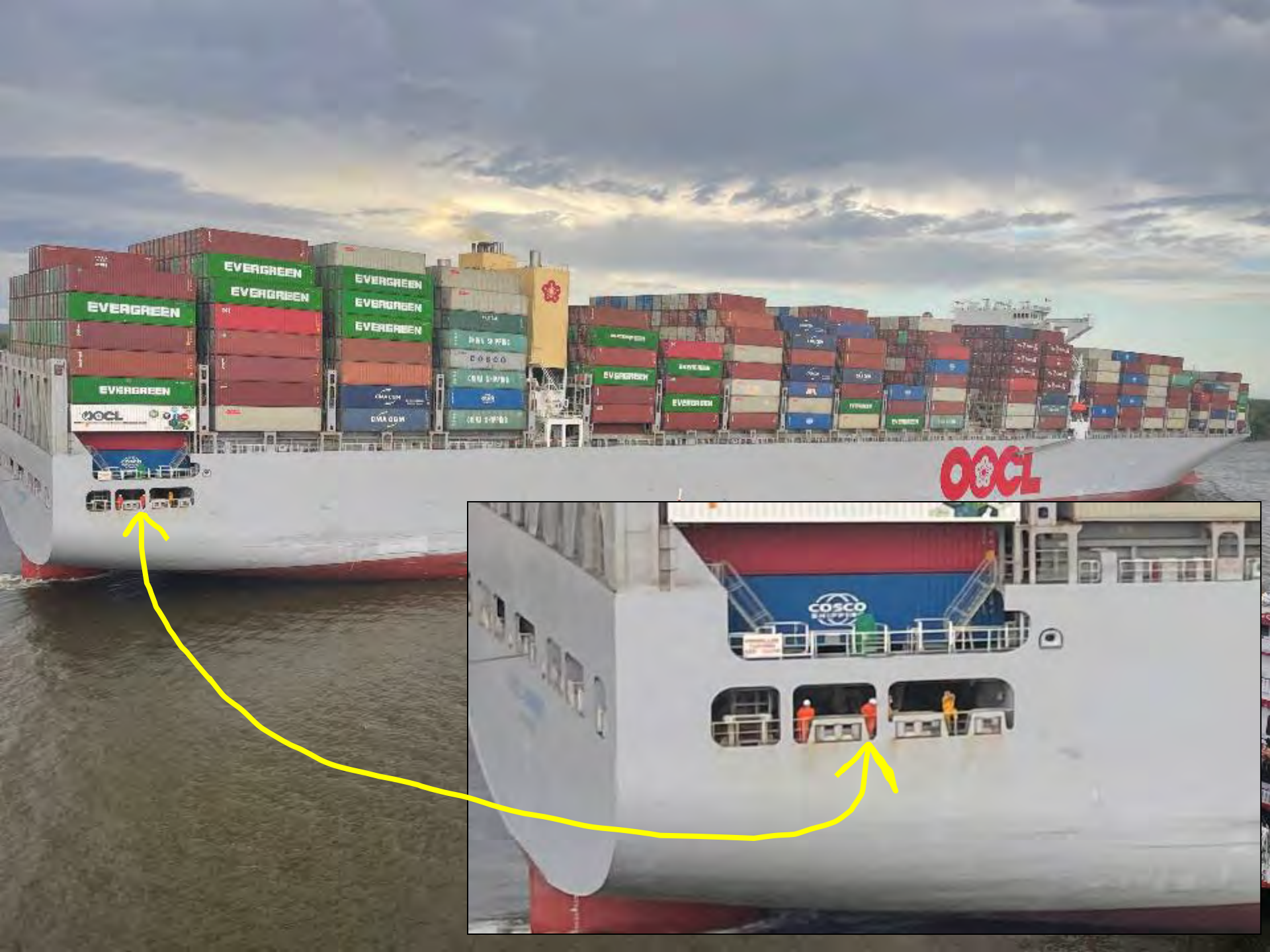
Greenwood et al. 2023. Exploring pest mitigation research and management associated with the North American wood packaging supply chain: what and where are the weak links? Biological Invasions 25: 2395-2421.

You said “dunnage” before…
What’s dunnage?

Typical pathway for SWPM



Greenwood et al. 2023. Biological Invasions 25: 2395-2421.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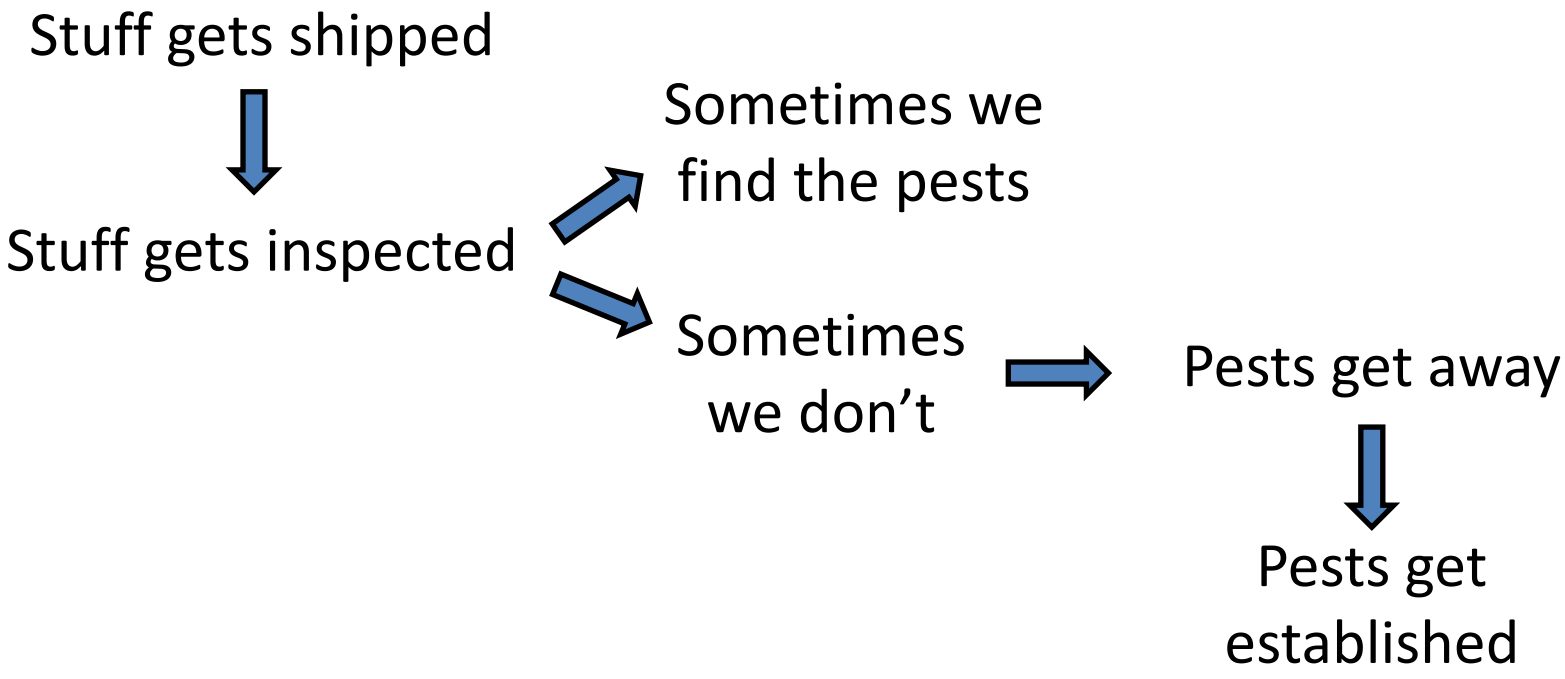
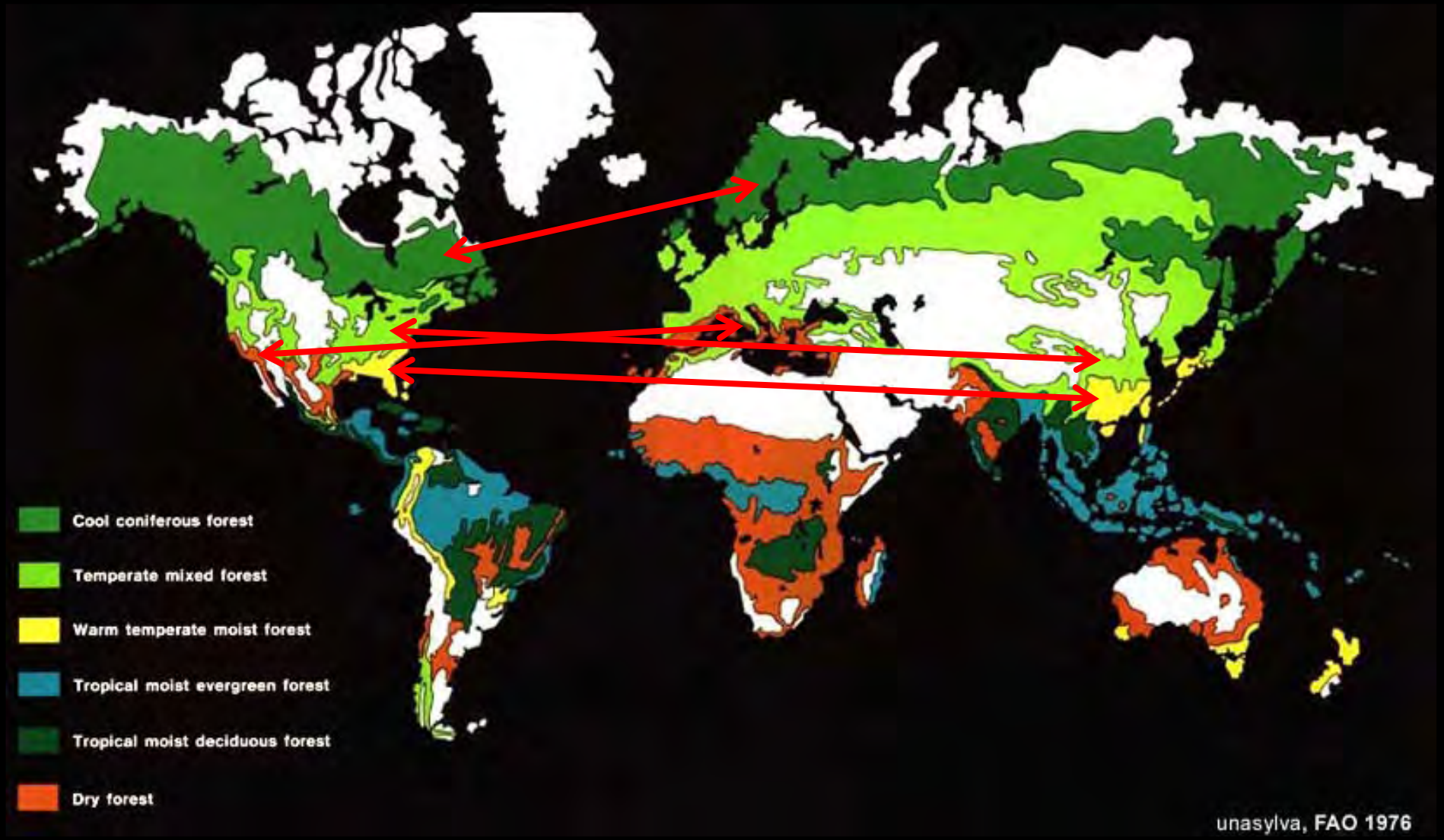
How do we get invasive pests?



World forest vegetation zones



www.fao.org

Once they're here, we move them around

http://rosecity-mi.us/tag/firewood/; https://www.forestryimages.org/browse/detail.cfm?imgnum=1197026;
https://extension.entm.purdue.edu/GM/index.php?page=home_before

How do we get invasive pests?

Once we're here

Management and mitigation come next

Are all non-native insects and pathogens bad?

~450 known non-native insect and pathogen species established in the U.S.

A handful cause significant damage

Non-native things are everywhere

All native

All native

Table 1 Native and non-native woodborer and scolytine captures during summer 2011 and 2013 at the Savannah River Site near Aiken, South Carolina, U.S.A.

Group	Family	Origin	Number of species	Total captures
Woodborers	Buprestidae	Native	8	120
		Non-native	0	0
	Cerambycidae	Native	41	936
		Non-native	0	0
	Siricidae	Native	1	30
		Non-native	0	0
	Total		50	1086
Scolytinae	Scolytinae	Native	40	2582
		Non-native	12	9646
	Total		52	12228
Weevils*	Various	Native	25	2192
		Non-native	0	0
	Total		25	2192

For a complete species list and abundance, see Supporting information, Table S1.
*excluding Scolytinae.

23% NN species
79% NN beetles

Coyle et al. 2015

Invasive pests are primary pests.

“Why are you the way that you are?”

-Michael Scott to Toby Flenderson, The Office, Season 2

Characteristics of invasive species

Rapid dispersal capabilities

High reproductive rate

Survive wide range of conditions

Feed on many different things

Most native pests are secondary pests.

Secondary pests respond to stressed trees.

Defoliators!

Oaks support ? species of defoliators

Oaks support >1,100 species of defoliators

Tallamy et al. 2025

So many caterpillars!

Forest tent caterpillar
(*Malacosoma disstria*)

No tent

Native to US, one generation per year

They generally don't eat red maple, sycamore, and conifers – everything else is on the table

Forest tent caterpillar life cycle

Hatch in spring and EAT

Overwinter as eggs

About a week to mate and lay eggs

Cocoons in protected places

Forest tent caterpillar outbreaks are cyclical

Usually don't kill tree, repeated defoliations are not good (i.e. another stressor)

Image from David Jenkins, SC Forestry Commission

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Eastern tent caterpillar

(*Malacosoma americanum*)

Tent!

Egg mass

Eastern tent caterpillar

White line

Forest tent caterpillar

Boot prints

Fall webworm

(*Hyphantria cunea*)

2-3 generations/year

Native to North America

WIDE host range: >400 sp., mostly hardwoods

Prefer pecan, persimmon, sourwood, willow

Reference:

Schowalter, T.D. & D.R. Ring. 2017. Biology and management of the fall webworm, *Hyphantria cunea* (Leopdiptera: Erebidae). J. Integr. Pest Manage. 8: 1-6.

Fall webworm life cycle

Females lay eggs on leaves

Eggs hatch in late summer,
feed for several weeks

Larvae make webs

Adults emerge in late spring

Overwinter as pupae

Fall webworm

Fall webworm

Management not usually required

Damage is unsightly but not detrimental

Do NOT set it on fire

Fall cankerworm

(*Alsophila pometaria*)

Loopers/inchworms/measuringworms

One generation per year

Native to North America

Many hosts: ash, basswood, beech, black cherry, maples, oaks, apple, birch, boxelder, dogwood, elm, hickory…

Big nuisance in some areas w/ repeated outbreaks

- e.g., Charlotte, NC

Fall cankerworm life cycle

Overwinter as eggs

Eggs hatch in early spring, feed for several weeks

Females climb high in tree and lay eggs

Pupate in soil

Adults emerge in late autumn

Oakworms
Anisota spp.

https://www.fairfaxcounty.gov/publicworks/news/orange-striped-oakworm

Oakworms

All species are similar in terms of impact and life cycle

Hosts almost always oaks (*Quercus*)

Yellow-necked caterpillar

Datana spp.

Variable oakleaf caterpillar

Lochmaeus spp.

Appearance is…variable!

Rosy maple moth

Dryocampa rubicunda

Redhumped caterpillar

Oedemasia concinna

Redhumped caterpillar

Defoliation can happen FAST

Native caterpillar management

One option = do nothing

Natural enemies usually take care of populations

Can treat with insecticide (Bt)

Single tree controls include banding, egg mass removal, or individual Bt treatment

Bagworms

Nuisance pest

Prefer juniper, arborvitae, conifers, but will feed on hardwoods

Males leave bags, fly to females to mate; females lay eggs in bags

Hand pick bags fall-spring



Elm leaf beetle

Xanthogaleruca luteola

All elm (*Ulmus*) species are used as hosts

Adults can be a nuisance (overwinter in houses)

Active beginning in May

Elm leaf beetle

Larvae
"skeletonize"
leaves

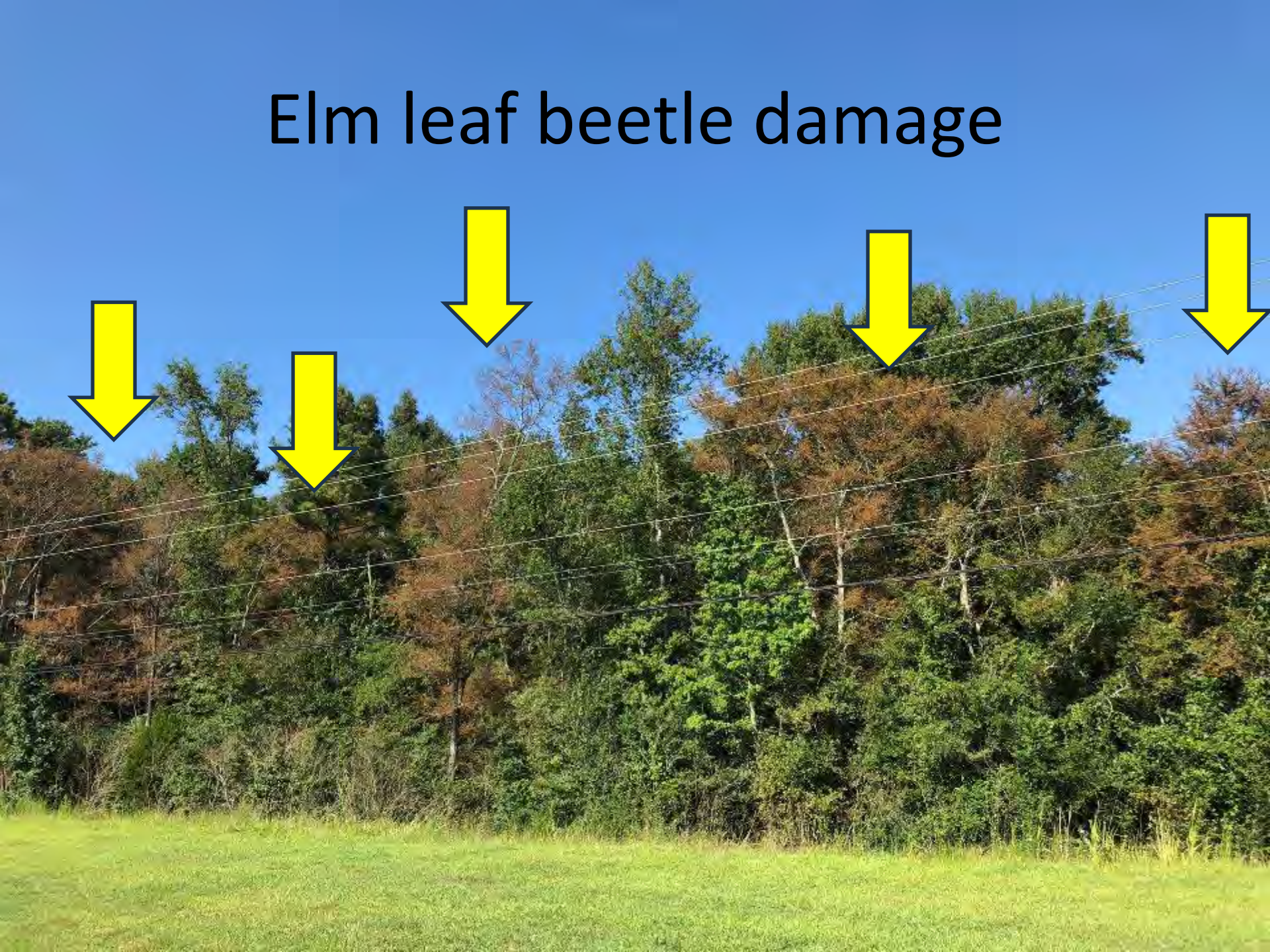
↓

Eat between the
leaf veins

Elm leaf beetle

Leaf feeding causes “bronzing” after leaf dies

Elm leaf beetle damage



Elm leaf beetle management

Not necessary in most cases
(including urban/managed forest areas)

Natural enemies typically take care of things

Systemic or contact insecticides are effective

Defoliating Sawflies

Stingless wasp relatives

Damaging stage = larvae

Some are slug-like

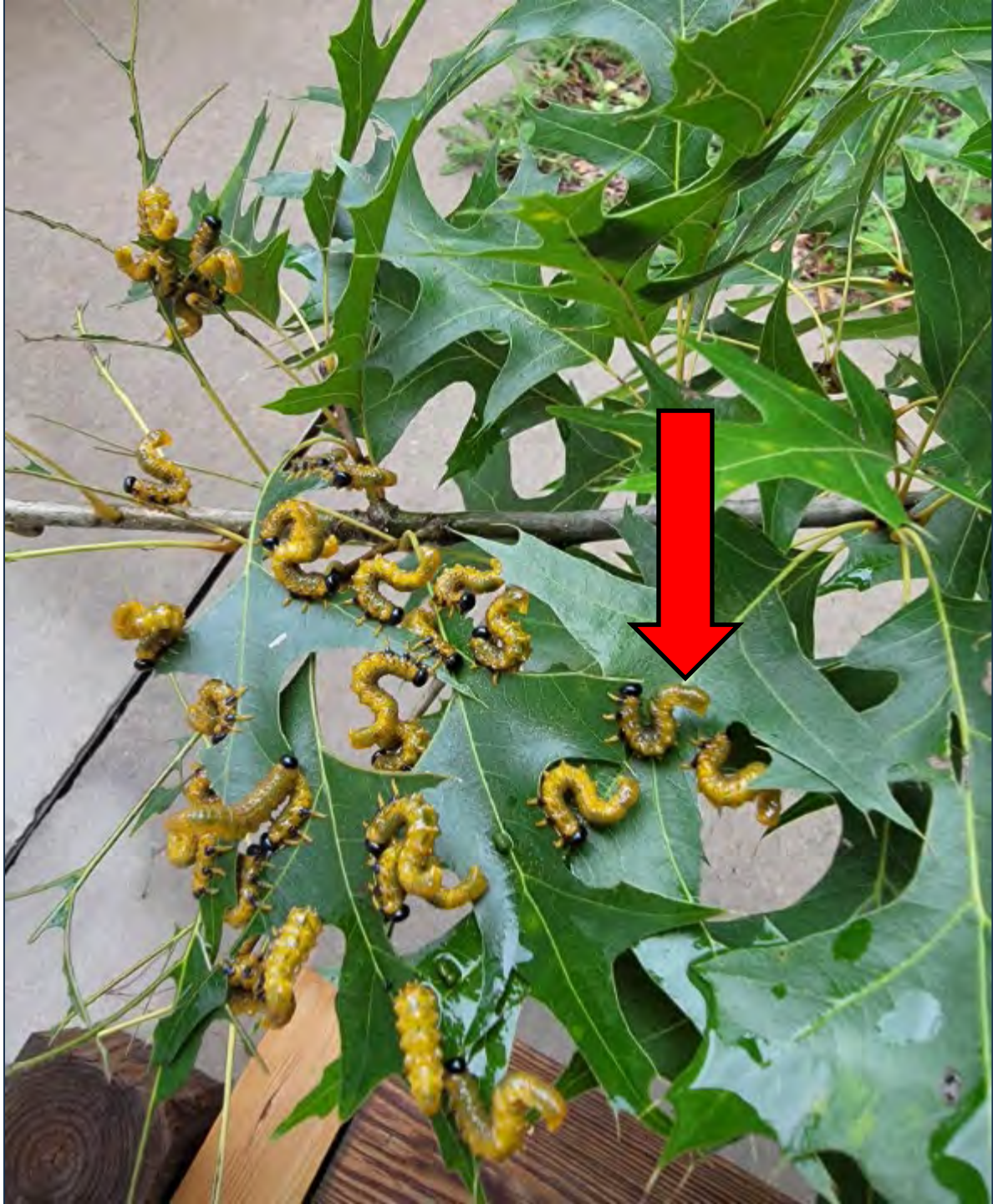
Defoliating Sawflies

Windowpane damage

Defoliating Sawflies

Many species

Many hosts

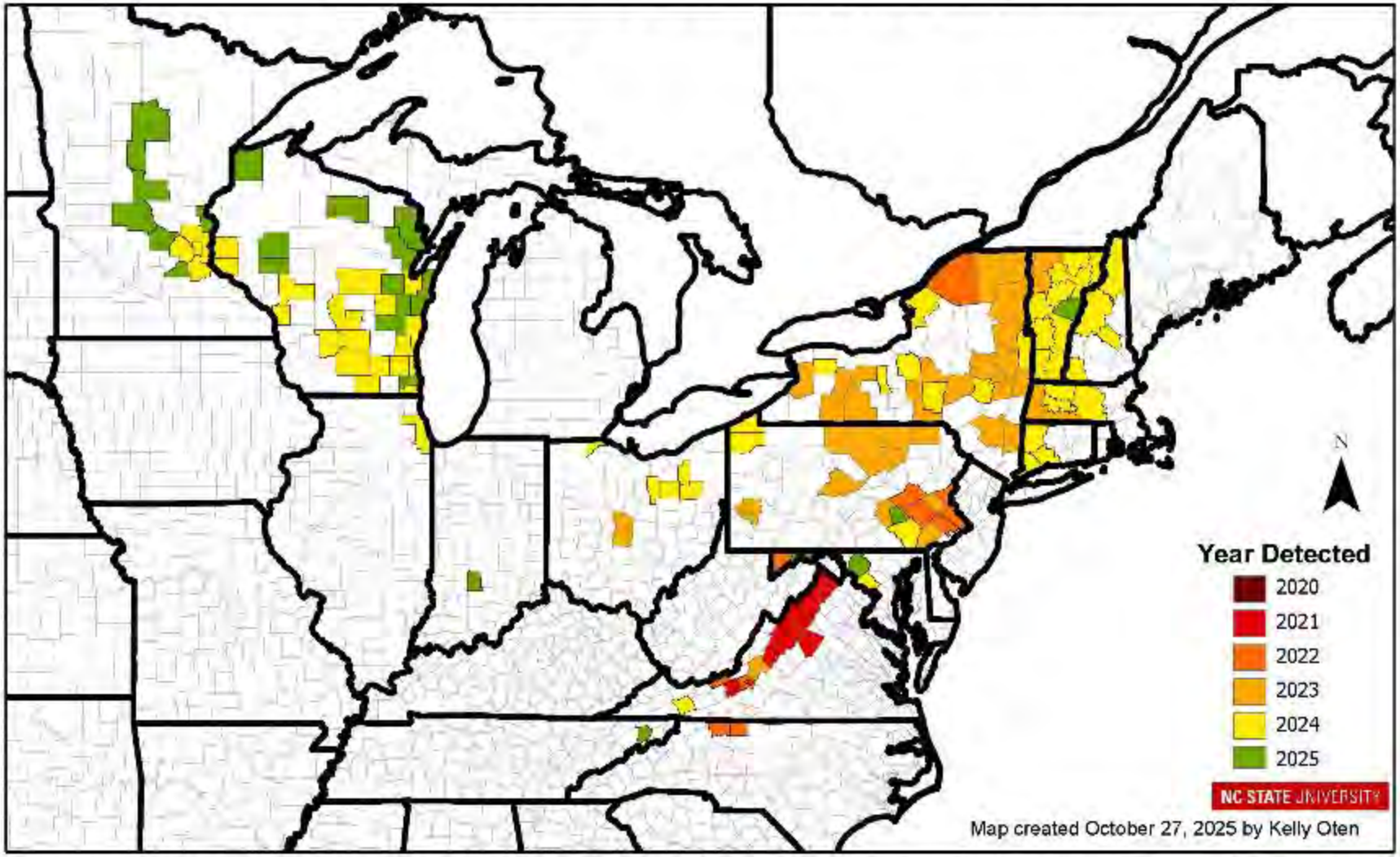


Elm zigzag sawfly (*Aproceros leucopoda*)

Native to East Asia; now found in Europe and NA

Hosts: all elm (*Ulmus*) species and *Zelkova*

Elm zigzag sawfly (*Aproceros leucopoda*) detections in the United States



The elm zigzag sawfly is an invasive defoliating pest of trees in the Ulmaceae family. Native to Asia, it was first detected in North America in Québec in 2020. Thank you to Véronique Martel & Olivier Morin for Canadian province records and the following for state records: Eric Day (VA), Lawrence Barringer (PA), Jess Cancelliere and Liam Somers (NY), Tom Macy (OH), Felicia Hubacz (MA), Heather Disque (MD), Josh Halman (VT), Angie Ambourn (MN), Michael Hillstrom (WI), Katy Kilbourne (TN), & Nathan Siegert (USFS).

Elm zigzag sawfly

Characteristic larval feeding pattern

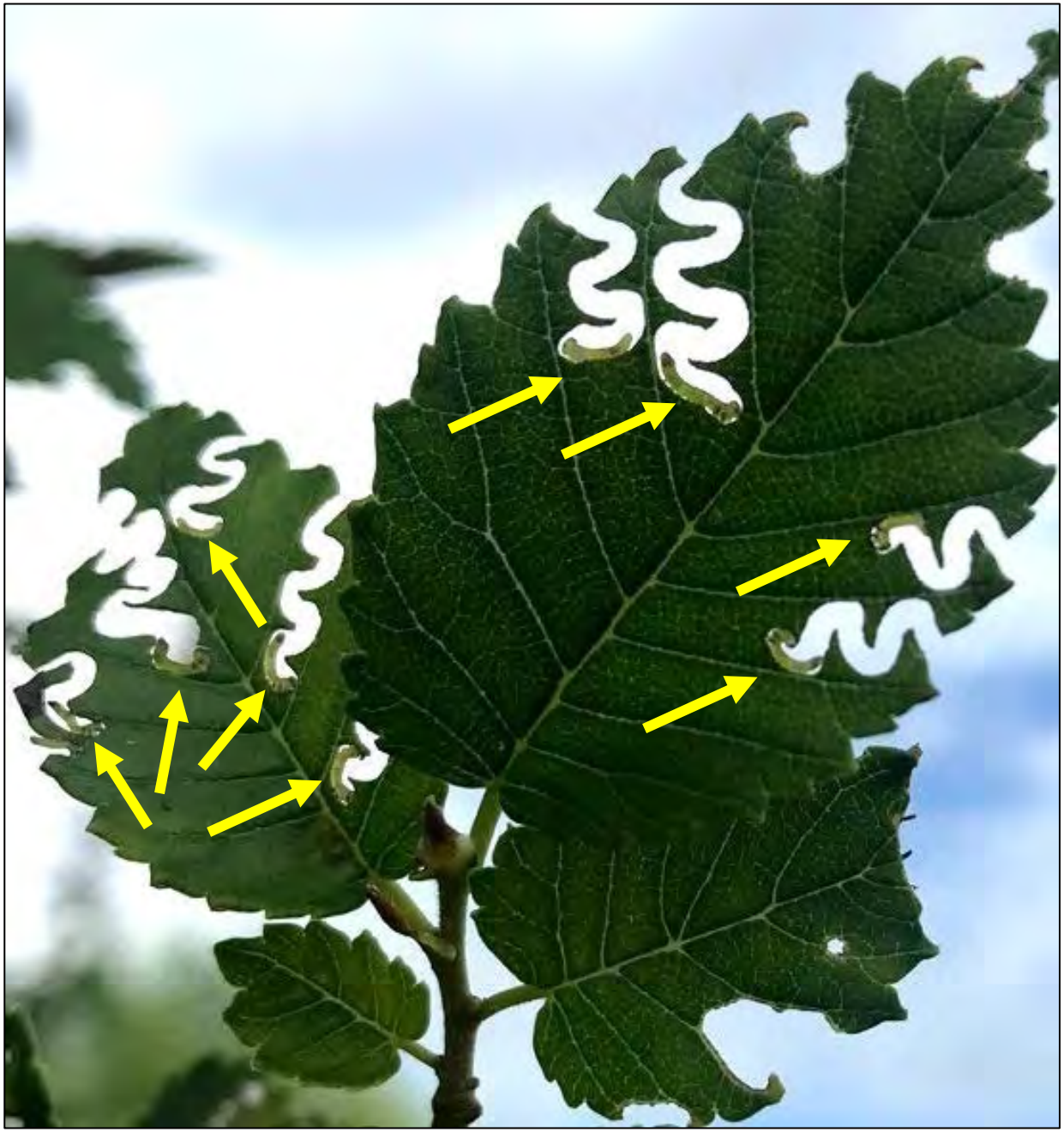
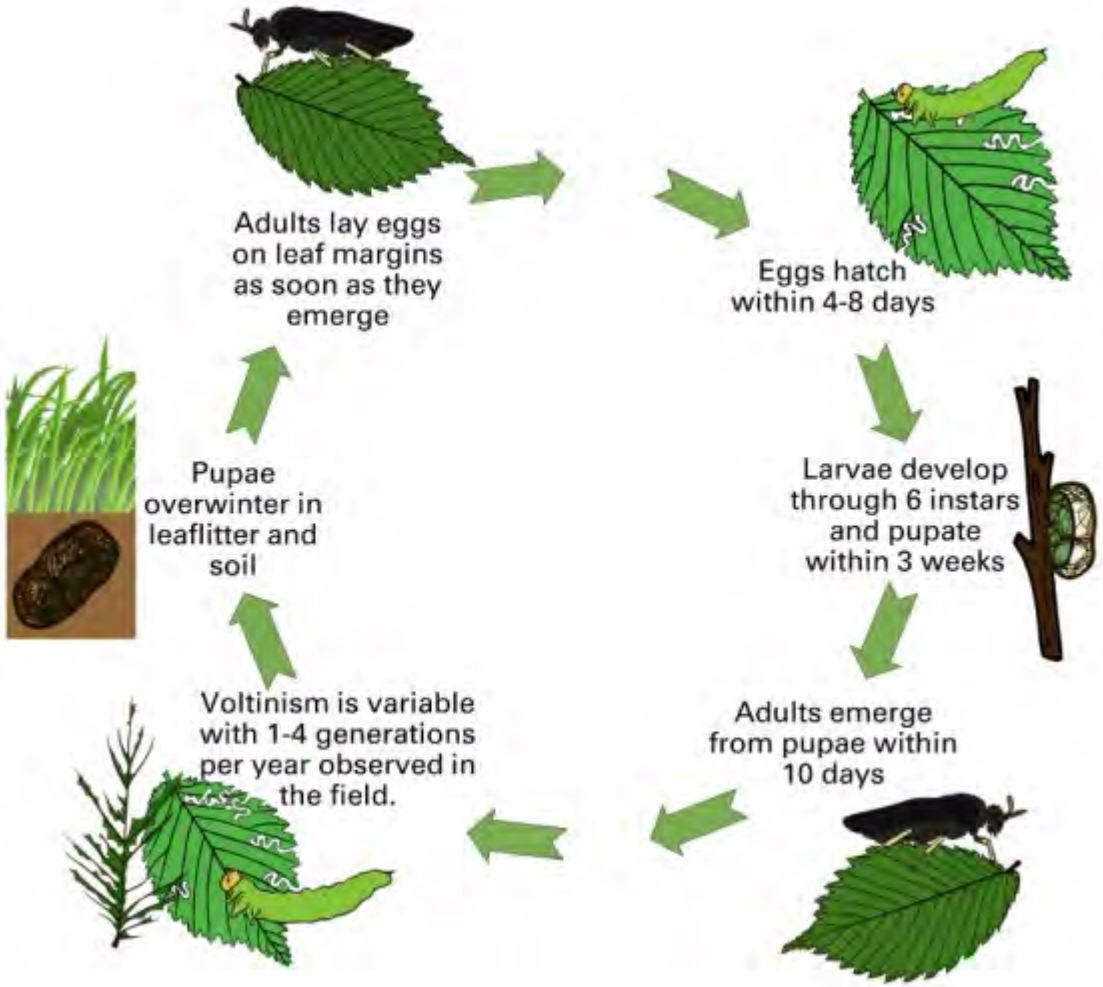


Photo by Eric Day, VT

Very hungry ~~caterpillars~~ sawflies

Photo by Dr. Kelly Oten, NCSU

Elm zigzag sawfly lifecycle in NC



Created by Ms. Abby Ratcliff, NCSU

Elm zigzag sawfly management: there are options!

1. Do nothing: natural enemies can manage populations
2. Hand removal (it works)
3. Insecticides: while none labeled for EZS, this thing isn't indestructible
4. Prevention: don't move infested material; inspect things from areas where EZS is established

Elm zigzag sawfly

If you see it, report it!

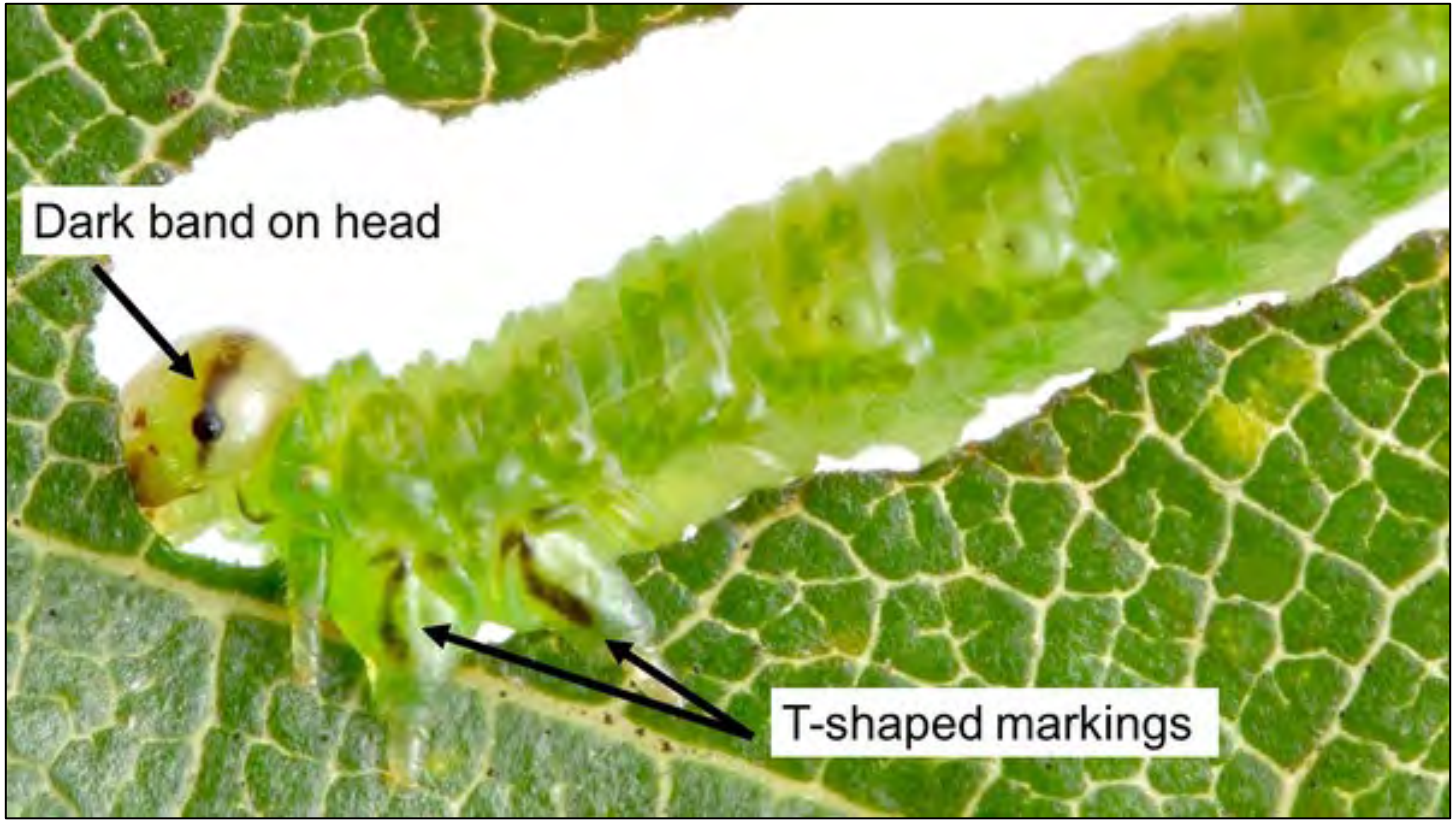


Photo by Dr. Matt Bertone, NCSU

Box tree moth
(*Cydalima perspectalis*)

Native to China and the Korean peninsula

Now common (and invasive!) across Europe

First found in North America (Ontario) in 2021

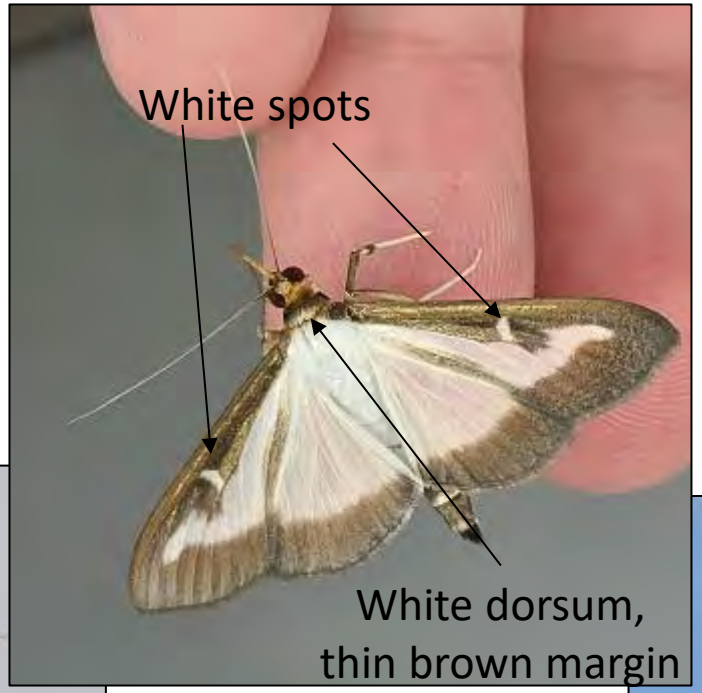
Confirmed in DE, KY, MD, MA, MI, OH, PA, VA, WV

Not yet known in ISA Southern region but BOLO!!

Box tree moth

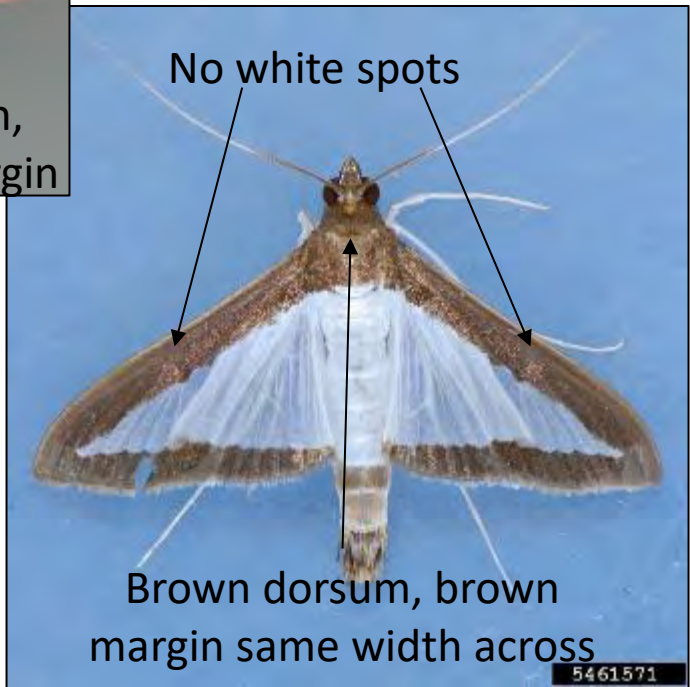
Preferred hosts:
boxwoods (*Buxus* spp.)

Box tree moth



Coyle et al. 2022.

White spots on forewing

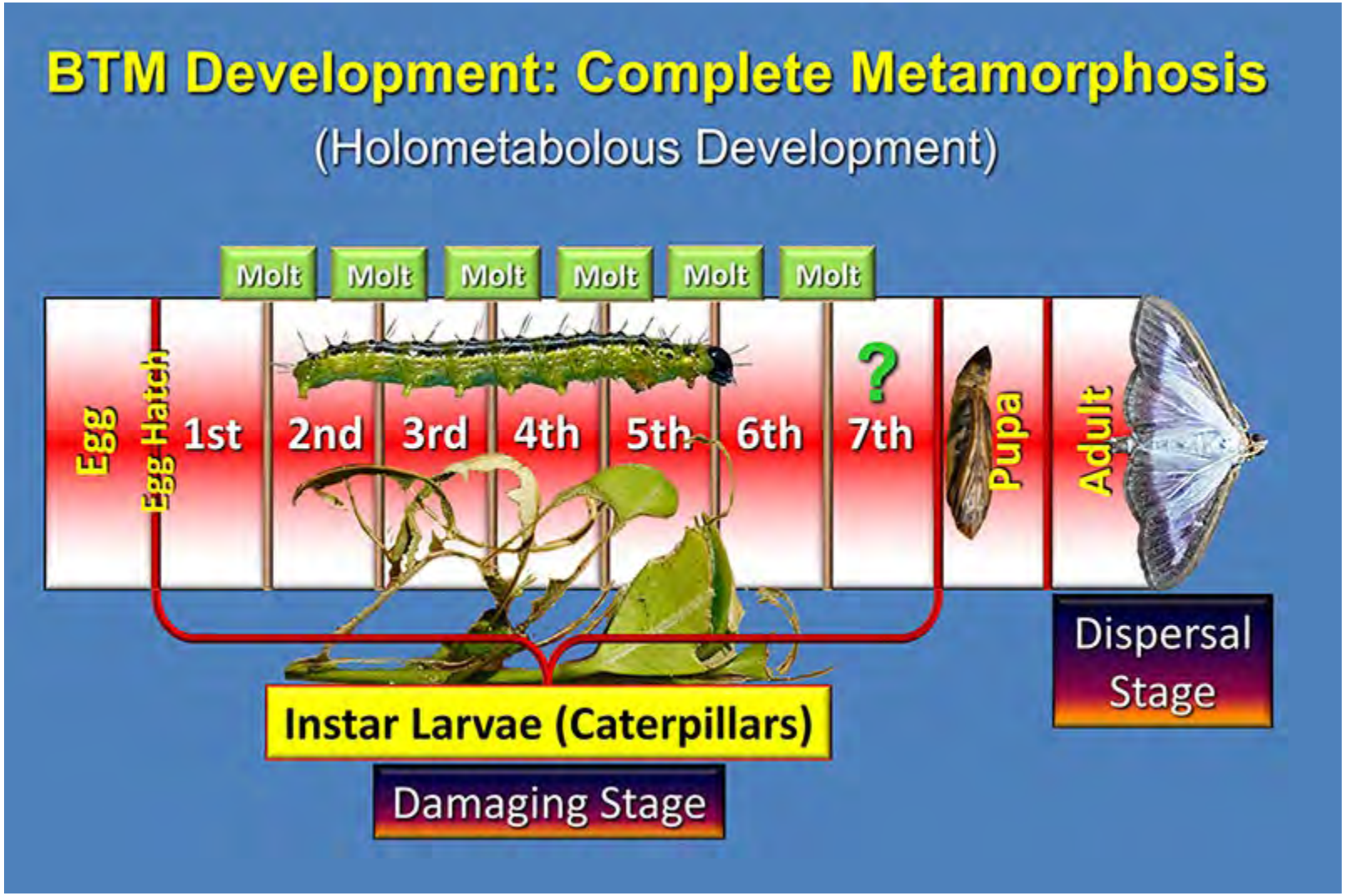






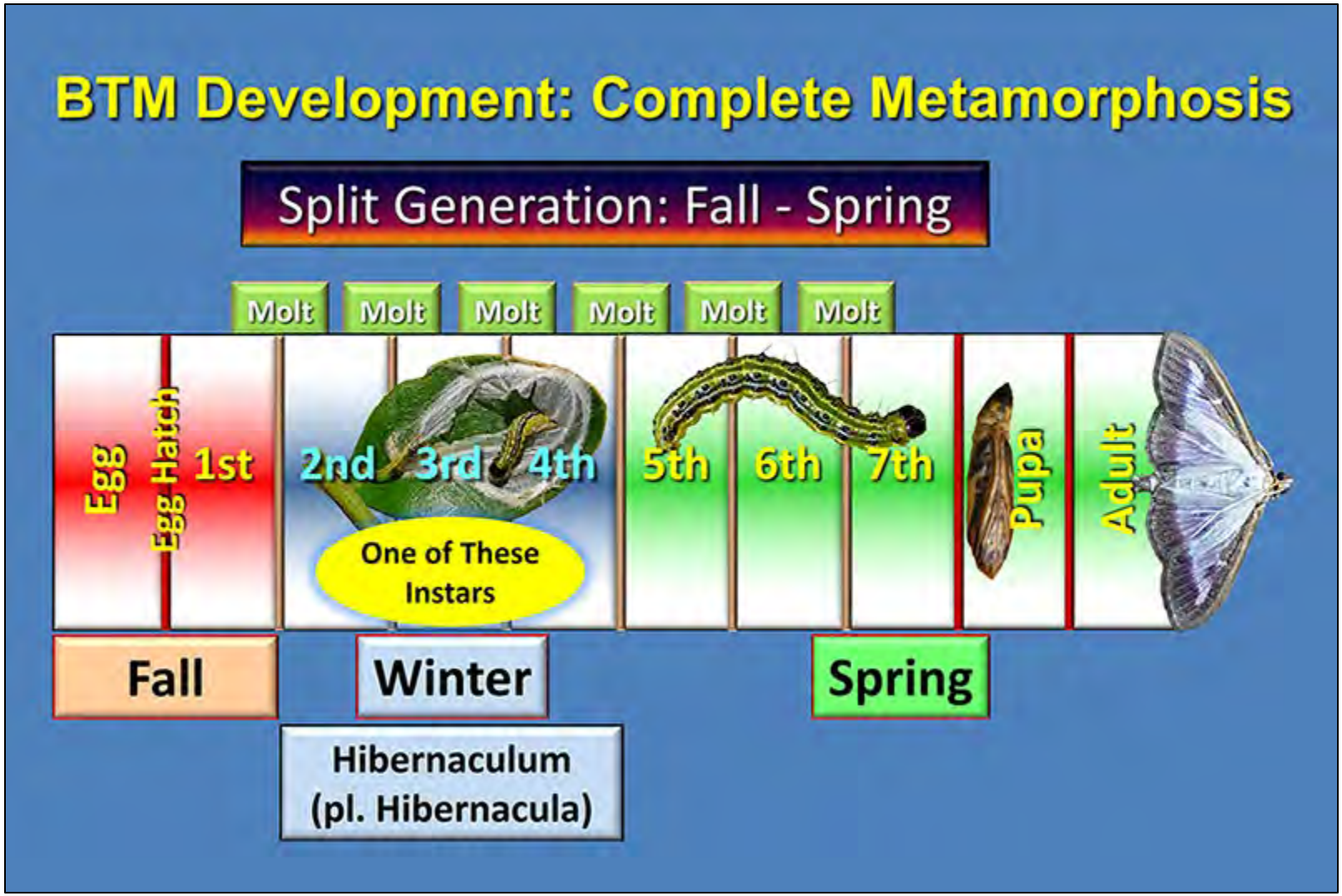
Coyle et al. 2022.

Box tree moth life cycle



OSU Extension 2025: https://ohioline.osu.edu/factsheet/ent-0099

Box tree moth life cycle



OSU Extension 2025: https://ohioline.osu.edu/factsheet/ent-0099

Box tree moth damage

Coyle et al. 2022.

Box tree moth damage

Larvae tend to leave “strips” of foliage

Coyle et al. 2022.

Box tree moth management: there are (few) options!

1. Hand removal (it works)
2. Clear away leaf litter to remove overwintering sites
3. Insecticides: while none labeled for BTM, this thing isn't indestructible
4. Prevention: don't move infested material from areas where BTM is established

Box tree moth

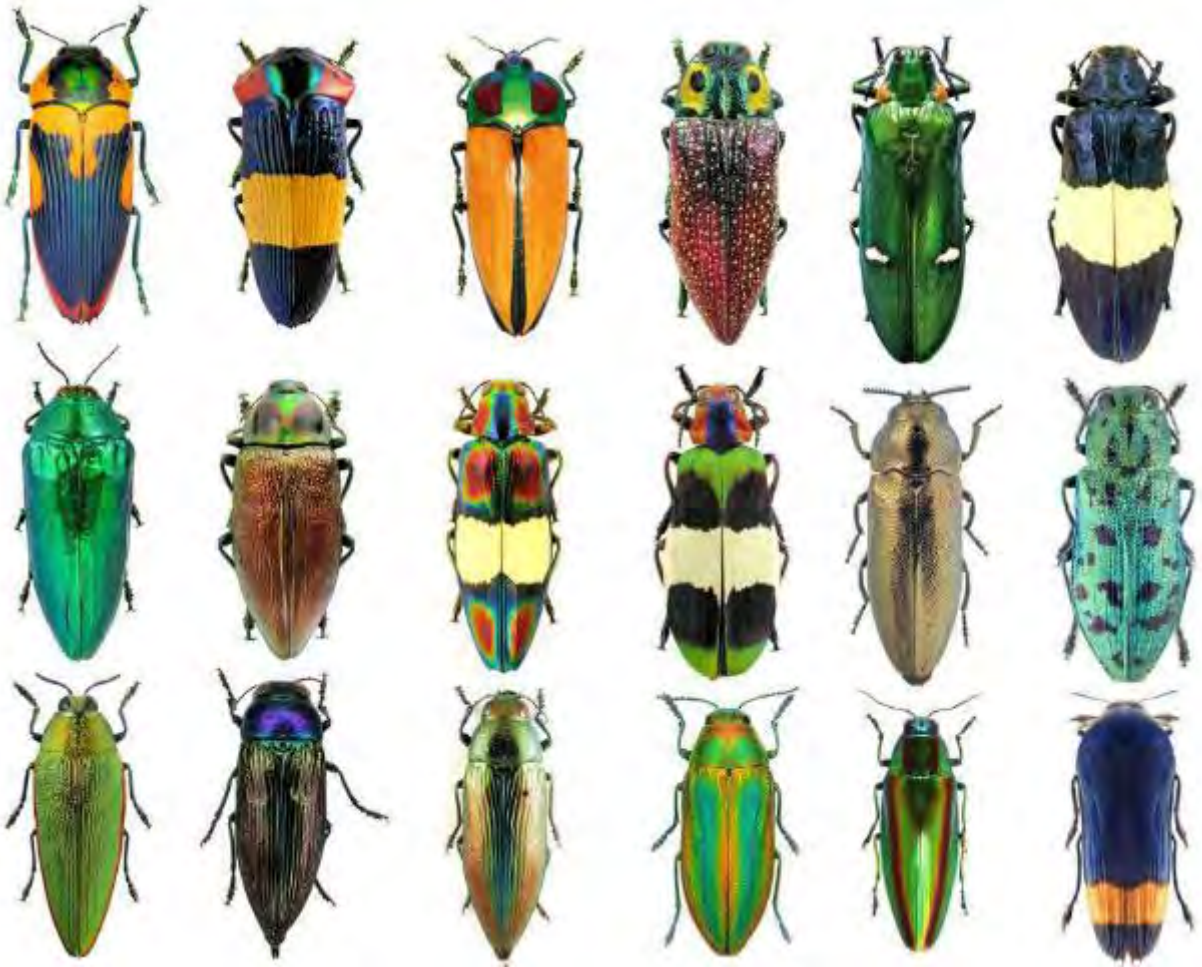
If you see it, report it!

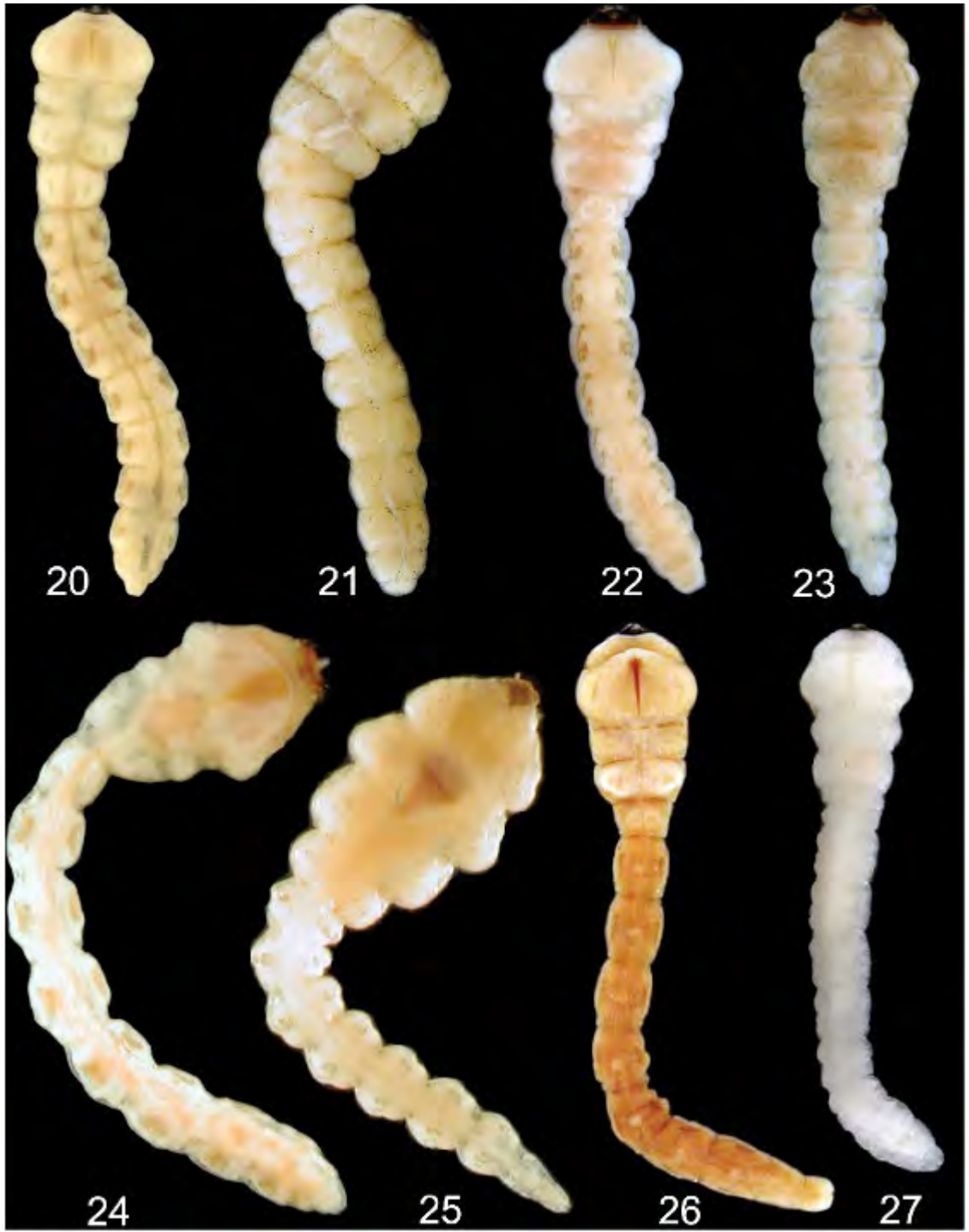
Photo by Joe Boggs, OSU

Boring insects!

Common woodboring beetles on southern hardwoods

Buprestidae (jewel beetles)





Buprestidae larvae = flatheaded borers

Volkovitsh & Bily 2015.

Flatheaded appletree borer

Chrysobothris femorata

Common, attacks weakened or stressed trees

Adults appear in summer

Flatheaded appletree borer

Larvae feed on phloem, girdling trees

Newly-planted trees may need chemical or physical protection

Emerald ash borer
(*Agrilus planipennis*)

Millions of trees. Billions of dollars.

Know the host, or your ash is toast

Compound leaf

Fruit/seed = samara

Bark

https://www.fdacs.gov/Forest-Wildfire/Our-Forests/Forest-Health/Forest-Insects/Emerald-Ash-Borer/Ash-Fraxinus-spp.-Identification

“But I heard EAB will eat other things too”

White fringetree
Chionanthus virginicus

Manzanillo olive tree
Olea europaea 'Manzanillo'

https://nc.audubon.org/news/plant-fringe-tree-three-season-appeal

https://www.coastlinepalmtrees.com/manzanilla-olive-tree

Emerald ash borer life cycle

As early as late March
Peak in April/May
End in late June

Has preceded leaf-out by 1-2 wks

BUT adults can survive 1-2 wks without food

April-June

Adults feed on foliage

Eggs hatch in 1-2 weeks

Emerald ash borer life cycle

Larval period = rest of spring/summer/fall/ early winter

Winding galleries

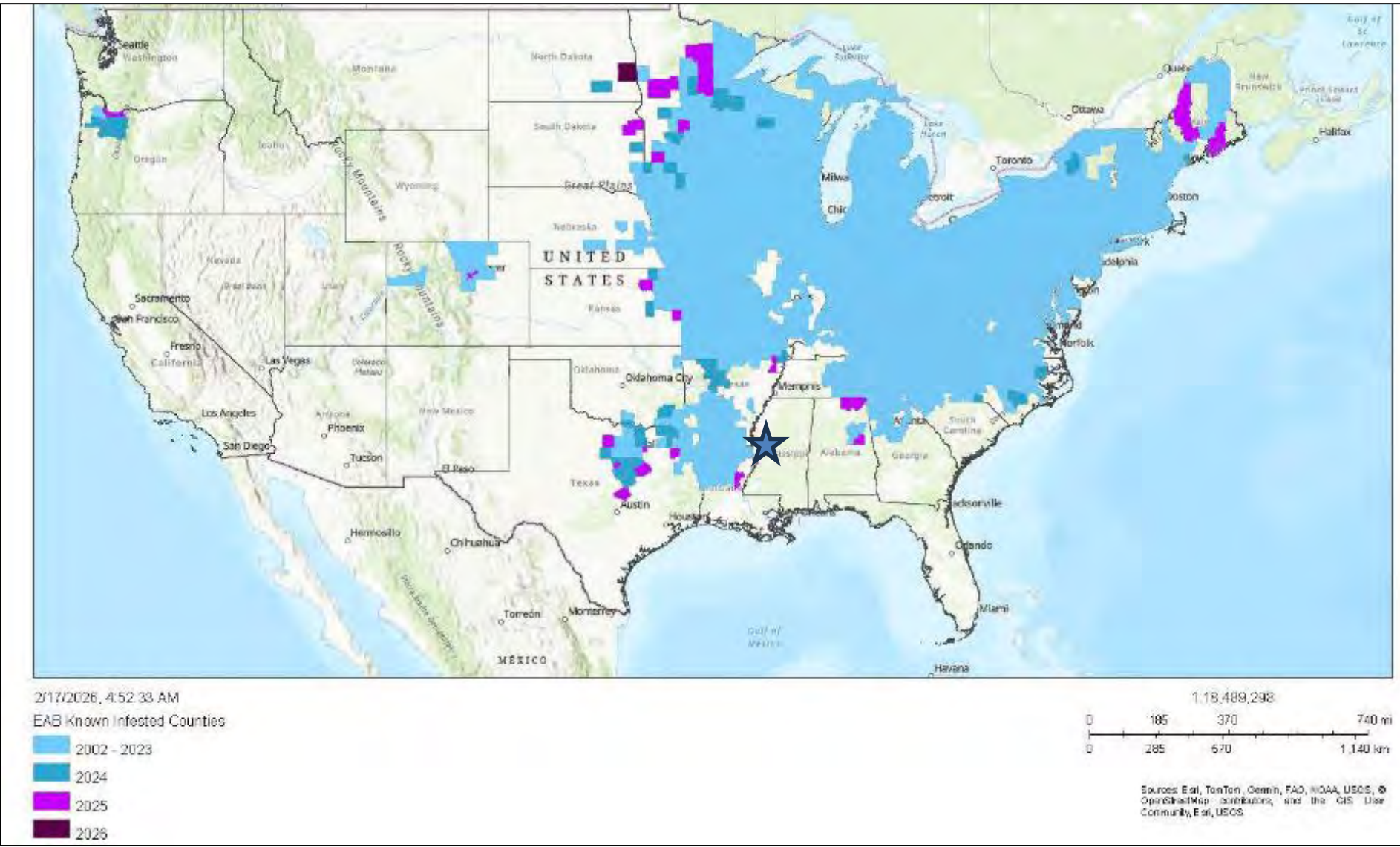
Frass-packed galleries

Pupate in Jan-Feb

Pupal chambers

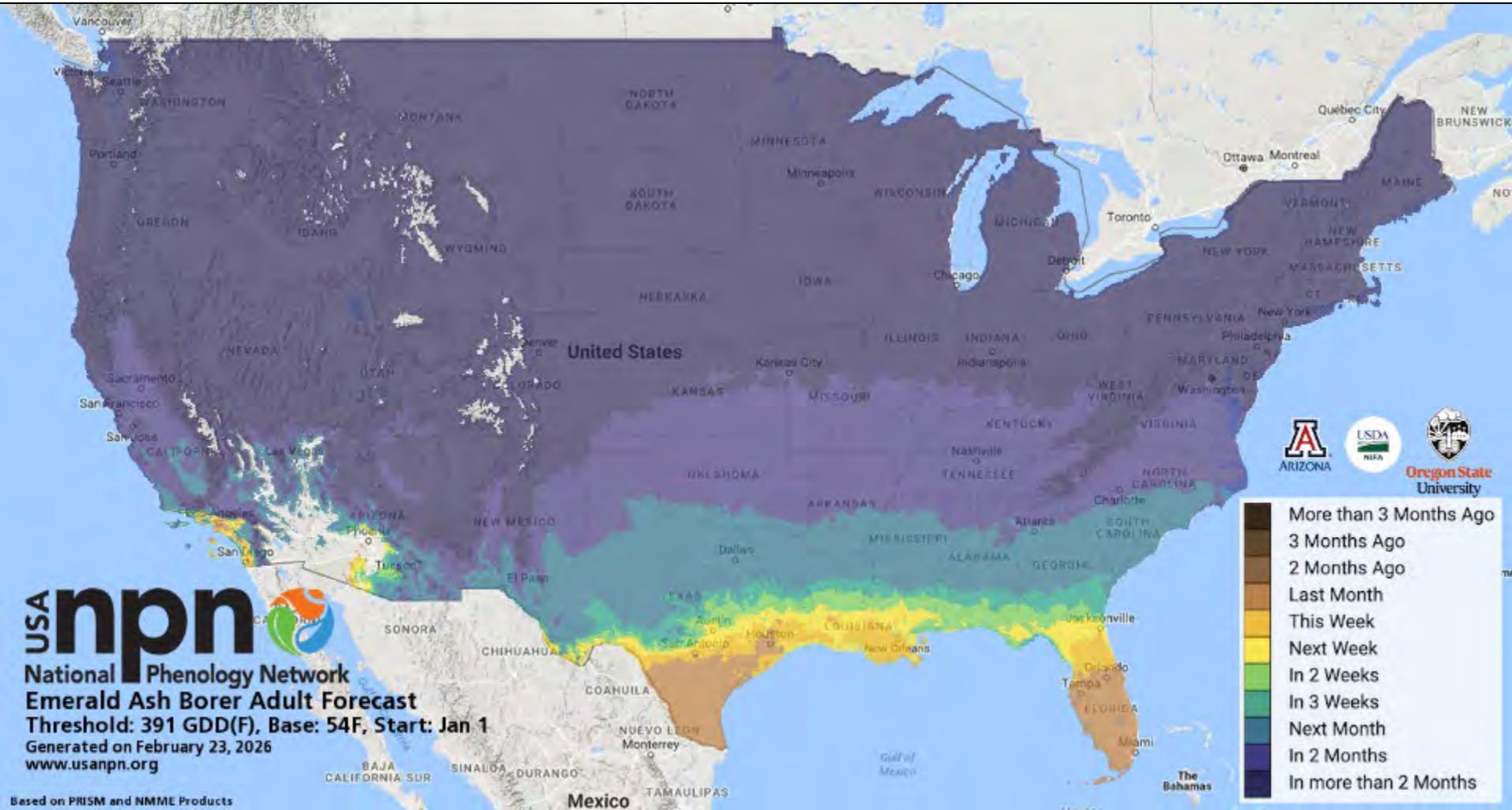
Emerald ash borer: where is it?

https://www.aphis.usda.gov/plant-pests-diseases/eab/eab-infestation-map



Emerald ash borer: when to expect it

https://www.usanpn.org/data/maps/forecasts/emerald_ash_borer



EAB: What to look for

Declining/thinning crown

Epicormic sprouts

EAB: What to look for

Cracking/
swollen bark

D-shaped holes

Winding galleries
under bark

EAB: What to look for

Ash blonding

EAB: What to look for

Woodpecker activity

Early intervention is critical for saving an ash tree

Good < 10%	Fair > 10% and ≤ 30%	Poor or worse > 30% thinning

From C. Sadof webinar, 28 March 2018, available at http://southernforesthealth.net/webinars

Hard to detect, easy to save

Asymptomatic, infested ash trees

From C. Sadof webinar, 28 March 2018, available at http://southernforesthealth.net/webinars

Easy to detect. Too late to save

From C. Sadof webinar, 28 March 2018, available at http://southernforesthealth.net/webinars

EAB chemical control

<u>Systemic</u>

Basal drench

Trunk injections

Trunk sprays

Imidacloprid

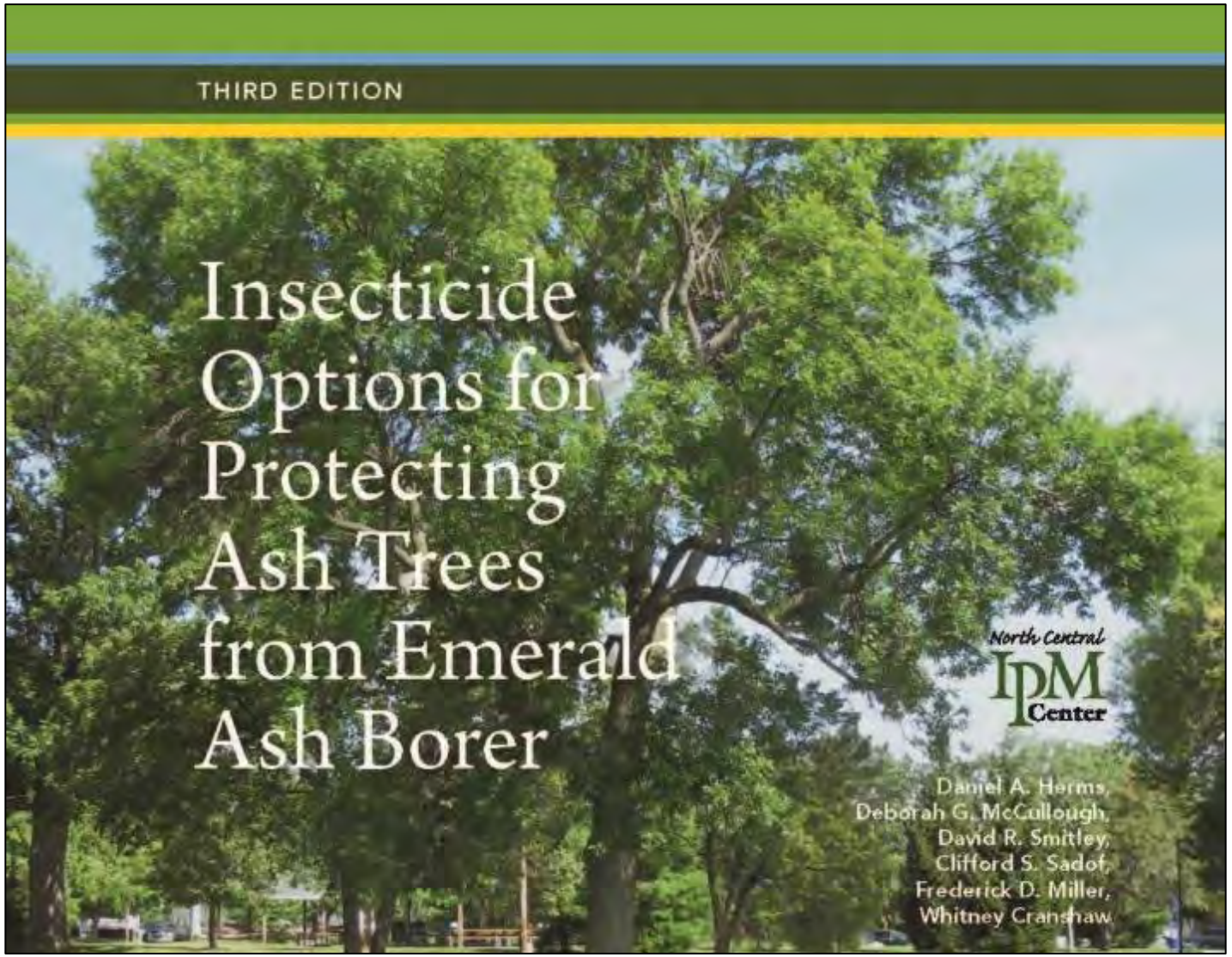
Dinotefuran

Emamectin benzoate

Azadirachtin

Google “EAB Chemical Treatment”

http://www.emeraldashborer.info/documents/Multistate_EAB_Insecticide_Fact_Sheet.pdf



Flatheaded appletree borer

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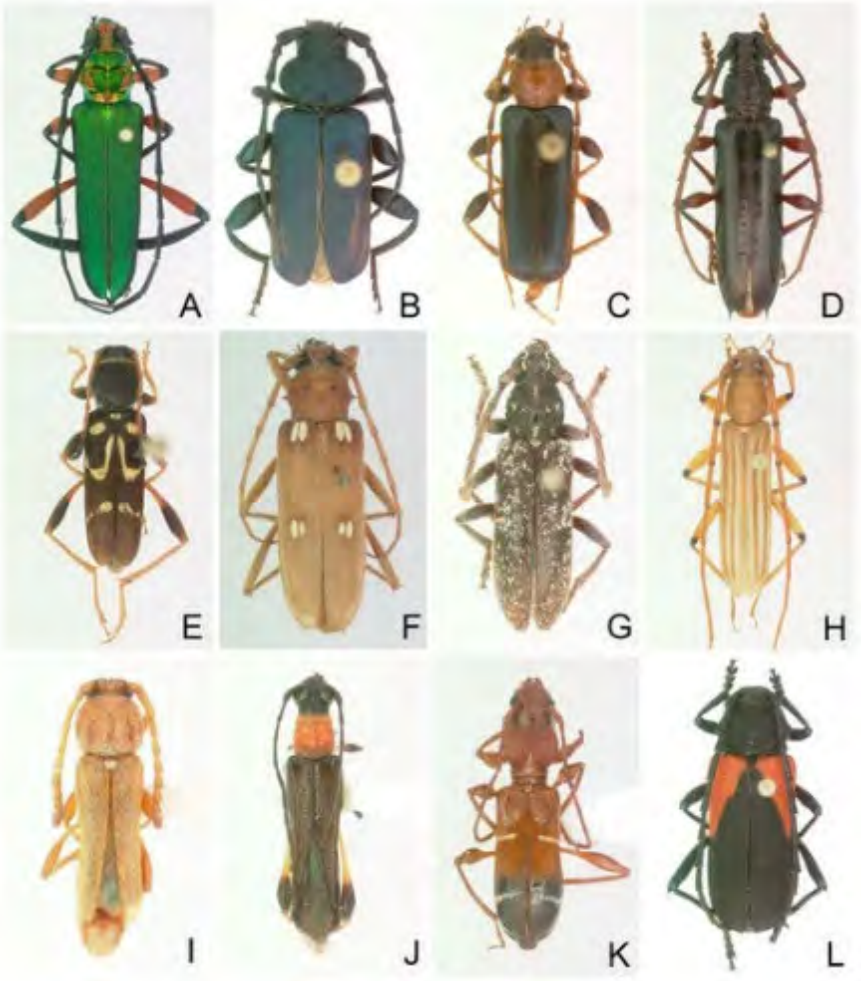
Common woodboring beetles on southern hardwoods

Cerambycidae (longhorned beetles)



Sutherland et al. 2021.

Cerambycidae larvae = roundheaded borers

Wu et al. 2017.

Asian longhorned beetle
(*Anoplophora glabripennis*)

Native to Asia

Extremely wide host range (>220 spp.)

Eradication efforts

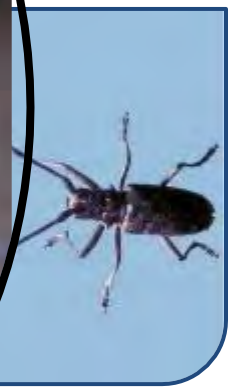
Large, bluish feet

White bands on antennae

ALB Look-alikes

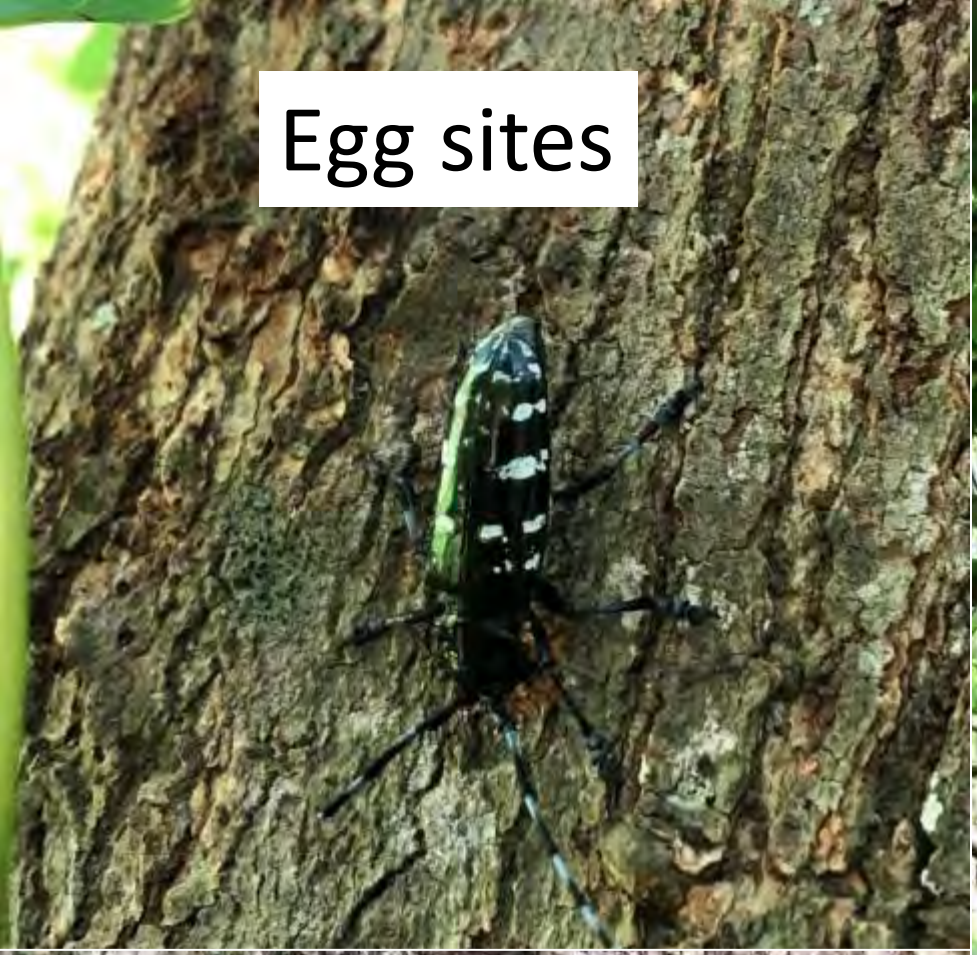
Alaus oculatus
Eastern eyed click beetle

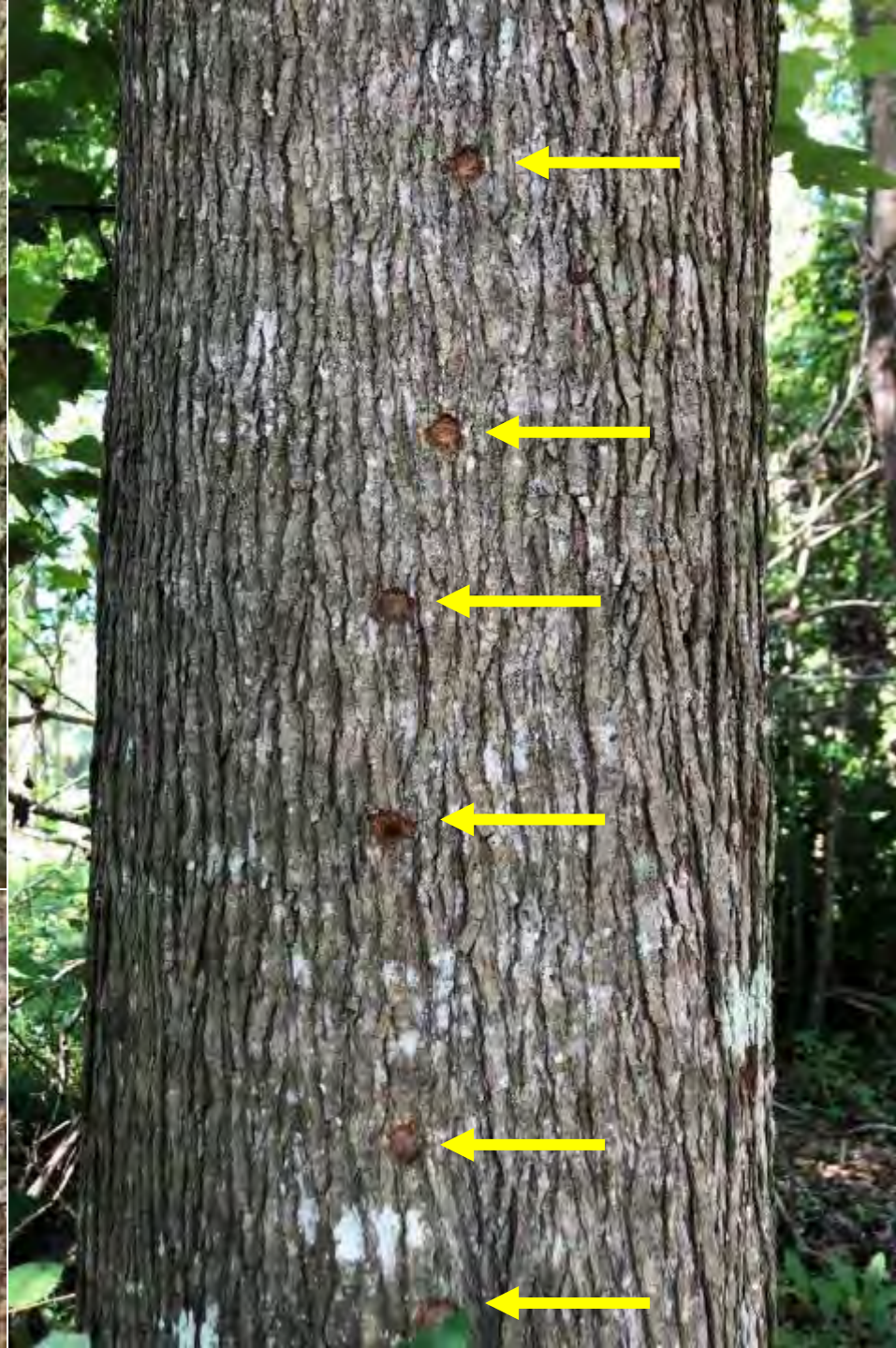
Plectrodera scal
Cottonwood borer
G.J. Lenhard, Louisiana State Univers
Bugwood.org.



hamus titillator
n pine sawyer beetle
. Baker, North Carolina State University

Egg sites






Bleeding at egg sites

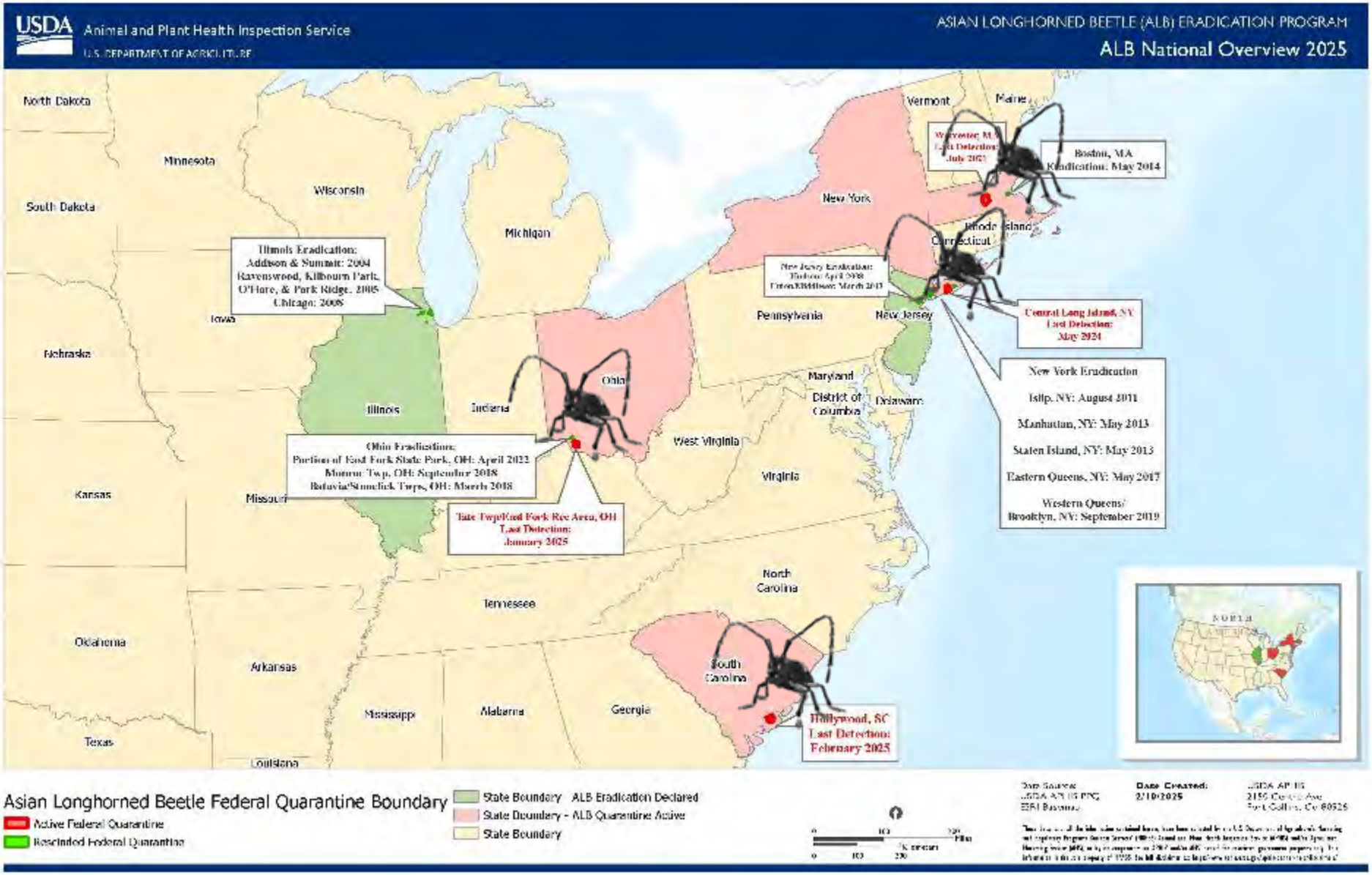

Sawdust/frass from larval feeding

Larval feeding damage


Broken/falling branches

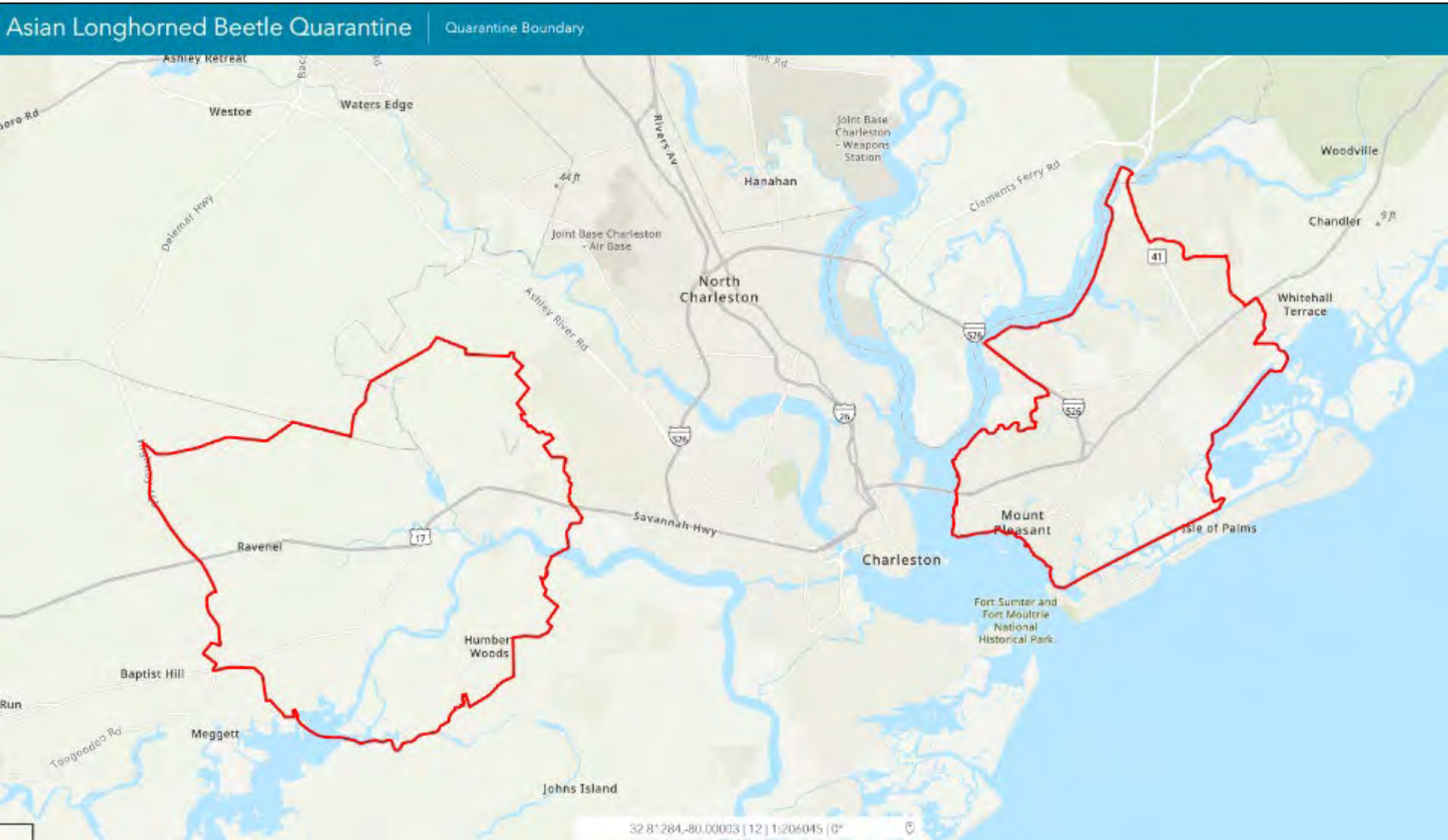

Egg site
Exit hole

ALB: where is it?



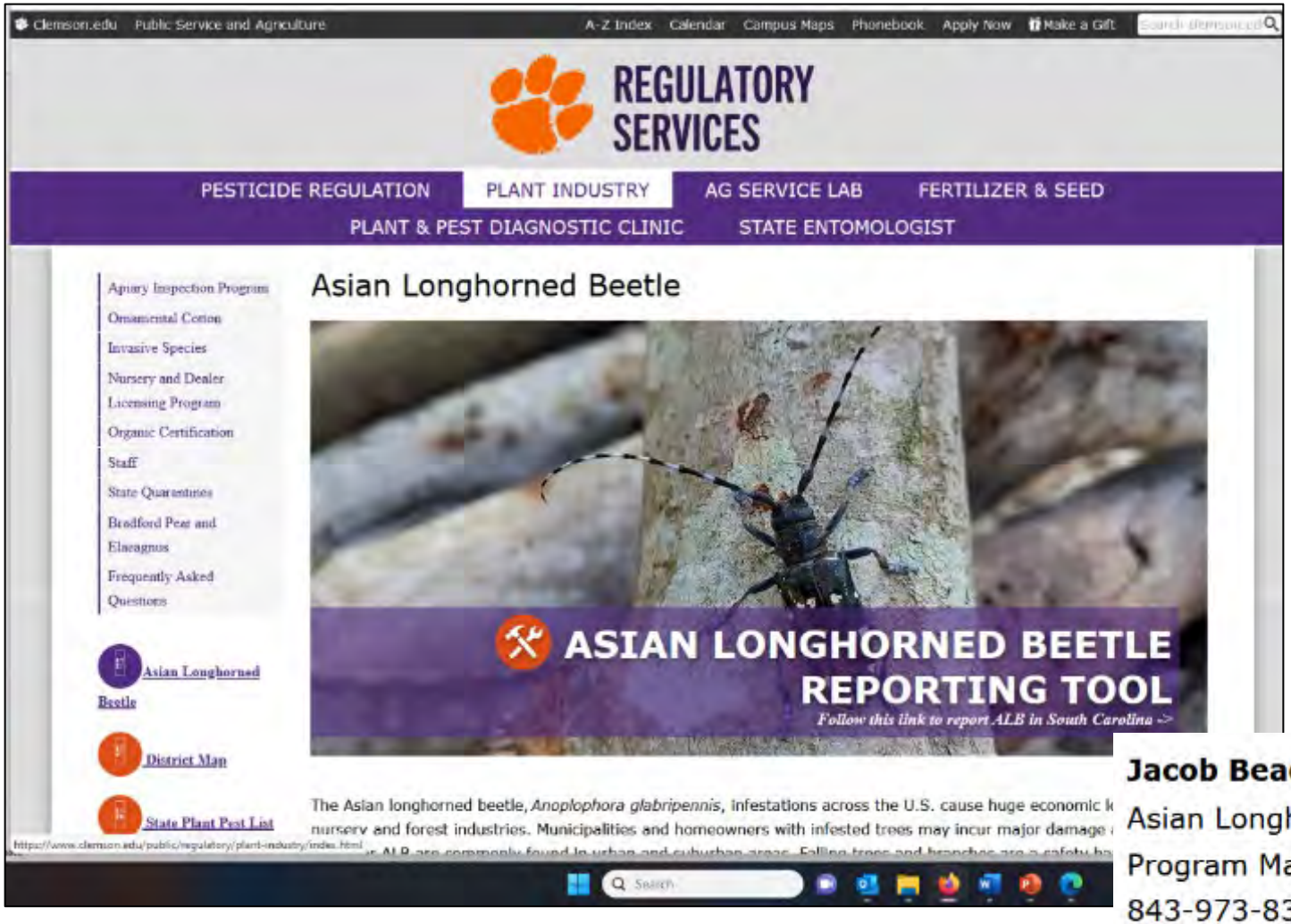
ALB: where is it?

https://www.clemson.edu/public/regulatory/plant-industry/invasive/



Think you saw an ALB?

https://www.clemson.edu/public/regulatory/plant-industry/plant-pest-regulations/state-plant-pest-information/alb.html



Jacob Beach
Asian Longhorned Beetle
Program Manager
843-973-8329
stopalb@clemson.edu

Ambrosia beetles: hundreds of species, very common

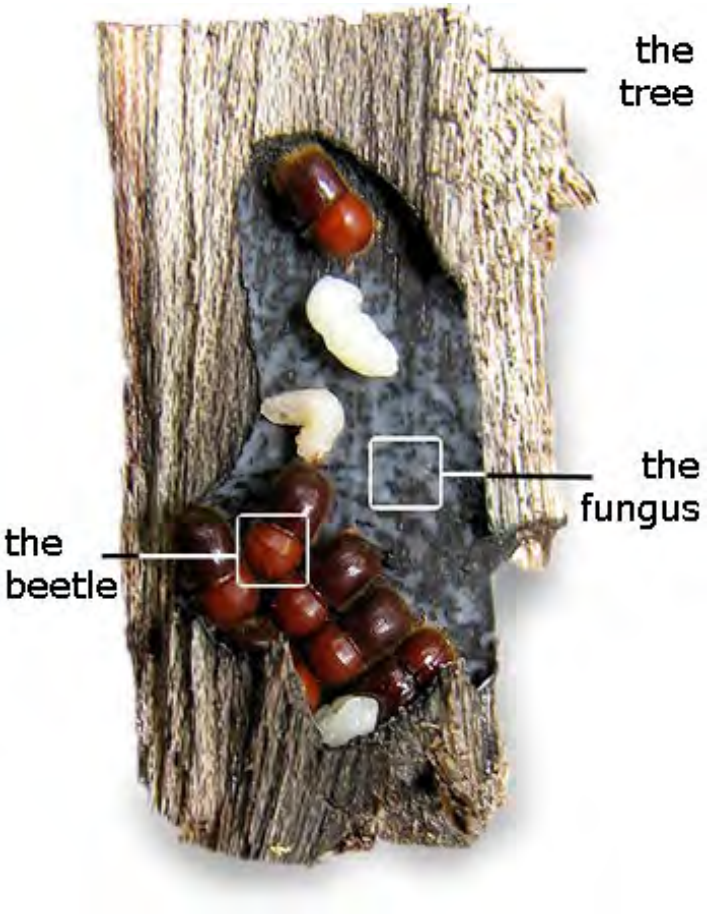
- Forests
- Nurseries
- City squares
- Your yard
- The park
- Suburbia
- Golf courses
- Streets

Ambrosia beetles are small

(and some can do a lot of damage)

Ambrosia beetles

Create fungal gardens (which larvae eat)



Pics: J. Hulcr

Ambrosia beetles

Toothpicks! Noodles! Frass tubes!



Usually the thing that “finishes off” a tree

Ambrosia beetles

Several species of troublesome invasive ambrosia beetles are in the U.S.

Granulate ambrosia beetle

Xylosandrus crassiusculus

Camphor shoot borer

Cnestus mutilatus

Black twig borer

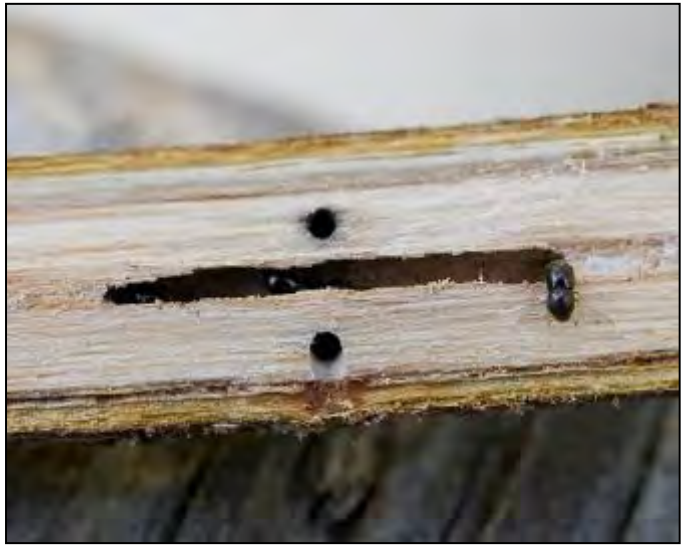
(*Xylosandrus compactus*)

Native to Asia

Occurs throughout the SE US

Extremely wide host range (>220 spp.)

Tiny! 1-2 mm long



Black twig borer damage

Flagging

Aesthetic

Generally not a problem for established plants

May impact new plantings or transplants

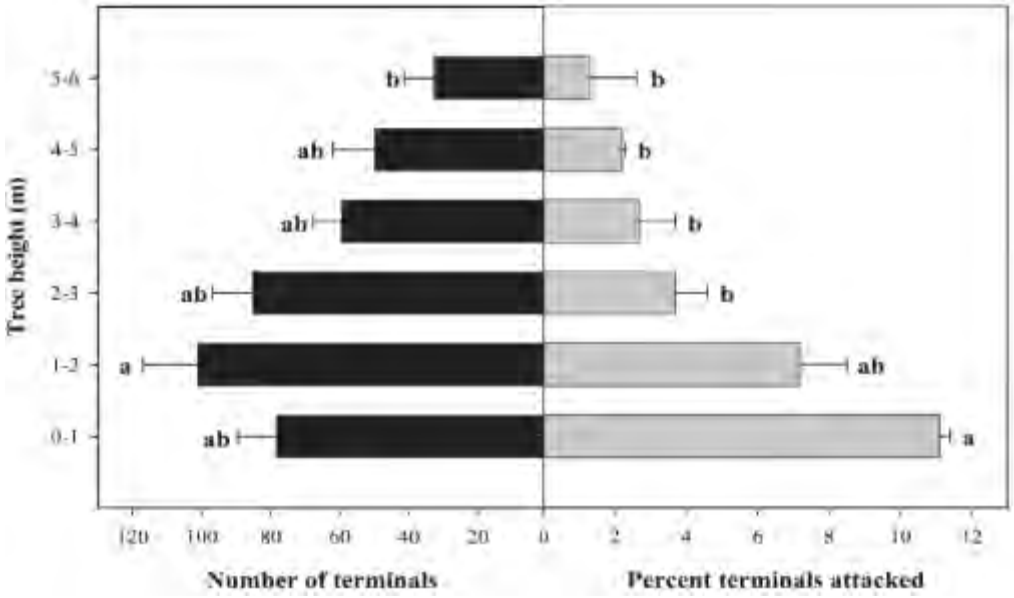
Black twig borer damage

Mechanical (cultural/physical) control

Hand pruning works!

No effective chemical control once beetle enters tree - preventative is effective

Attacks tend to be closer to ground



Laurel wilt (*Harringtonia lauricola*)

Redbay ambrosia beetle (*Xyleborus glabratus*)

Both Native to Asia

Hughes et al. 2017

Laurel wilt

Adult attacks tree

Mass attack
Frass/sawdust tubes

Larvae feed on fungi

Galleries

Fungal staining

Laurel wilt hosts = all Lauraceae

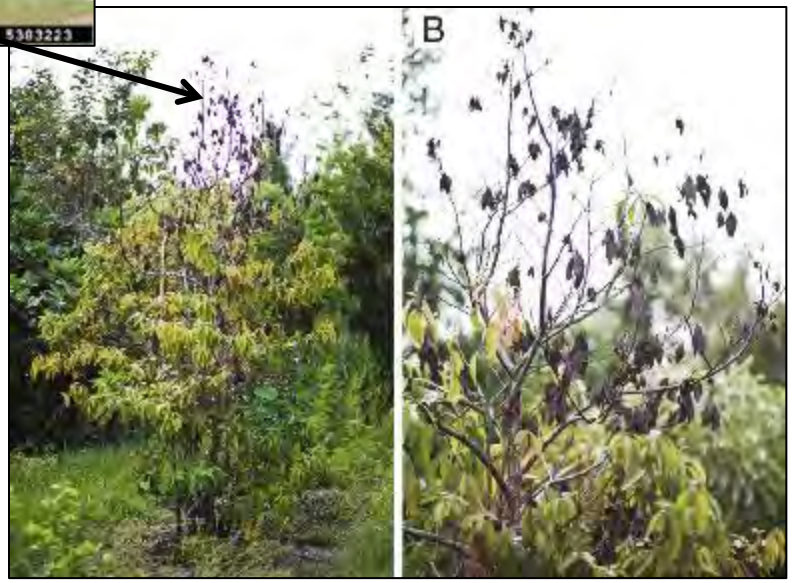
Redbay/swamp bay/silk bay

Camphortree

Sassafras

Bay laurel

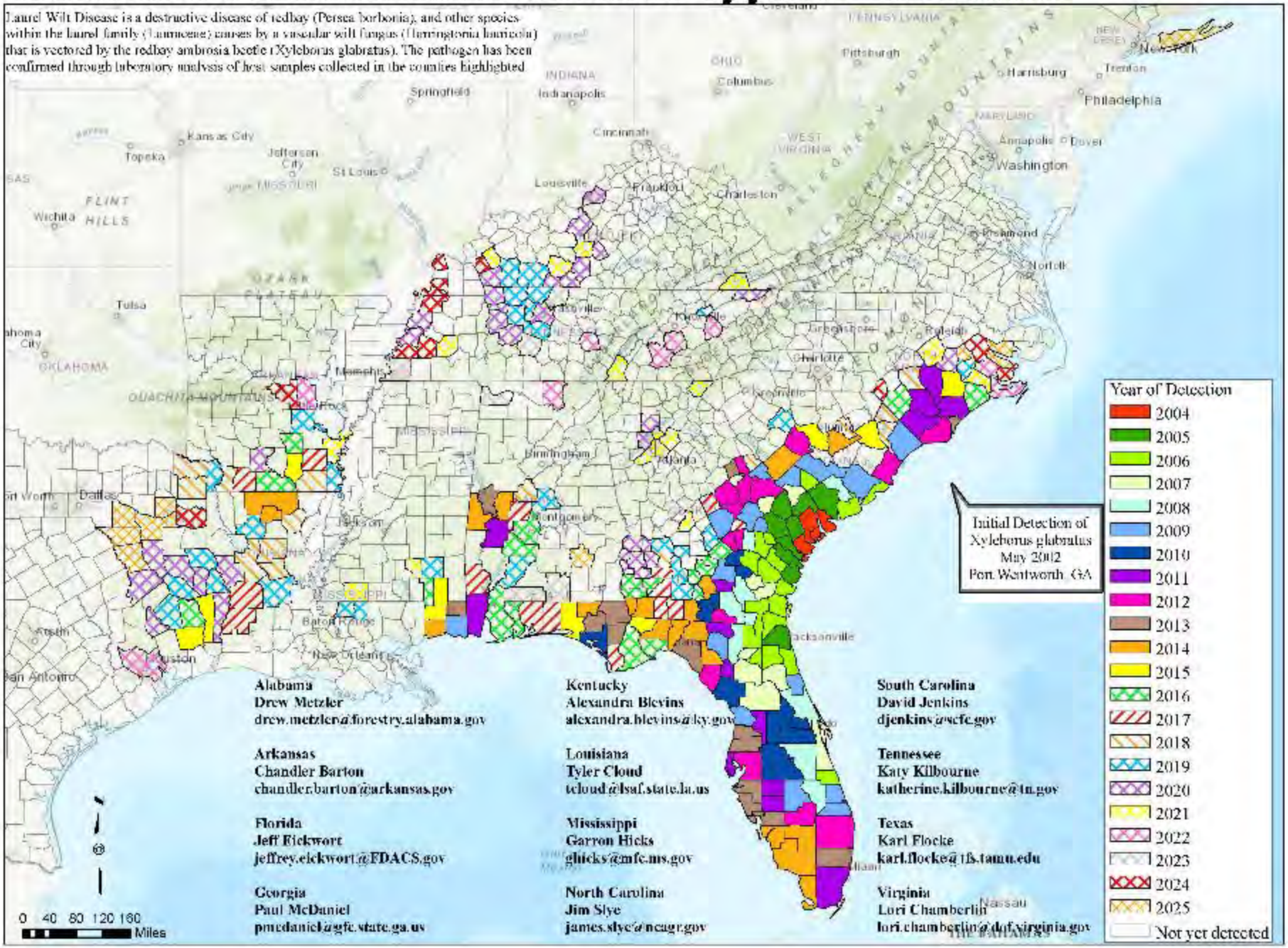
Pondspice



Distribution of Counties with Laurel Wilt Disease* by year of Initial Detection

Aug 29, 2025

Laurel Wilt Disease is a destructive disease of redbay (Persea borbonia), and other species within the laurel family (Lauraceae) caused by a vascular wilt fungus (Harringtonia lauricola) that is vectored by the redbay ambrosia beetle (Xyleborus glabratus). The pathogen has been confirmed through laboratory analysis of host samples collected in the counties highlighted



Laurel wilt management

Sanitation

Physical protection

Laurel wilt management

Fungicides

Propiconazole
(Alamo®)

Insecticides

Several tested, efficacy good but short-lived!

Arthropods in Relation to Plant Disease

Potential of Contact Insecticides to Control *Xyleborus glabratus* (Coleoptera: Curculionidae), a Vector of Laurel Wilt Disease in Avocados

DANIEL CARRILLO,[1] JONATHAN H. CRANE, AND JORGE E. PEÑA

Tropical Research and Education Center, University of Florida, 18905 SW 280 Street, Homestead, FL 33031

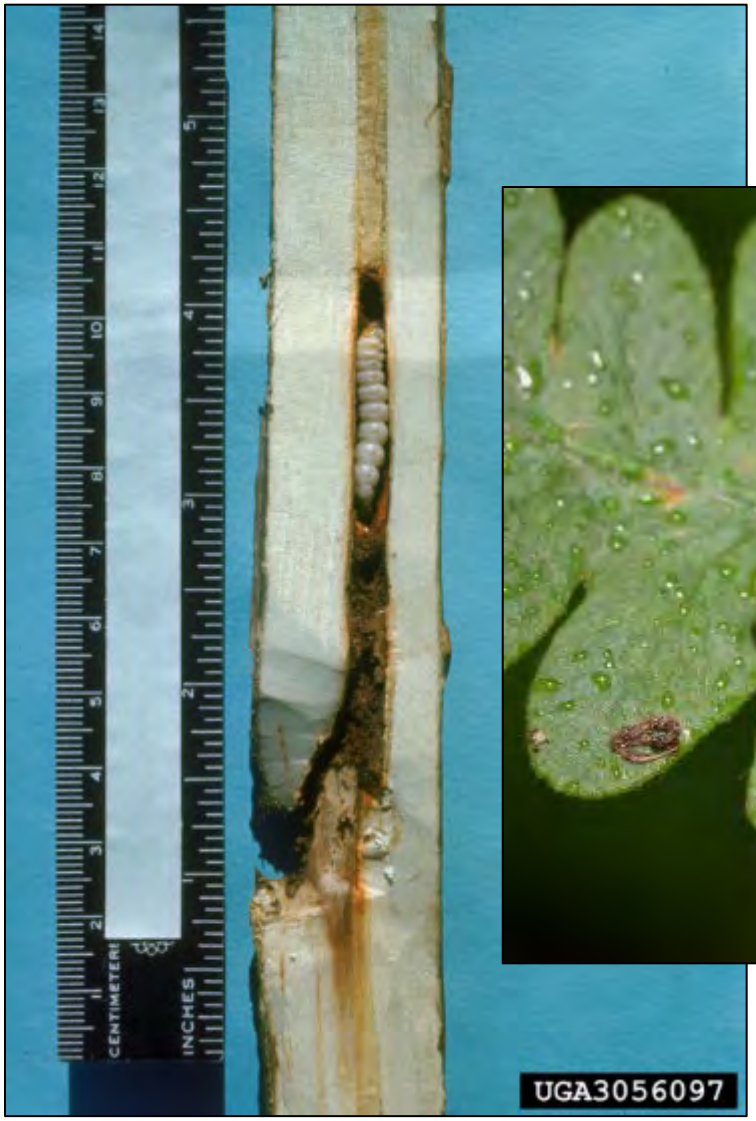
J. Econ. Entomol. 106(6): 2286–2295 (2013); DOI: http://dx.doi.org/10.1603/EC13205

Woodboring Lepidoptera

Sesiidae (clearwing moths)

Red oak clearwing borer

Paranthrene simulans



Sesiidae contribute to tree decline

Photo by Chandler Barton, Arkansas Dept. of Agriculture

Photos by Chandler Barton, Arkansas Dept. of Agriculture

Woodboring Hymenoptera

Siricidae (woodwasps)

General woodborer management

Keep trees healthy

Reduce stress

General woodborer management

Chemical treatments do work but…

In most cases, if native woodborers are a problem, there are underlying issues with that tree/shrub's health that NEED to be addressed.

Suckers!

Cicadas

Cicadas

Cicadas

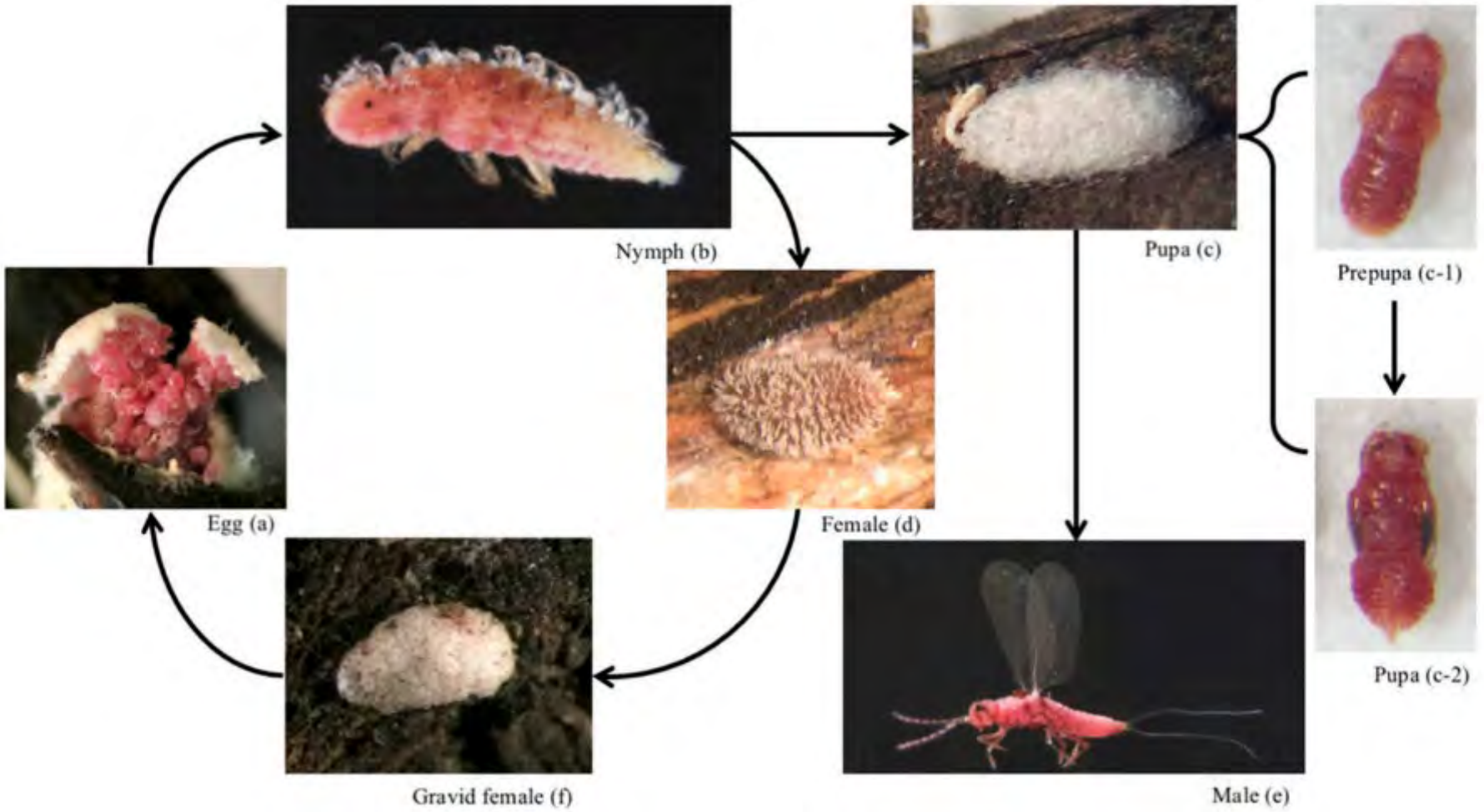
Crape myrtle bark scale (*Anthococcus lagerstromiae*)

Native to Asia; found in TX in 2004

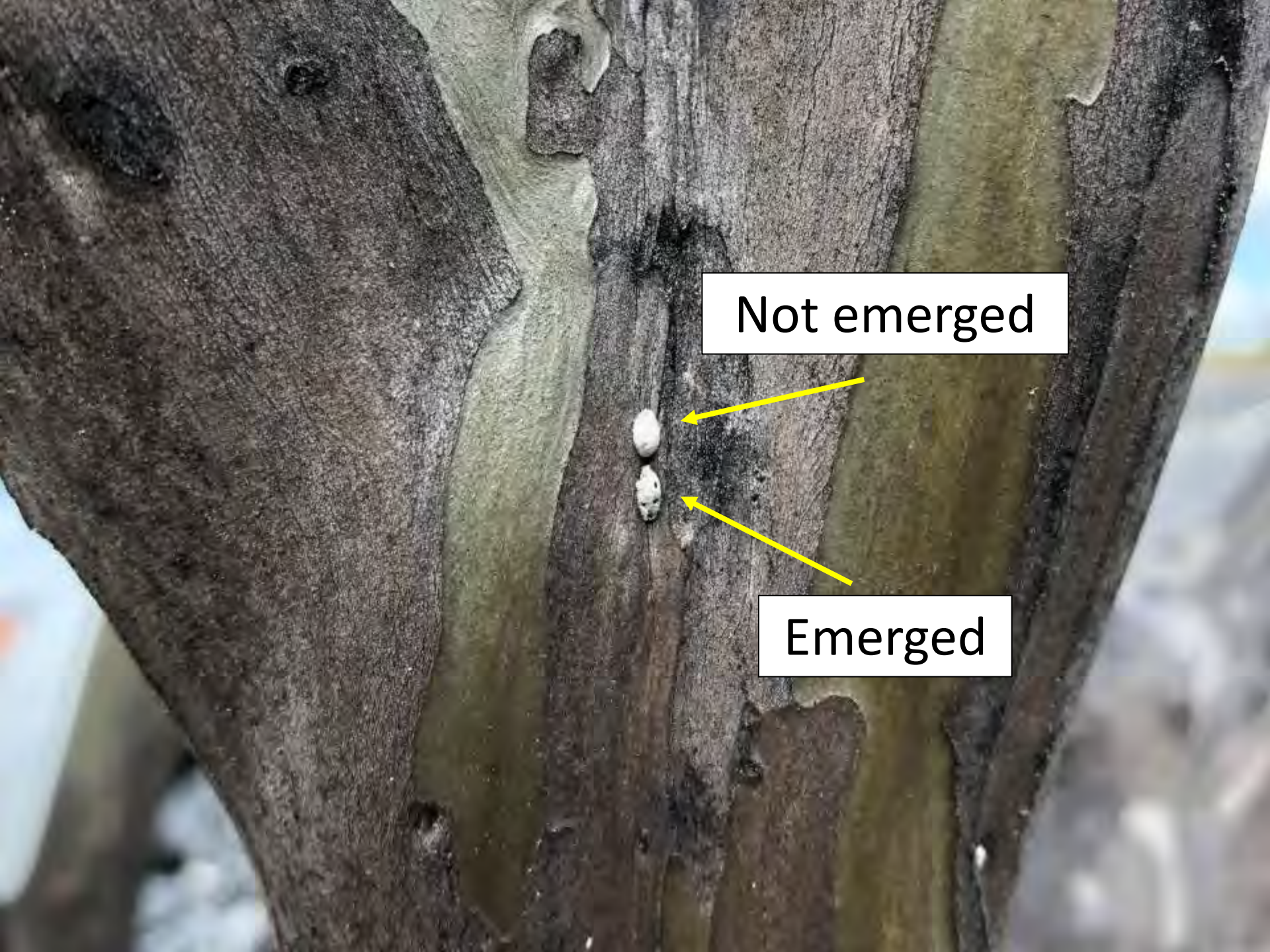
Sooty mold = black fungus, grows on honeydew = excreted by scale insects

Stunted growth, dieback, aesthetics

CMBS life cycle (it's complicated)

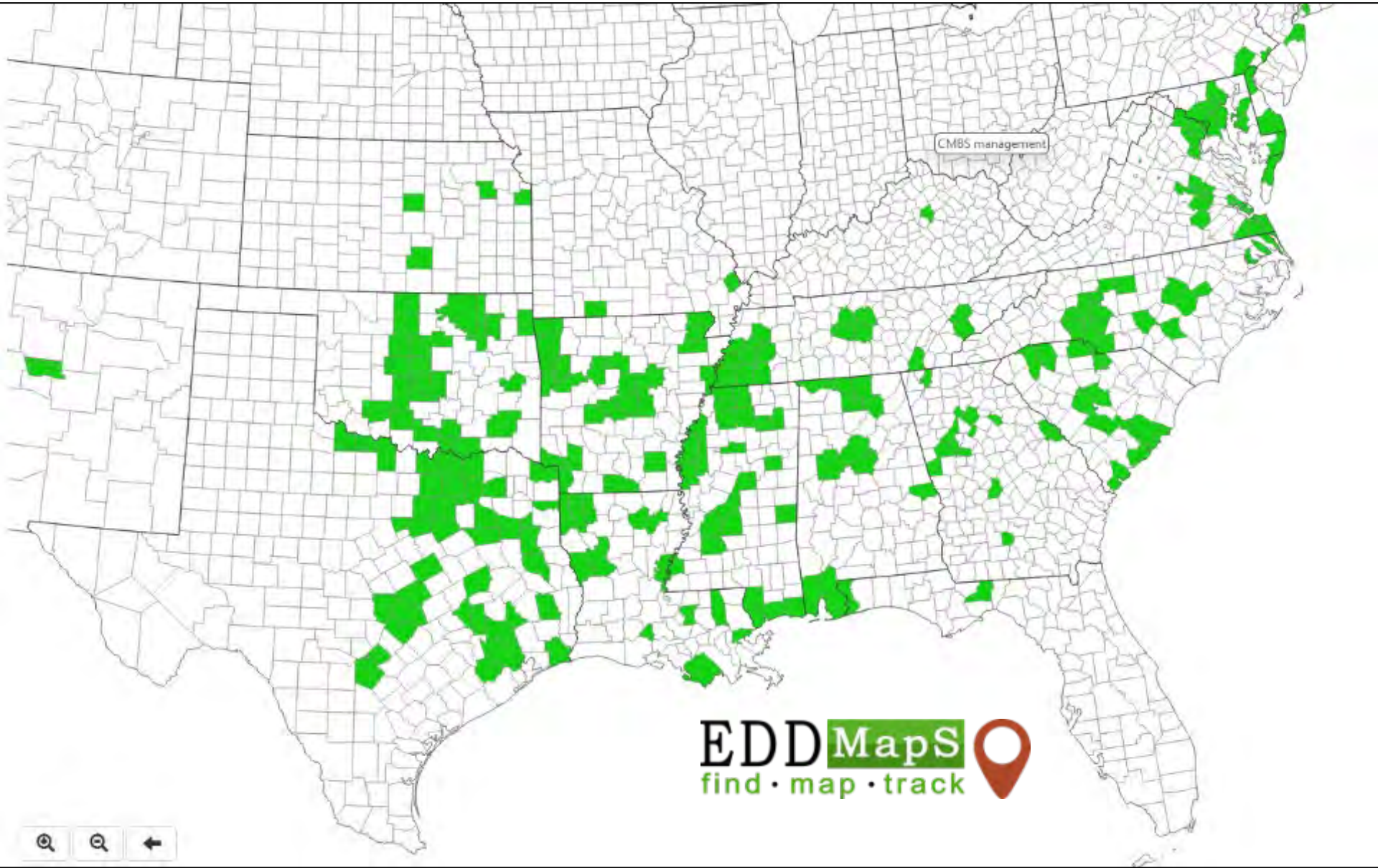


https://www.lsuagcenter.com/%20~/media/system/7/8/d/1/78d165df43ac0d4767607d88dadfb841/pub3440bugbizcrapemyrtlebarkscale_final.pdf


Not emerged
Emerged


Pink guts

CMBS distribution



CMBS management

Avoid purchasing infested plants

Diversify plantings

Eliminate infested plants

Few natural enemies

Foliar sprays need to be timed perfectly for crawlers

- Bifenthrin
- Horticultural oil

CMBS management

Soil-applied systemic insecticides

- Imidacloprid
- Imidacloprid + clothianidin
- Dinotefuran
- Thiamethoxam

More info at

https://hgic.clemson.edu/factsheet/crapemyrtle-bark-scale/

(search crape myrtle bark scale)

Spotted lanternfly
(*Lycorma delicatula*)

Major pest of fruit trees & vines

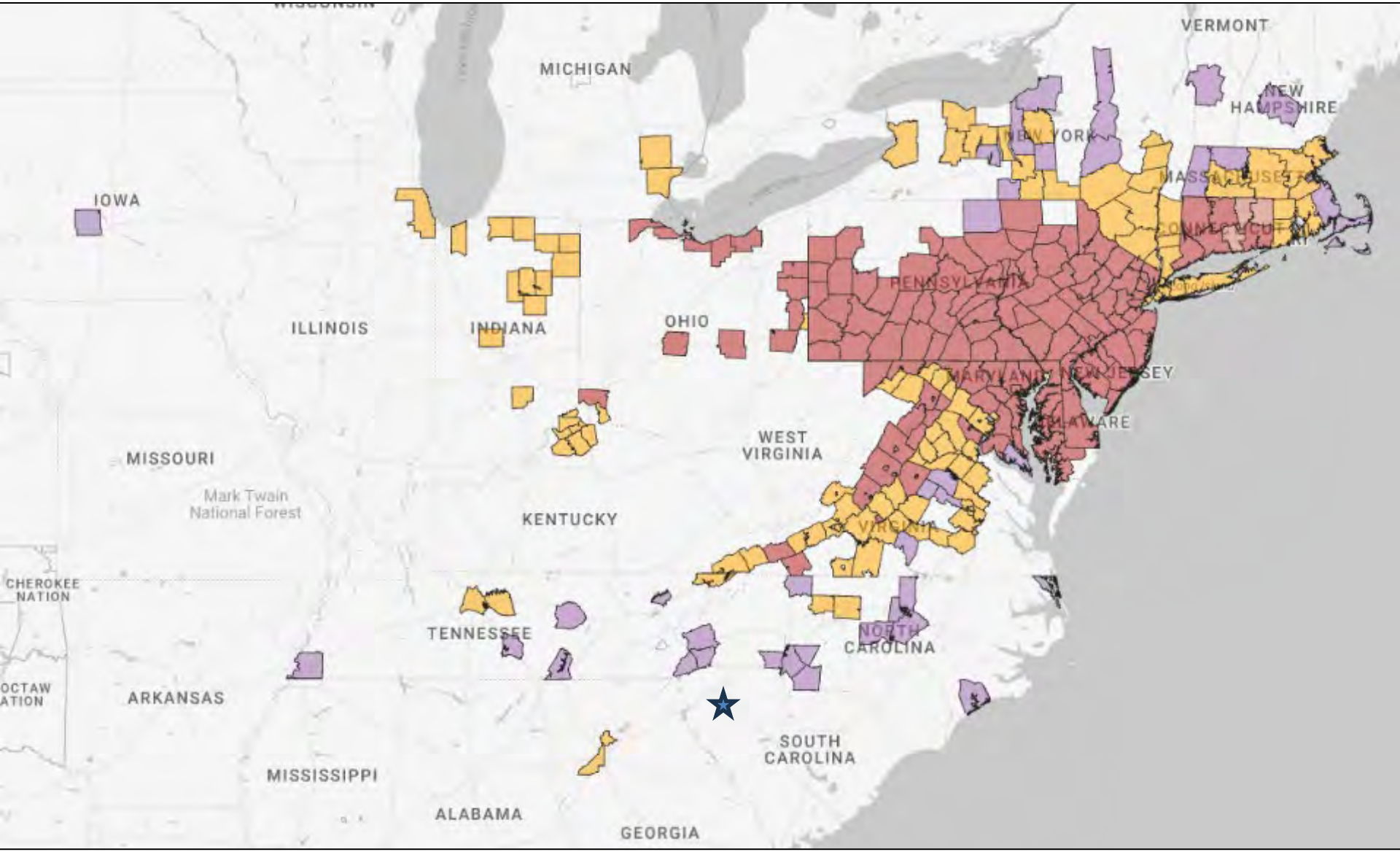
Native to China, Bangladesh, Vietnam

Pennsylvania, 2014

South Carolina

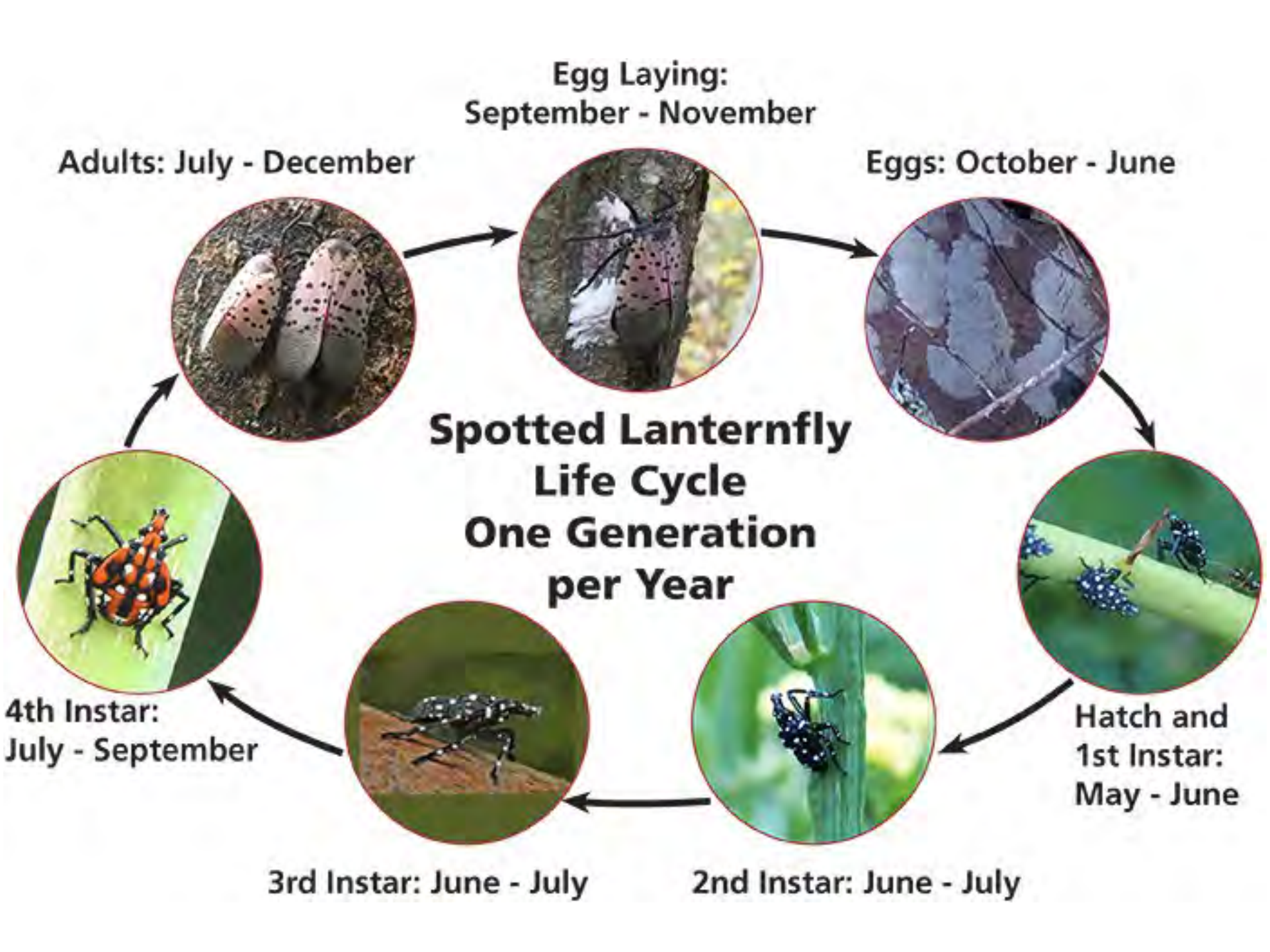
Every other state with spotted lanternfly

Spotted lanternfly distribution



https://cals.cornell.edu/integrated-pest-management/outreach-education/whats-bugging-you/spotted-lanternfly/spotted-lanternfly-reported-distribution-map

Spotted Lanternfly Life Cycle One Generation per Year



Uses over 100 hosts; strong preference for tree-of-heaven

Spotted lanternfly impacts: agriculture

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

Spotted lanternfly impacts: nuisance

https://www.reddit.com/r/pittsburgh/comments/1f2nh0v/the_only_good_bug_is_a_well_you_know/#lightbox

Spotted lanternfly impacts: nuisance

https://entomologytoday.org/2026/01/21/spotted-lanternfly-honeydew-attracts-insects-arthropods-food-webs/

Spotted lanternfly management

Monitoring (it's critical)

Insecticides (they work)

Trap trees (Ailanthus / tree-of-heaven)

Egg mass removal

Biological control (still early, still learning)

Spotted lanternfly management calendar

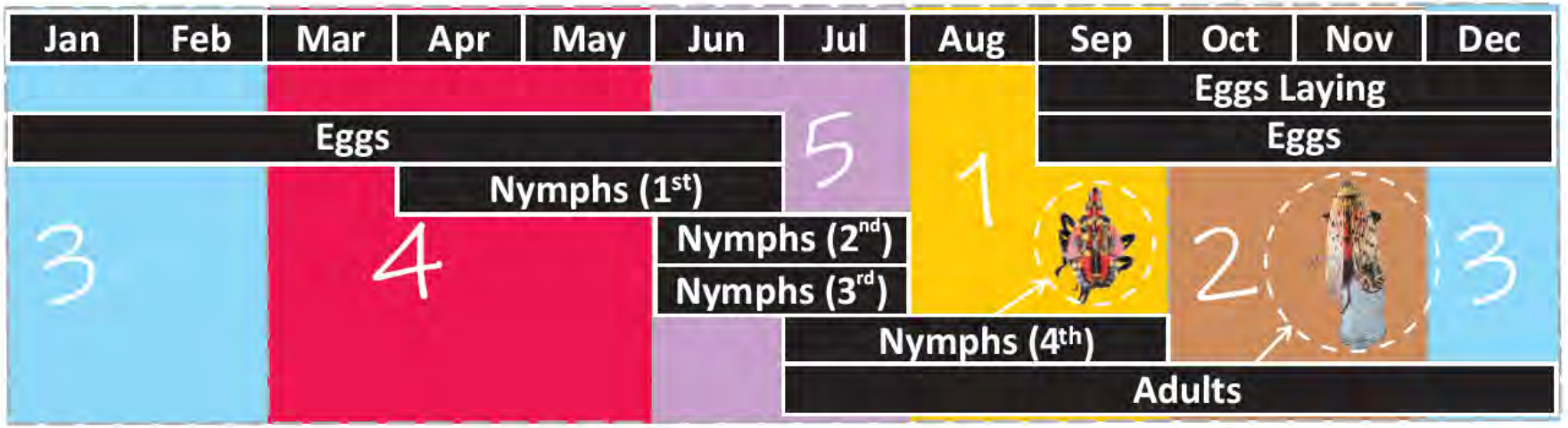
https://zeeahmed.org/spotted-lanternfly-checklist-for-growers-printable/

Spotted Lanternfly Management Calendar for Ornamental Growers 2025–2026

Muhammad "Zee" Ahmed[1], Shimat V. Joseph[2], Karla M. Addesso[3], Alejandro Del Pozo-Valdivia[4], Midhula Gireesh[5]

[1]Clemson University, South Carolina, USA — mahmed2@clemson.edu, [2]University of Georgia, Georgia, USA — svjoseph@uga.edu, [3]Tennessee State University, Tennessee, USA — kaddesso@tnstate.edu, [4]Virginia Tech, Virginia, USA — adelpozo@vt.edu, [5]University of Tennessee, Tennessee, USA — mgireesh@tennessee.edu

Purpose: The spotted lanternfly (SLF) has been established in 19 U.S. states since its initial detection in Pennsylvania in 2014. It was confirmed in North Carolina in 2022, Tennessee in 2023, most recently in Georgia in 2024, and South Carolina in 2025. While other neighboring states in the southern U.S. do not yet have confirmed established populations, the risk of establishment remains high. This calendar is designed to support early detection and proactive management efforts for ornamental growers.



Think you saw a SLF?

https://www.clemson.edu/public/regulatory/plant-industry/invasive/invasive-spotlights.html#main-section4

CLEMSON

SPOTTED LANTERNFLY

Spotted Lanternfly (Lycorma delicatula) is a voracious invasive planthopper that feeds on over 100 plant species including fruit, ornamental, and woody trees. SLF was first detected in the U.S. in 2014 in Pennsylvania and has since spread via human travel in all life stages to several surrounding states including North Carolina. Please keep an eye out for SLF in South Carolina.

Learn more about Spotted Lanternfly

Report SLF in SC

Contact

Matthew Howle
Invasive Species Program Manager
State Survey Coordinator
864.646.2140
mhowle@clemson.edu

Galls

Two general types of galls: open and closed

Open galls: produced by insects with piercing, sucking mouthparts - aphids, psyllids, scales and mites

Galls have an opening through which the gallmakers escape

Closed galls: made by insects with chewing mouthparts - larvae of beetles, flies, wasps, and moths

These gallmakers chew their way out of the gall

None of these insects reproduce within the galls

Maple eyespot gall midge

Acericecis ocellaris

Steven Katovich, USDA Forest Service, Bugwood.org

Joseph O'Brien, USDA Forest Service, Bugwood.org

Black cherry finger gall mite

Eriophyes spp.

Andrew J. Boone, South Carolina Forestry Commission, Bugwood.org; Steven Katovich, USDA Forest Service, Bugwood.org; https://entomologytoday.org/eriophyes-dimocarpi/

Maple bladder gall mite

Vasates quadripedes

https://www.projectnoah.org/spottings/337156343;
John Weidhass, VPI, Bugwood.org

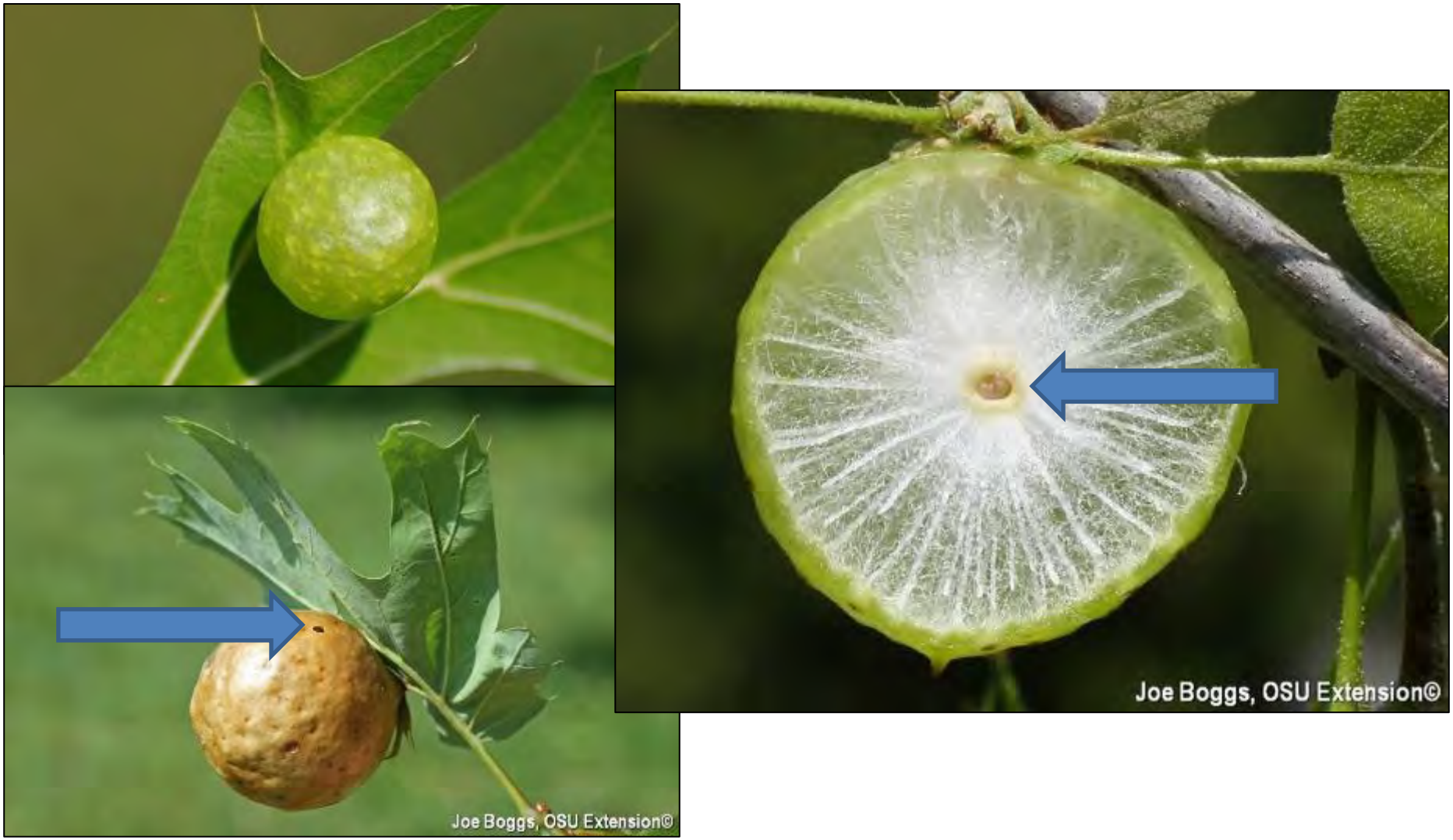
Hickory gall phylloxera

Phylloxera caryaecaulis

Lacy L. Hyche, Auburn University, Bugwood.org;
https://bugguide.net/node/view/649952

Oak apple gall

Amphibolips spp.



Wool sower gall

Callirhytis seminator

Do I need to control galls?

Let’s talk about pathogens!

Phytophthora root and crown rots

Host: Affects both hardwood and conifer trees, shrubs and other landscape plants

Pathogen: Oomycetes – *Phytophthora* spp.

primarily *P. cinnamomi* in the Southeast

Favorable Environment: Wet, saturated soils and moderate temperatures

Symptoms:

Chlorosis & wilting of the foliage

Orange to red to brown roots, lack of feeder roots

Bleeding cankers on trunk

Phytophthora species are not true fungi

More closely related to plants

Grouped with golden & brown algae, diatoms

Previously referred to as “water molds”

Now commonly referred to as Oomycetes or fungus-like organisms…

Phytophthora root and crown rots

Some of the most economically important and damaging diseases on woody plants

Cause problems annually

Particularly serious in or following “wet” years

Diseases often are associated with wet or saturated soils = a double “whammy”

- anaerobic conditions in soil stress roots
  - increase susceptibility to infections
- free water promotes inoculum release & dispersal
  - swimming zoospores!

Some Trees & Shrubs Attacked

Abies—fir
Acer—maple
Arbutus—madrone
Betula—birch
Buxus—boxwood
Camellia—C. japonica
Castanea—chestnut
Cedrus—cedar
Cercis—redbud
Chamaecyparis—false cypress
Citrus—orange, lemon, etc.
Cornus—dogwood
Cryptomeria—Japanese cedar
Cupressus—cypress
Elaeagnus—Russian olive
Eucalyptus
Fagus—beech
Ficus—fig
Forsythia
Ilex—holly
Juglans—walnut
Juniperus—juniper
Kalmia—laurel
Malus—apple
Persea—avocado
Picea—spruce
Pieris—pieris, andromeda
Pinus—pine
Platanus—sycamore
Prunus—cherry, plum, etc.
Pseudotsuga—Douglas fir
Pyrus—pear
Quercus—oak
Rhododendron—rhody, azalea
Robinia—locust
Rosa—rose
Rubus—raspberry
Syringa—lilac
Taxus—yew
Thuja—arborvitae
Tsuga—hemlock
Vaccinium—blueberry, cranberry
Viburnum—arrowwood
Ulmus—elm

Phytophthora spp. as pathogens of woody plants

Constantly finding new species

These fungi can attack all parts of the plant

Blight / dieback on shoots and foliage — *uncommon*

Cankers on stems / trunk — *common*

e.g., “bleeding” cankers

Root and crown rots — *most common*

Symptoms: Above ground

Appear **after** roots are diseased

Chlorosis and yellowing of the foliage

- very slight at first, then becoming obvious

Stunted growth

Overall wilting & decline

Cankers—orange, red, and brown discoloration

- on stems and trunk
- distinct margin between healthy & diseased tissues
- often exuding sap = “bleeding”

Plant death – eventually

Phytophthora foliage blight

Phytophthora canker on laurel oak in SC

Phytophthora canker on laurel oak in SC

Symptoms—Below ground

- Must expose roots for examination
  - this usually requires digging!
  - need to know what healthy roots look like!
- Reduced root volume – lack of feeder roots
- Roots discolored – red, brown, dark brown
  - healthy roots are white or off-white
- Cortex sloughing / general decay of roots
- Cankers and necrosis on root crown
  - may move up stem above ground

Phytophthora root rot

Phytophthora root rot

Phytophthora root rot

cryptomeria

deodar cedar

leyland cypress

Phytophthora root & crown rot on chestnut seedlings

Potential management strategies

Trees with bleeding cankers and extensive root rot probably can not be cured because too much tissue has been damaged

but treatments may slow disease progress

Treatment should focus on healthy-appearing trees in areas where disease has occurred

Several fungicides are available that should be effective – for nurseries and landscapes

Consider replanting on berms or raised beds

Improve drainage in heavy or poorly drained soils

Cherry black knot

Apiosporina morbosa

Biscogniauxia canker

aka hypoxylon canker

Most common on stressed red/post oaks

Bark becomes thin, flakes off

Dry spores travel in wind

Spores are EVERYWHERE

Even on healthy trees…

Asexual stage
Dry and dusty

Biscogniauxia canker

Weak parasite!

Usually on dying/dead limbs

If on trunk, tree's probably almost dead anyway

Biscogniauxia didn't kill the tree – it finished it off

Sexual stage
Hard and black

Oak anthracnose

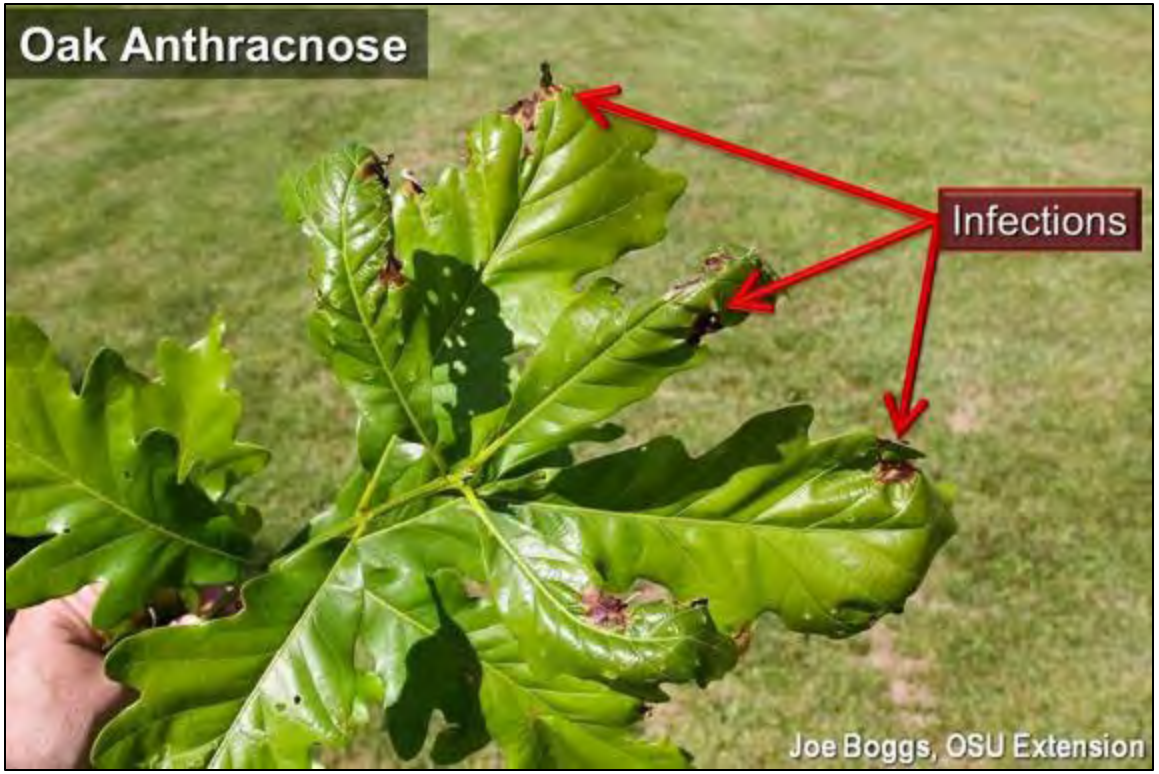
Caused by fungus *Discula quercina*

White oak group most susceptible

Minor stressor

Trees recover

Sanitation!



Leaf scorch

Death of cells along margin of leaf

Often associated with:

- Drought/moisture stress
- Root damage

Often happens in summer

Bacterial leaf scorch

Caused by *Xylella fastidiosa*

Transmitted by leafhoppers and planthoppers

Occurs when bacteria invade xylem

Bacteria plug xylem, reducing water transport

Bacterial leaf scorch

Chronic, potentially fatal, no cure ☹

Different from oak wilt in that:

- The cycle repeats
- No sapwood streaking
- Browning goes edge to midvein
  - More uniform browning in oak wilt

Browning begins in old leaves, spreads to branch tips

Need lab confirmation to be sure

Bacterial leaf scorch management

- Maintain good vigor
- Remove infected shoots
  - Disinfect pruning tools
- Diverse plantings
- Resistant species
- Antibiotic injections
  - Expensive
  - Unknown long-term effects
  - Need to be redone each year

Leaf scorch

- Newest is between veins
- Bacterial = yellow line
- Drought = no yellow line

Anthracnose

- On veins, curling

Maple tar spot

Rhytisma acerinum

No significant damage, may be some leaf drop

Yellow and green spots in the late spring/summer

Tar spots are shiny, black stromata on upper surface of infected leaves where spores are formed

Dawn Dailey O'Brien, Cornell University, Bugwood.org

Steven Katovich, USDA Forest Service, Bugwood.org

Tubakia leaf spot

Aka actinopelte, caused by *Actinopelte dryina*

Fungus overwinters in twigs and foliage

Spores spread in spring by rain splash & wind

More common in wet years

Oak leaf blister

Caused by the fungus *Taphrina caerulescens*

Fungus overwinters on bud scales, infects newly emerging leaves

More common in wet years

Butt (and Root) Rot

Ganoderma root rot (*Ganoderma* spp.)

Inotonus root rot (*Inonotus dryadeus*)

Laetiporus root rot (*Laetiporus sulfureus*)

Armillaria

Usually see after damage is done

Can take years to kill the tree

Butt (and Root) Rot

Any decay at the base of a living tree

Spores enter heartwood through wounds

Butt (and Root) Rot

Prevention is the only control

- Good tree care practices!
- Avoid mechanical injury! (esp. lawnmowers…)

Biggest issue: infected trees = hazard trees

Conks at base of tree (year 2)

Science suggests these organisms feed on dead tissue…NOT cause dead tissue.

Armillaria Root Disease
(*Armillaria* spp.)

Many symptoms:

- Stunted/chlorotic needles/leaves
- Reduced growth
- Twig/branch dieback

EXTREMELY broad host range

- Only resistant genera are larch and birch

Usually a secondary fungus

- i.e. attacks weakened/stressed trees

Armillaria root disease

Armillaria root disease

Slime flux (Bacterial wetwood)

Affects many hardwoods

Vertical streaks on trunk

Wet/slimy/smelly

Caused by bacteria in wounds

Trees usually survive

Reduced lumber value

Avoid damage

Not bugs

Sapsucker damage

Rows of holes

Image by Riley Coy

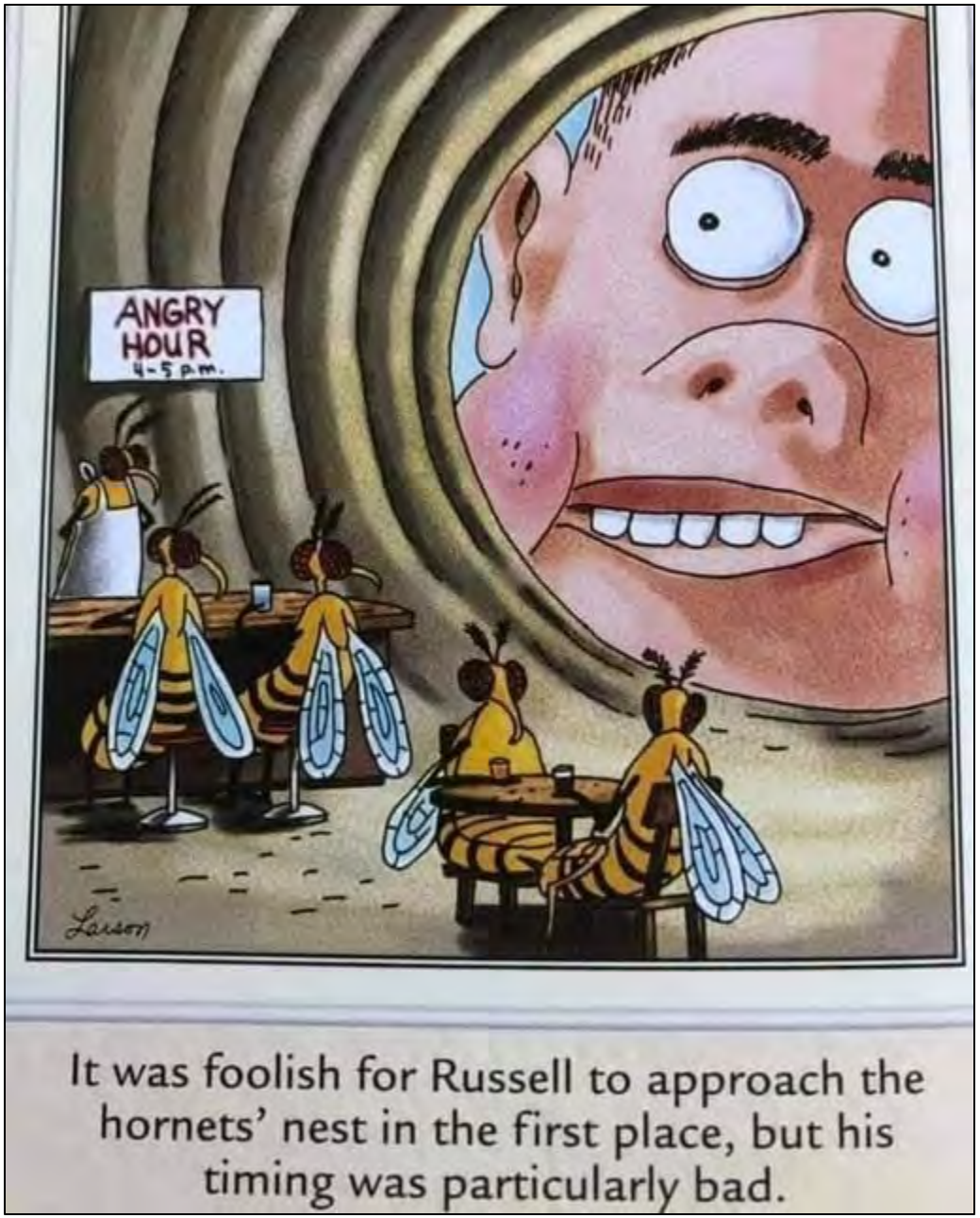
Not bugs

Sapsucker damage

Rows of holes

Image by Riley Coy

An invasive hornet?



Yellow-legged hornet
(*Vespa velutina*)

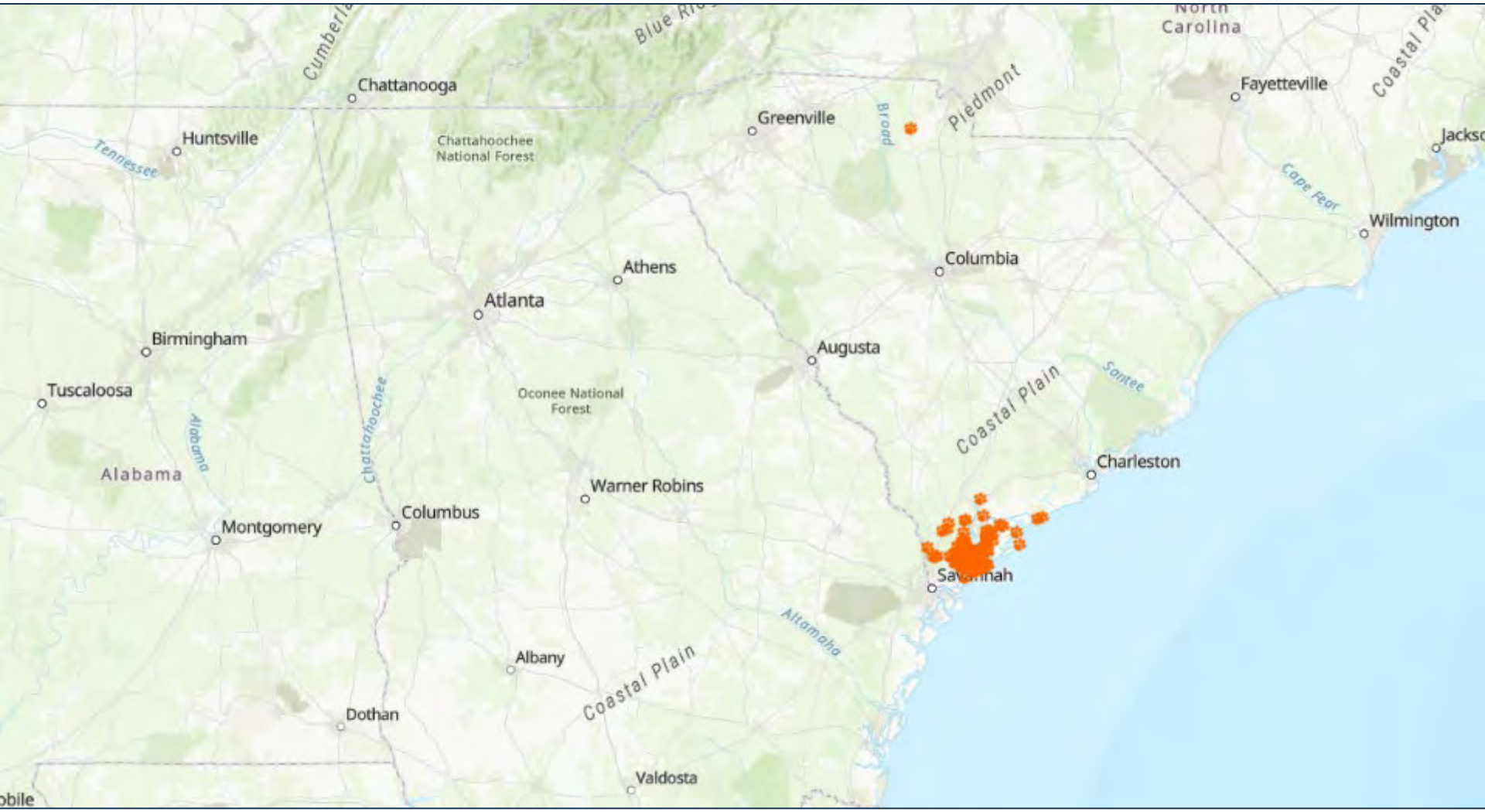
Native to SE Asia

Georgia and South Carolina (2023)

No risk to humans

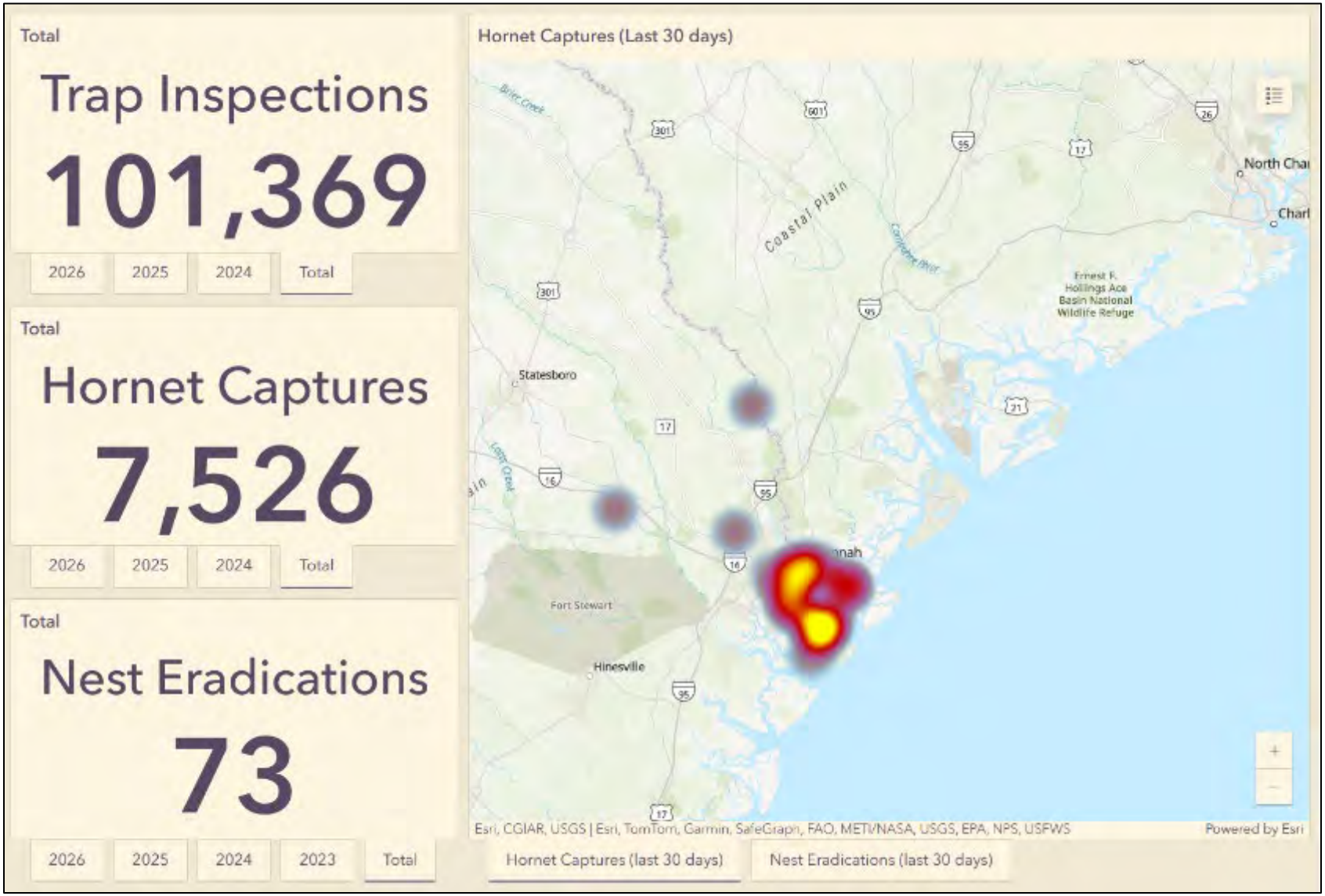
https://agr.georgia.gov/yellow-legged-hornet

Yellow-legged hornet in SC

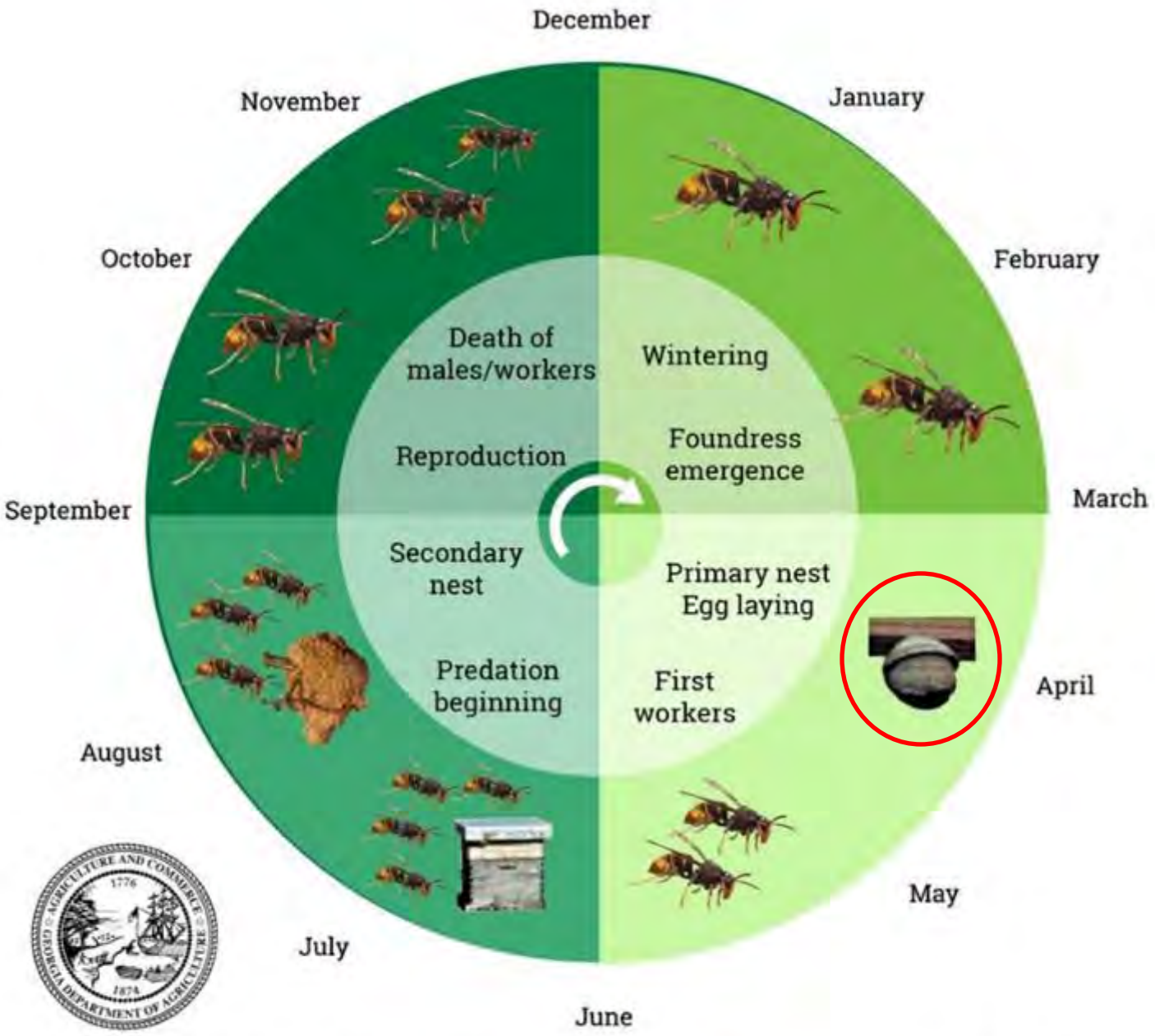


https://cugisadmin.maps.arcgis.com/apps/mapviewer/index.html?webmap=ebe281822ff942e8a68fae38b78392ff

Yellow-legged hornet in GA



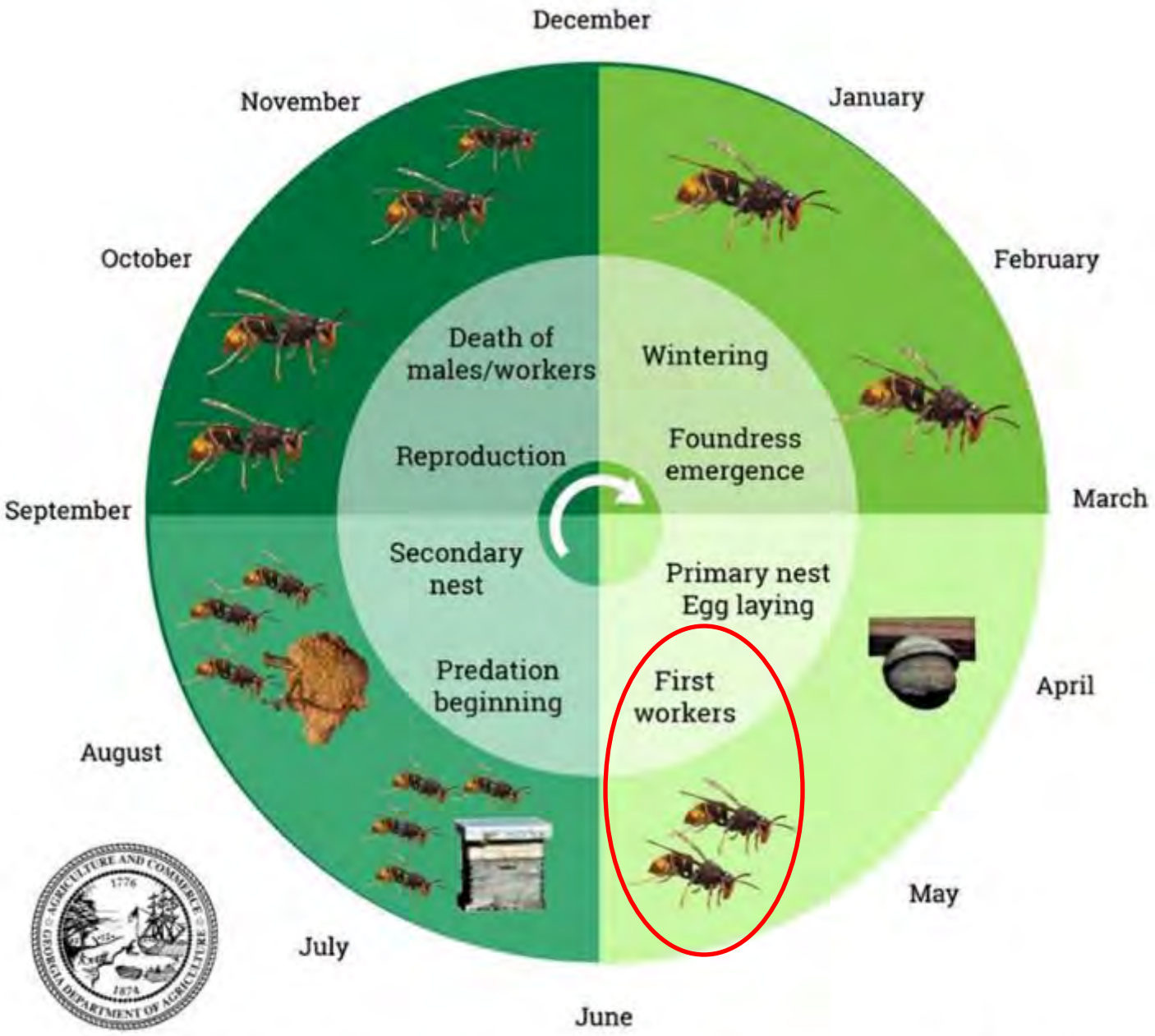
https://agr.georgia.gov/yellow-legged-hornet-eradication-map



Source: Monceau, Karine & Thiery, Denis. (2016). Vespa velutina: current situation and perspectives. Atti della academia nazionale Italiana di Entomologia.

Yellow-legged hornet: embryo nest

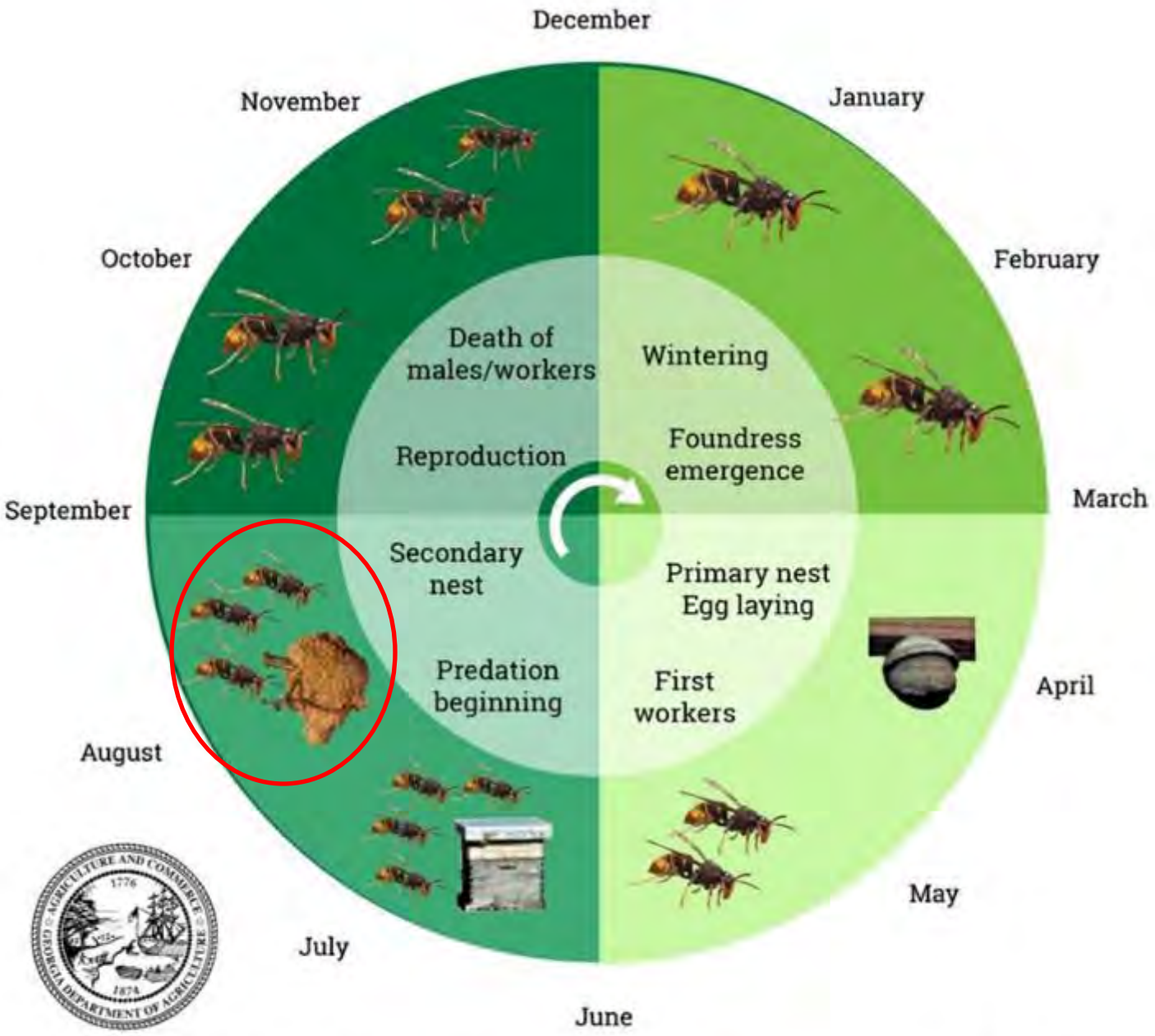
https://agr.georgia.gov/yellow-legged-hornet



Source: Monceau, Karine & Thiery, Denis. (2016). Vespa velutina: current situation and perspectives. Atti della academia nazionale Italiana di Entomologia.

Yellow-legged hornet: primary nest

https://agr.georgia.gov/yellow-legged-hornet



Source: Monceau, Karine & Thiery, Denis. (2016). Vespa velutina: current situation and perspectives. Atti della academia nazionale Italiana di Entomologia.

Yellow-legged hornet: secondary nest

https://agr.georgia.gov/pr/yellow-legged-hornet-nest-eradicated-savannah-area

Yellow-legged hornet: secondary nest

Yellow-legged hornet

Major pest of honeybees

Displays “hawking” behavior

https://survey123.arcgis.com/share/4654e1d5a6be4b47aa7acd2ff0a357cf

Yellow-legged hornet - hawking

https://agr.georgia.gov/photo-gallery-yellow-legged-hornet-image-gallery

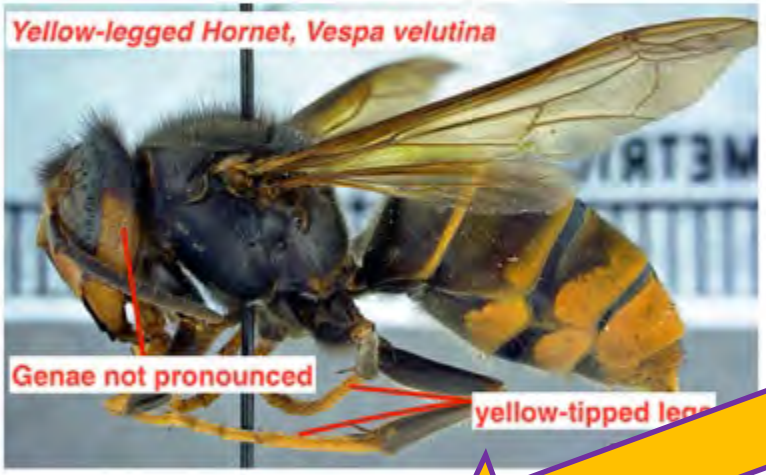
Think you saw a YLH?

https://www.clemson.edu/public/regulatory/plant-industry/invasive/invasive-spotlights.html#main-section1

CLEMSON

Invasive Species Spotlights

YELLOW LEGGED HORNET



Report YLH in SC

How to make a YLH Trap

How to use reporting tool

Map of YLH Nest Locations in SC

Contact

Matthew Howle
Invasive Species Program Manager
State Survey Coordinator
864.646.2140
mhowle@clemson.edu

And invasive spider?

Joro spider (*Trichonephila clavata*)

Native to Asia

Likely arrived early 2010s as a stowaway

Joro spider life cycle

Overwinters as an egg sac

Joro spider life cycle

Spiderlings

Probably late April to early May

Joro spider life cycle

Juveniles

Early-May to August

Joro spider life cycle

Adolescents (just bigger juveniles)

August to early September

Joro spider life cycle

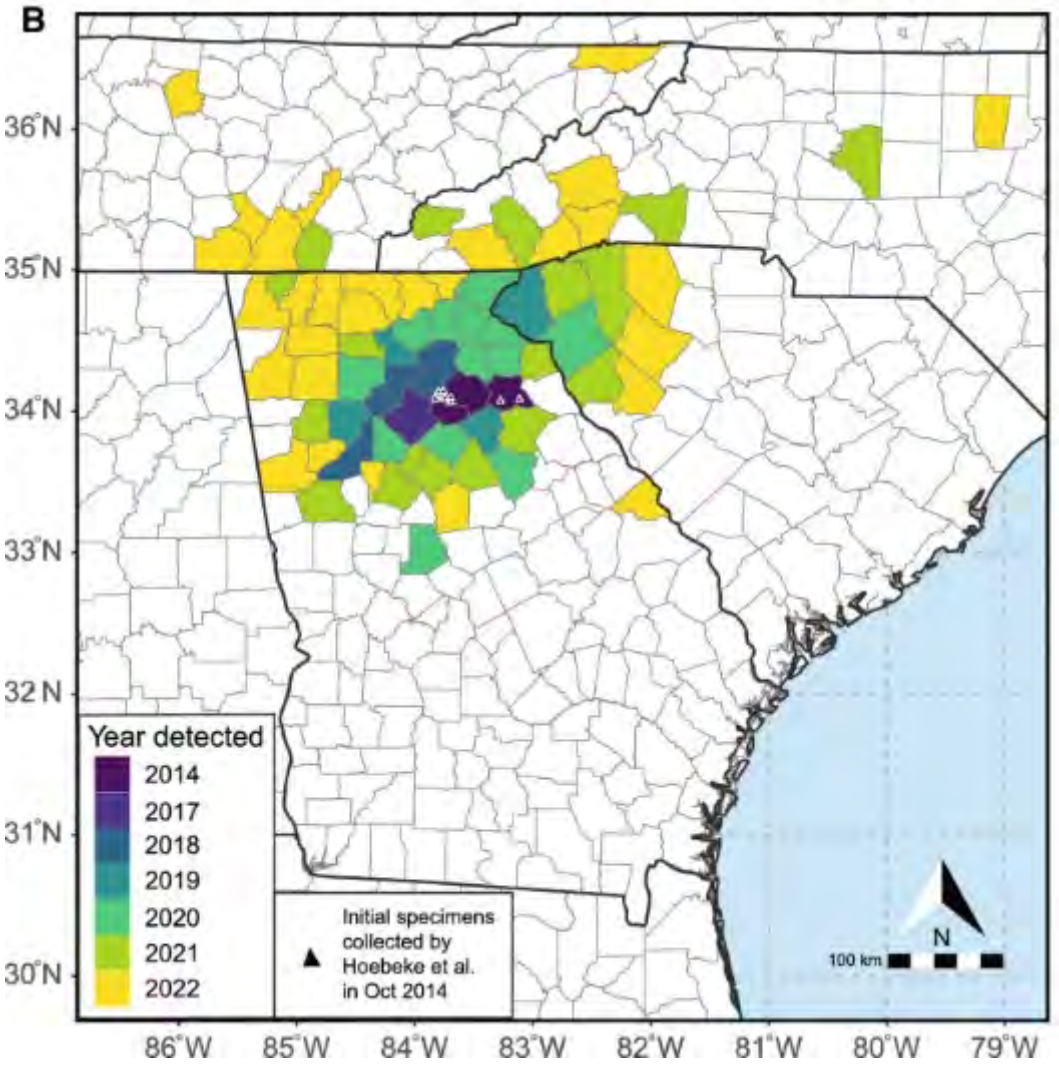
Adults

September to December


ESSO
club

Joro spider

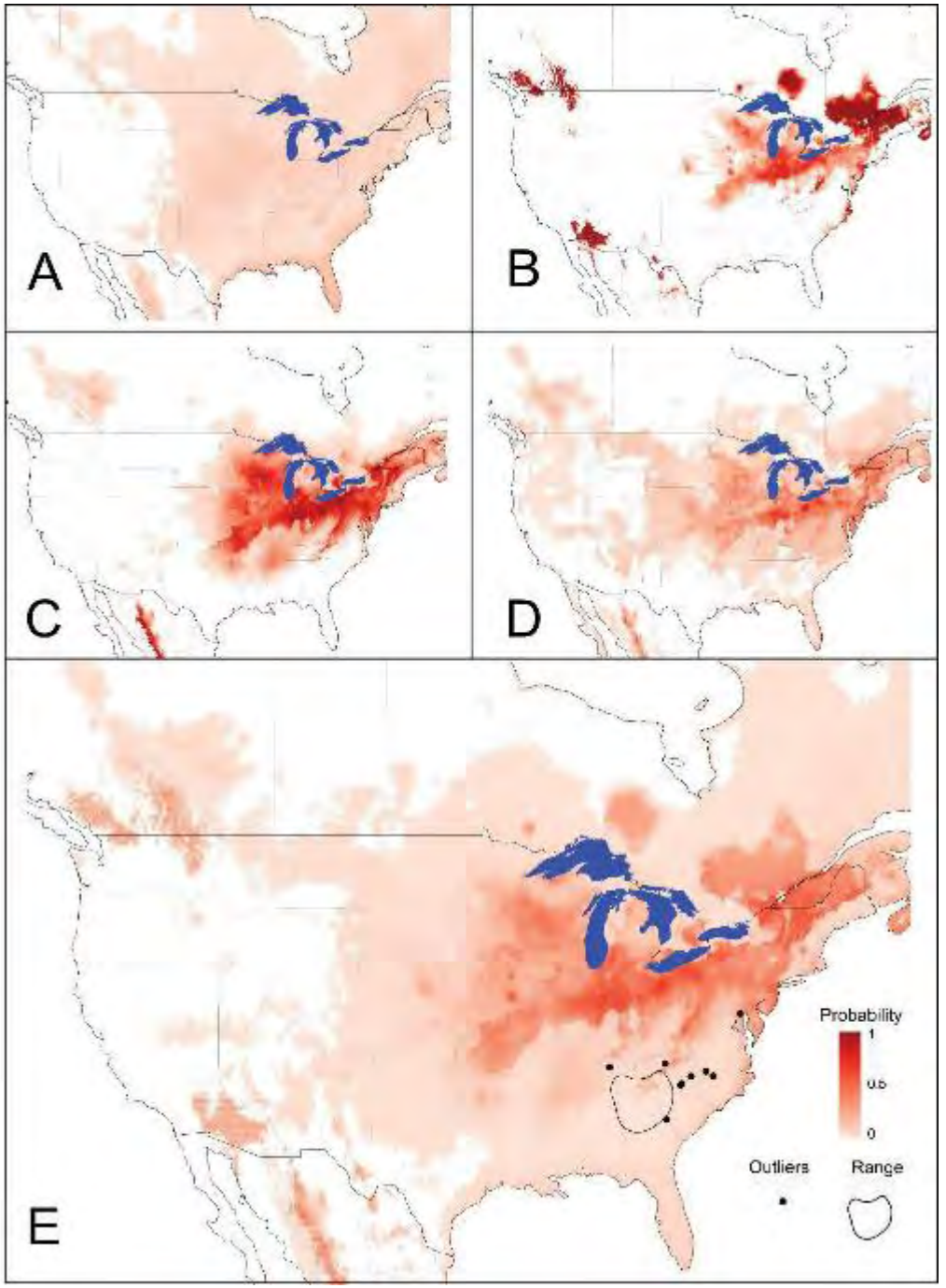
They’re spreading…



Chuang et al. 2023. Biol. Invasions 25: 17-26

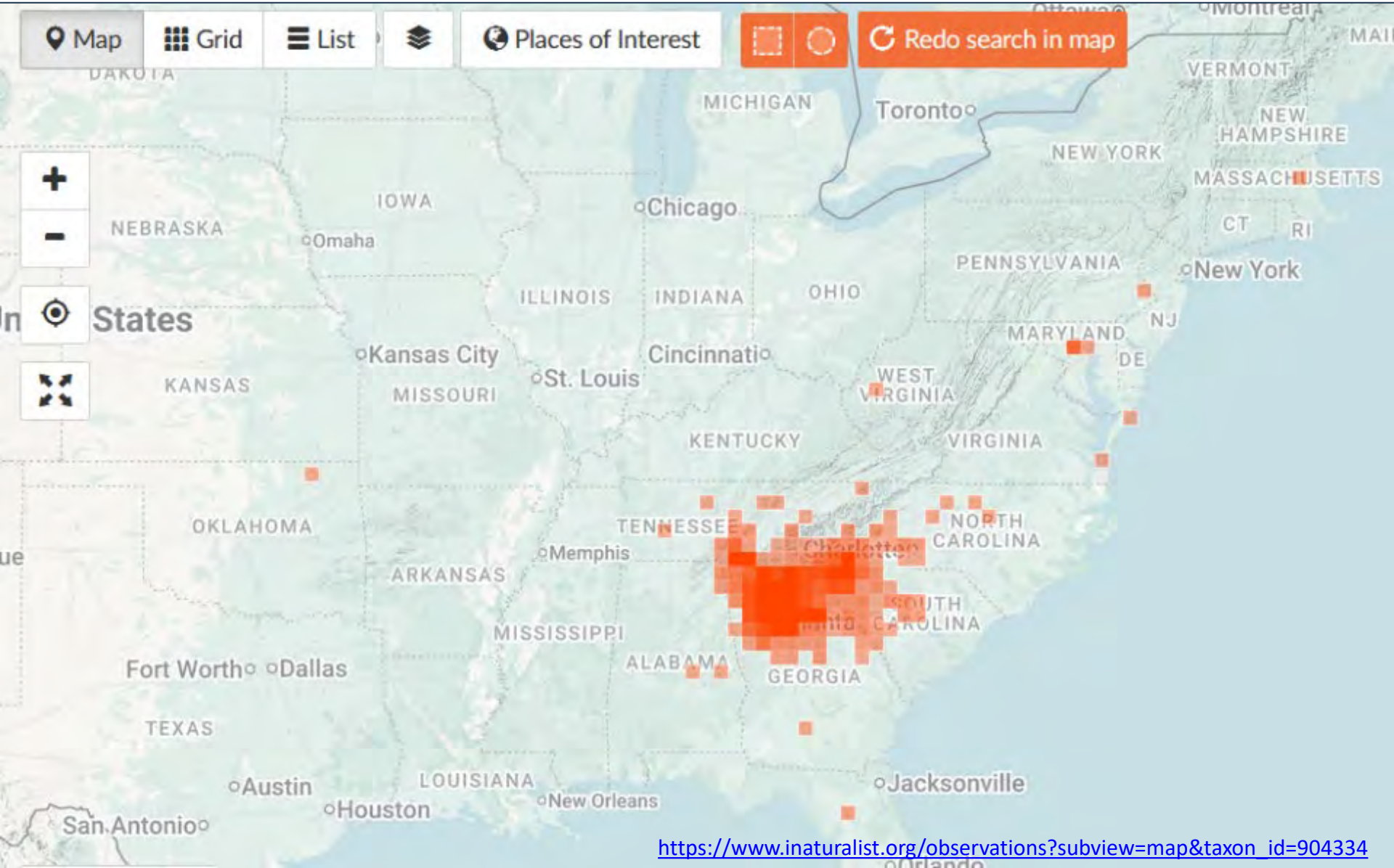
Joro spider

…and are likely to keep spreading.



Nelsen et al. 2023. Ecol. Evol. 13:e10728. https://doi.org/10.1002/ece3.10728

Joro spider distribution in the U.S.

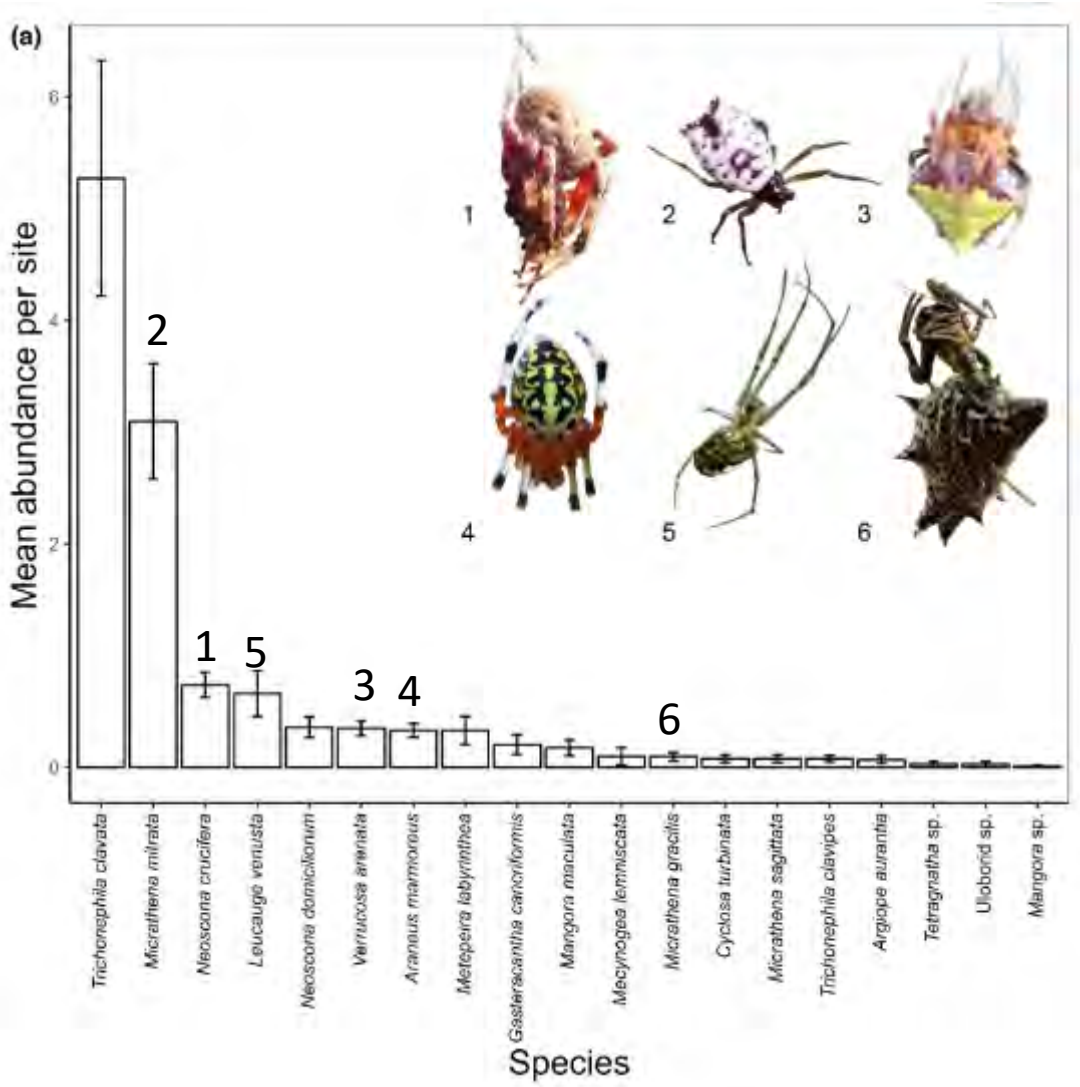


https://www.inaturalist.org/observations?subview=map&taxon_id=904334

Joro spider: good news?

Depends on your point of view…

Joro spider: impacts



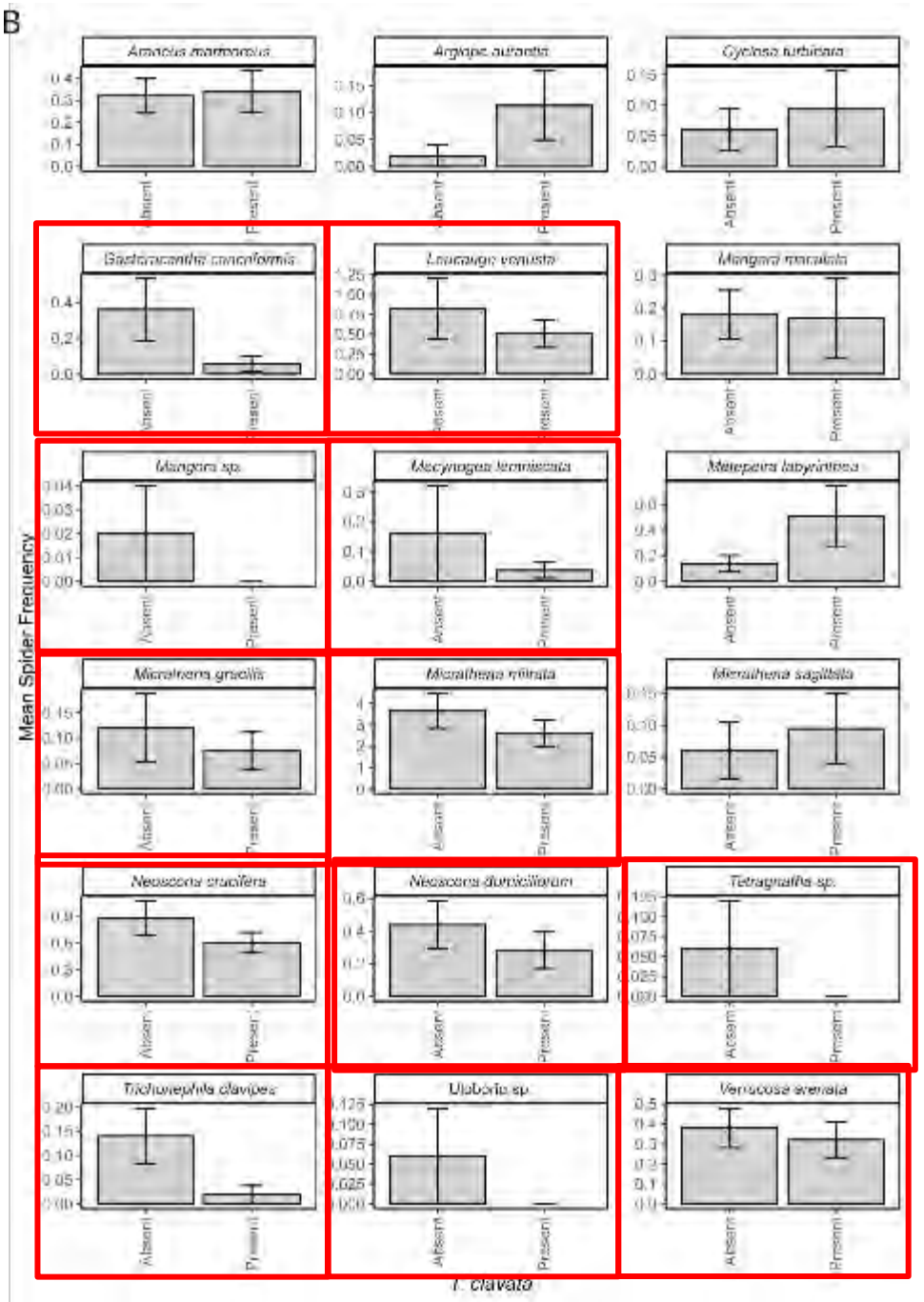
Most common orb-weaver in our surveys

Where Joro spiders are, several native species are not

Nelsen et al. 2023. Ecol. Evol. 13:e10728. https://doi.org/10.1002/ece3.10728

Joro spider impacts

Where Joro spiders are, several native species are not

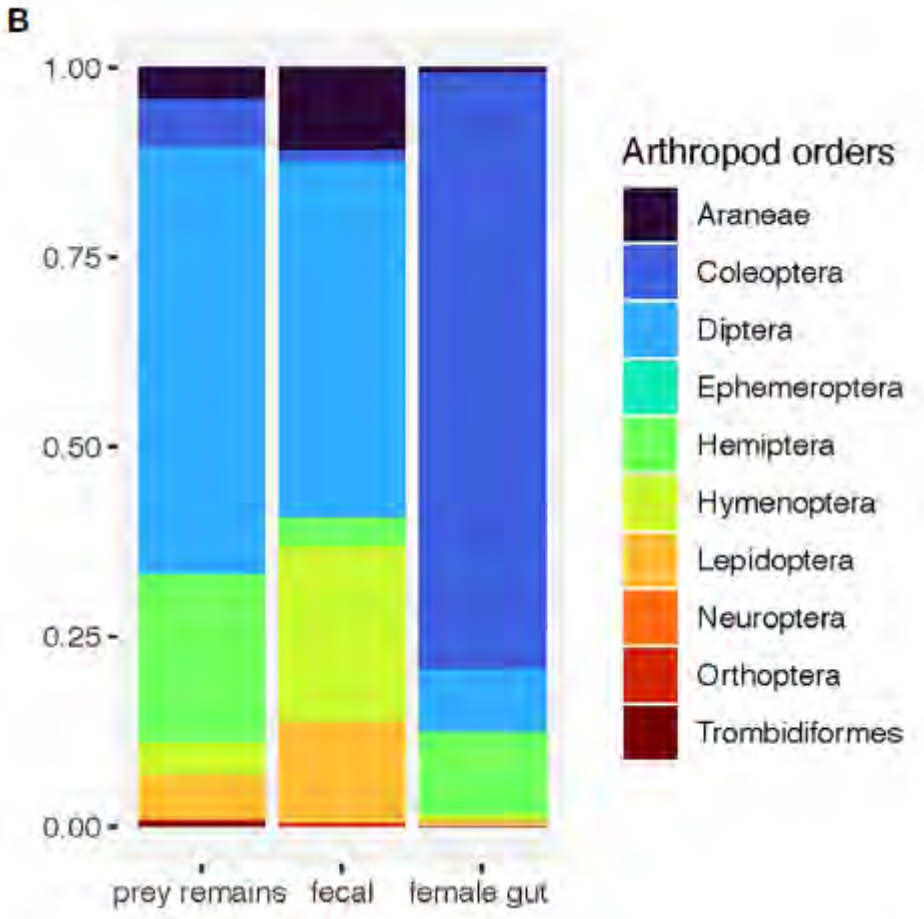


Nelsen et al. 2023. Ecol. Evol. 13:e10728. https://doi.org/10.1002/ece3.10728

Joro spider impacts

They are indiscriminate predators

(i.e., they will eat anything)



Grabarczyk et al. 2023. Front. Ecol. Evol. 13:11:1177446.

Joro spider Q & A

Q: Are they venomous?

A: Yes, all spiders are venomous.

Q: Will they get in the house?

A: Not unless you bring them inside.

Q: Will they bite me (or my pets)?

A: Only if you REALLY to provoke them.

Questions?

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