

Beech Leaf Disease: Emergence and Spread in Connecticut and New England



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Station



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Beech Leaf Disease

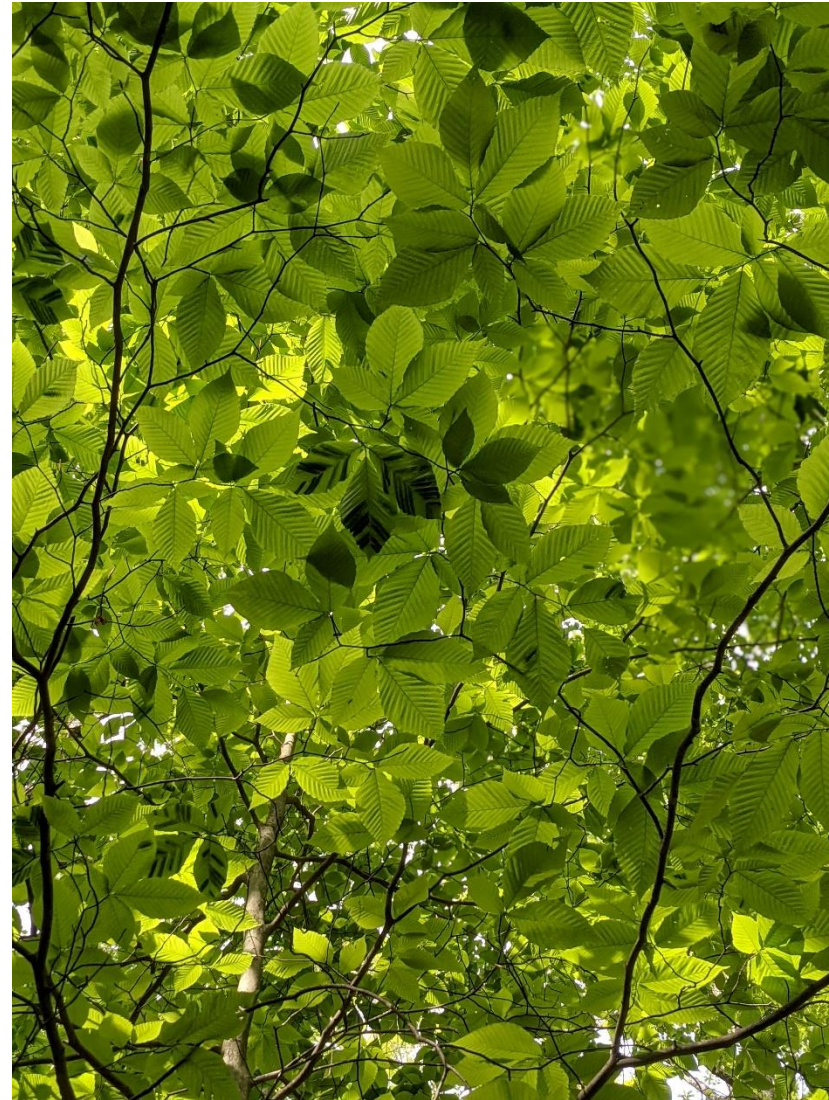
First identified in Ohio
in 2012

Affects American,
European, Oriental
beeches:

Fagus grandifolia

F. sylvatica

F. orientalis



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European beech cultivars



Wendy Hogan



Van Den Berk Nurseries



George Weigel

American beech, *Fagus grandifolia*



Brandon Woo



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Beech Leaf Disease

Disease Progression

Early season:

- Leaves emerge fully symptomatic
- Darkened bands, hypertrophy
- No new symptoms appear during growing season



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Beech Leaf Disease

Disease Progression

Late season:

- **Banding darkens, thickens, hardens**



Beech Leaf Disease

Disease Progression

Subsequent seasons:

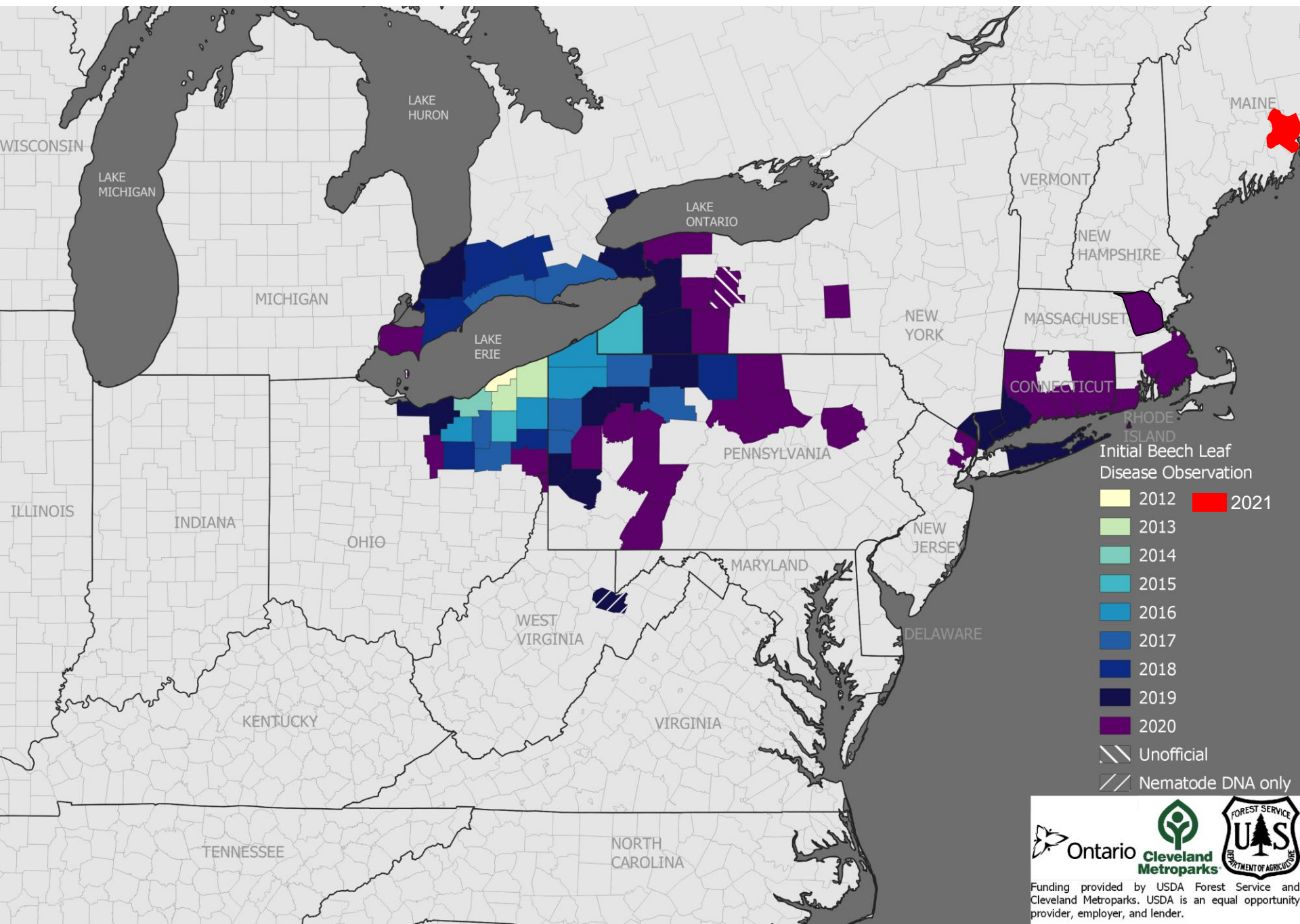
- Aborted bud development
- Thinning of canopy
- Mortality in 2-5 yrs in diseased saplings



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Beech Leaf Disease

2020 Fieldwork

USFS Region 9 Emerging Pest Funding:

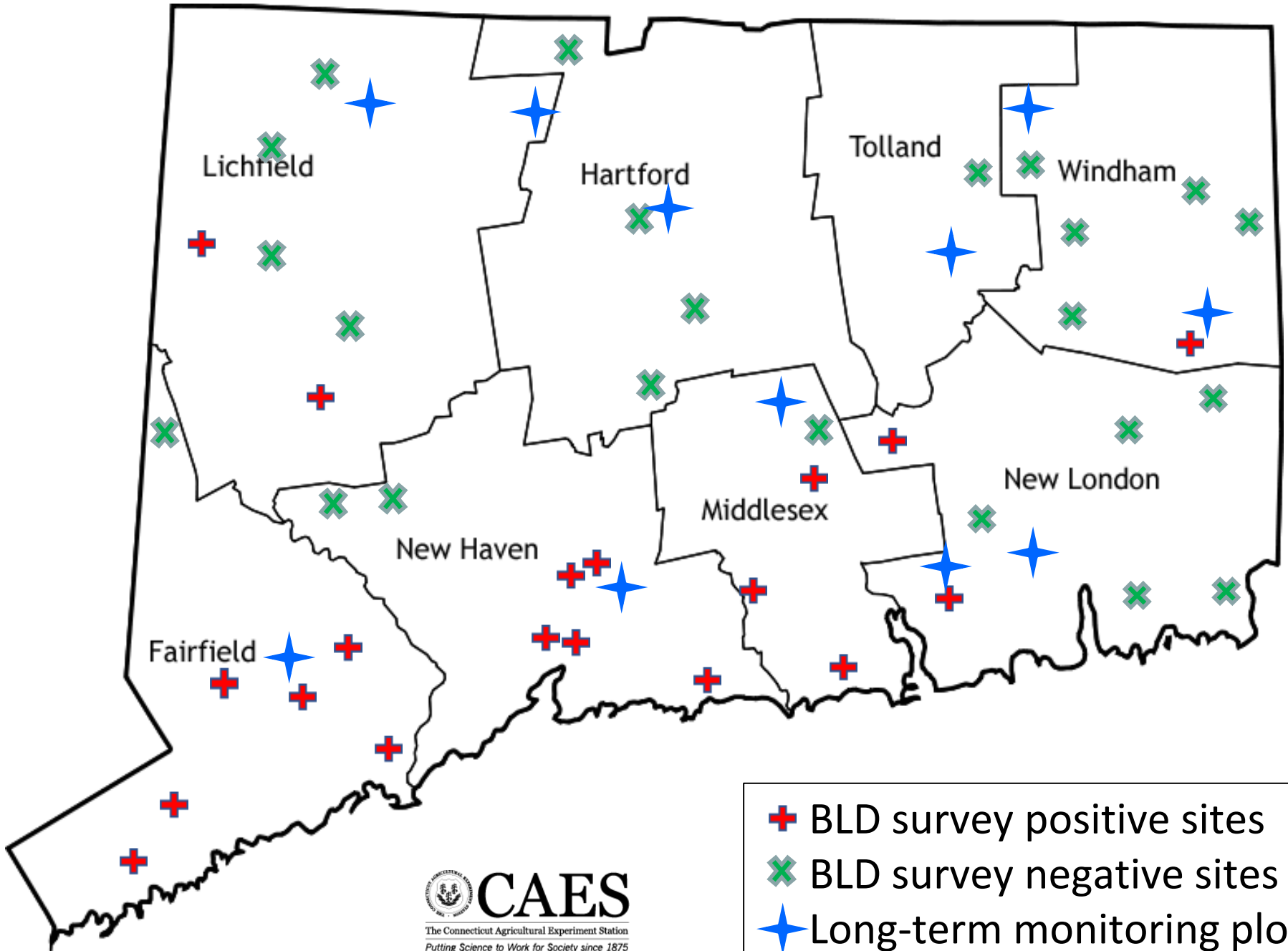
- Distribution surveys;
- 10 long-term monitoring plots in CT.



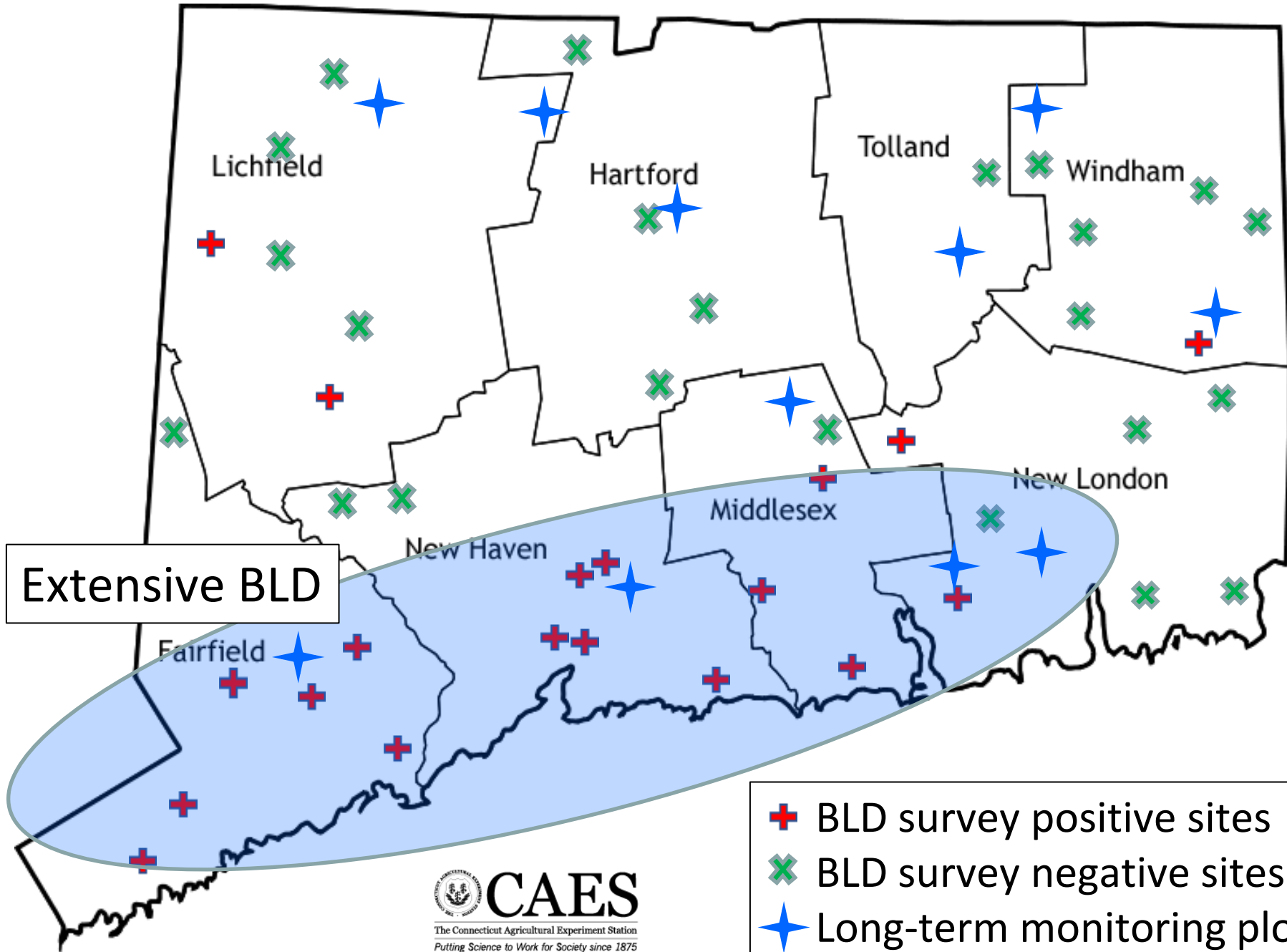
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- ✚ BLD survey positive sites
- ✖ BLD survey negative sites
- ★ Long-term monitoring plots



Extensive BLD

- + BLD survey positive sites
- X BLD survey negative sites
- ★ Long-term monitoring plots



Haddam, CT



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Haddam, CT



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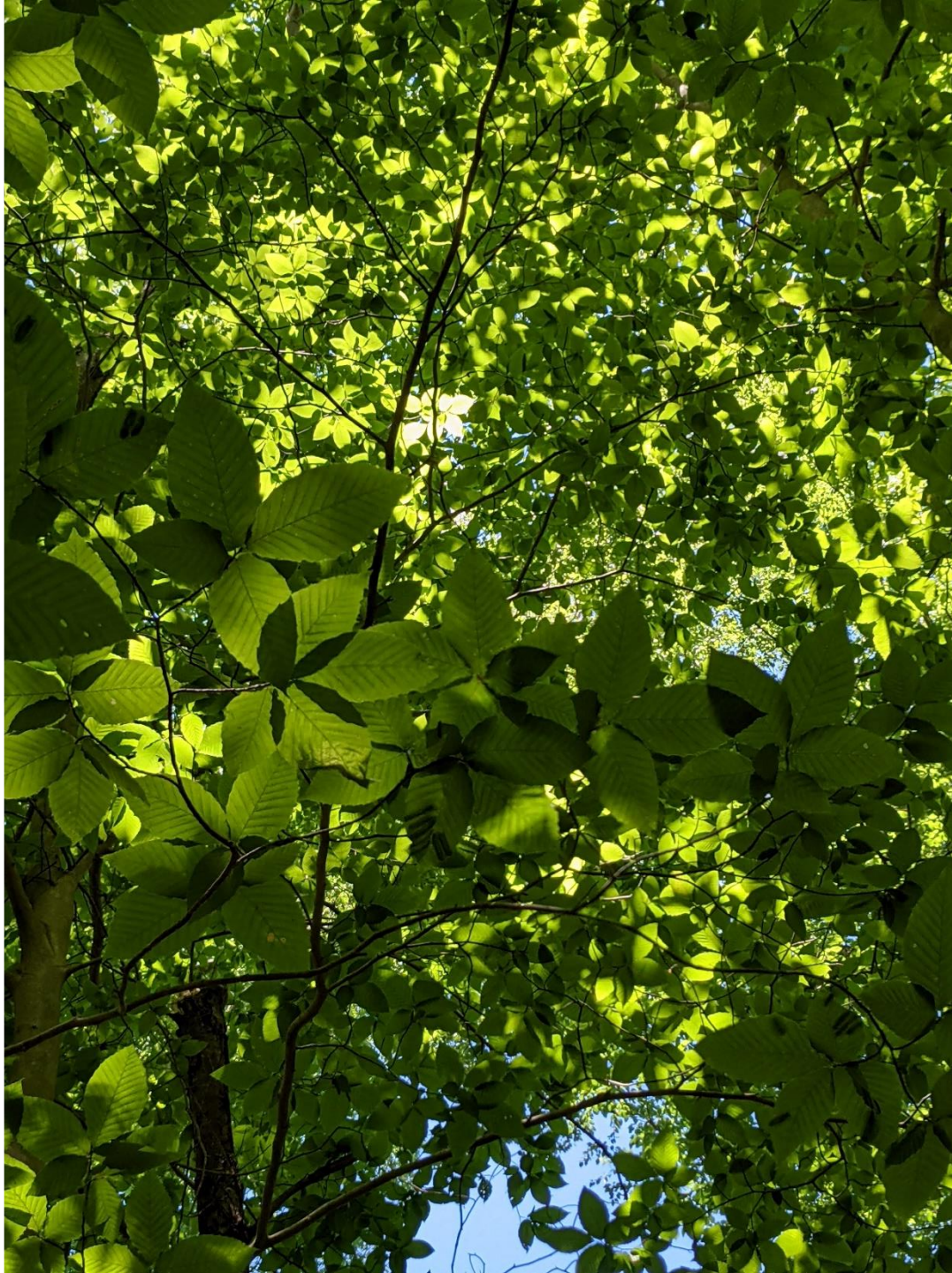
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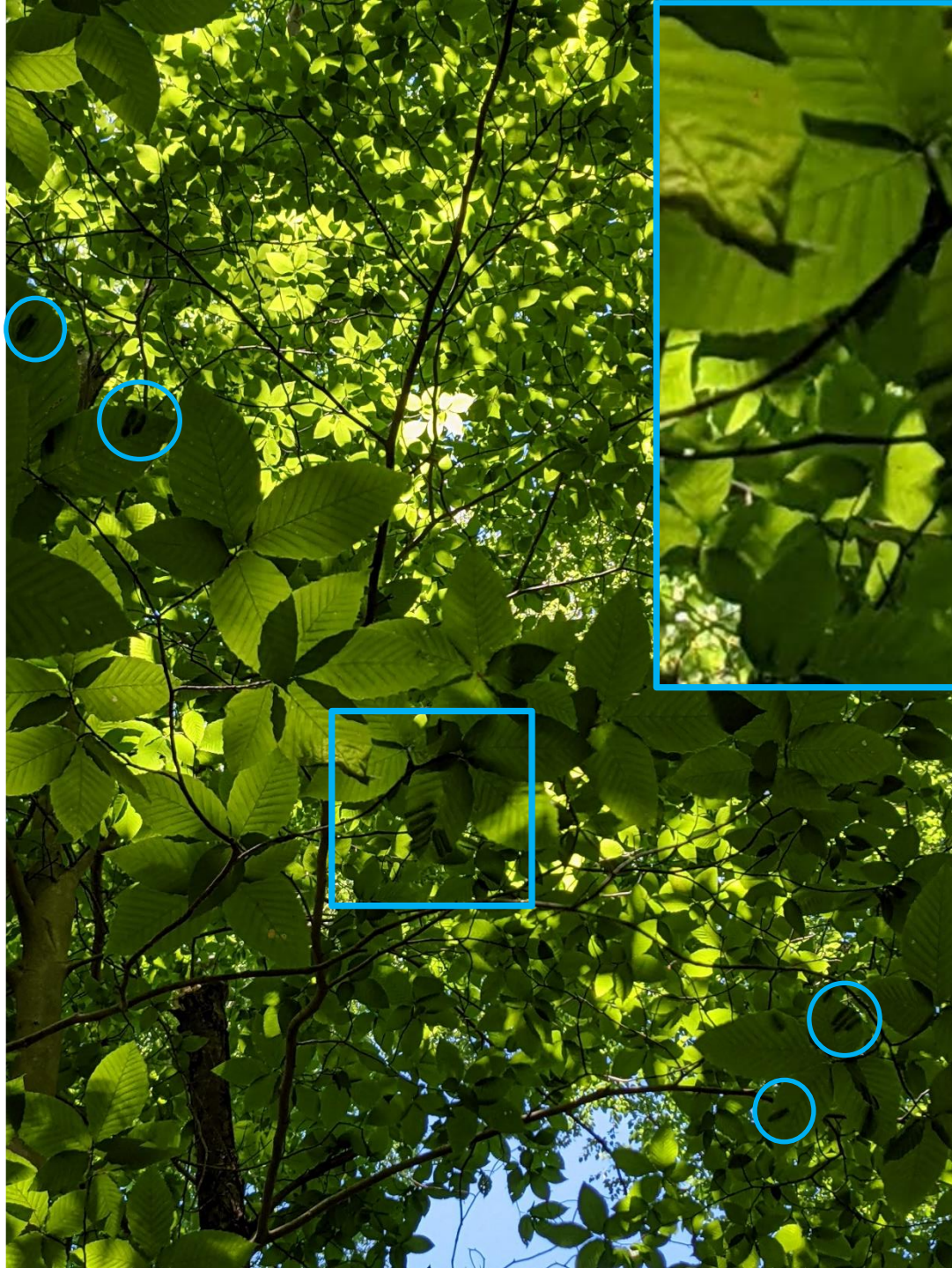
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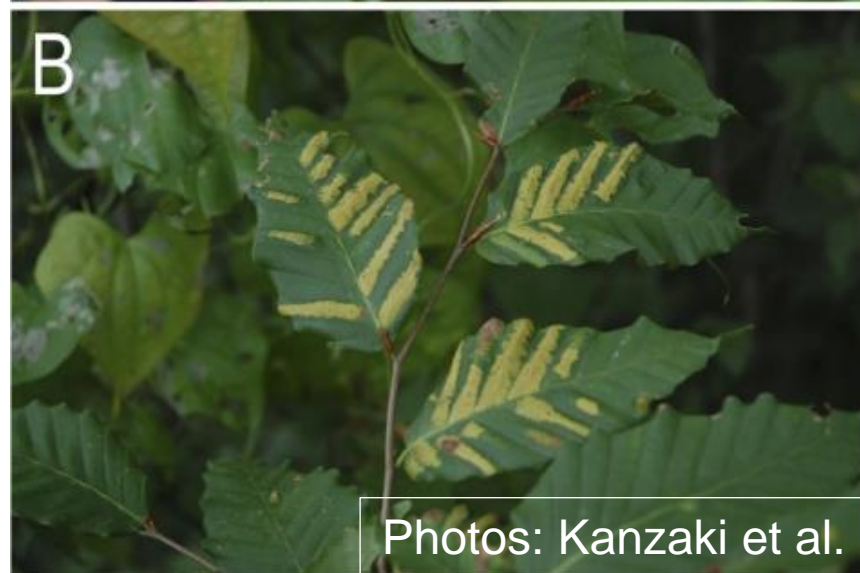
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Beech Leaf Gall

2004: First
observed in Japan
on Japanese beech
(*Fagus crenata*)

Associated with a
“leaf gall [foliar]
nematode”

Litylenchus crenatae
(Kanzaki et al. 2019)



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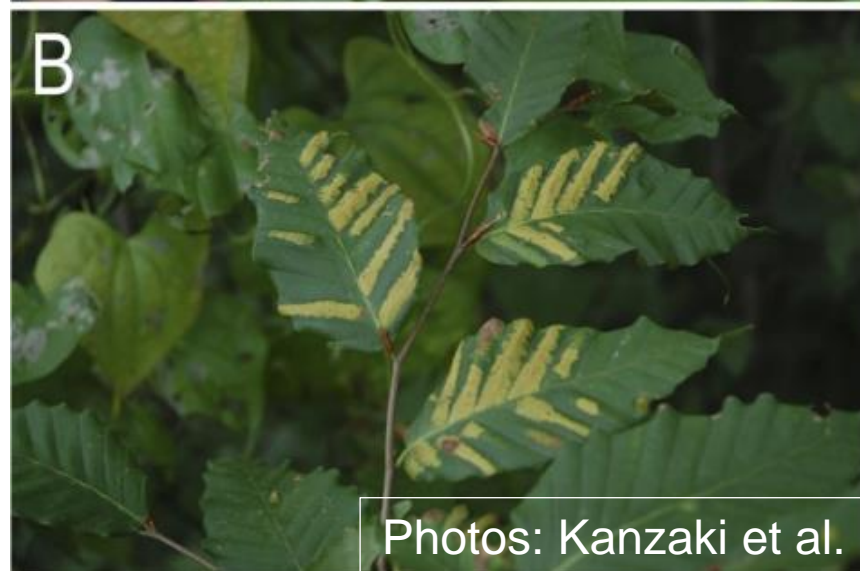
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Beech Leaf Gall

Found only on
Japanese beech
(*Fagus crenata*)

- Not on ornamental
American or
European beeches
growing nearby



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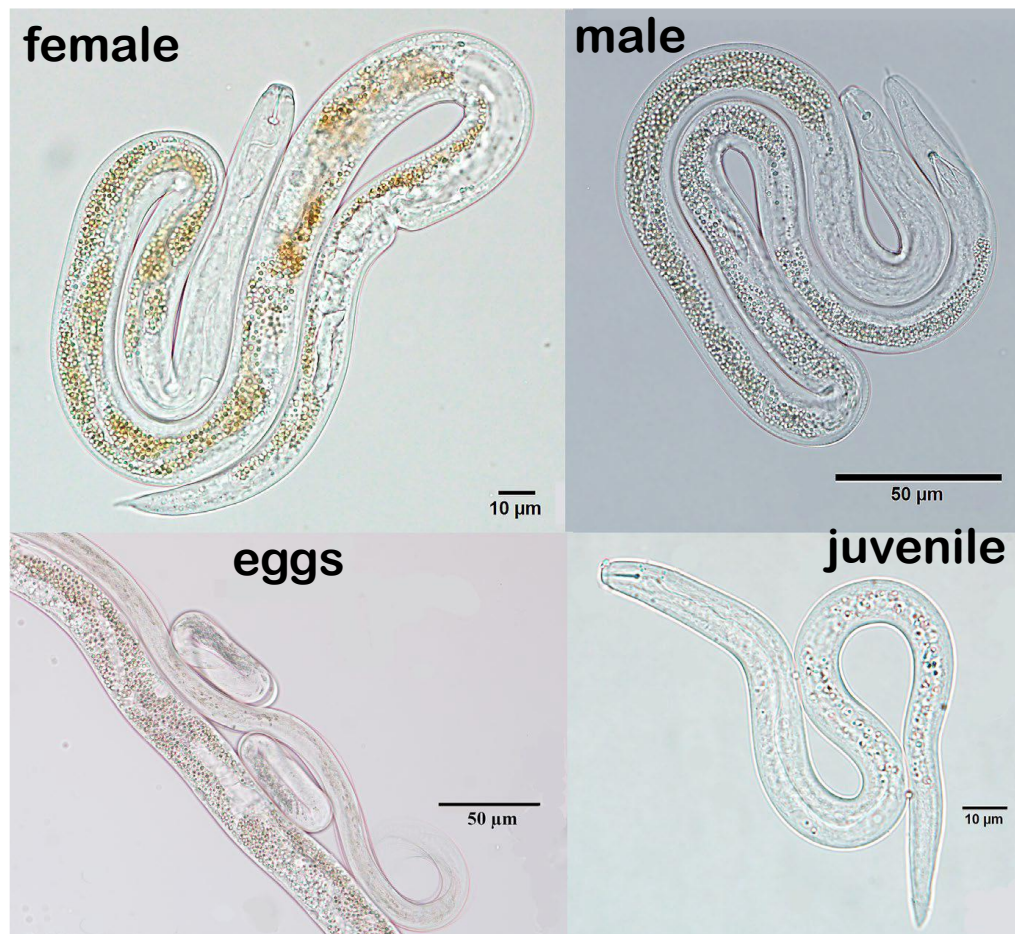
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Beech Leaf Disease

North America,
2019

- Nematode:
Litylenchus crenatae,
subspecies
mccannii (**Lcm**)

– Confirmed as
causal



Carta et al. 2020
Forest Pathology 50(2)



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Beech Leaf Disease

Holden Arboretum (OH):

BLD nematode (*Lcm*) causing disease on American, European, and Oriental beeches;

- Neither symptoms nor *Lcm* on Japanese beeches growing nearby.



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Foliar nematodes

- **Require water films to move outside of leaf;**
- **In presence of water, juveniles and adults will exit/enter through leaf stomata.**



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Beech Leaf Disease

Transmission of *Lcm*
nematode:

Little is known

Local movement via rain
splash?



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Beech Leaf Disease

Intermediate- and long-distance transmission:

- insects, mites, birds, mammals?
 - Passage through bird gut?
 - Overwintering birds – e.g., finches – regularly feed on beech buds
- Nurseries (European beech)?



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Beech Leaf Disease Working Group

- OH
- Ontario
- CT
- NY
- WV
- PA
- RI
- GA
- USDA-ARS, -USFS



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Beech Leaf Disease

Life cycle of BLD nematode

Winter: Nematodes found in buds



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Life cycle of BLD nematode

Spring, bud-break through early summer:

- None (or few) nematodes observed in symptomatic leaves;
- DNA (qPCR) signal confirms presence of the nematode:
 - eggs?
 - recalcitrant juveniles/adults?



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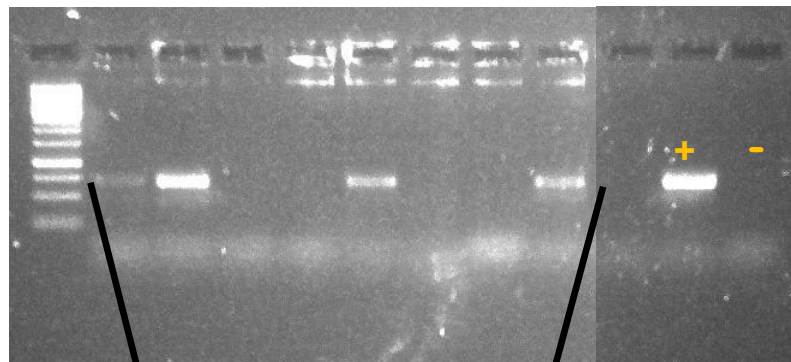
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Distribution of BLD nematode in early-season symptomatic tissue

➤ eggs?

CO-1 PCR



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Life cycle of BLD nematode

July – October:

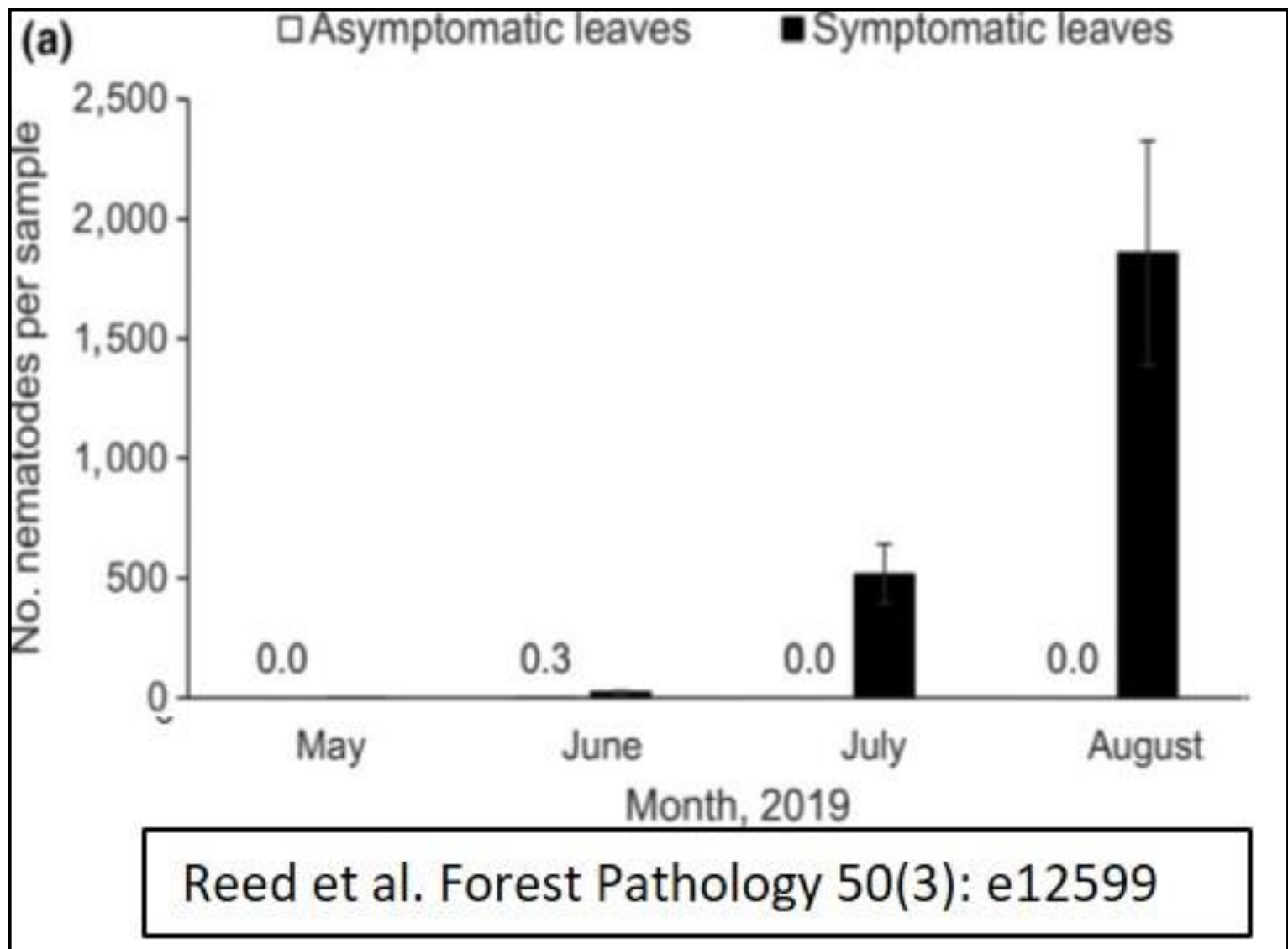
- Nematodes found in symptomatic leaves.**
- Population densities of juveniles and adults increase through autumn.**



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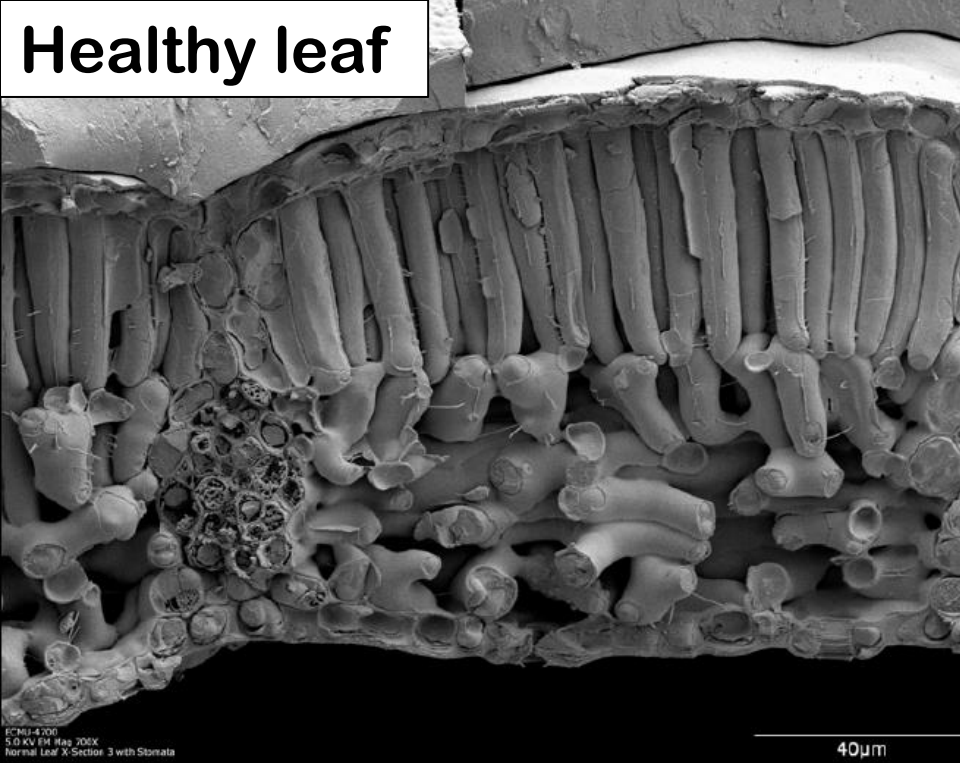
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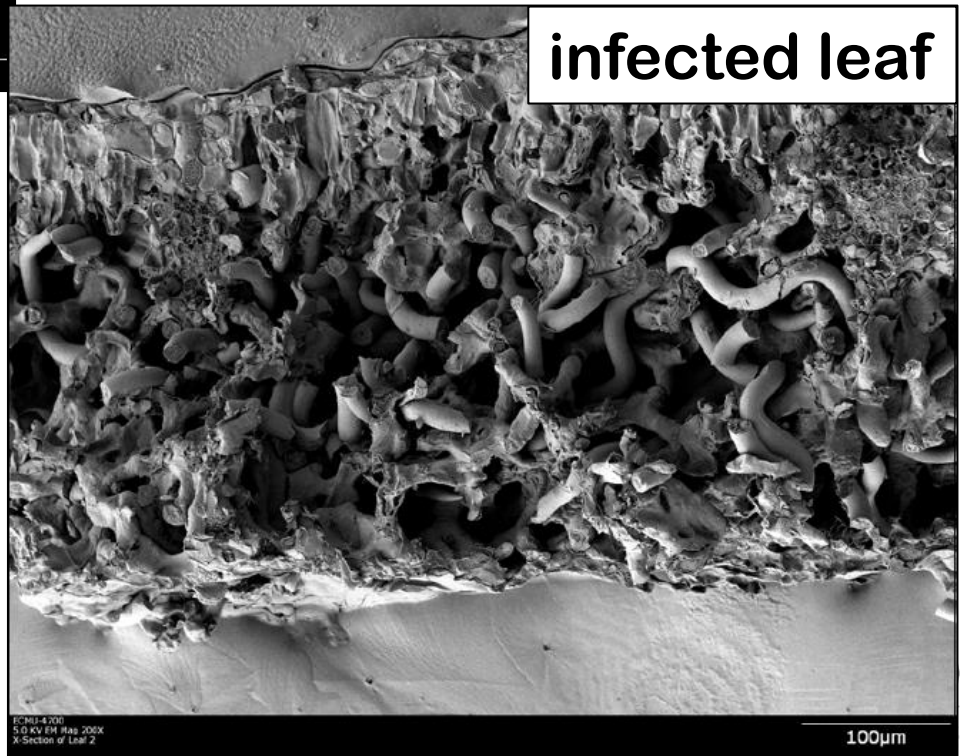
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Healthy leaf

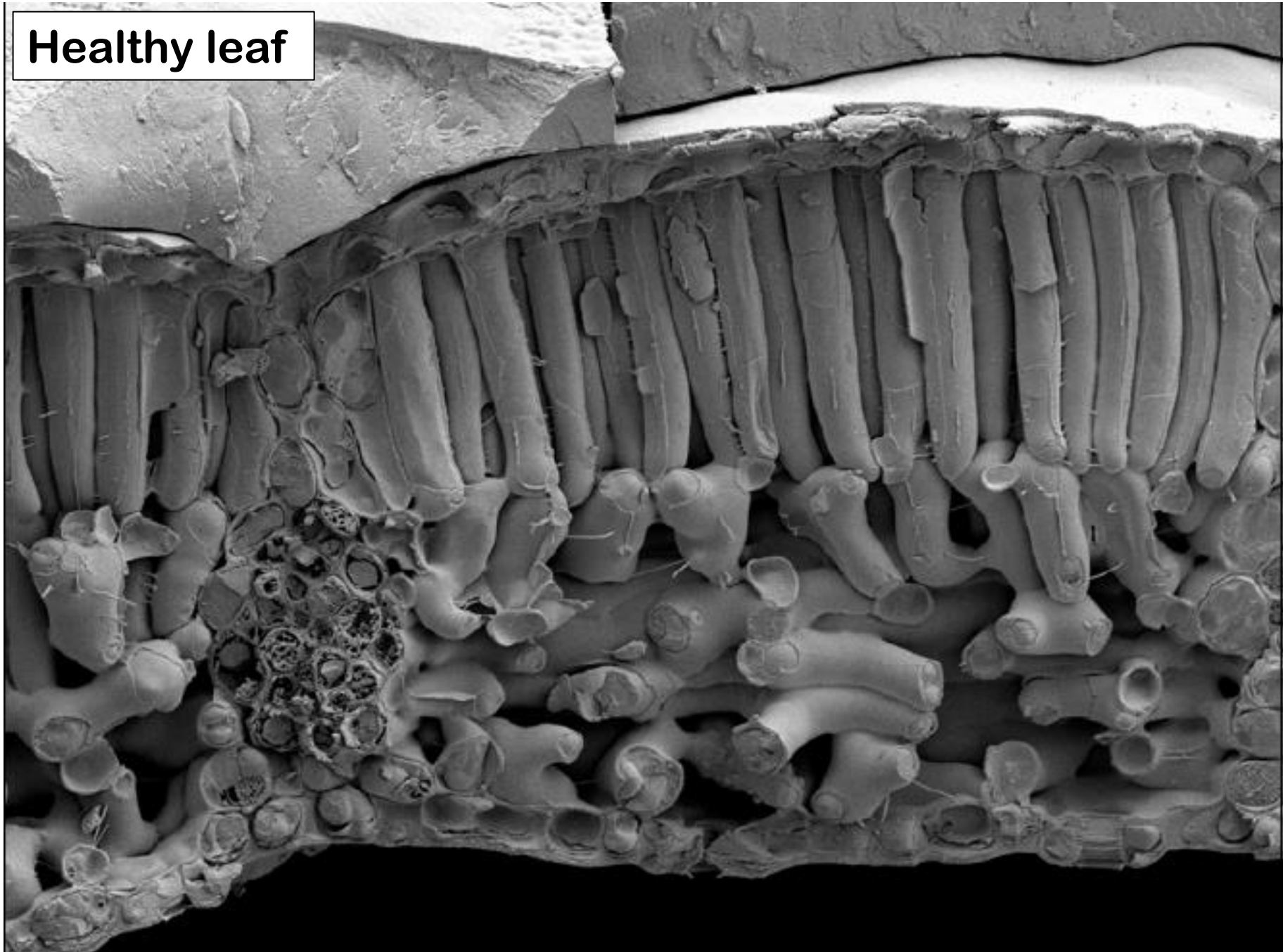
Beech leaves,
in cross-
section, late
season



infected leaf

Electron micrograph images:
Gary Bauchan, USDA-ARS

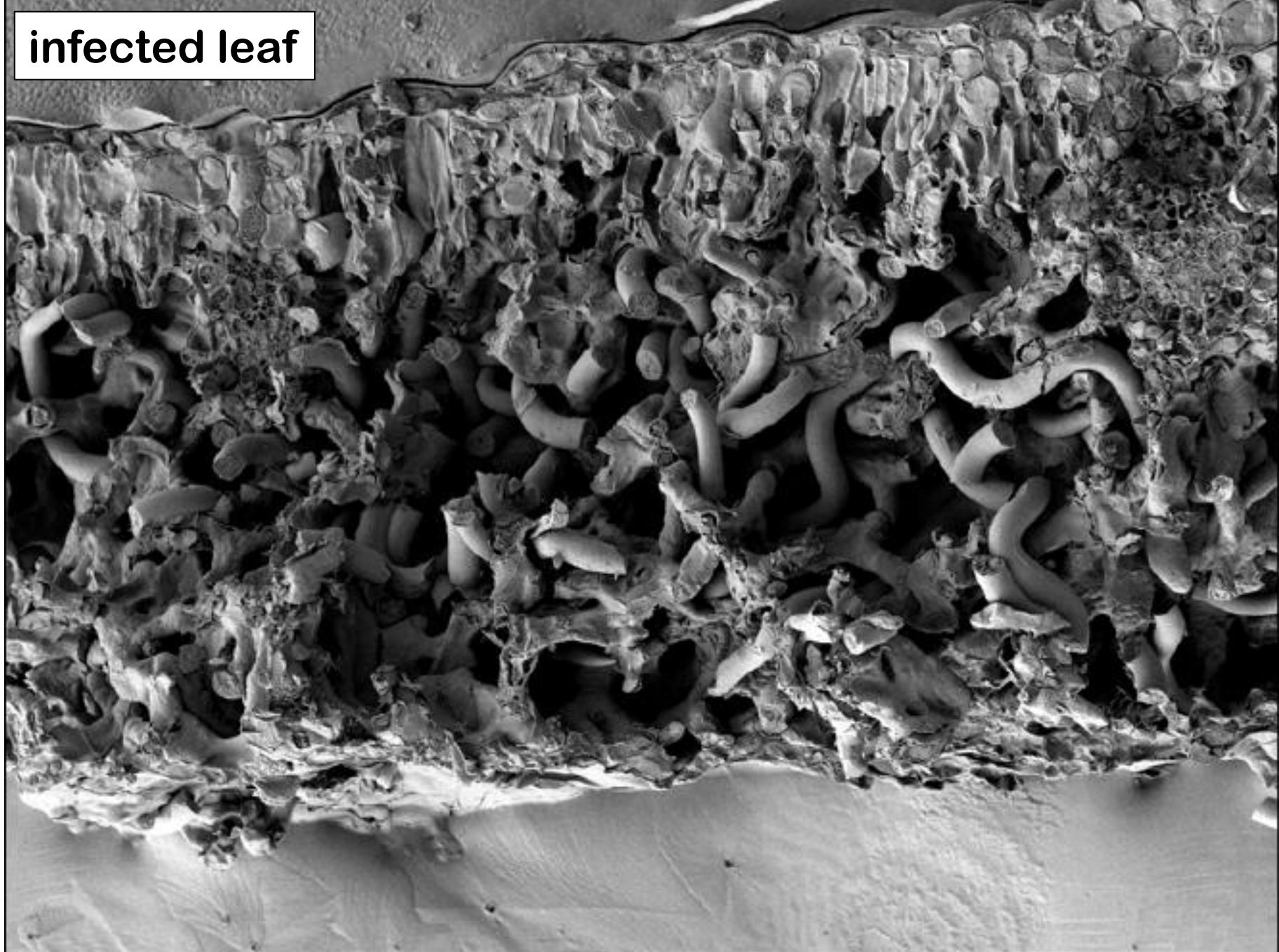
Healthy leaf



ECMU-4700
5.0 KV EM Mag 705X
Normal Leaf X-Section 3 with Stomata

40µm

infected leaf



Beech Leaf Disease Research

Control?

Research conducted in Ohio, Ontario,
western PA

Emamectin benzoate:

- trunk injections
- efficacy unclear



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Beech Leaf Disease Research

Control?

Research conducted in Ohio, Ontario,
western PA

Poly-phosphite:

- soil injections / drenches
- promising results on saplings



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Beech Leaf Disease Research

➤ Molecular markers

- Early detection of *Lcm*
- Discriminate between *Lcm* and Japanese subspecies, *Lcc*

➤ Pathways of spread, origin of *Lcm*

- Population genetics
 - » Whole-genome sequence of *Lcm*
 - » DNA fingerprinting markers



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More information:

- **CAES BLD Fact Sheet**
 - in Publications Tent
 - <https://portal.ct.gov/caes>

- **Concerned your tree may have BLD?**
 - Send diagnostic photos to the PDIO:
 - Yonghao.Li@ct.gov
 - Contact your arborist or town's tree warden.



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Summary

- **Beech Leaf Disease is spreading rapidly in the Northeast;**
- **Caused by a newly described foliar nematode:**
 - *Litylenchus crenatae* subsp. *mccannii*.
- **Symptoms in current year are result of nematode infestation the previous year;**
- **Poly-phosphite soil applications appear to have a salutary effect;**
- **More research (funding) is needed!**



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- Dr. Lynn Carta, USDA-ARS
- Beech Leaf Disease Working Group
- USFS R9E Emerging Pests Award
- USDA NIFA McIntire-Stennis Project CONH657
- CT DEEP, Division of Forestry



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QUESTIONS?



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