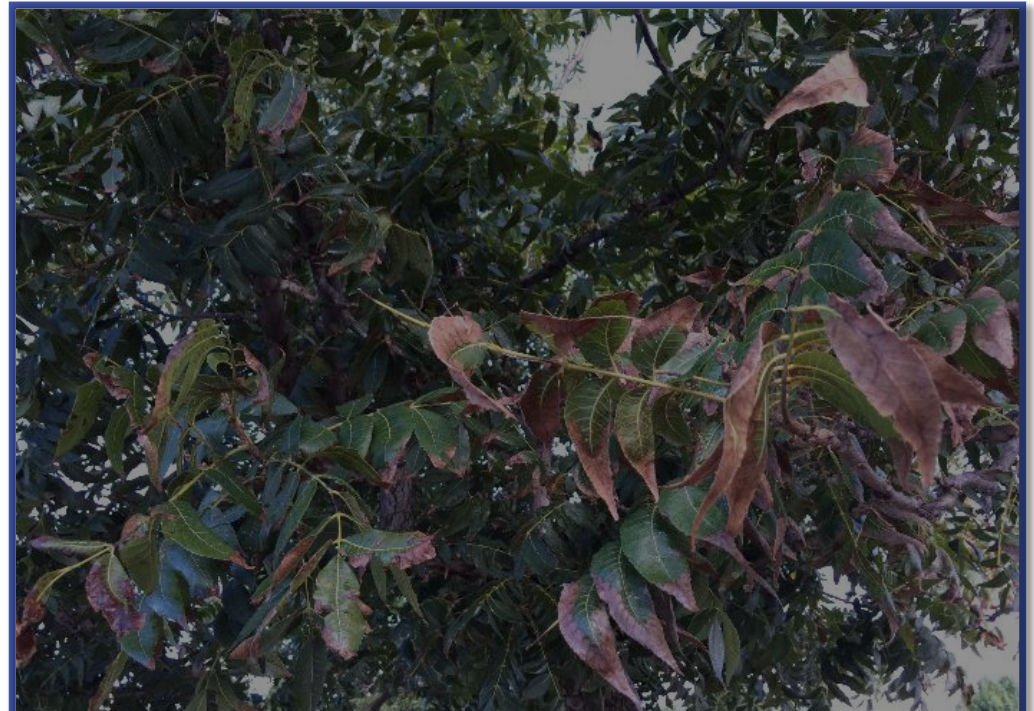


Discovery of Pecan Bacterial Leaf Scorch in the West

Richard Heerema
Extension Pecan Specialist
New Mexico State University



New Mexico State University
All About Discovery!
nmsu.edu

Photo: Natalie Goldberg, NMSU

Cooperative Extension Service

Pecan Bacterial Leaf Scorch (PBLs) in the Southwestern U.S.

- Arizona - July 2015
- New Mexico - August 2015
- California - August 2015
- Texas - September 2015
- “New” disease in pecan in the Southwestern U.S. (known in SE)
- Not a new pathogen
 - Causes disease in several crops/plants in Arizona, California, Texas, and New Mexico



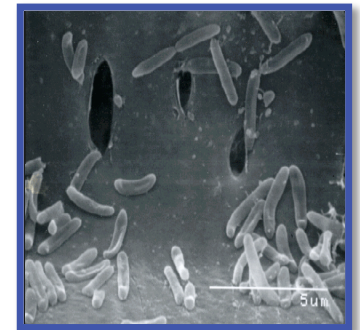
Photo: Natalie Goldberg, NMSU

Pecan Bacterial Leaf Scorch

- Disease in pecan was confirmed to be caused by a bacterium (*Xylella fastidiosa*) in Louisiana in 1998
 - Before 1970' s – symptoms thought to be caused by environmental or cultural stress
 - 1970's – identified as a disease caused by several different fungi or unknown fungi (“Fungal Leaf Scorch”)
 - Improvements in diagnostic techniques in the 1980's and 1990's helped to identify the causal agent as a fastidious bacterium
 - Explosion in discovery of “new” hosts: pecan, blueberry, citrus, ornamentals (oleander, sycamore, oak, elm, mulberry, and many others)

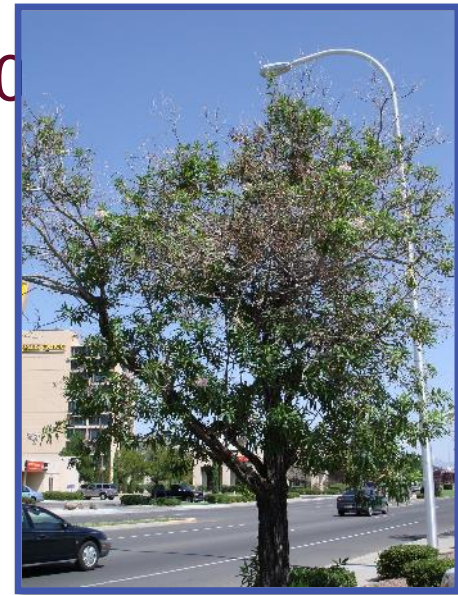
Pecan Bacterial Leaf Scorch

- Caused by *Xylella fastidiosa*, a xylem-limited **plant pathogenic** bacterium
 - **Not** a human or animal pathogen
- The bacteria resides and multiplies in the xylem vessels
 - Plants are deprived of water and nutrients – symptoms similar to **drought, nutrient deficiency and salt damage**



Xylella fastidiosa in New Mexico

- First found in NM in *Chitalpa* in July 2008 and in grapes later that year
- In others plants:
 - 2008 - *Catalpa* (one of the parents of *Chitalpa*)
 - 2010 - Peach in Northern NM
 - 2015 - Pecan
 - 2015 - Oak (Las Cruces and Albuquerque)
 - 2015 - Sycamore
 - 2015 - Mexican Elder
 - 2015 - Crape myrtle
 - 2015 – *Vitex*
 - And several others

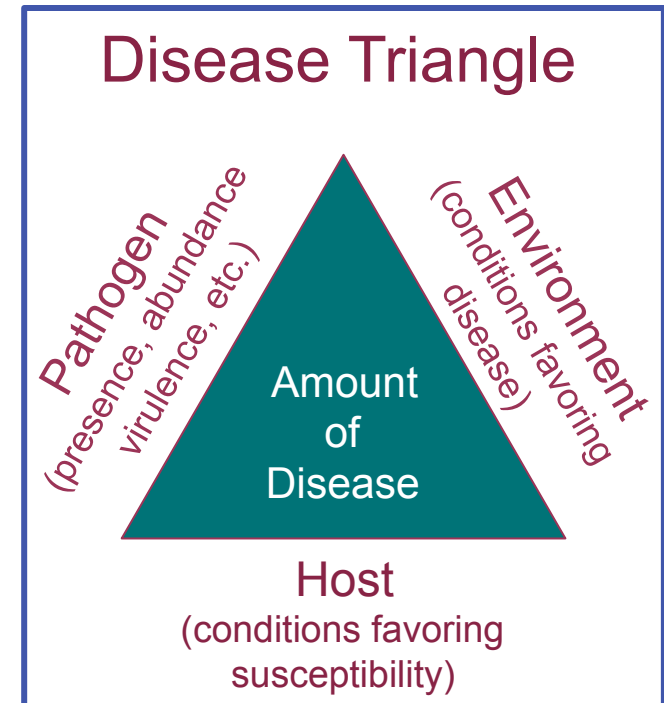


Photos: Natalie Goldbero, NMSU

The list of plant species documented to host *Xylella fastidiosa* is at least as long in AZ, CA, and TX.

Xylella fastidiosa

- Large host range (over 150 plants)
 - Causes disease in a relatively small number of hosts (10 - 20%)
- Why the bacterium causes disease in some plants and not others is unknown
 - The mechanisms of disease are not fully known and may not be the same in all hosts
 - **Plant stress** plays a significant role in symptom development



Xylella Detection Methods

| Technique | Sensitivity (No. of bacterial cells) | Time | Cost/Labor |
|-----------|---|-----------|------------|
| ELISA | 100,000 | 1 day | Med |
| PCR | 100 | 1 day | High |
| IC-PCR | <100 | 1 day | High |
| Culture | 1000 | >2 months | High |

- **ELISA** (Enzyme Linked Immuno-Sorbent Assay) - Antibody/Antigen test
- Polymerase Chain Reaction (PCR) - Makes copies of DNA until there is a large amount that can be detected
- Culture – requires selective media and patience!

Xylella Detection Methods

- ELISA can yield a false negative
 - Bacterial population in the plant may be very low
 - Bacterial population fluctuates with the time of year
 - Bacterial population varies from leaf to leaf
 - Symptoms are not indicative of presence of the bacterium
 - Extraction of the bacteria from the xylem vessels is challenging
 - “hammer” vs. “bombing”
- PCR is much more sensitive than ELISA
 - BUT, a reliable PCR test for pecan doesn't exist (there are PCR inhibitors - phenolic compounds - in pecan sap)
 - Right now, ELISA is the most reliable detection method we have, but a negative result doesn't really mean anything

Pecan Symptoms



Leaf symptoms
Somewhat variable...

Pecan Symptoms

- Somewhat variable ...
- Universal symptom: “Scorch” beginning at the edges and the tips of the leaflets
 - sometimes a distinct dark brown line separates “symptomatic” and “healthy” tissue



Photos: Jason French, NMSU-PDC



Photo: Natalie Goldberg, NMSU

Pecan Symptoms (not seen in NM)

- In Louisiana – leaflet death and defoliation, branch dieback, reduced tree growth, & yield loss
- In Arizona – terminal shoot dieback, defoliation



Photo: Randy Sanderlin, Louisiana State University



Photo: Joshua Sherman, University of Arizona

Disease Detection Results to Date (ELISA)

| New Mexico | Arizona |
|---|---|
| 112 trees tested; 43* trees (pr. cham.) | 130* trees tested (press. cham.) |
| 39% positive; *84% positive | *71% positive |
| 3 NM counties (Dona Ana, Eddy, Valencia) | 6 AZ counties |
| 9 cultivars (Pawnee, Western, Barton, Mandan, Lakota, Spence, Cape Fear, Bradley, Burkett (seedling tree), plus unknowns) | 13 cultivars (Pawnee, Western, Wichita, Bradley, Burkett, Mandan, Mahan, Cheyenne, plus unknowns) |

PBLS in the Southwestern US

- Positive trees range in age from very young to very old
- Positive trees are in established orchards, relatively new orchards, and are isolated, random, backyard trees
- Positive tests have come from trees with severe symptoms, very few or mild symptoms, and no symptoms



Photo: Natalie Goldberg, NMSU

PBLS in the Southwestern U.S.

- We are in the early stages of this discovery
 - We've learned a lot, but there is still a lot we don't know
- The pathogen (*X. fastidiosa*) is widespread
 - It is widely distributed in many different hosts across the southwest including pecan
 - It is in a high number of pecan trees



Photo: Richard Heerema, NMSU

What we think:

- Bacterium has been in pecan in NM and AZ for a LONG time and has gone undetected
 - The pathogen may be “resident” in pecan – (we don’t have enough data to know this for sure, but from what we know, we are starting to think this might be the case) – only causing disease symptoms when conditions are right (fulfilling the requirements of the disease triangle)
- The better we manage the trees and the less environmental stress on “infected” trees, the less impact the bacterium may have on the tree
 - In well managed trees with little plant stress, the pathogen may have little effect on overall tree health and yield

What we don't know:

- Where it came from
- How it's spread (in pecan in the Southwest)
 - Potential vectors?
 - Propagation?
- If and what differences there may be in cultivar susceptibility
- What strain of the pathogen is in pecan in the Southwestern U.S., what strain is in the other newly identified hosts, and whether or not they are the same strain

PBLS Collaborators

- New Mexico State University
 - Natalie Golberg
 - Jennifer Randall
 - Jason French
 - Rio Stamler
- University of Arizona
 - Mary Olsen
 - Josh Sherman
- Presentation and handout available online:
 - <http://aces.nmsu.edu/ces/plantclinic/>
 - <http://pecans.nmsu.edu>

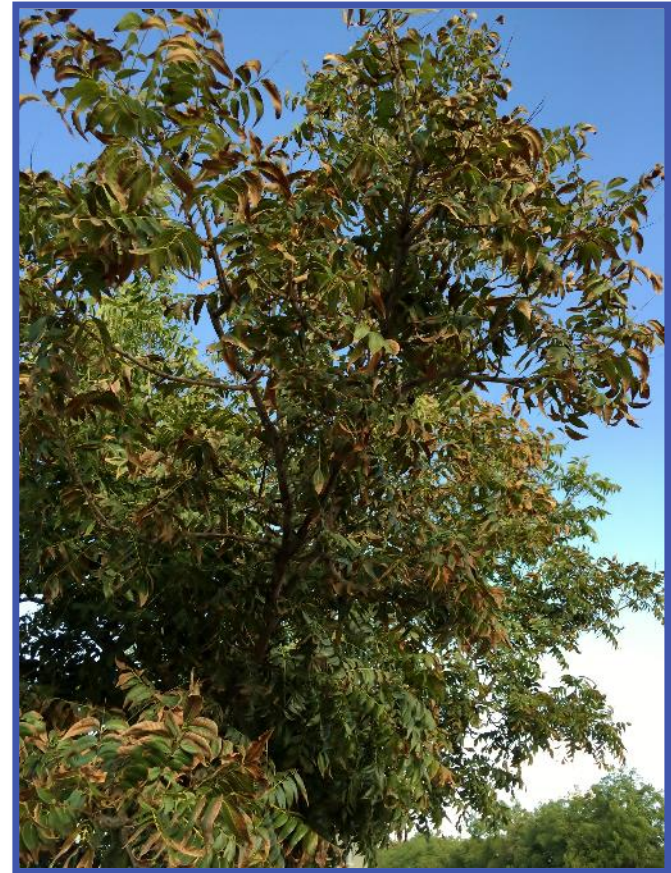


Photo: Natalie Goldberg, NMSU