# Pierce's Disease Vectors and Management in NC

Hannah Burrack, Rocio Davila, and Aurora Toennisson
Department of Entomology & Plant Pathology
North Carolina State University

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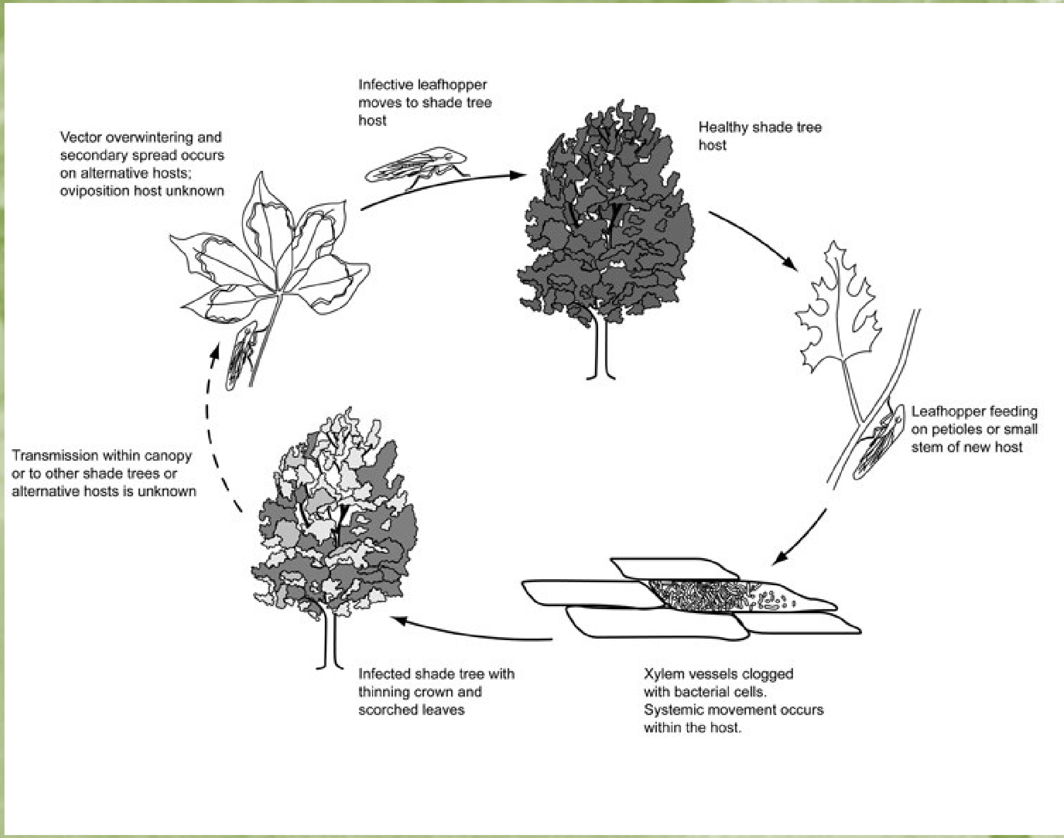
# Pierce's Disease Vocabulary

**Hosts** – Host range is extremely broad with naturally occurring infections documented from 93 plant species in the United States, including woody perennials (where most of the economic damage occurs). Some strains of the pathogen infect a narrower host range (e.g. the strain causing oleander scorch does not appear to infect grapes).

**Pathogen –** *Xylella fastidiosa,* bacterium that infects the xylem of host plants.

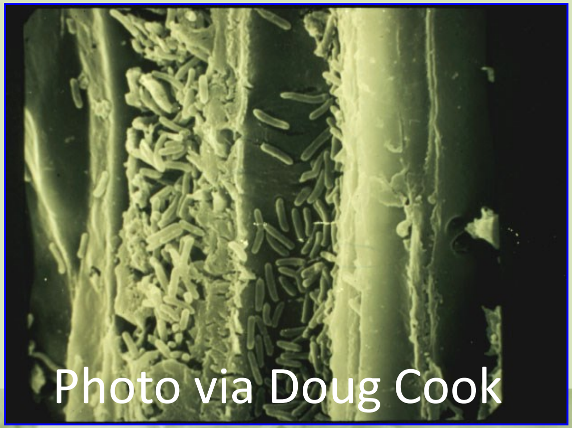
**Vector –** The insect that moves the pathogen between hosts. In the case of PD, xylem feeding insects including leafhoppers and spittle bugs are potential vectors.

# Pierce's disease cycle




Xylem feeding leafhoppers, sharphooters, and spittlebugs acquire the bacterium

*X. fastidiosa* adheres to the foregut of the insect & multiplies



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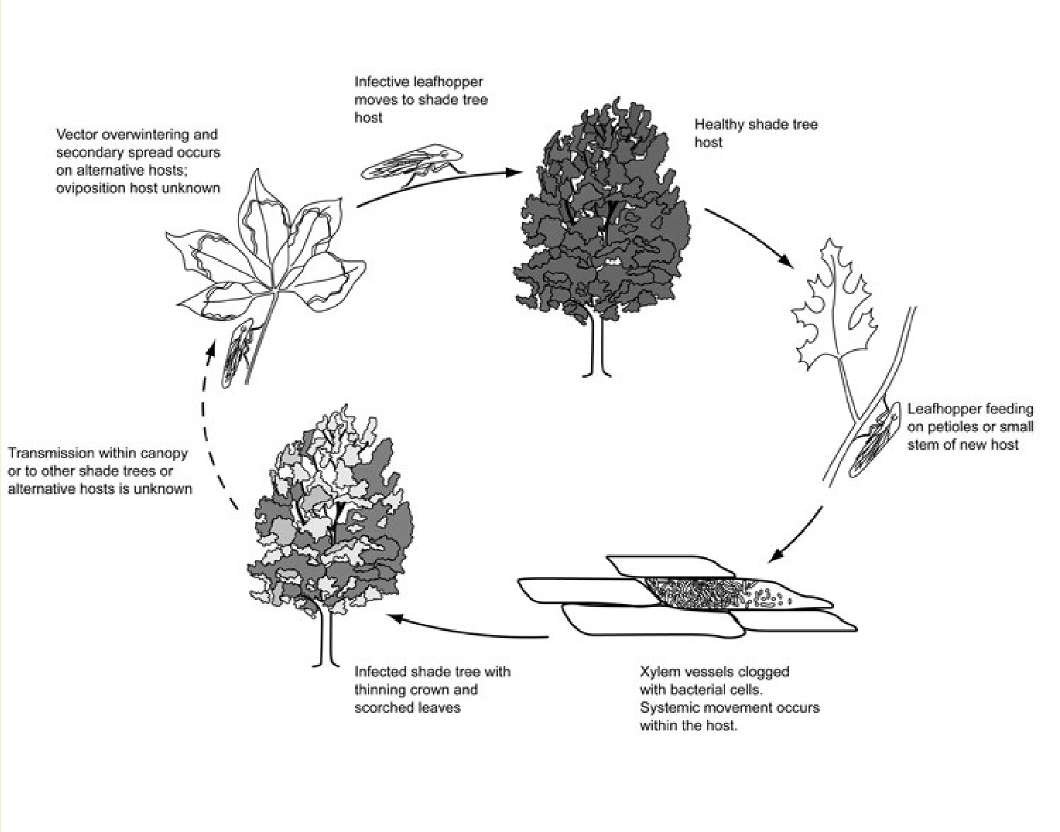
# Pierce's Disease management considerations




Insect is no longer infectious after molting (forgut is shed during molting) = semi persistent transmission mechanism

Immature insects cannot transmit after molting. Adults may transmit longer and are more mobile.

No latent period for infection = insects can transmit immediately after acquiring the pathogen from an infected host

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# Systemic vs. local infections

*Local infections occur in and near the tissue where the bacteria was first introduced = present for a single growing season*

*Systemic infections require the bacteria to move and reproduce within the plant = remains for multiple seasons or permanently*

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# What determines if a vine becomes systemically infected?

1. Timing – Spring infections are more likely to become systemic

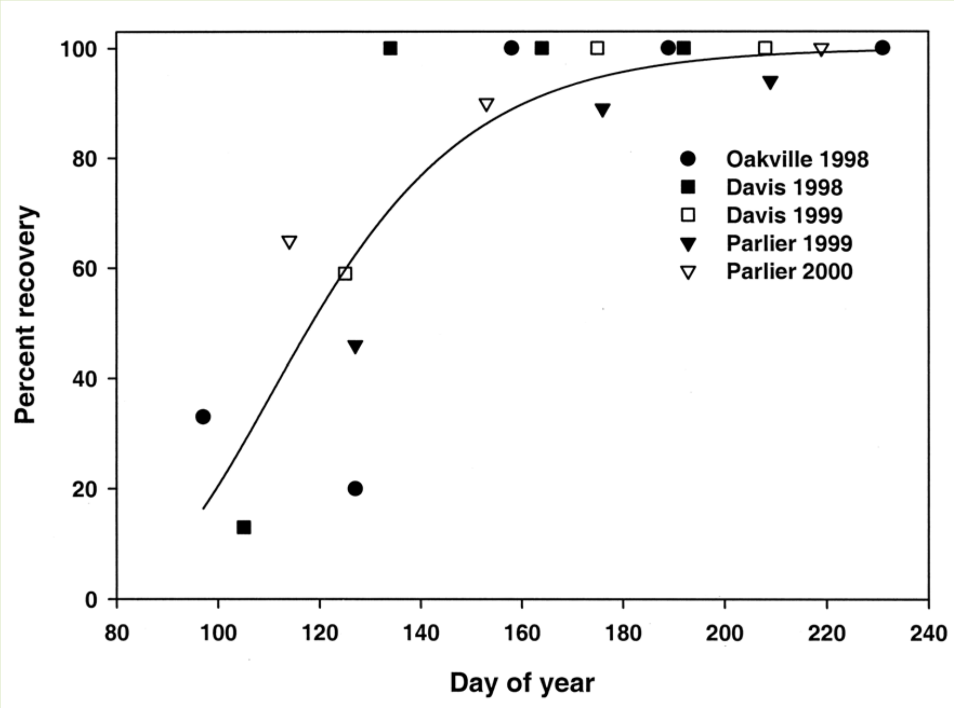
2. Temperature – Low winter temps aid recovery

3. Variety/species – " recovery is higher in **Chenin blanc, Sylvaner, Ruby Cabernet**, and White Riesling, compared to Barbera, Chardonnay, Mission, Fiesta, and Pinot noir. Thompson Seedless, Cabernet Sauvignon, Gray Riesling, Merlot, Napa Gamay, Petite Sirah, and Sauvignon Blanc are intermediate in their susceptibility to this disease and in their probability of recovery. In tolerant cultivars the bacteria spread more slowly within the plant than in more susceptible cultivars." – UC IPM

# Importance of infection timing

**In high risk areas, early season infections are more likely to result in systemic disease.**

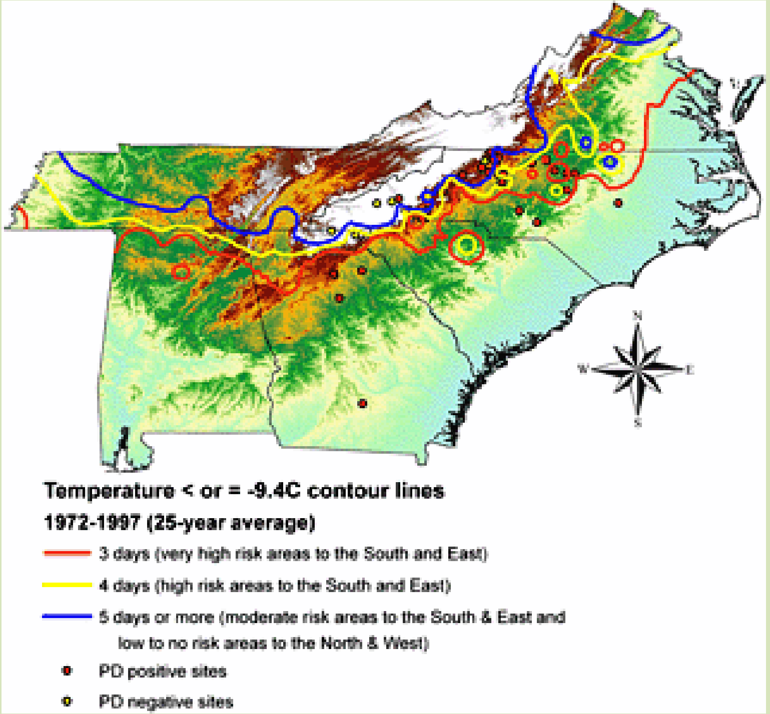
"Vines inoculated on the earliest inoculation dates (April to May) developed more extensive and severe PD symptoms, and only 54% recovered after the following winter, compared with vines that had been inoculated during June through August, of which 88% recovered from PD the following winter."

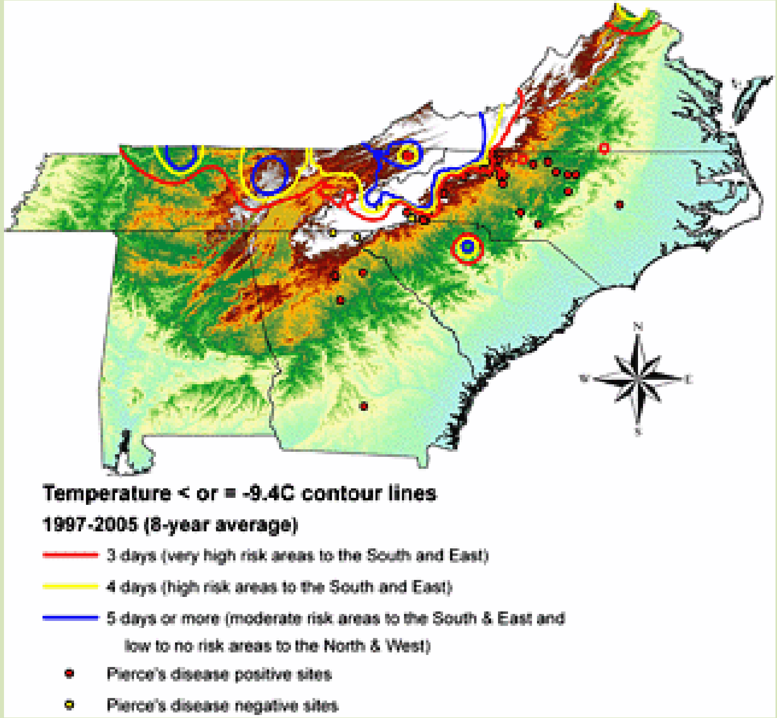



Feil, et al. 2003. Phytopathology.

# Effects of winter temperatures in NC
# *Where are high risk areas?*

**Locations with 5 or more days with a low of 15F (-9.4C) are at lower risk of developing systemic PD**




Anas, et al. 2008. Plant Health Progress. https://www.plantmanagementnetwork.org/pub/php/research/2008/pierces/

# Pierce's Disease management considerations

Transmission efficiency:

*Sharpshooters*

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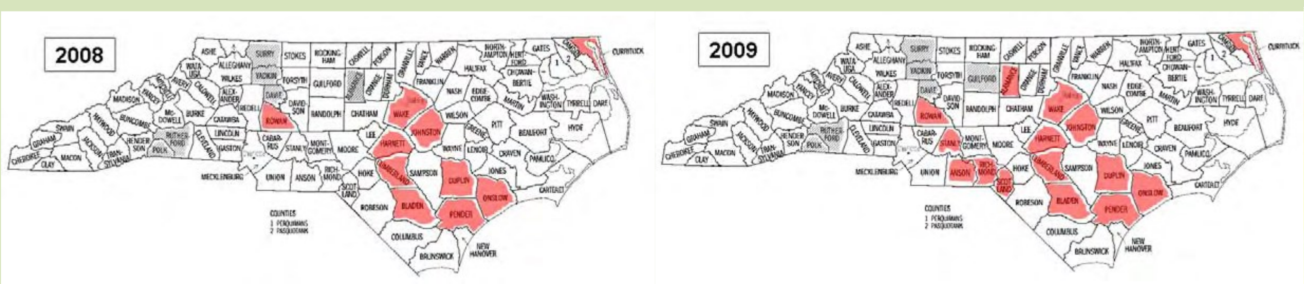
*Leafhoppers*

>

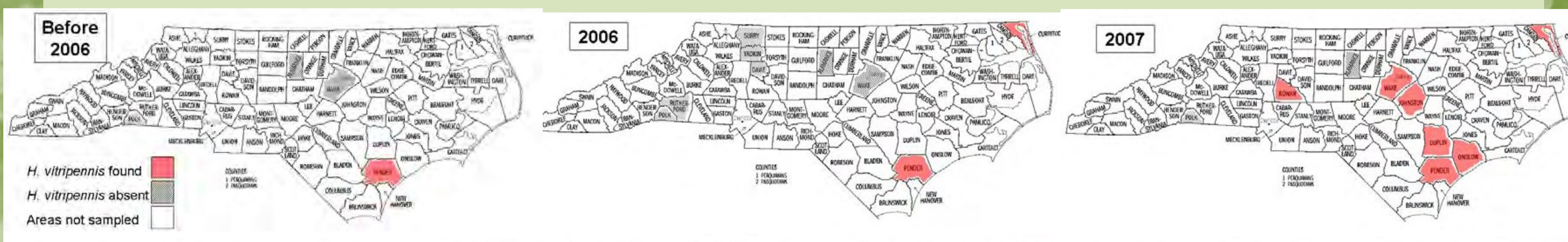
*Spittlebugs*

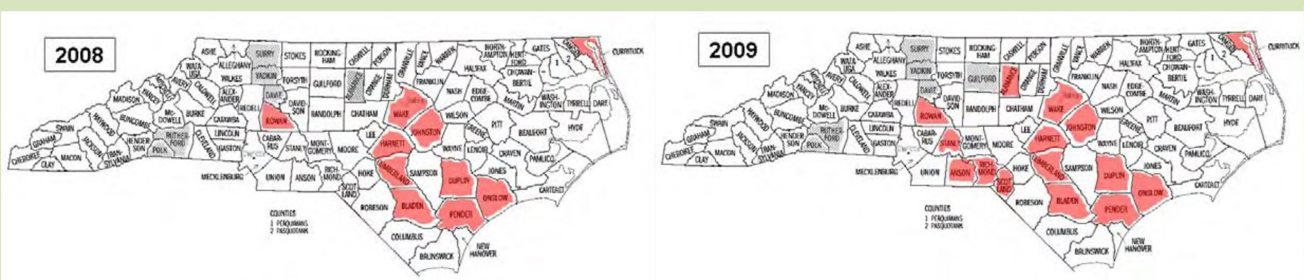
# Insect vectors
## *Glassy-winged sharpshooter (Homalodisca vitripennis) is not the primary vector*


GWSS has not been observed statewide, and even in areas where it is present, other vectors are more common and more abundant

# Insect vectors
## *Glassy-winged sharpshooter (Homalodisca vitripennis) is not the primary vector*




In 2019, we confirmed GWSS in New Hanover and Perquimans Counties, areas not previously sampled

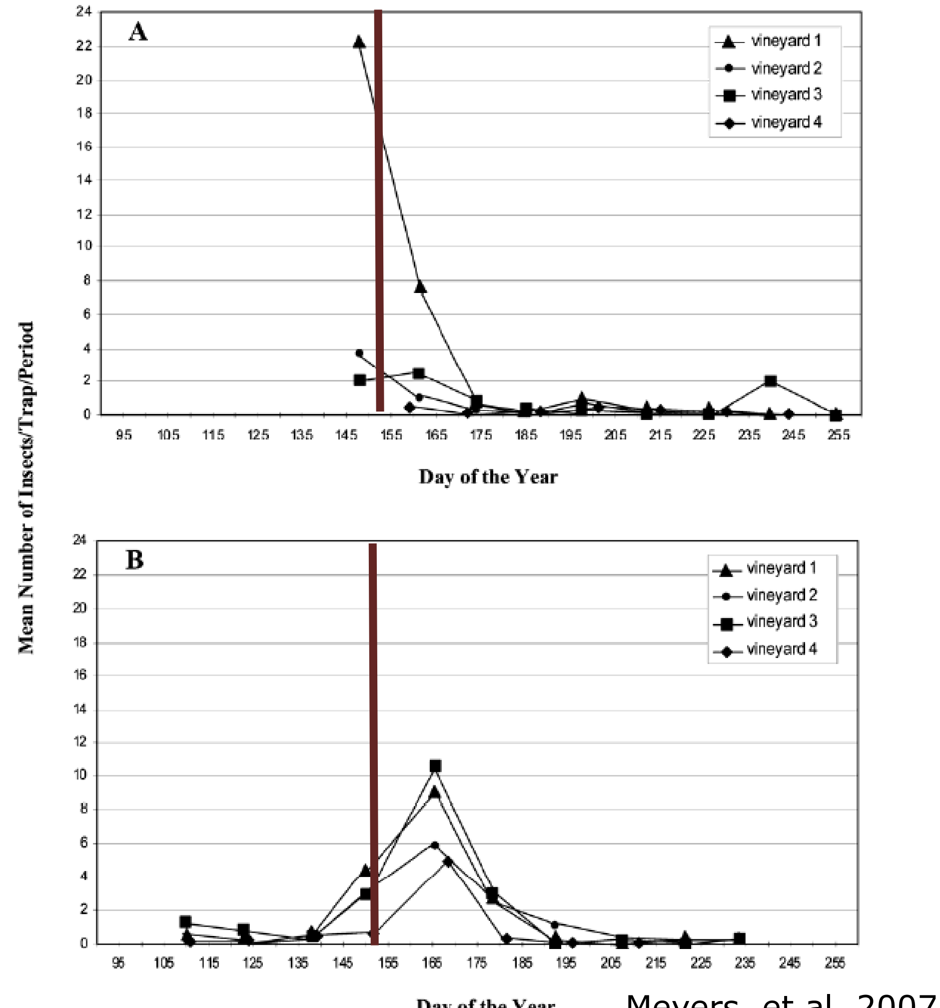
# Insect vectors
# *Glassy-winged sharpshooter is not the primary vector*

***Oncometopia orbona***

27% of field collected samples positive for PD

69% of attempted greenhouse transmissions successful

Image via BugGuide.net




Meyers, et al. 2007

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# Insect vectors
# *Glassy-winged sharpshooter is not the primary vector*

***Graphocephala versuta***

28% of field collected samples positive for PD

5% of attempted greenhouse transmissions successful

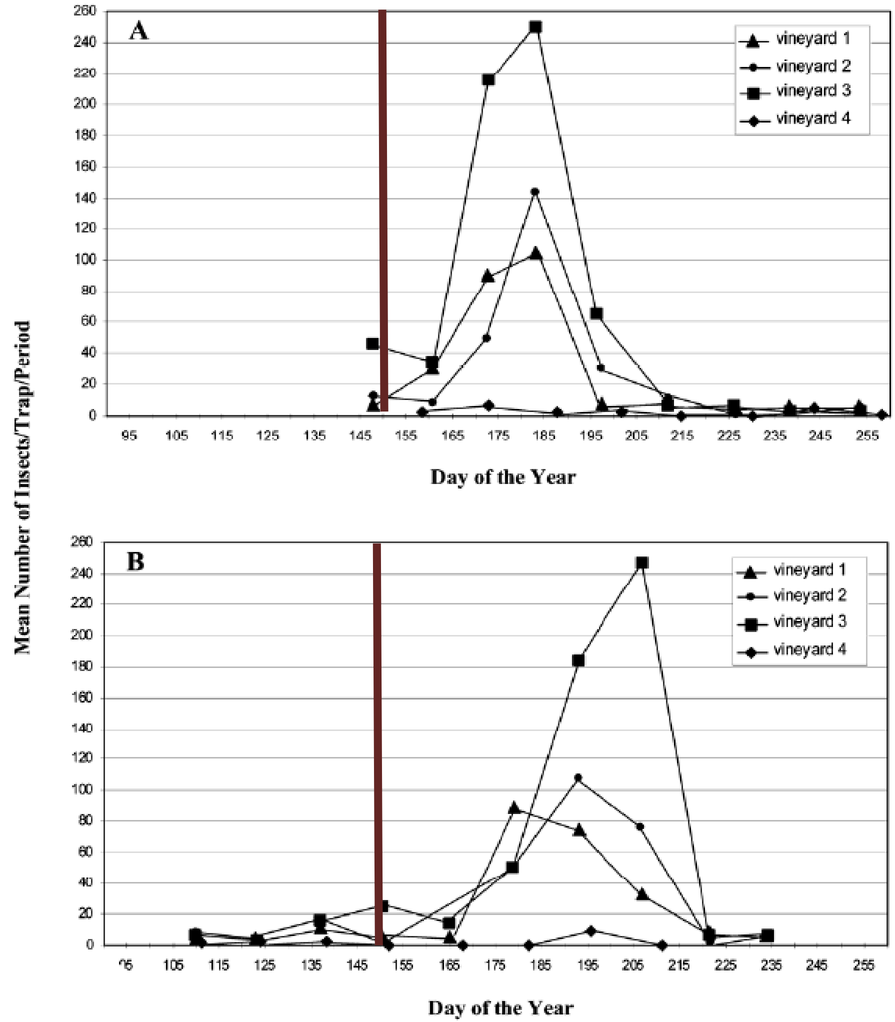


Image via BugGuide.net

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# Insect vectors
# *Glassy-winged sharpshooter is not the primary vector*

***Paraphlepsius irroratus***

33% of field collected samples positive for PD

Likely transmission efficiency unknown

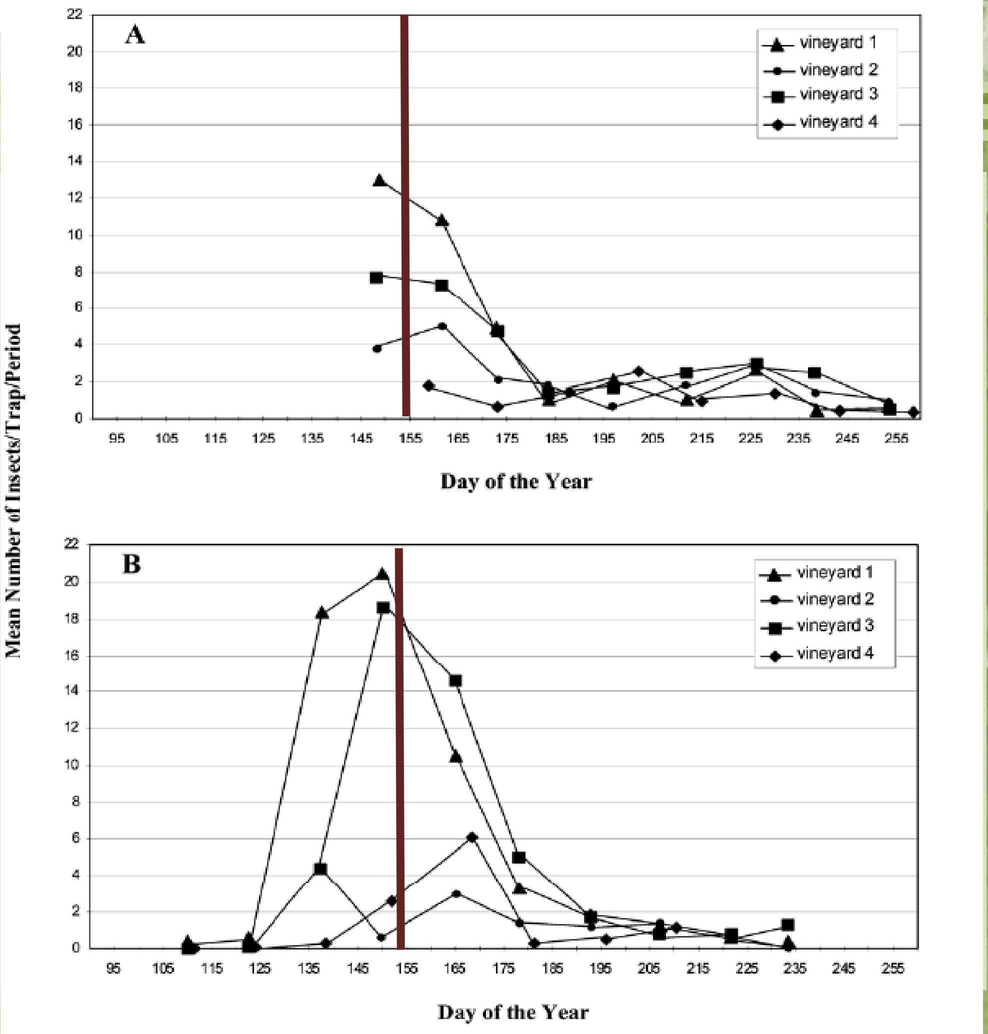


Image via BugGuide.net

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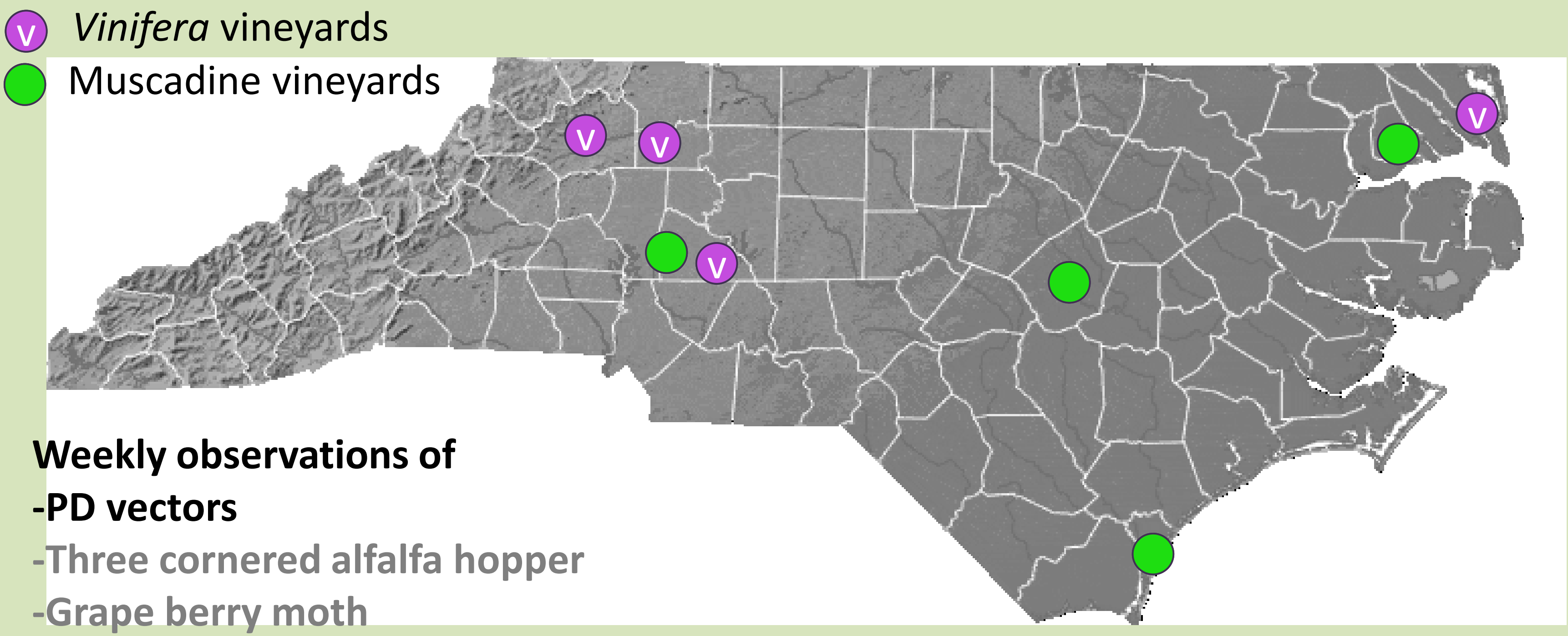
# Vector monitoring methods
# *2019 assessment*

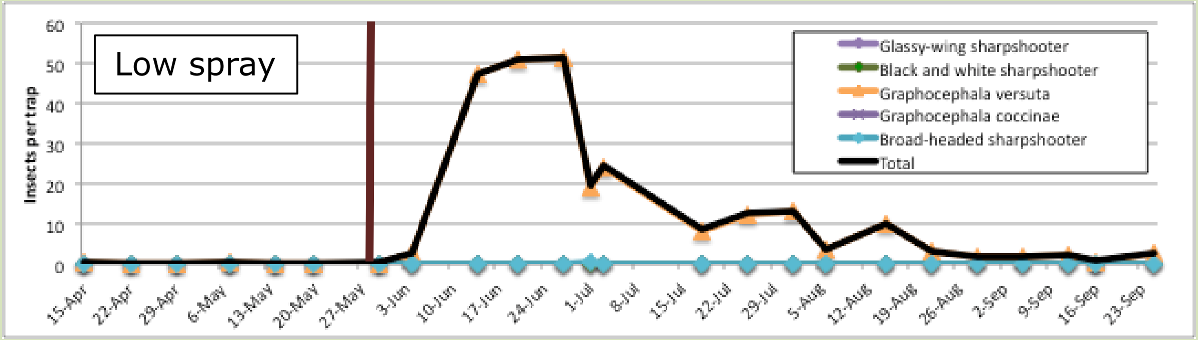



**Weekly observations of**
**-PD vectors**
-Three cornered alfalfa hopper
-Grape berry moth
-Spotted lanternfly

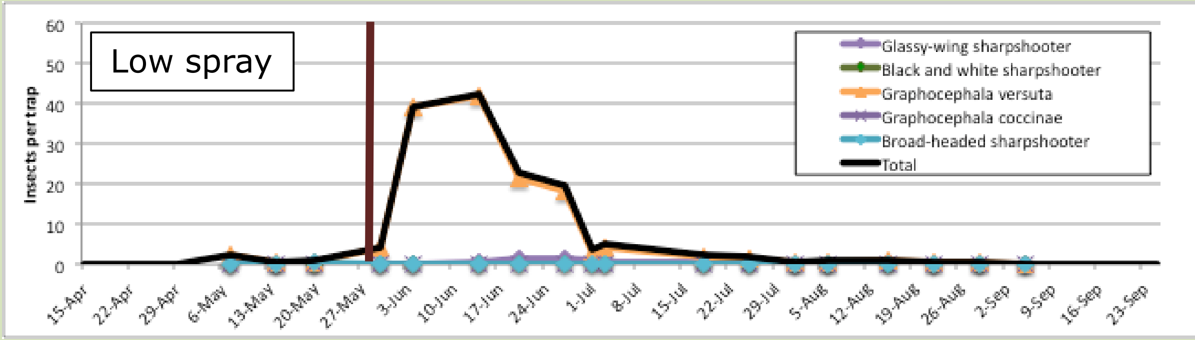
# Vector monitoring methods
# *2019 assessment*

- Use AM-type unbaited yellow sticky traps (color is the attractant)
- Check weekly, and remove captured insects
- Traps can be reused as long as they remain sticky
- Record captures of main vector species (*Oncometopia, Graphocephala, Paraphlepsius, Homalodisca*) weekly; also record other leafhopper & spittlebug like species (NCSU Plant Disease & Insect Clinic can assist with ID of insects from photos

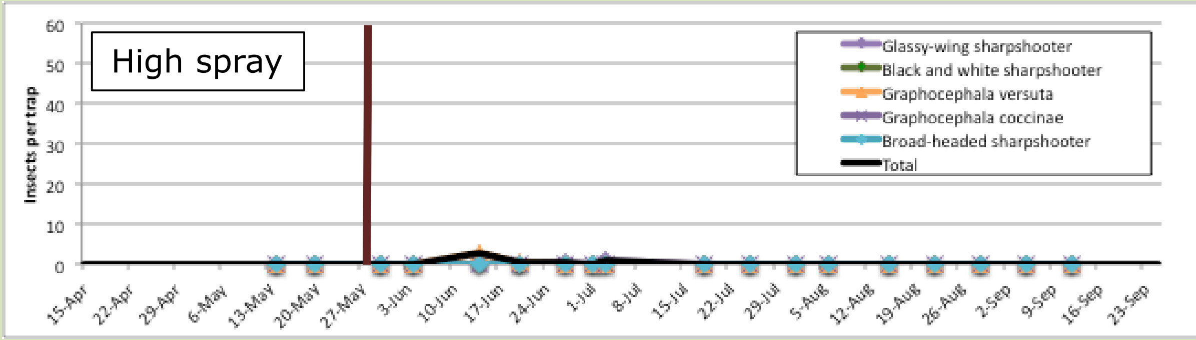
Rowan County, muscadine



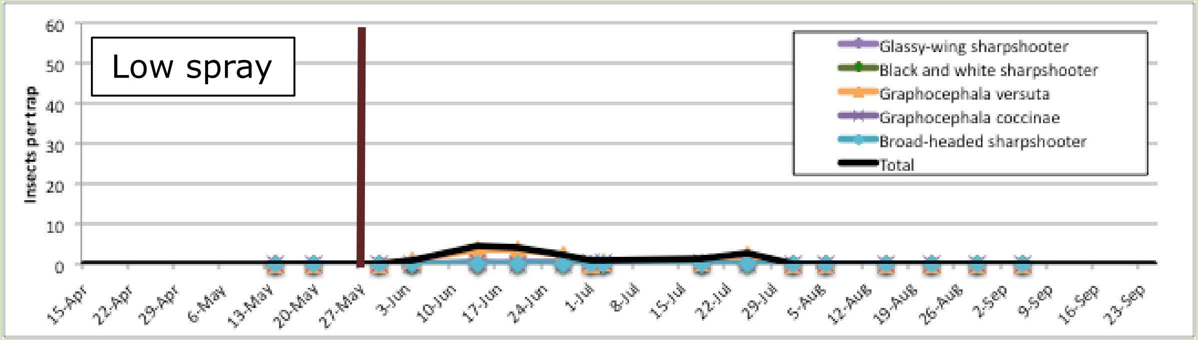

Perquimans County, muscadine




Johnston County, muscadine




New Hanover County, muscadine



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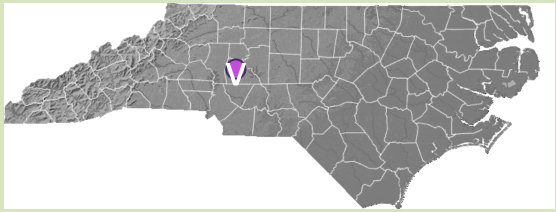
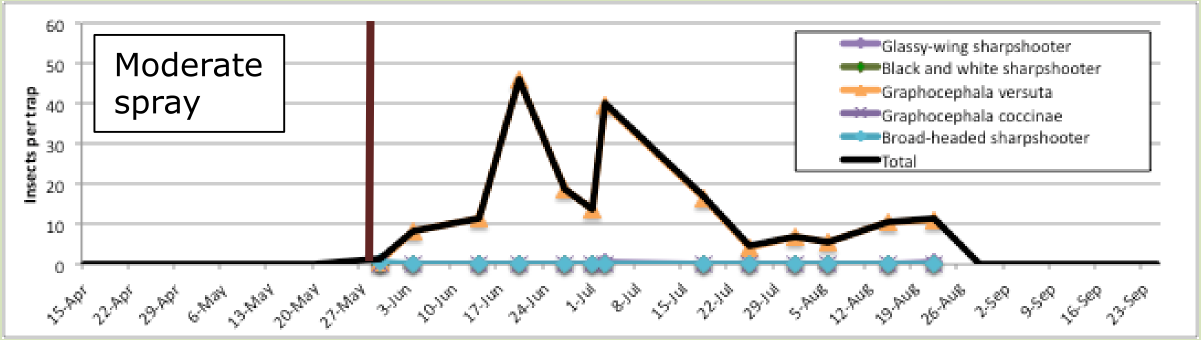
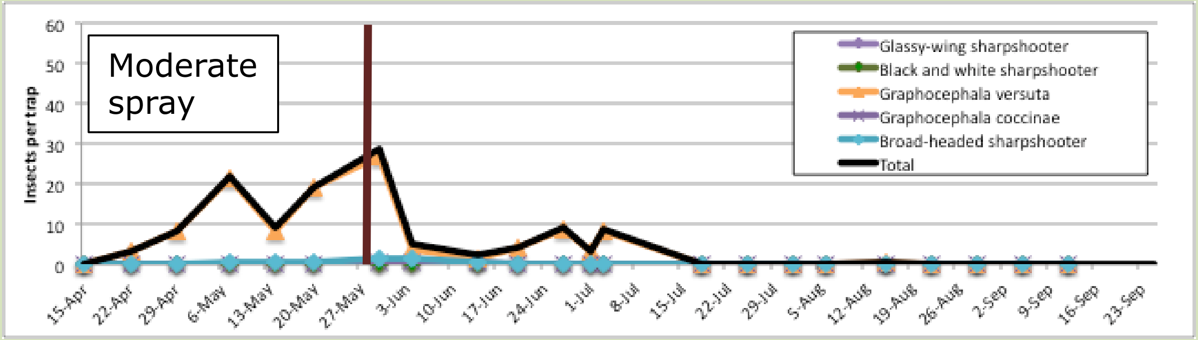
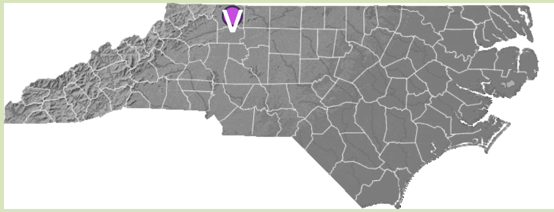


Rowan County, vinfera

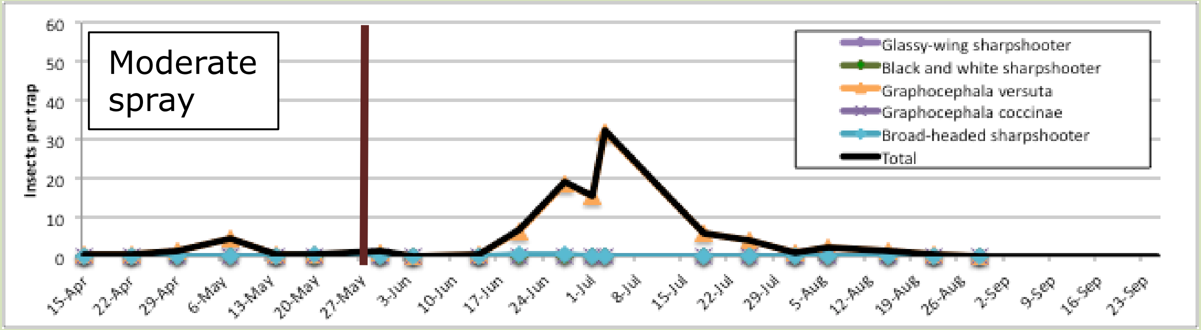



Wilkes County, vinfera

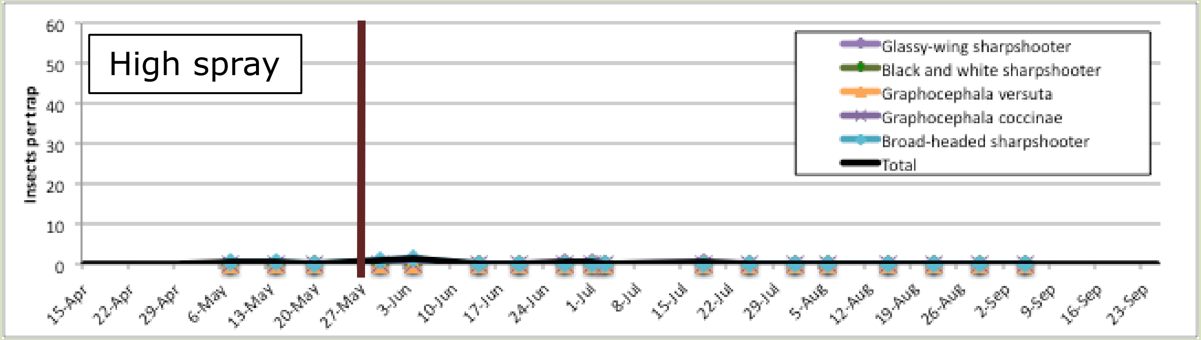


Surry County, vinfera




Currituck County, vinfera



# Vector monitoring results
## *2019 assessment*

- *Graphocephala versuta* remains most abundant vector and drives total vector abundance
- Peak activity occurs after highest infection risk period
- Populations vary both by locations and pesticide use
- **What about more efficient vectors?**

# Vector monitoring results
## *2019 assessment*

- **What about more efficient vectors?**
- Observed three sharpshooter species (more efficient) & one additional *Graphocephala* species (unknown efficiency)

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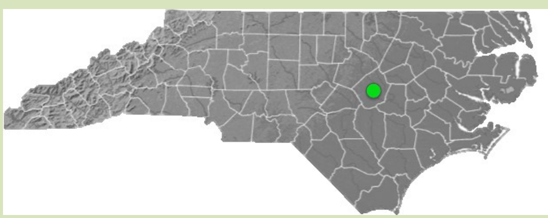
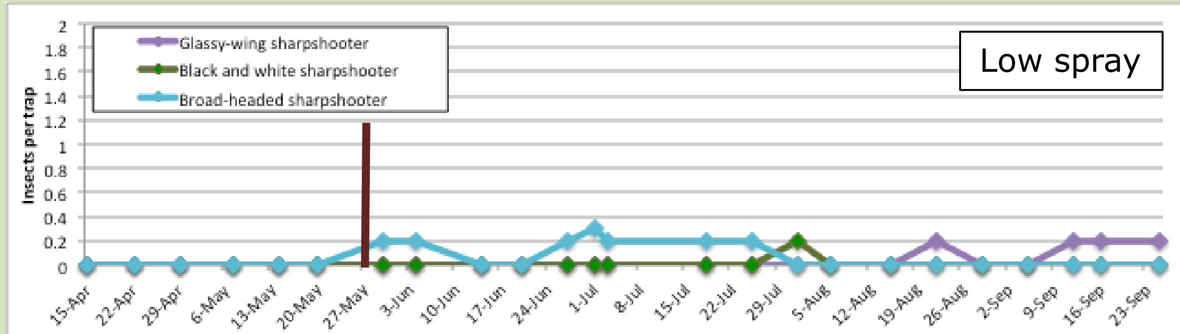
Rowan County, muscadine

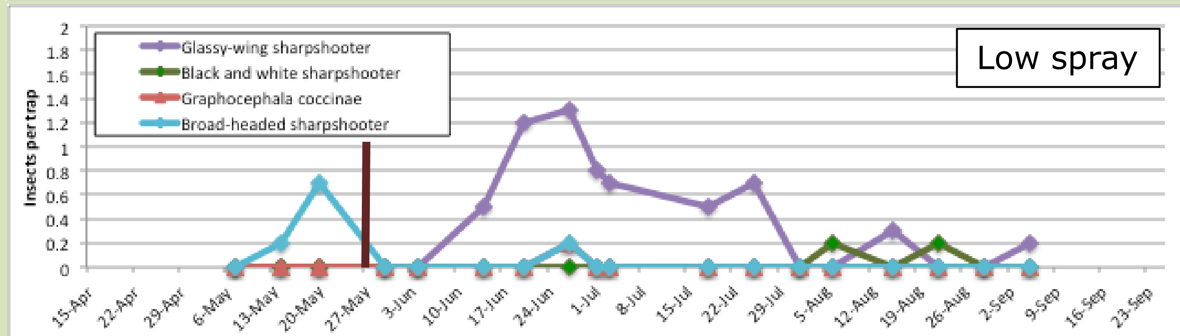
Perquimans County, muscadine

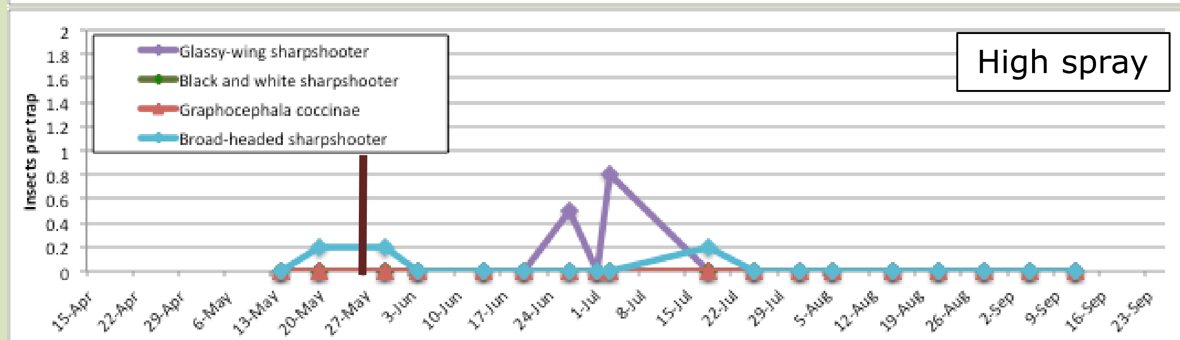


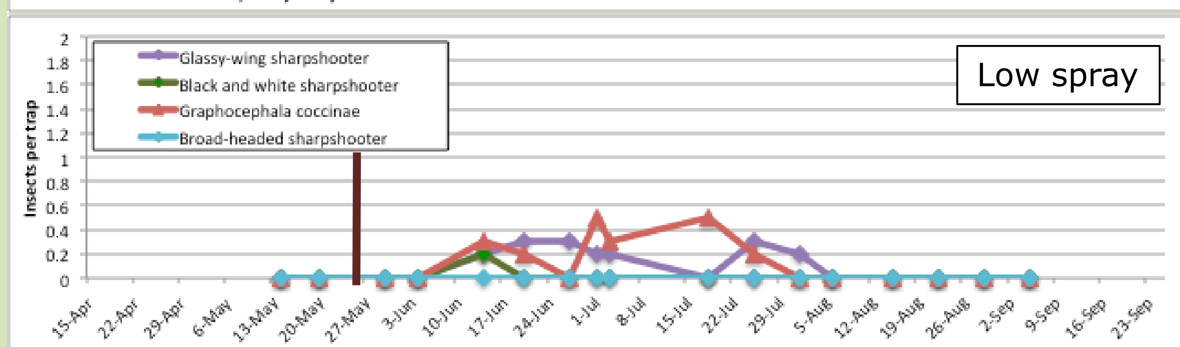
Johnston County, muscadine

New Hanover County, muscadine



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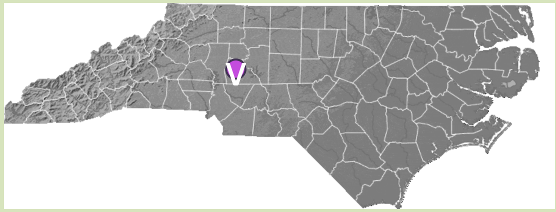
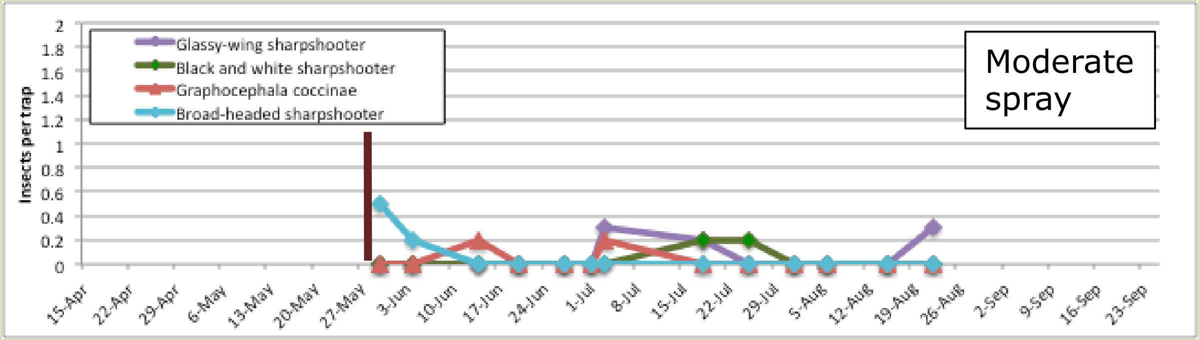
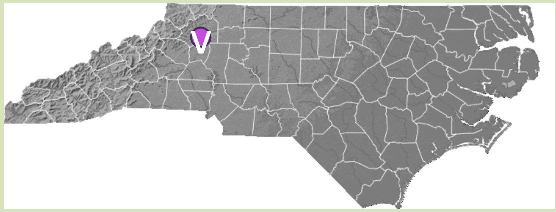
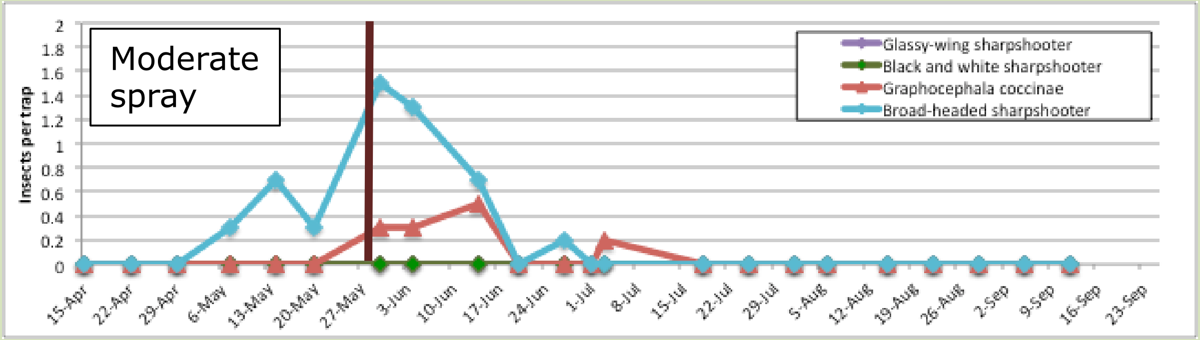


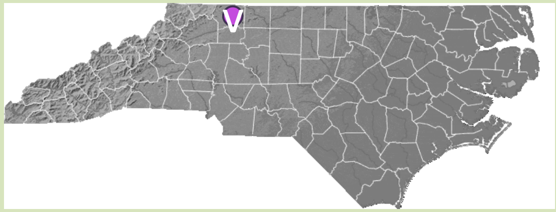
Rowan County, vinfera



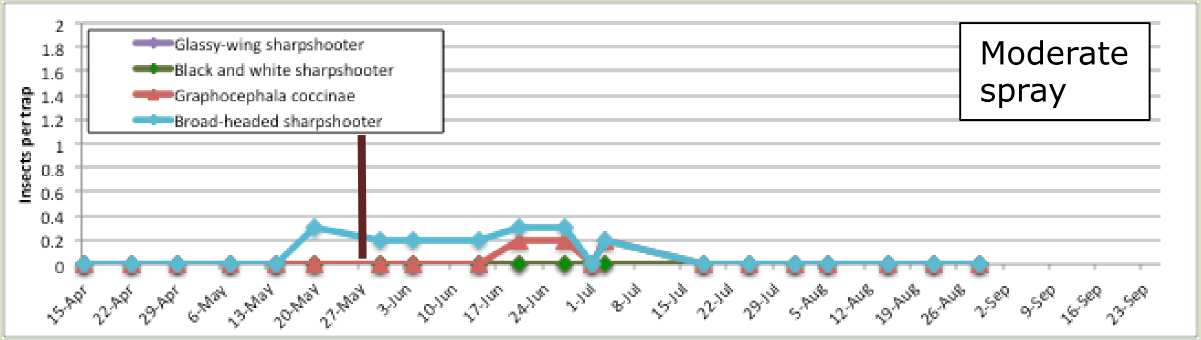



Wilkes County, vinfera

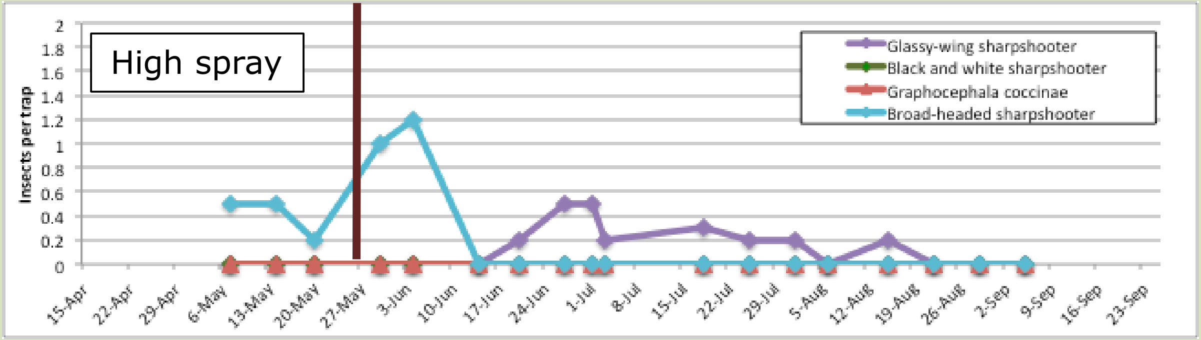


Surry County, vinfera




Currituck County, vinfera



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# Vector monitoring
# *Conclusions to date*

- Most abundant vector appears active after highest risk period
- More efficient vectors may be active during highest risk period, but in much lower densities
- Glassy-winged sharpshooter is uncommon in western NC

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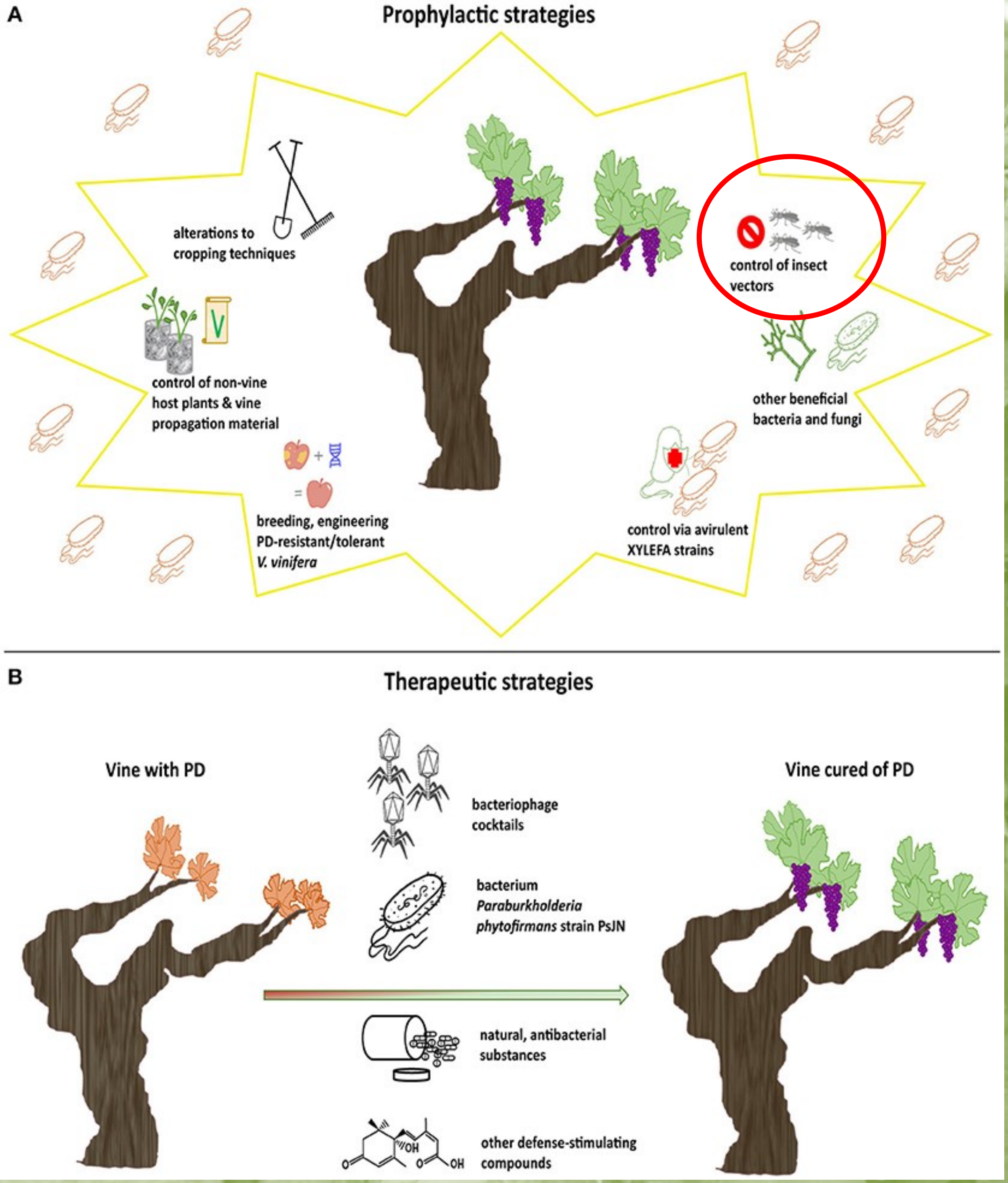
# Vector management *What tools are available?*

*Soil applied insecticides*

*Foliar applied insecticides/protectants*




Via Kyrkou et al. 2018. Front. Microbiol. https://doi.org/10.3389/fmicb.2018.02141

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# Soil applied insecticides

Registered materials include:
Admire Pro (IRAC 4A, and other imidacloprid materials)
Venom (IRAC 4A, and other dinotefuran materials)
Belay (IRAC 4A, clothianadin)

*Work conducted in CA suggests that imidacloprid treatments may take up to 8 days to reach target concentrations in grapes but can persist for essentially the whole season (Byrne & Toscano 2006)*

https://smallfruits.org/files/2020/02/2020-Bunch-Grape-Spray-Guide.pdf

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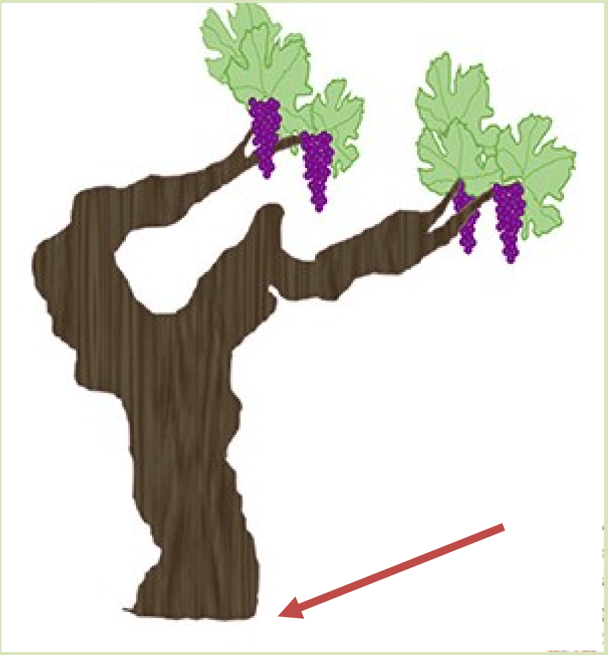
# Foliar materials

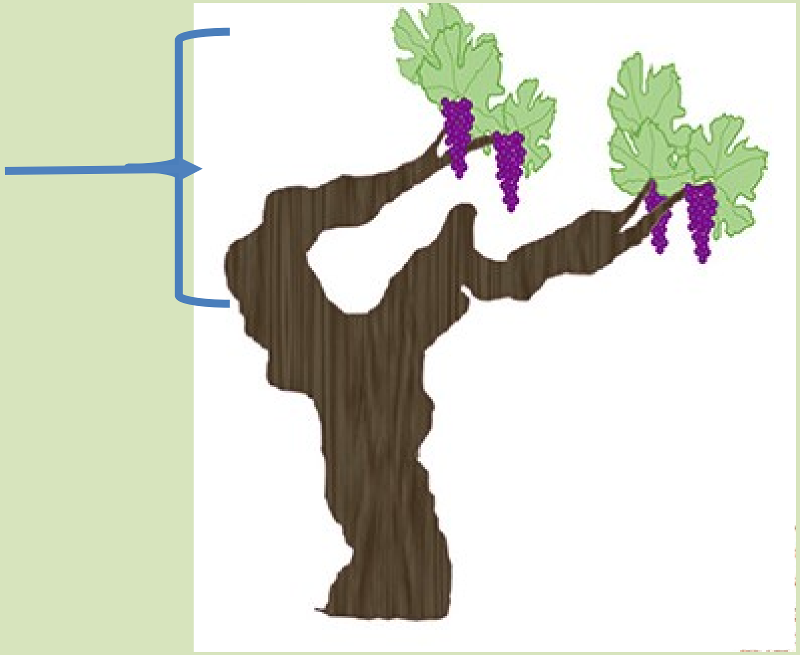
Registered materials include:
Admire Pro (IRAC 4A, and other imidacloprid materials)
Venom (IRAC 4A, and other dinotefuran materials)
Assail (IRAC 4A, acetamiprid)
Brigade (IRAC 3, and other bifenthrin materials)
Baythroid XL (IRAC 3, beta-cyfluthrin)
Danitol (IRAC 3, fenpropathrin)
Surround* (kaolin clay)
Malathion* (IRAC 1B, malathion)
Sevin XLR* (IRAC 1A, carbaryl)

https://smallfruits.org/files/2020/02/2020-Bunch-Grape-Spray-Guide.pdf

# Why soil vs. foliar?



*Pro: Single application provides long term activity*
*Con: Most effective via drip irrigation, May not always be needed, Longer non target exposure*



*Pro: Can time to pest presence*
*Con: Requires scouting, Reapplications will likely be needed (weekly or biweekly when pressure is high), Greater non target exposure*

# Relative importance?

Work comparing the reduction in systemic disease from soil treatments to foliar treatments in NC has not been conducted

*We hypothesize that in most years, soil treatments will be sufficient to reduce disease risk in moderate risk vineyards.*

# Management recommendations

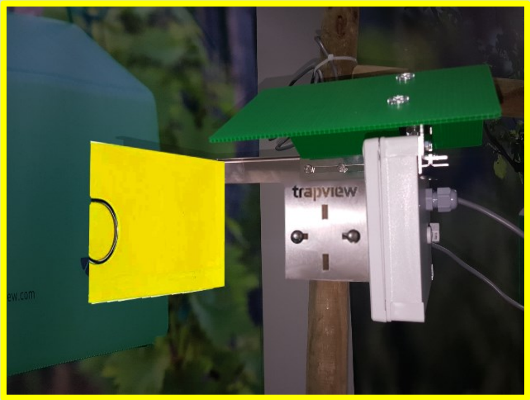
- Expect systemic infections to be worse following **warm winters**
- In high risk areas, use systemic insecticides to prior to bud break to provide long term feeding suppression
- Follow with foliar application if needed (in very high risk areas) though mid summer
- Scout symptomatic vines in fall, flag, and revisit the following year in mid summer to determine if infections are systemic
- *Recommended materials in Bunch Grape IPM Guide at www.smallfruits.org*

# Working to improve vector monitoring
## *2020 Activities*

A planned project to measure the degree of infection reduction provided by soil vs foliar applications is on hold due to the pandemic

In the interest of moving technology for managing PD forward, we are taking advantage of this time to develop remote trapping tools powered by machine learning to identify and track vectors

Working at 3 western NC vineyards


trapview

# Working to improve vector monitoring

## *2020 Activities*


Photos via Aurora Toennisson

# New grape pest factsheets
## *2020 Activities*

https://grapes.ces.ncsu.edu/grape-insect-and-mite-pest-factsheets/

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