# What information do we need to know to manage insects in North Carolina muscadines?

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What information do we need to effectively manage insect pests in muscadine grapes?

What insects or mites are present in muscadine grapes and potential cause damage either as direct pests or pathogen vectors?

How many of these insects are mites needed to cause economic losses? (damage relationships)

What cultural, biological, and chemical tools do we have available to manage insects and mites that are causing economic losses?



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# **Muscadine grape pests**



Feeds on fruit or flowers

Feeds on stems/branches



Feeds on leaves





# **Potential muscadine pests**



Feeds on fruit or flowers

<sup>4</sup> Feeds on stems/branches



Feeds on leaves



Grape berry moth

Grape rootworm

Flower thrips

Stink bugs

sometimes





## These are NOT grape pests

#### Grape leaf skeletonizer

Wasps and bees

Spotted wing drosophila\*

![](_page_5_Picture_5.jpeg)

### What about stink bugs?

#### Concern #1

Grapes with brown, dried seeds Growers are concerned that this type of damage may be due to stink bug feeding.

![](_page_6_Picture_4.jpeg)

However, stink bug feeding causes external fruit damage, usually with a "corky" mass underneath. (Photos, below: University of California IPM).

![](_page_6_Picture_6.jpeg)

![](_page_6_Picture_7.jpeg)

![](_page_6_Picture_8.jpeg)

![](_page_7_Picture_0.jpeg)

### What about stink bugs?

#### Concern #2

Injury to fruit at harvest

![](_page_7_Picture_4.jpeg)

harvest causing necrotic berries.

![](_page_7_Picture_5.jpeg)

Fig. 6. BMSB feeding on Chardonnay at pre-Fig. 7. BMSB feeding on Traminette at preharvest period.

![](_page_7_Picture_8.jpeg)

Fig. 8. BMSB feeding causing sour rot infection in Chardonnav at veraison.

![](_page_7_Picture_10.jpeg)

http://www.stopbmsb.org/stopBMSB/assets/File/BMSB-in-Grapes-English.pdf

### What about stink bugs?

#### **Confounding concerns**

Targeting insects such as stink bugs and Japanese beetles with insectides can cause other problems

Applications of broad spectrum insecticides, such as pyrethroids, can flare mite populations.

![](_page_8_Figure_5.jpeg)

<u>Miticides</u> should be used for mites, if needed. Grape miticides include: Zeal, Portal, Acramite, Agri-Mek, Nexter, Vendex, Envidor, and Onager

Twospotted spider mite populations in <u>strawberries</u> following artificial infestation (red arrow) and chemical application (blue arrow). Note the dramatic increase in mites in plots treated with bifenthrin.

# How are we working to increase our understanding of muscadine pests?

![](_page_9_Picture_2.jpeg)

Vinifera vineyards Muscadine vineyards

![](_page_10_Picture_0.jpeg)

#### What methods are we using?

Sites visited weekly

Two transects of three monitoring sites each along (1) vineyard edge and (2) 6-8 rows into vineyard

Monitoring blocks selected for proximity to potential alfalfa hopper or SLF habitat

Scouting reports posted online weekly at: https://entomology.ces.ncsu.edu/tags/grape-insect-scouting-2019/

![](_page_11_Picture_0.jpeg)

#### What are we monitoring?

#### Grape berry moth

![](_page_11_Picture_3.jpeg)

Monitored with pheromone lures attractive males - Lures changed every 4 weeks

# An endemic but uncommon pest Grape berry moth

Grape berry moth is considered a significant pest of grapes in VA and other eastern states, but damage is rarely reported in NC.

We want to understand if GBM is less problematic here or if we are underreporting damage.

#### What have we found so far?

GBM has been detected at our 4 <u>western</u> locations (1 muscadine, 3 vinifera) in very low densities No GBM have been detected in the east thus far, and no crop damage has been observed

![](_page_12_Picture_6.jpeg)

(Michigan State University photos)

![](_page_13_Picture_0.jpeg)

# An endemic but uncommon pest Grape berry moth

![](_page_13_Figure_2.jpeg)

![](_page_14_Picture_0.jpeg)

#### What are we monitoring?

#### Three cornered alfalfa hopper

![](_page_14_Picture_3.jpeg)

# **Emerging pest concerns** *Three cornered alfalfa hopper*

![](_page_15_Picture_2.jpeg)

Threecornered alfalfa hopper (*Spissistilus festinus*)—male (A) and female (B).

- Likely 3 to 4 generation in NC
- Seasonal biology in NC grapes unknown
- Understanding when grapes are most likely to be infected is important for defining management programs

- Confirmed vector of grape red blotchassociated virus
- Overwinter as adults and can have multiple, overlapping generations

![](_page_15_Picture_9.jpeg)

https://entomologytoday.org/2017/05/05/get-to-know-the-threecornered-alfalfa-hopper-a-maybe-serious-crop-pest/

![](_page_16_Picture_0.jpeg)

### What have we learned so far?

![](_page_16_Picture_2.jpeg)

We have determined that sticky traps are not an appropriate monitoring tool for alfalfa hoppers in grapes – sweep nets are more effective We also plan to test alfalfa hoppers & G. versuta for GVBR via the NCSU MPU

![](_page_17_Picture_0.jpeg)

### What have we learned so far?

![](_page_17_Figure_2.jpeg)

![](_page_18_Picture_0.jpeg)

#### What are we monitoring?

#### **Pierce's Disease vectors**

![](_page_18_Picture_3.jpeg)

### What have we learned so far?

![](_page_19_Figure_2.jpeg)

We have confirmed GWSS in New Hanover and Perquimans Counties, areas not previously sampled

Figure 1 North Carolina mans showing counties where GWSS were present absent

![](_page_20_Picture_0.jpeg)

# Invasive species of concern for grapes Spotted lanternfly

![](_page_20_Picture_2.jpeg)

Images via https://extension.psu.edu/spotted-lanternfly-grape-pest-alert

![](_page_21_Picture_0.jpeg)

# Invasive species of concern for grapes Spotted lanternfly

![](_page_21_Picture_2.jpeg)

# No SLF found in NC during 2020

![](_page_21_Figure_4.jpeg)

Images via https://extension.psu.edu/spotted-lanternfly-grape-pest-alert

### The "big one" – Grape root borer

#### Grape root borer

Endemic to the eastern US Oligophagous on Vitaceae (grape) Eggs laid above-ground Neonates burrow to find roots Larvae mine the root cortex Vines express symptoms similar to those from other conditions "Slow vine decline" reduced cane growth smaller leaves & berries fewer bunches susceptibility to winter injury potential vine death

(University of Kentucky photos)

![](_page_22_Picture_4.jpeg)

![](_page_22_Picture_5.jpeg)

### The "big one" – Grape root borer

#### Monitoring

Pheromone traps

- Highly effective for GRB
- Proxy for relative differences size of local populations

#### Pupal exuviae monitoring

 Non-destructive means to confirm vine infestation

![](_page_23_Picture_7.jpeg)

![](_page_23_Picture_8.jpeg)

![](_page_23_Picture_9.jpeg)

![](_page_23_Picture_10.jpeg)

![](_page_24_Figure_0.jpeg)

- GRB pupal cases found in 47 of 50 blocks sampled
- Large variation in number of pupal cases per vine

Rijal et al. 2014. Effects of biotic and abiotic factors on grape root borer (Lepidoptera: Sesiidae) infestations in commercial vineyards in Virginia. Environ. Entomol. 43: 1198-1208

![](_page_24_Picture_4.jpeg)

![](_page_25_Figure_0.jpeg)

#### Conclusion

- Pupal exuviae were found to be spatially aggregated in vineyard blocks in which mean pupal exuviae densities were ≥ 0.5 per vine
- Vines infested by grape root borer larvae were aggregated within a mean distance of 8.8 ± 2.7m
- Based on sampling from 2008–2012, weekly sampling throughout the 3 or 4 wk period of peak emergence should provide a reasonable estimation of GRB abundance in most seasons, with least effort
- ❑ We recommend a grid of sample vines (~9 m apart) constituted of vines in every second row and of a minimum of 50 vines per vineyard block of average size (~1−2 ha)

![](_page_26_Picture_5.jpeg)

![](_page_27_Picture_0.jpeg)

Captures varied widely among all vineyards, including among those within production regions

![](_page_28_Figure_1.jpeg)

![](_page_28_Picture_2.jpeg)

qPCR revealed variation in *H. bacteriophora* abundance within and among production regions (combined data from June and July samples)

![](_page_29_Figure_1.jpeg)

![](_page_29_Picture_2.jpeg)

![](_page_30_Figure_0.jpeg)

### Conclusions

- GRB and *H. bacteriophora* abundance varied within and among vineyard production regions
- Strongest predictors of GRB abundance were H. bacteriophora presence assessments from July and vineyard soil clay content
- Optimal regression model of GRB abundance included vineyard clay content, *H. bacteriophora* abundance in July, and their interaction, explaining 62% of the variability in GRB abundance
- Including additional variables in the model, such as other measures of soil texture and vineyard area, did not improve explanatory power

![](_page_31_Picture_5.jpeg)

### **Other emerging issues**

#### What?

Grape rootworm Two species: Fidia viticida and F. longipes Two year life cycle Larvae feed on roots Adults feed on leaves, creating a distinctive "chain link" pattern

Images via http://www.virginiafruit.ento.vt.edu/rootworm.html

![](_page_32_Picture_5.jpeg)

![](_page_32_Picture_6.jpeg)

![](_page_33_Picture_0.jpeg)

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