Efficacy of Plant Host Defense and Signalling Compounds in Preventing Ambrosia Beetle Infestations in Apple Trees

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Xylosandrus germanus – Black Stem Borer
“Ambrosia Beetle” (Curculionidae: Scolytinae)

Female drills a hole ~1mm in diameter, and hollows out a channel into heartwood of (usually small) physiologically stressed trees.

larva/pupa in brood chamber
Discoloration and blistering of bark; compressed sawdust toothpicks visible from adult tunneling. Attack shuts down tree’s vascular system: wilting, dieback, death.
Introducion from eastern Asia - first found in NY in 1932, now widespread in US

- Attacks >200 ornamental/forest species
  - American beech, maple, dogwood, black walnut, oak, magnolia
- Apple and sweet cherry reported in 1982
- Opportunistic colonizers of weakened or physiologically stressed trees – which produce ethanol (and attract beetles)
  - flooding, drought stress, atypical winter/cold injury, severe pruning, disease attack
- Have identified >50 sites with trees dying 2013-2019; some at levels of 30%; occurs statewide
- plantings 1–15 yrs old; Gala, Fuji, Honeycrisp, Ginger Gold commonly affected
Inverted juice bottle traps, with rectangular openings cut in side panels
Baited with AgBio ethanol lures
Hung 2-3 feet off the ground
- Placed on edge of orchard next to woods
- Also in interior of orchard
- Traps checked weekly

ex. P. Schultz, VA Tech
C. Ranger, USDA, OH
First catch in WNY on May 8-10 (same as 2018)
1st adult flight through June 20; peak May 21-28
2nd adult flight extended until Sept; peak in July
Higher counts along edges than in interiors
Plot Set-Up

✧ potted/flooded nursery trees; set directly in adjacent woods
✧ individual ethanol lures additionally affixed to each tree
✧ trunks treated with candidate products before 1st flight
Recap of Previous Results

- 2015: sprays of Lorsban, pyrethroids
  - no measurable infestation impact, no treatment separation
- 2016: sprays of Lorsban, pyrethroids; added dispensers (sachets) of verbenone repellent
  - Verbenone did not improve control over use of insecticides alone
- 2017: directly applied verbenone to trunks, both alone & in combo with methyl salicylate (SPLAT/caulking gun)
  - Verb+MeSa combo was only treatment with zero damage
- 2018: different rates of SPLAT Verb+MeSa, plus Actigard (SAR)
  - 10g/tree rate significantly decreased number of attack sites and galleries containing adults or brood
  - Actigard also had an effect on number of attack sites
2019 Control Trial – Repellents & Plant Defense/Signalling Compounds

- Lorsban Advanced (chlorpyrifos); 1.5 qt/100 gal, applied May 15
- SPLAT Verb (verbenone); 10 g/tree dollop, caulking gun
- SPLAT MeSa (methyl salicylate); 10 g/tree dollop
- SPLAT Verb+MeSa “early”; 10 g/tree, applied May 15 (pre-1st flight)
- SPLAT Verb+MeSa “late”; 10 g/tree, applied July 9 (pre-2nd flight)
- Actigard* (SAR, acibenzolar-S-methyl); 0.05 g/liter, Solo backpack
- Regalia* (SAR, Reynoutria sachalinensis); 30 ml/gal, Solo backpack
- SAR Salicylic Acid*; 8 fl oz/100 gal, Solo backpack
- * = applied 3 times (4-week intervals): May 15, June 12, July 9
- Untreated Flood-Stressed Check
On final evaluation date (Sept 3), treatments with the fewest infestation sites were the early application of verbenone+methyl salicylate; and verbenone

Lorsban had the highest number
2019 Results – Galleries w/ Adults

- Fewest number of galleries containing adults were in the verbenone+methyl salicylate (and UTC!) treatments
- Lorsban and Regalia plots had the highest numbers
Brood numbers were uniformly low in all the treatments.

The only treatment to break out statistically was the Salicylic acid, but only on the early (July 9) evaluation date.
The fewest numbers were found in the combination verbenone+methyl salicylate early treatment, on both evaluation dates.

Salicylic acid had the highest number on the July 9 date, and the Lorsban treatment had the highest on the Sept 3 date.
Still formulating recommendations

- Important to avoid stress to trees
  - site selection: water & air drainage, irrigation, frost protection
  - good disease prevention; fire blight, phytophthora
- Trapping/monitoring adults using ethanol lures is useful
- Remove and destroy infested trees; wait until after 1st flight?
- Ambrosia beetles are difficult to control with insecticides
  - should be closely timed with beetle attacks
  - best timing likely against emerging OW adults
- loss of Lorsban after 2021 season
- Isca Tech MeSa SPLAT product: “Beetle Repel”
- 2020 trials: ??
Acknowledgments

Cooperators & Assistants

- Todd Furber, Cherry Lawn Farms, Sodus, NY
- Wayne Hermenet, Hermenet Farms, Huron, NY
- Ken Simpelaar, Simpelaar Fruit Farms, Lyons, NY
- JD Fowler, Fowler Farms, Wolcott, NY
- Bill Pitts, Wafler Nursery, Wolcott, NY
- Scott Palmer, Reality Research, Lyons, NY
- Collaborators: John Vandenberg, Louela Castrillo, Michael Griggs, USDA ARS, Ithaca, NY
- Chris Ranger, USDA ARS, Wooster, OH

Materials & Funding Support

- Dow AgroSciences (Alejandro Calixto)
- Valent Biosciences (Gary Kirfman)
- UPI (United Phosphorus) (Tony Estes)
- Isca Technologies (Agenor Mafra-Neto)
- Hercon Environmental (Katie Ellis)
- USDA Hatch Funds
- NY Apple Research & Development Program