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

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History

Xylosandrus germanus – Black Stem Borer

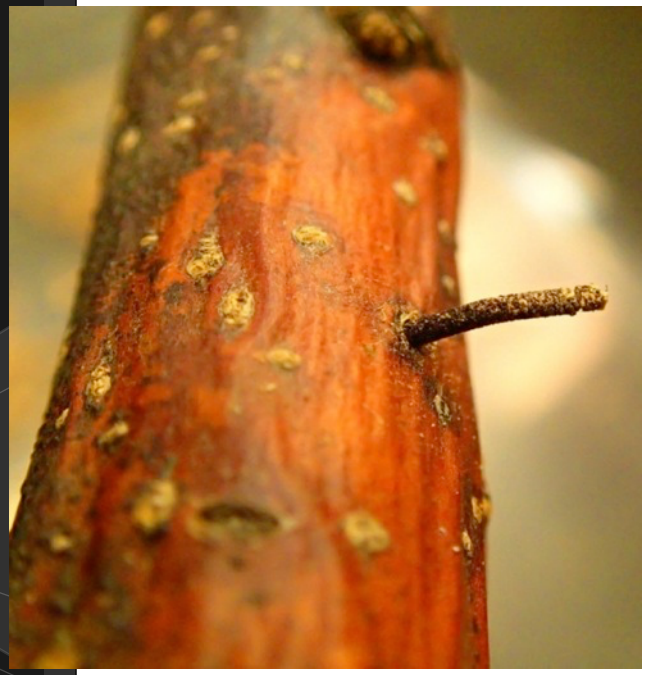
"Ambrosia Beetle" (Curculionidae: Scolytinae)

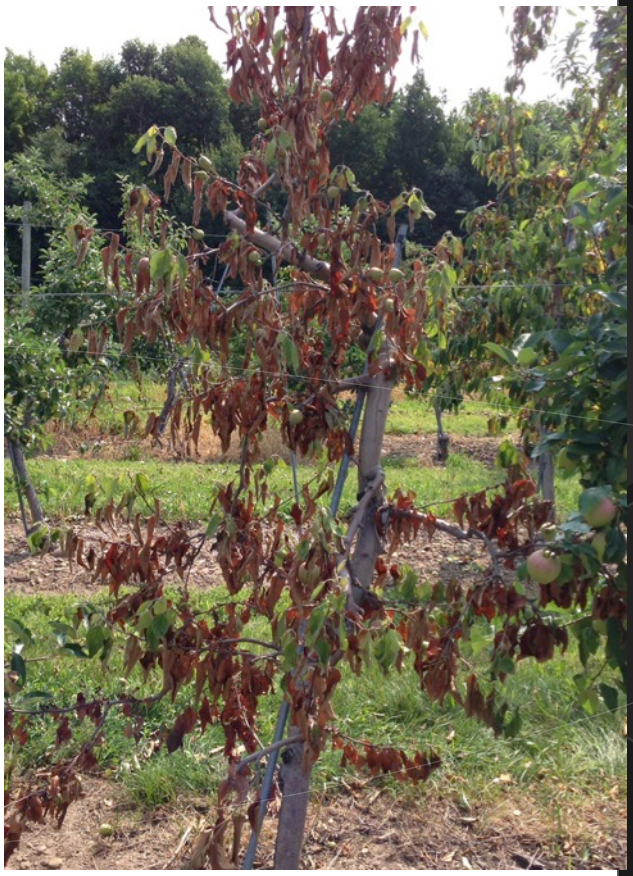
Female drills a hole ~1mm in diameter, and hollows out a channel into heartwood of (usually small) physiologically stressed trees.

larva/pupa in brood chamber

Damage

Discoloration and blistering of bark; compressed sawdust toothpicks visible from adult tunneling. Attack shuts down tree's vascular system: wilting, dieback, death.





History

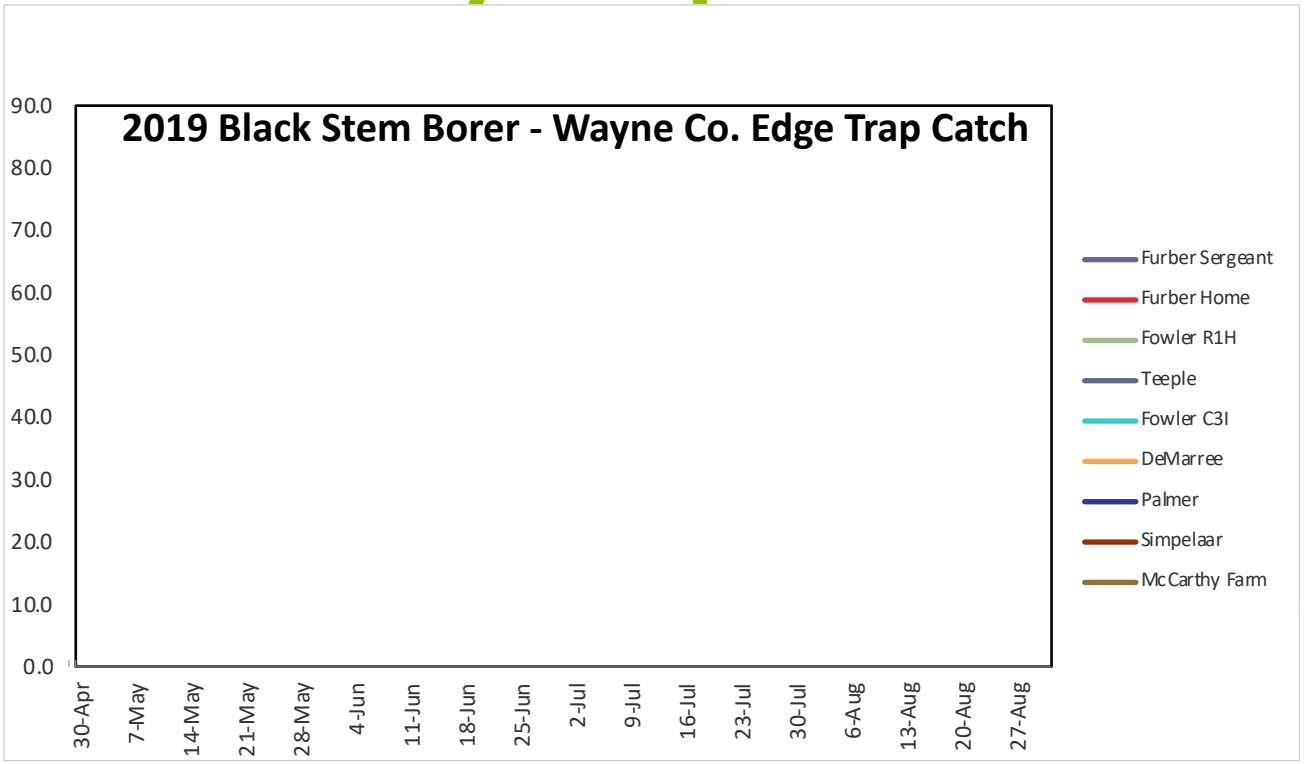
- Introduced from eastern Asia - first found in NY in 1932, now widespread in US
- Attacks >200 ornamental/forest species
  - American beech, maple, dogwood, black walnut, oak, magnolia
- Apple and sweet cherry reported in 1982
- Opportunistic colonizers of weakened or physiologically stressed trees – 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

Trapping

ex. P. Schultz, VA Tech
C. Ranger, USDA, OH

- 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

BSB weekly trap catch 2019



- 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

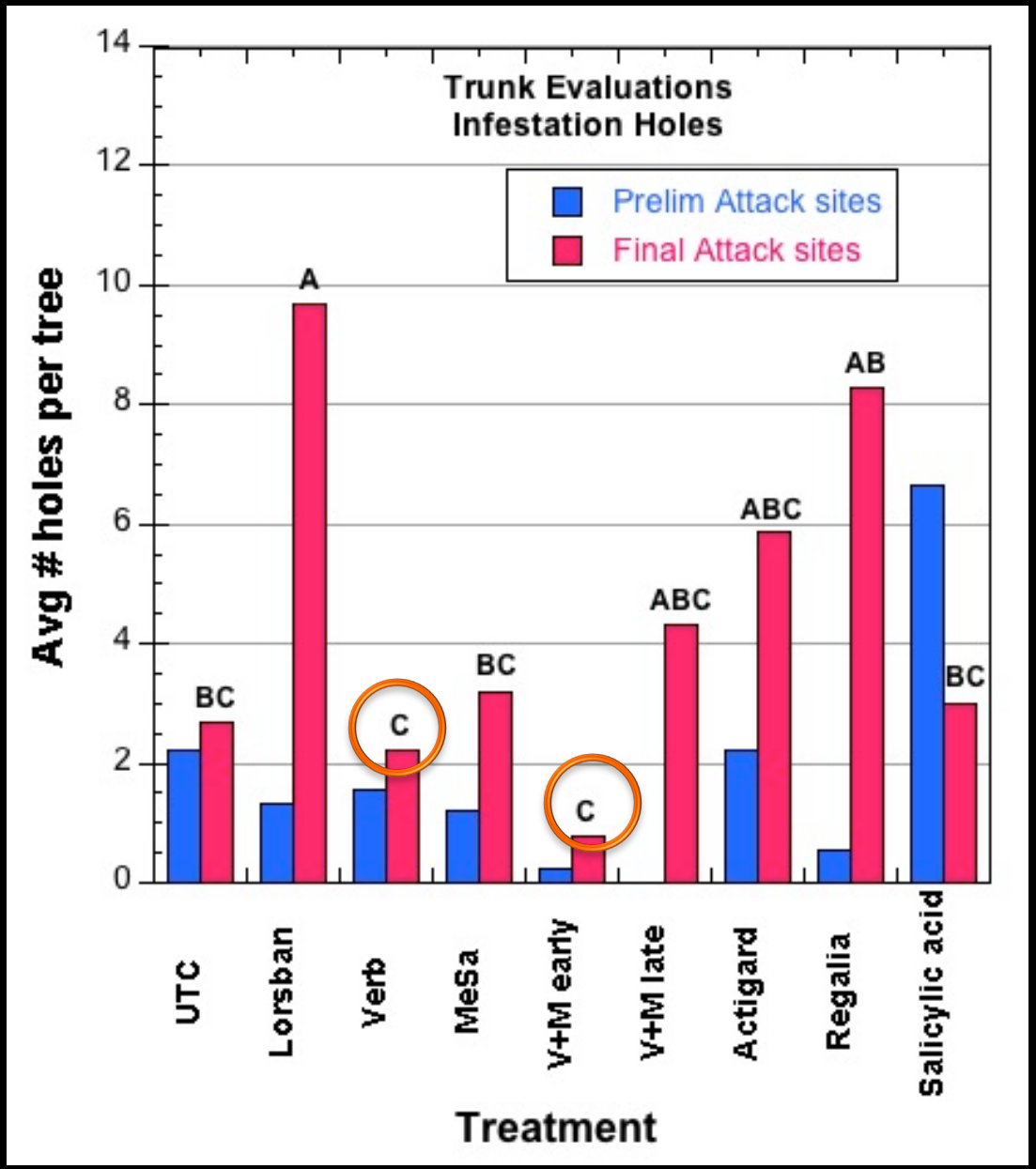
2019 Control Trial – Repellents & Plant Defense/Signalling Compounds

- Lorsban Advanced (chlorpyrifos); 1.5 qt/100 gal, appl. 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


Hypertherm
Powermax

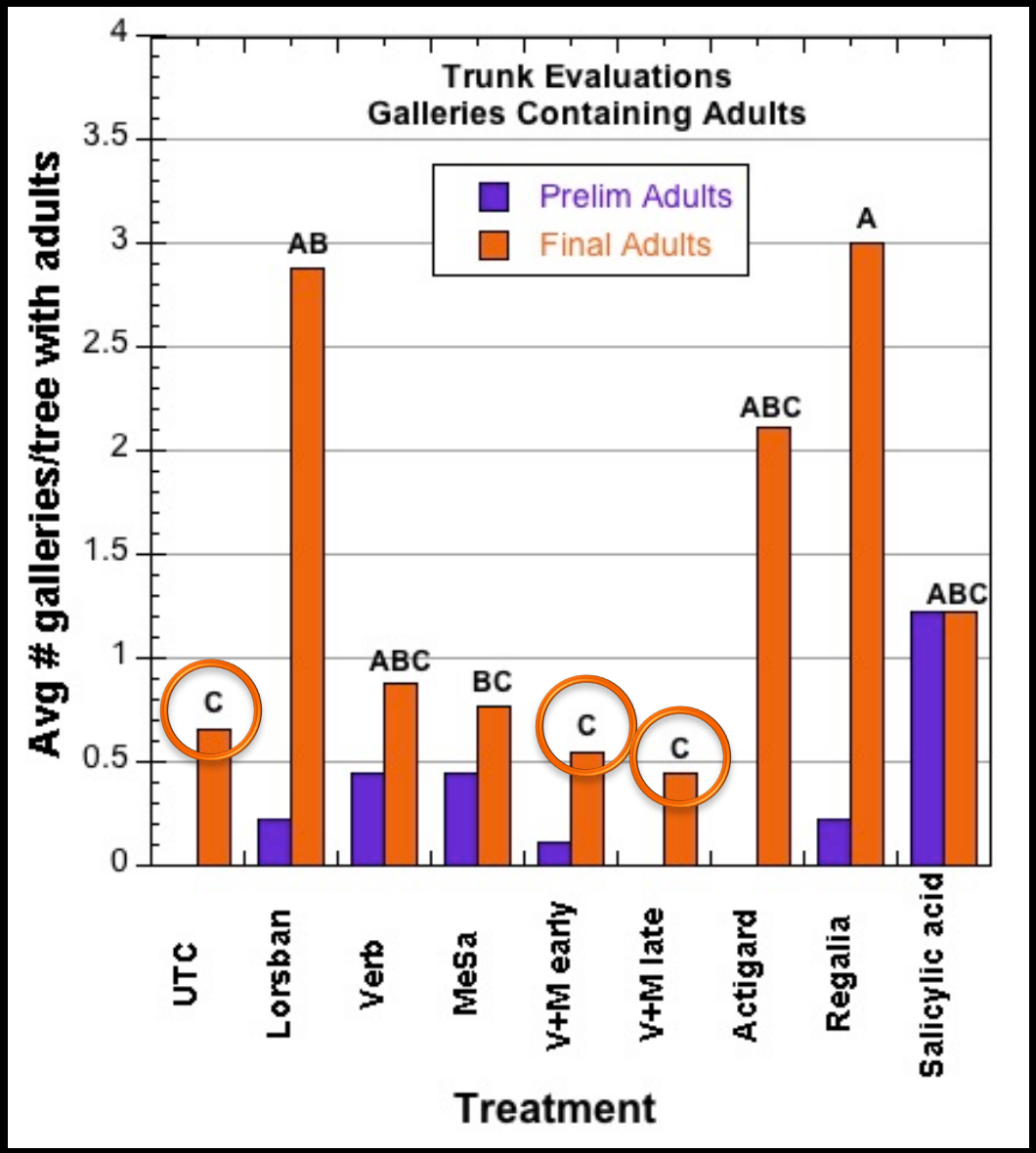
2019 Results – Infestation Holes

- 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



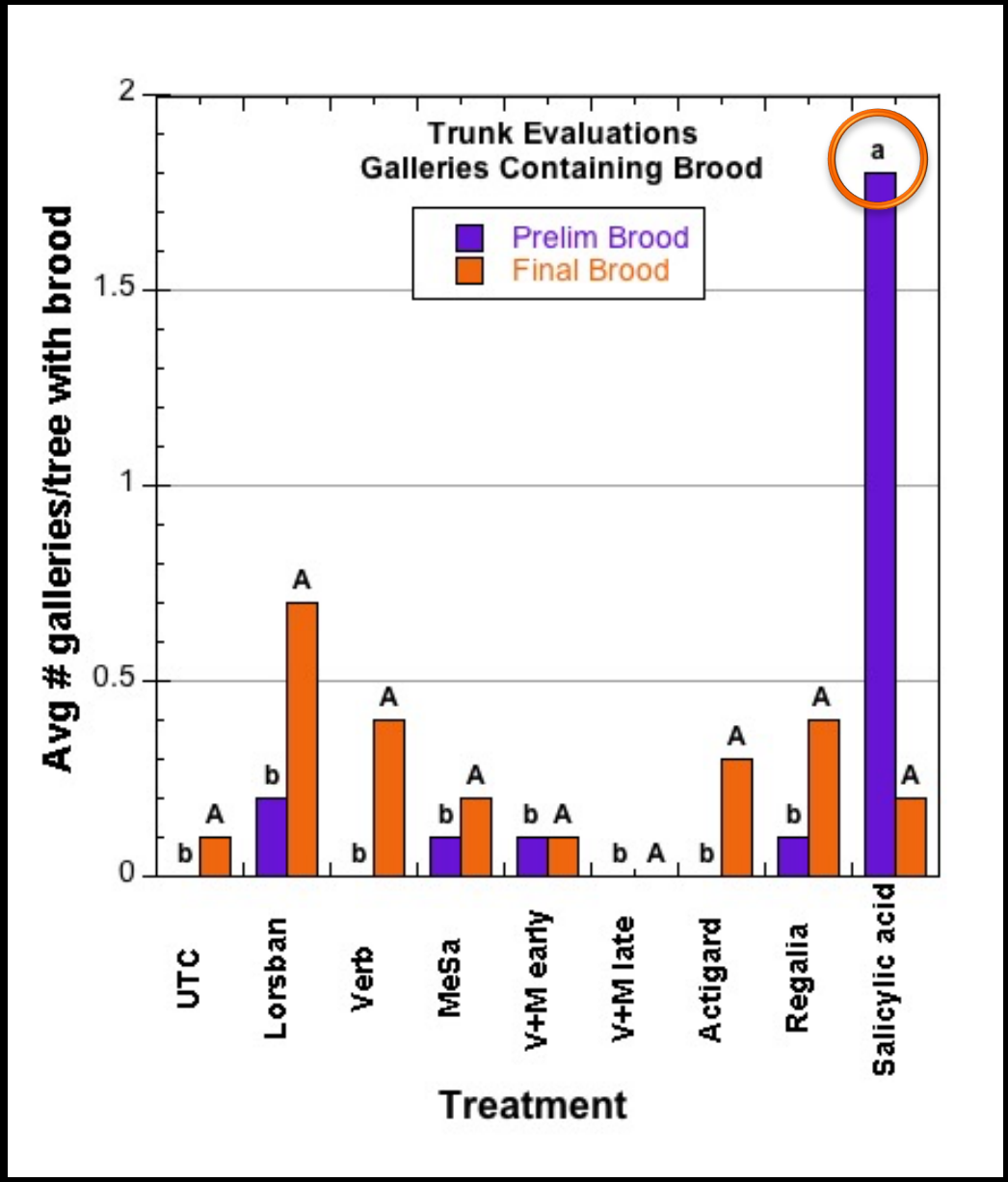
2019 Results – Galleries w/ Adults

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



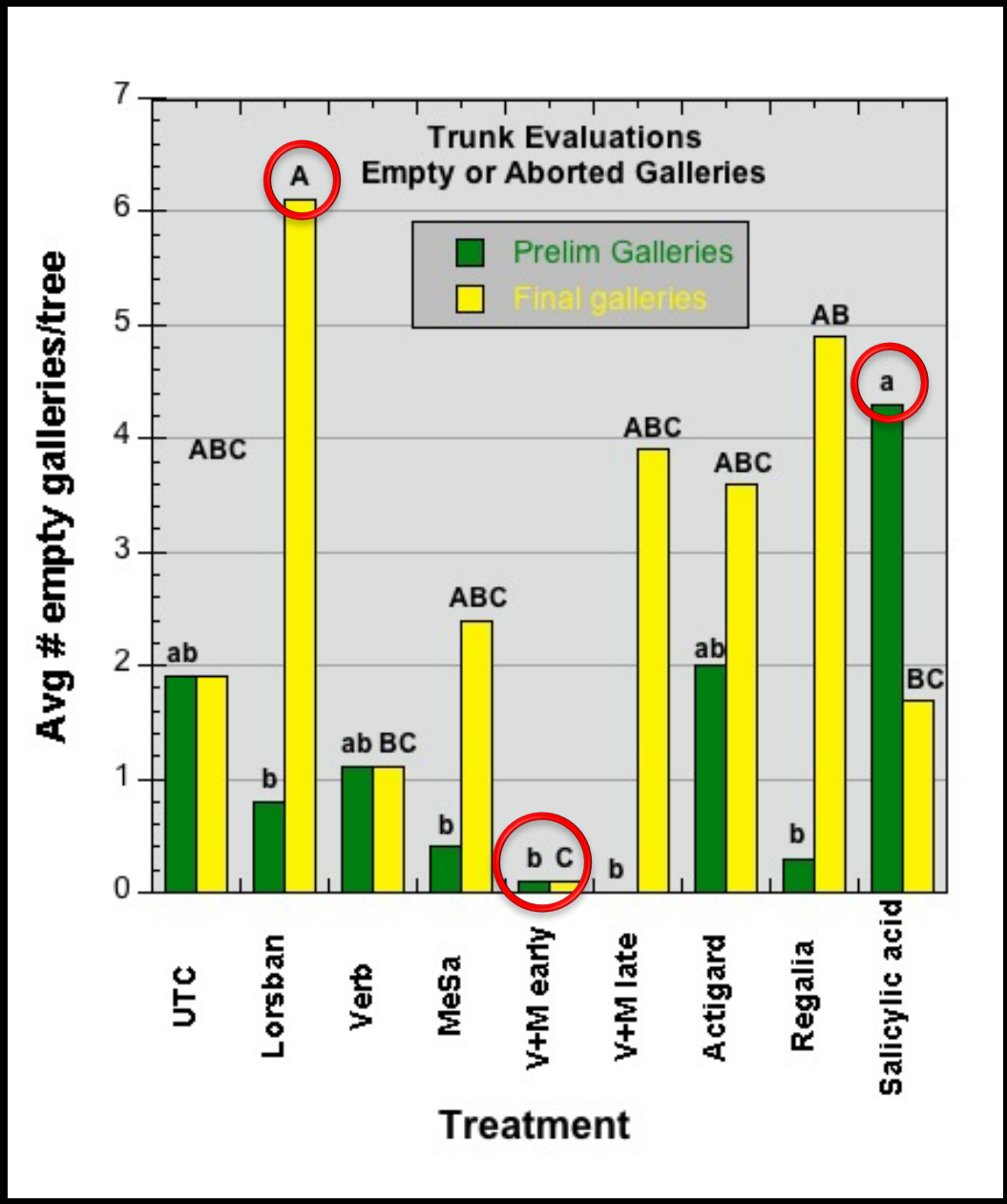
2019 Results – Galleries w/ Brood

- 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.



2019 Results – Empty or Aborted Galleries

- 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: ??

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