Black Stem Borer – A New Pest in Apples

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Thanks to
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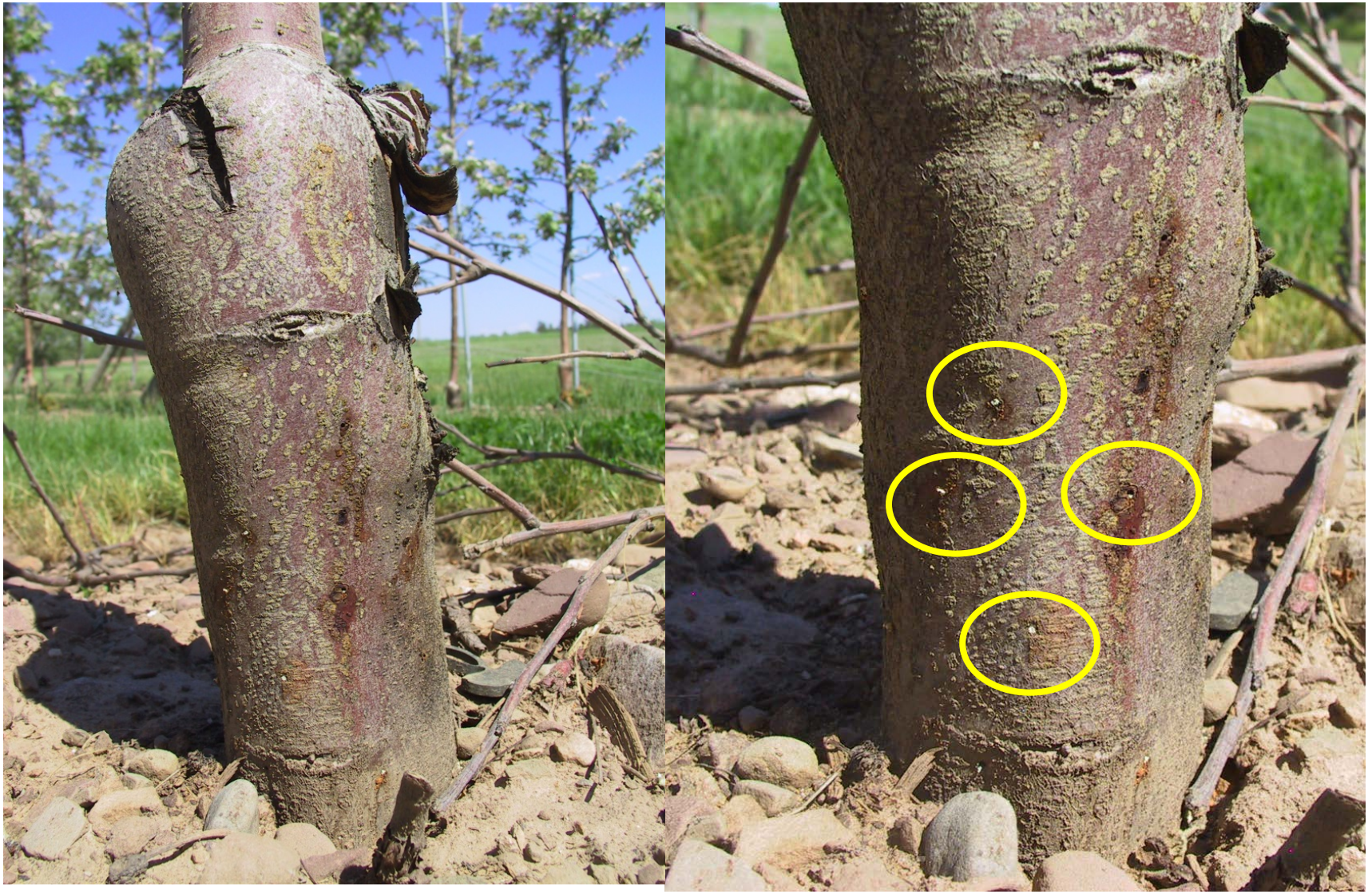
Some borrowed slide.

Introduction

- History
- Biology
- Trapping and monitoring
- Attempt at control

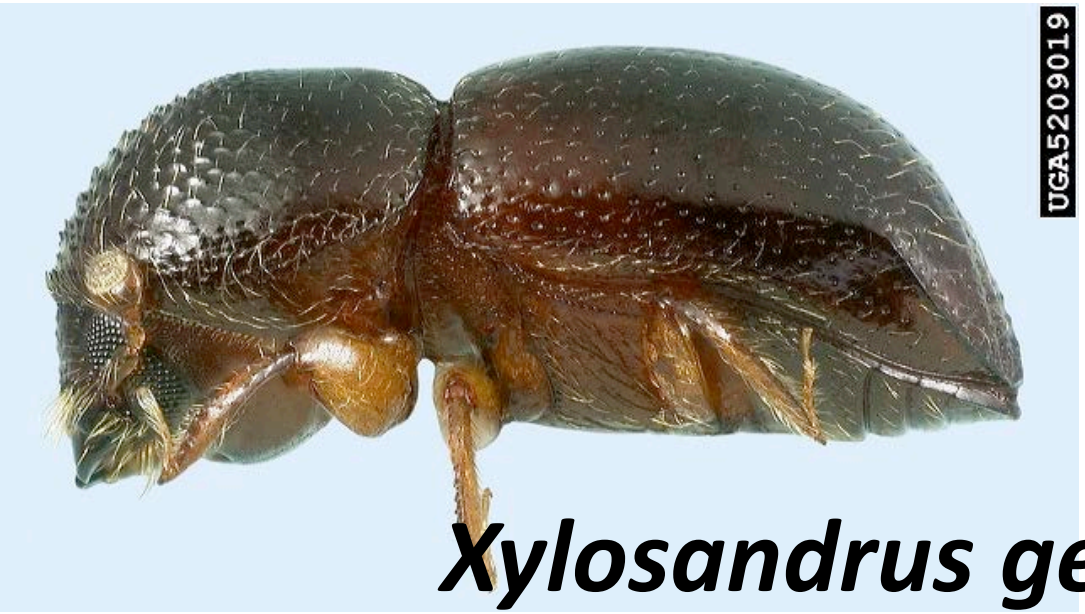


Found in 6 sites in 2013 associated with fire blight.

Which came first? Fire blight or borers?


A second site 90 miles away in 2013.


Also found in apple nurseries,
commercial and on-farm.



Keyed out by Dan Gilrein

Xylosandrus germanus – black stem borer

J.R. Baker & S.B. Bambara, North Carolina State University, Bugwood.org - See more at: http://www.forestryimages.org/browse/detail.cfm?imgnum=5159039#sthash.CkGlyPun.dpuf

History

- Ambrosia beetle, a general wood boring insect which carries a fungal food source
- Introduced from eastern Asia - first found in NY in ’32
- Northeastern, Midwestern, Southern, and Northwestern US
- Widely established in Europe
- Attacks >200 ornamental/forest species
- American beech, maple, dogwood, black walnut, oak, magnolia,
- Apple and sweet cherry reports in 1982

History

- BSB attacks weakened but also “apparently healthy” trees that emit ethanol
- 2013- Growers complained of trees collapsing or sap oozing from holes or fire blight from oozing rootstocks
- Identified >25 sites with trees dying 2013-14
- Newly planted orchards to 15 year old plantings
- Fuji, Honeycrisp, Gala, Gingergold, etc.

Black Stem Borer
Xylosandrus germanus

- Female can fly 2 km, and spread 10's of km/year
- Males come from unfertilized eggs
- Inbreeding
- The ratio of females to males is about 10:1.
- Males are flightless

Biology

- Females overwinter in galleries at the base of infested trees
- Females emerge from overwintering sites to infest new sites after 2-3 days with max temperatures ≥ 68°F
- Attracted by ethanol

Biology

Female beetle “Foundress” drills a hole ~1mm (1/25 inch) in diameter, and hollows out a channel into the heartwood of small trees (1-20 inch diameter) .

Ambrosia Beetle Fungal Symbionts

- *Ambrosiella* species

- *Raffaelea* species
- *Fusarium* species
- Bacteria

Biology

- She lays her eggs (tiny, ~1mm white, football shaped) in the chamber.
- Larvae also white with 3 instars

Gallery with eggs, larvae and pupae for BSB first generation

Biology

When the "Foundress" is finished, she plugs the hole with her own body to protect the gallery and dies.

Therefore, we cannot evaluate treatments by counting dead BSB

Biology

- It takes ~ 30 days for development from egg to adult
- Produce 2 generations per year
- Late summer the beetles migrate to a hole lower in the trunk to overwinter - as many as 100 in one chamber.
- The beetles go into diapause - not active again until the next spring.

Monitoring

- Toothpick “frass” after calm, rainfree days.
- Compacted sawdust from channels

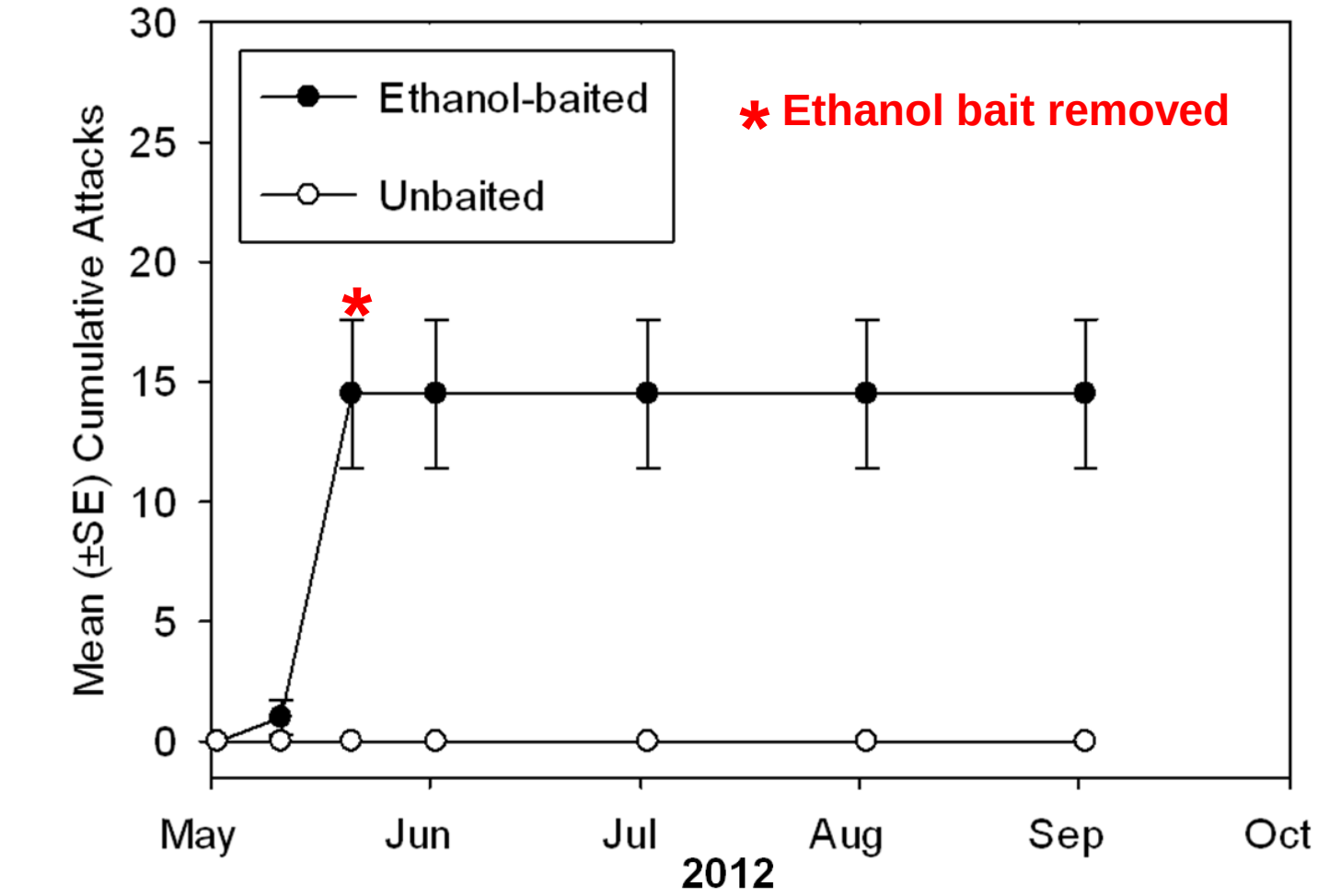
Monitoring

Look for discoloration and blistering of bark.

Monitoring

Oozing sap or FB ooze from holes

Trees Attacked in the Presence of Ethanol



Magnolia virginiana

Attacks ceased in the absence of ethanol

Ranger et al. (2014) *Biological Invasions*

Why ethanol?

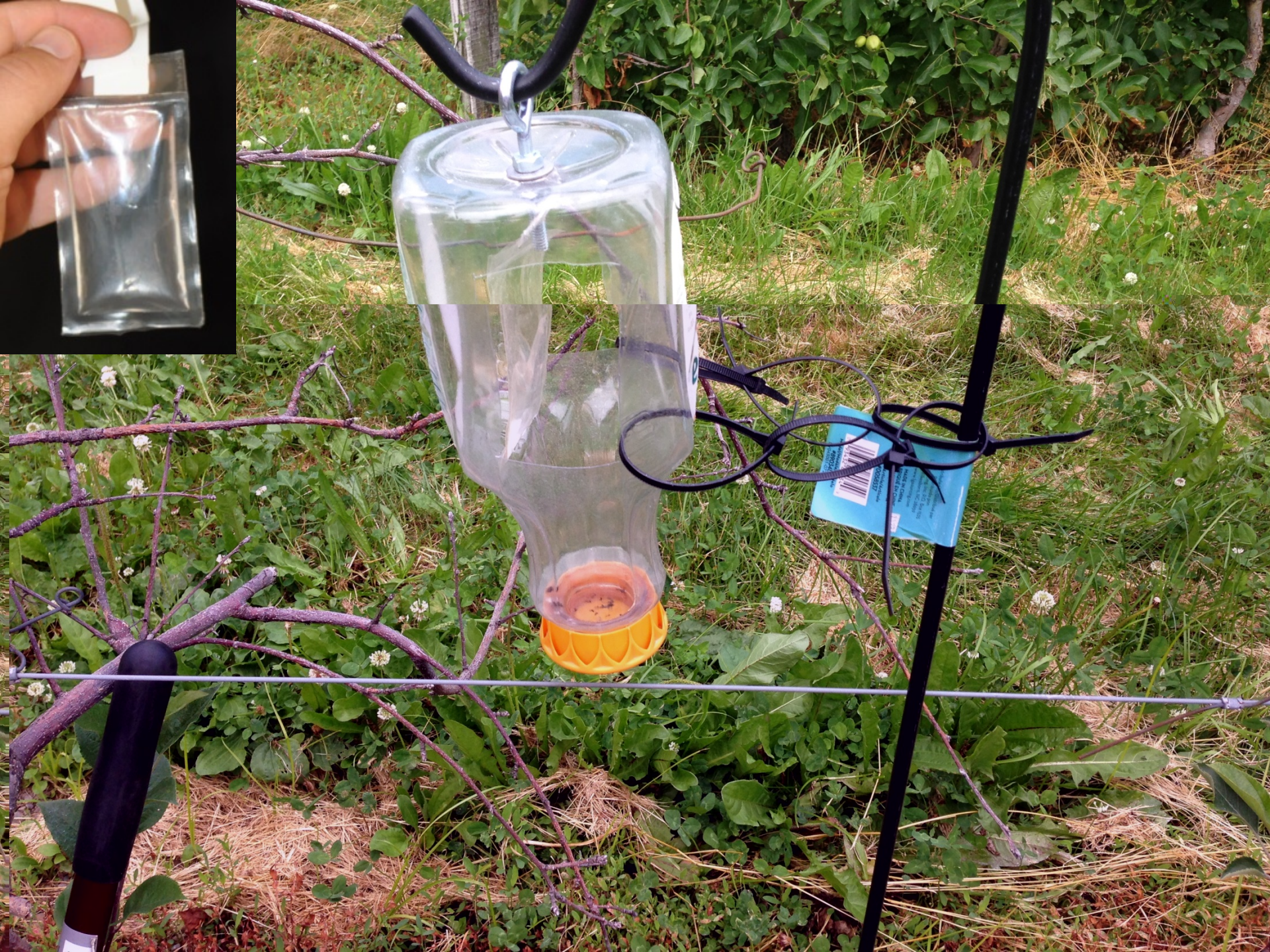
- Abiotic and biotic stressors:
  - Flooding/Over-watering
  - Drought
  - Frost injury
  - Excessive heat
  - Girdling
  - Pollutants
  - Pathogens
  - Impaired root function

- Ethanol can be emitted within 1-2 days following stress

- Asymptomatic, but still emit ethanol (i.e. “apparently-healthy”)

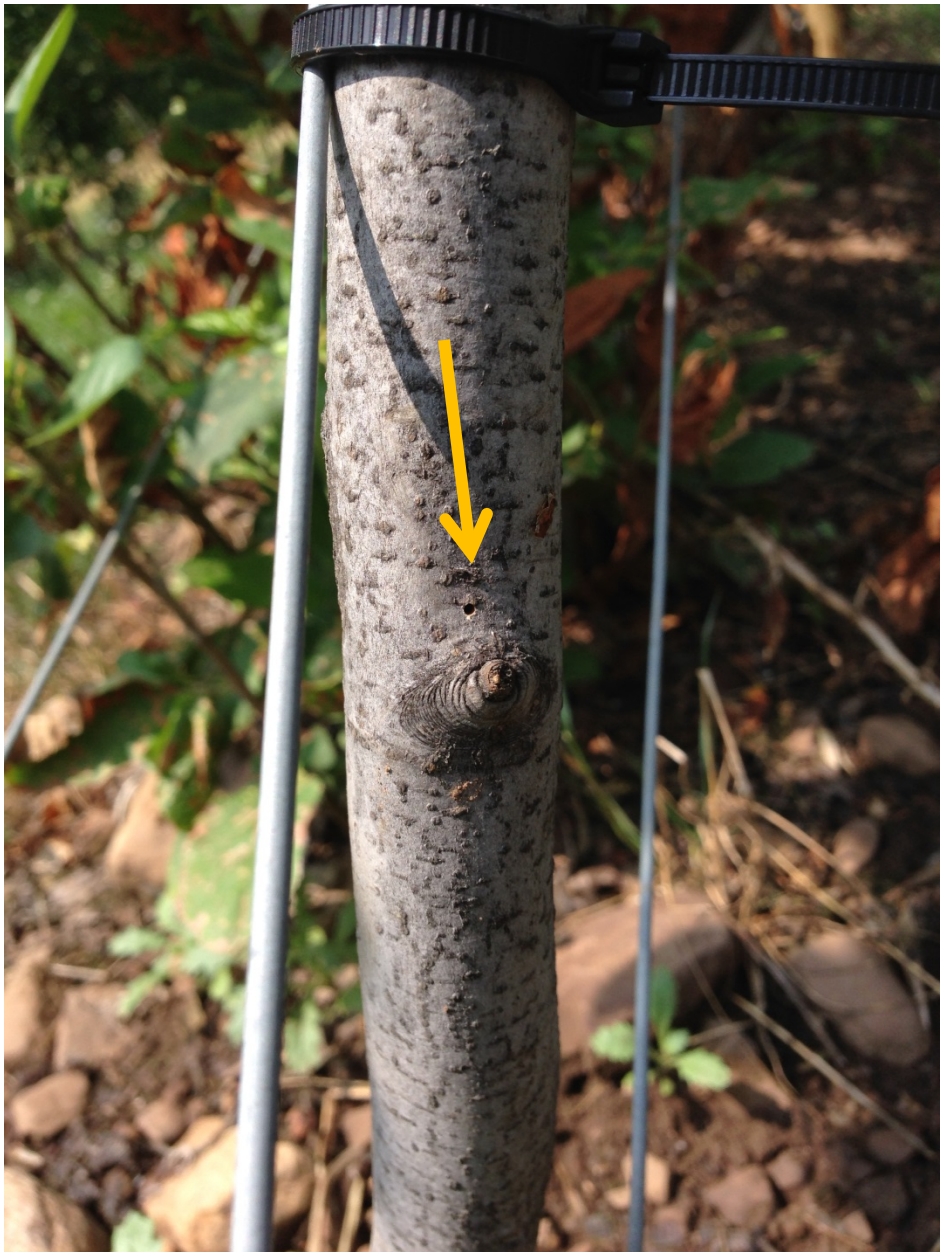
Trapping BSB

- **RE: Peter Schultz, PhD, Virginia Tech**
- **inverted “Simply” traps with rectangular openings cut in side panels**
- **Agbio: agbio@agbio-inc.com ethanol lures**
- **Hung 2-3 feet off the ground**
- **A drop of low toxicity anti-freeze in lid or soapy water**
- **Hang on edge of woods next to orchard.**
- **Hang in interior of orchard.**
- **Check traps weekly**



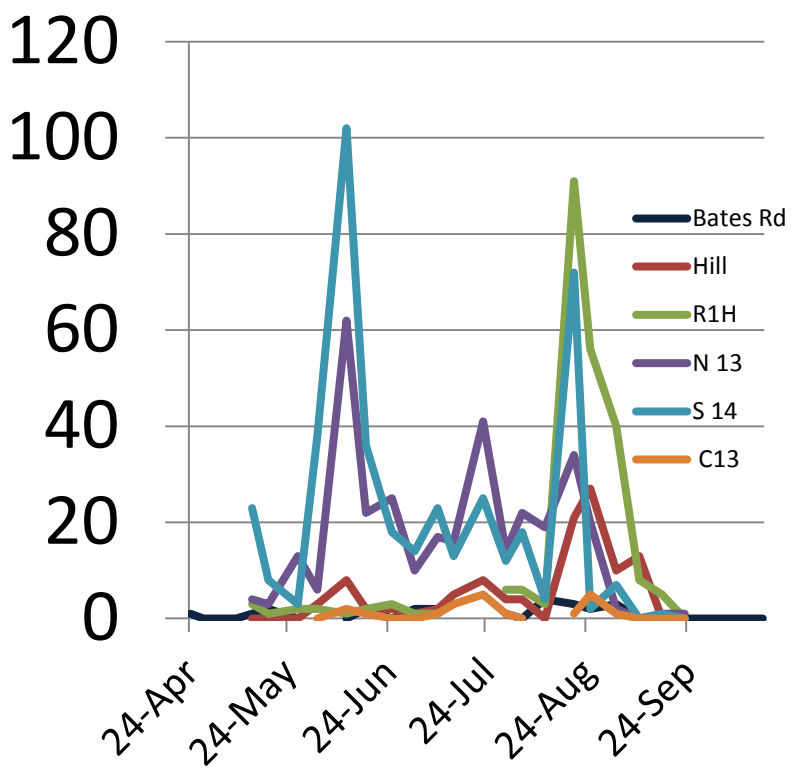
Trapping

- RE: John D. Vandenberg, USDA
- Forestry industry uses beech loglets, ~1 in diameter beech sticks soaked in 10 -15% EtOH for 3 days.
- Hang loglets 1 feet above ground.
- Count holes.
- Change every 3 days.

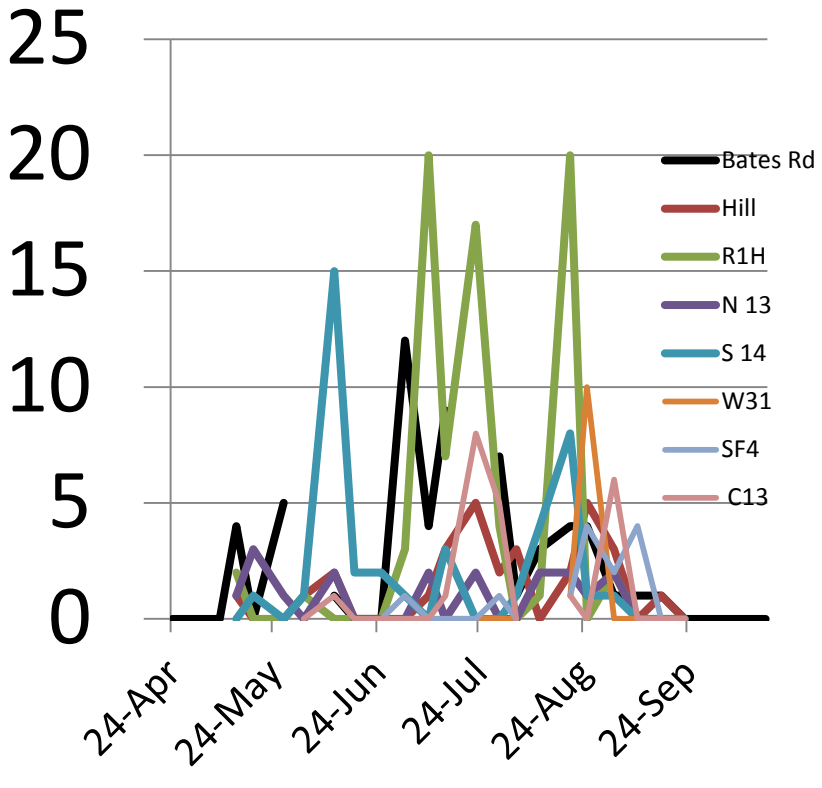


BSB weekly trap catch.

Edge

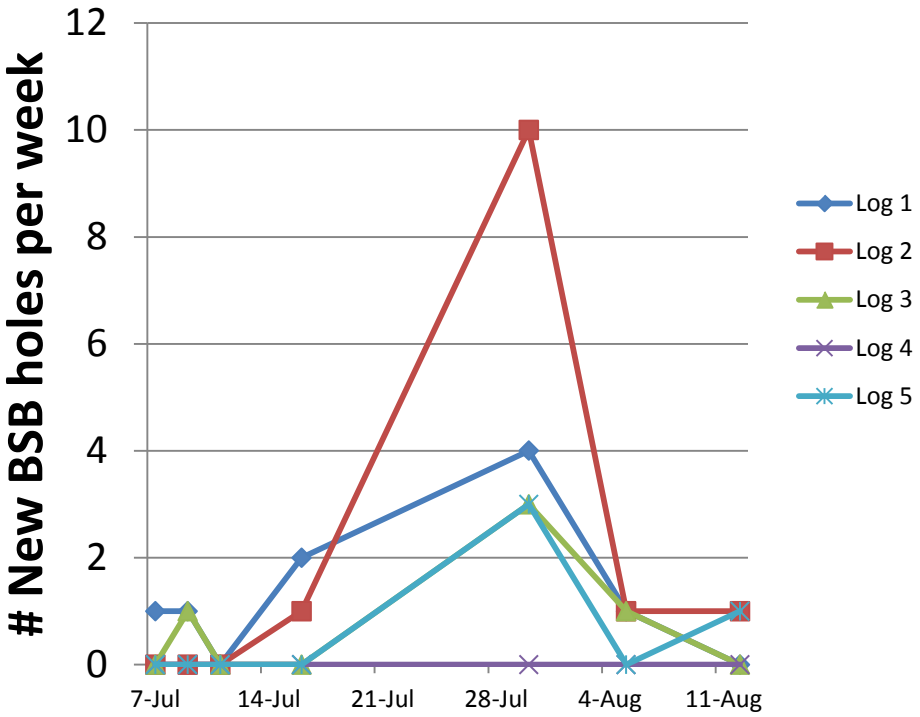


Interior



Trapping

Loglet BSB data for one site.



Trapping Conclusions:

- Need to change loglets every 3 days
- Caught fewer BSB in loglets in comparison to “Simply” traps.
- Loglets required more intensive trapping practices.
- Could they be used as traps to keep BSB out of the orchard?

Trapping

What we learned in 2014.

- **2014 - Ethanol-baited traps so far worked best to detect and monitor the presence of *BSB***
- **First activity noted in WNY on April 24 after a few warm days over 68 F.**
- **No activity again until May 13. Temperatures did not exceed 65 F between 4/22-5/8.**
- **Higher counts in traps along edges than interiors.**
- **Peak on Jun 11 for emerging from overwintering sites to new holes.**
- **1st generation adults emerged July 9-23**
- **2nd generation adults emerged Aug 20 but continued to be active through September 16.**

Chemical control:

Ornamental Nurseries

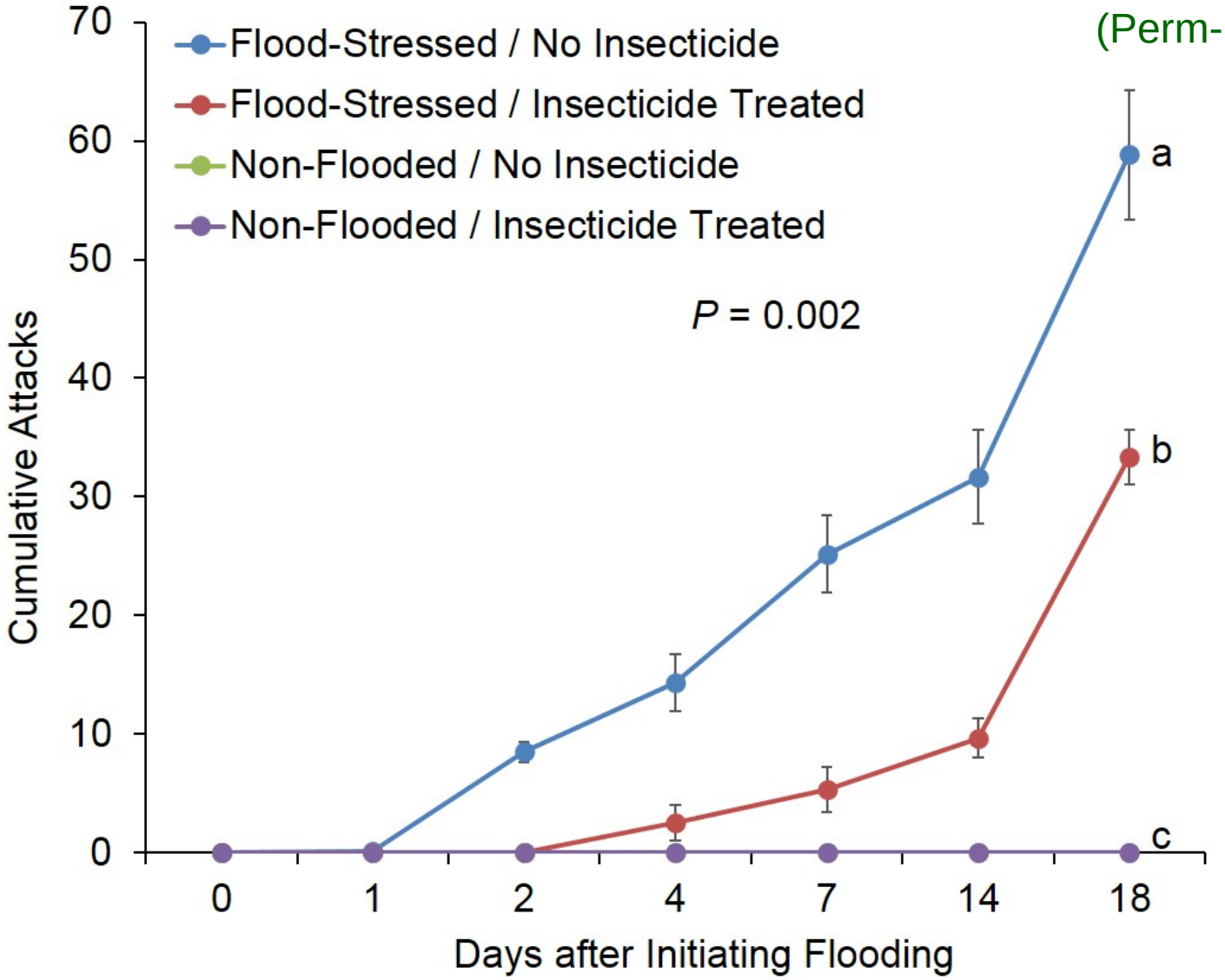
- ☑ permethrin on a 2-week schedule
- ☑ **not effective -** neonicotinoids, anthranilic diamides (cyazypyr, acelepryn), and tolfenpyrad,

Apples?

- ☑ Warrior II or Grizzly, lambda-cyhalothrin, labeled for tree borer species
- ☑ DECLARE is gamma-cyhalothrin.
- ☑ chlorpyrifos trunk sprays for borers may be effective

Importance of Maintaining Host Vigor?

- Insecticides do not always protect trees from attack



Insecticide trials – May 5, 2014

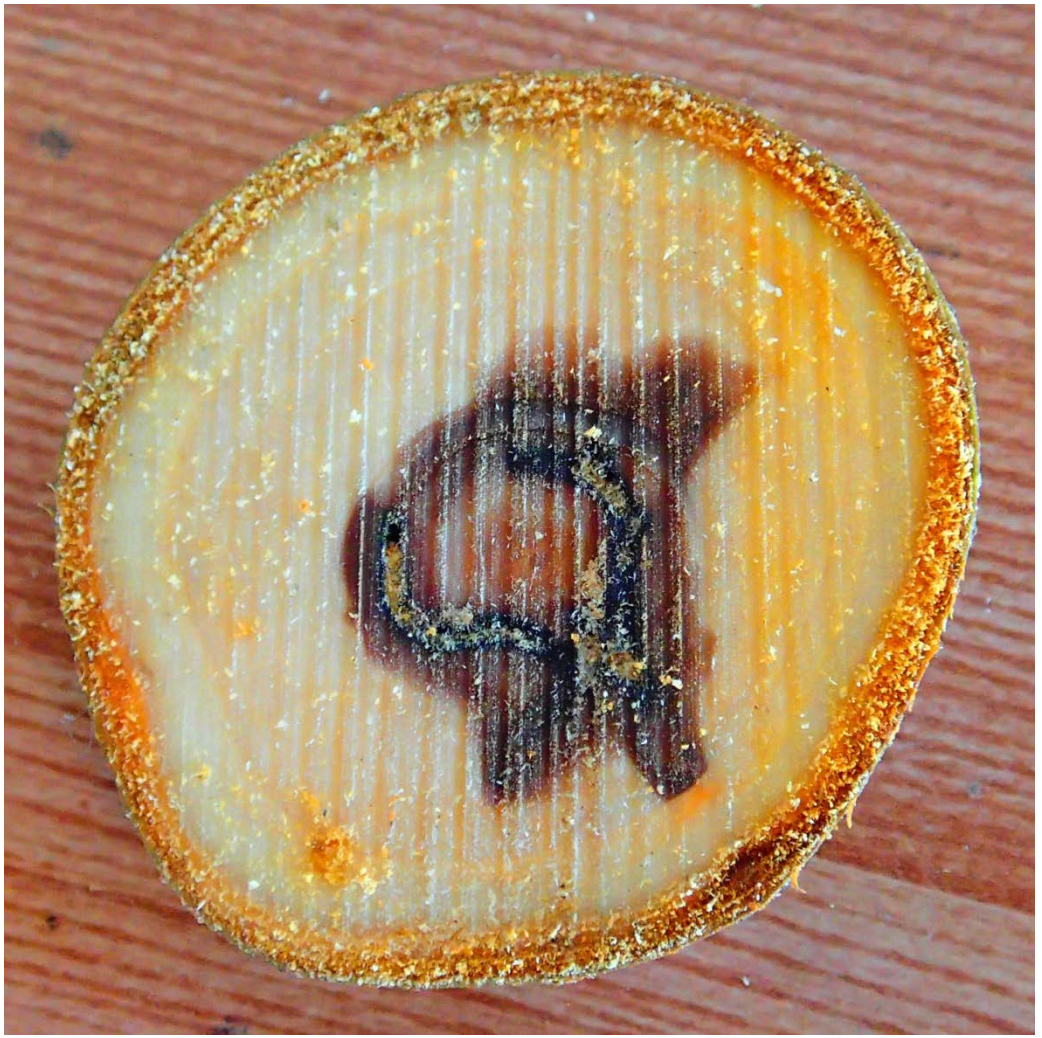
- **Lorsban Advanced @ 1.5 qt./100**
- **Danitol @16 oz./100**
- **Cobalt Advanced @1.3 qt./100**
- **Applied to drip with mist blower sprayer.**
- **Randomized block design, 4 reps**
- **No stats !**
- **no untreated check!**

% Trees Active BSB	TRT
6%	Danitol
3%	Cobalt
1%	Lorsban
5%	STD

Other interesting notes…

- **Bandsaw was the best tool to study BSB activity.**
- **Looking for methods to evaluate trials without destroying trees?**

Good News! ?



But how healthy is this tree now?

Summary for 2014

More questions than answers !

- **Trapping using ethanol lures was successful**
- **Controls ???**
  - **Is it spray coverage – top to bottom of tree.**
  - **Will biological controls kill beetles or symbiotic fungus.**
  - **Is it necessary to destroy infested trees? Many have lost 30% of trees.**
  - **Not all trees die. Is it dependent on the fungus?**
  - **How to evaluate controls?**

Anecdotal Observations Predisposing Apples to BSB Attack

- 2011 in WNY was a very wet year
- Mild winter temps in 2011-12
- Early budbreak in 2012
- April 2012 with at least 3 frosts/freezes
- Due to significant crop losses in 2012, some growers did some root pruning to reduce vigor.
- “Impaired root function” is a stressor that can cause a tree to emit ethanol
- Loss of broad spectrum insecticides

Recommendations?

- **Prevent stress ?**
- **Remove and destroy infested wood**
- **Monitor flight**
- **Ambrosia beetles are difficult to control with insecticides - insecticides must be closely timed with beetle attacks, or applied repeatedly, or have long residual activity**
- **Insecticides appropriately labeled as bark treatments may be used against new attacks**
- **Systemic insecticides are not effective.**

Plans for 2015

- **Agnello – Hatch grant to monitor and test controls in established orchards**
- **Breth – applied for NYFVI grant to monitor and test controls in apple nurseries**
- **Cox – identify pathogenic fungi and bacteria associated**
- **Breth/Tee will report trap data on website, in *Fruit Fax,* and newsletter**
- **Need to continue to study effects on trees – survival vs. mortality**

Thanks for all the advice from Peter Shultz and Chris Ranger