

Efficacy of Essential Oil Lures for Detection of Redbay Ambrosia Beetle, *Xyleborus glabratus* (Coleoptera: Curculionidae: Scolytinae)

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The Avocado Industries in the U.S. and Mexico – and the USDA avocado germplasm collection in Miami, FL – are currently threatened by laurel wilt. This lethal vascular disease of avocado and other trees in the Lauraceae is caused by a mycopathogen (*Raffaelea lauricola*) vectored by an exotic wood-boring insect, the redbay ambrosia beetle (*Xyleborus glabratus* Eichhoff). Impact of this pathogen/pest complex is potentially devastating. Once infected, tree mortality can occur in as little as 6 weeks. First detected in the U.S. near Savannah, Georgia in 2002, the beetle and its fungal symbiont have since spread along the coastal plain into the Carolinas, Florida, and west to Mississippi. In February 2011, laurel wilt and breeding populations of *X. glabratus* were detected in Miami-Dade County, ~9 miles north of commercial avocado groves. Avocado production in Florida is worth \$14 million annually, and replacement costs of commercial and backyard avocado trees in south Florida have been estimated at \$429 million.

Xyleborus glabratus is a cylindrical beetle ~2 mm long. Males are flightless and remain within host trees. Females disperse and bore into new hosts, forming galleries where eggs are laid. Galleries are inoculated with *Raffaelea* spores (carried in mandibular mycangia), and the fungal growth (ambrosia) provides food for larvae and adults. Host wood is not consumed, but extruded at the entry holes. The fungus spreads throughout the host vascular system, and the tree responds by forming parenchymal tyloses (walls within the xylem vessels) which block water transport. This results in systemic wilt and ultimately tree death (Mayfield and Thomas 2006, Fraedrich et al. 2008, Harrington et al. 2008).

Known hosts: avocado (*Persea americana*), redbay (*P. borbonia*), swampbay (*P. palustris*), silkbay (*P. humilis*), sassafras (*S. albidum*), camphor tree (*Cinnamomum camphora*), spicebush (*Lindera benzoin*), pondberry (*L. melissifolia*), and pondspice (*Litsea aestivalis*).



Xyleborus glabratus (female)



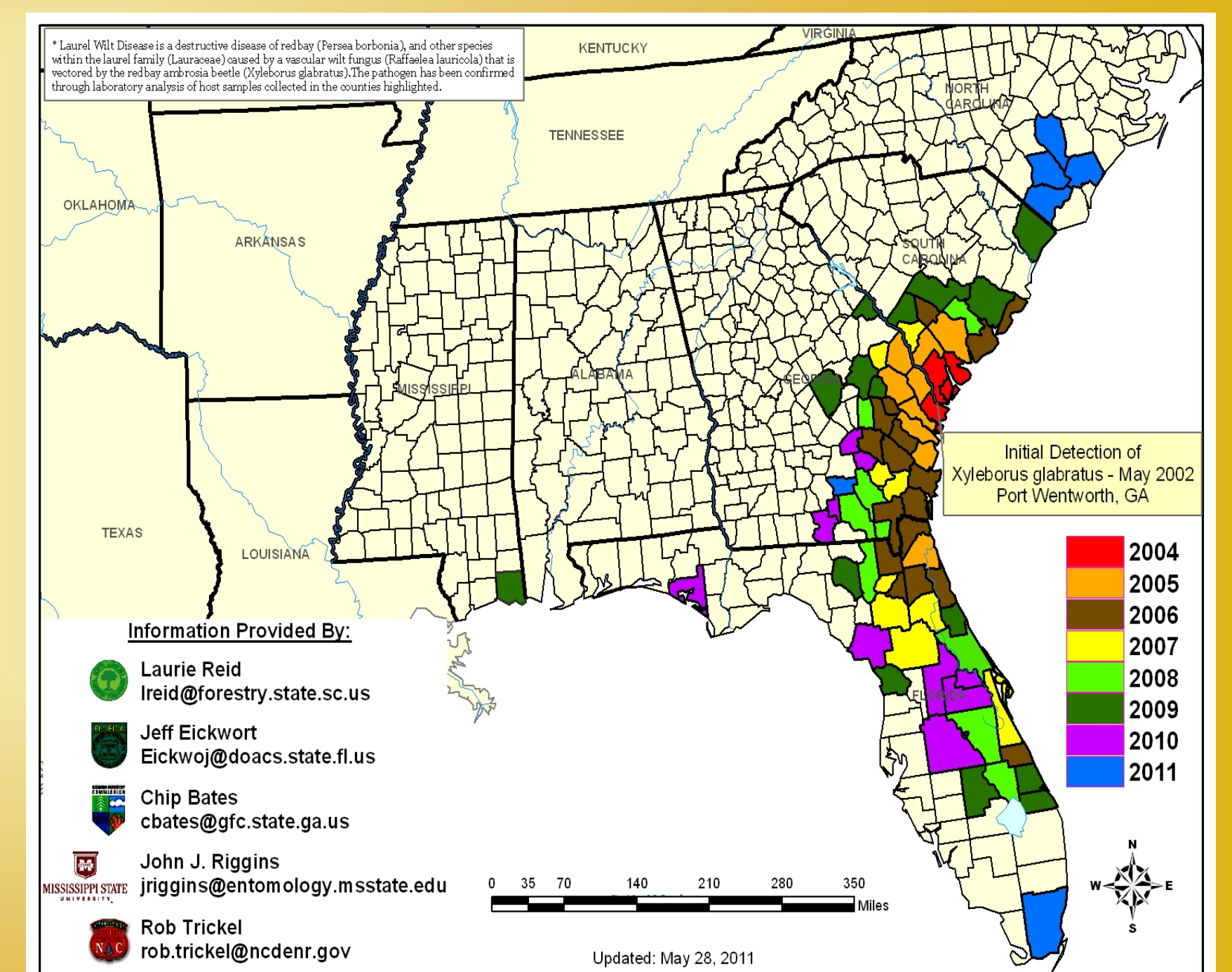
Initial wilt symptoms



Galleries in host tree



Sawdust sticks at entry holes



Distribution of Laurel Wilt by Year of Detection

Background – Attractants for Redbay Ambrosia Beetle

Development of monitoring and management tools for the redbay ambrosia beetle (RAB) is contingent upon identification of effective attractants. Forest entomologists previously identified manuka oil and phoebe oil as baits for field monitoring of RAB in South Carolina, and hypothesized that α -copaene and calamenene were the chemicals responsible for attraction (Hanula and Sullivan 2008). Based on that information, action agencies now use commercial manuka lures deployed in Lindgren funnel traps for detection of RAB. However, field tests in Florida indicated that essential oil lures captured many non-target Scolytinae (Kendra et al. 2011a) and that manuka lures had limited longevity and were not competitive with volatiles from host avocado wood (Kendra et al. 2011b). Here we report the results of research that rigorously evaluated the efficacy and longevity of commercial manuka and phoebe lures for capture of RAB in Florida.

Field Tests

Traps/Lures

- Manuka and phoebe lures (Synergy Semiochemicals)
- 4-unit Lindgren funnel traps (BioQuip)
- Sticky panel traps, 23 x 28 cm (Great Lakes IPM)

Study Sites

- Lochloosa Wildlife Conservation Area (Alachua County); Apr-Jul 2010; Advanced laurel wilt; Low RAB density
- Lake Wales Ridge Wildlife Management Area (Highlands County); Sep-Dec 2010; Early laurel wilt; High RAB density

Field Design

- Test 1:** 12-wk, randomized complete block, 10 replicate blocks, Lindgren and sticky traps, checked every 2 wk, trap positions rotated within block at each sampling
- Test 2:** 12-wk, randomized complete block, 5 replicate blocks, only sticky traps used; checked every week, positions rotated at each sampling

Methods



Chemical Analysis

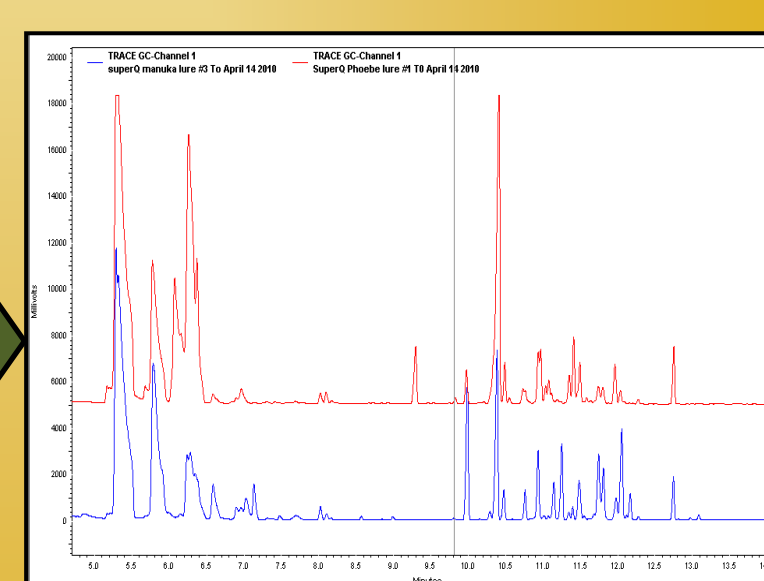
Separate manuka and phoebe lures were hung in Lindgren traps and aged in the field for 12 wk (SHRS, Miami, FL). Periodically, lures were brought into the lab and volatile emissions were sampled using Super-Q collection and analysis by gas chromatography-mass spectroscopy (GC-MS).



Super-Q Collection System



GC-MS



Identification and Quantification

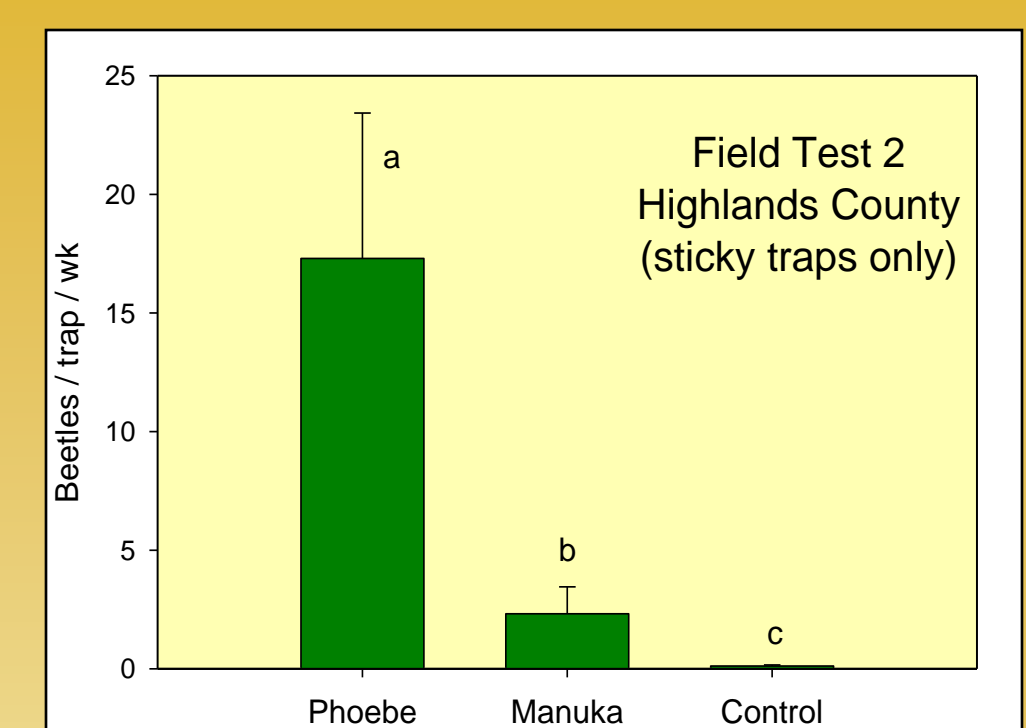
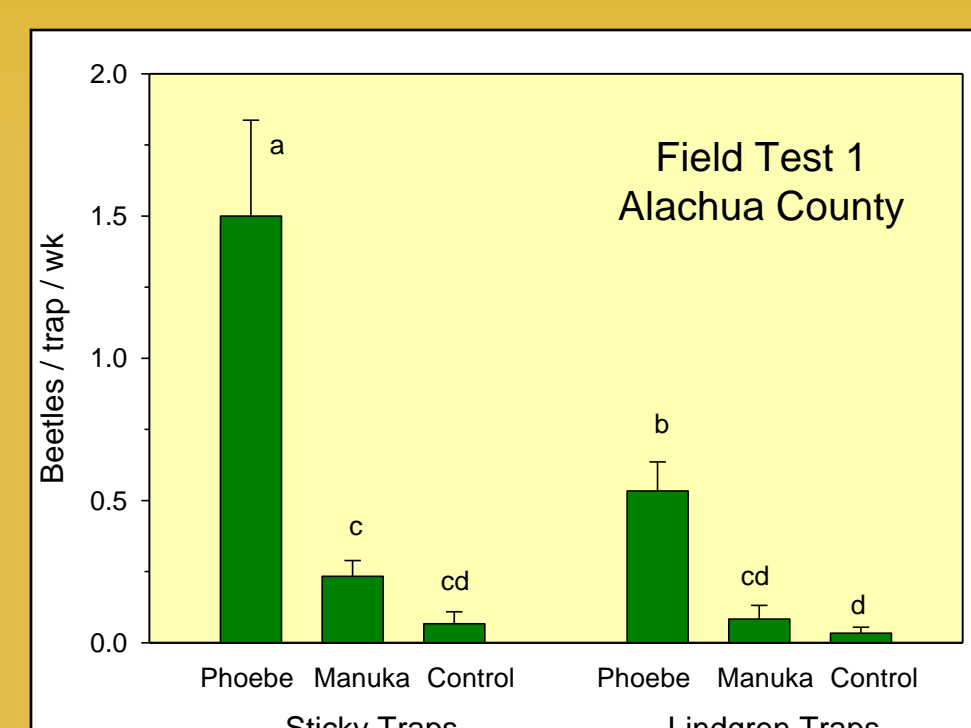
We gratefully acknowledge David Long and Ricardo Joseph for technical assistance; Connie Rightmire (St. Johns River Water Management district) and Nicole Ranalli (Florida Fish and Wildlife Conservation Commission) for permits to conduct research at Lochloosa Wildlife conservation Area and Lake Wales Ridge Wildlife Management Area, respectively; and funding from the USDA-ARS National Plant Disease Recovery System, a NIFA Critical Issues Grant, and the Florida Avocado Administrative Committee.

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Results

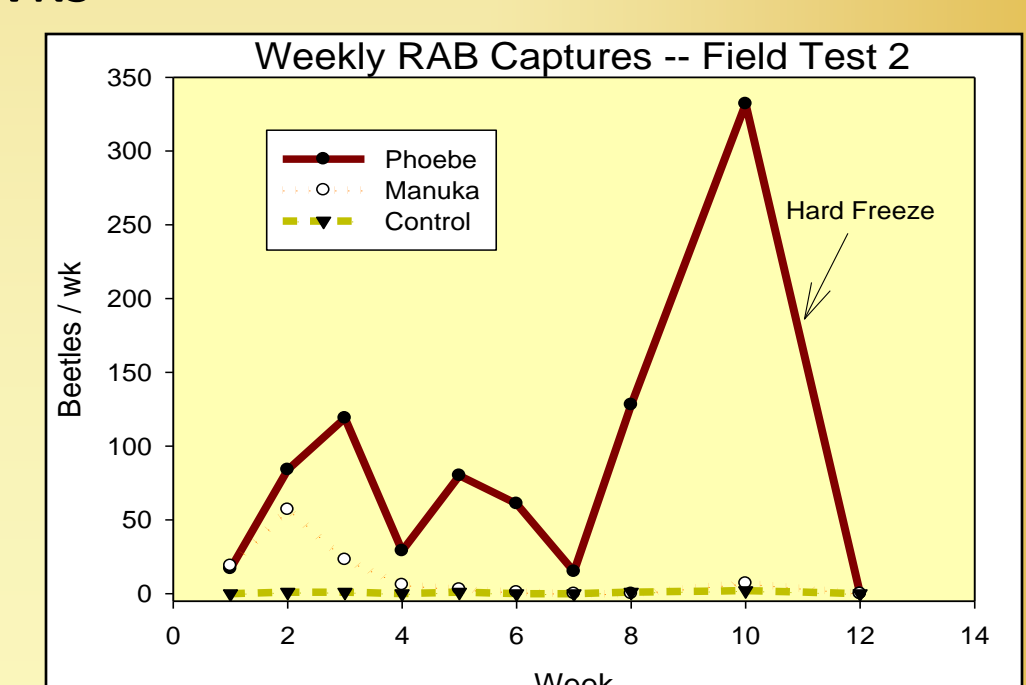
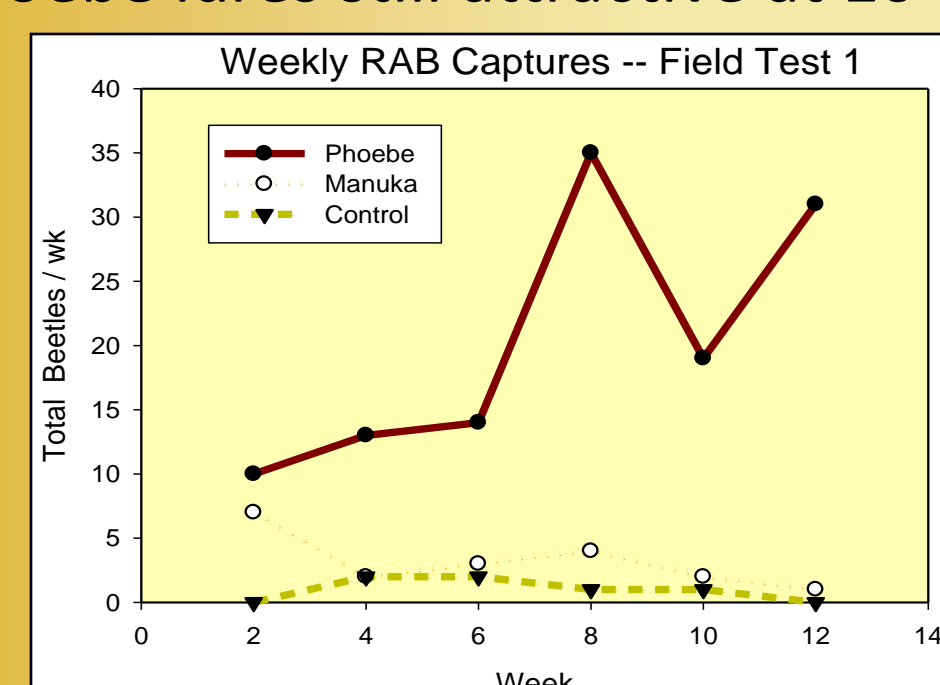
Trap-Lure Efficacy

- Sticky traps captured more RAB than Lindgren traps
- Phoebe lures captured more RAB than manuka lures



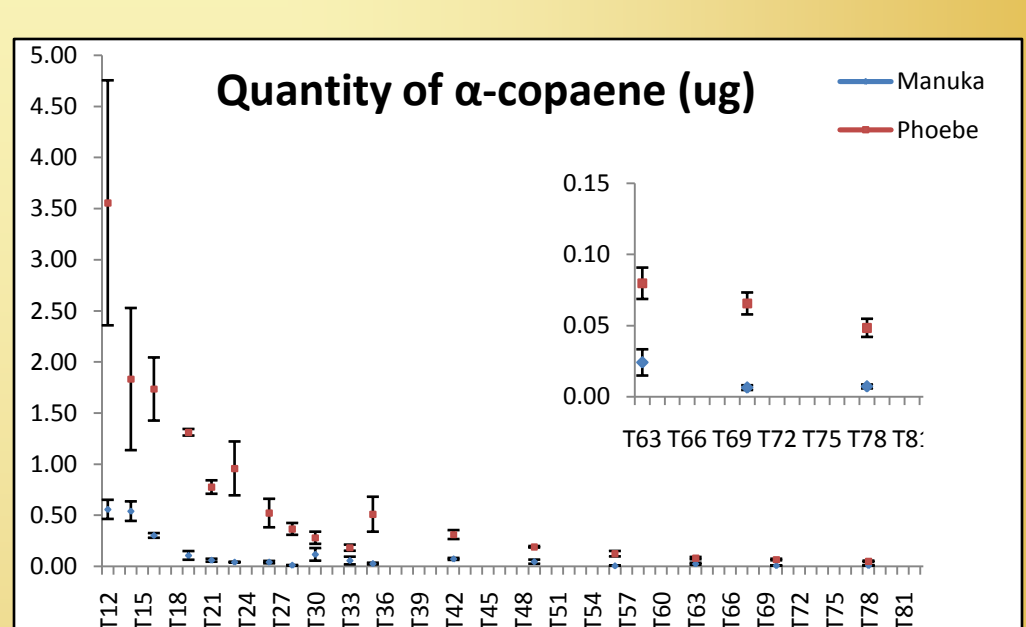
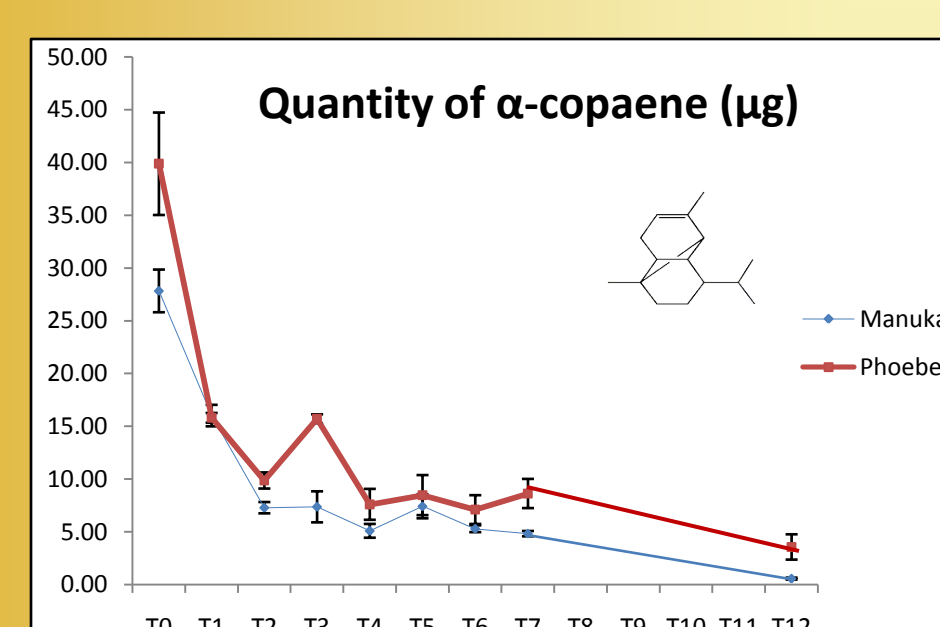
Lure Longevity

- Equal RAB captures with manuka and phoebe lures at 1-2 wk
- By 4 wk, captures with manuka were no greater than unbaited control traps
- Phoebe lures still attractive at 10-12 wks



Emissions of α -Copaene

- First 2 wk: Rapid decline in volatile emissions from both lures; no significant difference in α -copaene release rates
- After 2 wk: Phoebe lure released more α -copaene than manuka lure



Conclusions

- Phoebe-baited sticky traps are more effective for early detection of RAB than the currently used manuka-baited Lindgren traps. Unfortunately, phoebe oil is a limited resource not likely to be available in the near future.
- Field life of manuka lures in Florida is 2-3 wk. Improved formulations are needed.
- Emissions of α -copaene may explain differences in attraction between the 2 lures.

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