Invasive Ambrosia Beetle Conference
The Situation in California
August 12 – 14, 2012

Meeting sponsored by:

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Session 5

Monitoring and Control Strategies

Monitoring and Development of Detection Methods

Redbay Ambrosia Beetle Attractants and Trapping

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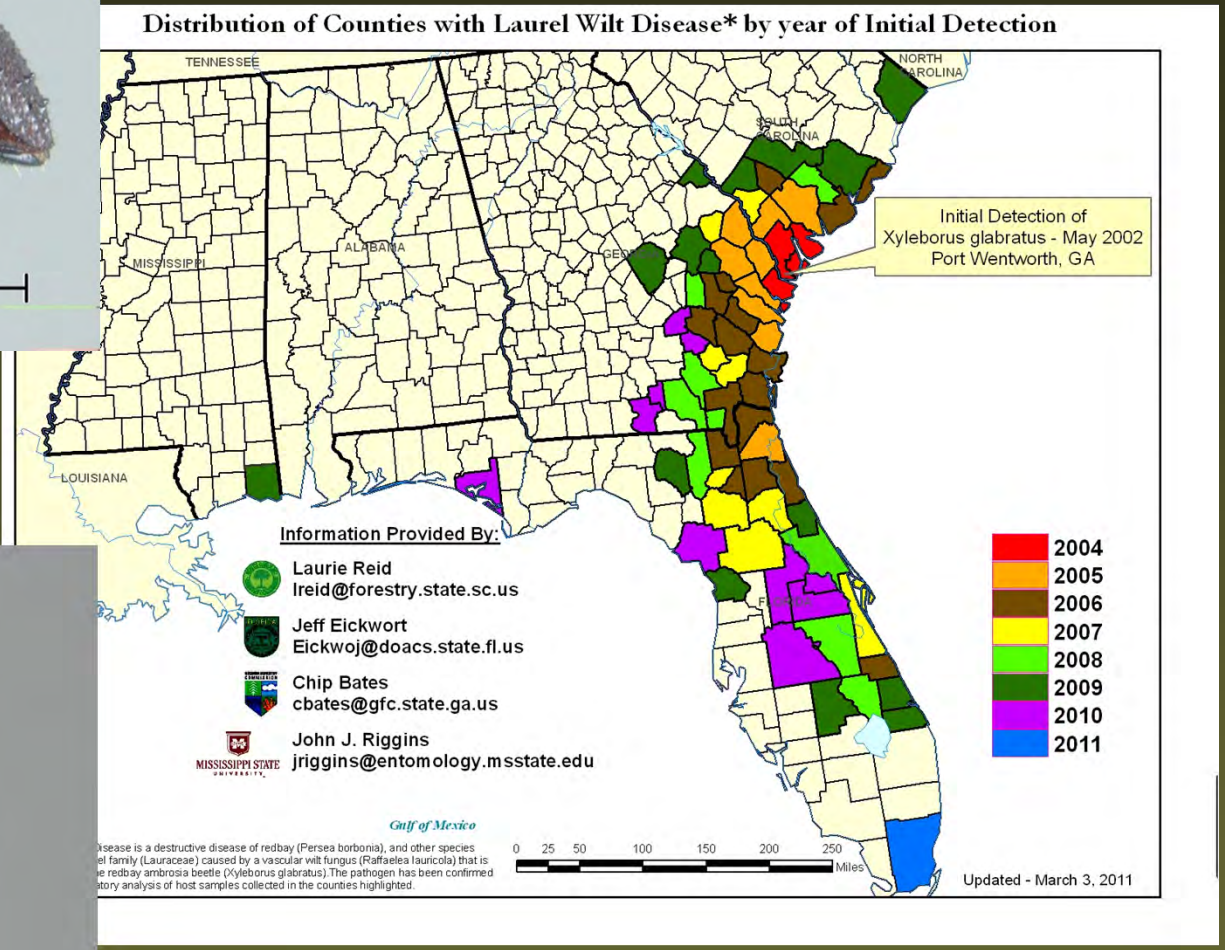
- Chip Bates, Scott Cameron and James Johnson, Ga. Forestry Commission
- Laurie Reid, SC Forestry Commission

Background

- *Xyleborus glabratus was* discovered near Savannah in 2002
- Role in transmission of laurel wilt discovered in 2004
- From Asia
- Vectors laurel wilt disease, *Raffaelea lauricola*, killing redbay and sassafras trees
- Distributed from south Florida to southern North Carolina

Female

Male - flightless



Impact of *X. glabratus* on Redbay Populations

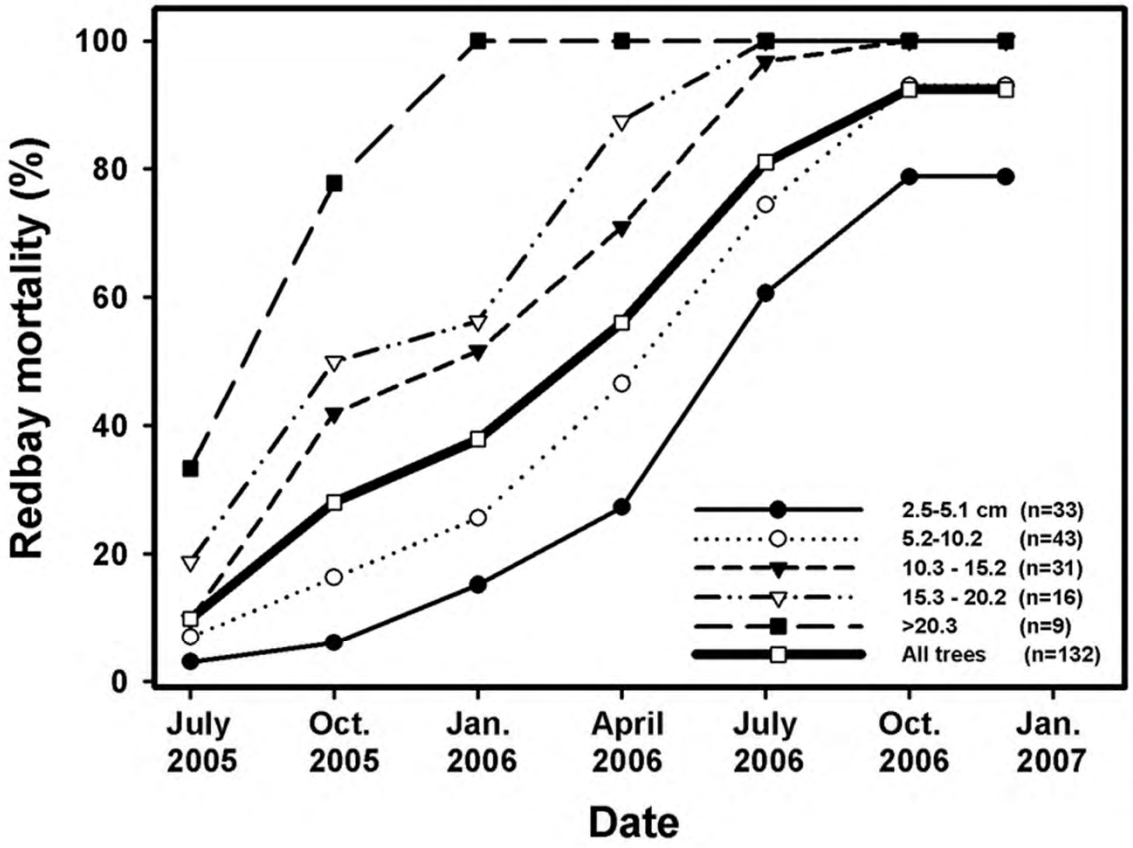
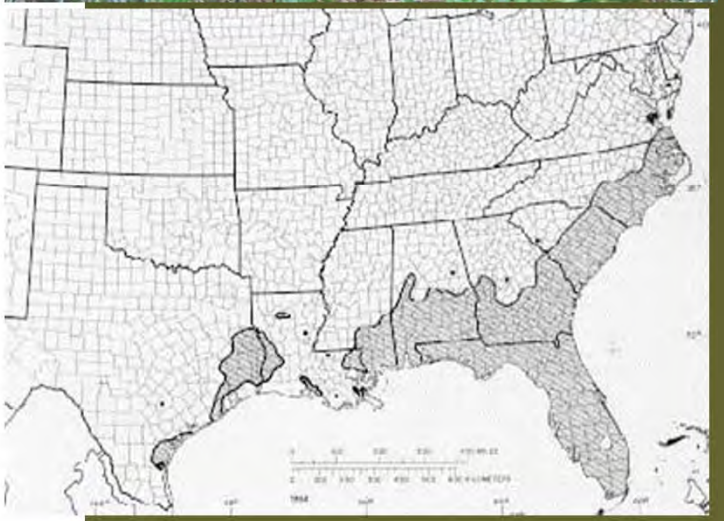


Fig 2, Fraedrich, Plant Disease



Ambrosia Beetle Attractants

Source: Pherobase

(http://www.pherobase.com/database/family/family-Scolytidae.php)

- 21 ambrosia beetles with attractant information available
- 18 attracted to ethyl alcohol
- Other attractants include (4 species):
  - Salicylic acid
  - Turpentine
  - Propan-2-ol
  - Eugenol
  - Alpha-pinene
  - Lineatin

Redbay ambrosia beetle is not attracted to ethyl alcohol

X. glabratus Host Attraction

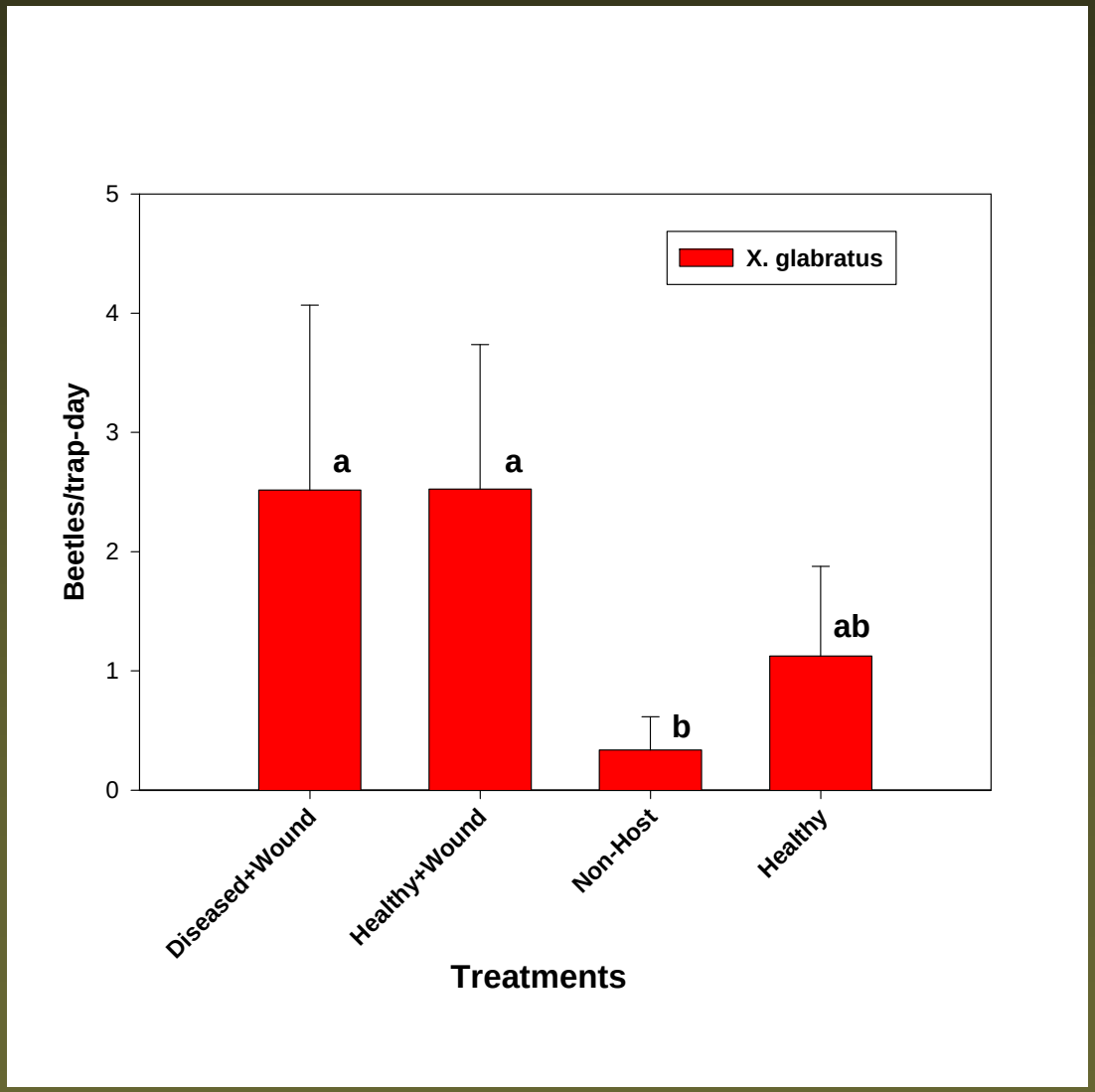
4 Experiments

- Attraction of beetles to wounded, diseased, and healthy redbay trees
- Attraction of beetles to *X. g.* infested and uninfested redbay bolts
- Attraction of beetles to sassafras
- Attraction of beetles to avocado

Attraction of Beetles to Wounded, Diseased and Healthy Trees

- 4 treatments
  - Non-host oak
  - Non-wounded healthy redbay
  - Wounded healthy redbay
  - Wounded diseased redbay
- Trapped March 21 to June 27, 2006
- 4 replicates

Attraction of Beetles to Wounded, Disease and Healthy Trees



Hanula et al. 2008

Attraction of Beetles to Wounded, Disease and Healthy Trees

- Diseased trees were not more attractive than healthy trees
- Wounding trees increases attraction
- Redbay ambrosia beetles are attracted to redbay

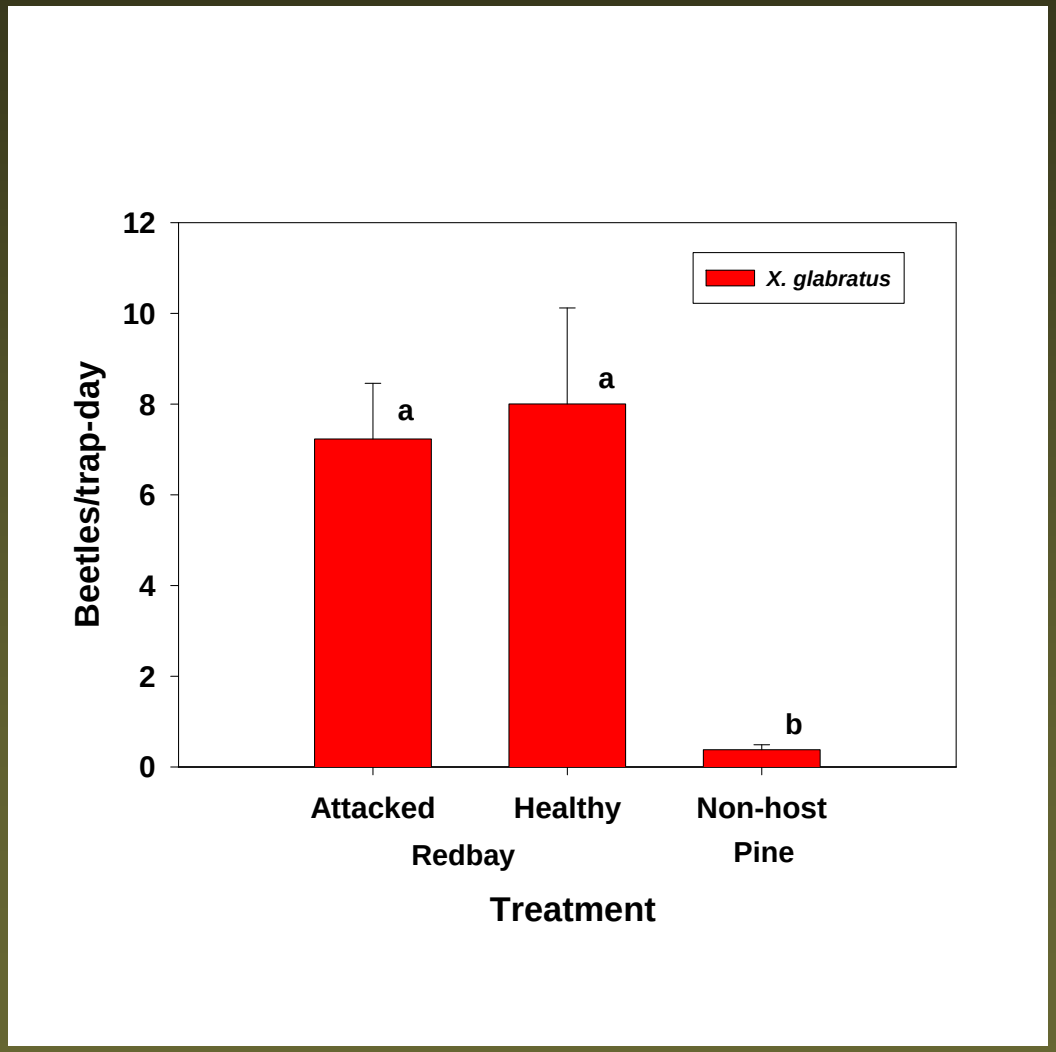
Attraction of Beetles to Attacked and Unattacked Redbay

- Purpose
  - to test whether ambrosia beetles produce an attractant
- 3 Treatments (4 reps)
  - Enclosed redbay bolt from healthy tree
  - Enclosed redbay bolt from infested tree
  - Non-host (pine) bolt
  - June 14 to August 20

Attraction of Beetles to Attacked and Unattacked Redbay

Infested Bolt

Attraction of Beetles to Attacked and Healthy Redbay

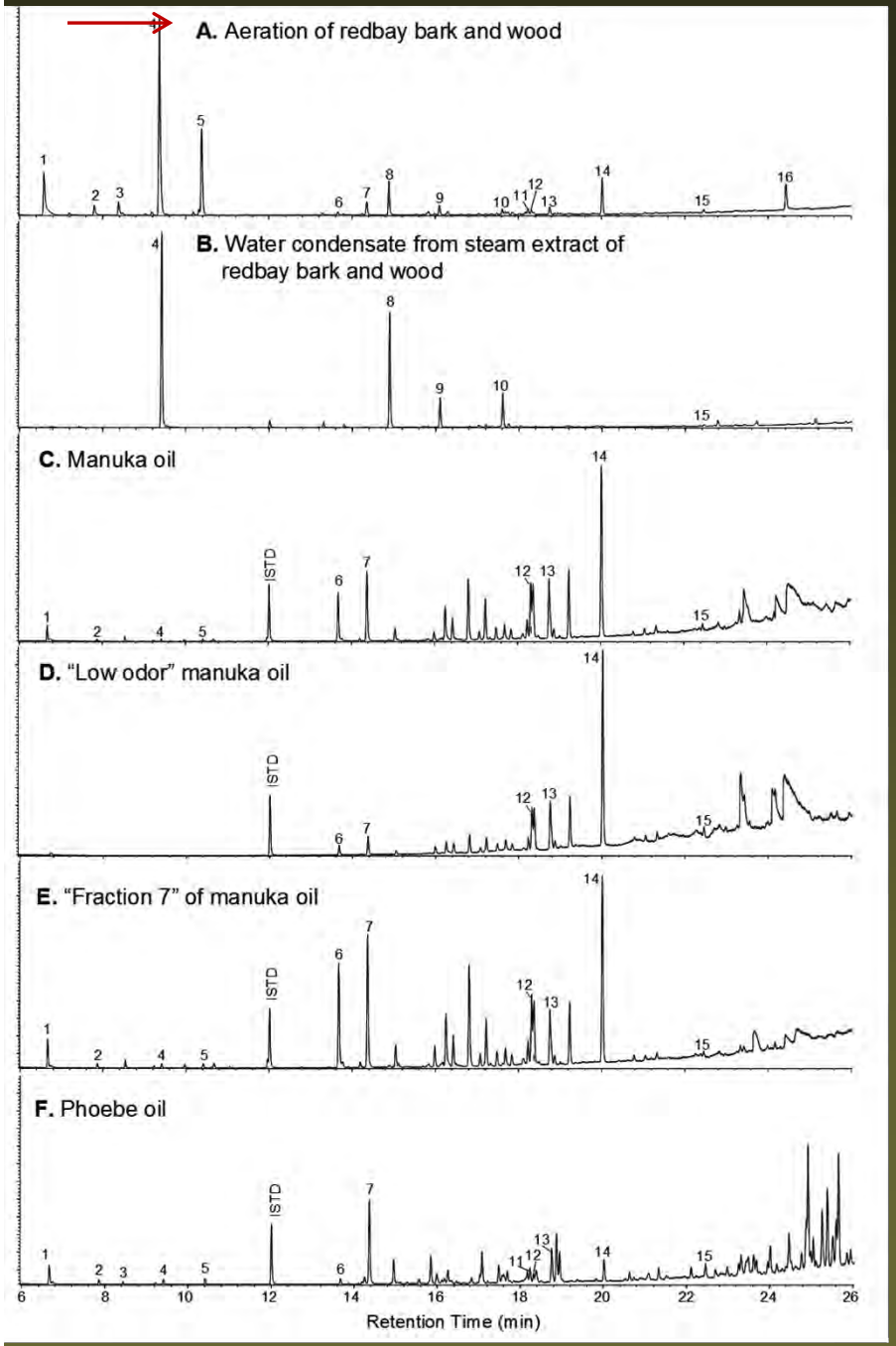


Hanula et al. 2008

Attraction of Beetles to Attacked and Healthy Redbay

- Summary
  - Beetles do not produce an attractant
  - Bolts of healthy or infested redbay trees were equally attractive
  - Bolts were attractive for 70 days

Attractants and Traps



Redbay Aerations

Peak No.	Compound
4	Cineole (=Eucalyptol)
5	*p*-Cymene
6	α-Cubebene
7	α-Copaene
8	Linalool
9	Terpinen-4-ol
10	α-Terpineol
14	Calamenene
15	Caryophyllene oxide
16	Nonanoic acid

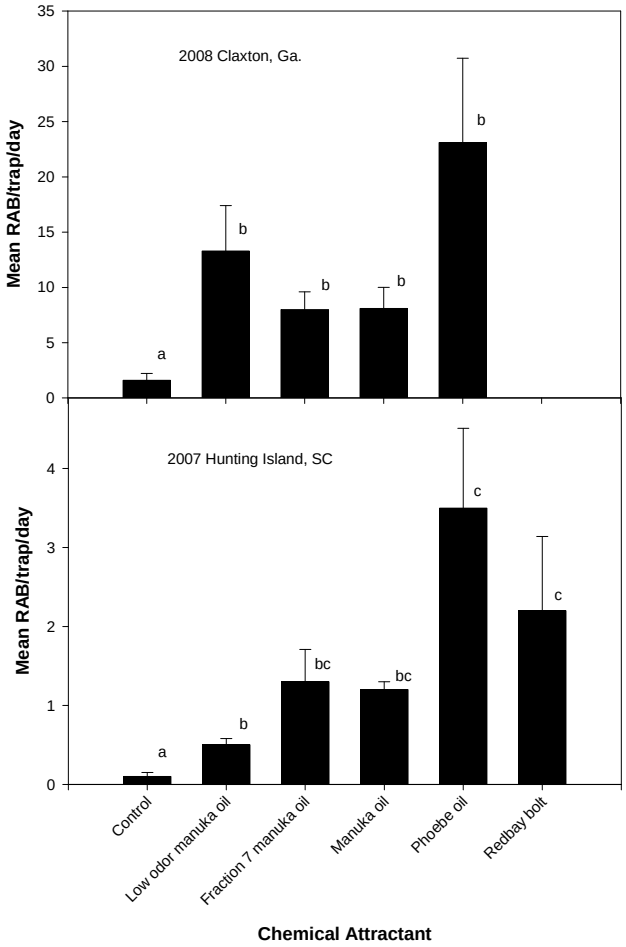
Hanula and Sullivan 2008

Testing Volatile Compounds

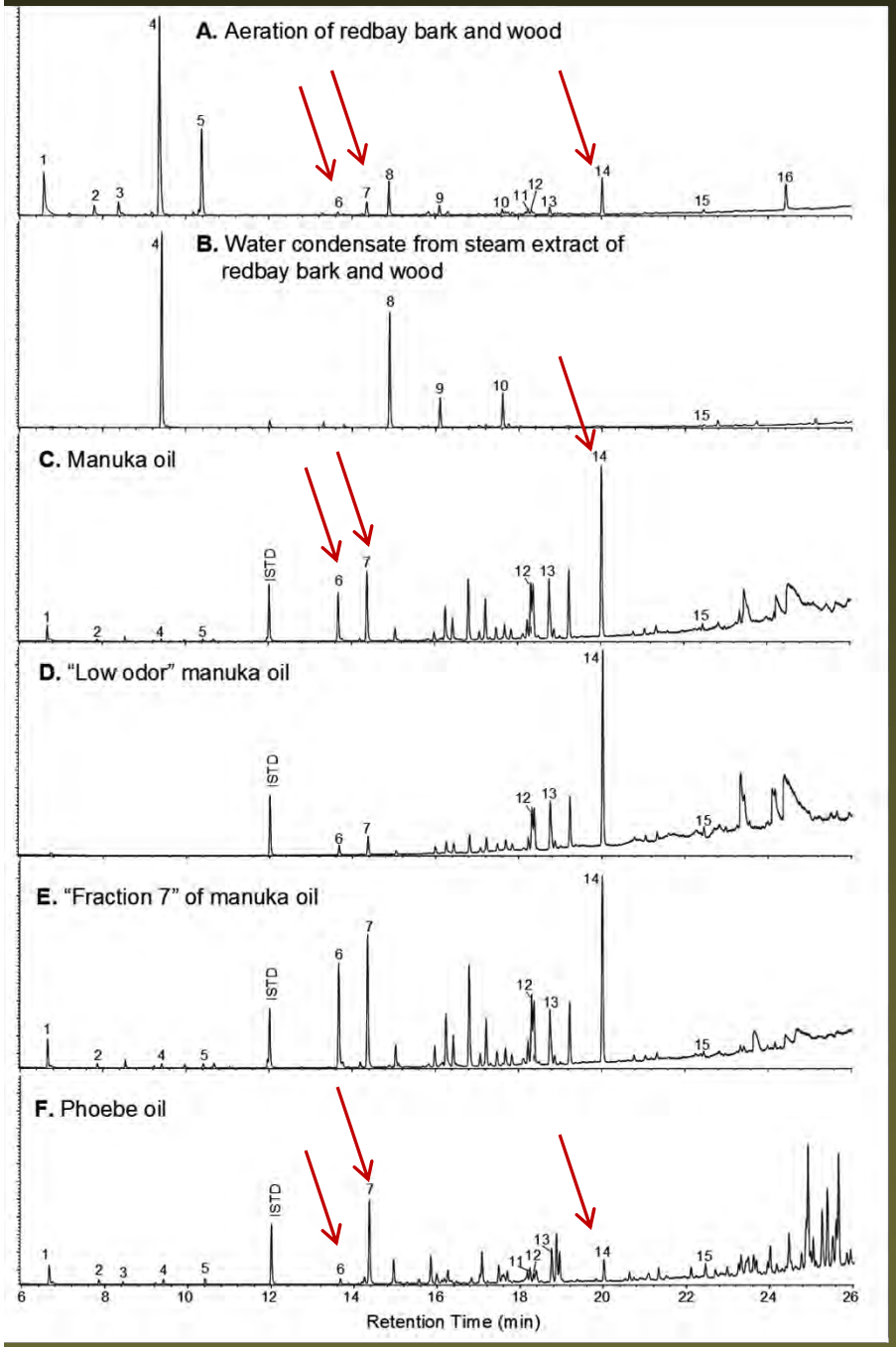
Compound	Trial 1 (100µl) Total RAB Caught	Trial 2 (300µl) Mean RAB/trap (SE)
Methanol blank	3	0.8 (0.47) b
Cineole	**6**	1 (0.41) b
p-Cymene	1	-----
Linalool	2	-----
(-) -Terpinen-4-ol	2	-----
α-Terpinene	4	-----
Caryophyllene oxide	**5**	1.3 (0.95) b
Nonanoic acid	1	-----
Manuka oil	**9**	**28.8 (0.47) a**
All combined	**8**	----
Steam Extract (1 ml)	Not tested	0.5 (0.29) b

Hanula and Sullivan 2008

Manuka Oil Fractions and Phoebe Oil -2007



Hanula and Sullivan 2008



Attractive Compounds?

Peak No.	Compound
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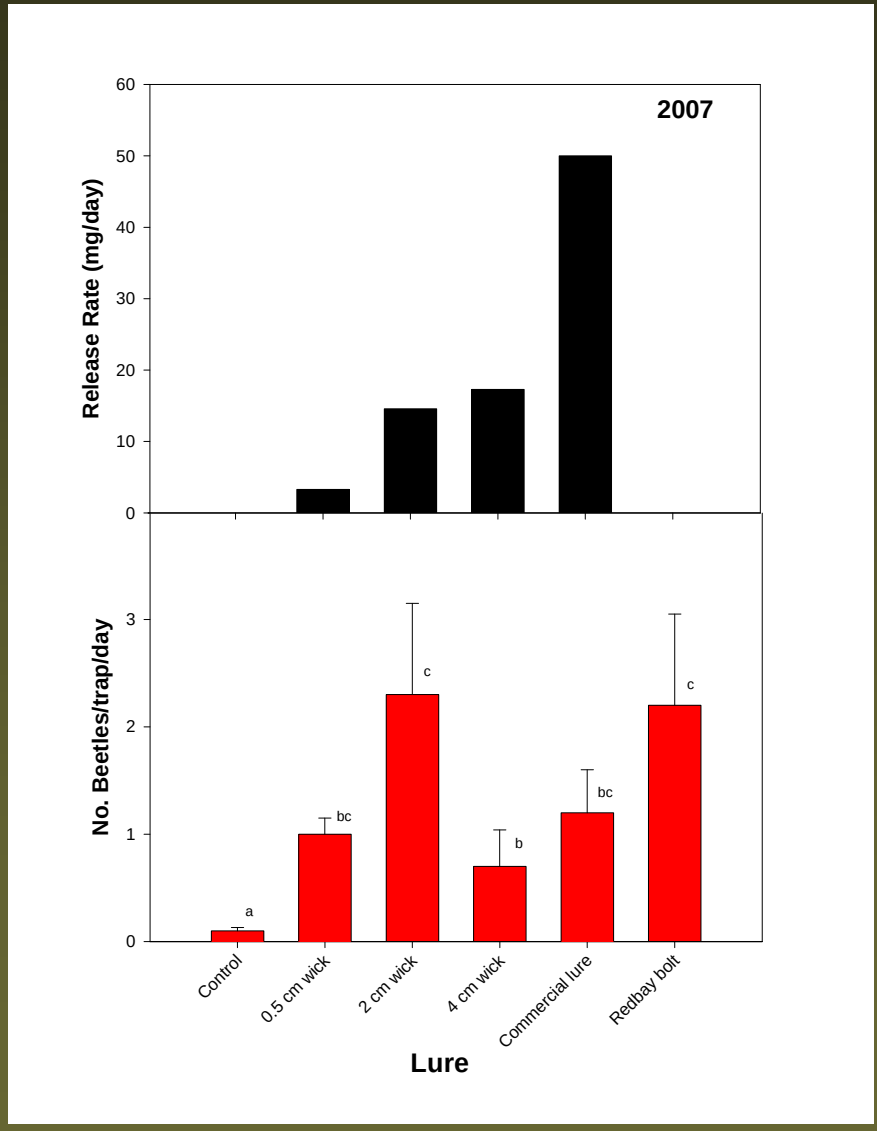
Hanula and Sullivan 2008

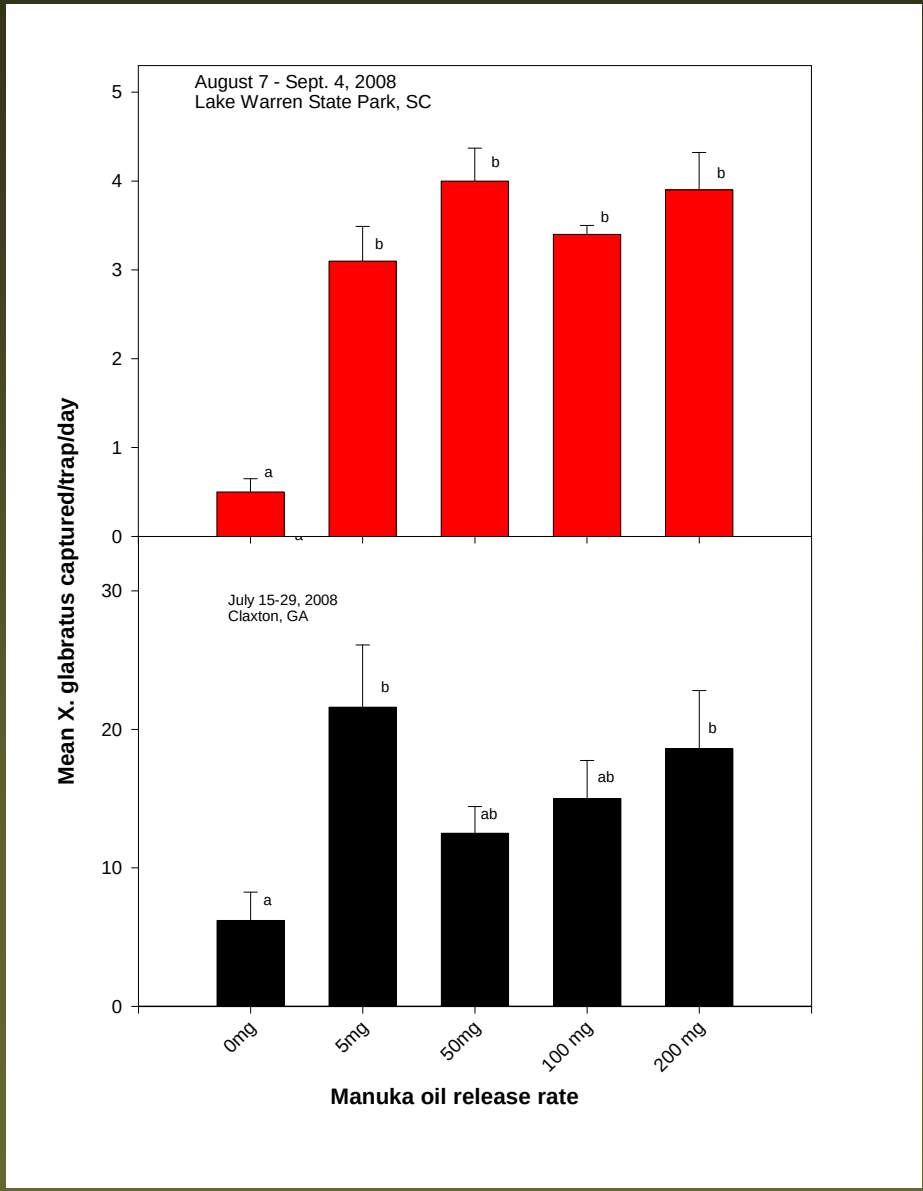
Manuka Oil Release Rate -2007



Hanula and Sullivan 2008

Manuka Oil Release Rate -2008

Newer lures could have lower release rates or existing lures may last longer.

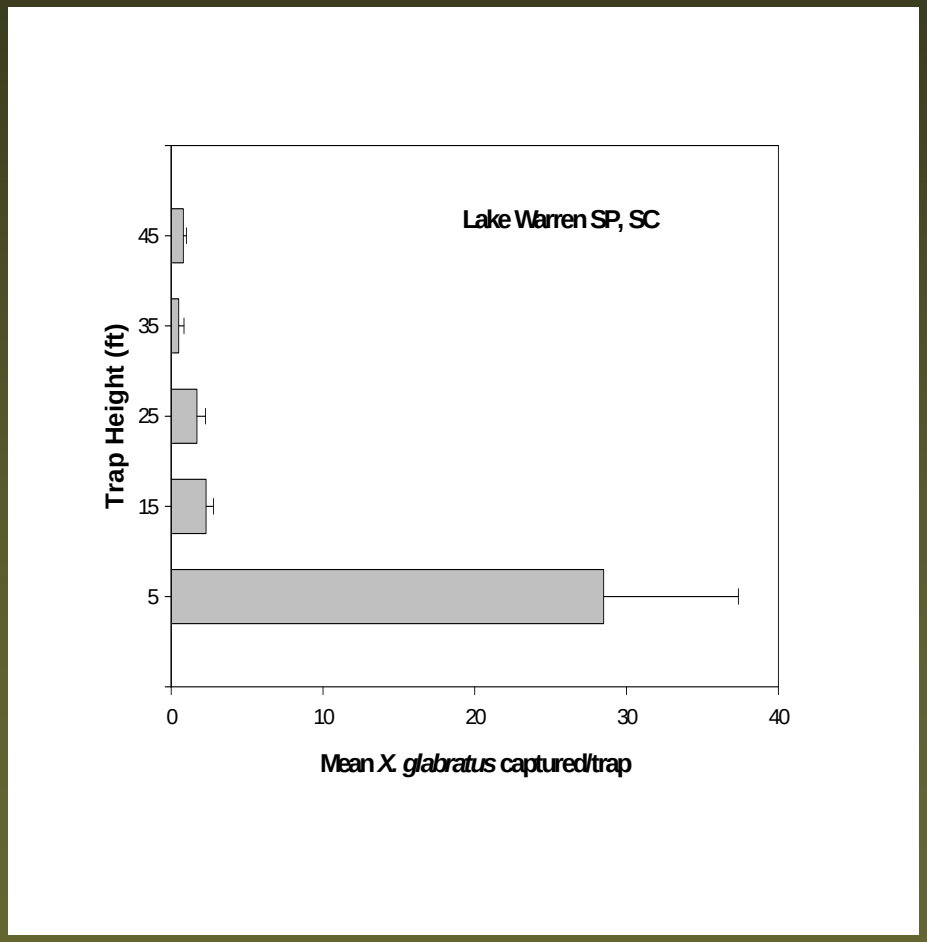


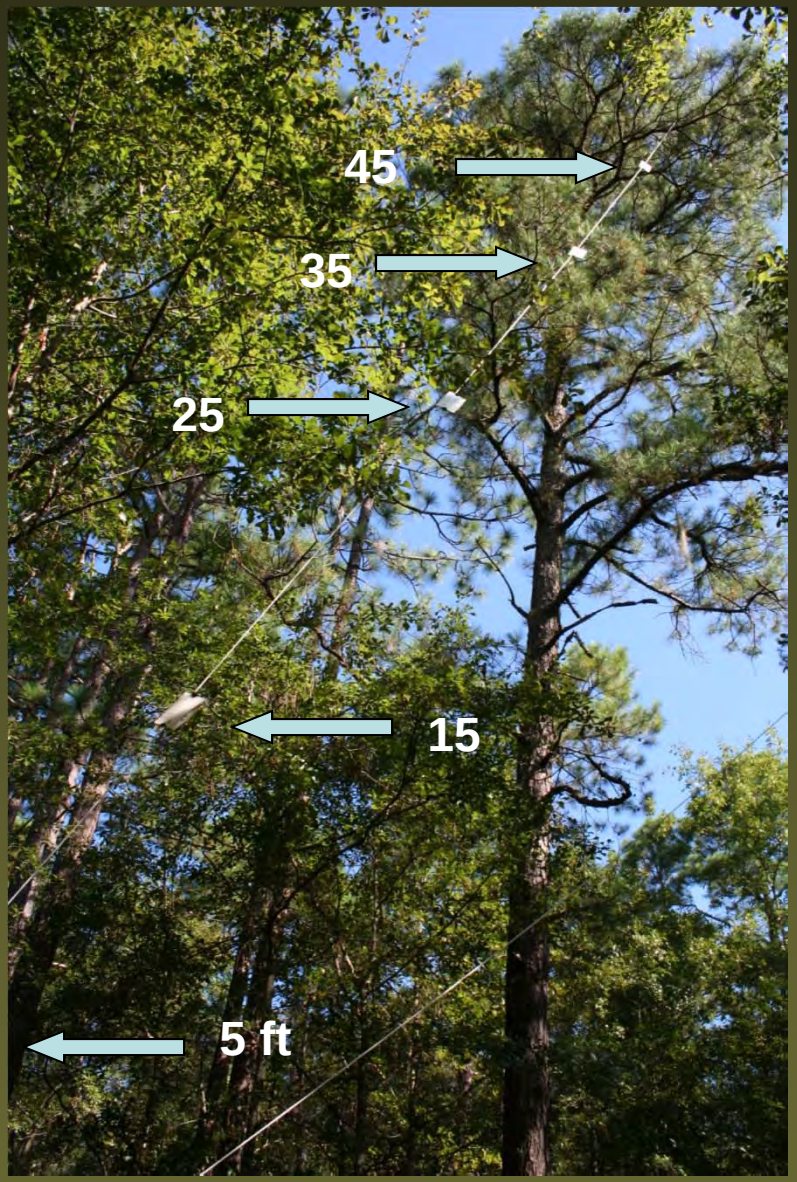
Manuka Oil Release Rate - 2009

Only takes one lure.

	Mean *X. glabratus*/trap/day			
No. of 50 mg Baits	**Feb 10 – Mar 11**	**Mar 12 – Apr 8**	**Apr 9 – May 7**	**May 8 – June 3**
0	**0.2a**	**0.2a**	**0.3a**	**0.1a**
1	**3.3b**	**4.0b**	**2.1b**	**2.2b**
2	**1.3ab**	**4.1b**	**2.9b**	**2.3b**
3	**1.2ab**	**3.5b**	**2.5b**	**2.7b**

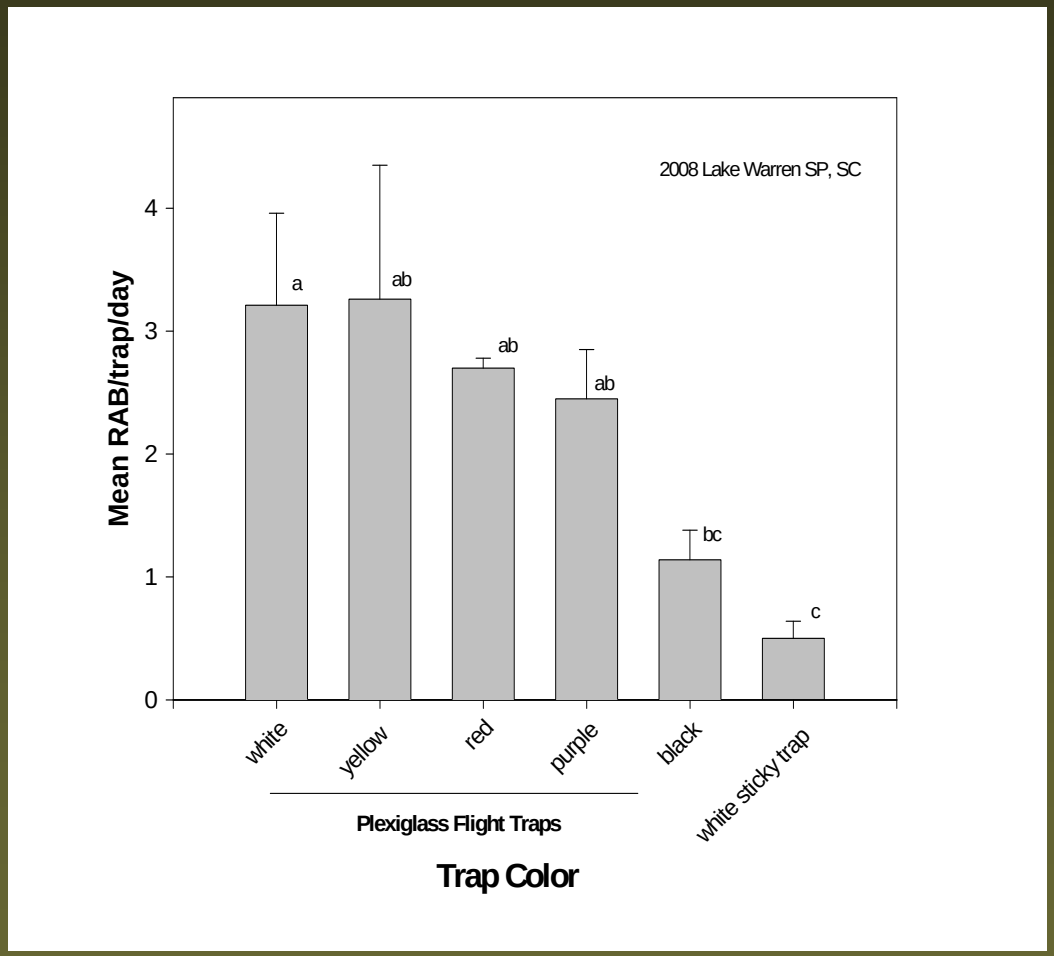
Trap Height – Lake Warren SP, SC 2008





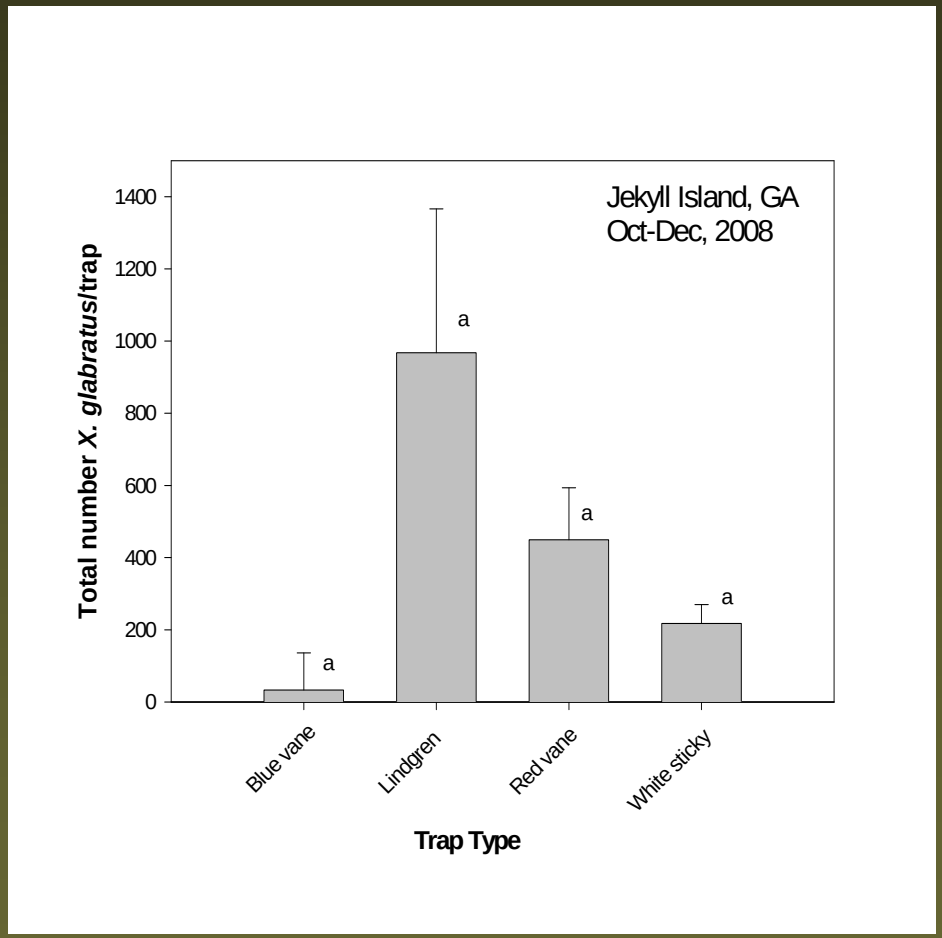
Hanula et al. 2011

Trap Color – Lake Warren SP, SC 2008



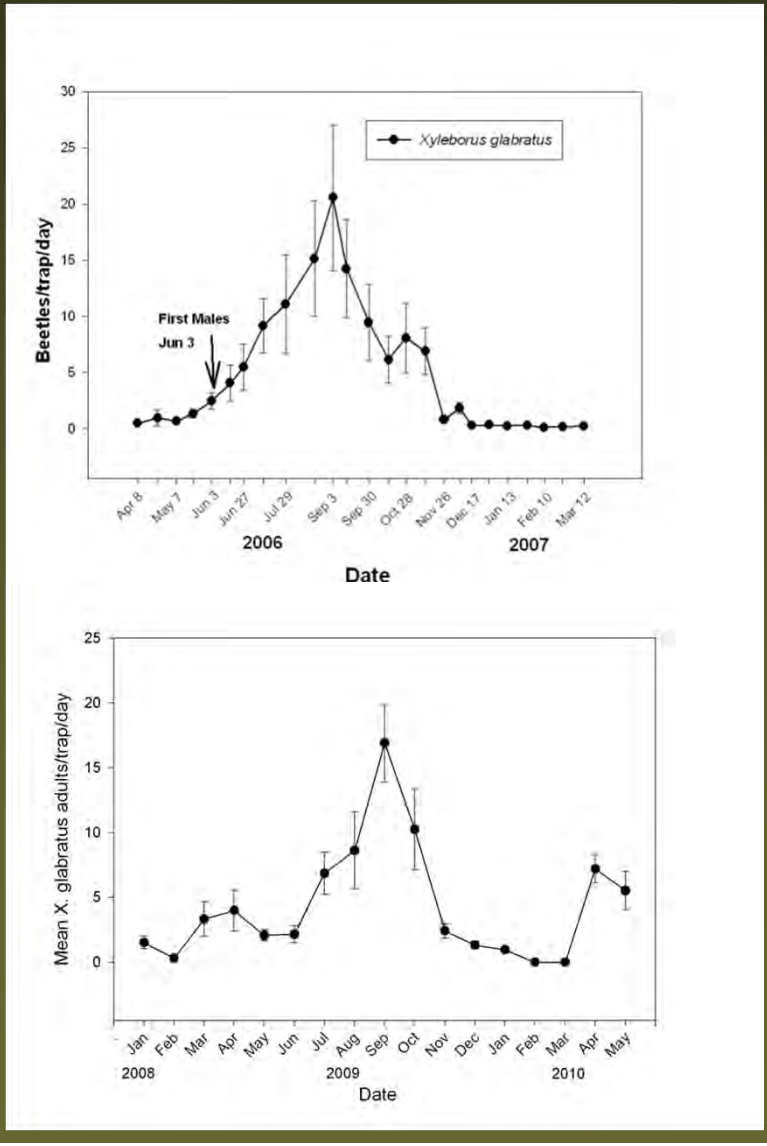
Hanula et al. 2011

Trap Type – Jekyll Island, GA 2008



Hanula et al. 2011

Redbay Ambrosia Beetle Seasonal Flight



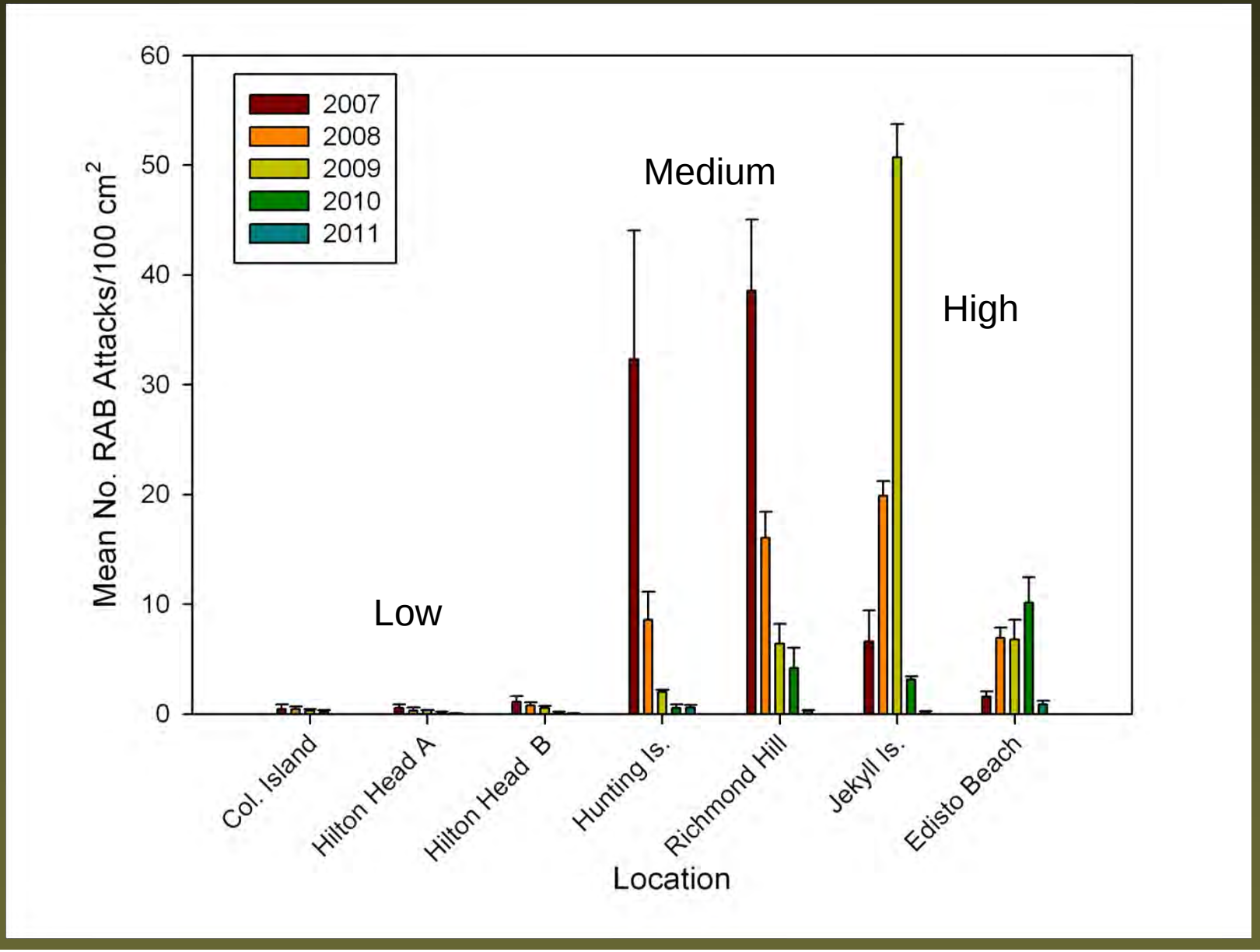
Arrival at dead or dying trees

Traps baited with manuka oil

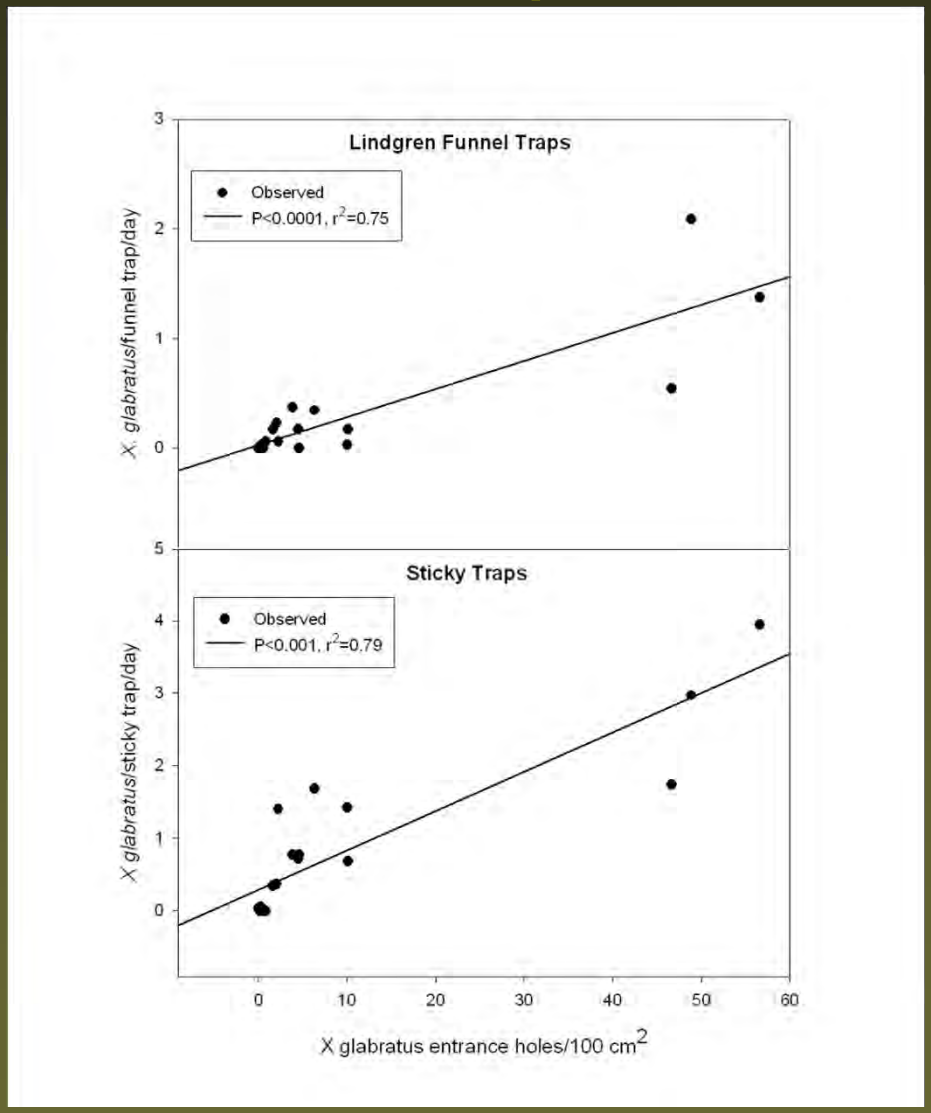
Hanula et al. 2008, 2011

RAB Population Trends

Number of RAB Entrance Holes



Lindgren vs. Sticky Traps for Population Monitoring



Hanula et al. 2011

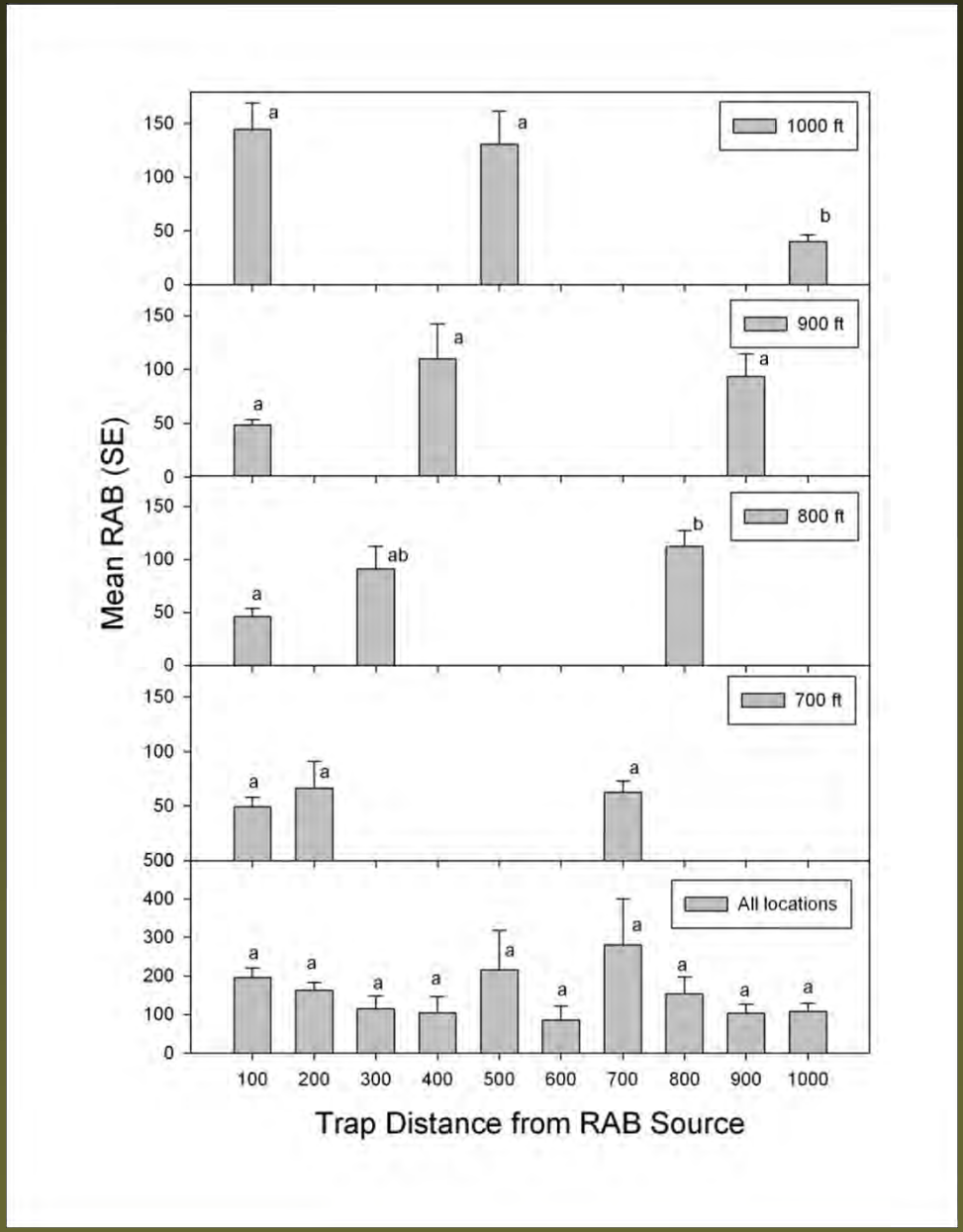
RAB Trapping Distance Study 2011

RAB Trapping Distance Study 2011

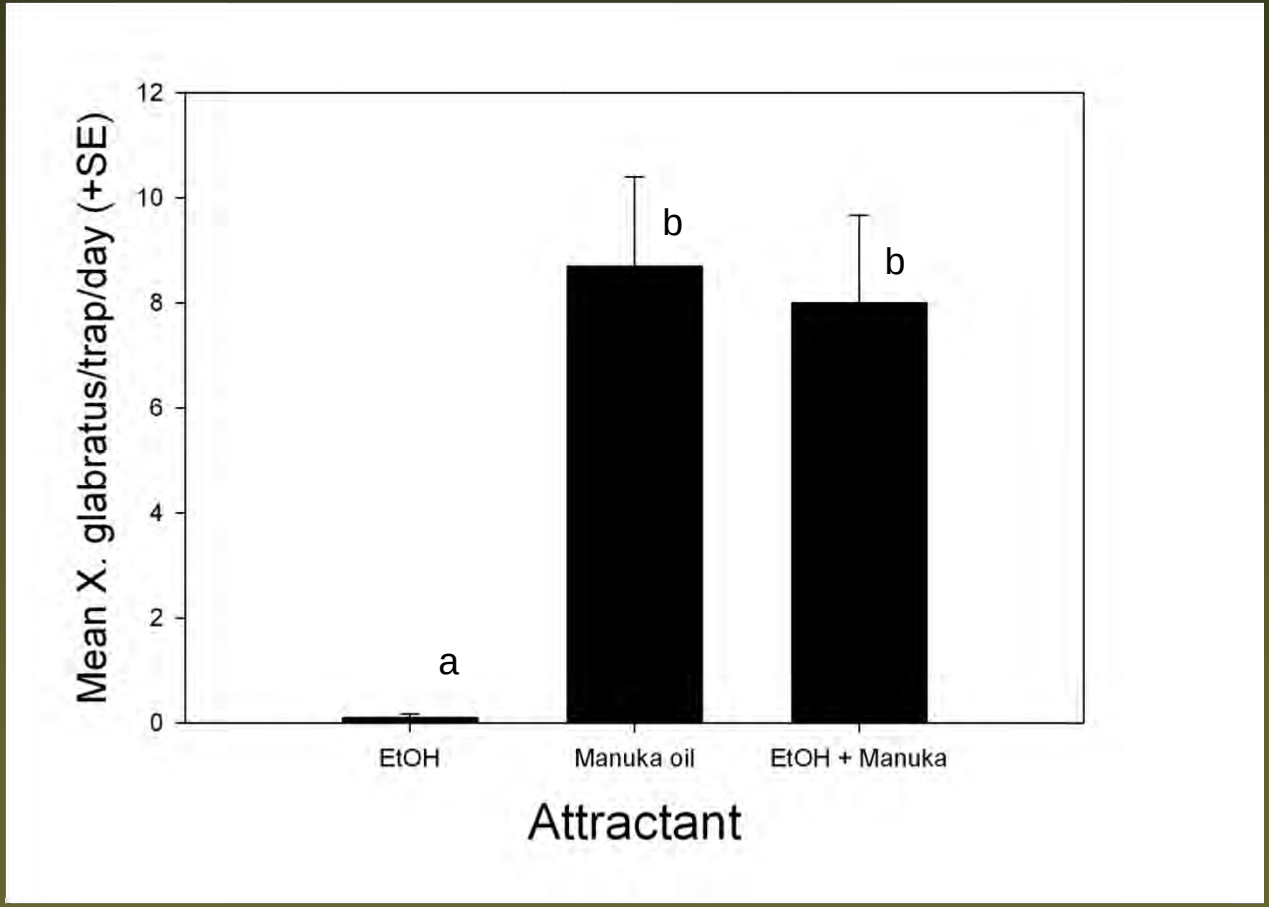
Traps at 1000 ft caught fewer than those at 100 and 500 ft.

Traps at 800 ft caught more than those at 100 and 300 ft.

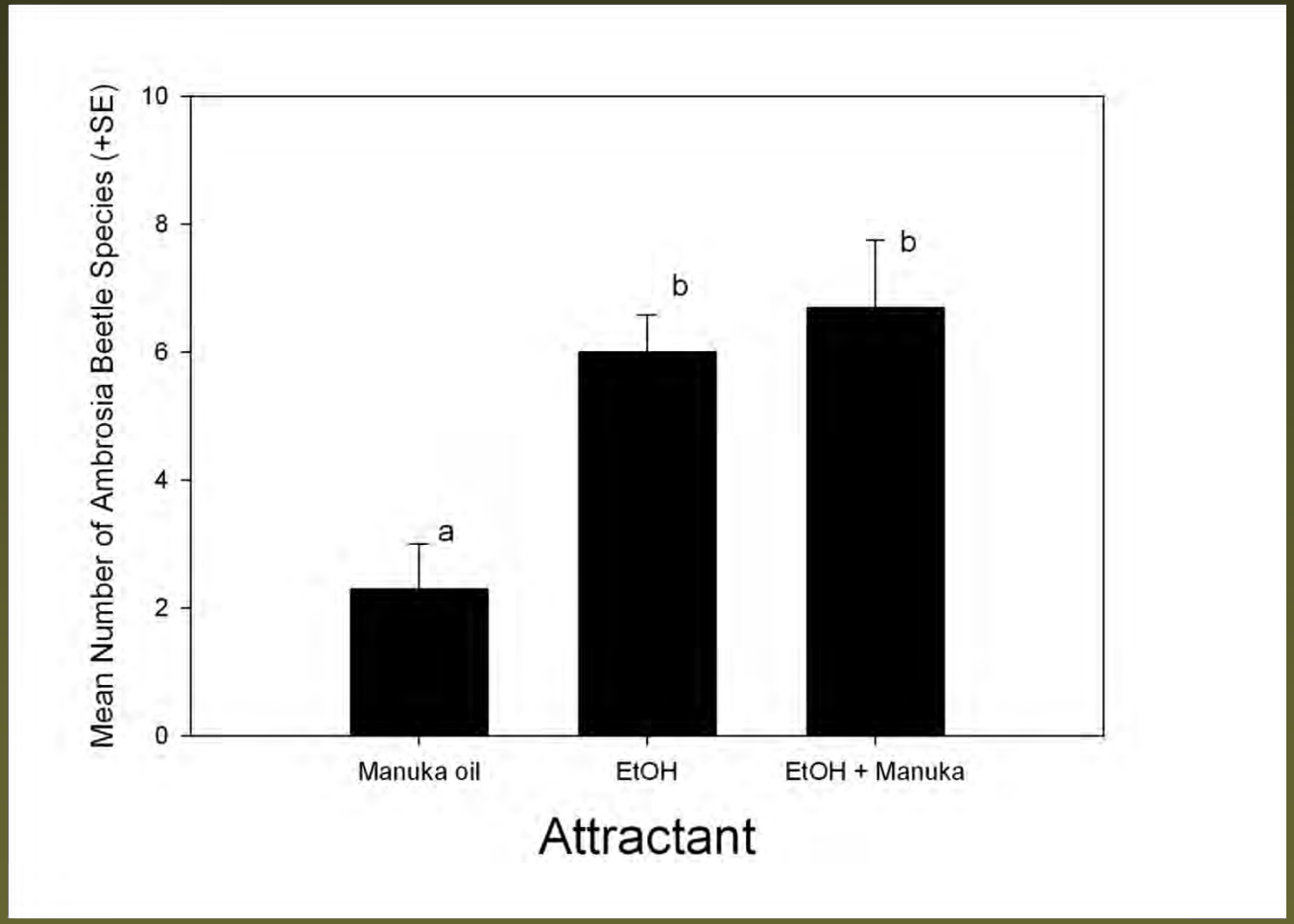
There were no differences in RAB captures when traps were located at every position throughout the grid.



Manuka Oil and Ethyl Alcohol



Does Manuka Oil Inhibit or Attract Other Ambrosia Beetles?



X. glabratus Attractants and Traps

- Essential oils extracted from manuka shrubs and phoebe trees are as attractive as redbay wood.
- α-Copaene is the likely attractive compound but is not available in large quantities.
- 8-unit Lindgren funnel traps baited with one 50mg/day manuka oil lure works as well as redbay wood.
- Traps 1 m above the ground are most effective
- Manuka oil can be combined with ethanol without reducing the number of species of ambrosia beetles caught.

Monitoring Redbay Ambrosia Beetle