# Vector Ecology and Lateral transfer

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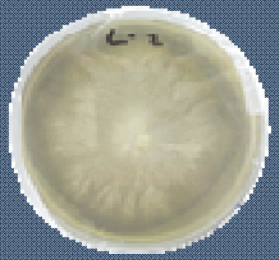
Tropical Research and Education Center

# Ambrosia beetles = fungal farmers

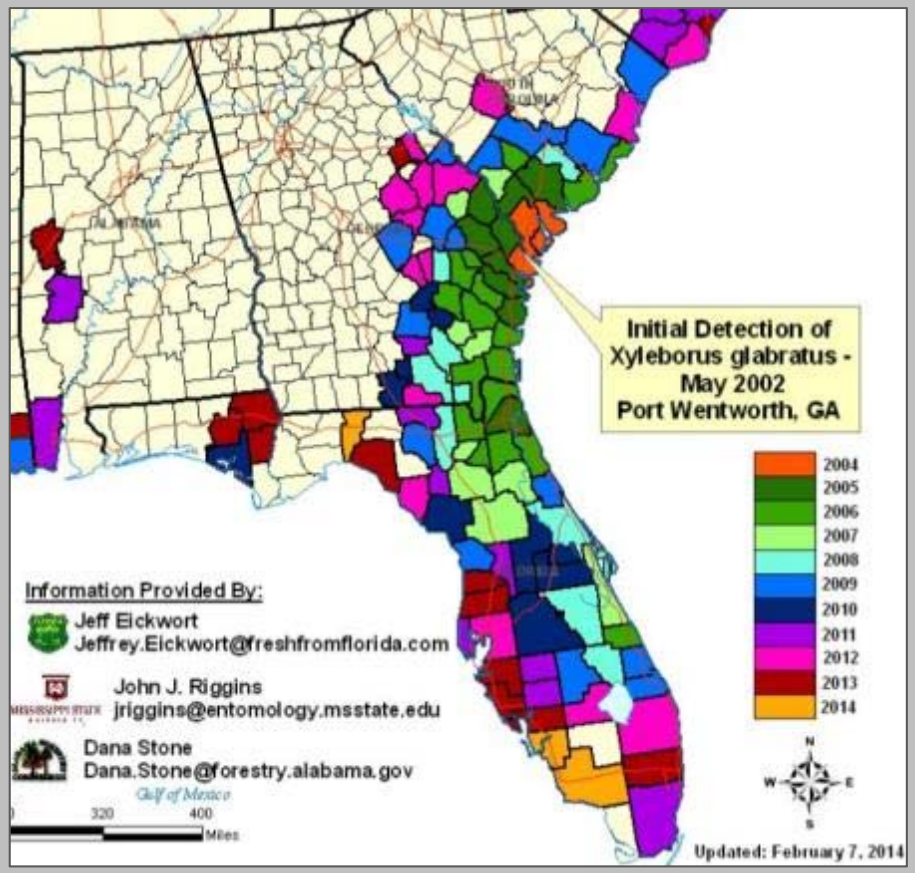
# Ambrosia fungi=usually saprobes but some are plant pathogens

# Vector= carries and transmits an infectious pathogen to another living organism

*Xyleborus glabratus*



*Raffaelea lauricola*



- 2010 1st RAB in Miami Dade
- Feb 2012, 1st avocado diagnosed with LW

# AMBROSIA BEETLES (COLEOPTERA: CURCULIONIDAE: SCOLYTINAE) THAT BREED IN AVOCADO WOOD IN FLORIDA

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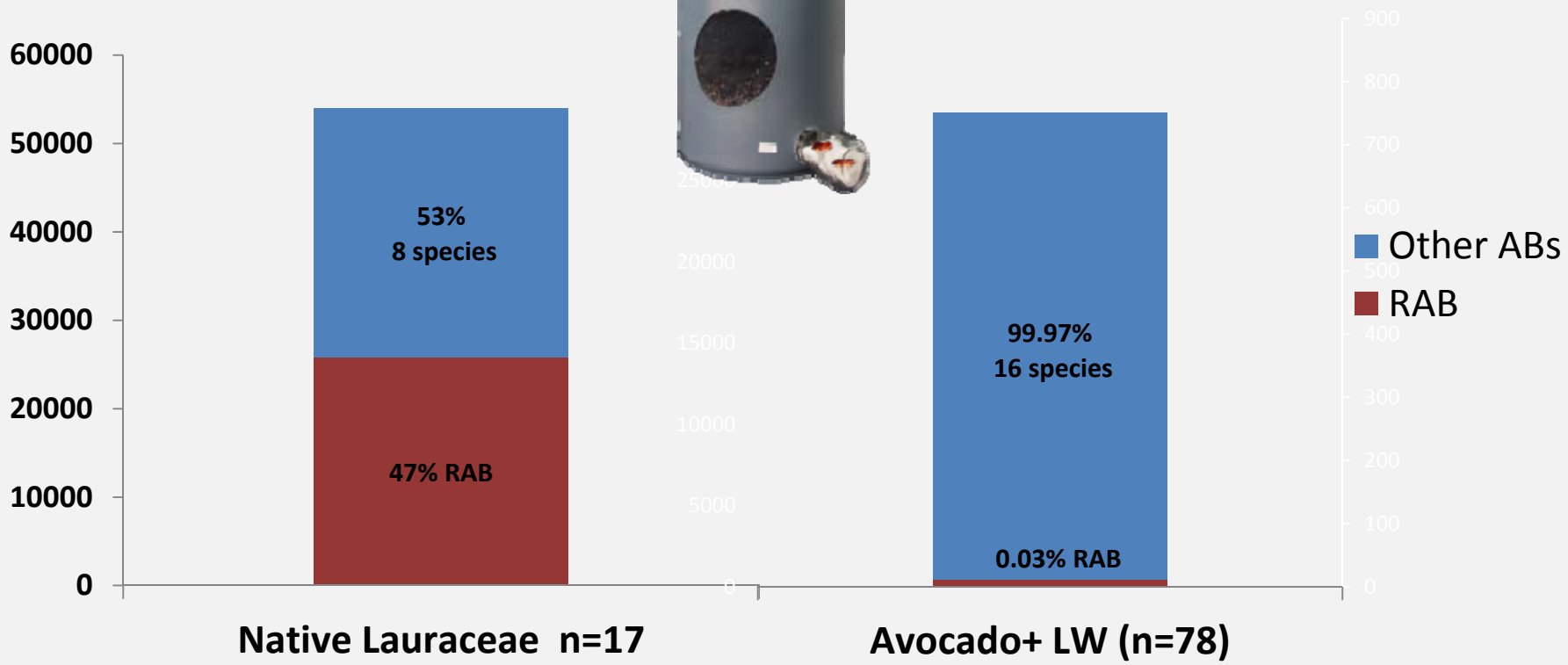


**commercial avocados**
**Complex of 16 spp.**
**no *X. glabratus***

# Trapping

## Commercial Avocados

- 6 RAB individuals total in 5 yrs trapping (FDACS)

## Native Hosts

- 50-200 RAB individuals/ trap/week

# June 2015
# 9000 destroyed trees (1% industry)

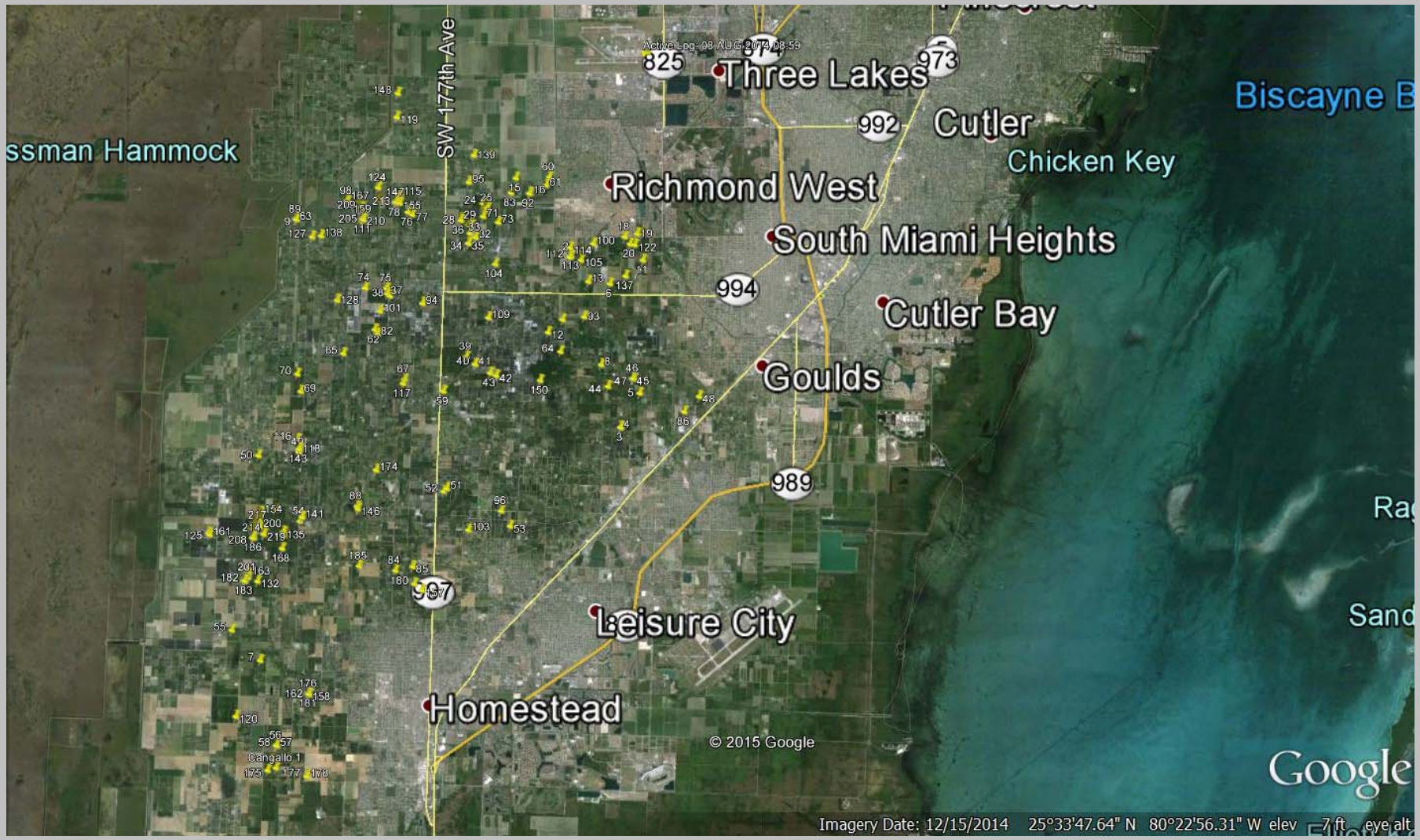
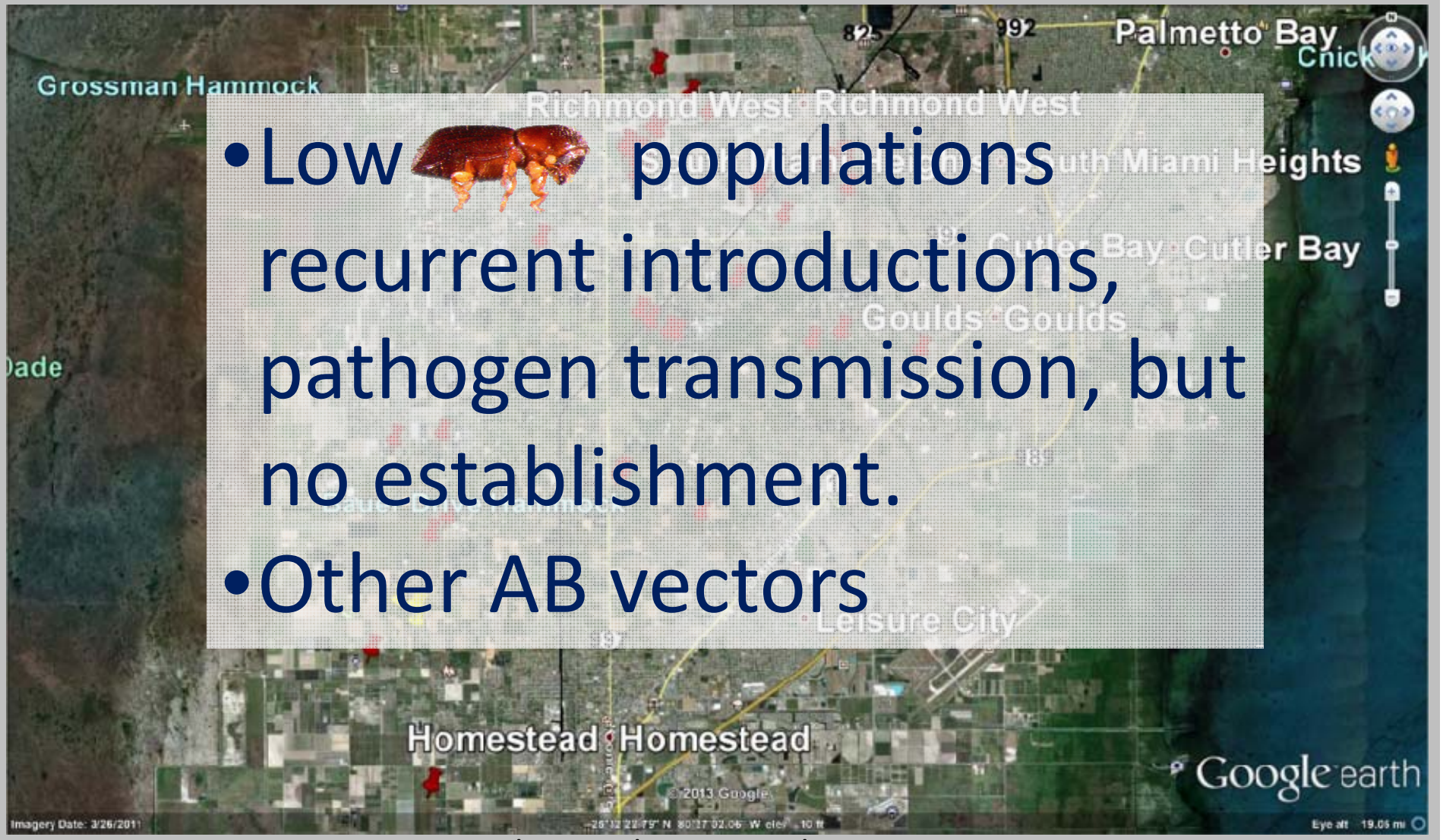



Image by D. Pybas, Avocado Committee

# How is LW Spreading in commercial Avocados?




- Low populations recurrent introductions, pathogen transmission, but no establishment.
- Other AB vectors

Image by D. Pybas, Avocado Committee

**Can they carry RL?**
**Can they transmit RL?**

*Plant Pathology* (2014) **63**, 54–62 Doi: 10.1111/ppa.12073

**Lateral transfer of a phytopathogenic symbiont among native and exotic ambrosia beetles**

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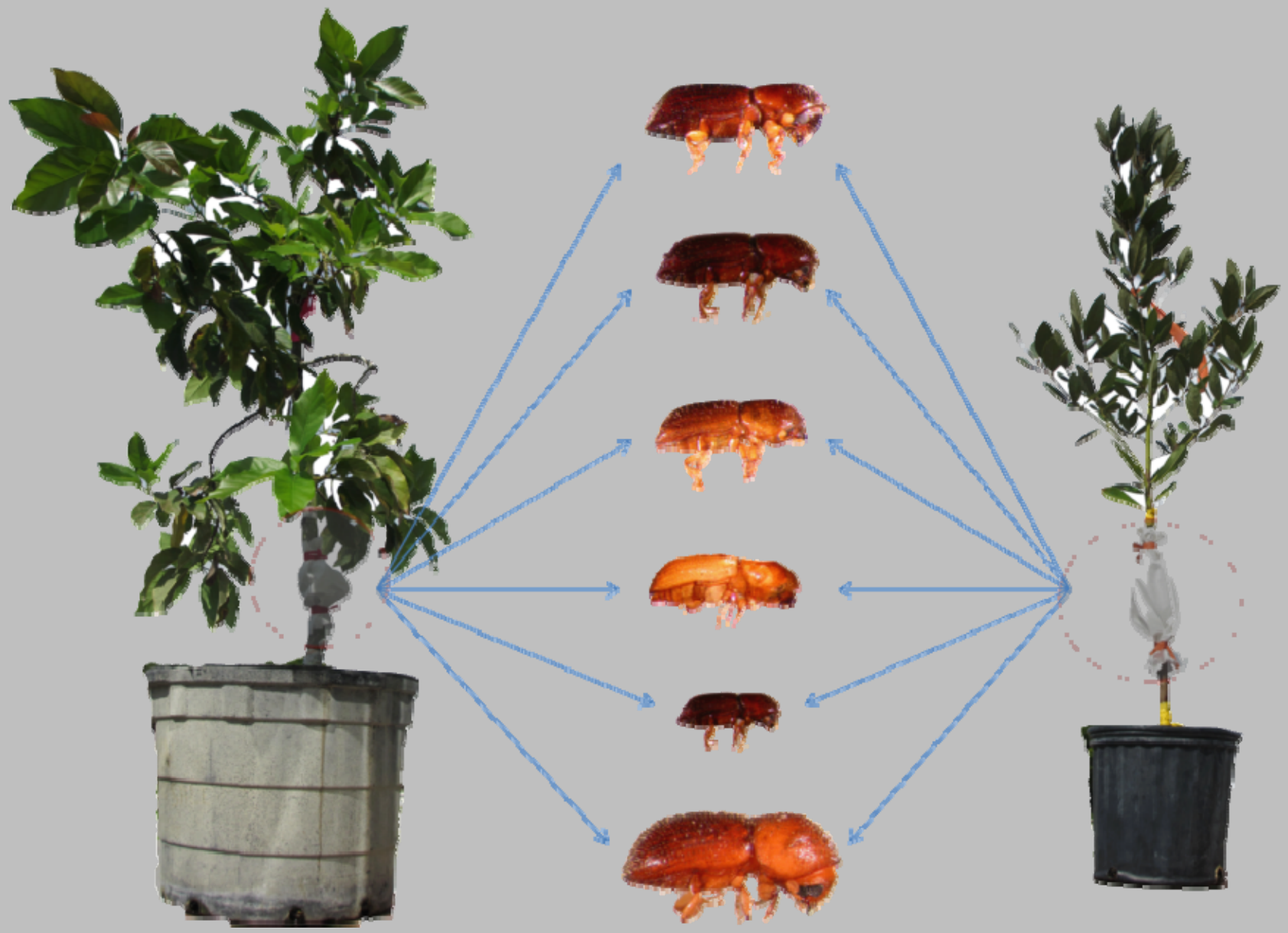
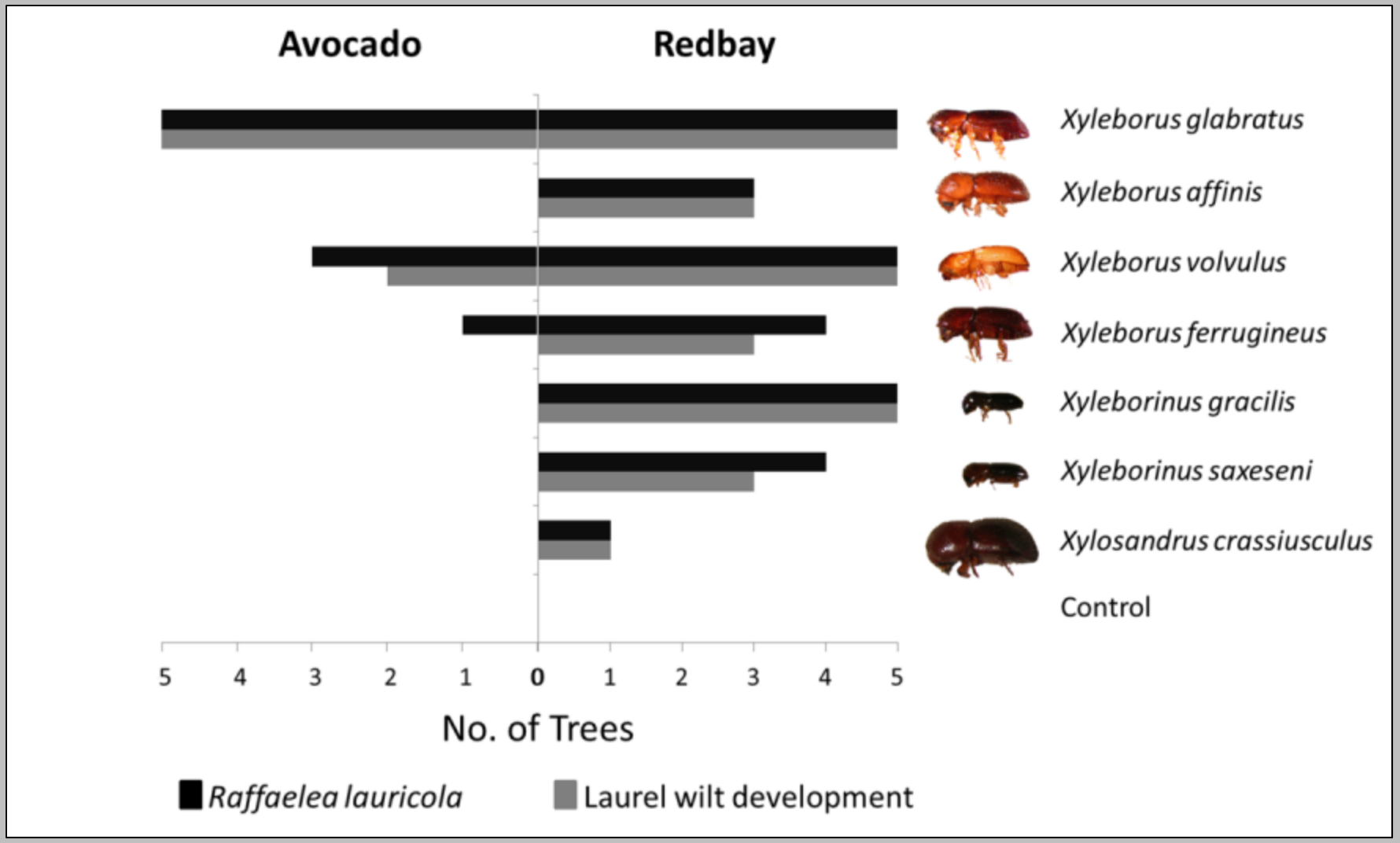
| species | n= | No. beetles carrying *R. lauricola* | probability of a beetle carrying *R. lauricola* | CFUs Mean ± SEM | CFU Range |
|---|---|---|---|---|---|
| *Xyleborus glabratus* | 50 | 43 | 0.86 a | 2783.3 ± 281.9 a | 0 - 7800 |
| *Xyleborus affinis* | 41 | 5 | 0.12 c | 1 ± 0.6 c | 0 - 20 |
| *Xyleborus volvulus* | 39 | 20 | 0.51 b | 28.4 ± 10.6 b | 0 - 100 |
| *Xyleborus ferrugineus* | 118 | 70 | 0.59 b | 33 ± 7.4 b | 0 - 118 |
| *Xyleborinus gracilis* | 52 | 26 | 0.50 b | 100.6 ± 34 b | 0 - 1240 |
| *Xyleborinus saxeseni* | 68 | 2 | 0.03 c | 1.5 ± 1 c | 0 - 60 |
| *Xylosandrus crassiusculus* | 39 | 1 | 0.03 c | 2.6 ± 2.6 c | 0 - 100 |
| *Ambrosiodmus devexulus* | 25 | 0 | - | - | - |
| *Ambrosiodmus lecontei* | 41 | 0 | - | - | - |

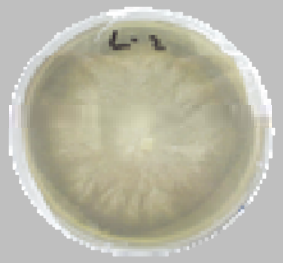
# Controlled infestations



# Controlled infestations



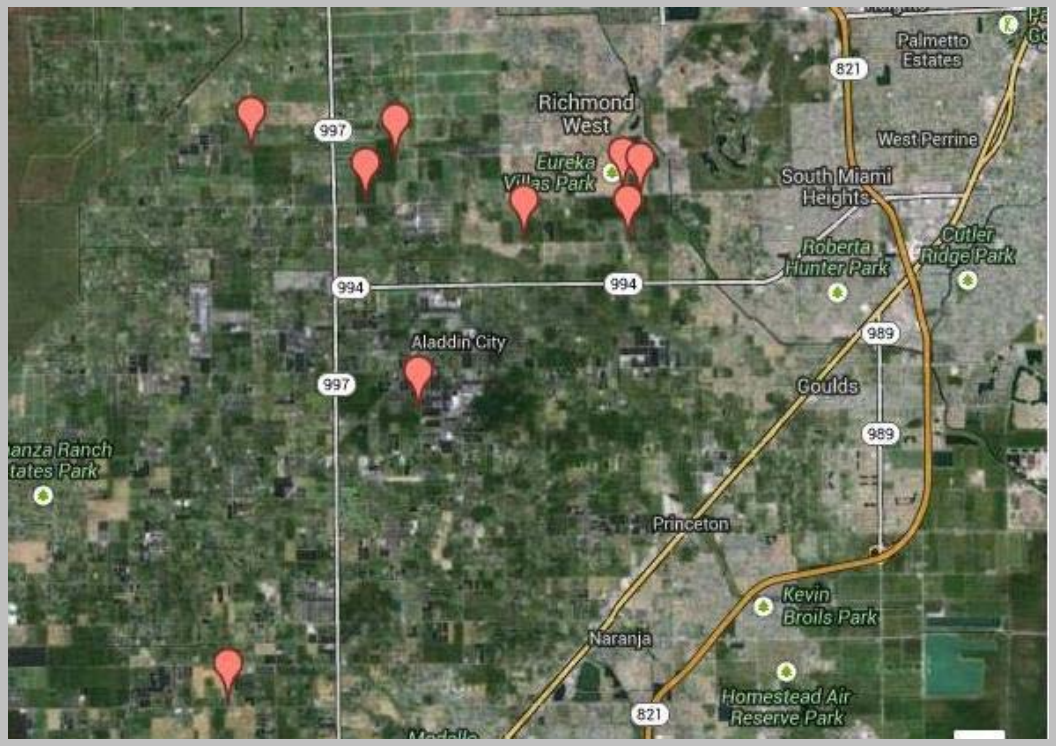
# Summary



- ~8 beetle species associated with LW infected trees
- Horizontal (Lateral) transmission of *R. lauricola*
- Resident ambrosia beetles can carry *R. lauricola*
- Some can transmit *R. lauricola* to healthy trees

# Trapping AB in LW-affected avocado groves

**12 groves-120 traps- Funded by the Avocado Committee**



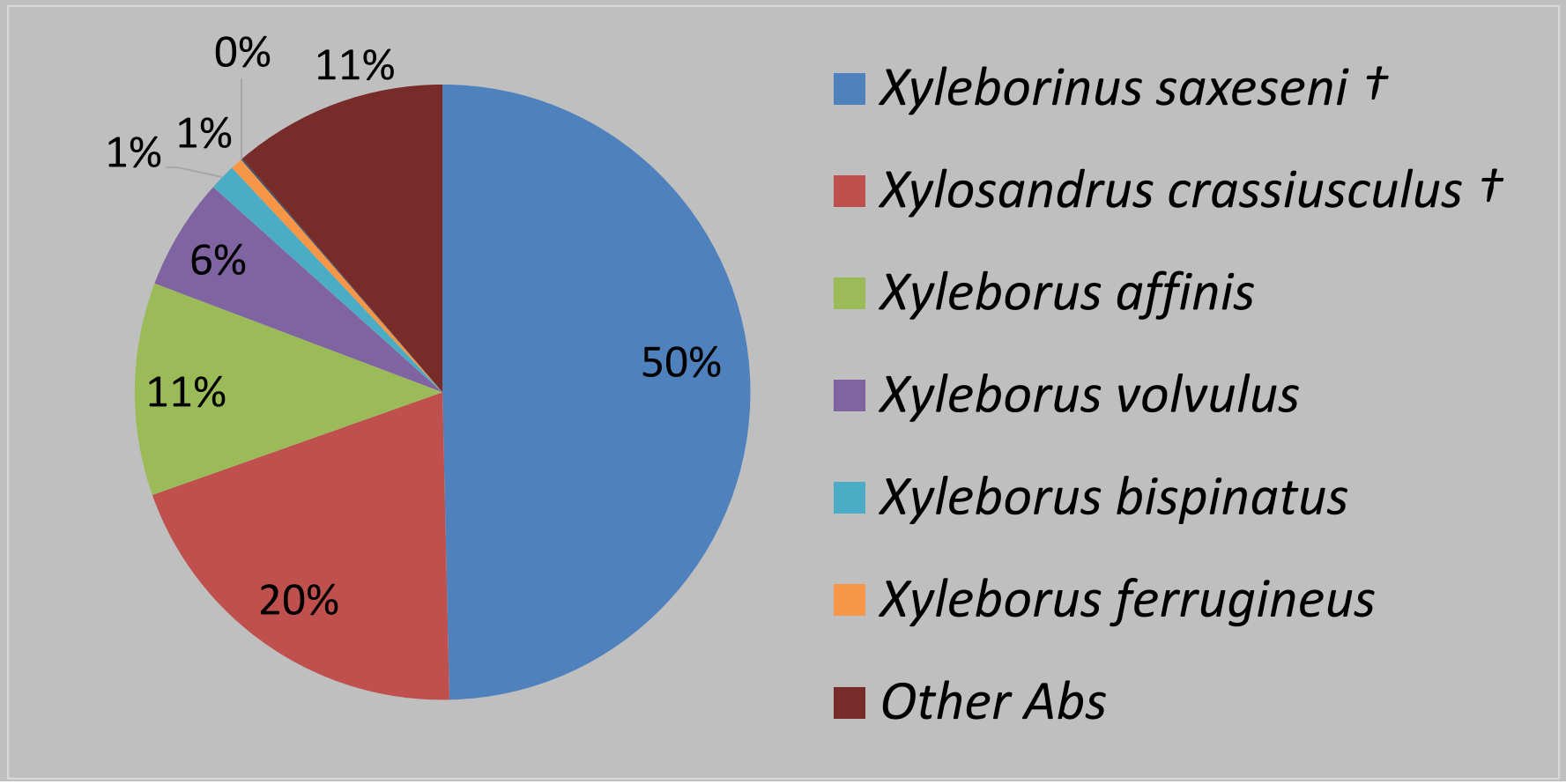
**Goals:**

1. Clarify the situation with *X. glabratus*
2. Learn about ABs associated with avocados in south Florida.

# Trapping ABs in avocado

Beetles captured in 1 yr : **176,562**

*Xyleborus glabratus* = RAB = 0



# Assays with ABs associated with LW affected avocados

| Species | Avocado logs | | | | | From Traps | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n= | No. carrying R. lauricola | % of beetles carrying R. lauricola | CFU mean ± SEM | CFU range | n= | No. carrying R. lauricola | % of beetles carrying R. lauricola | CFU mean ± SEM | CFU range |
| *Xyleborus glabratus* | 0 | n/a | n/a | n/a | n/a | 0 | n/a | n/a | n/a | n/a |
| *Xyleborus affinis* | 16 | 0 | - | - | - | 69 | 1 | 1.4 | 2.9 ± 2.9 | 0 |
| *Xyleborus bispinatus* | 5 | 5 | 100 | 40.8 ± 16.1 | 40-80 | 35 | 6 | 17.1 | 4.7 ± 2.3 | 0 - 2 |
| *Xyleborus ferrugineus* | 2 | 2 | 100 | 5 ± 1 | 4 - 6 | 2 | 1 | 50 | 50 ± 50 | 0 - 100 |
| *Xyleborus volvulus* | 53 | 10 | 19 | 30.0 ± 21.8 | 0 - 1140 | 117 | 3 | 2.6 | 0.4 ± 0.2 | 0 - 20 |
| *Xylosandrus crassiusculus* | 24 | 1 | 4 | 15 ± 15 | 0 - 360 | 88 | 1 | 1.1 | 616 ± 616 | 0-54200 |
| *Xyleborinus saxeseni* | 51 | 0 | - | - | - | 182 | 4 | 2.2 | 2.4 ± 1.6 | 0 - 200 |
| *Xyleborinus gracilis* | 10 | 0 | - | - | - | 3 | - | - | - | - |

# Summary

## Natural areas

*Xyleborus glabratus*

## Commercial Avocados

*Xyleborus affinis*

*Xyleborus volvulus*

*Xyleborus ferrugineus*

*Xyleborinus gracilis*

*Xyleborinus saxeseni*

*Xylosandrus crassiusculus*

# Next:
# ABs generally attack stressed trees

*Xyleborus affinis*

*Xyleborus volvulus*

*Xyleborus ferrugineus*

*Xyleborinus gracilis*

*Xyleborinus saxeseni*

*Xylosandrus crassiusculus*

Ethanol

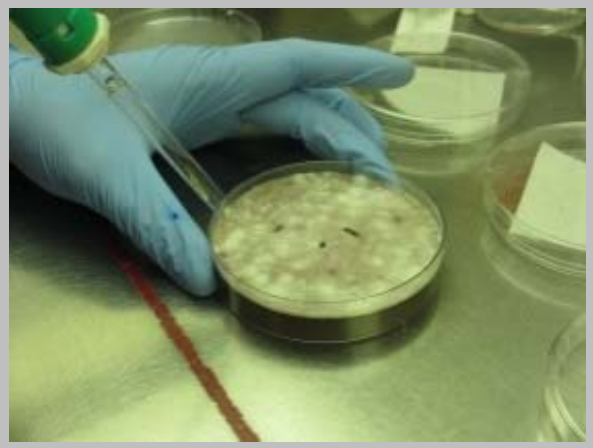
**Characterize symbiotic association between *R. lauricola* and alternative vectors**

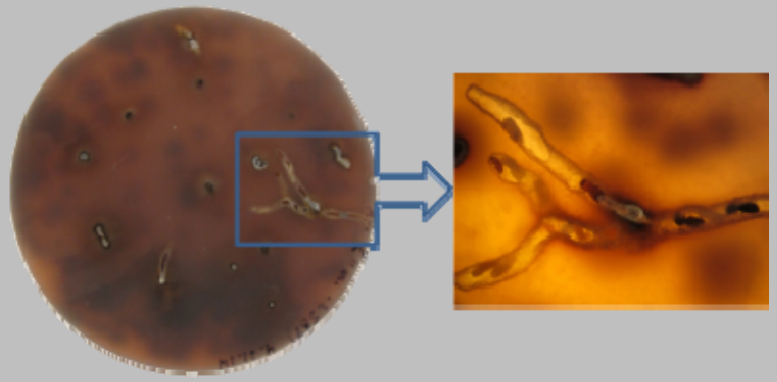
# Beetle-fungi functional relationships?

**nutritional symbiont**
**carried passively**
**contaminants**

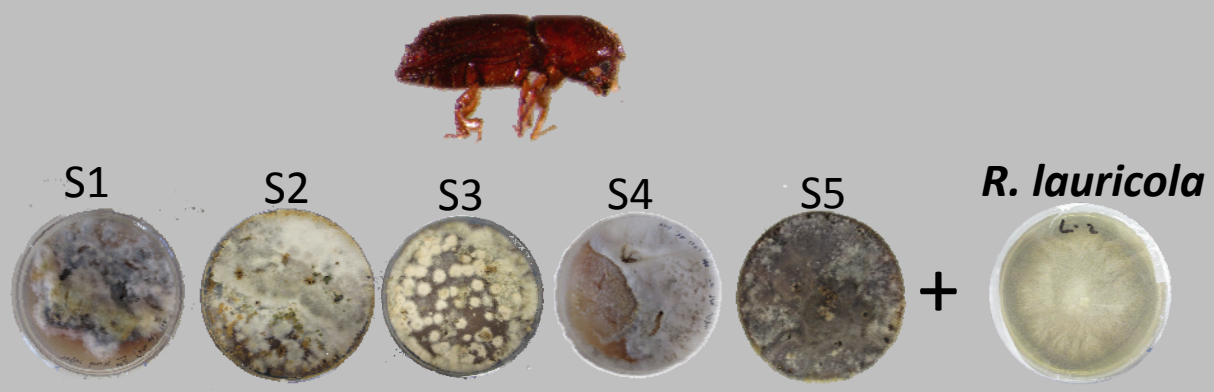
# Artificial colonies

# Symbiont-free (gnotobiotic) beetles exposed to symbionts in a no-choice condition.





**role of microbial community on the acquisition and transmission of R. lauricola.**




# Tactics to exclude *R. lauricola* from microbial communities associated with alternative vectors.

Acknowledgements

Avocado growers

Florida Avocado Committee

Florida Department of Agriculture

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