A close-up photograph of a tree trunk showing significant damage from the Ambrosia Beetle and Fusarium complex. The bark is dark, rough, and cracked, with several vertical and horizontal wounds. These wounds are filled with a light-colored, powdery substance, likely fungal growth or beetle frass. The background is blurred, showing more of the tree and some green foliage.

# Update on the Ambrosia Beetle – Fusarium complex

Michele Eatough Jones  
Tim Paine

Department of Entomology  
University of California  
Riverside, CA

John Kabashima  
UC Cooperative Extension, Orange & L.A.  
County



# *Euwallacea* species

## ***The vector beetle:***

- The beetle is a new *Euwallacea* species relative of the tea shot hole borer (an exotic Asian ambrosia beetle).
- It is very small and difficult to see.
- The beetle holes penetrate approximately 0.4-1.57 inch into the wood and there are often many entry/exit holes on an infested tree.
- Females are black colored and about 0.07-0.1 inch long,
- Males are brown colored and about 0.05 inch long.
- The entry hole on avocado is about 0.033 inch wide.



Photos: Richard Stouthamer





Photo by G. Arakelian

- Mated female bores into tree, creates galleries
- Galleries are infected with symbiotic fungus
- Fungus grows on gallery walls and spreads through the tree

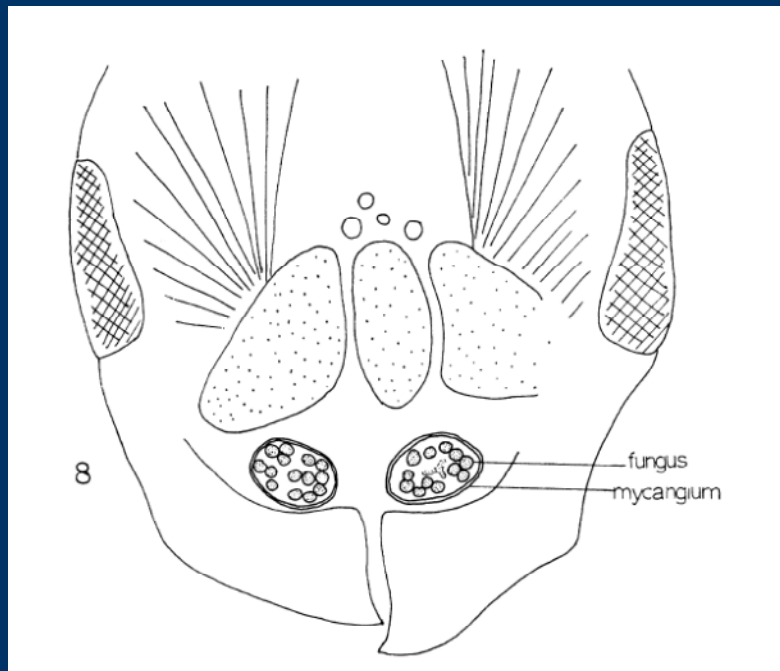


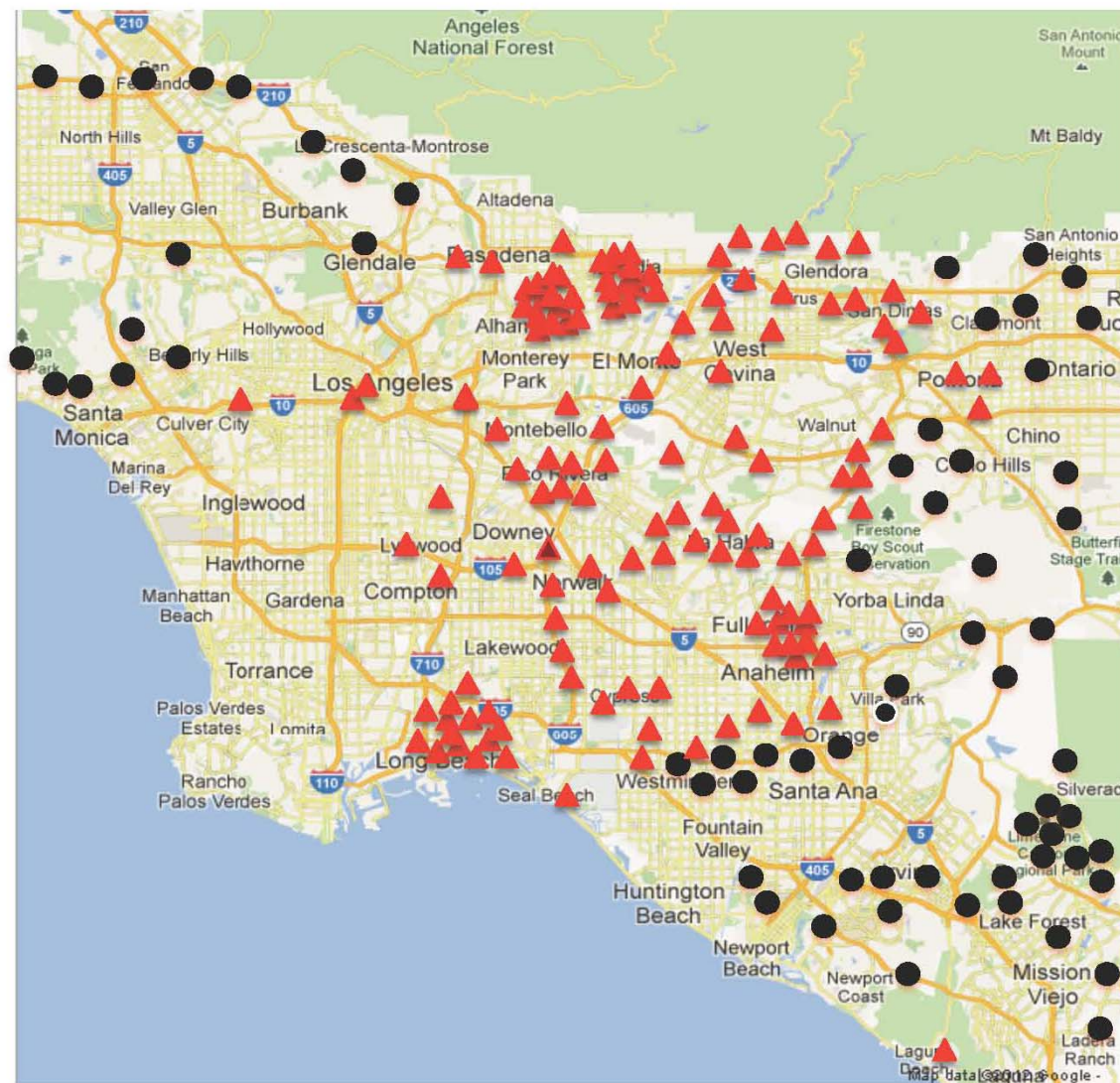
Photo: Richard Stouthamer

# *Euwallacea* sp

- First detected in CA in 2003 in Whittier Narrows
- Caused death of large number of Box Elder street trees in Long Beach in 2010
- February 2012: Akif Eskalen found it on a backyard avocado in South Gate
  - Widely spread in LA Co. and parts of Orange Co.
  - Attacks many host tree species

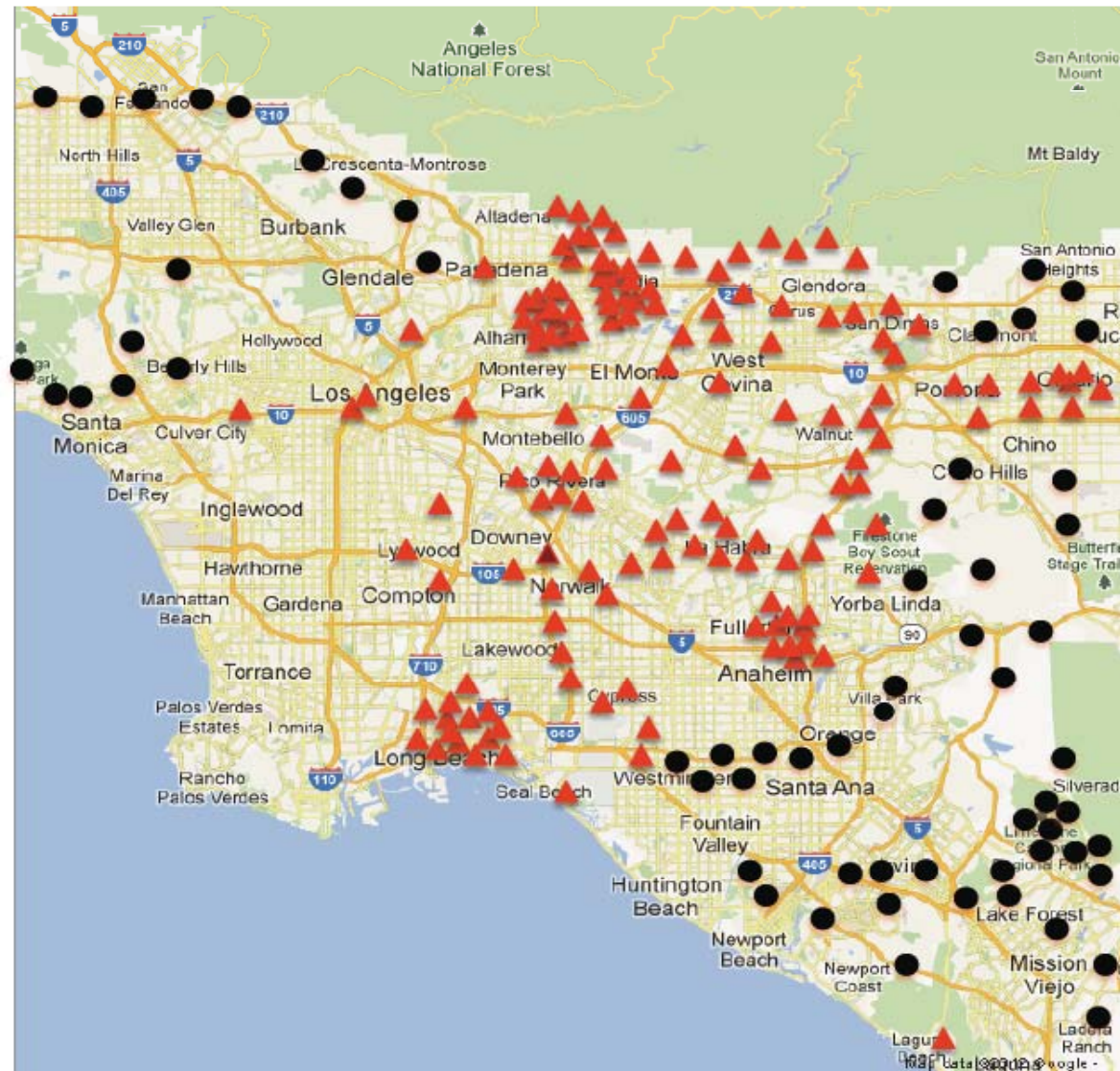


# Known distribution of *Fusarium* dieback/ Polyphagous shot hole borer in southern California 10/31/2012



- ▲ Positive finding *Fusarium* sp./Polyphagous Shot Hole Borer
- Negative-*Fusarium* sp./Polyphagous Shot Hole Borer

# Known distribution of *Fusarium* dieback/ Polyphagous shot hole borer in southern California 12/17/2012



- ▲ Positive finding *Fusarium* sp./Polyphagous Shot Hole Borer
- Negative-*Fusarium* sp./Polyphagous Shot Hole Borer



# *Euwallacea fornicatus*-like sp.

- Where does the beetle come from?
  - Probably South East Asia, possibly Africa
  - Also an invasive species in Israel causing extensive damage to Avocado
- Beetle identity: Morphologically *E. fornicatus*
  - Based on DNA evidence it is another species
  - Suggested common name Polyphagous Shot Hole Borer
- California and Israeli form of beetle identical and different from the tea infesting form from Sri Lanka (original collection site of *E. fornicatus*).

# Beetle Life Cycle

- Sex ratio offspring very female biased, brothers mate with sisters in galleries and mated females leave the galleries to create their own galleries for offspring production
- Lifestyle leaves very few ways to combat the beetle. Single mated female can initiate new population



PSHB/*Fusarium* sp. complex in sample of tree species found in the botanical gardens found in a heavily infested part of Los Angeles County.

	# tree species	% of all sp	% of sp attacked
Total Number	335		
Attacked by PSHB	207	62	
Hosts for <i>Fusarium</i> sp	112	33	54
Weeping spots on bark	147	44	71
Powder depositions	22	7	11
Gumming on bark	69	20	33
Reproductive Hosts	19	6	9

From A. Eskalen, R. Stouthamer, S.C. Lynch, P. Rugman-Jones, M. Twizeyimana, A. Gonzalez, T. Thibault (submitted). Host Range of fusarium dieback and its ambrosia beetle (Coleoptera: Scolytinae) vector in southern California.

## Number of tree species specimens susceptible to PSHB in the southern Californian urban forest.

Estimations were made using a representative tree species list  
(City of Orange, 1999)

	Number of species
Total species	103
Attacked by PSHB	53
Host for fungus	36
Host for reproduction	6

From A. Eskalen, R. Stouthamer, S.C. Lynch, P. Rugman-Jones, M. Twizeyimana, A. Gonzalez, T. Thibault (submitted). Host Range of fusarium dieback and its ambrosia beetle (Coleoptera: Scolytinae) vector in southern California.



# Trees that host fungus and support beetle reproduction

- Mild: branch dieback
- Severe: tree death
- Known hosts
  - Castor bean
  - Box elder
  - Coast live oak
  - Avocado
  - Sycamore



Richard Stouthamer and Akif Eskalen

## *Known Reproductive Hosts (22):*

- Box *styraciflua*),
- Silk Tree (*Albizia julibrissin*),
- Coral tree (*Erythrina corallodendron*),
- Titoki (*Alectryon excelsus*),
- Blue palo verde (*Parkinsonia florida*),
- Palo verde (*Cercidium floridium*),
- Tortuosa (*Salix matsudana*),
- Weeping willow (*Salix babylonica*),
- Red Willow (*Salix laevigata*)
- Trident maple (*Acer buergerianum*),
- Japanese maple (*Acer palmatum*),
- Evergreen Maple (*Acer paxii*),
- Chinese holly (*Ilex cornuta*),
- Brea (*Cercidium sonora*),
- Black bean (*Castanospermum australe*),
- Camelia (*Camelia semiserrata*)



# Trees that host fungus but not beetle reproduction

- We do not know the final outcome of this interaction
  - Often leakage of xylem fluid noticed on trunk and branches:
  - May cause dieback of branches
  - Maybe tree will be OK



# Castor Bean



Photos: Akif Eskalan



# Coast Live Oak



Photos: Richard Stouthamer



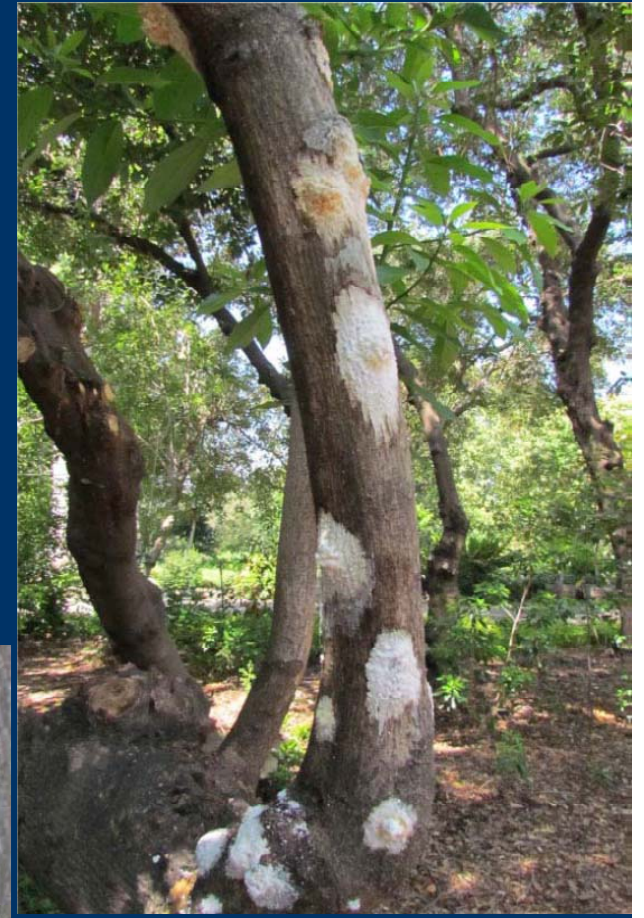
# Box Elder



Photos: Richard Stouthamer



# Avocado



Photos: Richard Stouthamer

# Ambrosia Beetles are difficult to control

- Generally only short time outside the tree
- Attract Sex pheromones- No
- Aggregation pheromone No



## *What to do:*

- Certain plant species appear to be a preferred host for the beetle such as
  - box elder,
  - castor bean,
  - English oak,
  - sycamore,
  - liquidambar,
  - goldenrain tree and
  - coast live oak.

## *What to do:*

- If such plants are present close to avocado groves, inspect them for evidence of the presence or damage by the beetles.
- The highest beetle exit/entry holes density is found at the base of the plant. If no beetle holes are present, it may be a good idea to remove the plants.

## *What to do:*

- Look for a single entry/exit holes with surrounding white powdery exudate on avocado. The symptoms may be different on different hosts such as different levels of staining and/or gumming.





## *What to do:*

- Scrape off the bark layer around the infected area to look for necrotic tissue.
- Follow the gallery to look for the discolored necrosis caused by the fungus.



# Cultural Control and Sanitation

- Tree removal
- Treatment of slash and debris
- Chipping or grinding
- Solarization and composting
- Firewood movement





# Chemical Control

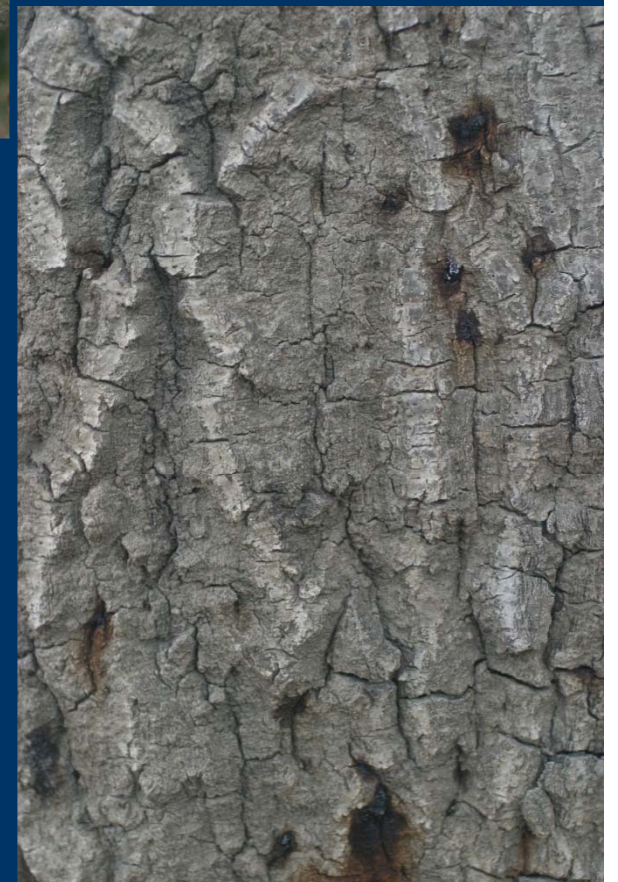
- Insecticides and bark beetles – getting the material to the target
- Systemic insecticides – new materials and delivery, injections or drenches
- Contact insecticides – barrier sprays
- Value of trees and cost of treatments



UC Statewide IPM Project  
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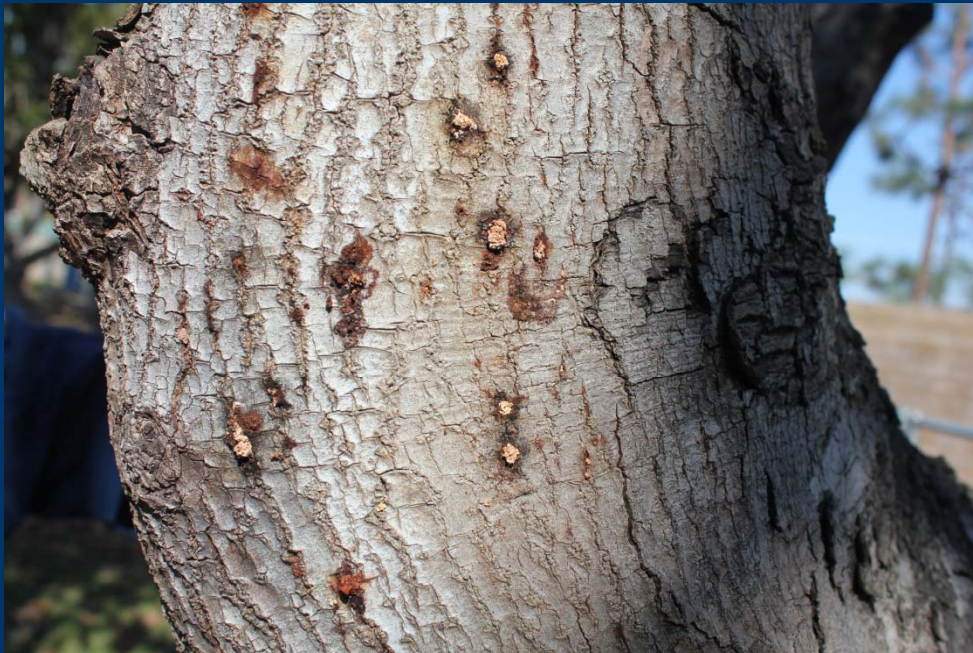


# Field Monitoring





# Identification of Symptomatic Trees





# Firewood movement



UGA5039049

Joseph O'Brien, USDA Forest Service, Bugwood.org



# Chipping

- < 1 inch
- 1-2 inch
- >2 inch
- Control, trunk sections

Box elder (Nov 6)

Oak (mid-October)





# Chipping

- Oak
  - No emergence
  - No activity in buckets
- Box elder
  - Emergence: 2 beetles from trunk
  - Control: many spots of beetle activity
  - 1-2 activity spots in coarse
  - No activity medium and fine



# Pesticide Trials

Name	Active	Method	Equipment
Merit 75 WP	Imidacloprid	Soil injection	Kioritz injector
Safari 20 SG	Dinotefuran	Trunk spray	Hand sprayer
Arena 50 WDG	Clothianidin	Soil drench	Nalgene bottle
Onyx	bifenthrin	Trunk spray	Hand Sprayer
Control	Untreated		

- All treatments at high label rate
- Treated: Sept 19
- Taken down: Oct 18 (29 days)
- Bucket check: Nov 8 (50 days)
- Count: Nov 27 (69 days)



SAFARI



ONYX



CONTROL



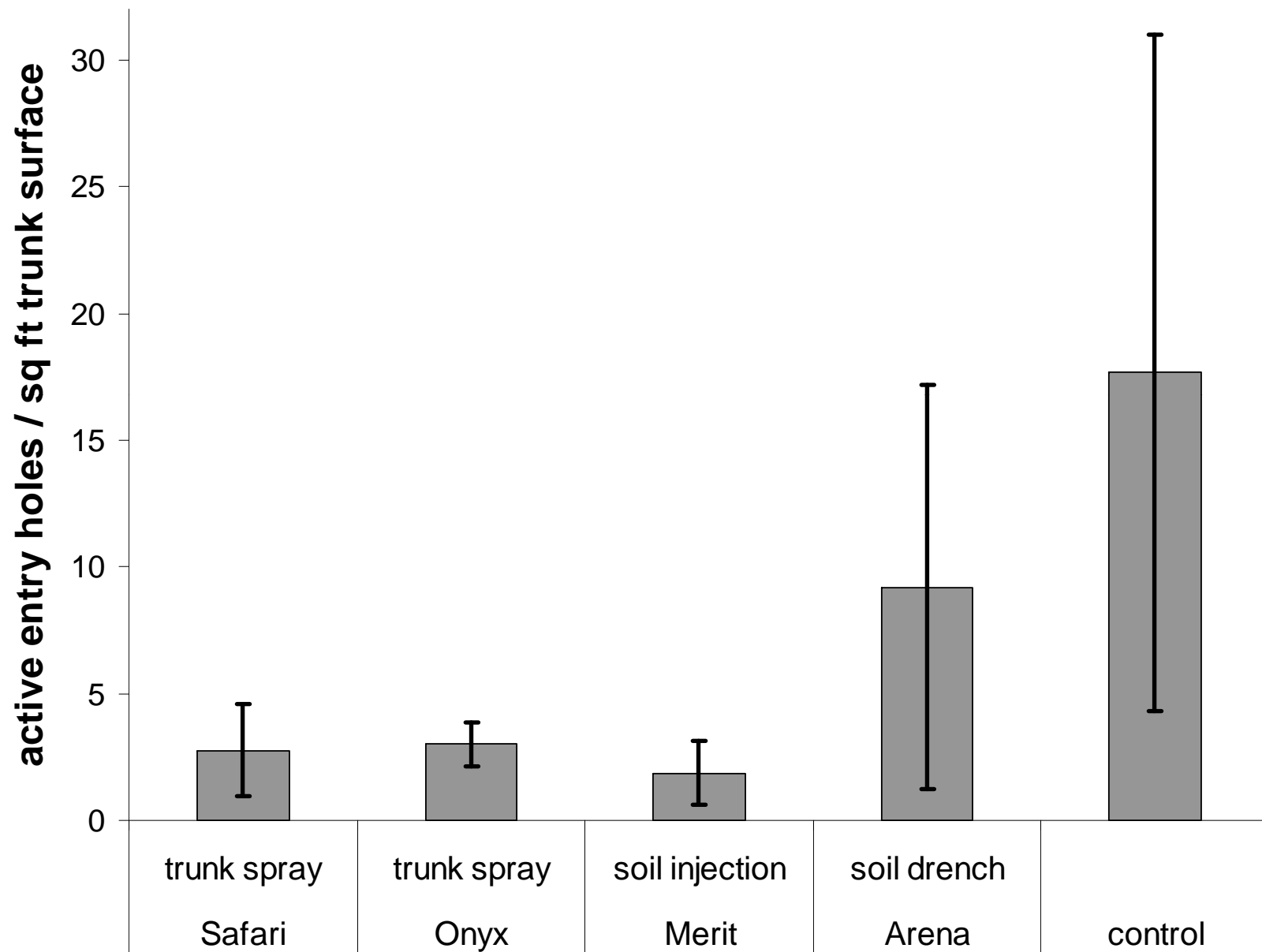
ARENA



MERIT







# Conclusions

- Monitoring: symptomatic trees
- Firewood movement will spread beetle
- Chipping appears effective
- Solarization: not yet tested
- Pesticides:
  - Merit
  - Safari
  - Onyx

- If you think you have PSHB

- [eskalenlab.ucr.edu](http://eskalenlab.ucr.edu)

- [timothy.paine@ucr.edu](mailto:timothy.paine@ucr.edu)

- Do not move firewood

- Chipping

- Pesticides:

- trunk sprays

- soil injection



- New beetle and fungus:
- Mapping distribution and tree impacts
- Pesticide trials continue
  - Insecticides
  - Fungicides
  - Entomopathogens
- Solarization

## ■ WEBSITES

- <http://www.avocadosource.com/>
- [http://cistr.ucr.edu/polyphagous\\_shot\\_hole\\_borer.html](http://cistr.ucr.edu/polyphagous_shot_hole_borer.html)
- <http://eskalenlab.ucr.edu/avocado.html>
- <http://acwm.lacounty.gov/pdf/Polyshotholeborer.pdf>



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