

Update on the Polyphagous Shot Hole Borer in California

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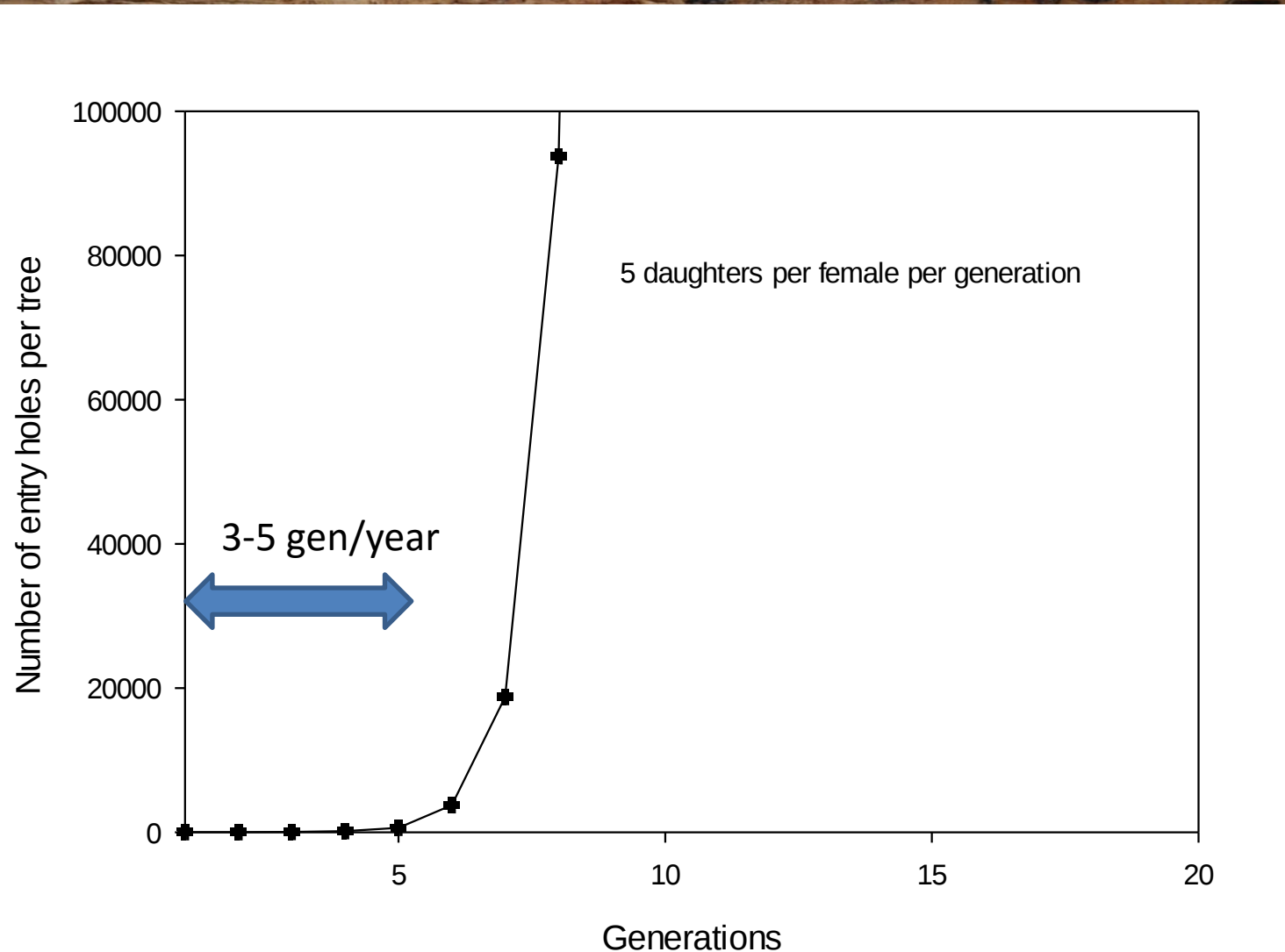
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Polyphagous Shot Hole Borer (PSHB)

- Ambrosia beetles
- Self-sufficient bunch;
 - Bring along their own food
 - Live inside the wood
 - Produce mainly daughters
 - Are already ready to reproduce when leaving their birth place
 - Single female can start a whole population

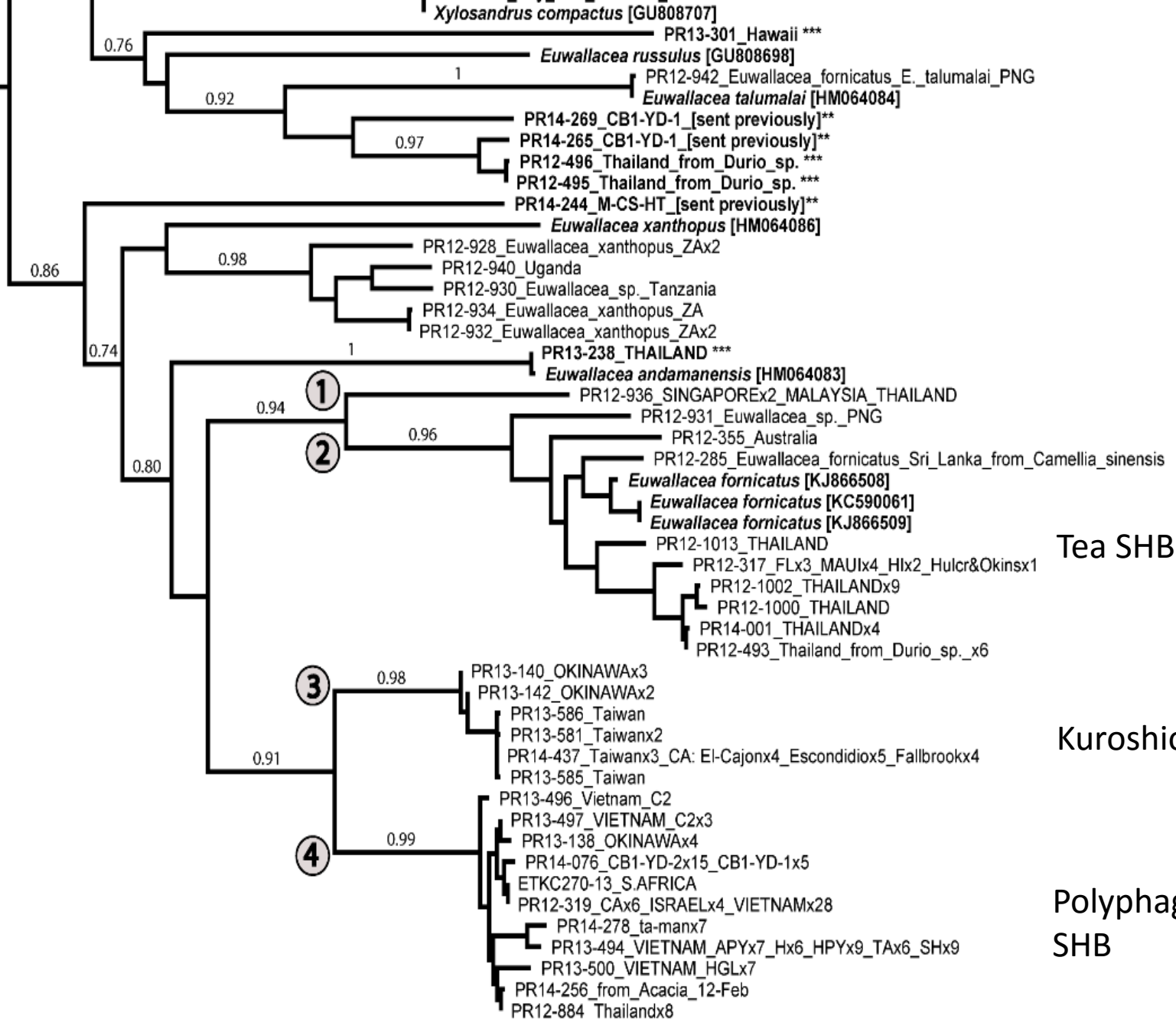


Growth of entry hole number per tree when a single female initiates the population at generation 1 and 5 daughters/ generation/mother remain on tree



Where did they come from?

- Initially we did not know
- Based on the morphology of the beetle *Euwallacea fornicatus* “Tea Shot Hole Borer” - pest of tea in SE Asia (India, Sri Lanka)
- DNA finger printing showed it was another species
- We named it “Polyphagous Shot Hole Borer”
- Using DNA finger printing it became clear that we had two different invasions (LA and SD) of two different species.



Tea SHB

Kuroshio SHB

Polyphagous SHB

0.3

Worldwide distribution of *Euwallacea fornicatus* complex

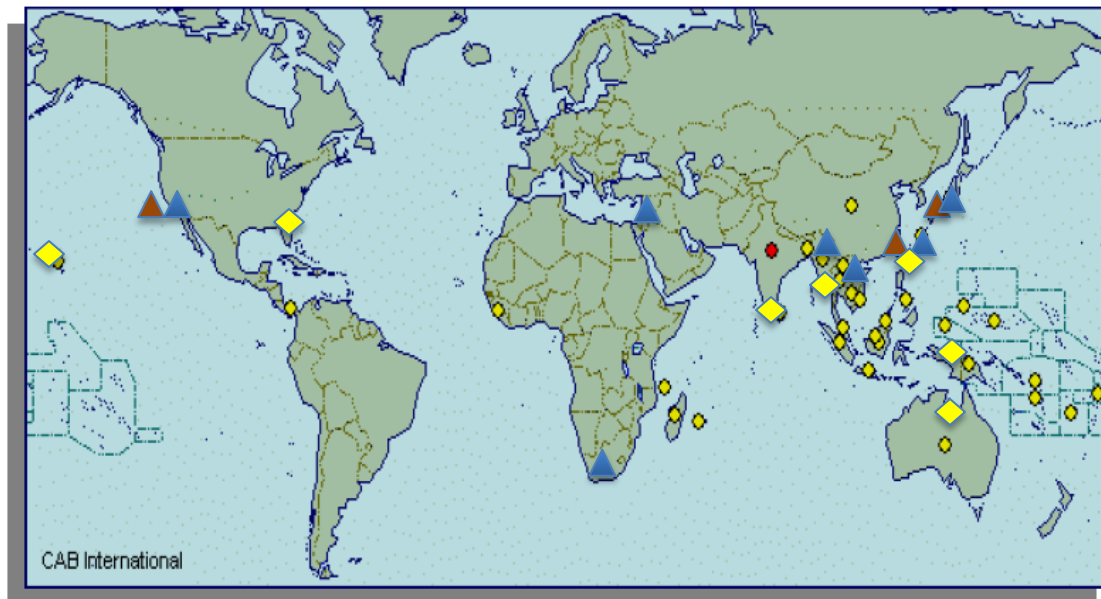


Plate 2 Distribution of *Xyleborus fornicatus* Eichh. (Coleoptera: Scolytidae) in the world (source, CABI CPC 2004) (Yellow dot indicates at least one positive record from the country).

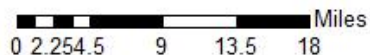
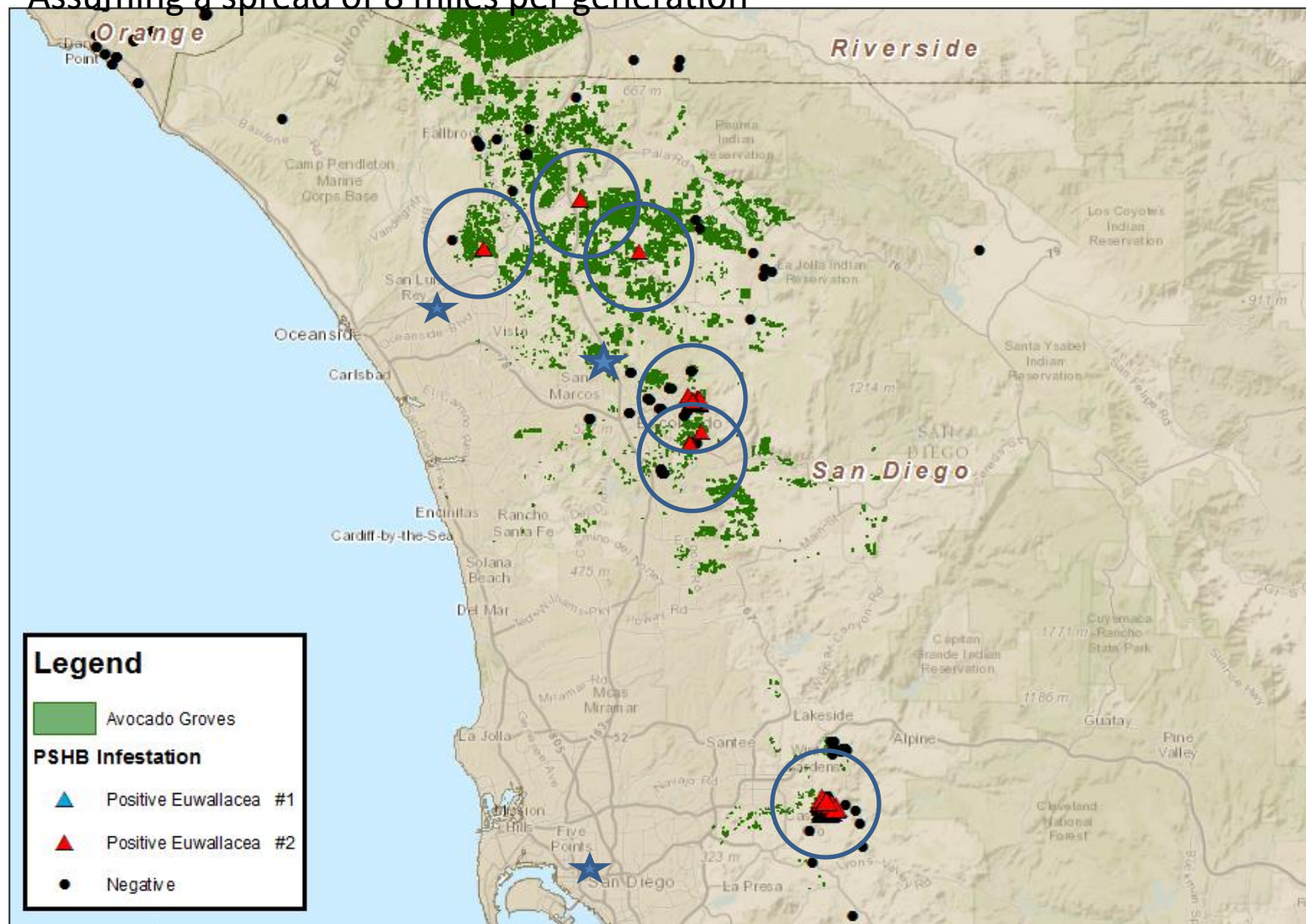
Tea Shot Hole Borer: ◆

Polyphagous SHB: ▲ Kuroshio SHB: ▲

TSHB can fly without help 0.4-0.6 m/s

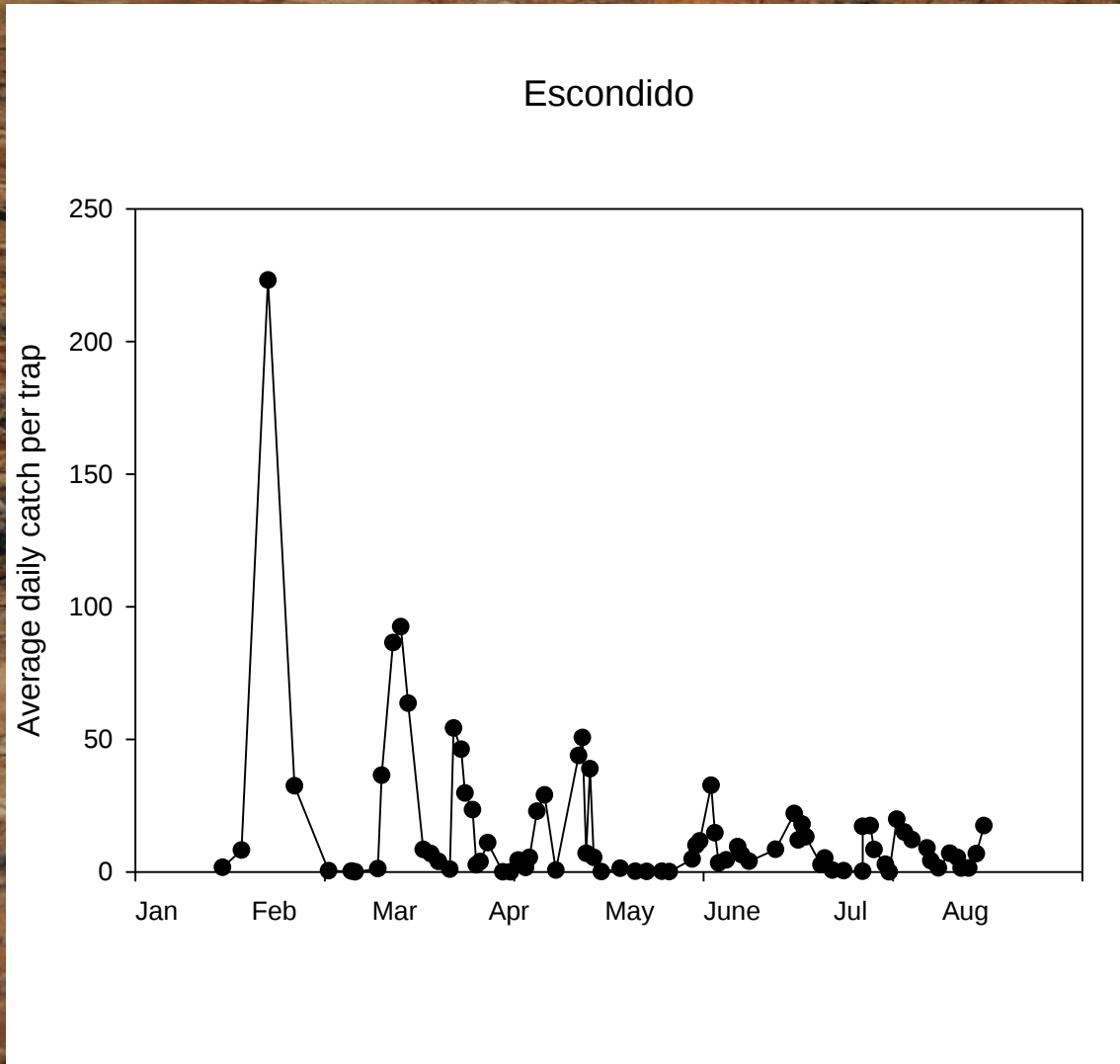
- Calculations assume PSHB is equivalent to TSHB
- Mean wind speed from 12pm-4pm is 3.2 m/s for total of 3.8 m/s
- Can fly less than 1hr
- If they fly 1 hr they cover 13km= 8 miles
- Prevailing winds in Escondido W-NW
- So max per generation using these assumptions is 8 miles
- In Escondido 4-5 generations per year most in from June-end of October
- Lets say per year 16 miles

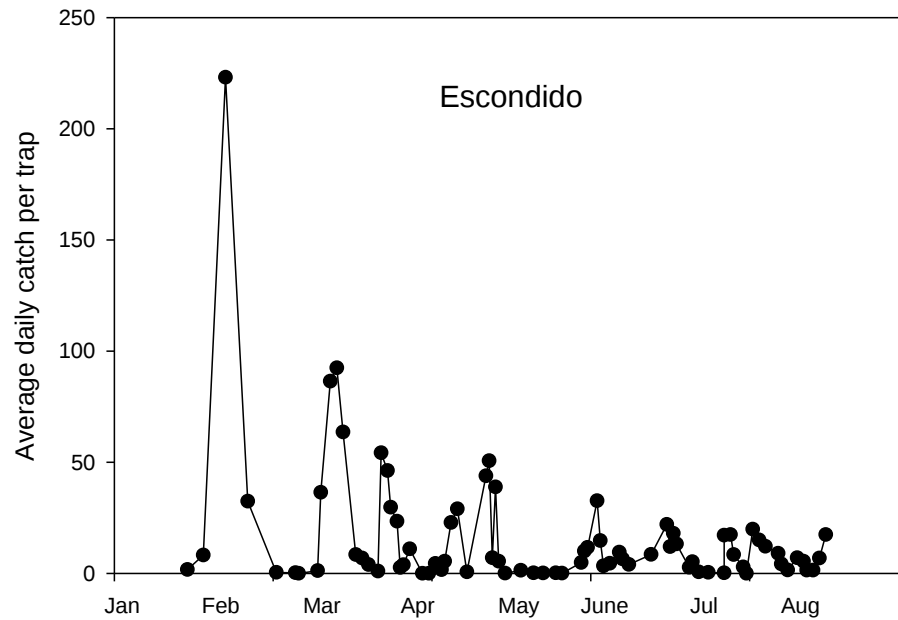
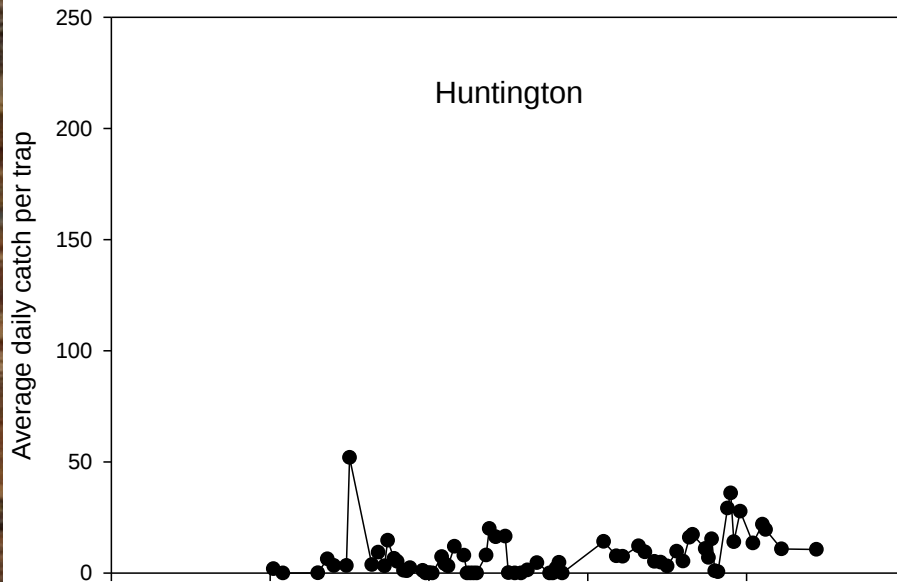
Assuming a spread of 8 miles per generation



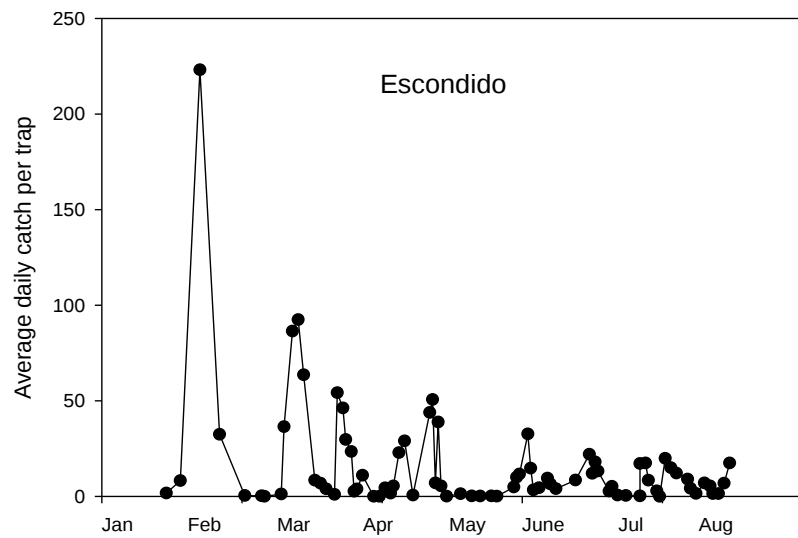
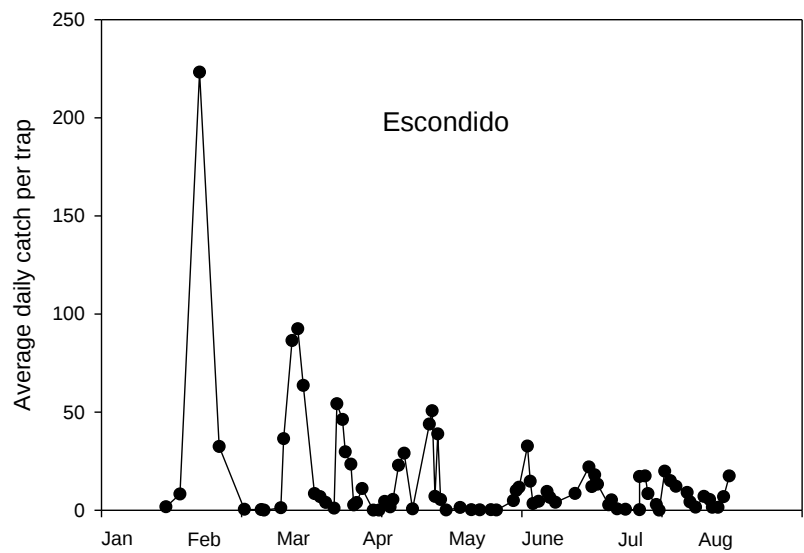
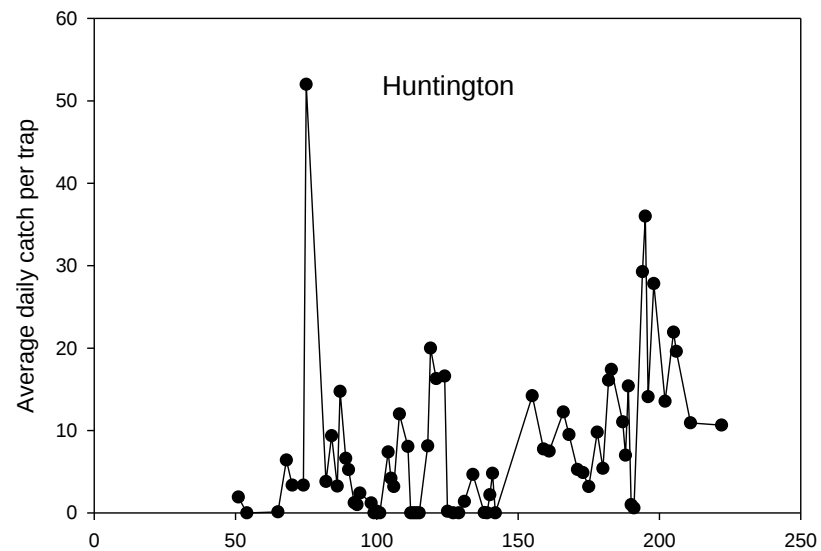
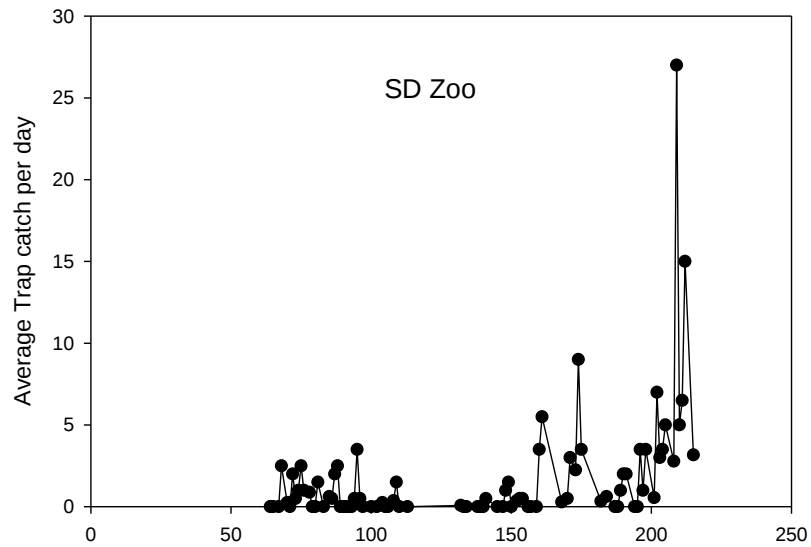
The graph displays the average daily catch per trap for Escondido. The y-axis is labeled 'Average daily catch per trap' and ranges from 0 to 250 in increments of 50. The x-axis shows the months from January to August. The data points are connected by a line, showing a significant peak in early February, followed by a sharp decline and then several smaller peaks throughout the spring and summer months.

Month	Approximate Average Daily Catch per Trap
Jan	0
Feb	220
Mar	90
Apr	55
May	50
June	35
July	20
Aug	20

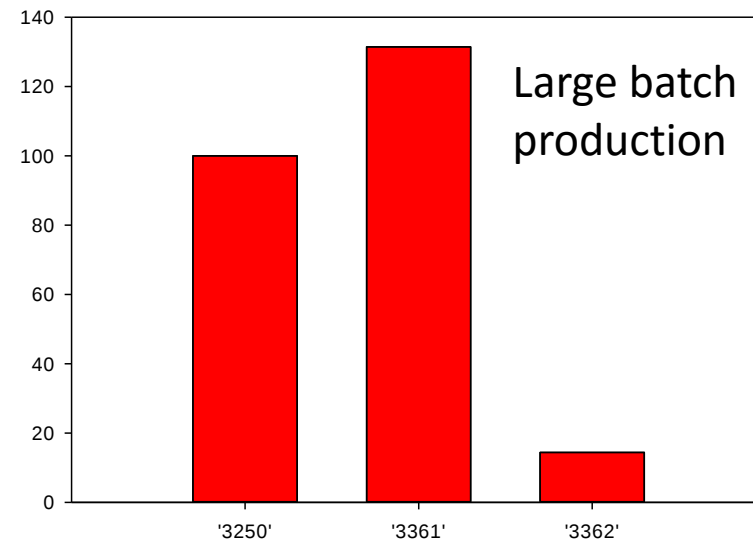
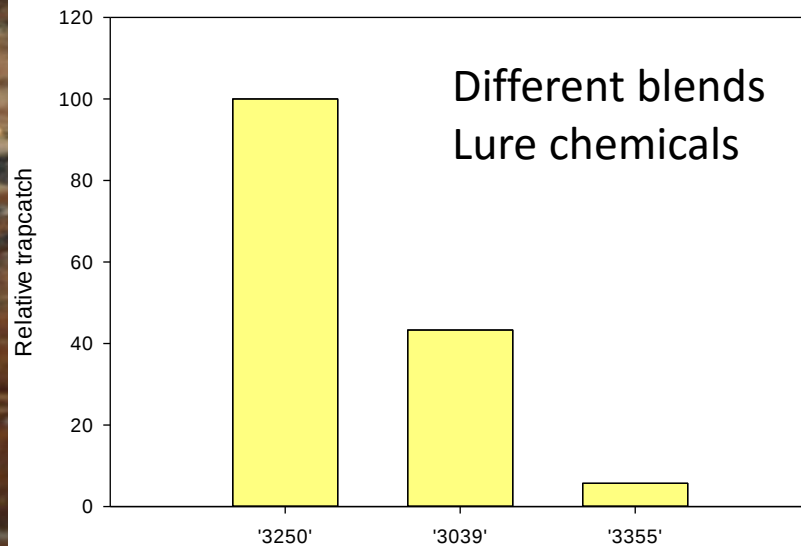
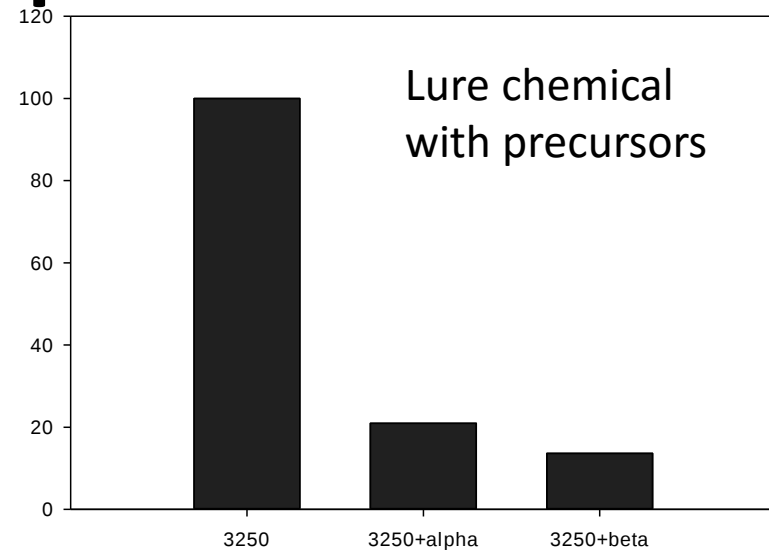
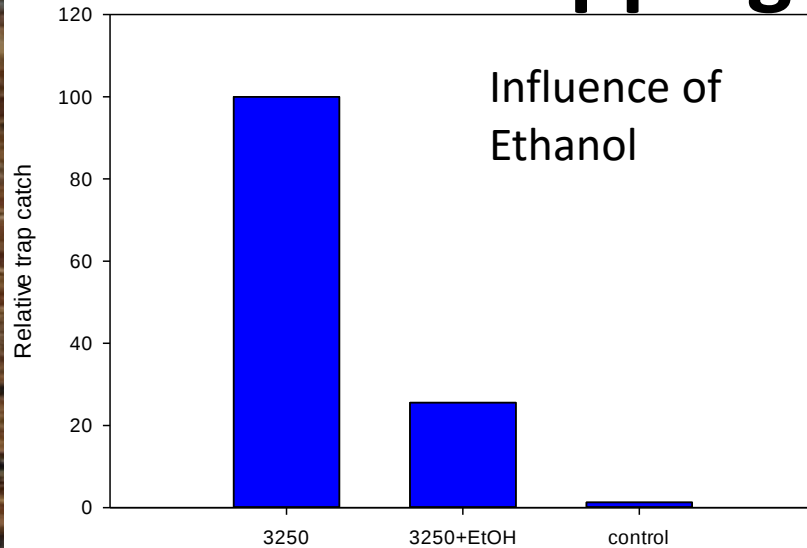




**Average catch per day
per trap at the
Huntington Gardens
(PSHB) and an avocado
grove in Escondido
(KSHB)**



Trapping optimization



Quercivorol occurs in 4 different configurations,
ratio of different configurations important

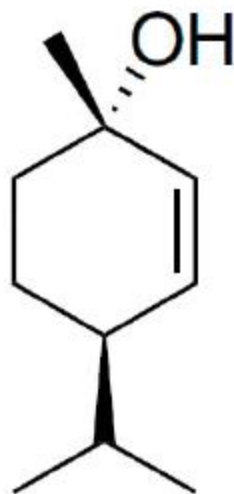
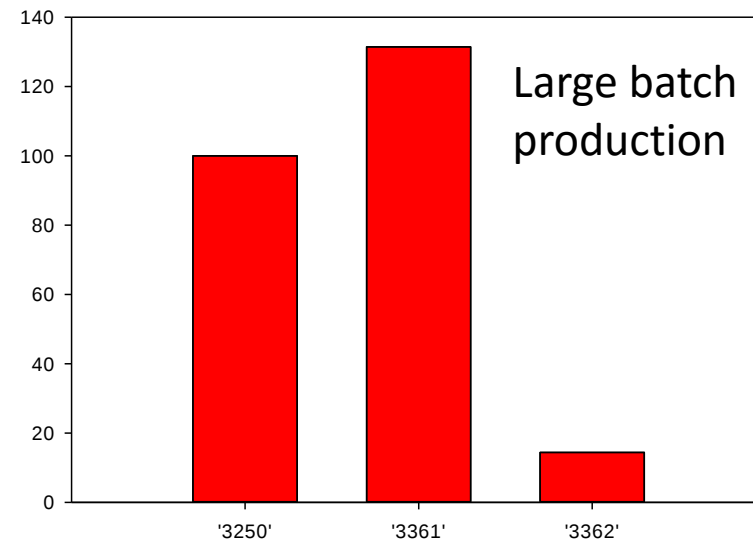
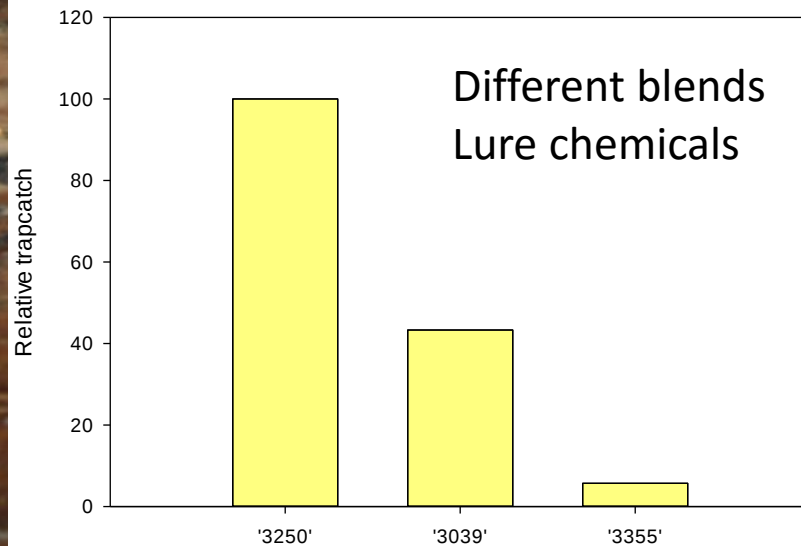
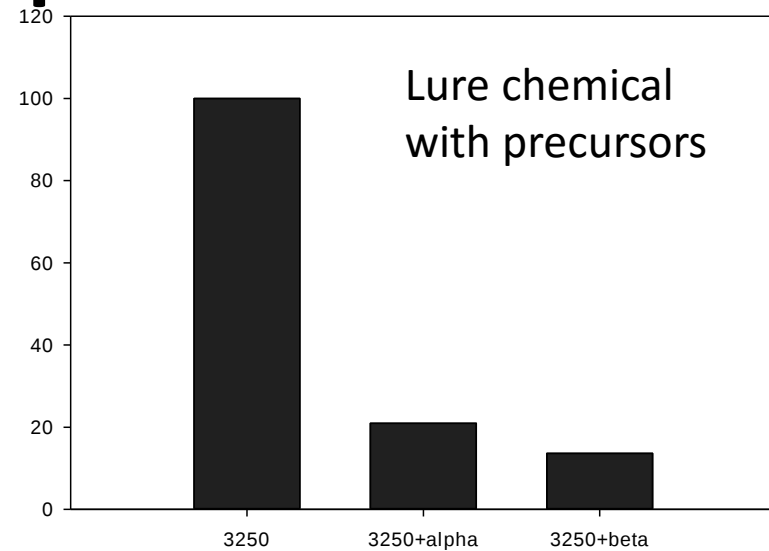
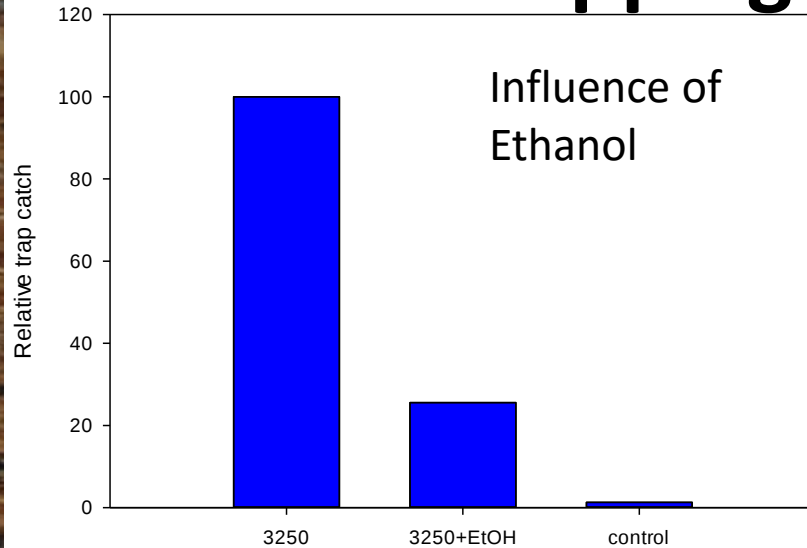


Fig. 4. Chemical structure of aggregation pheromone of *P. quersivorus*.
(1*S*,4*R*)-*p*-menth-2-en-1-ol (quercivorol)

Trapping optimization



Testing different trap types



Long

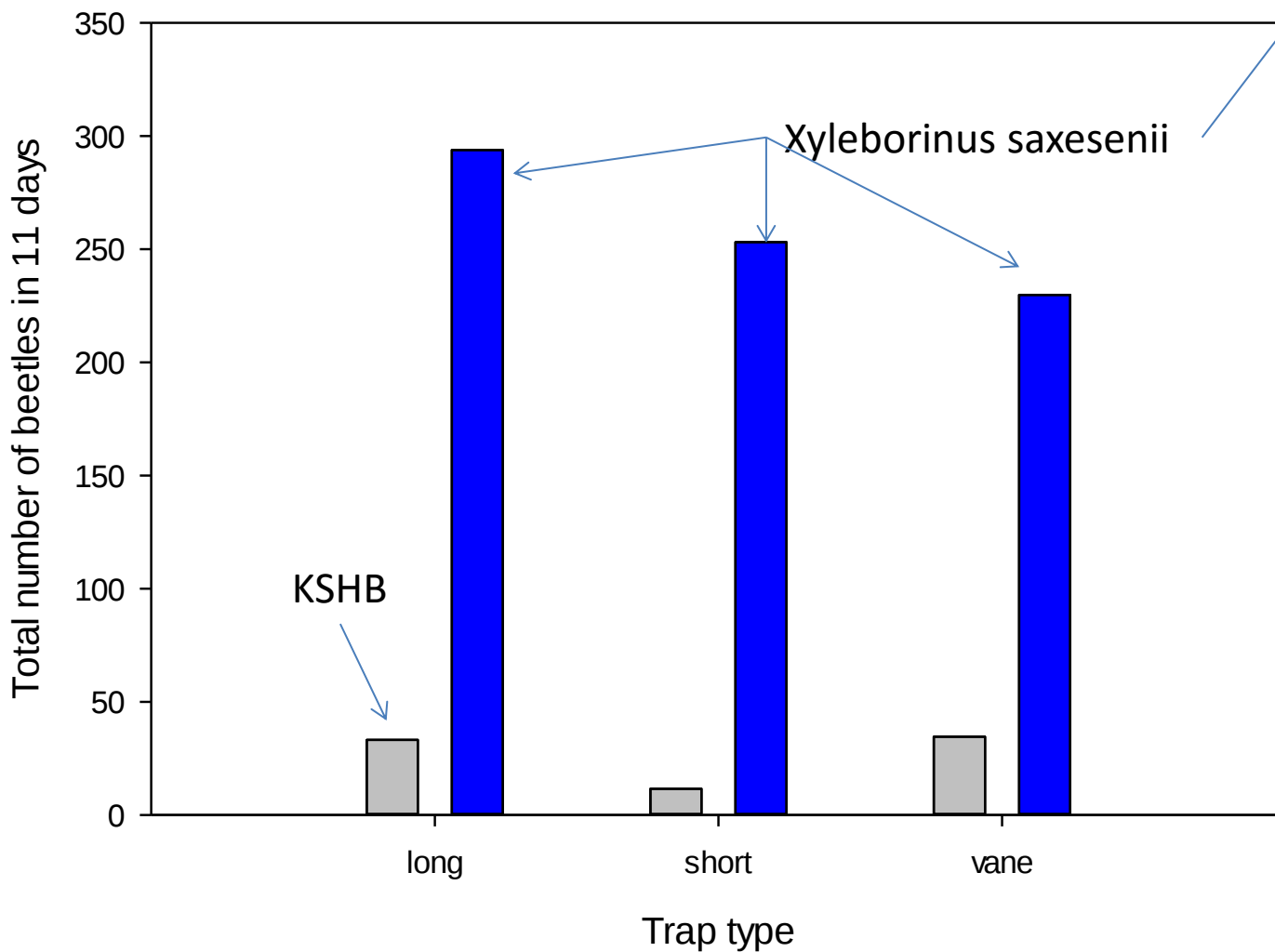


Short



Vane

Influence of trap type on beetle catch

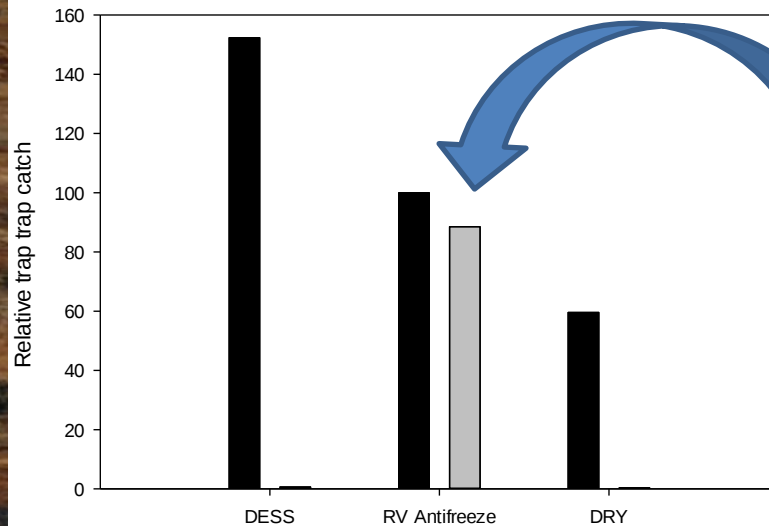


Trap type

Long and vane
equivalent: need to
repeat experiment

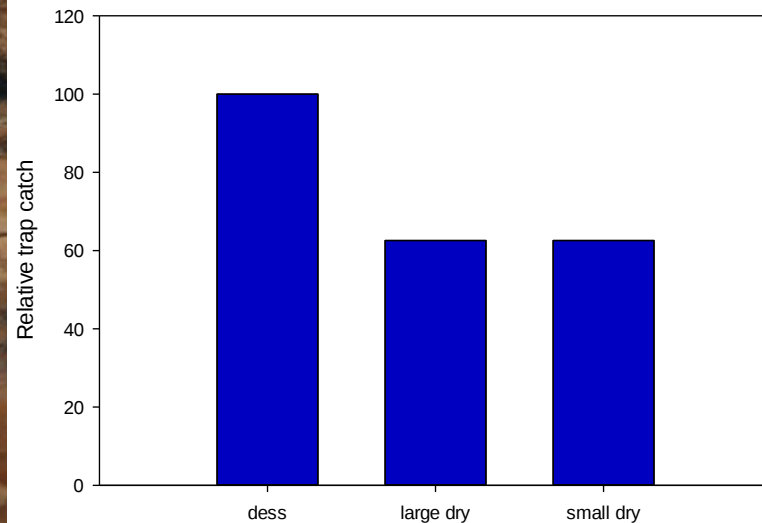
Waste a lot of time
counting *X.*
saxesenii

Testing the influence of preservatives in traps



Xyleborinus saxeseni
problem

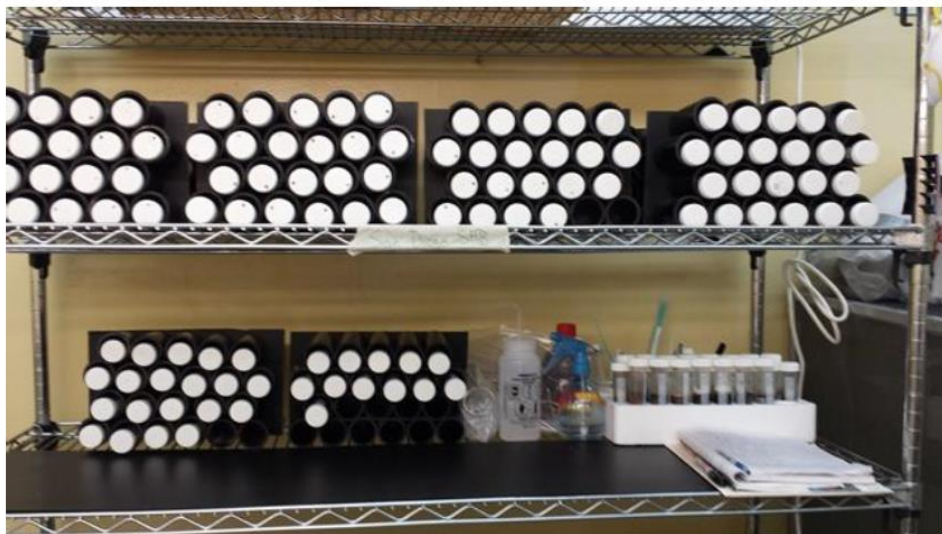
Testing different
preservatives



Beauveria bassiana



- *B. bassiana* entomopathogen
- Found everywhere
- Collected from beetles in Escondido
- Testing these isolates against KSHB



Loss of xylem fluid



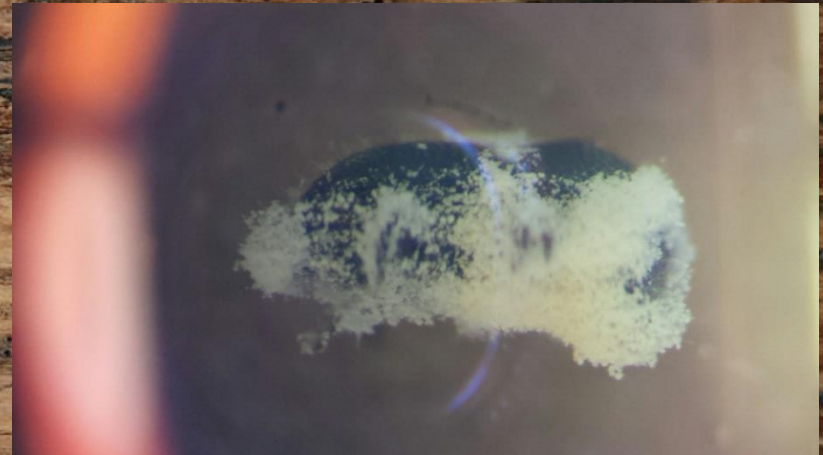
Predrill	Loss of xylem in number of cases	Average loss
yes	12/30	0.76 ml
no	14/32	1.49 ml
Per beetles	26/62	~0.5 ml

Important?

Probably not in itself
10,000 beetles ~ 1 gallon

Biological controls

- Entomopathogens
 - Local strains
 - Commercially available strains
 - Imported strains
- Nematodes
 - Found in Vietnam and Taiwan



A close-up photograph of a piece of light-colored wood with a dark, diagonal crevice. A small, yellowish-brown wood-boring insect is visible in the crevice. Below it, a dark, oval-shaped object, likely a parasitoid, is visible. The wood has a rough, fibrous texture.

Biocontrol

Parasitoids

Summary

- *E. fornicatus* harbors several species
- California invaded by two (Polyphagous, Kuroshio), Florida and Hawaii by another (Tea)
- Can reproduce on many tree species
- Populations can grow very rapidly (yearly pattern)
- Is spreading both in SD Co and in LA Co
- We are optimizing lures and traps
- No control yet (local Beauveria), biocontrol agents from Vietnam and other Asian countries (parasitoids and nematodes)?

Work supported by

- CAC
- USDA-Farmbill
- Huntington Gardens
- Hofshi foundation
- USDA-Forest Service

