Coconut Rhinoceros Beetle, *Oryctes rhinoceros*

A Major Threat to Hawaii's Coconut and Palm Trees

South Oahu Soil and Water Conservation District

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Topics to Be Covered

*Life Cycle
*Host
*Distribution
*Known serious threat to Hawaii because of a severe CRB infestation in Guam since 2007
*Discovery in Hawaii in Dec 2013
*Attempt to eradicate the infestation
    +Control strategies
        =Physical Control (tub grinding infested mulch, bird netting)
        =Chemical (pyrethroids and neonicotinoids)
        =Heat (steam and hot water)
        =Composting (In-vessel - heat and ammonia toxicity)
        =Incinerating infested trees (air curtain burner)
*Current Status
*Questions?

LIFE CYCLE OF THE COCONUT RHINOCEROS BEETLE (CRB)

Adult females lay eggs in dead coconut palms, decaying organic matter or mulch.

Grubs (larvae) hatch in 8 to 12 days from whitish brown eggs (<1/4" long) laid in organic matter.

Adults live 4 to 9 months; each female lays 50 to 140 eggs during her lifetime.

Beetle feeding damage: hole bored into trunk (below); leaves with V-cuts (right)

Grubs feed on decomposed organic matter for 82 to 207 days, and grow from ¼" to 4" long (3 instars).

Adult beetles remain in pupae for 17- to 22 days, then emerge and fly to palm crowns to feed on exududed sap.

Grubs enter non-feeding prepupal stage for 8 to 13 days usually in the soil; pupal stage lasts 17 to 22 days.

Egg to egg-laying adult
(132 to 282 days)

Coconut Rhinoceros Beetle (CRB)

Native range: Southeastern Asia

China, India, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore,

Sri Lanka, Taiwan, Thailand, and Vietnam

*CRB was introduced throughout the Pacific islands, primarily as a result of the increased sea traffic during World War II.

*Prior to discovery in Hawaii in Dec 2013, CRB was first discovered in Guam on Sep 2007.

Female with shorter horn than male

Female with fuzzy orange rear

Bores into live coconut and palms trees and feeds on exuding sap.

CRB Hosts

Larval (grub) Hosts:
Rotting coconut, breadfruit, kamani, mango, hala and other rotting organic matter including steer manure.

Adult Feeding Hosts:
Young terminals of coconut, African oil palm and other palms species including areca, bamboo, bottle, date, fan, fish-tail, foxtail, pandanus and sago palms.

Coconut Rhinoceros Beetle (CRB) damage symptoms in Guam

*Primary damage caused by adults boring from the petioles of fronds into the crown, cutting through developing unopened fronds, feeding on the exuded sap.

*V-shape cut on open fronds.

*Similar to mechanical pruning damage to unopened fronds

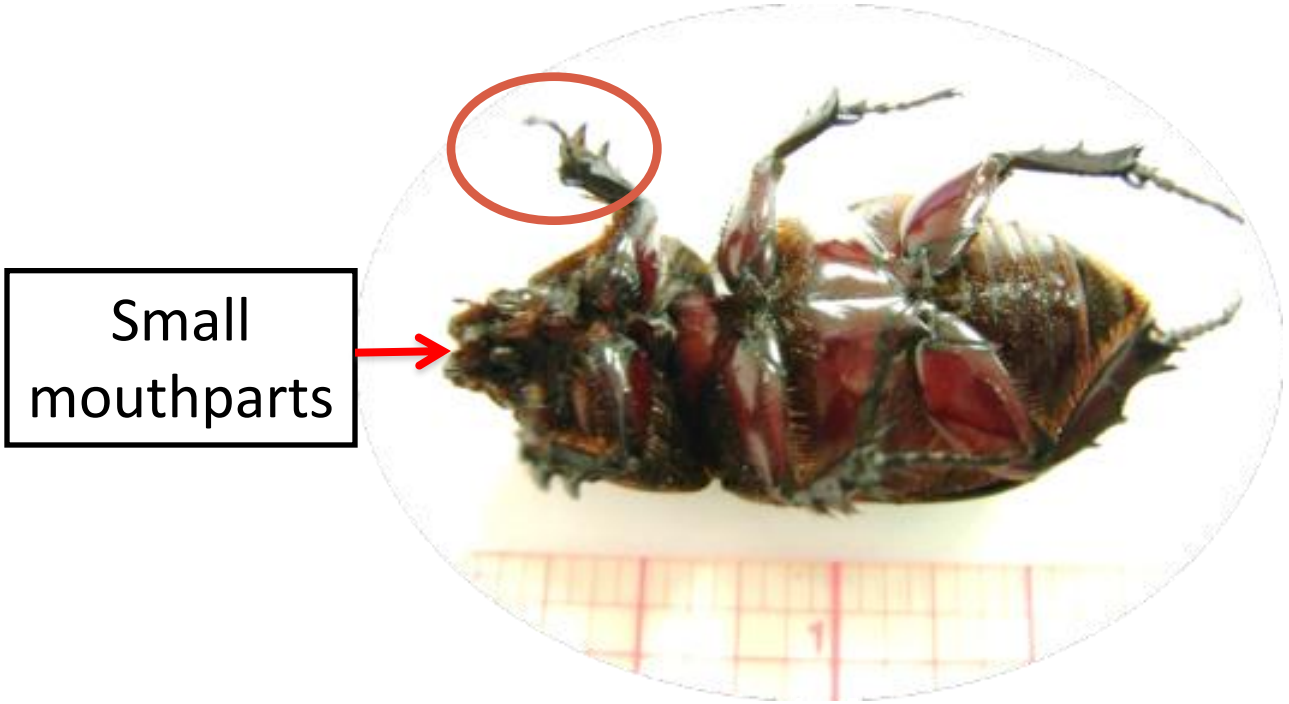
Visited Guam in Sept 2013 because of a serious CRB threat to HI

Active adult boring hole thru petiole

Active adult boring hole in petiole - “wet look”

Coconut fibers from adult boring

Beetles bore into frond stem and growing tips with their legs (tarsi, circled below) that are lined with very sharp, prickly spines, to feed/suck on plant sap, not on foliage itself.



Damage to Foxtail palm emerging frond

Boring with exposed coconut fiber

Major Breeding Site in Coconut Trimming Debris, Asan, Guam

09/13

Major Breeding Site with all CRB stages, Asan, Guam

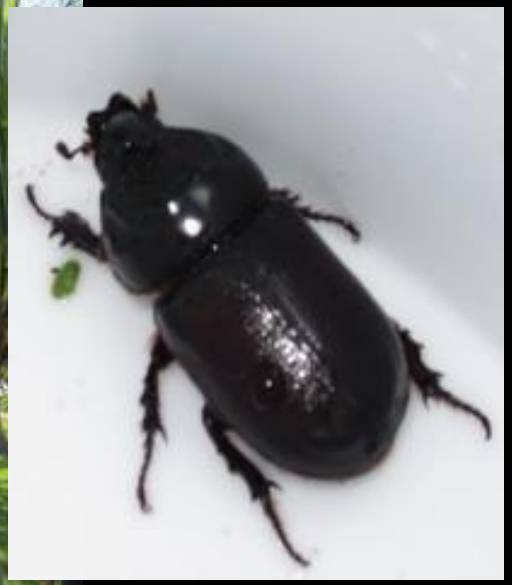
Asan Beach
Guam

Dead Coconut Tree with CRB

Adults and grubs found in rotting coconut trunk terminal

O9/13

Joint Base Pearl Harbor-Hickam Military Facility



Mamala Bay Golf Course

09/13 – CRB trap deployed at Hickam as part of USDA pest survey for coconut pests not yet in Hawaii.

12/23/13 - One coconut rhinoceros beetle (CRB) was caught in a trap circa one mile from the infested mulch pile at the edge of the golf course. Infested mulch included all stages of CRB

Mamala Bay Golf Course (Hickam Air Force)

*Coconut trees on golf course with CRB feeding damage.

*Golf Course is near the international runway w/military and commercial flights landing and taking-off overhead.

Adults and grubs found at the Mamala Bay (Hickam) Golf Course

Infested mulch pile was covered with bird netting to prevent adult emergence on January 11, 2014.

Evolution of THE CRB TRAP

A

Aggregation Pheromone

FIRST CRB ADULT TRAPPED IN HONOLULU, HI

B

C

A) Original design bucket covered with burlap; CRB pheromone lure affixed to bucket lid; entry holes just below the rim prevents beetle escape.

B) Single bucket, black vane, pheromone lure, solar UV light

C) Collection cup instead of bucket. (lighter, easier to deploy)

More Efficient CRB Trap in Guam

50 gal steel barrel filled with rotting coconut debris, live CRB, grubs & aggregation pheromone. Ultraviolet LED light over trap. Chicken wire allows CRB to enter but cannot fly out. (Moore & Quitugua, per. com. 09/13)

Latest Bucket Trap Design by University of Guam

Lid with UV light and entry holes

CRB (L) Oriental Flower Beetle (R)

pheromone lure

Oriental flower beetle

In Hawaii since 2002; first discovered at Hickam.
Adult beetles active during the day (diurnal)
Adult feeds on pollen, nectar, plant sap. May damage flowers of papaya, mango, coconut.

Body up to 1” length

Adult moss green to reddish-black with white or metallic flecks

Grub crawls straight or flips on its back

Coconut Rhinoceros Beetle

Adult beetles active at night (nocturnal)

Body length up to 2.5”
Largest beetle In Hawaii.

Grub curls into a C-shape and crawls on its side

Coconut Rhinoceros Beetle Infestation

2/21/14

–Double grinding mulch (2000 cu yd) with tub grinder.

After grinding, mulch spread and covered with plastic and bird netting.

Steaming Ground Mulch

*Tarp steaming tested but penetration was slow, but has potential for smaller mulch volume.

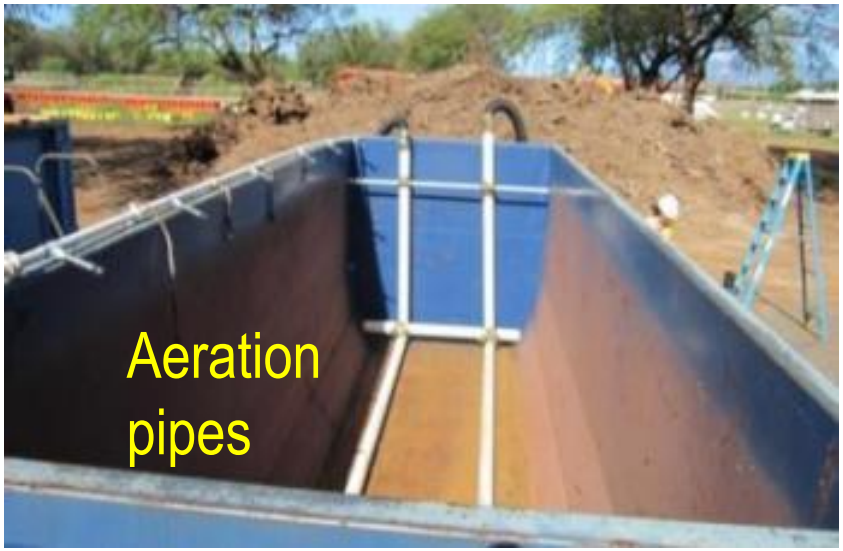
In collaboration with Dominican University of California

Thermal Mortality of CRB

Conducted in collaboration with Dr.Michael Melzer (UH-CTAHR, PEPS)

<u>100% Mortality</u>
Between
122 F for 10 min
to 131 F for 5 min

In-Vessel Composting to Heat Treat CRB-Infested Mulch



At Hickam Base

Composting Recipe. During composting, the limiting nutrient is often nitrogen and the target range for nitrogen is a carbon to nitrogen ratio in the range 30:1 to 60:1. **If the nitrogen concentration is inadequate, the compost will not heat up.** A concentrated solution of urea and ammonium nitrate (total nitrogen 3.54 pounds per gallon) is used. Temperature rises to 170 F and maintained for 4 days. Ammonia is also toxic.

CRB grubs = 100% mortality at 131 F for 5 min

Vessels covered with air blowers operating (tarp is inflated).

Insecticide Control

Conducted in collaboration with Derek Arakaki (HDOA)

*Studies in Guam indicated that cypermethrin (Demon) and the insect growth regulator, pyriproxyfen (NyGard) were effective against CRB.

*Quick tests in Hawaii conducted with bifenthrin (Talstar), clothianidin (Arena), cypermethrin with and without the synergist, piperonyl butoxide (pbo).

*Tests conducted spraying insecticides directly on adults and grubs and by treating mulch infested with adults and grubs.

*Pyrethroids did not kill all grubs; no grubs were killed by neonicotinoid insecticides.

*Adults were paralyzed by pyrethroids but recovered after 48-72 hours.

*Addition of piperonyl butoxide (pbo), a synergist, killed adults but not grubs.

Live grubs used in tests

Pyrethroid- treated adults are initially paralyzed (on backs with legs twitching) but recover after 48-72 hrrs.

Insecticide Treatment Needed in Crown Area to Prevent Adult Attack

Symptoms of CRB Attack: V-cut with associated lateral boring thru fronds

Status of CRB on O`ahu

http://hdoa.hawaii.gov/pi/main/crb/n/crbcip/

May 21, 2014

Single male CRB found in a trap at Barbers Point.

The majority of the CRB detection remain within a two-mile zone with the Mamala Hickam Golf Course as the center.

June 9-20, 2014

46 adult beetles found in traps, 45 were on JBPHH property (41 in and around Mamala Bay Golf Course, 3 at the Navy Marine Golf Course and 1 at Iroquois Point), and 1 at Honolulu International Airport; 8 second instar CRB larvae from a mulch pile on JBPHH property at Iroquois Pt.

June 23-July 4, 2014

Larvae were found in mulch at Navy Marine Golf Course (Radford Dr) and the infested material covered with netting to prevent beetles from emerging.

Status of CRB *(continued)*

July 9, 2014 HDOA

Adult CRB found at Campbell Industrial Park. This is the farthest west that a CRB has been found. Since CRB was first detected, about 540 beetles, 600 larvae and 16 pupae have been found on O`ahu.

July 10, 2014 KHON NEWS

"As a destructive pest that targets palm trees spreads farther west on O`ahu, close to 170 trees at a military base on the island will have to be destroyed."

July 11, 2014 KHON NEWS

"Agriculture officials fear invasive beetles could hurt Hawaii's image. Hawaii typically conjures up images of sun, sand and coconut palm trees swaying in the breeze, but an invasive pest, the Coconut Rhinoceros Beetle is threatening to take down those trees."

August 13, 2014 KHON NEWS

Crews are removing 150 coconut trees, most from the golf course there.

After the fronds are cut down, workers go through the leaves to look for any of the live insects that might be inside.

So far, officials have found 10-15 beetles and 10-15 of their larvae in these trees.

"This will have large-scale landscape-changing effects on the state," Rob Curtiss, Hawaii Department of Agriculture said. "It affects palm trees. Picture Waikiki with half the trees that are there now."

The military is asking people who live and work there to discard their green waste immediately., says the pest can pose a large problem in Hawaii, affecting multiple industries.

Since Dec 2013

Area	Date	Last Detection adults/grubs	Total Detection adults/grubs/pupae
JointBase Pear Harbor Hickam	8-29-14	31/0	770/613/16
Outside JBPHH Furthest find (Campbell Industrial Park)	8-22-14	0/0	36/0/0

KHON Sept 3, 2014

"Every mulch pile we can identify, every infested tree that we can identify, we're going to destroy," said Rob Curtiss, pest control branch manager for the Hawaii Department of Agriculture.

"There are a few methods of destroying these piles, but the most effective is to incinerate them."

"The incineration is a much faster way and there's no way for the incinerated areas becoming re-infested because they are gone," said Curtiss.

Conclusion:

Eradicated
or
Established?

THANK YOU!

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