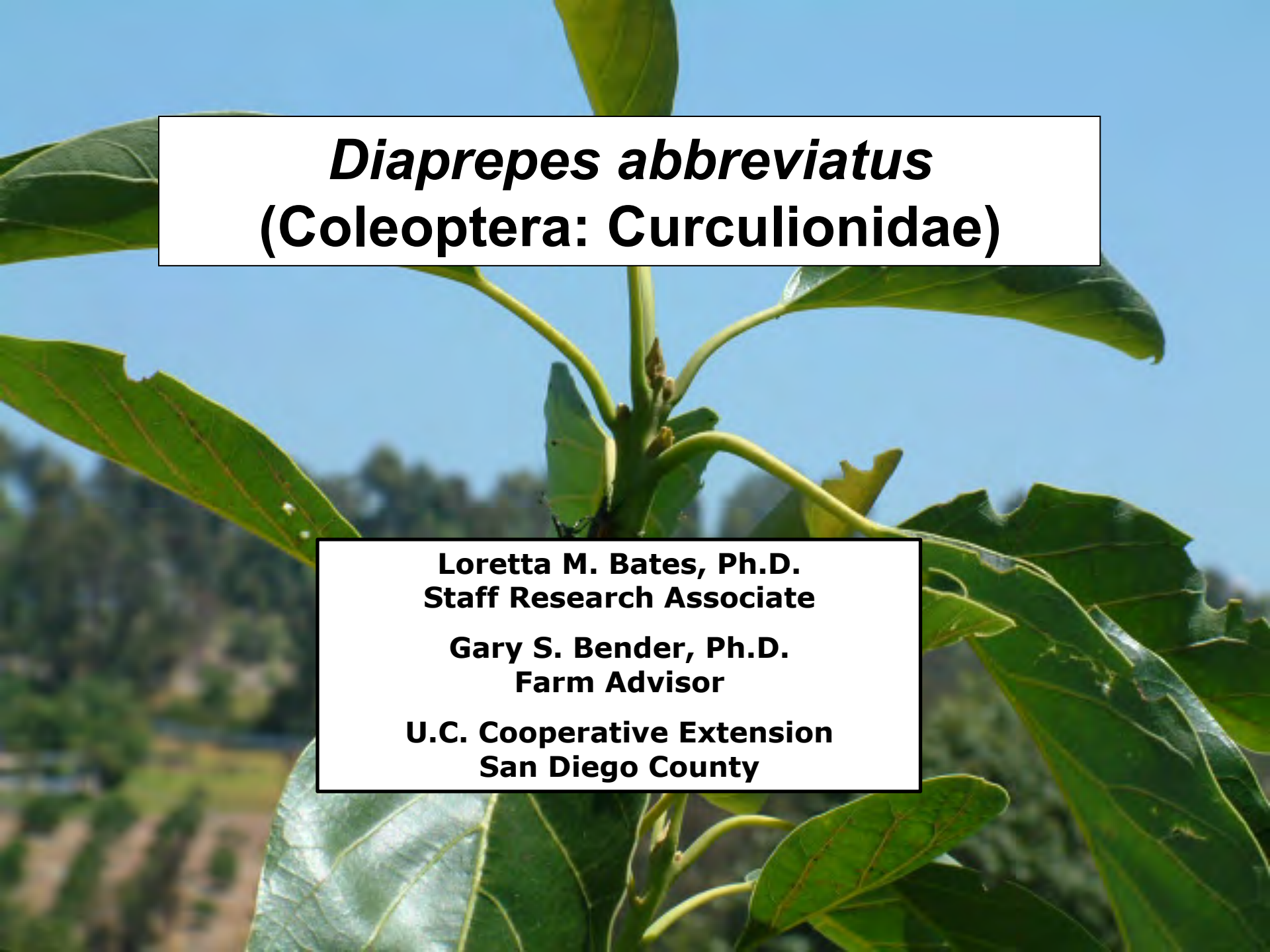


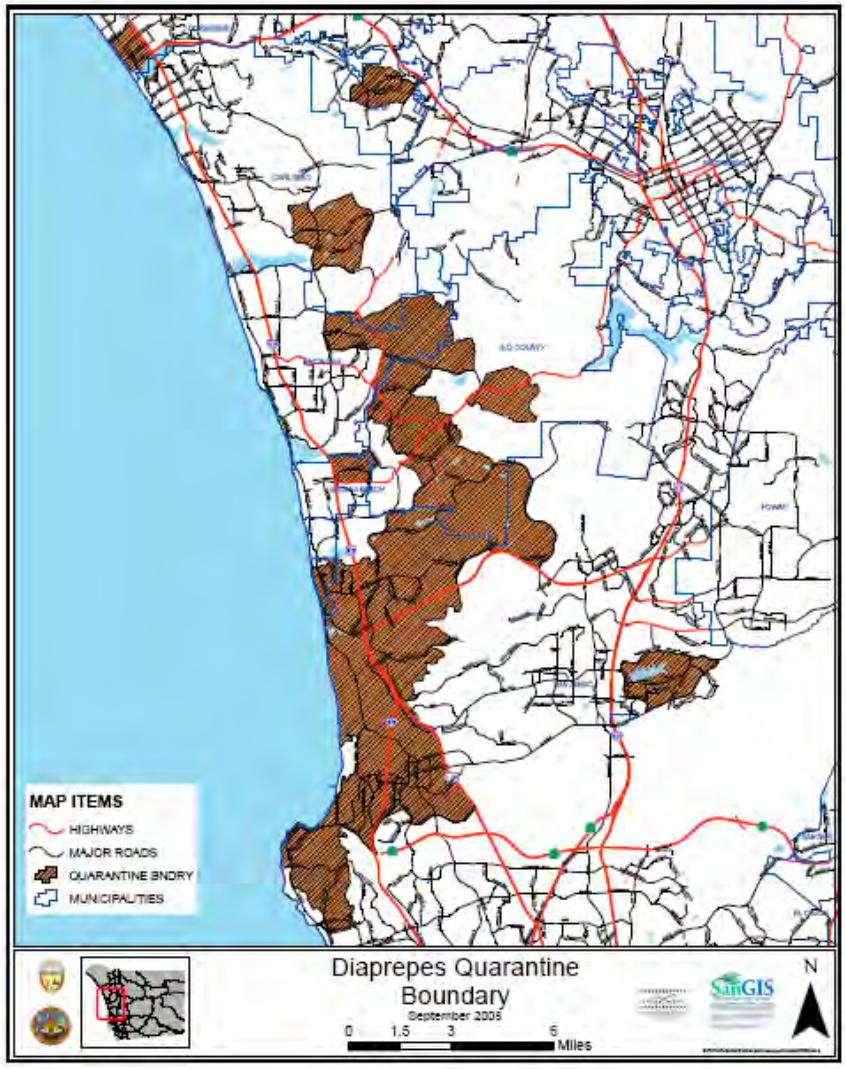
Diaprepes abbreviatus (Coleoptera: Curculionidae)

Loretta M. Bates, Ph.D.
Staff Research Associate

Gary S. Bender, Ph.D.
Farm Advisor

U.C. Cooperative Extension
San Diego County

Locations in San Diego County



- The root weevil *Diaprepes abbreviatus* (Coleoptera: Circulionidae) is a pest species originating in the Caribbean and first reported in Florida in 1964, in Los Angeles and Orange Counties in 2005 and in San Diego County in 2006.
- The weevil is currently found in southern California coastal areas from LaJolla through Long Beach.

- The Diaprepes root weevils are large colorful weevils. They range from dime to quarter size and occur in shades of orange (very common), tan, purple and green, all with black stripes against the colored background.

Adult Damage

Leaf notching and frass pellets

- The adult weevils feed on leaves of many different plant species leaving notches which begin at the leaf margin and extend toward the midrib (center) of the leaf.
- Frass (weevil waste) may be found on leaves near feeding damage.
- Other local weevils also leave notches at leaf margins so this alone is not definite proof that the Diaprepes root weevil is responsible.

Larval Damage

Effects of Larval Feeding

- Although weevil feeding damage on leaves is unsightly, it is not responsible for the eventual decline or death of the host plant.
- Feeding damage by weevil larvae on underground portions of the plant is directly or indirectly responsible for plant death.
- In the previous slide, 2 Diaprepes larvae were introduced into the pot of citrus and allowed to feed for 4 months. You can see the damage caused compared to the non-inoculated control pot. This work was done at the U. of Florida by Dr. Michael Rodgers.

Larval Damage to a Lemon

- Significant numbers of lemon trees in groves in Encinitas, Rancho Santa Fe and Fairbanks Ranch have been damaged or lost as a result of larval feeding.
- Ornamental shrubs and trees are being lost due to weevil root feeding in urban areas.

In So. Cal. the Adults Have Been Found On:

Fern	**Avocado**	**Pygmy Date Palm**
Peach	**Bougainvillea**	**Ornamental Pear**
Rose	**Bottlebrush**	**Night Blooming Jasmine**
Birch	**Lemon, Orange**	**Japanese Privet**
Pine	**Coral Tree**	**Live Oak**
Camphor	***Hisbiscus***	**India Hawthorne**
Canna	**Crape Myrtle**	**California Pepper Tree**
Ficus	***Mandevilla***	**Brazilian Pepper**
Ivy	***Pittosporum***	**Golden Lantern Tree**

Known Larval hosts

Dracaena rainbow	Ground nut, peanut	Alemow=*Citrus macrophylla*
A *dracaena*	Rattlebox	Lime
Dragon tree	Lima bean, haba lima	Pummelo x trifoliate orange (2N)
Ribbon plant, Belgian evergreen	String bean, kidney bean, navy bean, etc.	Pummelo x trifoliate orange (4N)
Yellow mombin, lobo	*Pithcellobium*	Milam lemon
Apio, apio tuberoso, arracacha	Bread and cheese, catclaw, black Jessie	Rough lemon
Schefflera	Aloe	Acid citron
False *Aralia*	Lilyturf	Cleopatra mandarin
Adonidia palm, Christmas palm	Caesar weed, Congo jute	Orange
Wax plant	Prayer plant	Maize, corn, Indian corn
Papaya	Mahogany	Grapefruit
Sweet potato	Coralberry, coral ardisia	Red grapefruit
Shore juniper	Surinam-cherry	`Flying Dragon' x `Nakorn'
Red-cedar, eastern red-cedar	Pepper (black)	Carrizo citrange
Nut grass	Pitted bluestem	Swingle citrumelo
Yellow yam	Sugarcane	Pepper
Wild or common persimmon	Guinea corn	Eggplant
Yucca, cassava, manioc, tapioca	Sorghum	Cacao, cocoa

- In southern California, there is evidence of adult or larval deeding on a wide variety of ornamental and fruit species, including citrus, avocado, coral, golden lantern, gold medallion, *Acacia* and California and Brazilian pepper trees, India Hawthorne, roses, pygmy date palm, *Ficus*, bougainvillea, *Caliandra* and hibiscus.

Diaprepes Root Weevil – Life Cycle

- Adults emerge after a rainfall or irrigation event
- Most active at dawn and dusk
- Females live about 147 days, and males, about 135 days

- The adult Diaprepes root weevils emerge from the ground after a rainfall or irrigation. They instinctively seek a trunk or branch and climb to the upper and outer canopy of a plant where they feed, mate and lay eggs. They are most active at dawn and dusk and retreat into the canopy during the hottest part of the day.

Oviposition and Egg Stage

- Females deposit eggs in clusters of 30-260 eggs.
- Each female may oviposit a maximum of 5,000 eggs.

- Female weevils live about 147 days (males 135) and continue to mate and lay eggs throughout their lifetimes, ovipositing (laying) up to 5,000 eggs per female. The females deposit eggs in clusters of 30-300 eggs on leaf surfaces and protect them by gluing two leaves together to from the characteristic “leaf and egg sandwich”.

Diaprepes Eggs

Eggs between leaves

Eggs hatch in 7 – 10 days.

- The weevil eggs hatch in 7-10 days and the tiny larvae called neonates drop to the ground where they may crawl around for several hours before entering the soil and beginning to feed on the plant roots.

Diaprepes Larvae

- Newly emerged larvae burrow into the soil in search of roots or below-ground plant parts.
- Completes 10–11 instars in 5–15 months

- The larvae feed on the bark and cambium where food is transported down from the top of the plant and new cells are produced. Larval feeding may also open the root to attack by pathogens such as *Phytophthora*. As the larvae grow and develop over a period of 5-15 months, they feed on progressively larger roots. On a plant with significant visible damage larvae may be found as large white grubs in the soil near the crown. The grubs appear to be legless although they possess tiny pro-legs.

Diaprepes Pupae

- Pupate in a soil chamber
- Pupal stage lasts from 15-30 days
- Time from egg to adult 5 – 18 months

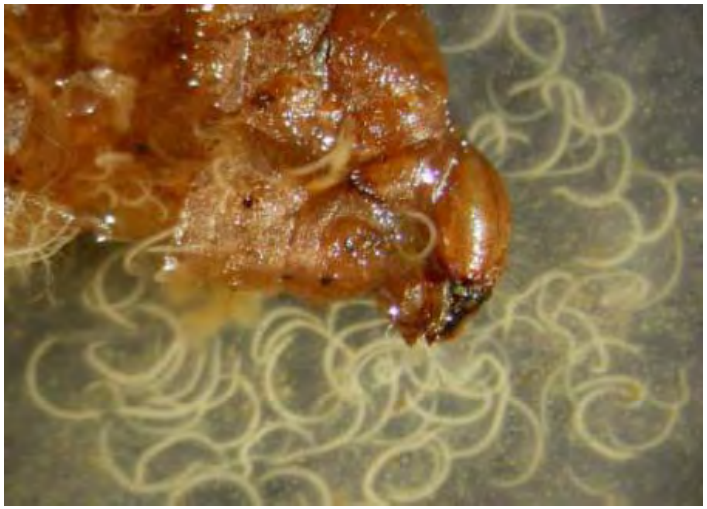
- During the later stages of development, a larva ceases to feed and begins to form a protective chamber around itself in the soil. Within the chamber the larva develops into a pinkish colored pupa. The pupa progressively develops over 15 to 30 days to produce a new adult weevil.

Diaprepes adult beetles ready to emerge from within earthen pupal cells

- The new adult weevil in the soil possesses deciduous mandibles which look like little pincers and are used to dig out of the soil, eventually falling off.

- Current efforts to control the Diaprepes root weevil in southern California are focused on management using a combination of pesticide applications by property owners and biological control. Members of the University of California Cooperative Extension (San Diego County) and U. of Calif., Riverside are working jointly with scientists from CDFA and the University of Florida to introduce and establish populations of bio-control agents for control of the weevil. These efforts are supported by the Departments of Agriculture in San Diego, Orange and Los Angeles Counties.

Biological Control Options



***Heterorhabditis indica and Steinernema riobrave* nematodes**

- Scientists in Florida have had some success with nematodes, bacteria and parasitoid wasps. Nematodes are soil invertebrates which feed on either underground plant or animal species. Among the nematodes, members of several genera (e.g., *Heterorhabditis* and *Steinernema*) demonstrate some control of root weevil stages in the soil, but may be less successful in clay soils than in sandy soils.

Biological Control Options

Beauveria bassiana

- Bacteria such as *Beauveria bassiana* have shown some success in Florida, but they are relatively expensive and must be applied repeatedly.

Biological Control Options

***Aprostocetus vaquitarum* – ectoparasitoid of Diaprepes eggs. Released in 2001 and 2002 in southern Florida. By 2004, this parasitoid was responsible for 78-91% of the mortality of Diaprepes egg masses in south Florida. It has been approved for release in California and several thousand have been released in San Diego Co. in 2007-2010. The wasps are now being released in Orange and Los Angeles Counties.**

- In Florida, small parasitoid wasps have been quite effective controlling the root weevil. In 2007 we began releasing the parasitoid wasp *Aprostocetus vaquitarum* in quarantine areas of San Diego County. We have begun monitoring to see whether Aprostocetus has become established in San Diego County. Wasp establishment may be inhibited by pesticide spraying.

Wasps (cont.)

- The wasps were collected in the Caribbean where they are natural control agents of the Diaprepes root weevil. The adult *Aprostocetus* wasps feed on plant nectar and after mating oviposit their eggs in the weevil “sandwich” alongside the much larger weevil eggs. The wasp eggs are only laid in newly deposited weevil egg masses and develop much faster than the weevil eggs. When the wasp eggs hatch, the wasp larvae feed on the weevil eggs, each wasp larva consuming approximately two weevil eggs as it develops.

Diaprepes Management in the Future

- We have noticed that Diaprepes adults have low emergence from dry soil. A trial is currently running where we are comparing adult emergence from soil in a lemon grove where either 1) soil under the tree is mulched, 2) soil under the tree is covered with landscape fabric, 3) soil under the tree is dry, irrigation is done by underground drippers, 4) control is irrigated normally by mini-sprinklers
- Adult emergence from the dry soil is very low and from landscape cloth almost zero. Emergence from mulched soil is high. (See next 2 slides).

Landscape Cloth

Mulch (composted wood chips)

IPM for Control of Diaprepes

- We believe effective control of Diaprepes will be a result from an Integrated Pest Management that includes parasite release, ground covers or underground irrigation, chemical control of adults if populations are high, and natural predators in California soils.