Palm Weevils

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What are Weevils?

- Beetles of the superfamily Curculionoidea
- Known for their elongated snouts
- There are about 97,000 species known with many being pests to wheat, grains, garden products, trees, and agricultural fields

Weevils are beetles belonging to the superfamily Curculionoidea. Being insects, they have 6 legs and a 3-part body.

The 97,000 species are generally split between primitive weevils and true weevils (family Curculionidae). This presentation will focus on species from the true weevil family.

True weevils have chewing mouthparts at the end of the rostrum (elongated snout) and elbowed antennae. Being beetles, they also have a full elytra, or a modified hardened forewing.

Many species of weevils are pests to people. They are often found infesting dried products such as wheat, grain, and cereals. They can also infest gardens and larger agricultural fields.
Examples of damage caused by weevils

Weevils can cause damage on leaves with their chewing mouth parts at the end of their long, snout-like projection at the anterior of the head called a rostrum. For those species that are considered economic pests, the most damage is caused by larvae that feed inconspicuously inside the host plant. They can also be a pest for stored products like grain in the photo on the right.
This presentation focuses on **three** giant palm weevil species of the genus *Rhynchophorus*. **Palmetto weevil** (*Rhynchophorus cruentatus*), **red palm weevil** (*Rhynchophorus ferrugineus*), and **South American palm weevil** (*Rhynchophorus palmarum*) are all important pests of palm.

While all are considered pests, the Palmetto weevil is native to Florida whereas the latter can become invasive.
The palmetto weevil, *Rhynchophorus cruentatus*, is native to Florida and the southeastern United States. The adult weevils can vary greatly in coloration from nearly solid black to almost solid red with a variable black pattern. It also varies in size from 1.9 to 3 cm and is the largest weevil in North America.
Palmetto Weevil Susceptible Plants

Native host plant:
- Sabal palms
- Saw palmetto
- Florida thatch palm
- Royal palms

Other host plants:
- Canary Island date palms
- Bismarck palms
- Fan palms
- Date palms
- Coconut palm
- Latania palms
- Fishtail palms

The native host plant of *R. cruentatus* is sabal palm (*Sabal palmetto*). This pest’s host range is restricted to wounded or dying sabal palm, or newly planted landscape palms that are stressed.

Since the late 1990’s, however, it has caused damage to apparently healthy Canary Island date palms (*Phoenix canariensis*), latania (*Latania sp.*), and bismark (*Bismarckia nobilis*) palms. At times, it has even achieved severe pest status on Canary Island date palm (*Phoenix canariensis*) in Florida nurseries.

Other host plants of palmetto weevil include: Fan palms (*Washingtonia sp.* and *Pritchardia sp.*), Saw palmetto (*Serrenoa repens*), Date palm (*Phoenix dactylifera*), Royal palms (*Roystonea sp.*), Coconut palm (*Cocos nucifera*), Fishtail palms (*Caryota sp.*), and Florida thatch palm (*Thrinax radiata*).
Most damage is caused by larvae feeding on palm tissue. Larvae feed inconspicuously inside the host palm; thus early detection is very difficult.

Symptoms can vary, but generally include irreversible decline of younger leaves. Palm species with upright leaves, such as Canary Island date palms, show early symptoms in older leaves which first droop then collapse. Damage can be so severe that a condition called “popped neck” may occur where the top of the palm falls over as the integrity of the crown is compromised.

When the dead crown and stem eventually collapse, fronds are completely necrotic, and a large amount of weevil frass is evident. If the crown is pulled apart, cocoons, larvae and even adults may be found.
Palmetto weevil is found in its native range in the coastal plain of the southeastern United States from South Carolina to southern Texas. In Florida, it occurs throughout the state.

It is also found in the Bahamas.
Volatile odors called “palm esters” are released by stressed, wounded or dying trees. Palmetto weevils are able to detect these odors and are attracted to the trees. Once *Rhynchophorus cruentatus* has found such a host, it will then release aggregation hormones that attract even more palmetto weevils. When a population of weevils has massed on the tree, mating and egg laying take place.

**Eggs:** Under laboratory conditions, females lay an average of 207 eggs over the course of their lives. Eggs are laid in wounds or the bottom of leaves in host plants. After about 3 days, eggs hatch and begin to feed.

**Larvae:** Larvae are creamy yellowish in color and can be quite large, weighing close to 6 grams. The prominent head capsule is hard and dark brown with large mandibles. Larvae are voracious feeders and prefer the soft tissue surrounding the apical meristem (central growing point). When mature, larvae migrate to the edge of stems and petioles where cocoons are prepared from palm fibers.

**Pupae:** Palmetto weevils first enter a prepupal stage then a pupal stage. The pupal stage lasts several weeks.

**Adults:** Once the adult molts, it may immediately leave the cocoon or stay within the cocoon for several days to weeks before emerging. Adults are active fliers and can vary greatly in coloration from nearly solid black to almost solid red with a variable black pattern. They vary in size from 1.9 to 3 cm. Lifespan of is about 84 days, but in laboratory conditions adults have lived up to 26 weeks under adequate moisture conditions.
Palmetto Weevil Monitoring & Management

- Bucket traps for monitoring
- Prevention is key
  - Promote plant health
  - Avoid pruning/wounding
  - Plant non-susceptible species
- Once infestation is detected, little can be done to save the tree

Bucket traps with freshly cut palm tissue and/or commercially available pheromones can be used to monitor for various palm weevil species, including the palmetto weevil. The traps are most effective for capturing *Rhynchophorus cruentatus* adults if bait tissue is harvested within the previous 72 hours.

Cultural practices provide the best management options. Firstly, palms should be properly fertilized and irrigated to promote plant health and vigor. Secondly, pruning or wounding of trees should be avoided. Canary Island date palms, which are not adapted to South Florida, should not be planted. Otherwise, these palms should be carefully cared for to ensure their health.

Since larvae feed inconspicuously inside the host palm, early detection before there is lethal damage to the crown is difficult. By the time an infestation is detected, there is little that can be done to save the tree. Recently transplanted palms can be prophylactically treated with insecticides, but costs may be prohibitive. Systematic neonicitinoid insecticides can be used for curative and preventative treatments, but persistence and vigilance are necessary.

The recommended course of action is to cut down and destroy infested palms before adults emerge, thus reducing the possibility of spreading the infestation to adjacent trees.
RED PALM WEEVIL

*Rhynchophorus ferrugineus*

Invasive
Some consider the red palm weevil to be the most damaging insect pest of palms in the world.

From an economic standpoint, the nursery production of palm trees in Florida has an estimated value of $127 million, and $203 million throughout the United States. If the red palm weevil were detected in Florida, this could effect the production and trade of palm trees.

The red palm weevil may also affect other species of palm and outcompete native palm weevils, such as the palmetto weevil (Rhynchophorus cruentatus). Palm trees in the landscapes of major cities, residences, or local parks may also be at risk – who would want to see droopy palm trees along the coastal waters of Florida?

From an environmental perspective, the red palm weevil could heavily affect the threatened or endangered species of palms in Florida such as Sabal miamiensis, the Miami palmetto which is only found in Miami-Dade county, if the insect were to use these palms as hosts. It should be noted that it is currently unknown whether S. miamiensis would be a suitable host of the red palm weevil.

The red palm weevil was recently detected for the first time in the western hemisphere in 2009 in the Caribbean Islands of Aruba and Curaçao.
The red palm weevil is predominately reddish-brown in the most typical form. However, coloration is not the most reliable method of identification since the red palm weevil has multiple color morphs ranging from almost entirely red with black markings to almost entirely black with red markings. Accurate identification can only be made using molecular data.
Red Palm Weevil Susceptible Plants

Some of the hosts found in Florida include:
- African oil palm
- Canary Island date palms
- Chinese fan palm
- Coconut
- Cuban royal palm
- Fishtail palm
- Sago palm
- Queen palm
- Washington palms

Primary hosts of the *Rhynchophorus ferrugineus* include:

- African oil palm (*Elaeis guineensis*)
- Betelnut palm (*Areca catechu*)
- Canary Island date palm (*Phoenix canariensis*)
- Chinese fan palm (*Livistona chinensis*)
- Chinese windmill palm (*Trachycarpus fortunei*)
- Coconut (*Cocos nucifera*)
- Cuban royal palm (*Roystonea regia*)
- Date palm (*Phoenix dactylifera*)
- East Indian date palm (*Phoenix sylvestris*)
- Fishtail palm (*Caryota cumingii*)
- Gebang palm (*Corypha utan*)
- Mountain fishtail palm (*Caryota maxima*)
- Nibung palm (*Oneosperma tigillarium*)
- Palasan (*Calamus merrillii*)
- Pygmy date palm (*Sabal blackburniana (=umbraculifera]*)
- Queen palm (*Arecastrum roman佐ffianum*)
- Ribbon fan palm (*Livistona decipiens*)
- Sago palm (*Metroxylon sagu*)
- Sugar palm (*Arenga pinnata*)
- Thorny palm (*Oneosperma horrida*)
- Toddy palm (*Borassus flabellifer*)
- Washington palms (*Washingtonia sp.*)

Of the above-mentioned hosts, *Phoenix* and *Elaeis* are the most economically important species.

Sugarcane (*Saccharum officinarum*) is a secondary host. Sugarcane is one of Florida’s most economically valuable crops, so it being a host for weevils is significant.

The image shows an infested Canary Island date palm.
Early infestations of red palm weevil is difficult to detect. Much of their life cycle is spent within the tissue of palms. It is possible to find tunnels or frass (excrement) on the crown of the palm where the central growing point (apical meristem) is located.

Later stages are more noticeable. Newer leaves will not grow properly, leaving the palm with older decaying leaves. These old leaves will appear yellow and brown. Additionally, old leaves will begin to droop downwards. Look for pupal cases and deceased adults around the base of the tree.

Symptoms of the red palm weevil include tunnels in the base of the tree, frass or plant fluids near external tunnel entrances, a distinct fermented odor, empty pupal cases and/or dead adults, and breaking trunks or drooping branches.
The red palm weevil is native to southeast Asia and Pacific Islands. Its current range includes parts of Asia, the Middle East, Africa, Europe, Oceania, and the Caribbean.

It is most commonly believed that the spread of this species and other species of giant palm weevils is due to international trade of infested palm plants or the use of untreated coconut coir as packing material. Since the palm weevils would be introduced to new areas along with their food source, the likelihood of establishment is high.

In 2010, it was reported that the first detection of the red palm weevil was detected in Laguna Beach, California. However, in 2013, it was found to not be *Rhynchophorus ferrugineus*, but a genetically distinct species. Researchers are currently debating whether or not to resurrect this species under the name *R. vulneratus* (Panzer).

As of 2019, there are no additional specimens reported of *R. ferrugineus* in the USA.

Distribution by region:
Asia: Bangladesh, Cambodia, China (Guangdong, Taiwan), India, Indonesia, Japan, Laos, Malaysia (Sabah, Sarawak), Myanmar, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, and Vietnam.
Middle East: Bahrain, Georgia, Syria, Iran, Iraq, Israel, Jordan, Kuwait, Oman, Palestine, Qatar, Saudi Arabia, and the United Arab Emirates.
Africa: Algeria, Egypt, Libya, Madagascar, Malta, and Morocco.
Europe: Cyprus, France, Greece, Italy, Spain, Portugal, and Turkey.
Oceania: Australia, Papua New Guinea, Samoa, and the Solomon Islands.
The Caribbean: Aruba, Curacao
The life cycle description provided here is for red palm weevils.

**Eggs:** The adult female penetrates plant tissue using her long, slender snout (rostrum) and deposits several eggs before cementing the hole closed. Each female lays an average of 250 eggs. The light-yellow eggs are about 2.5 mm long. The eggs hatch in about 1–6 days.

**Larvae:** Larvae have soft, yellow grub-like bodies with hard, reddish-brown head capsules and grow up to 2 in long. The larvae feed on surrounding plant tissue, boring their way to the center of the tree. The larvae will continue to feed and tunnel through the plant for about two months. Before reaching the pupa stage, the larvae will create a cocoon out of dead plant tissue and coarse palm fibers in the trunk of the tree.

**Pupae:** Pupation in the cocoons requires an average of three weeks before pupae molt into adults.

**Adults:** Once the adult molts, it remains in the cocoon for several days until it reaches sexual maturity. Then the adult emerges and, within one week, begins mating and laying eggs. Adults are predominantly active during the day and can fly long distances of more than 900 m (0.56 mi). The average adult is reddish-brown color and 35 x 12 mm (1.4 x 0.5 in) in size. The lifespan of an adult is ~2 – 3 months.
Red Palm Weevil Monitoring & Management

• Control methods
  – Systemic insecticides (i.e. trunk injections, soil applications, etc.)
  – Mass trapping with aggregation pheromones
  – Chipping and burning infested material

• Refer to *New Pest Response Guidelines: Red Palm Weevil* (USDA PPQ)

There are a few methods used to control or suppress populations of red palm weevil. Insecticides in the form of dusts, liquid sprays, trunk injections, or soil applications are the most commonly used and can be very effective. To reduce population densities without the use of chemicals, mass trapping has been used. The trapping consists of a combination of aggregation pheromones, fermented food bait, and ethyl acetate in bucket traps.

At this time, there are no effective methods of biological control for this species.
SOUTH AMERICAN PALM WEEVIL

*Rhynchophorus palmarum*
South American Palm Weevil

- Native to Mexico, Central and South America
- Vector of Red Ring Nematode, *Bursaphelenchus cocophius*

The South American palm weevil, *Rhynchophorus palmarum*, is also an invasive pest of palms and can be found in Mexico, Central America, and South America.

*Rhynchophorus palmarum* can vector a nematode, *Bursaphelenchus cocophius*, that causes red-ring disease in coconut.
South American Palm Weevil Susceptible Plants

• Primary hosts include:
  – Coconut palm
  – African oil palm
  – Sago palm
  – Canary Island date palm
  – Date palm
  – Sugar cane
  – Juçara palm

Primary host plants of *Rhynchophorus palmarum* are: Coconut palm (*Cocos nucifera*), African oil palm (*Elaeis guineensis*), Juçara palm (*Euterpe edulis*), Sago palm (*Metroxylon sagu*), Canary Island date palm (*Phoenix canariensis*), Date palm (*Phoenix dactylifera*), and sugarcane (*Saccharum officinarum*).


South American Palm Weevil Damage

Symptoms involve progressive yellowing of leaves, necrotic flowers and the death of emerging leaves. Leaves dry out from the crown down, with the apical meristem drooping and eventually dying. Most of the damage is caused by older larval instars which can excavate tunnels up to 40 cm in length and 3 cm wide in 24 to 36 hours. Larval galleries are clearly evident in leaves and stems of heavily infested hosts. The internal tissue of a 3 to 5 year old palm can be completely destroyed by larvae in just 5 to 6 weeks. It has been reported that just 30 larvae are sufficient to kill an adult coconut palm.

Pupae and older instars are often found in the petiole bases of the crown where they are well concealed.

Infested trees emit a characteristic odor which is foul and strong.

Symptoms of the lethal red ring disease of palms may also be evident as Rhynchophorus palmarum vectors the nematode Bursaphelenchus cocophilus which transmits the disease. A characteristic “red ring” is evident when the interior of the tree stem is exposed. Other symptoms vary depending on host species but can include yellowing of older leaves followed by younger leaves, premature nut fall and withering of inflorescences. Trees infected with red ring disease typically die 2 - 4 months after first showing symptoms. Red ring disease causes serious damage to over 17 species of palms but is especially important to coconut and oil palms in the Neotropics where it is causes up to 10 – 15% of the annual losses of these two species.
South American palm weevil is found in the tropical Americas, and the Caribbean. It has also been detected in parts of the United States (California and Texas).

*Rhynchophorus palmarum* has been recorded from Argentina, Belize, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Dominica, Ecuador, El Salvador, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Honduras, Martinique, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, St. Vincent, Surinam, Trinidad and Tobago, Uruguay and Venezuela.

The South American palm weevil has been intercepted or detected but is not established in California and Texas. It is considered to be a threat to palms in Florida.

As of 2019, it has been additionally sampled in Nevada, South Carolina, and Arizona. In 2019, more specimens were found in California and Arizona. It is still not considered established in any state.
The life cycle of South American palm weevils is similar to other palm weevils but there are some differences.

**Eggs:** The adult female penetrates plant tissue using her long, slender snout (rostrum) and deposits a single egg before cementing the hole closed. Females have been documented to lay up to 718 eggs in a lifetime. The pearly white eggs are about 2.4 mm long and 0.9 mm wide and hatch in about 3 – 5 days.

**Larvae:** Larvae go through 6 – 10 larval molts, with 9 molts being most common. Larvae are creamy white, legless and caterpillar-like and can grow up to 5 in long and 1 in wide. A deep orange-brown head houses stout mandibles. Larvae are voracious feeders, feeding on live vegetative and rotting tissue and preferring the softer tissue of the host plant. The larvae will continue to feed and tunnel through the plant for about two months. Once mature, the cuticle darkens to a reddish-brown with a dark brown head. Before reaching the pupa stage, the larvae will create a cocoon out of tough, fibrous palm fibers.

**Pupae:** Pupae spend 4 -17 days in a prepupal stage and 8-23 days in a true pupal stage.

**Adults:** Once the adult molts, it remains in the cocoon for 4 -11 days. Then the adult emerges and, within 12 – 24 hours, begins feeding and mating indiscriminately. Oviposition occurs 2 – 9 days after first mating. Adults are strong fliers which are predominately active during the morning and late afternoon. Adults fly an average of 20 feet per second and can travel distances up to 1600 m (1 mile) in 24 hours. The average adult is a deep black color and 33 x 15 mm (1.3 x 0.6 in) in size. The lifespan of an adult averages 40 – 45 days.
South American Palm Weevil Monitoring & Management

- Monitoring by:
  - Pheromone traps
  - Visual inspection
- Management by:
  - Pheromone traps
  - Phytosanitation
- Management of red ring disease by control of *R. palmarum* populations

Since *Rhynchophorus palmarum* are well concealed within the tissues of the host, infestations can only be detected once the palm begins to die, by using pheromone traps to detect adults or via visual surveys to detect larval populations before adults emerge.

Visual inspections are typically conducted once signs of infestation are evident for suspect trees. Palm fronds are removed from the base with a pole cutter and the petiole is inspected for tunneling, larvae, pupae or adults. Splitting the base of the palm frond with a hatchet can be helpful.

Another method for visual inspection is to cut a “window” by cutting multiple fronds from the crown to the beginning of the trunk. This method may be able to detect larval and pupal stages before adults emerge but will affect the appearance of the palm and should only be used with highly suspect trees.

These techniques can be used to monitor other palm weevil species as well.

Traps can be homemade using a 5-gallon bucket or bought. A lure with aggregation pheromones, ethyl acetate (the chemical emitted by stressed trees) and a sweet food bait such as sugarcane are used. A 1:1 solution of propylene glycol and water are poured over the bait to cover 75% of the food bait. This mixture retains the captured weevils in the trap as well as extends the life of the food bait. It is also acceptable to used the same trap to lure the red palm weevil. In such a case, a pheromone lure specific to the red palm weevil should also be used.

Various variations of traps and lures also exist.

Traps are used not only to monitor but also to control *R. palmarum* populations. Most often, however, infested trees are destroyed to reduce infestation levels. Chemical control has not been successful and is not recommended. Research is currently being conducted on the use of natural enemies such as *Paratheresia menezesi* (Diptera: Tachinidae), mites (*Hypoaspis* sp. and *Tetrapolypus rhynchophori*) and the entomopathogenic fungi *Beauveria bassiana* to control populations but more work needs to be done in this area.

Currently the only method of managing red ring disease is to control the vector *R. palmarum* as efficient control of the nematode vector does not exist.
Side by Side Comparison
The best way to distinguish these three species of giant palm weevils is to look at the shape of the pronotum, the plate that covers the thorax. First, look at the posterior end (back edge) of the pronotum. The palmetto weevil (top left photo) and the red palm weevil (top center photo) both have flat/evenly curved back ends of the pronotum, whereas the South American palm weevil (top right photo) has a rounded/lobed posterior end.

Then, look at the anterior end of the pronotum (front). As you follow the pronotum of the palmetto weevil (top left photo) from the front to the back, it looks like this weevil has broad “shoulders”. However, if you view the pronotum of the red palm weevil and the South American palm weevil (top center and right photo), you can see that there are no “shoulders” (it slopes down).

In addition, the scutellum of palmetto weevil (bottom left photo) tapers acutely, whereas it tapers broadly on red palm weevil (bottom center photo) and South American palm weevil (bottom right photo).
In addition, the rostrum (snout) of male palmetto weevils does not have setae, which are bristle or hair like structures (top left photo), whereas setae are present on the rostrum of red palm weevil (top center photo) and South American palm weevil (top right photo). These setae makes it look like the males of the red palm weevil and the South American palm weevil have mustaches.

The mandible of males is unidentate (single toothed) in palmetto weevils (top left photo), tridentate (triple toothed) in red palm weevil (top center photo), and bidentate (double toothed) in South American palm weevil (top right photo).

The submentum (of both sexes) also varies among the three species as follows:
- Palmetto weevils have straight subgenal sutures (bottom left photo)
- Red palm weevils have concave subgenal sutures (bottom center photo)
- South American palm weevils have a narrow suture and sculpturing between antennal scrobes.
The Digital Diagnostic Identification System (DDIS) connects extension clientele, extension agent, specialists, plant disease clinics, and government officials. Users can submit electronic samples through the system to get rapid identification of insect, weed, mushroom, plant pathogens, and abiotic disorder samples. The general public and shareholders must contact their local county extension agent before signing up as extension clientele.
The UF/IFAS faculty is responsible for reporting diseases, insects, weeds, nematodes, or any other invasive species to the Florida Department Agriculture and Consumer Services, Division of Plant Industry (FDACS, DPI). Reporting this information is essential to protect Florida agriculture, communities and natural areas.

Local county extension agents can assist in identifying plant pests or submitting a pest sample to the correct department or agency for identification. Local extension agents can also sign up for DDIS and receive samples electronically.

Lyle Buss is the insect identifier at the University of Florida. Visit the link to download the sample submission form or email him with questions.

Dr. Carrie Harmon is the head of the plant diagnostic center in Gainesville, Florida. Visit the PDC website to download the sample submission forms. She highly recommends calling prior to sample submission.

The diagnosticians and identifiers in each area will also provide management strategies for the sample. If an invasive pest is found, they will send it FDACS, DPI for further testing.
Reporting
FDACS: Division of Plant Industry

- FDACS, DPI Responsibility
  - Announcing detection or establishment of new invasive species.
  - Reporting is a legal obligation under Florida Statute 581.091.
- Submission Form
  - [http://forms.freshfromflorida.com/08400.pdf](http://forms.freshfromflorida.com/08400.pdf)
  - [https://www.fdacs.gov/Agriculture-Industry/Pests-and-Diseases/How-to-Submit-a-Sample-for-Identification](https://www.fdacs.gov/Agriculture-Industry/Pests-and-Diseases/How-to-Submit-a-Sample-for-Identification)

Florida Department of Agriculture and Consumer Services: Division of Plant Industry is a regulatory agency dedicated to the detection and prevention of introduction and spread of pests and diseases that can affect Florida’s native and commercially grown plants. Announcing the establishment of new invasive species can affect Florida’s agricultural producers and trade of agricultural products.

FDACS, DPI provides online submission forms to fill out and send to the agency for proper identification. DPI provides useful videos of how to properly handle the specimens before shipping them for identification.
The DPI contacts provided will assist in determining the next steps if the pest found is of regulatory concern. Additionally, FDACS, DPI has a hotline with both a phone number and email for questions and concerns.
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