CAPS Datasheets provide pest-specific information to support planning and completing early detection surveys.

Rhynchophorus ferrugineus

Scientific Name
Rhynchophorus ferrugineus (Olivier, 1790)

Common Name
Red palm weevil, Asiatic palm weevil, coconut weevil, red stripe weevil

Type of Pest
Weevil

Taxonomic Position
Class: Insecta, **Order**: Coleoptera, **Family**: Curculionidae (often listed as Dryophthoridae)

Figure 1. *R. ferrugineus* adult (Image courtesy of Amy Roda, USDA-APHIS).

Notes on taxonomy and nomenclature: There is an array of color variations across the native and introduced range of *Rhynchophorus ferrugineus* (Fig. 1), and the taxonomy has changed multiple times in the past. Recent molecular research suggests that *Rhynchophorus ferrugineus* may actually be a species complex composed of two or more cryptic species (Rugman-Jones et al., 2013).

Figure 2. *R. vulneratus* adult, red stripe color morph (Image courtesy of Center for Invasive Species Research).

A closely related and similar species, *Rhynchophorus vulneratus* (Panzer) (Fig. 2), was detected was detected and eradicated in Laguna Beach, California in 2010 (Hoddle et al., 2017; Rugman-Jones et al., 2013). PPQ acknowledges there are two species, but for detection and operational purposes, both will be handled in the same way.

Pest Recognition
This section describes characteristics of the organism and symptoms that will help surveyors recognize possible infestations/infections in the field, select survey sites, and collect symptomatic material. For morphological descriptions, see the Identification/Diagnostic resources on the AMPS pest page on the CAPS Resource and Collaboration website.

Pest Description: *Rhynchophorus ferrugineus* is a pest of certain palms. Larval stage feed on meristematic tissue which, when severe enough, can kill palms. Adult weevils are large insects that can be seen crawling on palms, flying, and captured in traps loaded with commercially-available aggregation pheromone and fermenting bait which are used for monitoring, detection, surveys, and population-level control.

Eggs are deposited in stem and trunk tissues, usually in the crown. They are creamy white and approximately 0.1 inch long by 0.04 inch wide (Menon and Pandalai, 1960; EPPO, 2020).

Larvae are found within palm offshoots, the crown, and occasionally in the woody parts of the trunk. Larvae are legless, creamy white to ivory in color with a brownish-red to brilliant brown or black head capsule (Fig. 3). There are 3-7 instars and the last instar averages 2 inches in length and 0.8 inches in width, and pupates within a fibrous cocoon. The pupa (Fig. 3) is approximately 1.4 inches long and 0.6 inches wide (Menon and Pandalai, 1960; EPPO, 2020).

Adults are large weevils (Fig. 1, 3). Males and females are similar in appearance; varying in size from 0.6 to 1.6 inches in length and 0.3 to 0.6 inch in width (Rochat et al., 2017). Male weevils have hair in the dorsal side of the snout. The body is elongate, oval in shape, can be variable in color but often is a dull orange with dark spots. The antennae arise from the base of the snout. The elytra (wing covers) can be dark red to black, shiny or dull, and slightly pubescent; the black spots on pronotum are extremely variable in appearance (see the dorsal region behind the head of the adult weevils seen in Fig. 1, 3). Adults primarily fly during the day but will also fly at night (Menon and Pandalai, 1960; EPPO, 2020; Rugman-Jones et al., 2013).

Figure 3. *R. ferrugineus* larva, pupa, and adult (Image courtesy of Center for Invasive Species Research).

Signs and Symptoms:
Early detection of weevil infested palms is challenging because feeding larvae are concealed within the palm. Larval feeding destroys meristematic which may not present exterior signs of of attack (Menon and Pandalai, 1960).

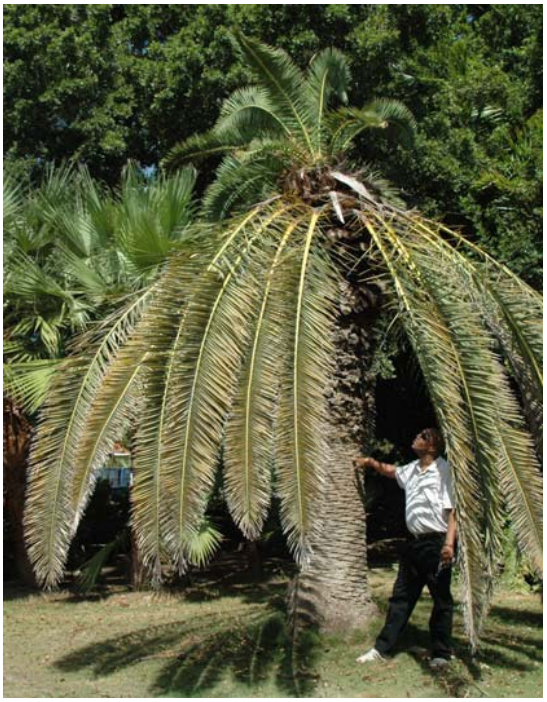

Figure 4. Deformed, offset growth of the top canopy and umbrella-like appearance of a palm infested with *R. ferrugineus* (Image courtesy of Amy Roda, USDA-APHIS).

Visible signs of weevil infestation include a distorted or deformed growing point at the top of the palm; often with an umbrella-like appearance (Fig. 4) due to the drooping of the damaged leaf petioles (Azmi et al., 2017; Conti et al., 2008). Distorted or “clipped” fronds may also be seen (Fig. 5, 6).

Infested palms may be detected during visual surveys by carefully searching for holes in the crown or trunk of the tree (Fig. 7, 8) or frass and cocoons, which may be visible at the base of damaged fronds after they are removed from the tree (Fig. 9, 10, 11). Holes in the trunk may be accompanied by oozing brown liquid, chewed up fibers, or a foul fermented odor (Amzi et al., 2017; Bokhari et al., 1992).

Larvae may be found in the trunk, frond, or crown of young palms; however, as palms age, larvae are generally found in the crown and at the base of fronds (Menon and Pandalai, 1960). Infested palms can die within 4 to 6 months depending on the level of infestation (Conti et al., 2008).

Damage caused by larval feeding can resemble symptoms caused by other palm pests, namely *Fusarium* fungi (*e.g.*, wilting, drooping fronds) or rodents (*e.g.*, holes at the base of fronds). It can be difficult to definitively diagnose the damage until *R. ferrugineus* specimens are found inside the palm.

Figure 5. Extreme *R. ferrugineus* adult damage to palm fronds (Image courtesy of Amy Roda, USDA-APHIS).

Figure 6. *R. ferrugineus* larval damage to palm fronds (Image courtesy of Amy Roda, USDA-APHIS).

Figure 7. *R. ferrugineus* larval feeding holes at base of frond (Image courtesy of Amy Roda, USDA-APHIS).

Figure 8. Adult *R. ferrugineus* emergence holes (Image courtesy of Amy Roda, USDA-APHIS).

Figure 9. *R. ferrugineus* tunnels in frond and fibrous pupal cocoons are visible. (Image courtesy of Amy Roda, USDA-APHIS)

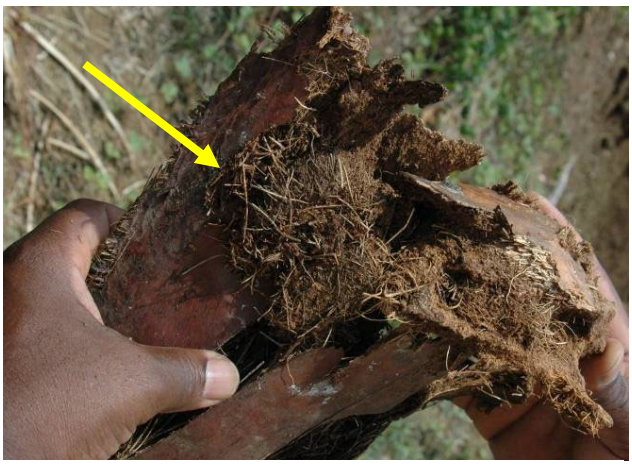

Figure 10. Frond with fibrous pupal cocoons. (Image courtesy of Amy Roda, USDA-APHIS).

Figure 11. Palm frond with unemerged adult weevils inside partially opened pupal cocoons. (Image courtesy of Amy Roda,

Easily Mistaken Species

Rhynchophorus palmarum, a large black weevil, has established in San Diego County in California and has been trapped in Arizona, and Texas (NAPPO PAS, 2011; 2012; 2015a). *Rhynchophorus cruentatus* is a large weevil with similar colors to *R. ferrugineus* that is native to the southeastern United States including Florida (Giblin-Davis and Howard, 1988). Due to the possibility of misidentification, all large weevils infesting palms should be collected and submitted to USDA-APHIS experts for proper identification.

Commonly Encountered Non-targets

Based on the non-target arthropods found in traps for the closely related beetle, *Rhynchophorus palmarum* (Milosavljević et al., 2020), traps baited for *R. ferrugineus* are likely to contain arthropod bycatch, but are unlikely to contain any easily mistaken species.

Biology and Ecology

Females bore into palm tissue at the base of the fronds and lay their eggs in holes excavated by female weevils (Dembilio and Jacas, 2011; Navarro-Llopis et al., 2018). Eggs may also be laid in existing tree wounds (e.g., pruning damage) or in wounds caused by other palm pests like the coconut rhinocerus beetle, *Oryctes rhinoceros* (Coleoptera: Scarabaeidae) (EPPO, 2020). Females lay an average of 250 eggs in their lifetime and under optimal conditions eggs hatch in approximately three days (Murphy and Briscoe, 1999).

After hatching, larvae begin feeding on the surrounding soft tissue, tunneling into the interior of the palm (Fig. 9). Tunnels are filled with frass and plant sap. Larvae often bore into the trunk of young trees at the base of leaves emerging from the center growing point (Bokhari et al., 1992). On mature palms, this can occur at the tree crown, upper portion of the trunk, or base of the petioles (Murphy and Briscoe, 1999). Larval development averages around two months and can take as long as 105 days (Murphy and Briscoe, 1999). Once fully grown, larvae pupate in a fibrous, oval-shaped cocoon within the tree or at the base of the palm frond, taking an average of three weeks to emerge (Murphy and Briscoe, 1999). It is not unusual to find all life stages in a single tree (Rochat et al., 2017) and multiple generations can be completed in a single host (Esteban-Durán et al. 1998; Dembilio and Jaques, 2015).

The adult weevil emerges from the pupal case but may stay within the cocoon (Fig. 5) for several more days before completely emerging (Menon and Pandalai, 1960). The preoviposition period after emerging ranges from 1-17 days (El-Mergawy and Al-Ajlan, 2011; Menon and Pandalai, 1960). Adult weevils live for 1 to 3 months (Esteban-Durán et al., 1998) during which they will mate multiple times and lay eggs (Menon and Pandalai, 1960).

Development time varies substantially with temperature (Dembilio and Jacas, 2011). In India, the complete life cycle from egg to adult averages 82 days (Menon and Pandalai, 1960), but has been reported to take as long as 210 days under laboratory conditions (Kalshoven, 1981, as reported by Dembilio and Jacas, 2011). *Rhynchophorus ferrugineus* in Spanish palm trees complete 1 to 2 generations per year, depending on location (Dembilio and Jacas, 2011), while lab-raised beetles produced 3 generations per year at 77-81°F (El-Ezaby, 1997). Dembilio and Jacas (2011) predicted that there would be less than 2 generations per year in California and more than 2 generations per year in Florida and the Caribbean.

Rhynchophorus ferrugineus adults are active mostly during the day (Aldryhim and Ayedh, 2015; Menon and Pandalai, 1960) and in the laboratory they can fly long distances in a 24 hr period (Hoddle et al., 2015a). Mark and release field studies conducted by Abbas et al. (2006) found that weevils could migrate up to 4.3 miles in 3 to 5 days. Adults are usually attracted to damaged or dying palms although undamaged palms can also be attacked (Murphy and Briscoe, 1999).

Known Hosts

Rhynchophorus ferrugineus infests several economically important palm species, including coconut, date, and oil palms (Menon and Pandalai, 1960). It also infests native palm species and a number of cultivated ornamental palms, especially Canary Island date palms, all of which are present in the United States.

The host list below includes cultivated and wild plants that 1) are infested by the pest under natural conditions, 2) are frequently described as major, primary, or preferred hosts, and 3) have primary evidence for feeding and damage documented in the literature. Plants are highlighted in bold if they are commercially produced and the pest causes economically significant damage.

Preferred hosts

Arecaceae: ***Cocos nucifera**** L. (coconut palm), ***Phoenix canariensis**** Hort. ex Chabaud (Canary Island date palm), ***Phoenix dactylifera**** L. (date palm) (Abe et al., 2009; Al-Saad and Aletby, 2018; Dembilio et al., 2009; El-Mergawy et al., 2011; Esteban-Durán et al., 1998; Menon and Pandalai, 1960)
*Hosts with known U.S. distribution.

Other hosts

Arecaceae: *Areca catechu* (betel nut palm), *Arenga pinnata* (sugar palm), *A. pinnata* (syn: *A. saccharifera*) (sugar palm), *Borassus flabellifer* (plamyru/toddy palm), *Brahea armata* (Mexican blue palm), *Calamus merrillii* (palasan), *Caryota cumingii* (Philippine fishtail palm), *C. maxima* (pugahan), *Chamaerops humilis* (dwarf fan palm), *Corypha utan* (syn. *C. elata*, *C. gepanga*) (gebang palm), *C. umbraculifera* (talipot palm), *Elaeis guineensis** (oil palm), *Livistona australis* (Australian fan palm), *L. chinensis** (Chinese fan palm), *L. decipiens* (ribbon fan palm), *L. rotundifolia** (fountain palm) *L. saribus* (serdang palm), *Metroxylon sagu* (sago palm), *Oncosperma horridum* (thorny palm), *O. tigillarium* (nibung palm), *Phoenix sylvestris* (date palm), *P. theophrasti* (Cretan date palm), *Roystonea regia* (royal palm), *Sabal palmetto** (syn. *S. blackburniana*) (cabbage palm), *Trachycarpus fortunei** (windmill palm), *Washingtonia robusta* (Mexican fan palm), *Washingtonia** sp. (Esteban-Durán et al., 1998; Murphy and Briscoe, 1999; Malumphy et al., 2017; Melifronidou-Pantelidou, 2009; Rochat et al., 2017; Uribarrena, 2013).
*Hosts with known U.S. distribution.

Pest Importance

Rhynchophorus ferrugineus is considered to be one of the most important palm pests in the world (Fiaboe et al., 2012; Kontodimas et al., 2006). It has spread to many palm

growing regions, and it frequently kills trees (Murphy and Briscoe, 1999). It has been reported as a pest on coconut in India and Sri Lanka (Menon and Pandalai, 1960), sago and oil palms in Malaysia, and date palms in the Middle East (Murphy and Briscoe, 1999). High crop losses can occur with severe infestations. Yield losses as high as 25% have been recorded for coconut palms in India (Murphy and Briscoe, 1999).

In the United States, dates are commercially produced in California and Arizona (USDA NASS, 2022) and could be at risk if this pest became established. Additionally, ornamental palms grown across the southern United States are at risk and this weevil could cause major economic impacts to ornamental palm producers, property owners, resorts, and municipalities. The ornamental palm industry is valued at approximately $70 million per year in California alone (Milosavljević et al., 2019). The cost of replacing an individual Canary Island date palm can range from $1,365 for a 1-1.5 foot tall tree (NLG, 2023) to $6,500 for an 18 foot tall tree (Quality Palms, 2023).

Rhynchophorus ferrugineus is included on the current EPPO A2 List of Pests Recommended for Regulation (EPPO, 2021) and it is also considered a Harmful Organism by the European Union and 21 other countries (PCIT, 2022). Hence, its establishment could impact trade due to possible quarantine restrictions.

Pathogens or Associated Organisms Vectored

This pest is not currently known to vector any pathogens or other associated organisms, but it could potentially vector *Bursaphelenchus cocophilus*, the nematode that causes red ring disease of palms. Known vectors of the nematode include *Rhynchophorus palmarum* and other closely related weevils in the subfamily Rhynchophorinae. With the recent introduction of *R. ferrugineus* to the Caribbean, where *R. palmarum* and the red ring nematode occur, there is now the potential for it to come into contact with the red ring nematode vectored by *R. palmarum*.

Known Distribution

Rhynchophorus ferrugineus is native to southern Asia, but has been widely introduced to the Middle East and Mediterranean Countries, the Maghreb region of Africa, and the Caribbean (Abdel-Baky et al., 2022; Wang et al., 2017).
Africa: Djibouti, Egypt, Libya, Mauritania*, Madagascar, Morocco,, and Tunisia*, **Asia:** Bahrain, Bangladesh, Cambodia, China, Cyprus, Georgia, India, Iran, Iraq, Israel, Japan, Jordan, Kuwait, Laos, Malaysia, Myanmar, Oman, Pakistan, Philippines, Qatar, Saudi Arabia, Sri Lanka, Syria, Taiwan, Thailand, Turkey, United Arab Emirates, Vietnam, and Yemen; **Caribbean:** Aruba, Curaçao, and Saint Maarten (listed as Netherland Antilles); **Europe:** Bosnia and Herzegovina, France*, Greece, Italy, Malta, Montenegro, Portugal, and Spain (Abbas et al., 2006; Abdel-Baky et al. 2022; Abe et al., 2009; Al-Otaibi et al., 2022; Al-Saad and Aletby, 2018; Assggaf, 2013; Bozbuga and Hazir, 2008; Conti et al., 2008; Cox, 1993; El-Mergawy, et al., 2011; EPPO, 2022; Faleiro et al., 2019; Fiaboe et al., 2011; Hrnčić et al., 2012; Murphy and Briscoe, 1999; Ostojic et al, 2019; Roberti et al., 2013; Rugman-Jones et al., 2013; Soomro et al., 2022; Vacas et al., 2017; Wang et al., 2017; Wattanapongsiri, 1966).

*Currently considered under official control (EPPO, 2022).

Pathways

There are only two likely pathways for entry into the United States; the importation of live infested palms and smuggling. Due to the concern over this pest, the importation of palms large enough to harbor this pest is prohibited (USDA, 2022). It has been suggested that the *R. vulernatus* infestation eradicated in California may have been the result of smuggled and released insects (CISR. 2011; Hoddle, 2015b).

Use the PPQ Commodity Import and Export manuals listed below to determine 1) if host plants or material are allowed to enter the United States from countries where the organism is present and 2) what phytosanitary measures (e.g., inspections, phytosanitary certificates, post entry quarantines, mandatory treatments) are in use. These manuals are updated regularly.

Agricultural Commodity Import Requirements(ACIR) Manual: ACIR provides a single source to search for and retrieve entry requirements for imported commodities. https://acir.aphis.usda.gov/s/

Plants for Planting Manual: This manual is a resource for regulating imported plants or plant parts for propagation, including buds, bulbs, corms, cuttings, layers, pollen, scions, seeds, tissue, tubers, and like structures. https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/plants_for_planting.pdf

Treatment Manual: This manual provides information about treatments applied to imported and domestic commodities to limit the movement of agricultural pests into or within the United States. https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf

Potential Distribution within the United States

APHIS estimated that *R. ferrugineus* could establish in global Plant Hardiness Zones 8-14 (USDA-APHIS-PPQ, 2011) which includes Hawai'i, all the Territories, and parts of the southern U.S. mainland including California, Arizona, Florida and other southern U.S. states, where palm hosts are commercially grown or used as landscape plantings. Another modelling study indicated *R. ferrugineus* could establish in Puerto Rico, the U.S. Virgin Islands, 16 counties in Florida, 4 counties in Louisiana, and the coastal portions of 13 counties in California (Fiaboe et al., 2012).

Survey and Key Diagnostics

Approved Methods for Pest Surveillance*:

For the current approved methods and guidance for survey and identification, see Approved Methods for Pest Surveillance (AMPS) pest page on the CAPS Resource and Collaboration website, at https://approvedmethods.ceris.purdue.edu/ (USDA-

APHIS-PPQ-S&T, 2022).

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Versions

June 2023: (Version 14)

- All sections reorganized, updated and revised on new template
- New references added to most sections and Literature Cited
- Palm weevil cone trap added to approved traps

July 2016 (Version 13)

- NAPPFAST map removed.

March 2014 (Version 13)

- Revised version posted to CAPS website.
- Taxonomic note added about the possibility of *Rhynchophorus ferrugineus* being a species complex.

February 2013

- Yemen added as a new country in Distribution section.

January 2011 (Version 1)

- Final datasheet posted to CAPS website.

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