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# CARIBBEAN FOOD CROPS SOCIETY

## 46

**Forty Sixth  
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**Boca Chica, Dominican Republic  
Vol. XLVI – Number 2  
T-STAR Invasive Species Symposium**

PROCEEDINGS  
OF THE  
46<sup>th</sup> ANNUAL MEETING

Caribbean Food Crops Society  
46<sup>th</sup> Annual Meeting  
July 11-17, 2010

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**“Protected agriculture: a technological option for competitiveness of the Caribbean”**

**“Agricultura bajo ambiente protegido: una opción tecnológica para la competitividad en el Caribe”**

**“Agriculture sous ambiance protégée: une option technologique pour la compétitivité de las Caraïbe”**

**United States Department of Agriculture,  
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**Toward a Collective Safeguarding System for the Greater Caribbean Region:  
Assessing Accomplishments since the first Symposium in Grenada (2003)  
and Coping with Current Threats to the Region**

**Special Symposium Edition  
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**THE RED PALM WEEVIL, *RHYNCHOPHORUS FERRUGINEUS*, A NEW PEST THREAT IN THE CARIBBEAN: BIOLOGY AND OPTIONS FOR MANAGEMENT...**

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**ABSTRACT.** The red palm weevil (RPW) *Rhynchophorus ferrugineus*, is a serious pest of palms. RPW is native to Asia, but over the last few decades it has spread to the Middle East, Africa, and Europe, where it has caused major economic damage. This pest was accidentally introduced to the Caribbean (Curacao and Aruba) probably around 2008 through trade in ornamental palms. In these localities, the pest has caused considerable damage and death to several palm species, and it now poses a serious threat to the rest of the region. This paper provides a brief summary of the current knowledge of the pest with particular reference to the neotropics.

## **INTRODUCTION**

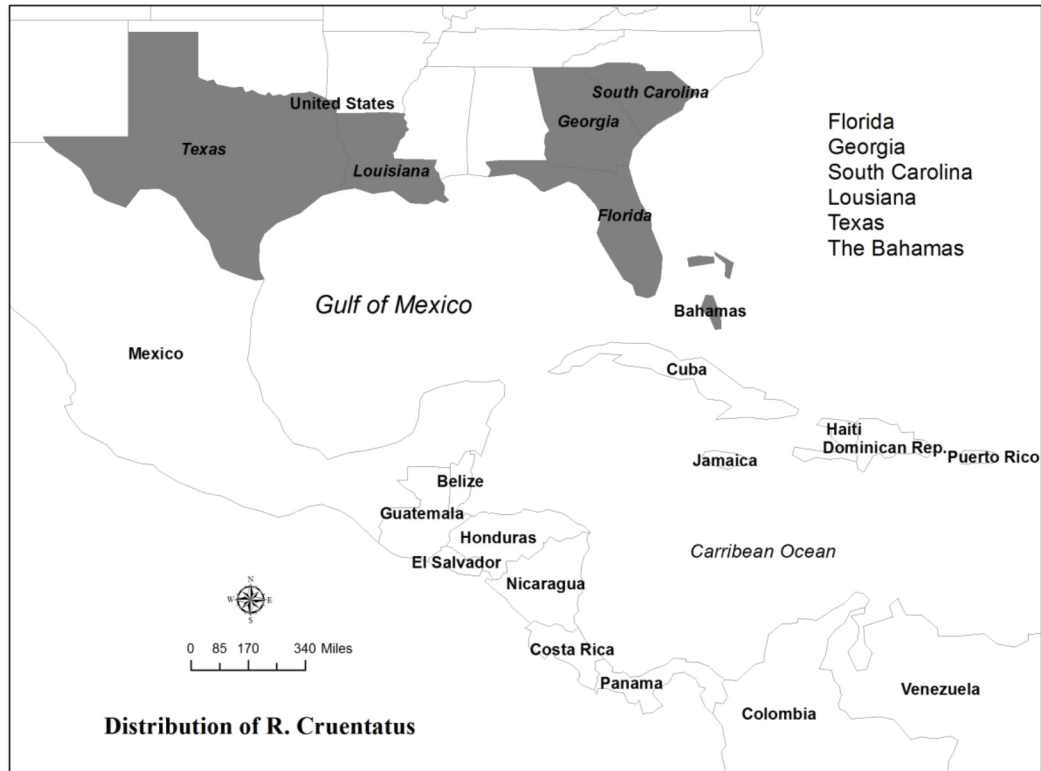
Palms in their various guises are a central feature of the landscape in most countries in the Caribbean basin where they play a multifunctional role. For many people, the archetype of the Caribbean as a tourist destination is beautiful landscapes of palms, sand, and water. There are many species of palms in the Caribbean, but perhaps the most obvious are coconut palms. Not surprisingly, palms are an important feature in most tourist amenity and residential areas. The importance of coconut palms (Arecaceae: *Cocos nucifera* L.) has increased considerably in recent times. An article in Fortune magazine (June 14, 2010) stated that during the previous two years, sales of coconut water had more than doubled to US\$60 million. While there has been no comprehensive assessment of the economic impact of palms, it is clear that this is highly significant. In recent years, palms have been facing several new pest/disease threats such as lethal yellowing (causal agent: mycoplasma-like organism), red palm mite (*Raoiella indica* Hirst), and spiraling whitefly (*Aleurodicus dispersus* [Russell]), among others. The most recent threat, however, is posed by red palm weevil (RPW), *Rhynchophorus ferrugineus*, an Asian species that was first reported in the Western Hemisphere in Curacao about two years ago. The genus *Rhynchophorus* is comprised of at least ten types of fairly large weevils, two of which are native to the neotropics; *R. cruentatus* and *R. palmarum*.

## **Distribution and Pest Status of Neotropical *Rhynchoporus***

### ***Rhynchophorus cruentatus***

The distribution of *R. cruentatus* includes parts of the southern United States and the Bahamas. Its native host is *Sabal palmetto*, but it seems to attack mainly wounded or dying palms. Occasionally, this species can be a severe nursery pest of *Phoenix canariensis* in Florida (Hunsberger et al. 2000). Other recorded hosts include *Bismarckia nobilis*, *Washingtonia* sp., *Serrenoa repens*, *P. dactylifera*, *Pritchardia* sp., *Roystonea* sp., *Cocos nucifera*, *Latania* sp., *Caryota* sp., and *Thrinax radiata*.

Figure 1. Distribution of *Rhynchophorus cruentatus* (after Hunsberger et al., 2000)



### ***Rhynchophorus palmarum***

*Rhynchophorus palmarum* has been reported as a pest on palms and sugarcane (EPPO 2005). The species is a vector of the nematode, *Bursaphelenchus cocophilus*, which causes red-ring disease of palms. The species has a wide host range which includes 35 plant species in 12 different families. It is, however, found predominantly on Arecaceae. Among the key hosts are *Cocos nucifera*, *Elaeis guineensis*, *Euterpe edulis*, *Metroxylon sagu*, *Phoenix canariensis*, *Phoenix dactylifera*, *Saccharum offi cinarum*. *Rhynchophorus palmarum* is widely distributed in the neotropics

### **Red Palm Weevil (RPW) *Rhynchophorus ferrugineus***

#### **Distribution and appearance of RPW in the Western Hemisphere**

RPW probably arrived in the Dutch Antilles in 2008, but the earliest documented reports go back to the beginning of 2009 (EPPO 2009). It appears likely that the weevil was brought in on mature palms imported from Egypt by the landscaping industry. RPW is native to tropical Asia but over the last two to three decades, the pest has spread to the Middle East, Africa, and the Mediterranean, including the Canary Islands (EPPO 2008, 2009). RPW has a long history, and research and management efforts have been ongoing for the last century. Most of the earlier work was recently reviewed by Faleiro (2006) and USDA/APHIS (2010), and the account summarized below is largely derived from these publications unless stated otherwise. The specific focus of this summary is information that is of relevance to the Caribbean.

Figure 2. Distribution of *Rhynchophorus palmarum* (after EPPO, 2005)



## Host plants

According to Esteban-Duran et al. (1998), RPW has been recorded on at least 17 palm species including: *Areca catechu*, *Arenga pinnata*, *Borassus flabellifer*, *Caryota maxima*, *C. cumingii*, *Cocos nucifera*, *Corypha gebanga*, *C. umbraculifera*, *C. elata*, *Elaeis guineensis*, *Metroxylon sagu*, *Oreodoxa regia*, *Phoenix canariensis*, *P. dactylifera*, *P. sylvestris*, *Sabal umbraculifera*, *Washingtonia sp.* In the Caribbean, the pest has been reported on at least seven palm species but the most seriously affected are *Phoenix canariensis* and *P. dactylifera* (Table 1).

Table 1. Host plant list of the red palm weevil in the Caribbean.

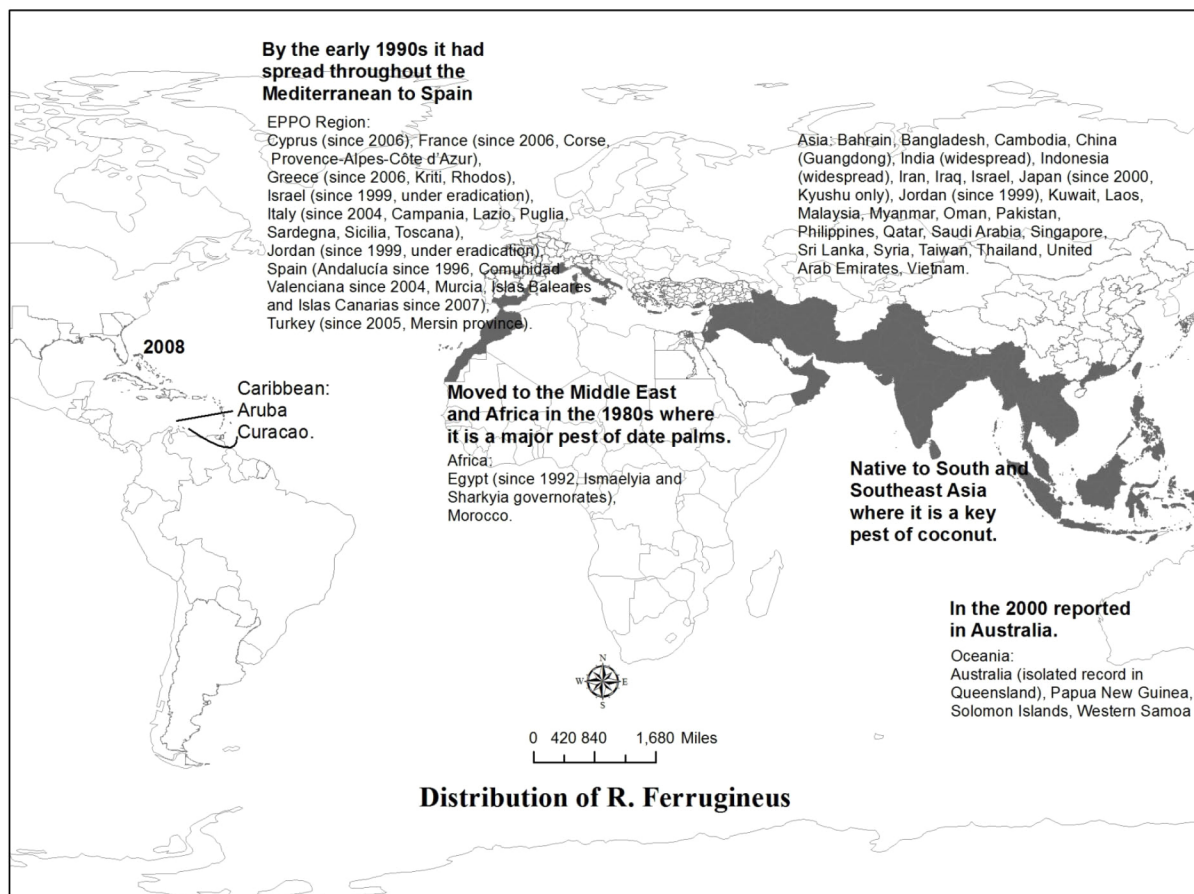
Host Plant Species	Status
<i>Phoenix dactylifera</i>	Highly attacked
<i>Phoenix sylvestris</i>	Highly attacked
<i>Cocos nucifera</i>	Reported

Note: Weevil larvae have been found in *Bismarckia nobilis*, *Washingtonia robusta*, *Pritchardia pacifica*, *Dictyosperma album*, but these have not been identified to species.

## Developmental and reproductive biology

Faleiro (2006) reviewed a range of previous studies which are used as the basis for the summary below, but more recent studies have also been conducted in Spain (Dembilio and Jacas 2011). Females lay 58–531 eggs which undergo a 1–6 days incubation period. Larval and pupal development ranges from 25–105 and 11–45 days, respectively. The overall lifecycle may last from 45–139 days while adults can live for 2–3 months. The number of reported generations per year varies considerably, with reports ranging 3–21 per year.

Figure 3. Distribution of *Rhynchophorus ferrugineus* (after EPPO, 2008, 2009).



## Dispersal and spread

Long-distance spread of RPW is mainly through the palm trade. The introduction of the pest to the Netherlands Antilles is strongly linked to the importation of mature palms from Egypt. Based on this information, it is imperative that care is taken when importing material from regions where the pest is present. Adult weevils are also attracted to ripening fruits, which raises the possibility of them hitch-hiking. This can be important in situations where there is high boat traffic involving inter-island or island/continent fruit and vegetable traders. Such trade is for instance common between Curacao and Venezuela. At the local level, adults can fly up to 1 km per day.

## Options for control

As a pest that has become established in areas outside its native range, classical biological control would seem like a logical solution. However, to-date, no studies have shown promise using this approach (USDA/APHIS 2010; Faleiro 2006). Thus efforts have been focused on development and implementation of Integrated Pest Management (IPM). For instance, in India, RPW has been successfully managed on coconut using IPM since the mid-1970s. More recently, successful IPM programs have been implemented in the Middle East for date palms. In Spain



(Canary Islands), recent years have shown good promise with eradication, although these efforts are ongoing (Jacas personal communications). The essential components of IPM include early detection of infestations, and use of a variety of approaches such as, trapping, sanitation, chemical control, biological control, and education and outreach.

**Detection of early infestations:** The ability to detect early stage infestations of RPW is critical for the effective implementation of IPM. As an internal feeder, symptoms of RPW may not be immediately obvious and by the time they become apparent, it may be too late to take remedial action. Among the damage symptoms to look out for are gnawing sound due to larvae feeding, notched and deformed fronds, oozing out of thick brown fluid from the tunnels, appearance of frass with a typical fermented odor, drooping fronds/yellowing, pupal cases and dead adults, and in advanced infestations the trunk may break and the crown may topple. It is noteworthy that in contrast to what commonly happens in the Middle East where infestations commonly occur on the trunk near the ground, in the Caribbean RPW infestation are most commonly found attacking the crown. Infestations have been noticed on the trunk near the ground but these are relatively rare and are associated with very humid conditions (irrigation).

Considerable effort has been made to develop tools to assist in the detection of early infestations. Such tools have typically been based on the detection of sound made by feeding larvae or on olfactory detection of infestations using sniffer dogs (Mankin et al. 2011; Siriwardena et al. 2010; Faleiro 2006).

**Trapping:** Trapping is used for monitoring infestations and control through adult trapping. RPW trapping is based on the use of pheromone-based lures (comprised of a male aggregation pheromone made up of two molecules, 4-methyl-5-nonanol and 4-methyl-5-nonanone) and host-based lures (ethyl acetate and/or food baits such as sugarcane, apples, palm pieces, or dates).

**Sanitation:** Sanitation is a crucial component of any management program. When palms are severely infested, the solution is often to cut down the plants. Because weevils will continue to emerge from infested palms even after they are cut down, it is important that such material is disposed of properly so that they do not remain a source of infestation. This can be done by burning, chipping the material into small bits, or deep burial of the material. When chipping the material, this should be done to a size that is smaller than the typical pupa.

**Chemical control:** Insecticides are a critical component of IPM programs and these may be used for preventative or curative treatments (USDA/APHIS 2010; Faleiro 2006). Both contact and systemic pesticides are used. The latter are particularly critical in order to target the internally feeding larvae. Careful considerations should be made where material may be harvested for human consumption. Depending on the product, several application methods have been used, including sprays, ground drenches, and tree injections.

**Biological control:** Recent efforts have examined the use of biopesticides based on the nematode *S. carpocapsae* (Llacer et al. 2009; Dembilio et al. 2009). A product, Biorend<sup>R</sup>, which is comprised of the nematode+ Chitosan (N-acetyl-glucosamine), has been registered. The literature also includes fungal-based biopesticides although it is unclear how effective these are. In the Netherlands Antilles, some fungal-based products were being recommended for application by injection.

**Public awareness:** In the Caribbean, RPW is mainly a pest of amenity and is often found in residential areas where palms are grown as ornamentals. Education and outreach components are

therefore vital to the success of any management program. The audiences are typically, government officials, hotels, commercial nurseries, and homeowners. The purpose of such campaigns is typically to increase awareness of the serious economic impact of RPW by providing information on the necessary actions to mitigate the risks of re-importing or spreading the pest and on preventative and/or management actions, including proper use of pesticides.

### **Current status in Curacao and Aruba**

Our ongoing work in Curacao and Aruba has been focused on the following elements: assessing the current distribution and impact of RPW, implementing a pilot monitoring/surveillance program, conducting critical applied research to validate relevant technologies, developing new pest response guidelines, and providing assistance in the development and implementation of a long-term management response.

### **CONCLUSIONS**

RPW is a serious threat to the Caribbean, so it is imperative that a cooperative regional effort is developed to address the problem. There is a strong need for increased public awareness across the region and preparation of detailed contingency plans for the management of the pest should it spread beyond its current distribution. Part of the problem is that some of the countries in the region have inadequate, or lack appropriate, legislation to allow implementation of appropriate phytosanitary measures. It will therefore be important for policy makers to address this challenge in order to effectively deal with invasive species in general. Given the results that are being achieved in the Canary Islands, it seems reasonable to consider the possibility of eradicating RPW in the affected Caribbean islands. Such a program would be beneficial to the rest of the region as it would minimize the risk of spread. However, to ensure success, the program would need to be carefully planned and adequately resourced.

### **ACKNOWLEDGMENTS**

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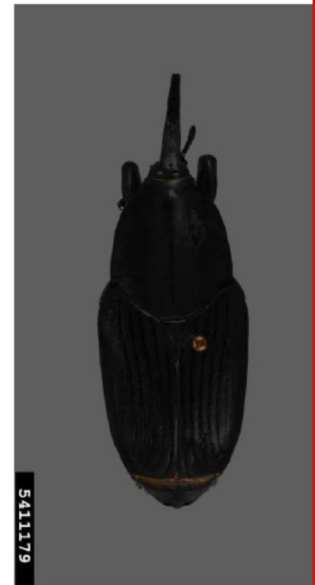
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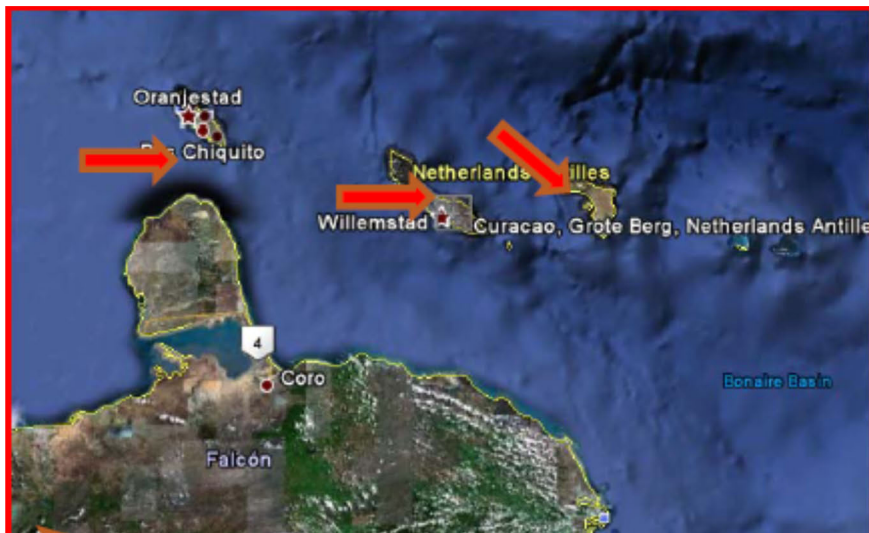
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# NEOTROPICAL PALM WEEVILS

- *Rhynchophorus cruentatus*
- *Rhynchophorus palmarum*
- *Rhynchophorus ferrugineus*



By - Jennifer C. Girón Duque



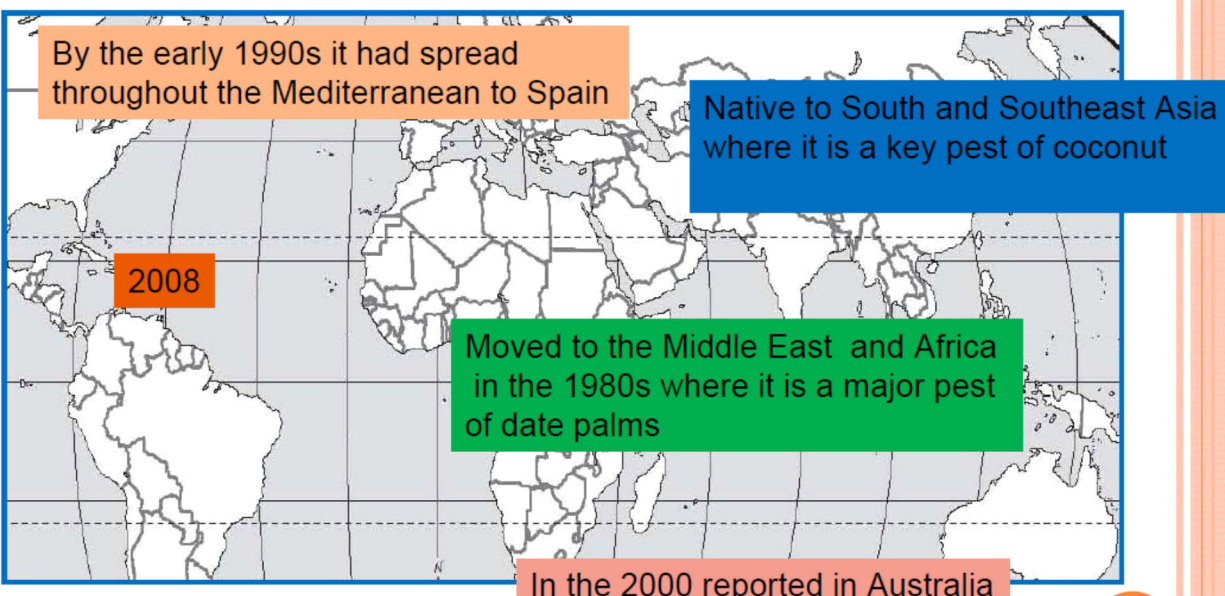
Netherlands Antilles infested with Red Palm Weevil.

# RED PALM WEEVIL

## *RHYNCHOPHORUS FERRUGINEUS*



## ORIGIN AND DISTRIBUTION

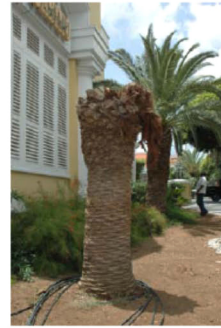


OEPP/EPPO, 2008, Bulletin OEPP/EPPO Bulletin 38, 55–59

The inextinguishable spread of the Red Palm Weevil.



## DAMAGE IN THE CARIBBEAN



Damage to valuable palms near resort hotels caused by the Red Palm Weevil in the Netherlands Antiles.

## DEVELOPMENTAL AND REPRODUCTIVE BIOLOGY - LIFE CYCLE

