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Rhynchophorus ferrugineus (Olivier, 1790) (Coleoptera: Curculionoidea: Dryophthoridae), an exotic weevil recently introduced into Portugal

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Abstract: The tropical weevil *Rhynchophorus ferrugineus* was first recorded in southern Portugal from a region with a Mediterranean-type climate, in August 2007. Five months later, some infested *Phoenix canariensis* and *Phoenix dactylifera* palms were found 500 km north of the first infested area. The absence of infested palm trees between these two regions is an indication of the important role played by the transportation of adult palm trees in the insect's dispersal. The climatic differences between these two infested spots show that the insect is able to colonize temperate areas as well. The presence of other arthropods and mice associated with *R. ferrugineus* is also mentioned.
Key words: Coleoptera, Curculionoidea, Dryophthoridae, *Rhynchophorus ferrugineus*, palm trees, introduction, Portugal.
***Rhynchophorus ferrugineus* (Olivier, 1790) (Coleoptera: Curculionoidea: Dryophthoridae), gorgojo exótico introducido recientemente en Portugal**
Resumen: *Rhynchophorus ferrugineus* se detectó por primera vez en Portugal en Agosto de 2007, en una zona con clima de tipo mediterráneo. Cinco meses más tarde se detectó un nuevo foco de infestación, 500 km al norte del primero, en *Phoenix canariensis* y *Phoenix dactylifera*. La ausencia de infestaciones en la zona intermedia evidencia el papel activo del transporte de palmeras adultas en la dispersión del insecto. Por otro lado, las diferencias climáticas entre estos dos focos conocidos muestran la capacidad del insecto para establecerse en zonas de clima templado. Se citan otros artrópodos y ratones encontrados asociados a *R. ferrugineus*.
Palabras clave: Coleoptera, Curculionoidea, Dryophthoridae, *Rhynchophorus ferrugineus*, palmeras, introducción, Portugal.

Introduction

Rhynchophorus ferrugineus (Olivier, 1790) (Coleoptera: Curculionoidea: Dryophthoridae) is a weevil, originating from the tropical zones of southeast Asia and Melanesia, which attacks different cultivated palm species (Family *Arecaceae*). In India, Sri Lanka and Pakistan *R. ferrugineus* is known as an important pest of the coconut tree (*Cocos nucifera*) (OEPP/EPPO, 2007). Larvae develop in the soft tissues inside palm trees, boring tunnels and cavities where individuals of different stages can be found simultaneously. The attack may go undetected for a long period, allowing for the development of several insect generations within a palm. The death of the host plant is in general unavoidable, and is a consequence of sap bundles being cut and of the destruction of the growing apex. In the beginning of the 1980's, the insect began to spread to the Gulf Region, where it became a serious threat to date plantations (*Phoenix dactylifera* L.). It was indeed found in 1986 in the United Arab Emirates, in 1987 in Saudi Arabia, and in 1992 in Iran (Abbas *et al.*, 2001). The pest continued to spread further North, being observed in Egypt in 1992 (Kehat, 1999) and in Israel and Jordan in 1999 (Abbas *et al.*, 2006). In the Middle East, damage in *P. dactylifera* plantations was considered threatening (Soroker *et al.*, 2004). In Europe, it was observed for the first time in 1993, in the South of Spain (Barranco *et al.*, 1996). After this, it was reported in other European zones in the Mediterranean basin, destroying ornamental palm trees belonging to several species, in particular to the species *Phoenix canariensis* Hort. ex Chabaud. In Italy it was recorded for the first time in 2004, in Turkey in 2005, in France and in Greece in 2006 (EPPO 2006a, 2006b, 2007).

Although adult *R. ferrugineus* are able to fly to colonise new host plants, the fast rate of its recent spread in the Mediterranean zone has been related to the increase in the trade of adult ornamental palm trees originating from infested zones and in the interior of which the infestation was not detected (Ferry & Gómez, 2002; Soroker *et al.,* 2004). In Portugal as well, the introduction of this species into the southern part of Portugal in 2007 (C. Soares, J. E. Fernandes, and M. F. Caetano, personal communications), was related to the increasing demand for fully grown palm trees for private and public gardens (Fernandes, 2007). In Portugal, the Canary palm (*P. canariensis*) and the date palm (*P. dactylifera*) have been used as ornamentals since a long time (Vasconcellos & Franco, 1948) and are widespread from north to south. Other palm species belonging to the list of *R. ferrugineus* host-plants became popular and are increasingly demanded for public and private gardens. Furthermore, *R. ferrugineus* is able to develop under a wide range of climates, mainly because its larvae live in a protected situation, concealed in the interior of the host plant (Murphy & Briscoe, 1999). Inside the cavities produced by their feeding activity, the larvae evolve surrounded by a moist and warm mass of fermenting vegetable debris, preserved from external temperature and humidity fluctuations, from natural enemies and from pesticides.

Alerted by the importance of the threat caused by the spread of *R. ferrugineus*, the European Union adopted obligatory urgency measures for the invaded countries, in order to stop and eradicate the pest (Commission Decision No. 2007/365/CE of May 31, 2007). In the present note, the observation of *R. ferrugineus* in *P. canariensis* and *P. dactylifera* palm trees in the centre of Portugal, some 500 km to the north of the previously known infested spots is reported. The probable pathway for its introduction is discussed, as well as the possibility of the pest dispersal to all regions of the country where susceptible palm trees are present, unless efficient containment and eradication measures are taken.

The association of *R. ferrugineus* with other arthropods and with mice, observed in the infested palm trees, is also reported.

Material and methods

In the framework of the official survey carried out by the national plant protection authority, three infested palm trees (two *P. canariensis* and one *P. dactylifera*) were found in January 2008 in the centre region of Portugal (Vila Nova de Poiares) some 27 km east of Coimbra. These palm trees were detected on the basis of a range of symptoms observed in the crown and/or in the stem. They were destroyed and a sample of infested material was collected from one of the *P. canariensis* and taken to the laboratory, after being carefully packed to prevent insect escape. This palm tree was approximately 50 years old and was planted in the garden of a private residence (geographic coordinates 40.1º N 8.2º W) close to another asymptomatic Canary palm. The sample was composed of a chewed and fermented mass of palm fibres, containing large adult beetles, larvae and cocoons.

The insects were identified to genus according to keys from Arnett *et al.* (2002) and from Lepesme (1947), for the genus *Rhynchophorus,* and to species with keys from Wattanapongsiri (OEPP/EPPO, 2007). The specimens were photographed, observed under a stereomicroscope and prepared for collection. The morphological characteristics used for the species identification are described and illustrated in detail in a document from OEPP/EPPO (2007).

Results and discussion

External infestation symptoms varied, although all three palm trees showed an asymmetrical crown, somehow flattened. In the date

palm, cocoons could be seen outside the stem, nested on the axils of cut leaves, in contrast to *P. canariensis*, where no symptoms could be seen in the trunk. After felling and being split open, both *P. canariensis* and *P. dactylifera* showed extensive damage by *R. ferrugineus* inside their stem, in the form of large rotten cavities, filled with warm fermented debris and insects. In the latter host-plant species, large infested rotten zones were found inside the basal part of the stem and also in the subterranean zone of transition to the roots. In *P. canariensis* holes were observed in the base of the leaves of the crown, close to the growing point, penetrating deep into the interior of the stem. By contrast, in *P. dactylifera* no symptoms of attack in, or close, to the growing point could be seen. Regarding the age, location, and origin of the infested palm trees, the two *P. canariensis* were 50 and 15 years old, respectively, and had been planted in private gardens of two distinct suburban zones, separated circa 8 km from each other, one located close to a national road. Their origin was unknown. The *P. dactylifera* palm tree belonged to a population of approximately 50 specimens of *P. dactylifera* and *Washingtonia* sp. palms and *Cycas revoluta*, recently planted in a public garden in a town centre, separated from the *P. canariensis* spots approximately 10 km. They had been purchased from a nursery in the South of Portugal and had been imported from Egypt as adult palms.

Although adult *R. ferrugineus* are able to fly some distances to colonize new host plants (Lepesme, 1947), their dispersal from the palm tree where they complete their development normally occurs only when the nutritive resources of the host plant become depleted, which occurs in an advanced phase of the infestation, when the palm tree is dying. Before that, successive generations, originating from the same parents, may develop in one host plant. Since the infested spot reported in this note in the centre of Portugal (Beira Litoral) and the initial infested spot located in the south (Algarve) are separated by some 500 km and, until now, no other infested palm trees have been observed in the intermediate zones of Portugal, despite the abundance of susceptible host-plants, the main pathway for introduction into new zones seems to be the trade and movement of adult palms from infested zones, located inside and outside the country. Consequently, the importation and the circulation of susceptible material inside Portugal should be prohibited, in order to contain the pest's spread.

In the sample observed in the laboratory 13 adult insects belonging to the species *R. ferrugineus* (9 males and 4 females), 10 larvae of different ages and 5 cocoons were identified. A few specimens were prepared for the entomological collection of Instituto Nacional de Recursos Biológicos (INRB).

Besides *R. ferrugineus*, the sample included 5 big sized scarabaeiform beetle larvae not yet identified. Large quantities of mites from the family Uropodidae (nymphs) were also present. Also, after felling one of the *P. canariensis* palm trees, a mouse nest containing some newborn mice was found inside a hole in the trunk, in cohabitation with *R. ferrugineus* larvae.

The association of *R. ferrugineus* with scarabaeoid beetles of the family Dynastidae, namely with insects belonging to the genus *Oryctes*, whose larvae feed on decomposing vegetable tissues, was considered by Lepesme (1947) recurrent and decisive in determining the noxious role of both insect species in tropical agriculture. Indeed, while the feeding activity of *R. ferrugineus* adults is almost harmless to their hosts, the adults of *Oryctes* spp. are extremely damaging to palm trees because they feed on the young growing tissues, destroying it and causing sap exudates that ferment and act as an attractive for ovipositing *R. ferrugineus* females. On the other hand, while burrowing inside the palm trunk, *R. ferrugineus* larvae produce large tunnels and holes that become filled with chewed fermenting material, producing decomposed organic matter suitable for the development of *Oryctes* spp. larvae.

Some mites of the family Uropodidae that live in unstable environments composed of decomposing organic matter, are known to establish phoretic relationships with saprophagous beetles, in order to assure their own dispersal (Bajerlein & Bloszyk, 2004). The association of *R. ferrugineus* and mites found underneath the beetle's elytra was observed in the Canary Islands (Barrera 2006).

The occurrence of mice nests in palm trees is common (Lepesme, 1947) and this is confirmed in Portugal (A. Vinhas, personal communication). Apart from the protection found by the mice brood living inside such cavities, Lepesme (1947) refers that different rodent species are able to consume larvae of both *R. ferrugineus* and *Oryctes* spp. in abundance.

The relationships eventually existing between *R. ferrugineus* and other organisms living in palm trees should be further investigated, in order to improve control strategies.

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