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REVIEW ARTICLE

Phoenix spp. and other ornamental palms in Turkey: The threat from red palm weevil and red palm scale insects

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Abstract

Phoenix theophrasti is the only palm species native to Turkey and it exists in small numbers in only a few locations along the Mediterranean Coast. Other *Phoenix* species and other palms are mainly grown in Turkey for environmental and ornamental purposes in house gardens, public gardens, parks and as street plantings. The common usage of palms in landscaping highlights their economic importance for the country, especially in coastal tourism areas. Date palms grown in Turkey produce fruits which are small in size, of low nutritional value and with little sugar content due to insufficiently warm temperatures to ripen fruit. Adult date palm trees were imported into the country, mainly from Egypt, until 2005, when imports ceased to prevent further introduction of red palm weevil, *Rhynchophorus ferrugineus*, which has become a serious threat to Phoenix and other palms. The other major insect problem is red palm scale insect *Phoenicococcus marlatti*. Measures are being taken to control these two pests. The limiting of palm imports has stimulated seed propagation of palms within Turkey.

Key words: Datça date palm, *Phoenix dactylifera*, *Phoenix theophrasti*, *Rhynchophorus ferrugineus*, *Phoenicococcus marlatti*

Introduction

Palms (Arecales: Arecaceae) are a plant group of 183 genera and over 2,300 species in tropical and subtropical climatic regions of the world; the genus *Phoenix* has 14 formally described species (Kew, 2013). The palm tree is a symbol often depicting values such as victory, peace and productivity in many cultures throughout history. Today, the palm tree is a symbol of the tropics and of tourism. In Turkey, palms provide some shade but no marketable fruit; they are entirely ornamental and used as decorative plants. The palm trees are mostly planted along the touristic coastline regions of Turkey.

Only a single palm species (*Phoenix theophrasti* Greuter) and a subspecies (*P. theophrasti* spp. Gölköy) are native to Turkey. All of the other palm grown planted in the various provinces, but mainly along the Turkish coast, are exotic.

The purpose of this article is to summarize the current status of *Phoenix* spp. in Turkey, as well as other palms grown for ornamental purposes in the country, and to outline the threats posed by the red palm weevil and red palm scale insect and measures to control them.

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Phoenix spp. in Turkey

Native *Phoenix* palms

In 400 B.C., Theophrastus, the Greek "father of botany," noted the existence of palm trees in Crete. Thus, a second palm species was recorded in Europe in addition to the Mediterranean fan palm (*Chamaerops humilis*), native to the central and western Mediterranean. In 1967, the Swedish botanist Werner Greuter denominated this species in Crete as *Phoenix theophrasti* to honor its discoverer. The palm was subsequently found to occur in ten stands on Crete and nearby islands. It was not until 1982 that *P. theophrasti* was first found on the Datça Peninsula, Turkey by Melih Boydak (Boydak, 1985). In addition another occurrence was recorded in 1986 on the Kumluca coast of Finike Bay, Turkey (Boydak, 1986, 1987). Apparently, *P. theophrasti* also occurs on three islands of the Dodecanese group in the Southeast Aegean area of Greece. Typical common names for *P. theophrasti* are Datça date palm or Cretan date palm. The subspecies *P. theophrasti* ssp. *Gölköy* occurs on the Bodrum Peninsula-Gölköy in Turkey (Boydak and Barrow, 1995; Barrow, 1998; Esener, 1999; Anonymous, 2010). Turkish locations are shown in Figure 1 and photos of the palms in habitat in Figure 2.

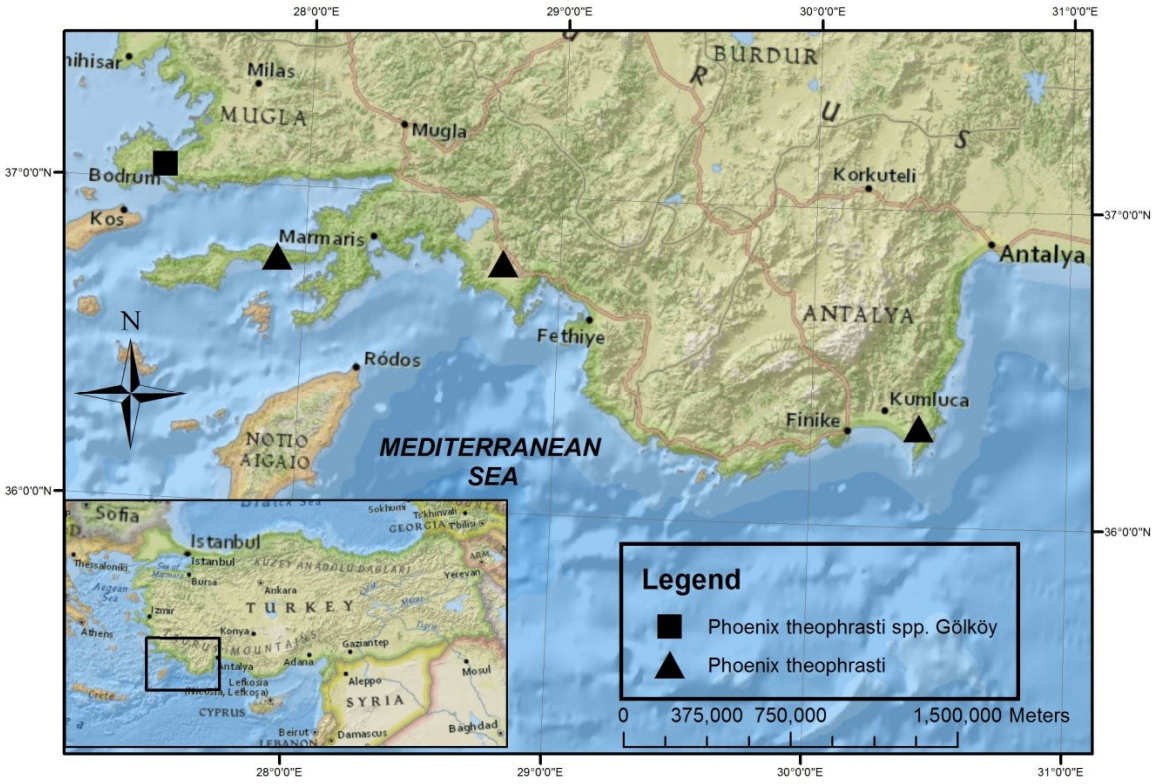

Figure 1.The native stands of endemic palms *Phoenix theophrasti* and *P. theophrasti* ssp. Gölköy in Turkey.

The Datça date palm (*Phoenix theophrasti*) has a clustering stem and can grow up to 17 meters while *P. dactylifera* can grow up to 30 meters. The leaves are composed of smaller, shorter and thicker leaflets when compared to *P. dactylifera.* The tips of the leaflets are pointed and very sharp and can cause a wound when touched. In addition, *P. theophrasti* has obliquely vertical bluish-colored leaves which turn brown when old. The old, dead leaves persist on the tree for a few years before eventually falling off. This species is resistant to fire and, even if all of the offshoots are burned, new shoots are produced. In order to survive in nature, the Datça date palm needs a warm climate and a ground water supply. The Datça date palm is dioecious and therefore there is a distinct difference between the male and female palm. The palm blooms in May and the flower pedicel length grows to 30 cm in female plants which is twice as long as in the male plant. Male plants generate a large amount of pollen which is carried by wind onto female flowers. After pollination, the fruit, which is smaller than *P. dactylifera*, matures in autumn. Immature (raw) fruit is bright orange in color and has an acrid taste. Mature fruit are dark brown in color, soft, and edible but have no commercial value. In Datça, the fruit matures at the end of September and into October.

The Gölköy date palm (*Phoenix theophrasti* spp. Gölköy) has been known to local people for centuries because of the presence of a date palm grove in Gölköy, northern Bodrum province. The first scientific survey of the region in 1988 was done by landscape professors from Ege University in Izmir. In 1990, M. Boydak realized that the Bodrum-Gölköy date palms differed from the *P. theophrasti* in Datça. In a study in collaboration with S. Barrow from Kew Gardens, Boydak determined that the date palm group in Gölköy was either a new species or a subspecies of the Datça date palm (Boydak and Barrow, 1995; Anonymous, 2010). The subspecies has not yet been formally described and published as a valid taxon.

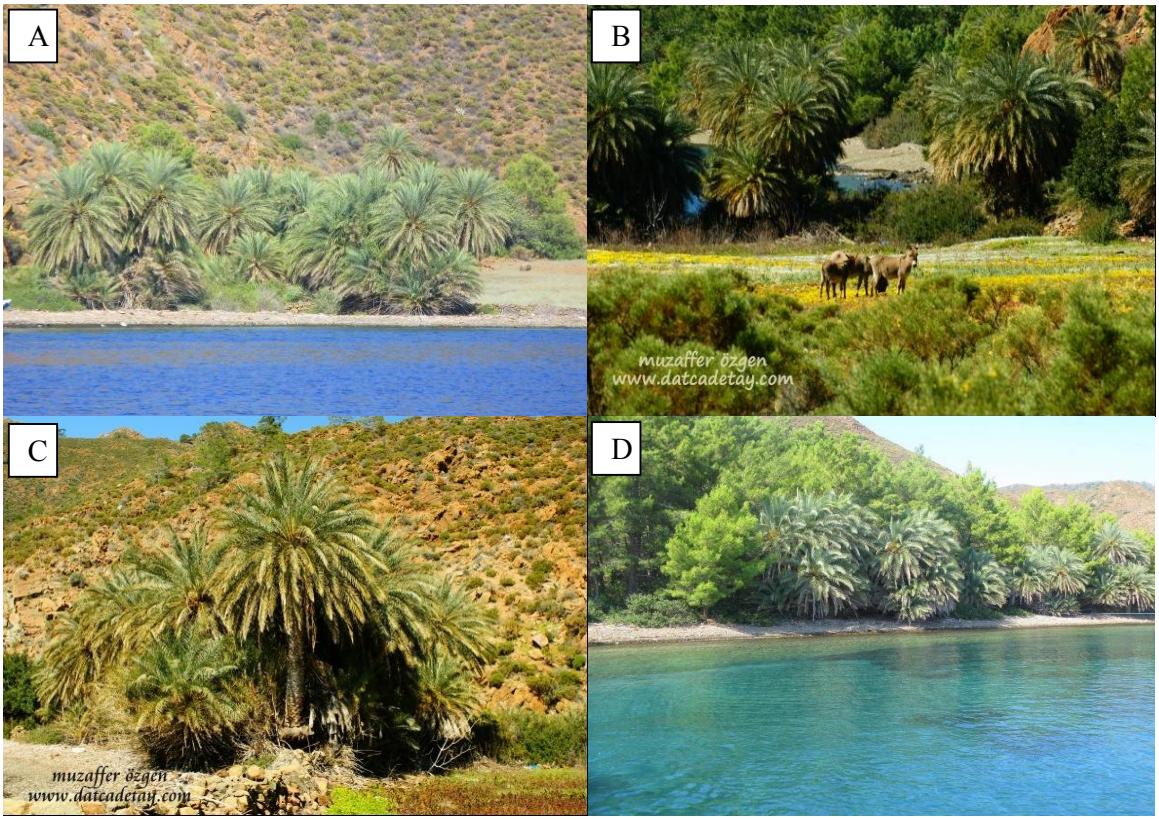

Figure 2**.** *Phoenix theophrasti* in Datça/Hurmalıbük, Turkey.
Source:
(A) www.agaclar.net/forum/agaclar-hakkinda-genel-konusmalar/27930.htm
(B) www.datcadetay.com/dogagezisi/datcahurmalibuk/datcahurmalibuk4.html
(C) www.datcadetay.com/dogagezisi/datcahurmalibuk/datcahurmalibuk5.html
(D) www.agaclar.net/forum/agaclar-hakkinda-genel-konusmalar/27930.htm

The aforementioned study found that the Gölköy date palms grow, at most, to 8 meters while the Datça and Finike date palms reach up to 17 meters. The pedicel length of the Gölköy species is 60-200 cm, while the Datça species bears a 30 cm pedicel. It was also found that the Datça date palms had larger seeds as compared to those of the Gölköy species. A small lake exists in the area where the Gölköy date palms are found. In the dry Mediterranean climate summer months, the palm trees are not water stressed because of the water sources that feed the lake. In winter, the region stands under water for 2 to 3 months (Esener, 1999). For a long time, the palm grove has been under pressure by expansion of the local village and from summer house settlers, chiefly through disrupted water drainage and fire. Endemic date palm trees can still be found in the gardens of the houses in the region. Because of the human population growth in this and the regions, the conservation status of *Phoenix theophrasti* is classified as Lower Risk / Near Threatened, according to the IUCN Red List of 2007.

Table 1. Enumeration of palm trees in Turkey in 2010.

Province	Number of *Phoenix* spp.	Number of other species	Number of young trees	Total
Muğla	13,425	26,090	35,850	75,365
Antalya	35,000	100,000	50,000	185,000
İzmir	9,554	47,015	155,465	212,034
Mersin	5,000	40,000	20,000	63,000
Adana	8,500	30,000	25,000	63,500
Hatay	2,000	5,000	5,000	12,000
Aydın	2,500	15,000	5,000	22,500
Total	73,979	263,105	296,315	633,399

Source: Republic of Turkey Ministry of Agriculture Provincial Directorate of Agriculture Report, 2010.

Introduced *Phoenix* palms

Climatic conditions in Turkey are favorable for growth of all 14 species of *Phoenix*, assuming there is adequate ground water. Coşkuner **(**2006) included eight species of *Phoenix* in his evaluation of palm species suitable for ornamental cultivation in Turkey: *acaulis, canariensis, dactylifera, pusilla, reclinata, robelenii, rupicola* and *sylvestris.* It is highly likely that the remaining accepted *Phoenix* species (*andamanensis*, *atlantica, caespitosa, loureiroi, paludosa*) could also be successfully grown.

The Canary island date palm, *Phoenix canariensis* is found along the Black Sea coastline, in Istanbul, and on the Aegean and Mediterranean coasts. This palm has a thick trunk, long and feathery leaves, and never produces suckers. *Phoenix dactylifera* is another ornamental species found in Antakya, Mersin, Adana, and some other southern provinces. This species has bluish-grey colored leaves and produces suckers in younger palms. The small attractive *P. roebelenii* is only found on the Mediterranean coastline. An enumeration of all palm trees grown in Turkey, carried out in 2010 (Table 1), revealed that *Phoenix* spp. represented 22% of all mature palm trees in the country.

The date palm (*Phoenix dactylifera*) is known in Turkey as the Arabic date palm. In addition to ornamental plantings, about 100 date palms are reportedly being grown for research purposes at the Citrus Research Station in Antalya (Dowson, 1982).

Information about worldwide date palm fruit production indicates that there is commercial fruit production in Turkey. This error can be attributed to language and possibly influenced by history.

Since 1961, FAO has included Turkey as a date palm growing country in their annual production statistics, and the error has been carried over into books such as Date Palm Cultivation (Zaid and Arias-Jiménez, 2002). Possibly related to this misunderstanding, is the fact that during the late 19th Century, Ottoman Turkey recorded date fruit exports. For example, in 1897, dates were ranked 16th in value of exports, amounting to 19.4 million Kuruş (Shaw and Shaw, 1977). Prior to the partitioning of the Ottoman Empire and the creation of the modern Republic, Turkey's, border extended farther south and included an area of known commercial date production, which is now within the boundaries of Syria. Ottoman Turkey date exports may have come from that area.

Language is the more obvious reason for the misreporting of date fruit production from Turkey. In the Turkish language, the noun "hurma" can refer to date palm or to the Japanese persimmon (*Diospyros kaki*). It is clear that persimmon production amounts are being given by mistake to FAO and reported as date production. A recent study of date fruit marketing and consumption in Turkey confirms that all commercial dates must be imported from neighboring date-growing countries because the fruits borne by trees grown in Turkey fail to ripen fruit (Karadeniz, 2010).

Palms in the Turkish landscape

Virtually all of the palm trees found in Turkish landscapes have been introduced. Most commonly they are found along the Black Sea coastline, in Istanbul, and in the Marmara region. A typical landscape palm with thin stems and fan-shaped leaves is the Chinese fan palm (*Trachycarpus fortunei*). This species is produced by tree nurseries in İzmir and sold under the name of "dwarf chamaerops." The former classification name of this species, which was believed to be an interior palm by many growers and landscaping architects, was *Chamaerops fortunei*, hence the common name. In comparison, the dwarf Mediterranean fan palm (*Chamaerops humilis*) has smaller leaves than

Trachycarpus fortunei. The leaves of *C. humulis* are bluish-grey in color and bear small thorns on the pedicel. The tree grows no more than 1.5-2.0 meters in height and has multiple stems. This species is seen on the Aegean and Mediterranean coastlines, at hotels and in seaside residential gardens in Istanbul.

The California fan palm (*Washingtonia filifera*) is another species frequently found along the Aegean and Mediterranean shorelines and in Denizli, but rarely in İstanbul or the Marmara region. The thick stem of this palm is relatively smooth and brown in color and the leaves are large and fan-shaped with thorns on the leaf stalk. A related palm, the Mexican fan palm (*W. robusta)* is grown in the Mediterranean provinces, in Köyceğiz, and Dalaman, but is not found in the Black Sea, Marmara and Aegean regions. This species is taller than *W. filifera* and has a thinner trunk.

In recent years, a popular new species have been imported, the Queen Palm (*Syagrus romanzoffiana*), which has a smooth trunk and pinnate leaves hanging downwards (Anonymous, 2010). All of the abovementioned species are commonly used along streets and in landscaped central parks of many provincial cities. These species are also planted in home and hotel gardens for the same purpose (Esener, 1999).

The preferred ornamental palms in Turkey are *Washingtonia filifera* and *Phoenix canariensis*; followed by *Washingtonia robusta*, *P. dactylifera*, *Trachycarpus fortunei* and *Chamaerops humilis.* Coskuner (2006) determined that a few species were produced from seed in significant quantities locally in and around İzmir province, while the other species were imported. *Phoenix dactylifera* (formerly) and *W. robusta* were the leading species imported. *Washingtonia filifera*, *Phoenix roebelenii, P. canariensis*, *Chamaerops humilis*, *Trachycarpus fortunei*, *Syagrus romanzoffiana, Livistona chinensis, Archontophoenix* spp., *Butia* spp., *Sabal* spp., *Brahea* spp. and *Ravenea rivularis* are other imported species. *Butia capitata*, *P. roebelenii* and *S. romanzoffiana* are produced in limited quantities from seed (Esener, 1999; Coskuner, 2006).

Palm species suitable for Turkey

The number of palm genera throughout the world is 183. According to cold hardiness criteria, 35 genera were determined to be able to grow in Turkey if the other ecological conditions such as soil pH, soil saltiness, air humidity, and wind were suitable. Coşkuner (2006) proposed that 112 species in these 35 genera were suitable for the country as a whole (Table 2.). İzmir province (9a climate zone) on the Aegean Coast is a major tourism area. There Coskuner (2006) suggested the following genera as most suitable: *Brahea*, *Butia*, *Chamaedorea*, *Chamaerops*, *Guihaia*, *Jubaea*, *Livistona*, *Nannorrhops*, *Phoenix*, *Rhapidophyllum*, *Rhapis*, *Sabal*, *Serenoa*, *Trachycarpus*, *Trithrinax* and *Washingtonia.*

Table 2. Exotic palm species suitable for Turkey.

Genus	Species
Acoelorraphe	*wrightii*
Acrocomia	*aculeata, hassleri*
Allagoptera	*arenaria, campestris*
Archontophoenix	*alexandrae, cunninghamiana*
Arenga	*engleri*
Attalea	*cohune*
Bismarckia	*nobilis*
Brahea	*aculeata, armata, brandegeei, calcaria, decumbens, dulcis, edulis, moorei, pimo*
Butia	*archeri, campicola, capitata, eriospatha, microspadix, paraguayensis, purpurascens, yatay*
Caryota	*mitis, obtusa, ochlandra, urens*
Chamaedorea	*cataractarum, costaricana, fragrans, klotzschiana, metallica, microspadix, oreophila, plumose, radicalis, seifrizii*
Chamaerops	*humilis*
Copernicia	*alba*
Dypsis	*decipiens, lutescens*
Guihaia	*argyrata, grossefibrosa*

Table 2. Contd..

Genus	Species
Hedyscepe	*canterburyana*
Howea	*belmoreana, forsteriana*
Jubaea	*chilensis*
Jubaeopsis	*caffra*
Livistona	*australis, carinensis, chinensis, decora, drudei, muelleri, nitida*
Nannorrhops	*ritchiana*
Parajubaea	*cocoides, sunkha, torallyi*
Phoenix	*acaulis, canariensis, dactylifera, pusilla, reclinata, robelenii, rupicola, sylvestris*
Ravenea	*rivularis*
Rhapidophyllum	*hystrix*
Rhapis	*excelsa, humilis, multifida, subtilis*
Rhopalostylis	*baueri, sapida*
Roystonea	*regia*
Sabal	*bermudana, causarium, domingensis, etonia, guatemalensis, maritima, mexicana, minor, palmetto, pumos, rosei, uresana, yapa*
Serenoa	*repens*
Syagrus	*coronata, romanzoffiana, sancona, schizophylla*
Trachycarpus	*fortunei, geminisectus, latisectus, martianus, nanus, oreophilus, princeps, takil*
Trithrinax	*brasiliensis, campestris, schizophylla*
Washingtonia	*filifera, robusta*
Wodyetia	*bifurcata*

Source: Coşkuner, 2006.

Entomological threats to palms in Turkey

The red palm weevil *Rhyncophorus ferrugineus* (Olivier) (Coleoptera: Curculionidae)

The importation of ornamental palms led to the inadvertent introduction of the red palm weevil (*Rhynchophorus ferrugineus*) (RPW) around 2005. Subsequently, plant quarantine regulations were modified to prohibit imports of palms from 37 infested countries. The quarantine stimulated palm propagation within Turkey. Although there have been many difficulties encountered during the production of young palm trees, the entrepreneurs found production easier than attempting to importation palms from pest free countries. Propagation problems are related to slow development of young trees and adaptation problems mainly associated with inadequate or unfavorable ecological and climatic conditions.

The RPW is a serious pest of various palm species (e.g. coconut, *Cocos nucifera* and African oil palm, *Elaeis guineensis*), *Phoenix* palms in particular. The adult beetles are reddish-brown in color, 19-42 mm in length, 8-16 mm in width and have a long, curved rostrum. The head and rostrum comprise about one third of the total length of the insect. The rostrum of females is bare, while in males the dorsal apical half of the rostrum is covered by a patch of short, brownish hairs. Both the male and female adults have dark spots on the upper side of their thorax. Adult females lay an average of 204 eggs. The eggs average 2.62 × 1.12 mm in size and are creamy white, oblong and shiny. The larvae have a brown head and measure 36-47 mm in length and 15-19 mm in width (Figure 3). They have a slightly curved creamy white body composed of 13 segments; mouthparts are well developed and strongly chitinized (Anonymous, 2007, 2008a). The larvae develop within the palm trunk, destroying its vascular system, and eventually cause the collapse and death of the tree, such as in the *Phoenix canariensis* shown in Figure 4.

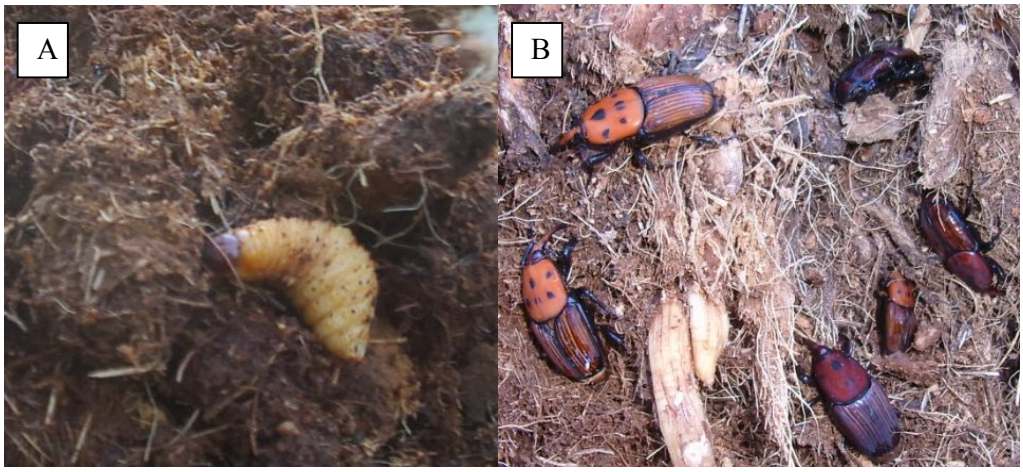

Figure 3. *Rhyncophorus ferrugineus* adults (A), larvae (B).
Photo by: D. Büyüköztürk.

Figure 4. *Phoenix canariensis* infested with red palm weevil, Pissouri village, Cyprus.
Source: http://www.about-pissouri.com/component/content/article/116-charities-directory/4140-charities-news.pdf

Red palm weevil infestation was first detected in Turkey in the summer of 2005 in parks and gardens of Mersin province along the Mediterranean Coast (Karut and Kazak, 2005).

Following discovery of the pest, integrated pest management (IPM) measures were initiated in June 2007 to include destruction and burning of infested plant material, applying prophylactic insecticide chemical treatments and by adult weevil trapping on palm plantations. During 2008-2010, approximately 2,000 infested palms were removed in Turkey. In order to monitor the adult beetles and the extent of pest infestation, traps containing a commercial aggregation pheromone were hung in dense palm tree areas. To reduce the weevil population by mass trapping, traps were placed at 100 m intervals in urban parks, gardens and on streets. The area where the traps were placed was estimated to contain about 640,000 trees in 2008-2010. A significant decrease in the number of trapped beetles and the destruction of infested plant material was observed in 2009 and continued the following years in several cities in Turkey.

A study was conducted by Zeki and Ozkan (2009) in Antalya during 2007-2008. In this study, "Rhyfer®" pheromone + Scandinavian-type trap system was used to monitor the RPW population. The results showed that pheromone + trap system was highly effective in attracting both males and females of the RPW. It was determined that the pheromone + trap system could be used for the survey studies indicating the presence of the pest on palms and cycads; the adult flight activity for its control and monitoring of population activity.

In a study conducted in Adana, natural infestations with the entomopathogenic nematodes (EPN), *Heterorhabditis bacteriophora* (Poinar, 1975) (Nematoda: Heterorhabditidae) on the weevil individuals was evaluated. Seasonal mortality rate in the total larval population of *Rhyncophorus ferrugineus* by the EPN was 50%. EPN caused a significant mortality rate (85%) in the pupae population and also killed a few adults, corresponding to 1-5% of the mortality rate (Atakan et al., 2012).

As to chemical control, pesticides were used in the infested areas as both preventive and curative treatments. Preventive treatments, which included stem spraying up to 2 m high, were implemented from 2008 to 2010 to prevent weevil attacks in highly infested areas. The application of pesticides was conducted each month from March until September with imidacloprid + betacyfluthrin. In the infested plantations, all young, offshoot-bearing trees were treated. Remedial actions against the RPW involved stem injection or soil application with imidacloprid SL 200 or SC 350 at different concentrations (Buyukozturk et al., 2011). According to Plant Protection Technical Instructions Book (Anonymous, 2008b), a pit with 20-30 cm depth is burrowed in the ground where the stem of the tree joins the soil then the systemic insecticide is applied with a dose of 35 ml/tree with 10-20 liters of water. Another application of systemic insecticide is stem injection. For this purpose, 10-15 cm long four holes are drilled in the stem of the tree at 1-1.5 m height from the ground and then 35 ml insecticide/tree is injected into these holes. After the application, the holes are closed with grafting wax. Soil or injection applications should be applied preferably in spring or summer and should be repeated every 25-30 days to prevent new infections.

It has been observed that control efforts including mass trapping, prophylactic and curative pesticide applications, and natural infestation of the EPN are effective in reduction of the RPW populations in palm plantations in Turkey.

There are certain other methods employed around the world to control this pest, such as to drench the base of palm fronds with the entomopathogenic fungus *Metarhizium anisopliae*, or *Beauveria bassiana* (Gindin et al., 2006). The Ecopalm method is another control tool developed in Italy which depends on the sterilization of infested trees by a microwave collar (Yamen Khatip et al., 2010). According to the researchers, the Ecopalm method has given promising results in the fight against the red palm weevil by eradicating all the individuals hosted in the infested trunk, in whatever stage of their development they are found. The microwaves destroy selectively the eggs, larvae, pupae and adults, breaking and interrupting their life cycle completely, without causing any collateral damage to the host palm, which is saved (Yamen Khatip et al., 2010; Anonymous, 2013).

The red date scale, *Phoenicococcus marlatti* Cockerell (Hemiptera: Phoenicococcidae)

The red date scale is native to North Africa and the Middle East and infests the bases of inflorescences or it occupies roots. It affects date palm, other *Phoenix* spp., and has been reported on tropical rattan palm species of *Calamus* and *Daemonorops* (Howard et al., 2001). Adult females are small, spherical-shaped insects with a body length of approximately 1.0-1.5 mm with legs that are reduced or absent. Adult females are red to reddish-brown in color and may be found embedded in a mass of white, cottony wax on plant tissue (Anonymous, 2011) (Figure 5). Wax forms around the body and often completely covers it as curly, shiny, white strands. Eggs are smooth, oval, and pinkish in color. Males and 1st instars of both

sexes have well-developed eyes, antennae and legs. Wax is denser on 2nd instar males, but present in sufficient quantity to completely cover the body of all instar males and females. Prior to emergence as adults, small, wingless, elongated white male cocoons may be visible (Anonymous, 2011). In Turkey, this pest was first detected in Antakya province in 2008 by Doğanlar et al. (2008). It was found in Antalya and Adana provinces during ongoing survey studies.

Red date scale insects usually establish themselves at the base of fronds near the trunk, leaf midribs or fruit stalks. Host plant leaves, stems, trunk, fruits, as well as exposed and underground roots may also be infested (Figure 6). Extensive damage may occur and be undetected until pruning occurs (Anonymous, 2011). Premature leaf aging, drying of the fruit, disruption of normal plant metabolic functions and even plant death may result from heavy infestations (Zaid et al., 2002). Cultural practices are recommended as control methods of this pest. For that purpose, cutting and burning of the infested leaves and applying a deep pruning in order to expose the base of the leaves and the pests at the base directly to sunlight are recommended.

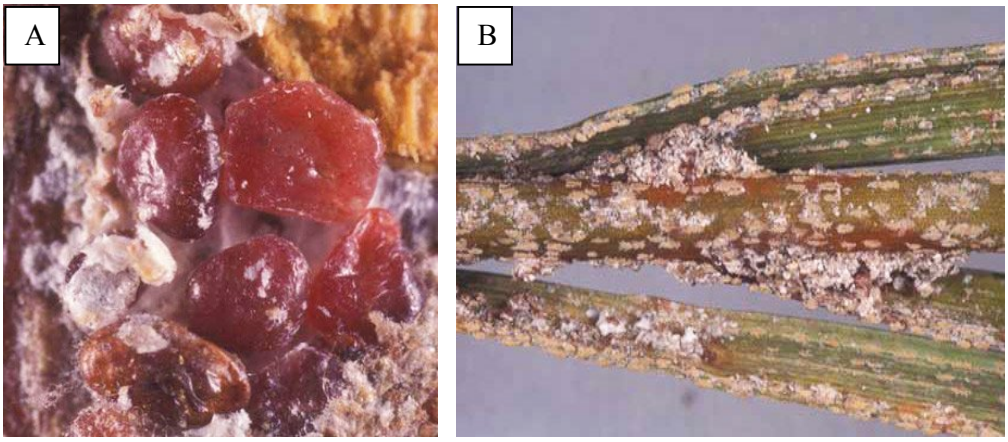

Figure 5. (A) Reddish-brown body of adult female red date scale insect.
(B) heavy infestation of red date scale insect, *Phoenicococcus marlatti* (Cockerell).
Photograph by Lyle J. Buss, University of Florida

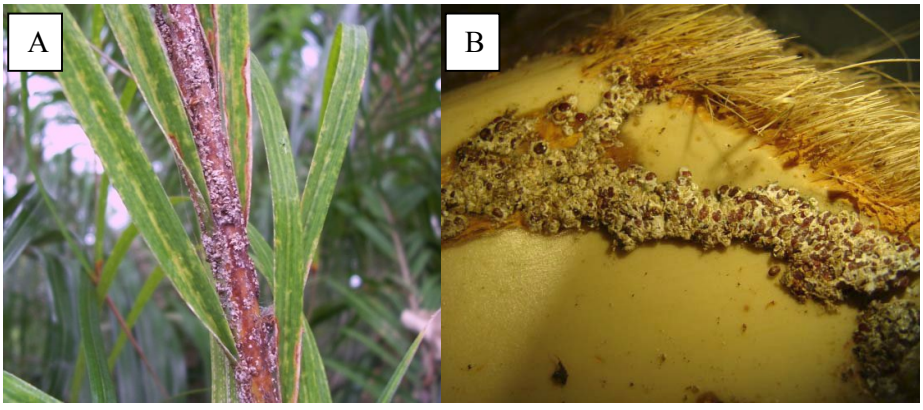

Figure 6. (A) Red date scale insect colony on the base of a date palm leaf pedicel.
(Photo by M. Doğanlar).

(B) Red date scale insect on Pygmy Date Palm.
Source: http://www.bug-master.com/PestAlert/tabid/100/EntryId/14/Red-Date-Scale.aspx.

Doğanlar et al. (2008), found two natural enemies on the nymphs of the pest, one is larvae of an undefined Cecidomyiidae (Diptera) species and the other adults of *Chilochorus bipustulatus* (L.) (Coleoptera: Coccinellidae). Further studies must be conducted on these natural enemies in order to determine their effect on the pest.

As to chemical control, Djerbi (1995) proposed to apply methidathion or dimethoate during the time active nymphs are seen. Zaid et al. (2002) proposed 80-100 g malathion per100 L water or 26 g parathion per 100 L water in infested nurseries (Doğanlar et al., 2008). Horticultural oil and insecticidal soaps also can provide good control, but must be treated like contact insecticides which require thorough coverage and repeat applications (Anonymous, 2011).

Conclusion and Prospects

Exotic and endemic palm species are present in Turkey. Large numbers of exotic species that were introduced to the country by importation are planted for decorative purposes in gardens, parks and along street in many provinces of the country. The endemic species are seldom seen.

Phoenix theophrasti and *P. theophrasti* ssp. Gölköy are of considerable scientific importance to the country's flora because they are the only representations of native palms. These endemic species should be conserved in terms of biodiversity against possible threats such as physical development on private property, tourism, cultivation and also against pests. The planting of imported exotic date palm trees should be forbidden in Datça date palm areas in order to prevent the endemic species from being infested with the red palm weevil, the red date scale, and some other exotic pests that may be inadvertently introduced. This prohibition will also prevent the genetic deterioration of the endemic *Phoenix* species through hybridization. In order to avoid importation, studies should be done by universities and research institutes on the propagation of the endemic and exotic palms adaptable to the country by seed or tissue culture**.** In addition, the planting of these locally-propagated species should be encouraged in fields, parks and gardens.

Preventing the spread of pests has proven difficult on palm trees grown in private and public gardens, in parks and along streets. Close cooperation is needed among the public sector, municipalities, communities and private property owners, so that a plant quarantine system can work properly in order to prevent new entomological problems.

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