

# A preliminary study on the main insect pests associated with a date palm *Phoenix dactylifera* in the western part of Saudi Arabia

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**Abstract--** A knowledge of the ecological aspects of insect pests is one of the most important portions for applying the integrated pest management. This study was conducted to survey the main insect pests of date palms in the Agricultural Research Station, affiliated to King Abdul-Aziz University, which is located in Huda Al-Sham region, western Saudi Arabia as a preliminary study in this region. In this field, insects were biweekly collected by using light and pitfall traps starting from 1/1/2020 to 30/12/2020. Results showed that date palms were infested by seven pests including the palm fruit stalk borer *Oryctes elegans*, the red palm weevil *Rhynchophorus ferrugineus*, the cadelle beetle *Tenebroides mauritanicus*, the palm frond borer *Phonapate frontalis*, the bluegrass billbug *Sphenophorus parampunctatus*, the desert locust *Schistocerca gregaria* and the island pinhole borer *Xyleborus perforans*. However, the island pinhole borer *X. perforans* was found to be the dominant species (5730 individuals) in the abundance compared to the other species, whereas the desert locust *Schistocerca gregaria* was found to be a much rarer species (21 individuals). The results of this study could be useful for managing date palm pests under harsh climate conditions.

**Keywords:** Date palm, Insect pests, the red palm weevil, the palm frond borer, the island pinhole borer.

## INTRODUCTION

The date palm *Phoenix dactylifera* is a key crop in Saudi Arabia, contributing to the country's incomes (Aleid *et al.*, 2015; Hussain *et al.*, 2020). The Saudi government has provided an important support to develop the agricultural sector in general, and the palm trees in particular, over the last few decades (Aleid *et al.*, 2015). As for the production amount, Saudi Arabia is the world's second-largest producer of dates, accounting for 17% of total global output. This country has around 31 million palm trees and annually produces more than 1.5 million tons of dates (Statista, 2019). This has led the Saudi government to rank date palm as the highest priority for research (Aleid *et al.*, 2015). In addition, one of the goals of Saudi vision 2030 is to become the world's largest source of dates. However, there are some challenges facing the production date palm including cultivation, marketing, processing and pests like insects and diseases (Al-Khatri, 2004). The red palm weevil *Rhynchophorus ferrugineus* and Al-Wijam disease are the most common pests that damage date palms in Saudi Arabia (Alhudaib *et al.*, 2007; Soroker *et*

*al.*, 2005). In addition, the red palm weevil and the palm stem borer beetle are considered major economic pests of date palm trees (Al-Dosary *et al.*, 2016). The larvae of *R. ferrugineus* and, *Jebusaea hamerschmidtii* cause serious damage by boring and feeding on palm tissues, which leads to reduce production, and then breaking of fronds and trunks. The larvae of the fruit stalk borer, *Oryctes elegans* Prell (Coleoptera: Scarabaeidae) usually attack date palm trees causing a great damage. In Saudi Arabia, adults, and larvae of *O. elegans* can cause substantial commercial damages to young date palm orchards (Martin, 1972). The larvae of *O. elegans* attack roots and extensively feed on them leading to rotting of wood, while plant sap, fruit, and nectar are consumed by the adult stage (Bedford, 1980). Thus, adults and larvae of *O. elegans* feeding form long tunnels in tissues and attack the apical buds and fruit stalks of growing causing these tunnels will be straightforward to other pathogens, which leads to secondary infections. Also, date palm trees are attacked by adults of the palm frond borer *Phonapate frontalis* (Coleoptera: Bostrichidae) (Anil *et al.*) which are able to break the palm green fronds and this pest has the potential to dig tunnels

within the green frond tissues and within which the couples are met for mating (Imam, 2019). Although there are more than 132 insect and mite species associated with date palm trees, only the red palm weevil, (*R. ferrugineus*), the old world date mite (*Oligonychus afrasiaticus*), the lesser date moth (*Batrachedra amydraula*), the Dubas date bug (*Ommatissus lybicus*), the green pit scale (*Palmaspis phoenicis*), the carob moth (*Ectomyelois ceratoniae*), the date palm longhorn beetle (*J. hamerschmidtii*), and the almond moth (*Cadra cautella*) are considered major economic pests of date palm trees (El-Shafie *et al.*, 2017). In advanced cases, the injury caused by these major pests leads to the death of the palm (Al-Dosary *et al.*, 2016). So, continuous monitoring and surveillance of insect pest populations are necessary for valuation the extent of damage and identifying the necessary needs for control pest measures (El-Shafie, 2018). The purpose of this study was to investigate the main insect pests that associated with date palm orchards in the western part of Saudi Arabia.

## MATERIALS AND METHODS

### • Study area

The field experiment was conducted at the Agriculture Research Station of Faculty of Meteorology, Environment and Arid Land Agriculture, King Abdul-Aziz University, which is in Makkah Al Mukarramah region, western of Saudi Arabia. In this station, six random date palm *P. dactylifera* L. Var. Barhi were chosen in their field area (2300 m<sup>2</sup>) to be experimental units to survey the abundance and population dynamics of the palm pests starting from 1/1/2020 to 30/12/2020.

### • Insect collection

In each tested date palm, specimens were collected every two weeks by using:

### • Light traps:

This technique was used to monitor the foliage-dwelling insects. One light trap for each palm was used to monitor populations of insects or other arthropods by trapping individuals and killing them. Each light trap was contained 60% Propylene Glycol After every two weeks, specimens from the light traps were collected and returned to the laboratory for subsequent storage and sorting and to identify species. All specimens were kept in 70% Ethanol for a future identification.

### • Pitfall traps:

This technique was used for collecting ground-dwelling insects. One pitfall trap (8.5 diameter x 13cm deep) was used for each date palm in which each pitfall trap was contained 60% Propylene Glycol was left open for two weeks. After two weeks, pitfall traps were collected and returned to the

laboratory for subsequent storage and sorting. All specimens were kept in 70% Ethanol for a future identification.

### • Specimens' identification:

The collected samples were counted and identified to the genus and species level by using taxonomic keys: (Luff (1998); Marshall (2018); Borror and White (1970); Blatchley (1910), and Westwood (1840)).

### • Statistical analysis:

The number of counted insects were separately summed for each species in a particular experimental unite (tested date palm) and across the sampling dates. Mean and standard error of summed abundance for each were calculated. Also, means of specimens were separately determine of each sampling date (24 points). All these analyses were preformed within SPSS® 14.0.

## RESULTS

### 1. The abundances of the date palm pests:

In this study, several insect pests (6410 individuals) belonged to two orders (Coleoptera & Orthoptera) were captured during this experiment (Table1). Six species of Coleoptera were captured including palm fruit stalk borer *O. elegans* (Coleoptera: Scarabaeidae) (54 individuals), the red palm weevil *R. ferrugineus* (Coleoptera: Curculionidae) (44 individuals), the Cadelle beetle *Tenebroides mauritanicus* (Coleoptera: Trogossitidae) (62 individuals), the Frond borer *P. frontalis* (Coleoptera: Bostrichidae) (243 individuals), the Denver billbug *Sphenophorus parampunctatus* (Coleoptera: Curculionidae) (256 individuals), and the Lesser grain borer *Xyleborus perforans* (Coleoptera: Curculionidae) (5730 individuals). In contrast, only one Orthopteran species belongs to the desert locust *Schistocerca gregaria* (Orthoptera: Acrididae) (21 individuals) was captured (Table1). Data showed that the Island pinhole borer *X. perforans* was found to be the dominant species (5730 individuals) in the abundance compared to the other species, whereas the desert locust *S. gregaria* was found to be a much rarer species (21 individuals).

TABLE 1. THE TOTAL ABUNDANCE, MEAN AND SE OF THE MAIN INSECT PESTS INFESTED DATE PALMS IN 2020.

Total abundance	Common name	Pest name	Mean ±SE
54	Palm fruit stalk borer	<i>Oryctes elegans</i>	9±1.87
243	Palm frond borer	<i>Phonapate frontalis</i>	40.5±11.62
256	Bluegrass billbug	<i>Sphenophorus parampunctatus</i>	42.6±10.36
44	Red palm weevil	<i>Rhynchophorus ferrugineus</i>	7.33±1.95
21	Desert Locust	<i>Schistocerca gregaria</i>	3.5±1.25
5730	Island pinhole borer	<i>Xyleborus perforans</i>	955±147.22

62	Cadelle beetle	<i>Tenebroides mauritanicus</i>	10.3±4.27
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2. The temporal distribution of insect pests:

The first appearance of the *O. elegans*, and *P. frontalis* was in January 2020. The abundance of the *O. elegans*, and *P. frontalis* showed a peak in April 2020 (Figure 1). After that, there was a drop in the abundance of *O. elegans*, and *P. frontalis* in May 2020 showing a low abundance of *X. perforans* in the following months (Figure 1). From May to December 2020, these pests continued to appear in few numbers (Figure 1).

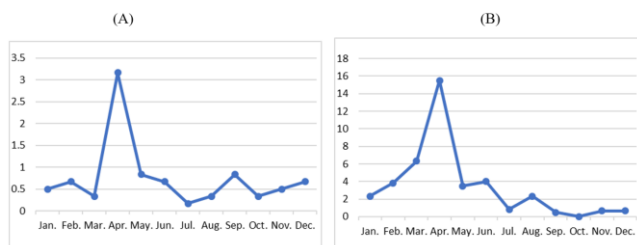


Figure 1: Temporal distribution of (A) *O. elegans*, (B) *P. frontalis* within a date palm field in 2020

The *R. ferrugineus*, *S. parampunctatus*, *X. perforans*, *T. mauritanicus* appeared for the first time in January 2020. The abundance of *X. perforans*, and *R. ferrugineus* increased in March, reaching a peak in April 2020 (Figure 2). In May 2020, there was a drop in the abundance of *X. perforans*, *R. ferrugineus*, and *S. parampunctatus* as well as in the following months. The abundance of *S. parampunctatus*, *T. mauritanicus* reached a peak in October 2020 (Figure 2).

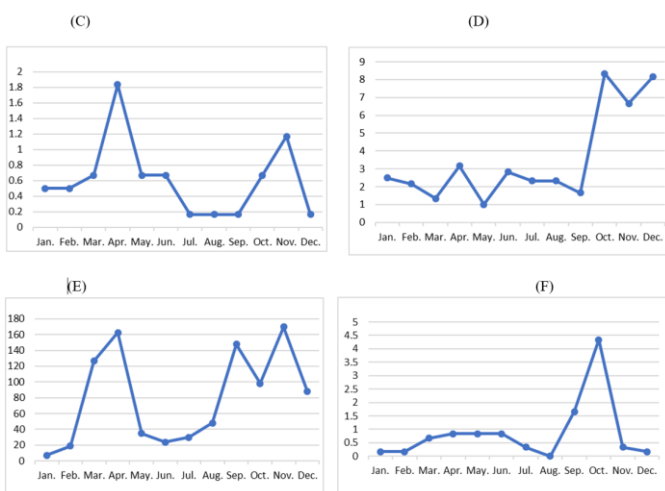


Figure 2: Temporal distribution of (C) *R. ferrugineus*, (D) *S. parampunctatus*, (E) *X. perforans*, (F) *T. mauritanicus* within a date palm field in 2020.

The first appearance of the *S. gregaria* started with a high peak in January 2020 (Figure 2). From May to August 2020, there was a drop in the abundance of *S. gregaria* until May 2020 showing no number of its abundance (Figure 3). From

June to the end of year 2020, the presence of *S. gregaria* was very few (Figure 3).

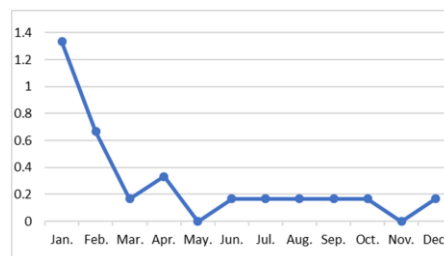


Figure 3: Temporal distribution of *S. gregaria* within a date palm field in 2020

DISCUSSION AND CONCLUSION

The present study showed that *O. elegans*, *R. ferrugineus*, *T. mauritanicus*, *P. frontalis*, *S. parampunctatus*, *S. gregaria* and, *X. perforans* were associated pests with date palms in the west of Saudi Arabia. This finding is in consist with El-Shafie *et al.* (2017) who reviewed and listed possible arthropod pests associated with date palms and they concluded that date palms are usually infested by few major pests including the red palm weevil (*R. ferrugineus*), the old world date mite (*O. afrasiaticus*), the lesser date moth (*B. amydraula*), the Dubas date bug (*O. lybicus*), the green pit scale (*P. phoenicis*), the carob moth (*E. ceratoniae*), the date palm longhorn beetle (*J. hammerschmidtii*), and the almond moth (*C. cautella*). However, the associated pests with date palms in this study showed a considerable variation in their occurrence. The population dynamics of these pests showed different abundances with different time scales, which can be useful for giving information about their life cycle in date palm fields and their relationship to changes in the four seasons. In terms of damage, the population dynamics of different insect pests varied at the vegetative and reproductive stages of palm trees. According to the data, the desert locust infestation in the Makkah regions was linked to the severity of rainfall (Al-Ajlan, 2007). There was a decent relationship between *S. gregaria* infestation (Solitary phase), the relative humidity, and temperature (Al-Ajlan, 2007). The desert locust infestation in Makkah al-mukarramah in Saudi Arabia was heavy during 1992-95, 1997-98, and 1986-88 (Al-Ajlan, 2007). The few abundance *S. gregaria* during 2020 in this study can be justified to this annual survey process in the recession (Solitary phase) because desert locusts rely on gregarious invasions following a seasonal pattern (Piou *et al.*, 2017). In the present work, *T. mauritanicus*, and *S. parampunctatus* populations were found to be more in October 2020 which was the harvest phase of date. However, the seasonal activity of *P. frontalis* varied depending on the locale and environmental factors showing a higher population in April 2020. This finding is roughly consistent with Zaid *et al.* (2002) who reported that the palm frond borer rose in April but reached its peak in May. However, Al-Deeb and Khalaf (2015) found different results in which their study showed the highest activity of *P. frontalis* occurred in Iraq during May, June and July. The variation of the population dynamics of insects from regions to other is affected by weather conditions

(Khaliq *et al.*, 2014). In addition, in this study the red palm weevil, *R. ferrugineus* showed a higher density in April 2020, and a lower density in December. This finding agrees with Manzoor *et al.* (2020) who reported the highest population of RPW during April, May, and June. Also, the obtained result is consistent with that obtained by Al-Khatiri (2004) who recorded a few number of RPW in January and December. This study showed that the populations of *O. elegans* and *X. perforans* were higher in April 2020. This does not agree with Ghaedi *et al.* (2020) who found that the maximum population densities of *O. elegans* were recorded in July and June in Iran. Based on our expectations, the temporal distributions and spatial distributions are significantly affected by many factors, such as temperature conditions, processing practices, and food availability in different areas.

#### CONCLUSION

Palm trees, *P. dactylifera* is an important fruits crop, are commonly cultivated in different parts in the world, especially in the Middle East, where it is often severely damaged by insect pests. Thus, the main constraint to produce date is the loss of fruits before harvest and post-harvest loss during storage. The results of this research could be helpful for the management of date palm pests, considering their infestation on date palm verity as well as the meteorological conditions. It is a desirable attribute since trapping programs such as pheromone, light traps, in addition to monitoring insect activities, would significantly minimize pest population growth.

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## دراسة أولية عن أهم الآفات الحشرية المصاحبة لأشجار النخيل في الجزء الغربي من المملكة العربية السعودية

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**مستخلص.** يعتبر معرفة الجوانب البيئية للآفات الحشرية من أهم العوامل لتطبيق الإدارة المتكاملة للآفات. أجريت هذه الدراسة لخصر أهم الآفات الحشرية لنخيل التمر في محطة الأبحاث الزراعية التابعة لجامعة الملك عبد العزيز الواقعة في منطقة هدى الشام غربي المملكة العربية السعودية كدراسة أولية في هذه المنطقة. في هذا الحقل، تم جمع الحشرات كل اسبوعين باستخدام المصائد الضوئية والأرضية ابتداء من ٢٠٢٠/١/١ حتى ٢٠٢٠/١٢/٣٠. وقد أظهرت النتائج إصابة نخيل التمر بسبعة آفات تشمل جعل النخيل *Oryctes elegans*، وسوسة النخيل الحمراء *Rhynchophorus ferrugineus*، خنفساء الكاديل *Tenebroides mauritanicus*، حفار سعف النخيل *Phonapate frontalis*، وحشرة *Sphenophorus parampunctatus*، الجراد الصحراوي *Schistocerca gregaria* وسوسة البلح *Xyleborus perforans*. ومع ذلك، فقد اظهرت هذه الدراسة أن سوسة البلح *X. perforans* هي النوع السائد (٥٧٣٠ فرداً) في الوفرة العددية مقارنة بالأنواع الأخرى، في حين وجد أن *Schistocerca gregaria* هو النوع الأكثر ندرة (٢١ فرداً). لذا، يمكن أن تفيد نتائج هذه الدراسة في إدارة آفات نخيل التمر في ظل الظروف المناخية القاسية.

**الكلمات الدالة:** نخيل التمر، الآفات الحشرية، سوسة النخيل الحمراء، حفار سعف النخيل، سوسة البلح.