

Management Protocol Depending on Both Pheromones and Burning Palms for the Red Palm Weevil *Rhynchophorus ferrugineus* Oliv. (Coleoptera: Curculionidae) Recently Recorded in Libya

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Abstract

Tobruk is a coastal city on the Mediterranean basin. Vegetation coverage of the city is a combination of wild vegetation spots, smallholder farms, landscapes and house backyards. Date palm is one of the most popular trees in these areas. The red palm weevil, *Rhynchophorus ferrugineus* Oliv., (Coleoptera: Curculionidae), was detected in Tobruk for the first time in January 2009.

In May 2009, 40 pheromone-kiromone traps were introduced by the Pest Control Center, Libyan Agriculture Ministry. Nineteen traps were placed at 19 smallholder farms inside Tobruk city. Forteen traps were placed at 14 small holder farms in a belt around the city. Seven traps were placed at 7 commercial palm farms at El-Gaghboob oasis to detect the red palm weevil. Data revealed that occurrence of adults was in center of Tobruk. Traps placed at Tobruk borders and El-Gaghboob oasis did not record any weevil adults.

According to the previous data, Libyan Ministry of Agriculture decided to burn all palms in the city, Burning Procedures started in August 2009. Palm trees were removed by winches and burned in a crematorium (burning place) inside marked infested zone. During removal and burning process, traps collected more adult weevils. After burning most palm trees, mean numbers of captured adults significantly reduced. Generally, detection and monitoring of red palm weevil should be undertaken in other places in Libya because of the possibility of invading from many neighboring countries.

Keywords: *Rhynchophorus ferrugineus*; Traps; Libya

Introduction

The date palm, *Phoenix dactylifera* (Palmae) is the most common and widely cultivated plant in the arid regions of the Middle East and North Africa where, in many areas, its fruit has provided the staple carbohydrate source for local people for nearly 5000 years [1,2]. The red palm weevil, *Rhynchophorus ferrugineus* Oliv., (RPW) (Coleoptera: Curculionidae) is an economically important, tissue-boring pest of date palm in many parts of the world. The date palm crop in these countries is now facing a threat. In the mid 1980s, it was discovered attacking palms in the Arabian peninsula [3,4]. It was recorded for the first time in the United Arab Emirates in 1986; then in Saudi Arabia in 1987. However, it has now crossed the Red Sea into North Africa, as the latest record is from the Sharqiya region of Egypt in 1992 [5]. By 1995, it had infested over 10,000 farms across Arabia. In infested plantations, yields have been estimated to have dropped from 10 tons to 0.7 tons per hectare [3].

The weevils are attracted to dying or damaged parts of palms but it is possible that undamaged palms are also attacked. The males of *R. ferrugineus* produce a pheromone which causes the weevils to aggregate on damaged trees [6]. The larvae can only bore in soft tissue; for example, in the tree crown, upper part of the trunk and at the base of petioles. They can also bore into the trunk of young palms and the decaying tissue of dying palms. Aggregation pheromones have been reported as effective tools for monitoring and trapping *R. ferrugineus* in the field [6-9]. In Libya, one adult of *R. ferrugineus* were collected occasionally from Tobruk city (North east of Libya) during January 2009 [10]. The aim of the present investigation is to study the pest status of the red palm weevil under management protocol for the pest at Tobruk region.

Materials and Methods

Tobruk is a small coastal city on the Mediterranean basin. Desert surrounds the city from east, west and south. The area of the populated city is about 35 km². The vegetation coverage of the city is wild vegetation spots, smallholder farms and plantations in the house backyards. Date palm is one of the most popular trees in these areas. Once red palm weevils have been confirmed by catching one adult, 40 pheromone-kiromone traps were introduced by Pest Control Center, Libyan Agriculture Ministry. In May 2009, 19 traps were placed at 19 smallholder farms and landscapes in the populated area of the city starting from the original find place of *R. ferrugineus*. Distance between each two traps was between 1000 – 2000 m according to occurrence of palm trees in the city. Fourteen traps were placed at 14 smallholder farms in a belt around the city which consider as buffer zone (more than 15 km from the city center). On the other hand, 7 traps were placed in 7 commercial farms at El-Gaghboob oasis (300 km south of Tobruk) to detect and monitor the red palm weevil.

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The standard pheromone-kiromone trap used in this study consisted of (i) a 20 liter yellow plastic container; the container had two 10 cm diameter openings on the upper lateral sides for the entrance of the attracted adults, (ii) Soft date fruits were placed at the lower part of the container as baits with two liters of tape water. One ml detergent was added to the mixture to help drowning the trapped adults. Pheromone and kiromone packages were hanged up by metal wire on the inner side of the container cover. The registered commercially pheromone lure was used under the trade name "PO28 Ferrolure+", 700 mg lure (ChemTica International S.A., Costa Rica). The components of this pheromone lure are 4-methyl -5-nonanol (9 parts) + 4- methyl-5 nonanone (1 part) - purity of both components is about >95% and release rate is 3-10 mg/day. Kiromone used in this study is ethyl acetate 95% mixed with jelly as release substance. Each package contained 50 ml. Pheromone-kiromone traps were placed in the ground with the lower half of the container inserted in the ground between the date palm trees. Traps located at ground level captured significantly more weevils than those hanged up above the ground [11]. Traps were examined weekly and numbers of caught adults were recorded.

Results and Discussion

The first detection of the red palm weevil was in a moisture area characterized by raise of subterranean water level in the center of Tobruk. This detection was in January 2009 [10]. Figure 1 shows the numbers of *R. ferrugineus* per trap per week inside Tobruk city during summer 2009. Data revealed that the mean recorded numbers ranged between 0.33 – 7.91 adults /trap /week. Total numbers of collected adults were 565 during investigation period from May to October, 2009. On the other hand, Traps placed at Tobruk borders and EL-Gaghboob oasis did not record any attracted adults. In this concern, El-Garhy [8] reported that catch rates are highest during the period from April to June (50-65 weevils). Also, El-Ezaby et al. [7] reported maximum catches in March and April which corresponds to the warmer weather in Egypt.

Although presence adult stage of *R. ferrugineus*, no symptoms or advanced infestations were observed on the palm trees grown in infested locations. This agrees with Bokhari and Abuzuhairah (1992) [13] who reported that because the red palm weevil is a concealed tissue borer, symptoms of attack at an early stage of infestation are difficult to detect. Later in the infestation process the presence of larvae can be detected through the occurrence of tunnels on the trunk and at the bases of leaf petioles, and through the presence of frass and plant sap which oozes from these tunnels. When a palm is severely infested, the stem or crown sometimes breaks off the tree [1]. Palm trees in wild vegetations often are out of regular control procedures, therefore they are considered as "natural reservoirs" which release adults of *R. ferrugineus* from time to time to threaten new areas. Programmers should put in mind this situation during the planning of "the national campaign of monitoring and eradication of red palm weevil".

Bertone *et al.* [12] reported that countries where occurrence of this pest has been reported must take additional emergency measures to limit its spread and insure eradication. It was possible by the establishment of demarcated areas which include marking infested zones and buffer zones when the adopting chemical and other measures. Trace-back investigations help determine priorities for delimiting survey activities after an initial detection. Trace-back investigations attempt to determine the source of infection. Once a positive detection is confirmed, investigations are conducted to determine the extent of the infestation or suspect areas in which to conduct further investigations.

In this context, a FAO delegate of department of agriculture met the research team in February, 2010 at Tobruk city to confirm the occurrence RPW. They discussed the emergency plan for RPW eradication. Also, the Arab Organization for Agricultural Development has sent a delegate in May, 2010 to do overview of the taken procedures against RPW.

General situation of obtained data in the present study indicates possibility of promising eradication of this invaded pest in Tobruk in the current time. Particularly, *R. ferrugineus* was concentrated in cultivated palms in smallholder farms, landscapes and house backyards inside populated area of Tobruk city. Furthermore, the city is considered as isolated area because of surrounding with Mediterranean from the north and Sahara from east, west and south. For the aforementioned reasons, Libyan Ministry of Agriculture decided burning all palms in the city, burning procedures started in August 2009. Palm trees in the city streets, landscapes and smallholder farms were removed by winches then transferred to crematorium (burning place) inside infested zone, in addition to palms in the buffer zone around the city. Palms were carefully burned until ash stage. Local quarantine units on the city borders monitored the pulled palms to prevent passing any infested palm outside the city. During collecting and burning process, traps collected more adult weevils where the recorded mean number was 35.22 adult / trap (Table 1). After burning most palm trees, number of captured adults was significantly reduced where the recorded mean number was 3.09 adult / trap (Table 2).

Burning program still continues in house backyards synchronized with traps monitoring. When traps do not recorded any adults of red

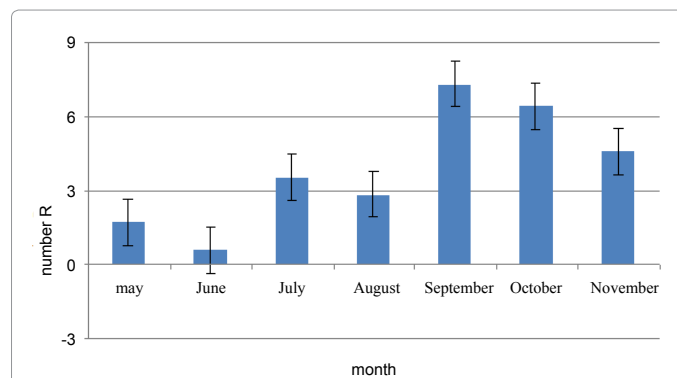


Figure 1: Mean numbers of *Rhynchophorus ferrugineus* adults / trap / week at different sites inside Tubrouk city during the season of 2009.

Trap No.	March	April	May	June	Total
1	0	-	-	-	
2	-	0	3	1	
3	-	-	1	4	
4	26	81	12	85	
5	42	11	11	35	
6	7	7	10	114	
7	16	45	110	154	
Total	91	144	147	393	775
Mean	18.20	28.80	24.50	65.50	35.22

Table 1: Mean numbers of *Rhynchophorus ferrugineus* adults / trap / week at different sites inside Tubrouk city during the removal and burning program in the period between March 2010 to June 2010.

Trap No.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1	-	-	0	0	0	0	
2	0	0	0	0	0	0	
3	0	0	0	0	0	0	
4	0	-	-	-	-	-	
5	0	0	-	0	0	0	
6	0	0	-	0	0	0	
7	18	0	0	0	0	0	
8	42	0	0	0	0	0	
9	7	1	1	0	0	0	
10	21	8	4	0	0	0	
Total	88	9	5	0	0	0	102
Mean	8.0	0.9	0.63	0.0	0.0	0.0	3.09

Table 2: Mean numbers of *Rhynchophorus ferrugineus* adults / trap / week at different sites inside Tubrouk city after removing and burning most palms in the period between July 2010 to Dec 2010.

palm weevil at least for six months, the program could be concluded. Generally, detection and monitoring of red palm weevil should be undertaken in other places in Libya because it invaded many neighboring countries.

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