

EVALUATION OF SOME CONTROL METHODS AGAINST THE RED PALM WEEVIL, *RHYNCHOPHORUS FERRUGINEUS* OLIVIER (COLEOPTERA : CURCULIONIDAE) INFESTING DATE PALM TREES

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ABSTRACT: The red palm weevil (RPW), *Rhynchophorus ferrugineus* is a worldwide serious and destructive insect pest for date palm trees. The present work was carried out to evaluate different methods in the control of red palm weevil infesting palm trees. The obtained results of the experiments revealed that the five holes method of injection and aluminum phosphide tablets 57 % is very safe to the palm trees 3-6 years old recording 80-90 mortality %. Furthermore, low pressure pump increases the efficacy of the injection process for infested date palms above 7 years old. The experiments revealed that the manual method as only one hole of injection gave reduction percentages ranging between 30-40%. From the obtained results, it could be reported that the recommendation injection method and the use of aluminum phosphide tablets are safer for palms above 3 years old except the cases of the infested head of palms, while pressure pump is a safe method except for infestation of head and top date palm 7 years old.

Key words: Aluminum phosphide, date palm, injection method, pressure pump, safe control.

INTRODUCTION

The date palm, *Phoenix dactylifera* L. Family Areaceae is the most common and widely cultivated in the arid regions of the Middle East and North Africa. However, Arab countries contain 78.3% of the total world date palm trees which demonstrate 75% of the production. Based on the Agricultural statistics issued by FAO (2023), the number of female date palm trees revealed about 10.229.630 million planted in 70132 feddan (4200 m²). The total production at 2001 reached about 1.113.270 metric ton (estimated yield/tree = 108.83 kg) harbored 26.5% of the world production (Abdel-Megeed *et al.*, 2004). The number of infested trees were 85435 at Sharkia governorate, where 27503 trees were removed, and 130217 trees at Ismaelia governorate, where 32354 trees were removed. The total infested trees in Egypt at 2007 were 216118 and 60527 were removed (El-Sebay 2007). Despite enormous efforts to control the

red palm weevil (RPW), the empirical evidence shows persistent devastating effects and considerable negative socioeconomic impacts of RPW spread in almost all territories and date palm farming systems in Egypt and Saudi Arabia. The ongoing control and treatment programs annually cost Egypt and Saudi Arabia more than 5.7 million USD and 34.4 million USD, respectively. The ongoing control and treatment programs also achieved less than 75% success. These treatment programs were unable to recover an annual loss of more than 213 million USD and 401 million USD net present worth of investment in the form of falling date palms and associated forgone revenues in Egypt and Saudi Arabia, respectively (Boubaker *et al.*, 2024). Red palm weevil was registered in Egypt since 1992. Muthurman (1984), El-Ezaby (1997), and El-Sebay (2004), proved that injection method is the most successful control factor. Gomez *et al.* (2019) developed a very simple technique based on an infusion process to inject

an emamectin benzoate (EMA) formulation, at 3,5% concentration, and the results showed excellent efficiency under different experimental conditions, in addition, the palms of more than 8 meters height, 100% of the larvae were killed even 360 days after injection, compared to 11% in the control treatment. Refaat *et al.* (2017), developed a hydraulic injection device to be suitable for controlling Red Palm Weevil (RPW) at young date palms, also to determine and control the injection dose in young date palms and offshoots especially at top infestation. The performance was conducted under the following parameters: four injection pressures 100, 150, 200, and 250 kPa., three different diameters < 30, 30-40, and 40-50 cm, three different materials for controlling, two insecticides (chlorpyrifos and profenofos (48%) and natural material (Neem extract) on three different palm tree varieties, i.e., Hayani, Samani and Zaghlool. The performance of the developed hydraulic injection device was evaluated taking into consideration: controlling spent time and productivity, controlling efficiency, total consumed power, and the economic cost (Refaat *et al.*, 2017). They added that, from the proper values for red palm control at Hayani variety were obtained under injection pressure of 150 kPa, with palm tree diameter of 30-40 cm and chlorpyrifos insecticide.

From the previous view, this work was conducted at Qasassin district, at Elsharkia Governorate, Egypt to compare the recommendation injection methods (5 holes), manual injection (1hole), pressure injection method (HPI) and used aluminum phosphide tablets during two successive seasons of 2022 to 2023 on different ages of date palm trees infested with red palm weevil.

MATERIAL AND METHODS

The present work was conducted at El Qasassin district at Elsharkia Governorate, Egypt to compare four methods to control the red palm weevil, *Rhynchophorus ferrugineus* as follow:

- 1- The recommendation injection methods (5 holes)
- 2- Manual injection (one hole),

- 3- High pressure injection method (HPI) .
- 4- Aluminum phosphide tablets.

The experiments were conducted during 2022 & 2023 years on date palm trees naturally infested with red palm weevil.

Sixty infested date palm trees were chosen and classified to three groups, the first group contain date palm trees 3- 6 years old, the second group include date palms 7-10 years old, and the third group of trees were aged 11-15 years old.

Methods of red palm weevil control

- 1- Recommended injection method was carried out by making 5 holes inside date palm trunk around the infested places with the aid of drill work benzene 14 inch bullet where the solution pesticides were injected. Placing a small piece of dry date palm fibers in the opening of the holes after injection.
- 2- Manual injection treatment was carried out making one hole above infested places by drill work benzene 14 inch bullet where solution pesticides were injected. Placing a small piece of dry date palm fibers in the opening of the holes after injection.
- 3- Phostoxin fumigant (aluminum phosphide 57%) was used as 6 tablets/ palms via the following steps:
 - 3.1- Definition of heavily infested date palms showing obvious infestation symptoms.
 - 3.2- Clean hole or cavity infestation palm trunk places.
 - 3.3-Applied Phostoxin tables on dry date palm fibers and entered in the holes
 - 3.4- Closing the opening of the hole or cavity by a paste of cement and gypsum
- 4- Injection of pesticides with the aid of high pressure pump (1-2 bar = unit of pressure/cm²) directly into the holes of weevil infestation (Figure 1) .

Heavily natural infested palms were treated by injection with the insecticide chlorpyrifos at 3 ml / liter and 6 tables aluminum phosphide 57% (Phostoxin) /tree .. All treated date palms were inspected 21 days after treatment of the tested insecticides that determined as a recovery percentage of infested date palms according to the disappearance of the most obvious infestation

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symptoms i.e., dryness of yellowish brown viscous liquid in the infested places of palm trunk.

Efficiency percentages of red palm weevil control

The efficiency % of control was calculated

according to percentage of recovery trees, 21 days of different treatments, as follows:

$$\text{Efficiency (\%)} = \frac{\text{Number of recovery trees}}{\text{Total number of treated trees}} \times 100$$



Fig. (1). Photographs for the different methods to control red palm weevil under field conditions.

RESULTS AND DISCUSSION

The effectiveness of four methods to control red palm weevil *R. ferrugineus*: Recommendation injection method, Manual injection one hole, Phostoxin aluminum phosphide and pressure pump was assessed 21 days of different treatments under field conditions. The obtained results in Table 1 and Figures (2-3) revealed that the efficiency averages of the four tested methods were ranged between 80, 20-40,80-100 and 80- 100%, after 21 days of application, respectively. As shown in Table 1 all injected trees with the three methods (Recommended injection method, Manual injection in one hole, Phostoxin), did not affected the physical case of the injected trees in all aged. Also, in the low pressure method with hand pump, the results show damage to the treated

trees in the first and second groups as 40% reduction in the numbers of treated trees., while the methods of (Recommended injection method and Phostoxin) recorded good results and safe of date palm trees. Statistical analysis of data revealed that the used rates of the four treatments registered significant differences at 5% level of probability. While, there were no significant differences between the three treatments (Recommended injection method, Manual injection one hole, Phostoxin) and the pressure pump treatment. For effective control of the red palm weevil it can be reported that the application of Recommended injection and phosphide aluminum at the rate of 6 tablets per tree is sufficient to achieve a complete recovery for the heavy infested palms.

Table 1: Effect of four methods in the control of the red palm weevil on different ages of palm trees

Method control	Recovery rates %					recovery mean	% dead palm after treatment
	Rep.1	Rep.2	Rep.3	Rep.4	Rep.5		
Group 1: date palms 3-6 years old							
Recommended injection	100	0	100	100	100	80	0%
Manual injection one hole	100	0	0	0	0	20	0
Phostoxin tables	100	100	100	100	100	100	0
Pressure pump	100	100	100	0	100	80	40
Group 2 : date palms 7-10 years old							
Recommended injection	100	100	100	0	100	80	0
Manual injection one hole	0	0	0	0	0	0	0
Phostoxin tables	100	100	0	100	100	80	0
Pressure pump	100	0	100	100	100	80	20
Group 3: date palms 10-15 years old							
Recommended injection	100	100	100	0	100	80	0
Manual injection one hole	0	100	100	0	0	40	0
Phostoxin tables	100	100	100	100	100	100	0
Pressure pump	100	0	100	100	100	100	0

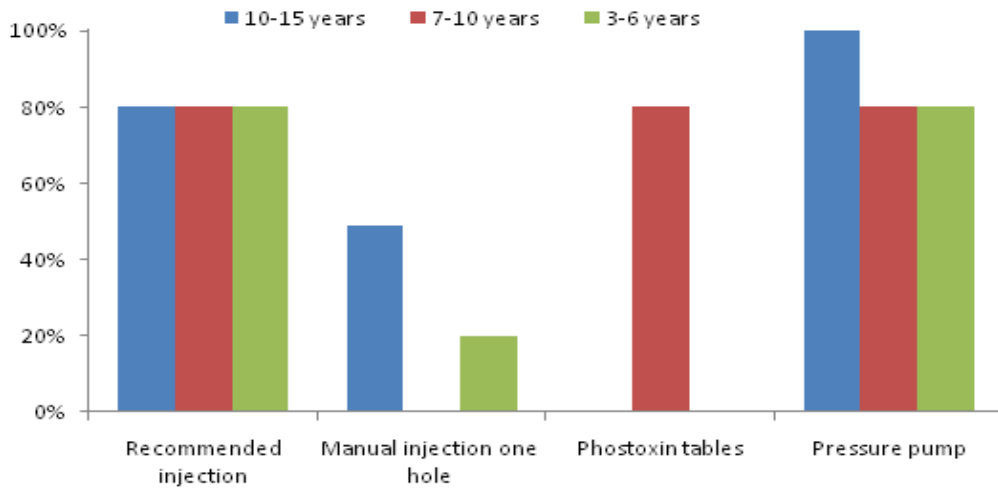


Fig. 2 : Palm recovery percentages due to injection with liquid and fumigant insecticides against the red palm weevil, *Rhynchophorus ferrugineus* 21 days of treatment under field conditions.

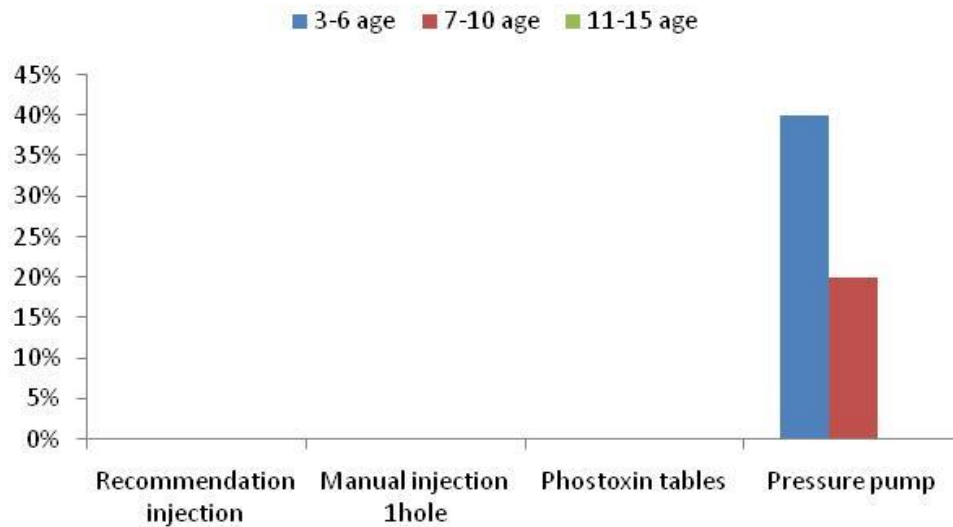


Fig. 3 : Dead palm percentages due to injection with liquid and fumigant insecticides on the red palm weevil, *Rhynchophorus ferrugineus* 21 days of treatment under field conditions.

The obtained results are in agreement with those recorded by many researchers who evaluated different methods of insecticides application against the red palm weevil under field conditions such as El-Ezaby (1997). El Sayed *et al.* (2017) El-Sebay and Abbas (2008) Muthuraman (1984), Saleh *et al.* (2011), and El-Sebay (2003 & 2004) who recorded that the

efficacy of the tested methods that belonging to different groups date age palm varied against *R. ferrugineus* and resulted good control against red palm weevil.

Recently, Hajjar (2024) reported that, the red palm weevil *Rh. ferrugineus* is a dangerous pest in Europe and recommended for regulations as a quarantine pest by EPPO, and added that,

Prohibition of offshoots movement with a given country or among different countries, as quarantine against serious pests and diseases, negatively affect trading and eventually the farmers income. In addition the same author developed a treatment protocol dealing with RPW infestation in palm seedlings using Eco2fume (Phosphine 2% and Carbon dioxide 98%) which proved to be an efficient quarantine fumigant against all stages of the red palm weevil, when used at an application rate of 1500 ppm and exposure time of 72 h. The Eco2fume showed no phytotoxicity effect on the treated date palm offshoots. Physiological parameters of the offshoots such as stomata opening, photosynthesis, and chlorophyll contents were not adversely affected.

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تقييم بعض طرق مكافحة سوسة النخيل الحمراء التي تصيب اشجار النخيل *Rhynchophorus ferrugineus* Olivier (Coleoptera :Curculionidae)

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الملخص العربي

تعتبر سوسة النخيل الحمراء *Rhynchophorus ferrugineus* آفة حشرية خطيرة ومدمرة لأشجار النخيل. تم تنفيذ العمل الحالي لتقييم الطرق المختلفة لمكافحة إصابة النخيل بسوسة النخيل الحمراء. أظهرت التجارب أن طريقة الخمس ثقب للحقن وأقراص فوسفيد الألومنيوم ٥٧٪ المستخدمة آمنة جداً للشجرة للأعمار الصغيرة من ٣-٦ سنوات وأعطت نتائج جيدة حيث سجلت معدل نجاح بلغ ٨٠-٩٠٪. استخدام مضخة الضغط المنخفض يمكن أن تزيد من فعالية الحقن لنخيل التمر في العمر الذي يزيد عن ٧ سنوات. وأظهرت التجارب أن طريقة الحقن اليدوية (فتحة واحدة) لم تعطى نتائج جيدة حيث تراوحت بين ٣٠-٤٠٪. ومن خلال النتائج المتحصل عليها فإن طريقة الحقن الموصى بها واستخدام أقراص فوسفيد الألومنيوم كانت أكثر أماناً للنخيل فوق ٣ سنوات باستثناء الإصابة بالرأس، بينما استخدام مضخة الضغط أكثر أماناً باستثناء الإصابة في الأجزاء القريبة والعليا للأشجار فوق ٧ سنوات من العمر.

الكلمات المرشدة : فوسفيد الألومنيوم - طريقة الحقن - نخيل البلح - مضخة الضغط - مكافحة الآمنة