

# Evaluation of a Sound Detector in the Early Detection of Red Palm Weevil *Rhynchophorus ferrugineus*. Oliv. Infestation of Date Palm in Egypt

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## ABSTRACT

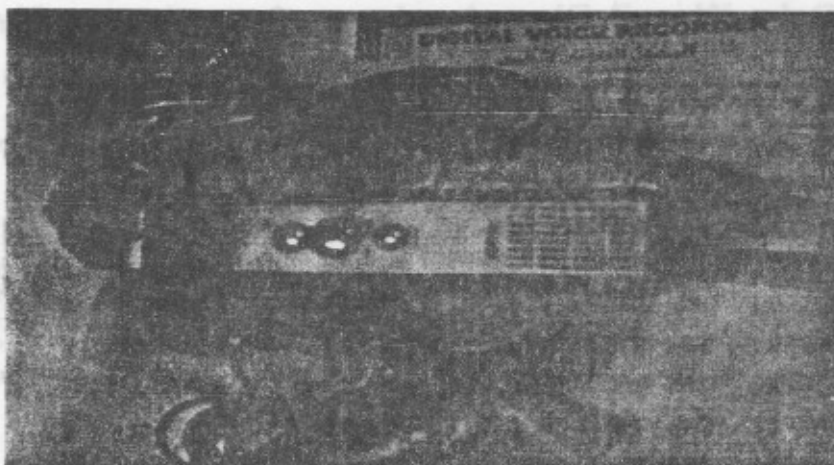
Sound detector equipment was utilized to detect the infested palms in the field. Detection accuracy in the laboratory tests were 72-100% for 2<sup>nd</sup> larval instar, 80-100% and 100% for the 4<sup>th</sup> and 6<sup>th</sup> larval instars and adult stage respectively. Field accuracy was 85-100% for free infestation trees, while it was 95-100% for infested trees 85-100% for randomized chosen trees and 90-100% for treated infested trees. Results clarified a promising tool for early detection and quarantine inspection.

## INTRODUCTION

*Rhynchophorus ferrugineus*. Oliv. Which known as the red palm weevil was introduced to Egypt during 1992-1993 through infested offshoots. Due to the lack of early detection researches and difficulty of recognition the infested trees (which all stages are inhabited inside the tree), early detection becomes one of the most important factor in controlling the dispersal of the pest in the field and applying fast control before spread out is happened. Also in preventing incoming infested palms from outside countries. Intra and or inter-quarantine is very important measure for controlling such pest. Inspections should have quick, easy, and handled tools to support quarantine activities. Nakach *et al.* (2000), in Israel, reported that dogs could be used early for detection. Soroker *et al.* (2004), in Israel, tested a sounding equipment for detection for palm weevils' larvae.

## MATERIALS AND METHODS

**Equipment (Fig.1).** Equipment (My Voice) was introduced by United Group Company in Egypt, Model DMR 909s has 16MB memory. Built-in directional condenser microphone (mono), 23 mm 16 Ohm speaker, frequency range 400Hz- 3400Hz working with two DC "AAA" batteries.



Evaluation experiment was conducted at Red Palm Weevil Research Lab., Qasassin, Ismaielia, Egypt, during 2001-2002. Sound wave can be saved through PC into files and appear like in Fig. 2.



**Fig. 2. Sound wave recording and analysis**

**Laboratory evaluation:**

The study was carried out to detect the sound of different stages of red palm weevil inside infested parts. To perform such experiment, 25 pieces of freshly sugar cane cutting, 3 cm in diameter and 10 cm in tall were prepared, each five cutting considered as one replicate. The second instar larvae were inserted into cutting as one larva for each cutting and kept under laboratory Conditions at the rate of (27°C & 51% RH) for three days to supply enough time for boring. Fourth and sixth larval instars (25 larvae for each) were also inserted into the cuttings, separately as one larva per each cutting.

For detecting the sound of adult stage, 25 cuttings of palm trunk, were partially evacuated from its contents and one adult was inserted inside each cutting, covered with a piece of bark, fixed with rubber band and left for three days.

Sound sensor was attached to each cutting and equipment operated; sound could be heard through air phone and recorded by cassette recorder in each test. Results for each stage were recorded and tabulated.

### Field Evaluation:

Twenty trees were chosen to evaluate the accuracy of the equipment in each case as follows:

One. Detection of healthy trees.

Two. infested trees.

Three. Random choice of trees and against the treated infested trees (post chemical application) to ensure the absence of alive stages inside the palm.

## **RESULTS AND DISCUSSIONS**

Data in Table (1) show the obtained results of the utilized sound detector in the laboratory for detection of the different larval instars.

The second larval instar was successfully detected with an average of 72% accuracy in 25 infested sugar cane pieces ranged from 40-100%. The frequency rate was 60 – 100 Hz. The percent of the accuracy detection in the 4<sup>th</sup> larval instar was increased to 96% and the detection range decreased between 80 – 100% at the frequency rate was 175 – 250 Hz.

Table (1) also show that, sound could be detected the occurrence of 6<sup>th</sup> larval instar and adult stage with 100% accuracy and with no range of mistakes at the frequency rate: 1.0 – 2.0 K Hz.

**Table 1. Sound detection of the different larval instars and adult stage under laboratory conditions**

Replicates*	Tested Stages			Adult
	2 <sup>nd</sup>	4 <sup>th</sup>	6 <sup>th</sup>	
R1	80%	100%	100%	100%
R2	60%	80%	100%	100%
R3	100%	100%	100%	100%
R4	80%	100%	100%	100%
R5	40%	100%	100%	100%
Aver.	72%	96%	100%	100%

- Each replicate contained 5 individuals per each stage
- 2<sup>nd</sup> instar larva (Frequency rate: 60 – 100 Hz)
- 4<sup>th</sup> instar larva (Frequency rate: 175 – 250 Hz)
- 6<sup>th</sup> instar larva (Frequency rate: 1.0 – 2.0 k Hz)

**Field Examinations:**

Data in Table (2), represents the result of the sound detector equipment used as an external tool for detection of the infestation inside the palm trees. The first tested group was healthy palm trees, out of 20 trees, result indicated that the equipment failed in three detected trees and was successful in seventeen trees with a percent of 85%.

**Table 2. Tested 20 free of infestation trees and equipment response.**

Rep.	Observed	Tested	Result	Rep.	Observed	Tested	Result
1	free	Free	positive	11	Free	free	Positive
2	Free	Free	Positive	12	Free	Free	Positive
3	Free	Free	Positive	13	Free	Free	Positive
4	Free	No	Negative	14	Free	Free	Positive
5	Free	Free	Positive	15	Free	Free	Positive
6	Free	Free	Positive	16	Free	Free	Positive
7	Free	Free	Positive	17	Free	no	Negative
8	free	Free	positive	18	Free	Free	Positive
9	Free	Free	Positive	19	Free	Free	Positive
10	Free	Free	Positive	20	Free	Free	Positive
<b>Mean</b>			<b>90%</b>	<b>Mean</b>			<b>80%</b>

Table (3) show the observed infested trees and the role of sound detector equipment assuring such result. Infested trees detected with accuracy of 95%.

**Table 3. Tested 20 of infested trees and equipment response.**

Rep.	Observed	Tested	Result	Rep.	Observed	Tested	Result
1	infested	Yes	Positive	11	infested	Yes	Positive
2	Infested	Yes	Positive	12	Infested	Yes	Positive
3	Infested	Yes	Positive	13	Infested	Yes	Positive
4	Infested	Yes	Positive	14	Infested	No	Negative
5	Infested	Yes	Positive	15	Infested	Yes	Positive
6	Infested	Yes	Positive	16	Infested	Yes	Positive
7	Infested	Yes	Positive	17	Infested	Yes	Negative
8	Infested	Yes	Positive	18	Infested	Yes	Positive
9	Infested	Yes	Positive	19	Infested	Yes	Positive
10	infested	Yes	Positive	20	Infested	Yes	Negative
<b>Mean</b>			<b>100%</b>	<b>Mean</b>			<b>90%</b>

Random tested trees were detected with accuracy of 85%. Such result indicated that it could be detect RPW infestation by sound detector equipment, and that may increase the accuracy of the infestation more than depending on human experience.

**Table 4. Tested 20 of random trees equipment response.**

Rep	Observed	Tested	Result	Rep	Observed	Tested	Result
1	Infested	Yes	Positive	11	Free	Yes	Positive
2	Free	Yes	Positive	12	Free	Yes	Positive
3	Infested	no	Negative	13	infested	Yes	Positive
4	Infested	Yes	Positive	14	Infested	Yes	Positive
5	Infested	Yes	Positive	15	Free	Yes	Positive
6	Free	Yes	Positive	16	Infested	Yes	Positive
7	Infested	Yes	Positive	17	Infested	no	Negative
8	Infested	Yes	Positive	18	Free	Yes	Positive
9	Free	Yes	Positive	19	Infested	No	Negative
10	Infested	Yes	Positive	20	infested	Yes	Positive
Mean			90%	Mean			80%

Twenty treated trees with different chemicals, were inspected by such equipment and gave 90% success of detection. The present method can increase the ability of trees treatment and prevent the human mistakes in wrong believe about the recover of the palm tree from infestation.

**Table 5. tested 20 of treated trees and equipment response.**

Rep.	Observed	Tested	Result	Rep	Observed	Tested	Result
1	Free	Yes	Positive	11	Free	Yes	positive
2	Free	No	negative	12	Free	Yes	Positive
3	Free	Yes	Positive	13	Free	Yes	Positive
4	Free	Yes	Positive	14	Free	Yes	Positive
5	Free	Yes	Positive	15	Free	Yes	Positive
6	Free	Yes	Positive	16	Free	Yes	Positive
7	Free	Yes	Positive	17	Free	Yes	Negative
8	Free	Yes	Positive	18	Free	Yes	Positive
9	Free	Yes	Positive	19	Free	Yes	Positive
10	Free	Yes	Positive	20	Free	No	Negative
Mean			90%	Mean			90%

According to the above cited results, it could be concluded that using the sound detection equipment as new approach for early detection for RPW infestation in the field. This present findings is a new technology to save more trees from infestation.

It is obvious that more than 90% of red palm weevil distribution is due to translocations of infested palm, detecting devices are necessities for facilitating quarantine operation. Therefore the detector may introduce one of those facilities can be used in the field to inspect infested trees too.

In general, out break of red palm weevil in Egypt and other countries should be faced with more efforts to discover different methods that help in controlling such pest.

## REFERENCES

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## الملخص العربي

### التقييم الحقلّي لجهاز التصنّت الصوتي للاستشعار المبكر لإصابة نخيل البلح

### بحشرة سوسة الخيل الحمراء في مصر

تامر إبراهيم محيّم

محمد كمال عبد اللطيف

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أمكن للتوصل لاستخدام جهاز تصنّت صوتي يباع عن طريق إحدى الشركات في التسمع لأطوار حشرة سوسة النخيل الحمراء. و تم تقييم استخدام هذا الجهاز معمليا حيث أعطى درجة دقة تتراوح بين ٧٢-١٠٠% للعمر الليرقّي الثاني ومن ٨٠-١٠٠% للعمر الرابع و ١٠٠% للعمر السادس والحشرة الكاملة. أما في الحقل فقد تراوحت درجة الدقة بين ٨٥-١٠٠% للأشجار التي ليس بها إصابة والأشجار المصابة عشوائيا بينما أعطى ٩٠-١٠٠% دقة في الأشجار المصابة فعلا هو التي تم علاجها من الإصابة. والجهاز يعطي أملا في التقييم الدقيق لكشف الإصابة مبكرا سواء في الحقل هو في الحجر الزراعي.