

EVALUATION OF CERTAIN NATURAL AND INSECTICIDES COMPOUNDS AGAINST THE RED PALM WEEVIL, *Rhynchophorus ferrugineus* (Oliv.) UNDER LABORATORY AND FIELD CONDITIONS

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ABSTRACT: *Particular knowledge based on control studies was contributed to the red palm weevil, Rhynchophorus ferrugineus (Oliv.). In laboratory experiments data revealed that chlorfenapyr, Diazinon and Chlorpyrifos proved to be the most potent compounds, followed by garlic juice and neem on different stages (eggs, different instars larvae and adults of R ferrugineus. The advancement of embryogenesis with the susceptibility of eggs with chlorfenapyr,, Diazinon and Chlorpyrifos. Considering the larval stage, chlorfenapyr, Diazinon and Chlorpyrifos proved to be the most effective compound among the compound against all tested instars. The susceptibility of tested insecticides was negatively correlated with the progression of both larval development and adult tested insecticides. The obtained results revealed that there were significant differences between the tested compounds on the reproduction of females. Under field conditions chlorfenapyr, Diazinon and Chlorpyrifos proved to be more effective than other compounds recording the highest values of % recovery that ranged between 80-100% compound.*

Keywords: *Rhynchophorus ferrugineus, red palm weevil, insecticides and susceptibility effective*

INTRODUCTION

Red palm weevil, *Rhynchophorus ferrugineus* is an economic insect –pest on date palm trees, *Phoenix dactylifera* L. (Palmace) is the most common and widely cultivated in the arid regions of the Middle East and North Africa. In many areas, date palm fruit has provided the stable carbohydrate food for local people since long time age. The total number of date palm trees recorded in the ancient life reached about 109 million which yielded 4,2 million metric tons in Arab countries. However, contain 78,3% of the total world date palm trees which demonstrate 75% of the production (Abdel-Megeed *et al.*, 2004). Based on the Agricultural statistics issued by Ministry of Agriculture and Land Reclamation, the number of female date palm trees, in Egypt revealed about 10.229.630 million planted in 70132 Fedden. The total production/ton at 2001 reached about 1.113.270 metric ton (estimated yield/tree = 108.83 kg) harbored 26.5% of the world production serious tissue

boring pest for date palm in many parts of the world, causing considerable damage .

El-Sebay (2007) mentioned that about 215652 trees were infested until 2000, represented 2.2% of whole number of palm trees in Egypt .About 59857 trees were completely removed represented 0.6% of the whole number of trees .Due to extensive use of insecticides, spraying and injection the total number of applied chemicals was about 272 ton till years 2000 In India the red palm weevil has successfully managed on coconut by employing an integrated pest management (IPM) program comprising several strategies (Abraham *et al.*,1989).

This work aimed to evaluate some biocide plant extracts and insecticides against eggs, larvae and adults of red palm weevil, with special concern to deleterious effect on reproductive capacity of adult females..

MATERIALS AND METHODS

The present laboratory studies was carried out in the Dr. Yousry El-Sebay Laboratory Researches of Red Palm Weevil at Kassasin, Ismailia Governorate, during 2008 and 2009 to evaluate the toxic effect of certain compound against different stages of red palm weevil. Effect of tested pesticides on the biotic potential with special concern to reproduction was also considered on second, six and last instars larval and adults.

Tested compounds

1-Biocides

a- bioranza,10% (*metarhizium anisopliae*)

2- Plant extracts

a- garlic juice (garlic juice 99.3% and Ediznts0.7%)

b- neem

3-Conventional insecticides

a-Challenger36%SC (chlorfenapyr)

b-Diazinon 60% EC(Diazinon)

c-Dursban 48% EC(Chlorpyrifos).

1-Bioassay experiments:

Serial concentrations of each compound were prepared in tap water i.e. 0.5,1, 1.5, 3, 6, and 9 cm or gm / liter. Sugarcane stalks, (5cm in length, 1.5 cm in diameter) were dipped in the prepared solutions for 30 seconds, and then allowed to dry in air for 4 hours. Sugarcane stalks were transferred to plastic cups (100cc) with perforated covers. Second, six and last instars larvae as well as adults were introduced into the cups using 25 replicates for each concentration. The mortality percentage recorded after 15 days of treatment and corrected according to Abott's formula (1925) and the LC₅₀ and LC₉₀ for the tested compounds were graphically drawn (Finney, 1971)

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The alive individuals were daily inspected pupation for emergence and oviposition.

On the other hand, one day old eggs were dipped in the prepared solutions for 30 seconds, then eggs were transferred to plastic cups containing moist filter paper. For each concentration 25 eggs replicated four times were used. The untreated eggs were dipped in water as check. Eggs for each treatment were kept for 8 days under observation.

2-Field experiment

Field application of tested compounds using regular injection method was applied as follows: making holes 1cm in diameter by electric drill above the infested location at 10-15cm distance and may make from 5 holes in are shape. The depth of hole was about 10-15 cm deep into the tree tissue. Ten infested palm trees were selected to be treated with LC₉₀ doses of the tested compounds.

RESULT AND DISSECTION

1-Ovicidal effect

Data presented in Table (1) Indicated that ovicidal effect of six tested compounds namely *Metarhizium anisopliae*, garlic juice, neem, diazinon, Chlorpyrifos and chlorfenapyr against one day old eggs of, *R. ferrugineus*.

In general the higher concentration, the higher rate of mortality and vice versa. Considering % hatching of one day old eggs, diazinon , chlorfenapyr and chlorpyrifos proved to be effective compounds. Whereas, the other compounds (garlic juice, neem, bioranza)were not effective on eggs.

Table (1): Toxicity of certain compound against 1 day old eggs of *R. ferrugineus*.

Compound	LC ₅₀	LC ₉₀	Slope	Mean of Hatch %
chlorfenapyr	0.920	1.17	1.24	34
diazinon	1.93-	3.56	0.271	29
<i>Metarhizium anisopliae</i>	0	0	0	75
chlorpyrifos	1.76	3.9	0.203	36
garlic juice	0	0	0	84
neem	0	0	0	85
control	0	0	0	89

The efficiency of the conventional insecticides, according to LC₅₀ and LC₉₀ were desendingly arranged as chlorfenapyr (0.92, 1.17), diazinon

(1.93,3.56) and chlorpyrifos (1.76,3.9ppm %) .These results are harmany with those obtained by Abbas (2005) reported considering one day old eggs, of *R ferrugineus* that profenofos proved to be the most effective compound followed by emamectin, abamectin and lufenuron, respectively.

2- Larvicidal effect

Data in Table (2) indicate that the larvicidal activities of the six tested compounds against second, six and last instar larvae of *R. ferrugineus*. The larvicidal effects were considerably varied due to tested compound, used concentration of tested compound and treated instars.

Considering 2nd and 6th instar larvae, Diazinon proved to be the most effective compound at both LC₅₀ and LC₉₀ values were (0.56,1.22) and (1.56, 2.7) respectively. In case of last instar larvae, chlorfenapyr seemed to be the most potent compound recoding the lowest LC₅₀ value were 1.18; while, adult stage challenger was the most potent compound LC₅ =0.48.

Table (2): Toxicity of certain compound against different larval instars and adult of *R. ferrugineus*.

stage	Compound	LC ₅₀	LC ₉₀	Slope
2 nd instar	chlorfenapyr	0.594	2.45	2.634
	diazinon	0,56	1.56	0.765
	<i>Metarhizium anisopliae</i>	11.46	26.8	2.20
	chlorpyrifos	.87	1.78	1.75
	garlic juice	14.34	50.876	2.76
	neam	1.4	4.49	1.234
6 th	chlorfenapyr	0.648	5.03	1.87
	diazinon	1.22	2.7	1.987
	<i>Metarhizium anisopliae</i>	13.92	47.64	3.07
	chlorpyrifos	1.97	2.97.	2.08
	garlic juice	0	0	0
	neem	15.79	86.87	1.11
Last instar	chlorfenapyr	1.18	12.2	1.62
	diazinon	2.64	3.32	2.4
	<i>Metarhizium anisopliae</i>	17.06	48.89	3.95
	chlorpyrifos	2.076	4.76	2.53
	garlic juice	0	0	0
	neem	36.23	242,6	0.899
Adult	chlorfenapyr	0.84	5.95	1.93
	diazinon	1.88	3.67	1.43
	<i>Metarhizium anisopliae</i>	21.87	111.8	2.47
	chlorpyrifos	1.3	3.5	1.31
	garlic juice	0	0	0
	neam	36.87	242.8	0.982
	control	0	0	0

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The obtained results, it could be concluded that chlorfenapyr, Diazinon and Chlorpyrifos proved to be the most potent compound followed by other pesticides Also; the garlic juice lowest effect of six and last instars by using high doses

The efficiency of tested insecticides on adult varied considerably due to the chemical nature of tested compounds and the used concentration. Generally, the higher the concentration higher rate of mortality and vice versa.

It could be concluded that, larvae were most susceptible stage followed by egg and adult stage, respectively. In this respect, Barranco *et al.* (1998) showed that the younger larvae of *R. ferrugineus* were more susceptible compared with the older ones by using azadirachtin Ajan *et al.* (2000) mentioned that, pirimiphos- methyl gave 19.1, 19.0 and 1.0 times more toxic than chlorpyrifos to the adult males, females and larvae of the red palm weevil, *R. ferrugineus*, indicating the higher susceptibility of larval stage when compared with adult males or females. Abbas (2005) generally, emamectin proved to be the most effective compound followed by profenofos, lufenuron and abamectin, respectively.

3-Effect on certain biological aspects

- The latent effect of tested insecticides on the percentages of pupation , adult emergence and number of laid eggs

Data in Table (3) and fig (1) indicate the latent effect of six compounds treated on the rates of pupation, adult emergence and number of laid eggs. chlorfenapyr and diazinon the deleterious effects of the tested compounds as reduction of pupation rates and adult emergence.. The first compound shows significance difference in number of egg laid female with control and other compounds resending the lowest number of egg. (123 egg /female)The effect of tested compounds on the biotic potential of red palm weevil is still in its infancy. But the available literature on Lepidopterous insects agree with the obtained results. Barance *et al.* (1998) in Egypt studied the efficiency of chemical control of *R. ferrugineus*. evaluation of pesticides was carried out in two assays, the first with 7-day old larvae and the second with 1-month old larvae. In both cases, the insecticides were incorporated into semi-artificial diet, which is used to rear this species in the laboratory. The insecticides tested were a natural extract of neem tree seeds (azadirachtin 3cc/l) and Exp60720 A (fipronil at 1500, 0.4, 0.2, 0.1, 0.05 and 0.01 ppm). Efficacy values were obtained using the equation of about 15 days after treatment. The obtained results showed that for younger larvae, the mortality reached 100% at doses greater than 0.1 ppm of fipronil. On the other hand, the mortality caused by azadirachtin was less than 50%. Mortality of 100% was only reached for 1-month old larvae with doses of fipronil exceeding 0.2 ppm In this respect, El-Khouly *et al.* (1987) found that dimilin treated 4th instar larvae

of *Trichoplusia ni* caused reduction in pupation moth emergence, female fecundity and egg hatchability. Drastic effect on percentage of pupation was obtained by Watson *et al.* (1988) when insecticides were treated on egg stage of *Heliothis armigera*. Abdel-Kader *et al.* (1995) recorded that, insect growth inhibition and their combinations decreased pupal weight, egg hatchability and fecundity of *S. littoralis*. In this respect, Barranco *et al.* (1998) showed that the young larvae of *R. ferrugineus* were more susceptible compared with the older ones by using azadirachtin. Ajlan *et al.* (2000) mentioned that, pirimiphos- methyl gave 19.1, 19.0 and 1.0 times more toxic than chlorpyrifos to the adult males, females and larvae of the red palm weevil, *R. ferrugineus*, indicating the higher susceptibility of larval stage when compared with adult males or females. Prased *et al.* (1992) mentioned that, topical application of last instar larvae of *Spodoptera littoralis*. with diflubenzuron resulted in 100% sterility of treated males and females. Abbas (2005) Obtained results showed that the rate of both pupation and adult emergence varied tremendously due to the chemical nature of tested insecticides. The age of treated eggs had no clear difference in this respect. As a general trend, both bioagents; i.e. abamectin and emamectin induced lower rate of pupation and adult emergence.

Table (3): Effect of certain compounds against (treated during larvae and egg) on % pupation and adult emergence of *R. ferrugineus*.

Insecticides	pupation	pupal malform.	Adult emerg	adult malform	No of egg Mean /female
chlorfenapyr	15	8	7	4	123
Diazinon	15	3	6	2	204
<i>metarhizium anisopliae</i>	20	5	15	5	195
Chlorpyrifos	22	3	11	3	231
Garlic juice	34	8	26	4	209
neam	22	6	16	3	201
control	32	7	25	6	244

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A-Second in star treatment chlorfenapyr



B- different stage treatment with chlorfenapyr



C- normal larva

Fig. (1): Malformation treated as with chlorfenapyr_ and normal larvae

4- Trunk injection

Data given in Table (5) showed that chlorfenapyr, Diazinon and Chlorpyrifos was proved to be the most effective compounds followed as the present of trees recovery was ranged 80%, -100% while the other pesticides were of less efficiency as they ranged between 0.0-20%. El-Sebay (2004) in Egypt reported that, injection method of infested trees with *R. ferrugineus* was carried out, applying 15 insecticides belonging to 11 chemical active ingredients. Results indicated that at 10000 ppm of all tested chemicals gave 100% mortality, except in Actara. At 1000 ppm a reduction ranged between 80-100%, while at 100 ppm the most effective compound gave 60 % mortality by Selecron, Quick and Vydat, and the other chemicals gave less mortality. At 10 ppm the mortality ranged between 0–60%. The most effective active ingredients were chlorpyrifos (Dursban, chlorzan and Pyriban) followed by Diazenon (Basudin and Diazenox), phentoat (Cidial) and methomyl (Quick).

Table (5): Efficacy of certain compounds treated trunk injection for controlling of *R. ferrugineus*.

Insecticides	NO of plant injection	NO of plant recovery	%
chlorfenapyr	10	8	80
Diazinon	10	10	100
<i>metarhizium anisopliae</i>	10	1	10
Chlorpyrifos	10	9	90
garlic juice	10	0	0
neam	10	2	20

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تقييم عديد من المركبات الطبيعية وغير الطبيعية على سوسة النخيل الحمراء معمليا وحقليا

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المخلص العربي

أجريت هذه الدراسة بهدف تقييم بعض المركبات وهى بيورانزا (مركب حيوي) وعصير الثوم ومركب النيم (مستخلصات نباتية) وثلاثة مركبات كيمائية وهى شالنجر ، ديازنون ، دروسبان على أطوار مختلفة لسوسة النخيل الحمراء معمليا وحقليا .ولقد أوضحت النتائج أن مبيد شالنجر ، الديازنيون ، الدروسبان كان أكثر المبيدات كفاءة على الأطوار المختلفة للحشرة (البيض- اليرقات-والحشرة الكاملة) ولوحظ أن مبيد شالنجر كان له تأثيرات متأخرة مقارنة بباقي المبيدات كما وجد أن مبيد شالنجر ، الديازنيون ، الدروسبان أعطت أفضل النتائج حقليا مقارنة بباقي المبيدات المستخدمة حيث تراوحت كفاءة هذه المبيدات حقليا من ٨٠-١٠٠% أما باقي المركبات بيورانزا وعصير الثوم ومركب النيم أعطت اقل فعالية.