

## Effect of different compounds on *Icerya seychellarum* (Hemiptera: Monophlebidae) and *Rodalia cardinalis* (Coleoptera: Coccinellidae) on mango leaves under laboratory conditions

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### ABSTRACT

The relative toxicity of different compounds against the seychellarum mealybug, *Icerya seychellarum* (Westwood) (Hemiptera: Monophlebidae) and the vedalia beetle, *Rodalia cardinalis* (Mulsant) (Coleoptera: Coccinellidae) were studied on mango leaves under laboratory conditions. The obtained data indicated that different compounds (Biofly, NeemAzal and Super Mesrona oil) gave medium effects on nymphs, and adult females of *I. seychellarum* and immature and mature stages of their predator *R. cardinalis*, compared with Malathion which gave highly effects on the mealybug and its predator using direct exposure technique.

**Keywords:** *Icerya seychellarum*, *Rodalia cardinalis*, mango leaves.

### INTRODUCTION

The mealybug, *Icerya seychellarum* (Westwood) (Hemiptera: Margarodidae) infests different parts (leaves, branches and fruits) of mango trees (*Mangifera indica* L.). The female lays a large number of eggs (600-800 eggs/female) in an ovisac made of wax secreted from wax gland lays on the lower side of *I. seychellarum*. The mealybug is usually found in clusters on branches and leaves; it also feeds on the sap sucked from the host plant tissues. As this sap contains only a very low concentration of protein, the insect sucks a great amount of sap from which it obtains the amount of protein sufficient for its growth and egg development. The high number of insects, attacking leaves, branches and fruits of the tree results in a great loss of sap, thus leading to defoliation, dryness and reduction of the tree vitality. In addition, the mealybugs secrete honeydew, which offers a suitable medium for the growth of fungus (Dreistadt *et al.*, 1994). The vedalia beetle, *Rodalia cardinalis* (Mulsant) (Coleoptera : Coccinellidae) was introduced to Egypt from Los Angeles during (1890-1892) and in 1922, Willcocks made another attempt to introduce the beetle into Egypt from California. That introduction was succeeded and this beneficial beetle became established and common all over the country (Kamal, 1951).

The present work aimed to study the relative toxicity of different compounds against the seychellarum mealybug, *Icerya seychellarum* and the vedalia beetle, *R. cardinalis* on mango leaves under laboratory conditions.

### MATERIALS AND METHODS

#### 1. Relative toxicity of different compounds against the seychellarum mealybug, *I. seychellarum* and their predator the vedalia beetle, *R. cardinalis*:

The experimental insects of the seychellarum mealybug, *I. seychellarum* used in the present investigation were the, nymphs, and adult females, also, the experimen-

tal predator of the predator the vedalia beetle, *R. cardinalis* used in the present investigation were the, immature and mature stages. The infested mango leaves were collected from the field and kept in polyethylene bags and transferred to the laboratory few hours before treatment. The laboratory experiments were carried as mentioned above. The method of direct exposure was used throughout the present investigation. Five concentrations of each compound were used; five leaves infested with mealybugs and their predators were dipped in each concentration for five seconds. Leaves were divided into four replicates. Also, five leaves were dipped on clean water and used as untreated check (control). The leaves were transferred to clean wide plastic dishes which then covered with muslin cloth held in position by rubber bands. They were maintained at laboratory temperature about  $25\pm 1^\circ\text{C}$  and  $65\pm 1\%$  relative humidity in polyethylene bags according to (Zidan *et al.*, 1982). After 24 hours, the dead nymphs, and adult females were counted.

## 2. The following materials were tested:

- Biofly, an entomopathogenic fungi ( $3 \times 10^7$  c.f.u./1ml), containing the fungus *Beauveria bassiana*.
- NeemAzal, a botanical extract containing 1% Azadirachtin A (10 g/liter) from the neem tree, *Azadirachta indica* (Meliaceae).
- Super Mesrona oil 95% EC, a local mineral oil, containing 95% paraffinic oil w/w and 5% inert ingredients, unsulfonated residue content reached 92%.
- Malathion 57% EC, a chemical insecticide of the common name Malathion and the chemical name, O, O-dimethyl-S- (1,2-dicarbethoxyethyl) dithio phosphate.

## 3. Statistical analysis:

In laboratory tests, the mortality percentages were calculated and corrected for natural mortalities by Abbott's formula (1925). The corrected percent mortalities were statistically computed according Finney (1971) and plotted on probit analysis paper. The tested compounds were compared for their efficiency on the mealybugs according to their  $LC_{50}$ ,  $LC_{90}$  and slopes of the toxicity lines

## RESULTS AND DISCUSSION

### 1. Relative toxicity of different compounds against the seychellarum mealybug, *Icerya seychellarum* and their predator the vedalia beetle, *R. cardinalis* on mango leaves under laboratory conditions:

Results showed that the potency of different compounds (Biofly, NeemAzal and Super Mesrona oil) compared with Malathion against the nymphs, and adult females of the seychellarum mealybug, *I. seychellarum* and immature and mature stages of their predator the vedalia beetle, *R. cardinalis* using direct exposure technique.

#### 1.1 Effect of Biofly, *B. bassiana*:

Data in Table (1) and Fig. (1) indicated that Biofly gave medium effects on the nymphal and adult stages of *I. seychellarum* ( $LC_{50}$  and  $LC_{90}$  0.6705, 3.5216 against nymphal stages and 0.8165, 4.1417 against adult females, respectively). On the base of the slope of line is useful to know the homogeneity of different stages (nymphs, adult females) of mealybug population and the different stages (mature, immature stages) of predator population, which collected from the field to different compounds. When the population of mealybug or predator is similar in homogeneity or the degree of resistant meaning that the slope is big or increase in regression. Data in Table (1) and Fig. (1) showed that the slope of all stages, (nymphs and adult females) of *I. sey-*

*chellarum* population is big (1.7792, 1.8173) this meaning that the insect population is homogeneity in response to Biofly.

Also, results Table (1) and Fig. (1) indicated that Biofly gave medium effects on the immature and mature stages of *R. cardinalis* ( $LC_{50}$  and  $LC_{90}$  0.7782, 5.0516 against immature stages and 0.841, 6.0646 against immature stages, respectively). Data in Table (1) and Fig. (1) showed that the slope of all stages, (immature and mature stages) of *R. cardinalis* were (1.5777, 1.4937) this meaning that the insect population is homogeneity in response to Biofly.

Table 1: LC values of Biofly, *Beauveria bassiana* against the different stages of the seychellarum mealybug, *Icerya seychellarum*

Stages		$LC_{50}$	$LC_{90}$	Slope
<i>Icerya seychellarum</i>	Nymphs	0.8165	4.1417	1.8173
	Adult females	0.6705	3.5216	1.7792
<i>Rodalia cardinalis</i>	Mature	0.841	6.0646	1.4937
	Immature	0.7782	5.0516	1.5777

and its predator, the Vidalia beetle, *Rodalia cardinalis* on mango leaves using leaf-dipping technique under laboratory conditions.

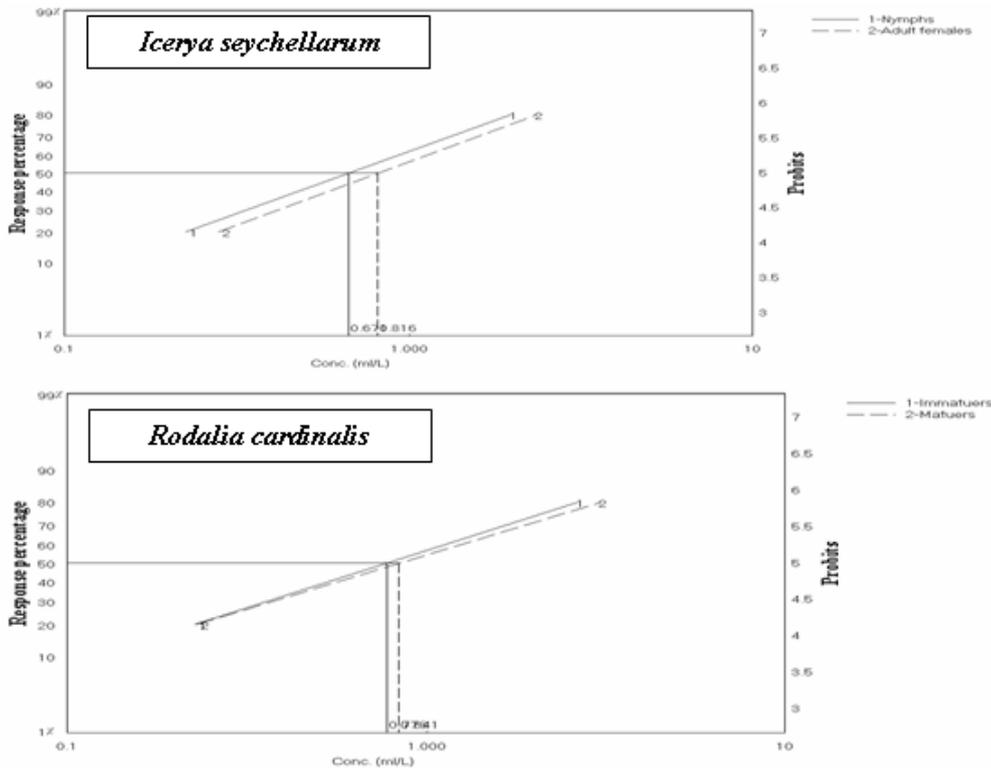


Fig. 1: Toxicity lines of Biofly, *Beauveria bassiana* against the different stages of the seychellarum mealybug, *Icerya seychellarum* and its predator, the Vidalia beetle, *Rodalia cardinalis* on mango leaves using leaf-dipping technique under laboratory conditions.

**1.1 Effect of NeemAzal, *A. indica* :**

Data in Table (2) and Fig. (2) indicated that NeemAzal gave medium effects on the nymphal and adult stages of *I. seychellarum* ( $LC_{50}$  and  $LC_{90}$  0.8994, 6.0852 against nymphal stages and 0.8915, 11.9979 against adult females, respectively). Also, results in Table (2) and Fig. (2) showed that the slope of all stages, (nymphs and adult females) of *I. seychellarum* population (1.5435, 1.1352) this meaning that the insect

population is homogeneity in response to NeemAzal. Also, results Table (2) and Fig. (2) indicated that Biofly gave medium effects on the immature and mature stages of *R. cardinalis* ( $LC_{50}$  and  $LC_{90}$  0.959, 6.9537 against immature stages and 0.841, 6.0646 against immature stages, respectively). Data in Table (2) and Fig. (2) showed that the slope of all stages, (immature and mature stages) of *R. cardinalis* population (1.5426, 1.4896) this meaning that the insect population is homogeneity in response to NeemAzal.

Table 2: LC values of NeemAzal, *Azadirachta indica* against the different stages of the seychellarum mealybug, *Icerya seychellarum* and its predator, the Vidalia beetle, *Rodalia cardinalis* on mango leaves using leaf-dipping technique under laboratory conditions.

Stages		$LC_{50}$	$LC_{90}$	Slope
<i>Icerya seychellarum</i>	Nymphs	0.8994	6.0852	1.5435
	Adult females	0.8915	11.9979	1.1352
<i>Rodalia cardinalis</i>	Mature	0.8595	5.8221	1.5426
	Immature	0.959	6.9537	1.4896

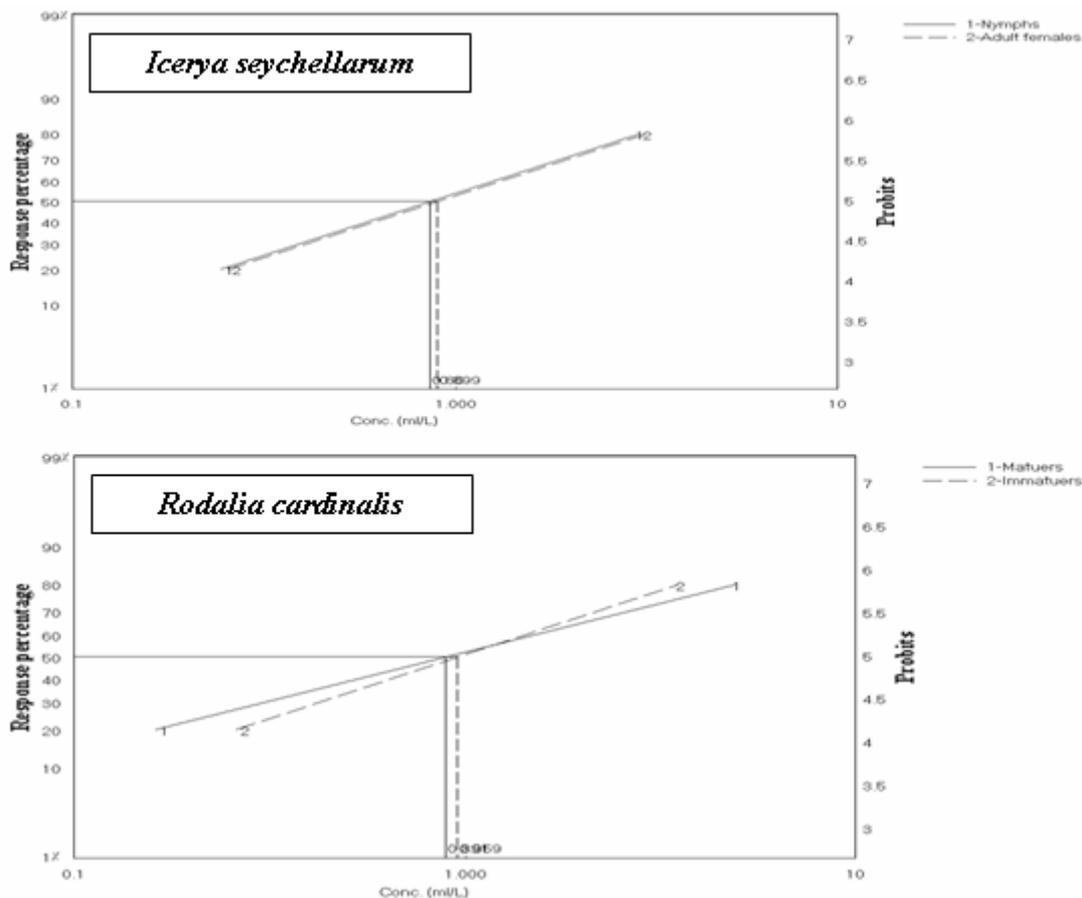


Fig. 2: Toxicity lines of NeemAzal, *Azadirachta indica* against the different stages of the seychellarum mealybug, *Icerya seychellarum* and its predator, the Vidalia beetle, *Rodalia cardinalis* on mango leaves using leaf-dipping technique under laboratory conditions.

### 1.2 Effect of Super Mesrona oil:

Data in Table (3) and Fig. (3) indicated that NeemAzal gave medium effects on the nymphal and adult stages of *I. seychellarum* ( $LC_{50}$  and  $LC_{90}$  11.2451, 35.1153 against nymphal stages and 8.9765, 32.82 against adult females, respectively). Also, results in Table (3) and Fig. (3) showed that the slope of all stages, (nymphs and adult females) of *I. seychellarum* population (2.5915, 2.2763) this meaning that the insect population is homogeneity in response to Super Mesrona oil. Also, results Table (3)

and Fig. (3) indicated that Biofly gave medium effects on the immature and mature stages of *R. cardinalis* ( $LC_{50}$  and  $LC_{90}$  9.5705, 42.0769 against immature stages and 10.0483, 49.812 against mature stages, respectively). Data in Table (3) and Fig. (3) showed that the slope of all stages, (immature and mature stages) of *R. cardinalis* population (1.9928, 1.8434) this meaning that the insect population is homogeneity in response to Super Mesrona oil.

Table 3: LC values of Super Mesrona oil against the different stages of the seychellarum mealybug, *Icerya seychellarum* and its predator, the Vidalia beetle, *Rodalia cardinalis* on mango leaves using leaf-dipping technique under laboratory conditions.

Stages		$LC_{50}$	$LC_{90}$	Slope
<i>Icerya seychellarum</i>	Nymphs	11.2451	35.1153	2.5915
	Adult females	8.9765	32.82	2.2763
<i>Rodalia cardinalis</i>	Mature	10.0483	49.812	1.8434
	Immature	9.5705	42.0769	1.9928

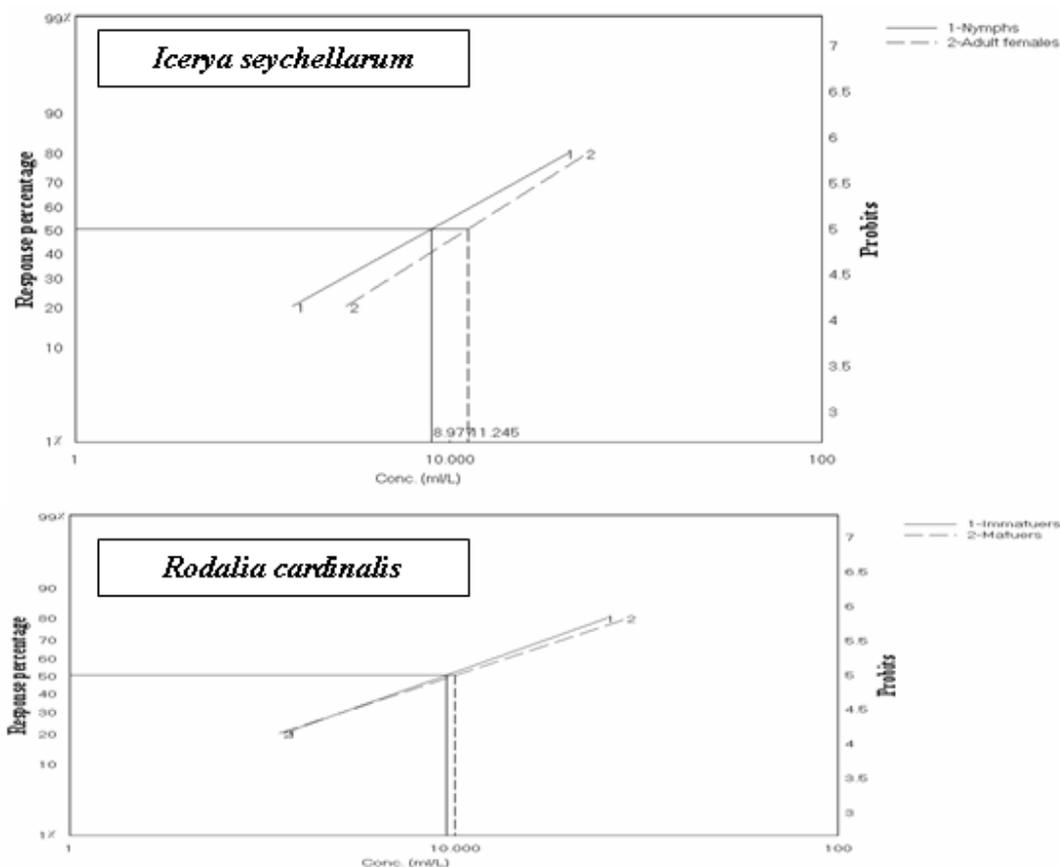


Fig. 3: Toxicity lines of Super Mesrona oil against the different stages of the seychellarum mealybug, *Icerya seychellarum* and its predator, the Vidalia beetle, *Rodalia cardinalis* on mango leaves using leaf-dipping technique under laboratory conditions.

**1.3 Effect of Malathion:**Data in Table (4) and Fig. (4) indicated that Malathion gave highly effects on the nymphal and adult stages of *I. seychellarum* ( $LC_{50}$  and  $LC_{90}$  0.2496, 1.4244 against nymphal stages and 0.1528, 1.4601 against adult females, respectively). Also, results in Table (4) and Fig. (4) showed that the slope of all stages, (nymphs and adult females) of *I. seychellarum* population were (1.6942, 1.3075) this meaning that the insect population is homogeneity in response to Malathion. Also, results Table (4) and Fig. (4) indicated that Malathion gave highly effects on the immature and mature stages of *R. cardinalis* ( $LC_{50}$  and  $LC_{90}$  0.3032, 1.2405 against

immature stages and 0.1528, 1.4601 against immature stages, respectively). Data in Table (4) and Fig. (4) showed that the slope of all stages, (immature and mature stages) of *R. cardinalis* population (2.0948, 2.0948) this meaning that the insect population is homogeneity in response to Malathion.

Table 4: LC values of Malathion against the different stages of the seychellarum mealybug, *Icerya seychellarum* and its predator, the Vidalia beetle, *Rodalia cardinalis* on mango leaves using leaf-dipping technique under laboratory conditions.

Stages		LC <sub>50</sub>	LC <sub>90</sub>	Slope
<i>Icerya seychellarum</i>	Nymphs	0.2496	1.4244	1.6942
	Adult females	0.1528	1.4601	1.3075
<i>Rodalia cardinalis</i>	Mature	0.1528	1.4601	1.7728
	Immature	0.3032	1.2405	2.0948

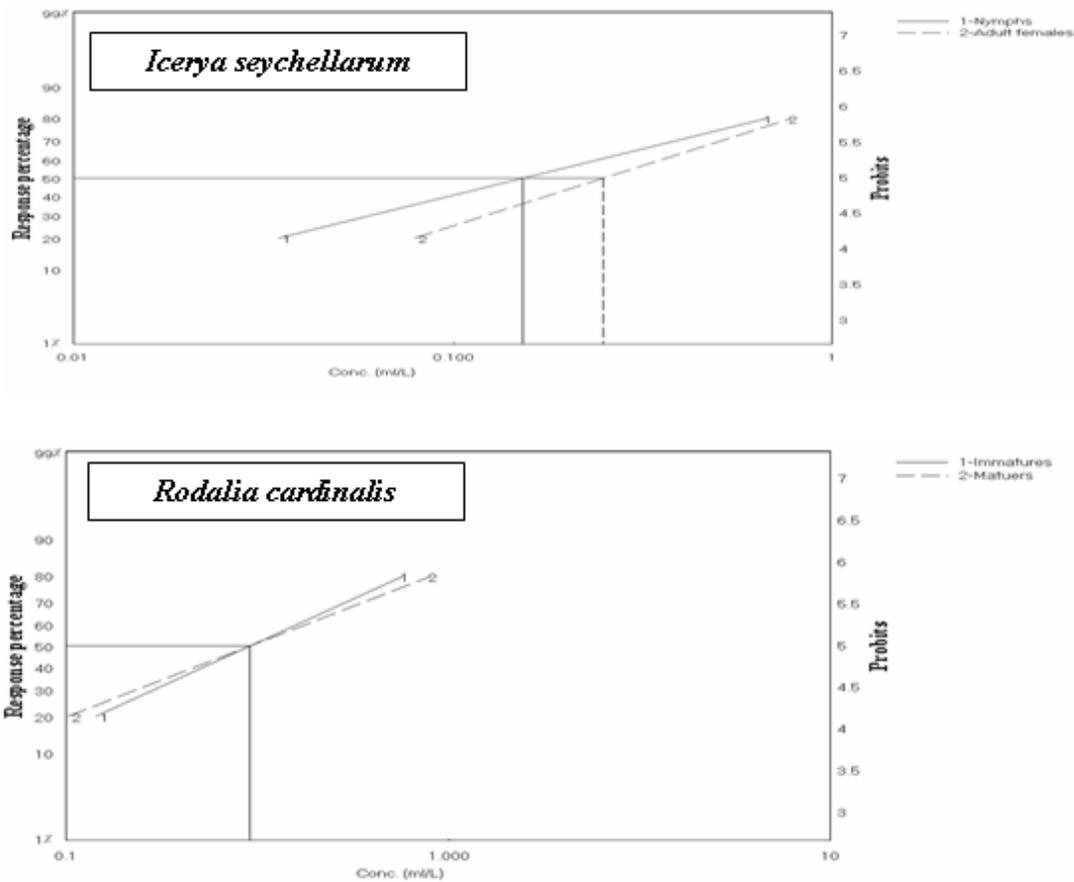


Fig. 4: Toxicity lines of Malathion against the different stages of the seychellarum mealybug, *Icerya seychellarum* and its predator, the Vidalia beetle, *Rodalia cardinalis* on mango leaves using leaf-dipping technique under laboratory conditions.

The obtained data are harmony with those obtained by Mangoud (1994) who stated that pro-fenophos is the most potent insecticide as compared to (diazinon, fenitrothion, formthion, malathion, primiphos-methyl and prothiophos) against all stages, (nymphs, non-ovipositing and ovipositing females) of the seychellarum mealybug, *Icerya seychellarum* using direct exposure technique. Also, Mangoud *et al.* (2007), found Super Misrona oil is come in the first category. Biovar come in the second category, while Bio-Ranza gave the least effect. On the other hand the OP insecticide (Sumithion) gave highly effect against all stages of the seychellarum mealybug, *Icerya seychellarum* on Washingtonian leaves under laboratory conditions.

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## ARABIC SUMMARY

تأثير بعض المركبات ضد بق السيشيلارم الدقيقي ومفترس الفيداليا علي أوراق المانجو تحت الظروف المعملية

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تم دراسة التأثير السام لبعض المركبات ضد الأعمار المختلفة لحشرة بق السيشيلارم الدقيقي ومفترس الفيداليا علي أوراق المانجو تحت الظروف المعملية باستخدام طريقة التعريض المباشر. أوضحت النتائج أن فعالية مركبات (بيوفلاي، نيمازال، زيت سوبر مصرونا المعدني) مقارنة بمبيد الملاثيون ضد الأعمار غير الكاملة والإناث لبق السيشيلارم الدقيقي وضد الأعمار الكاملة وغير الكاملة لمفترس الفيداليا. أوضحت النتائج أن فعالية مركبات (بيوفلاي، نيمازال، زيت سوبر مصرونا المعدني) كانت متوسطة ضد الأعمار المختلفة لحشرة بق السيشيلارم الدقيقي ومفترس الفيداليا مقارنة بمبيد الملاثيون الذي أعطي تأثيراً شديداً ضد الأعمار غير الكاملة والإناث لبق السيشيلارم الدقيقي وضد الأعمار الكاملة وغير الكاملة لمفترس الفيداليا.