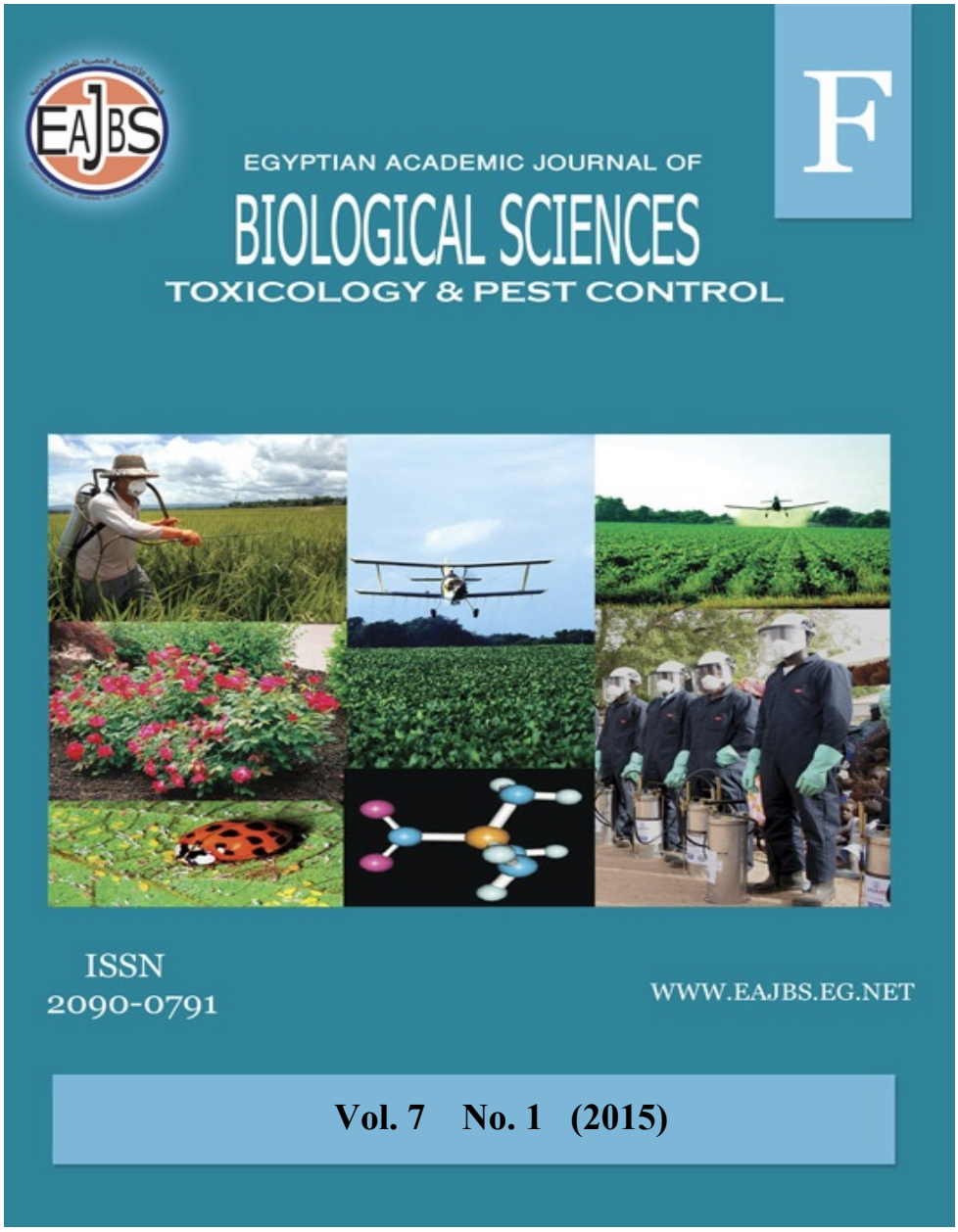

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Toxicological Sudies on Some Scale Insects Attacking Fig Trees in Egypt

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ABSTRACT

The fig has been of great importance in the early history of people about the Mediterranean. The edible fig trees, *Ficus carica* L. are well spread over a large area at the northern coastal region of Egypt as well as in many other localities such as in Qalubiya and Faiyum governorates. Chemical control studies were carried out at Leqada, (El-Dabaa, Matrouh governorate). This locality is charactarized by no previous chemical control measures. Results obtained from the present study revealed that, all the tested materials showed high reduction percentage (%) in the *Hemiberlesia lataniae, Lepidosaphes ficus and Russellaspis pustulans* population; except malathion and geer after two and three months were less efficient materials. Plastic paint was the most effective material all over the time and gave the highest rate of reduction of scale insects populations compared to other treatments.

INTRODUCTION

The fig has been of great importance in the early history of people about the Mediterranean. Having probably originated in Southern Arabia, where the Capri fig or wild fig still exists, it was carried to Syria and the Mediterranean shores in ancient times. The fig compared with any other fruit, is one of nature's oddities both in its morphology and its manner of development. Botanically, it belongs to the great genus *Ficus* of family Moracea and is called *Ficus carica* L. The edible fig trees, *Ficus carica* L. are well spread over a large area at the northern coastal region of Egypt as well as in many other localities such as in Qalubiya and Faiyum governorates. Due to the fact that fig propagation is done by means of cuttings, and the comparatively early age at which the tree begins to bear, fig orchards are considered amongst the most economic agricultural enterprises in non-irrigated areas (Serag, 2005). Scale insects are found around the world including Egypt. Scale insects attacks different parts of host plants (Hassan *et al.* 2012).

Chemical control play an important role in controlling scale insects (Hemiptera: Coccoidae). Many authors evaluate the efficiency of different chemical control against scale insects on citrus trees (Helmy *et al.* 1992). It may be warranted when natural enemies and other control measurements are not sufficient to prevent plant injury and reduce produce value (Mangoud and Abou-Setta, 2012). This study was designed to evaluate the efficiency of some chemicals for controlling of the most important scale insects attacking Fig trees in Egypt.

MATERIALS AND METHODS

Chemical control:

Chemical control studies were carried out at Leqada, (El-Dabaa, Matrouh governorate). This locality is charactarized by no previous chemical control measures.

Tested materials:

a. Malathion 57% EC, containing 57% malathion (O, O - dimethyl dithio-phosphate of diethyl mercaptosuccinate) at the rate of 0.03% (spray).

b. Kz oil, contained 98.5% V/V base oil at the rate of 3% (spray).

c. Kemi oil 95%, contained 95% V/V base oil at the rate of 3% (spray).

d. Malathion + Kz oil, at the rate of application of 0.15% + 2% (spray).

e. Malathion + Kemi oil, at the rate of application of 0.15% + 2% (spray).

f. Geer (Calcium hydroxide), at the rate of 5 Kg geer + 10 liter water (paint).

g. Plastic (Emulsion paint), an emulsifiable paint, diluted at the rate of 5 Kg plastic paint + 3 liter water (paint).

Tested insects:

Hemiberlesia lataniae, *Lepidosaphes ficus* and *Russellaspis pustulans*

Experimental design:

Five fig trees approximately similar in growth and infestation were assigned for two experiments using the tested materials. The first experiment was carried out on December and the second experiment was carried out on March of next year using the same treatments, but only Kz oil in the first experiment was replaced by Kemi oil in the second experiment. The third experiment was carried out on the same locality without any treatment.

Sampling methods:

For each experiment a pre-count was conducted on the application date as well as successive three post counts at one, two and three months after application. Each treatment was presented by one sample of the five trees. Each sample was consisted of five branches 10 cm each.

Efficiency of tested treatments:

The equation of Henderson and Tilton (1955) was used to calculate the efficiency of tested treatments.

% Mortality = (1- (Ta X Cb) / (Tb X Ca)) X 100.

Where: Ta = Post-treatment count.

Cb = Untreated count before treatment.

Tb = Pre-treatment count.

Ca = Untreated count after treatment.

RESULTS

Results obtained from the field control experiments by applying different materials in the two experiments on fig trees at El-Dabaa, Matrouh governorate for *H. lataniae*, *L. ficus* and *R. pustulans*, the results are illustrated and presented in Tables (1 – 3). For *H. lataniae* (Table 1), the 1st count (after one month of application) indicated that, all tested materials showed high percentage of reduction in the insect population (81.69 to 100%) in the second experiment. However, the reduction percent in the second experiment (during March) was more than that in the first experiment (during December).

Table 1: Reduction of *Hemiberlesia. lataniae* population as result of applying different tested materials in the two experiments on fig trees at El-Dabaa, Matrouh governorate.

Experimental date	Materials	1st count		2nd count		3rd count	
		Scales / sample	Reduction %	Scales/ sample	Reduction %	Scales / sample	Reduction %
December	Malathion	20	85.92	30	66.67	25	55.36
	Geer	25	82.39	35	61.11	30	46.43
	Plastic paint	1	99.3	8	91.11	5	91.07
	Kz oil	26	81.69	17	83.33	7	87.5
	Kz + Mal.	23	83.8	18	80	8	85.71
	Control	142	-	90	-	56	-
March	Malathion	8	90.7	15	79.73	20	78.26
	Geer	1	98.84	13	82.43	25	72.83
	Plastic paint	0	100	1	98.64	4	95.65
	Kemi oil	13	84.88	8	89.19	5	94.57
	Kem. + Mal.	14	83.72	8	89.19	7	92.39
	Control	86	-	74	-	92	-

1st count after one month. 2nd count after two months 3rd count after three months.

In case of malathion and geer treatments, the reduction percent considerably decreased in the second observation (counts after two months) and third observation (counts after three months). While the reduction percent with plastic paint in the 2nd and 3rd counts were generally similar to that of the 1st count. But the percent of reduction with other materials slightly increased in the 2nd and 3rd counts. Generally, the plastic paint was the most effective as protective and its reduction percent in controlling *H. lataniae*. The obtained results were higher in the second experiment (in March) than the first experiment (in December). For *L. ficus*, the obtained results were presented in Table (2), which the 1st count indicated that, all tested materials showed high efficiency reduction percent in the insect population (80-100%) in the second experiment except for geer only in the first experiment.

Table 2: Reduction of *Lepidosaphes ficus* population as result of applying different tested materials in the two experiments on fig trees at El-Dabaa, Matrouh governorate.

Experimental date	Materials	1st count		2nd count		3rd count	
		Scales/ sample	Reduction %	Scales/ sample	Reduction %	Scales/ sample	Reduction %
December	Malathion	10	83.33	22	69.44	12	62.5
	Geer	13	78.33	20	72.22	13	59.38
	Plastic paint	1	98.33	3	95.83	3	90.63
	Kz oil	12	80	9	87.5	4	87.5
	Kz + Mal.	13	78.33	9	87.5	6	81.25
	Control	60	-	72	-	32	-
March	Malathion	7	92.78	5	72.22	8	71.43
	Geer	0	100	4	77.78	10	64.29
	Plastic paint	0	100	0	100	1	96.43
	Kemi oil	10	89.69	1	94.44	1	96.43
	Kem. + Mal.	11	88.66	2	88.89	2	92.86
	Control	97	-	18	-	28	-

1st count after one month. 2nd count after two months 3rd count after three months.

The geer and plastic paint gave 100% population reduction in the 2nd experiment. In case of malathion and geer treatments, the reduction% considerably decreased in the 2nd and 3rd counts in the two experiments like *H. lataniae*.

The reduction percent with plastic paint in the 2nd and 3rd counts was generally similar to that of the 1st count, but the percent of reduction with other materials slightly increased in the 2nd and 3rd counts. Also generally, the plastic paint was the most effective and the percentage of reduction was slightly higher in the second experiment than the first experiment like *H. lataniae*. For *R. pustulans*, the obtained results were presented in Table (3). The 1st count indicated that, all the tested materials gave good results of efficiency reduction in insect population (80-100) in the two experiments; except geer (in December) gave 77.14% reduction and (Kem. + mal.) in March gave 78.26% reduction. Clearly, the reduction percent in the second experiment slightly higher than the first experiment. In case of malathion and geer treatments, the percent of reduction considerably decreased in the 2nd and 3rd counts for the experiment in March. Then, the reduction percent with plastic paint in the 2nd and 3rd counts was generally similar to that of the 1st count; but the reduction percent with other materials slightly increased in the 2nd and 3rd count.

Table 3: Reduction of *Russellaspis pustulans* population as result of applying different tested materials in the two experiments on fig trees at El-Dabaa, Matrouh governorate.

Experimental date	Materials	1st count		2nd count		3rd count	
		Scales/ sample	Reduction %	Scales/ sample	Reduction %	Scales/ sample	Reduction %
December	Malathion	3	91.43	8	79.17	10	66.67
	Geer	8	77.14	15	68.75	13	56.67
	Plastic paint	1	97.14	2	95.83	3	90
	Kz oil	7	80	6	87.5	4	86.67
	Kz + Mal.	7	80	7	85.42	5	83.33
	Control	35	-	48	-	30	-
March	Malathion	3	86.96	15	74.14	17	72.59
	Geer	1	95.65	8	70.69	20	67.74
	Plastic paint	0	100	2	96.55	2	96.55
	Kemi oil	4	82.61	5	91.38	3	95.16
	Kem. + Mal.	5	78.26	7	87.93	5	91
	Control	23	-	58	-	62	-

1st count after one month. 2nd count after two months 3rd count after three months.

DISCUSSION

Results obtained from the present study revealed that, all the tested materials showed high reduction percentage (%) in the *H. lataniae, L. ficus* and *R. pustulans* population; except malathion and geer after two and three months were less efficient materials. Several authors used mineral oils alone, organophosphorous their mixtures and natural control agents for controlling scale insects infesting fig and other fruit trees (Hindi *et al.*, 1964; Hafez and Salama, 1968; Hamon, 1977; El-Kifl *et al.*, 1980; Cen, 1986; Su and Wang, 1988; Eraki, 1991; Ali, 1993, Mohamed, 1999, Mangoud & Abd El-Gawad 2003, Mangoud 2008, Mangoud *et al.* 2008a&b, Mangoud *et al*. 2010, Abo-Shanab 2012 and Mangoud & Abo-Setta 2012).

During the present study, we found that, the reduction percent of the population increased in 2nd count (after two months) and 3rd count (after three months) and the reduction percent in the examined population in the 2nd experiment conducted at March was more than in the 1st exp. (December). This could be attributed to the difference in the population structure (pre-adults, adult females and gravid females) at the time of applications; where in March mainly consists of gravid females and

pre-adults (immature stages) but in December the population structure was mainly consists of over wintering females; where the adult female have thick waxy layer covering it and the pre-adult had not. Also, Busvine (1971) noticed that the differences in relative susceptibility of the tested insecticides might be due to the changes in anatomy, physiology and size of the population structure of the insect and also the toxicant penetration through them. Similar conclusion was stated by, Cermeli (1966), Hamon (1977), Uygun *et al.* (1984), Cen (1986), Ali 1993 and Asfoor (1997). Depietri *et al.* (1962) and Serag (2005) stated that the proper time of application would therefore appear to be at winter or spring when the fruits are either absent or not yet infested.

In the present study considerable variation in the population reduction percent resulting from the application of different materials was observed. Therefore, the tested materials could be arranged according to their efficacy against these insects. Plastic paint was the most effective material allover the time and gave the highest rate of reduction of scale insects populations compared to other treatments. No previous references are available on using plastic paint in controlling the scale insects. however, Mangoud (2000) have illustrated that plastic paint could be used efficiently in controlling the clear wing moth, *Synanthedon myopiformis* and the woolly apple aphid, *Erisoma lanigerum* on apple trees.

The second efficient materials were the mineral oils (Kemi & Kz oil) followed by mineral oil plus malathion. Mineral oils have been used for a long time as specific insecticides for scale insects. Helmy *et al.* (1984) reported that formulations of proper mineral oil were effective, safe and economic without resistance problems developed by pests. They added that the separate miscible oils were preferred for controlling scale insects due to the non-harmful effects on the beneficial parasites.

In the present study, Kemi or Kz oils gave good results of the efficiency reduction of *H. lataniae*, *L. ficus* and *R. pustulans* populations; which the oil more effective for all the stages of the insect (eggs, immature stages, adult females and gravid females). The combination or mixing between mineral oils and organophosphorous such as malathion gave also good results on reduction in insect population. Similar results of application with mineral oils alone or mineral oils plus organophosphorous stated by Cressman *et al*. (1954), Rawhy (1960), Hindi *et al*. (1964), Cermeli (1966), Ezzat and Rawhy (1966), Rashad (1966), Hafez & Salama (1968), Hamon (1977), El-Kifl *et al*. (1980), Eraki (1991), Helmy *et al*. (1992), Asfoor (1997), Mohamed (1999, Abo-Shanab 2012 and Mangoud & Abo-Setta 2012).

The proper time for controlling the population of *H. lataniae, L. ficus* and *R. pustulans* was very effective, when immature stages are present, especially at spring or early summer.

Expected proper timing for control:

The factors to be considered for proper timing for chemical control if needed are:

1. The presence of most susceptible stages at maximum abundance.
2. The presence of high population which is expected to cause damage to the crop or the host plant.
3. To be in accordance with other horticultural procedures required for proper production.
4. To allow enough time for residues to be reduced to the safe levels at harvest time.
5. Taking in consideration if this control is preventive of curative, and the method of application.

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ARABIC SUMMARY

دراسات سمية على بعض الحشرات القشرية التي تصيب شجر التين في مصر

مسعد محمد حسن1 ، رضا فضيل على بكر1و2، محمد محمد ابوسته[3] ومحمد حسن سعفان[3] وعادل محمد سراج

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يعتبر التين من المحاصيل ذات الأهمية التاريخية. أشجار التين واسعة الانتشار في مناطق عدة منها الساحل الشمالي لمصر ومحافظات القليوبية والفيوم. تم إجراء دراسة المكافحة الكيميائية لبعض الحشرات القشرية التي تصيب شجر التين في منطقة الضبعة – بمحافظة مطروح وهذه المنطقة تتميز بعدم استخدام المكافحة الكيميائية من قبل. وأظهرت الدراسة انخفاض نسبة الإصابة بالحشرات القشرية *H. lataniae, L.* *ficus* and *R. pustulans* في جميع المعاملات الكيميائية المستخدمة أثناء الثلاث قراءات لكل تجربة ما عدا الملاثيون والجير لقد قل كفاءة هاتين المادتين خلال الشهر الثاني والثالث في حين المعاملة ب Plastic paint أعطت كفاءة عالية في خلال الثلاثة أشهر لكل تجربة.