Residual Effect of Certain Insecticides Against Different Strains of Peach Aphid on Pepper

Tawfiq M. Al-Antary[1] *and Basil Khader*[1]

ABSTRACT

Green peach aphid was collected from Madaba and Deir-Alla as two field strains. The sensitive strain was collected from far-away valleys in Um-Al-Ammed on the wild mustard, and then it was reared in the greenhouse in the University of Jordan for ten generations. The pepper plants were used in the residual effect experiments. Survived aphids after treatment separately l with LC50 of Calypso, Karate, Evesict and Dimethoate for the three strains were observed and monitored to find the residues effect of these pesticides and on the aphid offsprings. Number of aphids were decreased within two weeks after treatment with Calypso in the three strains, and then aphid population remained constant until the end of the experiment. A number of aphids were decreased within two weeks after treatment separately with Karate, Evesict and Dimethoate in the three strains, and then aphid population increased until the end of the experiment.

Keywords: Green Peach Aphid, Three Strains, Insecticides, Residual Effect, Survived Aphids, Offspring, Jordan.

INTRODUCTION

The green peach aphid *Muzus persicae* Sulzer (Homoptera:Aphididae) is one of the most important pest world wide. It causes a destructive damage to vegetables and fruit trees in the world (Lecrone and Smilowitz, 1980, Parker *et al*, 1983). In Jordan, Mustafa (1986a and b) recorded the green peach aphid on many host plants. Many of planted vegetables and wild plants in Jordan are considered hosts for the green peach aphid (Al-Mommany and Al-Antary, 2008). Hamdan, (1986) investigated factors affecting the green peach aphid populations on economic vegetables in Jordan. The green peach aphid is a polyphagous species. It is an economic pest because of its ability to suck sap plant and transmit viruses to cultivated plants.

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Received on 29/5/2011 and Accepted for Publication on 2/10/2012.

It reproduces sexually a year around on large secondary hosts including potatoes, tomatoes, brassicas, beets, cereals, pasture clovers, peas, peppers Roses (Cameron and Fletcher, 2004) and parthenogenesis on solanacious vegetables in Jordan valley. Direct feeding damage by low numbers of green peach aphid causes little damage to plants. Green peach aphid is capable of being resistant to a wide range of insecticides groups. Pest management strategies aimed at preventing or minimizing resistance will help to maintain control and conserve the effectiveness of existing products (Cameron, 1996).

The aim of this study is to investigate the residual effect of four recent and classic pesticides from different groups on survived aphids of the two field strain and third sensitive one for several generations after separately treated with the L50 of each insecticide. This will help to understand long run effect for the pesticides on green peach aphid to avoid pesticide resistance and practice good integrated pest management for

controlling the aphid and minimizing viral infection to cultivated plants.

3. Materials and Methods

3. 1. Pesticides

Four Pesticides including the commonly used in Jordan for pepper protection were evaluated for their effects on green peach aphid, *Myzus persicae*.

A fresh stock solution of each pesticide was prepared in tap water on each test daily. All further dilutions were prepared from the stock solution. Tap water was used as control. The pesticides used in this study as commercial formulations were:

1. Calypso 480 SC

It belongs to neonicotinoids chemical group. The common name is thiaclopried.

Trade name is Calypso 480SC. The mode of action acts as agonists of the acetylcholine receptor. That is why they mimic the action of the neurotransmitter acetylcholine (Ach) (Insect Resistance Action Group, 2004).

2. Karate 5% EC

It belongs to pyrethroids. The common name is lamda- cyhalothrin. Trade name is Karate 5 EC. The mode of action in this pesticides is acting on tiny channels through which sodium is pumped to cause excitation of neurons. They prevent the sodium channels from closing, resulting in continual nerve impulse trans-mission tremors, and eventually dying (Insect Rsistance Action Group, 2004).

3. Evicect 50 SP

It belongs to trithiane. The common name is thiocyclam. The trade name is Eivsect 50SP. The mode of action acts by the interruption of transmission sion of nerve impulses in the synapses of the nervous system central. A few minutes pre-poisoned insects feel signs of paralysis leading to their death (Insect Resistance Action Group, 2004).

4. Dimethoate 40 EC:

It belongs to organophosphates. The common name is Dimethoate. It has many trade names. Dimethoete was used in the experiments. The mode of action acts as cholinesterase inhibitors. They bind to the enzyme that is normally responsible for breaking down the acetylecholine (Ach) after it has carried its message across the synapse affecting the chloride channel by inhibiting GABA receptor (Insect Resistance Action Group, 2004).

Suspected resistant strains :

Two suspected resistant strains were collected from fields. One was collected from peppers from Deir Alla fields and the second strain from peppers in Madaba. These collected strains were reared and maintained on pepper plants at the Entomology laboratory in the Faculty of Agriculture in the University of Jordan for testing. The residual effect of four insecticides after treating the aphid with the Lc50 Temperature ranged from 20-25 C°. Apterous aphids (adults) were tested only.

Mounting of the green peach aphid on the slides were prepared for identification according to Blackman and Eastop (1994). Taxonomical confirmation was carried out by Dr. Tawfiq Al- Antary from the university of Jordan. In the green house, a three wooden cages containing 25 pepper plants were infested with the isolated nymphs using camel brush and were monitored daily. The plants were irrigated regularly when necessary.

Aphid Culture:

Green house aphid culture

In the green house at The University of Jordan, a separated cabinet containing 50- 75 plants was used for green peach aphid culturing. The temperature ranged from 25-35 C°. Infested leaves from the wooden cage were taken after 3 weeks, distributed on the plants and then monitored daily. The plants and the aphid culture were renewed after 4 - 5 months from aphid infestation. The plants were irrigated regularly when needed.

Lab aphid culture

In the lab, three wooden cages, each containing five pepper plants were infested with aphid collected from the green house culture. The plants were renewed regularly when necessary, and from time to time infested leaves from green house culture were distributed on the plants. This culture was kept during the whole period of the study and used for re-infestation of the newly established culture in the green house.

Lab conditions

Rearing of the aphid in this experiment were conducted under the following conditions: Temperature was ranged between 24 -30 C°, R. H. 60 -70%, L:D 14:10, and light intensity from 4000- 7000 LUX

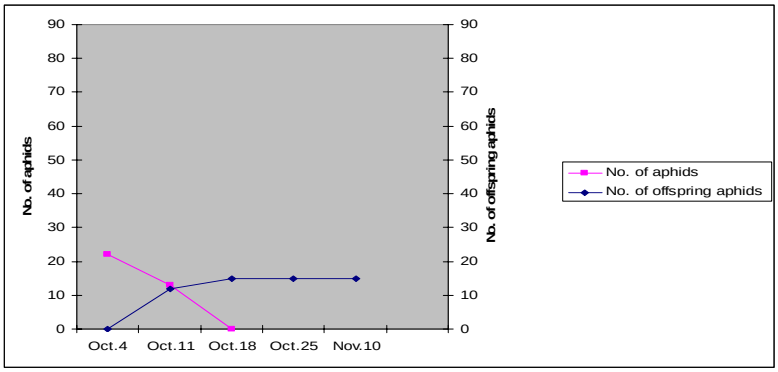
The residual effect of the pesticides on survived aphids and their offspring under lab conditions

This experiment was carried out during the period between October to December, 2010. In the lab. Average temperature and relative humidity fluctuations during this period were ranged between 23-28 C° and relative humidity 65-70%. One hundred of 3rd and 4th nymphal instars of the green peach aphid were placed by camel brush on four pepper plants in a wooden cage. There were four replicates for each pesticide and the control. The sprayed pesticides were Calypso 480SC, Karate 5EC, Evisect 50SP and Dimethoate 40EC. They were separately sprayed at the obtained LC50 from the previous experiment. Number of survived aphids were counted weekly from early Oct. to Dec, 2010. The plants were 60 days old. Tap water was used to be sprayed as a control treatment.

3. Results

Calypso with sensitive strain:

Number of the aphids and off-springs aphids after one week of spraying with the estimated LC50 (26. 5 ppm) of Calypso were 22 aphids, and zero off-springs (Fig. 1a.).

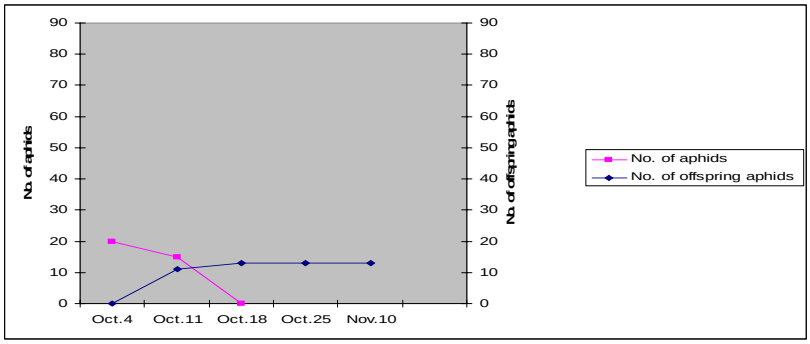


(a). Calypso treatment with sensitive strain

The number of aphids were decreased to 13 and zero for the following two weeks, while the number of off-springs aphids were increased to 12, 15. This number of aphids and off-springs aphids remained constant to the end of the experiment for sensitive strain (Fig. 1a.).

Calypso with Deir- Alla strain:

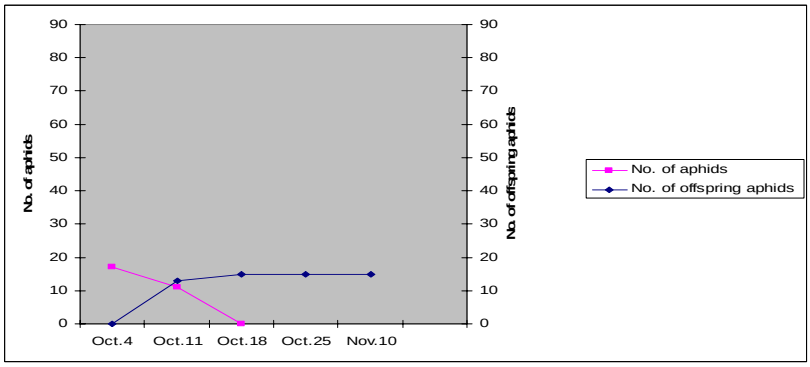
A number of the aphids and off-springs aphids after one week of spraying with the estimated LC50 (34. 33 ppm) of Calypso were 20 aphids, and zero off-springs (Fig. 1b.). The number of aphids were decreased to 15 and zero for the following 2 weeks, while the number of off spring aphids were increased to 11, 13. This number of aphids and off-springs aphids remained constant to the end of the experiment (Fig. 1b.).



(b). Calypso treatment with Deir-Alla strain

Calypso with Madaba strain:

A number of the aphids and off-springs aphids after one week of spraying with the estimated LC50 (34. 97 ppm) of Calypso were 17 aphids, and zero off-springs (Fig. 1c.).

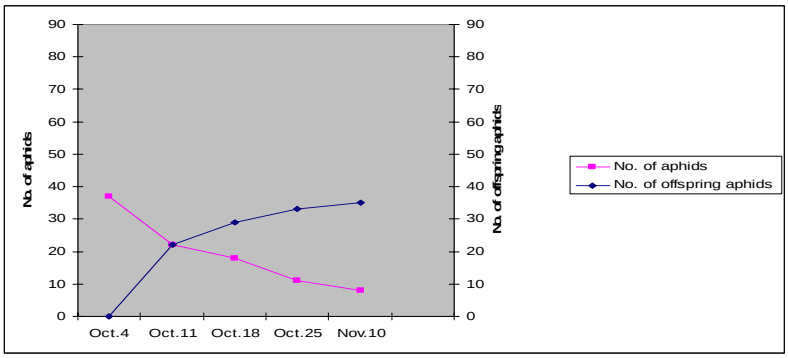


(c). Calypso treatment with Madaba strain

The number of aphids were decreased to 11 and zero for the following two weeks while the number of off-springs aphids were increased to 13, 15. The number of aphids and off-springs aphids remained constant to the end of the experiment (Fig. 1c.).

Karate with sensitive strain

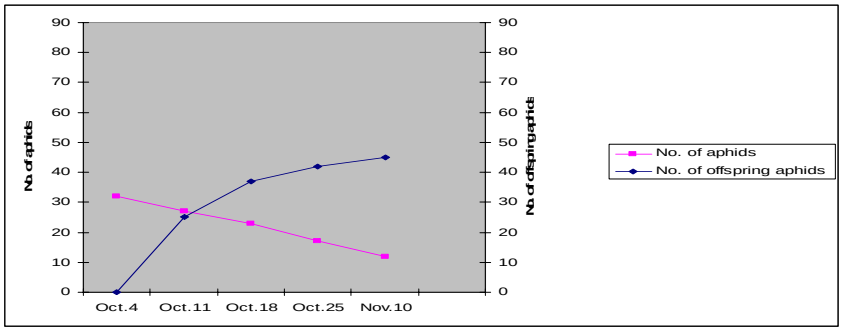
A number of the aphids and off-springs aphids after one week of spraying with lab estimated LC50 (4. 73 ppm) of Karate were 37 and zero off-springs (Fig. 1d.). The number of aphids were decreased to 22, 18, 11 and 8 for the second, third, fourth and fifth weeks, respectively, while the number of the off-springs aphids were increased 20, 29, 33 and 35, respectively, (Fig. 1d.).



(d). Karate treatment with sensitive strain

Karate with Deir – Alla strain:

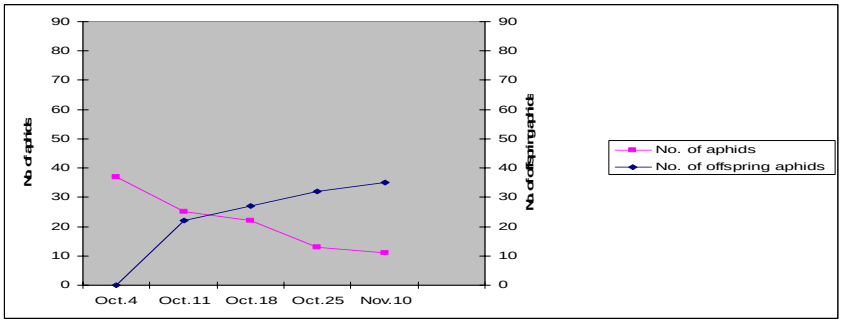
The number of the aphids and off-springs aphids after one week of spraying with lab estimated LC50 (6. 26 ppm) of Karate were 32 and zero off spring (Fig. 1e.). A number of aphids were decreased to 27, 23, 17 and 12 for the second, third, fourth and the fifth weeks, respectively, while the number of off-springs aphids were increased 25, 37, 42, and 45, respectively, (Fig. 1e.)



(e). Karate treatment with Deir-Alla strain

Karate with Madaba strain:

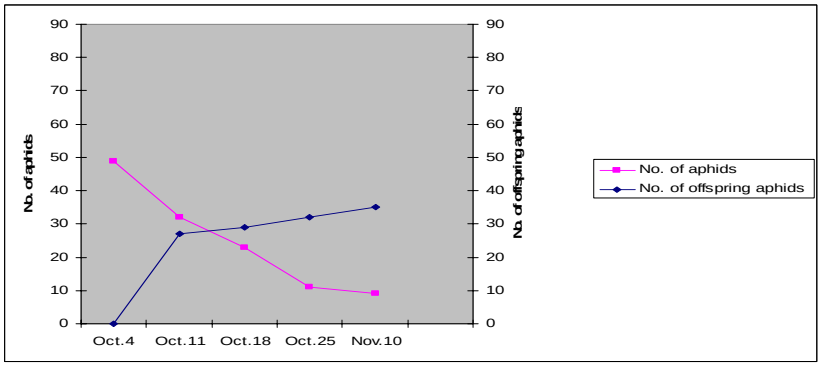
A number of the aphids and off-springs aphids after one week of spraying with lab estimated LC50 (18. 34 ppm) of Karate were 37 and zero off-springs (Fig. 1f.). A number of aphids were decreased to 25, 22, 13 and 11 for the second, third, fourth and fifth weeks, respectively, while the number of off-springs aphids were increased 22, 27, 32 and 35, respectively, (Fig. 1f.).



(f). Karate treatment with Madaba strain

Evisect with sensitive strain:

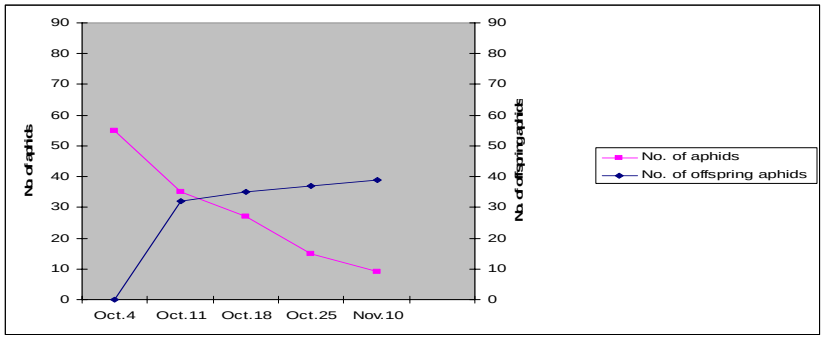
A number of aphids after one week of spraying with lab estimated LC50 (0. 42 ppm) of Evisect were 49 and zero off-springs (Fig. 1g.). The number of aphids were decreased to 32 23, 11 and 9 for the second, third, fourth and fifth weeks, respectively, while the number of off-springs aphids were increased to 27, 29, 32 and 35, respectively, (Fig. 1g.).



(g). Evisect treatment with sensitive strain

Evisect with Deir- Alla strain:

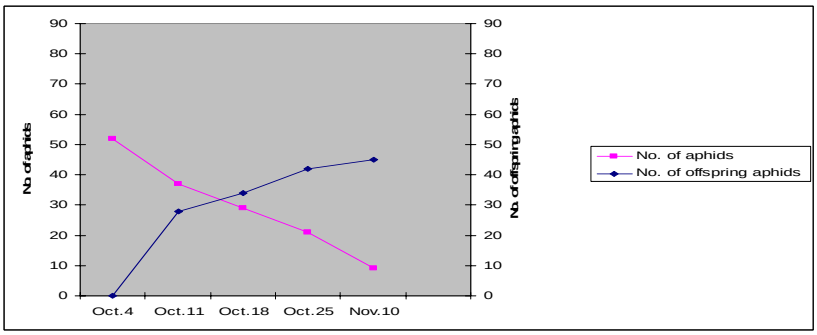
A number of aphids after one week of spraying with lab estimated LC50 (1. 37 ppm) of Evisect were 55 and zero off-springs (Fig. 1h.). A number of aphids were decreased to 35 27, 15 and 9 for the second, third, fourth and fifth weeks, respectively, while the number of off-springs aphids were increased to 32, 35, 37 and 39, respectively, (Fig. 1h.).



(h). Evisect treatment with Deir-Alla strain

Evisect with Madaba strain:

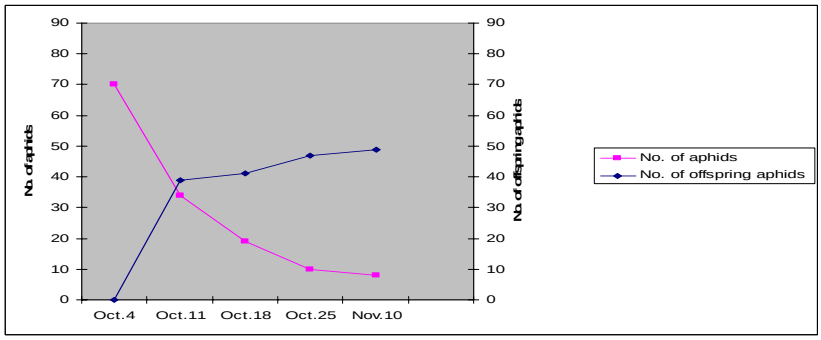
A number of aphids after one week of spraying with lab estimated LC50 (2. 13 ppm) of Evisect were 52 and zero off-springs (Fig. 1i.). A number of aphids were decreased to 37, 29, 21 and 9 for the second, third, fourth and fifth weeks, respectively, while a number of off-springs aphids were increased to 28, 34, 42 and 45, respectively, (Fig. 1i.).



(i). Evisect treatment with Madaba strain

Dimethoate with sensitive strain:

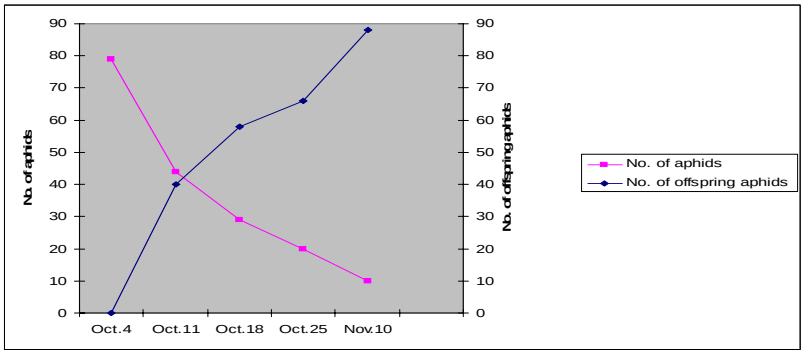
A number of aphids and off-springs aphids after one week of spraying with lab estimated LC50(0. 50 ppm) of Dimethoate and off-springs were 70 aphids and zero off-springs (Fig. 1j.). A number of aphids were decreased to 34, 19, 10 and 8 for the second third, fourth and fifth weeks, respectively, while a number of off-springs aphids were increased to 39, 41, 47 and 49**,** respectively, (Fig. 1j.).



(j). Dimethoate treatment with sensitive strain

Dimethoate with Deir- Alla strain:

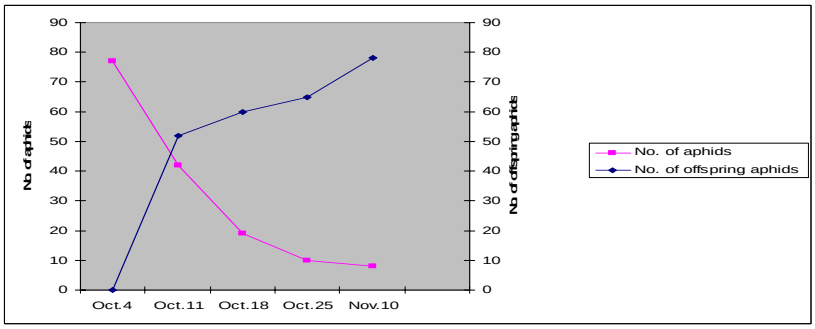
A number of aphids and off-springs aphids after one week of spraying with lab estimated LC50 (2. 18 ppm) of Dimethoate were 79 aphids and zero off-springs (Fig. 1k.). A number of aphids were decreased to 44, 29, 20 and 10, respectively, while a number of off-springs aphids were increased to 40, 58, 66 and 88, respectively, (Fig. 1k.).



(k). Dimethoate treatment with Deir-Alla strain

Dimethoate with Madaba strain:

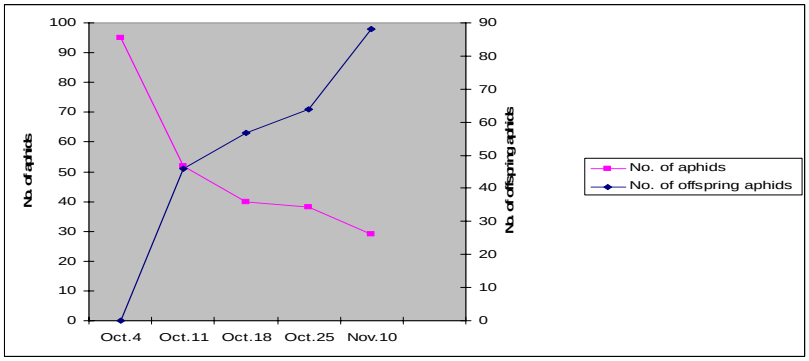
A number of aphids and off-springs aphids after one week of spraying with lab estimated LC50 (17. 95 ppm) of Dimethoate were 77 aphids and zero off-springs (Fig. l.). A number of aphids were decreased to 42, 19, 10 and 8 for the second, third, fourth and fifth weeks, respectively, while a number of off-springs aphids were increased to 52, 60, 65 and 78, respectively, (Fig. l.).



(l). Dimethoate treatment with Madaba strain

Control treatment:

In the control treatment, a number of aphids and off-springs aphids after one week of spraying with Tap water were 95 aphids and zero off-springs (Fig. 1m.). A number of aphids were decreased to 52, 40, 38 and 29 for the second, third, fourth and fifth weeks, respectively, while a number of off-springs aphids were increased to 51, 63, 71 and 98, respectively, (Fig. 1m.).



(m). Control treatment

Discussion

From the experiment of residual effect of insecticides on survived aphids and their offspring under lab condition, the relatively high percentage reduction achieved even one week after treatment with Calypso in comparison with other pesticides. It was much more when applied directly to aphids on infested plants. The life processes of any insect are affected by chemical factors such as the use of insecticide and physical factors such as temperature, humidity, wind, evaporation and light, and affected by biotic factors such as their food, their natural enemies or for competitors for food.

The results in the anther experiment (Al-Antary and Khader, 2012) showed that exposure to Calypso (neonicotinoid) increased relatively the longevity and fecundity of green peach aphid in the 2nd and 3rd generations. This might be due to the speed of egg hatch, and the total of egg hatch. However, it is known that the sublethal doses of many insecticides stimulate pest resurgence in the filed. It is usually due to the suppression of a natural enemy or the reproductive stimulation of pests (Mores and Zareh 1991, Nandihalli *et al*. 1992, Nemoto 1993). Moreover, in laboratory experiments, James and Price (2002) reported a significant increase in egg production in *T. urticae* after spray with systemic applications of Imidacloprid (neonicotinoid) at field-relevant rates for hop yards. In contrast, significantly reduced oviposition in *T. urticae* following drench or foliar applications of imidacloprid and ascetamiprid at field-relevant rates was reported in another study (Ako *et al.* 2004). Ako *et al.* (2006) suggested that the ovipositional response of *T. urticae* to field-recommended doses of imidacloprid is strain-dependent. It is generally understood that imidacloprid and, most likely, neonicotinoids in general, used at their field-recommended rates, are not the sole factors contributing to the propagation of mite pests by oviposition stimulation, and one possible explanation currently under investigation is interspecies competition. The Karate (pyrethroid), Evesic (Nereis), Dimethoate (organophosphate) decreased the survived green peach aphid numbers with in two weeks after their treatment separately with the LC50 rate in the three strains, and then the aphid populations increased until the end of the experiment. However, Karate decreased the longevity and the fecundity of *Myzus persicae* in an other study (Al-Antary and Khader, 2012). These results agreed with those of Abo El-Ghar and El- Sayed (1992), who tested five different insecticides against the cabbage aphid *Brevicoryne. brassicae* (L.), and its associated parasitoid *Diaeretiella. rape* (M Intosh). They reported that the pyrethroids were preferable to the organophosphate insecticides, due to their minimal adverse effects on the emergence of parasitoids from off-springs aphids and their subsequent survival.

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تأثر المتبقي لبعض المبيدات الحشرية على سلالات مختلفة من من الدراق الاخضر على الفلفل

توفيق العنتري[1]، وباسل خضر[1]

ملخـص

أجريت تجارب مخبرية على أربعة من المبيدات التقليدية والحديثة شائعة الاستعمال تجاه سلالات مختلفة من حشرة من الدراق الأخضر، جمعت الحشرات من منطقة مأدبا ، ودير علا ، ومن الوديان البعيدة عن المزارع في منطقة أم العمد على عشبة الخردل البري وتم تربيتها داخل البيت الزجاجي في الجامعة الأردنية لعشرة أجيال لاعتمادها كسلالة حساسة في التجربة ، وتمت تربية السلالات الثلاث على نبات الفلفل الحلو داخل البيت الزجاجي وفي المختبر ايضا. درس التأثير المتبقي للمبيدات المجربة وهي الكاليبسو والكاراتي والأيفسكت والدايموثويت تجاه أفراد المن الاحياء وخلفتها بعد معاملة نبات الفلفل العائل بالجرعة النصفية القاتلة لكل مبيد على الثلاث سلالات. وقد أظهرت النتائج المتحصل عليها انخفاضا. لقد لوحظت وقدرت أفراد المن الاحياء وخلفتها بعد معاملتها منفصلة بالجرعة النصفية القاتلة لكل مبيد على الثلاث سلالات لمعرفة تأثير المبيدات على تعدادها وخلفتها. واما المبيدات المجربة فهي الكاليبسو والكاراتي والأيفسكت والدايموثويت. كما قلت أعداد المن المعاملة بالكليبسو خلال الأسبوعين الأولين بعد المعاملة بالمبيد في الثلاث سلالات وبعد ذلك بقيت أعداد المن ثابتة حتى نهاية التجربة. وقلت أعداد المن المعاملة بالكراتي والأيفسكت والدايمثويت خلال الأسبوعين الأولين بعد المعاملة في الثلاث سلالات وبعد ذلك ازدادت اعداد المن حتى نهاية التجربة.

الكلمات الدالة: الدراق الاخضر، ثلاثة سلالات، المبيدات، تأثير المتبقي، النسل.

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تاريخ استلام البحث 2011/5/29 وتاريخ قبوله 2012/10/2.