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# EFFECT OF BIO-INSECTICIDE, BIOSECT, THE IGR, ADMIRAL AND TWO NATURAL INSECTICIDES ON FECUNDITY OF *Aphis craccivora* KOCH. (HEMIPTERA - HOMOPTERA: APHIDIDAE).

BY

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## ABSTRACT

This investigation was carried out under laboratory conditions (25 ± 3°C, 65 ± 5% R.H.), at Faculty of Science (For Girls) during the period extended from early January 2005 to mid June 2006. Sub lethal concentrations i.e., LC50, LC25 and LC12.5, of Selecron (as comparison), Achook, Bemistop, Biosect and Admiral were tested against *Aphis craccivora* to show its effects on progeny number and mortality through 10 days at three period of aphid infestation after application (zero, 3 and 7 days). Results showed that, among the treatments the lowest number of offspring and aphid survival were observed at zero time infestation at LC50 and at 3 days infestation after application at LC25 with Selecron followed by Admiral, the botanical compound Bemistop and the bioinsecticide Biosect. But the botanical compound, Achook gave the same effects at 3 days infestation after application, for the three concentrations.

Concerning the persistence of the studied compounds, it was found that, at 7 days infestation after application, the compounds could be arranged descendingly according to persistence as follows:

Selecron (-83.2, -66.2 & -30.9%), Bemistop (-73.6, -34.9 & -13.7%), Achook (-64.4, -50.2 & -22.8%), Admiral (-66.1, -22.7 & -14.4%) and Biosect (64.4, -19.1 & -16.1 decrease than control, at LC50, LC25 & LC12.5, respectively).

Regarding the percentage mortality of *A. craccivora* resulted from treatments of LC50, LC25 and LC12.5, of different compounds, maximum mortality values were obtained at zero time infestation for all treatments at all concentrations. However, values of mortality gradually decreased by the time lapses at 3 days and 7 days infestation for all compounds and all concentrations.

**Key words:** *Aphis craccivora*, fecundity, natural insecticides.

## INTRODUCTION

Aphids are a group of sap-sucking insect pests causing many damages to various vegetable crops. They also, play an important role as vectors of plant viruses and produce honeydew either under open field or green house conditions. Aphids

also, succeed to reproduce at wide latitude weather conditions and they are polyphagous insects, this classifies aphids as serious pests. Many investigators carried out experiments on biology of this pest as a trial to control and decrease its population (Dimetry and El-Hawary, 1997; Thayaalini and Raveendranath, 1997 and Xue *et al.*, 2002).

This work aimed to evaluate the effect of sub lethal concentrations of some preparations on some biological aspects of *A. craccivora*. Preparations used included: the organophosphorus compound, Selecron 72%EC. (Profenofos), the two botanical insecticides (Achook 0.15% & Bemistop 21.1% EC.), the bioinsecticide, Biosect 32 x $10^6$ conidia/mg (*Beauveria bassiana*) and the insect growth regulator, Admiral 10% EC. (Pyriproxyfen).

## MATERIALS AND METHODS

**Mass rearing of the legume aphid:**

A laboratory strain of the legume aphid was obtained from Sucking and Piercing Insects Research Dept., Plant Protection Research Institute, A.R.C.

Common bean seeds were cultivated in plastic pots (15 $cm^2$ diameter), two seedlings per pot.

After 10-15 days of growing, infested leaves with *Aphis craccivora* were transferred to these pots and left for reproduction under glasshouse conditions. Pots were held in rearing cages (60 cm height, 50 cm wide and 50 cm long.). Infested seedlings were transferred to other fresh common bean seedlings whenever needed.

**Materials used:**

Three sub-lethal concentrations (LC50, LC25, and LC12.5) of each of the tested preparations were used in planned experiments. Values of these concentrations were as follows:

| Treatments | Concentrations/100 L. | | |
|---|---|---|---|
| | LC 50 | $LC_{25}$ | $LC_{12.5}$ |
| Selecron 72%EC. | 10.7 $cm^3$ | 6.2 $cm^3$ | 1.7 $cm^3$ |
| Achook 0.15%EC. | 33.0 $cm^3$ | 19.5 $cm^3$ | 6.0 $cm^3$ |
| Bemistop 21.1% EC. | 103.8 $cm^3$ | 65.8$cm^3$ | 27.5 $cm^3$ |
| Biosect 32 x$10^6$ Conidia/mg | 68.2 gm. | 36.4 gm. | 24.6 gm. |
| Admiral 10% EC. | 93.4 $cm^3$ | 65.6$cm^3$ | 37.9 $cm^3$ |
| Control | -- | -- | -- |

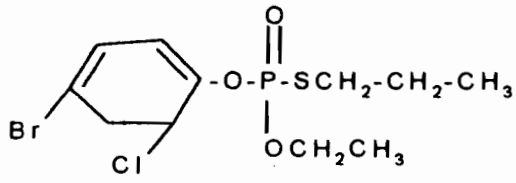
**Chemical compounds tested:**

1-The organophosphorus compound, Profenofos (Selecron 72%EC), produced by Novartis Company, Switzerland. (used as comparison)

**Chemical name:**

O-(4-bromo-2-chlorophenyl)–5-ethyl-S-Propyl phosphoro thioate.

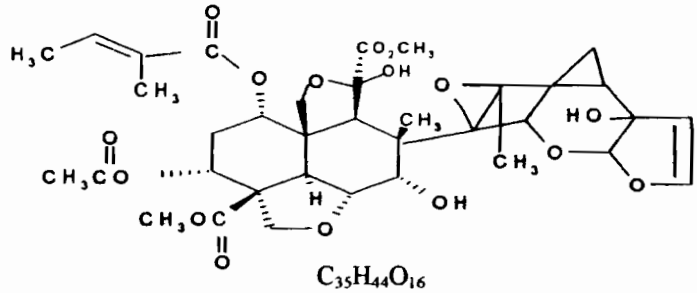
**Structure formula:**



2- The botanical insecticides:

2. a- Achook 0.15% (Azadirachtin 1500 ppm) [neem kernel based EC containing Azadirachtin 0.15%ww (1500ppm), *Azadirachta indica* A., [Fam: Meliaceae]. Produced by Bahar Agrochem and Foods Pvt. Ltd., India.

**Structure Formula:**



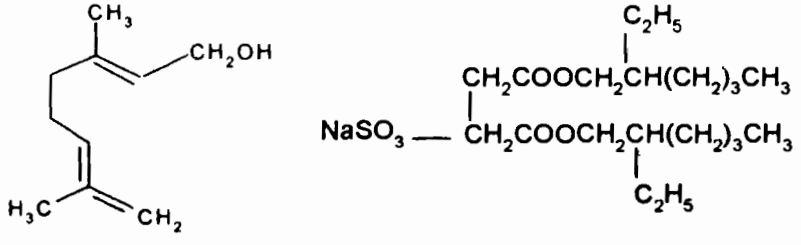
$C_{35}H_{44}O_{16}$

Chemical structure of Azadirachtin

2. b-Bemistop 21.1%EC. A combination of sodium dioctyl sulfosuccinate with Geraniol (Kairomone) (SDSS + Geraniol).

A new product of NM Agro Egypt Company Coded 98402.
(Geraniol) (Geropon)

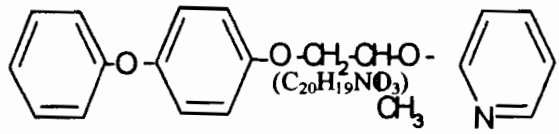
3. 7- dimethyl-2, 6-octadien-1-01 Dioctyl sulfosuccinate Sodium salt



3- Biosect. A bioinsecticide containing the entomopathogenic fungus, *Beauveria bassiana* (at 32 x $10^6$ conidia/mg). Produced by Kafr El-Zayat Chemical and Pesticide Company, Egypt.

4- Admiral 10% EC (Pyriproxyfen). An insect growth regulator produced by Sumitomo Chemical Co. Ltd. Osaka, Japan.

**Chemical name:** 4-phenoxyphenyl (Rs)-2-(2-pyridyloxy) propyl ether.
**Structure Formula:**




**Treatment procedures:-**

By using a hand sprayer, the prepared concentrations of the previous materials were sprayed (10 ml/pot), 27 pots/preparation. Water was sprayed on the control pots. Each pot was considered as a replicate. Then (by using a fine brush), artificial infestation was carried out by transferring 10 apterous aphid to each treated pot (3 pots/concentration) at three periods after application i.e.,

1- Zero time application period, after complete dryness of spray solution on seedlings.
2- Three days after spraying.
3- Seven days after treatment.

Pots were held in rearing cages throughout the period of experiment. Direct count of progeny took place 24 hours after infestation and continued daily for 10 days to determine the progeny per female under each of the applied treatments.

A reaction coefficient (Wr) was calculated using the formula of (Ignatowicz, 1979)

$$Wr = - \frac{NP \times 100}{NK} \quad 100$$

Mortalities were corrected using Abbott's formula (1925).

## RESULTS AND DISCUSSION

Data in Table (1) & Fig. (1) showed the effect of three sub lethal concentrations i.e., $LC_{50}$, $LC_{25}$ and $LC_{12.5}$, of the organophosphorus insecticide, Selecron, two botanical compounds, Achook and Bemistop, the bioinsecticide, Biosect and the I.G.R. Admiral on the progeny number of *Aphis craccivora* during 10 days at three periods of infestation after spraying (zero, three and seven days) under glasshouse conditions (25 ± 3°C and 65 ± 5 R.H.).

Results showed that, the organophosphorus compound, Selecron decreased the fecundity of aphids at zero time infestation after application greater than the two other periods for all concentrations, where fecundity was decreased by (99.6, 94.0 and 60.6% at $LC_{50}$, $LC_{25}$ and $LC_{12.5}$, respectively) than the fecundity in control. The decrease in progeny production by infestation 3 days after application was less than at zero time infestation after application at all concentrations, being 95.2, 86.5 and 62.7% decrease than control. Whereas, decrease in fecundity when infestation took place 7 days after application was the

lowest one recorded the highest aphid survival and fecundity, where the progeny production decreased by 83.2, 66.2 and 30.9% for the three concentrations, respectively than the control treatment.

It was evident that, the highest decrease in aphid fecundity (after 24 hours) resulted from Selecron treatment as compared with the remaining treatments. Then the residual effect of Selecron on fecundity was gradually decreased by the time lapses, where aphid fecundity recorded its highest values at when infestation took place 7 days after treatment followed by the infestation after 3 days post-application.

Regarding the botanical compound, Achook, aphid fecundity decreased by 71.9, 48.7 and 18.4% than control for $LC_{50}$, $LC_{25}$ and $LC_{12.5}$, respectively by infestation at zero time post-application, then the compound showed more decrease in fecundity than control (78.0, 59.3 and 40.9%) at 3 days infestation after spraying. However, at 7 days infestation after spraying decrease in fecundity reduced once more than control to reach 64.4, 50.2 and 22.8% for the three concentrations, respectively.

These results indicated that, Achook caused intermediate decrease in fecundity by infestation at zero time after application, while, greatest decrease occurred at 3 days post-treatment. The lowest decrease in aphid fecundity occurred by infestation at 7 days after application.

Treatments by the botanical insecticide, Bemistop, the bioinsecticide, Biosect and the I.G.R. Admiral at LC50 resulted in greatest decrease in fecundity at zero time infestation after application, where they produced 86.4, 86.6 and 88.9% less off spring (than the control) respectively; then their residual effect on aphid fecundity at 3 days infestation after application was slightly reduced, where the fecundity decreased by 82.0, 83.8 and 81.9% (than control) for the three compounds.

However, at 7 days infestation after application, their residual effect was gradually reduced producing 73.6, 64.4 and 66.1% less progeny (than those of control) for Bemistop, Biosect and Admiral, respectively. Additionally, $LC_{25}$ and $LC_{12.5}$ for the three previous compounds showed different behavior on fecundity, where at zero time infestation after application achieved an intermediate and low decrease in aphid offspring (45.7 and 9.7% for Bemistop), (41.3 and 1.2% for Biosect) and (51.3 and 15.5% for Admiral) less than the control at $LC_{25}$ and $LC_{12.5}$, respectively

Thereafter, $LC_{25}$ and $LC_{12.5}$ produced the greatest decrease in fecundity at 3 days infestation after application, where fecundity decreased by (59.3 and 31.9% for Bemistop), (67.8 and 22.9% for Biosect) and (65.3 and 33.3% for Admiral) than the control at $LC_{25}$ and $LC_{12.5}$, respectively The effect of the three above compounds at 7 days infestation after application at $LC_{25}$ and $LC_{12.5}$ caused decreases by (34.9 and 13.7% for Bemistop), (19.1 and 16.1% for Biosect) and (22.7 and 14.4% for Admiral) than fecundity in control.

Generally, among the treatments, the lowest aphid fecundity was observed at zero time infestation after application with the organophosphorus compound followed by Admiral, the botanical compound, Bemistop and the bioinsecticide, Biosect at zero time infestation after application at $LC_{50}$, and at 3 days infestation after application of the botanical compound, Achook after application at the three concentrations.

Concerning the persistence of the studied compounds it was found that, at 7 days infestation after application, the compounds could be arranged in descending order according to persistence as follows:

Selecron, Bemistop, Achook, Admiral and Biosect which was the least effective one.

Results in Table (2) & Fig. (2) showed the percentages of mortality of *A. craccivora* resulted from treatments of $LC_{50}$, $LC_{25}$ and $LC_{12.5}$ of different chemical compounds at three infestation periods after application i.e., zero, three and seven days. Results indicated that, maximum mortality values were obtained at zero time infestation after application for all compounds at all concentrations. However, values of mortality gradually decreased by the time lapses at 3 and 7 days infestation after application for all compounds and all concentrations.

Regarding the period of 7 days infestation after spraying, the organophosphorus compound was the highest toxic and led to the greatest reduction in progeny number (79.1, 60.9 and 30.5%), followed by the botanical compound, Bemistop (70.0, 33.8 and 16.0%), the botanical compound, Achook (62.2, 49.4 and 20.0%), Admiral (59.8, 20.6 and 11.6%) and the bioinsecticide, Biosect (58.1, 18.9 and 15.6%, mortality for $LC_{50}$, $LC_{25}$ and $LC_{12.5}$, respectively) which was the less toxic one to *A. craccivora*.

The present data indicated that; Selecron had an immediate and prolonged effect on *A. craccivora*. However, the remaining compounds, Bemistop, Achook, Admiral and Biosect have considerably delayed effect as compared with Selecron.

The previous results agree with those of Ammer *et al.* (1986) who evaluated in laboratory the effectiveness of 5 moult-inhibiting insect growth regulators of the benzoyl-phenol urea group against *Brevicoryne brassicae*. They mentioned that, exposure of 3rd instar nymphs to cabbage leaves treated with any of the test compounds (Diflubenzuron, Triflumuron, Dowco 439) at 0.1–100 ppm showed that at 10-100 ppm they acted more as insecticides than as growth regulators, causing 100% delayed accumulated mortality by the adult stage. More than 50% mortality of nymphs occurred within 24 h of exposure to the compounds at 100 ppm. At 0.1-5 ppm, the compounds resulted in a 70-100% reduction in progeny production.

Chaunan *et al.* (1988) stated that, phosphamidon, monochrotophos and oxydemeton-methyl caused > 70% mortality for up to 10 days after application against *Aphis craccivora*. It was recommended that application of phosphamidon, monochrotophos, oxydemeton-methyl and dimethoate should be repeated at 13 to 15 days intervals, while those of Malathion at 7 day intervals.

**Table (1): Effect of sub-lethal concentrations of tested compounds on reproductively of *Aphis craccivora* Koch. at various periods from treatment.**

| Waiting Period after treatment (days) | | Mean number of individuals/10 days | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Selecron 72% EC. | | | Achook 0.15% EC. | | | Bemistop 21.1% EC. | | | Biosect 32x10$^6$ conidia/mg | | | Admiral 10% EC | | | Control |
| | | $LC_{50}$ | $LC_{25}$ | $LC_{12.5}$ | $LC_{50}$ | $LC_{25}$ | $LC_{12.5}$ | $LC_{50}$ | $LC_{25}$ | $LC_{12.5}$ | $LC_{50}$ | $LC_{25}$ | $LC_{12.5}$ | $LC_{50}$ | $LC_{25}$ | $LC_{12.5}$ | |
| Zero | Mean | 0.4± 0.1 | 6.7± 1.3 | 44.0± 3.8 | 31.4± 3.9 | 57.3± 5.8 | 91.2± 7.9 | 15.2± 2.6 | 60.7± 4.1 | 101.0± 9.5 | 15.0± 2.58 | 65.6± 5.9 | 110.5± 7.86 | 12.4± 1.88 | 54.5± 5.02 | 94.5± 5.5 | 111.8± 13.2 |
| | Wr% | -99.6 | -94.0 | -60.6 | -71.9 | -48.7 | -18.4 | -86.4 | -45.7 | -9.7 | -86.6 | -41.3 | -1.2 | -88.9 | -51.3 | -15.5 | – |
| Three | Mean | 9.3± 1.9 | 26.2± 3.5 | 72.6± 7.9 | 42.7± 5.8 | 79.2± 11.4 | 114.9± 11.3 | 34.9± 6.56 | 79.2± 10.9 | 132.2± 10.7 | 31.5± 6.4 | 62.6± 11.3 | 149.9± 16.1 | 35.1± 5.04 | 67.4± 8.9 | 129.6± 15.3 | 194.4± 16.3 |
| | Wr% | -95.2 | -86.5 | -62.7 | -78.0 | -59.3 | -40.9 | -82.0 | -59.3 | -31.9 | 83.8 | -67.8 | -22.9 | -81.9 | -65.3 | -33.3 | – |
| Seven | Mean | 27.8± 5.4 | 56.0± 1.6 | 114.5± 17 | 59.1± 13.6 | 82.6± 15.1 | 128.1± 18.7 | 43.8± 8.3 | 108.0± 15.7 | 143.2± 10.7 | 59.1± 9.1 | 134.2± 17.0 | 139.2± 16.1 | 56.2± 10.2 | 128.3± 15.6 | 142.0± 19.2 | 165.9± 21.3 |
| | Wr% | -83.2 | -66.2 | -30.9 | -64.4 | -50.2 | -22.8 | -73.6 | -34.9 | -13.7 | -64.4 | -19.1 | -16.1 | -66.1 | -22.7 | -14.4 | – |

**Table (2): Effect of sub-lethal concentrations of tested compounds on mortality of *Aphis craccivora* Koch. at various periods from treatment.**

| Waiting Period after treatment (days) | % Mortality/10 days | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Selecron 72% EC. | | | Achook 0.15% EC. | | | Bemistop 21.1% EC. | | | Biosect 32x10$^6$ conidia/mg | | | Admiral 10% EC | | |
| | $LC_{50}$ | $LC_{25}$ | $LC_{12.5}$ | $LC_{50}$ | $LC_{25}$ | $LC_{12.5}$ | $LC_{50}$ | $LC_{25}$ | $LC_{12.5}$ | $LC_{50}$ | $LC_{25}$ | $LC_{12.5}$ | $LC_{50}$ | $LC_{25}$ | $LC_{12.5}$ |
| Zero | 99.5 | 93.0 | 75.8 | 82.0 | 67.6 | 46.9 | 88.2 | 63.9 | 39.6 | 90.8 | 62.1 | 33.6 | 90.9 | 66.0 | 41.5 |
| Three | 94.7 | 84.9 | 61.0 | 78.9 | 61.1 | 39.3 | 83.2 | 60.0 | 30.4 | 84.9 | 68.1 | 23.5 | 84.2 | 65.8 | 31.4 |
| Seven | 79.1 | 60.9 | 30.5 | 62.2 | 49.4 | 20.0 | 70.0 | 33.8 | 16.0 | 58.1 | 18.9 | 15.6 | 59.8 | 20.6 | 11.6 |

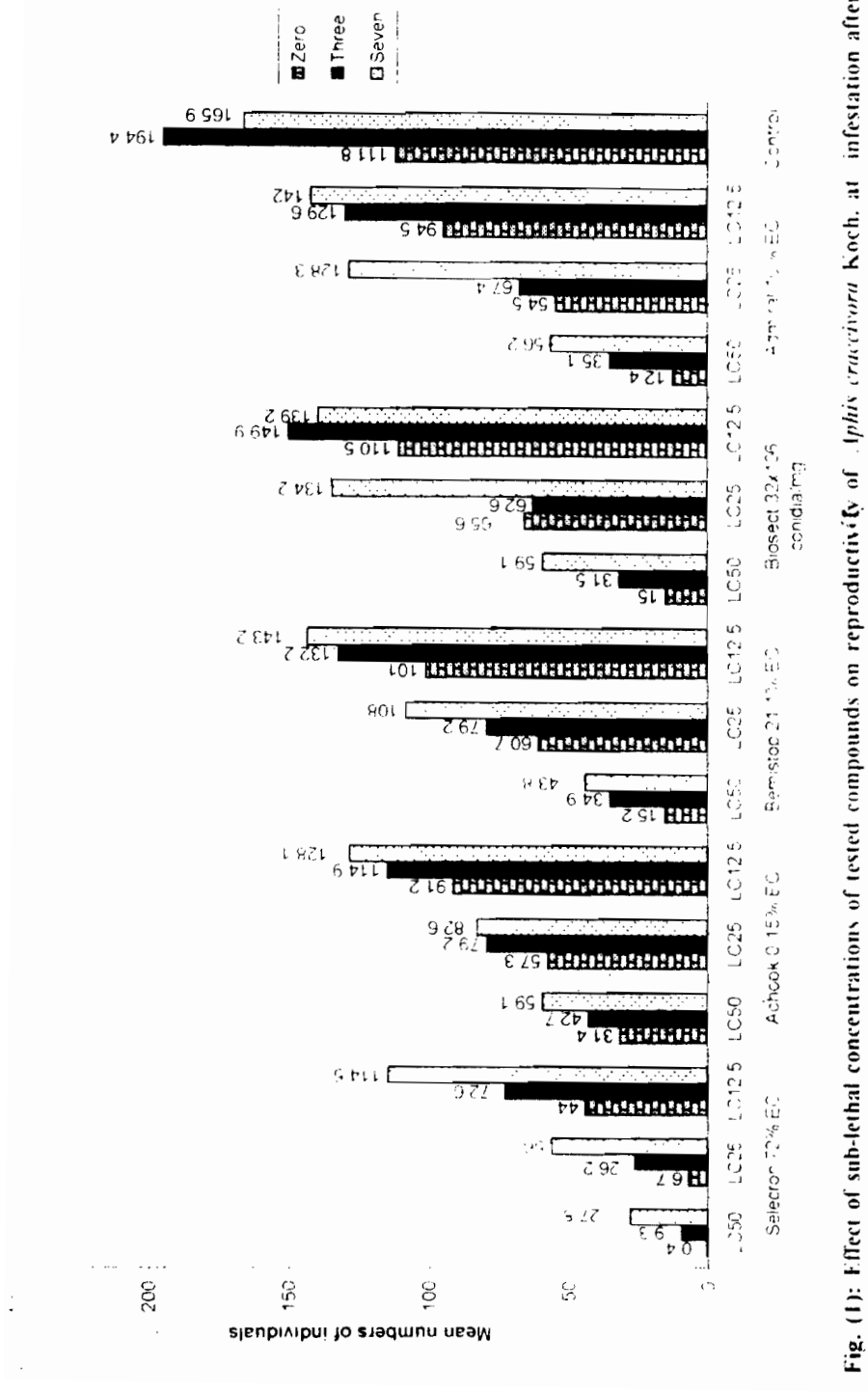



**Fig. (1): Effect of sub-lethal concentrations of tested compounds on reproductivity of *Aphis craccivora* Koch. at infestation after various periods from treatment.**

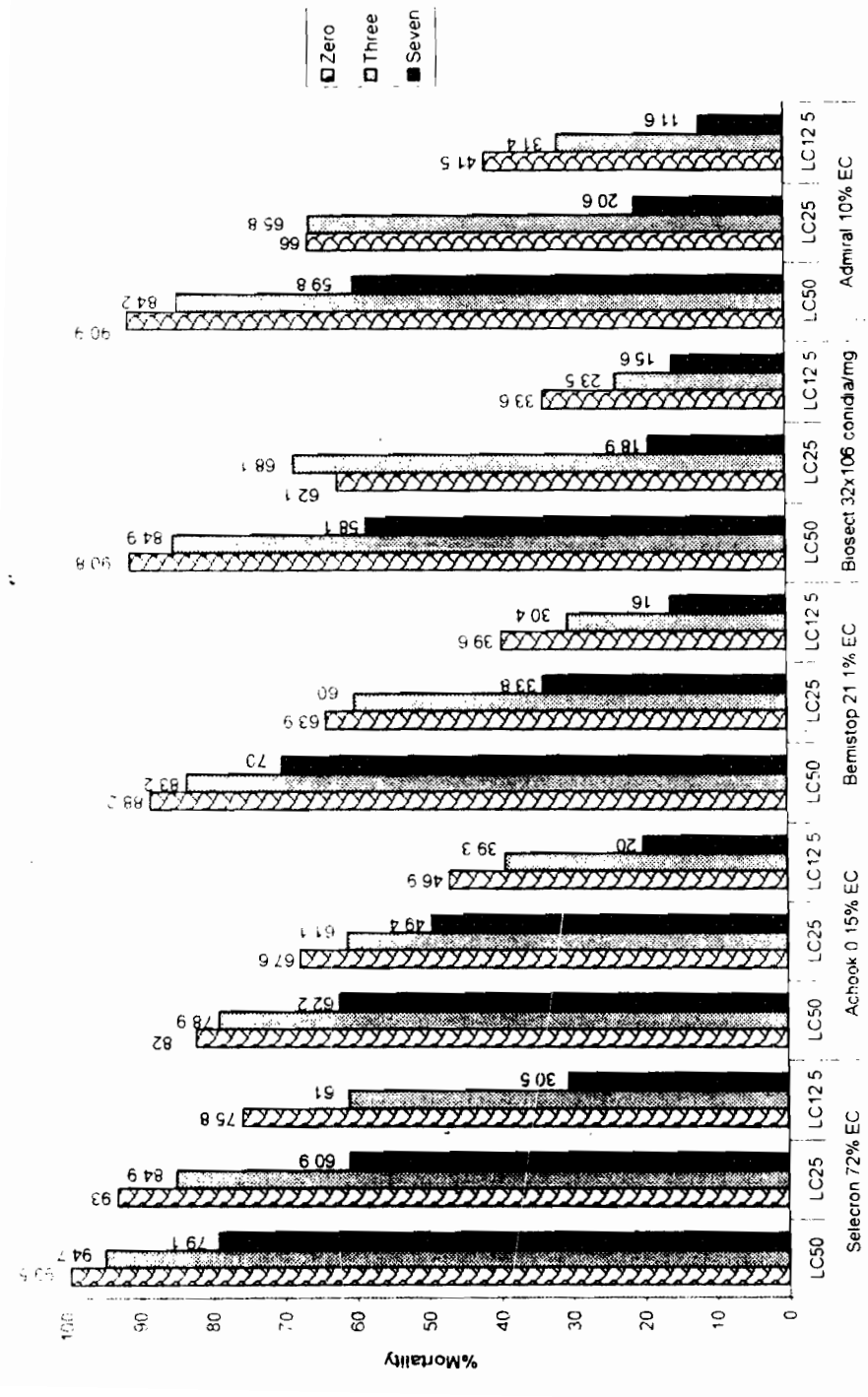



**Fig. (2): Efficacy of sub-lethal concentrations of tested compounds on mortality of *Aphis craccivora* Koch. at various periods from treatment.**

Dimetry and El-Hawary (1997) studied under the laboratory conditions the effect of various conc. of Neem Azal-T and Neem Azal-T/S (both containing extracts of *Azadirachta indica*) on the biology and percentage mortality of *Aphis craccivora* adults in Egypt. They mentioned that, both extracts had an aphicidal effect against adults and significantly decreased fecundity.

Wood *et al.* (1998) examined in controlled greenhouse experiments with cotton, the efficacy of knack (Pyriproxyfen) and applaud (Buprofezin) applications before and after aphid (*Aphis gossypii*) infestation. They stated that knack was the effective in reducing the number of offspring produced by adult aphids.

Kerns and Stewart (2000), in USA, studied the sub-lethal effects of dosages of Bifenthrin, Acephate, Carbofuran or Pyriproxyfen on cotton aphid reproduction. They did not detect any increase or decrease in the intrinsic rate of increase of cotton aphids exposed to Bifenthrin, Acephate or Carbofuran. However, they detected some increases in the net reproductive rate of aphids treated with Bifenthrin justifying further investigation of the effect on reproduction by these insecticides. Pyriproxyfen demonstrated significant activity towards cotton aphid reared on treated cotton in the bioassays. Pyriproxyfen caused sterility in most aphids exposed to dosage exceeding 1 ppm and it did not appear to greatly influence the reproductive potential.

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## تأثير المبيد الحشري الحيوي بيوسكت، منظم نمو الحشرات أدميرال ومبيدين طبيعيين على خصوبة منّ البقوليات.

**عفاف عبد الوهاب عباس**
كلية العلوم (بنات) – جامعة الأزهر

تم دراسة تأثير التركيزات تحت المميتة ($LC_{50}$, $LC_{25}$, $LC_{12.5}$) لكلا من السليكرون وأشوك وبمستوب وبيوسكت وأدميرال لبيان تأثيراتهم علي عدد النسل الناتج ونسبة الموت لمّن البقوليات*Aphis craccivora* خلال عشرة أيام عند ثلاث فترات من العدوى بعد المعاملة (صفر، ٣ ، ٧ أيام). وقد وجد الآتي:

- لوحظ أن أقل عدد من نسل المّن سجل عند العدوى في الفترة صفر بعد الرش وكان السليكرون الأكثر تأثيرا تلاه في ذلك مركب أدميرال ثم بيمستوب ثم المركب الحيوي بيوسكت عند التركيز $LC_{50}$،كما لوحظت نفس الظاهرة عند الفترة ٣ أيام بعد المعاملة مع التركيز $LC_{25}$، أما المركب النباتي أشك فقد كان أقلهم في التأثير علي الخصوبة .
- أما بالنسبة لبقائية هذه المركبات تحت الدراسة فقد وجد أنه عند عدوى النباتات بالمّن بعد ٧ أيام من المعاملة بالمبيد يمكن ترتيب المركبات ترتيبا تنازليا من حيث الأثر الباقي لها كما يلي:
- سليكرون (٨٣,٢، ٦٦,٢ و٣٠,٩٪) ثم بيمستوب (٧٣,٦، ٣٤,٩ و١٣,٧٪) ثم أشك (٦٤,٤، ٥٠,٢ و٢٢,٨٪) ثم أدميرال (٦٦,١، ٢٢,٧ و١٤,٤٪) ثم بيوسكت (٦٤,٤، ١٩,١ و١٦,١٪ نقص عن الكنترول للتركيزات $LC_{50}$، $LC_{25}$، $LC_{12.5}$ على الترتيب).
- كما سجلت أعلي نسب موت لمّن البقوليات كانت عند عدوى النباتات بالمن بعد الرش مباشرة لجميع المعاملات عند كل التركيزات. كما لوحظ أن نسبة الموت تتناقص تدريجيا بمرور الوقت عند العدوى بعد ٣ و ٧ أيام من الرش لكل المعاملات عند كل التركيزات.
- وبالرجوع إلي معدل الموت عند العدوى في اليوم السابع بعد الرش فقد وجد أن المبيد الفوسفوري سليكرون كان أكثر المعاملات سمية علي المن وتسبب في أعلي نسب موت في النسل الناتج (٧٩,١،٦٠,٩ و٣٠,٥٪) تلاه في ذلك المبيد النباتي بيمستوب (٧٠,٠،٣٣,٨ و١٦,٠ ٪) ثم نظيرة أشوك (٦٢,٣٢،٤٩,٤ و٢٠,٠٪) ثم منظم النمو الحشري أدميرال (٥٩,٦،٢٠,٦ و١١,٦٪) ثم المركب الحيوي بيوسكت (٥٨,١،١٨,٩ و١٥,٦٪) عند الثلاث تركيزات المستعملة بالتتابع