

**Efficiency of certain insecticides on the population(s) of the pink hibiscus mealybug *Maconellicoccus hirsutus* (Green) and their natural enemies under the field condition in Ismailia governorate**

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**ABSTRACT**

The pink hibiscus mealybug *Maconellicoccus hirsutus* is a serious pest on the ornamental plant *Hibiscus rosa sinensis* at Ismailia governorate and elsewhere . So, the comparative effects of six commonly used insecticides [four nonconventional pesticides ; Biofly, Biovar, Bioranza and Orange oil & two conventional pesticides Admiral (pyriproxyfen) and Cidial (phenthoate)]. They applied under field conditions on the population(s) of the pink hibiscus mealybug, *Maconellicoccus hirsutus* and its natural enemies of the encyrtid parasitoid *Anagyrus kamali* and the coccinellid predators *Scymnus coccivora* & *Cryptolaemus montrouzieri*. Results showed that the least reduction value was recorded by Biovar, Bioranza, Admiral and Orange oil on the mealybug population(s) and their natural enemies. The highest effect was occurred by cidial treatment. So, biocides are recommended for using in the control of this insect pest for its least effect on the natural enemies of these pests.

**INTRODUCTION**

The pink hibiscus mealybug *Maconellicoccus hirsutus* (Green) (Homoptera :Pseudococcidae) has been the most injurious mealybug species occurring in Egypt, following its introduction to Egypt in about 1908, presumably from India. By 1926, it spreads rapidly all over the country (Mousa *et al.*, 2001). It has become a major pest on several crops, various fruits and ornamental plants .It injects toxins at the point of feeding, causing several distortion of leaves, new shoots, and fruits (Williams, 1996) .Many researches recorded that the *Hibiscus rosa-sinensis*, one of a common and spread ornamental plants in Egypt seems to be one of the main host plants for *Maconellicoccus hirsutus* (Assem, 1982).

Pollution of pesticides residues and high cost of chemical control, which are

resulted from miss using of the pesticides, push us to eliminate the use of pesticides.

Biological control at a high level of pest is not enough to suppress the population (Prokopy *et al.*; 1990). Therefore, under integrated pest management program (IPM), coordination between the use of pesticides and biological control is necessary.

The present study aims to evaluate the efficiency of certain insecticides in controlling the pink hibiscus mealybug *Maconellicoccus hirsutus* and clarify the selectivity of these insecticides on its natural enemies, *Anagyrus kamali*, *Scymnus coccivora* and *Cryptolaemus montrouzieri*, in order to establish the compatibility between each in integrated mealybug management programme.

## MATERIALS AND METHODS

The following is a list of recommended concentrations of certain insecticides used to evaluate their efficiency against *Maconellicoccus hirsutus* and their natural enemies found in separated shrubs of the ornamental plant *Hibiscus rosa sinensis* in Ismailia governorate:-

### I-Insecticides used:-

#### A- Bioinsecticides:-

**1-Bio-fly**, *Beauveria bassiana* (Bio-fly  $3 \times 10^3$  conidia/ ml l.)

Recommended concentration is 150 ml / 100 liters of water.

**2-Biovar**, *Beauveria bassiana*

(Biovar  $3 \times 10^3$  conidia/ ml l.)

Recommended concentration is 200 gm / 100 liters of water.

**3- Bioranza**, *Metarhizium anisopliae* (Bio-ranza  $32 \times 10^6$  spore/gm wp,)

Recommended concentration is 200 gm / 100 liters of water.

#### B- Insect growth regulators (IGR)

**-Admiral**, pyriproxyfen, 4-phenoxyphenyl (RS)- 2-(2-pyridyloxy)propyl ether.

Recommended concentration is 75 ml / 100 liters of water.

#### C- Phosphorous insecticides :-

**- Cidial (50 %) Ec**, phenthoate S- $\alpha$ -ethoxycarbonylbenzyl O,O-dimethyl phosphorodithioate

Recommended concentration is 150 ml / 100 liters of water.

#### D- Mineral oil

**- Orange oil** (mineral oil).

Recommended concentration is 800 ml / 100 liters of water.

#### I-Field trail:-

The trail was carried out in different and separated shrubs of the ornamental plant *Hibiscus rosa sinensis*, around Ismailia governorate in August 2008 to evaluate the susceptibility of the *Maconellicoccus hirsutus* (Green) and their natural enemies to the aforementioned insecticides. The

experimental shrubs were heavily infested with the mealybug, *Maconellicoccus hirsutus*.

The trail included five replicates of the hibiscus shrubs for each treatment besides untreated ones that were served as control. Representative samples of 25 *Hibiscus rosa sinensis* branches 15cm., each was taken at random from each treatment (just before spraying) and four counts at a week interval after spraying. The collected samples were backed in paper packages that were transported to plant protection laboratory at Ismailia Agricultural Research Station . Numbers of living individuals of the hibiscus mealybug and their natural enemies were recorded. The branches were examined by using a stereo-binuclear microscope. The average climatic conditions of minimum – maximum temperature, mean relative humidity and air speed were 25.2-30.5°C, 74.4% R.H and 14 km/hr., respectively. These conditions were favorable for spraying. Reduction percentages in the *Maconellicoccus hirsutus* population (s) were estimated according to the equation of (Henderson and Tilton, 1955).

## RESULTS AND DISSCUSION

### I- The effect of six insecticides on the mealybug *Maconellicoccus hirsutus* under the field conditions in Ismailia governorate.

Data presented in Table (1) and Fig (1) shows that the percentages of reductions were: 45.8, 44.4, 44.1, 44.3, 90.9 and 85.1% respectively after one week of application. They were 41, 45.9, 43, 39.7, 88.4 and 81.1% respectively after two weeks of application. While they were 86.7, 87.7, 85.1, 92.1, 81 and 73.3% respectively after three weeks of application and 88.3, 88.2, 87.5, 94.3, 69.8 and 69.9% respectively after four weeks of application for Biofly, Biovar,

Bioranza, Admiral, Cidial and Orange oil, (Fig.1).

While Fig (2) shows the mean percentages of reduction 65.45, 66.55, 65, 67.6, 82.53 and 77.35%, respectively for Biofly, Biover, Bioranza, Admiral, Cidial and Orange oil . Statistical analysis shows no significant difference among Biofly, Biover, Bioranza, Admiral and Orange oil, while the highest reduction percentage is obtained by cidial treatment. These results

is in agreement to that obtained by (Anwar, 1991). Mani (1988) controlled the *Maconellicoccus hirsutus* in India by spraying or dipping fruit bunches in dichlorvos in combination with fish oil rosin soap and got good result. (Persad and Khan, 2000) mentioned that chemical control was the best achieved by using either pirimiphos- methyl or triazophos on *Maconellicoccus hirsutus*.

Table 1: Effect of six insecticides on the hibiscus mealybug, *M. hirsutus* population on hibiscus plant under the field conditions in Ismalia governorate.

| Insecticides | Rate application ml/100 liters water | pretreatment | Mean no. of mealybug population / branch and % reduction after at indicated days |      |                 |      |                 |      |                 |      | % Mean reduction |
|--------------|--------------------------------------|--------------|--|------|-----------------|------|-----------------|------|-----------------|------|------------------|
|              |                                      |              | Post Treatment Counts  |      |                 |      |                 |      |                 |      |                  |
|              |                                      |              | 1 <sup>st</sup>  |      | 2 <sup>nd</sup> |      | 3 <sup>rd</sup> |      | 4 <sup>th</sup> |      |                  |
|              |                                      |              | 7 days   |      | 14 days         |      | 21 days         |      | 28 days         |      |                  |
| No           | %                                    | No           | %  | NO   | %               | No   | %               |      |                 |      |                  |
| Biofly       | 150ml                                | 83.4         | 40.2   | 45.8 | 35.6            | 41   | 10.8            | 86.7 | 8.8             | 88.3 | 65.45            |
| Biover       | 200gm                                | 92.2         | 45.6   | 44.4 | 36.1            | 45.9 | 11              | 87.7 | 9.8             | 88.2 | 66.55            |
| Bioranza     | 200gm                                | 94.2         | 46.6   | 44.1 | 38.8            | 43   | 13.6            | 85.1 | 10.6            | 87.5 | 65               |
| Admiral      | 75ml                                 | 85.8         | 42.5   | 44.3 | 37.4            | 39.7 | 6.6             | 92.1 | 4.4             | 94.3 | 67.6             |
| Cidial       | 150ml                                | 59.6         | 4.8  | 90.9 | 5               | 88.4 | 11              | 81   | 16.2            | 69.8 | 82.53            |
| orange oil   | 800ml                                | 99.4         | 13.2   | 85.1 | 13.6            | 81.1 | 25.8            | 73.3 | 27              | 69.9 | 77.35            |
| untreated    |                                      | 113.4        | 100.8  |      | 82              |      | 110.2           |      | 102.2           |      |                  |
| LSD at 5%    |                                      |              |  |      |                 |      |                 |      |                 |      | 32.16            |

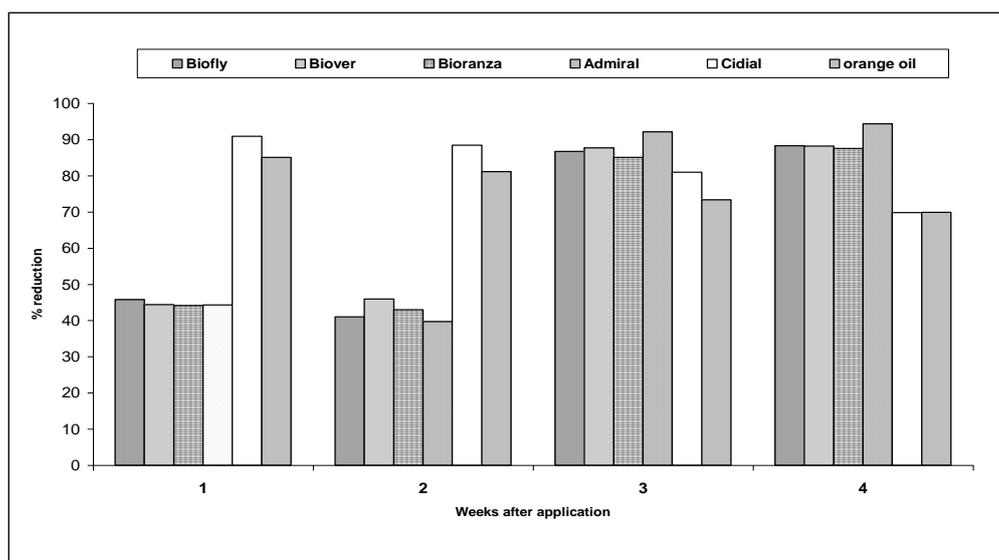


Fig. 1: Reduction percentages of certain insecticides against *M. hirsutus*

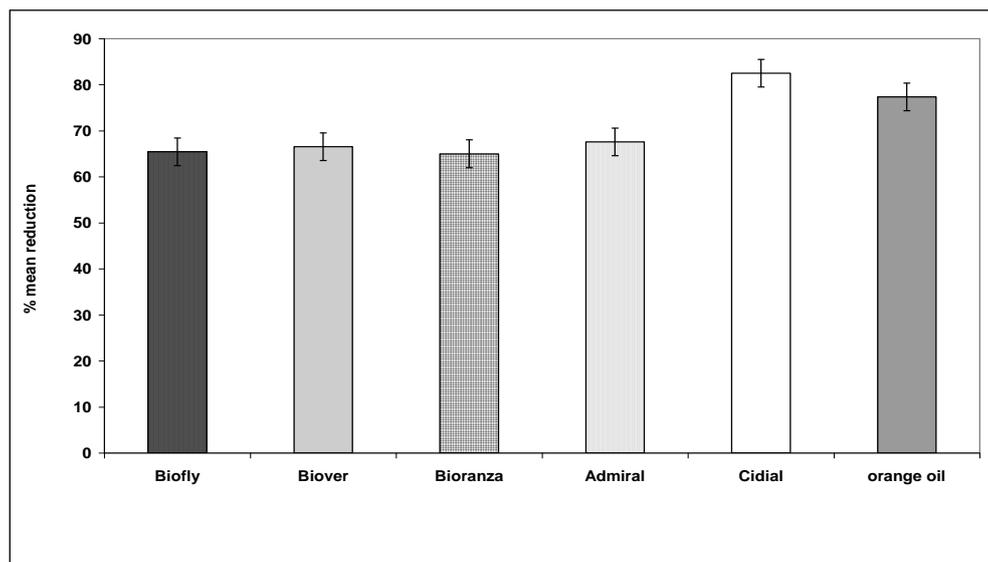


Fig. 2: Mean reduction percentages of certain insecticides against *M. hirsutus*

## II- The effect of six insecticide on *Maconellicoccus hirsutus* and its natural enemies under the field conditions.

Table (2) shows the effect of six insecticides on the populations of the encyrtid parasitoid *Anagyrus kamali*, and the coccinellid predators *Scymnus coccivora* and *Cryptolaemus montrouzieri* on *Maconellicoccus hirsutus* (Green).

### II.1. *Anagyrus kamali* Moursi

The results obtained in Table (2) and Fig. (3) referred that the six insecticides caused 37, 41, 54, 47, 90 and 75.5% reduction one week after application; 31, 36, 51, 41, 89.6 and 78%, two weeks after application; 61, 62.1, 69, 60.3, 87 and 74%, three weeks after application and 54, 56, 62, 59.5, 79.2 and 53%, four weeks after application for Biofly, Biovar, Bioranza, Admiral, Cidial and Orange oil, respectively.

The mean percentages of reduction were 45.8, 48.8, 59, 51.9, 86.5 and 70.13% for Biofly, Biovar, Bioranza, Admiral, Cidial and Orange oil, respectively.

There was no significant difference among Biofly, Biovar, Bioranza, Admiral and Orange oil, while Cidial showed the highest significant reduction among the other five insecticides used.

### II.2. *Scymnus coccivora* Aiyar

The result in Table (2) and Fig. (3) shows that the effect of the six insecticides were 29, 27, 43, 44, 100 and 84%, reduction one week after application; 59, 45, 66, 51, 100 and 79%, two weeks after application; 73, 71, 80, 72, 92 and 82%, three weeks after application and 77, 71, 84, 86, 88 and 72% four weeks after application for Biofly, Biovar, Bioranza, Admiral, Cidial and Orange oil, respectively.

From these obtained results, Biovar had the least significant reduction percentage (53.5%), followed by Biofly (59.5%), Admiral (63.3%), Bioranza (68.3%) and then orange oil (79.3%) with no significant difference among the five insecticides. On the other hand Cidial have the highest reduction percentage (95%).

Table (2): Effect of six insecticides on natural enemies; the parasitoid *Anagyrus kamali*, and the predators *Scymnus coccivora* and *Cryptolaemus montrouzieri* associated with *M. hirsutus* on the hibiscus plants under field conditions in Ismailia governorate.

| Insecticides                               | Rate application<br>ml/100 liters<br>water | pretreatment | Mean no of mealybug natural enemies population / branch and %<br>reduction after at indicated days |      |                 |      |                 |      |                 |      | % Mean<br>reduction |
|--|--|--------------|--|------|-----------------|------|-----------------|------|-----------------|------|---------------------|
|  |  |              | Post treatment counts  |      |                 |      |                 |      |                 |      |                     |
|  |  |              | 1 <sup>st</sup>  |      | 2 <sup>nd</sup> |      | 3 <sup>rd</sup> |      | 4 <sup>th</sup> |      |                     |
|  |  |              | 7  |      | 14              |      | 21              |      | 28              |      |                     |
| <b>1- <i>Anagyrus kamali</i></b>           |  |              | No   | %    | No              | %    | No              | %    | No              | %    |                     |
| Biofly                                     | 150ml                                      | 10.4         | 6.2  | 37   | 5.6             | 31   | 4               | 61   | 3.4             | 54   | 45.8 b              |
| Biover                                     | 200gm                                      | 12.8         | 7.2  | 41   | 6.4             | 36   | 4.8             | 62.1 | 4               | 56   | 48.8 b              |
| Bioranza                                   | 200gm                                      | 13.8         | 6  | 54   | 5.2             | 51   | 4.2             | 69   | 3.8             | 62   | 59 b                |
| Admiral                                    | 75ml                                       | 15.8         | 8  | 47   | 7.2             | 41   | 6.2             | 60.3 | 4.6             | 59.5 | 51.9 b              |
| Cidial                                     | 150ml                                      | 17.4         | 1  | 90   | 1.4             | 89.6 | 2.2             | 87   | 2.6             | 79.2 | 86.5 a              |
| Orange oil                                 | 800ml                                      | 9.4          | 2.2  | 75.5 | 1.6             | 78   | 2.4             | 74   | 3.2             | 53   | 70.13 b             |
| control                                    |  | 17           | 16.2   |      | 13.2            |      | 16.8            |      | 12.2            |      |                     |
| LSD  |  |              |  |      |                 |      |                 |      |                 |      | 15.63               |
| <b>2- <i>Scymnus coccivora</i></b>         |  |              |  |      |                 |      |                 |      |                 |      |                     |
| Biofly                                     | 150ml                                      | 6.8          | 3.8  | 29   | 2               | 59   | 1.8             | 73   | 1.4             | 77   | 59.5 ab             |
| Biover                                     | 200gm                                      | 7            | 4  | 27   | 2.8             | 45   | 2               | 71   | 1.8             | 71   | 53.5 b              |
| Bioranza                                   | 200gm                                      | 7.2          | 3.2  | 43   | 1.8             | 66   | 1.4             | 80   | 1               | 84   | 68.3 ab             |
| Admiral                                    | 75ml                                       | 9.6          | 4.2  | 44   | 3.4             | 51   | 2.6             | 72   | 1.2             | 86   | 63.3 ab             |
| Cidial                                     | 150ml                                      | 7.8          | 0  | 100  | 0               | 100  | 0.6             | 92   | 0.8             | 88   | 95 a                |
| Orange oil                                 | 800ml                                      | 8            | 1  | 84   | 1.2             | 79   | 1.4             | 82   | 2               | 72   | 79.3 ab             |
| control                                    |  | 10.2         | 8  |      | 7.4             |      | 10              |      | 9               |      |                     |
| LSD  |  |              |  |      |                 |      |                 |      |                 |      | 25.1                |
| <b>3- <i>Cryptolaemus montrouzieri</i></b> |  |              |  |      |                 |      |                 |      |                 |      |                     |
| Biofly                                     | 150ml                                      | 5.4          | 2.2  | 49   | 1.6             | 62   | 1.4             | 73   | 1.2             | 75   | 64.8 b              |
| Biover                                     | 200gm                                      | 6            | 3  | 37   | 2.4             | 49   | 1.8             | 69   | 1.4             | 74   | 57.3 b              |
| Bioranza                                   | 200gm                                      | 6.4          | 3.4  | 34   | 2               | 60   | 1.6             | 74   | 1               | 82   | 62.5 b              |
| Admiral                                    | 75ml                                       | 8.6          | 4  | 42   | 3.2             | 52   | 2               | 76   | 1.8             | 76   | 61.5 b              |
| Cidial                                     | 150ml                                      | 6.4          | 0  | 100  | 0               | 100  | 0.2             | 90   | 0.6             | 89   | 94.8 a              |
| Orange oil                                 | 800ml                                      | 7.2          | 0  | 100  | 0.8             | 86   | 1               | 86   | 1.4             | 78   | 87.5 ab             |
| control                                    |  | 9            | 7.2  |      | 7               |      | 8.8             |      | 8               |      |                     |
| LSD  |  |              |  |      |                 |      |                 |      |                 |      | 21.89               |

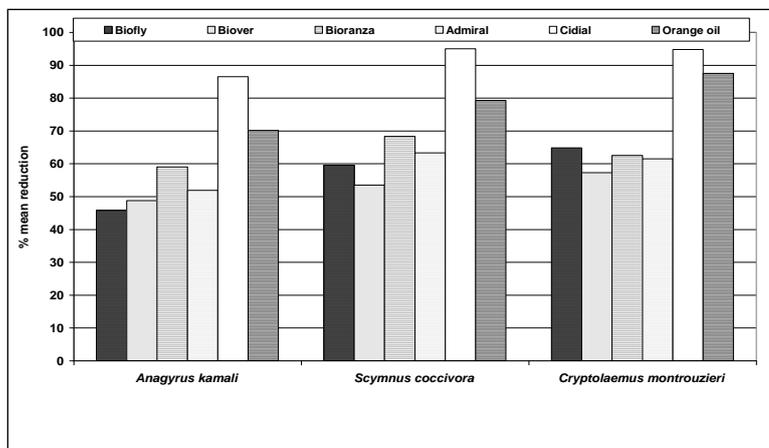


Fig. 3: Mean reduction % of certain pesticides against the parasitoid *Anagyrus kamali*, and the predators *Scymnus coccivora*, *Cryptolaemus montrouzieri* of *M. hirsutus* on the hibiscus plant under field conditions in Ismailia governorate.

### II.3. *Cryptolaemus montrouzieri* Mulsant

The data in Table (2) and Fig. (3) showed that the effect of the six insecticides were 49, 37, 34, 42, 100 and 100%, reduction one week after application; 62, 49, 60, 52, 100 and 86% , two weeks after application; 73, 69, 74, 76,90 and 86% , three weeks after application and 75, 74, 82, 76, 89 and 78% four weeks after application for Biofly, Biovar, Bioranza, Admiral, Cidial and Orange oil, respectively.

The obtained results showed that Biovar had the least significant reduction percentage (57.3%), followed by Admiral (61.5%), followed by Bioranza (62.5 %), after that Biofly (64.8 %) and orange oil (87.5 %) with no significant difference among the five insecticides, while the highest reduction percentage was cidial (94.8%).

From the aforementioned results, six commonly used insecticides of different concentrations were field applied to evaluate their efficiency against the pink hibiscus mealybug, *Maconellicoccus hirsutus* and their natural enemies. Latter insecticides were: Biofly, Biovar, Bioranza, Admiral, Cidial and Orange oil. Infact, this insect pest was introduced in Egypt since 1908 from India (Mousa *et al.*, 2001), gave considerable damage for several crops, fruits and trees. In addition, toxins injected by it causes deleterious effects (Williams, 1996).

Thus, study aims to choose the best among the above mentioned chemicals to reduce the cost and minimize residues in order to control pollution in the ecosystem.

Hence, it can conclude that Cidial was the most effective insecticide for both *Maconellicoccus hirsutus* and their natural enemies, which has harm effect on them. These results was also obtained by (Negm *et al.*, 2000) who found that Cidial the best insecticide to control the pest.

Finally, biocides are the least effect on the natural enemies associated with the pest, so it is recommended that broad spectrum insecticides not be applied to the pink hibiscus mealybug during the presence of it's natural enemies, while they could be used against the pest for their low effect on the natural enemies.

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## ARABIC SUMMARY

فاعلية بعض المبيدات الحشرية علي بق الهيسكس الدقيقي وأعدائه الطبيعية تحت الظروف الحقلية بمحافظة الإسماعيلية

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تمت مقارنة تأثير ستمبيدات حشرية أربعة منهم مبيدات غير تقليديه وهي : ( بيوفلاي - بيوفار - بيورنزا - ورنج أويل) إلي جانب مبيدين تقليدين (ادميرال - سيديال ) تحت الظروف الحقلية على بق الهيسكس الدقيقي المتواجد على نبات الزينة الهيسكس وأعدائه الطبيعية (طفيل اناجبرس كمالى - المفترس سكيمينس كوكسيفورم - كريبتوليمس منتوريوزيري).

و لقد أشارت النتائج إلي أن السيديال هو أكثر المركبات المختبرة تأثيرا على بق الهيسكس الدقيقي و أعداءه الطبيعية بلهه كلا من الأورنج أويل - بيوفلاي - بيوفير - بيورنزا - ادميرال .