Full Length Research

Field evaluation of some insecticides against *Insulaspis pallidula* and *Icerya seychellarum* on mango trees at Qena Governorate, Egypt

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The evaluation of synthetic insecticides, biopesticides and two concentrations of mineral oils to control the Maskell scale insect, *Insulaspis pallidula* (Green) and mealybug, *Icerya seychellarum* (Westwood) on mango trees was conducted at Esna district, Qena Governorate, Egypt. Admiral was the most effective treatment against *I. pallidula*, followed by Challenger, Biover, Bioranza, Chemi oil 2% and Chemi oil 1%. Bioranza and Biover were highly effective treatments against *I. seychellarum*, followed by Challenger, Admiral, Chemi oil 2% and Chemi oil 1%. The mineral oil was the least effective in controlling either of the two pest species and doubling the concentration of mineral oil did not significantly enhance its performance. The synthetic insecticides (Admiral and Challenger) and the biopesticides (Bioranza and Biover) were effective in controlling the scale insects. The greatest effectiveness of these products was observed four weeks after application.

**Key words:** Scale insect, mealybug, control, mango trees.

INTRODUCTION

In Egypt, mango (*Mangifera indica* L.) is considered the second most important tropical fruit after bananas, in terms of production, marketing and consumption due to its succulence, exotic flavor and delicious taste (El-Said, 2006). Mango trees may become infested with many serious pests during their growth stages, including the phloem feeding mealybug, *Icerya seychellarum* (Westwood) (Assem, 1990) and the Maskell scale, *Insulaspis pallidula* a common scale insect on mango trees in Egypt (Elwan, 1990, 2005). Scale insects and mealybugs attack the leaves surface of tender shoots, twigs and leaves, in addition the fruit of mango trees. At severe infestation levels, serious damage results in young leave that greatly values yield reduction (Bakry, 2009).

The present work was conducted at Esna district, Qena Governorate to evaluate the efficiency of selected synthetic insecticides, biopesticides and two concentrations of mineral oils against the Maskell scale insect, *I. pallidula* (Green) and mealybug, *I. seychellarum* (Westwood) on mango trees.

**MATERIALS AND METHODS**

The effectiveness of different control treatments against the Maskell scale, *I. pallidula* (Green) and the mealybug, *I. seychellarum* (Westwood) on mango trees (Hindy variety) was conducted at Esna district, Qena Governorate, Egypt during August, 2008. The altitude, latitude and longitude of this region were 72 m, 26.1°N and 32.7°E, respectively. Mango trees were about fifteen years old, 12 m in height and were not treated with insecticides during the last two years prior to this study. Tested treatments were distributed in randomized complete
blocks design, with three trees used as replicates for each treatment. The trees were treated with the chemicals using a six horse power motor beam sprayer, with a 600 liter tank, at 2/bs/sq.in pressure. Approximately, 20 to 25 liters of the solution was applied to each to ensure complete saturation. The spraying from down to upper leaves because the insect prefers the basal part of tree and was received the highest population density of insect than the other stratum.

Ten leaves were collected from all directions of the tree at 5 to 10 m height from the ground level for each replicate immediately before spraying. The post-treatment counts were recorded one, two, three and four weeks after treatment. The samples were transferred to the laboratory in labeled bags and examined by the stereoscopic microscope and viable nymphs, adult and gravid females recorded per leaf. Control treatments (mineral oil, pesticides and two fungi formulations) and their concentrations of applications were as follows:

1. Chemi oil 80% EC (mineral oil): Chemical class, aliphatic hydrocarbons and mode of action was Asphyxia and formulation type was Mayonnaise, source: the National Company for Agrochemicals Production (Agrochem), Egypt used by 1 Liter/100 liter water.
2. Chemi oil 80% EC (mineral oil): Chemical class, aliphatic hydrocarbons and mode of action was Asphyxia and formulation type was Mayonnaise, source: the National Company for Agrochemicals Production (Agrochem), Egypt used by 2 Liter/100 liter water.
3. Challenger 36% SC (Chlorfenapyr), Technical: CL 303630; 4-bromo-2-[4-chlorophenyl]-1-[ethoxymethyl]-5- [Trifluoromethyl]-1H-pyrrole-3- carbonitrile. M.f. C<sub>15</sub>H<sub>11</sub>BrClF<sub>3</sub>N<sub>2</sub>O of chemical formula, used by 50 cm<sup>3</sup>/100 L water.
4. Admiral 10% EC (Pyriproxyfen): Insect growth regulator, used by 50 cm<sup>3</sup>/100 L water. Company: Sumitomo Chemical Australa Pty Ltd. Chemical Name: 4-Phenoxy phenyl (RS)-2-(2-pyridyloxy) propyl ether. Chemical Formula: C<sub>20</sub>H<sub>19</sub>NO<sub>3</sub>.
5. Bioranza (10% WP) Metarehizum anesaopliae Sorok: (32 × 106 spores/ml) and 90% inert ingredient, used at rate of 200 g/100 L water. Produced by Insect Pathogens Unit, Plant Protection Research Institute, Agriculture Research Centre, Dokki, Giza, Egypt.
6. Biover 10% WP: Biover a commercial formulation of Beauveria bassiana and it is a product of Special Unit of Producing Bioinsecticiles. PPRI-ARC. Egypt. The international unit was 32,000 viable spores per mg. The active ingredient was 10% W.P, used by 200 g/100 L water.

The treatments were imposed following the randomized complete block design with three replications. Means were statistically analyzed and compared according to least significant difference (LSD test.) at the 5% level. The reduction percentage for different stages of the Maskell scale insect, I. pallidula (Green) and the mealybug, I. seychellarum (Westwood) were estimated according to the equation of Henderson and Tilton (1955) as follows:

\[
\text{Reduction percentage} = 100 \left(1 - \frac{T_a \times C_b}{T_b \times C_a}\right)
\]

Where: \(T_a\) = No. individuals in treated trees after treatment. \(T_b\) = No. individuals in treated trees before treatment. \(C_a\) = No. individuals in control trees after treatment. \(C_b\) = No. individuals in control trees before treatment.

RESULTS AND DISCUSSION

**Insulaspis pallidula**

**Initial effect after one week of application**

Data concerning the mean percentage of reduction in different stages of *I. pallidula* after one week of application was presented in Table 1. Numerically, nymphs were the most susceptible stage to all tested treatments. Spraying after nearly all eggs have hatched to nymphs is most abundant to achieve good control. Applying an insecticide after scales have produced the hard, white armor will not be effective because scales and even scale eggs are well protected by the white armor. Mean percentage of reduction was 60.62, 56.65 and 52.97%, respectively, for nymphs, gravid females and adult females. However, the statistical analysis of data showed that there were insignificant differences among different stages in their susceptibility toward tested treatments. Analysis showed significant differences among treatments in their initial effectiveness one week post treatment where (\(F = 2.69\) and LSD was 9.74 at \(P \leq 0.05\)). For the whole periods, Chemi oil at 1% was statistically the least effective treatment. The tested treatments could be arranged according to their initial effect on *I. pallidula* in the following descending order: Challenger (61.7%), Admiral (60.8%), Biover (58.3%), Bioranza (57.4%), Chemi oil 2% (53.8%) and Chemi oil 1% (48.5%).

**Residual effect after two weeks of application**

Data represented in Table 1 show that nymphs were more susceptible to all tested treatments than adult females and gravid females. % Reduction was 77.8, 63.5 and 63.3%, respectively. Also, the statistical analysis of the contained data of all stages revealed significant differences among treatments where \(F\) value was 7.12 and LSD value was 6.04 at 5% level of probability. Tested treatments gave moderate control against the total population of this pest. Admiral was the most effective treatment (72.2%), followed by, Challenger, Biover and Bioranza which gave 71.8, 70.2 and 69.8% reduction, respectively. While, Chemi oil at 1 and 2% were the least effective treatments (60.6 and 64.9% reduction, respectively).

**Residual effect after three weeks of application**

Reduction percentage in different stages and the total population of the Maskell scale insect, *I. pallidula* after three
weeks of application with tested treatments were depicted in Table 1. Data revealed that nymphs and gravid females were slightly more susceptible to the tested compounds than adult females. The general average of % reduction was 86.2, 81.02 and 78.4 for nymphs, gravid females and adult females. The statistical analysis also revealed significant differences among the tested treatments on the total population of this insect where F value was 5.12 and LSD value was 2.81 at 0.05 level of probability. Admiral, Biover, Challenger and Bioranza were statistically similar. However, mineral oil at 1 and 2% was significantly less effective (Table 1).

The aforementioned results are corroborate with the findings of Aleksidze et al. (1995) who reported that the application of mineral oils at the rate of 1.5% was effective against the over wintering stages. But the application of organophosphorus or pyrethroid (0.15%) insecticides was effective against the hatching crawlers. Helmy et al. (1997) however with different insect species and different host, observed that super Masrona oil gave a satisfactory initial effect on nymphs (88.63%) and adult females (85.66%) of A. aurantii (Mask) on sweet orange. Elwan et al. (2005) evaluated the efficiency of some pesticides for controlling the sugarcane soft scale, Pulvinaria tenuivalvata in sugarcane. They concluded that the effective tested

data represented in Table 1 revealed that nymphs and gravid females were more susceptible to the tested treatment than adult females. The general average of reduction was 91.04, 89.5 and 87.3%, respectively. Generally, all tested treatments gave satisfactory control. However, the statistical analysis revealed significant differences among the tested treatments on the total population of this insect where F value was 8.56 and LSD value at 5% level of probability = 8.4. Admiral, Biover, Challenger and Bioranza were statistically similar. However, mineral oil at 1% was significantly less effective (Table 1).

The data were summarized in Table 1. Based on the comparison among tested treatments on the general average of % reduction during the whole period (4 weeks), it could be concluded that Challenger and Admiral were the most effective treatments, however, Chemi oil was significantly less effective. It can be concluded from the results obtained that the tested treatments could be arranged according to their effectiveness against this insect population in the following descending order: Admiral was the most effective, followed by Challenger, Biover and Bioranza and finally Chemi oil 2% and Chemi oil 1%. However, the two synthetic insecticides and the two biopesticides were not significantly different when the comparison was based on % reduction after four weeks of application. Chemi oil was the least effective treatment even after doubling its concentration.

### Residual effect after four weeks of application

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### Table 1. Evaluation of certain chemical and non-chemical insecticides against different stages of *Insulaspis pallidula* (Green) counted on mango trees at weekly intervals up to four weeks post treatment.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate of application</th>
<th>% Reduction in the different stages</th>
<th>General average of % reduction during the whole period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial effect</td>
<td>Residual effect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 week</td>
<td>2 week</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pre-adults</td>
<td>Adult Females</td>
</tr>
<tr>
<td>Chemi oil</td>
<td>1%</td>
<td>55.0</td>
<td>42.1</td>
</tr>
<tr>
<td>Chemi oil</td>
<td>2%</td>
<td>59.3</td>
<td>48.6</td>
</tr>
<tr>
<td>Challenger</td>
<td>50 cm³</td>
<td>62.78</td>
<td>61.1</td>
</tr>
<tr>
<td>Admiral</td>
<td>50 cm³</td>
<td>63.8</td>
<td>57.5</td>
</tr>
<tr>
<td>Bioranza</td>
<td>200 g</td>
<td>62.1</td>
<td>52.3</td>
</tr>
<tr>
<td>Biover</td>
<td>200 g</td>
<td>60.9</td>
<td>56.3</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>60.6</td>
<td>53.0</td>
</tr>
</tbody>
</table>

### F Value between treatments
- LSD at 0.05 level: 2.81
Table 2. Evaluation of certain chemical and non-chemical insecticides against different stages of *Icerya seychellarum* counted on mango trees at weekly intervals up to four weeks post treatment.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate of application</th>
<th>% Reduction in the different stages</th>
<th>General average of % reduction during the whole period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial effect</td>
<td>Residual effect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 week</td>
<td>2 week</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pre-adults</td>
<td>Adult Females</td>
</tr>
<tr>
<td>Chemi oil</td>
<td>1%</td>
<td>75.9</td>
<td>77.2</td>
</tr>
<tr>
<td>Chemi oil</td>
<td>2%</td>
<td>79.5</td>
<td>77.2</td>
</tr>
<tr>
<td>Challenger</td>
<td>50 cm³</td>
<td>81.4</td>
<td>78.6</td>
</tr>
<tr>
<td>Admiral</td>
<td>50 cm³</td>
<td>80.4</td>
<td>75.0</td>
</tr>
<tr>
<td>Bioranza</td>
<td>200 g</td>
<td>83.01</td>
<td>81.0</td>
</tr>
<tr>
<td>Biover</td>
<td>200 g</td>
<td>81.8</td>
<td>77.5</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>80.3</td>
<td>77.9</td>
</tr>
</tbody>
</table>

**F Value**
- between treatments: 1.7, 1.5, 2.11, 4.1, 3.5
- L.S.D. at 0.05 level: N.S., N.S., N.S., 4.5, 4.8

**Residual effect after four weeks of application**

It was clear from the results presented in Table 2 that the gravid females were more susceptible to the tested treatments than adult females and nymphs. Moreover, all tested treatment gave satisfactory effects against the total population of this pest. However, Bioranza was the more effective treatment (93.3% reduction), followed by Biover and Admiral which gave 93.20 and 89.4% reduction, respectively. In general, as recorded in Table 2, it could be concluded that the tested compounds gave satisfactory control of *I. seychellarum* population within the period of four weeks after application. However, Chemi oil was statistically less effective against this insect species. Moreover, duplicating its rate of application did not significantly increase its performance. Data in Table 2, revealed the greatest reduction was recorded in the fourth week post-treatment followed by the third and was the most effective reducing the population density to 82.5, 82.22 and 80.1% for nymphs, gravid females and adult females, respectively. Statistically the variations among treatments were not significant in Table 2.

**Icerya seychellarum**

**Initial effect after one week of application**

Data represented in Table 2 revealed that nymphs were more susceptible than adult females and gravid females. Concerning the effect of treatments on the total population density, analysis of variance revealed insignificant differences where F value was 1.48 and their effects ranged from 75.8 to 80.6% with no significant differences between them in this respect.

**Residual effect after two weeks of application**

The more reduction percentages were recorded in the population of nymphs as well as gravid females while adult females were the least responded stage. Bioranza was the most effective reducing the population density to 82.5, 82.22 and 80.1% for nymphs, gravid females and adult females, respectively. Statistically the variations among treatments were not significant.
the 2nd weeks with % reduction averaging 89.4, 84.2, 78.9 and 78.2%, respectively. On the other hand, the results obtained that based on the initial and residual effects of tested formulations within the first three weeks after application, tested treatments were not significantly different in their performance against this insect species. However, the data obtained after 4 weeks, showed that the two biological control agents (Bioranza and Biover) were superior in their use effectiveness, but they came in the same statistical order of the two synthetic insecticides (Challenger and Admiral). Duplicating the concentration of Chemi oil did not significantly enhance its performance.

Previous studies by Aytes et al. (1997) stated that the recommended concentration of summer oils was found to be more suitable and effective. Negm et al. (2001) reported that the highest percentage of reduction of the mealybug, Icerya seychellarum infested mulberry trees was 90.8% with Cidial were used at a rate of (420 litter/feddan). They also recommended to use mineral oils because they are local products, safe and more economical than conventional insecticides. Mangoud et al. (2007) mentioned that the tested natural based formulations (Biover, Bioranza and Super Masrona oil) was more effectiveness than compared with Sumithion against different stages of I. seychellarum. The aforementioned results emphasize that; Admiral was the most effective treatment against I. pallidula, followed by Challenger, Biover, Bioranza, Chemi oil 2% and Chemi oil 1%. While, Bioranza and Biover were highly effective treatments against I. seychellarum, followed by Challenger, Admiral, Chemi oil 2% and Chemi oil 1%. The mineral oil was the least effective in controlling either of the two pest species and doubling the concentration of mineral oil did not significantly enhance its performance. The greatest effectiveness of these products was observed four weeks after application for controlling the scale insect and mealybug infesting mango trees.

Conflict of interest

Authors have none to declare.

REFERENCES


