*J.Pest Cont. & Environ. Sci. 7( 3 ): 15 - 24 (1999).*

# Evaluation of Some Local Spray Oils and Bio- Insecticides for the Control of Citrus White Flies and Mealy-Bug on Citrus Trees.

By

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*Recived 16/6/1999, Accepted 3/9/1999*

## ABSTRACT

This study was conducted to evaluate the efficacy of some local mineral oils at late winter, for controlling citrus mealy-bug, *Planococcus citri*,(Risso) and two citrus white flies, *Acaudaleyrodes citri* (Priesner & Hosny) and *Dialeurodes. citri* (Ashmed).

The study indicated that Masrona oil is the most effective one against the two citrus white flies, *A. citri* and *D. citri*. The other oils were arranged in the following order Masrona, Albolium and Folk respectively for *A. citri*, while, it was Masrona and Albolium for *D. citri*,. On the other hand, There was no significant effect between Folk and the control .

Studying the efficiency of five meniral oils against citrus mealy-bug, *P. citri* indicated that effective materials were Folk, Kz oil, Royal oil , super Royal and Masrona oil respectively. On the other hand the highest percentage of reduction of *P. citri* was recorded after 4 and 6 weeks.

The laboratory study for three mineral oils and three bio-insecticides on citrus mealy-bug indicated that, the citrus mealy-bug, *P. citri* was more susceptible to the tested local mineral oils and bacterial compound (Spinosad) and less susceptible to fungi compounds (Natural L and Bio fly). The toxicity of the tested compounds were highly significant with more time and concentrations.

The tested compounds can be arranged descendingly as $LC_{50}$ as follows : Spinosad, Natural-L, Masrona, Albolium, Kz and Biofly after 96 hrs.

## INTRODUCTION

The citrus trees are attacked by many scale insects, mealy-bugs, white flies and other pests which cause serious damage and noticeable reduction in the yield.(Helmy *et al.*, 1984 and Moursi *et al.*,1991).

The citrus white flies, *Dialeurodes citri* (Ashmed) and *Acaudaleyrodes citri* (Priesner & Hosny) suck phloem sap causing leaves to wilt and drop when populations are large. The honeydew excreted by the nymphs collects dust and supports the growth of sooty mold. Large infestations can almost blacken entire trees, reducing photosynthetic activity and causing defoliation.(Clark *et al.*, 1992 and Shaaban & El-Sheikh, 1988).

The citrus mealy-bug, *Planococcus citri* (Risso) occur on a wide variety of fruit trees, field crops and ornamental plants. It can be a pest of citrus in certain areas of the world. It extracts plant sap, reducing tree vigor and excretes honeydew which provides a medium for the growth of sooty mold. (Mckenzie, 1967 and Oetting *et al.*, 1984).

The present investigation was undertaken to investigate the effectiveness of late winter spray of five local mineral oils at the rate of 2 % on citrus mealy-bug and three local mineral oils on two citrus white flies. Also, a laboratory experiment was carried out to compare the effectiveness of the local mineral oils and bio-insecticides on the citrus mealy bug.

## MATERIALS AND METHODS

**Field experiment :-**

The field experiment was conducted in the last week of February, 1997 in a private orchard of Washington Navel orange located at Maamora, Alexandria district. All trees were of the same age and of approximately 3 maters height. Treatments were replicated three times, and were randomly distributed over thirty trees. The local mineral oils were Royal oil, Super Royal, KZ, Masrona and Folic with the rate of application of each as 2%.

Sixty leaves from each treatment were selected at random. Pre-treatment and post-treatment counts were immediately recorded before and after spraying (2, 4. 6, and 8 weeks). The living insects (immature and

adults) were examined.

To evaluate the efficiency of the tested materials, percentage of reduction was determined according to Stafford & Summer (1963).Analysis of variance and LSD value for comparing the mean of each treatment was adopted (Snedecor, 1961).

**Laboratory experiment :**

Potatoes buds were sprayed with a series of the tested compound concentrations by micro manual atomizer to assure homogenity spraying and replicated three times for each concentration.

Ten adult females of *Planococcus citri* were transferred individually from stock culture using a fine-point prob. The tested materials were :-

**Three local mineral oils :**

Masrona oil, produced by Egyptian Co. of petroleum.
Kz oil, produced by Kafr El-Ziat Co. for pesticides and Chemicals.
Albolium, produced by Kafr El-Ziat Co.
Three bio-insecticides
Spinosad (44%) : It is a mixture of spinosyn A and D. It's naturally derived from new species of Actinomycetes, *Saecharopolyspora spinosa*, which is characterized as bacteria. ($2.3 \times 10^7$ conidia/ml).
Natural-L (27%) : It is a fungi, *Beanvaria bassiana* + 73% Inert.
Bio-fly (100%), it is the previous fungi without inert.

The mineral oils were used at concentrations of 4000, 7500, 15000 and 30000 ppm, while the bio insecticides concentrations. were, 1000, 2500, 5000 and $10^4$ ppm.

Mortality was recorded after 24, 48, 72 and 96 hrs according to the preliminary tests. This assay method is a modified technique of Fisher and Wernch (1986). Analysis of data by probit regressions was carried out according to Finney, 1971. $LC_{50}$'s, $LC_{95}$'s, Slope, Chi-square ($X^2$) and Probability (P) were also calculated.

## RESULTS AND DISCUSSIONS

**Field experiment :-**

The experiment was conducted to evaluate the efficacy of local

mineral oils at late winter, just before leaf emergence in the early spring for controlling citrus mealy-bug, *Planococcus citri*,(Risso) two citrus white flies, *Acaudaleyrodes citri* (Priesner & Hosny) and *Dialeurodes. Citri* (Ashmed).

Data shown in Table (1) and Fig. (1) clearly indicate that Masrona oil is significantly more effective against the two citrus white flies, *A. citri* and *D. citri*. Materials could be arranged according to the mean reduction percentage of *A. citri* population in the following order; Masrona (92.33%), Albolium (65.29%) and Folk (53.72%) while the natural reduction in the control was 39.36%. On *D. citri*, the mineral oils could be arranged as Masrona (92.34%) and Albolium (60%). On the other hand, There were no significant effect for the Folk treatment compound (47.47) to the natural reduction in the control (38.76%).

Comparing the efficiency of Masrona oil at different intervals from spray application, is shown in the data recorded in Table (1) and Fig (1) which show that, oil was effective significantly against *A. citri* and *D. citri* at different intervals from spray.

The efficiency of five mineral oils on reduction percentage through the different examined periods of citrus mealy-bug, *P. citri* is presented in Table 2 and Fig 2.

Results in Table 2 clearly indicated that the reduction percentage amounted to 92.17% for Folk; 90.84% for Kz oil and 80% for Royal oil with significant differences between them. Materials could be arranged according to the mean reduction percentage of *P. citri* population in the following order; Folk, Kz oil, Royal, super Royal and Masrona oil, while the natural reduction in the control was 13.33%. (Table 2 and Fig. 2).
Comparing the efficiency of the different treatments of the tested oils at different intervals after application Fig (2) shows that the high percentage of reduction of *P. citri* was recorded after 4 and 6 weeks.

Concerning the side effects of the spray local mineral oils on citrus trees, field observations revealed negligible leaf drops.
It is worthy to mention here that the local mineral oils were more effective for controlling citrus white flies and mealy-bug. It is well known that the local mineral oils have least harmful effects on the beneficial species as parasites and predators and for the environment. These results agree with those obtained by El-Sebae *et al.*, (1976), Helmy *et al.*, (1984), Moursi *et al.*, (1991), Yigit *et al.*, (1992) and Gomma *et al.*, (1995).

**Table (1) : Efficacy of three local mineral oils against two citrus white flies, A. citri & *D. citri* during late winter season, 1997 in Alexandria district.**

| Treatments | Reduction (%)after | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *A. citri* | | | | | *D. citri* | | | | |
| | 2 weeks | 4 weeks | 6 weeks | 8 weeks | Mean | 2 weeks | 4 weeks | 6 weeks | 8 weeks | Mean |
| Folk | 54.00 | 53.72 | 51.18 | 56.00 | 53.72$^{c}$ | 55.00 | 46.68 | 33.20 | 55.00 | 47.47$^{c}$ |
| Masrona | 97.29 | 89.24 | 98.12 | 84.69 | 92.33$^{a}$ | 98.66 | 100.0 | 100.0 | 70.70 | 92.34$^{a}$ |
| Albolium | 96.00 | 39.59 | 73.40 | 52.17 | 65.29$^{b}$ | 60.00 | 60.00 | 60.00 | 60.00 | 60.00$^{b}$ |
| Control | 46.72 | 51.15 | 20.22 | 39.35 | 39.36$^{d}$ | 46.25 | 47.02 | 32.42 | 29.34 | 38.76$^{c}$ |
| $LSD_{0.05}$ | 4.420 | | | | | 8.91 | | | | |

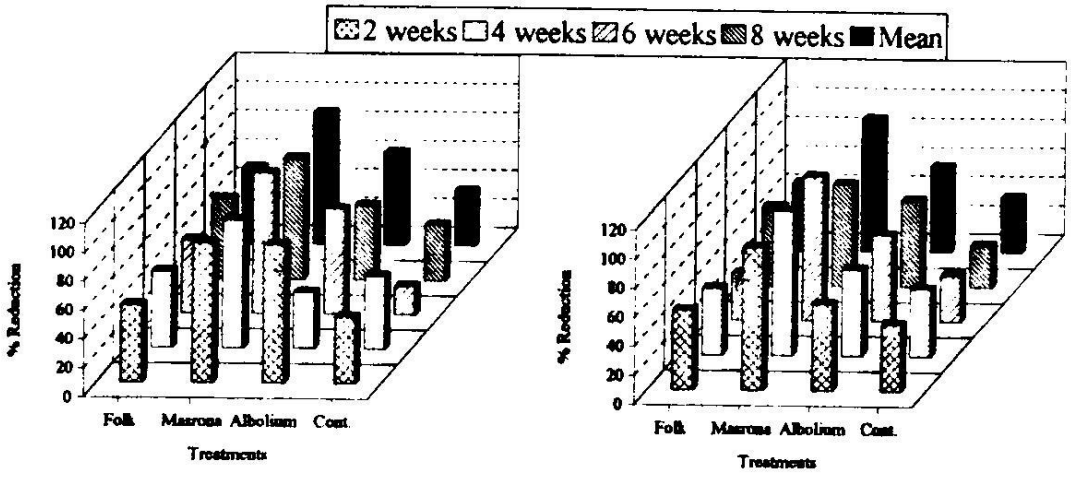

**Table (2) : Efficacy of five local mineral oils against citrus mealy-bug, *P. citri* during late winter season, 1997 in Alexandria district.**

| Treatments | Reduction (%)after | | | | |
|---|---|---|---|---|---|
| | 2 weeks | 4 weeks | 6 weeks | 8 weeks | Mean |
| Folk | 86.66 | 86.00 | 100.0 | 96.00 | 92.17 [a] |
| Masrona | 93.34 | 82.86 | 80.00 | 50.00 | 76.55 [b] |
| Kz oil | 100.0 | 100.0 | 70.00 | 93.34 | 90.84 [a] |
| Super Royal | 73.34 | 100.0 | 66.68 | 73.34 | 78.34 [b] |
| Royal | 40.00 | 80.00 | 100.0 | 100.0 | 80.00 [ab] |
| Control | 10.00 | 00.00 | 16.66 | 26.66 | 13.33 [c] |
| $LSD_{0.05}$ | 1.98 | | | | |

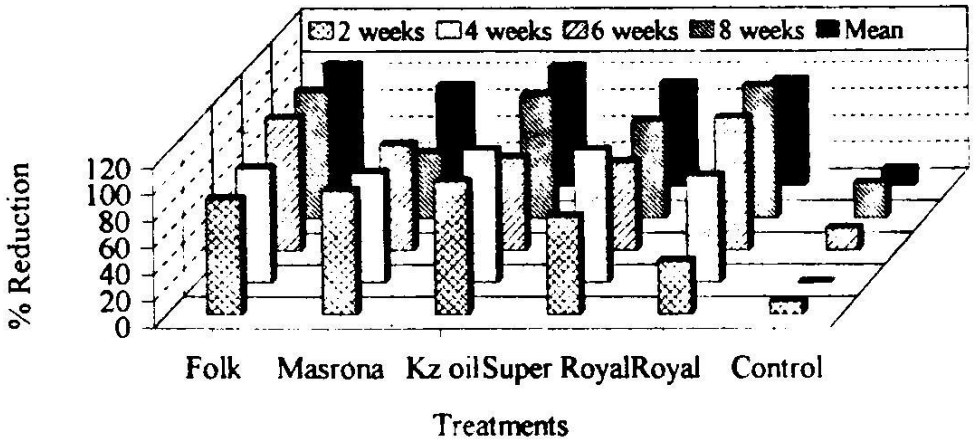

**Table (3) : Toxicity of three local mineral oils and three bio-insecticides on citrus mealy-bug (*Planococcus citri* ).**

| | Time | Mortality (%) | | | | Confidence limits at 95% level | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (h) | 4000* | 7500 | 15000 | 30000 | $LC_{50}$ | $LC_{95}$ | Slope | **$X^2$ | P |
| Masrona | 24 | 8.33 | 25.00 | 26.66 | 33.33 | 77240.72 | 5494566 | 0.239 | 0.975 | 0.613 |
| | 48 | 21.66 | 36.66 | 48.33 | 68.33 | 14370.87 | 219617.7 | 0.209 | 0.105 | 0.949 |
| | 72 | 31.66 | 46.66 | 68.33 | 83.33 | 7973.290 | 76661.23 | 0.224 | 0.299 | 0.985 |
| | 96 | 41.66 | 56.66 | 78.33 | 95.00 | 5598.040 | 36733.00 | 0.277 | 0.385 | 0.824 |
| Kz-Oil | 24 | 5.00 | 18.33 | 28.33 | 36.66 | 4702.29 | 855819.7 | 0.268 | 0.600 | 0.741 |
| | 48 | 11.66 | 25.00 | 45.00 | 60.00 | 19653.96 | 195719.5 | 0.232 | 0.112 | 0.945 |
| | 72 | 18.33 | 35.00 | 66.66 | 81.66 | 11541.96 | 74108.09 | 0.239 | 0.335 | 0.954 |
| | 96 | 28.33 | 45.00 | 71.66 | 91.66 | 7881.32 | 43788.38 | 0.262 | 0.227 | 0.893 |
| Albolium | 24 | 5.00 | 18.33 | 23.33 | 31.66 | 70853.09 | 2087578 | 0.273 | 0.659 | 0.719 |
| | 48 | 13.33 | 23.33 | 38.33 | 53.33 | 25566.94 | 407213.9 | 0.227 | 0.727 | 0.996 |
| | 72 | 21.66 | 38.33 | 53.33 | 76.66 | 11881.80 | 114395 | 0.219 | 0.143 | 0.930 |
| | 96 | 35.00 | 46.66 | 75.00 | 85.00 | 7145.76 | 63624.06 | 0.232 | 0.376 | 0.828 |
| | | 1000* | 2500 | 5000 | 10000 | $LC_{50}$ | $LC_{95}$ | Slope | **$X^2$ | P |
| Spinosad | 24 | 23.30 | 38.33 | 55.00 | 60.00 | 4793.59 | 194495.6 | 0.159 | 0.224 | 0.894 |
| | 48 | 28.30 | 45.00 | 66.65 | 86.65 | 2540.75 | 25040.48 | 0.181 | 0.431 | 0.806 |
| | 72 | 38.30 | 53.30 | 83.33 | 93.33 | 1688.91 | 13393.15 | 0.206 | 0.988 | 0.609 |
| | 96 | 43.30 | 56.65 | 88.30 | 98.33 | 1461.93 | 9099.33 | 0.243 | 2.050 | 0.358 |
| Natural-L | 24 | 20.00 | 35.00 | 38.33 | 43.33 | 15288.20 | 5850480 | 0.161 | 0.271 | 0.872 |
| | 48 | 25.00 | 38.33 | 46.66 | 48.33 | 8902.31 | 3255408 | 0.154 | 0.231 | 0.891 |
| | 72 | 33.33 | 41.66 | 48.33 | 53.33 | 6512.23 | 9551235 | 0.148 | 0.424 | 0.966 |
| | 96 | 40.00 | 45.00 | 55.00 | 58.33 | 3519.27 | 7505683 | 0.146 | 0.267 | 0.964 |
| Bioflay | 24 | 16.66 | 30.00 | 31.66 | 31.66 | 71415.57 | 2.8E+8 | 0.169 | 0.481 | 0.786 |
| | 48 | 25.00 | 35.00 | 40.00 | 38.33 | 36263.63 | 6.4E+8 | 0.155 | 0.264 | 0.876 |
| | 72 | 30.00 | 36.66 | 41.65 | 46.66 | 15225.36 | 8.3E+7 | 0.151 | 0.269 | 0,991 |
| | 96 | 33.33 | 40.00 | 43.33 | 51.66 | 9361.36 | 3.8E+7 | 0.148 | 0.374 | 0.981 |

* Concentration by ppm

** Chi squared

Data in Table (3) showed that, the citrus mealy-bug, *P. citri* was more susceptible to the tested local mineral oils and bacterial compound (Spinosad) and less susceptible to fungi compounds (Natural L and Bio fly). The toxicity of the tested compounds were highly significant with time and concentrations. If concentration and time increase the toxicity increases and vise versa. Values of $LC_{50}$'s (ppm.) showed that the toxicity of the tested materials can be arranged descending lye as follows : Spinosad (1461.93) > Natural L (3519.27) > Masrona (5598.0) > Albolium (7145.76)> Kz (7881.32) > Biofly (9361.36) after 96 hrs (Table3).

The data also cleared that Spinosad was the most effective bio-insecticide against *P. citri* while Biofly was the least effective one, Also, it can be noticed that, although Natural L and Biofly have the same biotic agent, *B. bassiana*, the Natural L is more effective because it contain 73% inert.

This data agree with that obtained by Shehata *et al.*, (1993) who recommended that one spray of *Bacillus pumilus* at the rate of $10.9 \times 10^5$ spore / ml or *B. thurengensis* at the rate of $74.4 \times 10^6$ spore / ml are adequate effective to control the scolytid bark beetle, *Hypoborus ficus* Eric. On fig.

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## الملخص العربى

# إختبار بعض الزيوت المعدنية والمبيدات الحيوية ضد نوعين من ذباب الموالح الأبيض وبق الموالح الدقيقى على أشجار الموالح

**مصطفى فتح الله الديب**
معهد بحوث وقاية النبات - مركز البحوث الزراعية
الصبحية - الإسكندرية

تم إختبار ثلاث زيوت معدنية محلية (فولك ، مصرونا ، البوليم) على نوعين من ذباب الموالح الابيض وخمسة زيوت معدنية محلية (فولك ، مصرونا ، كزد ، سوبر رويال ، رويال) على بق الموالح الدقيقى بإحدى حدائق الموالح بالمعمورة.

وأوضحت نتائج الدراسة أن زيت المصرونا كان أكثرها تأثيرا على ذباب الموالح الابيض، وكذلك لم يكن هناك فروق معنوية بين زيت الفولك وزيت الكزد والرويال في التاثير على خفض تعداد بق الموالح الدقيقى وإن كان زيت الرويال أكثرها تأثير بعد ٤ ، ٦ أسابيع حيث اعطى اعلى نسبة خفض فى التعداد (١٠٠%).

وفى الدراسة المعملية على حشرة بق الموالح الدقيقى لإختبار ثلاث زيوت معدنية محلية (مصرونا ، كزد ، البوليم) وثلاث مبيدات حيوية (سبينوساد (بكتيرى) ، ناتشرال-ل (فطرى) ، بيوفلاى (فطرى)) أوضحت الدراسة أن هناك علاقة طردية بين الزمر والتركيز والسمية، وأن المبيد الحيوى البكتيرى كان أكثر سمية من المبيدات الحيوية الفطرية. وكان ترتيب السمية عن طريق التركيز القاتل لـ ٥٠% من الحشرات كالأتى : سباينوساد > ناتشرال-ل > مصرونا > البوليوم > كزد > بيوفلاى بعد ٩٦ ساعة من المعاملة.