J. Pest Control & Environ. Sci. Vol 3 No. 1 : 130 - 142 (1991)

FIELD AND LABORATORY EVALUATION OF CERTAIN INSECTICIDES AGAINST APPLE WOOLY APHID *Eriosoma lanigerum* (Hausmann)

Ahmed A. Zaytoon, Mohamed S. Shawir* and Tawfik A. Hassan**
Division of Entomology, Faculty of Agriculture, University of Alexandria, Egypt.
*Division of Pesticides Chemistry, Faculty of Agriculture, University of Alexandria, Egypt.
**Faculty of Agriculture, University of Sanna, Yemen.

ABSTRACT

The compatibility of mineral oil mixed with pirimiphos-methyl (50% E.C.) or chlorpyrifos (48% E.C.) was tested before and after mixing in both laboratory and the field . No creaming separation was observed in the field and the mixtures thus passed the emulsion stability standard test. Mixing of chlorpyrifos with mineral oil improved the phsico-chemical properties of the mixtue because it incrased the rate of spontaneous emulsification. Mineral oil, pirimiphos-methyl, chlorpyrifos, cypermethrin (20% E.C.) and methomyl(90% SP) as well as the mixture of pirimiphos-methyl or chlorpyrifos with mineral oil were tested in the laboratory for their toxicity against *Eriosoma lanigerum* the apple wooly aphid, by using two application methods.

chlorpyrifos/oil mixture was the most toxic followed in a descending order by pirimiphos-methyl/oil mixture, chlorpyrifos and pirimiphos-methyl. Methomyl and cypermethrin were the least toxic insecticides; based on concentration/mortality regressions. Under the field testing concentrations, the highest reduction in field population was gained after treatment with chlorpyrifos/oil mixture, while the single oil treatment gave less reduction.

INTRODUCTION

Aphid are among the important fruit insect pest worldwide The widespread use of insecticides on this pest had led to the development of resistance throughout the world. Petroleum oil formulations have been used as insecticides in Egypt for a long time and they are still effective against many types of insects. No incidence of developed resistance to mineral oils has been recorded in any treated pest under field conditions for several successive generations, because of its physical mode of toxic action (El-Sebae, 1970; El-Sebae et al 1978; Dodwell and Harrison, 1983).

The oil has been used for years in dormant spray applications on apple trees for the control of aphids. To avoid injury to fruit and foliage; (Wilson, 1962) used 0.5% instead of 2% concentration in dormant applications in summer.

Organophosphorus insecticides were used in orchards for several years and replaced DDT and lead arsenate (Penman and Chapman, 1980). Triavop(4.3% dimethoate and 30% light oil) at the concentration (0.8-1.4%) was effective against all forms of aphids (Natskova, 1984). The apple wooly aphid *E. lanigerum*, has developed resistance to the used insecticide; so alternative chemicals have been required periodically for aphid control.

The present work is carried out to find an alternative insecticide effective against apple wooly aphid.

MATERIALS AND METHODS

Insect

Field strain batches of *E. lanigerum* were collected from apple trees (Edko region, El-Bohera governorate). Tissue paper within perforated plastic bags were used to transfer batches from the field to the laboratory. The batches were employed for bioassay tests in the same day of collection.

Insecticides

The following formulated insecticides were evaluated in the course of the present work:- pirimiphos-methyl(Actellic, 50% E.C.), chlorpyrifos(Dursban, 48% E.C.), cypermethrin (Cypergard 20% E.C.) and methomyl(Lannate, 90% S.P.).

The mineral oil was supplied by Amerria Petroleum Refinement Company, Alexandria, Egypt, and purified

according to Hassan, 1990. It has specific gravity of 0.8585g/cc.; Saybolt viscosity of 64 Saybolt sec. USR of 94.8%; distillation 354 C° and flash point by Cleveland open tester of 310 C°.

-Emulsion Stability and Spontaneous emulsification tests.

Emulsion stability test was carried out according to WHO specifications(Annonymous, 1979), and the method of spontaneous emulsification was done according to(El-Sebae and El-Akkawi, 1971).

-Compatibility of emulsifiable mineral oil with emulsifable concentrate of insecticides.

The method of emulsion stability test was used in the determination of compatibility of the emulsifiable mineral oil with chlorpyrifos and pirimiphos-methyl. The tests were carried out at the field dilution and WHO concentration. The amount of creaming, separation and spontaneous emulsification were recorded.

-Expermintal methods

a. Dipping methods:-

Apple branches containing batches of 20-30 aphids were immersed in various insecticide concentrations of aqueous preparations for 10 seconds. Branches partly dried and held in a glass cup (250 cc.,capacity), covered with muslin texture and mortality percentage was recorded 24 hours after exposure. Binocular microscope was used in recording the mortality data. Three replicates were carried out for each

concentration.

b. Residual film method:-

Filter papers (Whatman's No.1, 9cm diameter) were dipped for 15 seconds in the prepared concentrations of insecticides. Filter papers were dried for an hour after treatment. Ten aphids were placed on a treated filter paper within Petri dish. The aphids were held for 24 hours without food, at 25 C° and 70±5 % relative humidity. The mortality counts were recorded after 24 hours. Every concentration was triplicated. Values of LC 50 were determined directly from the dosage-mortality regression lines.

Abbott's formula (1925) was used to correct mortality percent. Statistical analysis was carried out according to Litchfield and Wilcoxon (1949).

c. Field evaluation:-

A field experiment was carried out to study the toxicity of chlorpyrifos and chlorpyrifos/oil mixture against *E. lanigerum* in comparision with pirimiphos-methyl/oil mixture and pirimiphos-methyl which is recomended for controling aphids. The experiment was conducted at a farm in Edko region. A randamize sample of infested apple trees were chosen for each treatment (five plus control). The mixtures of the two insecticides with oil were prepared at the recomended concentration of each insecticide alone with (0.25% oil) to avoid any phytotoxicity of the mineral oil.

RESULTS AND DISCUSSION

- Spontaneous emulsification test.

Spontaneous emulsification test was carried out for the mineral oil, pirimiphos-methyl and chlorpyrifos alone and their mixtures. The obtained results were recorded in (Table 1). Pirimiphos-methyl and chlorpyrifos gave high spontaneous emulsification (100%) at field and WHO concentrations using hard water, but mineral oil gave low spontaneous emulsification, because it had a speceific gravity less than that of water. The data are in good agreement with the results of (El-Sebae, and El-Okda, 1972). Mixing of chlorpyrifos with mineral oil improved the physico-chemical property of the treated mineral oil; it increased the amount of spontaneous emulsification at the field and WHO concentration.

-Compatibility of emulsifiable mineral oil with emulsifiable concentrate of insecticides.

The compatibility of treated mineral oil with pirimiphos-methyl and chlorpyrifos were studied using hard water at the field and WHO concentration. Data in (Table 1) showed that all mixtures of mineral oil with pirimiphos-methyl and chlorpyrifos passed the test. The compatibility test should alawys be checked before mixing of the pesticides in the field application(Matthews, 1985). Mixing of chlorpyrifos with mineral oil improved the physico-chemical property of

Table (1) : Spontaneous emulsification and compatibility of emulsifiable mineral oil with chlorpyrifos and pirimiphos-methyl (1:1 v\v)

Serial No.	Treatment	Field concentration		WHOconcentration	
		Spon Test%	Comp. Test Sep.(ml)	Spon. Test%	Comp.Test Sep.(ml)
1	Chlorpyrifos	100.0	0.0	100.0	0.0
2	Pirimiphos-methyl	100.0	0.0	100.0	0.0
3	Treated mineral oil	18.0	0.7	30.0	1.0
4	1 + 3	20.0	0.0	40.0	0.0
5	2 + 3	8.0	0.7	18.0	1.0

Spon. = Spontaneous emulsification
Comp. = Compatability
Sep. = Separation

Table(2) : Laboratory Toxicity of the tested insecticides against a field strain of *E. lanigerum* by the dipping Technique.

Insecticide	LC_{50} (ppm)	Confidence limits of LC_{50}	Slope
Pirimiphos-methyl	17.0	12.14 - 24.57	1.00
Pirimiphos-methyl/oil mixture	4.0	1.90 - 8.46	0.59
Cypermethrin	35.0	21.20 - 57.90	0.92
Chlorpyrifos	9.5	6.60 - 13.70	1.10
Chlorpyrifos/oil mixture	1.0	0.58 - 1.83	0.72
Methomyl	20.0	11.40 - 35.10	0.79

mineral oil alone give < 50% mortality.

the treated mineral oil; it did not give any creaming separation under the field concentrations. The improvement of emulsion stability properties is due to the amount and type of surfactants, which already are present in the chlorpyrifos formulation.

-The insecticidal efficacy:-

The values of LC 50, confidence limits and the slope are presented in (Table 2). The results of dipping methods showed that chlorpyrifos/oil mixture was the most effective treatment followed by pirimiphos-methyl/oil mixture, chlorpyrifos, pirimiphos-methyl, methomyl and cypermethrin. Mineral oil treatment (0.25%) gave less than 50% mortality. In the residual film technique chlorpyrifos/oil mixture gave the higher efficacy while methomyl gave the lower efficacy (Table 3). In general the insecticide/oil mixtures were more toxic to *E. lanigerum* than insecticide alone. Also the organophosphorus insecticides (pirimiphos-methyl and chlorpyrifos) were more effective than the oxime carbamate (methomyl) or the synthetic pyrethriod (cypermethrin). The obtained results were in good agreement with the results of Jackson and Wilkins, 1985. They found that pyrethriods, being contact insecticides, are less successful as aphicides than systemic insecticides. Moreover, the method of application affects the efficiency of insecticides. The insecticides and their mixtures with oil were effective when the aphids were treated by dipping than by the residual

Table (3): Laboratory Toxicity of the tested insecticides against a field starin of E. lanigerum By the residual film method

Insecticide	LC50 (ppm)	Confidence limits of LC50	Slope
Pirimiphos-methyl	40.0	19.40 - 82.40	0.80
Pirimiphos-methyl/oil mixture	10.0	3.92 - 25.50	0.70
Cypermethrin	28.0	14.00 - 56.00	0.83
Chlorpyrifos	14.0	7.18 - 27.30	1.00
Chlorpyrifos/ oil mixture	5.0	2.12 - 11.78	0.97
Methomyl	130.0	70.27 -240.50	0.93

mineral oil alone give < 50% mortality

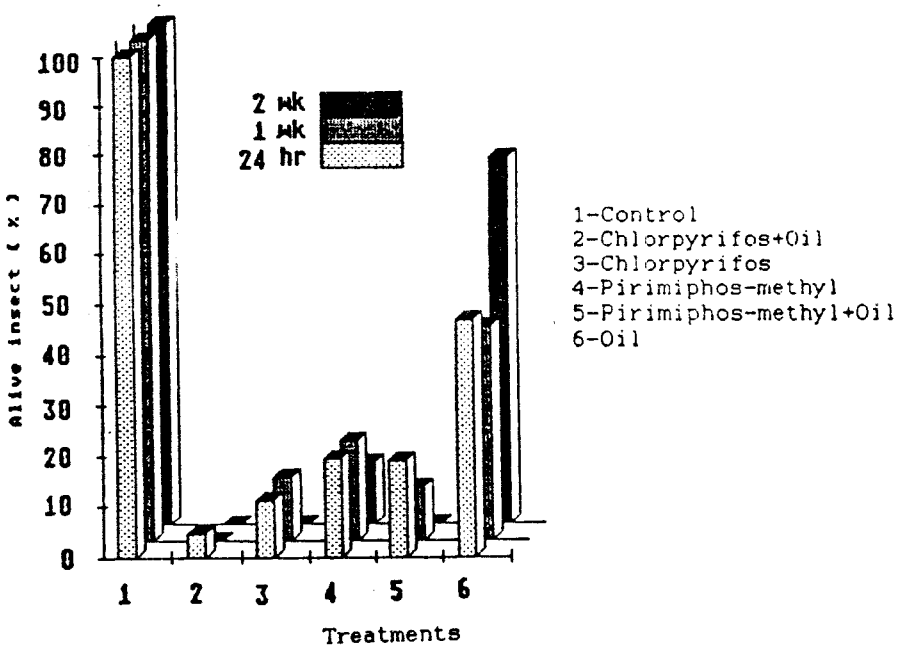

Fig (1) Effect of the tested insecticides on a field strain of E. lanegrium under field condition

film, so if the application of insecticides covering every part on an apple tree, it will give a good effeciency in controlling aphids.

Fig. 1, illustrated the percent reduction in *E. lanigerum* population after treatment with pirimiphos-methyl or chlorpyrifos and their mixtures with oil. The highest reduction in *E. lanigerum* was gained after treatment with chlorpyrifos/oil mixture and the least reduction was for the single oil treatment. The results suggest the possible use of chlorpyrifos/oil mixture or chlorpyrifos alone as an alternative compound to control *E. lanigerum*. In addition a good coverage of foliage will give a good efficacy.

ACKNOWLEDGMENT

The authers would like to thank Prof. A. H. El-Sebae and Prof. Sh. M. I. Kassem for their kind help through out this work.

REFERENCES

Abbott, W. S (1925). A method of comparing the effectiveness of an insecticide. J. Econ. Entomol. 18: 265-267.

Anonymous (1979). Specifications for pesticides used in puplic health. World Health Organization (WHO), pp. 327

Dodwell, R. C. and R. L. Harrison (1983). Arosurf MSF: a new larvicide and pupicide for mosquito control. Proc. and

papers 36th Annual Meeting of the Utah Mosq. Abatement Assoc., Eccles Conf. Center, Utah State Univ., Logan, Utah, Oct. 3-4. (Eds., B. Rosay and G.C.Collett). [CAB Abstracts 1984- June, 1987, 02352880J072].

El-Sebae, A. H. (1970). Studies on chemical structure and insecticidal activity. III. Toxicity and joint action of surface active agents. Alex. J. Agric. Res., 18(2): 263-267.

El-Sebae, A. H. and M. M. El-Akkawi (1971). Studies on the chemical structure and insecticidal activity. IV. Efficiency of locally formulated spray mineral oils. Alex. J. Agr. Res. 19: 131-138.

El-Sebae, A. H. and M. K. El-Okda (1972). Studies on local formulation of emulsifiable insecticides concentrates. Bull. Ent. Soc. Egypt. Econ. Ser., VI: 67-71.

El- Sebae, A. H.; F. A. Hassan-Eldeen; M. Abo-Elamayem and A. El-Marei (1976). Insecticidal eficiency of miscible spray petroleum oils formulated from locally produced Egyptian ingredients. 2nd Arab conf. on petro chemicals. Abu Dhabi, March 15-22.

Hassan, T. A. (1990). Factors affecting the efficiency of pesticides against economic pest, "formulation and insecticidal efficiency of mineral oils". Ph.D. Thesis, Fac. of Agric., Univ. of Alex., Alexandria, Egypt.

Jackson, A. E. M. and R. M. Wilkins (1985). The effect of sub-lethal dosages of the synthetic pyrethriod

fenvalerate on the reproductive rate of the aphid *Myzus persicae*. Pestic. Sci. 16, 364-368.

Litchfield, J. T., Jr. and F. Wilcoxon (1949). A simplified method of of evaluating dose-effect experiments. [illegible] Pharmacol. and Exp. Therap., 96: [illegible] 113.

Matthews, G. A. ([illegible]). Pesticide a[illegible]ation methods EB., [illegible] Group [illegible] England, pp. 336.

Moskova V. [illegible] Trlavnp. [illegible]aina Zashchita [illegible] 27. (CAB Abstract [illegible] 19:8, 024,0580807)

Penman, D. R. and R. I. Chapman (1980). Wooly [illegible] outbreak following use of fenvalerate in ap[illegible] Cantebury, New Zealand. J. Econ. Entomol. 73: 49-51.

Wilson, J. D. (1962). Oil sprays are being used as supplement to vegetable fungicide. Ohio Farm and Home Research, 47: 44-46.

الملخص العربي

تم اجراء اختبار القابلية للخلط لمبيد بيريميفوس - ميثايل او كلوربيريفوس مع الزيت المعدني قبل اجراء الخلط في كل من المعمل والحقل. فلم يلاحظ أي فصل لطبقة كريمية في الحقل في أي من خلائط المبيدات مع الزيوت المعدنية من خلال الاختبارات القياسية لثبات المستحلب حيث أن خلط مبيد الكلوربيريفوس مع الزيت المعدني حقق من الخواص الفيزيوكيميائية للزيت المعدني حيث أنها تزود معدل الاستحلاب اللحظي . وتم اختبار سمية كل من الزيت المعدني *بيريميفوس - ميثيل او كلوربيريفوس مع الزيت المعدني في المعمل ضد أنثة من التاج الصوفي باستخدام طريقتين للمعاملة . وأظهرت النتائج أن مخلوط كلوربيريفوس مع الزيت المعدني كان أكثر سمية مقارنة بما مخلوط بيريميفوس - ميثيل مع الزيت المعدني ثم كلوربيريفوس ثم بيريميفوس - ميثيل وكان كل من المخلوطين أكثر من المبيدات منفردة . وأوضحت النتائج الحقلية أن مخلوط كلوربيريفوس مع الزيت المعدني كان الأكثر فعالية في مكافحة من التاج الصوفي بينما أظهر الزيت المعدني أقل فعالية .