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COMPARISON BETWEEN SOME MINERAL OILS AND CIDIAL FOR CONTROLLING MEALYBUG *ICERYA SEYCHELLARUM* (WESTWOOD) ON MULBERRY TREES BY USING KNAPSACK MOTOR SPRAYER

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Abstract

Mealybug *Icerya seychellarum* is considered one of the most important economic insect of mulberry trees. This insect pest causes serious problems to silk industry in Egypt. So, the present study is an attempet to test two local mineral oils (KZ-oil and CAPL-2) against this insect with Arimitsu sprayer compared with one of the recommended insecticides (Cidial), with two application rates 420,630 lit,/ fed. Biological date revealed that, application rate 420 lit./fed. of Cidial insecticide with pnuematic-rotary-atomization induced sufficient control against this insect. Droplet spectrum of deposited spraying with 420 lit./fed. were 158 spots/Cm^2 having an average diameter (VMD) of 94 micrometer (μm). Next comes KZ-oil at the lower rate of application 420 lit./fed. and droplet spectrum of deposited spraying was 138 spots/Cm^2 having an average diameter of 103 μm. The lowest biological activity treatment resulted from CAPL-2 at the same rate of application. The droplet spectrum of deposited spray 143 spots/Cm^2 having VMD of 99 μm.

The best control result (90.8%) was achieved by Cidial insecticide using flow rate 420 lit./fed. higher rate of application (630 lit./fed.) gave the next level of control result (77.2%) followed by KZ-oil which gave 76.5%, 72.1% reduction using lower and higher rates of application (420 lit./fed., 630 lit./fed.), respectively. Similar trend was found with CAPL-2 where 69.6% and 63.8% were achieved by applying 420 lit./fed. and 630 lit./fed. successively.

INTRODUCTION

The margarodid mealybug, *Icerya seychellarum* (Westwood) could be considered as one of the main pests attacking mulberry trees *Morus alba* in Nile Delta which negatively affected sericulture and silkproduction.

This species is a polyphagous insect. It was first recorded in Egypt by Ezz and Samhan (1965) on five host plants at Suez. Shadia *et al.* (1991) found that the range

of host plants of this mealybug includes 44 plant species and varieties in five Governorates in Egypt; (Cairo, Giza, Qualubia, Beheira and Suez.), most of those host plants are economic horticultural plants belonging to several plant families. This giant mealybug mainly attacks the foliage, sucks a great amount of plant-sap for its protein requirements and secretes honey-dew. Most mealybug individuals are accumulated along the leaf veins underside especially along the mid-rib (Shadia, 1990).

The most effective treatment for controlling mealybug *Maconellicoccus hirsutus* on mulberry in Indonesia was cutting back and spraying with Fenitrothion (Anwar, 1991). In India, good control result was achieved by an inorganic oil (Atso) against the same bug on guava (Jalaluddin and Sadakathulla., 1998). On the other hand, spraying with either 0.08% of Chlorpyrifos, Acephate, Methyl demton, Monocrotofos, Quinalfos, Dimethoate, Phenothoate or 0.02% of Cypermethrin, Fenvalerate and Carbaryl were equally effective against mealybug *Drosiche magniferae* on guava (Ghule and Dhumal., 1992).

The use of crude diesel emulsion against *Icerya seychellarum* was recorded in Mauritius by (Jepson, 1983). In Egypt the most effectieve insecticides against the same bug were Malathion, Cidial and Actellic (Saad, 1980).

The aim of the present study is to evaluate the biological activity of two local, safe and cheap mineral oils: KZ and CAPL-2 compared to Cidial (the recommended insecticide) under two techniques of application.

MATERIALS AND METHODS

A. Sprayed chemicals

1. Mineral oils

a. KZ-oil: Local mineral oil, produced by Kafr El-Zayaat Co. for Pesticides and Chemicals, formulated as emulsifiable concentrate used at a concentration of 1.5% (v./v.).

b. CAPL-2: Local mineral oil, formulated by Central Agricultural Pesticides Laboratory as emulsifiable concentrate contained 96.62% base oil, used at a concentration of 1.5% (v./v.).

2. Insecticide used

Cidial (phenthoate) 50%: Organophosphourus pesticide, used at a concentration of 0.15% (v./v.).

B. Spraying machine and techniques

Knapsack motor sprayer Arimitsu with pneumatic/rotary atomizer working at 6000 r.p.m. and chemical tank capacity 16 liters, was used instead of hydraulic spraying machines to avoid wide range of droplet sizes produced with such technique (Maas, 1971; Gabir and Sawicki, 1978) which is considered as a powerless droplets from the spray quality point of view (Gabir *et al.*, 1991). Two flow discs No. 2 and 3 were tested having a flow rate 0.91 and 1.30 lit./min., producing spraying volumes of 420 and 630 lit./fed., respectively, at an average working speed 1.2 Km/h. The swath width obtained by both discs was 1.5 meter, as target spray.

C. Mulberry trees and location

The experimental area was about half feddan of Japanes mulberry trees, infested with the mealybug *Icerya seychellarum* (Westwood) located in El Kanater El Khairia, Qualubia Governorate, containing about 1050 trees with interval spaces of 1 and 2 meters between each other and their average heights were about 3 meters, with a diameter about of 2.5 meter.

This race of mulberry is a light-foliage tree in comparison with the local Egyptian race, its leaf area is about 4-5 times less than the Egyptian one.

D. Experimental design and assessment of data

Each treatment was divided into three random replicates as well as the untreated control treatment. Each replicate contained 50 trees aproximately and results were based on counts of living individuals on 30 mulberry leaves on both leaf surfaces, just before spraying and four counts at week intervals after spraying. Reduction percentages were estimated according to the equation of Henderson and Tilton (1955).

E. Timing of application and climatic conditions

Spraying application was carried out on November 13th, 1998. The average climatic conditions of air temperature, relative humidity and air speed were, 24°C, 60% and 0.5 m/sec., respectively, these conditions were favourable for spraying.

F. Qualitative evaluation of spray coverage

Measurements of size and number of deposited droplets were carried out by means of scaled monocular. All necessary corrections and calculations connected with such technique of measurement were undertaken to determine volume median diameter (VMD) and number of droplets per square centimeter were carried out according to (Anonymous, 1978).

RESULTS AND DISCUSSION

This study was conducted to disclose the effects of two different flow rates of atomizer on the performance of Arimitsu (Knapsack motor sprayer) and the biological activity of the three different chemicals, Cidial, KZ-oil and CAPL-2 against Mealybug, *Icerya seychellarum*.

Table 1 shows that, the coverage efficiency of this sprayer with two flow rates which produce 420 and 630 lit./fed., was homogeneous in volume median diameter (VMD) and number of droplets per square centimeter (No./Cm^2) of the treated leaves with Cidial, KZ-oil and CAPL-2. There is no clear difference in VMD in the three levels on treated trees, but there is a slight increase in the number of droplets per square centimeter in middle and lower levels than the upper one. VMD of the two rates of application, 420 and 630 lit./fed. ranged between 94 and 112 micrometers, while the droplets number per square centimeter was between 107 and 158 drop/Cm^2.

Generally, VMD and No./Cm^2 of droplets increased in discending order on the three levels of the treated trees: upper, middle and lower ones as shown in Table 1.

Data in Table 2 indicates the effects of the three chemicals as a result of the obtained good coverage of the produced spectrum specially with flow rate 420 lit./fed. Cidial insecticide was the most potent chemical after one, 2, 3 and 4 weeks of spraying, compared with KZ-oil and CAPL-2. The application of Cidial with flow rate 420 lit./fed. induced 86.2, 95.0, 86.4 and 95.5 reduction percentages after one, 2, 3 and 4 weeks, respectively compared with 80.6, 71.1, 69.1 and 87.8 reduction percentages for the same periods after application with flow rate 630 lit./fed.

The same table also, shows that, application of KZ-oil with flow rate 420 lit./fed. resulted in 66.7, 84.8, 71.0 and 83.6 reduction percentages after one, 2, 3 and 4 weeks, respectively compared with 71.6, 55.9, 71.2 and 89.5 reduction percentages for the same periods after spraying with flow rate 630 lit./fed.

It is clear that the application of CAPL-2 with flow rate 420 lit./fed. induced 57.9, 53.8, 78.4 and 88.4 reduction percentages after one, 2, 3 and 4 weeks, respectively compared with 51.6, 49.3, 62.6 and 91.8 reduction percentages for the same periods after spraying with flow rate 630 lit./fed.

From the obtained results it could be concluded that the application of the three tested materials against this insect with 420 lit./fed. achieved high percentages of reduction in the population densities of this insect in comparison with 630 lit./fed. This result means that, the reduction percentages could be improved with decreasing the application rate. This result agreed with Womac, *et al.* (1989).

Also, the results in Table 1 supported this conclusion which indicates that, the droplet spectrum of the low rate of application (420 lit./fed.) has higher number of droplets per square centimeter and lower VMD, compared with those produced from application rate (630 lit./fed.). These specifications achieved good coverage of the infested leaves on the treated three levels of the tree in agreement with El-Sayed *et al.*, (1992) who obtained good results against whitefly *Bemisia tabaci* with homogeneous coverage of spraying solution to inhabitant immature stages. Also, Carlos *et al.* (1995) stated that, effectiveness of any chemical material not only depends on the material used, but also on other factors such as application technology and rate of application.

CONCLUSION

The highest percentage of reduction of the mealybug *Icerya seychellarum* infested mulberry trees was 90.8% using Cidial insecticide at an application rate (420 lit./fed.) using Arimitsu knapsack motor sprayer.

A medium control (76.5%) was achieved by KZ-oil using application rate (420 lit./fed.), and followed by CAPL-2 (69.6%) at the same rate. This spraying technique is suitable for use in small farms because of reducing the spraying volume and also reducing total spraying costs. Low volume technique revealed a high reduction amount of the insecticide used rather than in using conventional ground motor as a high volume technique.

Wherever, the conventional ground motor is used a spray volume not less than 2000 lit./fed. is applied. Thus, the reduction percentages spray volume is about 80%.

In spite of the obtained results, it is recommended to use mineral oils because they are local productes, safe and cheap than conventional insecticide, but to be used in low volume spraying techniques with application rate 420 lit./fed.

Table 1. Spray coverage of tested pesticides on mulberry leaves using two different flow discs of atomizer.

Treatment / Spray Vol. / Tree level	KZ - oil				Cidial				CAPL-2			
	420 l./fed.		630 l./fed.		420 l./fed.		630 l./fed.		420 l./fed.		630 l./fed.	
	VMD	N/Cm^2	VMD	N/Cm^2	VMD	N/Cm^2	VMD	N/Cm^2	VMD	N/Cm^2	VMD	N/Cm^2
Upper	102	125	111	108	93	139	102	125	95	136	105	102
Middle	102	141	111	115	95	161	102	131	100	143	110	103
Lower	104	148	115	122	95	175	103	141	103	151	114	115
Mean	103	138	112	115	94	158	102	132	99	143	110	107

Table 2. Effect of tested pesticides on coccide bug *Icerya seychellarum* (Westwood) infested mulberry trees.

Pesticide	No. of alive insects/ treatment* and % reduction						Control
	KZ-oil		Cidial		CAPL-2		
Spray Vol.	420 l./fed.	630 l./fed.	420 l./fed.	630 l./fed.	420 l./fed.	630 l./fed.	
Before application	168.7	113.3	148.3	65.0	58.0	48.0	139.7
After one week	46.0 66.7%	26.3 71.6%	16.7 86.2%	10.3 80.6%	20.0 57.9%	19.0 51.6%	114.3
After 2 weeks	6.0 84.8%	11.7 55.9%	1.6 95.0%	4.4 71.1%	6.3 53.6%	5.7 49.3%	32.7
After 3 weeks	9.0 71.0%	6.0 71.2%	3.7 86.4%	3.7 69.1%	2.3 78.4%	3.3 62.6%	25.7
After 4 weeks	7.0 83.6%	3.0 89.5%	1.7 95.5%	2.0 87.8%	1.7 88.4%	1.0 91.8%	35.3
Mean (%)	76.5%	72.1%	90.8%	77.2%	69.6%	63.8%	

* Each treatment = 150 trees.

* No. of alive insects per 30 mulberry leaves.

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مقارنة بين بعض الزيوت المعدنية والسيديال فى مقاومة البق الدقيقى على أشجار التوت باستخدام موتور الرش الظهرى

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أجرى هذا البحث بمركز القناطر الخيرية - محافظة القليوبية عام ١٩٩٨ بغرض معرفة تأثير معدلات التطبيق المختلفة وذلك باستخدام حجمين من الرش هما ٤٢٠ لتر/ف، ٦٣٠ لتر/ف للرشاشة الأريميتسولرش كل من مبيد السيديال لمكافحة البق الدقيقى بمعدل ٠,١٥ لتر/١٠٠ لتر ماء والزيوت المعدنية ك زد بمعدل ١,٥ لتر/١٠٠ لتر ماء وكابل ٢ بمعدل ١,٥ لتر/١٠٠ لتر ماء كمواد بديلة آمنة بدلاً من المبيدات على أشجار التوت.

وقد أظهرت النتائج الحقلية الآتى:-

١- أدى استخدام السيديال إلى خفض تعداد الحشرة بمتوسط ٩٠,٨٪ وبمتوسط ٧٧,٢٪ فى حالة استخدام حجوم الرش ٤٢٠ لتر/ف، ٦٣٠ لتر/ف على التوالى.

٢- أدى استخدام الزيت ك زد إلى خفض تعداد الحشرة بمتوسط ٧٦,٥٪ وبمتوسط ٧٢,١٪ فى حالة استخدام حجوم الرش ٤٢٠ لتر/ف، ٦٣٠ لتر/ ف على التوالى.

٣- أدى استخدام الزيت كابل ٢ إلى خفض تعداد الحشرة بمتوسط ٦٩,٦٪ وبمتوسط ٦٣,٨٪ فى حالة استخدام حجوم الرش ٤٢٠ لتر/ف، ٦٣٠ لتر/ف على التوالى.

من هذه النتائج ينصح باستخدام الزيوت المعدنية بحجم رش ٤٢٠ لتر/ف نظراً لتميزها بأنها مركبات آمنة للبيئة وحفاظها على الأعداء الطبيعية.