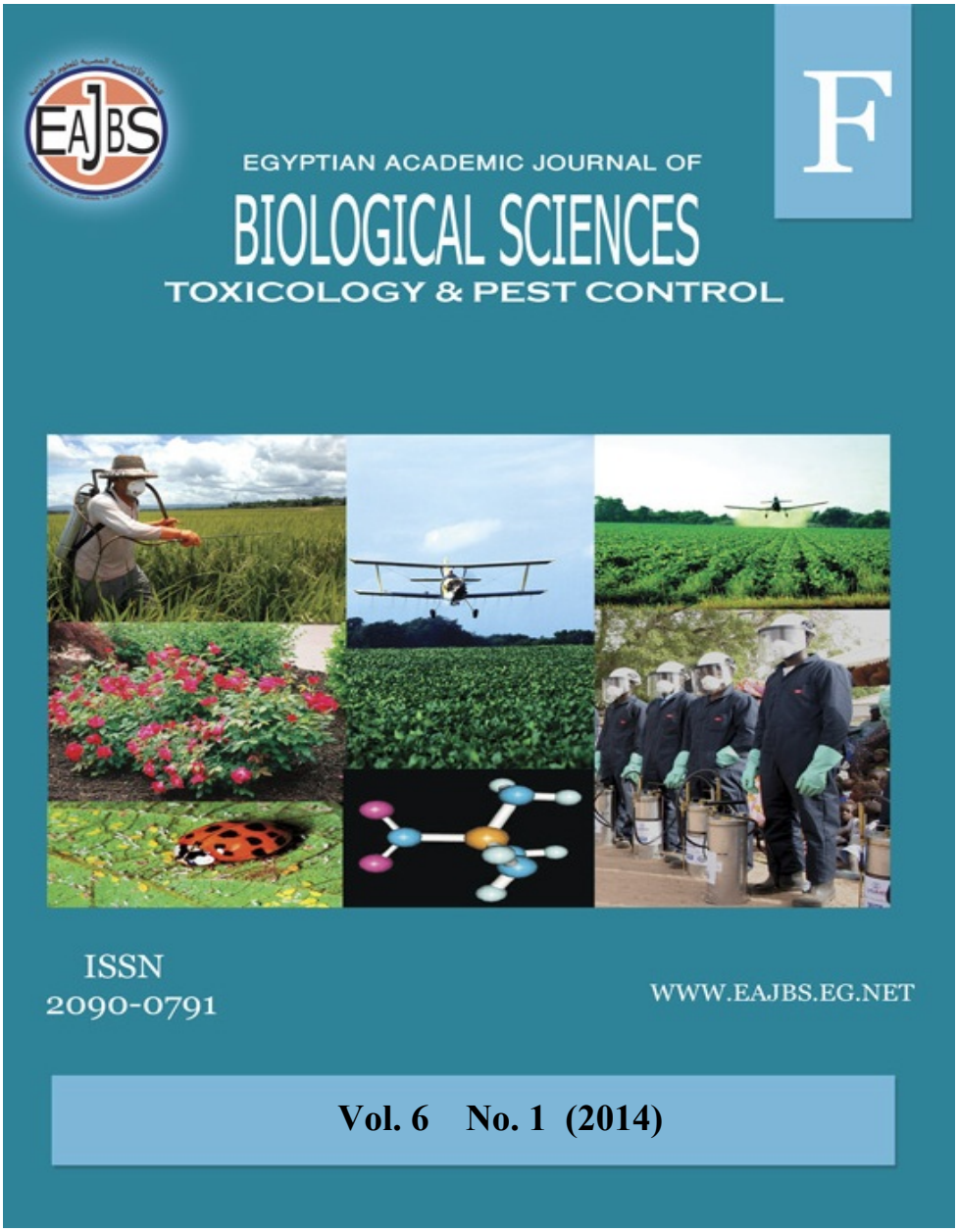

The journal of Toxicology and pest control is one of the series issued twice by the Egyptian Academic Journal of Biological Sciences, and is devoted to publication of original papers related to the interaction between insects and their environment.

The goal of the journal is to advance the scientific understanding of mechanisms of toxicity. Emphasis will be placed on toxic effects observed at relevant exposures, which have direct impact on safety evaluation and risk assessment. The journal therefore welcomes papers on biology ranging from molecular and cell biology, biochemistry and physiology to ecology and environment, also systematics, microbiology, toxicology, hydrobiology, radiobiology and biotechnology.

www.eajbs.eg.net

Egypt. Acad. J. Biolog. Sci., 6(1): 25 – 33 (2014)

Egyptian Academic Journal of Biological Sciences
F. Toxicology &Pest control

ISSN :2090 - 0791
www.eajbs.eg.net

Comprehensive Assessment Of Two Compounds And Spraying Equipment For Controlling Citrus Brown Mite *Eutetranychus orientalis* (Klein) (Acari : Tetranychidae) On Citrus Trees At Qalubia Province

Halawa, A.M[1]. ; Tarek .A .Abd-El Rahman[2]; Rehab, A.A. Dar[1] & Nabila[1], S .A. Hiekel.

1- Plant Protection Research Institute (PPRI), Agricultural Research Center (ARC). Dokki; Giza; Egypt.

2- Central Agricultural Pesticides Laboratory, Agricultural Research Center (ARC). Dokki; Giza; Egypt.

ARTICLE INFO

Article History
Received: 10/5/2014
Accepted: 12/6/2014

Key words:
Ground application techniques; Residue; Mites; Citrus

ABSTRACT

In the present paper three factors were assessed in controlling citrus brown mite *Eutetranychus orientalis* (Klein) on citrus trees namely: Efficiency of two Acaricides (Biomectin 5% EC as biocide and Dember 55%SC as chemical compound) ; efficiency of two types of sprayers (Knapsack motor sprayer Arimitsu (740 L. /Fed.) and conventional motor sprayer Wisconson (1200 L. /Fed.) ; efficiency of analytical method for the residue analysis of a novel Acaricide Biomectin 5% EC and its dissipation in the citrus fruits. The obtained results reported that, Dember 55%SC was most effective than Biomectin 5% EC by using spraying methods mentioned above, the reduction percentages were, 92.17 % and 90.56 % for Dember 55%SC by using Knapsack motor sprayer Arimitsu (740 L. /Fed.) and conventional motor sprayer Wisconson (1200 L. /Fed.), respectively, while the acaricides Biomectin 5% EC gaves reduction percentages, 88.31 % and 84.41 % by using Knapsack motor sprayer Arimitsu (740 L. /Fed.) and conventional motor sprayer Wisconson (1200 L. /Fed.), respectively. A satisfactory coverage was obtained on citrus trees and ground spray holders. The spectrum of droplets ranging between 111-177 microns (VMD). With sufficient number ranging from 54-224 N/cm².

Abamectin residues were extracted from orange samples and the extract was cleaned up according to QuEChERS method and determined by high-performance liquid chromatography with photo diode array detector (HPLC–DAD). The dissipation half-life time and the pre harvest interval (PHI) of abamectin residues in orange were 2.66 and 14.02 days, respectively in the case of Knapsack motor sprayer Arimitsu . Whole in the case of conventional motor sprayer Wisconson were 4.85 and 14.1 days, respectively. These results, pointed to that the first method of spraying (Knapsack motor sprayer Arimitsu (740 L. /Fed.)) was more effective than the other method (conventional motor sprayer Wisconson (1200 L. /Fed.)

INTRODUCTION

From an economic point of view, citrus fruits occupy first place in terms of fruit production and exportation in Egypt.

The citrus brown mite, *Eutetranychus orientalis* (Klein) one of the series mite pests infesting citrus trees where it concentrates around oil glands on leaves and fruits, and sucks the sap, causing the development of white spots that turn the surface of leaves and fruits pale green which reduces the quality and quantity of the crop (Dharmaraju and Reddy, 1975, in Bhumannavar and Singh, 1986). The pesticides have a great hazards on man, animal, plant and environment in addition the development of resistance of insects to most conventional pesticides which prompting the scientists to search on new, alternative insecticides like biotic agents and which achieved a great success in controlling many insects such as citrus brown mite with safe, cheap and effective methods. Also, suitable ground equipment for spraying in field has a great importance in controlling pests a definite amount of insecticide & water and minimum lost spray on ground to avoid environmental contamination (Jepson, 2009). Abamectin belongs to the family Avermectins which are macrocyclic lactones produced by the actinomycete Streptomyces avemitilis. It is a mixture of two homologues containing about 80% Avermectin B1a and about 20% avermectin B1b (Pesticide Manual, 1994).

Governments and international organizations are regulating the use of pesticides and are setting the acceptable MRL When these compounds are applied according to good agricultural practices, MRL are not exceeded, but there in correct application may leave harmful residues, which involve possible health risk and environmental pollution. Teratogenic, carcinogenic and toxic properties of these compounds have been reported by (Ali. M. Abdellseid and Tarek. A. Abdel. Rahman, 2014).

Thus the objective of this paper is comparison between chemical Acaricide (Dember 55%SC) and other biocide compound(Biomactin 5 % EC) contain of Abamectin as active ingredient to enhance the biological activity against citrus brown mite *E. orientalis* by choose the optimum spraying equipment, persistence of Abamectin on orange .

MATERIALS AND METHODS

Pesticides used:

The Pesticides tested are listed in Table (1) by Trade name, common chemical name, the manufacturer and the recommended citrus treatment rate.

Table 1: List of Pesticides commonly used on Texas citrus.

Trade name	Common name	Application Rate
Biomactin 5 % EC	Abamectin	20 cm/100 L
Dember 55%SC	Fenbutatin-oxide	100 ml/100L

Field experiment and sampling

A- Comparison of biopesticide compound (Biomactin 5 % EC) and chemical Acaricide Dember 55%SC against Citrus brown mite *E. orientalis*

Fifty of citrus trees were chosen at Qalubia governorate, these trees were highly infested by citrus brown mite *E. orientalis* without pesticides applying. The experimental design used was complete blocks.

Effect of type sprayer (Knapsack motor sprayer Arimitsu (740 L. /Fed.) and conventional motor sprayer Wisconson (1200 L. /Fed.) on the effectiveness of compounds and amounts of solution.

1-Spraying equipment tested on field:

Two ground application machines were selected to perform the scope of this work, as commonly used equipment in applying pesticides on orange trees. The percentage of green area to the total orchard area was about 50% and distances of cultivation was 4 ×4 m. The tested equipment could be represented according to the technical categorization mentioned in Table (2).

Table 2: techno-operational data of certain ground sprayers applied on citrus trees field during season (2013).

Item	Knapsack motor sprayer "Arimitsu"	Conventional motor sprayer "Wisconson"
Type of spraying	Pneumatic+Rotary	Hydraulic
Nozzle type	Rotary disc	Spray gun (hollow cone)
Number of Nozzle	1	1
Pressure(bar)	-	30.0
Spray tank(L)	20	600.0
Rate of application(L/fed)	740	1200
Working speed (Km/h.)	1.2	1.2
Swath width (m.)	2.03	1.3
Flow rate (L/min)	3	5.4
Spray volume\tree	4.62	8.12
Spraying technique	Target	Target
Productivity (fed./h.)	0.03	0.052
Rate of performance (fed./day)	1.6	2

*calculations of productivity and rate of performance after Hindy (1992).
*Number of orange trees\feddan=160 tree.
*Average height of orange tree about 2 m., age of orange tree=5 year.

2-Calibration and performance adjustment of the tested equipment:

Collection and measurement of Spray deposit:

Collection of spray deposit Before spraying each citrus tree treatments, a sampling line was constructed of five wire holder fixed in diagonal line inside each treatment to collect lost spray between plants; each wire holder top has a fixed water sensitive paper (Novartis Cards) on it. Also, each five citrus trees, the water sensitive paper cards were fixed as a sandwich covering each leaf at three levels; upper, middle and lower and four directions of each citrus tree; north, south, east and west to collect the spray deposit on citrus trees. All cards were collected and transferred carefully to the labroratory for measuring and calculating the number of droplets/cm² its volume (VMD) in all treatments. Necesary corrections and calculations of droplets were carried out on basis of that given by Hindy *et al.* (1977).

3- Determination of spray deposit:

Number and size of blue spots (deposited droplets) on water sensitive papers (Novartis cards) were measured with a special scaled monocular lens (Strüben)®.

4-**Execution of field experiments:**

Arrangements of the experiments

Field experiments were carried out during season 2013 on 19th June in private orange field located at tokh district, Kaliobea Governorate. The temperature was 35°C, 58% average RH and 2 m/sec. average wind velocity during experiment. The mean meteoroiogical conditions during testes were suitable for spraying according to Yates *et al.* (1963).

The Selected area split into 4 plots and control plot, two raws of citrus trees between treatments were not spraying as barrier zones to avoid drift spray, spraying operations have not been done with any insecticides before execution the field experiment. The experimental field was divided into two plots were sprayed with recommended rate of Biomectin, and another two plots with one alternative insecticide Dember, respectively.

A-Efficiency of analytical method for the residue analysis of a novel Acaricide Biomectin 5% EC and its dissipation in the Citrus fruits.

1. **Chemical and reagents:**

All organic solvents were of HPLC grade and supplied by Merck, USA. Primary and secondary amine (PSA, 40 lm Bondesil) was purchased from Supelco (Supelco, Bellefonte, USA). Anhydrous magnesium sulphate was of analytical grade, purchased from Merck, USA, and was activated by

heating at 250°C for 4 h in the oven before use and kept in desiccators.

2-Sample

Sampling was performed by randomly collecting from various places of the experimental. Three replicate samples (about one kg each) were collected from pesticide-treated fruit and the leaves of the treated trees. Samples were taken 2 h after the pesticide application. Subsequent samples were taken 1, 4, 7, 10, 15 and 21 days after treatment. During experiment, a control sample was taken in each sampling time. Immediately after collecting the samples, the samples were homogenized and sub sampling was done where three representative samples of 50 g were taken. Samples were then placed into polyethylene containers and frozen at –20◦C. The freezed sub samples were left to reach room temperature.

Analysis of Pesticide residue-

An analysis of tested pesecticide was carried out in the Central Agricultural Pesticide Laboratory, (CAPL), ARC.

Abamectin residues were extracted and clean up from orange fruits according to (Anastassiades *et al*. 2003).

4-Determination of Abamectin residues:

The residue was redissolved in 2 mL of acetonitrile for analysis by HPLC. HPLC analysis was performed with an Agilent 1100 HPLC system (USA), with photodiode array detector. The chromatographic column was C18 Zorbax SB. Flow rate of mobile phase (acetonitrile /Methanol/water = 45/ 40/15 v/v/v) was 1.5 mL/min, and injection volume was 20 uL. Detection wave length for detection of Abamectin was set at 245 nm. The retention time of Abamectin Avermectin B1a and about avermectin B1b) was about 8.5 and 11.26 min.

Recovery studies were carried out by spiking 3 replicates of untreated date samples (control) with 50, 100, and 50 mg/kg of Abamectin. Samples were analyzed using their prescribed procedure and mean values of the three replicates were calculated. Recovery percentages were satisfactory for the Abamectin and ranged from 92.88 % to 97.66 %. The minimum detection limit of Abamectin was 0.005mg/kg.

RESULTS AND DISCUSSION

Comparison of biopesticide compound (Biomactin 5 % EC) and chemical Acaricide Dember 55%SC against citrus brown mite *E. orientalis*.

Regardless of type sprayers and hazard occurring from each compound on environment, human and animal the results in Tables (3,4&5) reported that the chemical Acaricide (Dember 55%SC) was more effective on citrus brown mite *E. orientalis* than the biopesticide (Biomactin 5 % EC), where is the first one gave 92.17 % and 90.56% reduction in the population of mite by using (Knapsack motor sprayer Arimitsu (740 L. /Fed.) and conventional motor sprayer Wisconson (1200 L. /Fed.), respectively. While the second (Biomactin 5 % EC) gave 88.31% and 84.41% reduction of mite population by using type sprayers mentioned above, respectively. The statistical analysis showed Significant differences between the compounds used (LSD, 3.68).

Table 3: Mean of two Acaricidal percentage against *E. orientalis* after (one, two, three and four weeks) from application by using Knapsack motor sprayer (Arimitsu) (740 L. /Fed.)

Trade name	Rate of applicati-on \ 100 liters of water(cc)	No. of mites before treatmen-t	No. and % reduction of mites after treatment								Total avera-ge of % reduction
			One week		Two week		Three week		Four week		
			No.	%R	No.	%R	No.	%R	No.	%R	
Biomactin 5 %EC	20	199	41	86.1	39	89.6	44	89.1	49	88.4	88.31
Dember 55%SC	100	390	50	91.3	61	91.6	57	92.1	60	92.8	92.17
Control		240	356	–	450	—	487	—	510	—	–

Table 4: Mean of two Acaricidal percentage against *E. orientalis* after (one, two, three and four weeks) from application by using conventional motor sprayer (Wisconson)(1200L. /Fed.)

Trade name	Rate of applica-tion \ 100 liters of water (cc)	No. of mites before treatme-nt	No. and % reduction of mites after treatment								Total avera-ge of % reduct-ion
			One week		Two week		Three week		Four week		
			No.	%R	No.	%R	No.	%R	No.	%R	
Biomactin %5EC	20	212	49	84.4	47	88.2	54	87.5	61	86.5	84.41
Dember 55%SC	100	470	81	88.4	75	91.5	85	91.14	89	91.1	90.56
Control		240	356	—	450	—	487	—	510	—	—

Table 5L Differentiation between variable factors

Knapsack motor sprayer (Arimitsu) (740 L. /Fed.)		Conventional motor sprayer (Wisconson) (1200 L. /Fed.)		LSD
Biomactin 20c	Dember 100cc	Biomactin 20cc	Dember 100cc	
3.12		3.14		LSD
3.68				LSD

In despite of highly percentage reduction of mite population in case of using Dember 55% SC there are other factors effect on The possibility of using this compound in application such as (safety, cost, Sustainability).

B. Comparison between two sprayers by mean's of Droplet numbers and sizes:

The optimum spectrum of droplets for controlling insects of field crop should be sized between 140 and 200 μm (VMD) with number not less than 30 and 50 droplets/cm^2 distributed homogeneously on the treated target (Burt *et al.,* 1970) and Himel (1969). The following general trends could be extracted from the obtained data and may help in better understanding to the experimental results from Table (6).

I) In this work, the minimum size of measured spots was however about 50μm. This is due to the limited capability of the available technique of measurement, which means logically that a lot of invisible fine spots smaller than 50μm should occurred within the measured spots. This might clarify the appearance of certain reasonable killing results in some experimental treatments.

II) The range of droplets spectrum (VMD and N/cm^2) deposited on both the artificial and natural targets by using total recommended dose, used were 111 & 177μm, and 54 & 224 N/cm^2 respectively.

III) The lost spray on ground, between plants, was the only measured loss, whereas other sources of loss such as by wind (drift), evaporation,... etc, were not subjected to investigation throughout this work.

The obtained results in Table (6) confirmed the positive relationship between spray volume and droplet sizes, which affects negatively the number of formed droplets. Taking into account that the main studied factors affecting the spraying, were the rate of insecticide application, the specifications of the pesticide, its formulation and its mode of action, age of orange trees and level, position of deposited spray and the meteorological conditions during application of the treatments. The percentages of number of droplets /cm^2 in the case of Arimitsu Motor sprayer, were 15& 21 in the case of Biomectin and Dember, respectively. But, in the case of Wisconson sprayer the percentage of the same droplets number/cm^2 were 34.5& 40 for Biomectin and Dimber, respectively.

V) Data in Table (6) showed that, there was a significant differences between both the distribution percentages of droplet sizes(LSD=12,56 for equipment,32.022 for levels and 12,56 for compounds)and for the droplets number/cm^2 (LSD=27,898 for equipment,71,126 for levels and 27,898 for compounds).

Relations between spray quality and bioresidual effects of certain insecticides applied on orange trees.

Data in Table (6) showed that, Biomectin at its recommended rate 20 cm/100 L.and Dimber at its recommended rate was 100 ml/100 L., using two ground spraying equipment and varied spraying volumes depending on the sprayer used. Data indicated that, in general all the tested spraying equipment gave satisfactory coverage on orange trees i.e. more than 50 droplets / cm^2, and droplet sizes ranged from 111 to 177 µm (VMD)., but the difference in the mortality percentage was due to the different mode of action of the two insecticides used.

Table 6: Spray coverage on Orange trees and ground hoµm lders produced by certain ground spraying equipment, at season (2013) using total recommended dose rate of certain insecticides against *Eutetranychus orientalis* at Qaliobia governorate

Equipment	Conventional (Wisconson) Motor Sprayer				Knapsack mist blower (Arimitsu)			
Application Rate L/Fed.	1200				740			
Acaricide used	Biomectin 20cm/100L		Dimber 100 cm/100L		Biomectin 20cm/100L		Dimber 100 cm/100L	
Level targets	N/cm^2	VMD	N/cm^2	VMD	N/cm^2	VMD	N/cm^2	VMD
Top North	98	140	-	-	100	165	96	114
Top South	94	145	104	162	99	166	151	126
Top East	100	134	125	145	120	142	114	155
Top West	-	-	-	-	126	140	104	153
Middle North	-	-	150	136	115	145	96	114
Middle South	102	111	146	133	175	175	59	115
Middle East	113	131	54	120	110	144	100	117
Middle West	-	-	-	-	170	177	109	143
Bottom North	-	-	103	150	65	120	115	145
Bottom South	96	118	-	-	59	124	110	142
Bottom East	60	166	110	154	224	146	141	137
Bottom West	-	-	-	-	110	135	110	137
Mean	**102**	**133**	**105**	**143**	**123**	**138**	**109**	**133**
Cards on ground	54	120	59	115	21	193	29	157
% N/Cm^2 on ground (lostspray)	**34.5**	**-**	**40**	**-**	**15**	**-**	**21**	**-**

A satisfactory coverage was obtained on citrus trees, the droplet spectrum was obtained in field experiment was agreed with the optimum droplet sizes which mentioned by Himel (1969) and Carman (1975) The best obtained result was 740 L./Fed. As spray volume, 135µm and 116 droplets/cm^2, these results agreed with (Himel *et al*., 1969) and Carman (1975) in the optimum droplet size to control citrus pests by ground equipment, Biomectin revealed the best bio-efficiency results with the two tested sprayers (Arimitsu) motor sprayer (740 L./fed.) and wisconson motor sprayer (1200 L./fed.) followed by Dember with the same sprayer and these results agreed with Hindy *et al*. (2004) and Genidy *et al.* (2005) which recommended KZ oil and Pyriproxyfen followed by Agerin using low volume spraying because of reducing the time lost in process filling the machines, improve the homogeneity of the spray solution on the plant leaves and saving the lost spray of the ground. The data showed that Arimitsu motor sprayer (640L./fed.) is the best equipment to control on orange trees. Also, the lowest spray volume and the lowest percentage of lost spraying between plants, these results were agreed with Hindy *et al*. (1997) who mentioned that, there was a positive relationship between rate of application and lost spray on ground. Generally, Biomectin and Dember are recent insecticides that avoid the activity of citrus brown mite on citrus trees, and safe the children who were picked manually orange during hot days and saving also the

traditional insecticides which injures the human body and the agricultural environment.

C-Efficiency of analytical method for the residue analysis of a novel Acaricide Biomectin 5% EC and its dissipation in the Citrus fruits.

Data summarizes in Table (7) represent the amounts of Abamectin residues detected in pulp ,peel and total orange fruits after different intervals of orange trees spray with two spraying techniques. It was obvious that, the amounts of total Abamectin initially detected in orange were 5.367 and 7.508 mg/kg for knapsack sprayer equipped 740L\fed. and Conventional motor sprayer 1200 L\fed., respectively. These amounts decreased gradually till reached undetectable amounts after 15 days both of two spraying techniques.

Table 7: Residues of Abamectin (mg/kg) in /on peel and pulp of orange fruits by different spraying techniques under field conditions.

Time intervals days	knapsack motor sprayer 740L\fed.						Conventional motor sprayer1200L\fed.					
	Peel		Pulp		Total		Peel		Pulp		Total	
	mg/kg*	%loss	mg/kg*	% Migration	mg/kg*	%loss	mg/kg*	%loss	mg/kg*	% Migration	mg/kg*	%loss
0	5.36	00	0.007	0.13	5.367	00	7.5	00	0.008	0.1	7.508	00
1	3.79	29.29	0.043	0.8	3.833	28.58	5.38	28.26	0.54	0.72	5.92	21.15
4	1.05	80.41	0.086	1.6	1.136	78.83	3.07	59.06	0.98	1.36	4.05	46.05
7	0.99	81.52	0.03	0.55	1.02	80.99	1.02	86.4	0.05	0.06	1.07	85.74
10	0.51	90.48	0.005	0.009	0.515	90.40	0.7	90.66	0.009	0.012	0.709	90.55
15	0.009	99.83	**		0.009	99.83	0.008	99.98	**		0.008	99.89
21	**		**		**		**		**		**	
T0.5 (days)	2.42		……		2.66		3.64		……		4.85	
PHI (days)	14.02						14.1					

- *=average of 3 replicates
- **= blow detection limit(0.005 mg. kg^{-1})
- MRL=0.01 mg. kg-1 Reg (EU)No 600/2010
- % Migration in relation the initial deposits on peel

Abamectin dissipated rapidly after application. The concentration of Abamectin 1 h after treatment in orange peel and pulp were (5.36 and 7.5 mg/kg) and (0.007 and 0.008 mg/kg) for knapsack sprayer 740 L\fed. and Conventional motor sprayer 1200 L\fed., respectively.

The mounts of Abamectin residues reached the orange pulp were increased gradually to reach maximum level when determined after 4 days of treatment being 0.086 and 0.98 mg/kg indicating 1.6 and 1.36% for knapsack motor sprayer 740L\fed. and Conventional motor sprayer 1200 L\fed., respectively, migration of the initial deposits. The migrated residues were decreased gradually in orange pulp to reach 0.005 and 0.009 mg/kg after 10 days of treatment, representing 0.009 and 0.012 % migration respectively. At the end of the experiment 21 days undetectable amounts were recorded for two spraying techniques.

The dissipation rate of orange fruit exhibited a first order kinetics. The half-life of Abamectin calculated in knapsack motor sprayer and Conventional motor sprayer, treated at recommended dose were 2.66 and 4.85 days, respectively Table(7). European Union MRL for Abamectin in orange fruit is 0.01 mg/kg. It can thus be concluded that the preharvest interval (PHI) of Abamectin on orange fruit were 14.02 and 14.1-days for two spraying techniques after the treatment.

Finally, the obtained results were proved that:

- The residue amounts in orange fruits were much higher in case of Conventional motor sprayer 1200L\fed. than that with knapsack sprayer 740 L\fed..
- The rates of disappearance were much slower in Conventional motor treatment comparisons to knapsack motor sprayer.

- The migration percentages of two tested spraying techniques from the peel to pulp were increased gradually throughout the first four days to reach maximum level after which gradual decrease took place until the end of experimental period 21 days to reach 0.00 percentages.

These results were harmonize with other investigators working on residues of Abamectin in the same crop and other (Yutakea *et al*., 1985), (Attalla., 2006), (Sayeda *et al*., 2013) and (Ali. M. Abdellseid and Tarek .A. Abdel.Rahman, 2014).

CONCLUSION

The used Biomectin and Dember produce a great and strong proof to be used as controlling agents against citrus brown mite in field. The main factor governing the present study is formation of spray quality of the combined action of atomization process (sprayer) under the specific physical properties of the tested formulations, fixed operational conditions and suitable ambient climatic conditions according to the nature of the tested insecticides. The spray bulk produced by the tested spraying techniques was distributed mainly on the different surfaces and levels of the treated trees and ground holders, as well as lost spray on the ground between trees, By using various spraying volume rates, through various atomization methods with a certain ground equipment used, bio-efficacy results of pesticides against citrus brown mite infesting orange trees during early season showed a significant effect with Biomectin and Dember between all the treatments. It could be recommended to utilize Biomectin whitch is more effective than Dember in controlling citrus brown mite on citrus trees. It could be recommended that the most cheap available and effective with Knapsack motor sprayer Arimitsu (740L./fed.) for controlling citrus brown mite.

REFERENCES

Ali, M. Abdellseid and Tarek, A. Abdel. Rahman (2014). Residue and Dissipation Dynamics of Abamectin in Tomato Fruit Using QuEChERS Methodology. International Conference on Food, Biological and Medical Sciences (FBMS-2014) Jan. 28-29, 2014 Bangkok (Thailand).

Anastassiades, M.; Lehotay ,S.J.;Stajnbaher,D. and , Schenck, F. (2003). Fast and easy multiresidue method employing extraction/partitioning and ‘‘dispersive soild-phase extraction’’ for the determination of pesticide residues in produce. J AOAC Int 86:412–431

Attalla,I .E. (2006). Residues of phenthoate and Abamectin on orange fruits . Egypt.J. of Appl.Sci., 21 (6B) pp :751-757.

Bhumannavar, B. S. and Singh, S. P. (1986). Studies on population dynamics of Oriental red mite of citrus, Eutetranychus orientalis (Klein). Entomon 11, 223–226.

Burt, E.C.; Lloyed, E.P.; Scott. W.P.; Mccoy, J.R. and Tingles, F.C. (1970). Boll weevil control with insecticide applied in sprayers with narrow spectrum droplet sizes. J. Econ. Entomol., 63 (2): 265-270.

Carman, G. E (1975). Spraying procedures for pest control on citrus.Citrus Techn. Monogr. 4:28-34 .Ciba Geigy, Switzerland.

Dharmaraju ,E .and Reddy, G.S. (1975). Insect pests associated with citrus decline. In:Citrus Decline in Andhra Pradesh, Ed. Reddy GS and Murti VD, APAU, Hyderabad, 46–54.

Genidy, N.A.; Bakr, R. F.; Hindy, M. A. and Dar, R. A. (2005). Bioresidual activity certain insecticides against *Spodoptera littoralis* (Boisd) by using low volume ground spraying equipment on cotton plants. J. Egypt. Acad. Soc. Environ. Develop., (A-Entomology) 6(1):1-21.

Gomaa, E. and Belal, M. (1975). Determination of dimethoate residues in some vegetables and cotton plant. Zagazig J Agric Res 2:215–219

Gabir, I.; Zidan, Z.H.; Attallah, E. and Hindy; M. A. (1982). Calibration and evaluation of the performance of certain hydraulic nozzle types under laboratory conditions. Res. Bull. Fac. Agric. Univ. Ain Shams, Egypt.,1736:1-17.

Himel, C.M. and Moore, A.D. (1969). Spray droplet size in the control of Spruce. budworm, Boll weevil, Bollworm and

Cabbage looper. J. Econmol., 62 (4): 916-918.

Hindy, M. A.; Helmy, E.I.; El-Imery and Hassan, N. A. (1977). Evaluation of spray coverage of MISCIBLE oil on citrus trees by means of Aerrial and Ground applications. Egypt. J. Agric. Res., 75(2):363-375.

Hindy, M.A. (1992). Qualitative distribution of watery dyed spray produced by certain ground sprayers in cotton. Bull. Ent. Soc., Egypt 19:221-7.

Hindy, M.A.; El-Sayed, A.M.; Abd El-Salam, S.M. and Samy, M.A. (1997). Qualitative Assessment of certain insecticides applied by different ground sprayers against whitefly, *Bemicia tabaci* (Geen.) on eggplant. Egypt. J. Agric. Res., 75 (3): 565-577.

Hindy, M. A.; Bakr, R. F.; Genidy, N.A. and Dar, R.A. (2004). Qualitative distribution of certain insecticides deposits and artificial targets on the cotton larvae leafworm by using certain ground spraying equipment on cotton plants. J. Egypt. Acad. Soc. Environ. Develop., (A-Entomology), 5 (2):91-112.

Jepson, P. (2009). Barriers to IPM adoption in developed and developing countries. Phytopathology, 99:S174.

Pesticide Manual (1994). Hampshire, UK: Crop Protection Publications, British Crop Protection Council (10th ed., pp. 3–4).

Sayeda , F. Farghaly; Azza, I. Dawood; Ammar A.E.; Torkey, H.M. and Abd El Rahman, T.A. (2013). Effect of Lambada cyhalothrin residues, spraying volumes, physico-chemical properties of spray solution and rates of insecticides on spider mites control in eggplant plantation. Proc.of the International Conference of Environmental Sciences (ICES) 21-22May (2013)-pp80-94.

Yates, W. E. and Akesson, N. B. (1963). Equipment and application techniques in relation to pesticide drift and residue. Agric. Eng. Dept., Univ. of California, 1-14

Yutaka, I.; G. John; Mac Connell James; E. Flor and Travis M. Dinoff (1985). Residues of Avermectin B1 a on and in citrus fruits and foliage .J.Agric.Food Chem .33:467471.

ARABIC SUMMERY

تقييم شامل لمركبين واثنان من الات الرش لمكافحة اكاروس الموالح البنى على اشجار الموالح فى محافظة القليوبية

علاء حلاوة و طارق عبد الرحمن و رحاب عبد المطلب عبد المقضود و نبيلة سعد احمد هيكل

١- معهد بحوث وقاية النباتات – قسم نكنولوجيا الرش – الدقي – الجيزة

٢- المعمل المركزي للمبيدات – قسم متبقيات المبيدات و تلوث البيئة – الدقي – الجيزة

تم رش اثنين من بدائل المبيدات، مبيد حيوي (بيومكتين) و (ديمبر) باستخدام موتور الرش الظهري (أرميتسو) بحجم رش قدره (٧٤٠ لتر\فدان) و الموتور التقليدى (ويسكونسون) بحجم رش قدره (١٢٠٠ لتر\فدان) فى حقل برتقال مصاب اصابة شديدة باكاروس الموالح البنى.

تم الحصول على تغطية مرضية على أشجار البرتقال المعاملة، تراوح مدى طيف قطيرات الرش ما بين١١١- ٧٧ميكرون مع أعداد كافية من القطيرات\سم² تراوحت ما بين ٥٤-٢٢٤ قطيرة\سم² في المعاملات المختلفة.

كما أوضحت النتائج أن المركب الحيوى (بيومكتين) أكثر فاعلية في مكافحة اكاروس الموالح البنى يليه (ديمبر) و أن حجم الرش ٧٤٠ لتر\فدان الناتج من اشتخدام موتور الظهر (أريميتسو) حقق أعلى النتائج يليه الموتور التقليدى(ويسكونسون) بمعدل١٢٠٠ لتر\فدان.

يمكن التوصية بأن استخدام حجوم الرش القليلة أكثر اقتصادية في مكافحةاكاروس الموالح البنى و تحقيق تجانس محلول الرش على أشجار البرتقال المعاملة مع توفير الفاقد من الرش بين الأشجار وتقليل كمية الراسب من المبيد على ثمار البرتقال.

وبتحليل المتبقيات على و فى ثمار البرتقال كان متوسط عمر النصف لمبيد ابامكتين ٢,٦٦وفترة ماقبل الحصاد٢،١٤ يوم باستخدام الموتور الظهرى(ارميتسو) (٧٤٠ لتر \فدان) بينما كان متوسط عمر النصف لنفس المبيد ٨٥،٤ وفترة ماقبل الحصاد ١،١٤ يوم باستخدام الموتور التقليدى (ويسكونسون) (١٢٠٠لتر \فدان)٠