FIELD EVALUATION OF CERTAIN OILS (MINERAL AND PLANT EXTRACTS), CHEMICAL PESTICIDES AND BIO-INSECTICIDES AND THEIR MIXTURES ON SOME SUCKING PESTS INFESTING WATERMELON AND PEPPER PLANTATIONS

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ABSTRACT

The toxic effect of certain compounds including two pesticides [fenitrothion (Sumithion) and etoxazole (Baroque)], mineral oil (K.z-oil), plant oils extracted from citrus such as (baladi mandarin, sour orange, acidless orange and blue gum), microbial pesticides (biofly and agerin) and mixtures of [Kz-oil with plant oils and microbial pesticides], these tested compounds individually and in mixtures against *Thrips tabaci, Aphis gossypii, Empoasca* sp., *Bemicia tabaci* and *Tetranychus* sp. on watermelon (*Citrullus lanatus var.cococynthoides* L.) and pepper (*Capsicum annum* L.) plantations have been done under field conditions.

The results achieved in this study can be summarized in the following. Fenitrothion was the most toxic compound followed by Kz-oil on *Thrips tabaci*. Plant oil extracts were a moderate toxic effect, while etoxazole was the least toxic compound on *Thrips tabaci*. Fenitrothion, was the most toxic compound followed by baladi mandarin oil extract and Kz-oil on *Aphis gossypii*. Etoxazole was of a moderate toxic effect, but blue gum. sour orange oil and acidless orange oil extracts were the least toxic compounds on *Aphis gossypii*. Fenitrothion gave the highest effective compound in reducing the population density of *Empoasca* sp. after the first spray followed by Kz-oil + baladi mandarin oil, Kz-oil + sour orange oil and etoxazole. The other tested compounds were moderately effective except sour orange oil, acidless orange oil, blue gum oil, Biofly and agerin which were the least effective compounds on *Empoasca* sp. No significant differences were found between compounds after the second spray.

Fenitrothion was the most effective compound in reducing the population density of *Bemisia tabaci* after the first spray followed by baladi mandarin oil, Kz-oil, Kz-oil + baladi mandarin oil and Kz-oil + blue gum oil. The other tested compounds were moderately effective except sour orange oil. biofly and agerin which were the least

effective compounds. All the tested compounds gave satisfactory result in reducing whitefly population ranged between 64.27 and 91.62% after the second spray with significant differences. Kz-oil was the most toxic compound followed by fenitrothion and baladi mandarin oil extract on *Tetranychus urticae*. Sour orange oil, blue gum and acidless orange oil extracts have a moderate toxicity, while etoxazole was the least toxic compound on *Tetranychus urticae*.

The results showed that biofly and agerin were highly toxic to *T. tabaci* and *A. gossypii* while biofly and agerin were a moderate toxic to *T. urticae*. The results showed that all mixtures had potentiation effect against *T tabaci, A. gossypii*, and *T. urticae*. Generally we can said that, all tested compounds reduced the mean numbers of sucking pests on watermelon and pepper plantations., The tested compounds could be arranged descendingly according to their toxicity to the sucking pests as follows: Pesticides > mixtures > plant oil extracts > mineral oil > microbial pesticides.

INTRODUCTION

Vegetable crops are liable to a variety of pest infestations. Sucking pests is one of the most serious and destructive pests to invade watermelon and pepper plantations in Egypt.

The intensive use of chemical compounds for controlling pests resulted many problems such as population out breaks of the pests and their resistance development against all known pesticide groups which leads to pest control failures, high costs, crop loss and economic disaster, in addition to its effect on the environment which constitute toxic hazards to human health, domestic animals, predators and wildlife. Generally it is important to do our job carefully by both controlling pest populations meanwhile protecting the environment from the potential adverse effect of pesticide uses.

The possibility of controlling sucking pests by a combination of biological and chemical methods had proved to be less costly, safe on the environmental constituents, minimizing chemical residues in the end product and also, more permanent method of control than had pesticides alone (**Rizk et al., 1999 and Omar and El-Kholy 2001**).

Zein et al., (2002) reported that, potentiation effect of KZ-oil + black pepper extract against *Tetranycus uritica* adults. Moreover, the joint action of mixtures of plant oils on mineral oils with pesticides was found to be effective against *T. tabaci, A. gossypii* and *T. urticae*

as showed by many investigators **(Barakat et al., 1985; Haydar *et al.*, 1996 and Helmy et al., 2002).**

El-Khodary et al., (2007) revealed that, fenitrothion gave high toxic effect against *T. tabaci. A. gossypii* and *T. urticae* but etoxazole was the least toxic compound against *T. tabaci* while high toxic for *T. urticae.*

The present study aimed to investigate the effect of the following tested compounds, and their toxic poteniallity of fenitrothion and etoxazole, mineral oil (Kz-oil), plant oil extractions from citrus such as (baladi mandarin, sour orange and acidless orange) and blue gum, microbial pesticides such as biofly and agerin and mixtures of [Kz-oil with plant oils and microbial pesticides] against *T. tabaci, A. gossyiil, B. tabaci Genn., Empoasca sp.*and *Tetranychus sp.* on watermelon and pepper plantations.

MATERIALS AND METHODS

Tested compounds:

Nine compounds were tested in the formulated form. The dosages were calculated on the basis of ppm of active ingredient except microbial pesticides, Biofly (*Beauveria bassiana*) which calculated on the basis of number of conidia/ml. The tested compounds were as follows:

1- Pesticides :

- **Fenitrothion** (50% E.C.) *O,O*-dimethyl *O*-4-nitro-*m*-tolyl phosphorothioate
- **Etoxazole** (10% S.C.) (RS) –S- tert-butyl–2-[2-(2, 6-difluorophenyl) –4,5- dihydro- 1.3 oxazol-4-yl] phenetole.

2- Mineral oil:

K.Z. oil (95% E.C.) formulated mineral oil supplied by kafer El-Zayat pesticides and Chemicals Company.

3- Plant oil crude extracts:

Volatile oil extractions from citrus peels:

Volatile oil extracted from citrus fruit peels of [(*Citrus deliciosa* Blanc, baladi mandarin), (*Citrus aurantium* L., sour orange) and (*Citrus sinensis* Osbek, acidless orange)] (family. *Rutaceae*) in pesticide department at Kafr El- Sheikh by steam distillation using the method of A.O.A.C. (1990) with Clavenger traps apparatus (oils lighter than water type). Citrus fruits were purifyd thoroughly washed in detergent solution to remove any surface pesticidal residues and

rinsed with tap water. Then fruits were washed in methanol 30%, rinsed with tap watel again and finally rinsed with distilled water.The peels should be free from white spongy, the layer were cut into small pieces.

Batches of 50 gm small pieces were mixed with distilled water at ratio of 1:4, then blended and the mixture was placed in the distillation flask. Distillation was carried out for 1 hour until no further oil increasement was observed. The oils were separated from the water condensated and dried through anhydrous sodium sulphate and kept in dark containers in the refrigerator in addition to blue gum oil (*Eucalyptus globulus* L.)[trade shopping].

4- Microbial insecticides:

- **Biofly** = *Beauvaria bassiana* as a liquid microbial pesticide containing 3 XI0^7 conidia/ml. It was supplied by El-Nasser Company for Fertilizers and Pesticides. Egypt.
- **Agerin** = *Bacillus thuringiiensis* kurstaki 32000 International Units per milligram (6.4% a.i.) was supplied by Abbott Laboratories Chemical and Agricultural Products Division. North Chicago. 11, USA.

Field assessments:

Toxicological studies were carried out at experimental farm Faculty of Agric., Kafr El-Sheikh,'I'anta Univ. The tested compounds were applied at recommended doses using a knapsack sprayer with one nozzle. The experimental cultivated area watermelon and pepper was divided into plots of 40m^2. Each treatment was distributed in a completely randomized desigen with four replicates. Tested compounds used and their application rates are shown in Table (1).

The infestation was determined by counting all available stages appeared on 15 leaves which were taken from each replicate, (5 from lower, 5 from the middle and 5 from the top) for pepper plants , while it was from the first , middle and the end of watermelon plants respectively of random plants. The counts of thrips (nymphs and adults) aphid (nymphs and adults), whitefly (larvae), ledfhoppers (nymphs and adults) and mites (mobile stages) were done just before spraying, and then after 1,3,5,7 and 14 days of applications.

On watermelon plantations: for thrips sprayed the first was on 24 May and the second application on 14/ 6/ 2003. and for aphids and spider mites sprayed occurred on 28 June and the second application

on 19/ 7/ 2003.While whitefly sprayed occurred on 14 June , the second and third application on 28/6/2003 respectively. For leafhopper sprayed occurred on 24 May, the second application on 28/6/2003 respectively.

Table (1): Tested compounds in the field applications ; formulation and application rates:

Tested compounds	Rate of application/liter water		
	Thrips	Aphid, Whitefly, Leafhopper	Mite
Pesticides			
Fenitrothion (50% E.C.)•	3.75 cc	3.75 cc	3.75 cc
Etoxazole (10% S.C.)•	0.25 cc	0.25 cc	0.25 cc
Mineral oil			
K.Z. oil (95% E.C.)•	17.5 cc	10 cc	10 cc
Plant oil extracts			
Baladi mandarin**	30.1 cc	0.49 cc	15.4 cc
sour orange**	35.6 cc	5.7 cc	25.6 cc
Acidless orange**	36.4 cc	5.8 cc	40.1cc
Blue gum**	31.8 cc	4.7 cc	28.3 cc
Microbial pesticides			
Biofly (3 XI0^7 conidia/ml.)•	1.5 cc	1.5 cc	1.5 cc
Agerin ((6.4% W.P)•	1 gm	1 gm	1 gm
Mixtures			
K.Z. oil* + Baladi mandarin**	8.75 + 30.1cc	5cc + 0.49 cc	5cc + 15.4 cc
K.Z. oil* + sour orange**	8.75 + 35.6 cc	5cc + 5.7 cc	5cc + 25.6 cc
K.Z. oil* + acidless orange**	8.75 + 36.4 cc	5cc + 5.8 cc	5cc + 40.1 cc
K.Z. oil* + Blue gum**	8.75 + 31.8 cc	5cc + 4.7cc	5cc + 28.3cc
K.Z. oil* + Biofly*	8.75 + 0.75 cc	5cc + 0.75cc	5cc +0.75 cc
K.Z. oil* + Agerin*	8.75 +0.5 gm	5cc + 0.5 gm	5cc +0.5 gm

• = Recommended dose * = Half of the Recommended dose ** = LC_{50}

On pepper plantations for thrips sprayed occurred on 24 May and the second application on 7/6/2003. For aphids, whitefly and leafhopper mits sprayed occurred on 17 August and the second application on 13/9/ 2003. and for spider mites sprayed occurred on 7 June and the second application on 17/8/ 2003.

Percentages of reduction for the infestation of the target pests were estimated according to **Henderson and Telton (1955)** equation as follows:

$$\%\text{of reduction} = 100\ [1 - (BxA^*) / (AxB^*)]$$

Wheres:

A = No. of individuals before spraying.

B = No. of individuals after spraying.

A* = No. of individuals in check before spraying

B* = No. of individuals in check after spraying

RESULTS AND DISCUSSION

a): The effectiveness of the tested compounds on sucking pests inhabited watermelon plantations:

1- *Thrips tabaci*

Fenitrothion was the most effective compound in reducing *T. tabaci* population density (the same result was obtained by **Nasseh and Link (1990)**) after the first and second sprays (81.44 and 93.24) followed by kz-oil + baladi mandarin oil (78.70 and 86.59 %) , kz-oil + blue gum (75.15and 86.59%), Kz-oil + acidless orange oil (71.21and 86.09%), kz-oil + sour orange oil (74.96 and 82.62 %), etoxazole (71.08 and 82.62%). kz-oil + Biofly (70.25 and 76.84%) and Kz-oil + Agerin (68.89 and 86.59 %) respectively. The other tested compounds were of moderate effect except Biofly and Agerin which were the least effective compounds. Generally, no significant differences were found among compounds except fenitrothion, Biofly and Agerin (Table 2). Similar results were also obtained by **Abdel-Wahab *et al.*, (2001)** and **Al-Fawaeer and Abu-Abeid (2002).**

2- *Aphis gossypii*

Data in (Table 3) showed that fenitrothion was the most effective compound in reducing *A. gossypii* population density after the first and second sprays, followed by agerin, etoxazole, Kz-oil + Biofly. acidless orange oil, kz-oil + Agerin, Kz-oil + baladi mandarin oil, biofly, Kz-oil + blue gum oil, baladi mandarin oil and blue gum oil. Kz-oil + acidless orange oil and Kz-oil were of moderate effect, whereas sour orange oil was the least effective compound. Generally.

all treatments gave satisfactory results in reducing *A. gossypii*. The reduction percentage(general average) ranged between 70. 10 and 9 8.92 in the first spray and (70.05 and 99.29) in the second spray.,thes results agreed with the findings of **El-Hariry et al., (1998) Abdel - Aziz et al.(2002), Rizk et al(1999) and Sharaf and El-Basyouni (2002).**

Table (2): Reduction percentages of the tested compounds on *T. tabaci* (nymphs and adults) populations on watermelon plantations

Compounds	The first spray			The second spray		
	Initial effect %	R.e.	General average	Initial Effect %	R.e.	General average
Pesticides						
Fenitrothion	97.95a	77.31	81.44a	99.88a	91.58	93.24a
Etoxazole	80.40c	68.76	71.08ab	83.33c	82.44	82.62ab
Mineral oil						
K.Z. oil	64.99g	58.28	59.62ab	66.67e	64.97	65.31ab
Plant oil extracts						
Baladi mandarin	79.80cd	62.45	65.92ab	76.67d	64.97	67.31ab
sour orange	72.43e	57.61	60.57ab	73.33e	64.97	66.64ab
Acidless orange	77.63d	58.23	62.11ab	73.33e	64.97	66.64ab
Blue gum	69.96f	65.18	66.14ab	76.67d	94.97	67.31ab
Microbial pesticides						
Biofly	7.94j	67.76	55.79ab	33.33f	64.97	58.64b
Agerin	21.41i	60.48	52.67b	33.33f	94.97	58.64b
Mixtures						
K.Z. oil+B.M.	82.22c	77.82	78.70ab	83.33c	87.41	86.59ab
K.Z. oil+S.O.	80.94c	73.36	74.96ab	83.33c	77.47	82.62ab
K.Z. oil+A.O.	73.14e	70.73	71.21ab	86.67b	81.97	86.09ab
K.Z. oil+B.G.	58.08b	72.54	75.15ab	83.33c	87.41	86.59ab
K.Z. oil+Biofly	66.22g	71.26	70.25ab	77.78d	76.61	76.84ab
K.Z. oil+Agerin	59.77h	71.18	68.89ab	83.33c	87.41	86.59ab

B.M. = Baladi mandarin, S.O.= sour orange, A.O.= acidless orange, B.G.= Blue gum and R. e. = Residual effect (average). Mean followed by a common letter are not significantly different at the 5% level by DMRT 1955

3-*Empoasca sp.*:

Fenitrothion also was the most potent compound in reducing the population density of *Empoasca* sp. after the first treatment followed by Kz-oil + baladi mandarin oil and etoxazole. The reduction percentages of the other compounds were less than 70%.In case of the tested bio-insecticides (Biofly and Agerin) were the least effective compounds. After the second spray, it was observed that the

population density of *Empoasca* sp. decreased in all treatments except Biofly and Agerin (Table 4).

Table (3): Reduction percentages of the tested compounds on *A. gossypii* (nymphs and adults) populations on watermelon plantations

Compounds	The first spray			The second spray		
	Initial effect %	R. e.	General average	Initial effect %	R. e.	General average
Pesticides						
Fenitrothion	96.80b	99.44	98.92a	98.00b	99.29	99.04a
Etoxazole	90.41e	96.05	94.94ab	92.00d	95.73	94.98ab
Mineral oil						
K.Z. oil	85.41g	83.61	83.97c	86.00f	84.23	84.58b
Plant oil extracts						
Baladi mandarin	87.89f	91.49	90.77abc	88.00e	92.00	91.20ab
sour orange	72.39k	69.53	70.10d	73.00j	70.05	70.64c
Acidless orange	80.22i	97.50	94.05abc	81.00h	97.55	94.24ab
Blue gum	99.88a	87.17	89.91abc	99.90a	88.1	90.46ab
Microbial pesticides						
Biofly	87.59g	94.46	93.09abc	88.00e	94.73	93.38ab
Agerin	95.74bc	96.53	97.00d	97.00bc	97.23	97.18a
Mixtures						
K.Z. oil+B.M.	94.39c	92.98	93.26abc	95.50c	93.75	94.10ab
K.Z. oil+S.O.	85.29g	95.87	93.75abc	86.00f	96.30	94.24ab
K.Z. oil+A.O.	82.74h	85.25	84.75bc	84.00g	85.88	85.50b
K.Z. oil+B.G.	99.88a	91.27	92.99abc	99.90a	91.43	93.10ab
K.Z. oil+Biofly	92.33d	94.50	94.07abc	93.00d	95.07	94.66ab
K.Z. oil+Agerin	76.03i	98.61	94.09abc	77.00i	98.42	94.14ab

B.M. = Baladi mandarin, S.O.= sour orange, A.O.= acidless orange, B.G.= Blue gum and R. e. = Residual effect (average). Mean followed by a common letter are not significantly different at the 5% level by DMRT 1955

4- *Bemisia tabaci*

The data in Tables (5) showed that,Kz-oil + baladi mandarin oil was the most effective compound in reducing the population density of *B. tabaci* after the first spray, followed by Kz-oil + blue gum oil, etoxazole, Kz-oil + agerin, Kz-oil + acidless orange oil and sour orange oil. The other tested compounds were of a moderate effect except kz-oil, biofly and agerin which were the least effective compounds. The second spray, no significant differences were found among treatments.

Table (4): Reduction percentages of the tested compounds on *Empoasca* sp. populations on watermelon plantations

Compounds	The first spray			The second spray		
	Initial effect %	R. e.	General average	Initial effect %	R. e.	General average
Pesticides						
Fenitrothion	87.00a	84.26	84.81a	86.67a	82.51	83.34a
Etoxazole	74.00b	79.39	78.31ab	64.44f	80.53	77.31a
Mineral oil						
K.Z. oil	44.29g	58.99	56.05bc	46.67i	69.96	65.30ab
Plant oil extracts						
Baladi mandarin	51.25e	65.76	62.86abc	73.33e	70.87	71.43ab
sour orange	56.67d	64.73	63.12abc	75.38d	66.59	68.35ab
Acidless orange	48.00f	64.72	61.42abc	73.33e	60.81	63.32ab
Blue gum	67.50c	60.01	61.15abc	73.33e	57.54	60.69ab
Microbial pesticides						
Biofly	35.00h	53.44	49.75c	20.00k	57.94	50.36b
Agerin	56.67d	38.18	41.88c	33.33j	54.56	50.31b
Mixtures						
K.Z. oil+B.M.	67.50c	84.66	81.23ab	86.67a	80.46	81.70a
K.Z. oil+S.O.	48.00f	61.93	59.15abc	84.76b	76.19	77.90a
K.Z. oil+A.O.	44.29g	60.87	57.55abc	82.22c	73.95	75.60b
K.Z. oil+B.G.	56.67d	64.15	62.65abc	86.67a	77.02	78.95a
K.Z. oil+Biofly	48.00f	66.81	63.05abc	50.00h	70.77	66.62ab
K.Z. oil+Agerin	35.00h	64.41	58.52abc	62.67h	62.55	62.57ab

B.M. = Baladi mandarin, S.O.= sour orange, A.O.= acidless orange, B.G.= Blue gum and R. e. = Residual effect (average). Mean followed by a common letter are not significantly different at the 5% level by DMRT 1955

5- *Tetranycus urticae* Koch:

Etoxazole was the most effective compound in reducing *Tetranychus* sp. populations among the tested compounds after first spray, followed by kz-oil + baladi mandarin oil while Kz-oil + Agerin, Kz-oil + sour orange oil, acidless orange oil, Kz-oil + acidless orange oil and Kz-oil have a moderate effect, whereas Kz-oil + blue gum oil, baladi mandarin oil, blue gum oil, sour orange oil, Kz-oil + Biofly, biofly and agerin were the least effective compounds. After the second spray,Kz-oil + biofly,Kz-oil + blue gum oil and Kz-oil + acidless orange oil were the most effective compounds in reducing *Tetranychus* sp. populations followed by acidless orange oil, Kz-oil + sour orange oil, Kz-oil + agerin, Kz-oil + baladi mandarin oil, sour orange oil, etoxazole, baladi mandarin oil and blue gum oil while Agerin, Kz-oil and Biofly exhibited a moderate effect. Fenitrothion

was the least effective compounds (Table 6). , the same result was obtained with **Gamieh et al (2000).**

Table (5): Reduction percentages of the tested compounds on *B. tabaci* (larvae) populations on watermelon plantations

Compounds	The first spray			The second spray		
	Initial effect %	R. e.	General average	Initial effect %	R. e.	General average
Pesticides						
Fenitrothion	83.33c	70.80	73.31ab	50.00d	72.32	67.86a
Etoxazole	99.88a	72.14	77.69a	99.88a	64.85	71.85a
Mineral oil						
K.Z. oil	66.67c	51.49	54.53ab	53.57c	62.16	60.44a
Plant oil extract						
Baladi mandarin	66.67e	60.36	61.62ab	99.88a	70.76	76.58a
sour orange	77.78d	61.71	64.92abs	53.57c	74.48	70.29a
Acidless orange	66.67e	63.07	63.79ab	45.83e	80.38	73.07a
Blue gum	77.78d	67.04	69.18ab	99.88a	68.76	74.98a
Microbial pesticides						
Biofly	33.33f	60.42	55.00ab	40.91f	74.42	67.72a
Agerin	16.67g	47.03	40.95b	56.67b	75.81	71.98a
Mixtures						
K.Z. oil+B.M.	88.89b	78.15	80.29a	99.88a	74.09	79.25a
K.Z. oil+S.O.	83.33c	72.59	74.74a	99.88a	71.74	69.51a
K.Z. oil+A.O.	83.33c	72.59	74.74a	99.88a	64.86	71.86a
K.Z. oil+B.G.	88.89b	76.68	79.02a	99.88a	64.86	71.86a
K.Z. oil+Biofly	66.67e	68.17	67.87ab	45.83e	76.55	70.44a
K.Z. oil+Agerin	76.78d	75.94	76.11a	50.00d	67.55	64.04a

B.M. = Baladi mandarin, S.O.= sour orange, A.O.= acidless orange and B.G.= Blue gum. Mean followed by a common letter are not significantly different at the 5% level by DMRT 1955

Zein et al., (2002) reported that, potentiation effect of KZ-oil + black pepper extract against *Tetranycus urticae* adults. Moreover, the joint action of mixtures of plant oils or mineral oils with pesticides was found to be effective against *T. tabaci, A. gossypii* and *T. urticae* as showed by many investigators **(Barakat et al., 1985; Haydar *et al.*, 1996 and Helmy et al., 2002). El-Khodary et al., (2007)** revealed that fenitrothion gave high toxic effect against *T. tabaci. A. gossypii* and *T. urticae* but etoxazole was the least toxic compound against *T. tabaci* while high toxic for *T. urticae.*

Table (6): Reduction percentages of the tested compounds on *Tetranychus* sp. (mobile stages) populations on watermelon plantations

Compounds	The first spray			The second spray		
	Initial effect %	R. e.	General average	Initial effect %	R. e.	General average
Pesticides						
Fenitrothion	57.85i	52.49	60.29ab	84.73d	56.54	62.14d
Etoxazole	96.50a	79.64	83.04a	99.88a	78.72	82.95abc
Mineral oil						
K.Z. oil	77.30cd	58.24	61.89ab	77.22fg	73.53	74.26bcd
Plant oil extracts						
Baladi mandarin	72.75ef	52.22	56.33ab	78.63f	83.22	82.50abc
sour orange	73.12e	51.09	55.49ab	77.68fg	86.79	84.97abc
Acidless orange	67.25h	61.85	62.90ab	90.99b	88.53	89.02ab
Blue gum	70.83fg	53.33	56.84ab	75.98gh	81.28	80.22abc
Microbial pesticides						
Biofly	14.71k	51.51	44.15b	42.27j	80.86	73.03cd
Agerin	10.63l	51.14	43.04b	69.07i	80.42	78.15abc
Mixtures						
K.Z. oil+B.M.	78.07bcd	74.87	75.51ab	81.60e	87.63	86.39ab
K.Z. oil+S.O.	79.82b	63.03	66.39ab	86.81c	89.04	88.59ab
K.Z. oil+A.O.	78.89bc	58.98	62.86ab	91.89b	89.67	90.11a
K.Z. oil+B.G.	76.01d	52.93	57.55ab	84.57d	92.02	90.53a
K.Z. oil+Biofly	44.33j	54.72	52.61ab	86.59cd	91.87	90.81a
K.Z. oil+Agerin	70.30g	68.43	68.80ab	74.39h	91.58	88.14abc

B.M. = Baladi mandarin, S.O.= sour orange, A.O.= acidless orange, B.G.= Blue gum and R. e. = Residual effect (average). Mean followed by a common letter are not significantly different at the 5% level by DMRT 1955

b): The effectiveness of the tested compounds on sucking pests inhabited pepper plantations:

1) *T. tabaci*

Fenitrothion was the most effective compound in reducing the population density of *T. tabaci* after the first and second sprays followed by etoxazole and Kz-oil + baladi mandarin oil. The other tested compounds have moderate effects except Kz-oil, sour orange oil, Biofly and Agerin were the least effective compounds. Generally, significant differences were found among the tested compounds (Table 7), as reported by **Abdel-Aziz et al (2002) and Iskander and El-Sisi (2001).**

2) *A. gossypii*

The data presented in Table (8) concerning *A. gossypii* show that fenitrothion was the most effective compound in reducing its population density after the first and second sprays followed by etoxazole, Kz-oil + Agerin, baladi mandarin oil, kz-oil + sour orange oil, kz-oil + baladi mandarin and Kz-oil + acidless orange oil. The other tested compounds were moderately effective except Biofly which was the least effective one. Statistically, significant differences were found among the tested compounds, as reported by **Shaheen et al (1992) and Magouz (2003).**

Table (7): Reduction percentages of the tested compounds on *T. tabaci* (nymphs and adults) populations on pepper plantations

Compounds	The first spray			The second spray		
	Initial effect %	R. e.	General average	Initial effect %	R. e.	General average
Pesticides						
Fenitrothion	96.00a	80.10	84.28a	97.00a	84.34	86.87a
Etoxazole	81.00cde	82.66	82.33ab	82.00cd	83.13	82.90ab
Mineral oil						
K.Z. oil	65.00i	59.71	60.77bcd	66.50h	60.88	62.00bc
Plant oil extracts						
Baladi mandarin	80.00de	65.59	68.47ad	82.00cd	68.25	71.00abc
sour orange	71.00h	60.62	62.69ad	72.00g	60.75	63.00bc
Acidless orange	75.00g	61.31	64.05ad	76.00f	62.50	65.20abc
Blue gum	70.00h	68.53	68.82ad	71.00g	69.13	69.50abc
Microbial pesticides						
Biofly	15.00k	67.42	56.93cd	17.00j	71.75	60.80bc
Agerin	22.00j	58.67	51.33d	24.00i	65.13	56.90c
Mixtures						
K.Z. oil+B.M.	85.00b	80.81	81.65ab	87.00b	81.75	82.80ab
K.Z. oil+S.O.	82.00cd	76.65	77.72abc	83.00c	77.75	78.80abc
K.Z. oil+A.O.	79.14ef	76.67	77.16abc	80.00de	77.75	78.20abc
K.Z. oil+B.G.	83.50bc	76.05	77.54abc	84.00c	77.11	78.49abc
K.Z. oil+Biofly	77.22fg	74.01	74.65abc	78.00ef	77.25	77.40abc
K.Z. oil+Agerin	70.50h	78.89	77.12abc	71.00g	81.25	79.20abc

B.M. = Baladi mandarin, S.O.= sour orange, A.O.= acidless orange, B.G.= Blue gum and R. e. = Residual effect (average). Mean followed by a common letter are not significantly different at the 5% level by DMRT 1955

3) ***Empoasca sp.***:

The data presented in Table (9) show that, fenitrothion was the most effdctive compound in reducing the population density of *Empoasca* sp. after the first spray followed by Kz-oil + baladi mandarin oil, Kz-oil + sour orange oil and etoxazole. The other tested compounds were moderately effective except sour orange oil, acidless orange oil, blue gum oil, biofly and agerin which were the least effective compounds. No significant differences were found among compounds after the second spray.

4- ***Bemisia tabaci***

Fenitrothion was the most effective compound in reducing the population density after the first spray followed by baladi mandarin oil, Kz-oil, Kz-oil + baladi mandarin oil and Kz-oil + blue gum oil. **Negm (2001)** found that KZ - oil was the high effective against *B. tabaci*. The other tested compounds were moderately effective except sour orange oil, Biofly and Agerin which were the least effective compounds. All the tested compounds gave satisfactory result in reducing whitefly population ranged between 64.27 and 91.99% after the second spray with significant differences (Table 10).

5- ***Tetranycus urticae*** **Koch**:

Kz-oil + Agerin was the most effective compound in reducing the population density of *Tetranychus* sp. After the first and second sprays followed by Kz-oil + Biofly, Kz-oil + baladi mandarin oil, Kz-oil + acidless orange, Kz-oil + blue gum oil, Kz-oil + sour orange oil and etoxazole. Kz-oil, blue gum oil and fenitrothion were of moderately effective while the other compounds were the least effective and no significant differences were found among them (Table 11). Plant oils were found effective against *T. urticae* by many investigators under field conditions **(Castiglioni et al.(2002) and Farrag and Zakzouk, (2002)).**

The results achieved in this study can be summarized in the following findings:

- The results showed that all tested compounds reduced the mean numbers of sucking pests on watermelon and pepper plants.
- The data showed also that the tested compounds could be arranged descendingly according to their toxicity as follows: Pesticides > mixtures > plant oil extracts > mineral oil > microbial pesticides.

Table (8): Reduction percentages of the tested compounds on *A. gossypii* (nymphs and adults) populations on pepper plantations

Compounds	The first spray			The second spray		
	Initial effect %	R. e.	General average	Initial effect %	R. e.	General average
Pesticides						
Fenitrothion	99.88a	99.58	99.84a	99.88a	99.88	99.90a
Etoxazole	99.88a	96.89	97.59ab	76.19e	99.88	95.13ab
Mineral oil						
K.Z. oil	96.42b	81.53	84.51abc	76.19e	83.05	81.68ab
Plant oil extracts						
Baladi mandarin	82.79d	95.80	93.19abc	95.24b	96.66	96.38ab
sour orange	81.37de	70.69	72.82cd	96.19b	83.29	85.88ab
Acidless orange	91.26c	81.45	83.41ad	71.43f	70.40	70.61b
Blue gum	62.18f	81.78	77.86ad	88.09d	65.33	69.88b
Microbial pesticides						
Biofly	28.71g	69.73	96.53d	6.67i	92.03	74.96ab
Agerin	26.25g	93.35	79.93ad	26.98h	91.63	78.69ab
Mixtures						
K.Z. oil+B.M.	92.44c	89.01	89.69abc	90.48c	96.83	95.56ab
K.Z. oil+S.O.	91.49c	96.33	95.34abc	95.24b	97.41	96.98ab
K.Z. oil+A.O.	89.51c	92.19	91.65abc	96.19b	88.19	89.79ab
K.Z. oil+B.G.	79.02e	74.89	75.72bcd	90.84c	73.83	77.16ab
K.Z. oil+Biofly	84.27d	81.32	81.91ad	62.90g	99.88	92.48ab
K.Z. oil+Agerin	96.07b	96.22	96.19ab	99.88a	99.88	99.88a

B.M. = Baladi mandarin, S.O.= sour orange, A.O.= acidless orange, B.G.= Blue gum and R. e. = Residual effect (average). Mean followed by a common letter are not significantly different at the 5% level by DMRT 1955

Table (9): Reduction percentages of the tested compounds on *Empoasca* sp. populations on pepper plantations

Compounds	The first spray			The second spray		
	Initial effect %	R. e.	General average	Initial effect %	R. e.	General average
Pesticides						
Fenitrothion	99.88a	93.07	94.42a	99.88a	96.61	97.27a
Etoxazole	62.50c	91.19	85.45abc	87.33c	86.62	86.76a
Mineral oil						
K.Z. oil	62.50c	73.36	71.19abc	99.88a	80.44	84.33d
Plant oil extracts						
Baladi mandarin	75.00b	81.98	80.59abc	87.33c	82.48	83.45a
sour orange	62.50c	92.98	62.88bc	76.25d	80.41	79.58a
Acidless orange	75.00b	58.65	61.92bc	96.00b	83.11	85.69a
Blue gum	62.50c	67.11	66.19abc	99.88a	73.26	78.58a
Microbial pesticides						
Biofly	25.00d	67.54	59.03c	33.50e	84.66	74.42a
Agerin	25.00d	67.35	58.88c	24.00f	90.72	77.38a
Mixtures						
K.Z. oil+B.M.	99.88a	86.83	89.44ab	99.88a	92.79	94.20a
K.Z. oil+S.O.	99.88a	83.54	86.81abc	99.88a	87.64	90.09a
K.Z. oil+A.O.	99.88a	77.11	81.66abc	99.88a	88.67	90.91a
K.Z. oil+B.G.	99.88a	79.73	83.76abc	99.88a	83.65	86.89a
K.Z. oil+Biofly	75.00b	82.23	80.78abc	95.53b	89.11	90.39a
K.Z. oil+Agerin	75.00b	84.73	82.78abc	96.38b	87.48	89.26a

B.M. = Baladi mandarin, S.O.= sour orange, A.O.= acidless orange, B.G.= Blue gum and R. e. = Residual effect (average). Mean followed by a common letter are not significantly different at the 5% level by DMRT 1955

Table (10): Reduction percentages of the tested compounds on *B. tabaci* (nymphs and adults) populations on pepper plantations

Compounds	The first spray			The second spray		
	Initial effect %	R. e.	General average	Initial effect %	R. e.	General average
Pesticides						
Fenitrothion	86.89a	67.52	71.39a	95.40cd	77.18	80.83abc
Etoxazole	85.71a	61.96	66.71a	91.19f	91.73	91.62a
Mineral oil						
K.Z. oil	79.99b	66.91	69.52a	75.69h	75.91	75.87abc
Plant oil extracts						
Baladi mandarin	79.29b	67.79	70.09a	87.14g	83.10	83.91abc
sour orange	32.05h	49.78	46.23a	75.45h	81.22	80.07abc
Acidless orange	47.71g	65.76	62.15a	92.50ef	82.33	84.36abc
Blue gum	58.72f	58.08	58.21a	99.88a	90.03	91.99a
Microbial pesticides						
Biofly	13.74i	56.61	48.04a	25.00i	79.02	68.21bc
Agerin	14.94i	58.53	49.81a	10.00j	77.84	64.27c
Mixtures						
K.Z. oil+B.M.	71.72c	68.77	69.36a	96.06bcd	90.46	91.58a
K.Z. oil+S.O.	68.61d	65.39	66.04a	97.92abc	87.51	89.59a
K.Z. oil+A.O.	67.36d	69.26	68.88a	98.50ab	83.80	86.74ab
K.Z. oil+B.G.	73.02c	66.81	68.05a	99.88a	91.11	92.87a
K.Z. oil+Biofly	64.58e	55.58	57.38a	94.63de	85.19	87.08ab
K.Z. oil+Agerin	71.94c	61.64	63.69a	98.60ab	82.89	86.03ab

B.M. = Baladi mandarin, S.O.= sour orange, A.O.= acidless orange, B.G.= Blue gum and R. e. = Residual effect (average). Mean followed by a common letter are not significantly different at the 5% level by DMRT 1955

Table (11): Reduction percentages of the tested compounds on *Tetranycus urticae* (mobile stages) populations on pepper plantations

Compounds	The first spray			The second spray		
	Initial effect %	R. e.	General average	Initial effect %	R. e.	General average
Pesticides						
Fenitrothion	63.64fg	57.90	59.05a	64.00fg	59.00	60.00a
Etoxazole	99.88a	64.43	71.52a	98.00a	64.73	71.38a
Mineral oil						
K.Z. oil	60.00g	62.05	61.64a	62.00g	65.20	64.56a
Plant oil extracts						
Baladi mandarin	73.33d	54.32	58.12a	74.00d	61.50	64.00a
sour orange	75.38d	49.34	54.55a	75.00d	55.75	59.75a
Acidless orange	73.33d	52.68	56.81a	73.00d	56.00	59.40a
Blue gum	73.33d	57.66	60.79a	72.90d	61.50	63.78a
Microbial pesticides						
Biofly	20.00h	61.30	52.99a	22.00h	63.00	54.80a
Agerin	20.00h	67.50	58.00a	21.00h	71.13	60.35a
Mixtures						
K.Z. oil+B.M.	84.00b	78.66	79.73a	85.00b	79.85	80.88a
K.Z. oil+S.O.	80.00c	72.44	73.97a	81.00c	73.38	74.90a
K.Z. oil+A.O.	84.00b	76.52	78.97a	83.00bc	77.19	78.40a
K.Z. oil+B.G.	80.00c	74.94	75.95a	81.00c	76.00	77.00a
K.Z. oil+Biofly	65.71ef	84.50	80.39a	65.75ef	83.13	79.65a
K.Z. oil+Agerin	68.00e	83.87	82.68a	67.50e	82.87	79.69

B.M. = Baladi mandarin, S.O.= sour orange, A.O.= acidless orange, B.G.= Blue gum and R. e. = Residual effect (average). Mean followed by a common letter are not significantly different at the 5% level by DMRT 1955

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الملخص العربي

التقييم الحقلي لبعض الزيوت (المعدنية والنباتية المستخلصة) والمبيدات الكيميائية والمبيدات الميكروبية ومخاليطها على بعض الافات الماصة التي تصيب نباتات بطيخ اللب والفلفل

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تم دراسة التاثير السام لبعض المركبات وهى اثنان من المبيدات الموصى بها (الفينتروثيون و الاتوكسازول) والزيت المعدني كزد والزيوت النباتية المستخلصة من قشور ثمار الموالح (يوسفى ، نارنج، برتقال سكرى، زيت الكافور) ومبيدان من المبيدات الحيوية (بيوفلاى والاجرين). بالاضافه الى مخاليط المركبات السابقه مع زيت كزد على التربس ومن البطيخ والذبابه البيضاء والجاسيد والعنكبوت الاحمر على نباتات بطيخ اللب والفلفل تحت الظروف الحقلية.

ويمكن تلخيص النتائج المتحصل عليها فى النقاط التالية:

- مبيد الفنيتروثيون كان اكثر المركبات تاثيرا على التربس ويليه فى السمية زيت كزد وكانت الزيوت النباتية المستخلصة لها سمية متوسطة بينما مبيد الاتوكسازول كان اقل المركبات سمية.

- مبيد الفنيتروثيون كان اكثر المركبات سمية على من البطيخ ويليه زيت البرتقال السكرى ثم زيت كزد وكان مبيد الاتوكسازول له سمية متوسطة بينما الزيوت النباتية المستخلصة الاخرى كانت منخفضة السمية.

- مبيد الفنيتروثيون كان اكثر المركبات سمية فى خفض اعداد الجاسيد بعد الرشه الاولى ويليه مخلوط زيت كزد مع بعض المستخلصات النباتية ثم مبيد الاتوكسازول وكانت بقية المركبات لها سمية متوسطة فيما عدا بعض الزيوت النباتية المستخلصة والمبيدات الميكروبية كانت اقل سمية . وبعد الرشة الثانية لا توجد فروق معنوية بين المركبات المختلفة فى خفض تعداد الافة.

- مبيد الفنيتروثيون كان اكثر المركبات سمية فى خفض أعداد الذبابة البيضاء بعد الرشه الاولى ويليه الزيت المعدنى مع بعض المستخلصات النباتية الزيتية بينما باقى المركبات كانت لها سمية متوسطة ما عدا مستخلص النارنج والمبيدات الميكروبية كانت اقل سمية . بينما بعد الرشة الثانية كل المركبات اعطت نتيجة مرضية فى خفض تعداد الذبابة البيضاء بنسبة تتراوح من ٦٤,٢٧ الى ٩١,٦٢%.

- زيت كزد كان اكثر المركبات سمية على الاكاروس الاحمر يليه الفنيتروثيون ومستخلص زيت البرتقال السكرى. وكانت باقى الزيوت النباتية المستخلصة الاخرى متوسطة السمية بينما الاتوكسازول كانت له سمية منخفضة.

- ويمكن القول بصفة عامة ان كل المركبات المختبرة ادت الى خفض تعداد الافات الماصة على نباتات البطيخ والفلفل مع اختلاف نسب الخفض فى الاصابه. ويكن ترتيب المركبات المختبرة على حسب التاثير على الافات الماصة كالتالى: المبيدات الكيميائية > المخاليط > الزيوت النباتية > الزيوت المعدنية > المبيدات الميكروبية.