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Toxicity of some pesticides and oil plant extracts to plant sucking pests

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ABSTRACT

Toxicity of certain compounds including pesticides (fenitrothion and etoxazole), mineral oil (KZ-oil), plant oils extracted from citrus such as (baladi mandarin ***Citrus deliciosa*** Blanc, sour orange ***Citrus aurantium*** L. , acidless orange ***Citrus sinensis*** Osbek) and blue gum ***Eucalyptus globulus*** L., microbial pesticides (Biofly and Agerin) and mixtures of [KZ-oil with plant oils or microbial pesticides] against nymphs of ***Thrips tabaci*** Lind., adult of ***Aphis gossypii*** Glover and adult females of ***Tetranychus urticae*** Koch ,were evaluated under laboratory conditions. Results revealed that ,fenitrothion gave high toxic effect against all tested pests., ***T. tabaci,*** A.gossypii and ***T. uritica*** . Etoxazole was the least toxic compound against ***T.tabaci*** while high toxic for ***A. gossypii.*** The plant oils., blue gum, sour orange and acidless orange have a moderate toxicity to ***A. gossypii*** while slight toxicity to ***T.urtica.*** KZ-oil was higher toxic against ***T.urtica*** than all tested plant oils. Also the results showed that Biofly and Agerin were highly toxic to ***T.tabaci*** and ***A.gossypii*** while their moderately toxic to ***T. urtica*** Clearly a tested mixtures had a potential effect against ***T.tabaci, A.gossypii,*** and ***T.urtica.***,

INTRODUCTION

Sucking pests considered to be the most serious pests attacking field crops such as, vegetables, fruits and ornamental plants, and it causes a great damage through their feeding and draining of the plant sap, in addition to their importance as vectors of several pathogens such as virus and bacteria besides excreting different amounts of sticky honey dew during the feeding process which cover plants and provides an ideal media for fungal growth (Butler and Henneberry,1986 and Harris *et al.*, 1992).

A wide range of chemicals have been marketing for controlling pests. The intensive use of chemical compounds resulted many problems such as population out breaks of the pests and its resistance development against all known pesticide groups and also, many of these chemicals have residues in the environment which constitute toxic hazards to human health, domestic animals and wildlife generally.

Alternatively, non-chemical control methods have been widely assessed, and the most successful non-chemical techniques had been the exploitation of predators (Saied *et al.*, 2002 and Sharaf and El-Basyouni, 2002) which are commonly found in agricultural ecosystems.

The present study aimed to evaluate the toxic effect of certain compounds including two pesticides (Fenitrothion and Etoxazole), mineral oil (KZ-oil), plant oils (extracted from citrus and blue gum)., microbial pesticides (Biofly and Agerin A), and mixture of [KZ- oil with plant oils or two microbial pesticides], against some plant sucking pests (***T. tabaci*** Lind. nymphs, ***A. gossypii*** Glover adults and ***T. urticae*** Koch adult females) under laboratory conditions.

MATERIALS AND METHODS

1- Tested Pests: ***Aphis gossypii*** and ***Tetranycus uritica*** Koch., were obtained from infested watermelon plantations, while ***Thrips tabaci*** Lind. Colonies were obtained from infested onion plants from Kafr El- Sheikh fields, and reared on watermelon plants (***Cucurbit lanatus*** var. ***colocynthoids***) under laboratory conditions (21±2 C and 55 ± 5% R.H).

2- Tested Compounds:

2-1 Pesticides : Baroque (10% SC), Etoxazole (RS) – 5-tert-butyl-2[2-(2, 6-difluorophenyl)-4,5-dihydro-1,3-oxazol-4-yl] phenetole Sumithion (50% EC), Fenitrothion (O,O-dimethyl O-4-nitro-m-tolyl phosphorothioate)

2-2 Mineral oil: K.Z. oil (95% EC)

2-3 Plant oils:

a) crude extracts: Volatile oil extractions from citrus fruit peels of [(***Citrus deliciosa*** Blanc, baladi mandarin), (***Citrus aurantium*** L., sour orange) and (***Citrus sinensis*** Osbek, acidless orange)] (Family: ***Rutaceae***)

were extracted in Pesticide Department , Faculty of Agriculture Kafr El-Shiekh University, by steam distillation using the method of A.O.A.C. (1990) with Clavenger trap apparatus on the basis (the oils are lighter than water).

b) Blue gum : ***Eucalyptus globules L.***(trade shopping)

2-4 Microbial pesticides: Biofly , *Beauvaria bassiana* as a microbial liquid pesticide containing 3 x10 ^{7} conidia/ml. Agerin , *Bacillus thuringiensis* kurstaki 32000 I.U. /mg. (6.4 a.i W.P). The tested compounds were supplied by Plant Protection Research Institute, Agriculture Research Center, Dokki, Egypt.

3- Experiments :

a) Evaluation of oils and chemical pesticides toxicity:
The toxicity of tested formulated compounds was evaluated by leaf disc dip technique. While mineral and Plant oils were evaluated according to method of FAO, (1980). Four discs of watermelon leaves were dipped in each concentration of the concentration serious 125, 250, 500, 1000 and 2000 ppm for 5 seconds after air dried, 10 adults of ***A. gossypii, T. uriticae*** or 10 nymphs of ***T. tabaci*** were transferred to each disc. The discs were placed on moist filter paper, pads mounted in Petri dishes and kept under (21$\pm$2°C and 55 $\pm$ 5% R.H). Mortality counts were recorded after 24hours from treatment with the aid of binocular. The mortality percentage was corrected according to Abbott's Formula (1925). Data were plotted on log-dosage probit papers and statistically analyzed according to Finney's method (1952).

b) Evaluation of microbial pesticide toxicity:
The bio-compounds, Biofly and Agerin, were diluted with distilled water to prepare the concentrations of (15000, 30000, 60000, 90000 and 120000 conidia/ml) and (15, 30, 60, 120, and 240 ppm), respectively. Also four discs of watermelon leaves were dipped in each concentration and exposed to the tested pests. The mortality counts were recorded after 24, 48, 72 and 96 hours from treatment. The Mortality percentages were corrected and statistically analyzed as mentioned before.

c) Evaluation of mixtures toxicity:
Toxicity of the mixtures of the mineral oil plus each plant oil extracts or tested bio-insecticides was investigated against the same pests.

The joint action effect of tested compounds in combination was evaluated by the following equation (Mansour et al., 1966):

$$\text{Co - toxicity factor} = \frac{\text{Observed mortality \%} - \text{Expected mortality \%}}{\text{Expected mortality \%}} \text{ X } 100$$

Where: + 20 or more = synergistic effect
Between + 20 and – 20 = additive effect
- 20 or low = antagonistic effect

RESULTS AND DISCUSSION

1- Toxicity of tested compounds to *T. tabaci, A. gossypii* and *T. urticae*: Results in Table (1) showed that fenitrothion was the most toxic compound against ***T.tabaci*** nymphs followed by KZ-oil with LC50,s values of 1.67 and 286.64 ppm., respectively . While the plant oil extracts: baladi mandarin, blue gum, sour orange and acidless orange have a slight toxicities and the LC_{50},s values were 1504.78, 1591.85 , 1781.93 and 1820.47 ppm., respectively. Etoxazole was the least toxic to ***T. tabaci*** nymphs with LC_{50} of 6079.11 ppm.

The obtained result was agreed with Moustafa *et al.* (1985) Nasseh and Link (1990), Rizk *et al.* (1999) and Iskander and El-Sisi (2001) , Al-Fawaeer and Abu-Abeid (2002) and Abdel-Aziz *et al.* (2002). Results in Table (1) indicated that fenitrothion was the most toxic compound followed by baladi mandarin oil extract and KZ-oil to ***A. gossypii*** with LC_{50} values of 1.66, 24.29 and 25.79 ppm, respectively.

While etoxazole has a moderate toxicity with LC_{50} of 159.22 ppm., but blue gum, sour orange and acidless orange oil extracts were the least toxic to ***A. gossypii*** with LC_{50} values of 236.70, 286.98 and 289.37 ppm, respectively.

The results obtained are in agreement with those recorded by Shaheen *et al.* (1992), Nassef *et al.* (1996) , Misra (2002), Sharaf and El-Basyouni (2002)., Haydar *et al.* (1996) and Guirguis *et al.* (1991).

Table (1): Toxicity of some chemical pesticides, mineral oil and plant oil extracts against *T. tabaci* nymphs, *A. gossypii* adults and *T. urticae* adult females.

Compounds		*T.tabaci*	*A.gossypii*	*T.urticae*
		LC_{50} (ppm)	LC_{50} ppm	LC_{50} ppm
Chemical pesticides	Fenitrothion	1.67 (1.36 2.02)*	1.66 (1.31 2.08)	411.22 (302.71 543.73)
	Etoxazol	6079.11 (5050.8 7815.7)	159.22 (106.32 218.10)	9445.44 (8205.77 11000.8)
Mineral oils	KZ oil	286.64 (233.94 345.85)	25.79 (18.13 36.96)	242.80 (174.10 313.24)
Plant oil extracts	Baladi mandarin	1504.78 (1194.99 1959.72)	24.29 (18.24 31.92)	769.84 (212.41 1830.18)
	Sour orange	1781.93 (685.94 18007.91)	286.98 (223.33 355.52)	1278.79 (1053.65 1567.90)
	Acidless orange	1820.47 (678.06 27505.45)	289.37 (203.24 381.78)	2004.90 (1525.09 2885.81)
	Blue gum	1591.85 (800.49 4684.42)	236.70 (168.92 305.78)	1416.24 (1145.41 1789.19)

*Ninety five present lower and upper fiducial limits

Based on LC_{50} values presented in Table (1) KZ-oil was the highest toxic compound against ***T. urticae*** (LC_{50}= 242.80 ppm) followed by fenitrothion (LC_{50}= 411.22 ppm) and baladi mandarin oil extract (LC_{50}= 769.84 ppm)., The volatile oils of sour orange, blue gum and acidless orange and etoxazole have LC_{50} values of 1278.79, 1416.24 , 2004.90 and 9445.44 ppm, respectively. Similar results obtained by Osman, (1997); El-Naggar, (2000); Gamieh *et al.*, (2000); Saied *et al.*,(2002) and Magouz, (2003).

2- Toxicity of microbial pesticides, Biofly and Agerin to *T.tabaci*, *A.gossypii* and *T.urtica*: The entomopathogenic (Biofly) fungus, ***Beauveria bassiana*** and (Agerin) Bacteria, ***Bacillus thuringiensis*** were investigated against ***T. tabaci*** nymphs, ***A. gossypii*** adults and ***T. urticae*** adult females has been studied under laboratory conditions of (21± 2 °C and 55 ± 5% R.H). Toxicity of Biofly and Agerin are presented in Table (2). The LC_{50} values for ***T. tabaci*** Lind. Were 49376.38 conidia/ml of Biofly and 57.72 ppm (1847040 IU/ mg) of Agerin after 48 hours of exposure time, respectively. The results also showed that the LC_{50} of Biofly was 23748.32 conidia/ml and 29.13 ppm (932160 IU/ mg) for Agerin against ***A. gossypii*** after 48 hours of exposure time.

Data in Table (2) revealed that the LC_{50}s were 57857.82 conidia/ml of Biofly and 103.23 ppm (3303360 IU /mg) of Agerin against ***T. urticae***, after 48 hr. Biofly was effective against ***T. urticae*** and this result is in agreement with that recorded by Saenz de *et al.* (2003).and Zakzouk (2003). The recommended concentrations for field application is $3x10^4$ conidia/ml and 1 g/liter of Biofly and Agerin, respectively.

3- Toxicity of binary mixtures of KZ - oil and plant oil extracts or microbial pesticides to *T. tabaci*, *A. gossypii* and *T. urticae*:

Six mixtures of the mineral oil (KZ-oil) with four plant oil extracts (baladi mandarin, sour orange, acidless orange and blue gum) or with the two microbial pesticides (Biofly and Agerin) were tested against ***T. tabaci*** nymphs, ***A. gossypii*** adults and ***T. urticae*** adult females. Pests were subjected to sublethal concentrations (LC_{25}'s) deduced from the regression lines of each compound.

Table (2): Toxicity of Biofly (*Beauvaria bassiana*) and Agerin (*Bacillus thuringiensis*) to *T. tabaci* nymphs, *A. gossypii* adults and *T. urticae* adult females.

Compound	*T. tabaci*				*A. gossypii*				*T. urticae*			
	LC_{50}	Confidence limits		Slope	LC_{50}	Confidence limits		Slope	LC_{50}	Confidence limits		Slope
		Lower	Upper			Lower	Upper			Lower	Upper	
Biofly	49376.38 conidia/ml	39753.75	60786.79	2.15	23748.32 conidia/ml	12470.81	33664.61	1.31	57857.82 conidia/ml	43323.8	80271.7	1.48
Agerin	57.72 ppm (1847040 IU/ mg)	44.38	74.70	1.76	29.13 ppm (932160 IU/ mg)	17.19	42.10	1.15	103.23 ppm (3303360 IU / mg)	76.75	150.94	1.49

Table (3): Toxicity of binary mixtures of KZ-oil with plant oil extracts and (Biofly & Agerin) to *T. tabaci*, *A.gossypii* and *T.urtica*.

Combination	*T. tabaci*		*A. gossypii*		*T. urticae*	
	Observed% mortality	Co-toxicity factor	Observed% mortality	Co-toxicity factor	Observed% mortality	Co-toxicity factor
Kz-oil+Baladi mandarin oil	85	+70	97.5	+95	90	+80
Kz-oil+Sour orange oil	82.5	+65	100	+100	75	+50
Kz-oil+Acidless orange oil	70	+40	100	+100	74	+48
Kz-oil+Blue gum oil	77.5	+55	97.5	+95	80	+60
Kz-oil+Biofly	87.5	+75	100	+100	87.5	+75
Kz-oil+Agerin	75	+50	100	+100	80	+60

Data presented in Table (3) showed different levels of potentiations for the six pairs of mixtures. KZ-oil mixed with the tested plant oils gave different co-toxicity levels against ***T. tabaci*** + 70, 65, 40 and 55 for baladi mandarin, sour orange, acidless orange and blue gum respectively while KZ-oil with microbial pesticides gave + 75 and 50 co-toxicity factor for Biofly and Agerin, respectively. The same mixtures against ***A. gossypii*** showed almost 100% co-toxicity levels. In the case of ***T. urticae***, the co-toxicity factors of tested mixture ranged from +48 to + 80. Zein *et al.* (2002) reported potentiation effect of KZ-oil + black pepper extract against ***T. 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.urtica*** as showed by many investigators (Barakat *et al.*, 1985; Haydar *et al.*, 1996, and Helmy *et al.*, 2002).

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الملخص العربى

تتعرض نباتات الخضر للعديد من الآفات التى تؤثر عليها من ناحية الجودة وكمية المحصول ومن أهمها الآفات الماصة (الحشرية والحيوانية) ،ونظرا لخطورة المبيدات على كل من الإنسان والحيوان والبيئة فان هذه الدراسة تهدف إلى دراسة التأثير السام لبعض المبيدات الموصى بها والزيوت النباتية المستخلصة من قشور ثمار الموالح(يوسفى ، نارنج ، برتقال سكرى) وزيت الكافور ، وكذلك تأثير بعض الزيوت المعدنية(كزد) وبعض المبيدات الحيوية(الأجيرين و البيوفلاى) ، بالإضافة إلي مخاليط هذه المركبات السابقة مع (كزد) على حوريات تربس البصل ومن البطيخ والإناث البالغة من العنكبوت الأحمر بعد التغذية على أقراص أوراق نبات البطيخ المعامله تحت الظروف المعملية .

وأظهرت النتائج أن: مبيد فينيتروثيون (السومثيون) كان أكثر المركبات سمية يليه زيت (كزد) بينما كانت الزيوت النباتية المستخلصة ذات تأثير متوسط السمية فى حين كان مبيد ايتوكسازول (الباروك) أقل المركبات سمية على حوريات تربس البصل . كما أظهرت النتائج المتحصل عليها أن مبيد فينيتروثيون (السومثيون) كان أكثر المركبات سمية يليه الزيت المستخلص من قشور البرتقال البلدى ثم زيت(كزد) و ايتوكسازول (الباروك) كان له سمية متوسطة بينما كانت باقى الزيوت النباتية المستخلصة المختبرة منخفضة السمية على حشرة المن . زيت كزد كان أكثر المركبات سمية ثم يليه فينيتروثيون (السومثيون) وزيت البرتقال البلدى.كما أظهرت النتائج أيضا أن الزيوت النباتية المستخلصة الأخرى متوسطة السمية،فى حين كان ايتوكسازول (الباروك) منخفض السمية على الإناث البالغة للعنكبوت الأحمر. على الجانب الأخر أظهرت النتائج أن المبيدات الحيوية كانت سميتها عالية على التربس والمن بينما كانت سميتها متوسطة على الأكاروس. وكذلك أوضحت النتائج أن كل المخاليط من خلال معامل السمية المشترك قد أحدثت تأثير تقوية ضد كل الآفات المختبرة .