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COMPARATIVE STUDY OF CERTAIN INSECTICIDES AND THE MIXTURES OF SOME PLANT OILS AGAINST COTTON LEAFWORM *Spodoptera littoralis* (BOISD)

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ABSTRACT

Laboratory experiments were conducted under controlled conditions to test the insecticidal activity of two insecticides *i.e.* Cypermethrin (25% E.C) a synthetic pyrethroid and Chlorpyrifos (48% E.C) an organophosphate insecticide. Also five plant oils were used in a ratio (1:1) i.e (*v/v*) and they were as in following: *Menth piperita* L., *Syzygium aromaticum* L., *Cinnamomum camphora* L., *Allium sativum* L. and *Anethum graveolens* L. The 4th instar larvae was used in bioassay of these insecticides and oils alone and the mixture of (insecticide: oil). The acute toxicity (LC_{50}) of each treatment recorded after 120 hr. Also the toxicity index (T.I) and relative potency (R.P) were calculated. The results showed that cypermethrin is more toxic than chlorpyrifos, also the *Allium sativum* L. was the most toxic oil and the lowest one was oil *Syzygium aromaticum* L. Finally the most toxic mixture was with cypermethrin, especially the mixture of cypermethrin and *Allium sativum* L. (1:1).

Key words: Insecticidal activity, cypermethrin, chlorpyrifos, plant oils, *Menth piperita* L., *Syzygium aromaticum* L., *Cinnamomum camphora* L., *Allium sativum* L. *Anethum graveolens* L. 4th instar larvae of cotton leafworm *Spodoptera littoralis* (Boisd) and Mixtures of oil plant.

INTRODUCTION

According to **Conway *et al.* (1982),** today there are more than 432 species of insects, mites, or ticks which were recorded as resistant to insecticides or acaricides, of these species, 216 are agricultural pests .The rate of resistance development and frequency depend on many genetic and biological factors. Also **El-Sebae (1987)**, reported that, insect pests with potential rate of reproduction such as insect (cotton leafworm, aphids, spider mites ... *etc*.) are notorious for developing resistance. However the overriding factor is the selection pressure exerted by high and frequent rates of pesticide application. Resistance had developed to all insecticide groups. In a lot of early studies the use of mixtures of some promising plant oils and plant extracts (e.g Camphor - Garlic - Clove - Dill - Citrus.*etc*.) and various insecticides belonging to different chemical groups (*e.g*: O.P`s-Carbamates and Synthetic pyrethroids). These mixtures applied on many pests (cotton leafworm - stored grain pests - cut worm - soya bean borers- citrus leaf minor- *Culex pipens* ... *etc*). The use of these mixtures and the aim of these control tactics were studied by many authers, **Lichtenstein *et al.* (1974), Eldoksch *et al.* (1991), Guirguis *et al.* (1991), Taman (2002) and Hussein *et al.* (2005).** So the aim of that study was an attempt to use the tested mixtures of plant oils and the lowest amount of synthetic insecticides to be applied instead of using synthetic insecticides with its recommended concentration and amount

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for enhancing the minimizing and rationalizing the use of synthetics as it is possible.

MATERIALS AND METHODS

Rearing the tested insect

The cultured of Cotton leafworm, *Spodoptera littoralis* (Boisd) used in this study originated from egg masses obtained from susceptible strain established in the laboratory of Dept. Environ. Prot., Fac. Environ. Agric. Sci., Arish Univ., North Sinai, Egypt. The progency of the insects together with occasional fresh supplies of egg formed the basis of culture designed to provide insects used in the present investigation. Five replicates per each concentration were used and 50 larvae/ Treatment. The 4th instar larvae was used in the bioassay tests. Under lab. conditions of 25 ± 2^{o}C (Temperature) and 60±5% RH (Relative Humidity) **El-Defrawy *et al.* (1964)**.

Agrochemicals used in the study

1- Cypermethrin 25% E.C [RS –α-cyano -3-phenoxy benzl (RS, CIS-trans) -3- (2.2-dichloro vinyl) -2-2 dimethyl cycopropane carboxylate] (Pesticide manual Seventh Ed.1983).

2- Chlorpyrifos 48% E.C [o,o-diethyl o-3,5,6-trichloro-2pyridylphosphorothioate] [Pesticide manual seventh Ed.1983]

Commercial formulations of tested insecticides were obtained from Central Agricultural Pesticides Laboratory (CAPL) in Dokki, Egypt, Giza.

Chemical used in the study

Bioassay of tested Plant Oils against 4th Instar Larvae of *Spodoptera littoralis* (Boisd)

The tested plant oils used were as in the Table 1. A series of concentrations of each plant oil were prepared by dilutions with Triton X-100 (T-X100). A 100 larvae of 4th instar were used for bioassay using five replicates for each concentration or (treatment) per each plant-oil and by using a dipping disc method of castor bean leaves for 30 sec's and left to dryness before used in bioassay. The (%) mortality calculated every 24 hr. and for 120 hrs. The LC_{50} values, slopes and its confidence limits were obtained from the regression lines according to **Finney (1971).**

Bioassay of Tested Insecticides against 4th Instar larvae of *Spodoptera littoralis* (Boisd)

A series of concentrations of the two formulated insecticides *i.e*., Chlorpyrifos 48% E.C and Cypermethrin 25% E.C were prepared by dilution with dist. water and by using dipping disc method of castor bean leaves and 100 larvae of 4th instar larvae of *S. littoralis* (Boisd) were used for the bioassay, in five replicates for each concentration (treatment) for each tested insecticide. The (%) mortality recorded every 24 hrs. and for 120 hrs. The LC_{50} values, slopes and its confidence limits were obtained from the regression lines according to **Finney (1971)**.

Bioasssay of Tested Mixtures of Insecticides: Plant Oils Against 4th Instar Larvae of *Spodoptera littoralis* (Boisd).

A mixture of each insecticide plant oils were prepared by using T-X100 for preparing a series of concentrations also 100 larvae of 4th instar larvae of *S. littoralis* were used for the bioassay. By using five replicates for each concentration or (treatment) for each tested mixture and applying a dipping disc method. The (%) mortality recorded every 24 hr. and for 120 hr. The LC_{50} values, slopes and its confidence limits were obtained from the regression lines according to **(Finney 1971).**

Table (1): The list of tested plant oils.

No.	Scientific Name	English Name	Family
1	*Menth piperita*L.	Mint Oil	Lamiaceae
2	*Syzygium aromaticum*L.	Clove Oil	Myrtaceae
3	*Cinnamomum camphora*L.	Camphor Oil	Lauraceae
4	*Allium sativum*L.	Garlic Oil	Amaryllidaceae
5	*Anethum graveolens*L.	Dill Oil	Apiaceae

They were purchased from local market [El- Captain- company i.e a commercial producer of plant oils.

Solvents: chemical pure grade of Ethyl alcohol and acetone (95%) purchased from ADWIC chemicals.

Non Ionic surfactant: Triton X-100 (BDH) [Isooctyl phenoxy-polyethoxyethanol] containing (10 mols of ethylene oxide).

RESULTS

Acute Toxicity of Tested Plant Oils against 4th Instar Larvae of Cotton leafworm *Spodoptera littorlis* (Boisd).

Results presented in Table 2 comprise the LC_{50} values, where it arranged in a descending order as in the following: (1261, 1055.5, 1000, 883.3 and 763 ppm); representing the plant oils as following: (*C. camphora, S. aromaticum*, *M. piperita, A. graveolens* and *A. sativum*) in other words the toxicity of the plant oils was the highest at 763ppm, followed by 883.3, 1000, 1055.5 and 1261ppm representing the plant oils as in the following: (*A. sativum*, *A. graveolens, M. piperita*, *S. aromaticum* and *C. camphora*) respectively. The values of toxicity index (T.I) were arranged in a descending order as in the following: [*A. sativum* (100), *A.graveolens* (86.4), *M. piperita* (76.3), *S. aromaticum* (72.3) and *C.camphora* (60.5)] *i.e.* the *A. sativum* has the highest value of T.I (100) and *C. camphora* has the lowest value of T.I (60.5). Also the relative potency (R.P) achieved a similar trend of arrangement in a descending order as following: *A. sativum* (165.3), *A. graveolens* (142.8), *M. piperita* (126.1), *C.camphora* (100) *i.e.,* the *A. sativum* has the highest R.P (165.3) and the *C. camphora* has the lowest R.P (100).

Acute Toxicity of Tested Insecticides against 4th Instar Larvae of cotton leafworm *S. littorlis* (Boisd).

Results recorded in Table 3 show that the Cypermethrin is more toxic than Chlorpyrifos and showing LC_{50} values as following: 10 and 33.33ppm respectively.

Acute Toxicity of Tested Mixture (1:1) of Cypermethrin 25% E.C and Five Plant-Oils against 4th Instar Larvae of cotton leafworm *Spodoptera littoralis* (Boisd).

Results in Table 4 show that LC_{50} values were arranged in a descending order as follow, Mixture of (Cypermethrin + Camphor oil), Mixture of (Cypermethrin + Clove oil), Mixture of (Cypermethrin + Mint oil), Mixture of (Cypermethrin + Dill oil) and Mixture of (Cypermethrin + Garlic oil) causing the following LC_{50} values: (938.9, 736.7, 469.4, 426.1 and 382.8 ppm) respectively So, by other words the highest toxic mixture was that of (Cypermethrin + Garlic oil) leading to LC_{50} equal to 382.8 ppm and the lowest toxic mixture was that of : (Cypermethrin + Camphor oil) showing a LC_{50} equal to 938.9 ppm. The toxicity index values were arranged in a descending order as in the following: [*A. sativum* (100),

Table (2): Acute toxicity of tested (Plant oils) against 4th instar larvae of cotton leafworm, *Spodoptera littoralis* (Boisd).

No.	Treatment	Lc_{50} (ppm)	Slope	Confidence limits of LC_{50}	Toxicity index	Relative potency at fold
1	*Menth piperita* L.	1000	0.633	840 – 1195	76.3	126.1
2	*Syzygium aromaticum* L.	1055.5	0.503	727.9 – 1208.6	72.3	119.5
3	*Cinnamomum camphora* L.	1261	0.571	1096 – 1452	60.5	100
4	*Allium sativum* L.	763	0.603	620 – 938	100	165.3
5	*Anethum graveolens* L.	883.3	0.627	767 – 1023	86.4	142.8

LD_{50} values were calculated from the regression lines using method of **Finney (1971)**
Toxicity index according to **Sun`s (1950)**
Relative potency at fold according to **Zidan** and **Abd El-Megeed (1988).**

Table (3): Acute toxicity of tested insecticides against 4th instar larvae of cotton leafworm, *Spodoptera littoralis* (Boisd).

Treatment	LC_{50} (ppm)	Slope	Confidence limits(ppm)
Cypermethrin	10	0.627	7.256 – 13.788
Chlorpyrifos	33.33	0.79	19.83 – 56.29

LC_{50} values were calculated from the regression lines using method of Finney (1971)

Table (4): Acute toxicity of Cypermethrin and oils (1:1) mixtures against 4th instar larvae of cotton leafworm, *Spodoptera littoralis* (Boisd).

No.	Treatment	Lc_{50} (ppm)	Slope	Confidence limits of LC_{50}	Toxicity Index	Relative Potency at fold
1	*Menth piperita* L.	1000	0.633	840 – 1195	81.6	200
2	*Syzygium aromaticum* L.	1055.5	0.503	727.9 – 1208.6	52	127.4
3	*Cinnamomum camphora* L.	1261	0.571	1096 – 1452	40.8	100
4	*Allium sativum* L.	763	0.603	620 – 938	100	245.3
5	*Anethum graveolens* L.	883.3	0.627	767 – 1023	89.8	220.3

LD_{50} values were calculated from the regression lines using method of **Finney (1971)**
Toxicity index according to **Sun`s (1950)**
Relative potency at fold according to **Zidan** and **Abd El-Megeed (1988).**

A. *graveolens* (89.8), *M. piperita*(81.6), *S. aromaticum* (52) and *C. camphora* (40.8)]. *i.e.* T.I was the highest in case of *A. sativum* (100) and the lowest value in case of *C. camphora* (40.8). The relative potency (R.P) values were arranged in a descending order as in the following: [*A. sativum* (245.3), *A*. *graveolens* (220.3), *M. piperita* (200), *S. aromaticum* (127.4) and *C. camphora* (100)]. i.e the highest R.P value was (245.3) in *A. Sativum* and the lowest value was (100) in *C. camphora*.

Acute Toxicity of Tested Mixture (1:1) of Chlorpyrifos 48% E.C and Five Plant-Oils Against 4th Instar Larvae of cotton leafworm *Spodoptera littoralis*(Boisd).

Results in Table 5 show that LC_{50} values were arranged in a descending order as in the following Mixture :(Chlorpyrifos + Camphor oil), Mixture of (Chlorpyrifos + Clove oil), Mixture of (Chlorpyrifos + Dill oil), Mixture of (Chlorpyrifos + Mint oil) and Mixture of (Chlorpyrifos + Garlic oil) recording the following LC_{50} values: (1199.9, 808.3, 666.7, 641.6 and 449.9 ppm), respectively. So by other words the highest toxic Mixture was that of (Chlorpyrifos + Garlic oil) having LC_{50} equal to 449.9 ppm. and the lowest toxic Mixture was that of: (Chlorpyrifos + Camphor oil) having LC_{50} equal to 1199.9ppm. The toxicity index (T.I) values were arranged in a descending order as in the following: [*A. sativum* (100),*M. piperita* (70.1), *A.graveolens* (67.5),*S. aromaticum* (55.7) and *C.camphora* (37.5)]. *i.e* the highest value was 100 in *A. sativum* and the lowest value was 37.3 in *C.camphora*. In a similar trend, the relative potency (R.P) were also arranged in a descending order as in the following: [*A. sativum* (266.7), *M. piperita* (187.1), *A.graveolens* (180), *S. aromaticum* (148.8) and *C. camphora* (100)]. *i.e* the highest R.P was (266.7) *A. sativum* and the lowest value was (100) in *C.camphora*.

DISCUSSION

As it is obviously, the results of using plant-oils in treatment of 4th instar larvae of cotton leaf worm *Spodoptera littorlis* (Boisd). That the *Allium sativum* has showed the most effective response and achieving that the highest mortality (%) at all conc.`s tested. So that response was in an accommodation with the very early studies published **Murthy and Amonkar (1974)** and **by Huang *et al.* (2000).** Also results published recently by **Ibrahim** and **El-Naser (2009) Isikber (2010), Mikaiel *et al.* (2011) Younes *et al.* (2011) and Douiri *et al* (2013),** more over, recently studies by **Sharaby** and **El-Nojiban (2015)** and **Chowdhury *et al*. (2016)** where, all the previous studies assured the efficacy of garlic and achieving the highest activity against many spp`s of insect pests (H.fly – potato tuber moth, Red palm weevil, fungi, many lepidopterians and stored product insects). Where in the last one of insects, the garlic was used as a fumigant in the presence of Co_2 affirming the concept of stereo fumigation.

The 2-nd oil followed the garlic in efficiency was the *Menth piperita*, where its efficiency and results of the present study was in an agreement with early studies by **Zambnelli *et al.* (1996), Rezk** and **Gadelhak (1997), Seidilova** and**,Aggarwal *et al.* (2001), Algamal (2002).** Also resent studies by **Odeyem *et al.* (2008)** and **Younes *et al.* (2011)** more over by very recently studies their results were relevant to results of the present study. And by throwing more light, where many spp.'s of insects, herbs, fungi, stored insects and pathogenic microorganisms.

Table (5): Acute toxicity of chlorpyrifos and oils (1:1) mixtures against 4th instar larvae of cotton leafworm, *Spodoptera littoralis* (Boisd).

No.	Treatment	Lc_{50} (ppm)	Slope	Confidence limits of LC_{50}	Toxicity index	Relative potency at fold
1	*Menth piperita* L.	1000	0.633	840 – 1195	70.1	187.1
2	*Syzygium aromaticum* L.	1055.5	0.503	727.9 – 1208.6	55.7	148.4
3	*Cinnamomum camphora* L.	1261	0.571	1096 – 1452	37.5	100
4	*Allium sativum* L.	763	0.603	620 – 938	100	266.7
5	*Anethum graveolens* L.	883.3	0.627	767 – 1023	67.5	180

LD_{50} values were calculated from the regression lines using method of **Finney (1971)**
Toxicity index according to **Sun`s (1950)**
Relative potency at fold according to **Zidan** and **Abd El-Megeed (1988).**

The 3rd oil followed mint was the *Anethum graveolens*, where the results of it in the present study are in an agreement with early studies by **Eldoksch *et al.* (1991)** and **Algamal (2002)**. Also recently studies recorded by **Ibrahim** and **El-Naser (2009), Mikhaeil (2011) and Vokk *et al.* (2011). More over very recently studies by Al-snafi (2014), Ja Eun *et al.* (2016) and Stanojevic *et al.* (2016).** Where the studies confirmed that Dill oil was effective against *S. littorlis* and stored grain pests .Also the oil proved activity acting as (antimicrobial, antifungi, antibacterial, antiseptic, antiinflamatory and anticancer) agents. The **4th** oil followed dill was *Syzygium aromaticum*. That oil proved in its results which were showing a degree of similarity and correspondency as it was noticed in early studies by **Chatterjee (1990), Rezk and Gadelhak (1997), Zhu *et al.* (2001), Algamal (2002)** .Also recent studies carried out by **El-Zemity** and **Ahmed (2005), Mahfuz** and **Khalequzzman (2007), Allahvaisi *et al.* (2011), Ashamo *et al.* (2012)** and **Fouad (2013).** Also more recently studies fulfilled by **Moawad *et al.* (2015), Ebadah *et al.* (2016)** and **Bhatt *et al.* (2016)**. These studies confirmed the efficacy of clove oil against insects of Lepidoptera, stored product pests, termites and wax moth, beside no. of fungi showing a contact toxicity and chiefly fumigation effect. The *Cinnamomum camphora* was the 5th one and the last one in the study. The efficiency and results of that camphor oil was in agreement with early studies **Rezk Gadelhak (1997).** Also dedected with a lot of authors' recently published **El-Zemity and Ahmed (2005), Ibrahim** and **El-Naser (2009), Allahavaisi *et al.* (2011), Younes *et al.* (2011), Osman *et al.* (2012)** and **Fouad (2013).** Moreover very recently studies by **Dhen *et al.* (2014), Jun Hyung** and **Isman (2015)** and **Bhatt *et al.* (2016)**. Anticipating and proving in their studies the efficiency of applying the camphor with insect of Lepidoptera leaf – hoopers – caterpillers- stored grain insects and against mites. And by throwing more light on the use of these plant-oils as an alternatives to synthetic pesticides and the characteristics of these oils possessing a potential pesticidal action and the expected ways of causing the toxic action (*i.e* mode of action) against the target pests. Also, you can say in other words that time of exposure, dosage and fumigant toxicity of these used oils are very efficient and dependent factors (**El-Nahal *et al.*, 1989).** Also these oils proved to have a contact and fumigant toxicity **Huang *et al.* (2000).** And by going on and more deep in details, it was noticed that there is a direct and positive proportion between susceptibility of contact toxicity and age of target (larvae) and not only that but also it was confirmed that the complete constituents of the plant-oils is much higher and efficient than the use of each, constituent separately and alone **Ohkawa *et al.* (2007).** Also to know something about its expected mechanism mode of action, where the oil have certain physical effect *via* penetration of the cuticle and their insect`s integuments causing a membrane disruption in all target pests .Also a blockage of tracheal system and affecting nervous system and its specific constituents and neurotransmitters (**Ohkawa *et al.*, 2007).** And by more focus, it was noticed and proved that the susceptibility to plant-oils depends on chiefly insect spp's and plant families of these oils, especially Fam. Apiaceae-Fam./Lamiaceae, Fam./Lauraceae and Fam./Myrtaceae, reflecting their possessing the specific phytochemicals of each one and showing a high efficiency and significancy in causing their contact and fumigant toxicity, **Rajendran and Sriranjini (2008).** Recently some plant-oils act as a **J.H.`s Younes *et al.* (2011)** and more recently **Douiri *et al.* (2013)** declared that the essential oils could be considered as an IPM tactic scenario without or with at least possible risk hazards to man and its environment with all its constituents. On the other side (*i.e* LC_{50} of plant-oils), it was noticed that the results of the present study were showing similarity and an agreement with the results recorded by **Mansour *et al* (1995). Eldoksch** and **Abdel-Rassol (1995), El-Gendy *et al.* (2004), El-Zemity** and **Ahmed (2005), El-Araby (2014), Farid *et al.* (2014), Sharaby and El-Nojiban (2015)** proving that contact toxicity> stomach toxicity. In case of tested insecticides the obtained results about the acute toxicity of chlorpyrifos and cypermethrin were in an agreement with the results published by **Sharaf *et al.* (1995) and Eldoksch** and **Abd El-Rassol (1995).** By other words, the cypermethrin was much more toxic than chlorpyrifos. In a No. of early studies, the use of mixtures of some promising plants or plant-oils (*e.g.*- camphor- garlic- clove- dill - citrus … *etc.*) and various insecticides belonging to different chemical groups (*e.g*, o.p.'s- carbamates - synthetic pyrethroids) These mixtures applied on many pests (*e.g* cotton leaf worm – stored grain – cut worm -soya bean borers, citrus leafminor- c. pipens … *etc.*) The use of these mixtures and the aim of these control tactics, were confirmed in many studies, **Lichtenstein *et al.* (1974), Eldoksch *et al.* (1991), Guirguis *et al.* (1991), Taman (2002), Hussein *et al* (2005), Abhilash** and **Patil (2006), El-khodary *et al.* (2007), Mesbah *et al.* (2007), Chandla** and **Chandel (2007)** and **Besheli (2008).** The chemical insecticides are currently the method of choice to protect crops from insect damage, however, there widespread use has led to the development of resistant strains, to most of all synthetic insecticides. So the use of mixtures of insecticides from different chemical groups or by use of plant extracts, oils and other additive was the possible solution to avoid resistance criterion, and actually emphasizing the use of more safe alternatives **(El-Araby, 2008)**. Ideally the insecticides having different modes of action mixed on the assumption that they would complement the action of each other for killing the target pest. When two compounds are mixed, they can be either potentiating. Or an additive or antagonistic effect in an insect spp.`s. These effects can be varied on different insect spp`s or strains depending upon their physiology and mechanism (S) of resistance developed. So, in this case there may be a potential for reducing the application rate of one of both components, of the mixture [**El-Aswad (2007)** and **Osman *et al.* (2012)**] so and by respecting the principle and need for reducing the field doses of synthetic insecticides, enhancing the role of beneficial insects and reduce the cost of pest control [**Ismail *et al.* (2012)]** and by going more deep , pest control by direct or indirect use of essential oils is a promising approach. Very recently the proof of the presence of essential oils in members of many plant Fam.`s (e,g. Fam: Rutaceae) besides other fam`s evaluated previously and confirming the need and demand to be valid and having a real value to be as a natural source of botanical insecticides. [**Thodsare *et al.*, 2014**)]. Also essential oils can be used as a potential control agents against potato beetles [**Saroukolai *et al.*, 2014**)]. Several essential oils with insecticidal properties have been evaluated on biological, physiological and behavioral parameters upon *Spodoptera* spp's [**Cruz *et al.*, 2015; Jun Hyung** and **Isman, 2015)**. showed that the synergistic interactions between constituents of essential oils elucidating, the lowering of surface tension as well increased solubility of camphor by 1.8 cineole and explaining the enhanced penetration of camphor. And due to the similarities in biological function of animal and microbial membranes. These finding potential for application in other field of study .these findings showed a similarity of attitude and so an agreement with the obtained results in this study. Moreover and throwing more light, the need for a promising toxic mixture reflecting the validity and importance of effective alternatives, so for increasing their toxicity and decreasing insect resistant buildup. **(Sharaby** and **El-Nojiban, 2015)**. The resistance – negative impacts on non target organisms and residues in food of synthetic pesticides, necessitates the development of environmentally safe products for use in pest control **Ribeiro *et al.* (2015), Abdelgaleil *et al.* (2015), Barakzai** and **Lyall (2014), Sahak** and **Hement (2013), Derbalah, *et al.* (2012)** and **Isikber (2010)**. The present study was generally in an agreement with these results and showing different responses according to the plant oils used and bioassay system applied **Ja-Eun *et al.* (2016), Bhatt *et al.* (2016) and Chowdhury *et al.* (2016).** So finally we can conclude that it is a concept of an ecofriendly approach and no residual effect and not acting as a source of possible hazardous and impact effects to environment also it could be a new important tool in IPM programs.

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الملخص العربي

دراســـة مقـــارنـــة لبـــعض المبيـــدات ومخالـــيط بعـــض الزيـــوت النباتيـــة معـــــها

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أجريت تجارب معملية لاختبار كفاءة بعض المبيدات الصناعية مثل السيبرميثرن ٢٥% E.C (البيرثرينات الصناعية) والكلوروبيروفوس ٤٨% E.C (الفوسفورية العضوية) وتم استخدام خمس زيوت نباتية زيت (النعناع - القرنفل – الكافور – الثوم - الشبت) وتم تقدير كفاءة LC_{50} لكل من المبيدات والزيوت منفردة ومخالطيها بنسب ١:١ (V:V)، وتم تقدير LC_{50} بعد ١٢٠ ساعة لجميع المعاملات وتقدير T.I(دليل السمية) و R.P (الشدة النسبية) لها، واتضح من نتائج الدراسة أن مبيد السيبرميثرن كان أكثر سمية من مبيد الكلوروبيروفوس وكذلك عند الخلط مع الزيوت فكان أكثر المخاليط سمية مع السيبرميثرن وخاصة مخلوط (السيبرميثرن+زيت الثوم) حيث كانت أعلاها سمية.

الكلمات الإسترشادية: المبيدات الفعالة، النعناع، القرنفل ،الكافور، الثوم، الشبت، مخاليط الزيوت النباتية.

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