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TOXICITY OF SOME INSECT GROWTH REGULATORS (IGRs) AND THEIR BINARY MIXTURES WITH OILS ON COTTON LEAFWORM LARVAE *SPODOPTERA LITTORALIS (*BOISD)

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ABSTRACT

Toxicity effects of tow insect growth regulators (IGRs) chlorfluazuron and flufenoxuron alone and their combinations with oils at quarter, half and recommended rates were studied by using second (2^{nd}) and fourth 4^{th} larval instars of the cotton leafworm, *Spodoptera littoralis.* (Boisduval). The results achieved in this study can be summarized in the following, chlorfluazuron was more toxic on both 2^{nd} and 4^{th} larval instars than flufenoxuron when used alone at quarter, half and recommended rates.
Concerning the effect of binary mixtures of the tested compounds at half-and quarter recommended dose, chlorfluazuron when mixed with Kz oil exhibited highly mortalities against 2 nd instar larvae of field strain of *S. littoralis* which caused 96.17% as residual effect compared with chlorfluazuron when used alone (91.45%) at half recommended dose. While, chlorfluazuron + Hopa oil was recorded high mortality 94.47% at quarter- recommended dose as residual effect compared with chlorfluazuron when used alone (81.23%) at the quarter recommended rate .Also, Flufenuxuron + Hopa oil has the highest residual activity (95,25%) when compared to 79.10% for flufenuxuron alone at the half recommended rate. While, flufenuxuron + Misrona oil was recorded high mortality 82.93% as residual effect compared with 73.01% for flufenuxuron when used alone at the quarter recommended rate .

Also, regarding the chlorfluazuron when mixed with Kz oil exhibited highly mortalities against 4 th instar larvae of field strain of *S. littoralis* which caused 95.40% as residual effect compared with chlorfluazuron when used alone (92.94%) at the half recommended rate. While, chlorfluazuron + Kz oil was recorded high mortality 92.62% as residual effect as compared with chlorfluazuron when used alone (80.48%) at the quarter recommended rate .The data also confirmed that, flufenuxuron + Hopa oil has the highest residual activity (93, 5%) when compared of 71.53% for flufenuxuron alone at the quarter recommended rate . While, flufenuxuron + Misrona oil was recorded high mortality 79.29% as residual effect compared with 70.96% for flufenuxuron when used alone at the quarter recommended rate .

It could be concluded that,the oils when mixed with IGRS enhanced the toxicity effect of IGRs against 2^{nd} and 4 th instar larvae of field strain of *S littoralis*.
Keywords: IGRs, Oils*, Spodoptera littoralis*, cotton leafworm

INRODUCTION

The cotton leafworm *Spodoptera littoralis* (Boisduval). (Lepidoptrera : Noctuidae) is one of the most serious cotton pests in Egypt. Cotton leafworm *S. littoralis* considered most destructive pest attack all parts of cotton plants including green bolls. Chemical control is still adapted as one of the major techniques recommended to control such pest. The synthetic insecticides began to suffer from less potency controlling this pest owing to the increased rate developing resistance. The Egyptian cotton leafworm (*S. littoralis*) is an important and widespread pest of cultivated crops primarily in tropical and subtropical regions (Brown and Dewhurst, 1975). Because of its polyphagy,

this species causes economical yield losses on several crops (Carter, 1984) .Considerable damage is recorded regularly on cotton, spinach, alfalfa, pepper, egg plant, tomato, lettuce, bean, strawberry and some ornamental crops. *S. littoralis* has been recorded throughout Africa, the Middle East, in the Mediterranean basin, Asia, and Europe (Bayoumi *et al*., 1998; El-Aswad *et a*l., 2003; Pineda *et al*.,2007).In addition to the direct damage caused by reducing photosynthetic area, the occurrence of larvae, feeding damage and excrement reduce marketability of vegetables and ornamentals (Pluschkell *et al.,* 1998). The intensive use of broad-spectrum insecticides against *S. littoralis* has led to the development of resistance to many registered pesticides use for its control (Smagghe *et al*., 1999 Aydin and Gürkan, 2006). Recently in Egypt, the use of conventional insecticide applications during the period when egg-masses predominate is not recommended to conserve natural enemy populations. Meanwhile the use of the insect growth regulators (IGR_S) is considered as possible alternative for controlling the newly hatched larvae (Raslan, 2002). Insect growth regulators (IGRs) are compounds that can regulate the growth of insect pests and play an important role in integrated pest management systems (Kai *et al*., 2009). They are also called third-generation insecticides, as they disrupt the normal activity of the endocrine system of insects, affecting development, reproduction or metamorphosis of the target insects. IGRs include juvenile hormone (JH) mimics and chitin synthesis inhibitors (CSIs) (Hoffman and Lorenz, 1998; Tunaz and Uygun, 2004). IGR's considered new compounds, which kill the insect thought their interference with the mounting process, a process that is a vital to the well being of the insect (Moawad, 1974; Moawad *et al.*, (1996). In addition to their larvicidal activity, they were effective in producing abnormalities in larval. pupa and adult stages of insects. Moreover,the effect extended to include reduction in number of eggs and percent hatchability. The present work aims to evaluate toxicity and latent effects of chlorfluazuron and flufenoxuron (IGR's) and their mixtures with different oils at the half, and quarter recommended rate against second (2^{nd}) and fourth (4^{th}) instar larvae of field strain of the cotton leafworm, *S. littoralis* (Boisd.).

MATERIALS AND METHODS

Test insects:

Cotton leafworm, *Spodoptera littoralis* (Boisd):Egg-masses of the cotton leafworm, *S. littoralis* (Boisduval): were collected early in the season from cotton field in Gemmeiza Agricultural Research Station Gharbia Governorate before the beginning of any chemical control programme and reared in the laboratory as described by El- Defrawi *et al.*, (1964).

The tested compounds :

The insect growth regulator (IGRs) compound

- Chlorfluazuron (Atabron 5%EC) 1-(3,5 dichloro – 4-(3- chloro-5-trifluoromethyl-2-pyridyloxyl) phenyl)-3-(2,6 difluorobenzoyl) urea (Syngenta Company).
- Flufenuxuron (Cascade 10%EC)1-(4-(2- chloro- α, α, α- trifluoro- p-tolyoxy2-fluorophenyl)-3- (2,6—difluoro benzoyl) urea.

Oils used

- Hopa oil (plant oil). EC.69% extracted from jojoba plant.
- Misrona oil 94% is a mineral oil, produced the Misr petroleum Co. Egypt.
- K.Z. oil (Mineral oil) (95% E.C.) formulated mineral oil supplied by Kafer El-Zayat pesticides and chemicals Company.
- Cottonseed oil, prepared as emulsifiable concentrate contained 93 % base oil, used at concentration of 1.0 - 30.0%.
- Natrilo (97% blend of vegetable oil, emulsifies and antioxidant).

Treatments:

Experimental design:

The cotton area was divided into plots , each plot 1/ 100 of feddan , at Gemmeiza Agricultural Research Station Gharbia Governorate during 2011 season for assessing the toxicity of chlorfluazuron and flufenoxuron (IGR's) separately and their mixtures with different oils at quarter, half and recommended dose against second (2^{nd}) and fourth (4^{th}) instar larvae of field strain of the cotton leafworm, *S. littoralis* (Boisd.). Complete randomized blocks design was used and each treatment was replicated three times together with the control plots. The tested compounds and their binary mixtures were sprayed using a knapsack sprayer at their, quarter, half and recommended dose (200/ liters per feddan). All treatments are showan in Table (1).

Table (1): Teasted treatments, their rates of application, their binary mixtures and intervals of collecting post- treatment samples.

No	Treatments	Rate / Feddan	Intervals of teated cotton leaves collected post-treatment(days)
1	Chlorf. Chlorf. Chlorf.	400. cm^3 200 cm^3 100 cm^3	0. 3, 6, 9 , 12/ Rate
2	Chlorf.+ Natrilo Chlorf.+ Natrilo	200 cm^3 + 1.5L 100 cm^3+1,5L	0. 3, 6, 9 , 12/ Rate
3	Chlorf.+ Hopa oil Chlorf.+ Hopa oil	200 cm^3 + 1.5L 100 cm^3+1,5L	0. 3, 6, 9 , 12/ Rate
4	Chlorf.+ Mesrona oil Chlorf.+ Mesrona oil	200 cm^3 + 1.5L 100 cm^3+1, L	0. 3, 6, 9 , 12/ Rate
5	Chlorf.+ Kz oil Chlorf.+ Kz oil	200 cm^3 + 1.5L 100 cm^3+1,5L	0. 3, 6, 9 , 12/ Rate
6	Chlorf.+ c.s.oil Chlorf.+ c.s.oil	200 cm^3 + 1.5L 100 cm^3+1,5L	0. 3, 6, 9 , 12/ Rate
7	Flu. Flu. Flu.	200 cm^3, 100 cm^3 50 cm	0. 3, 6, 9 , 12/ Rate
8	Flu. + Natrilo Flu. + Natrilo	100 cm^3+1.5 1. 50 cm^3 + 1.5L	0. 3, 6, 9 , 12/ Rate
9	Flu. + Hopa oil Flu. + Hopa oil	100 cm^3+1.5 1. 50 cm^3 + 1.5L	0. 3, 6, 9 , 12/ Rate
10	Flu.+ Mesrona oil Flu.+ Mesrona oil	100 cm^3+1.5 1. 50 cm^3 + 1.5L	0. 3, 6, 9 , 12/ Rate
11	Flu. + Kz oil Flu. + Kz oil	100 cm^3+1.5 1. 50 cm^3 + 1.5L	0. 3, 6, 9 , 12/ Rate
12	Flu. + c.s.oil Flu. + c.s. oil	100 cm^3+1.5 1. 50 cm^3 + 1.5L	0. 3, 6, 9 , 12/ Rate

Chlorf. = Chlorfluazuron, c.s. oil = cotton seed oil and Flu. = Flufenuxuron

Samples of cotton leaves were collected at random from each treatment at intervals after spraying and the treated cotton leaves were offered to 2 nd and 4 th instar larvae (50 larvae /treatment / interval). Larvae were fed on treated leaves during the two day of each interval and the survive larvae were fed for another three days on untreated leaves. Cumulative mortalities were calculated at the end of each interval and corrected according to Abbott's formula (1925). The cumulative mortalities of the first intervals samples collected after spraying directly was considered as initial kill, while the total mean of the cumulative mortalities of the other intervals were considered as residual effects. Data were statistically analyzed by the analysis of variance and significance were determined at 5% level of significant by Duncan Multiple range Test (Snedecor 1962).

RESULTS AND DISCUSSION

Insect growth regulators (IGRs) are often considered as of lower impact on many beneficial organisms compared to other insecticides. They have attracted considerable attention recently for their inclusion in integrated pest management (IPM) programs, but effects are highly variable depending on the species and studied developmental stage Darvas and Polgar (1998) and Schneider, *et al*., (2003).IGRs are more effective on immature stages of insects compared to mature stages because they are known to disrupt the insect's normal processes of growth and development leading to eventual death. They have a slower knockdown rate resulting in extended time to kill pests. During insect development the shedding of the cuticle, known as molting, or ecdysis, occurs and all changes that involve growth, molting, and maturation are known as morphogenesis. The molting process begins when epidermal cells respond to hormonal changes by increasing their rate of protein synthesis. The first step of molting is a polysis: the separation of epidermal cells from the inner surface of the old endocuticle and the formation of the subcuticular space.

A molting gel (including enzymes) is secreted into this space. An insect larva that is actively constructing new exoskeleton is said to be in a pharate condition Marks (1980) and Truman *et al.,* (1983). .

1-Toxicity of chlorfluazuron and flufenuxuron and in binary mixtures with different oils at quarter, half and recommended dose against 2 nd and 4th instar larvae of field strain of *S. littoralis*.

Tables (2-5) represents the Initial effect at zero time and residual effect after 4 intervals (i.e.,3, 6, 9 and 12 days) from spraying of chlorfluazuron and flufenuxuron were applied alone and in binary mixtures with oils at quarter, half and recommended rates against 2 nd and 4 th instar larvae of field strain of *S littoralis* . Second and fourth instar larvae were fed on treated cotton leaves for 2 days , then alive larvae were fed on untreated cotton leaves for 3 days at each intervals.

2

3

1.1. Effect of chlorfluazuron and flufenuxuron alone against 2 nd instar larvae of field strain of *S littoralis* (Bosid) at quarter,half and recommended rate.

With regard to larval mortality, the data obtained in tables (2,3) showed that, the chlorfluazuron when applied alone was more effective on 2nd larval instar than flufenoxuron at the quarter, half- and recommended dose. Data revealed that, both IGRs has high initial and residual effects on the 2nd larval instars which caused 100, 100,and 100% as initial effect and, 81.23, 91.45 and 97%,06 mortality as residual effect at quarter, half, and recommended rate for chlorfluazuron respectively. While, initial and residual effects of flufenoxuron at quarter, half- and recomended dose were exhibited 100, 100 and 100% as initial effect and 73.01, 79.10 and 83.0% mortality as residual effect respectively.

It was noticed that, both IGRs resulted in 100% mortality after 5 days post treatment on the 2nd instar. 5 days after treatment (initial activity), the effect of chlorfluazuron was similar to flufenoxuron which gave 100% mortality when applield alone.

The highest residual activity (period 3 and 12) of chlorfluazuron when used alone, was 97.07% at recommended dose compared with 83.0% for flufenoxuron on the 2nd larval instars of the cotton leafworm,*S. littoralis*.

1.2. Effect of chlorfluazuron and flufenuxuron in binary mixtures with different oils against 2 nd instar larvae of field strain of *S. littoralis* at quarter and half recommended dose.

Concerning the effect of binary mixtueres of the tested compounds at quarter half-,and recommended dose, chlorfluazuron when mixed with Kz oil exhibited highly mortalities against 2 nd instar larvae of field strain of *S littoralis* which caused 96.17% as residual effect when compared with chlorfluazuron when used alone (91.45%) followed by chlorfluazuron + cotton seed oil 91,99% at the half recommended rate. While, chlorfluazuron + Hopa oil was recorded high mortality 94.47% as residual effect table (2) compared with chlorfluazuron when used alone (81.23%) at the quarter recommended rate .

Data presented in table (3) showed the initial and residual activities of the flufenuxuron when mixed with different oils against 2 nd instar larvae of field strain of *S. littoralis*, flufenuxuron + Hopa oil has the highest residual activity (95,25%) compared with 79.10% for flufenuxuron alone at half recommended rate. While, flufenuxuron + Misrona oil was recorded high mortality 82.93% as residual effect compared with 73.01% for flufenuxuron when used alone at the quarter recommended rate .

Results in Tables (2,3) indicated generally that, Kz oil, Hopa oil and Misrona oil when combined with chlorfluazuron and flufenuxuron at half- and quarter recommended rate induced high mortality against 2 nd instar larvae of field strain of *S. littoralis*

The comparative effectiveness of chlorfluazuron and flufenoxuron alone and in binaray mixtures at their recommended rates on the 2nd larval instars of the cotton leafworm,*S. littoralis*, data showed that the chlorfluazuron was more effective than flufenuxuron at quarter and half recommended rate.

It was noticed that, the highest residual activity of all tested mixtures with different oil ranged between 96,17% and 94.47% mortality on 2nd larval instar by chlorfluazuron ,while 95.25% and 82.93% mortality by flufenoxuron at quarter and half recommended dose respectively.

1.3. Effect of chlorfluazuron and flufenuxuron alone against 4 th instar larvae of field strain of *S. littoralis* (Bosid) at quarter, half and recommended dose.

Concerning the larval mortality, data obtained in tables (4,5) showed that the chlorfluazuron when applied alone was more effective on 4th instar larvae than flufenoxuron at quarter, half- and recommended dose. Data revealed that, both IGRs has high initial and residual effects on 4th instar larvae which caused 100, 100,and 100% as initial effect and, 80.48, 92.94 and 97,07% mortality as residual effect at quarter, half-, and recommended rate for chlorfluazuron, respectively. While, initial and residual effects of flufenoxuron at quarter, half- and recomended dose were exhibited 100, 100,and 100% and 70.96.0%, 71.53. % and 83.25% respectively . It was noticed that, both IGRs resulted in 100% mortality after 5 days post treatment on 4th instar larvae. 5 days after treatment (initial activity), the effect of chlorfluazuron was similar to flufenoxuron which gave 100% mortality when applield alone.

The highest residual activity (period 3 and 12) of chlorfluazuron when used alone was 97.07% at recommended dose compared with 83.25% for flufenoxuron on 4th instar larvae of the cotton leafworm,*S. littoralis*.

1.4. Effect of chlorfluazuron and flufenuxuron in binary mixtures with different oils against 4 th instar larvae of field strain of *S littoralis* (Bosid) at quarter and half recommended dose.

With respect to the effect of binary mixtueres of the tested compounds at quarter and half recommended rate, chlorfluazuron when mixed with Kz oil exhibited highly mortalities against 4 th instar larvae of field strain of *S. littoralis* which caused 95.40% as residual effect compared with chlorfluazuron when used alone (92.94%) at the half recommended rate. While, chlorfluazuron + Kz oil was recorded high motality 92.62% as residual effect table (4) compared with chlorfluazuron when used alone (80.48%) at the quarter recommended rate.

Data presented in Table (5) showed the initial and residual activities of flufenuxuron when mixed with different oils against 4th instar larvae of field strain of *S. littoralis*. Fufenuxuron + Hopa oil has the highest residual activity (93, 5%) compared to 71.53% for flufenuxuron alone at half recommended rate. While, flufenuxuron + Misrona oil was recorded high mortality 79.29% as residual effect compared with 70.96% for flufenuxuron when used alone at the quarter recommended rate.

Results in Tables (4,5) indicated generally that, Kz oil and Misrona oil when combined with chlorfluazuron and flufenuxuron at quarter and half-recommended rate induced high mortality against 4th instar larvae of field strain of *S littoralis*

The comparative effectiveness of chlorfluazuron and flufenoxuron alone and in binaray mixtures at their recommended rates, on 4th instar larvae of the cotton leafworm,*S. littoralis*, data showed that the chlorfluazuron was more effective than flufenuxuron at half and quarter recommended rate.

4

5

It was noticed that, the highest residual activity of all tested mixtures with different oil ranged beteen 96,17% and 94.47% mortality on 2nd larval instar by chlorfluazuron ,while 95.25% and 82.93% mortality by flufenoxuron at quarter and half recommended dose.

This data agrees with that of Abdel Rahman *et al.,* (2007) when they tested the direct and latent effects of lufenuron and a lufenuron +deltant mixture on the development of *S. littoralis* larvae. Their findings showed that lufenuron has more toxic and delayed effects on tested larval instars.

Salokhe *et al. (*2006) found that sublethal concentrations of flufenoxuron caused significant reduction in the chitin content in the larvae of *Tribolium castaneum* on the 15th day of development.They added that, sublethal concentrations of flufenoxuron on certain biochemical parameters in the larvae of *T. castaneum* which showed significant reduction in chitin content with all concentrations tested.

Toxicity effects and field persistence of the insect growth regulators, lufenuron, flufenoxuron and triflumuron were assessed by El-Sayed *et al*., (2011) in the laboratory using second and fourth larval instars of *Spodoptera littoralis*. Laboratory bioassays indicated that lufenuron was more effective on both 2nd and 4th larval instars, as well as killing both larval instars faster than flufenoxuron or triflumuron.

The efficiency of chlorfluazuron, teflubenzuron and flufenoxuron against third and fifth instars of both susceptible and field strains of *S. littoralis*, were investigated by Bayoumi *et al*. (1998) under laboratory conditions. They showed that third instars are more sensitive to the compounds tested than fifth instars.

Nasr *et al.* (2010) studed the lethal and sublethal effects of two insect growth regulators (IGRs), buprofezin and pyriproxyfen on activity of chitinase and polyphenol oxidase (PPO) were evaluated on larvae of cotton leafworm *S. littoralis*,the overall mortalities within 6 days of feeding at 2.0-fold were 46.67% and 100% for buprofezin and pyriproxyfen, respectively.

In conclusion, IGRs are claimed to be safe or have little impact on beneficial organisms compared with conventional insecticides, and they have attracted considerable attention for their inclusion in IPM programs (Schoonover and Larson,1995; Darvas and Polgar,1998; Ishaaya and Horowitz, 1999;Walter, 1999; and Schneider *et al*., 2003). Because IGRs are extensively available nowadays, they are being tested in many ways including for their efficacy on many different insect pests (Perez-Farinos *et al.,* 1998; Schneider *et al.*, 2004; Salokhe *et al.,* 2006; Ahire *et al.,* 2008; Arnold *et al.,* 2009; Kai *et al.,* 2009;Tassou and Schulz, 2009; and Mansur *et al*., 2010) or in combination with entomopathogenic nematodes and fungi (Irigaray *et al.,* 2003; Negrisoli *et al.,* 2010a; b), as well as the development of insect resistance to their action (Ahmad *et al.,* 2008).

Generally, it cauld be concluded that the use of insect growth regulator (IGRs) and their mixtures with different oils instead of conventional hazardous insecticides:were efficient as controlling for pests and this may reduce the environmental pollution and hazard effects on human health. Our data supported that IGRs are effective when applied in very minute quantities and apparently have no undesirable effects on human and wildlife.

Consequently, when used with precision, IGRs may play an important role in insect pest management programs especially when mixed with mineral oils.
In conclusion, the comparative effects of chlorflurazuron and, flufenoxuronon on the 2nd and 4th larval instar of *S. littoralis* after zero, 3,,6,9 and 12 days indicated that, chlorflurazuron was potential to kill *S. littoralis* larvae more efficiently than flufenoxuron.

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سمية بعض منظمات النمو الحشرية ومخاليطها مع الزيوت ضد الطور اليرقى الثانى والرابع لدودة ورق القطن

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تم دراسة التأثيرات السامة لاثنان من منظمات النمو الحشرية (كلوروفلوزيزون (الأتابرون) و فلوفينوكسيرون (كسكاد) بالاضافة الى خلائطها مع الزيوت المختلفة ضد الطور اليرقى الثانى والرابع لحشرة دودة ورق القطن ويمكن تلخيص النتائج المتحصل عليها فى النقاط التالية :

الأتابرون كان أكثرسمية على كل من الطور اليرقى الثانى والرابع لحشرة دودة ورق القطن بالمقارنة بـ كسكادعند استخدمهما منفردين بمعدلات الربع والنصف و الجرعة الحقلية الموصى بها.

أما فيما يتعلق بالخلائط الثنائية للمركبات المختبرة على معدلات الربع و النصف الحقلية فان الأتابرون عند خلطة بزيت كزد يعطى أعلى نسبة موت ضد الطور اليرقى الثانى بنسبة 96.17% كتأثيرمتبقى بالمقارنة بنفس المبيد عند استخدامة منفردا بنسبة 91.45% بنفس المعدل نصف الجرعة الموصى بها. بينما(الأتابرون + زيت الهوبا) سجل أعلى نسبة موت 94.47% كتأثيرمتبقى بالمقارنة بنفس المبيدعند استخدامة منفردا بنسبة81.17% بنفس المعدل السابق.

أيضا وجد أن (كسكاد + زيت الهوبا) يعطى أعلى نسبة موت ضد الطور اليرقى الثانى بنسبة 95.25% كتأثيرمتبقى بالمقارنة بنفس المبيد عند استخدامة منفردا بنسبة 79.10% بنفس المعدل نصف الجرعة الموصى بها. بينما (كسكاد + زيت المصرونا) سجل أعلى نسبة موت 82.93% كتأثيرمتبقى بالمقارنة بنفس المبيد عند استخدامة منفردا بنسبة73.01% بنفس المعدل ربع الجرعة الموصى بها.

و أيضا فيما يتعلق بالأتابرون عند خلطة بزيت كزد أظهر أعلى موت ضد الطور اليرقى الرابع بنسبة 95.40% كتأثيرمتبقى بالمقارنة بنفس المبيد عند استخدامة منفردا بنسبة 92.94% % بنفس المعدل نصف الجرعة الموصى بها. بينما(الأتابرون + زيت كزد) سجل أعلى نسبة موت 92.62% كتأثيرمتبقى بالمقارنة بنفس المبيد عند استخدامة منفردا بنسبة80.48% بنفس المعدل ربع الجرعة الموصى بها. وأيضا النتائج أكدت أن (كسكاد + زيت الهوبا) يعطى أعلى نسبة موت ضد الطور اليرقى الرابع بنسبة 93.5% كتأثيرمتبقى بالمقارنة بنفس المبيد عند استخدامة منفردا بنسبة 71.53% بنفس المعدل نصف الجرعة الموصى بها. بينما (كسكاد + زيت المصرونا) سجل أعلى نسبة موت 79.29% كتأثيرمتبقى بالمقارنة بنفس المبيد عند استخدامة منفردا بنسبة70.96% بنفس المعدل ربع الجرعة الموصى بها.وما يمكن استنتاجة أن خلط الزيوت تزيد من التأثير السام لمنظمات النمو المستخدمة فى التجربة على الطور اليرقى الثانى والرابع لحشرة دودة ورق القطن.

قام بتحكيم البحث

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Table (2): The initial and residual activity of quarter, half and recommended dose of Chlorfluazuron and their binary mixtures with oils against 2nd instar larvae of cotton leafworm *S. littoralis*

Treatments	Rate / fed	Corrected % mortality at indicated time intervales										% effectiveness	
		0 day		3 day		6 day		9 day		12 day			
		2day	5day	2day	5day	2day	5day	2day	5day	2day	5day	Initial activity 2day	Residual activity 5day
Chlorfluazuron	400cm^3	90ab	100a	80.12	100	95.8	100	69	97.81	30.12	90.44	68.76a	97.06a
Chlorfluazuron	200 cm^3	62f	100a	71.15	100	92.4	100	39	95.61	24.14	70.2	56.68ab	91.45a
Chlorfluazuron	100 cm^3	70abc	100a	72.30	100	90.2	100	34	94.33	5.0	30.61	50.38abc	81.23a
Chlorfluazuron + Natrilo	200 cm^3 + 1,5 L	94a	100a	69.33	100	84.82	100	39	96.66	40.60	85.33	58.34bcd	88.75a
Chlorfluazuron + Natrilo	100 cm^3 + 1,5 L	72abc	100a	60.4	100	83.51	100	29	88.67	16.60	50.11	47.63cd	84.70ab
Chlorfluazuron + Hopa oil	200 cm^3 + 1,5 L	89a	100a	81.12	100	84.81	100	39	95.56	31.12	59.90	59.01bcd	88.78ab
Chlorfluazuron+ Hopa oil	100 cm^3 + 1,5 L	85a	100a	80.20	100	69.34	100	13	87.71	7.60	90.10	42.54abcd	94.47a
Chlorfluazuron + Mesrona oil	200 cm^3 + 1,5 L	81ab	100a	88.20	100	78.22	100	48	90.61	14.71	60.51	57.33ab	87.78ab
Chlorfluazuron+ Mesrona oil	100 cm^3 + 1,5 L	80abc	100a	76.33	100	66.31	100	34	82	7.14	80.95	45.9bcd	90.74a
Chlorfluazuron + Kz oil	200 cm^3 + 1,5 L	79abc	100a	75.57	100	56.24	100	40	92.17	30	92.50	50.45abc	96.17a
Chlorfluazuron+ Kz oil	100 cm^3 + 1,5 L	50def	100a	60.66	100	50.33	100	26	83	14.20	93.50	37.81abcd	94.13a
Chlorfluazuron + cotton seed oil	200 cm^3 + 1,5 L	72abc	100a	70.4	100	44.63	99.04	41	93.13	17.62	75.82	43.41d	91.99a
Chlorfluazuron+ cotton seed oil	100 cm^3 + 1,5 L	42g	100a	52.91	100	39.15	100	28	71.62	18.67	60.16	34.68cd	82.95ab

Mean followed by the same letter in each column are not significantly at 5% level

Table (3) : The initial and residual activity of quarter ,half and recommended dose of Flufenuxuron and their binary mixtures with oils against 2nd instar larvae of cotton leafworm *S. littoralis*

Treatments	Rate / fed	Corrected % mortality at indicated time intervales										% effectiveness	
		0 day		3 day		6 day		9 day		12 day			
		2day	5day	2day	5day	2day	5day	2day	5day	2day	5day	Initial activity 2day	Residual activity 5day
Flufenuxuron	200cm^3	61a	100a	73	100	86.71	100	25.91	70	20.91	62	51.63abc	83.03ab
Flufenuxuron	100 cm^3	55abc	100a	71	100	82.23	92.41	23.83	64	19.41	60	49.14abcd	79.10ab
Flufenuxuron	50 cm^3	53ab	100a	62	90.22	80..91	90.22	19.42	60	11.21	54	43.39abcd	73.61bc
Chlorfluazuron + Natrilo	100 cm^3 + 1,5 L	61abc	100a	71	100	90.11	93.41	40.51	83	44.33	76	61.49abc	88.10ab
Chlorfluazuron + Natrilo	50 cm^3 + 1,5 L	43abc	100a	48	79.41	60.31	85.33	23.42	59	22.90	55	38.66abcd	74.19cd
Chlorfluazuron + Hopa oil	100 cm^3 + 1,5 L	54bc	100a	82	100	78.12	100	17.62	99	23.51	82	50.31abc	95.25ab
Chlorfluazuron+ Hopa oil	50 cm^3 + 1,5 L	36 c	100a	78	96.42	73.44	\88.11	9.41	75	7.62	38	42.12cd	74.38bcd
Chlorfluazuron + Mesrona oil	100 cm^3 + 1,5 L	39c	100a	95	100	64.52	95.62	25.93	76	28.61	68	53.52abc	84.91ab
Chlorfluazuron+ Mesrona oil	50 cm^3 + 1,5 L	38ab	100a	87	100	49.92	95.73	7.14	78	4.42	58	37.10cd	82.93bc
Chlorfluazuron + Kz oil	100 cm^3 + 1,5 L	42abc	100a	79	100	74.91	99.41	15.60	51	19.12	70	47.16ab	80.10bcd
Chlorfluazuron+ Kz oil	50 cm^3 + 1,5 L	39bc	100a	49	79.51	75.72	77.2	10.72	55	6.17	50	35.40cd	65.43d
Chlorfluazuron + cotton seed oil	100 cm^3 + 1,5 L	49abc	100a	82	100	58.61	97.42	19.61	94	16.71	69	44.23ab	92.61ab
Chlorfluazuron+ cotton seed oil	50 cm^3 + 1,5 L	40bc	100a	51	87.2	44.32	77.91	7.2	84	9.19	80	27.93d	82.28cd

Mean followed by the same letter in each column are not significantly at 5% level

Table (4) : The initial and residual activity of quarter ,half and recommended dose of Chlorfluazuron and their binary mixtures with oils against 4 th instar larvae of cotton leafworm *S. littoralis*

Treatments	Rate / fed	Corrected % mortality at indicated time intervales										% effectiveness(3-12days)	
		0 day		3 day		6 day		9 day		12 day			
		2day	5day	2day	5day	2day	5day	2day	5day	2day	5day	Initial activity 2day	Residual activity 5day
Chlorfluazuron	400cm^3	86ab	100^a	77.18	100	95.68	100	68	97.78	29.92	90.48	67.85a	97.07a
Chlorfluazuron	200 cm^3	56f	100^a	66.67	100	91.35	100	38	95.57	22.17	67.19	54.55abc	92.94a
Chlorfluazuron	100 cm^3	60ef	100^a	66.67	100	89.19	100	32	93.33	0.00	28.57	46.97abcd	80.48a
Chlorfluazuron + Natrilo	200 cm^3 + 1,5 L	88a	100^a	62.22	100	82.70	100	36	95.56	37.50	83.33	54.61ab	94.72a
Chlorfluazuron + Natrilo	100 cm^3 + 1,5 L	68cdef	100^a	55.56	100	80.54	100	24	86.67	14.58	47.14	43.67bcd	82.93ab
Chlorfluazuron + Hopa oil	200 cm^3 + 1,5 L	84abc	100^a	77.87	100	82.70	100	36	95.57	29.17	57.14	ab 56.44	88.18ab
Chlorfluazuron+ Hopa oil	100 cm^3 + 1,5 L	80abcd	100^a	75.56	100	63.24	100	10	86.67	5.50	88.10	38.58bcd	92.85a
Chlorfluazuron + Mesrona oil	200 cm^3 + 1,5 L	78abcd	100^a	84.44	100	74.04	100	44	88.89	12.50	59.52	abc53.75	87.10ab
Chlorfluazuron+ Mesrona oil	100 cm^3 + 1,5 L	72bcde	100^a	73.33	100	63.24	100	30	80.00	4.17	80.95	42.69abc	90.24ab
Chlorfluazuron + Kz oil	200 cm^3 + 1,5 L	74abcd	100^a	75.56	100	50.27	100	36	91.11	25.0	90.48	abcd46.71	95.40a
Chlorfluazuron+ Kz oil	100 cm^3 + 1,5 L	30g	100^a	55.56	100	48.27	100	22	80.00	12.0	90.48	34.46cd	92.62ab
Chlorfluazuron + cotton seed oil	200 cm^3 + 1,5 L	62def	100^a	62.22	100	41.62	97.04	36	91.11	16.67	37.81	39.13bcd	90.49ab
Chlorfluazuron+ cotton seed oil	100 cm^3 + 1,5 L	34g	100	48.48	100	35.14	100	22	68.89	16.67	57.14	d 30.68	81.51ab

Mean followed by the same letter in each column are not significantly at 5% level

Table (5) : The initial and residual activity of quarter, half and recommended dose of Flufenuxuron and their binary mixtures with oils against 4 th instar larvae of cotton leafworm *S. littorali*

Treatments	Rate / fed	Corrected % mortality at indicated time intervales										% effectiveness	
		0 day		3 day		6 day		9 day		12 day			
		2day	5day	2day	5day	2day	5day	2day	5day	2day	5day	Initial activity 2day	Residual activity 5day
Flufenuxuron	200cm^3	58a	100	70	100	84.78	100	22.92	68	21.28	65	49.75abc	83.25bc
Flufenuxuron	100 cm^3	54ab	100	68	97.22	78.26	90.91	20.83	60	17.02	58	46.03abcd	71.53bcd
Flufenuxuron	50 cm^3	50abc	100	58	88.84	78.26	87.88	16.67	56	4.27	50	39.3abcd	70.96cd
Chlorfluazuron + Natrilo	100 cm^3 + 1,5 L	58a	100	66	100	86.96	91.67	37.50	80	40.43	70	57.72a	85.42abc
Chlorfluazuron + Natrilo	50 cm^3 + 1,5 L	40abc	100	44	96.97	56.52	83.33	20.83	56	23.40	54	abcd36.19	72.58cd
Chlorfluazuron + Hopa oil	100 cm^3 + 1,5 L	50abc	100	78	100	76.09	100	14.58	96	25.53	78	abc51.40	93.5a
Chlorfluazuron+ Hopa oil	50 cm^3 + 1,5 L	34c	100	74	93.94	71.74	86.11	6.25	72	6.38	34	34.70abcd	71.51cd
Chlorfluazuron + Mesrona oil	100 cm^3 + 1,5 L	34c	100	92	100	60.90	93.94	22.92	72	29.79	65	45.39abc	82.74bcd
Chlorfluazuron+ Mesrona oil	50 cm^3 + 1,5 L	34abc	100	84	97.22	47.83	93.94	4.17	72	2.79	54	cd 32.58	79.29bcd
Chlorfluazuron + Kz oil	100 cm^3 + 1,5 L	40ab	100	76	100	73.91	100	12.50	48	19.15	75	ab 52.77	89.75ab
Chlorfluazuron+ Kz oil	50 cm^3 + 1,5 L	36bc	100	46	77.78	71.74	75	8.33	52	4.26	50	26.03d	63.70d
Chlorfluazuron + cotton seed oil	100 cm^3 + 1,5 L	46abc	100	78	100	56.52	96.97	16.67	92	14.89	75	52.77ab	90.99ab
Chlorfluazuron+ cotton seed oil	50 cm^3 + 1,5 l	38bc	100	48	84.55	41.30	77.78	4.17	80	10.54	57.58	26.03d	75.05cd

Mean followed by the same letter in each column are not significantly at 5% l