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EFFICACY OF CERTAIN PLANT EXTRACTS AND TRIFLUMURON ON BIOLOGICAL ACTIVITY OF *Spodoptera littoralis* (BOISD.) AND *Earias insulana* (BOISD.) AND ITS EFFECT ON COTTON YIELD

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ABSTRACT

Results indicated variation effects of some plant extracts (Demsisa, Lantana, Neemazal and Golden shower), IGR belonging to acylureas (Triflumuron) and its mixture with Neemazal on some biological parameters of *Spodoptera littorals* and *Earias insulana* such as percentage of pupation and adult emergence, larval and pupal duration, larval and pupal weight, yield and yield loss. These compounds also showed some effects on *S. littoralis* when fed on sprayed cotton leaves in Beni-Sueif and Minia Governorates.

INTRODUCTION

The cotton leaf worm, *Spodoptera littorals* (Boisd.) (Lepidoptera: Noctuidae) is considered one of the most serious and destructive lepidopterous insect pests, not only for cotton plants but also other field crops and vegetables. Also, the spiny bollworm, *Earias insulana* (Boisd.) (Lepidoptera : Arctiidae) is considered as mid-late season pests (El-Shaarawy *et al.,* 1975). It is a dangerous pest of cotton bolls in the majority of cotton areas. The importance of this pest is due to the fact that infestation happens in the early season. Control of these insects is primarily dependent upon foliar application of certain broad spectrum chemical insecticides, *i.e*. organophosphates, carbamates and synthetic pyrethroids against the larval stage. However, the continuous use of these insecticides created serious problem such as the environmental pollution, the development of resistance and the hazard to both the natural enemies (parasites and predators) and the beneficial insects. Natural pesticides, particularly plant-derived chemicals, have received considerable attention. The most familiar one of these chemicals in the recent years is azadirachtin that isolated from the fruits of Meliaazedarch and seeds of *Azadirachta indica* (Meliaceae). This chemical was found to induce growth disruption, feeding inhibition and interruption moulting that led to high mortality (Schmutterer 1981). Chitin synthesis inhibitors (CSI's) has been recognized for many years as a suitable target for selective chemical control of pests (Kramer *et al*., 1985). These compounds are biorational insecticides with novel modes of action, that are less harmful to non-target organisms than that of the conventional insecticides (Croft, 1990) and also acts by inhibiting synthesis of the insect chitin which confers a remarkable specific action, with low toxicity to mammals, birds and fish (Grosscurt & Andrsen 1980). These compounds are particularly effective against several lepidopterous immature stages, with relatively slow but delayed toxic action. Because of some insect pests showed a high level of resistance against some of the conventional insecticides, so that different potentiation techniques and joint

action with some IGR's and vegetable or mineral oils were tried to increase the efficiency of these compounds by mixing combined them or with either traditional chemical insecticides (Ishaaya *et al.,* 1986).

The aim of the present work to evaluate some plant extracts and IGR belonging to acylureas on some biological permanents of *S. littorals* and *E. insulana* with reference to its effect on cotton yield.

MATERIALS AND METHODS

Adults of the cotton leaf worm, *Spodoptera littorals* (Boisd.) and the spiny bollworm, *Earias insulana* (Boisd.) were originated from eggs which obtained from a laboratory established strains reared in Plant Protection Research Institute, Dokki, Giza, Egypt, for two successive seasons (2003 and 2004).

1. Laboratory rearing:

1.1. *Spodoptera littorals*:

The eggs of the cotton leaf worm were maintained in small gars (8 X 16 cm), covered with muslin and provided with a tissue paper in the bottom to absorb humidity and fresh castor leaves, *Ricinus communis* L., as food for hatched larvae. After hatching, the newly hatched larvae transfer to new gars with paper and food. The gars were daily examined and cleaning; the food and paper were put over a sow dust layer on the bottom of the gars for a better absorption of the humidity. Balanced groups of females and males were confined; each in a large glass gar (10 X 15 cm) provided with small tissue paper pieces in the bottom, and its upper opening was covered with muslin. The upper one provided with a cotton-piece soaked in 10% sugar-solution as a source for moth feeding. The upper muslin acts as an oviposition substrate for moths. Rearing was carried out under incubation conditions of 25±1°C and 65±5% relative humidity

1.2. *Earias insulana*:

The spiny bollworm reared on semi-artificial diet with a slight modification. The diet consists of 1000 g of dried beans boiled in water, 150 g dried yeast, 15 g methyl- P-hydroxy benzoate, 6.5 g sorbic acid, 10 g ascorbic acid, 16.6 ml formalin and 66.6 g agar. The prepared diet was transferred into glass vials (2X7.5 cm). The eggs of *E. insulana* were incubated at 25±1°C and 65±5% relative humidity until hatching. The newly hatched larvae were transferred, via fine hair brush, into diet-vials, one or two larvae per each vial. The latter was copped with cotton piece, and all vials were incubated at the same rearing conditions until pupation.

The newly formed pupae were transferred to another glass vials, until moth emergence. The newly emerged moths were confined to adequate groups of females and males, each in glass chimneys placed on a Petri-dish enclosed by muslin lay at its bottom. The upper chimney opening was covered with muslin that held in position by a rubber band. A thin strip of muslin fall down the upper one and a rubber stripe with cotton-piece soaked in 10% sugar solution for moth feeding. Muslin pieces were daily replaced by other clean ones and the old ones were put within small gars until egg hatching and incubated at the rearing conditions temperature 25ºC.

2. Plant extracts:

The experimental plants selected for this study are leaves of Golden shower (*Cassia fistula* L.), and whole plants of Demsisa (*Ambrosia maritimal* L.) and Lantana (*Lantana camara* L.). The effectiveness of these plant extracts compared with Neemazal and triflumuron.

3. Compound used:

3.1. Triflumuron (chitin synthesis inhibitor**,** Alysystin 5% EC): 1-(2-chlorobenzoyl)-3-(4-trifluoromethoxyphenyl) urea.

3.2. Neemazal: A botanical extract containing 1% Azadirachtin A (10 g/liter) from the neem tree, *Azadirachta indica* (Meliaceae).

4. Preparation of plant samples and extraction:

Green plant materials were washed with water and then left to dry under room conditions. The dry plant materials were ground in a grinder to a coarse powder.

Extraction was carried out according to the method adopted by Freedman *et al.* (1979) with slight modification, where ground leaves or whole plants were soaked in chosen solvent instead of using soxhelt procedure. These solvents which varied in their polarity were used for extraction (Ethanol 95%, Hexane and Petroleum ether). Then 150 g of each powder was soaked in 750 ml of the first solvent (ethanol) for 3 days in brown coloured bottles used as containers and was provided with light stoppers.

In addition, the extraction solution in the brown coloured bottles was intermittently shacked by an electric shaker for 2 hours daily. After that, the combined extract was filtered over anhydrous sodium sulphate and evaporated to dryness under reduced pressure by a rotary evaporator of a water bath adjusted at 40-50˚C. The crude extracts were weighed and kept in deep freezer until use. The marc was subsequently subjected to extraction with another solvent (hexane and petroleum ether, respectively) the same procedure was used.

As for the last solvent (water) a new weight of 150 g plant powder was soaked for three days at room temperature. The soaking flask was also shaked in water for 2 hours/day, and then extracted solution was left for natural dryness until obtaining the crude.

5. Determination of relative toxicity of different plant extracts and other compounds on *S. littorals* and *E. insulana* under laboratory conditions:

5.1. The cotton leafworm, *S. littorals*:

The experimental insects of *S. littorals* used in the present investigation were the 4th instar larvae. Dry film method was employed throughout the present experiments. Five concentrations of each compound were used; twelve of the 4th larval instars put in one dish and three replicates for each concentration were carried out. Dishes containing dry film of ethanol only were also occupied with the same number of larvae as control. The larvae of one dish for each concentration were transferred into agar (8X16 cm). The percentage of survivals and dead larvae for each dish was recorded after 24 hrs. The transferred larvae were placed over a paper piece that ledge over a saw dust layer at the bottom of the jar and provided with castor leaves for feeding. The upper opening of each jar was covered with muslin that held up

in position by a rubber band. The rearing condition 25±1°C and 65±5% relative humidity and examined until pupation.

5.2. The spiny bollworm, *E. insulana*:

The tested compounds were sprayed (0.07 ml/lab) on the upper surface of diet. Five concentrations of each compound were used; twelve 4th larval instars used and three replicates for each concentration were carried out. The percentage of survivals and dead larvae was recorded after 24 hrs.

6. Field experiment to determination the effect of different compounds on *S. littorals* and *E. insulana*:

6.1.*S. littorals*:

This study was conducted on cotton plants (Giza 80) grown in Beni-Sueif and Minia Governorates. Two experiments were conducted during June 2003 season in the two locations. The plots were arranged in complete randomized block with four replicates for each treatment, and another four replicates as control. The plots were sprayed with different tested agents using a knapsack sprayer. Control plots were sprayed with water only.

The cotton leaves were taken after spraying and transferred to laboratory for testing the effect of these compounds against the 4th instar of *S. littorals*. The average percent reduction of adult stage, percent of pupation and percent of emergence% of adult moths were calculated after 1, 3, 6, 9, 12, and 15 days from spraying.

6.2. *E. insulana*:

This study also conducted on cotton plants (Giza 80) grown in Beni-Sueif and Minia Governorates. The experiments were conducted during beginning, mid and late July 2003 season in the two locations. The plots were arranged in complete randomized block with four replicates for each treatment, and another four replicates as control. The plots were sprayed with different tested agents using a knapsack sprayer. Control plots were sprayed with water only.

The numbers of all natural enemies were counted and average percent infestation, yield weight and yield loss were recorded at the end of the season.

7. Statistical analysis:

In laboratory tests, mortality percentages were calculated and corrected for natural mortalities by Abbott's formula (1925):

Field studies:

Reduction percentage of adult stages was calculated according to the equation of Henderson and Tilton (1955).

RESULTS AND DISCUSSION

1. Effect of different compounds on percentage of pupation and adult emergence of *S. littorals* and *E. insulana*:

Results in Table (1) indicate the susceptibility of the 4th instar larvae of the cotton leafworm, *S. littoralis* and *E. insulana* at laboratory conditions under incubation at (25±1◦C and 65±5% R.H.) towards different plant extracts, Neemazal and chitin synthesis inhibitor (Triflumuron).

Table (1): Effect of different compounds on emergence% and pupation% when treated the 4th instar larvae of the cotton leaf worm, *Spodoptera littoralis* and the spiny bollworm, *Earias insulana.*

Trade name	Average of emergence%		Average of pupation%	
	S. littoralis	***E. insulana***	***S. littoralis***	***E. insulana***
Triflumuron	66.3	73.3	23.7	28.0
Neemazal	46.3	45.4	31.8	29.8
Triflumuron+ Neemazal	48.5	35.7	28.7	29.0
Lantana	65.4	55.8	26.7	26.3
Golden shower	55.7	75.3	25.8	24.04
Demsisa	65.8	55.8	28.2	24.7
Control	93.7	98.7	31.5	33.5

Results recorded pupal and adult deformities for Golden shower, Neemazal and mixture of Triflumuron+ Neemazal treatments.

Similar results were obtained by El-Badawy (1979), who found that diflubenzuron and Altosid (JHA), induced several morphogenetic effects in (larvae, pupae and adults) of *S. littoralis* treated as pre-pupae. Also, Prasad *et al.* (1992) found that topical treatment of last-instar larvae of *S. littoralis* with diflubenzuron caused inhibition of moulting and various deformities in the pupae and adults.

Results obtained in Table (1) showed that the percentage of adult emergence resulted from the larvae treated as 4th instar of *S. littoralis* with different compounds was highly reduced in comparison with the untreated larvae (control). Triflumuron, Demsisa and Lantana gave the highest reduction in percentage of pupation were 66.3, 65.8 and 65.4, respectively. While, Golden shower, mixture of Triflumuron+ Neemazal and Neemazal gave medium effect (55.7, 48.5 and 46.3%), respectively.

Results obtained in Table (1) showed that the percentage of pupation resulted from the 4th instar larvae of *S. littoralis* with different compounds was reduced in comparison with the untreated larvae (control). All tested compounds revealed reduction percentage of pupation, which were 28.7, 28.2, 26.7, 25.8, and 23.7 for Demsisa, Triflumuron+ Neemazal, Lantan, Golden shower and Triflumuron, respectively, while Neemazal was recorded no reduction in percent of pupation as compared with control (31.5%).

Also, results in Table (1) indicated that the percentage of adult emergence resulted from the treated larvae of *E. insulana* with different compounds was highly reduced in comparison with the untreated larvae (control). Golden shower and Triflumuron had the highest reduction percentage of adult emergence were 75.3 and 73.3, respectively. While, Lantana, Demsisa, Neemazal and Triflumuron+ Neemazal gave medium effect (55.8, 55.8, 45.4 and 35.7%), respectively at the same trend.

Besides, the percentage of pupation resulted from the treated larvae of *E. insulana* with different compounds was reduced in comparison to the untreated larvae (control). All tested compounds revealed reduction in adult emergence which were 29.8, 29.0, 28.0, 26.3, 24.7 and 24.04 for Neemazal, Triflumuron+ Neemazal, Triflumuron, Lantana, Demsisa and Golden shower, respectively compared with control (33.5%).

These results are in agreement with that obtained by El-Sayed (1981) and Aldebis *et al.* (1988). They found that the survival of treated *S. littoralis* larvae with diflubenzuron and flufenoxuron suffered a reduction in subsequent pupation and adult emergence. Also, Abd El-Naby *et al.* (1990) found that chlorfluazuron and triflumuron caused reduction percentages in pupation and adult emergence when 4th instar larvae of *S. littoralis* treated with different concentrations of the two tested compounds.

2. Effect of certain plant extracts on larval and pupal duration of *S. littorals* and *E. insulana*:

Obtained results in Table (2) showed that the duration of larvae of *S. littoralis* treated with different compounds was highly longer than untreated larvae (control). Neemazal, Triflumuron+ Neemazal, Triflumuron, Golden shower, Demsisa and Lantana revealed the highest longevity of larvae which were 25.8, 23.7, 23.5, 21.7, 21.3 and 20.8, respectively compared with control (15.7%).

Table (2): Effect of different compounds on larval and pupal duration when treated the 4th instar larvae of the cotton leaf worm, *Spodoptera littoralis* and the spiny bollworm, *Earias insulana*.

Trade name	Average of larval duration%		Average of pupal duration%	
	S. littoralis	***E. insulana***	***S. littoralis***	***E. insulana***
Triflumuron	23.5	12.7	14.0	11.8
Neemazal	25.8	18.3	9.8	16.4
Triflumuron+ Neemazal	23.7	13.8	7.6	13.7
Lantana	20.8	11.7	11.6	14.7
Golden shower	21.7	16.4	8.3	11.3
Demsisa	21.3	12.4	8.5	9.2
Control	15.7	13.5	8.3	8.7

Also, as shown in Table (2) data showed that the duration of larvae of *E. insulana* treated with certain plant extracts was similar longer when compared with the untreated larvae (control). Neemazal, Golden shower, Triflumuron+ Neemazal, Triflumuron, Demsisa and Lantana recorded 18.3, 16.4, 13.8, 12.7, 12.4 and 11.7, respectively compared with control (13.5%).

Obtained data in Table (2) showed that the duration of pupae of *S. littoralis* with certain plant extracts was highly longer than the untreated larvae (control). Triflumuron, Lantana, Neemazal, Demsisa, Golden shower, and Triflumuron+ Neemazal revealed the highest longevity of larvae were 14.0, 11.6, 9.8, 8.5, 8.3, and 7.6 respectively compared with control (8.3%).

Also, results obtained in Table (2) showed that the duration of larvae and pupal instars of *E. insulana* with different compounds was longer than the untreated larvae (control). Neemazal, Lantana, Triflumuron+ Neemazal, Triflumuron, Golden shower and Demsisa recorded 16.4, 14.7, 13.7, 11.8, 11.3 and 9.2, respectively compared with control (8.7%).

These results are in agreement with that obtained by Dimetry and Radwan (1979) indicated that the insect growth regulator, FMC-23509 pro-

longed slightly the duration of the larvae when topically applied to newly moulted 6th instar larvae of *S. littoralis.* Also the percentage of larvae pupated was progressively decreased as the doses increased. The pupal duration correlated negatively with the doses of the insect growth regulator which showed ovicidal potentials at higher doses.

Also, Abd El-Kader *et al.* (1995) studied the effect of triflumuron and chlorfluazuron and their combinations on some biological aspects of *S. littoralis.* Data indicated that larval and pupal durations became longer and decrease in pupal weight, while the adult life span shortened compared to the control insects. They also, reported that the fecundity of the produced adults was highly reduced in all treatments.

3. Effect of different compounds on larval and pupal weight of *S. littorals* and *E. insulana*:

Obtained results in Table (3) cleared that the weight of 4th instar larvaes of *S. littoralis* treated with different compounds was highly increased comparison with the untreated larvae (control). Neemazal, Demsisa, Triflumuron+Neemazal, Lantana, Golden shower and Triflumuron, and revealed high longevity of larvae which were 210.3, 188.3, 151.6, 150.3, 125.8 and 232.4%, respectively compared with control (380.6).

Table (3): Effect of different compounds on larval and pupal weight and mortality of larvae when treated the 4th instar larvae of the cotton leaf worm, *Spodoptera littoralis.*

Trade name	Average weight of larvae (mg)	Average weight of pupae (mg)	Average mortality
Triflumuron	232.4	332.4	28.2
Neemazal	210.3	220.5	36.4
Triflumuron+ Neemazal	151.6	220.9	36.4
Lantana	150.3	355.6	24.2
Golden shower	125.8	270.5	35.3
Demsisa	188.3	280.7	45.7
Control	380.6	400.8	8.0

Also, results obtained in Table (3) showed that the weight of pupal instar of *S. littoralis* treated with different compounds was increased compared with the untreated larvae (control). Lantana, Triflumuron, Demsisa, Golden shower, Triflumuron+ Neemazal and Neemazal revealed high longevity of larvae which were 355.6, 332.4, 280.7, 270.5, 220.9 and 220.5 mg, respectively compared with control (400.8 mg).

In addition, obtained results in Table (3) showed the morality of the 4th larval instars of *S. littoralis* treated with different compounds. Demsisa gave 45.7%, while Neemazal and Triflumuron+ Neemazal gave 36.4%, and Golden shower gave 35.3%, in addition Triflumuron and Lantana gave 28.2 and 24.2%, respectively compared with control which gave 8.0%.

Data obtained in Table (4) showed that the weight of larval instar of *E. insulana* treated with different compounds was increased when compared with the untreated larvae (control). Neemazal, Demsisa, Triflumuron+ Neemazal, Lantana, Golden shower and Triflumuron, revealed high longevity

of larvae which were 225.7, 324.2, 218.6, 313.6, 301.7 and 220.3 mg%, respectively compared with control (380.6 mg).

Also, obtained data in Table (4) showed that the weight of pupal instar of *E. insulana* treated with different compounds was increased when compared with the untreated larvae (control). Lantana, Triflumuron, Demsisa, Golden shower, Triflumuron+ Neemazal and Neemazal revealed high longevity of larvae which were 210.7, 120.8, 130.8, 187.6, 110.8, and 115.7 mg, respectively compared with control (130.5 mg).

Table (4): Effect of different compounds on larval and pupal weight and mortality of larvae when treated the 4th instar larvae of the spiny bollworm, *Earias insulana.*

Trade name	Average weight of larvae (mg)	Average weight of pupae (mg)	Average mortality
Triflumuron	220.3	120.8	48.6
Neemazal	225.7	115.7	35.3
Triflumuron+ Neemazal	218.6	110.8	28.7
Lantana	313.6	210.7	58.3
Golden shower	301.7	187.6	33.8
Demsisa	324.2	130.8	55.7
Control	380.6	130.5	10.8

In addition, obtained results in Table (4) cleared the morality of larval instar of *E. insulana* treated with different compounds. Lantana and Demsisa gave the highest percent mortality (58.3 and 55.7%), Triflumuron gave 48.6%, Neemazal and Golden shower gave 35.3 and 33.8%, while, Triflumuron+ Neemazal recorded the lowest mortality (28.7%), compared with control which gave 10.8%.

4. Effect of different compounds on yield and yield loss after infestation with *E. insulana*:

Results obtained in Table (5) indicated that the %infestation of *E. insulana* in Beni-Suief Governorate reached 13.4, 11.8 and 11.3% when sprayed with Golden shower, Demsisa and Triflumuron+ Neemazal, respectively. While were 9.7, 8.4 and 8.0% when sprayed with Triflumuron, Lantana and Neemazal, respectively compared with control (15.3%).

On the other hand, the %infestation with *E. insulana* in Minia Governorate reached 11.4 and 11.3% when sprayed with Golden shower and Demsisa, respectively. While it was 9.8, 9.7 and 9.0% when sprayed with Lantana, Triflumuron+ Neemazal and Neemazal, respectively compared with control (13.7%).

Besides, the yield loss after infestation with *E. insulana* in Beni-Suief Governorate reached 15.3 and 14.3 Kg/fed. when sprayed with Triflumuron+ Neemazal and Golden shower, respectively. While it was 11.4 and 10.8 when sprayed with Triflumuron and Lantana, respectively, whereas Demsisa and Neemazal gave 8.7 and 7.3 Kg/fed. loss, compared with control (16.3 Kg).

On the other hand, data obtained in Table (5) also indicated that the yield loss after infestation with *E. insulana* in Minia Governorate reached 13.7, 12.7 and 11.7 Kg/fed. when sprayed with Triflumuron+ Neemazal,

Golden shower and Lantana, respectively. While it was 10.3, 9.8 and 8.7 Kg when sprayed with Triflumuron, Demsisa and Neemazal, respectively compared with control (13.7 Kg).

Concerning, the actual yield after infestation with *E. insulana* in Beni-Suief Governorate reached 7.4, 6.8 and 6.5 Kg/fed. when sprayed with Neemazal, Lantana and Triflumuron+ Neemazal, respectively. While, actual yield were 5.5, 5.4 and 4.7 Kg/fed. when sprayed with Triflumuron, Golden shower and Demsisa, respectively, compared with control (3.8 Kg).

Table (5): Effect of different compounds on yield and yield loss after infestation with *E. insulana*:

Trade name	Beni-Sueif Governorate			Minia Governorate		
	Average % infestation	Yield loss (Kg/fed.)	Actual yield (Kg/fed.)	Average % infestation	Yield loss (Kg/fed.)	Actual yield (Kg/fed.)
Triflumuron	9.7	11.4	5.5	9.0	10.3	4.8
Neemazal	8.0	7.3	7.4	7.4	8.7	7.0
Triflumuron+ Neemazal	11.3	15.3	6.5	9.7	13.7	5.3
Lantana	8.4	14.3	6.8	9.8	11.7	6.8
Golden shower	13.4	10.8	4.7	11.4	12.7	4.5
Demsisa	11.8	8.7	5.4	11.3	9.8	5.0
Control	15.3	16.3	3.8	13.7	13.7	3.0

While, in Minia Governorate 7.0 and 6.8 Kg when sprayed with Neemazal and Lantana, respectively. While were 5.3, 5.0, 4.8 and 4.5 Kg when sprayed with Triflumuron+ Neemazal, Demsisa, Triflumuron and Golden shower, respectively, compared with control (3.0 Kg).

5. Effect of different compounds against *S. littoralis* when fed on sprayed cotton leaves under field conditions:

5.1. In Beni-Sueif Governorate:

Results obtained in Table (6) showed that the average percentage of mortality of *S. littoralis* after 1, 3, 6, 9, 12 and 14 days after spraying with different compounds. After 1 day, Neemazal and Triflumuron+ Neemazal gave 88.7 and 80.9% mortality, while Triflumuron, Demsisa and Golden shower gave 68.4, 65.7 and 55.8%, , respectively whereas Lantana gave 18.4% mortality. Then, after 14 days, Demsisa and Triflumuron gave 35.7 and 35.5% mortality, while, Triflumuron + Neemazal, Neemazal, and Golden shower gave 25.8, 25.7 and 25.6% mortality, respectively finally, Lantana gave 15.8% mortality.

Obtained results in Table (6) showed also the percentage of pupation and adult emergence resulted after spraying with different compounds. Golden shower, Triflumuron, Demsisa and Lantana gave 65.9, 55.7, 50.7 and 45.6% average of pupation, while, mixture of Triflumuron+ Neemazal and Neemazal gave 20.3 and 18.7%, respectively. On the other hand, Triflumuron, Demsisa, Lantana and Golden shower gave 85.6, 65.7, 55.6 and 45.8% average of emergency, while, mixture of Triflumuron+ Neemazal and Triflumuron gave 35.8 and 25.3% of emergency, respectively.

Table (6): Effect of different compounds on *S. littoralis* when fed on sprayed cotton leaves in Beni-Sueif Governorate.

Trade name	Average % mortality after:							
	One day	3 days	6 days	9 days	12 days	14 days	Average% pupation	Average % emergence
Triflumuron	68.4	66.4	65.4	60.7	55.4	35.5	55.7	85.6
Neemazal	88.7	86.4	76.4	66.8	60.3	25.7	18.7	25.3
Triflumuron+Neemazal	80.9	78.7	75.4	66.7	55.4	25.8	20.3	35.8
Lantana	18.4	65.4	60.3	48.3	30.5	15.8	45.6	55.6
Golden shower	55.8	55.6	50.0	40.7	35.8	25.6	65.9	45.8
Demsisa	65.7	60.7	50.7	40.9	35.7	35.7	50.7	65.7
Control	0.0	20.0	35.3	0.0	25.8	15.3	78.8	90.7

5.2. In Minia Governorate:

Obtained data in Table (7) showed the average percentage of mortality of *S. littoralis* after 1, 3, 6, 9, 12 and 14 days resulted after spraying with different compounds. After 1 day, Triflumuron+ Neemazal and Neemazal gave 80.4 and 80% mortality, while Lantana and Triflumuron gave 70.4 and 70.3%, whereas Demsisa and Golden shower gave 60.4 and 56.7% mortality, respectively. Then, after 14 day, Triflumuron, Triflumuron + Neemazal and Neemazal gave 45.7, 45.5 and 45.5% mortality, while Lantana, Golden shower and Demsisa gave 30.7, 35.3 and 25.7% mortality, respectively.

Table (7): Effect of different compounds on *S. littoralis* when fed on sprayed cotton leaves in Minia Governorate.

Trade name	Average % mortality after:							
	One day	3 days	6 days	9 days	12 days	14 days	Average % pupation	Average % emergence
Triflumuron	70.3	60.5	65.0	60.7	50.6	45.7	50.6	35.7
Neemazal	80.4	80.3	70.4	68.4	58.4	45.5	33.7	40.3
Triflumuron+ Neemazal	80.0	70.4	75.6	65.7	55.6	45.5	30.5	30.3
Lantana	70.4	60.4	55.4	50.3	45.5	30.7	40.3	45.7
Golden shower	56.7	50.7	55.3	55.4	35.7	35.3	55.6	45.6
Demsisa	60.4	68.7	40.7	50.7	45.3	25.7	40.7	55.6
Control	4.0	15.3	15.8	16.7	11.4	10.3	88.7	88.6

Results obtained in Table (7) showed also the percentage of pupation and adult emergence resulted after spraying with different compounds. Golden shower, Triflumuron gave 55.6 and 50.6% average of pupation, while, Demsisa, Lantana, Neemazal and mixture of Triflumuron+ Neemazal gave 40.7, 40.3, 33.7 and 30.5%, respectively. On the other hand, Demsisa, Lantana, Golden shower and Neemazal gave 55.6, 45.7, 45.6 and 40.3% average of emergency, while, Triflumuron and mixture of Triflumuron+ Neemazal gave 35.7 and 30.3% of emergency, respectively.

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فعالية بعض المستخلصات النباتية ومنظم النمو الحشري تراي فلوميرون علي بعض الأنشطة الحيوية لدودة ورق القطن ودودة اللوز الشوكية وعلاقتها بمحصول القطن

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