

**Insecticidal Efficiency and Latent Effect of certain IGR Compounds on
Cotton Leafworm *Spodoptera littoralis* (Boisd.) in
El-Gemmeiza Agricultural Research Station during season 2011**

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ABSTRACT

During summer season 2011 an experiment was carried out at El Gemmeiza Agricultural Research Station, Gharbia Governorate to evaluate the efficiency and latent effect of six IGR compounds on 2nd and 4th larval instars of cotton leafworm *Spodoptera littoralis* (Boisd.). The tested compounds were: Caprice, Kingbo, Leveuron, Steward, Virtu and Dimeuron. The efficiency and residual effect proved that these products induced high efficacy in this respect . The Leveuron compound was the most effective compared with other compounds, while Steward recorded the least toxic product on both 2nd and 4th instars as the initial effect. Reduction percent at end of larval stage of the 2nd and 4th instar larvae ranged between 100% and 50% for Leveuron and Steward; respectively. Also, results obtained indicated that Caprice, Kingbo and Dimeuron compounds induced high level of reductions of insect population. The residual effect of the tested compounds after 7, 14 and 21 days proved that Leveuron treatment had the highest efficacy against cotton leafworm *S. littoralis* which ranged between 100% to 88%, while Steward treatment gave the lowest one in both larval stages. The biological aspects of These compounds showed that all treatments succeeded in reducing the weights, the instar period of larvae and the leave consumption for the 4th instar larvae.

Key wards: *Spodoptera littoralis*, Caprice, Kingbo, Leveuron, Steward, Virtu and Dimeuron

INTRODUCTION

The traditional pesticides were successfully used for long time to control different pests . Recently, the adverse consequences of those pesticides were

recorded . For instance, Imbalance between insect communities which leads to resurgence of the pest population and raising minor pest to the status of major pest, resistance phenomena, residual problem (persistence and biomagnifications),adverse effect on non-target organisms (fish , birds and predators..... etc). Finally lead to more environment complications, therefore more attention needed to use other methods for pest control in role of integrated pest management .So, recently , several researches concentrated on search about new agrochemical either synthetic or natural origin which have different mode of action. So insect growth regulators (IGR's) which stimulate or retard growth of insect are very interesting products due to its fitness for resistance management, because of its unique biological mode of action and also more safe to environmental elements.

In course of this study, six IGR's were chosen .Three of them(Leveuron, Caprice, and Dimeuron) belongs to benzoylurea chemical group which inhibit chitin synthesis, therefore, the treated larvae become unable to molt successfully into next stage (**Farag, 1979; Ravi and Verma ,1997; Hassanein 2004 and El-Aswad,2007**) . Another product called (virtu) which act as ecdystriod aganist which push the treated larvae to early molt, Steward product has new mode of action that it blocks Na^+ chemical in nerve cells causing cease feeding with poor co- ordinations paralysis and ultimately death .The last product called (kingbo) as new type of botanical pesticide which has unique biological mode of action that cause gastrointestinal disorder leading to death.

The evaluation of the above products on most important pests, cotton leafworm *S. littoralis* was carried out to study the initial and residual effects under field condition by field – Lab procedure . On the other hand, the physiological aspects were also studied as latent effect of these products to chose the most efficient product as control tool and its consequences on biological aspects of alive larvae.

MATERIALS AND METHODS

The present study was conducted to investigate the susceptibility of a laboratory strain of the cotton leafworm *S. littoralis* to six IGR compounds ,which used in the course of study, these products ,its chemical groups and rate of application per feddan were illustrated in the following **Table (1)**.

Products		Rate of application/ fed.	Chemical group
Trade name & formulation	Common name		
Leveuron 5% EC	Lufenuron	160 cc	benzoylurea
Caprice 5% EC	chlorfluazuron	400 cc	benzoylurea
Dimeuron 5% EC	hexaflumuron	200 cc	benzoylurea
Virtu 80% WP	chromafenozide	25 gm	diacylhydrazine
Steward 15% EC	indoxacarb	200 cc	oxadiazine
Kingbo 0.6% SL	(oxymatrine 0.2% + prosuler 0.4%)	500 cc	Botanical

An area of 700 m² planted with cotton in the El- Gemmeiza Research Station farm was divided into 7 blocks 100 m², each six of them were sprayed with the respected compounds using a knapsack sprayer provided with one nozzle delivering 200 litre water/feddan, the last block was left without spraying as source of untreated leaves. Samples of leaves were collected at random from both treated and untreated ones at certain period from spraying as plane of this research .

The cotton leafworm *S. littoralis* colony needed for the present study was established early in May from egg masses collected from El- Gemmeiza Agricultural Research Station, Gharbia Governorate farm .This strain was reared as described by **El-Defrawi et al, 1964**. technique for some generations before starting the laboratory tests to minimize as possible its heterogeneity . The morphological features of larval instars described by **Willcoks and Bahgat , 1937** was taken as base to differentiate between the larvae and identify their different instars .

The efficiency of IGR compound (as initial and residual effects) on the 2nd and 4th instar larvae of cotton leafworm (five replicates each of 10 larvae for each instar) was estimated .The respected instar larvae fed on treated cotton leaves along with the untreated control for 48hr's in glass jar (30x25cm) which covered with muslin and maintained under room temperature .Treated cotton leaves were removed after exposure period (48hr's) and then fresh untreated one was provided . The larvae of cotton leafworm were monitored daily to record the alive ones for two days, five days and uptill end of larval stage . So four groups were established , 1st group represented the initial effect which larvae fed on treated leaves 0 and 1 day from spraying . 2nd ,3rd and 4th groups represented residual effect which larvae fed on treated leaves (7 and 8 days , 14 and 15 days, 21 and 22 days) after spraying and untreated leaves to end of larval stage.

On other hand , to find out the physiological effect (latent effect) of each tested compounds . Another group of the 4th instar larvae (five replicates : each of 10 larvae) were fed for two days on treated leaves collected after spraying later on , the larvae daily fed on untreated leaves till end of larval stage.

The physiological parameters were recorded ; the daily larval weight , the larval instar periods and leave consumption of larvae . The daily rate of food consumption was calculated in gram/larva/day according to **Waldbauer equation (1968) and Scriber and Slansky (1981)**.

For all experiments, mortality values were corrected according to **Abbot's formula (1925)**, Duncan's multiple range test, **Duncan (1955)** at 5% level was used to compare the means of different treatments at the end of the larval stages using MINITAB program. Percentages of reduction were calculated according to **Fleming and Retnakaran (1985)** as follows:-Population Reduction =

$$1 - \left\{ \frac{\text{Post-treatment population in treatment}}{\text{Pre-treatment population in treatment}} \times \frac{\text{Pre-treatment population in check}}{\text{Post-treatment population in check}} \right\} \times 100$$

RESULTS AND DISCUSSION

The data of initial effect against 2nd larval instar of cotton leafworm were illustrated in **table (2)**. The initial efficacy of tested products differ from product to other and the bulk of mortality was recorded after five days from treatment due to the mode of action of these products that interfere with metamorphosis of larval stage . This findings are agreement with that reported for Dimilin as one of benzoylurea product by several researches (**El-Gendy 1977, El-Sayed 1978, Khalil,1978 and Farag, 1979**). However, Leveuron significantly recorded highest mortality (70%) after two days from exposure comparing with other products followed by Dimeuron and Kingbo (52 and 40%) resp. without significant differences between both products but, significantly differ with other products. Regarding ,accumulative mortality at bulk mortality (5days after exposure) Leveuron and Dimeuron gave highest mortality (100% and 98% mortality) without significant differences with Caprice and Kingbo (94 and 90 % m. respectively) and also with Vitu (84% m.) Indeed, the Steward fail to give reasonable mortality that had a lowest significant mortality (46%) comparing with other tested products . On other hand the accumulated larval mortality at the end of larval stage , Caprice, Leveuron , Dimeuron and Kingbo showed significant highest mortality (100% for all) . Again Steward significantly fail to give reasonable mortality (58.33% mortality. But Virtu product gave also significant moderate mortality (87.5%).

The data of initial effect against 4th larval instar of cotton leafworm that were illustrated in **table (3)** confirmed again that the bulk of larval mortality was recorded after 5 days from exposure to tested compound and leveuron product gave significant pronounced initial activity after 2 days from exposure (66% mortality) followed by Kingbo and Dimeuron products that gave a significant initial activity comparing with other products (30% and 26 mortality respectively), but without significant differences between both products. Regarding accumulative mortality at bulk mortality period (5 days after

exposure) . Leveuron product showed a highest mortality (100%) without a significant differences with Caprice and Kingbo products (90% and 88% mortality respectively). Dimeuron product also gave a significant mortality (86%) less than leveuron but significantly similar with Caprice and Kingbo products. However, vertu product significantly showed not acceptable initial mortality comparing with above products. (74% mortality) lastly, steward product fail again to give reasonable mortality (28%) and came in lowest rank in this respect . The accumulated larval mortality showed a superiority of leveuron, Caprice and Kingbo in this respect (100% mortality for all product) . Followed by Dimeuron product that significantly similar (87.5 % mortality) with above group but also with Virtu (81.25% mortality). Unfortunately , Steward still significantly fall in this respect that gave a lowest mortality (47.92%) . As conclusion of initial effect of tested products we can say that :-

- 1- The efficacy of tested products differ according either to the chemical groups that its belongs or chemical structure within the same chemical group.
- 2- All the products showed slow action except Leveuron against both larval tested instar. However, the bulk of mortality was very clear after five days from exposure for both larval instar . so this period considered as minimum period to show IGR's its activity.
- 3- Kingbo product showed a promising results in this respect while steward product failed.

Regarding the residual effect of the tested product after 7 days from spraying against 2nd larval instar **table (4)**.The data indicated that the efficacy of tested product after two days feeding on treated leaves showed a weak response for all products except Leveuron products which significantly showed pronounced efficacy (56 % mortality). However, the acceptable efficacy was pronounced after five days from exposure . So, benzoylurea products, Dimeuron, Leveuron and Caprice significantly showed high efficacy

(94,90,90% mortality respectively) followed by Virtu and Kingbo (70 and 60% mortality respectively), as a moderate effective group while the Steward showed a lowest efficacy (30 % mortality) . The same trend also was clear at the end of larval stage that , the benzoylurea products group were significantly high efficient (94 - 100 % mortality) followed by Virtu and Kingbo products that gave 88 % and 90 % mortality respectively , while Steward showed insignificant differences with Dimeruon and Caprice which failed again in this respect (50 % mortality)

Regarding the residual effect tested product after 14 and 21 days from spraying , the two days after feeding on treated leaves seems not enough for all products (**table 4**) to show its efficacy except Leveuron which gave (28% mortality) . So we will discuss only the efficacy of products after 5 days and at the end of larval stage only . The data of residual effects of products after 14 days from spraying , again segregate the products efficacy at five days from exposure into three groups as following benzoylurea group that significantly represent the most efficient group (70,80, and 84% mortality) for Caprice , leveuron and Dimeuron respectively, followed by Virtu which gave 50% mortality , while Kingbo and Steward gave (20 and 24% mortality respectively) represented a lowest rank in this respect.. However , the efficacy of tested products at end of larval stage conformed again the highest efficacy of Leveuron 92 % mortality and lowest efficacy of Steward product 38 % mortality . Dimeuron as benzoylurea product , Virtu and Kingbo showed moderate acceptable efficacy where the mortality percentage were 86, 82 and 76 % respectively . The data of residual effect of tested product after 21 days from spraying showed that Leveuron as the benzoylurea product still significantly had a pronounced effect either after 5 days or at end of larval stage (70 and 88 % mortality respectively) followed by the other members of benzoylurea group , Caprice and Dimeuron where showed moderate efficacy after five days from feeding on treated leaves (40 and 50 % mortality respectively). The other

products fail to have an acceptable efficacy . However at end of larval stage period the remained benzoylurea products; Caprice and Dimeuron along with Virtu showed a moderate efficacy (62 -72 % mortality respectively) while other products ; Steward and Kingbo have a lowest efficacy (28 and 40 % mortality respectively) . Regarding the residual effect of tested products against 4th larval instar, the efficacy of tested products after 7 days from spraying (**table 5**) showed that two days after feeding on treated leaves were not enough for produce its efficacy for all tested products except Leveuron which had a significant efficacy (48% mortality).However, the pronounced efficacy was recorded after 5 days and the end of larval stage. So, Leveuron, Caprice and Dimeuron as benzoylurea products had significantly highest efficacy (88 ,90, and 88% mortality) respectively., followed by virtu and kingbo significantly had a moderate efficacy as group (58 and 54% mortality respectively). On the other hand Steward product fail to show acceptable efficacy (18% mortality).

Regarding the efficacy of tested products at the end of larval stage, the same trend was recorded, means , benzoylurea group , Leveuron, Caprice and Dimeuron showed significant highest efficiency (100, 90 and 88% mortality respectively), followed by virtue and kingbo that had a significant moderate efficacy (72 and 66 % mortality respectively). Again the steward product fail to show acceptable efficacy (34 % mortality) . The residual effect of tested product after 14 days from spraying showed again the two days after feeding the larvae on treated leaves was not enough to show the efficacy of all products except Leveuron product which had a significant fast effect (26% mortality). However, the residual efficacy of tested products after 5 days and the end of larval stage was pronounced and classified significantly the product into three groups as following, the highest efficacy group was for Dimeuron, Leveuron and Caprice as benzoylurea product (78 ,76 and 66% mortality) respectively , followed by Virtu which showed a moderate efficacy 48% mortality). Latterly , both steward and kingbo were a least effective group 26% mortality for both

product and without significant difference with untreated larvae. The residual efficacy of tested products the end of larval stage also confirm the above results, while the benzoylurea products along with virtue significant had highest efficacy (66,78,86 and 74% mortality for Caprice, Dimeuron, Leveuron and Virtu products respectively) followed by Steward and kingbo products as lowest effective group significantly (30 and 42 % mortality respectively). The data of residual effect of tested products after 21 days from spraying segregates clearly the products into three groups also either at five days from exposure at the end of larval stage. Regarding the efficacy of product at bulk of mortality (5 days after exposure) Leveuron as benzoylurea product was significantly more efficient product (50% mortality) followed by the rest benzoylurea products, Dimeuron and Caprice which showed significantly a moderate efficacy (32 and 36% mortality respectively) . The rest products which belong to other chemical groups Virtu , Steward and Kingbo fail to show pronounced efficacy that gave (20 % , 16 % and 14 % mortality respectively).

Regarding the efficacy data at the end of larval stage also segregate the products as above; Leveuron as benzoylurea product significantly has a highest efficacy (76% mortality) followed by the rest benzoylurea products, Caprice and Dimeuron along with Virtu (48 ,56 and 56% mortality respectively). However , kingbo and Steward showed a significant lowest efficacy (18 and 16% mortality respectively) without significant differences with untreated group.

Last but not least it could be concluded that the obtained initial and residual effect of the tested products under field conditions differs from product to another as well as from one larval instar to another which 2nd larval instar showed more susceptibility to all products than 4th larval instar even as initial or residual efficacy up till 21days from spraying. In respect of the efficacy of tested products , it must be notice the following finding ; the benzoylurea group which regulate insect metamorphosis by interfering with cuticle deposition

during molting was the most attractive group in this respect Leveuron product showed highest efficient either as fast killing (2days from feeding on treated leaves) or long lasting density control effects under field condition followed by Dimeuron but Caprice products did not show fast effects but still have long lasting effects. So in view of chemical control programs these finding is very important which dramatically reduce the pest population that means more reduce the pest injury to the leaves canopy of cotton plants which latterly will reflect on the yield of crop. On the other hand the other products which had a different mode of action we can notice that Steward which block Na^+ channel in nerve cells fail to show pronounced efficacy either as initial or residual effect against both tested larval instar . The virtu as ecdystroid agonist product showed a same trend for both larval instar either for initial efficacy or residual effect up till 21days from spraying which showed moderate efficacy .The kingbo as gastrointestinal disorder product showed the highest pronounced efficacy as initial effect same as benzoylurea group but short residual effect against of both larval instar comparing with all tested products while its efficacy was moderate against 2nd and 4th larval instar after 14th days from spraying ,this efficacy was diminished after 21st days of spraying . So the short residual effect of Kingbo was in agreement with finding of (El- Aswad , 2007) agonist of *S. littoralis* also .

On the other hand , in course of present study , the some biological aspects of 4th instar larvae of cotton leafworm that fed only 48 hrs on field treated leaves and on untreated leaves up till end of larval stage were studied and the data illustrated in **table (6)** . Regarding the average larval weight was maximized for control treatment (0.2228 gm) with no significant difference with Leveuron , Dimeuron (0.1292 and 0.1256 gm respectively) . The other tested products ; Steward . Caprice Vitru and Kingbo significantly reduced the larval weight comparing with other product as well as untreated one . In term of figure , the average larval weight was (0.0542, 0.0746 , 0.1110 and 0.1066 gm)

for the above product respectively) . Moreover , the retarding effect on average larval period of the tested products except Virtu and Steward was more pronounced comparing with control treatment and without significant in between where the average larval period was 2.4 , 2.22 , 1.9 and 1.7 days for Caprice , Dimeuron, Kingbo and Leveuron respectively. Mean while the virtu and Steward don't showed significant retarding effect in this respect (4.92 and 5.5 days respectively) comparing with control (5.9days) also. However, all tested products reduce the leave consumption of larvae by different level than control . However , the tested products in this respect were classified into two significant group comparing with control , while average leaf consumption of Leveuron , and Caprice were (0.0248 and 0.0302 gm) respectively but significantly the same as control (0.0554 gm) and also with other tested product .But Steward , Dimeuron , virtu and Kingbo had the same significant effects (0.006 , 0.0073 , 0.0124 and 0.0258 gm) respectively . It worth to say, these findings not indicate to true antifediant phenomena but indicate to the adverse effects of tested product on disturbance of physiological metabolism that occur to the treated larvae along with its effect on fetal target that depend on the mode of action of each product **Hala et al.(2007)** . The data of the average of rate food consumption ashore the previous results in respect of the disturbance effect of IGRs on physiological metabolism for survival larvae after treatment . However ,all IGRs gave significantly different trend (either positive or negative effects) of rate of food consumption according to either the chemical group of each IGRs or chemical structure of IGRs in the same group . While , Leveuron, Kingbo and Caprice had positive effect (+ 0.1129 , + 0.1274 and +0.1686 gm) respectively, Steward, Virtu and Dimeurom had negative effects (- 0.0201, - 0.0227, - 0.0262 gm) respectively .On the other hand, the group of antichitin synthesis , belongs to the same chemical group gave different trend , Caprice , and Leveuron had appositive effect while Dimeuron showed a

negative effect . So this means the chemical structure also play a role in this respect .

References

- Abbot, W.C. (1925): Methods for computing the effectiveness of insecticide. J. Econ. Entomol Vol.18 (2): 265-273.
- Duncan, D.B. (1955): Multiple range and multiple F. test Biometrics, 11: 1-42.
- El-Aswad, A.F. (2007): Efficiency of certain insecticides and insect growth regulators alone or in mixture with chlorpyrifos of integrated control of the Egyptian cotton leafworm. Journal and Environmental Sciences, 15 (2): 29-48.
- El-Defrawi, M.E. ; Topozada, A. ; Mansour, N. and Zeid, M. (1964): Toxicological studies on Egyptian cotton leafworm *Prodenia litura* (F.). I. Suceptibility of different larval instar to insecticides. Journal of Economic Entomology, 57: 591–593.
- El-Gendy, S.K. (1977): Chemical control of economic pests, " effect of some pesticides on phenoloxidase in cotton leafworm" .M.Sc. Rgesis Fac. Of Agric. Alex. University .
- El-Sayed , D.I. (1978): Larvicidal and ovicidal rffects of Dimilin, PH66-14 on the Egyptian cotton leafworm. 4th conf. Pest, Control , NRC, Cairo Part I,pp. 381-391.
- Farag, A.R. (1979) : Studies on integrated control of some cotton insects "Factors affecting the control of the two major cotton insects by *Bacillicus thuringiensis* and Dimilin " M.Sc. Thesis. Fac. Of . Agric. Alex. Univ. , PP.281.
- Fleming, R. and A. Retnakaran (1985): Evaluating single treatment data using Abbot's Formula with reference to insecticides, J. Econ. Entomol., 78: 1179-1181.
- Hala R. A. R. and Reem N. A. (2007) . Antifeedant and Toxic Activity of Some Plant Extracts Against Larvae of Cotton Leafworm *Spodoptera littoralis* (Lepidoptera: Noctuidae).Pakistan Journal of Biological Sciences, 10: 4467-4472.
- Hassanein, A.M. (2004): Toxicity and mechanism of action of some new and environmental safe compounds on cotton leafworm *Spodoptera littoralis*. PhD. Thesis, Faculty of Agric., Al-Azhar University.
- Khalil, A.A. (1978): Toxicological studies with some pesticides and certain insect growth inhibitor compounds for control of the cotton leafworm *Spodoptera littoralis*. M. Sc. Thesis Fac. Of Menoufia .Univ. , Shebin El-Kom.

- Ravi,G. and Verma, S. (1997): Persistence and dissipation of insecticides against *Heliothis armigera* on chickpea. Indian Journal of Entomology, 59: 62-68.
- Scriber, J.M. and F. Slansky (1981): The nutritional ecology of immature insects. Ann. Rev. Entomol. 26: 183-211.
- Waldbauer, G.P. (1968): The consumption and utilization of food by insects. Adv. Insect Physiol. 3: 229-282.
- Willcocks, F.W. and S. Bahgat (1937) : The insect and related pests of Egypt . Roy. Agric. Sc. Ent. Sec. Vol. (1), part 2.

Table (2) Initial effect of some IGR on 2nd instar larvae of cotton leafworm *S. littoralis* as mean average numbers, season 2011

Compounds	Rate of use a.e/ fed.	After 2 days		After 5 days		At pupation	
		alive	M.%	alive	M.%	alive	M.%
Caprice (5% EC)	20 g/ fed.	8.8 a	12	0.6 cd	94	0.0 d	100
Leveuron (5% EC)	8 g/ fed.	3.0 c	70	0.0 d	100	0.0 d	100
Dimeuron (10%EC)	20 g/ fed.	4.8 b	52	0.2 d	98	0.0 d	100
Kingbo (0.6% SL)	1.2 g/fed.	6.0 b	40	1.0 cd	90	0.0 d	100
Steward (15% EC)	30 g/ fed.	8.4 a	16	5.4 b	46	4.0 b	58.33
Virtu (80% WP)	20 g/ fed.	9.6 a	4	1.6 c	84	1.2 c	87.5
Control	--	10.0 a	0.0	10.0 a	0.0	9.6 a	4

L.S.D = Least significant difference
Mean in the same column not followed by the same letter are not significantly different
(P< 0.05) according to Duncan's multiple range test.

Table (3) Initial effect of some IGR on 4th instar larvae of cotton leafworm *S. littoralis* as mean average numbers, season 2011

Compounds	Rate of use a.e/ fed.	After 2 days		After 5 days		At pupation	
		alive	M.%	alive	M.%	alive	M.%
Caprice (5% EC)	20 g/ fed.	9.8 a	2.0	1.0 de	90.0	0.0 d	100.0
Leveuron (5% EC)	8 g/ fed.	3.4 d	66	0.0 e	100.0	0.0 d	100.0
Dimeuron (10%EC)	20 g/ fed.	7.4 c	26	1.4 d	86.0	1.2 cd	87.5
Kingbo (0.6% SL)	1.2 g/fed.	7.0 c	30	1.2 de	88.0	90.0 d	100.0
Steward (15% EC)	30 g/ fed.	9.8 a	2.0	7.2 b	28.0	5.0 b	47.92
Virtu (80% WP)	20 g/ fed.	9.8 a	0.0	2.6 c	74.0	1.8 c	81.25
Control	--	10.0 a	0.0	10.0 a	0.0	9.6 a	4.0

L.S.D = Least significant difference
Mean in the same column not followed by the same letter are not significantly different
(P< 0.05) according to Duncan's multiple range test.

Table (6): Biological aspect of 4th instar larvae of cotton leafworm *S. littoralis* that fed for 48 hours on leaves treated with IGR compounds as mean average numbers, season 2011

Compounds	Rate of use a.e/ fed.	Larvae weight	Instar period	leave consumption	Rate food consumption
Caprice (5% EC)	20 g/ fed.	0.0746 ^b	2.4 ^b	0.0302 ^{ab}	0.1686 ^a
Leveuron (5% EC)	8 g/ fed.	0.1292 ^{ab}	1.7 ^b	0.0248 ^{ab}	0.1129 ^c
Dimeuron (10%EC)	20 g/ fed.	0.1256 ^{ab}	2.22 ^b	0.0073 ^b	0.0262 ^e
Kingbo (0.6% SL)	1.2 g/fed.	0.1066 ^b	1.9 ^b	0.0258 ^b	0.1274 ^b
Steward (15% EC)	30 g/ fed.	0.0542 ^b	5.5 ^a	0.006 ^b	0.0429 ^g
Virtu (80% WP)	20 g/ fed.	0.111 ^{ab}	4.92 ^a	0.0124 ^b	0.0227 ^f
Control	--	0.2228 ^a	5.9 ^a	0.0554 ^a	0.0201 ^d
L.S.D	--	0.105	1.036	0.035	0.078

L.S.D = Least significant difference
Mean in the same column not followed by the same letter are not significantly different
(P < 0.05) according to Duncan's multiple range test.

Table (4) Residual effect of some IGR compounds on 2nd instar larvae of cotton leafworm *S. littoralis*, as mean numbers, season 2011

Compounds	Rate of use a.e/fed.	Residual effect																	
		2 nd Group (7 DAS)						3 rd Group (14 DAS)						4 th Group (21 DAS)					
		2 days	% M	5 days	% M	pupation	% M	2 days	% M	5 days	% M	pupation	% M	2 days	% M	5 days	% M	pupation	% M
Caprice (5% EC)	20 g/fed.	8.6 ab	14	1.0 d	90	0.6c d	94	9.2 ab	8	3.0 d	70	3.0c	70	9.0 ab	16	6.0 bc	4	3.8c d	72
Leveuron (5%EC)	8 g/fed.	4.4 c	56	1.0 d	90	0.0d	100	7.2 c	2	2.0 d	80	0.8e	92	8.0 b	20	3.0 d	7	1.2e	88
Dimeuron (10%EC)	20 g/fed.	7.8 b	22	0.6 d	94	0.4c d	96	8.4 b	1	1.6 d	84	1.4d e	86	8.8 ab	12	5.0c d	5	3.8c d	62
Kingbo (0.6% SL)	1.2 g/fed.	8.0 b	20	4.0 c	60	1.0c	90	9.4 ab	6	8.0 b	20	2.4c d	76	9.4 a	6	8.0a b	2	6.0b c	40
Steward (15% EC)	30 g/fed.	8.6 ab	14	7.0 b	30	5.0b	50	10.0a	0	7.6 b	24	6.2b	38	9.2 ab	8	7.8a b	2	7.2b	28
Virtu (80% WP)	20 g/fed.	9.4 ab	6	3.0 c	70	1.2c	88	9.4 ab	6	5.0 c	50	1.8c de	82	9.6 a	4	7.6a b	2	2.8d e	72
Control	--	10.0a	--	10.0a	--	9.6a	4	10.0a	--	10.0a	--	9.6a	4	10.0a	--	10.0a	--	9.6a	4

% M = Mortality

DAS= Days after spray

The larvae fed on treated leaves 2 days and untreated leaves up till end of larval stage

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

Table (5) Residual effect of some IGR compounds on 4th instar larvae of cotton leafworm *S. littoralis* as mean numbers, season 2011

Compounds	Rate of use	Residual effect															
		2 nd Group (7 DAS)				3 rd Group (14 DAS)				4 th Group (21 DAS)							
		2 days	%	5	%	pupation	%	2 days	%	5days	%	pupation	%	2 days	%	5	%

	a.e/ fed.		M	days	M		M		M		M		M		M	days	M
Caprice (5% EC)	20 g/ fed.	8.8 ^{ab}	12	1.0 ^d	90	1.0 ^d	90	9.4 ^a	6	3.4 ^c	66	3.4 ^c	66	9.0 ^a	10	6.8 ^d	32
Leveuron (5% EC)	8 g/ fed.	5.2 ^c	48	1.2 ^d	88	0.0 ^d	100	7.4 ^b	26	2.4 ^c	76	1.4 ^c	86	8.0 ^b	20	5.0 ^c	50
Dimeuron (10% EC)	20 g/ fed.	8.0 ^b	20	1.2 ^d	88	1.2 ^d	88	9.0 ^a	10	2.2 ^c	78	2.2 ^c	78	9.4 ^a	6	6.4 ^d	36
Kingbo (0.6% SL)	1.2 g/fed.	8.8 ^{ab}	12	4.6 ^c	54	3.4 ^c	66	9.8 ^a	2	8.4 ^a	16	5.8 ^b	42	9.4 ^a	6	8.6 ^b	14
Steward (15% EC)	30 g/ fed.	9.6 ^{ab}	4	8.2 ^b	18	6.6 ^b	34	9.8 ^a	2	8.4 ^a	16	7.0 ^b	30	9.6 ^a	4	8.4 ^b	16
Virtu (80% WP)	20 g/ fed.	9.2 ^{ab}	8	4.2 ^c	58	2.8 ^c	72	10.0 ^a	0.0	5.2 ^b	48	2.6 ^c	74	10.0 ^a	0.0	8.0 ^b	20
Control	--	10.0 ^a	--	10.0 ^a	--	9.6 ^a	4	10.0 ^a	--	10.0 ^a	--	9.6 ^a	4	10.0 ^a	--	10.0 ^a	--

% M = Mortality

DAS= Days after spray

The larvae fed on treated leaves 2 days and untreated leaves up till end of larval stage

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

الأثر الإبادى والأثر المتبقى لبعض منظمات النمو الحشرية على دودة ورق القطن بمحطة البحوث الزراعية بالجميزة خلال موسم ٢٠١١

السيد جابر ابراهيم حمادة ، المدثر عبد العظيم وهبه ، ابراهيم ابو المعاطى الشامى

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - جيزة - مصر

اجريت تجربة فى موسم ٢٠١١م ، بمحطة البحوث الزراعية بالجميزة بمحافظة الغربية لتقييم كفاءة والتأثير المتأخر لسته مركبات تابعة لمجموعة IGR ضد العمرين الثانى والرابع لدودة ورق القطن . هذه المركبات هى كابريس ، ليفيرون ، ديميرون ، كنج بو ، استيوارد و فيرتو . اثبتت هذه المركبات كفاءة عالية فى الابداء الفورية والتأثير المتبقى . وكان مركب ليفيرون اكثر المركبات فعالية بينما استيوارد اكثر المركبات تأثيرا على كلا العمرين الثانى والرابع كتأثير فوري وكانت نسبة الانخفاض تتراوح بين ١٠٠% ، ٥٠% لليفيرون واستيوارد على التوالي . ووضحت النتائج ان كابريس ، كنج بو والديميرون اعطت مستوى عالى من الانخفاض فى التعداد اما بالنسبة للتأثير المتبقى للمركبات بعد ٧ ، ١٤ ، ٢١ يوم اظهر ليفيرون اكثر المركبات كفاءة ضد دودة ورق القطن حيث تتراوح من ١٠٠% ، ٨٠% بينما استيوارد كان اقل المركبات كفاءة أوضحت النواحي البيولوجية لهذا المركبات فى انخفاض الوزن ، فترة العمر اليرقى وانخفاض معدل الاستهلاك الغذائى للعمر اليرقى الرابع .

