SUMMARY

The present investigation aimed to evaluate the efficiency of some toxic compounds, Curacron, IGRs (Consult and Cascade) and bacterial biocides (Dipel -2x and Xentari) as control agents against the cotton leafworm, ***Spodoptera littoralis*** (Boisd.) and certain insect predators, ***Coccinella undecimpunctata*** **L.,** ***Scymnus*** **spp.,** ***Chrysoperla carnea*** **(Steph.),** ***Paederus alffierii*** **(Koh.) and** ***Orius*** **spp.**

A-Laboratory Studies:

1-Effect of some toxic compounds on 3rd and 5th instar larvae and adult stage of *S. littoralis*:

1-1-Effect on 3rd instar larvae:

a-Acute toxicity:

On basis of toxicity index, Cascade was the most efficient (100%) followed by Consult (92.13&84.62%) and Curacron (5.52&4.42%) at (LC_{50} and LC_{90} levels) on 3rd instar larvae of ***S. littoralis***.

b- Latent effect on some biological aspects of *S. littoralis*:

b-1-Duration of larval stage:

Data indicated that there are no significant difference between the effect of tested compounds and control on duration of 3rd and 5th larval instar of ***S. littoralis***. In contrast, there are significant differences between the effects of all compounds and control on the duration period of 4th and 6th instar larvae of cotton

leafworm, ***S. littoralis*** where these durations were 2.03, 2.00, 2.00 and 2.00 days respectively, compared with 2.40 days in the check and the durations of 6^{th} instar larvae were 4.00, 3.89, 3.33 and 3.99 days, respectively, but 3.40days in control.

b-2- Duration of pupal stage:

Statistical analysis of data showed that there were significant effects between Curacron &Xentari and control on duration period of the pupal stage of **S. *littoralis*** resulted from the 3^{rd} instar larvae fed on castor-bean leaves treated with sub-lethal concentration (LC_{25}) of the compounds Curacron, Cascade & Consult and half recommended of bacterial biocide, Xentari. These periods were 8.77and 9.06 days, respectively compared with 10.23 days in control.

b-3- Weight of pupae:

Results revealed that the sub-lethal concentration LC_{25} of the tested compounds, Curacron, Cascade, Consult and half recommended of Xentari did not effect on the weight of pupae.

b- 4-Effect on Adult stage:

1- Longevity:

The obtained results of the average longevity of male moths resulted from 3^{rd} instar larvae fed on treated castor bean leaves with sub-lethal concentration LC_{25} of tested compounds, Curacron, Consult, Cascade and half recommended of Xentari showed that there were significant differences between Consult and control on the male longevity. Longevity of male recorded 6.66 days as compared with 10.66days in control. But the

difference was significant between sub- lethal concentrations LC_{25} of both compounds and untreated one on the longevity of females.

2- Oviposition periods:

Results cleared that there were significant differences between IGRs tested compounds and control on the pre-oviposition and oviposition period of females. The pre-oviposition periods were 2.63, 3.66, 6.00 and 2.33 days for tested compounds, Curacron, Cascade, Consult and half recommended of Xentari, respectively, compared with 2.00 days in control. Also, the oviposition period were 5.66, 3.00, 1.33 and 6.00 days, respectively, compared with 6.00 days in control. But there were nonsignificant difference between the effect of all compounds and control on post-oviposition periods of females.

b -5- Mortality of immature stage:

- % of larval mortality:

Results indicated that the latent effect of IGRs (Consult & Cascade) was the highest on the subsequent larval instars of cotton leafworm, ***S. littoralis***.

- Percentage of pupation:

Data clear that the percentages of pupae resulted from the 3^{rd} instar larvae fed on castor bean leaves treated with sub-lethal concentration LC_{25} of toxic compounds, Curacron, Consult, Cascade and half recommended of Xentari were 96.67, 63.33, 66.77 and 80.00 % , respectively. While, data recorded 100 % emergence in control.

-% of pupal mortality:

The pupal mortality percentages were 37.90, 53.60, 25.00 and 16.70 % for compounds, Curacron, Consult, Cascade and half recommended of Xentari, respectively

b-6- % of adults' emergence:

Percentages of adults' emergence were 62.10, 47.40, 75.00 and 83.30 for compounds, Curacron, Consult, Cascade and half recommended of Xentari, respectively, while in control, it was 100%.

-Sex ratio:

Data indicate that the sex ratio of adult stages (male: females) recorded (0.6:1), (0.8:1), (2:1) and (0.8:1) (males: females) with compounds, Curacron, Consult, Cascade and half recommended of Xentari, respectively. While, it was (0.8:1) for males: females in control**.**

1-2-Effect on 5^{th} instar larvae:

a–Acute toxicity:

On basis of toxicity index,Consult was most efficient (100%) followed by Cascade (75.27& 97.18%) and Curacron (9.15 & 19.31%) at LC_{50} and LC_{90} levels, respectively, against 5^{th} instar larvae of cotton leafworm.

b- Latent effect on some biological aspects of *S. littoralis*:

b-1- Duration of larval stage:

Data about the duration periods of the 5^{th} larval instar of **S. *littoralis*** treated with sub-lethal concentration LC_{25} of toxic compounds, Curacron, Consult and Cascade and half recommended concentration of the bacterial formulation of ***B. t***. subsp ***aizawai*** (Xentari) cleared that the differences were significant between Xentari and control on the duration of 5^{th} instar larvae. Also, results cleared that there are significant differences between all treatments and control on the duration periods of 6^{th} instar larvae resulted from the 5^{th} instar fed on treated castor bean leaves.

b-2- Duration of pupal stage:

Results cleared that there was no significant difference between op and IGRs compounds and control on the duration period of the pupal stage of **S. *littoralis*** resulted from the 5^{th} instar larvae fed on castor bean leaves treated with sub-lethal concentration LC_{25} of the tested compounds Curacron, Consult & Cascade. But there was significant between the bacterial formulation of ***B. t***. subsp. ***aizawai*** (Xentari) and control.

b-3- Weight of pupae:

Results revealed that the sub-lethal concentrations of tested compounds decreased significantly the pupal weight of those resulted from 5^{th} instar larvae of ***S. littoralis*** fed on castor bean leaves treated with sub-lethal concentration LC_{25} of the tested compounds, Curacron, Consult & Cascade and half recommended of Xentari.

b- 4-Effect on Adult stage:

1- Longevity:

Results of the average longevity of male moths resulted from 5^{th} instar larvae fed on treated castor bean leaves showed that there were significant differences between all treatments and control on the longevity males and females. The longevity of male was 8.33, 10.00, 8.33 and 9.66 days with toxic compounds, Curacron, Consult& Cascade and half recommended of Xentari, respectively as compared with 6.33 days in control. While, there were significant differences were between Consult (only) and control on longevity of female was 12.33 days compared with 8.66 days in control.

2- Oviposition periods:

Results cleared that there were significant differences between tested compounds, Curacron, Cascade & Xentari and control on pre- oviposition period. Also, between Consult and control on post-oviposition period. While, there was no significant difference between tested compounds and control.

b -5- Mortality of immature stages:

- % of larval mortality:

Data indicated that the latent effect of Curacron compound was the highest on the subsequent larval instars of ***S. littoralis***. The % of larval mortality were 66.67, 43.33, 36.67 and 33.33% with LC_{25} of toxic compounds, Curacron, Consult & Cascade and half recommended of Xentari, respectively.

- % of pupation:

Data cleared that the percentages of pupae resulted from the 5th instar larvae fed on castor bean leaves treated with sub-lethal concentration LC_{25} of toxic compounds, Curacron, Consult& Cascade and half recommended of Xentari were

33.33, 56.67, 63.33 and 66.67%, respectively. While recorded 100 % in control.

-% of pupal mortality:

The pupal mortality percentages were 60.00, 52.90, 57.90 and 55.00% with sub-lethal concentration LC_{25} of toxic compounds, Curacron, Consult& Cascade and half recommended of Xentari , respectively.

b-6- % of adults' emergence:

Percentages of adults emergence were 40.00, 47.10, 42.10 and 45.00 % with sub-lethal concentration LC_{25} of toxic compounds, Curacron, Consult& Cascade and half recommended of Xentari, respectively. Compared with 100 % in control.

-Sex ratio:

Data indicated that the sub-lethal concentration LC_{25} of tested compounds on sex ratio of ***S. littoralis***, the IGR, Cascade was the highest effective on the sex ratio ♂: ♀ for treated 5th instar larvae, where the sex ratio were (1.6:1) & (3:1) and (0.5:1) for (males: females) with Consult & Cascade and Xentari, respectively, compared with (1:1) in control.

3-Effect of some toxic compounds under study on adult stage:

a- Acute toxicity:

On basis of toxicity index, the Cascade was most efficient (100%) on adults of ***S. littoralis*** followed by Curacron (39.08&65.20%) and Consult (21.38&45.17%) at LC_{50} and LC_{90} level, respectively.

b-Latent effect of sub-lethal concentrations (LC_{50} and LC_{25}) of the tested toxic compouds on som biological aspects of *S. littoralis* (treated in adult stage):

b-1- Effect of Curacron,(OP) on:

- Oviposition periods:

Data reveal that there are significant variances between the effect of two sub- lethal concentrations (LC_{50} & LC_{25}) of Curacron and control on pre- oviposition, whereas the pre-oviposition periods were 3.00 and 3.33 days, with sub-lethal concentrations (LC_{50} & LC_{25}) of Curacron, respectively, compared with 2.00 days in control. While, the LC_{50}, (only) significantly effected on oviposition periods were 3.00 and 7.00 days, respectively, while it was 6.66 days in untreated females of ***S. littoralis*.** But non significant on post-oviposition period of females of ***S. littoralis*.**

- Longevity:

Data indicated that there were significant differences between the effect of the two tested concentrations (LC_{50}& LC_{25}) of Curacron on longevity of females and between LC_{50} and

untreated females (7.00 and 11.33 days, respectively, compared with 10.33 days for untreated females).While, no significant differences between the effect of sub-lethal concentrations (LC_{50} &LC_{25}) of Curacron and control on longevity of males.

-Number of deposited eggs and hatchability:

Fecundity of treated females was reduced and the hatchability % of deposited eggs by females exposed to sub-lethal concentrations (LC_{50}&LC_{25}) of Curacron recorded low values 59.90 and 70.30%, respectively than in control (95.30 %).

b-2- Effect of IGR, Consult on:

- Oviposition periods:

Data cleared that no significant differences between the effect of sub-lethal concentrations (LC_{50}&LC_{25}) of Consult on oviposition periods (pre- oviposition, oviposition and post-oviposition of treated and untreated females. Also, the sub-lethal concentrations (LC_{50} & LC_{25}) of Consult non-significantly effected on average longevity of females and males were noticed.

- Number of deposited eggs and hatchability:

The two sub-lethal concentrations of this tested compound significantly decreased fecundity of females of ***S. littoralis*** which recorded 53.00±7.80 and 482.33 ± 67.80 eggs, respectively, compared with 2318.66 ± 20.42 eggs / female in check. Also, these concentrations were highly reduced hatchability of eggs (recorded 0.00 and 52.22%, respectively compared with 95.30% for untreated females).

b-3- Effect of IGR, Cascade on:

- Oviposition periods:

Data revealed that there are significant differences between the effect of sub-lethal concentration (LC_{50}) and control only**.** The pre-oviposition period of ***S. littoralis*** females recorded 4.33 and 3.66 days, respectively comparing with 2.00 days in control. While, there are no significant differences between the effect of sub-lethal concentrations of Cascade and control on oviposition and post- oviposition period of females.

- Number of deposited eggs and hatchability:

The tested compound of Cascade at the two concentrations (LC_{50} & LC_{25}) highly decreased fecundity and caused inhibition of eggs hatchability of females. Whereas the average number of deposited eggs/females recorded 583.00 ±77.36 and 800.66 ± 64.60 eggs/ female, respectively. While, in control it was 2318.66 ± 20.42 eggs/ female. While, the hatchability percentages of eggs deposited by females were recorded 7.83 and 83.99%, respectively comparing with 95.30% in control.

b-4- Effect of bacterial biocide, Xentari on:

-Oviposition periods:

Results showed that there are no significant differences between the effect of two concentrations of Xentari (2.5g/L &1.25g/L) on the mean oviposition periods (pre-oviposition,

oviposition and post- oviposition) of ***S. littoralis*** females and untreated one.

-Longevity:

Results indicated that there are no significant differences between the half recommended and recommended concentration and control on the longevity of ***S. littoralis*** females. The average longevity of females recorded 8.66and 10.33 days, respectively compared with 8.33 ± 0.33 days in check. But there are significant differences between the effect of the half recommended concentrations of Xentari and control on longevity of males.

-Number of deposited eggs and hatchability:

Results indicated that there are significant differences between the effect of each concentration and control on the number of deposited eggs / female of ***S .littoralis.*** But the bacterial biocide, Xentari caused significantly reduction up to 50 % in eggs / laying / female and caused highly reduction in eggs hatching.

-Malformations:

Results indicated that the abnormality rating varied according the tested compound. Curacron and Xentari gave the highest abnormality rating. While the IGR, Cascade gave a moderate effect (A.R), but Consult gave the lowest effect rate of malformation**.**

2-Insect predator, *Chrysoperla carnea*

2-1-Effect of toxic compounds on egg stage :

a- Acute toxicity:

On basis of toxicity index, Curacron (100%) followed by Cascade (91.58 & 58.15%) were more effective than Consult (30.72 & 48.08%) as ovicidal against aphid lion at LC_{50} and LC_{90} level, respectively.

b- Latent effect of sub-lethal concentration (LC_{25}) of the tested toxic compounds on some biological aspects of *C. carnea*. :

b-1- Larval stage:

Results showed that there are no significant differences between the effects of sub -lethal concentration of toxic compounds Curacron, Consult &

Cascade and half recommended of bacterial biocide, Xentari on the duration periods of larval instars of ***C. carnea*** resulted from treated eggs and control.

b-2- Pupal stage:

Results cleared that there are significant differences between the effect of toxic compounds and control on the duration of pupal stage of insect predator, ***C. carnea***. Where the mean duration periods of Curacron, Consult, Cascade and Xentari were 9.30, 10.20, and 12.30 and 8.50 days, respectively, compared with 7.80 days in control.

b-3- Adult stage:

- Longevity:

Results indicated that no significant differences between the effect of sub-lethal concentration LC_{25} of tested compounds (Curacron, Consult, Cascade) and half recommended 0f Xentari and control on longevity of males **.** While, there are significant differences between the effect of toxic compounds and control on longevity of females. Whereas longevity periods of females recorded 11.82, 13.66, 15.32 and 18.56 days, respectively compared with 20.65 days in check.

b-4- Oviposition periods:

Results indicated that there are no significant differences between all toxic compounds and control on oviposition periods (pre, oviposition & post – oviposition)

of females of ***C. carnea***.

b-5- Effects on immature stages:

Results indicated that the sub-lethal concentration LC_{25} of toxic compounds, Curacron, Consult, Cascade and half recommended of Xentari induced highly increase in mortality % during larval and pupal stages of ***C. carnea***. Whereas the percentage of larval mortality recorded 25.00, 29.40, 38.50 and 27.30 % respectively, but in control was 5.40 %.While, mortality percentages of pupae were 41.70, 33.30, 25.00 and 25.00%, respectively compared with 5.00% in control.

-Pupation and emergence:

Results reported that all toxic compounds used in this study were decreased pupation and emergency compared with control.% of pupation recorded 75.00, 70.60, 61.50 and 72.70 %, respectively compared with 92.60 % in control. While, % of adult's emergence of ***C.carnea*** was 58.30, 66.70, 75.00 and 75.00%, respectively compared with 95.00 % in control. Also, the toxic compounds effect on sex ratio of aphid lion, which recorded (1.3:1), (1.3:1), (1.6:1) and (2:1), respectively compared with (1:1) for males: females in control.

2-2-Effect of toxic compounds tested on 3rd instar larvae of aphid lion:

a- Acute toxicity:

On basis toxicity index, Cascade was most effective (100%) at LC_{50} level, followed by Curacron (69.54%) and Consult (42.24%), respectively. While at LC_{90} level, Consult was most effective (100%) followed by Curacron (95.40%) and Cascade (92.90%) against 3rd instar larvae of insect predator, ***C. carnea.***

b- Latent effect of sub-lethal concentrations of the tested toxic compounds on some biological aspects of aphid lion:

Results showed that there are no significant differences between each of all sub-lethal concentrations (LC_{25}) of toxic compounds, Curacron, Consult & Cascade and half recommended of bacterial biocide, Xentari and control on

duration of 3rd instar larvae of aphid lion fed on egg-masses of cotton leafworm treated with toxic compounds.

b-1-Pupal stage:

Results showed that there are significant differences between each of all

Sub-lethal concentrations (LC_{25}) of toxic compounds and control and prolonged duration of pupal stage of ***C. carnea***. Whereas the mean duration of pupal stage of ***C. carnea*** recorded 9.30, 10.20, 12.30 and 8.50 days, respectively compared with 7.80 days in control.

b-2 Adults stage:

-Longevity:

Data cleared that there are significant differences between each of all sub-lethal concentrations (LC_{25}) of toxic compounds and control on the longevity of males and females of aphid lion. Whereas the average longevity of males recorded 20.90, 25.10, 15.07 and 22.50 days, respectively compared with 23.10 days recorded in control. While, the longevity of females were 12.50 , 10.34, 7.50 and 14.42 days, respectively compared with 18.33 days in control.

B-3–Oviposition periods:

Results indicated that no significantly effects with sub-lethal concentration of the toxic compounds on pre - oviposition & post- oviposition periods of females of ***C. carnea*** and control were noticed. While there are significant differences between the

effect of each toxic compound and control on oviposition period of females of ***C. carnea***. The mean of oviposition periods were 7.84, 7.03, 4.50 and 9.53 days, respectively, compared with 11.50 days in check.

b-4 - Effects on immature stages:

Results revealed that all toxic compounds caused increased larval and pupal mortality and decreased the percentage of pupation, adults emergence and effect on sex ratio of ***C. carne***a.

2-3-Effect of toxic compounds tested on pupal stage of *C. carnea*:

a-Acute toxicity:

On basis of toxicity index, Cascade was most toxicant (100%) at LC_{50} and LC_{90} followed by Consult ((50.10%) and Curacron(27.63 %),

respectivelyat at LC_{50}, while at LC_{90} followed by Curacron (65.20%) and Consult (30.34 %), respectively.

b-Latent effect of sub-lethal concentrations of the tested toxic compounds on pupal stage of aphid lion:

b -1-Pupal stage:

Data revealed that toxic compounds prolonged the duration of pupal stage and there are significant differences between the effect of toxic compounds and control on the duration of pupal

stage of insect predator, ***C. carnea***. Whereas duration of pupae was 9.30, 10.20, and 12.30 and 8.50 days, respectively, compared with 7.80 days in check.

b-2-Adults stage:

-Longevity:

The sub-lethal concentration (LC_{25}) of toxic compounds, Curacron, Consult &cascade and Xentari was significantly shorter than untreated one on the longevity of both males and females of ***C. carnea***.

b-3- Oviposition periods:

Oviposition periods no significantly affected with sub-lethal concentration of the tested toxic compounds of females of ***C. carnea***.

b- 4-Pupal mortality percentage:

Results indicated that all toxic compounds showed high pupal mortality of ***C. carnea.***

-Percentage of adult's emergence and sex ratio:

Results indicated that all toxic compounds showed reductions in adults emergence of ***C. carnea*** (66.70, 66.30, 53.30 and 70.0% with toxic compounds, Curacron, Consult & Cascade and Xentari respectively compared with 93.30 %in check). While, the sex ratio of adults were also affected ((1.5:1), (1.3:1), (1.7:1) and (2.2:1) for males: females with toxic compounds, Curacron, Consult & Cascade and Xentari respectively compared with (1.2: 1) in control).

2-4-Effect of toxic compounds on adult stage of aphid lion:

a-Acute toxicity :

On basis of toxicity index, Cascade had the highest efficiency (100%) at LC_{50} and $LC_{90,}$ followed by Consult (78.87, 71.88%) and Curacron (57.99, 74.10%), respectively against adult stage of ***C. carnea***.

b- Latent effect of sub-lethal concentrations of the tested toxic compounds on biological aspects of adult stage of *C. carnea*:

b-1- Adults stage:

-Longevity:

The sub-lethal concentrations of the tested compounds significantly effected on the longevity and caused shortened on adult longevity of both males and females of ***C.carnea***. Whereas averages longevity of males were 10.06, 9.54, 6.34 and 16.03 days with Curacron,Consult, Cascade and Xentari, respectively comparing with 21.60 days in control. While, for females were 11.00, 11.00, 9.00 and 17.06 days, respectively comparing with 19.02 days in control.

b-2- Oviposition periods:

Results observed that the sub-lethal concentrations of tested compounds were significantly affected on oviposition and post-oviposition periods. The oviposition periods of ***C. carnea*** females were 5.00, 5.00, 3.00 and 9.67 days, respectively. While

was 12.02 days in control. The average post- oviposition period of females, ***C. carnea*** recorded 1.00, 1.00, 1.00 and 3.06 days, respectively compared with 4.00 days in control. But there are no significant on pre- oviposition of ***C.carnea***.

b-3- Number of eggs/female and hatchability:

Results indicated that sub-lethal concentrations of toxic compounds significantly reduced adult longevity, fecundity and egg hatchability of ***C. carnea.*** Whereas the average number of deposited eggs /female recorded 20.67 ± 0.6, 45.60 ± 6.30, 25.23 ± 2.80 and 80.27 ± 2.73 eggs/ female, respectively compared with 164.10 ± 6.20 eggs/ female in check. While, the hatchability % of eggs laying by females treated with sub-lethal concentration of compounds, Curacron, Consult, Cascade and half recommended of Xentari were 70.00, 63.00, 34.40 and 90.00%, respectively compared with 95.50 % in control.

3-Effect of toxic compounds on the insect predator, *Coccinella. undecimpunctata* L.

3-1- Effect of some the toxic compounds tested on egg stage:

a- Acute toxicity :

On basis of toxicity index, Curacron was the most efficient insecticide (100%) at LC_{50} level, followed by Cascade (95.39%) and Consult (84.67%), respectively. On the other hand, at LC_{90} Consult was the most efficient (100 %) followed by Curacron (96.90%) and Cascade (92.27%), respectively, against eggs of insect predator, ***C. undecimpunctata***.

b- Latent effects of sub-lethal concentration (LC_{25}) of the toxic compounds tested on some biological aspects of C. *undecimpunctata* (treated in egg stage).

b-1- Duration of Larval stage and pupal stage:

Results indicated that no significant differences were found between sub-lethal concentrations (LC_{25}) of toxic compounds, Curacron, Consult & Cascade and half recommended concentration of Xentari and control on duration of larval stage and pupal stage of ***C. undecimpunctata***.

b-2- Mortality of immature stages:

-Larval and Pupal mortality percentage:

The sub-lethal concentration (LC_{25}) of toxic compounds increased larval mortality and caused high mortality during pupal stage of ***C. undecimpunctata***. The percentages of larval mortality of ***C. undecimpunctata*** descended from eggs treated with Curacron, Consult, Cascade and Xentari were 20.00, 28.60, 18.80 and 20.00%, respectively compared with 6.40% in check. While, mortality percentages of ***C. undecimpunctata*** pupae were 46.70, 23.50, 22.20 and 20.00 %, respectively compared with 4.00 % in control**.**

% of pupation and emergence and Sex ratio:

Pupation and emergency had negatively affected by sub-lethal concentration (LC_{25}) of toxic compounds Curacron, Consult & Cascade and half recommended concentration of Xentari. Whereas % of pupation of ***C. undecimpunctata***

estimated 80.00, 71.40, 81.20 and 93.60%, respectively compared with 93.60% in control. But the percentages of adults emergence of ***C. undecimpunctata*** were 63.30, 76.50, 77.80 and 80.00%, respectively compared with 96.00 % in check. While this toxic compounds effected on sex ratio of adults emergence (males: females) of ***C. undecimpunctata*** produced from treated eggs.

3-2- Effect of the tested toxic compounds on 3rd instar larvae:

a-Acute toxicity

On basis of toxicity index,Cascade was the most effective toxicant given (100 %) at LC_{50} and LC_{90} levels, follwed by Curacron (83.65 &77.59%) and Consult (39.20 & 80.89%), respectively, against the 3rd instar larvae of ***C. undecimpunctata***.

b- Latent effects of the tested toxic compounds on some biological aspects of *C. undecimpunctata*.

B-1-Duration of:

-3rd and4th instar larvae:

Results revealed that there are significant differences between effect of the sub-lethal concentration (LC_{25}) of toxic compounds, Curacron, Consult & Cascade and half recommended of Xentari and control on duration of 3rd, 4th & (Total of *3*rd and 4th instars larvae) and pupal stage of ***C. undecimpunctata.*** The duration of the 3rd instar larvae of ***C. undecimpunctata*** recorded 3.90, 4.03, and 4.20 and 2.90 days,

respectively compared with 3.00 days in control. With 4^{th} instars were 3.25, 4.29, 4.66 and 3.94 days, respectively, compared with 4.38 days in check.

b-2- Mortality of immature stages:

-Larval and pupal mortality percentage:

The sub-lethal concentration (LC_{25}) of toxic compounds caused increased the percentages of larval and pupal mortality of ***C. undecimpunctata***.

- Percentage of pupation and adult's emergence:

The sub-lethal concentration (LC_{25}) of the tested compounds caused decreased percentages of pupation and adult emergence of ***C. undecimpunctata.*** Also, affected on the sex ratio of adults emergence (males: female) of ***C. undecimpunctata*** produced from 3^{rd} instar larvae treated.

B-Field studies:

I -Effect of some toxic compounds under study on cotton leafworm and some insect predators in cotton fields during 2005, 2006 and 2007 seasons:

I- 1- Effect of Curacron, insecticide:

a -Effect on *Spodoptera littoralis:*

Data showed that the highest initial reduction percentages of ***S. littoralis*** was 94.98, 93.70& 90.72% during 2005, 2006 and 2007seasons, respectively. While, the highest mean reduction

percentages were 93.77 % in the first season, 88.45 % in the second and 92.48 % in the third seasons, respectively.

b- Effect on insect predators:

1- *Chrysoperla carnea*:

Results revealed that the highest value of % reduction in numbers of ***C.carnea*** 100.00% were recorded after 1st and 3rd days of application by Curacron during the three seasons, respectively. The averages of reduction % during the three year ranged between 81.23 - 84.81%.

2- *Coccinella undecimpunctata:*

Data revealed that the highest initial reduction percentage was 100.0% at 1st and 3rd days after application by compound, Curacron during 2005, 2006 and 2007 seasons, respectively. While, the means % reduction of population were 74.75, 83.19 and 77.59% during 2005, 2006 and 2007 seasons, respectively.

3- *Scymnus* spp.:

The highest initial reduction percentages of ***Scymnus* spp**. Recorded 100.00% after 1st and 3rd days after spraying by insecticide, Curacron in 2005, 2006 and 2007 Seasons, respectively. On the other hand, the highest average percentage of reduction, 77.12, 74.09 and 68.62 % during 2005, 2006 and 2007 seasons, respectively.

4- *Paederus alfierii:*

The highest initial % reduction percentages of ***P. alfierii*** were 100.0 % recorded after 1st and 3rd days after application

during three Seasons. On the other hand, the highest average percentage of reduction that estimated 59.68, 62.13 and 59.68 during 2005, 2006 and 2007 seasons, respectively.

5- *Orius* spp.:

Results revealed that initial reduction percentage recorded 100.00 % after 1st and 3rd days after application during the three studied seasons, respectively. But the highest average percentage of reduction, 73.58, 64.22 and 74.83 % during 2005, 2006 and 2007 seasons, respectively.

I-2 Effect of IGR$_s$ (Consult and Cascade):

a- Effect on *Spodoptera littoralis*:

Data indicated that the IGR (Consult) caused the initial population reduction percentages of ***S. littoralis*** were 95.52, 97.46 and 94.83% after 5th days of application for the tested compound in three seasons, respectively, while the highest average of populations reduction percentages 93.73, 93.93 and 91.75% during 2005,2006 and 2007 seasons, respectively. On the other hand, IGR, Cascade caused the initial of reduction percentages were 46.47, 39.45 and 33.96% after 5th days of application. But the average reduction percentages were 50.85, 51.94 and 43.70% during 2005, 2006 and 2007 seasons, respectively.

b-Effect on insect predators:

1- *Chrysoperla carnea:*

Results revealed that the highest value of % reduction in numbers of ***C. carnea*** (27.99, 29.45 and 35.86 %) for Consult and (27.66, 25.25 and 28.92%) for Cascade were recorded after 10 and 15 days of application during 2005, 2006 and 2007 seasons, respectively. The three year averages of reduction % for the two tested compounds (Consult and Cascade) ranged between 26.57-33.71 and 22.00- 26.06%, respectively.

2- *Coccinella undecimpunctata:*

Data indicated that the highest population reduction percentage of ***C. undecimpunctata*** during 2005 season, (23.80 & 25.74%) after 10 days of application by Consult and Cascade, respectively. While during 2006 season, the highest percent reduction was (32.77 & 30.48%) after 15 days of treatment for Consult and Cascade, respectively. AS for 2007 season highest values of reduction percentages reached (33.71 & 23.49 %) after 15 days of application for Consult and Cascade, respectively. Data reveal that Consult gave the higher averages of reduction percentage than Cascade (28.08 & 32.76%) during 2006 and 2007 seasons, but 18.72% during 2005 season, the reverse was true.

3- *Scymnus* spp.:

The highest adverse effect of the two tested compounds (Consult and Cascade) against ***Scymnus*** spp. were (28.20 and 29.74%) at 10^{th} day after application in 2005 season, but during 2006 season the highest reduction percentages were (32.77 & 30.46%) at

15th day after spray by Consult and Cascade, respectively. While, the highest reduction percentages were (30.66 and 28.75%) at 10th day after application in 2007 season.

4- *Paederus alfierii:*

Data indicated that the highest reduction percentages of ***P. alfierii*** counts during 2005 season (22.59 and 22.07%) occurred after 5 and 15 days of application for Consult and Cascade, respectively. While the highest reduction percentages (32.40 & 22.36% after 10 and 5 days of spray by Consult and Cascade in 2006 and (28.78 & 28.57 % in 2007 seasons) were recorded after 10 days of application by Consult and Cascade, respectively. Also results reveal the highest overall average of reduction percentage was 31.86% during 2006 season for Consult followed by 25.68%) for Cascade during 2007 season, but the lowest value (14.89%) recorded for Consult during 2005 season

5- *Orius* spp.:

The highest reduction percentage after the treatment with Consult and Cascade during 2005 season were 34.33 & 27.20% after 10 and 15 days of treatment, respectively, but in 2006 season the highest reduction percentages (28.91 & 26.15 %) were recorded after 10 days of application with the two tested with IGRs,Consult and Cascade, respectively. On the other hand, the highest reduction percentages in 2007 season (23.35 & 27.63%) were recorded after 15 and 10 days of treatment with Consult and Cascade, respectively. In addition, the overall average of reduction of ***Orius* spp**. population was 26.76 % and 22.76 % for Consult during 2006 and 2007seasons,

while, the lowest value of 21.82% was given with Consult during 2005 season.

I-3-Effect of bacterial biocides (Dipel-2 X and Xentari):

a- Effect on *Spodoptera littoralis*:

Results indicated that the population reduction were (34.00 % & 48.40 %) after 6^{th} and 8^{th} days application for Dipel-2X and Xentari, respectively in 2005 season. But in 2006 season the highest mean percentages of population reduction were (45.27%& 57.78%) at 8^{th} days after application for Dipel-2X and Xentari with % average reduction were (36.84% &48.24%) for Dipel-2X and Xentari, respectively. While, in 2007 season the highest average percentage of population reduction were (43.05%&40.47%) after 8 and 6 days after spraying by Dipel-2X and Xentari , respectively.

b- Effect on insect predators:

1- *Chrysoperla carne*:

Data indicated that the highest reduction percentage in ***C. carnea*** population during 2005 season were 20.73 and 22.66% at 6 days after application with Dipel-2x and Xentari, respectively. The highest reduction percentage were 28.33% for Dipel-2x and 14.43% for Xentari at 6 days after application during 2006 season. While in 2007 season, the highest reduction percentages calculated were 23.07 and 19.31 % at 4 days after treatment with Dipel-2x and Xentari, respectively.

2- *Coccinella undecimpunctata:*

The highest reduction percentages of population were (22.53% & 25.92%) at the 4^{th} day after application for Dipel-2X and Xentari, respectively in 2005, but during 2006 season the highest reduction percentages were (22.34% & 15.86%) for Dipel-2x and Xentari at 4^{th} and 6^{th} day after treatment, whereas the highest reduction percentages were (26.76% & 15.81%) after 6 days of spraying of Dipel-2X and Xentari during 2007 season.

3- *Scymnus* spp.:

During 2005 season the highest effect of the two tested compounds Dipel-2X and Xentari were (21.12% & 28.41 %), respectively at the 8^{th} and 4^{th} days after application. While, these percentages reached 21.90 &17.82% after 8 and 2 days of treatment with the two biocide materials, respectively during 2006 season. During 2007 season the highest calculated reduction percentage was 13.38 and 22.66 %, respectively at 2^{nd} and 6^{th} days after application.

4- *Paederus alfierii:*

Results revealed that the highest reduction percentages in 2005 season reached 21.25 and 35.88 after 4 and 6 days of application for Dipel-2X and Xentari, respectively. During 2006 season, those reached (23.00% & 15.34%) after 6 and 4 days of application of the two tested compounds, respectively .While, during 2007 season, the highest reduction percentages reached (23.07% & 25.90 %) , 4 and 6 days after application with Dipel-2X and Xentari, respectively.

5- *Orius* spp.:

The highest reduction percentages of ***Orius* spp** during 2005 season were (22.61%&25.41%) recorded after 6 days of Dipel-2X and Xentari treatments, respectively. While during 2006, the highest reduction percentages were (28.72%& 16.39%) recorded at 4^{th} after spray with Dipel-2X and Xentari, respectively. But in 2007 season these percentages reached (22.50%&22.62%) after 6 days of treatment with Dipel-2X and Xentari, respectively.