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## **VI. Summary**

Field and laboratory experiments were carried out during two successively seasons 2008 and 2009. The field experiments conducted in the cotton fields at Manzala district, Dakhlia Governorate and the laboratory experiments were conducted at Plant Protection Research Institute, Dokki, Giza. The aims of this investigation to survey and study the seasonal abundance of certain insect pests attacking cotton crop and their associated predatory insects; some ecological studies on certain insect pest attacking cotton crop and their associated predatory insects; evaluation the release of certain natural enemies in cotton field and evaluation the efficiency of some plant extracts on leaf worm *S. littoralis*.

### **1 – Survey and seasonal abundance of certain insect pests attacking cotton crop and their predatory insect.**

The field experiments conducted to survey and study the seasonal abundance of certain insect pests and their associated predators in cotton field. Two methods were used visual examination and yellow sticky traps.

#### **1-1-Visual examination**

##### **A: Survey of insect pests**

The obtained results revealed that there were nine insect species have been recorded infesting cotton crop at Manzala district during the two seasons of study. These species belonging to four orders namely Homoptera, Thysanoptera; Hemiptera and Lepidoptera. The total number individuals recorded from these species were 28053 in 2008 and 35793 in 2009 seasons.

Homopterous insects were the most dominant in the two seasons of study. Four insect pests were collected from this order namely. *A. gossypii*, *B. tabaci*, *E. lybica* and *E. diasciops*. *Aphis gossypii* was the most dominant one during the two seasons of study. Order Thysanoptera, only the species *T. tabaci* was recorded. From order Hemiptera, two species were recorded *N. viridula* and *L. hesprus*. The results revealed that *N. viridula* was the most important in this order.

From order Lepidoptera, two species were found *S. littoralis* and *S. exigua* during the two seasons of study.

### **B: Predatory insect species**

The obtain results revealed that seven predators were recorded belonging to three orders, these orders were Coleoptera; Neuroptera and Hemiptera. The total recorded individuals of these predators were 1966 in 2008 and 2565 in 2009 seasons.

Coleopterous predatory insects were the most dominant during the two seasons of study as there were four species have been recorded from this order namely: *C.undecimpunctata*; *P. aifirii*; *Cy. v. isis* and *S. syriacus* during 2008 and 2009 seasons.

Order Neuroptera was represented by two species namely. *C. carnea* and *C. septempunctata*.

From order Hemiptera only one species was recorded *O. albidipennis* during the two seasons of study.

## **1-2-Yellow sticky traps:**

### **A: Survey of insect pests**

There were seven insect species have been recorded infesting cotton crop during the two seasons of study. These species belonging to three orders namely Homoptera, Thysanoptera and Hemiptera. The total number individuals recorded from these species were 15794 in 2008 and 30803 in 2009 seasons.

Homopterous insects were the most dominant in the two seasons of study. Four insect pests were collected from this order namely. *A. gossypii*, *B. tabaci*, *E. lybica* and *E. diascipiens*. *Aphis gossypii* was the most dominant species during the two seasons of study. Order Thysanoptera, only the species *T. tabaci* was found.

From order Hemiptera, two species were recorded *N. viridula* and *L. hesprus*. The obtain results revealed that *N. viridula* was the most domenant one in this order.

### **B: Predatory insect species**

The obtain results revealed that six predators were recorded belonging to two orders; these orders were Coleoptera and Neuroptera. The total recorded individuals of these predators were 1966 in 2008 and 2565 in 2009 seasons.

Coleopteous predatory insects were the most dominant during the two seasons of study as there were four species have been recorded from this order namely: *C.undecimpunctata*; *P. alfierii* ; *Cy. v. isis* and *S. syriacus* during 2008 and 2009 seasons.

Order Neuroptera was represented by two species namely. *C. carnea* and *C. septempunctata*.

## **2-A- Seasonal abundance of certain insect pests**

The obtain results showed that *A. gossypii*, had four peaks during the two successive seasons 2008 and 2009. These peaks were recorded in the third week of June, the second week of July, the second week of August and in the first week of September in 2008 season respectively. In the second season these Peaks were found in the third week of June, in the second week of July, in the first week of August and in the first week of September.

*Bemisia tabaci* had five peaks during the two successive seasons of study. These peaks were recorded in the second week of June in the last week of June in the second week of July, in the second week of August and in the last week of September during the two seasons respectively.

The data revealed that *Thrips tabaci* had three peaks during the two successive seasons 2008 and 2009. These peaks were occurred in the third week of June, the first week of July and the first week of August during the two seasons respectively.

The population fluctuation showed that *E. lybica*, had four peaks in 2008 season and five peaks in 2009. These peaks were recorded in the third week of June, in the second week of July in the first week of August and in the last week of August in 2008 season respectively, while that were found during the second season, in the third week of June, in the second week of July, in the first week of August, and in the end of August and in the second week of September.

*Embosca diescipiens* had five peaks in 2008 and four peaks in 2009 season. These peaks were recorded, in the third week of June in the second week of July, in the last week of July, the second week of August and first week of September during 2008 season respectively while that were found, in the third

week of June, in the second week of July, in the second week of August, in the first week of September.

The obtain results revealed that *Nezara viridula* had five peaks during the two successive seasons 2008 and 2009. These peaks were occurred in the third week of June, in the last week of June in the third week of July, second week of August and in the last week of August, respectively.

*Lygus hesprus* had four peaks during the two season of study. These peaks were found, in the last week of June, in the third week of July, in the second week of August and in the last week of August, respectively

There were two species recorded by using visual examination more than that collected by sticky traps these species belonging to order Lepidoptera (*S. littoralis* and *S. exiqua*). *Spodoptera littoralis* had four peaks during the two successive seasons 2008 and 2009. These peaks were recorded, in the last week of June, the third week of July, the third week of August and the third week of September during the two seasons of study

### **B: Predatory insect species**

The data revealed that *P. alfierii*, had four peaks in 2008 and five peaks in 2009 seasons. These peaks were recorded, in the first week of June, in the first week of July, in the third week of July, and in the first week of September in 2008 season respectively, while that were found in the second season in the first week of June, in the last week of June, in the third week of July, in the third week of August and in the third week of September.

*Coccinella undecimpunctata* had four peaks in 2008 and five peaks in 2009 seasons. These peaks were occurred in the second week of June, in the last week of June, in the first week of August and in the first week of September



respectively during the first seasons of study, while that was found in the third week of June, in the third week of July, in the second week of August in the last week of August and second week of September in 2009 season.

The obtain results revealed that *Cy. v. isis*, had third peaks in 2008 and five peaks in 2009 season. These peaks were recorded in the first week of June, in the last week of June, in the third week of August in 2008 season respectively, while that were found in the second season in the last week of June, in the third week of July, in the second week of August, in the last week of August and in the third week of September in 2009, season

*Scymnus syriacus* had third peaks in 2008 and five peaks in 2009 season. These peaks were occurred, in the second week of June, in the last week of June, in the second week of August, in 2008 season respectively, while that were found, in the third week of June, in the second week of July, in the last week of July, in the second week of August, and in the third week of September in 2009 season respectively

*Chrysoperla carnea* had five peaks during 2008 season and four peaks during the two seasons of study. These peaks were found in the last week of June, in the third week of July, the first week of August, in the last week of August, and in second week of September in 2008 season respectively, while that were found in the third week of June, in the second week of July, in the second week of August and second week of September in 2009, season respectively

*Chrysopa septeumpunctata* showed four peaks in 2008 and five peaks during 2009 seasons of study. These peaks were recorded in the second week of June, in the second week of July, in the first week of August and in the third week of

August in 2008 seasons respectively, while that were occurred in the third week of June, in the second week of July, in the second week of August, in the last week of August and in the second week of September in 2009 respectively

*Orius albidipennis* had third peaks during the two seasons of study. These peaks were found, in the last week of June, in the last week of July, in the second week of August in 2008 season, respectively, while that were occurred, in the last week of June, in the second week of July and the third week of September in 2009 respectively.

### **3- Ecological studies on the population density of some insect pests infesting cotton crop and their associated predators**

#### **3. A. Insect pests**

The simple correlation coefficient values between insect pests and certain weather factors on cotton crop during 2008 and 2009 seasons were estimated. The data indicated that there were insignificant effects between the population of insects and average temperature and average Relative humidity in the two seasons for visual examination. Meanwhile, there were highly significant positive relationship between the population density of *A. gossypii* and average temperature in the second season while, there were significant positive relationship between the population density of *E. lybica* and avg. temp in 2008 season and average relative humidity in 2009 season. Moreover there were significant positive relationships between the population density of *N. viridula* and average of relative humidity in the two seasons. Whereas, during the two seasons there were significant positive relationships between the population density of *L. hesprus* and average Relative humidity

### **3. B. Predatory insect species**

The data revealed that the relationship between the predators and certain weather components, there was a significant positive relationship between the population densities of *P. alfierii*, *C. septempunctata*, *Cy. v. isis*. and avg. temp in the first season of study. Meanwhile, there were significant positive relationship between the population density of *C. undecimpunctata* and avg. temp. during the two seasons of study by visual examination method. While, there were significant positive relationships between the population density of *P. alfierii*, *C. septempunctata*, *C. undecimpunctata* and average temperature during the first season of study by the sticky traps method.

### **4- Release of certain natural enemies**

#### **Release of *Coccinella undecimpunctata* for controlling certain insects pests cotton crop.**

##### **A- visual examination**

The obtain results revealed that the predator prey ratio was exceeded 1:10 (the critical ratio) in the third week of June, in the third week of July, in the second week of August and the end of August. The numbers needed from the reared predator to justify the ratio were 2500, 2000, 2000 and 2500 individuals in the four release date's, respectively. The results indicated that the weekly total number of insect pests were lower than that in the control area, that is due to the effective role of the released coccinellid predator in checking the insect pests as long as ratio of their abundance was within the critical ratio 1: 10.

The data revealed that the using of insecticides aiming to control the injurious insects in cotton during 2008 season. The predator prey ratio was exceeded 1:10 (the critical ratio) in the third week of June, in the third week of

July, in the second week of August and in the first week of September. The results indicated that the weekly total number of insect pests were lower than that in the untreated area, that is due to the effective role of the insecticides in checking the insect pests as long as ratio of their abundance was within the critical ratio 1: 10. It can be concluded from these results that using predator *C. undecimpunctata* aiming to control the insect pests in cotton field during 2008 and 2009 seasons.

In the treated area with *C. undecimpunctata* the reduction percentages of the insect pests reached 44.91% during 2008 season, while this percentage was 48.21 % during 2009 season, compared with the untreated area. The obtained results revealed that the effectiveness of the release of *C. undecimpunctata* for controlling the insect pests attacking the cotton crop. In the treated area with insecticides the reduction percentages of insect pest reached 67.74 % and 68.55% during 2008 and 2009 seasons respectively, compared with untreated area and that due to the efficiency of the insecticides on the population densities of the insect pests infesting.

The total number of the predatory insect species which recorded in treated area with *C. undecimpunctata* was equal or more than the total number of these insects in untreated area (control), while the total number of the predators decreased in the area which treated with the insecticides compared with the control area. The reduction percentages of these insects reached 60.94 % in 2008 season and 68.03 % in 2009 Season respectively these reduction were achieved due to the using of the insecticides.

## **B- Released of *Trichogramma evanescens***

The obtained results revealed that the percentages of infestation with PBW ranged between 1-4 % with an average of 1.9% in *Trichogramma* release area, while that were ranged between 3-4 % with an average of 3.4% in insecticides treated area. The percentages of infestation with SBW ranged between 0-3 % with an average of 1.0 % in *Trichogramma* release area, while that were ranged between 1-3% with an average of 2.0 % in insecticides treated area. The average percentages of infestation by the PBW and SBW throughout the whole season were 2.9 % and 5.4% in *Trichogramma* release area and insecticides area respectively. The percentages reductions of infestation by the two insects were ranged between 28.57- 80% with an average of 53.91%, this reduction was achieved due to *T. evanescens* release.

The results showed that the percentages of infestation by PBW ranged between 1-3% with an average of 1.6% in *Trichogramma* release area while that were ranged between 2-5% with an average of 3.5% in insecticides treated area. The percentages of infestation with SBW ranged between 0-2% with an average of 0.7% in *Trichogramma* release area, while that were ranged between 1-2% with an average of 1.8% in insecticides treated area in 2009 seasons. The average of percentages infestation by the PBW and SBW throughout the whole season 2.3% and 5.3% in *Trichogramma* release and insecticides treated area respectively.

It can be concluded that, the percentage reduction ranged between 25-83.33% with an average of 56.88%, these reduction were achieved due to *T. evanescens* release. The present investigation revealed that *T. evanescens* is able

to be used as biological control agent against *P. gossypiella* and *E. insulana* in cotton fields.

#### **4-Evaluation the efficiency of plant extracts**

##### **1.1. Toxicity of the most effective plant extracts against the 2<sup>nd</sup> larval instar of *S. littoralis* (Boisd.) after seven days**

The results indicated that *M. deliciosa* methanol fraction was the most effective fraction among the tested plant fractions against the 2<sup>nd</sup> instar larvae of *S. littoralis* after seven days of treatment giving LC<sub>50</sub> value of 478.702 ppm followed by *A. indica* chloroform fraction and *H. salicornicum* chloroform fraction showing LC<sub>50</sub>s of 2709.487 and 3020.443 ppm, respectively, while *E. camaldulensis* hexane fraction was considered to be the less toxic tested plant extracts showing LC<sub>50</sub> value of 7604.019 ppm. However, LC<sub>90</sub>s reached 1983.497, 42617.373, 55218.489 and 152890 ppm, respectively. The toxicity index being 17.668, 15.849 and 6.295% for *A. indica* chloroform fraction, *H. salicornicum* chloroform fraction and *E. camaldulensis* hexane fraction (Based on LC<sub>50</sub> of *M. deliciosa* methanol fraction 100.0%), respectively.

##### **1.2. Toxicity of the most effective plant extracts against the 4<sup>th</sup> instar larvae of *S. littoralis* (Boisd.) after seven days**

The results presented indicated that *M. deliciosa* methanol fraction was the most effective fraction among the tested plant fractions against the 4<sup>th</sup> instar larvae of *S. littoralis* after seven days of treatment giving LC<sub>50</sub> value of 884.369 ppm followed by *H. salicornicum* chloroform fraction and *A. indica* chloroform fractions showing LC<sub>50</sub>s of 1408.846 and 2175.685 ppm, respectively, while *E. camaldulensis* hexane fraction was considered to be the less toxic tested plant

extracts showing LC<sub>50</sub> value of 15442.61 ppm. However, LC<sub>90's</sub> reached 13945.038, 34411.465, 30179.909 and 131420 ppm, respectively. The toxicity index being 62.773, 40.648 and 5.727% for *H. salicornicum* chloroform fraction, *A. indica* chloroform fractions and *E. camaldulensis* hexane fraction (Based on LC<sub>50</sub> of *M. deliciosa* methanol fraction 100.0%), respectively.

### **1.2.1. Influence of *M. deliciosa* extract on *S. littoralis* immature stages when treated as 2<sup>nd</sup> larval instar :**

Data indicated that the treatment of the 2<sup>nd</sup> instar larvae of *S. littoralis* by LC<sub>50</sub> concentration of *M. deliciosa* led to the prolongation and directly increased the larval duration as it was 16.62 compared with the untreated one 15.02 days. On the other hand, the larval mortality percentages were 57 and 4 % for treatment and control, respectively. The pupation percentage was 43 and 93 % for treated and untreated larvae of *S. littoralis*, respectively. The mean pupal weight was 0.3256 and 0.3524 gm for treated and untreated, respectively. While, the male and female pupal weight were 0.3101 and 0.3412 gm for treatment, and 0.3417 and 0.3632 gm for untreated, respectively. The mean pupal duration was 11.70 and 12.29 days for treated and untreated ones respectively. The data revealed that pupal duration increase in both male and female by treatment with LC<sub>50</sub> which were (12.4 and 11.00 days) for both ♂ and ♀, compared with their controls (13.02 and 11.56 days), respectively. pupal mortality reached to 21.3 % in treatment, while it dose not exceed than 3 % in control.

### **1.2.2. Influence of *M. deliciosa* extract on *S. littoralis* adult stage when treated as 2<sup>nd</sup> larval instar:**

Regarding the effect of *M. deliciosa* on adult stage, indicated that the total emergence percent for 2<sup>nd</sup> larval instar treated with *M. deliciosa* were 78.7 and 97 % for treatment and control, respectively. *M. deliciosa* extract indicated adult malformation with 31% compared with 4% for the control. On the other hand, the adult stage was affected by *M. deliciosa* treatment; the normal adult was 69 % for treatment compared with 96 % for control.

The percentage of male and female sex ratio % were 0.60 and 0.40 % for *M. deliciosa* extract, 0.51 and 0.49 % for control, respectively. Also, *M. deliciosa* extract decrease adult longevity. Male longevity were 10.91 and 11.00 days for the treatment and the control respectively, while female longevity was 12.03 days for both pre-oviposition, oviposition and post-oviposition periods of the treatment, respectively, while those of the control was 12.0 days.

The present data showed the affected by treatment by *M. deliciosa* extract, the average total number of eggs laid by female throughout its life span was 783.0 eggs/female while it reaches to 1104.5 eggs/female in the control.

### **1.2.3. Influence of *M. deliciosa* extract on *S. littoralis* immature stages when treated as 4<sup>th</sup> larval instar:**

Data indicated that the treatment of the 4<sup>th</sup> larval instar of *S. littoralis* by LC<sub>50</sub> concentration of *M. deliciosa* led to the prolongation and directly increased the larval duration, it was 10.56 days compared with 9.55 days in the untreated one.

On the other hand, the larval mortality percentages were 48 and 9 % for treatment and control, respectively. The pupation percentage was 52 and 91 %



for treated and untreated larvae of *S. littoralis*, respectively. The mean pupal weight was 0.2920 and 0.3070 gm for treated and control, respectively. While, the male and female pupal weight were 0.2830 and 0.3000 gm for treatment, and 0.2900 and 0.33140 gm for untreated, respectively. The mean pupal duration was 12.52 and 12.66 days for treated and untreated ones, respectively. The pupal duration increase in both male and female by treatment with LC<sub>50</sub> which was (12.00 and 13.05 days) for both ♂ and ♀, compared with their controls (12.17 and 12.14 days), respectively. Pupal mortality reached to 17.6 % in treatment, while it dose not exceed than 11 % in control, reducing of adult emergence by plant extract had mentioned before by Sharaby and Ammar (1997).

#### **1.2.4. Influence of *M. deliciosa* extract on *S. littoralis* adult stage when treated as 4<sup>th</sup> larval instar:**

Regarding the effect of *M. deliciosa* on adult stage indicated that the total emergence percent for 4<sup>th</sup> instar larvae treated with *M. deliciosa* were 82.4 and 89 % for treatment and control, respectively. *M. deliciosa* extract indicated adult malformation with 21.6% compared with 3 % for the control. On the other hand, the adult stage was affected by *M. deliciosa* treatment; the normal adult was 78.4 % for treatment compared with 97 % for control. The percentage of male and female sex ratio % were 0.61 and 0.39 % for *M. deliciosa* extract, 0.54 and 0.46 % for control, respectively. Also, *M. deliciosa* extract decrease adult longevity, male longevity were 12.56 and 10.15 days for the treatment and the control respectively, while female longevity was 13.42 days for both pre-oviposition, oviposition and post-oviposition periods of the treatment, respectively, while those of the control was 10.44 days.

Data showed that affected by treatment by *M. deliciosa* extract, the average total number of eggs laid by female throughout its life span was 855.3eggs/female while it reaches to 987.0 eggs/female in the control.