

## SUMMARY

Cotton is the major economic crop in Egypt. During the growing season, the plants are attacked by several pest insects during its different development stages of growth. Lepidopteran pests (*Pectinophora gossypiella*, *Earias insulana* and *Spodoptera littoralis*) are considered to be important and key insects causing a lot of damage and loss of cotton yield. The extensive use of the conventional insecticides creating a lot of problems such as the insects resistance to insecticides and environment pollution. So, it is necessary to use particular insecticides such as Insect Growth Inhibitor and bio-insecticides to aggrandize role of the naturally enemies (predators and parasitise) and for obtaining less environmental pollution and the hazards to human.

The field experiments of the present study were carried out at El-Bassiuony Farm at Abo-Homos, El-Bihaeira Governorate, Egypt, during the subsequent cotton seasons of 2003 and 2004. The objectives of this contributonal study were initiated to evaluate the combined role of the natural enemies by using the parasitoid *Trichogramma evanescens* in reducing cotton infestation by some lepidopterous pests through the application of insect growth inhibitors and bio-insecticides compared with achemical insecticide as standard and determining the effect on the yield characteristics.

The obtained results can be summarized as follows:

### **1. Field Application of certain IGIs, *B.t* based formulations and a chemical insecticide (Chlorpyrifos) against *Spodoptera littoralis*.**

#### **1.1. The growing season of 2003:**

The detected number of *S. littoralis* larvae before the application of tested compounds was ranging between 678-708 larvae/ 25 cotton plants. Overall 14days post-

treatment, the number of larvae in those plants treated with Chlorpyrifos was sharply decreased to 4 larvae / 25 plants. It was noticed that the IGI compound Chlorfluazuron was as effective as the chemical insecticide Chlorpyrifos giving 6 larvae / 25plants after 14 days post-treatment. In this respect it could be said that Chlorpyrifos can be replaced by Chlorfluazuron and to be used since the chemical insecticides might contaminate the environment. Lufenuron (an IGI) was proved to as effective as Dipel-2x<sup>®</sup> (*Bt*) against *S. littoralis* larvae giving a number of 24 larvae/25 plants after 14 days post-treatment, while Dipel-2x<sup>®</sup> gave 26 larvae / 25 plants. The least effective compound was Agerin<sup>®</sup> (*Bt*) which gave 146 larvae / 25 plants compared with the other tested compounds and control (untreated check) (530 larvae/25 plants).

### 2.1. The growing season of 2004:

It is noticed that as Chlorpyrifos was the most effective compound since it reduced the number of the larvae, it gave the higher percentage of the reduction calculated by 96.34% as a general mean during a fortnight inspection. Both Dipel-2x<sup>®</sup> and Chlorfluazuron gave a same reduction percentage (about 62% for both). In this respect, Chlorfluazuron was proved to be more effective than the other tested IGI compound Lufenuron since the latter gave a reduction percentage of 51.10%. The least effective compound was Agerin<sup>®</sup> which gave a reduction percentage of 35.98. Therefore, Agerin<sup>®</sup> was replaced by the new introduced compounds (Spintor<sup>®</sup>) during the field application program to be among the tested compound in 2004 season. Again, Chlorpyrifos was proved to be the most effective compound since it reduced the number of the larvae to 3 larvae/ 25 plants compared with the other tested compounds and the untreated check (control). It is noticed that chloropyrifos has the action of fast killing and reduced the number sharply after one or two days. The other tested compounds have the slow mode of action and the reduction of the larvae extended all over the period of inspection (14 days). Spinosad (Spintor<sup>®</sup>) was proved to be more or less as effective as Dipel2x<sup>®</sup> (*Bt*) since they reduced the number of the larvae to 8 and 6 larvae / 25 plants, respectively compared with the untreated check (400 larvae / 25 plants) when the inspection was done 14 days post-

treatment. Comparing the two tested IGIs compounds themselves, it was found that Chlorfluazuron was more effective than Lufenuron.

## **2. The effect of field application of tested IGIs, Es-Fenvalerate and bio-insecticides with the release of *Trichogramma evanescens* on bollworms infestation:-**

### **2.1. The growing season of 2003:**

The parasitoid release was done before the application of the tested compound and then the parasitoid was released at different intervals (14 days) at a time of 7 days before the application of the tested compounds to avoid the effect of such compounds on the parasitoid itself. The data found that all the running treatment except Agerin<sup>®</sup>, reduced the number of both the pink and spiny bollworm larvae to be less than EIL (Economic Injury Level). It could be observed obviously that Agerin<sup>®</sup> (a *Bt* based formulation) was the least efficient compound all over the inspection and application period. On the other hand, the chemical insecticide Es-Fenvalerate was the most efficient compound all over and by the end of the application period. Chlorfluazuron was as effective as Es-Fenvalerate giving more or less a same trend as that gained by the application of Es-Fenvalerate. Therefore, Es-Fenvalerate as a chemical insecticide which might have its own effect on the environment can be eradicated and alternated by Chlorfluazuron to get best results through the treatment of releasing the parasitoid *T. evanescens*.

### **2.2. The growing season of 2004:**

It could be seen that the infestation during the cotton growing season of 2004 was low compared with that of 2003. Therefore, the effect of the different treatment with the parasitoid release will not be clearly pronounced. Nevertheless, it could be said that the running treatments kept the level of the infestation low. Es-Fenvalerate was the most effective

insecticide followed by Spintor<sup>®</sup>. The two tested IGIs, Lufenuron and Chlorfluazuron were equal in their effect on reducing the number of bollworms larvae. Dipel<sup>®</sup> was more effective on the spiny bollworm and less effective on the pink bollworm.

### **3. The side effect of Chlorpyrifos, IGIs & bio-insecticides on the biological agents during the cotton vegetative growth (seasons of 2003&2004).**

#### **1.3 The growing season of 2003:**

The highest calculated percentages of the total numbers of the predators during the vegetative growth were 91.1, 90.7 % for Dipel-2x<sup>®</sup> and Agerin<sup>®</sup>, followed by Chlorfluazuron "Atabron<sup>®</sup>", Lufenuron "Match<sup>®</sup>" [90.7, 89.6 %]. That percentage was 70.6 % for Chlorpyrifos "Dursban<sup>®</sup>" showing a moderate effect on these predators.

#### **2.3 The growing season of 2004:**

The highest calculated percentages of the total numbers of the predators during the vegetative growth were 98.9 and 98.9 % for Dipel-2x<sup>®</sup> and "Spintor<sup>®</sup>", followed by Chlorfluazuron "Atabron<sup>®</sup>", Lufenuron "Match<sup>®</sup>" [98.2 and 97.8 %] and 87.5 % for Chlorpyrifos "Dursban<sup>®</sup>". That least number obtained in case of Chlorpyrifos treatment showed a moderate effect on these predators.

### **The side effect of Es-Fenvalerate, IGIs & bio-insecticides on the biological agents during the cotton boll growth (season of 2003&2004).**

#### **1.4 The growing season of 2003:**

The calculated percentage of that total numbers of the predators during the cotton boll growing seasons of 2003 were 78.8 & 75.3% for Lufenuron "Match<sup>®</sup>" and Chlorfluazuron "Atabron<sup>®</sup>", followed by Dipel-2x<sup>®</sup> [80.8%] and Agerin<sup>®</sup> [74.5%] and it was 40.4% for Es-

Fenvalerate "Sumi-Alfa®". The obtained data showed that conventional insecticide "Sumi-Alfa®" have its negative and significant side effect on the number of the inspected predators and decreased their populations to less than 50 % during the cotton boll growing seasons.

#### 2.4 The growing season of 2004:

The calculated percentages of the total numbers of the predators during the cotton boll growing seasons of 2004 were 64.8 & 63.2% for Lufenuron "Match®" and Chlorfluazuron "Atabron®", followed by Dipel-2x® [75.2%], "Spintor®" [76.8%] and "Sumi-Alfa®" [43.2%]. Again, the results showed that the conventional insecticides "Sumi-Alfa®" also have its negative and significant side effect on the number of the inspected predators and decreased their populations to less than 50 % during the cotton boll growing seasons.

#### **4. Effect of the tested compounds on cotton yield (seasons of 2003 and 2004).**

The use of the unconventional insecticides [Lufenuron "Match®", Chlorfluazuron "Atabron®", Agerin® and Dipel-2x®] and conventional [Es-Fenvalerate"SumiAlpha®"] with the release of *Trichogramma evanescens* produced higher yield giving 7.7, 7.9, 3.7, 7.8 and 8.5 ken./F, respectively by the end of the growing season of 2003. In this concern, the tested insecticides can be arranged as the following descending order: SumiAlpha® › Atabron® › Dipel-2x® › Match® › Agerin® in comparison to the untreated check (3.5 ken./F). However, the application of Agerin® gave a lower cotton yield of 3.7 ken./F in comparison to the other treatments. The results showed that the unconventional insecticides [Lufenuron "Match®", Chlorfluazuron "Atabron®", Spintor® and Dipel-2x®] and conventional [Esfenvalerate "SumiAlpha®"] with the release of *Trichogramma evanescens* produced higher yield giving 7.9, 8, 8.2, 8.1 and 8.2 ken. / F respectively (2004 season). In this concern, Spintor® & SumiAlpha® gave the higher yield that mounted to 8.2 ken. / F in comparison to the untreated check (4.4 ken. / F).