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# EFFICIENCY OF INSECTICIDE ,BIOCIDE AND RELEASE OF *Trichograma evanescens* WEST WOOD IN REDUCING COTTON BOLLWORMS INFESTATION AT KAFR EL-SHEIKH.

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## ABSTRACT

This study was carried out at the Farm of Sakha Agricultural Research Station, Kafr El-Sheikh governorate during three successive seasons; 2008, 2009 and 2010 for assessing some agents for controlling the cotton bollworms, *Pectinophora gossypiella* (Saund.) and *Earias insulana* (Boisd.) Result showed that the most efficient insecticide against *P. gossypiella* larvae was sumi-alpha withe reduction 80.9, 78.7 and 79.9% in the first spray while in the second spray the reduction were 82.1, 85.2 and 83.7% in the three seasons of study, 2008, 2009, 2010 respectively Biovar and protecto were the least effective compounds in controlling this pest. As for *Earias insulana* larval population took almost the same trend with sumi-alpha while biovar and protecto were the least effective. Releasing *trichograma evanescence* West wood in two waves gave reduction for *P. gossypiella* and *Earias insulana* larvae with ranges of 31.7- 44.8 and 23.3 -36.7 % respectively .

## INTRODUCTION

Cotton is considered one of the principle economic crops in Egypt. The pink bollworm, *Pectinophora gossypiella* (Saund.) and the spiny bollworm, *Earis insulana* (Boisd) are major pests attacking cotton in Egypt. Such pests may cause severe losses in cotton yield quantity and quality. (Abdel-Hafez *et al,* 2004)

Successful cotton production depends on efficient pest management program which reduces the risk of crop losses caused by cotton bollworms (El-Nagar, 2007).

Control of cotton bollworms by chemical insecticides is the main tool for combating such pests but repeated applications of insecticides on cotton and other crops induced many problems, including toxic and persistent environmental residues, development of pesticide resistant strains of pests and destruction of non-target organisms particularly beneficial natural enemies.( shawer, 2000 )

*Bacillus thuringiensis* var. *kurstaki* must be ingested by susceptible insect in order to be effective. This microorganism produces both spores (resting stage) and crystalline protein (an endotoxin) which becomes activated and binds to certain receptors in the insect gut causing pores through which gut contents can enter to the body cavity and bloodstream of the insect. The insect ceases feeding and dies within a few days (Tabashink *et al*., 2003) .

*Beauveria bassiana,* (Balsamo) vuillemin is a pathogenic fungus with a large host range and is isused for insect biological control. *B. bassiana* infects and kills the pest when it comes in contact with the fungal spores. Once the fungal spores attach to the cuticle of insect, they germinate sending out structures (hyphae) that penetrate and proliferate in the body of the insect. (Long *et al*.,2000) .

*Trichogramma evanescens* (Westwood) was recorded in Egypt and reported to be an egg parasitoid for *Sesamia cretica* Led. and *Chilo agamemnon* Bles. (Kamal, 1951) and *P. gossypiella* (Abdel-Hafez *et al,* 2004). The release of *T. evanescens* is less costly than chemical sprays. At the same time, natural enemies are protected and environmental pollution is avoided during the outbreak years of bollworms. Both release of the parasite and spraying chemicals may be necessary.

The present study aimed to evaluate the efficiency of insecticide, biocide and release of *Trichogramma evanescens* in reducing cotton bollworm infestation.

## MATERIALS AND METHODS

A field study was carried out at Sakha Agriculture Research Station Farm, Kafr El-Sheikh region during three successive seasons; 2008, 2009 and 2010.

An area of about one and half feddan, cultivated with Giza 86 cotton variety on March 20$^{th}$ was assigned during three seasons. The normal agricultural practices were adopted throughout the growing season as recommended, but without any pesticides.

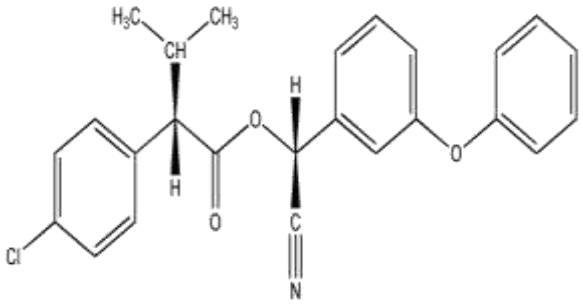
**Effect of insecticide and biocide applications on cotton bollworm :**

Insecticides and biocides belonging to different groups, were tested against cotton bollworm.

**Trade name:** Sumi-alpha

**Common name:** Esfenvalerate

**Chemistry composition:** (S)-α-Cyano-3-phenoxybenzyl (S)-2-(4-chlorophenyl)-3-methylbutyrate (IU PAC)



**Chemical structure:**

**Protecto (10 % W.P):**

A commercial formulation of *Bacillus thuringiensis* var. *kurstaki* and is a product of the special unit for producing Bioinsecticides, Plant Protection Research Institute, Agriculture Research Center, Egypt, with 3200 International toxicity Unit (IU). The active ingredient concentration is 9.4% and the application is was 500 g/feddan. It is a wetable powder formulation.

**Biovar:**

A trade name of the entomopathogenic fungus, *Beauveria bassiana* (Balasamo) as a liquid containing 3 x $10^7$ conidia/ml. The recommended application rate is 200 g/100 water litter/feddan. The product was provided by El-Nasr Company for Fertilizers and Pesticides, Egypt.

The tested chemical and biocide compounds were applied twice; July 26$^{th}$ and August 11$^{th}$ during 2008, 2009 and 2010 cotton seasons. Knapsack sprayer (20 L volume) was used to spray the tested compounds. Numbers of insects were counted before spray, and then 1, 2, 3, 7 and 14 days after spray. Numbers of cotton bollworms were counted per 100 bolls. The reductions in bollworms populations were calculated using Abbott

(1925) equation as follows =

Population reduction % = $$\frac{C - T}{C} \times 100$$

**Where:**

C: Number of bollworms in control.

T: Number of bollworms in treatment.

**Efficiency of the parasitoid, *Trichogramma evanescens* in reducing cotton bollworms infestations:**

During 2008, 2009 and 2010 cotton seasons, under natural infestation conditions, the egg-parasitoid, *T. evanescens* was released in small scale (half feddan) in two wave technique. The paper cards, containing the parasitoid eggs, were prepared at the Department of Biological Control of Plant Protection Research Institute, Giza, Egypt. The carton cards were inserted in vials with top and bottom covered with wire screen to allow the parasitoid adults to pass out and to prevent any predators to enter. The vials were attached to cotton plants by using pieces of wire. Each vial contained 1500 parasitized eggs, and cards were attached at 0.5 m high from the ground surface. To achieve the recommendation, spacings among parasitoid cards were approximately 15 m.

For assessing the effectiveness of the parasitoid, *T. evanescens* in reducing bollworm numbers (pink and spiny bollworms) , samples were taken 4, 7 and 14 days after release. Each sample consisted of 100 bolls that were collected randomly from about 50 cotton plants. The boll samples were taken into plastic bags to the laboratory and dissected for estimating the boll infestation and the actual numbers of bollworm larvae per sample Percentage of reduction in numbers of bollworm larvae and infested bolls in the treated area were recorded.

**Statistical analysis:**

To illustrate the data in Figures, the numbers were transformed using square root method to avoid the extreme values, Analysis of variance was computed in case of insecticide and biocide treatments, and means were compared using Duncan multiple range test (Duncan 1955)

## RESULTS AND DISCUSSION

**Effect of insecticide and biocide application on cotton bollworm:**

Data in Table (1)and (2) show the efficiency of tested insecticides and biocides against bollworms under field conditions during three successive cotton seasons; 2008, 2009 and 2010.

**Pink bollworm, *Pectinophora gossypiella*:**

Data in Table(1) show that two sprays of Sumi-alpha in each of the three seasons proved to be the most effective against *P. gossypiella*, as the bollworm populations were reduced in the first spray by 80.9, 78.7 and 79.9 % for 2008, 2009 and 2010 seasons, respectively. In the second spray, the reductions were 82.1, 85.2 and 83.7% in the three seasons with overall averages of 81.6,81.9 and 81.8 , respectively . Biovar and Protecto were not efficient in controlling this pest,In case of Biovar, the reductions in bollworm populations were 13.7&13.9, 15.7&17.6 and 15.7&20.3% in the first and second sprays, respectively with overall averages 13.8 ,16.7 and 18.0%. Protecto casued reductions of 18.13&14.86, 18.7&18.7 and 22.2& 24.7 in the first and second spray for three seasons, with overall average 16.5,18.7 and 23.4% respectively. The differences among treated compounds were significant.

These results are in line with those of Watson *et al,* (1981) and El-Ghobary (2011) who recommended using alternations of pyrethroids and conventional insecticides for more effective control of *P. gossypiella*.

**Spiny bollworm, *Earis insulana*:**

Data in Table (2) show that, Sumi-alpha (pyrethroids) caused the highest reduction of spiny bollworm; 81.4& 83.7, 81.3&84.3 and 78.3&76.2% in the first and second sprays in both seasons , respectively with overall averages of 82.5,82.8 and 77.2% , respectively. However, Biovar was the least effective recording 15.1&13.9, 15.7&13.2 and 15.5&12.2%, respectively, in two sprays with overall averages of 14.5,14.4 and13.9 % The efficiencies of tested compounds differed significantly.

The obtained results agree with El-Ghobary (2011) , Sharaf (2003) and El-Basyouni (2003) who reported that synthetic pyrethroids are considered the most efficient compounds and were superior to the other types of insecticides.

**Effeciency of *Trichogramma evanescens* in reducing cotton bollworms infestation.**

Table (3) shows that, during 2008, average percentages of reduction in the 1st release of *T. evanescens* were 44.8, 36.7 in larvae of *P. gossypiella* and *E. insulana*, respectively. However, in the 2nd release the percentages of reduction were 40.9 and 23.3% for both insects, respectively.

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In 2009 season ,the redution was 38.2 % for *P. gossypiella* and 30% reduction for *E. insulana*. However, in the second release, reduction was 33.9 and 27.7 to the first insect and second insect, respectively.

In 2010 season, the first release gave 35.1 and 33.3% reduction or *P. gossyiella* and *Earias insulana* espectively.However, in the second release the reduction was 31.7 and 26.5% to the first and second insects, respectively. These results are in agreement with El-Heneidy *et al*. (2004) and Abd El-Rahman *et al*. (2008) who reported that releasing *Trichogramma* parasitoid successfully reduced the losses in cotton yield.

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## تقييم فاعلية بعض المبيدات الكيماوية والحيوية وإطلاق الترايكوجراما في خفض الإصابة بديدان اللوز فى حقول القطن بكفر الشيخ

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****معهد بحوث وقاية النباتات – محطة البحوث الزراعية بسخا – مركز البحوث الزراعية , مصر**

أجريت هذه الدراسة فى المزرعة البحثية لمحطة البحوث الزراعية بسخا – كفر الشيخ خلال المواسم الزراعية 2008 ، 2009 ، 2010 بغرض تقييم فاعلية بعض المبيدات الكيماوية و الحيوية وكذلك تأثير إطلاق طفيل الترايكوجراما في خفض تعداد حشرتي دودة اللوز القرنفلية و الشوكية في حقول القطن.

أوضحت الدراسة أن مبيد Sumi- alpha هو الأكثر تأثيرا على دودتي اللوز القرنفيلية و الشوكية حيث أدى الرش إلى خفض الإصابة بنسبة 80.93 ، 78.7 ، 79.9% وذلك فى الرشة الأولى ، وبنسبة 82.1 ، 85.2 ، 83.7% خلال الرشة الثانية وذلك خلال مواسم الدراسة الثلاثة.

وكذلك أوضحت النتائج أن مبيد Sumi-alpha كان له نفس درجة التأثير على دودة اللوز الشوكية خلال مواسم الدراسة الثلاثة. كانت المبيدات الحيوية Biovar ,Protecto متوسطة التأثير على دودتي اللوز القرنفيلية والشوكية .

كذلك أوضحت الدراسة أن اطلاق طفيل الترايكوجراما مرتين بفاصل زمنى قدره 10 أيام بين الإطلاق الأول والثاني أدت النتائج إلى خفض تعداد يرقات دودة اللوز القرنفلية بمعدلات تراوحت بين 31.7 ، 44.8 ٪ وخفض تعداد دودة اللوز الشوكية بمعدلات تراوحت بين 23.3 ٪ ، 36.7 ٪ خلال سنوات الدراسة الثلاثة .

**قام بتحكيم البحث**

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| **أ.د / سمير صالح عوض الله** | **كلية الزراعة – جامعة المنصورة** |
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**Table (1): Reduction in *Pectinophora gossypiella* larvae (per 100 cotton bolls) as influenced by insecticide and biocide applications during 2008,2009 and 2010 cotton seasons at Kafr El-Sheikh region.**

| Treatment | Date of treatment | 2008 | | | | | | | 2009 | | | | | | | 2010 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Population reduction % | | | | | | | Population reduction % | | | | | | | Population reduction % | | | | | | |
| | | 1 day | 2 days | 3 days | 7 days | 14 days | Average | Overall average | 1 day | 2 days | 3 days | 7 days | 14 days | Average | Overall average | 1 day | 2 days | 3 days | 7 days | 14 days | Average | Overall average |
| **Control** | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0a | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0a | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0a | 0.0 |
| | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0a | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0a | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0a | |
| **Sumi-alpha** | 26July | 66.7 | 80.0 | 85.7 | 90.0 | 84.7 | 81.4c | 82.5 | 72.8 | 80.0 | 75.0 | 88.9 | 90.0 | 81.3d | 82.8 | 66.7 | 80.0 | 83.3 | 88.9 | 72.8 | 78.3c | 77.2 |
| | 11Aug | 73.3 | 80.0 | 87.5 | 91.7 | 85.7 | 83.7c | | 75.0 | 84.7 | 87.5 | 90.0 | 87.6 | 84.3d | | 60.0 | 72.8 | 75.0 | 90.0 | 83.3 | 76.2c | |
| **Biovar** | 26July | 11.1 | 0.0 | 18.1 | 25.0 | 21.4 | 15.1b | 14.5 | 0.0 | 9.0 | 25.0 | 23.0 | 21.4 | 15.7b | 14.4 | 10.0 | 14.2 | 8.3 | 30.8 | 14.2 | 15.5b | 13.9 |
| | 11Aug | 0.0 | 8.3 | 18.1 | 23.0 | 20.0 | 13.9b | | 9.0 | 0.0 | 28.6 | 15.3 | 13.3 | 13.2b | | 7.7 | 13.3 | 0.0 | 26.7 | 13.3 | 12.2b | |
| **Protecto** | 26July | 12.5 | 10.0 | 20.0 | 25.0 | 35.8 | 20.7b | 20.0 | 20.0 | 16.7 | 30.0 | 30.8 | 28.6 | 25.2c | 22.3 | 20.0 | 16.7 | 10.0 | 11.1 | 23.0 | 16.1b | 16.2 |
| | 11Aug | 0.0 | 7.7 | 20.0 | 35.8 | 33.3 | 19.3b | | 16.7 | 14.2 | 9.0 | 37.5 | 20.0 | 19.4bc | | 28.6 | 15.3 | 6.7 | 18.1 | 13.3 | 16.4b | |

**Means followed by a common letter are not significantly different at the 5% level by DMRT**

**Table (2): Reduction in *Earis insulana* lravae (per 100 cotton bolls) as influenced by insecticide and biocide during 2008,2009 and 2010 cotton season at Kafr El-Sheikh region.**

| Treatment | Date of treatment | 2008 | | | | | | | 2009 | | | | | | | 2010 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Population reduction % | | | | | | | Population reduction % | | | | | | | Population reduction % | | | | | | |
| | | 1 day | 2 days | 3 days | 7 days | 14 days | Average | Overall average | 1 day | 2 days | 3 days | 7 days | 14 days | Average | Overall average | 1 day | 2 days | 3 days | 7 days | 14 days | Average | Overall average |
| Control | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0a | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0a | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0a | |
| | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0a | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0a | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0a | 0.0 |
| Sumi-alpha | 26July | 62.5 | 80.0 | 83.4 | 88.9 | 90.0 | 80.9c | 81.6 | 55.6 | 70.0 | 83.3 | 91.7 | 92.9 | 78.7c | 81.9 | 63.7 | 77.8 | 85.8 | 92.3 | 80.0 | 79.9d | 81.8 |
| | 11Aug | 69.2 | 81.9 | 80.0 | 92.8 | 86.7 | 82.1c | | 80.0 | 77.8 | 88.9 | 92.9 | 86.7 | 85.2c | | 80.0 | 83.3 | 77.8 | 87.5 | 90.0 | 83.7d | |
| Biovar | 26July | 0.0 | 7.7 | 8.4 | 21.5 | 31.3 | 13.7b | 13.8 | 9.0 | 15.8 | 25.0 | 0.0 | 23.6 | 15.7b | 16.7 | 9.0 | 8.3 | 20.0 | 18.1 | 23.0 | 15.7b | 18.0 |
| | 11Aug | 7.1 | 0.0 | 21.5 | 28.6 | 12.5 | 13.9b | | 0.0 | 20.0 | 18.1 | 23.0 | 26.7 | 17.6b | | 7.1 | 20.0 | 25.0 | 23.0 | 26.7 | 20.3bc | |
| Protecto | 26July | 11.1 | 18.1 | 25.0 | 23.0 | 13.4 | 18.1b | 16.5 | 10.0 | 27.2 | 23.0 | 10.0 | 10.0 | 18.7b | 18.7 | 8.3 | 16.7 | 36.3 | 23.0 | 26.7 | 22.2bc | |
| | **11Aug** | 14.3 | 16.7 | 6.6 | 18.8 | 17.7 | 14.8b | | 8.3 | 13.3 | 20.0 | 25.0 | 25.0 | 18.7b | | 7.7 | 26.7 | 30.8 | 33.3 | 25.0 | 24.7b | 23.4 |

**Means followed by a common letter are not significantly different at the 5% level by DMRT**

**Table (3): Efficacy of *Trichogramma evanescens* release on the reduction percentage of *Pectionophora gossypiella* and *Earis insulana* larvae during 2008,2009 and 2010 cotton season at Kafr El-Sheikh region.**

| insect | | 2008 | | | | |
|---|---|---|---|---|---|---|
| | | Population reduction % | | | | |
| | | 4 days | 7 days | 14 days | Total | Average |
| ***P. gossypiella*** | 1st release | 50.0 | 66.7 | 17.7 | 134.4 | 44.8a |
| ***E. insulana*** | | 46.4 | 50.0 | 13.3 | 110.0 | 36.7a |
| ***P. gossypiella*** | 2nd release | 25.0 | 60.0 | 37.5 | 122.5 | 40.9a |
| ***E. insulana*** | | 33.3 | 20.0 | 16.7 | 70.0 | 23.3a |
| **2009** | | | | | | |
| ***P. gossypiella*** | 1st release | 33.3 | 54.6 | 26.7 | 114.6 | 38.2b |
| ***E. insulana*** | | 20.0 | 50.0 | 20.0 | 90.0 | 30.0ab |
| ***P. gossypiella*** | 2nd release | 16.7 | 50.0 | 35.0 | 101.7 | 33.9a |
| ***E. insulana*** | | 26.7 | 37.0 | 18.8 | 83.0 | 27.7a |
| **2010** | | | | | | |
| ***P. gossypiella*** | 1st release | 33.3 | 47.0 | 25.0 | 105.3 | 35.1a |
| ***E. insulana*** | | 28.6 | 40.0 | 31.5 | 100.1 | 33.3a |
| ***P. gossypiella*** | 2nd release | 35.0 | 35.0 | 25.0 | 95.0 | 31.7a |
| ***E. insulana*** | | 36.8 | 25.0 | 17.7 | 79.5 | 26.5a |