

## ASSISSMENT OF *Trichogramma evanescens* WESTWOOD EFFECTIVENESS IN CONTROLLING LEPIDOPTEROUS INSECT PESTS ON DATE PALM TREES IN BAHARIA OASES

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### ABSTRACT

Releasing the egg parasitoid *Trichogramma evanescens* west. (Hymenoptera: Trichogrammatidae) in date palm orchards at El-bahria Oases Giza, Egypt, was evaluated as an eco-biological agent for suppression of date infestation with date palm insect pests. Results revealed a significant efficacy of this parasitoid for controlling lepidopterous insect pests of date palms. Releasing *T. evanescens* in the flowering season and emergence of spathes during the mid of March has a clear effect on the *Arenipses sabella* Hampson percent of infestation and reduced the infestation by 58.4%. While Releasing *T. evanescens* in the mid June has a great impact on the *Deudorix livia* Klug percent of infestation with 85.5% of reduction. Percent of infestation of *Batrachedra amydraula* Meyrick and *Coccytrypes dactyliperda* Fabricius were also diminished by 72.6%, and 48.4%, respectively. Releasing *T. evanescens* wasps using two densities (one and two cards per tree) in date palm orchards resulted a reduction of date fruit infestation. The effect of releasing *T. evanescens* using two cards resulting a great reduction of *Ephestia calidella* Guenee infestation by 87.6%. While *C. dactyliperda* was reduced by 73.5%. The lowest mean percent of reduction was 58.4 found in the *A. sabella* infestation, which is actually a reasonable suppression for this important pest. While the highest mean percent of reduction was recorded 87.76 in *E. calidella*. Results revealed that the timing of release, parasitoid density and number of releases appear to be an important factors influencing the efficacy of the parasitoid action against the insect pests. Releasing the egg parasitoid *T. evanescens* in date palm orchards can play a great role and utilized as eco-biological agent to suppress lepidopterous insect pests and its infestation of dates and date palm trees in El-bahria oases, Giza, Egypt.

**Keywords:** *Trichogramma evanescens*, egg parasitoids, Lepidopterous insect pests, El- bahria Oases, date palm orchards

### INTRODUCTION

Bahria oases lies in the western desert of Egypt, 360 km south west of Cairo.

It is considered as an isolated area cultivated mainly with economic fruit trees, particularly, date palm trees (about one million tree) which producing about 872.8 tons of semidry (saidi) and dry dates (Kakea, Ferihi, and Soltani).

Date palms play an important role in Oasean social life where it represents the main source of the income and food. In the recent past years many factories were established for manufacturing and packing semi dry date where date fruits become best product for export and localized consuming.

Thus, in the recent years the growers taking care with date palm cultivation for increasing date palm production, but the problems of infestation prevent improvement of this product and according to recommendation of the ministry of agriculture for making Bahria oases free from insecticides. Therefore, all researchers of the universities and research centers aim to find modern safe methods to avoid environmental pollution and controlling recently application of insect parasitoid perform this objective. *Trichogramma evanescens*: Fam. Trichogrammatidae Order. Hymenoptera is the most common insect parasitoid for controlling many insects of different crops in many countries of the world. Genus *Trichogramma* include hundred species (Hassan, 1994), species in the genus *Trichogramma* are polyphagous egg parasitoids that attack lepidopterous hosts. They are the most frequently used entomophagous insect species in biological control, particularly in inudative release projects (Corrigan and Laing 1994). *Trichogramma spp.* currently is the most widely augmented arthropods natural enemy with 32 million hectares or more of agricultural and forestland worldwide treated annually (Li 1994). The efficacy of this parasitoid in the field depends on its behavior, host preference and its tolerance to environmental conditions (Qudan 1956, Kochetova 1969, Schieferdecker 1969, Lenteren *et al.* 1982, Dijken *et al.* 1986). There are great success in controlling insect pests of stored products, horticultural and field crops (Oatman and Platner 1971, Brower and press 1990). When Flanders developed the first-production system with *Sitotroga cerealella* eggs (Flanders 1929, Olkwski and Zhang 1990) has the utilization of *Trichogramma* been realized in many countries. The last 20 years have seen considerable use of this parasitoid on a particularly large scale on corn, sugar cane, cotton, fruit trees and vegetables in more than thirty countries. According to the data collected by Hassan 1988, Filippov, 1990 and Li 1992, over 32 million hectare (ha) of agriculture and forestry were likely treated annually with *Trichogramma*. The largest area of *Trichogramma* use in the world was in the former USSR (Filippov 1990). The species of *Trichogramma* attacks more than 400 species in 203 genus, 44 families and seven orders (Bao and Chen, 1989). The experiments in Germany proved that the efficiency of *Trichogramma* parasitoid, *Trichogramma. embryophagum* , *Trichogramma. dendrolium* in population reduction of codling moth, Tolix moth in 1988-1990 (Hassan *et al.* 1978, Hassan and Rost 1993). Furthermore, many *Trichogramma* species were effective in controlling *Ostrinia nubilalis* Hbn. (Tran *et al.* 1986, El-Sherif *et al.* 1987, Breithanpt 1994). Also *Trichogramma* was utilized successfully for controlling sugar-cane borers and rice leaf rolling and cotton bollworms (Gonzales *et al.* 1970). The objectives of this research study is to evaluate the effectiveness of *T. evanescens* in reduction of Lepidopterous infestation in date palm orchards as a potential bio-agent for protecting environment and avoiding insecticides pollution.

## **MATERIAL AND METHODS**

This research study was carried out in date palm orchards in Bahria Oases during fruiting season 2003. Random date palm trees Saidi cultivar at

the same age and height were selected and remarked by coded colored card papers. These trees divided into three divisions to evaluate the effectiveness of releasing *T. evanescens* wasps on the infestation reduction of *A. sabella* and *D. livia* as a first division during the flowering season and emergence of spathes. The number of date palm trees of the first division tested and inspected were eight and five, respectively. The second division to evaluate the efficacy of *T. evanescens* to reduce the infestation percent of both *B. amydraula* and *C. dactyliperda* during four different inspection dates, eight different date palm trees used as a replicates. The third division was to determine impact of releasing the egg parasitoid *T. evanescens* wasps in two different densities (one and two cards per tree) during the mid of June in date palm orchards on date fruit infestation of *C. dactyliperda* and *E. calidella* using five replicates of date palm trees for each of them and by taking and examining periodical samples of date bunches and fallen dates from fruit set April until harvest by the end of September.

*Trichogramma. evanescens* wasps obtained from local and reared in laboratory on *Sitotroga cerealella* Olivier eggs. At  $25\pm 1^{\circ}\text{C}$  card papers 2X2 cm, Grain moth eggs was obtained from mass rearing unit since 1999 that held in the Entomology Research Laboratory in Department of Plant Protection, Faculty of Agriculture, Al-Azhar University.

Fresh Grain moth eggs were placed and glued using adhesive material on card 10X10 cm and exposed to other cards contained parasitized *S. cerealella* eggs in the pupal stage. *T. evanescens* wasps were emerged at the exposure day and kept under  $25\pm 1^{\circ}\text{C}$ , after three days these cards divided into small cards 2X2 cm (contain 50-100) parasitoid egg kept under  $4^{\circ}\text{C}$  till release. Three releases of *T. evanescens* wasps were conducted in March, April and August 2003 using a rate of about 1600-17500 parasitoid per Fadden, one card of parasitized eggs hanged on each remarked date palm tree. Another set of date palm trees have been used as untreated (control). Inspection of the treated and untreated date palm trees was carried out of date bunches and fallen dates from fruit set during the time of the season started from April until harvest date by the end of September. The infestation rates of date fruits by studied Lepidopterous insects estimated in treated and untreated (control) palm trees as mentioned above.

Data were statistically analyzed using proc. ANOVA in SAS (SAS Institute 1988). Mean separations were conducted using Duncan multiple range test in the same program.

## RESULTS AND DISCUSSION

### *Arenipses sabella* and *Deudorix livia*

Results recorded in table (1) indicated that releasing *T. evanescens* in the flowering season and emergence of spathes during the mid of March has a clear effect on the *A. sabella* percent of infestation. These observations agreed with Michael (1969), Saleh (1974) and Hussain (1986). Data reflected that the highest mean numbers of *A. sabella* percent of infestation in date palm trees were 31.3 and 12.2% in the untreated and treated trees, respectively. While the lowest mean numbers of *A. sabella* percent of

infestation were 2.0 and 0.0 % in the untreated and treated trees, respectively. In addition, there were a promising percent of reduction of *A. sabella* infestation (58.4%) due to the effect of the bioagent egg parasitoid *T. evanescens*.

**Table 1: Effect of *T. evanescens* parasitoid releasing in date palm orchards in Bahria oases on the percent of infestations by *A. sabella*, and *D. livia*.**

| No. of date palm trees (Replicates) | <i>Arenipses sabella</i> |               |             | <i>Deudrix livia</i> |               |             |
|-------------------------------------|--------------------------|---------------|-------------|----------------------|---------------|-------------|
|                                     | Infestation %            |               | Reduction % | Infestation %        |               | Reduction % |
|                                     | Untreated Trees          | Treated Trees |             | Untreated Trees      | Treated Trees |             |
| 1                                   | 28.6                     | 8.3           | 70.9        | 52                   | 10            | 80.8        |
| 2                                   | 8.3                      | 6.3           | 24.1        | 11                   | 1             | 90.9        |
| 3                                   | 12.5                     | 0             | 100         | 11                   | 2             | 81.8        |
| 4                                   | 14.3                     | 12.2          | 14.7        | 42                   | 10            | 76.2        |
| 5                                   | 31.3                     | 7.1           | 77.3        | 41                   | 10            | 97.6        |
| 6                                   | 2.0                      | 0             | 100         |                      |               |             |
| 7                                   | 9.1                      | 7.7           | 15.4        |                      |               |             |
| 8                                   | 20.0                     | 7.1           | 61.5        |                      |               |             |
| Mean                                | 15.76                    | 6.08          | 58.4        | 31.4                 | 6.6           | 85.5        |
| MS                                  | 140.553                  |               |             | MS                   | 1085.41       |             |
| F                                   | 24.29                    |               |             | F                    | 29.205        |             |
| P = 0.05                            | 0.0079                   |               |             | P = 0.05             | 0.0057        |             |

Data in table (1) also revealed that releasing *T. evanescens* in the mid June has a great impact on the *D. livia* percent of infestation. Results showed that the highest mean numbers of *D. livia* percent of infestation were 52.0 and 10.0%, while the lowest mean numbers were 11.0 and 1.0% in the untreated and treated date palm trees, respectively. Releasing *T. evanescens* during the flowering season has a great impact on the reduction of *D. livia* percent of infestation (85.5%).

Statistical analysis illustrated that there were a significant difference between the tested untreated and treated date palm trees in both pests *A. sabella* and *D. livia* (P = 0.0062 and 0.0057), respectively (Table 1).

#### ***Batrachedra amydraula* and *Coccotrypes dactyliperda***

During the period extended from Mid March till end of May, releasing *T. evanescens* in date palm orchards lead to great reduction of infestation rate by *B. Amydraula* where the infestation rate general mean was 23.9% in untreated date palm orchards (Table 2).

**Table 2: Effect of *T. evanescens* parasitoid releasing in date palm orchards in Bahria oases on the percent of infestations by *B. amydraula*, and *C. dactyliperda*.**

| Inspection date | <i>B. amydraula</i> |               |             | Inspection date | <i>C. dactyliperda</i> |               |             |
|-----------------|---------------------|---------------|-------------|-----------------|------------------------|---------------|-------------|
|                 | Infestation %       |               |             |                 | Infestation %          |               |             |
|                 | Untreated Trees     | Treated Trees | Reduction % |                 | Untreated Trees        | Treated Trees | Reduction % |
| 15/4            | 10.8                | 0.8           | 92.6        | 15/6            | 35.8                   | 20.4          | 48.6        |
| 30/4            | 27.4                | 5.6           | 77.9        | 30/6            | 42.5                   | 21.9          | 55.9        |
| 15/5            | 16                  | 12.1          | 36.5        | 15/7            | 62.8                   | 38.6          | 40.4        |
| 30/5            | 41.4                | 6.9           | 83.3        | 30/7            | 48.6                   | 25            | 48.7        |
| Mean            | 23.9                | 6.4           | 72.6        | Mean            | 47.4                   | 26.5          | 48.4        |
| MS              | 459.375             |               |             | MS              | 655.215                |               |             |
| F               | 48.127              |               |             | F               | 10.582                 |               |             |
| P = 0.05        | 0.0023              |               |             | P = 0.05        | 0.0313                 |               |             |

While the treated trees infestation rate general mean was 6.4%, there are a significant reduction ( $P = 0.0023$ ) of infestation rate general reduction mean was 72.6%. The highest reduction of the infestation rate recorded in Mid April was 92.6% after one month from the time to releasing of *T. evanescens* parasitoid. The efficacy of the parasitoid *T. evanescens* declined by passing time where the least efficacy observed after two months from parasitoid releasing time, but the efficacy returned to increase again at the end of May where the reduction percentage was 83.3% and that probably due to increasing of infestation rate by *B. amydraula* in the second generation.

Due to releasing *T. evanescens* from mid June till the end of July in date palm orchards has a clear impact on the reduction of infestation rate by *C. dactyliperda* where the infestation rate general mean was 47.4% in untreated date palm orchards (Table 2) while the treated trees infestation rate general mean 26.5%, there were a significant reduction ( $P = 0.0313$ ) of infestation rate general reduction mean was 48.4%. The highest reduction of the infestation rate recorded in end of June was 55.9% after two weeks from the time to releasing of *T. evanescens* parasitoid. The efficacy of the parasitoid *T. evanescens* increased from the releasing date to the end of June, then declined in the Mid of July but the efficacy returned to increase again by the end of this period with 48.7% reduction percentage.

***Ephestia calidella*, and *Coccotrypes dactyliperda***

Releasing *T. evanescens* in the Mid August has a dramatical impact on the infestation rate of date fruits by *E. calidella* in treated date palm orchards compare to untreated date palm trees. After 30 days from releasing *T. evanescens* the effectiveness of the egg parasitoid was represented by the reduction of infestation of date fruits. Also results in table (3) indicated that the time of release in the mid August increase the effectiveness of the *T. evanescens* and *E. calidella* eggs was the most suitable host for this parasitoid. These observations agreed with those of Hussain (1986 and 1996).

This research study was carried out on oases date moth *E. calidella* for knowing the effect of parasitoid density on the infestation of date fruits by *E. calidella*. This experiment designed using one and two cards of parasitoid on each date palm trees (two treatments) and thereafter, estimate the infestation percent.

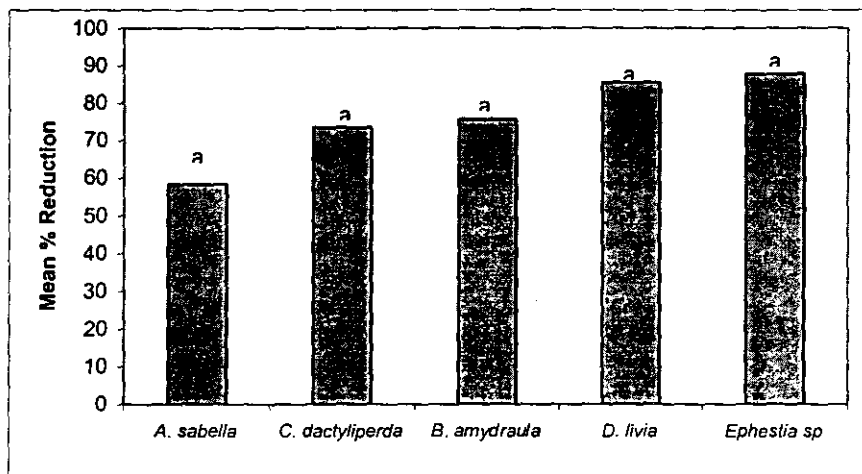
**Table 3: Effect of *T. evanescens* parasitoid releasing in date palm orchards in Bahria oases on the percent of infestations by *Ephestia sp.*, and *C. dactyliperda*.**

| No. of date palm trees (Replicates) | <i>Ephestia sp.</i> |             |                |             | <i>C. dactyliperda</i> |             |                |             |
|-------------------------------------|---------------------|-------------|----------------|-------------|------------------------|-------------|----------------|-------------|
|                                     | One card/tree       |             | Two cards/tree |             | One card/tree          |             | Two cards/tree |             |
|                                     | Infestation %       | Reduction % | Infestation %  | Reduction % | Infestation %          | Reduction % | Infestation %  | Reduction % |
| 1                                   | 32                  | 100         | 22             | 100         | 62                     | 88.3        | 32             | 100         |
| 2                                   | 41                  | 50          | 11             | 100         | 51                     | 60          | 40             | 50          |
| 3                                   | 11                  | 83.3        | 21             | 50          | 72                     | 64.6        | 30             | 66.7        |
| 4                                   | 11                  | 47.7        | 31             | 100         | 61                     | 50          | 45             | 100         |
| 5                                   | 31                  | 75.0        | 20             | 88.8        | 42                     | 62.7        | 62             | 50.8        |
| Mean                                | 25.2                | 71          | 21             | 87.76       | 57.6                   | 65.1        | 41.8           | 73.5        |
| MS                                  | 26.46               |             |                |             | 600.0                  |             |                |             |
| F                                   | 0.343               |             |                |             | 1.411                  |             |                |             |
| P = 0.05                            | 0.589               |             |                |             | 0.3005                 |             |                |             |

Data in table (3) indicated that the general mean reduction of date fruit infestation by *E. calidella* was 87.76% by using two cards of the parasitoid date palm tree while the reduction was 71% by using one card of parasitoid per date palm tree. Using two cards of parasitoid per date palm tree lead to more reduction of infestation percent by *E. calidella* than one card of parasitoid per date palm tree. According to results in table (3) statistical analysis illustrated that no significant difference was recorded ( $P = 0.5895$ ) although there were differences in the reduction between the two densities of releasing the *T. evanescens*. The highest percent of reduction recorded in date palm orchards were 83.3 and 100% using one card and two cards per tree, respectively. While the lowest percent of reduction found in date palm orchards were 46.7 and 50% using one and two cards, respectively.

Releasing *T. evanescens* wasps by two densities (one and two cards per tree) during the mid of June in date palm orchards resulted a reduction of date fruit infestation percent of *C. dactyliperda* by 65.1% and 73.5%, respectively (Table 3). The highest percent of reduction recorded in date palm orchards were 88.3 and 100%, respectively. While the lowest percent of reduction recorded in date palm orchards were 50.0% in both densities using one and two cards. Statistical analysis showed that the reduction of the *C. dactyliperda* infestation in both densities not significantly differed ( $P = 0.3005$ ).

Great impact was recorded in our results due to releasing *T. evanescens* in date palm orchards to reduce infestation of lepidopterous insect pests, the lowest mean percent of reduction was recorded 58.4 in the *A. sabella* infestation, which is actually a reasonable suppression for this important pest. While the highest mean percent of reduction was recoded 87.76 in *E. calidella*. Statistical analysis indicated that there were no significant differences between the mean percent of reductions for all the five tested insect pests (Figure 1).



Means followed by same letter are not significantly different ( $P = 0.05$ )

**Figure 1: Mean percentage of reduction for the tested five lepidopterous insect pests due to releasing *T. evanescens* in date palm orchards, El-bahria oases, Giza, Egypt.**

Further investigations are needed to study the host suitability between the five tested lepidopterous pests for the egg parasitoid *T. evanescens*.

Generally, Releasing the egg parasitoid *T. evanescens* in date palm orchards can play a great roll and utilized as eco-biological agent to suppress lepidopterous insect pests and its infestation of dates and date palm trees in El-bahria oases, Giza, Egypts.

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### تقييم فاعلية اطلاق طفيل التريكوجراما *Trichogramma evanescens* (West.) في مكافحة الافات الحشرية من رتبة حرشفية – (Trichogrammatidae)

(Hymenoptera) الاجنحة التي تصيب اشجار نخيل البلح في الواحات البحرية

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ان اطلاق طفيل التريكوجراما *Trichogramma evanescens* في بستتين نخيل البلح بالواحات البحرية – الجيزة – مصر قد تم تقييمه كعامل بيئي حيوي يمكن استخدامه في قمع وتقليل نسبة الاصابة بالافات الحشرية من رتبة حرشفية الاجنحة والتي تصيب التمور ونخيل البلح. كان لاطلاق الطفيل في فترة موسم التزهير وظهور السباطات خلال شهر مارس تأثيرا واضحا على نسبة الاصابة بحشرة *Arenipses sabella* وادى ذلك الي خفض نسبة الاصابة بمعدل ٥٨,٤%، بينما ادى اطلاق الطفيل في منتصف شهر مايو الي خفض كبير في نسبة الاصابة بحشرة أبو دقيق الرمان *Deudorix livia* وذلك بنسبة ٨٥,٥%، بلغ الانخفاض في نسبة الاصابة بحشرتي *Coccotrypes dactylipetra* و *Batrachedra amydraula* ٧٢,٦%، ٤٨,٤% على التوالي. كان لاطلاق الطفيل بكثافتين ( كارت واحد وكارتين للنخلة الواحدة) في بستتين نخيل البلح تأثيرا كبيرا على خفض نسبة الاصابة في ثمار السبلح *Ephestia calidell* والتي بلغت ٨٧,٧٦% وكانت في *dactyliperd* ٧٣,٥% في الكثافة العالية (كارتين). قد بينت النتائج ان وقت الاطلاق وكثافة الطفيل وعدد الاطلاقات يبدو انها من العوامل الهامة التي لها تأثيرا فعالا في كفاءة وفعل الطفيل ضد هذه الافات الحشرية .

ان اطلاق هذا الطفيل في بستتين نخيل البلح له دور هام ويمكن ان يستخدم كعامل بيولوجي بيئي لقمع وتقليل اعداد الافات الحشرية من حرشفية الاجنحة في بستتين النخيل بالواحات البحرية .