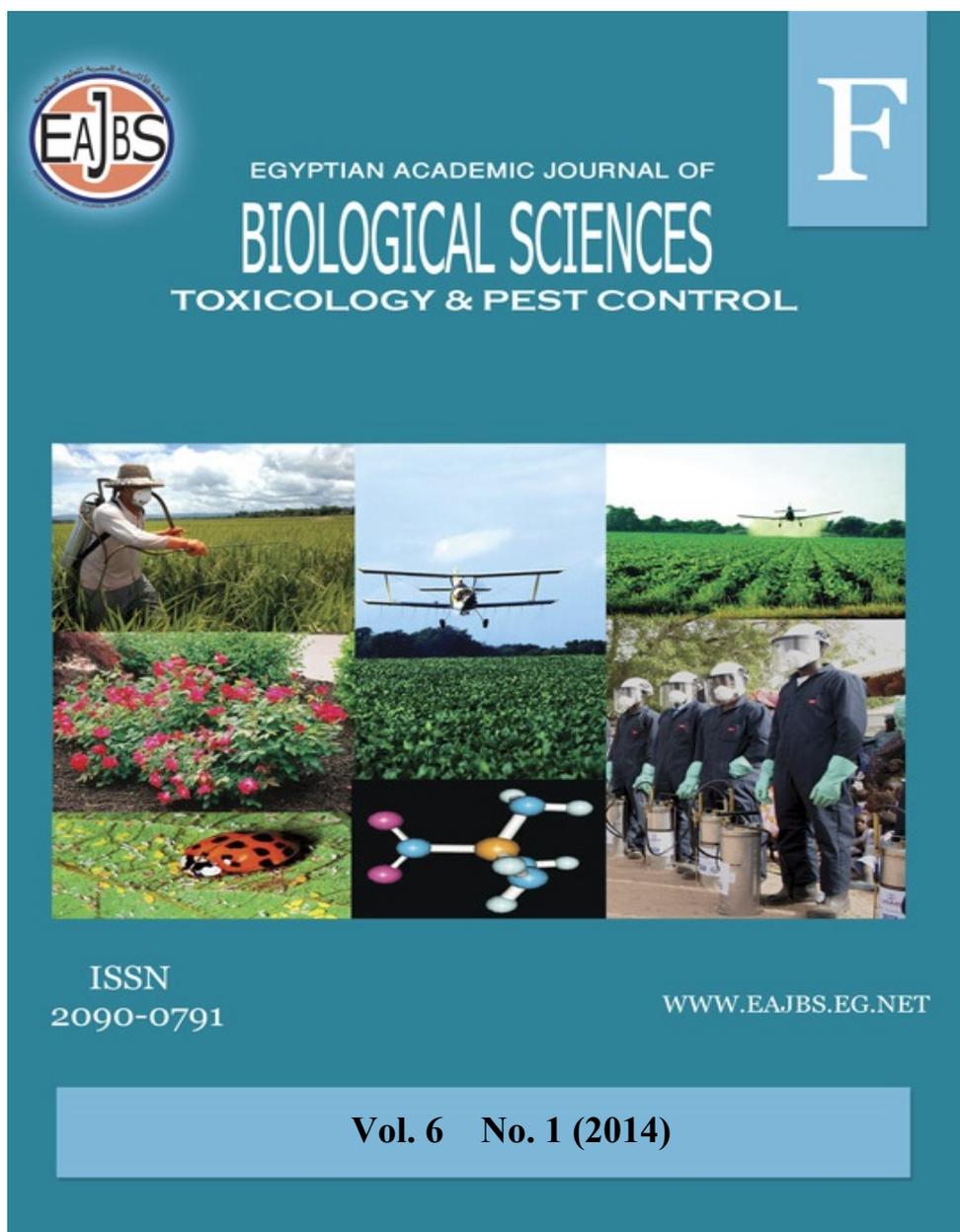


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Using of *Trichogramma evanescens* west (Hymenoptera: Trichogrammatidae) for controlling *Arenipses sabella* hmpson and *Batrachedra amydraula* meyrick in the date palm fields at the new valley-Egypt

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ABSTRACT

Five years of field trials were conducted to investigate the efficacy of releasing the egg parasitoid, *Trichogramma evanescens* West. (Hym. *Trichogrammatidae*) on controlling *Arenipses sabella* Hmpson and *Batrachedra amydraula* Meyrick (Lepidoptera: Pyralidae) at El-Kharga Oasis, New Valley, Egypt. Five farms of date palm (*Phoenix dactylifera*) represented about 30Km were used during this study from 2009 to 2013.

Release of *T. evanescens* for one time (beginning of May) by the rate of ten releasing envelopes (20,000 parasitized eggs/feddan) induced a remarkable reduction in the infestation levels with the greater date moth and the lesser date.

In the case of *A. sabella* as a result of *Trichogramma* parasitoid releasing, the reduction increased after the successive parasitoid releasing to reach the maximum level (72.78%) in 2013 season. Generally, the reduction rate of the infestation of the pest ranged between 59.41 and 77.38% with an average of 70.26% in the all experimental locations. The rate of damaged bunches, as a result of infestation with the greater date moth, decreased from 42.86% at control to 12.36% at the *Trichogramma* parasitoid releasing locations.

Concerning to *B. amydraula*, the reduction increased after the successive parasitoid releasing to reach the high level (75.06%) in 2013 season. In general, the reduction rate of the infestation with the leaser date moth ranged between 72.49 and 75.97% with an average of 73.74% in the all experimental locations.

The rate of date fruit falling, as a result of infestation with *B. amydraula*, decreased from 7.22% at control at the 2.00% as a result of *Trichogramma* parasitoid releasing locations.

INTRODUCTION

Date palm (*Phoenix dactylifera*) is considered the most important cash crops in the New Valley Governorate. More than one million date palm trees are grown. Besides the local consumption, dates are exported to foreign countries.

Many lepidopterous species were recorded as a key insect pests attack date fruits successively during the season. The infestations start during flowering with the bunch date moth, *Arenipses sabella* (Hampson) followed by the lesser date moth, *Batrachedra amydraula* Meyrick which infests the newly formed date fruits and causes fruit falling. The larvae of pomegranate fruit butterfly, *Virachola livia* (Klug.) infest date fruits when they start coloring. The larvae of *Ephestia cautella* Walker and *E. calidella* (Guenee) start infesting date fruits later, affecting crop quality and quantity after harvest and during storage (Saleh, 1974; Ali *et al.*, 1988; Abul Fadl, 2001; El-Dakrouy *et al.*, 2002; Abdel-Rahman *et al.*, 2007; Sayed *et al.*, 2007; Temerak *et al.*, 2007; Gameel and Sayed, 2010 and Alrubeail *et al.*, 2014).

A. sabella (Lepidoptera: Pyralidae) is an early season pest. Spathes, bunches and fruit stalks were attacked in March and early April, and infestation was high at the end of April. When the larvae infested at the later stage of growth, bunch bases broken and caused superficial damage to fruits and affected its quality. This usually happens during August such bunches are heavy enough and then these infested bunches were unable to bear their weight. Two generations per year were recorded (Saleh, 1974; Ali *et al.*, 1988 and Abdel-Rahman *et al.*, 2007). Recently, *A. sabella* became a major pest attacks the date trees in the New Valley (Gameel and Sayed, 2009).

The lesser date moth, *B. amydraula* is the most serious early pest on date fruit in the Oases of the New Valley (Saleh 1974 and Temerak *et al.*, 2007). The larvae attack young date fruits and usually stop growing. Larvae of this pest were observed feeding on the flesh along the stone in May and June, causing changes in colour of most fruits to become red-brown and finally drop

(Venezian and Blumberg, 1982). During the period from April to September, 3 distinct peaks and generations of *B. amydraula* were recorded, the first and serious peak during May and two relatively smaller ones on July and September Under the New Valley conditions (Saleh, 1974).

As known, in 1995 for environmental and toxicity reasons, Ministry of Agriculture in Egypt banned all conventional insecticides in the New Valley, this encourages the use of biological control methods particularly by natural enemies which playing an important role among others through integrated pest management programs.

Trichogramma spp. is the most important egg parasitoids of several lepidopterous pests and other pest in the world. The using *Trichogramma* parasitoids was recommended for controlling the lesser sugar-cane borer, *Chilo agamemnon* in Upper Egypt (Abbas *et al.*, 1988 and 1990) and tomato fruit worm, *Heliothis armigera* Hb. infesting tomato fruits in the newly reclaimed area around lake of Nasser in Aswan Governorate (Abbas, 1998). Mass-production and release of *trichogramma* egg parasitoids is regarded as a promising to reduce egg and subsequent crop damage by cotton bollworms (Sakr *et al.* 2007). In Siwa Oasis when *T. evanescens* was used, the reduction of infestation with six lepidopterous pests of date fruits was 97.8% (El-Dakrouy *et al.*, 2002).

The present work deals with mass production of *T. evanescens* parasitoids utilization for controlling *A. sabella* and *B. amydraula* in palm orchards of El-Kharga Oasis.

MATERIALS AND METHODS

The egg parasitoid *T. evanescens* was obtained from the laboratory at El-Kharga Oasis, New Valley.

Production of the host:

The parasitoid, *T. evanescens* was mass-produced on eggs of the grain moth, *Sitotroga cerealella* (Oliv.). The insect was reared in the laboratory on wheat grains which butted in the boiler water for about 5 minutes to get rid of any previous infestation. Rearing was carried out in metal cages (100 x 80 x 60 cm) with the four sides covered with black cotton cloth. The cage contained 10 metal frames covered from the two sides with wire mesh. The frame has its opening at the top side. Each frame was filled with 8 kg of wheat grains and was infested with 8 grams of *Sitotroga* eggs. The moths start to emerge one month after grains being infested and the emergence of moths continues for two months. Moths were collected daily and were confined in oviposition cages (40cm long and 18 cm in diameter) made of metal body covered with wire screen, collected eggs were used for reification and /or rearing of the parasitoid.

Rearing of the parasitoid:

Eggs of *S. cerealella* were glued onto cardboard cards, 13x9 cm, each one contained almost about 60,000 eggs. Rearing of *T. evanescens* took place in glass jars 21cm high and 10 cm in diameter covered with muslin cloth kept in position by means of rubber bands. Six cards of newly deposited eggs (one day old) were confined in each glass jar with two cards containing parasitized eggs witch give rise to parasitoid adults within 24 hours. Rearing of *S. cerealella* and *T. evanescens* took place at a constant temperature of 25 + 1°C and 50-70% R.H.

Releasing of the parasitoid:

Each card, containing parasitized eggs, was cut into small pieces, each piece contained 2,000 eggs. A piece of cardboard 10 x 8 cm was bound to make an envelope like which was clipped with a double piece of thread by means of a stapler. This envelope protects the

parasitized eggs from predators as well as from sun heat.

Each releasing envelope contained one small piece of cardboard (2,000 parasitized eggs) having three different ages of parasitized eggs so that the parasitoids emerged in three waves at three – day intervals. Releasing took place before sun set to avoid sun heat El-Dakroury *et al.*, 2002.

Field Trials:

Trials were conducted in Kharga Oasis from 2009 (control) to 2013. Five farms of date palm variety Saidi (Sewi) represented about 30Km were used. Releasing of parasitoids was carried out from 2010 to 2013 (once/year) in the beginning of May. Ten releasing envelopes (20,000 parasitized eggs) were hanged on palm tree branches (2meters high) / feddan. Every one contained about 80 date palm trees with about 7 meters between every one. Releasing of parasitoids was covered the area around the experimental locations which represented about 1400 feddan / year.

One date palm tree was considered as one replicate. Samples size was 10 strands / one date palm taken at random from ten replicates. In each assessment fruit having alive larvae of *B. amydraula* or symptoms of infestation or those dropped but having the webbing silk and or faces in their places were recorded. In the case of *A. sabella*, sample size was all bunches / one date palm from ten replicates. Inspection times were conducted at two weeks interval from the middle of April until the end of May.

Statistical analysis was done for infestation figures and reduction % was calculated based on Abbott formula (1925). Data were statistically analyzed by F-test and the means were compared according to Duncan's Multiple Range Test (Snedecor and Cochran, 1971).

RESULTS AND DISCUSSION
The greater date moth, *A. sabella*

The results in Table 1 indicate that, the rate of the infestation with *A. sabella* were significant in all tested date palm farms. Release of *T. evanescens* for one time induced a remarkable reduction in the infestation levels with this pest.

Table 1: Average percent reduction in the *A. sabella* infestation of the date palm bunches after releasing of *T. evanescens* parasitoid in El-Kharga Oasis, New Valley.

Experimental Locations	Infestation reduction (%)				Average
	2010	2011	2012	2013	
El-Gindi	80.27a	77.52a	75.82b	75.92a	77.38
El-Sherka 55	76.42b	75.17b	73.30b	75.72a	75.15
El-Kharga 1	59.10d	61.90c	60.97c	67.62b	62.39
El-Kharga 10	67.62c	77.90a	82.97a	79.57a	77.01
Ganah	58.70d	61.15c	52.70d	65.10b	59.41
Average	68.42	70.72	69.15	72.78	70.26

Means within columns followed by the same letter (s), are not significantly different at 0.05 level of probability.

During 2010 season, *T. evanescens* induced the highest average reduction percentage in the population densities of the pest (80.27 %) was recorded in El-Gindi location. The low reduction percentages of *A. sabella* (58.70 and 59.10%) were observed in Ganah and El-Kharga 1 villages, respectively. The average reduction percentage was (68.42%).

The obtained results in 2011 season indicated that, the maximum reductions (77.90 and 77.52%) were obtained in El-Kharga 10 and El-Gindi locations, respectively. On the other hand, the minimum average reduction percentages (61.15 and 61.90%) were observed in Ganah and El-Kharga 1 villages, respectively.

Concerning to the data of 2012 season, the highest average reduction percentages in the infestation of the pest (82.97%) was recorded in El-Kharga 10. Meanwhile, the lowest reduction percentage of *A. sabella* was observed in Ganah (52.70%).

The ratio of the infestation with the greater date moth in 2013 season, decreased to (79.57, 75.92 and 75.72%) as recorded in El-Kharga 10, El-Gindi and El-Sherka 55 fields, respectively.

Meanwhile, El-Kharga 1 and Ganah locations, recorded the low reduction percentages (67.62 and 65.10%) respectively.

As a result of *Trichogramma* parasitoid releasing, the reduction increased after the successive parasitoid releasing to reach 72.78% during 2013 season with adaptation of the parasitoid in the environment. In general, the reduction rate of the infestation with the greater date moth ranged between (68.42 and 72.78%) with an average of 70.26% in the all experimental locations.

As shown in Table 2, the rate of bunches damaged, as a result of infestation with the greater date moth, decreased from 42.86% (control) to 12.36% as a result of *Trichogramma* parasitoid releasing for four years. The parasitoid, *T. evanescens* was recorded as a key biological control agent against many lepidopterous pests of date palm (Mohammad *et al.*, 2011 and Alrubeail *et al.*, 2014. In Siwa Oasis by releasing *T. evanescens*, the reduction of infestation with six lepidopterous pests included *A. sabella* of date fruits was 97.8% El-Dakroury *et al.*, (2002).

Table 2: Infestation ratio of the date palm bunches with *A. sabella* after *T. evanescens* releasing.

Experimental locations	Infestation reduction (%)					Average
	2009 (Control)	2010	2011	2012	2013	
El-Gindi	35.80	7.06	8.05	8.75	8.62	8.12
El-Sherka 55	49.80	11.84	12.46	13.39	12.19	12.47
El-Kharga 1	43.40	17.85	16.53	16.93	14.15	16.36
El-Kharga 10	55.70	18.03	12.30	9.58	11.47	12.84
Ganah	29.60	12.23	11.59	14.00	10.33	12.03
Average	42.86	13.40	12.18	12.53	11.35	12.36

The Lesser date moth, *B. amydraula*

Data in Table 3 indicate generally that, releasing the egg parasitoid *T. evanescens* induced a remarkable reduction in the infestation with the lesser date moth with different levels.

During 2010 season, *T. evanescens* induced the highest average reduction

percentages in the population densities of the pest (79.42 %) in El-Kharga 10. The low reduction percentage of *B. amydraula* (70.95%) was observed in El-Sherka 55, while the reduction percentage of the five locations averaged 74.98%.

Table 3: Average percent reduction in the *B. amydraula* infestation of date fruits after releasing of *T. evanescens* parasitoid in El-Kharga Oasis, New Valley.

Experimental Locations	Infestation reduction (%)				Average
	2010	2011	2012	2013	
El-Gindi	75.95ab	72.92a	71.25b	73.22a	73.33
El-Sherka 55	70.95b	72.22a	74.55a	73.97a	72.92
El-Kharga 1	73.67ab	71.92a	69.75b	74.62a	72.49
El-Kharga 10	79.42a	73.65a	74.82a	76.02a	75.97
Ganah	74.50ab	72.42a	69.57b	77.50a	73.49
Average	74.89	72.62	71.98	75.06	73.64

Means within columns followed by the same letter (s) are not significantly different at 0.05 level of probability.

After two years of releasing, nearly the same ratio of the infestation reduction with the lesser date moth was recorded in the all tested locations. The ratio ranged between 71.92 and 73.65% in all tested fields.

The obtained results in 2013 season indicated that, the maximum reductions (74.82 and 74.55%) were obtained in El-Kharga 10 and El-Sherka 55 fields, respectively. On the other hand, the minimum reductions (69.75 and 69.57%) were observed in El-Kharga 1 and Ganah, respectively.

The ratio of the infestation with *B. amydraula* in 2013 season decreased to the below of control by 77.50 and 76.02% in Ganah and Kharga 10 fields, respectively. Meanwhile, El-Gindi

location, recorded the low reduction percentage (73.22%).

As a result of *Trichogramma* parasitoid releasing, the reduction increased after the successive parasitoid releasing to reach 75.06% during 2013 season with adaptation of the parasitoid in the environment. In general, the reduction rate of the infestation with *B. amydraula* ranged between (72.49 and 75.97%) with an average of 73.74% in the all experimental locations.

As shown in Table 4, the rate of date fruit falling, as a result of infestation with *B. amydraula*, decreased from 7.22% (control) to 2.00% as a result of *Trichogramma* parasitoid releasing for four years. Mohammad *et al.*, 2011 found that, the highest control efficiency was 70.8% against the date lesser moth

obtained for the parasitoid *T. evanescens* when used at the rate of three capsules per date palm tree (each capsules contained about 100 parasitoid pupae). Alrubeail *et al.*, (2014) found that, the release of egg parasitoid *T. evanescens*

by rate of 500 and 1,000 parasitoids/palm tree achieved 55.06% and 67.45% reduction in infestation percentage with *B. amydraula*, respectively.

Table 4: Infestation ratio of the date palm fruits with *B. amydraula* after *T. evanescens* releasing.

. Experimental locations	Infestation reduction (%)					Average
	2009 (Control)	2010	2011	2012	2013	
El-Gindi	3.91	0.94	1.15	1.12	1.05	1.06
El-Sherka 55	7.85	2.28	2.38	1.99	2.04	2.17
El-Kharga 1	10.73	2.83	3.01	3.35	2.72	2.97
El-Kharga 10	6.79	1.49	1.88	2.70	1.74	1.95
Ganah	6.86	1.84	1.99	2.09	1.55	1,86
Average	7.22	1.87	2.08	2.25	1.82	2.00

Finally, it could be useful recommended that, the release of egg parasitoid *T. evanescens* for one time (beginning of May) by the rate about of 20,000 capsules/feddans (ten cards) gave a good results to control *A. sabella* and *B. amydraula* at El-Kharga Oasis, New Valley. Promising data were obtained and hoping carrying out more work to assure these results. This study may ensure the importance of the utilization of *Trichogramma* parasitoid to control pests in date fruits to obtain a good “bioproduct”.

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ARABIC SUMMERY

استخدام طفيل التريكوجراما لمكافحة حشره دودة البلح الكبرى (ثاقبه العراجين) وحشره دودة البلح الصغرى (الحميرة) بمحافظة الوادي الجديد- مصر

صلاح محمود محمد جميل؛ محمد عرفه عويس؛ أحمد أمين سيد أحمد
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - الجيزة

أجريت هذه الدراسة لأول مرة بمزارع النخيل بواحة الخارجة - محافظة الوادي الجديد لمعرفة تأثير إطلاق طفيل التريكوجراما لمرة واحدة بمعدل عشرون ألف طفيل لكل فدان من نخيل البلح في مكافحه حشره دودة البلح الكبرى (ثاقبه العراجين) وحشره دودة البلح الصغرى (الحميرة) وذلك في خمس مواقع بمركز الخارجة في الفترة من ٢٠٠٩ حتى ٢٠١٣. أظهرت النتائج ما يلي:

بعد أربع سنوات من إطلاق طفيل التريكوجراما في واحة الخارجة حدث استقرار للطفيل حيث بلغت أعلى نسبة خفض في إصابة سباطات نخيل البلح بحشره ثاقبه العراجين ٧٢.٧٨٪ في عام ٢٠١٣. وجود انخفاض معنوي في معدل الإصابة بحشره فراشة البلح الكبرى في كل المواقع التجريبية. حيث تراوحت نسب الخفض ما بين ٥٩.٤١ و ٧٧.٣٨٪ بمتوسط عام بلغ ٧٠.٢٦٪ خلال أعوام الدراسة.

انخفض متوسط اصابه السباطات من ٤٢.٨٦٪ الى ١٢.٣٦٪ وذلك بعد أربع سنوات من إطلاق طفيل التريكوجراما خلال الفترة من عام ٢٠١٠ حتى ٢٠١٣.

بالنسبة لحشره دودة البلح الصغرى (الحميرة) حيث بلغ أعلى نسبة خفض في إصابة ثمار نخيل البلح بحشره الحميرة ٧٥.٠٦٪ في عام ٢٠١٣. وجد انخفاض معنوي في معدل الإصابة بحشره دودة البلح الصغرى في كل المواقع التجريبية. حيث تراوحت نسب الخفض ما بين ٧٢.٤٩ و ٧٥.٩٧٪ بمتوسط عام بلغ ٧٣.٧٤٪ خلال أعوام الدراسة. انخفض متوسط معدل الثمار المتساقطة من ٧.٢٢٪ الى ٢.٠٠٪ وذلك بعد أربع سنوات من إطلاق الطفيل.