

A Study on the Effect of *Trichogramma principium* Releases on Cotton Bollworms and the Chrysopid Predator *Chrysoperla carnea* in Syrian Cotton Fields

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Abstract

Babi, A., M. Al-Nabhan and B. Pintureau. 2002. A Study on the Effect of *Trichogramma principium* Releases on Cotton Bollworms and the Chrysopid Predator *Chrysoperla carnea* in Syrian Cotton Fields. Arab J. Pl. Prot. 20: 59-61.

The effect of the parasitoid, *Trichogramma principium*, releases on the cotton bollworms and the chrysopid predator, *Chrysoperla carnea*, were tested in Syrian cotton fields. Tests were carried out during September 1998 and August 1999 near Aleppo (Al-Zerbeh and Om-Houche). In 1998, the investigated field (Al-Zerbeh) was infested by *Helicoverpa armigera* and protected by *C. carnea*. The nearby field was planted with cabbage infested with *Pieris rapae*. Plastic capsules containing about 1000 parasitoids (not emerged adults of *T. principium*) were hanged on cotton plants, one capsule for every 10 x 10 m. In 1999, the studied fields (in Al-Zerbeh and Om-Houche) were only settled by *C. carnea* eggs, and 2 capsules were used at each release point. In 1998 and 1999, eggs of *H. armigera*, *C. carnea* and *P. rapae* were collected several times (before the releasing date, on the releasing date and few days thereafter), and then observed in order to determine the level of their parasitism. Results showed that *T. principium* did not parasitize *C. carnea* eggs in the field. On the other hand, the level of parasitism of *H. armigera* eggs reached 12.5%, and that of *P. rapae* eggs 29%. The presence of *Telenomus acrobates* was confirmed in Syria on *C. carnea* eggs and the parasitism level ranged from 11 to 65% during the test period.

Key words: *Trichogramma principium*, *Chrysoperla carnea*, *Pieris rapae*, *Telenomus acrobates*, biological control, cotton, Syria.

Introduction

The Syrian cotton fields include a number of parasitoids and predators (12). These natural enemies could be important agents for reducing the density of many cotton pests.

In Syria, egg parasitoids belonging to *Trichogramma principium* Sugonyaev and Sorokina (Hymenoptera: Trichogrammatidae) were recorded earlier (1) on cotton spiny worm *Earias insulana* Boisduval (Lep.: Noctuidae). Biological and ecological studies were then carried out to determine the suitable conditions for their mass rearing in the laboratory (3, 4). In the world, many trials were carried out using *Trichogramma* species as efficient agents against cotton bollworms (7). The present research investigates the potential detrimental side effects of the parasitoid releases, i.e. the parasitism of eggs of beneficial insects such as *Chrysoperla carnea* Steph. (Neuroptera: Chrysopidae), the main predator in Syrian cotton fields. Eggs of this predator were experimentally parasitized by *T. principium* in the laboratory, and different studies recorded other *Trichogramma* species, such as *T. evanescens* Westwood, on Chrysopid eggs collected in the field (2, 5, 9).

The main objective of this study is to investigate further the biology of *T. principium* in order to broaden its uses in biological control programmes.

Materials and Methods

Experiments were carried out in September 1998 and August 1999 in cotton fields near Aleppo, i.e. Al-Zerbeh (25 km south) and Om-Houche (30 km west-north). The fields were planted with 8-10 plants/m². The plant height was 90-120 cm during the test period.

The parasitoid tested, *T. principium*, was collected from Syrian cotton fields on *Earias insulana* eggs, and was mass reared on *Ephestia kuehniella* Zeller (Lepidoptera: Pyralidae) eggs at 23°C, 70% R.H. (16 h of light and 8 h of darkness). Release of *T. principium* in the fields was carried out by means of plastic capsules containing 1000 parasitized *E. kuehniella* eggs. Adult parasitoids emerged in less than 12 h after their release in the field.

In 1998, the test was carried out in Al-Zerbeh. Eggs of two species were recorded in the test cotton field, *Helicoverpa armigera* Hbn. (Lep.: Noctuidae) and *C. carnea*. Eggs of another species, *Pieris rapae* L. (Lep.: Pieridae), were recorded in the nearby field planted with cabbage. In the cotton field, 1000 *T. principium*/100 m² were released (1 capsule each 10x10 m). Another release was carried out one week later. One week after the second release, *T. principium* was released in a part of the cabbage field, at the same rate. The *C. carnea* and *H. armigera* eggs were collected 0, 2 and 4 days after the 1st release in cotton, and 0, 3 and 6 days after the 2nd release in cotton. An additional collection of only *H. armigera* eggs was carried out one day before the 1st release. The *P. rapae* eggs were collected 6 days after the 2nd release in cotton and 3 days after the release in cabbage. The collected eggs were isolated in tubes and placed at 23°C, 70% R.H. and exposed to 16 h of light and 8 h of darkness.

In 1999, only *C. carnea* eggs were recorded in the test fields (Al-Zerbeh and Om-Houche). Two thousands *T. principium*/100 m² were released in each field. The *C. carnea* eggs were collected 0, 3 and 6 days after the release. They were isolated in similar conditions as those used in 1998.

Results and Discussion

Effect of *T. principium* release on *H. armigera* eggs in 1998 - Table 1 shows that no eggs of bollworms were found parasitized before the first release. The percentage of parasitized eggs by *T. principium* increased gradually to reach 12.5%, 6 days after the second release. The number of bollworm eggs/100 plants decreased from 20 on September 12 to 4 on September 27. Observations were stopped thereafter.

Effect of *T. principium* release on *C. carnea* eggs in 1998 and 1999 - In Al-Zerbeh, 7-16 *C. carnea* eggs/100 plants were collected during 1998 and 15-23 eggs/100 plants during 1999 (Table 2). The percentage of egg mortality ranged between 11.5 and 32% during 1998 and between 2 and 11%

during 1999. No *C. carnea* eggs were parasitized by *T. principium*. On the other hand, *C. carnea* eggs were parasitized by *Telenomus acrobates* Giard (Hym.: Scelionidae). The parasitism rate caused by this parasitoid varied between 11 and 25 % during 1998 and between 59 and 65% during 1999 (Table 2).

In Om-Houche, a higher density of *C. carnea* eggs was recorded (38-41 eggs/100 plants). The percentage of egg mortality ranged between 5 and 13%. As in Al-Zerbeh, no *C. carnea* eggs were parasitized by *T. principium*. The rate of parasitism by *T. acrobates* varied between 19 and 26% (Table 2).

Table 1. Parasitism rates of *Helicoverpa armigera* by *Trichogramma principium* in a cotton field after the 1998 releases in Al-Zerbeh.

Date	No of eggs/100 plants	No. of collected eggs	% of hatched eggs	% of egg mortality	% of parasitized eggs
12/9	20	20	65.0	35.0	0
13/9*	10	20	75.0	25.0	0
15/9	8	32	78.0	18.8	3.2
17/9	10	40	85.0	10.0	5.0
21/9*	12	47	72.3	19.2	8.5
24/9	15	60	66.7	25.0	8.3
27/9	4	8	62.5	25.0	12.5

* Release dates.

Effect of *T. principium* release on *P. rapae* eggs in 1998 - Six days after the 2nd release in the cotton field, 4 and 21% of the *P. rapae* eggs collected from the nearby cabbage field were dead or parasitized by *T. principium*, respectively (Table 3), an indication that parasitoids can migrate from the cotton field to the cabbage field. Three days after the *T. principium* release in a part of the cabbage field, 7 and 17% of the *P. rapae* eggs were dead or parasitized by *T. principium*, respectively, in the release area. Surprisingly, these percentages reached 9 and 29% of the collected eggs, respectively, in another part of the cabbage field, indicating that the parasitoids were carried by wind to a relatively long distance (50-100 m) from the release area..

The release of *T. principium* to control the cotton bollworms had no detrimental effect on *C. carnea* eggs, whether *H. armigera* eggs were present or not, whether the release rate was 1000 or 2000 parasitoids/100 m², and whether the density of *C. carnea* was 20 or 40 eggs/100 plants. This result confirms previous observations on the impact of *T. principium* on the predator *C. carnea* (5). On the other hand, *T. principium* was efficient in parasitizing *H. armigera* eggs. Moreover, *T. principium* parasitized also eggs of the pest *P. rapae* present in the cabbage field nearby the cotton field where parasitoids were released.

The presence of *T. acrobates* in Syria as a natural parasitoid of *C. carnea* eggs was confirmed in this study. Its present distribution includes Europe (France, Germany, Italy, Romania, Russia, and Spain), Asia (Japan and Uzbekistan) and Africa (Mauritania) (6, 8, 10, 11). This parasitoid could be effective in decreasing the population of the chrysopid predators in some areas.

Table 2. Parasitism rates of *Chrysoperla carnea* by *Trichogramma principium* in cotton field after the 1998 and 1999 releases.

Location (Year)	Date	No. of eggs/100 plants	No. of collected eggs	% of hatched eggs	% of egg mortality	% of parasitized eggs by <i>T. principium</i>	% of parasitized eggs by <i>T. acrobates</i>
Al-Zerbeh (1998)	13/9*	9	37	62.2	27.0	0	10.8
	15/9	7	26	69.2	11.5	0	19.3
	17/9	16	62	67.7	12.9	0	19.4
	21/9*	10	40	60.0	15.0	0	25.0
	24/9	11	43	65.1	14.0	0	20.9
	27/9	15	37	46.0	32.4	0	21.6
Al-Zerbeh (1999)	23/8*	23	46	32.6	8.7	0	58.7
	26/8	21	63	23.8	11.1	0	65.1
	29/8	15	45	37.8	2.2	0	60.0
Om-Houche (1999)	22/8*	38	76	65.8	11.8	0	22.4
	25/8	40	79	75.9	5.1	0	19.0
	28/8	41	82	61.0	13.4	0	25.6

* Rrelease dates.

Table 3. Parasitism rates of *Pieris rapae* by *Trichogramma principium* in a cabbage fields after the 1998 releases in a nearby cotton field (13/9 and 21/9) and in the cabbage field (28/9).

Area of collection (on cabbage)	Date	No. of eggs / plant	No. of collected eggs	% of hatched eggs	% of egg mortality	% of parasitized eggs
Near the area of release in the cotton field*	27/9	12	24	75.0	4.2	20.8
In the area of release	1/10	21	137	76.6	6.6	16.8
Near the area of release in the cabbage field*	1/10	19	34	61.8	8.8	29.4

* From 50 to 100 m

المخلص

بابي، عدنان، منير النبهان و بيرنارد بينيتيرو. 2002. دراسة تأثير إطلاق الطفيل *Trichogramma principium* في بيوض ديدان لوز القطن وأثره في بيوض المفترس *Chrysoperla carnea* في حقول القطن في سورية. مجلة وقاية النبات العربية. 20: 59-61.

هدف هذا البحث إلى دراسة احتمال وجود تأثيرات جانبية غير مرغوبة للمتطفل *Trichogramma principium* عند استخدامه في مكافحة الحيوية لبيوض عث فراشات ديدان جوز القطن في سورية، وذلك بتطفله على بيوض بعض الحشرات غير المستهدفة في مكافحة كحشرة أسد المنّ النافعة *Chrysoperla carnea* التي هي من المفترسات الأكثر انتشاراً في حقول القطن في سورية، والحشرات الأخرى المنتشرة في الحقول المجاورة لحقول القطن لمكافحة. نفذت التجربة في أيلول/سبتمبر 1998 في حقل مزروع بالقطن في محافظة حلب. ينتشر في الحقل بيض دودة جوز القطن الأمريكية *Helicoverpa armigera* بكثافة 20 بيضة/100 نبات وبيض *C. carnea* بكثافة 20 بيضة/100 نبات. ويجاوره حقل مزروع بالملفوف تنتشر فيه بيوض أبو دقيق الملفوف *Pieris rapae* بكثافة 2-3 بيضة/ورقة نبات الملفوف. تم تجهيز كبسولات بلاستيكية متقبلة تحوي كل واحدة حوالي 1000 متطفل من النوع *T. principium* بطور الحشرة الكاملة قبل الفقس. علقت الكبسولات على نباتات القطن في الحقل، بمعدل (1 كبسولة/النقطة). كان البعد بين نقاط الإطلاق 10×10 م، و بمعدل مرتين للإطلاق خلال أسبوعين. تم جمع بيض *H. armigera* و بيوض *C. carnea* و بيوض *P. rapae* بعد 2، 4 و 6 أيام من إطلاق الطفيل. حضنت البيوض المجموعة من الحقل في المختبر لمراقبة نسبة تطفل التريكوغراما على هذه البيوض. أظهرت النتائج أن المتطفل *T. principium* لا يتطفل على بيوض أسد المنّ في الظروف الحقلية. وقد وصلت نسبة التطفل على بيوض *H. armigera* إلى 13% من مجمل البيوض المجموعة. وعلى بيوض *P. rapae* إلى 29% من مجمل البيوض المجموعة. تم تسجيل متطفل بيضي آخر على بيوض *C. carnea* جديد منتشر طبيعياً هو *Telenomus acrobates* بنسبة تطفل تراوحت بين 11-65%.

كلمات مفتاحية: *Trichogramma principium*، أسد المنّ، أبو دقيق الملفوف، *Telenomus acrobates*، مكافحة الحيوية، القطن، سورية.

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Received: October 12, 2000; Accepted: September 4, 2001.

تاريخ الاستلام: 2000/10/12؛ تاريخ الموافقة على النشر: 2001/9/4