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Evaluation of Release Patterns of The Parasitoids *Eretmocerus Mondus* and *Encarsia Formosa* (Hymenoptera: Aphelinidae) to Control The Whitefly (Homoptera: Alyerodidae) on Sweet Potato Plants

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ABSTRACT

Three patterns of release for the parasitoid *Eretmocerus mondus* were compared with a low rate of *Encarsia Formosa* on the whitefly in sweet-potato fields. The patterns of *Ere. mondus* included that fixed weekly release number (3females/plant/week), variable release (5 females/plant/wks 7) follow (1 females/plant/wks 7), low release rate (1 females/plant/wk), while a low release of *Encarsia Formosa at* (1 females/plant/wk) was compared. The control was without parasitoid releases and whitefly nymphal densities reached 33100 individuals /50 leaves after 10 weeks. In patterns of parasitoid release, percentage parasitism was 77.9% by fixed-rate *Ere. mondus* after 8 weeks, while it was 47.5% with variable rate *Ere. mondus* after 6 weeks. The low-rate of *Ere. mondus* and *E. Formosa* induced 64.5%, 62.0%, respectively after 14 weeks.

Releases of low numbers of *E. formosa* provided commercially acceplable whitefly control.

There was no difference between the fixed and variable release rate treatment of *Ere. mondus*, indicating a high percentage of parasitism as a result of absence the host whitefly and honeydew increasing on the leaves. Also, the results proved that the low release gave satisfactory reduction on whitefly population and suitable parasitism percent to occur parasitoids continuously.

INTRODUCTION

Environmental pollution is worldwide problem. The whitefly, *Bemisia tabaci* (Gennadius), has recently become increasingly difficult to control on various crops in Egypt. It has showed a considerable resistance to the insecticides used on cotton (Dittrich and Ernst, 1983 and Ahmed *et al*., 1987). Eggs and pupae in particular, were found the most resistant stages (Webb *et al*. 1974).

The outbreak of this pest is attributed to the extensive use of insecticide, causing kill the natural enemies, continuous cropping of cotton and succulent plant growth due to excessive use of nitrogenous fertilizers (Natarajan *et al*.,1986 and Rajak and Diwakar, 1987).

The Biological control applications on *B.tabaci, using* parsitoids such as *Encarsia formosa* and *Eretmocerus sp*. were studied.

Van Lenteren *et. al*., (1996), used commercial biological control against greenhouse whitefly, *Trialeurodes vaprarioum* through release *E. formosa*.

In Egypt, Abd-Rabou (1998) and Ibrahim, Evleen G. (2003), released this parasitoid.

According to Hoddle (2000), Hoddle *et al*. (1996, 1997 a) and Jones *et. al*. (1995), *E. formosa* Gahan is among the parasitoids that has been considered important agent in IPM program.

It is a commercially available parasitoid that is used to control the greenhouse whitefly *B.tabaci*, a serious pest of greenhouse vegetable crop.

The present work was carried out to evaluate the release patterns for the aphelinid whitefly parasitoid *Eretmocerus mondus*. (fixed and variable release) and compared of them to a low release rate of *Encarsia formosa* which widely used on whitefly control in greenhouse crops.

Key words: *Eretmocerus mondus*, *Encarsia formosa*, greenhouses, fixed rate, variable rate.

MATERIALS AND METHODS

1- Culture of the parasitoid

In the two greenhouses (6 X 4 X 4 m.),the two parasitoids *Eretmocerus mondus* and *Encarsia formosa* were successfully mass reared on infestation of the greenhouse whitefly, *Bemisia tabaci,* that were feeding on cauliflower plants. Parasitized pupal case of whitefly were collected from the culture by brushing them from leaves and put in vials after counting for releasing.

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Table 1. Comparative evaluation of four patterns parasitoid release for the aphelinid whitefly parasitoid

Weeks	Control			Fixed release (Ere.mondus) (A)			Variable release (Ere.mondus)(B)			Low release (Ere.mondus) (C)			Low release (E. formosa) (D)		
	Number of w.f. immature *	number of parasitoid **	% parasitism	number of w.f.imm. *	number of parasitoid **	% parasitism	Number of w.f. imm. *	Number of parasitoid **	% parasitism	number of w.f. imm. *	number of parasitoid **	% parasitism	number of w.f. imm. *	number of parasitoid **	% parasitism
Pre-release	10549	304	2.8	14011	298	2.1	13011	275	2.1	16021	311	1.9	10901	320	2.9
1	12440	312	2.4	9112	313	3.3	1129	354	23.9	15113	384	2.5	10507	345	3.2
2	12131	211	1.7	9001	325	3.5	914	380	29.4	4420	401	8.3	10117	383	3.6
3	20121	234	1.1	7221	419	5.5	835	416	33.3	2200	455	17.1	10100	415	3.9
4	24101	151	0.6	6015	914	13.2	637	487	43.3	1211	498	29.1	2521	455	15.3
5	24501	195	0.8	988	1011	50.5	606	526	46.5	1125	503	30.9	2431	560	18.7
6	30111	214	0.7	915	1201	56.8	564	510	47.5	1110	487	30.5	1401	591	29.7
7	29001	180	0.6	600	1500	71.4	677	424	38.5	1001	511	33.8	1911	582	23.3
8	22102	205	0.9	514	1812	77.9	950	312	24.7	911	598	39.6	998	611	38.0
9	25120	198	0.8	719	1713	70.4	981	301	23.5	750	610	44.9	954	603	38.7
10	33100	178	0.5	899	985	52.3	1084	210	16.2	719	630	46.7	881	633	41.8
11	31410	251	0.8	1090	411	27.4	1171	211	15.3	614	681	52.6	764	719	48.5
12	21135	217	1.0	1141	400	26.0	1207	194	13.8	523	714	57.7	710	723	50.5
13	19812	111	0.6	1604	350	17.9	1512	170	10.1	412	730	63.9	615	669	52.1
14	18455	120	0.6	1900	211	10.0	1718	175	9.2	384	699	64.5	411	670	62.0

umber of whitefly / 50 leave
number of parasitoid /50 leave

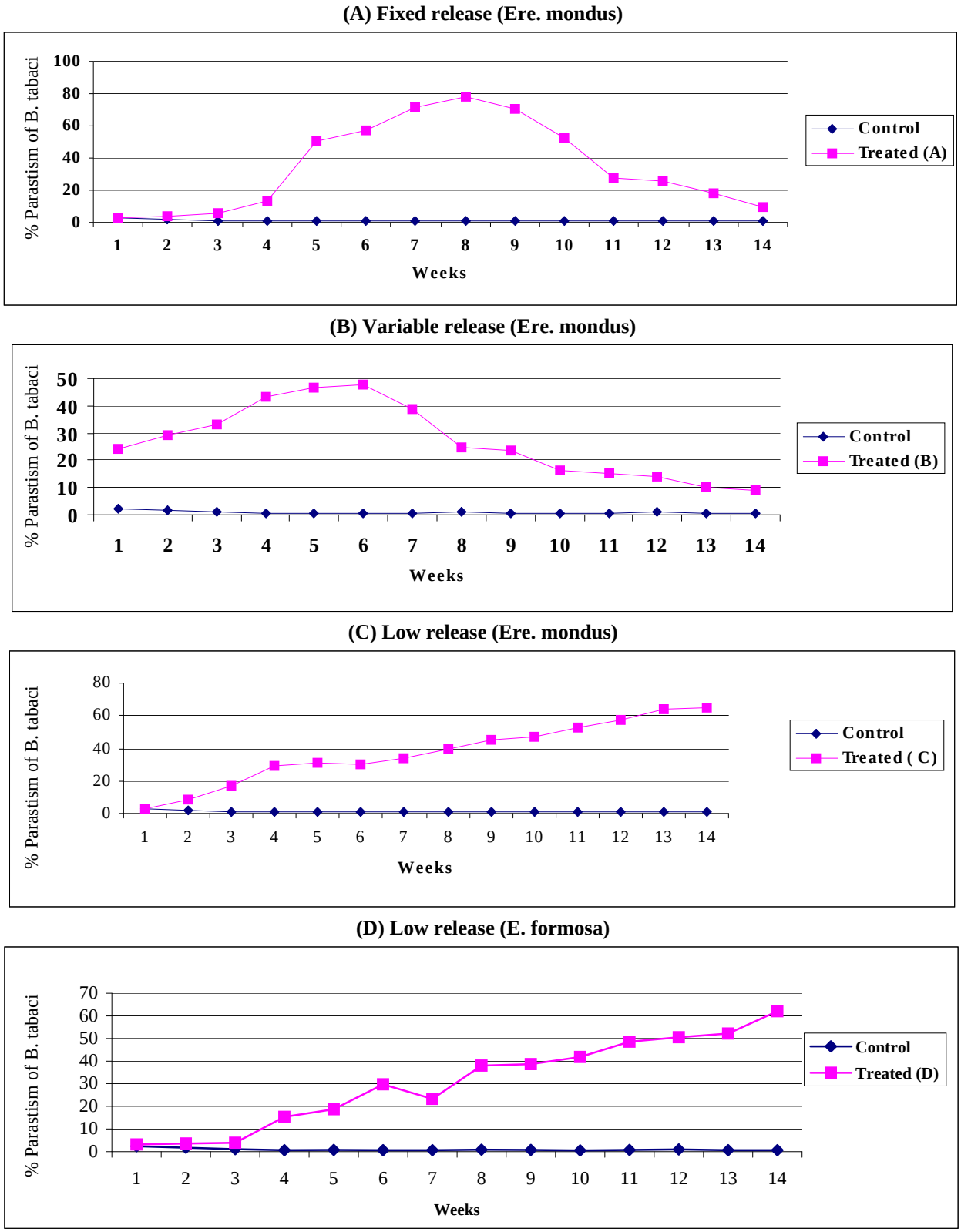

Fig 1 . Percent Parasitism of *Bemisia tabaci* on sweet- potato plants by *Eretmocerus mondus*(A, B, C) and *Encarsia Formosa* (D)

2- Field trails

The experimental plots were selected in fields of sweet-potato in Sabahia region, Alexandria. One hundred plants were divided into four treatments and control.

Vials containing adult parasitoids, were tied to an infested portion of the central plant and then the vials were opened at both ends to allow the parasitoids to crawl out slowly.

In case of *Ere. mondus*, the procedure included the following: (1) a fixed release rate of three females of *Ere. mondus* par plant par week June 2-Sept. 8, (2) a variable release with five females released per plant per week for the first seven weeks (June 2-Jully 21) and one female per plant per week for the last seven weeks (Jully 21- Sept. 8), (3) low release of *Ere. mondus* at one female per plant per week, while, in case of *E. formosa* was used with one female per plant per week. In the control was without parasitoid.

Each week, replasing of five leaves from each line (10 lines) were taken out randomly, from each treatment and transferred to the laboratory. *B. tabaci* Eggs and the first larval stages were eliminated. The second, third and fourth instars of nymphs were recorded per leaf. Each leaf was stored in well-ventilated emergence glass tubes and monitored daily till the parasitoid emergence.

The same procedures were done on the control plots. The total parasitism was calculated and recorded, as follows:

$$\text{Percentage parasitism} = \frac{\text{Number of parasitized}}{\text{Number of parasitized + Number of unparasitized}}$$

(Abd-Rabou, 1998)

For distinguishing the parasitoids, *Encarsia formosa* is indicating pupal black skin while it was pupal yellow skin, with *Ere. mondus.*

RESULTS AND DISCUSSION

After successfully Mass-rearing of the parasites *Eretmocerus mondus* (Rose) and *Encarsia formosa* (Gahan.) on whitefly *Bemisia tabaci* (Genn.) under semi-field conditions, we compared two patterns of parasitoid release for aphelinid whitefly parasitoid *Ere. mondus* and *E. formosa* were released on sweet-potato plant under the field conditions.

We compared the currently used pattern of fixed weekly release number (3females par plant per week) to an experimental pattern in which more parasitoids (five females) were released (wks. 1-7), followed by a lower number (one females) was released (wks. 7-14). We compared the out come of these two treatments (fixed and variable) to a two low release rate (1 parasitoid per pl. per wk.) of *Ere. mondus* and also *E. formosa* which an aphelinide parasitoid widely used for whitefly control in field crops. In control plant without parasitoid releases, percent parasitism of *B. tabaci* reached 0.6% at week 14 [Table 1 and Fig 1].

Percent parasitism in first pattern (fixed release) was 2.1%, before releasing of *Ere. mondus* and increased gradually to (77.9%) after 8 weeks, giving highest peak. However, this value decreased gradually to (10.0%) after 14 week. [Fig 1,A]. By fixed release *Ere. mondus* gave 77.9% reduction of nymphs, thus the host whitefly absence so super parasitism was occurred.

In the second pattern with variable release-rate, the parasitism percentage was (2.1%) before releasing this parasite, followed by higher percent after 6 weeks (47.5%), then decreased rapidly to (9.2%) after 14 week [Fig 1,B].

In the third and four patterns, low release-rate of both *Ere. mondus* and *E. formosa*, the parasitism percentages were (1.9% and 2.9%) before releasing parasite, respectively. Parasitisms were gradually increased to (64.5% and 62.0%) respectively after 14 week. [Table 1 and Fig 1 C,D]. The results indicated that, there was no difference between the fixed and variable release rate treatments of *Ere. mondus*, indicating that whitefly suppression was not increased by concentrating the release of this parasitoid on the crop. Also, the results gave that the low release (1 parasite/plant/week) proved satisfactory reduction on whitefly population with suitable parasitism percent to occur parasitoids continuously.

The results agree with that obtained by Hoddle *et. al.*(1997 b), mentioned that the low release rate provide better control of *B. argentifolii* than the higher release rate.

In addition the present work agree with Van Driesche *et al.* (2001), who indicated that release of low number of *E. formosa* (1 parasitoid/plant/week) gave commercially acceptable whitefly control.

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الملخص العربي

تقييم نماذج إطلاق كل من طفيل *Eretmocerus mondus* وطفيل *Encarsia formosa* لمكافحة ذبابة القطن البيضاء علي نباتات البطاطا

إيفلين جوده ابراهيم

الهدف من البحث الوصول لأفضل نموذج لإطلاق نوعين من طفيليات ذبابة القطن البيضاء وهما *Ere.mondus* و*E.formosa* لتقليل إعداد الذبابة البيضاء المتواجدة علي نباتات البطاطا تحت الظروف الحقلية.

تم مقارنة أربعة نماذج من الإطلاق وهم: (١) إطلاق ثابت لمدة ١٤أسبوع(٣إناث/نبات/أسبوع) للطفيل الأول *Ere.mondus*، (٢)إطلاق متغير يتكون من مرحلتين(٥إناث/نبات/٧أسابيع الأولي) ثم (١أنثي/نبات/٧أسابيع الأخيرة) للطفيل الأول (٣) إطلاق منخفض لمدة ١٤أسبوع للطفيل الأول عبارة عن (١أنثي/نبات/أسبوع) (٤) إطلاق منخفض لمدة ١٤أسبوع للطفيل الثاني *E.formosa* (١أنثي/نبات/أسبوع).

و لم يتم إطلاق أي من الطفيليين في المقارنة والذي بلغت تعداد حوريات الذبابة البيضاء إلي(٣٣١٠٠فرد/٥٠ ورقة) وذلك في الأسبوع العاشر.

أظهرت النتائج أن الإطلاق الثابت أدي إلي تقليل التعداد بنسبة (٧٧,٩%) بعد ٨أسابيع من الإطلاق ولكن بعد ذلك انخفضت النسبة تدريجياً و لعدم وجود أطوار للذبابة كعائل للطفيل مما أدي إلي ظهور ظاهرة "التطفل المتعدد"حيث يفشل خروج الطفيل. أما في حالة نموذج التطفل المتغير فلا يوجد فرق بينه وبين التطفل الثابت.

وقد أظهرت أفضل النتائج في حالة التطفل المنخفض حيث زاد التطفل تدريجياً ووصلت النسبة المئوية للتطفل إلي(٦٤,٥%، ٦٢,٦%) لكل من طفيل *Ere. mondus*، *E. formosa* علي التوالي في الأسبوع ١٤ كذلك أحدث وجود أعمار الذبابة البيضاء كعائل لإستمرار عملية التطفل فأدي إلي إنخفاض للذبابة البيضاء.