EFFICIENCY OF SECOND INSTAR LARVAE OF *CHRYSOPERLA CARNEA* TO SUPPRESS SOME PIERCING SUCKING INSECTS INFESTING CANTALOUPE UNDER SEMI- FIELD CONDITIONS

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Abstract

Evaluation the efficiency of *Chrysoperla carnea* second instar larvae , of predator were released at three different rates (3, 5 and 7 larvae / plant) for suppression aphids the cotton – melon aphid, *Aphis gossypii* Glover and the green peach aphid, *Myzus persicae* Sulzer as well as nymphs and pupae of *Bemisia tabaci* Genn. on cantaloupe (*Cucumis melo* L.) plants (the local cantaloupe variety, Arafa) .The experiment was conducted under semi-field conditions during early summer plantation season of 2010 . The promising and best results were obtained after 21 days from releasing date at rate of 5 predatory larvae / plant, however, these larvae reduced populations of aphids and whitefly by 73.9 and 83.07%, respectively.

INTRODUCTION

The chemical controlling methods by insecticides are currently used inspite of their power contamination, volatilization and bioaccumulation. It could interchange in the air - water- soil system at rate that depends on various climatic and environmental factors putting the whole food chain at risk **(**Vighi *et al.,* 1997). Also the chemical insecticides induced insect resistance, phytotoxicity, unbalance in the normal biotic ecosystem by overcoming upon the natural insect enemies and environmental pollution resulting from the undesirable chemical residues. Therefore, it is necessary to apply alternative methods to control the insect pests, and one of these is biological control by predacious insects such as *Chrysoperla carnea* **(**Stephens) which used in the present study as biological control agents on some cantaloupe pests such as *Aphis gossypii* Glover, *Myzus persicae* Sulzer and *Bemisia tabaci Genn..* The common green lacewing, *Ch. carnea* appears to be a good candidate for use in I.P.M. programs information **(**Aziza *et al.,* 2007). A control option for these insect pests reviewed here includes using 2nd instar larvae of *Ch. carnea*.

The predator is usually found on different parts of plants together with aphids and whiteflies and this species feeds on adults and immature stages of its preys.

MATERIALS AND METHODS

The aim of this experiment is to studying the efficiency of 2nd instar larvae of *Ch. Carnea* (Stephens) as biocontrol agent against some sap-sucking pests,(*A. gossypii* and *M. persicae*) as well as nymphs and pupae of *B. tabaci* on cantaloupe plants under semi-field conditions. A greenhouse of about 270 m^2 was chosen in the Experimental Farm of Central Laboratory for Climate and Meteorology. The chosen area was divided into 12 plots (9 plots as treated groups and 3 plots as control group).Each plot (replicate) measures 22.5 m^2 , and all plots distributed in a complete randomized block design. Sowing seeds of the local cantaloupe variety (Arfa) was applied on 16th February 2010 at a distance of 50 cm between hills.

The normal agricultural practices for cultivation were performed and no specific chemical treatments were conducted during the whole period of study. Envelopes (A4 size) containing the second larval instar of *Ch.carnea* were obtained from Mass Rearing Unit of the Faculty of Agriculture, Cairo University , which were used for transportation of larvae. A serious of white paper sheets displaying eggs of *Ephestia kuehniella* (Zell.) were found in each envelope, so the larvae could feed freely until they were dispatched on the plants. Releasing 2nd instar larvae of *Ch. carnea* was carried out on April 29th at three ratios, 3, 5 and 7 larvae per plant. Larvae were brushed on the treated plants by using a fine and smooth paint brush. Samples of 120 leaves (30 leaves / treatment and the same for control group) were randomly picked out after 1, 3, 5, 7, 11, 14 and 21 days from releasing. Leaves were kept in polyethylene bags to be transferred to the laboratory in order to be examined by a binocular stereomicroscope. Counts of *B. tabaci* immature stages and aphids were determined by inspection the whole leaf area.

Duncans multiple range test (1955) was used to clear the significanct among the reduction percentages after each release as well as in case of the overall mean reduction in aphids and *Bemisia tabaci* population.

The reduction percentages in whitefly immature stages population and aphids mean numbers were calculated according to Abbott's formula (1925)

$$\frac{\text{Control - treatment}}{\text{Control}} \text{ X100}$$

RESULTS AND DISCUSSION

1- Effect of *Ch. carnea* predator as biological control agent on population of *A. gossypii* and *M. persicae*:

Data presented in Table (1) indicating the efficiency of 2nd instar larvae as biological agent for controlling aphids population on cantaloupe plants when introduced in the greenhouse at three different ratios, 3, 5 and 7 larvae/ plant. Twenty four hours after releasing, the efficiency of 2nd instar larvae of *Ch. carnea* was determined in all treatments under investigation. Aphid populations being 7.13, 3.7 and 6.03 aphid individuals / leaf at the 1st day post-treatment with 3,5 and 7 predaceous larvae/ plant, respectively. However, aphid's population increased in the control treatment to reach 21 individuals/ leaf. The corrected reductions in aphid counts were calculated according to Abbott's formula as 66. 51, 82.6 and 71.7 than those of the control in plots received 3, 5 and 7 larvae/ plant, respectively. Three days after predator release, results demonstrated that the mean number of aphids reached 4.3, 7.1 and 5.4 individuals/ leaf in plots treated with *Ch. carnea* at rates of 3, 5 and 7 predaceous larvae/ plant, respectively, compared to 17.6 individuals/ leaf in the control group. Thus, the corrected reduction percentages, opposed to the control mean counts, were 75.6, 65. 6 and 69.5 %, respectively.

Two days later (5 days after release), the predaceous larvae gave reduction percentages as 85.05, 74.04 and 49.9%, while the mean counts of aphids infested cantaloupe plants in plots treated with 3, 5 and 7 predaceous larvae/ plant were 2.5, 4.3 and 8.3 individuals/ leaf, respectively, compared to 16.5 individuals / leaf infesting control group.

One week after release the predator , the mean counts of aphids became 1.17, 2.5 and 11.2 individuals / leaf of at rates of 3, 5 and 7 predacious larvae/ plant, respectively, opposed to 15.4 individuals / leaf as mean count/ cantaloupe leaves of control group. However, the corrected reduction percentages according to Abbott's formula were 92.42, 83. 8 and 27.48 % in plots received 3, 5 and 7 predaceous larvae
/ plant, respectively.

Eleven days after release, the mean number of aphids reached 1.8, 1.74 and 3.44 individuals/ leaf, in plots treated by the above mentioned three rates , 3, 5 and 7 larvae/ plant, respectively. However the control plants harboured 12.98 individuals/ leaf. The calculated reduction gave percentages of 86.5, 86.61 and 73.5%, respectively.

Two weeks after release, aphid populations increased in the control group to reach 31.6 individuals/ leaf in contrast to 6.7, 6.2 and 3.48 individuals / leaf, on cantaloupe plants treated with 3, 5 and 7 predaceous larvae / plant, respectively. The corrected reduction percentages for aphids mean counts compared to control groups were 78.88, 80.41 and 88. 96% in plots treated with the above mentioned rates, respectively.

Results obtained after three weeks of release clearly indicated the presence of aphid individuals on cantaloupe plants, but in a few numbers, where aphids mean counts were 3.65, 2.5, 0.9 and 4.4 individuals/ leaf for the forecited three treatments and control, respectively. Thus giving 26.5, 43.93 and 80.32 % reductions in aphids population since releasing of 2nd instar larvae of *Ch. carnea* at 3, 5 and 7 larvae/ plant, respectively Table (1).

Generally, data presented in Table (1) demonstrated that releasing of 2nd instar larvae of *Ch. carnea* at the three different rates (3, 5 and 7 larvae/ plant) induced to general reduction in aphid populations than the control treatment. The statistical analysis revealed that, the efficiency of 2nd instar larvae of *Ch. carnea* was more evident when released at 5 larvae/ plant as biocontrol agent against aphids attacking cantaloupe plants under greenhouse conditions. Accodingly, it gave the highest overall mean percentage of reduction in aphid populations (73.9%), followed by 3 larvae/ plant (73.07%). On the contrary releasing of 2nd instar larvae of *Ch. carnea* at rate of 7 larvae/ plant gave an overall mean of 65.91 % reduction in aphid populations which considered the lowest reduction percentage.

From the above mentioned results, it is clear that releasing at 5 larvae / plant may be appropriate application rate to reach satisfied reduction of aphids on cantaloupe plant.

The present results are in harmony with those of Gurbanov (1982), in USSR, who found that after one week of releasing *Chrysopa carnea* (3- 4 days old eggs and 1st and 2nd instar larvae) against *A. gossypii* at the predator-prey ratio, 1 : 1, the reduction percentage was 98.5%. Driesche *et al.* (1987), in USA, found that the three aphid species (*M. persicae, A. gossypii* and *Macrosiphum euphorbiae*) which considered as main pests of greenhouse crops could be highly controlled by releasing *Ch. carnea*. Shuvakhina and Novozhilov (1987), found that highly reduction in the aphid populations in cucumber in glasshouses in USSR related by using the Far Easter lacewing, *Chysoperla sinica*.

Successful use of *Chrysopa perla* for control of *A. gossypii* on cucumber in USSR, and found that this predator used as biological control agent against *M. persicae* and against *Aulacorthums circamflexum* on decorative plants (Ushchekov,

1989). El-Arnaouty and Ferran (1993), in Egypt, stated that *M. persicae* was caught as first prey by larvae of *C. carnea* when it reared on *M. persicae* as well as eggs of *Ephestia kuehniella* (Zell.)

Burgio *et al.,* (1997), studied the effect of biological and integrated control of *A. gossypii* infesting cucumber (cv Darina) and melon (cv. Harper) during April – May in plastic tunnels in Italy. They stated that wild predators (*Coccinellids* and *Ch. carnea)* were essential for complete aphid control in both of vegetable crops. In Egypt, El-Arnaouty *et al.* (2000), obtained best results in the control of *M. persicae* by releasing 2nd instar larvae of *Ch. carnea* on green pepper plants under greenhouse conditions than those obtained after releaisng eggs and combination between eggs and 2nd instar larvae. Biological control of aphids with *Ch. carnea* on strawberry was conducted by Turquet *et al.* (2009).

Table 1. Efficiency of 2nd instar larvae of *C. carnea* in reducing aphid* populations on cantaloupe plants under semi - field conditions (greenhouse) at indicated days after releasing.

Inspection date (days) / Treatments		1st	3th	5th	7th	11th	14th	21st	Mean of reduction (%)	F value	L . S. D.
3 larvae/ plant	M	7.13	4.3	2.5	1.17	1.8	6.7	3.65	73.07[a]	0.87	13.29
	R%	66.51[a]	75.6[a]	85.05[a]	92.42[a]	86.5[a]	78.88[a]	26.5[b]			
5 larvae /plant	M	3.7	7.1	4.3	2.5	1.74	6.2	2.5	73.9[a]		
	R%	82.6[a]	65.6[a]	74.04[a]	83.8[b]	86.61[a]	80.41[a]	43.93[b]			
7 larvae/plant	M	6.03	5.4	8.3	11.2	3.44	3.48	0.9	65.91[a]		
	R%	71.7[a]	69.5[a]	49.9[b]	27.48[c]	73.5[a]	88.96[a]	80.32[a]			
Control		21	17.6	16.5	15.4	12.98	31.6	4.4			
F value		1.42	0.49	13.25	814.99	0.96	0.25	7.81			
L . S . D.		23.85	24.94	17.12	4.3	26.72	37.5	33.98			

* Counting was recorded on two species (*Aphis gossypii* and *Myzus persicae*).

M : Mean numbers of aphids / cantaloupe leaf (data culculated from 3 replicates/ each releasing rate).

R% : Reduction percentage of aphids' population / cantaloupe leaf.

- Means within a column followed by the same letter are not significantly different (Duncans Multiple Range Test at 0.05)

2- Effect of *Ch. carnea* as predator on nymphs and pupae of *B. tabaci*:

Data presented in Table (2) elucidate that there were reductions in numbers of immature stages of *B. tabaci* in all treatments than those infested cantaloupe leaves in the control groups during three weeks after release 2nd instar larvae of *Ch. carnea* under semi-field conditions.

One day after release, reduction in the immature stages of *B. tabaci* than the control group was observed. However, releasing of 2nd instar larvae of *Ch. carnea* at rates of 5 and 7 larvae / plant induced reduction in the mean count of immatures, where it was 3.23 and 3.28 individuals/ leaf, respectively as compared to 10.08 individuals/ leaf in control group. The mean reduction percentage of these rates in *B. tabaci* counts were 67.95 and 67.5%, respectively. On the other hand, the mean number of *B. tabaci* immature stages in the same day after releasing the predaceous larvae at rate 3 larvae / plant was 25.54 individuals/ leaf more than the control group.

Threedays after release, the population of *B. tabaci* immatures increased in the control group to reach mean count of 24.4 individuals / leaf as compared to 2.54, 4.43 and 1.86 individuals / leaf in plots treated with 3, 5 and 7 larvae / plant, respectively. The corrected reduction percentage after 72 hours of release was 89.57, 81.83 and 92.4% in plots treated with predaceous larvae at rates of 3, 5 and 7 larvae/ plant, respectively.

The mean reduction percentages in *B. tabaci* immature population stages after five days of releasing were 61.3, 83.2 and 69.55% in plots treated with 3, 5 and 7 predaceous larvae / plant, respectively. It is quite clear from the obtained results that the mean count of immature stages in treated plots and control group was 7.91, 3.43, 6.22 and 20.43, respectively (Table, 2).

Observations were conducted at 7 and 11 days after releasing of 2nd instar larvae of *Ch. carnea* confirmed descending in *B. tabaci* populations compared to the control group, where the mean counts after 7 days being 13.24, 2.4 and 10.6 individuals / leaf and 16.02, 2.64 and 9.45 individuals/ leaf at 11th day in plot treated with rates of 3, 5 and 7 predaceous larvae/ plant, respectively. However, the mean counts of *B. tabaci* immatures that infested cantaloupe leaves in the control group plots being 16.5 and 21.42 individuals/ leaf after 7 and 11 days from release, respectively. The corrected reduction percentages were 52.5, 85. 5 and 35.9% for 7th day after releasing and 58.8, 87.69 and 55.9% for 11th day after releasing.

As shown in Table (2), the population of *B. tabaci* immatures increased in the control groups to reach 31.3 and 66.1 individuals/ leaf, after two and three weeks, respectively. The mean numbers of *B. tabaci* immature stages in plots treated with 2nd

instar larvae of *Ch. carnea* at levels 3, 5 and 7 larvae/ plant being 7.63, 0.5 and 15.78 individuals/ leaf after two weeks and 10.1, 15.3 and 11.2 individuals/ leaf after three weeks. The mean reduction percentages among *B. tabaci* populations being 75.62, 98.4 and 49.6 % and 84.71, 76.9 and 83.06% after two and three weeks, respectively.

Generally, the statistical analysis clearly indicated that, releasing of 2nd instar larvae of *Ch. carnea* at a rate of 5 larvae gave 83.07% which considered as the highest overall mean in reduction percentages among *B. tabaci* immaturs' population infesting cantaloupe plants under greenhouse conditions.

These results could be also proved from the weekly counts of *B. tabaci* after releasing of 2nd larvae of *Ch. carnea* at level of 5 larvae/ plant which led to significant reductions in *B. tabaci* population than the control groups during the period of the present study after releasing the biological control agent. This reduction percentage followed, significantly by 7 larvae / plant (64.84%), on the other hand, the cantaloupe plants which treated with 2nd instar larvae of *Ch. carnea* at rate of 3 larvae/ plant had the lowest reduction percentage in *B. tabaci* population (60. 4%).

The forecited results clearly indicated that releasing of 2nd instar larvae of *Ch. carnea* as biocontrol agent in applied control of *B. tabaci* nymphs and pupae infesting cantaloupe plants under greenhouse conditions at rate of 5 larvae / plant may be judicious application of this predator to control *B. tabaci* nymphs and pupae on cantaloupe plants.

In addition the above mentioned results revealed that releasing of 2nd instar larvae of *Ch. carnea* induced reduction in the percentage of
B. tabaci immatures at all employed rates of releasing predaceous larvae as well as at all time of examined observations with only one exception at 1st day post - treatment with rate of 3 larvae/ plant where the mean count of *B. tabaci* was 25.54 individuals/ leaf.

These results are in accordance with findings of El-Sayed (1986), in Egypt, who reported that *Ch. carnea* larvae fed on the body fluids of different immature stages, especially pupal stage of *B. tabaci* on eleven host plants. Abdel-Gawaad *et al.* (1990), in Egypt, recorded during field experiment that *Chrysopa carnea* larvae fed on the immature stage of *B. tabaci* preferably the pupae on 13 host plants.

In 1999, Zaki *et al.*, studied the effect of two predators *Ch. carnea* and *C. undecimpunctata* and two parasitods *Diaeretiella rapae* and *Eretomocerus mundus* against some insect pests including *A. gossypii* and *B. tabaci*. Authors found that releasing of these biological agents induced highly significant reduction of these pests at different rates of releasing.

Comparison of development and predation of *Ch. carnea* on different densities of two hosts' *B. tabaci* and *Amrasca devastans* was studied by Sayed *et al.* (2000). They found that the larval durations of *Ch. carnea* were significantly different among the number of larvae fed on *B. tabaci* and *A. devastans.*

The same application was carried out using *Ch. carnea* and other predators as bioagent to control *A. gossypii, M. persica* and *B. tabaci* in different areas of the world (Ermolaev, 2003).Hanafy (2004), studied in Egypt the efficiency of releasing 2nd larval instar of *Ch. carnea* at different levels (3, 6 and 9 larvae / plant) to control *A. gossypii*, *M. pericae* and *B. tabaci* which attacking cucumber (Medina variety) and came to conclusion agree with the obtained results in the present study which revealed that there was a positive relationship between the different levels and the reduction percentage of the treated pest.

Table 2. Efficiency of 2nd instar larvae of *C. carnea* in reducing *B. tabaci* immature stages* on cantaloupe plants under semi- field conditions (greenhouse) at indicated days after releasing.

Treatments \ Inspection date (days)		1st	3th	5th	7th	11th	14th	21st	Mean of reduction (%)	F value	L . S. D.
3 larvae /plant	M	25.54	2.54	7.91	13.24	16.02	7.63	10.1	60.4[b]	4.11	16.8
	R%	-	89.57[a]	61.3[a]	52.5[a]	58.8[a]	75.62[ab]	84.71[a]			
5 larvae / plant	M	3.23	4.43	3.43	2.4	2.64	0.5	15.3	83.07[a]		
	R%	67.95[a]	81.83[a]	83.2[a]	85.5[a]	87.69[a]	98.4[a]	76.9[a]			
7 larvae / plant	M	3.28	1.86	6.22	10.6	9.45	15.78	11.2	64.84[b]		
	R%	67.5[a]	92.4[a]	69.55[a]	35.9[a]	55.9[a]	49.6[b]	83.06[a]			
Control		10.08	24.4	20.43	16.5	21.42	31.3	66.1			
F value		23.34	1.63	0.47	2.19	0.88	8.79	0.35			
L . S . D.		28.02	14.8	55.8	59.03	64.9	28.5	24.15			

* Counting was recorded on nymphs and pupae.

M : Mean counts of *B. tabaci* immature stages / cantaloupe leaf (data from three replicates / each releasing rate).

R % : Reduction percentage of *B. tabaci* immature stages / cantaloupe leaf.

- Means within a column followed by the same letter are not significantly different (Duncans Multiple Range Test at 0.05)

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كفاءة العمر اليرقى الثانى للمفترس الحشرى أسد المن فى القضاء على بعض الحشرات الثاقبة الماصة التى تصيب نباتات الكنتالوب تحت ظروف نصف حقلية

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لدراسة كفاءة العمر اليرقى الثانى من المفترس الحشرى أسد المن ، تم إطلاق يرقات المفترس فى ثلاث معدلات مختلفة وهى (3، 5، 7 يرقات / نبات) و ذلك لمكافحة بعض أنواع المن (من القطن و البطيخ و من الخوخ الأخضر) و الأطوار الغير متحركة من ذبابة القطن والطماطم البيضاء (حوريات و عذارى) التى تهاجم نباتات الكنتالوب (الصنف المحلى عرفة). تم إجراء التجربة تحت ظروف نصف حقلية و ذلك فى العروة الصيفية المبكرة لعام 2010 . وتم الحصول على أفضل نتائج واعدة بعد 21 يوم من الإطلاق تحت ظروف الصوب الزجاجية عند إطلاق المفترس الحشرى بمعدل 5 يرقات / نبات حيث أدت إلى خفض أعداد المن و الذبابة البيضاء بنسب 09 . 73 و 83.07 % على التوالى .