J. Agric. Sci. Mansoura Univ., 28(5): 4013 - 4019, 2003

PREDACIOUS EFFICIENCY OF ADULTS OF THREE PREDATORS ON *Coccus hesperidum* L UNDER LABORATORY AND FIELD CONDITIONS.

El-Batran, Laila A.
Economic Entomol. Dept. ,Faculty of Agriculture, Mansoura University

ABSTRACT

The feeding capacity of the three adult - predators, *Chrysopa septempunctata* Wesm., *Coccinella septempunctata* L., and *Coccinella undecimpunctata* L. on soft scale insect, *Coccus hesperidum* L. was evaluated under laboratory and field cosnditions, where different densities from every predator individual, namely 1, 4, 6, 8 and 10 were introduced for eighty individuals of they prey. *C. undecimpunctata* showed the highest feeding capacity in both laboratory and field conditions, and that was for almost all population densities of the predator. On the other hand the feeding capacity in the field was higher than that in the laboratory for the three experimental predators. Also, in case of single predator (density: 1), the feeding capacity was higher than all other densities (4, 6, 8 and 10).This was common for the three experimental predators under both field and laboratory conditions.

INTRODUCTION

Chrysopids are widely distributed predators attacking aphids, spider mites, mealy bugs, scale insects, eggs and newly hatched larvae of certain lepidopterous insect pests as well as soft scale insects.

In Egypt, Awadallah *et al.* (1976), El-Haidari and Aziz (1978), El-Batran and Fathy (1991) recorded that, larvae of *Chrysoperla carnea* Steph. are common in citrus orchards preying the soft-scale insect; *Coccus hesperidum* L.

According to El-Batran (1992) the predator *Chrysopa. Septempunctata* was the most effective natural enemy of the mealy bugs; *Planococcus citri* (Risso), *Icerya aegyptiaca* (Douglas) and *Icerya. purchasi* Mask. In 1987, Wang and Hu-HL recorded *Chrysopa kulingensis* Naves as a predator of aphids and scale insects.

Lady-birds have been recorded from a wide range of habitats feeding on many different insect-species infesting citrus, mango, and hedges such as aphids, scale insects, and mealy bugs, that was recorded in Egypt (El-Batran, 1988 and Hashem and El-Halawany, 1996) as well as many parts of the world (Pasqualini, 1975 in Italy; Oncuer, 1977 in Turkey and Selim, 1977 in Iraq).

The Coccus species (Homoptera - Coccidae) cause damage to citrus groves and many other economic crops and that's why it's considered to be key pests for citrus orchards in Egypt and in other countries.

Therefore the present work is an attempt to evaluate the predacious efficiency of *Chryspa septempunctata*, and two coccinellid species; *Coccinella septumpunctata*, and *Coccinella undecimpunctata* under laboratory and field conditions.

MATERIAL AND METHODS

1-Predators source:

Adults of *Chryspa septempunctata* Wesm., *Coccinella septumpunctata* L. and *Coccinella undecimpunctata* L., were collected in summer 2000 from the citrus orchards cultivated at the experimental farm of Mansoura University. Adult-predators were identified and transferred to the laboratory where they were supplied with *Aphis gossypii* Glover. Collected from its host plants in the same farm.

2-Laboratory experiments:

To evaluate the predacious efficiency of the three tested predators under different densities; 1, 4, 6, 8 and 10 individuals/Petri dish measured (15cm. in diameter). Each density was replicated five times and supplied, daily, with 80 individuals of *Coccus hesperidum* collected from sweet orange trees. After 24 hours, the number of preys consumed by each predator at every density was recorded.

Laboratory experiments were carried out in the laboratory under 30.0 ± 5.0 °C and 70 ± 5 %.RH.

2-Field experiments

To determine the rate of prey consumption by any tested predator at five densities (1, 4, 6, 8 and 10 individuals) under field conditions (33.0± 5.0 °C and 75± 5%.RH), a group of infested leaves on one branch of sweet orange having eighty individuals of *Coccus hesperidum* were caged by using cylinder screen cages (10 cm. in diameter x 30 cm. in length). Every density of the predator was introduced to one cage, for 24 hours, and replicated five times. Then, the remained individuals of the prey were recorded.

The percentages of predation (*N*%) was calculated as follows:

$$N\% = \frac{P}{M} x100$$

where, (*P*) is the number of eaten scale insects.

(*M*) is the initial number of prey used.

The obtained data were analyzed using the Student "t-test"

RESULTS AND DISCUSSION

As shown in Table (1), the predation percentages under field conditions (54.09%) were significantly higher than those under laboratory conditions (38.18%). This was common for all experimental predator species, where means of 53.90, 53.90 and 54.45% were recorded for the predation percentages of *Chrysopa septempunctata, Coccinella septempunctata* and *Coccinella undecimpunctata*, under field conditions, respectively. On the other hand, the corresponding values for the preceding predators under laboratory conditions were 34.06, 39.35 and 40.60% respectively.

The same table (Table1) clearly shows that adults of *C. undecimpunctata* seemed to be the most voracious feeder (47.53%), followed by *C. septempunctata* (46.63%) and *Chrysopa septempunctata* (44.25%) with no significant difference between these means.

It can be also noticed in the same table (Table: 1) that the consumption rate of the prey in the field is more than that in the laboratory for the three predators, it also shows that feeding capacity decreases as the number of predator increases, which occurred, specially, in *C. septempunctata*, because of its high mutual interference which is higher that the other two predators. The results of t-test show that, the consumption rate of one predator in the field is significantly higher ($p<0.005$) than that under laboratory conditions, and that applies for the three predators, where the mean percentages of consumed preys of the three predators, at the population density of one predator, under field and labcratory conditions were 59.75 and 74.42%, respectively. An increase in the density of the predator caused an obvious decrease in the rate of predation and vise versa, being lowest (17.08 and 35.92% under laboratory and filed conditions, respectively) at the population density of ten predators.

The correlation between the predation-rate and the density of any of the tested predator was worked out; the straight line relation was obtained and plotted in Figure (1). The statistical values are summarized in Table 2 as follows:

Table (1): Percentages of predation of the three adult predators under different densities fed on *C. hesperidum* L under laboratory and field conditions

Densities of the predator* (No./dish)	Experimental predators							
	Chrysopa septempunctata		*Coccinella septumpunctata*		*Coccinella undecimpunctata*		Mean	
	Lab.	field	Lab.	field	Lab.	field	Lab.	field
1	54.25	70.00	66.00	77.50	59.00	75.75	59.75	74.42
4	42.50	63.00	54.75	67.25	53.75	63.00	50.33	64.42
6	33.25	53.25	39.00	52.50	40.75	55.25	37.67	53.67
8	25.25	45.75	23.25	38.50	29.75	41.75	26.08	42.00
10	17.75	37.50	13.75	33.75	19.75	36.50	17.08	35.92
Average	34.60	53.90	39.35	53.90	40.60	54.45	38.18	54.09
Mean	44.25		46.63		47.53			

Table (2): slope and the intercept values for the three tested predators under the laboratory and field conditions

Predator	Laboratory			Field		
	slope	intercept	r^2	slope	intercept	r^2
Chrysopa. septempunctata	-4.1004	58.437	0.9993	-3.7008	75.365	0.9860
C. septumpunctata	-6.1199	74.845	0.9815	-5.2480	84.358	0.9737
C. undecimpunctata	-4.5779	67.152	0.9612	-4.6245	80.693	0.9882

Fig. (1) shows the change of percentage of predation with the predator capacity for the predators, in the field and in the laboratory, it's clear that the relation is straight line relation, in the form:

$$X = aP + b$$

Where *(X)* is the percentage of predation.

(a) is the slope of the line.

(P) is the predator density.

(b) is the intercept of the line.

Table (2) shows the value of (a) and (b) for the three predators in the laboratory as well as in the field.

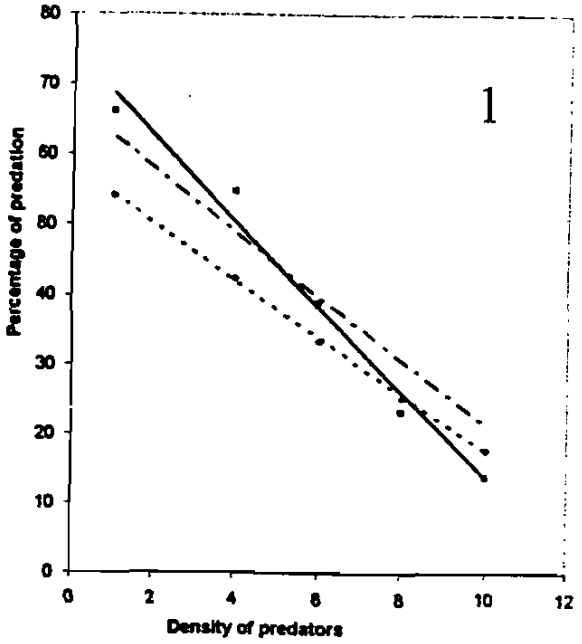

Fig. (1): The relation between the percentages of predation and density of the three predators, where:

—— ***Chrysopa septempunctata***

----- ***C. septempunctata***

-·-·- ***C. undecimpunctata***

1- In the laboratory 2- In the field

In the available literature, larvae of the lacewing *Chrysoperla plorabunda* (Fitch) were evaluated in laboratory and field tests aiming to reduce the population density of the brown citrus aphid *Toxoptera citricida*, these results agree with those obtained by Michaud (2001) who found a great difference between the laboratory and field

Zou Yunding *et al.* (1997) found that the searching behavior of larvae *Harmonia axyridis* (Pallas) coccinellidae affected by many factors such as the distribution area and light intensity. Behavior of some adults of coccinellid species were studied by Gravsted and Klepetka (1992). They noticed that the level of predation may depend more on plant architecture than on the particular species of natural enemies present. According to Sengonca and Kranz (2001), the reactions of beneficial arthropods to stimuli of prey are becoming more important in the biological control of pests. They added that the volatiles emitted by the odor source "both plants and aphids" were attractive to about 28% of the reared predators and to 38% of the field-collected predators. In 1998, Slosser *et al.* found that Lady beetles and lacewing affected by many factors such as population development and rate of population decline of the prey, *A. gossypii*, which were mostly influenced by plant nutrition, solar radiation, and temperature. Of course, in the field many factors affected the prey-predator relationship and obviously reflected on the predation coefficient and efficiency of the tested predators.

REFERENCES

Awadallah, K.T.; Abou-Zeid, N.A. and M.F.S. Tawfik (1976). Development and fecundity of *Chrysopa carnea* Stephens. Bull. Soc. Ent. Egypt, 59, 323-329.

El-Batran Laila A. (1988). Studies on predator and parasite insects, attacking scale insects and mealy bugs in Dakahlia Governorate. Ph.D. Thesis, Fac. Agric. - Mansoura Univ., Egypt.

El-Batran Laila A. and H. M. Fathy (1991), Biology of Chrysoperla Carnea (steph). In relation to feeding upon *Toxoptera aurantii* and *Coccus hesperidum* L. Egypt. J. Biol. P. Cont., 1 (2), 93-98.

El-Batran Laila A. (1992). Biological study on the development and predation ability of *Chrysopa septempunctata* Wesm. on some mealy bugs. Egypt J. Biol. Pest Control, 2(1): 17-22.

El-Haidari, H.S. and F.I. Aziz (1978). Biology of *Chrysopa septempunctata* (Chrysopidae: Neuroptera) in Iraq. Year-book of plant protection research, Iraq. Min. Agric. and Agrarian Reform (1974/1976): 51-53.

Grevstad, F.S. and Klepetka, B.W. (1992). The influence of plant architecture on the foraging efficiencies of a suite of ladybird beetles feeding on Aphids. Oecologia, 92(3), 399-404, (Network, National Library, Ministry of Agriculture, Dokki.)

Hashem, A.G. and M.E. El-Halawany (1996) Citrus pest problems and their control in the Near East. FAO Plant Production and Protection, 135pp.

Michaud, J. P. (2001). Evaluation of green lacewings, *Chrysoperla plorabunda* (Fitch) (Neurop., Chrysopidae), for augmentative release against *Toxoptera citricida* (Hom., Aphididae) in citrus. J. Appl. Entomology, 125(7): 383-388.

Oncuer, C. (1977). Investigation on the identification, distribution and effectiveness of the families of the natural enemies associated with most important species of scale insects (Coccidae: Homoptera) causing damage to fruit trees in the province of Izmir. Ege Univ., Ziraat Fakultesi Yayinlari, No. 336. [C.F. Rev. Appl. Ent., A, 66(4):2031].

Pasqualini, E. (1975); Tests on the rearing of Chrysopa carnea Steph. (Neuroptera, Chrysopidae) in a controlled environment. Bollettino dell'Instituto di Ent della Univ. degl i studi di Bologna, 32: 291-304. (C.F. Rev. Appl. Ent., A 65:5, 2542).

Selim, A.A. (1997). Some notes on the activity of certain insects predators and parasites of the Hammam Al-Ali area. Mesopotamia J. Agric., 12(1):65-73. [C.F. Rev. Appl. Ent., A, 66(8):3874].

Sengonca, C.; Kranz, J. (2001) A modified, four armed olfactometer for determining olfactory relations reactions of beneficial arthropods, Anzeiger SchädlingsKunde, 74(5):127-132.
(Network, National Library, Ministry of Agriculture, Dokki.)

Slosser-JE, Pinchak-WE, and Rummel-DR (1998). Biotic and abiotic regulation of *Aphis gossypii* Glover in west dry land cotton, Southwestern- Entomologist, 23:1, 31-65.
(Network, National Library, Ministry of Agriculture, Dokki.)

Wang-Ly, and Hu-HL (1987). Studies on *Chrysopa kulingensis* Navas. Natural-Enemies-of-Insects, 9:1, 25-28.
(Network, National Library, Ministry of Agriculture, Dokki.)

Zou ,Yun Ding; Chen,GaoChao; Meng,Qinglei; Geng,JiGuang; Wang, Gong Ming, Zou,Y.D.; Chen,G.C.; Meng,Q.L.; Geng,J.G.; Wang,G.M.(1997). Searching behavior of *Harmonia axyridis* (Pallas) larvae. Acta-Entomologica-Sinica. 40(2):145-150
(Abstract, Network, National Library, Ministry of Agriculture, Dokki)

J. Agric. Sci. Mansoura Univ., 28(5), May, 2003

الكفاءة الافتراسية للحشرات الكاملة من المفترسات *Chrysopa septempunctata* Wesm., *Coccinella septempunctata* L. and *Coccinella undecimpunctata* L. لحشرة *Coccus hesperidum L.* وذلك تحت الظروف الحقلية و المعملية

ليلى عبد الستار عبد اللة البطران .
قسم الحشرات الإقتصادية – كلية الزراعة – جامعة المنصورة

الهدف من الدراسة هو تقييم الكفاءة الافتراسية للحشرات الكاملة لثلاث مفترسات هامة فى البيئة المصرية وهم *Chrysopa septempunctata* *Coccinella septempunctata* و *Coccinella undecimpunctata*

وذلك تحت الظروف المعملية والحقلية عند تغذيتهم على الحشرة القشرية الرخوة باعتبارها حشرة هامة خصوصا فى السنوات الأخيرة حيث أصبحت تهاجم محاصيل هامة وبصورة موسعة مثل محصول قصب السكر وكثير من أشجار الفاكهة

ولقد تمت الدراسة على الحشرات الكاملة من المفترسات الثلاثة السابقة فى صورة كثافات مختلفة تشمل ١و٤و٦و ٨ و١٠ مفترسات, لكل مفترس على حدة على عدد ثابت من الحشرة القشرية الرخوة (٨٠ حشرة) سواء كان ذلك فى المعمل أو الحقل ولقد أظهرت النتائج مايلى :

١- فى جميع الكثافات المختلفة كانت أعلى كثافة افتراسية عندما كانت كثافة المفترس (فرد واحد) وذلك فى المفترسات الثلاثة سواء كان ذلك فى المعمل أو الحقل وقد بلغ نسبة متوسط افتراس حشرة *Chrysopa septempunctata* فى المعمل ٥٤,٢٥% أما فى الحقل كان نسبة متوسط ما افترسه هو ٧٠,٠٠% أما فى المفترسين *Coccinella septempunctata* و *Coccinella undecimpunctata* كان نسبة متوسط ماافترس فى المعمل ٦٦,٠٠ و ٥٩,٠٠% وفى الحقل كان متوسط الافتراس ٧٧,٥٠ و٧٥,٧٥% على التوالى .

٢- الكفاءة الافتراسية فى الحقل أكثر وبفروق معنوية واضحة عن المعمل ولقد بلغ مجموع نسبة متوسط الافتراس فى المفترسات الثلاثة فى المعمل ٥٩,٧٥% و فى الحقل ٧٤,٤٢ % وذلك فى حالة عدد المفترسات (فرد واحد فقط) .

٣- كلما زادت عدد المفترسات تقل معها الكفاءة الافتراسية وذلك فى جميع المفترسات الثلاثة ولكن كانت بصورة ملحوظة وكبيرة فى المفترس *Coccinella septempunctata* . وذلك لظاهرة ال mutual interference .

٤- لقد أظهر المفترس *Coccinella undecimpunctat* أكثر كفاءة افتراسية من المفترسين الأخرين سواء كان ذلك فى المعمل أو الحقل وقد بلغ نسبة متوسط ما افترسه فى المعمل ٣٩,٣٥% أما فى الحقل بلغ ٥٣,٩٠%وذلك مجموع ما افترسه فى الكثافات المختلفه .

٥- من الملاحظ أن المفترسات الثلاثة تلعب دور هام فى القضاء على الحشرة القشرية الرخوة بنسبة كبيرة قد تصل إلى أكثر من (٥٠%) فى الحقل وفى هذه الدراسة بلغ نسبة متوسط ما افترسته المفترسات الثلاثة فى الحقل فى جميع الكثافات هو ٥٣,٩٠ و ٥٣,٩٠ وأخيرا ٥٤,٤٥% فى Chrysopa septempunctata, Coccinella septempunctata, Coccinella *undecimpunctata* على التوالى.