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Predation Efficacy of *Chrysoperla carnea* (Steph.) on *Parlatoria proteus* (Curtis) and *Fiorinia phoenicis* (Balachowsky) under Semi Field Conditions at Giza Governorate

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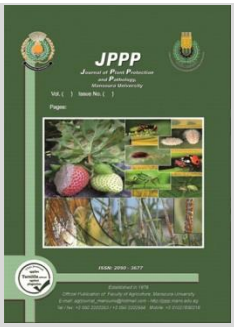

ABSTRACT

An experiment was conducted to evaluate the efficacy of *Chrysoperla carnea* (Steph.) against two hard scale insects *Parlatoria proteus* (Curtis) and *Fiorinia phoenicis* (Balachowsky); Hemiptera:Diaspididae, in the nursery of El-Orman Botanical Garden Giza Governorate by releasing 5,10 and 15 individuals of 2nd larval instar of *C. carnea* and counts were taken 15, 30 and 45 days after treatment. Results showed that there were an effective reduction percentage in population of both scale insects. The mean of reduction percentages after 45 days after treatment in case of *P. proteus* different stages were 52.54, 68.95 and 77.14% for 1st, 2nd and 3rd treatments, respectively. While mean of reduction percentages of different stages of *F. phoenicis* recorded 58.38, 59.03 and 65.34% for 1st, 2nd and 3rd treatments, respectively.

Keywords: *Chrysoperla*, Diaspididae, Predation, *Parlatoria*, *Fiorinia*.

INTRODUCTION

Parlatoria proteus Signoret and Fiorinia date scale *Fiorinia phoenicis* Balachousky (Hemiptera : Diaspididae) are hard scale insects causing severe damages as they have a piercing sucking mouth parts, it sucks plant sap which cause yellowish color then leaf dryness and plant weakness. *P. proteus* is found to infest laural shrubs (*Laurus nobilis* (Family: Lauraceae) which is an aromatic evergreen shrub which is used as a herb in cooking. Also, it used as an ornamental plant in some regions and it has some medical effects where it was used in treatment of some diseases like an aid to digestion and in the treatment of bronchitis and influenza (Phillips and Foy 1990) and treats various types of cancer (Duke and Ayensu 1985) Also, laurel oil was supposed to treat: paralysis, spasms, sciatica, bruises, headaches, catarrhs, ear infections, and rheumatismin (Clapham *et al.* 1962). While, *F. phoenicis* was found infesting different palm species severely all over the year, it recorded 3 annual overlapping generations (Elwan *et al.* (2011) it also found to infest brahea palms (*Brahea* sp.) which is an evergreen palm related to Family: Arecaceae used commonly as an ornamental plant grows in warm temperature.

***Chrysoperla carnea* (Stephens) larvae (Neuroptera :** Chrysopidae) is a polyphagous predator especially on species related to Order Hemiptera like aphids, whiteflies, coccids, and mealybugs (McEwen *et al.* 2001). It seems to be a good candidate to be used in IPM programs, as it is a voracious feeder (Balasubramani and Swamiappan, 1994) its easily mass produced (Morrison , 1985 and El-Arnaouty 1991) and tolerant to some groups of pesticides (Hassan *et al.* 1985, Bigler and Waldburger 1994, Chen and Liu, 2002).

The aim of this study was to evaluate the feeding potential of *C. carnea* larvae as biological control agent to the different insect stages (nymphs and adults) of both hard scale insects; *P. proteus* and *F. phoenicis* under semi field conditions.

MATERIALS AND METHODS

Source of green lacewing *Chrysoperla carnea* larvae:

The second larval instar of *C. carnea* was brought from Predators Mass Rearing Laboratory, Faculty of Agriculture- Cairo University. Larvae were placed in a plastic box covered with a muslin sheet. Ephestia eggs and sawdust were added to provide nutrition for larvae and to avoid cannibalism until the implement of the experiment.

Experimental design:

This experiment was conducted in nursery of El-Orman Botanical Garden, Giza Governorate on 9th October 2017, with corresponding temperature 28°C and average relative humidity was 55%.

In this experiment, laural shrubs and brahea palms, 2 years old planted in pots were chosen with heavy infestation with *P. proteus* and *F. phoenicis*, respectively, and not received any insecticides treatments for two years prior to the experiment. The treatments were 5 leaves and 5 leaflets replicated 3 times for each experiment for laural and brahea, respectively and treated by releasing the 2nd larval instar of *Chrysoperla carnea* with three rates 5, 10, 15 larvae/ treatment. *Chrysoperla* larvae were placed carefully on infested leaves by aid of a fine camel brush.

Sampling procedures

Post treatment counts were taken after 15, 30 and 45 days. Samples were kept in a polyethelene bags and transferred immediately to the laboratory to be inspected. Different stages of both insects were detected (alive

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individuals) to calculate the reduction percentage in population.

Statistical analysis

Percentage of reduction in population of both *Parlatoria proteus* and *Fiorinia phoenicis* different stages in proportional to the pre-treatment count were estimated according to Stafford and Summers (1963) equation.

$$R = \frac{\text{Pre-treatment count} - \text{Post-treatment counts}}{\text{Pre-treatment counts}} \times 100$$

The obtained results were analyzed using Costat computer program to figure the "F value" and L.S.D. between treatments of different larval instars of *C. carnea.*

RESULTS AND DISCUSSION

1-Biological control of *Parlatoria proteus* infesting laural shrubs:

This experiment was conducted by releasing of the 2nd larval instar of *Chrysoperla carnea* to prey on *P. proteus* different stages infesting laural shrubs in the nursery of El-Orman Botanical Garden on October 2017.

A) 1st treatment (5 individuals of 2nd larval instar of *C. carnea*):-

Results presented in Table (1) and illustrated in Fig. (1), showed that the highest reduction percentage in total population of *P. proteus* was recorded after 45 days after treatment with 61.81% followed by the 2nd post count with 58.79% then the 1st post count with 37.04%. Also, statistical analysis revealed that there was a significantly difference between 1st count and both 2nd and 3rd counts with F value = 5.47 and L.S.D. = 19.97.

B) 2nd treatment (10 individuals of 2nd larval instar of *C. carnea*):-

Data obtained in Table (1) and illustrated in Fig. (1), cleared that, it followed the same as in the previous experiment as the 3rd post count (45 days after treatment) recorded the highest reduction percentage in total population followed by 2nd post count (30 days after treatment) then the 1st post count (15 days after treatment) with reduction percentage 75, 67.5 and 64.37%, respectively.

Besides there was no significant difference between counts with F value = 4.41.

C) 3rd treatment (15 individuals of 2nd larval instar of *C. carnea*):-

Results in Table (1) and arranged in Fig. (1) revealed that the reduction percentage of total population of *P. proteus* were arranged ascendingly as follows 69.51, 79.41 and 82.50 % after 15, 30 and 45 days after treatment, respectively.

It was obvious that there was a significant difference between 1st count and both 2nd and 3rd counts with F value =10.14 and L.S.D. = 7.10.

Table 1. Reduction percentages in population of *P. proteus* different stages infesting laural shrubs with three treatments.

Sampling dates	1st treatment (5 larvae)				2nd treatment (10 larvae)				3rd treatment(15 larvae)			
	Nymphs	Adults	Ovipositing females	Total population	Nymphs	Adults	Ovipositing females	Total population	Nymphs	Adults	Ovipositing females	Total population
1st post count(after 15 days after treatment)	31.11	23	57	37.04b	66	69	58.12	64.37a	73	68.4	67.12	69.51b
2nd post count (after 30 days after treatment)	62.22	57.14	57	58.79a	71.23	69.27	62	67.50a	82.14	78	78.1	79.41a
3rd post count(after 45 days after treatment)	69	51.43	65	61.81a	76	77	72	75.00a	87.5	78	82	82.50a
Mean of total population of treatments				52.54b				68.95ab				77.14a
F value between counts				5.47				4.41				10.14
L.S.D. between counts				19.97				n.s.				7.10
F value between treatment						5.46						
L.S.D.						18.54						

a,b,c letters indicating significantly differences between counts and treatments

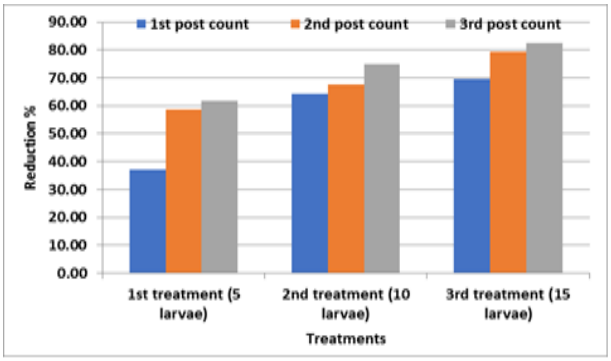

Fig. 1. Reduction percentages in population of *P. proteus* different stages infesting laural shrubs with three treatments in El-Orman Botanical Garden 2017

It was obvious that there was a significant difference between treatments with F value =5.46 and L.S.D. = 18.54.

2- Biological control of *Fiorinia phoenicis* infesting brahea palms:

This experiment was conducted in El-Orman Botanical Garden on October 2017 by releasing of the 2nd larval instar of *Chrysoperla carnea* to prey on *F. phoenicis* different stages infesting brahea palms.

Results in Table (2) and demonstrated in Fig. (2), showed that, the following:

a. 1st treatment (5 individuals of 2nd larval instar of *C. carnea*):-

Obtained results showed that, reduction percentage of total population of *F. phoenicis* 15 days after treatment was 61.61%, then it gradually increased to reach 65.88%

after 30 days and then it decreased to 47.64% after 45 days from treatment. It was clear that there was no significant difference between counts where Fvalue was 1.45.

b. 2nd treatment (10 individuals of 2nd larval instar of *C. carnea*):-

Data presented in Table (2) revealed that the percentage of reduction of total population recorded 64.70% 15 days after treatment then it decreased gradually in next counts with 62 and 50.40% after 30 and 45 days from treatment. Also, there was no significant difference between counts F value = 1.22.

c.3rd treatment (15 individuals of 2nd larval instar of *C. carnea*):-

Almost the results took the same trend as previously mentioned results where the reduction percentage of the total population of the 1st count (15 days after treatment) recorded 64.85%, then it recorded 69.99 and 61.19 % after 30 and 45 days after treatment, respectively.

The statistical analysis showed that there were no significant differences between counts with F value = 0.27. Also, there no significant difference between treatments with F value =0.79.

Table 2. Reduction percentages in population of *F. Phoenicis* different stages infesting brahea palms with three treatments.

Sampling dates	1st treatment (5 larvae)				2nd treatment (10 larvae)				3rd treatment (15 larvae)			
	Nymphs	Adults	Ovipositing females	Total population	Nymphs	Adults	Ovipositing females	Total population	Nymphs	Adults	Ovipositing females	Total population
1st post count(after 15 days after treatment)	75.27	62.00	47.56	61.61	73.00	62.10	59.00	64.70	87.84	58.30	48.40	64.85
2nd post count (after 30 days after treatment)	75.59	61.91	60.13	65.88	77.19	54.80	54.00	62.00	76.76	77.81	55.40	69.99
3rd post count(after 45 days after treatment)	67.57	36.10	39.26	47.64	66.22	45.54	39.43	50.40	66.14	65.31	52.12	61.19
Mean of total population				58.38				59.03				65.34
F value between counts				1.45n.s.				1.22n.s.				0.27n.s.

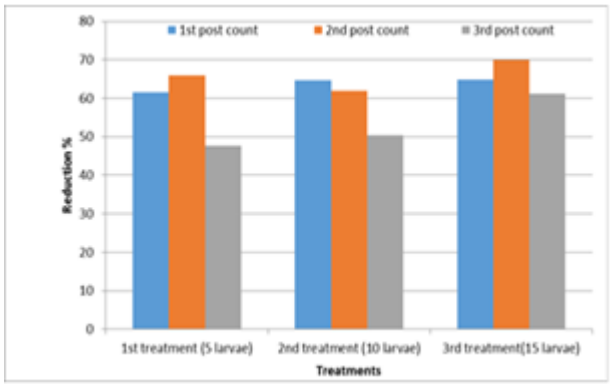

Fig. 2. Reduction percentages in population of *F. Phoenicis* different stages infesting brahea palms with three treatments in El-Orman Botanical Garden 2017

Results presented in Tables (1&2) showed that reduction percentage of nymphs was higher than adults and ovipositing females in the 3 treatments as well as the three counts after treatments. That may be because nymphs especially the 1st instar (crawlers) does not have their scales yet which consider an obstacle to the larvae of *C. carnea* to prey on. While, the adult females and ovipositing females are almost complete or totally secreted the scales.

In addition, it was shown that the reduction percentages were lower in the third counts (after 45 days after treatment) than the 1st (after 15 days) and 2nd count (after 30 days) after treatments. That could be of the larvae of *C. carnea* devour on most of the different stages of both *P. proteus* and *F. phoenicis*.

Also, it was cleared that there was a positive relation between numbers of released larvae of *C. carnea* and reduction percentage where the third treatment showed higher reduction percentages than the other two treatments.

These results of the previous two experiments are in agreement with those conducted on diaspid insects and mealybugs El-Sahn and Gaber (2012) stated that *C. carnea* has a high efficacy as a biological control agent on *Planococcus citri* different stages as it consumed about 194.86 nymphs/larva. Helmy (2014) in Egypt recorded that the predator caused the highest reduction (84.97%) of the total population of *Saissetia oleae* (Olivier) in the 1st post treatment and the highest reduction (32.94%) in the 2nd post treatment of the total population of *Hemiberlesia lataniae* (Signoret) in March at Giza Governorate. El-Zahi (2017) in no choice trails, 3rd instar larvae of *C. carnea* were the most voracious feeder comparing to 1st and 2nd instar larvae and consumed 673.3+ 6.38, 2756.3 + 20.10, 326.9 + 5.07 and 115.2 + 3.45 insects of aphid, 1st , 2nd , and 3rd instar nymphs of the mealybug *Phenacoccus solenopsis*, respectively. First instar nymphs of the mealybug were significantly the most consumed prey.

Also, other trials conducted on other insect species related to Order Hemiptera showed a high effectiveness of *C. carnea* as a predator. Zaki *et al.* (1999) stated that double releases of *C. carnea* (1:5 predator**:** aphids**)** achieved 100% reduction in *Aphis gossypii* (Glover) after 12 days. Chakraborty and Korat (2010) stated that 1st, 2nd and 3rd instars of *C. carnea* consumed 185 to 321 of *A. gossypii*. Also, they concluded that *C. carnea* can be utilized more efficiently in cotton ecosystem than others as it feeds not only on aphids and other sucking pests but also on bollworm eggs. Younes *et al.* (2013) evaluated the efficiency of *C. carnea* second instar larvae released at three different rates (3, 5 and 7 larvae / plant) for suppression aphids, *A. gossypii* and *Myzus persicae* as well as nymphs and pupae of *Bemisia tabaci* on cantaloupe plants. The experiment was conducted under semi-field conditions during early summer plantation. The results

were obtained after 21 days from releasing date at rate of 5 predatory larvae / plant, which reduced the populations of aphids and whitefly by 73.9 and 83.07%, respectively.

CONCLUSION

It can be concluded that *C. carnea* is a very effective biocontrol agent for both diaspid insects *P. Proteus* and *F. phoenicis* and can be included in IPM programs

REFERENCES

Balasubramani, V. and Swamiappan M. (1994): Development and feeding potential of the green lacewing, *Chrysoperla carnea* (Stephens) Neuroptera: Chrysopidae on different insect pests of cotton. Anzeiger fur Schadling Skunde Pflanzenschutz ummeitschutz, 8: 165-167.

Bigler, F. and Waldburger M. (1994): Effect of pesticides on *Chrysoperla carnea* Stephens. (Neuroptera: Chrysopidae) in the laboratory and semi field. J. Appl. Entomol., 17:55-59.

Chakraborty, D. and Korat D. M. (2010): Feeding efficiency of green lace wing, *Chrysoperla carnea* (Stephens) on different species of aphids. Karnataka J. Agric. Sci.,23 (5) :793-794.

Chen, T.Y. and Liu T.X. (2002): Susceptibility of immature stages of *Chrysoperla rufilabris* (Neuroptera: Chrysopidae) to pyriproxyfen, a juvenile hormone analog. J. Appl. Entomol., 126: 125-129.

Clapham, A.R., Tutin T.G. and Warburg E.F. (1962): Flora of the British Isles. 2nd ed. Cambridge University Press, Cambridge.

Duke, J.A. and Ayensu E.S. (1985): Medicinal Plants of China Reference Publications, Inc. 1985 ISBN 0-917256-20-4

El-Arnaouty, S.A. (1991): Studies on the biology and manipulation of *Chrysoperla carnea* (Stephens) and *Chrysoperla sinica* Tjeder (Neuroptera: Chrysopidae) for controlling the green peach aphid *Myzus persicae* Sulzer (Homoptera: Aphididae) in green houses. Ph.D. Thesis, Cairo Univ., PP. 247.

El-Sahn, O.M.N. and Gaber N.M.A. (2012): Feeding potential of *Chrysoperla carnea* (Stephens) on different stages of *Planococcus citri* (Risso) under laboratory conditions. Egypt. J. Biol. Pest Control, 22(2):217-221.

Elwan, E.A., El-Sayed M.I. and Serag A.M. (2011): Seasonal activity of Fiorinia date scale, *Fiorinia phoenicis* Balachowsky (Hemiptera: Diaspididae) on date at Giza Governorate, Egypt. Egypt. J. Agric. Res., 89 (2):549-565.

El-Zahi, S.E. (2017): Preference and Predatory Potential of *Chrysoperla carnea* (Stephens) and *Coccinella undecimpunctata* Linnaeus on *Phenacoccus solenopsis* Tinsley: A New Threat to the Egyptian Economic Crops. Alex. Sci. Exchange J.,38(4):837-843.

Hassan, S.A.; Klinghauf F. and Shanin F. (1985): Role of *Chrysopa carnea* as an aphid predator on sugar beet and the effect of pesticides. Zeitschrift fur angewandte Entomologie, 100: 163-174.

Helmy S.M.Y. (2014). Ecological studies on some olive pests in Egypt and their biocontrol. Ph.D. Thesis. Fac. Aric., Cairo Univ., Egypt, 172 pp.

McEwen, P.K.; New T.R.R. and Whittington A. (2001). Lacewings in the crop environment. UK: Cambridge University Press, 546pp.

Morrison, R.K. (1985): *Chrysopa carnea*, in P. Singh and R. F. Moore (eds.), Hand book of insect rearing, Elsevier, Amsterdam, vol. (i): 419-426.

Phillips, R. and Foy N. (1990): Herbs Pan Books Ltd. London. ISBN0-330-30725-8

Stafford, E.M. and Summers F.M. (1963): Evaluation control of San Jose scale. Hilgardia, 35(2):13-32

Younes, M.W.F.; Shoukry I. F.; Metwally S. A.G. and Abd-Allah Y. N. M. (2013): Efficiency of second instar larvae of *Chrysoperla carnea* to suppress some piercing sucking insects infesting cantaloupe under semi-field conditions. Egypt. J. Agric. Res., 91 (1):169-179

Zaki, F. N.; EL-Shaarawy; M. F. and Farag, N. A. (1999): Release of two predators and two parasitoids to control aphids and whiteflies. J. Pest Science 72, 19-20.

دراسة الكفاءة الإفتراسية لـ *Chrysoperla carnea* على حشرتي *Parlatoria proteus* و *Fiorinia phoenicis* تحت الظروف شبه الحقلية بمحافظة الجيزة

سماح محمد ياسين حلمي ، أمنية محمد نبيل الصحن و مها إبراهيم عبد الرازق

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أجريت تجربة لتقييم فاعلية أسد المن *Chrysoperla carnea* ضد حشرتي *Parlatoria proteus* و *Fiorinia phoenicis* واللتان تتبعان الحشرات القشرية المسلحة فصيلة Diaspididae ورتبة Hemiptera في مشتل حديقة الأورمان النباتية بمحافظة الجيزة وتمت بإطلاق 5 ، 10 و 15 فرد من العمر اليرقي الثاني لأسد المن. وتم أخذ العينات بعد 15 ، 30 و 45 يومًا من الإطلاق. أظهرت النتائج أن هناك نسب خفض فعالة في تعداد كل من الحشرتين. كان متوسط نسب الخفض بعد 45 يوماً من الإطلاق في الأعمار المختلفة من حشرة *P. proteus* 52.54 و 68.95 و 77.14٪ للمعاملة الأولى ، الثانية والثالثة على التوالي. بينما سجلت متوسط نسب الخفض في الأعمار المختلفة لحشرة *F. phoenicis* 58.38 ، 59.03 و 65.34٪ للمعاملة الأولى ، الثانية والثالثة على التوالي.