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AVALABILITY OF USING APHID LION *Chrysoperla carnea* (Step.) AGAINST *Tetranychus urticae* (KOCH).

Iman I. Imam[1] and M. A. Nawar[2]
Economic Entomology Unit[1] and Animal Pest Unit[2], Plant Protection Department, Desert Research Center.

ABSTRACT

The functional response of the three larval instars of predatory green lacewing, *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae), fed the two spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae). First and second instars functional type II predator responses against *T. urticae* prey. Third instar showed type III functional response. The rate of the three larval instars of *C. carnea* attack was 0.0113, 0.061 and 0.057 respectively. Whereas handling time (T_h) of the three larval stages of *C. carnea* was recorded 0.5639 and 0.048 respectively 0.021h., on the other side, the expected maximum consumption (T/ T_h) of three larval instat of *C. carnea* is 42.8, 500 and 1142 per day for adult *T. urticae* respectively. The results of this study showed that larvae of *C. carnea*, mostly the final instars, have well possibility to benefit from predation spider mites.

INTRODUCTION

Natural enemies (predators and parasites) play a very important part in controlling pest populations. *Chrysoperla carnea*, known as the common aphid lion, green lacewing, is an insect in the Chrysopidae family. The adults feed on nectar, pollen and aphid honeydew and are not predatory, but the larvae are active predators and feed small insects and soft- bodied phytophagous arthropods (Pappas *et. al*. 2007),. It has been used in the biological control of pests on crops. This feature helps the survival of this predator for long periods and increase the ability of predatory on different pests (Mahdian *et.al*. 2007). The two spotted spider mite, *Tetranychus urticae* Koch. (Acari: Tetranychidae), It is an important pest in agriculture systems (Walter *et.al.* 1999). Pesticides usually to provide satisfactory results fail due to the development pest resistance to various types of Chemical control in a few years (Cranham and Helle 1985). Pesticide has also adverse effects on the interest In addition to other untargeted living creature in the surroundings (Alzoubi and Çbanoğlu 2007). There has been a growing interest in integrating biological control methods against spider's management programs. By using natural enemies in in control programs was reduced use of chemical pesticides and will be avoiding the use of higher doses of these pesticides (Sarmento *et.al*. 2007). Some studies have been conducted on the predatory ability of aphid lion on acarine preys (Pappas, *et. al*. 2008) but not on the functional response, [i.e. The percentage of the death of the prey increases with the increase of the numerical prey (Solomon, 1949) (Holling, 1959&1961) and (Juliano, 2001)]. Partly associated with the effectiveness of predator to the type of its functional response either in the field or from laboratory experiments information. It can be used to deduce the basic mechanism of the predator-prey interactions in field conditions (Houck and

Strauss 1985). In addition, Study of respond functional help in the success of biological control agents (Wiedenmann and Smith 1997)

The aim of this study was to identify the type and estimate the functional response of three larval instar of *C. carnea* on different densities of adult of *T. urticaeat*. Adult stages have been used because it is more effective (Fenlon and Faddy 2006).

MATERIALS AND METHODS

1-Origin and maintenance of arthropod cultures:

Tested insect:

The predator, *Chrysoperla carnea* was initially collected from the cotton field and reared on Angoumois grain moth, *Sitotrogacerealella* at the same mentioned laboratory conditions. The adults of *C. carnea* were sexed and 10 pairs of adults were placed in plastic boxes (22x13x10 cm) covered with black muslin for deposited eggs and changed daily. Drops of Semi artificial diet solution consists of 2g yeast extract, 1g fructose and 1cm distilled water were provided on tape stacked on the muslin cover. The deposited eggs were collected daily and kept in glass jars until hatching. The hatched larvae were reared on *S. cerealella* eggs. (Karim and Nahla 2009).

Mites culture:

Two-spotted spider mite, *T. urticae* was collected from naturally infested plant. *T. urticae* was maintained in the laboratory on clean freshly mulberry plant leaves arised on moisten on cotton pads in Petri dishes. *T. urticae* were captured from the culture and offered to the predator. Massrearing was carried out in the laboratory of the Economic Entomology Unit, Plant Protection Department, Desert Research Center.

2- Functional response experiments:

The functional response tests it was directed with the three larval instars of *C. carnea* on *T. urticae.* The First instar larval (<16 hours old) were taken from the culture. In the second and third instar *C. carnea* for use in the experiments, larvae were first raised separately in petri dishes to the desired location. The predatory larvae used in experiments were hungry for 12 hours before using them by placing them alone in a petri dish without prey. *C. carnea* larvae were given individual form mite densities of 10, 20, 40,60, 80 and 20, 40,60, 80, 100, 120, 140 and 20, 40,60, 80, 100, 120 140 the first, second and third larvae, steps, respectively. *C. carnea* was put to the experimental arenas one hour after transfer of prey. They are produced by adult female's mites eggs were extracted during the experiment every two hours. It counted the number of prey consumed within 24 hours after the launch predators in the experimental arenas. Not replaced swap consumed during the test. Use ten repetitions for each prey density. In order to control *T. urticae* adults are predators same number of repetitions for each of us was fixed, without prey density

3- Data analyses:

The type of functional response (type II or III) regression analysis using [SAS / STAT CATMOD procedure (SAS Institute, 2001)] in the

proportion of prey consumed over Prey offered (Trexler and Travis in 1993 & Trexler determined *et al.,* 1988). The sign of the estimated by linear logistic regression was used to determine the functional response type. If the sign is negative, a type II functional response is clear, while a positive sign indicates a type III functional response. The proportion of prey consumed decreases monotonically with the density of the prey in a type II reaction, but depend more on prey density range in density response type III (Juliano, 2001). In this study, because the trial was conducted without replacement of the prey, random predator equation (Juliano 2001, Rogers 1972 & Royama 1971) were used to calculate the parameters of attack rate (a) and handling time (T_h) both functional reactions of type II and III. A functional response type II, the next model used to be suitable for the experimental data:

$$\mathbf{Ne = N_0 \{1\text{-}exp [a (T_h N_e - T)]\}} \quad \mathbf{[1]}$$

Ne: the quantity of devoured prey..

N_0: the total number of prey given.

T: the total time available for the predator (in this study T= 6 h).

T_h: the handling time.

a: the attack rate.

By replacing the equation $a = (d+bN_0)/(1+cN_0)$ the average calculated to the first density of prey in [1], a model is obtained for a functional response type III, where b, c and d are unchanging factor (Hassell 1978).

$$\mathbf{N_e = N_0 \{1\text{-}exp [(d+bN_0) (T_h N_e - T)/ (1+cN_0)]\}} \quad \mathbf{[2]}$$

In instance the data displayed a functional response type III (third instar lacewing larvae to adult females of *T. urticae*), the parameters C and D are not significantly different from 0 [ie, a confidence interval of 95 % (CI) including 0], and therefore, a type III reduced to adjust the experimental data:

$$\mathbf{N_e = N_0 \{1\text{-}exp [bN_0 (T_h N_e - T)]\}} \quad \mathbf{[3]}$$

The parameters were evaluated utilizing PROC NLIN method of SAS (SAS Institute 2001) and compared on the basis of the confidence limits of 95%.

RESULTS AND DISCUSSION

Functional response, Even however the significant impact; yet it can not be ascribed to the achievement or disappointment that was declared in. biocontrol programs. For instance, there are different components, for example, inborn development rates, predation and rivalry, and the host attributes, and natural complexities (abiotic and indispensable variables), additionally have a noteworthy effect on the predator populace in the productive administration of prey (Pervez and Omkar 2005). The normal number of spider mites who was attacked with *C. carnea* Proportional to prey density during 24 h period. Prey consumption by with the three larval instars of *C. carnea* increased from 10 to 41, 10 to 71 and 10 to 89 individuals with increasing density of *T. urticae*, respectively. While, the ratio of killed preys by three larval instars of *C. carnea* decreased from 1 to 0.193, 1 to 0.547 and 1 to 0.596 with increasing density of *T. urticae*, respectively.[Figure 1(A) and (B)]. A decrease in the proportion of prey consume with increasing prey density is common for arthropods predator (Holling 1961).

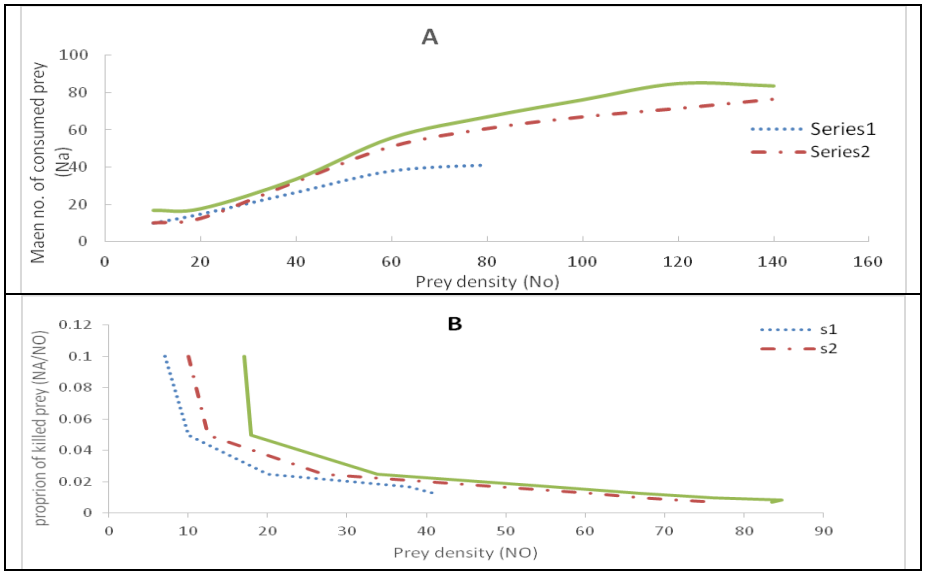

Figure 1. (A) and (B) Observed functional response of first, second and third larval instars of *Chrysoperla carnea*to the adult females of *Tetranychus urticae* densities

Data presented in (Table 1) showed that the outcome of the logistic regression first, second and third larval instars of *C. carnea* to *T. urticae* densities reflected a type II functional response; in all cases, the sign of the linear term was negative (Table 1).Whereas, the type of functional response can be determined based on the sign of the linear coefficient: negative for type II and positive for type III (Juliano 1993).

Table 1. Results of logistic regression analyses, indicating estimates and standard errors of linear, quadratic and cubic coefficient for the proportion of prey eaten by *C. carnea* against the initial prey number offered at 25 °C.

Larval instars	Coefficient	Estimate	SE	Chi-Square	*p*
First	Intercept P_0	-5.2321	1.6235	10.39	0.0013
	Linear P_1	0.277	0.2281	1.47	0.2246
	Quadratic P_2	-0.0110	0.00898	1.50	0.2212
	Cubic P_3	0.000145	0.000103	1.98	0.1596
Second	Intercept P_0	1.5332	0.3829	16.04	<.0001
	Linear P_1	-0.1323	0.0167	62.73	<.0001
	Quadratic P_2	0.00173	0.000213	65.73	<.0001
	Cubic P_3	-6.25E-6	8.198E-7	58.18	<.0001
Third	Intercept P_0	-0.1376	0.4233	0.11	0.7451
	Linear P_1	-0.074	0.0178	17.34	<.0001
	Quadratic P_2	0.00110	0.000223	24.46	<.0001
	Cubic P_3	-4.15E-6	8.511E-7	23.82	<.0001

The functional response data of third larval instars of *C. carnea* to density of *T. urticae* were successfully fitted to the Holling disk equation (Holling 1959) figure 1(B), (Table 2).

The attack rate of the three larval instars of *C. carnea* was 0.0113, 0.061 and 0.057, respectively (Table 2). Whereas, the handling time (T_h) of the three larval instars of *C. carnea* recorded was 0.5639, 0.048 and 0.021, respectively. On the other hand, expected maximum consumption (T/T_h) of three instar larvae of *C. carnea* was 42.8, 500 and 1142 per day of *T. urticae* adult, respectively.

Table 2. Effect of *T. urticae* stage on the attack rate (a), handling time T_h and the maximum number of consumption (T/T_h) on *C. carnea* derived from random predator equation.

Stage	A	Asymptotic 95% CI		T_h	Asymptotic 95% CI		T/T_h
		Lower	Upper		Lower	Upper	
First	0.0113 ± 0.049	0.013	0.212	0.5639 ± 0.4180	-0.2770	1.4048	42.8
Second	0.061±0.0966	0.042	0.081	0.048±0.105	-0.258	0.161	500
Third	0.057± 0.09576	0.037	0.076	0.021± 0.103	-0.226	0.184	1142

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مدي امكانية أستخدام المفترس أسد المن في مكافحة العنكبوت الأحمر

إيمان إبراهيم إمام[١] و محمد عادل نوار[٢]
١- وحدة الحشرات الاقتصاديه- قسم وقاية النبات- مركز بحوث الصحراء
٢- وحدة الآفات الحيوانيه- قسم وقاية النبات- مركز بحوث الصحراء

تعتبر حشرة اسد المن أحد اهم الحشرات النافعة في المكافحة الحيوية ضد العديد من الآفات الزراعية. وقد نفذت الدراسة الحالية لتحديد فاعلية المفترس أسد المن في السيطرة علي العنكبوت الأحمر، وتضمنت الدراسة تحديد نمط الاستجابة الوظيفية للمفترس مع كثافات متنوعة من الفريسة بعد ٢٤ ساعه من بدء التجربة . وقد أظهر العمر اليرقي الأول والثاني للمفترس توافقه مع النمط الثانى من الاستجابة الوظيفية في حين أظهر العمر اليرقي الثالث توافقه مع النمط الثالث من الاستجابة الوظيفية . وقد سجل معامل الهجوم للأطوار اليرقيه المختلفه لأسد المن ٠.٠١١٣ و٠.٠٦١ و٠.٠٥٧ علي التوالي في حين انخفض وقت المعالجة بتطور يرقات المفترس من ٠.٥٦٣٩ و٠.٠٤٨ و٠.٠٢١ ساعه علي التوالي . وقد سجل أقصى استهلاك متوقع للفريسه ١١٤٢ فى اليوم خلال العمر اليرقي الثالث للمفترس .