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INFLUENCE OF CERTAIN PREY TYPES ON SOME BIOLOGICAL CHARACTERISTICS OF *Chrysoperla carnea* (STEPH.) UNDER CONSTANT TEMPERATURE AND RELATIVE HUMIDITY.

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ABSTRACT

Laboratory experiments were carried out in Economic Entomology Department, Faculty of Agriculture , Mansoura University under constant temperature of 28 ± 2° c and relative humidity of 70 ± 5 % to investigate the influence of some prey types on certain biological aspects of *Chrysoperla carnea* (Steph.) . These prey types were *Aphis gossypii* Glover, *Macrosiphum rosae* (L.), *Aphis nerii* Boyer and *Gynikothrips ficorum* Marchal .

The obtained results indicated that the shortest developmental time was obtained when the larvae of *C. carnea* reared on *M. rosae* (12.07±0.53days), while the longest developmental time was recorded when the larvae of this predator fed on *A. gossypii* (15.46 ± 0.8 days).

The results showed that, the numbers of the insect species as prey consumed by a predator larval stage varied according to insect species as it averaged 194.20± 9.75; 129.28±7.56; 80.58± 4.78 and 132.33±8.42 individuals when fed on *A. gossypii*; *M. rosae* ;*A. nerii* and *G. ficorum*, respectively. The data cleared that, the second and third larval instar were the most efficient in predation. The variation in the prey typs also showed difference in the duration of the larval stage as it averaged 15.46 ± 0.86; 12.07± 0.53; 12.8±0.85 and 11.74 ±1.86 days for previously mentioned species, respectively. Female fecundity also varied from 423.2±7.86; 340.20 ± 5.32; 188.40±2.46 and 423.2±8.42 eggs for *A. gossypii* ; *M. rosae* ; *A. nerii* and *G. ficorum*, respectively.

The obtained results assured the effect of prey kinds on the developmental time, consumpation rate of larval stage and the longevity of male and longevity and fecundity of *C. carnea* female. The highest number of eggs obtained when the females (which their larvae) reared on *G. ficorum ,* while the lowest number of eggs were achieved when they reared on *A. nerii* .

INTRODUCTION

Chrysopids are important predators of some crop pests and their larvae are known to fed on over 80 species of insect pests and ten of tetranychid mites (Kharizanov and Dimitrou, 1972). From chrysopids predators the green lacewing *C. carnea* is one of the most beneficial and prolific predators found on field crops and ornamental plants in many parts of the world (Whitcomb and Bell, 1964), Van den Bosch and Hagen, 1966 ; Abd El- salam , 1995 and Ghanim *et al.* 2009).

Only the larval stage can feed on aphids, thrips, spider, mites, scale insects, mealybugs, whiteflies, leafhoppers and other insects , while the adult live longer and lay more eggs when provided nectar, pollen and insect honeydew . Some biological characteristics of *C. carnea* were studed in different parts of the world (Awadallah *et al.* 1976; El-Dakroury *et al.* 1977;

Afzal and Khan, 1978; Sengonca and Grooterhors, 1985; Ghanim *et al.* 1988; Obryck *et al.* 1989; Abd El-Aziz, 1991; Klingen *et al.* 1996; Osman and Selman, 1996; Morris *et al.* 1998, El-Serafi *et al.* 2000 ; Gautan and tesfaye 2002 ; Sattar *et al.* 2007 and Ghanim *et al.* 2009).

Therefore this investigation has been outlined to study some biological characteristics of *C. carnea* when reared on certain insect pests associated with ornamental plants under laboratory condition.

MATERIALS AND METHODS

Laboratory experiments were carried out in the insectary belonging Economic Entomology Department , Faculty of Agriculture , Mansoura University under constant temperature of 28 ± 2° C and relative humidity of 70 ± 5 %. Four insect species namely : *Aphis gossypii* Glover ; *Macrosiphum rosae* (L.); *Aphis nerii* boyer and *Gynikothrips ficorum* Marchal were used as preys for *Chrysoperla carnea* (Steph.). The predators and the prey individuals were obtained from a maintained culture in the Insectary .

A. **Larval experiments :** Newly hatched predator larvae each put single in a petri dish (10 cm. dimater) with filter paper on its bottom were prepared as replicates ,and twenty replicates were used for each prey . Known surplus numbers from each prey was offered and the devoured were replaced daily . Attacked prey individuals were counted daily during laval stage of predator. The duration period , feeding capacity of larval stage were recorded and estimated.

B. **Adult experiments :** four experiments each include ten newly emerged adults of the predator were used . A predator female and male were confined together in glass chimneys open from upper and lower side . Each chimney was placed on a half petri dish (10 cm in diameter) famished with a moistened filter paper to provide humidity for the insects . The artificial diet for adults was prepared by adding yeast oxido , fructose suger , water as ratio 5:6:10 and put together in a beaker which mixed with a mixer . The dite should be a viscous pulp which is easy to spread using a spatula . A piece of cotton with the mixture (artificial diet) was offered to adults . The chimney was covered with a piece of black cloth for attracting females to oviposit . After copulation took place , adult females which their larval stage reared on the four previously prey types were kept single to deposit their eggs , and number of laid eggs per each female during oviposition period was recorded daily . The longevity of the predator male and female was calculated

Data analysis

Data for developmental time of C. carnea immature stages , consumption rate of larval stage , longevity and fecundity of female and longevity of males when fed on four insect pests were subjected for one way analysis of variance (ANOVA) and the means were separated using Duncan's Multiple Range Test (COHRT SOFTWARE 2004).

RESULTS AND DISCUSSION

Biological characteristics of *C. carnea* reared on four insect pests as preys

1-Reared on *A. gossypii*

A: Immature stages :

Data presented in Table (1) showed that,the average duration of *C. carnea* immature stages and the consumption rate per larva when fed on ***A. gossypii*** **was as follows:**

1- Egg incubation period :

Table(1) showed that,the incubation period of the predator eggs lasted 5.45 ± 0.42 days .

2-Predator larval stage

As shown in Table(1) the duration period of the predator larval stage has an average of 15.46± 0.86 days . The average of total consumption during the different three larval instars of this predator were 27.3±2.5; 56.35±4.75 and 110.55 ±6.82 Aphid individuals, respectively . A predator larval instars consumed a total average of 194.20±9.75 aphid individuals . the result showed that the third larval instar proved to be the most efficient in its feeding capacity . It consumed 56.93% of the total numbers of aphid individuals throughout the larval period, followed by second larval instar, so it consumed 29.02% from the total number of the preyed aphid individuals .

3-Pupal stage :

The duration period of the pupal stage lasted an average of 8.88 ± 0.51 days Table (1).

dTable (1): Efficiency and duration periods of the immature stages of *C. carnea* reared on *A. gossypii* at 28 ± 2 °C and 70.0 ± 5% R.H.

Predator immature stages		Duration in days	Larval Consumption		
			Daily average	Total	%
A : Egg Incubation period		5.45± 0,42	-	-	-
B:Larval stage	1st instar	3.71±0.25	7.36	27.3±2.5	14.06
	2nd instar	4.25±0.38	13.26	56.35±4.75	29.02
	3rd instar	7.5±0.47	14.74	110.55±6.82	56.92
	Total	15.46±0.86	12.56	194.20±9.75	100
C: Pupal stage		8.88±0.51	-	-	-
Total		29.79±1.72	-	-	-

B: Adult stage :

Concerning the predator female adult stage, the preoviposition, oviposition, post- oviposition and longevity period were 9.0±1.15; 22.6± 2.84; 7.2±0.89 and 38.8±4.79 days, respectively. The obtained results revealed that the total average number of eggs laid per female was 423.2 ± 7.86 eggs with a daily rate of 18. 73 eggs . The predator male longivety was 22.4±2.97 days (Table 2) .

Table (2): Fecundity and longevity of *C. carnea* adult stage fed on *A. gossypii* at 28 ± 2 ° C and 70.0 ± 5 % R.H.

Adult stage	Period in day	No. of eggs per female	
		Daily	Total
A: Female Pre-oviposition period	9.0±1.15	-	-
Oviposition period	22.6±2.84	18.73	423.2±7.86
Post- oviposition period	7.2±0.88	-	-
Longevity	38.8±4.79	-	-
B: Male Longevity	22.4±2.97	-	-

2-Reared on *M. rosae*

A: Immature stages :

Data recorded in Table (3) showed that the average duration of *C.carnea* immature stages and the consumption per larva when reared on *M. rosae*

1- Egg incubation period :

It can be seen from this table that the incubation period of the predator eggs lasted 4.9 ± 0.26 days .

2- Predator larval stage

As shown in Table (3),the duration period of the predator larval stage has an average of 12.07 ± 0.53 days . The average of total consumption during the different three larval instars of this predator were 17.00±1.3 ; 40.12± 3.6 and 72.16 ± 5.9 Aphid individuals, respectively . A predator larval instars consumed a total average of 129.28±7.65 aphid individuals . The Result showed that the third larval instar proved to be the most efficient in its feeding capacity . It consumed 55.82% of the total numbers of aphid individuals throughout the whole larval period ,while it followed by the second larval instar which consumed 31.03% from the total number of the preyed aphid individuals .

3- Pupal stage :

The period of the pupal stage lasted an average of 8.31 ± 0.44 days Table (3).

Table (3): Efficiency and duration period of immature stages of *C. carnea* reared on *M. rosae* at 28 ± 2 ° C and 70.0 ± 5 % R.H.

Predator immature stages		Duration in days	Larva Consumption		
			Daily average	Total consumption per larva	%
A : Egg Incubation period		4.9±0.38	-	-	-
B:Larval stage	1st instar	2.83±0.24	6.01	17.01±1.31	13.15
	2nd instar	3.59±0.35	11.18	40.12±3.60	31.03
	3rd instar	5.65±0.50	12.77	72.16±5.90	55.82
	Total	12.07±0.53	10.71	129.29±7.65	100
C: Pupal stage		8.31±0.79	-	-	-
Total		25.28±2.64	-	-	-

B: Adult stage :

Data obtained in Table (4) illustrated the longevity and fecundity of the the predator female and the male longevity .Results indicated that , the pre-oviposition , oviposition , post- oviposition periods and longevity were 7.4± 0.6; 22.6±1.84; 6.2 ±0.42 and 36.2 ± 2.67days ,respectively.The obtained results revealed that the total average number of eggs laid per female was 340.2 ± 9.64 eggs with a daily rate of 15.05 eggs . The predator male longivety was 20.4±1.97 days.

Table (4): Fecundity and longevity of *C. carnea* adult stage reared on *M. rosae* at 28 ± 2 ° c and 70.0 ± 5 % R.H.

Adult stage	Period in days	No. of eggs per female	
		Daily	Total
A: Female Pre-oviposition period	7.4±0.60	-	-
Oviposition period	22.6±1.84	15.05	340.2±9.64
Post – oviposition period	6.2±0.42	-	-
Longevity	36.2±2.67	-	-
B: Male Longevity	20.4±1.97	-	-

3-Reared on *A. nerii*

A: Immature stages :

Data illustrated in Table (5) showed that the average duration and consumption rate of *C. carnea* immature stages fed on *A. nerii*.

1- Egg incubation period :

The incubation period of the predator eggs lasted 6.05 ± 0.57 days (Table 5) .

Table (5): Efficiency and duration period and a total consumption of immature stages of *C. carnea* reared on *A. nerii* at 28 ± 2 ° C and 70.0 ± 5 % R.H.

Predator immature stages		Duration in days	Larva Consumption		
			Daily average	Total	%
A : Egg Incubation period		6.05±0.32	-	-	-
B:Larval stage	1st instar	3.6±0.32	4.24	15.27±1.62	27.28
	2nd instar	3.4±0.31	5.84	19.84±2.31	35.44
	3rd instar	5.8±0.48	3.60	45.47±3.83	37.28
	Total	12.8±0.85	6.30	80.58±5.40	100
C: Pupal stage		6.8±0.72	-	-	-
Total		25.65±1.97	-	-	-

2- Predator larval stage

The duration period of the predator larval stage has an average of 12.8 ± 0.85 days. The average of total consumption during the different three larval instars of this predator were 15.27±1.62; 19.84±2.31 and 45.47±3.83 Aphid individuals respectively . A predator larval instars consumed a total average of 80.58 ± 5.40 aphid individuals . the result showed that the third

larval instar proved to be the most efficient in its feeding capacity . It consumed 37.28 % of the total numbers of aphid individuals throughout the larval period, while the second larval instar consumed 35.44% from the total number of the preyed aphid individuals .

3- Pupal stage :

The duration period of the pupal stage lasted an average of 6.8 ± 0.56 days.

B: Adult stage :

The obtained results in Table (6) revealed that, the preoviposition, oviposition, post- oviposition and longevity period were 7.0 ± 0.82; 19.4±1.22; 4.8 ±0.31and 31.2 ±2.17days,respectively. The total average number of eggs laid per female was 188.4 ±7.9 eggs with a daily rate of 9.7 eggs. The predator male longivety was 16.6 ±1.15 days.

Table (6): Fecundity and longevity of *C. carnea* reared on *A. nerii* at 28 ± 2 ° C and 70.0 ± 5 % R.H.

Adult stage	Period in day	No. of eggs per female	
		Daily	Total
A: female Pre-oviposition period	7.0±0.82	-	-
Oviposition period	19.4±1.22	9.71	188.4±7.9
Post – oviposition period	4.8±0.31	-	-
Longevity	31.2±2.17	-	-
B: male Longevity	16.6±1.15	-	-

4- Reared on *G. ficorum*

A: Immature stages :

Data obtained in Table (7) showed the average duration periods and the consumption rate of *C. carnea* immature stages fed on *G. ficorum.*

1- Egg incubation period :

The incubation period of the predator eggs lasted 4.45 ± 0.03 days.

2- Predator larval stage

The duration period of the predator larval stage has an average of 11.74±1.86 days. The average of total consumption during the different three larval instars of this predator were 23.51± 3.17; 39.96 ± 4.86 and 68.86 ±7.68 thrips individuals, respectively. The predator larval instars consumed a total average of 132.33±12.75 thrips individuals. The third larval instar proved to be the most efficient in its feeding capacity. It consumed 52.03% of the total numbers of aphid individuals throughout the larval period and the second larval instar came next, it consumed 30.20 % from the total number of the preyed aphid individuals .

3- Pupal stage :

The duration period of the pupal stage lasted an average of 6.11 ± 0.49 days.

Table (7): Efficiency and duration period of immature stages and consumpation of *C. carnea* reared on *G. ficorum* at 28 ± 2 ° C and 70.0 ± 5 % R.H.

Predator immature stages		Duration in days	Larva Consumption		
			Daily average	Total	%
A : Egg Incubation period		4.45±0.36	-	-	-
B:Larval stage	1st instar	2.79±0.20	8.43	23.51±3.17	17.77
	2nd instar	3.78±0.29	10.57	39.96±4.86	30.20
	3rd instar	5.17±0.56	13.32	68.86±7.68	52.03
	Total	11.74±1.86	11.27	132.33±12.75	100
C: Pupal stage		6.11±0.49	-	-	-
Total		22.30±2.78	-	-	-

B: Adult stage :

Concerning the adult stage of predator female, the pre-oviposition, oviposition, post- oviposition and longevity periods were 6 ±0.88; 23±1.98; 4.8 ±0.37 and 33.8 ±1.54days ,respectively The total average number of eggs laid per female was 432 ± 12.56 eggs with a daily rate of 18.78 eggs. The predator male longivety was 16.6±0.89 days (Table 8) .

Table (8): Fecundity and longevity of *C carnea* fed on *G. ficorum* at 28 ± 2 ° C and 70.0 ± 5 % R.H.

Adult stage	Period in day	No. of eggs per female	
		Daily	Total
A: female Pre-oviposition period	6±0.88	-	-
Oviposition period	23.0±1.98	18.78	432.0±12.56
Post – oviposition period	4.8±0.37	-	-
Longevity	33.8±1.54	-	-
B: male Longevity	16.6±0.89	-	-

Effect of prey types on certain biological aspect of *C. carnea* :-

Data presented in Table (9) and figure (1a;1b) and figure(2) showed the effect of prey types on developmental time, consumption rate, longevity and fecundity of *C.carnea* under constant temperature and relative humidity . The obtained results indicated that the shortest developmental time was obtained when larvae reared on *M. rosae* , while the longest developmental time was recorded on *A. gossypii* . The total consumption rate from the four prey insects by the larval stage of *C. carnea* showed significant difference . The average male and female longevity of *C. carnea* was significantly longer when fed on *A. gossypii* followed by *M.rosae* ; *G. ficorum* and *A. nerii* . Meanwhile the prey types had a significant effect on females fecundity . The highest number of eggs obtained when females of *C. carnea* fed on *G. ficorum* followed by *A. gossypii* and *M.rosae,* while the lowest number of eggs was achieved when reared on *A.nerii* .

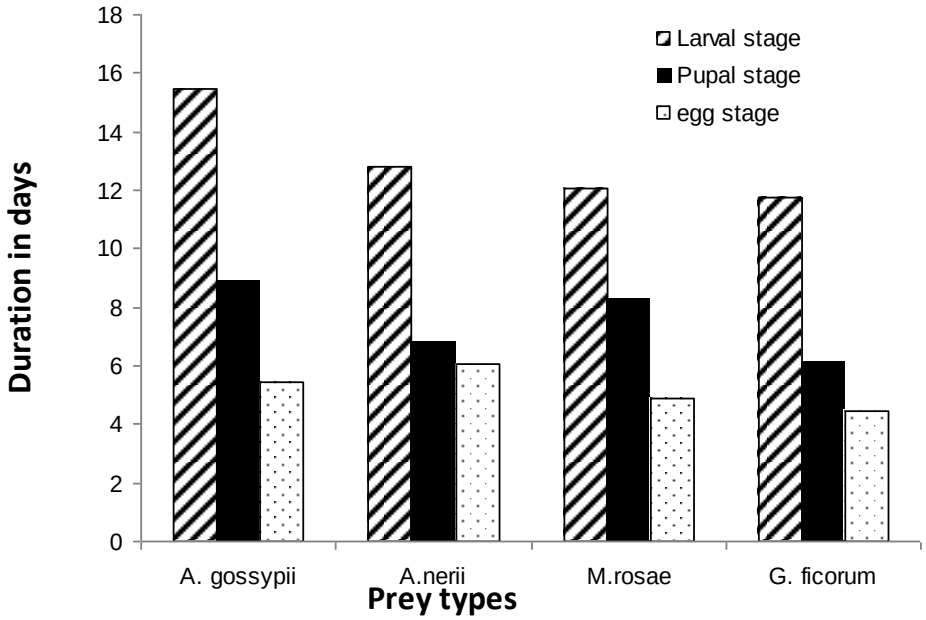
C. carnea larvae can prey on a variety of soft –bodied arthropods like aphids; coccids; leafhoppers; whiteflies; thrips tetranychid and eriophid mites; eggs and young larvae of certain species of Lepidoptera and less commonly on eggs and larvae of some species of Coleoptera and Diptera (Principi and Canard 1984; New 1984;and Miller *et al.* , 2004). Some species of these preys could be optimal for development and reproduction of *C. carnea* resulting in high larval developmental rates and increased preimaginal survival and adult longevity (Principi and Canard, 1984). The larvae of *C. carnea* considered as polyphagous, since they prey upon a great variety of aphids and thrips. Therefore, the development of larval, pupal and adult stage may be affected by the prey hosts; temperature and relative humidity . In the present study it was noticed that the aphid and thrips species had a strong influence not only on preimaginal development of the predator larvae but also on the female longevity and fecundity (Table) and Figures (1and2).

The obtained results in this study are finding is in complete agreement with those addressed by Scopes (1969) in England and with El-Dakroury *et al.*, (1977) in Egypt ; Ghanim and El-Adl (1987) and El-Serafi *et al.*, (2000) and Ghanim *et al.*(2009) in Egypt . Also they showed clearly that the insect preys differed in their degrees of suitability for this predator . The suitability of prey resulting in an increase of consumption rate, shorter developmental time, greater survival rate and higher fecundity of female (Slansky and Rodriguez, 1987) and Crawley, (1992). In addition, the suitable prey must provide almost important nutritients such as proteins carbohydrates, lipids, vitamins and minerals in balanced proportion and concenteration to meet predator metabolic requirements. Mobility of prey also plays a large role in prey suitability House, (1966); and (1977). Ghanim *et al.* (2009) .

Table (9): Effect of four prey types on certain biological aspects of *C. carnea* at constant temperature 28±2°c and 70±5% R. H .

Biological aspects / Prey types	Duration in days		Consumed/ larva	Longivety		Fecundity per female
	Larval stage	Pupal stage		female	male	
A. gossypii	15.46± 0.86 a	8.88± 0.51a	194.20± 9.75 a	38.8± 4.79 a	22.4 ± 2.97 b	423.2± 7.86 a
M.rosae	12.07± 0.53b	8.31± 0.53ab	129.28± 7.56c	36.2 b	20.4 c	340.20 ± 5.32b
A.nerii	12.8± 0.85b	6.8± 0.56bc	80.58± 4.78d	31.2 d	16.6 d	188.4 ± 2.46 c
G. ficorum	11.74± 1.86b	6.11± 0.49 c	132.33± b	33.8 c	16.6 a	432± 8.42d

Means followed by the same letter in a column between insect species are insignificantly different at the 5% level probability (Duncan's Multiple Range Test).



Figure(1a): Effect of four prey types on developmental time of the immature stage of *C. carnea* under constant temperature 28±2°c and 70±5% R.H.

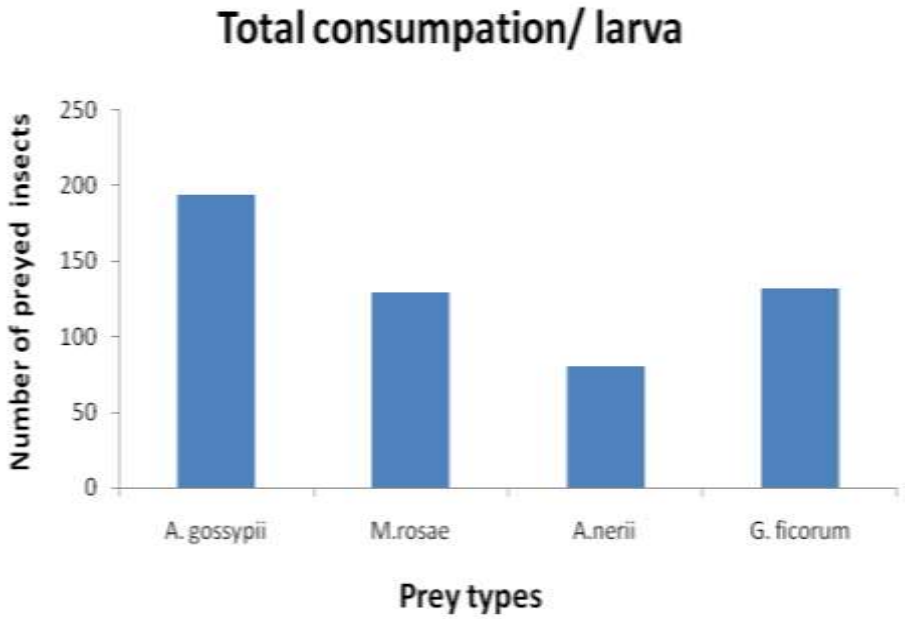
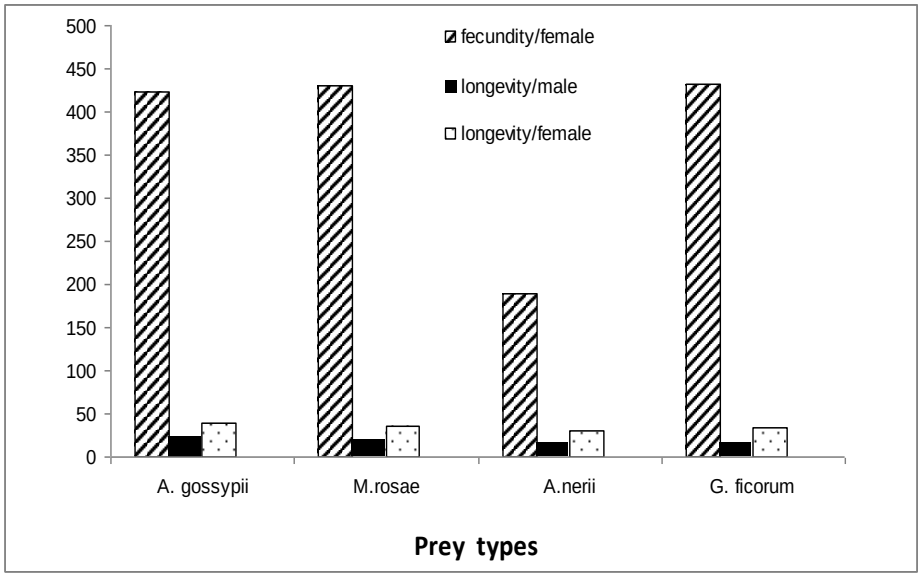


Figure (1b): Effect of four prey types on consumption rate per *C. carnea* larvae under constant temperature of 28±2°c and70±5% R.H.



Figure(2): Effect of four prey types on the longevity and fecundity of *C. carnea* adult stage under constant temperature of 28±2°c and 70±5% R.H.

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تـأثير بعـض أنـواع الفـرائس علـى بعـض الخصـائص البيولوجيـة لأسـد المـن الأخضر ***Chrysoperla carnea*** **(Steph.) تحت درجة الحرارة والرطوبة النسبية الثابتة**

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أجريت تجارب معملية بقسم الحشرات الاقتصادية – كلية الزراعة – جامعة المنصورة تحت درجة حرارة 28 ° م ± 2 ورطوبة نسبية 70 ±5% لدراسة تأثير بعض أنواع الفرائس الحشرية على بعض الخصائص البيولوجية لأسد المن الأخضر *Chrysoperla carnea* (Steph.) . وأوضحت النتائج المتحصل عليها فترة التطور والنمو ليرقات أسد المن الاخضر كانت الأقصر عند تربيتها على من الورد *Macrosiphum rosae* (L.) وبلغت 12,07 ± 5,53 يوميا بينما كانت هذة الفترة هى الأطول عندما ربيت هذة اليرقات على من القطن *Aphis gossypii* Glover فبلغت هذة الفترة 15,46 ± 5,86 يوما . وأظهرت النتائج أن أعداد الفرائس التى استهلكت بواسطة يرقة واحدة من اسد المن الأخضر اختلفت تبعا لنوع الفريسة فبلغت 194,2 ± 9,75 ; 129,28 ± 7,56 ; 80,58 ± 4,78 ; 132,33 ± 8,42 فردا عند التغذية على من القطن *A. gossypii* ومن الورد *M . rosae* ومن التفلة *Aphis nerii* Boyer وتربس الفيكس *Gynikothrips ficorum* Marchal على التوالى . وأوضحت النتائج المتحصل عليها أن العمر اليرقى الثانى والثالث أكثر الأعمار اليرقية فى كفائتها الافتراسية وأظهرت نتائج التحليل الاحصائى وجود اختلافات معنوية بين فترة النمو فى الاعمار اليرقية عند التغذية على الفرائس السابقة.

كما أكدت النتائج تأثير الفرائس على الكفاءة التناسلية لإناث أسد المن الأخضر فبلغ متوسط ما وضعته الانثى من البيض 423,2 ± 7,86 , 340,20 ± 5,32 , 188,4 ± 2,46 , 432,00 ± 8,42 بيضة فى حالة التغذية على من القطن ومن الورد ومن التفلة وتربس الفيكس على التوالى . وتوضح النتائج السابقة أن نوع الفريسة يؤثر على فترات النمو ومعدل الافتراس للاطوار اليرقية وفترة المدة البقائية للإناث والذكور والكفاءة التناسلية لإناث أسد المن .

هذة النتائج توضح إمكانية إستخدام هذا المفترس فى مكافحة هذة الحشرات الضارة كعنصر من عناصر المكافحة الحيوية .

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