

## EFFECT OF MEALYBUG SPECIES AS PREYS ON THE DEVELOPMENTAL TIME, FEEDING CAPACITY AND FECUNDITY OF VEDALIA BEETLE, *Rodolia cardinalis* (MULSANT) (COLEOPTERA : COCCINELLIDAE) UNDER LABORATORY CONDITIONS.

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### ABSTRACT

Laboratory studies were carried out in the Insectary of Economic Entomology Department, Faculty of Agriculture, Mansoura University, from the beginning of September, 2004 till the end of December 2005 to evaluate the effect of mealybug species as preys on the developmental time; feeding capacity and fecundity of vedalia beetle *Rodolia cardinalis* (Mulsant). The obtained results showed that, the averages of the duration period of the predator larvae were  $13.34 \pm 1.26$ ;  $15.28 \pm 1.78$  and  $12.23 \pm 1.95$  days when reared on *Planococcus citri* (Risso); *Icerya seychellarum* (Westwood) and *Icerya purchasi* Mask, ell respectively. The averages of the total consumption during the larval stage were  $76.98 \pm 5.96$ ;  $53.22 \pm 3.85$  and  $91.14 \pm 5.91$ , of third nymphal instar individuals from the three tested mealybugs respectively. The longevity period of the predator adult female, averages  $40.45 \pm 2.98$ ;  $45.62 \pm 2.40$  and  $36.56 \pm 2.65$  days when fed on *P. citri* ; *I. seychellarum* and *I. Purchasi, consecutively* . The predator female consumed during its life span an average of  $418.82 \pm 6.89$ ;  $305.54 \pm 3.79$  and  $311.92 \pm 6.75$  of third nymphal instar individuals when reared on the three tested mealybug species successively . The average total number of eggs laid by female of *R. cardinalis* through its life span was significantly affected by the prey consumed by these female. The number of eggs deposited per female reached an average of  $350.76 \pm 7.58$ ;  $296.47 \pm 22.65$  and  $420.85 \pm 8.5$  by rearing on the three previously mealybug species. During the longevity period of the predator male, averages  $25.76 \pm 1.57$ ;  $30.56 \pm 2.75$  and  $27.35 \pm$  respectively 1.92 days, when this predator male fed on *P. citri*; *I. seychellarum* and *I. purchasi*. The predator male consumed during its longevity period an average of  $202.22 \pm 5.94$ ;  $162.73 \pm 2.56$  and  $175.35 \pm 3.37$  of third nymphal instar individuals of the three previously mealybug species.

The statistical analysis showed that, there were highly significant differences in the biological characteristics of *R. cardinalis* larvae and adult when reared on *P. citri*; *I. seychellarum* and *I. Purchasi consecutively* .

In conclusion, the results obtained assured *R. cardinalis* preferred as prey *I. purchasi* than *P. citri* and *I. seychellarum*, because this predator has a short developmental time, a high predation efficiency and reproductive capacity when fed on *I. purchasi* and this predator can be used as biological control agent against the three previously mentioned mealybug species.

### INTRODUCTION

Vidalia beetle, *Rodolia cardinalis* (Mulsant), has been a primary natural enemy regulating populations of cottony cushion scale, *Icerya purchasi* Maskell in California since it was introduced in the winter of 1888-1889 from Australis ( Douth,1964 and Caltagirone and Douth, 1989). It provides excellent

During the late 1800s, the vedalia beetle saved the southern California citrus industry from devastating yield losses caused by cottony cushion scale, and since early success, it has been transported to other areas of the state and exported to many other parts of the world including Egypt, with equally successful results.

The biological aspects of vedalia beetle *R. cardinalis* have been studied by several investigators in different parts of the world (Matsuka and Watanabe, 1980; Khalaf, 1987; Hamed and Saad, 1989; Cardosa, 1990; Ragab, 1995; Hoddle, 2000; Causton et al. 2004; Grafton et al. 2005; Ibrahim, 2005).

Therefore, the present work aims to throw some light on the developmental time; feeding capacity and fecundity of vedalia beetle *R. cardinalis* when reared on three mealybug species namely: *Planococcus citri* (Risso); *Icerya purchasi* Maskell and *Icerya seychellarum* (Westwood) under laboratory conditions.

## MATERIALS AND METHODS

Laboratory experiments were carried out in the Insectary of Economic Entomology Department, Faculty of Agriculture, Mansoura University, from the beginning of September, 2004 till the end of December 2005 at  $26 \pm C^{\circ}$  and  $70 \pm R.H.$ . To prepare a laboratory culture from *Rodolia cardinalis*, pupae of the predator were collected from gauva and citrus trees, which were found to be heavily infested with its preys, *P. citri*; *I. seychellarum* and *I. purchasi*. Newly emerged adults were reared on the previous preys. Newly deposited eggs of the predator were kept at  $26 \pm 1 C^{\circ}$ . Twenty newly hatched first instar larvae of the vedalia beetle *R. cardinalis* were introduced singly into Petri-dishes of 10 cm diameter. The bottoms of the dishes were covered with a filter paper to facilitate the predator larval movements. A known number of mealybug species namely: *P. citri*; *I. seychellarum* and *I. purchasi* (third nymphal instar) were used as a prey for the predator. A small leaf was replaced daily as a food for the third nymphal instar of mealybug species. The devoured third nymphal instar mealybug species were recorded. The rest of third nymphal instar mealybugs and their parts were removed. From each mealybug species, consumed by larvae of this predator was recorded. The mean number of consumed third nymphal instar of the mealybug species by this predator larvae was also calculated. Just after emergence five couples of the beetles were put singly in Petri dishes. After three days of emergence, copulation were done and then the two sexes were separated and kept singly in the dishes. The technique of rearing the adult stage was the same of the larval stage. The daily number of the laid eggs of female during the oviposition period was counted, the total number per female was estimated. The daily average of food consumption during the longevity of the predator was calculated. The data of duration period of larval stage, average of total consumption per larva, percentage of mortality per larval instar, longevity of adult stage, feeding capacity and fecundity of adult were subjected for one way analysis of variance (ANOVA), and the means separated were using Duncan's Multiple Range Test (Costat Soft wara, 1990,).

## RESULTS AND DISCUSSION

### 1. Rearing on *Planococcus citri*:

#### Larval stage:

Table (1) shows the food consumption, duration period and mortality of vedalia beetle *R. cardinalis*. It can be seen from this Table that, the duration period of the larval stage averaged  $13.34 \pm 1.26$  days. The average of the total consumption during the four larval instars were  $9.76 \pm 0.69$ ,  $12.80 \pm 1.08$ ,  $13.75 \pm 1.10$  and  $40.67 \pm 2.65$ , third nymphal instar *P.citri* individuals, respectively, and the average of the total consumption per larva was  $76.98 \pm 5.96$  third nymphal instar individuals.

The percentages of feeding capacity for each of the four larval instars of this predator were: 12.68, 16.63, 17.86 and 52.83%, respectively. Therefore, it is obvious that, the third and fourth instar larvae of this predator represent together (70.69%) or the backbone in predation activity. The percentages of mortality were 19.75, 17.62, 8.97 and 5.85% during the larval instars.

**Table 1: Food consumption; duration period and mortality of *Rodolia cardinalis* larvae reared on the third instar of *Planococcus citri*, under laboratory conditions of  $26 \pm 1^\circ\text{C}$ . and  $70 \pm 5\%$  R.H.**

larval stage	Duration in days	Daily average consumption	Average of total consumption	% of feeding capacity	% of mortality
1 <sup>st</sup> instar	$3.50 \pm 0.31$	2.79	$9.76 \pm 0.69$	12.68	19.75
2 <sup>nd</sup> instar	$2.98 \pm 0.29$	4.30	$12.80 \pm 1.08$	16.63	17.62
3 <sup>rd</sup> instar	$2.50 \pm 0.21$	5.50	$13.75 \pm 1.10$	17.86	8.97
4 <sup>th</sup> instar	$4.36 \pm 0.82$	9.33	$40.67 \pm 2.65$	52.83	5.85
Total	$13.34 \pm 1.26$	5.77	$76.98 \pm 5.96$	100.00	

### B. Adult stage:

#### 1: Predator female:

The predator female fed on a total average of  $418.2 \pm 6.89$  third nymphal instar individuals., with a daily rate of 10.35 during the longevity period of  $40.45 \pm 2.98$  days as seen in Table 2.

**Table 2: Longevity, Food consumption and fecundity of *Rodolia cardinalis* adult reared on the third instar of *Planococcus citri* under laboratory conditions of  $26 \pm 1^\circ\text{C}$ . and  $70 \pm 5\%$  R.H.**

Adult stage	Period in days	Daily average consumption	Total consumption	No. of eggs	
				Daily	Total
Female	Pre-oviposition	$3.500 \pm 0.56$	11.56	$40.46 \pm 2.85$	
	Oviposition	$30.75 \pm 1.94$	10.95	$336.71 \pm 6.74$	11.411
	Post-oviposition	$6.2 \pm 0.75$	6.72	$41.65 \pm 3.50$	
	Longevity	$40.45 \pm 2.98$	10.35	$418.82 \pm 6.89$	
Male	Longevity	$25.76 \pm 1.57$	7.85	$202.22 \pm 5.94$	

The average of the pre-oviposition period was  $3.5 \pm 0.56$  days. The predator female consumed during this period  $40.46 \pm 2.85$ , with a daily rate of

11.56 third nymphal instar individuals. The predator female consumed during the oviposition period on average of  $336.71 \pm 6.74$  third nymphal instar individuals. this period lasted an average of  $30.75 \pm 1.94$  days with a daily rate of 10.95. The number of deposited eggs per predator female averaged  $350.76 \pm 7.58$  eggs with a daily rate of 11.41 per day. During the post-oviposition period, the female consumed  $41.65 \pm 3.50$  third nymphal instar individuals. this period lasted an average of  $6.2 \pm 0.75$  days, with a daily rate of 6.72. Hamed and Saad (1989) whom found that the larval period average 16.5 days when this predator reared on *I. seychellarum* at  $25^{\circ} \text{C}$

#### Predator male:

During its longevity period, which lasted for an average of  $25.76 \pm 1.57$  days (Table 2). The predator adult male consumed a total average  $202.22 \pm 5.94$  third nymphal instar individuals with daily rate of 7.85.

The result showed that the feeding capacity of the predator female was always higher than, that of the male as the female fed on 2.07 times of third nymphal instar *P.citri* more than the male.

## 2. Rearing on *Icerya seychellarum*:

### A: Larval stage:

Results presented in Table (3) illustrate the duration period of the larval stage averaged  $15.28 \pm 1.78$  days. The average of the total consumption during the four larval instar were  $5.96 \pm 0.7$ ;  $7.64 \pm 0.95$ ;  $8.95 \pm 1.50$  and  $30.67 \pm 1.96$  third nymphal instar individuals, respectively, and the average of the total consumption per larva was  $53.22 \pm 3.85$  third nymphal instar individuals. The percentages of feeding capacity for each of the four larval instars of this predator were 11.2, 14.36, 16.82 and 57.62%, respectively. Therefore, it may be obvious that, the third and fourth instar larval stage of this predator represent together (74.44%) or the backbone in predation activity. The percentages of mortality were 22.95; 20.89; 11.96 and 6.92% during the larval instars.

**Table 3: Food consumption; duration period and mortality of *Rodolia cardinalis* reared on the third instar of *Icerya seychellarum* under laboratory conditions of  $26 \pm 1^{\circ} \text{C}$ . and  $70 \pm 5\%$  R.H.**

larval stage	Average in days	Daily average consumption	Average total consumption	% of feeding capacity	% of mortality
1 <sup>st</sup> instar	$4.12 \pm 0.30$	1.45	$5.96 \pm 0.7$	11.20	22.95
2 <sup>nd</sup> instar	$3.40 \pm 0.23$	2.24	$7.64 \pm 0.95$	14.36	20.89
3 <sup>rd</sup> instar	$2.80 \pm 0.8$	3.20	$8.95 \pm 1.50$	16.82	11.96
4 <sup>th</sup> instar	$4.96 \pm 0.90$	6.18	$30.67 \pm 1.96$	57.62	6.92
Total	$15.28 \pm 1.78$	3.48	$53.22 \pm 3.85$	100	

### B. Adult stage:

#### 1-Predator female:

The predator female fed on a total average of  $305.54 \pm 3.79$  third nymphal instar individuals, with a daily rate of 6.70 during the longevity period of  $45.62 \pm 2.40$  days as seen in Table 4. The average of the pre-oviposition period was  $3.64 \pm 0.4$  days. The predator female consumed during this period

28.47 ±1.01 with a daily rate of 7.82 third nymphal instar individuals. The predator female consumed during the oviposition period an average of 253.81 ±2.96 third nymphal instar individuals, this period lasted an average of 36.52 ±1.70 days with a daily rate of 6.95. The number of deposited eggs per predator female averaged 296.47 ±22.65 eggs with a daily rate of 8.12 per day. During the post-oviposition period, the female consumed 23.26 ± 0.95 third nymphal instar individuals, this period lasted an average of 5.46 ± 0.60 days with a daily rate of 4.26.

**2-Predator male:**

During its longevity period, which lasted for an average of 30.56 ± 2.75 days (Table 4). The predator adult male consumed a total average 162.73 ± 2.56 third nymphal instar individuals with daily rate of 5.32. The present results disagreed with the findings of Hamed and Saad (1989) whom mentioned that the average longevity of females and males were 12.8 and 8.8 days when fed on *I. seychellarum*.

**Table 4 : Longevity, food consumption and fecundity of *Rodolia cardinalis* adult reared on the third instar of *Icerya seychellarum* under laboratory conditions of 26±1c°. and 70±5% R.H.**

Adult Stage		Period in days	Daily average consumption	Total consumption	No. of eggs	
					Daily	Total
Female	Pre-oviposition	3.64±0.4	7.82	28.47±1.01	8.12	296.47±22.65
	Oviposition	36.52±1.70	6.95	253.81±2.96		
	Post-oviposition	5.46±0.60	4.26	23.26±0.95		
	Longevity	45.62±2.40	6.70	305.54±3.79		
Male	Longevity	30.56±2.75	5.32	162.73±2.56		

The result showed that, the feeding capacity of the predator female was always higher than that of the male as the female fed on 1.87 times of third nymphal instar *I.seychellarum* more than the male.

**3. Rearing on *Icerya purchasi*:**

**Larval stage:**

Table (5) shows the food consumption, duration period and mortality of the coccinellid predator *R. cardinalis* larvae reared on the third instar of *I. purchasi*. it can be seen from this table that, the duration period of the larval stage, averaged 12.23 ± 1.95 days. The average of the total consumption during the four larval instars were 10.85 ± 1.20, 14.75 ± 1.8, 16.97 ± 1.95 and 48.57 ± 3.54 third nymphal instar individuals respectively and the average of the, total consumption per larva was 91.14 ± 5.91. The percentages of feeding capacity for each of the four larval instars of this predator were 11.9, 16.18, 18.63 and 53.29%, respectively. Therefore, it may be obvious that the third and fourth instar larvae of this predator represent together (71.92%) of the backbone in predation activity. The percentages of mortality were 17.23,15.50,6.40 and 4.27% during the larval four instars successively.

Kuwana (1922) in Japan revealed that the larval mortality was 27% when *R. cardinalis* was reared on *I. purchasi*.

**Table 5. Food consumption; duration period and mortality of *Rodolia cardinalis* larvae reared on the third instar of *Icerya purchasi* laboratory conditions of  $26\pm 1^{\circ}\text{C}$  and  $70\pm 5\%$  R.H.**

larval stage	Duration in days	Daily average consumption	Average of total consumption	% of feeding capacity	%of mortality
1 <sup>st</sup> instar	3.25±0.25	3.34	10.85±1.20	11.9	17.23
2 <sup>nd</sup> instar	2.50±0.20	5.90	14.75±1.80	16.18	15.50
3 <sup>rd</sup> instar	2.24±0.15	7.58	16.97±1.95	18.63	6.40
4 <sup>th</sup> instar	4.24±0.79	11.46	48.57±3.54	53.29	4.27
Total	12.23±1.95	7.45	91.14±15.91	100	

#### **B: Adult stage:**

##### **Predator female:**

The predator female fed on a total average of  $311.92\pm 6.75$  third nymphal instar individuals, with a daily rate of 8.53 during the longevity period of  $36.56 \pm 2.65$  days as seen in Table (6). The average of the pre-oviposition period was  $3.25\pm 0.90$  days. The predator female consumed during this period  $30.71 \pm 1.75$ , with a daily rate of 9.45 third nymphal instar individuals. The predator female consumed during the oviposition period an average of  $27.85 \pm 1.90$  days with a daily rate of 8.96. The number of deposited eggs per predator female averaged  $420.85 \pm 8.5$  eggs with a daily rate of 15.11. Kuwana (1922) reported that the female of *R. cardinalis* fed on *I. purchasi* deposited as many as 5.4 eggs per day in summer, while in spring and autumn sometimes only one egg was laid per day. Ragab (1995), who mentioned that, the average total number of eggs laid by female of *R. cardinalis* were  $331.05 \pm 0.42$  and  $423 \pm 33.63$  eggs and the longevity of female were  $31.54 \pm 2.04$  and  $37.11 \pm 2.31$  days when reared on *I. purchasi* and *I. aegyptiaca* respectively at  $25^{\circ}\text{C}$  and 60% R.H.. During the post-oviposition period, the female consumed  $31.67\pm 2.1$  third nymphal instar individuals, this period lasted an average of  $5.46 \pm 0.80$  days with a daily rate of 5.80.

##### **Predator male:**

During its longevity period, which lasted for an average of  $27.35 \pm 1.96$  days (Table 6). The predator adult male consumed a total average  $175.35 \pm 3.37$  third nymphal instar individuals with daily rate of 6.41. The results assured that the feeding capacity of the predator female was always higher than that of the male as the female fed on 1.77 times of the third nymphal instar of *I. purchasi* more than the male.

The present results shed light on the biological aspects of vedalia beetle *R. cardinalis* when reared on the three mealybug species. These findings agree with those obtained by some authors as Matsuka and Watanabe (1980) in Japan, indicated that adult females of this predator which fed on adults of *Icerya scales* in a Petri dish at  $25^{\circ}\text{C}$  produce an average of

365 eggs during their adult life span of 29.4 days, including 3.7 days of pre.oviposition. The average developmental period (egg to adulthood) was 19.70 days and they added that the 4<sup>th</sup> instar larva was the most voracious larval stage and consumed about 80% of the prey taken during whole larval period.

**Table 6: Longevity, food consumption and fecundity of *Rodolia cardinalis* adult reared on the third instar of *Icerya purchasi* under laboratory conditions of 26±1c°. and 70±5% R.H.**

Adul sttage		Period in days	Daily average consumption	Total consumption	No. of eggs	
					Daily	Total
Female	Pre-oviposition	3.25±0.90	9.45	30.71±1.75	15.11	420.85±8.50
	Oviposition	27.85±1.90	8.96	249.54±4.65		
	Post-oviposition	5.46±0.80	5.80	31.67±2.10		
	Longevity	36.56±2.65	8.53	311.92±6.75		
Male	Longevity	27.35±1.96	6.41	175.35±3.37		

The present results are in disagreement with those of Hamed and Saad (1989), whom mentioned that, the average of egg laid by female of *R. cardinalis* were 19.8 and 33.4 eggs, percentages of eggs hatchbilty were 32.09 and 48.4 % and female longevity were 12.8 and 15.8 days when *R. cardinalis* fed on *I.seychellarum* and *I. aegyptiaca* (Douglas) , respectively at 25 °C. On the other hand they studied the effect of *I. aegyptiaca* and *I. seychellarum* on the biological characteristics of *R. Cardinalis*, they found that, the average total number of eggs laid by female of this predator through its life span was significantly affected by the kind of prey consumed by these females and the longevity of females and males was comparatively shorter in association with *I. seychellarum* . Ragab (1995) in Egypt indicated the average total number of eggs laid per female of *R. cardinalis* were 331.0 ± 0.42 and 423±33.63 eggs when reared at 25 °c and 60 % R.H. on *I. purchasi* and *I. seychellarum*, and he found that *R. cardinalis* is well adapted to *I.aegyptiaca* , and the longevity of males and females was shorter in association with *I. purchasi* , this difference was not significant. In our study, we found that, the duration period of larval stage was comparatively shorter in association with *I. purchasi* . The average number of eggs per female when reared on *P. citri* ; *I.seychellarum* and *I. purchasi* was 350.76 ±7.58; 296.47±22.65 and 420.85±8.50 respectively.

Data presented in Table (7) show the effect of three mealybug species on some biological aspects of vedalia beetle . It can be seen from this table that there was highly significant difference on the average of total consumption; mortality of *R. cardinalis* larvae and longevity; feeding capacity and fecundity of the adult.

The results indicated that the duration period of the larval stage was the shortest, when these larvae reared on *I. purchasi* and the mortality percentages of larval stage was the lowest when the larvae of this predator fed on the same prey.

The data assured that, the egg productivity of the female predator was the highest with the feeding on *I. purchasi* followed by *P. citri* and *I. seychellarum*, that is due to the contents of the mealybug species.

In conclusion, *R. cardinalis* (larvae and adults) could be employed as the biological control agents against the three tested mealybugs (*P. citri*, *I. seychellarum* and *I. purchasi*), because this predator has short developmental time, a high survival rate, a high predation efficiency and reproductive capacity, when this predator reared on these mealybug species.

**Table7: Effect of three mealybug species on certain biological characteristics of *Rodolia cardinalis* larvae and adult under laboratory conditions.**

Mealybug species	Larval Satge			Adult				
	Durations in days	Average of total consumption	% of Aver. mortality	Female			Male	
				Longevity	Feeding capacity	Fecundity / Female	Longevity	Feeding Capacity
<i>P. citri</i>	13.34± 1.26 ab	76.98± 5.96 c	13.05 b	40.45± 2.98 b	418.82± 6.89 a	350.76± 7.58 b	25.76± 1.95 b	202.22± 5.94 a
<i>I. seychellarum</i>	15.28± 1.78 a	53.22± 3.85 b	15.68 a	45.62± 2.40 a	305.54± 3.79 c	296.47± 22.65 c	30.56± 2.75 a	162.73± 2.56 c
<i>I. purchasi</i>	12.23± 1.95 b	91.14± 5.91 a	10.85 c	36.56± 2.65 c	311.92± 6.75 b	420.85± 8.5 a	27.35± 1.92 b	175.35± 3.37 b

Average followed by the same letter for each aphid species are not significant different at 1% level of probability (Duncan's Multiple Range Test).

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### تأثير أنواع البق الدقيقى كفرائس على وقت النمو، الكفاءة الإفتراسية والتناسلية لمفترس روداليا كاردينالس تحت الظروف المعملية

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أجريت دراسات معملية بقسم الحشرات الإقتصادية -كلية الزراعة - جامعة المنصورة خلال الفترة من سبتمبر ٢٠٠٤ حتى نهاية ديسمبر ٢٠٠٥ وذلك لتقييم تأثير بعض أنواع البق الدقيقى كفرائس على وقت التطور ، الكفاءة الإفتراسية والتناسلية لمفترس خنفساء الفيداليا. ولقد أظهرت الدراسة أن متوسط قشرة نمو الطور اليرقى  $1.26 \pm 1.34$ ،  $1.78 \pm 1.52$  و  $1.95 \pm 1.23$  يوم عند التربية على بق الموالح الدقيقى التوالى. بالنسبة لكفاءة التغذية، كان متوسط الكفاءة الإفتراسية لليرقة الواحدة  $5.96 \pm 76.98$ ،  $3.85 \pm 53.22$  و  $5.91 \pm 91.14$  من حوريات العمر الثالث لأنواع البق الدقيقى الثلاثة، على التوالى. وأوضحت النتائج أن متوسط فترة حياة الأنثى  $2.98 \pm 40.45$ ،  $2.60 \pm 45.62$  و  $2.65 \pm 36.56$  يوم عند التغذية على *P. citri*، *I. seychellarum* و *I. purchasi* على التوالى. ولقد إستهلكت أنثى المفترس فى المتوسط حوالى  $6.89 \pm 418.82$ ،  $3.79 \pm 305.54$  و  $6.75 \pm 311.92$  من حوريات العمر الثالث عند التغذية على الثلاثة أنواع السابقة من البق الدقيقى. بينما بلغ متوسط وضع البيض لأنثى المفترس *R. cardinalis*  $350.76 \pm 7.58$ ،  $22.65 \pm 296.47$  و  $8.50 \pm 220.85$  بيضة عند التغذية على الثلاثة أنواع السابقة من البق الدقيقى.

ولقد بلغت فترة حياة الذكر فى المتوسط  $1.95 \pm 25.76$ ،  $2.75 \pm 30.56$  و  $1.92 \pm 27.35$  يوم عند التغذية على *P. citri*، *I. seychellarum* و *I. purchasi* على التوالى. وكان متوسط الكفاءة الإفتراسية للذكر حوالى  $20.22 \pm 5.94$ ،  $2.56 \pm 175.35$  و  $3.37 \pm 175.35$  من حوريات العمر الثالث عند التغذية على الثلاثة أنواع من البق الدقيقى، على التوالى.

ولقد أكد التحليل الإحصائى عن وجود إختلافات معنوية فى الصفات البيولوجية لليرقات والحشرات الكاملة للمفترس *R. cardinalis* عند التربية على *P. citri*، *I. seychellarum* و *I. purchasi*. وخلصت الدراسة إلى أن نوع البق *I. purchasi* كان أكثر الثلاثة أنواع تفضيلا للمفترس *R. cardinalis* عن *P. citri* و *I. seychellarum*، حيث سجل المفترس أقصر فترة نمو، وأعلى كفاءة إفتراسية، وكفاءة تناسلية عند التغذية على *I. purchasi*. ولهذا فإنه يمكن إستخدام هذا المفترس كعنصر من عناصر المكافحة البيولوجية ضد الثلاثة أنواع السابقة من البق الدقيقى.