



Research Article

Biology of Australian ladybird beetle, *Cryptolaemus montrouzieri* Mulsant on *Phenacoccus solenopsis* Tinsley

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ABSTRACT: The biological parameters of *Cryptolaemus montrouzieri* on *Phenacoccus solenopsis* were studied under laboratory conditions at 17-27°C and 58-82% RH. The mean incubation period and total larval periods were 4.36 and 17.33 days (2.78, 4.64, 6.13 and 3.79 days for 1st, 2nd, 3rd and 4th instar grubs, respectively). The pre-pupal, pupal and total development period recorded were 2.38, 8.69 and 32.75 days, respectively. Pre-oviposition, oviposition and post-oviposition periods were 7.23, 46.75 and 7.80 days, respectively. Males lived longer than females (68.30 and 61.78 days, respectively) and life cycle duration were 100.29 and 93.77 days, respectively. The mean fecundity was 98.15 (eggs/female) and sex ratio (male: female) was 1: 1.36. The per cent hatchability and adult emergence observed were 79.00 and 88.50, respectively.

KEY WORDS: Biological parameters, *Cryptolaemus montrouzieri*, *Phenacoccus solenopsis*

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INTRODUCTION

Among predators, coccinellids are of great importance since they have proved their value in checking mealybugs, scales, aphids, coccids, aleyrodids, etc. on a variety of plants in different parts of the world. Puttarudriah *et al.* (1952) ranked *Cryptolaemus montrouzieri* Mulsant as second only to *Rodolia cardinalis* (Mulsant) for its ability to check population of mealybugs. *C. montrouzieri* was reported to prey on citrus mealybug, *Planococcus citri* (Risso) (Singh, 1978), pink mealybug, *Maconellicoccus hirsutus* (Green) (Ranga Reddy and Lakshmi Narayanan, 1986; Mani and Thontadarya, 1988) and cochineal insect, *Dactylopius tomentosus* (Lamarck) infesting the waste land weed, prickly pear [*Opuntia dillenii* (Ker-Gawl) Haword] around Coimbatore (Murali Baskaran *et al.*, 1999). In the past few years, the mealybug, *Phenacoccus solenopsis* Tinsley has emerged as a major pest of *Bt* as well as non-*Bt* cotton in Punjab.

Cryptolaemus montrouzieri has been found effective for the management of mealybugs in citrus orchards (Singh, 1978) in Southern India; however, the biology of this predator on *P. solenopsis* under Punjab conditions has not been studied. The present study was planned to study the biology of *C. montrouzieri* on *P. solenopsis* in order to explore the possibilities of its involvement as a component

of integrated pest management program for *P. solenopsis* in Punjab.

MATERIALS AND METHODS

The nucleus culture of *C. montrouzieri* was obtained from National Bureau of Agriculturally Important Insects (NBAIL), Bangalore. These were maintained on different instar nymphs of the mealybug at Biological Control Laboratory, Punjab Agricultural University, Ludhiana. *P. solenopsis* was collected from infested cotton fields and mass multiplied on potted cotton, sprouted potato, tomato and pumpkin plants under screen house conditions at Entomological Research Farm, PAU, Ludhiana.

Freshly emerged male and female beetles were paired and 10 such pairs were kept in glass vials (70 × 15mm) separately. The mealybugs along with cotton leaves were provided to these pairs as food and all the pairs were observed for their pre-oviposition, oviposition, post-oviposition periods, fecundity and longevity. The total life cycle and adult longevity of both sexes were also calculated. The mean and standard error for all these biological parameters were worked out.

To study the development, a portion of the cotton leaf having newly laid beetle eggs was cut and each egg was placed carefully on a small bit of cotton leaf with the

help of a camel hair brush in a glass vial and these vials were plugged with cotton swab. Such twenty replications were prepared and observed daily. The time taken from egg laying to hatching (5 replications), duration of larval stages, pre-pupal and pupal stages and sex ratio were recorded and standard error worked out.

The temperature and relative humidity in the Biological Control Laboratory were recorded daily at 9.00 a.m. during the studies. Maximum and minimum temperatures and % RH during May-August were 24–27°C, 17–22°C and 61–82% during 2008 and 23–26°C, 19–23°C and 58–82% during 2009, respectively.

RESULTS AND DISCUSSION

Biological parameters of C. montrouzieri

The results on biological parameters during 2008 and 2009 (Table 1) indicated that the mean incubation period, durations of first, second, third and fourth grub instars and total grub period were 4.36 ± 0.08 , 2.78 ± 0.07 , 4.64 ± 0.11 , 6.13 ± 0.20 and 3.79 ± 0.09 and 17.33 ± 0.30 days, respectively. The pre-pupal period, pupal period and total developmental period recorded were 2.38 ± 0.05 , 8.69 ± 0.11 and 32.75 ± 0.46 days, respectively. Pre-oviposition, oviposition and post-oviposition periods were 7.23 ± 0.13 days, 46.75 ± 2.17 days and 7.80 ± 0.47 days, respectively. The longevity of male and female were 68.30 ± 2.85 and 61.78 ± 2.16 days, respectively, and males lived slightly longer than females. The life cycle

was completed in 100.29 ± 6.79 days and 93.77 ± 4.07 days by male and female, respectively.

Earlier Mani and Thontadarya (1987) reported the egg period of *C. montrouzieri* as 4.25 days on *M. hirsutus* eggs, 4.10 days on *M. hirsutus* nymphs and 4.30 days on *M. hirsutus* adults, which is in close agreement with the recorded observations on *P. solenopsis* (4.36 ± 0.08 days). In the present studies, the total larval period was 17.33 ± 0.30 days. Earlier, Liotta and Mineo (1965) and Tirumala Rao and David (1958) also reported the larval period of *C. montrouzieri* (12–17 days) on *M. hirsutus*. Murali Baskaran *et al.* (1999) observed the total larval period and total developmental period of *C. montrouzieri* was 12.42 ± 0.99 and 26.09 ± 2.73 days, respectively, on *P. citri* and 17.67 ± 0.87 and 32.51 ± 3.03 days, respectively, on *D. tomentosus*. In the present studies the total developmental period was 32.75 ± 0.46 days on *P. solenopsis*. The prepupal and pupal period of *C. montrouzieri* was 2-3 days and 7-9 days, respectively, on *M. hirsutus* (Tirumala Rao and David 1958) as in the present studies on *P. solenopsis*. The recorded pre-oviposition period of *C. montrouzieri* on *P. solenopsis* was 7.23 ± 0.13 days. However, Venkatesan *et al.* (2001) reported that it was 8.00 ± 0.51 days on *M. hirsutus*. Joshi *et al.* (2003) reported the longevity of *C. montrouzieri* (55–56 days) on its natural hosts (Unspecified).

Table 1. Biological parameters of *C. montrouzieri* on *P. solenopsis* under laboratory conditions during 2008 and 2009

Biological parameters	May – August 2008 Duration (days) (Mean \pm S.E.)	May – August 2009 Duration (days) (Mean \pm S.E.)	Mean Duration (days) (Mean \pm S.E.)
Incubation period**	4.43 \pm 0.08	4.30 \pm 0.08	4.36 \pm 0.08
Larval period**			
1 st instar	2.73 \pm 0.08	2.83 \pm 0.06	2.78 \pm 0.07
2 nd instar	4.45 \pm 0.10	4.83 \pm 0.09	4.64 \pm 0.11
3 rd instar	5.85 \pm 0.24	6.40 \pm 0.13	6.13 \pm 0.20
4 th instar	3.75 \pm 0.10	3.83 \pm 0.08	3.79 \pm 0.09
Total larval period**	16.78 \pm 0.07	17.88 \pm 0.31	17.33 \pm 0.30
Pre-pupal period**	2.35 \pm 0.05	2.40 \pm 0.05	2.38 \pm 0.05
Pupal period**	8.48 \pm 0.13	8.90 \pm 0.06	8.69 \pm 0.11
Total developmental period**	32.03 \pm 0.45	33.48 \pm 0.47	32.75 \pm 0.46
Pre-oviposition period*	7.13 \pm 0.13	7.33 \pm 0.14	7.23 \pm 0.13
Oviposition period*	47.90 \pm 2.24	45.6 \pm 2.14	46.75 \pm 2.17
Post-oviposition period*	8.10 \pm 0.58	7.50 \pm 0.35	7.80 \pm 0.47
Longevity*			
Male	70.10 \pm 2.13	66.50 \pm 3.46	68.30 \pm 2.85
Female	63.13 \pm 2.35	60.43 \pm 1.98	61.78 \pm 2.16
Life cycle duration*			
Male	101.48 \pm 6.97	99.10 \pm 6.65	100.29 \pm 6.79
Female	94.43 \pm 4.19	93.10 \pm 3.96	93.77 \pm 4.07

*Based on 10 individuals; ** based on 20 individuals

Table 2. Fecundity, hatchability, adult emergence and sex ratio of *C. montrouzieri* during 2008 and 2009 under laboratory conditions

Biological parameters	May – August 2008 (Mean ± S.E.)	May to August 2009 (Mean ± S.E.)	Mean (Mean ± S.E.)
Fecundity* (No. of eggs)	96.50 ± 4.29	99.80 ± 9.70	98.15 ± 7.32
Hatchability** (%)	80.00 ± 0.79	78.00 ± 1.28	79.00 ± 1.03
Adult emergence*** (%)	87.00 ± 1.28	90.00 ± 0.79	88.50 ± 1.06
Sex ratio male: female****	1:1.22	1:1.50	1:1.36

*Based on 10 females; **based on 20 eggs (5 replications); ***based on 20 pupae (5 replications); ****Based on 20 pupae

Fecundity, hatchability, adult emergence and sex ratio of C. montrouzieri

The data on mean values of the above biological parameters of *C. montrouzieri* (Table 2) revealed that the fecundity of *C. montrouzieri* was 98.15 ± 7.32 eggs and the per cent hatchability was 79.00 ± 1.03 . The per cent adult emergence was 88.50 ± 1.06 and the sex ratio (male: female) was 1:1.36.

Murali Baskaran *et al.* (1999) found that the sex ratio of *C. montrouzieri* (male: female) on *D. tomentosus* and *P. citri* was 1:1.75 and 1: 1.49, respectively and these studies are in close agreement with the recorded observations on *P. solenopsis* (1: 1.36). The per cent adult emergence recorded by Murali Baskaran *et al.* (1999) was 94.60 on *D. tomentosus* and 94.30 on *P. citri*. It was 90.00 ± 1.14 on *M. hirsutus* (Venkatesan *et al.*, 2001). In the present studies, it was slightly lower on *P. solenopsis*. Joshi *et al.* (2003) reported the fecundity of *C. montrouzieri* (299.27 eggs/female) on its natural hosts which varied from the present observations on *P. solenopsis* where it was less.

The variations in biological parameters observed in the present studies as discussed above could be due to the differences in the host or environmental conditions of the study period.

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