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Study of the Predatory Potential of Australian Ladybird Beetle (*Cryptoleamus montrouzieri Mulsant*) Feeding on Cotton Mealy Bug (*Phenococcus solenopsis Tinsley*) at Three Constant Temperatures

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Abstract:

Predatory potential of Cryptoleamus montrouzieri Mulsant (Coleoptera: Coccinellidae) feeding on Phenococcus solenopsis Tinsley (Hemiptera: Pseudococcidae) was evaluated at three different temperatures i.e. 24 ±1°C, 28 ±1°C and 32 ±1°C with 65 ±5% Relative humidity and 16:8 (L:D) photoperiod under growth chamber. Maximum predatory potential of 1st instar 24.45 was found at 28±1 ˚C, while minimum was 17.84 at 24±1 ˚C. The results further indicated that with increasing temperatures predatory potential decreased. Maximum predatory potential of 2nd instar 46.65 was found at 32±1

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˚C, while minimum was 33.30 at 24±1 ˚C. Predatory potential of third instar 65.84, 78.55 and 67.86 was recorded respectively. Predatory potential of fourth instar was found 101.45, 169.4 and 131.60 respectively. Maximum male predatory potential 1422 was recorded at 32±1 ˚C, while minimum was 1078.4 at 24±1 ˚C. Maximum female predatory potential 1501.1 was recorded at 28±1 ˚C, while minimum 1098.9 was at 24±1 ˚C. Hence it was concluded from the present study that 28 ±1°C was found comparatively the most suitable and favorable temperature for rearing of C. montrouzieri. Release of C. montrouzieri against P. solenopsis infesting field crops can manage infestation and thus get their sustainable productivity and enhance profitability of farming community.

Key words: *Cryptoleamus montrouzieri,* predatory potential, Cotton mealy bug, temperatures.

Introduction

Mealy bugs (*Phenococcus solenopsis Tinsley)* are soft bodied insects belonging to the family Pseudococcidae, order Hemiptera. About 5000 species of mealy bug have been recorded from 246 families of plants throughout the world. Among these, 56 species have been reported from 15 genera of family Malvaceae, including cotton and many other plants of economic importance (Ben-Dov, 1994). Indiscriminate use of pesticides creates problems in the agro ecosystem, such as environmental pollution, health hazards and also by killing beneficial insects and resistance in insect pests (Robert *et al.*, 1985).

Biological control plays an important role to manage a wide range of insect pests that are commonly found on horticultural and field crops. Biological control is a valuable component of integrated pest management (IPM) and is compatible with other control measures of IPM program. It is one of the safest, cheapest and most efficient methods of pest control. Moreover, from the public and health point of view, it does not pollute the air, land, rivers and sea (Bahaduri *et al.*, 1989).

Different bio-control agents are available for the management of insect pests. Among these predatory coccinelids play an important role for the management of insect pests. The insects of predacious family Coccinellidae are commonly known as lady beetles, lady bird or coccinellid beetles. Majority of beetles are useful because of predacious nature, while some are harmful having polyphagous nature. The other coccinellids are predacious against variety of pests i.e. mealy bugs, leafhoppers, scale insects, mites, aphids and also against soft bodied insects (Omkar and Bind 1996). About 5,200 species of coccinellids have been reported from the world. Khan *et al*., (2007) have recorded 12 species of coccinellids from district chitral, Pakistan. The potential of coccinellids for the management of different pests are quite promising in Pakistan. (Dean and Satasook, 1983).

Australian ladybird beetle **(***Cryptoleamus montrouzieri Mulsant)* belongs to order Coleoptera and family Coccinellidae. Its common name is mealy bug destroyer. It is small blackish beetle and native to Australia. It is highly voracious predator of mealy bug in both immature and adult stages. It can be easily mass reared under laboratory conditions. Therefore, it is vital to look for alternative methods of pest control, which should be safe to natural ecosystem and human health.

The current studies were therefore undertaken to study:

(1) The predatory potential of *Cryptoleamus montrouzieri* feeding on *Phenococcus solenopsis* at three constant temperatures 24 ±1°C, 28 ±1°C and 32 ±1°C.
(2) The functional response of *Cryptoleamus montrouzieri Mulsant* under Laboratory condition at 28 ±1°C.

Materials and Methods

The experiment was conducted to check the predatory potential of *Cryptoleamus montrouzieri* feeding on *Phenococcus solenopsis* at three constant temperatures 24 ±1°C, 28 ±1°C and 32 ±1°C at department of Plant Protection, The University of Agriculture Peshawar KhyberPakhtunkhwa during year 2013.

Procedure for Experiments:

To study the predatory potential of immature stages of *C. montrouzieri*, 50 newly emerged 1st instar grubs of *C. montrouzieri* were collected and kept in small transparent Petri dishes under growth chambers at each required temperature. Initially the grubs were provided 30 (1st and 2nd nymphal instar) of *P. solenopsis* on potato leaves and lady finger, because initially the size of *C. montrouzieri* was small the number of preys were increased with increasing age of the predator and up to 250 crawlers were provided to 4th instar grubs. Every time during the time of observation the crawlers consumed by each grub, dead and unconsumed were counted. The unconsumed and dead crawlers were removed with fresh one daily. The exuva found in Petri dishes was removed soon after the grub entered in to next instar, this procedure was continued till pupation. The data were recorded on predatory potential of 1st, 2nd, 3rd, 4th, total larval and survival rate at each stage of *C. montrouzieri*.

To study the adult male and female predatory potential, one day old emerged adults were separated and confined in plastic vials separately. A total of 20 male and female of known age (one day old) were kept separately in plastic vials of size (6x15 cm) covered with muslin cloth at the top. The adults were provided counted number of (2nd and 3rd) nymphal instar of *P. solenopsis* on respective vegetable twigs and leaves. A total of 200 crawlers were provided to the adult male/female of *C.*

montrouzieri separately. Crawlers were counted with the help of binocular microscope and were transferred to the vials with camel hair brush. The unconsumed and dead crawlers were counted every morning at the time of observations and were replaced with fresh one daily till the death of male/female adult at each required temperature.

The experiment was laid down in Randomized Complete Block Design (RCBD) replicated three times adult of *C. montrouzieri* per plant were tested for survival on mealybug densities. The data was statistically analyzed following the procedures (Gomez & Gomez, 1984). MSTATC computer software was used to carry out statistical analysis (Russel & Eisensmith, 1983). Means were determined and the standard error (SE) calculated. Means were separated following the Duncan Multiple Range Test (DMRT) procedure. The significance of differences among means was compared by using Least Significant Difference (LSD) test at $P < 0.05$ (Steel & Torrie, 1997).

Results:

Predatory potential of immature stages of *C. montrouzieri* feeding on *P. solenopsis*

The results indicated that the predatory potential of first instar 17.84, 24.45 and 22.39 was recorded at three constant temperatures, respectively. Maximum predatory potential of 24.45 was found at 28±1 ˚C, while minimum was 17.84 at 24±1 ˚C. The results indicated that the predatory potential of second instar 33.30, 42.34 and 46.65 was noted at three constant temperatures, respectively. The results further indicated that with increasing temperatures predatory potential decreased. Maximum predatory potential of second instar 46.65 was found at 32±1 ˚C, while minimum was 33.30 at 24±1 ˚C. The results showed that the predatory potential of third instar 65.84, 78.55

and 67.86 was recorded respectively. Maximum predatory potential of third instar 78.55 was found at 28±1 ˚C, while minimum was 65.84 at 24±1 ˚C. The results showed that the predatory potential of fourth instar was found 101.45, 169.4 and 131.60 respectively. Maximum predatory potential of 169.4 was found at 28±1 ˚C, while minimum was 101.45 at 24±1 ˚C. Kaur et al. 2011 found feeding potential of *C. montrouzieri* on *P. solenopsis*. Mean consumption of 1st instar *C. montrouzieri* on *P. solenopsis* was 15.56±0.73, 2nd instar grubs consumed significantly more than 1st instar nymphs of *P. solenopsis* i.e. 41.01±0.99, 3rd instar consumed 125.56±3.93 and 4th instar consumed 162.69±3.88. Total larval predatory potential of 231.33, 283.55 and 268.57.4 was found at three temperatures, respectively. Maximum predatory potential was 283.55 at 28±1 ˚C, while minimum was 231.33 at 24±1 ˚C.

Table-1: Mean predatory potential of *Cryptoleamus montrouzieri* Mulsant fed on *Phenococcus solenopsis* Tinsley at three constant temperatures.

	Means predatory potential ± (SD)		
Different temperatures	24 ±1°C	28 ±1°C	32 ±1°C
1st instar	17.84±0.06 c	24.45±0.03 a	22.39±0.03 b
2nd instar	33.30±0.03 c	42.34±0.03 b	46.65±0.03 a
3rd instar	65.84±0.03c	78.55±0.03a	67.86±0.03 b
4th instar	101.45±0.03 c	169.4±0.03a	131.60±0.03 b
Total larval	231.33±0.02 c	283.55±0.03a	268.57±0.05 b

Means followed by same letters (column wise) are non significant

Adult predatory potential

The results indicated that the male predatory potential 1078.4, 1422 and 1356.2 was found at each temperature, respectively. Maximum male predatory potential 1422 was recorded at 32±1 ˚C, while minimum was 1078.4 at 24±1 ˚C. The results further showed that male predatory potential was significantly different on each temperature level. The results indicated that female predatory potential 1098.9, 1501.1 and 1473.1 was found at each temperature respectively (Table 2). Maximum female predatory potential 1501.1 was recorded at 28±1 ˚C, while minimum 1098.9 was at 24±1 ˚C. The results further showed that female predatory potential was significantly different on each temperature level. Mari *et al.*, 2005 found the male predatory potential of *M. sexmaculatus* and *C. undecimpunctata* viz. 2548 and 2930 aphids and female consumed 2800 and 3080 alfalfa aphids.

Table-2: Mean predatory potential of adult of *Cryptoleamus montrouzieri* Mulsant fed on *Phenococcus solenopsis* Tinsley at three constant temperatures.

	Means predatory potential ± (SD)		
Different temperatures	24 ±1°C	28 ±1°C	32 ±1°C
Male predatory potential	1078.4±0.25a	1422.6±0.29b	1356.2±0.35c
Female predatory potential	1098.9±0.3a	1501.1±0.3b	1473.1±0.3c

Means followed by same letters rows wise are non significant.

Conclusion:

It is revealed from the present study that various temperatures levels have significant effect on the developmental durations and population buildup of *C. montrouzieri*.In respect to temperature maximum predatory potential was observed at 28 ±1°C, Feeding potential of adult female was found greater than male on all temperature level, In immature stages and adult stage predation of *C. montrouzieri* was recorded voracious.

The life table parameter indicates maximum survival of *C. montrouzieri* was at 28 ±1°C. Hence it was concluded from the present study that 28 ±1°C was found comparatively the most suitable and favorable temperature for rearing of *C. montrouzieri.*

This predator can be utilized for further investigation under laboratory condition. Release of *C. montrouzieri* against *P. solenopsis* infesting field crops can manage infestation and thus get their sustainable productivity and enhance profitability of farming community.

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