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Research Note

Predatory potential of *Cryptolaemus montrouzieri* Mulsant on mealybugs and aphids

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ABSTRACT: The predatory potential of *Cryptolaemus montrouzieri* Mulsant on mealybugs and aphids *viz, Maconellicoccus hirsutus, Phenacoccus solenopsis* and *Aphis gossypii* was studied at the Biocontrol Agents Laboratory, Department of Agricultural Entomology, College of Agriculture, Latur at the temperature of 25±2^{0}C maintained in BOD incubator during year 2013-14. The consumption rate of grubs and beetles of *C. montrouzieri* was in order of *A. gossypii>M. hirsutus>P. solenopsis.*

KEY WORDS: Aphids, ladybird beetle, mealybugs, predator

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Sucking pests that include mealybugs and aphids have been reported as serious pests of grapevine, cotton and several crops in India. Grape production is often adversely affected due to the mealybugs to the extent of damage being as much as 100 per cent in extreme cases in India (Babu and Azam, 1989). Infestation of mealybug on leaves, shoots, nodes, fruits and branches especially on growing point of the plant results in malformation of leaves and tips of shoots. The pink hibiscus mealybug, *Maconellicoccus hirsutus* (Green) (Hemiptera: Pseudococcidae) was commonly found causing wide spread damage to many grape growing areas in India (Mani and Thontadarya, 1987a). Similarly, cotton mealybug, *Phenacoccus solenopsis* Tinsely (Hemiptera: Pseudococcidae), a soft-bodied sucking insect is inflicting severe damage to the several commercial plants. Aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae) is another key pest of the cotton crop. The management of these sucking pest is becoming difficult and one of the benign alternatives is the use of biocontrol agents.

The coccinellids have emerged as strong and potent biocontrol agents and result oriented researches are further needed continuously to ascertain their efficiency in the integrated pest management programme. Hence, keeping this in view, the investigations on predatory potential of *Cryptolaemus montrouzieri* Mulsant on mealybugs and aphids were carried out.

The culture of *C. montrouzieri* was obtained from ICAR-National Bureau of Agricultural Insect Resources, Bengaluru for these studies.

Mass multiplication of *M. hirsutus* on pumpkins

The laboratory technique of rearing of mealybugs on ripe red pumpkins, *Cucurbita maxima* standardized by Chacko *et al.* (1978) and Singh (1978) was followed. The red ripe pumpkins having ridges and grooves with small stalk were used for multiplication of mealybugs. The pumpkins were washed with tap water to remove dust particles and then dipped in a solution of Bavistin 0.1 per cent to kill the pathogens. The injured pumpkins were discarded and minor wounds were plugged with hot paraffin wax and then dried. For shallow groove-less pumpkins, a simple roping technique was followed. This facilitated rapid multiplication of mealybugs on shallow grooves and groove-less pumpkins. Care was taken to treat the ropes "Sutali" with Bavistin solution. The rearing cages having size of 30 x 30 x 30 cm with slanting glass top were used for multiplication of mealybugs. All other sides of cages were fitted with 40 guage nylon mesh with the provision of sleeve on front side. The care was taken to close all cracks and crevices of the wooden cages to prevent escape of early instars of the mealybugs.

Inoculation of egg masses of mealybug on pumpkins

The pumpkins were inoculated with egg masses of *M. hirsutus* with the help of wet camel hair brush. Number of egg sacs placed on each pumpkin varied according to size of pumpkin. The pumpkins were then kept in wooden cages. The inoculation was done with ovisacs of *M. hirsutus* throughout period of study. The ambient temperature and relative humidity of the laboratory ranged from 25^0C to 30^0C and 65 to 75 per cent, respectively.

Mass multiplication of *P. solenopsis* on potato

The laboratory technique of rearing of mealybugs on potato sprouts reported by Branigan (1916) and further modified by Smith and Armitage (1920) and elaborated by Fisher (1963) was followed. The bold healthy potatoes were brought from the market. These potatoes were washed gently with tap water to remove any surface residue of insecticide. Such potatoes were surface treated with carbendazim 50 WP at the rate of 1g/litre of water to prevent rotting. The sandy and light soil was used for growing potatoes. The soil was sterilized by formalin before potato plantation**.** The plastic pots having 26 cm diameter and 24 cm height were used for growing the potatoes. After sowing, potatoes were slightly covered with soil. The pots were watered regularly. The potatoes were well sprouted in 10 to 12 days. On such sprouted potatoes the ovisacs of *P. solenopsis* were transferred. The mass culture of mealybugs was maintained throughout the period of investigation.

Mass multiplication of *A. gossypii* on cotton

The culture of aphids was obtained from the pesticide free cotton variety NH-630 sown in a plot size of 5 x 5 sq.m at the spacing of 45 x 10 cm.

Multiplication of *C. montrouzieri*

Six pairs of newly emerged beetles of *C. montrouzieri* grown on respective prey were transferred into each petridish of 10 x 2 cm size. The respective species of mealybugs and aphids were provided to these beetles as food. After completing pre-mating and pre-oviposition period, the females of *C. montrouzieri* laid eggs near the mealybugs/ aphids kept in petridish. Such petridishes were observed daily to obtain the eggs of *C. montrouzieri*.

The studies on predatory potential of *C. montrouzieri* on third instar nymphs of species of mealybugs *viz., M. hirsutus* and *P. solenopsis* and aphids *viz., A. gossypii* were carried out in completely randomized design replicated five times at 25 ± 2^0C temperature maintained in BOD incubator. Fifty grubs of predator comprising of 10 grubs in each replication were used to feed upon the respective preys separately.

The known numbers of preys were provided to grubs of *C. montrouzieri* daily until pupation. The observations on the number of prey consumed by each of larval instars of *C. montrouzieri* were recorded daily after 24 hours of its exposure till pupation. The male and female beetles of *C. montrouzieri* which were emerged from their immature stages fed on respective prey were used to record the observation on their feeding potential daily on each of the preys under investigation. An average weight of 10 third instar nymphs of respective species of mealybugs and aphids was recorded. The data on predatory potential in terms of number were converted into predatory potential on weight basis.

The results on predatory potential of grubs of *C. montrouzieri* on mealybugs and aphids are presented in (Table 1). The significantly minimum duration to the extent of 22.99 days was required to complete the entire development of *C. montrouzieri* by feeding on 103.38 third instar nymphs of *P. solenopsis* followed by 25.02 days by feeding on 136.08 nymphs of *M. hirsutus* and 28.30 days by feeding on 688.93 nymphs of *A. gossypii*. However, I, II, III and IV instar larvae consumed significantly minimum number of third instar nymphs of *P. solenopsis* followed by *M. hirsutus* to the extent of 10.10, 21.09, 44.11 and 60.77, respectively and *A. gossypii* to the tune of 54.24, 107.06, 212.50 and 315.20, respectively (Table 2).

Mani and Thontadarya (1987b) reported that the single I, II, III and IV instar grub of *C. montrouzieri* consumed on an average 4, 11, 80 and 164 nymphs of *M. hirsutus,* respectively. Babu and Azam (1987) found that I, II, III and IV instar larvae of *C. montrouzieri* consumed 6.9, 42.1, 140.1 and 354.7 nymphs of *M. hirsutus*, respectively. According to Naik *et al*. (2003), I, II, III and IV instar grub of *C. montrouzieri* consumed 3, 9, 64 and 156 nymphs of *M. hirsutus*. Fand *et al*. (2010) reported that I, II, III and IV instar grub of *C. montrouzieri* consumed 5.40, 8.20, 19.40 and 32.60 III nymphal instar of *P. solenopsis*.

The male and female adult beetles of *C. montrouzieri* consumed 770.12 and 917.80 of *A. gossypii*, 402.38 and 589.60 of *M. hirsutus* and 383.95 and 476.00 of *P. solenopsis* in a period of 54 and 62, 77 and 107, 84 and 96 days, respectively (Table 3). It indicate that the feeding potential of female was more than males. Al Khateeb and Raje (2001) reported that the predation rate of male beetle of *C. montrouzieri* on third nymphal instar of *P. citri* was 37.7 ± 3.51. Kulkarni (2000) reported that male predatory beetle consumed 521.37 (34.60 days) and 328.50 (30.03 days) nymphs of *M. hirsutus* and *F. virgata*, respectively. Deokar (2011) and Gore (2012) reported the consumption of 733.60 and 636.20 of II instar nymphs of *M. hirsutus* and *P. solenopsis,* respectively by male beetle of *C. montrouzieri* during its development. The female

Table 1. The mean larval instar duration of *C. montrouzieri* on mealy bugs and aphids

Name of prey	Larval instars				Total	Mean
	I	II	III	IV		
A. gossypii	5.97	5.32	8.17	8.84	28.30	5.66
M. hirsutus	4.94	4.51	7.48	8.09	25.02	5.00
P. solenopsis	4.48	4.36	6.79	7.36	22.99	4.60
S.E. +	0.06	0.03	0.07	0.05	-	-
C.D. at 5%	0.19	0.09	0.22	0.16	-	-
C.V. (%)	2.71	1.49	2.13	1.51	-	-

Table 2. Feeding potential of grubs of *C. montrouzieri* on mealy bugs and aphids

Parameter	Prey species			S.E.±	C.D at 5 %	C.V. (%)
	A. gossypii	***M. hirsutus***	***P. solenopsis***			
Duration of Ist instar grub (days)	5.97	4.94	4.48	0.06	0.19	2.71
Total prey consumption by Ist instar grub	54.24 (7.37)	10.10 (3.18)	7.53(2.75)	0.33	1.02	3.10
Per day prey consumption by Ist instar grub	9.04 (3.01)	2.04 (1.43)	1.68(1.29)	0.07	0.21	3.73
Duration of IInd instar grub (days)	5.32	4.51	4.36	0.03	0.09	1.69
Total prey consumption by IInd instar grub	107.06 (10.35)	21.09.06 (4.5)	16.38(4.04)	1.23	3.78	5.7
Per day prey consumption by IInd instar grub	20.20 (4.5)	4.56 (2.13)	3.75(1.93)	0.21	0.65	4.95
Duration of IIIrd instar grub (days)	8.17	7.48	6.79	0.07	0.22	2.13
Total prey consumption by IIIrd instar grub	212.50 (14.57)	44.11 (6.64)	32.06(5.66)	1.56	4.79	3.62
Per day prey consumption by IIIrd instar grub	26.01 (5.09)	5.89 (2.42)	4.71(2.17)	0.33	1.02	6.07
Duration of IVth instar grub (days)	8.84	8.09	7.36	0.05	0.15	1.51
Total prey consumption by IVth instar grub	315.20 (17.75)	60.77 (7.79)	47.33(6.78)	2.11	6.50	3.35
Per day prey consumption by IV th instar grub	35.65 (5.98)	7.51 (2.73)	6.43(2.53)	0.35	1.06	4.68
Duration of Ist to IVth instar grubs (days)	28.30	25.02	22.99	0.10	0.31	0.89
Total consumption by Ist to IVth instar grubs	688.93 (26.25)	136.08 (11.67)	103.38(10.17)	3.47	10.70	2.51

Table 3. Feeding potential of adults of *C. montrouzieri* on mealybugs and aphids

Parameter	Prey species			S.E.±	C.D at 5 %	C.V. (%)
	A. gossypii	*M. hirsutus*	*P. solenopsis*		.	
Duration of male adult (days)	54	77	84	0.98	3.03	3.07
Total prey consumption by male adult	770.12 (27.75)	402.38 (20.05)	383.95 (19.59)	4.14	N.S.	1.78
Per day prey consumption by male adult	14.26 (3.78)	5.22 (2.29)	4.57 (2.13)	0.07	0.22	2.01
Duration of female adult (days)	62	107	96	0.68	2.10	1.73
Total prey consumption by female adult	917.80 (30.29)	589.60 (24.29)	476.00 (21.81)	4.14	N.S.	1.40
Per day prey consumption by female adult	14.79 (3.84)	5.51 (2.34)	4.96 (2.22)	0.04	0.13	1.17

beetle of *C. montrouzieri* was reported to consume 567.60 nymphs of *M. hirsutus* in 42.77 days (Kulkarni, 2000), 835.70 nymphs of *M. hirsutus* (Kulkarni 2001), 880.20 II instar nymphs of *M. hirsutus* or 693.40 II instar nymphs of *P. solenopsis* (Gore 2012). Prabal Saikia and Balasubramanian (2000) reported that predatory potential of female beetle of *C. montrouzieri* was higher on all prey compared to the male. The order of predatory potential of female beetle on different prey insects was *A. gossypii* on cotton (92.80) *A. gossypii* on okra (90.60) > cowpea aphid (17.80) > mealybug adults (3.60).

The consumption rate of grub and adult beetle of *C. montrouzieri* was in the order of *A. gossypii>M. hirsutus>P. solenopsis.*

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