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Feeding potential of *Cryptolaemus montrouzieri* Mulsant on different species of mealybugs

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ABSTRACT

An experiment was conducted to study the feeding potential of *Cryptolaemus montrouzieri* Mulsant on different species of mealybugs at Department of Agricultural Entomology, College of Agriculture, Dapoli. The feeding potential of *C. montrouzieri* on grubs and adults of mealy bugs jointly revealed that the total consumption of grub was much higher on *M. hirsutus i.e.* 144.4±15.64 with their longevity of 12.10±2.1 days than *Phenacoccus solani* and custard apple mealy bugs. Similar pattern of consumption was found in case of adults, where the female predator consumed more *i.e.* 443.90±27.13 with longevity of 27.45±1.08 days. The overall findings of the feeding potential showed that the Australian ladybird beetle nymphs and adults consumed more number of preys of *M. hirsutus* than other two species.

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INTRODUCTION

The mealy bug is called as “hard to kill” pest of fruit crops. There are however, several reasons which may account for this fact. The waxy coating present on the body of mealy bug limits the efficiency of insecticides (Rao and David, 1958). The use of systemic insecticides for their management lives the residue in the fruits, which is not tolerable in the international markets. For achieving the export standards, the fruit production from the orchards should be free from pest and pesticide residue.

Hence, the situation demands urgent need to promote bio-control as a major input in the overall integrated pest management of mealy bug. In fact, mealy bugs as sessile insect, are more amenable to the biological control. Its control has long-term effect, inexpensive, self-sustaining system, causes no pollution and no risk to human health. Among the predators of mealy bugs, the Australian ladybird beetle, *Cryptolaemus montrouzieri* Mulsant (Coleoptera: Coccinellidae) has been reported to be a general predator at all the stages of its development. Hence, the use of Australian ladybird beetle is thought of as a possible solution to combat the menace of the mealy bug.

In India the coccinellid beetle *Cryptolaemus montrouzieri* Mulsant (Coleoptera : Coccinellidae) has provided spectacular control of heavy infestations of sucking pests, especially mealybugs (Mani, 1990; Mani and Krishnamoorthy, 2008) and some soft scales (Kumar and Prakasam, 1984; Mani and Krishnamoorthy, 1990). The number of fruit and plantation crops *viz.*, mango, cashewnut, coconut, arecanut and other crops are being cultivated on large scale in Konkan region of Maharashtra. The different

mealy bug species *viz.*, *Maconellicoccus hirsutus* (Green), *Ferrisia virgata* (Cockrell), *Phenacoccus solani* (Tansley), *Planococcus citri* (Risco), *Rastrococcus hirsutus* (Green) and *Drosicha mangiferae* GR. etc. were recorded from different crops in this region. The information on effect of insecticides on Australian ladybird beetle is not available, whereas the feeding potential of *C. montrouzieri* on different mealy bug species is also scanty. Keeping the above point in mind, the studies on feeding potential of *C. montrouzieri* on different species of mealybugs was undertaken.

MATERIAL AND METHODS

The investigation on feeding potential of *C. montrouzieri* was carried out by using grape mealy bug, *Maconellicoccus hirsutus* (Green), *Phenacoccus solani* (Tansley) and custard apple mealy bug as a host. The study was conducted at Biological Control Laboratory, Department of Agriculture Entomology, College of Agriculture, Dapoli during 2008-09.

The experiment on feeding potential of C. *montrouzieri* was carried out with a view to find out the suitability of the mealy bug species *viz.*, *M. hirsutus*, *P. solani* and custard apple mealy bug that can be used for mass production of Australian ladybird beetle. The feeding potential was studied to know the efficiency of the predator on different species of mealy bugs. The method adopted by Mani and Krishnamoorthy (1990) and Raju (2002) was followed for rearing the predator after sufficient development of mealy bugs on pumpkins. The method elaborated by Fisher (1963) was followed for rearing of the predator on mealy bug infested potato sprouts.

Feeding potential :

In order to determine the feeding potential of both the stages *i.e.* grub and adult of *C. montrouzieri*, known number of mealy bug nymphs, adults and combination of both were supplied daily and observed until grub, pupate and adult died. These were confined in plastic vials with perforated lids. The males and females were studied separately. The observations were recorded at an interval of 24 hours on the number of preys consumed by each grub and adult beetle. It was computed by subtracting the number of mealy bug bio stages left from the total number of bio stages provided.

RESULTS AND DISCUSSION

The feeding potential of *C. montrouzieri* on the nymphs of mealy bug species (Table 1) was compared within instars and the result depicted that the fourth instars have higher consumption potential among all the species of mealy bug. The longevity of grub instars showed nearly similar duration among all the instars and mealy bug species. The grub consumed a total of 254 ± 31.95 nymphs during its developmental period of 14.15 ± 1.66 days when reared on *M. hirsutus*, which was much higher than *P. solani* and custard apple mealy bugs feeding. These findings are in agreement with those of Pralhad *et al*. (2000) and Naik *et al.* (2003), who reported that single grub consumed on an average 239.6 and 227.0 nymphs, respectively. Superiority of fourth instar consumption was found similar with the results of Kakade and Patel (2013).

Similarly, the male beetle devoured on an average 539.45 ± 21.09 and 447.2 ± 23.99 with their longevity of 25.1 ± 0.96 and 21.3 ± 0.87 days on nymphs of *M. hirsutus* and *P. solani*, respectively, which was higher than custard apple mealy bugs. The female beetle also showed similar feeding trend with the more longevity on *M. hirsutus*. These findings are in conformity with those of Kulkarni (2000), who reported the higher male and female adult consumption potential on *F. virgata*.

In another trial, the total consumption of mealy bug adults from first to fourth instar of *C. montrouzieri* were found in the order of *M. hirsutus* > *P. solani* > custard apple mealy bugs. The consumption of male and female adults of *C. montrouzieri* was found 37.10 ± 5.76 and 47.65 ± 3.53 when fed on *M. hirsutus* with its better efficacy as compred to *P. solani* and custard apple mealy bugs. These higher consumption rates of *C. montrouzieri* on *M. hirsutus* and *P. solani* showed proportional longer longevity in male and female than custard apple mealy bugs. These findings are in agreement with the results of Kulkarni (2000) and Naik *et al.* (2003).

The feeding potential of *C. montrouzieri* on grubs and adults of mealy bugs jointly revealed that the total consumption of grub was much higher on *M. hirsutus i.e.* 144.4 ± 15.69 with their longevity of 12.10 $\pm$ 2.1 days than *P. solani* and custard apple mealy bugs. Similar pattern of consumption was found in case of adults, where the female predator consumed more *i.e.* 443.90 $\pm$ 27.13 with longevity of 27.45 $\pm$ 1.08 days. These findings are supported by the observations of Kulkarni (2000) and Kulkarni (2001) who found higher feeding potential on *M. hirsutus* by *C. montrouzieri*.

The overall results of the feeding potential of *C. montrouzieri* revealed that the feeding potential was higher when fed on *M. hirsutus* than other two species. It might be due to the variation in the size, stickiness and presence of mealy powder on body part of these different species. The nymphs of custard apple mealy bug are larger in size and the body is covered with thick white mealy powder. Similarly, the size and waxy coating of all the three species of the mealy bugs were altogether different.

Table 1 : Feeding potential of *C. montrouzieri* on nymphs and adult of different species of mealy bugs

Feeding potential	*M. hirsutus*		*P. solani*		Custard apple mealy bug	
	No. of mealy bug consumed	Longevity	No. of mealy bug consumed	Longevity	No. of mealy bug consumed	Longevity
			Feeding potential of *C. montrouzieri* on nymphs			
Grub stage						
I instar	17.35±1.88	3.45 ± 0.41	10.00 ± 1.41	2.55 ± 0.35	1.95 ± 0.52	2.60 ± 0.53
II instar	38.45±4.11	3.50 ± 0.31	17.10 ±1.72	3.20 ± 0.24	3.45 ± 0.61	2.95 ± 0.61
III instar	75.15 ± 8.5	3.35 ± 0.39	26.45 ± 2.22	3.35 ± 0.32	4.90 ± 0.48	3.15 ± 0.50
IV instar	123.05±17.46	3.85 ± 0.55	30.95 ± 3.10	3.95 ± 0.52	5.45 ± 0.65	4.05 ± 0.52
Total	254 ± 31.95	14.15 ± 1.66	84.5 ± 8.45	13.05 ±1.43	15.75 ± 2.26	12.75 ± 2.16
Adults stage						
Male	539.45 ± 21.09	25.1 ± 0.96	447.2 ± 23.99	21.3 ± 0.87	13.20 ± 0.84	11.55 ± 0.68
Female	749.85 ± 38.38	27.9 ± 1.17	612.7 ± 22.37	25.4 ± 0.48	16.10 ± 1.2	14.05 ± 0.61
Grub stage			Feeding potential of *C. montrouzieri* on adult			
I instar	4.7 ± 0.74	3.5 ± 0.39	2.3 ± 0.4	2.4 ± 0.3	1.7 ± 0.24	1.65 ± 0.39
II instar	5.7 ± 0.50	2.9 ± 0.48	4.7 ± 0.64	3.05 ± 0.41	2.35 ± 0.22	1.65 ± 0.39
III instar	8.55 ± 0.85	3.1 ± 0.48	6.45 ± 0.65	3.65 ± 0.32	2.65 ± 0.55	1.9 ± 0.48
IV instar	14.85 ± 0.89	3.8 ± 0.4	7.8 ± 0.64	3.8 ± 0.50	3.05 ± 0.41	2.65 ± 0.45
Total	33.8 ± 2.98	14.20 ± 1.54	21.25 ± 2.33	12.90 ± 1.53	9.75 ± 1.42	7.85 ± 1.67
Adults stage						
Male	37.10 ± 5.76	20.5 ± 0.86	21.85 ± 2.16	20.75 ±2.06	11.80 ± 0.64	10.05 ± 1.08
Female	47.65 ± 3.53	24.45 ± 0.82	27.45 ± 1.27	24.95± 1.17	15.45 ± 1.60	13.20 ± 0.45
			Feeding potential of *C. montrouzieri* on nymph and adult			
Grub stage						
I instar	(9.75 ± 1.00) + (4.25 ± 0.82)	(2.45 ± 0.41)	(4.1 ± 0.96) + (1.55 ± 0.52)	(1.95 ± 0.47)	(1.65 ± 0.55) + (1.45 ± 0.52)	(1.95 ± 0.41)
II instar	(20.25 ± 2.65) + (4.5 = 0.5)	(2.85 ± 0.67)	(9.5 ± 1.26) + (1.65 ± 0.77)	(3.25 ± 0.46)	(1.95 ± 0.35) + (1.1 ± 0.37)	(1.75 ± 0.51)
III instar	(36.55 ± 8.06) + (9.25 = 0.81)	(3.05 ± 0.47)	(10.15 ± 3.06) + (1.75 ± 0.84)	(3.55 ± 0.35)	(2.65 ± 0.45) + (2.15 ± 0.67)	(2.45 ± 0.52)
IV instar	(77.85 ± 3.98) + (17.25 ± 2.1)	(3.75 ± 0.55)	(16.00 ± 1.53) + (3.00 ± 0.92)	(3.85 ± 0.45)	(2.85 ± 0.50) + (2.6 ± 0.3)	(2.55 ± 0.72)
Total	(144.4 ± 15.69) + (35.25 ± 4.23)	(12.10 ± 2.1)	(39.75 ± 6.81) + (7.95 ± 3.05)	(12.60 ±1.73)	(9.10 ± 1.85) + (7.30 ± 1.86)	(8.70 ± 2.16)
Adults stage						
Male	(392.60 ± 32.79) (25.50 ± 5.58)	(22.75 ± 2.06)	(202.65 ± 27.41) + (23.75 ± 5.67)	(21.5 ± 0.86)	(9.15 ± 0.80) + (3.9 ± 0.48)	(11.10 ± 1.01)
Female	(443.90 ± 27.13) (33.25 ± 3.58)	(27.45 ± 1.08)	(228.60 ± 45.34) + (25.45 ± 1.08)	(25.45 ± 0.82)	(11.75 ± 0.78) + (5.50 ± 0.59)	(12.30 ±1.38)

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