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Feeding potential of lady bird beetle, *Cryptolaemus montrouzieri* (Mulsant) on cotton mealybug, *Phenacoccus solenopsis* (Tinsley)

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ABSTRACT : Investigation on feeding potential of *Cryptolaemus montrouzieri* (Mulsant) on cotton mealybug, *Phenacoccus solenopsis* (Tinsley) was carried out in Biocontrol Laboratory, Department of Agricultural Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari during August 2009 to October 2009 at 26.44 ± 0.74 ^{0}C temperature and 52.62 ± 2.46 relative humidity. The study revealed that the average food consumption of the first, second, third and fourth instar larva and adults were 2.68 ± 0.80, 8.16 ± 0.85, 74.28 ± 3.37, 104.96 ± 7.02 and 944.12 ± 31.02 nymphs of mealybug, respectively. The predatory grub consumed on an average 186.52 ± 9.23 nymphs of mealybug during its development. During entire life period, *C. montrouzieri* consumed on an average 1129.88 ± 30.53 nymphs of *P. solenopsis.* While the first, second, third and fourth instar larva and adult beetles of *C. montrouzieri* consumed on an average 1.32 ± 0.48, 3.12 ± 0.73, 6.40 ± 0.82, 14.08 ± 1.53 and 93.64 ± 3.86 adult mealybugs, respectively. The predatory grub consumed on an average 23.60 ± 1.68 adult mealybugs during its development. During entire life period of *C. montrouzieri,* consumed on an average 117.24 ± 3.73 adult mealybugs when reared on *P. solenopsis.*

Key words: *Cryptolaemus montrouzieri,* feeding potential, *Phenacoccus solenopsis*

Cotton, *Gossipium hirsutum* L. is an important natural fiber crop cultivated in varying climatic conditions of tropics as well sub tropic regions of more than 83 countries all over the world. Cotton plays a key role in the national economy in terms of generation of direct and indirect employment in the agricultural and industrial sectors. Due to ready availability of *Bt* cotton seeds since 2002 and apparent advantages over non *Bt* counterparts, it spread rapidly in India within short span of time. Changes in insect pest complex were evident with changed micro climate. A new pest, mealybug which was hitherto not familiar earlier started destroying cotton crops caused economic damage, reducing yields up to 40-50 per cent in affected fields since 2006. Mealybug infestation were recorded in 2006 on *G. hirsutum* in all the 9 cotton growing states of India, Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Tamil Nadu, Andhra Pradesh and Karnataka. Severe economic damage to *G. hirsutum* was reported in 2007 (Dhara *et al.*, 2008). The total damage in 2007 was estimated to range from US$400,000 to 500,000 in north India alone. Apart from the yield losses, the pest infestation increased the cost of insecticide application by US$250–375/ ac in both India and Pakistan.

There are many species of mealybugs, among which 5 species are attacking on cotton including *Bt.* hybrids *viz; P. solenopsis*, *Maconellicoccus hirsutus*, *Pseudocuccus longispinus*, *P. soleni* and *Ferrisia virgata* (Anonymous, 2007). To prevent yield losses caused by insect pests, it is essential for farmers to use insecticides. Pesticide consumtion in cotton ranks first (about 54%) among all crops (Anonymous, 2010). The pesticides currently used are mostly non selective and affecting the biotic and abiotic components of the environment.

Biological control is relatively, permanent, safe, economical and eco friendly. Among them, bioagents are used for the management of crop pests. The bioagents are predators, parasitoids and pathogens. The safety of biological control is outstanding, because most of the natural enemies are host specific or

restricted to few closely related species. Therefore, the non target species are not affected. Efficient natural enemies often continue to have suppressing effect over years together on insect pests. Coccinellids of order Coleoptera contains more than 4000 predacious species having great economic importance, as majority of them are predacious both in larval and adult stages, which frequency suppress the pest population of many crops (Sathe and Bhosle, 2001). *C. montrouzieri* was the first introduction of predatory biocontrol agent in India in 1898 from Australia to control green scale, *Coccus viridis* (Green) on coffee. *C. montrouzieri* is a good predator reported to prey on nearly 25 different species of mealybugs, 8 species of scale insect and 2 species of whitefly and aphid in their both larval and adult stages (Mani and Krishnamoorthy, 1997).

Inspite of prosperous biodiversity of this important predator, very scanty information is available on feeding potential of *C. montrouzieri* on cotton mealybug, *P. solenopsis*. It would be useful in understanding bio agent behavior and devising ecofriendly management strategies based on the situation to save the cotton and other important crops infested by mealybugs. To fill up the lacunae and imminent the knowledge on this aspect, the present study was undertaken.

An investigation on feeding potential of *C. montrouzieri* on adults of *P. solenopsis* was carried out in the Biocontrol Laboratory, Department of Agricultural Entomology, N.M. College of Agriculture, N.A.U., Navsari during August 2009 to October 2009 at 26.44 ± 0.74 ^{0}C temperature and 52.62 ± 2.46 relative humidity. After hatching, the newly hatched first instar larvae were kept in the petri dishes (75mm). Larvae of *C. montrouzieri* were reared separately to avoid cannibalism. A set of 25 larvae were provided with counted number of second instar nymphs as well adult of mealybugs (*P. solenopsis*). The number of second instar nymphs as well adult consumed by each instar larvae in both the sets during 24 hrs were recorded separately and in this way feeding potential of each instar was computed. The newly emerged adult beetles of *C. montrouzieri* were kept separately in plastic containers (10 x 5 cm). A set of 25 adults were provided with counted number of second instar nymphs as well adult of mealybugs (*P. solenopsis*). Number of second instar nymphs as well adult consumed during 24 hrs was counted and fresh new mealybugs were provided daily. Thus feeding potential of an adult was worked out.

The larva of *C. montrouzieri* was normal feeder and very active during predation. They preyed all three stages *viz.*, egg, nymph and adult of mealybug and attacked any part of the prey but very often in the soft part of the abdomen of the prey when they were reared on adult stage of *P. solenopsis*. The young larva of *C. montrouzieri* sucked the body parts, however, the older instars were most voracious feeder and showed a chewing action and the whole prey was consumed.

It can be seen from the data presented in Table 1 that the total number of nymphs of *P. solenopsis* consumed by the predatory larva during its first, second, third and fourth instars of *C. montrouzieri* was 2 to 4 (Av. 2.68 ± 0.80), 7 to 10 (Av. 8.16 ± 0.85), 68 to 82 (Av. 74.28 ± 3.37) and 90 to 113 (Av. 104.96 ± 7.02), respectively. The difference in consumption rate of larva of *C. montrouzieri* might be due to different prey host. The per day consumption on nymphs of *P. solenopsis* by predatory larva during first, second, third and fourth instar varied from 0.67 to 1.00 (Av. 0.83 ± 0.17), 3.50 to 5.00 (Av. 4.08 ± 0.43), 14.60 to 20.50 (Av. 17.94 ± 1.20) and 18.60 to 23.00 (Av. 21.21 ± 1.29), respectively. The per day predatory capacity of *C. montrouzieri* during its entire larval duration varied from 11.93 to 14.50 mealybug nymphs with an average of 13.03 ± 0.66. The consumption rate also increased with advancement of larval stage and the older larva became most voracious feeder of the mealybug nymphs.

The data presented in Table 1 on feeding

Table 1. Feeding potential of larva and adult of *C. montrouzieri* on nymphs of *P. solenopsis*

Stages	Number observed	Total number of nymphs of mealybug consumed			Per day consumption of mealybug nymphs (number)		
		Min.	Max.	Av. ± S.D.	Min.	Max.	Av. ± S.D.
Larva							
I instar	25	2.00	4.00	2.68 ± 0.80	0.67	1.00	0.83 ± 0.17
II instar	25	7.00	10.00	8.16 ± 0.85	3.50	5.00	4.08 ± 0.43
III instar	25	68.00	82.00	74.28 ± 3.37	14.60	20.50	17.94 ± 1.20
IV instar	25	90.00	113.00	104.96 ± 7.02	18.60	23.00	21.21 ± 1.29
Total consumption	**100**	**170.00**	**203.00**	**186.52 ± 9.23**	**11.93**	**14.50**	**13.03 ± 0.66**
Adult	25	883.00	992.00	944.12 ± 31.02	19.35	19.85	19.65 ± 0.14
Total consumption during entire lifespan	**125**	**1071.00**	**1186.00**	**1129.88 ± 30.53**	**17.66**	**18.65**	**18.12 ± 0.22**

potential of adult revealed that the adult consumed 883 to 992 mealybug nymphs with an average 944.12 ± 31.02. Data on per day consumption ability of *C. montrouzieri* adults revealed that the adult consumed 19.35 to 19.85 with an average of 19.65 ± 0.14 mealybug nymphs of *P. solenopsis*. Data on total feeding potential of lady bird beetle, *C. montrouzieri* was 1071 to 1186 with a mean of 1129.88 ± 30.53 mealybug nymphs of *P. solenopsis*.

It can be seen from the data presented in Table 2 that the total number of adult of *P. solenopsis* consumed by the predatory larva of *C. montrouzieri* during its first, second, third and fourth instars was 1 to 2 (Av. 1.32 ± 0.48), 2 to 5 (Av. 3.12 ± 0.73), 5 to 8 (Av. 6.40 ± 0.82) and 11 to 17 (Av. 14.08 ± 1.53), respectively. The predatory capacity of *C. montrouzieri* during entire larval duration varied from 21 to 27 adult mealybugs with an average of 23.60 ± 1.68. The per day consumption on adults of *P. solenopsis* by predatory larva during first, second, third and fourth instar varied from 0.25 to 0.67 (Av. 0.39 ± 0.11), 1.00 to 1.67 (Av. 1.21 ± 0.24), 1.50 to 2.33 (Av. 1.77 ± 0.20) and 2.75 to 3.75 (Av. 3.27 ± 0.30), respectively. The per day predatory capacity of *C. montrouzieri* during its entire larval duration varied from 1.40 to 1.93 adult mealybugs with an average of 1.70 ± 0.14 adult mealybugs. The consumption rate also found increased with advancement of stage of larva and the older larva became most voracious feeder of the mealybugs.

Looking to the data (Table 2) on feeding potential of adults, it revealed that the adult consumed 86 to 102 adults of mealybug with an average of 93.64 ± 3.86. Data on per day consumption ability of *C. montrouzieri* adults revealed that the adult consumed 1.83 to 2.11 with an average 1.98 ± 0.07 adult of *P. solenopsis*. The data obtained on total feeding potential of lady bird beetle, *C. montrouzieri* on adults of mealybug, *P. solenopsis* during their entire

Table 2. Feeding potential of larva and adult of *C. montrouzieri* on adults of *P. solenopsis*

Stages	Number observed	Total number of adult mealybug consumed			Per day consumption of adult mealybug (number)		
		Min	Max	Av. ± S.D.	Min	Max	Av. ± S.D.
Larva							
I instar	25	1.00	2.00	1.32 ± 0.48	0.25	0.67	0.39 ± 0.11
II instar	25	2.00	5.00	3.12 ± 0.73	1.00	1.67	1.21 ± 0.24
III instar	25	5.00	8.00	6.40 ± 0.82	1.50	2.33	1.77 ± 0.20
IV instar	25	11.00	17.00	14.08 ± 1.53	2.75	3.75	3.27 ± 0.30
Total consumption	**100**	**21.00**	**27.00**	**23.60 ± 1.68**	**1.40**	**1.93**	**1.70 ± 0.14**
Adult	25	86.00	102.00	93.64 ± 3.86	1.83	2.11	1.98 ± 0.07
Total consumption during entire lifespan	**125**	**111.00**	**125.00**	**117.24 ± 3.73**	**1.75**	**1.80**	**1.77 ± 0.01**

lifespan revealed that the consumption ability varied from 111 to 125 adult mealybugs with an average of 117.24 ± 3.73.

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REFERENCES

Anonymous, 2007. Mealybugs and their management. *NCIPM, Tech. Bull.* **19** : 2-4.

Anonymous, 2010. Eco friendly Management of Mealybug in Cotton. *Annual Report of RKVY Project.* MCRS, NAU, Surat.

Dhara, J. B., Surulivelu, T. and Gopalakrishnan, N. 2008. Status of mealybug on cotton in various parts of India. Proceedings of the *"National Consultation on Mealybug Management"*, 28–29 Jan. 2008, CICR, Nagpur pp. 8–10.

Mani, M. and Krishnamoorthy, A. 1997. Australian ladybird beetle *Cryptolaemus montrouzieri. Madras Agric. J.,* **84** : 237-49.

Sathe, T. V. and Bhosale, Y. A. 2001. Insect pests predators. Daya Publishing House, Delhi, pp. 1-195.

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