

Biological Studies on the Grapevine Mealybug Predator, *Scymnus coccivora* Ayyar (Coccinellidae: Coleoptera)

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ABSTRACT

Scymnus coccivora Ayyar is an important coccinellid predator of the grapevine mealybug, *Maconellicoccus hirsutus* (Green) in South India. The biology and feeding potential of *S. coccivora* were studied on different stages of *M. hirsutus*. The egg, grub, prepupal and pupal stages occupied 4.13-4.20, 9.45-11.75, 1.25-1.40, and 5.25-5.60 days respectively when the coccinellid was reared on different stages of *M. hirsutus*. Mean longevity of male and female was 60.5 and 68.7 days, respectively. A mean of 46.5 eggs was the fecundity rate. The predatory grub consumed 307.7 eggs or 62.2 nymphs or 6.55 adult females of *M. hirsutus* under laboratory conditions.

Key words: *Scymnus coccivora*, biology, feeding potential, grapevine mealybug, *Maconellicoccus hirsutus*.

The coccinellid, *Scymnus coccivora* Ayyar is a potent predator of aphids, scales and mealybugs. Ayyar (1925) reported that the grubs of *S. coccivora* were found feeding on the mealybug *Ferrisia virgata* (Ckll.) infesting custard apple, and *Planococcus lilacinus* (Ckll.) infesting *Ficus* sp. According to Puttarudraiah and Channabasavanna (1953), the grubs were known to prey on *Pseudococcus* sp. infesting guava, mango, cotton, etc. The predator was also reported to feed on *Rastrococcus iceryoides* (Green) by Tandon and Srivastava (1980), and *Rastrococcus spinosus* Robinson by Mahmood *et al.* (1980). Recent instances of outbreaks of mealybugs and their biological control have been discussed by Manjunath

(1987). *S. coccivora* has been considered as an important predator of grape mealybug *Maconellicoccus hirsutus* (Green) in South India (Mani, 1986). With a view to explore the possibilities to recommend this predator for managing the grapevine mealybug population, the present study was conducted on the development and feeding potential of *S. coccivora* on different stages of *M. hirsutus*.

MATERIALS AND METHODS

The mealybug and the predator were maintained on ripe pumpkins as suggested by Chacko *et al.* (1978) for *Cryptolaemus montrouzieri* Muls. The study was conducted in the laboratory at 26-29°C and 63-67% R.H. Influence of three stages of the mealybug *M. hirsutus*, viz., eggs, nymphs and adults on the developmental period

and feeding potential of *S. coccivora* was determined. Freshly laid eggs of *S. coccivora* (20) were kept individually in glass vials (10 x 2.5 cm) and plugged with cotton. Incubation period was recorded. After hatching, the predatory grubs were fed with known number of fresh eggs of the mealybug. Observation was made on the number of eggs preyed at 24 h and the remaining eggs were removed. Fresh eggs were offered to the predator every day until pupation. Developmental period of each instar of the grub, and prepupal and pupal periods were recorded. The second batch of newly hatched predatory grubs (20) were also fed with known number of 10-15 day-old mealybug nymphs until pupation. Similar observations on the developmental period of immature stages of the predator were recorded. Freshly hatched predatory grubs (20) were also fed with known number of adult mealybugs individually and similar observations were recorded.

RESULTS AND DISCUSSION

Life cycle

Egg : The pale yellow eggs were deposited singly in the colony of *M. hirsutus*, but occasionally more than one egg was also observed. Eggs were oval, 0.42 to 0.54 mm long and 0.20 to 0.23 mm broad. Incubation period ranged from 4 to 5 days. This is comparable with the incubation period of *S. quadrillum* Motsch and *S. gratiosus* Wiese (Kapur, 1942; Ramarurthy, 1982). There was no significant difference in the incubation period of eggs obtained from the adults reared on the eggs, nymphs and adult female mealybug (Table 1).

Grub : The grub had four instars. The newly hatched grub was 0.40 mm long and 0.22 mm broad. Duration of first instar grub was 2.60 to 3.50 days on different stages of the mealybug (Table 1). Second instar grub measured 1.69 to 1.80 mm long and 1.00 to 1.20 mm broad and its developmental period varied from 1.35 to 1.70

Table 1. Duration of development of *S. coccivora* on *M. hirsutus*

Stage of <i>S. coccivora</i>	Developmental period in days* (Mean \pm S. D.) when reared on		
	Mealybug eggs	Mealybug nymphs	Mealybug adults
Egg	4.13 \pm 0.37	4.20 \pm 0.41	4.25 \pm 0.44
Grub			
I instar	3.50 \pm 0.51	3.10 \pm 0.31	2.60 \pm 0.50
II instar	1.60 \pm 0.49	1.70 \pm 0.49	1.35 \pm 0.49
III instar	2.65 \pm 0.48	2.40 \pm 0.61	2.25 \pm 0.44
IV instar	3.95 \pm 0.60	3.40 \pm 0.50	3.25 \pm 0.44
Total	11.75 \pm 0.85	10.60 \pm 0.88	9.45 \pm 0.89
Prepupa	1.25 \pm 0.44	1.60 \pm 0.50	1.40 \pm 0.50
Pupa	5.60 \pm 0.50	5.50 \pm 0.44	5.25 \pm 0.43
Total	22.73 \pm 1.21	21.90 \pm 1.04	20.35 \pm 1.04

S. D. = Standard deviation

*Difference between the means of different stages not significant.

days when reared on different stages of the prey. The third instar grub was almost similar to the second instar in shape but measured 2.10 to 2.35 mm long and 0.85 to 0.95 mm broad. Third instar took 2.25 to 2.65 days for the development. Fourth instar grub was 2.80 to 3.10 mm long and 1.55 to 1.75 mm broad. Long waxy strands developed in late fourth instar. Duration of fourth instar varied from 3.25 to 3.95 days. The total development of grub was completed in 11.75, 10.60 and 9.45 days when the predatory grub was reared on mealybug eggs, nymphs and adult females, respectively. It is comparable to that of *S. graciosus* (Ramamurthy, 1982), less than that of *Scymnus includens* Kirsh. (Transfaglia and Viggiani, 1973) and more than that of *S. quadrillum* (Kapur, 1942). In the present study, variation in the developmental period of grubs when reared on different stages of the prey may be due to the quantity and quality of the prey available to the predator.

Pupa: The pupa was oval and light reddish brown fringed with short brown hairs. It was 2.00 to 2.20 mm long and 1.40 to 1.50 mm broad and partially hidden beneath the waxy threads, shed at the time of last moulting. The prepupal period varied from 1.25 to 1.60 days, and the pupal period ranged from 5.25 to 5.60 days. This is in agreement with Ayyar (1925) who reported a pupal period of 5-7 days when reared on *Pulvinaria maxima* Green. The pupal developmental time of *S. coccivora* is comparable to the pupal period of other *Scymnus* spp. (Kapur, 1942;

Johnson, 1972; Transfaglia and Viggiani, 1973; Ramamurthy, 1982).

Adult: The light brown adult measuring 1.70 x 1.30 mm spent a day in the pupal case before it emerged. In the present study, male to female ratio was 1:0.95. The sex ratio reported in different species of *Scymnus* is variable. It was 1:1 in *S. interruptus* Goeze. (Tawfike *et al.*, 1974) and 3:4 in *S. nubes* Casey (Davidson, 1923). The pre-mating period of 3 to 5 days observed in the present study closely agrees with that of *S. quadrillum* (Kapur, 1942) and *S. nubilus* Muls. (Johnson, 1972). The pre-oviposition period of 4-6 days in *S. coccivora* in the present investigation is comparable with *S. graciosus* (Ramamurthy, 1982) and *S. quadrillum* (Kapur, 1942) but is shorter than that reported for *S. nubilus* (Johnson, 1972). The oviposition period of *S. coccivora* (30 to 41 days) recorded in the present study is similar to that of *S. nubilus* (Johnson, 1972) but shorter than that of *S. marginicollis* Mannerheim (Buntin and Tamaki, 1980). The male and female beetles lived for 60.5 and 68.7 days, respectively. Similar trend in the adult longevity was reported in *S. includens* (Transfaglia and Viggiani, 1973). Mean number of eggs per female was 46.5 in the present study. Fecundity of *S. coccivora* is comparable with *S. nubes* (Davidson, 1923) and *S. quadrillum* (Kapur, 1942) but it is less than that of *S. includens* and *S. interruptus* (Transfaglia and Viggiani, 1973; Tawfik *et al.*, 1974).

Feeding potential

The grubs were active predators on all the stages of mealybug. During

Table 2. Consumption of different stages of *M. hirsutus* by different instars of *S. coccivora*

Larval instar	Number consumed (mean \pm S. D.) by <i>S. coccivora</i>		
	Mealybug eggs	Mealybug nymphs	Mealybug adults
I instar	44.10 \pm 5.89	5.89 \pm 0.89	1.10 \pm 0.31
II instar	40.75 \pm 2.21	7.60 \pm 0.92	1.20 \pm 0.41
III instar	60.35 \pm 5.43	12.75 \pm 1.00	1.75 \pm 0.51
IV instar	158.50 \pm 9.25	35.80 \pm 6.01	2.50 \pm 0.51
Total	307.70 \pm 13.23	62.20 \pm 7.24	6.55 \pm 0.75

S. D. = Standard deviation

the development of the first, second, third and fourth instars, a mean of 44.10, 40.75, 64.35 and 158.50 eggs of *M. hirsutus* respectively, was consumed by a grub. On an average, a total of 307.7 eggs was preyed by an individual grub during its development. The feeding potential of *S. coccivora* is nearly half that of *S. graciosus* on *M. hirsutus* (Ramamurthy, 1982). The present results also indicated that the grub consumed only 6.55 adult female mealybugs but a total of 62.2 nymphs were required for a grub to complete its development (Table 2). The adult mealybugs are bigger than the nymphs and hence, a lesser number of adult mealybugs is adequate for the *Scymnus* grub.

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