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Research Note

Biology and feeding efficiency of *Brumoides suturalis* (Fabricius) on *Phenacoccus solenopsis* Tinsley

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ABSTRACT: Investigations on the biology and feeding potential of *Brumoides suturalis* (Fab.) (Coccinellidae: Coleoptera) were carried out at ambient room temperature of 27± 3ºC and 65 ± 5% RH during 2009-10. Results revealed that the average egg, larval and pupal period were 5.12 ± 0.07, 14.54 ± 0.12 and 4.34 ± 0.08 days, respectively. Average duration of first, second, third and fourth instar larvae was 1.98 ± 0.06, 2.52 ± 0.07, 5.04 ± 0.09 and 4.36 ± 0.10 days, respectively. Male and female beetle survived for 17.72 ± 0.40 and 34.72 ± 0.60 days, respectively. Female beetle laid 102 to 205 eggs with an average of 142.84 ± 4.72 eggs during her adult period. Entire life of the predator was completed in 40 to 58 days (av. 49.18 ± 0.87 days). Sex ratio (M:F) was 1:1.48. The beetle predated significantly maximum (177.94 ± 2.75) number of *Phenacoccus solenopsis* Tinsley nymphs followed by *Coccidohystrix insolita* (Green) eggs (103.38 ± 2.60), *P. solenopsis* adults (149.69 ± 2.53) and *C. insolita* crawlers (108.31 ± 1.94).

KEY WORDS: *Brumoides suturalis*, biology, morphometry, feeding efficiency

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Coccinellids form an important group of predators. Among the various species of predatory coccinellids, *Brumoides suturalis* (Fab.) is considered to be an effective biocontrol agent feeding on some soft bodied insects in various agroecosystems. Information on the biology and feeding efficiency of *B. suturalis* is meager and therefore, the present investigations on these aspects were carried out in laboratory during the year 2009-10.

Initial culture of *B. suturalis* was collected from cotton fields and maintained on cotton mealybug, *Phenacoccus solenopsis* Tinsley. The field collected adults were confined in a plastic jar (10 × 20 cm) covered with black muslin cloth and held in position with a rubber band. The adults were provided with mealybug crawlers. Eggs laid by the female coccinellids on leaves or periphery of the jar were collected after 2 to 3 days by brushing with a soft camel hair brush and kept in glass vials (5 × 2 cm) with paper pieces to minimize cannibalism among emerging grubs. Initially, the newly hatched grubs were reared in groups for two days in plastic jar and then reared individually in multi-celled plastic leuver. Crawlers of mealybugs were provided daily in each individual cell of multi-celled plastic leuver to the predatory grubs until pupation. The adults emerged out from pupae were collected individually on plastic tube (5 × 2 cm) and transferred to an acrylic cage (60 cm × 30 cm × 30 cm) for mating. The culture of the predator maintained by above described method was used for further study of different biological parameters.

Eggs of *B. suturalis* were collected after two days of oviposition from acrylic cage as the freshly laid eggs breaks with slight touch of even soft camel hair-brush. The egg collection was made in the morning hours using soft camel hair-brush and kept individually in transparent plastic tube (5 × 2 cm). The open ends of such tubes were closed with cloth walled cotton plug. The eggs were critically observed under microscope for their colour, shape and changes in colour. The incubation period as well as hatching of the eggs was also recorded.

Freshly emerged grubs were kept in multi-celled plastic leuver to avoid cannibalism and provided daily with crawlers of mealybugs. Initially, 10 to 15 crawlers per grub were provided, but the numbers were increased with the increase in grub age. Number of instars along with their duration of each coccinellid was determined on the basis of exuvie casted-off by the grubs. The grubs were observed under microscope for their morphological characters.

Pupae formed inside the multi-celled plastic leuver were kept separately and undisturbed for adult emergence. Date of pupation and date of adult emergence were recorded.

Newly emerged adults were confined in plastic jar (10 × 20 cm) in pairs and provided with *P. solenopsis* as food. Laboratory reared adults were sexed as male and female on the basis of their body size and structure of external genitalia. Longevity of males and females were studied separately. Similarly, fecundity, pre-oviposition, oviposition, post-oviposition periods of females and sex-ratio were studied. For this purpose, fifteen pairs of *B. suturalis* were kept individually and data were recorded. With a view to determine the fecundity, eggs laid by each mated female were counted daily in the morning and total number of eggs laid during entire adult period was considered as fecundity. The time after emergence of adult from pupae and starting of oviposition was considered as pre-oviposition period. The period of egg deposition was considered as oviposition period. Post oviposition period of female was recorded as the period between the days of female ceased egg-laying to the day of death. Sex-ratio (male : female) was worked out for laboratory culture.

Newly hatched predatory grub and newly emerged adults of *B. suturalis* were confined individually in a glass vial (6.5 × 6.0 cm) and the open end was closed with white muslin cloth affixed with rubber band. Individual grubs as well as adults were reared in glass vial throughout their developmental stage. The grubs and beetles were fed individually in glass vial with various life stages of two different species of mealybug. Ten sets were used for determining feeding capacity of *B. suturalis*. Required number of prey was provided daily in the morning hours throughout the grub and adult period and their numbers were increased according to developmental stage. Predatory efficiency was calculated by counting the preyed and un-preyed hosts. Instar-wise predatory efficiency of grubs and total consumption by adults were determined.

Biology of *Brumoides suturalis*

Data on the duration of different life-stages, fecundity, hatching percentage of eggs and sex-ratio of *B. suturalis* were recorded and presented in Table 1. From data, it is evident that egg-period (Table 1) ranged from 4 to 6 days with an average of 5.12 ± 0.07 days. Larvae moulted three times during their development and there were four distinct instars. First, second, third and fourth instar larvae ranged from 1 to 2, 2 to 3, 4 to 6 and 3 to 6 days with an average of 1.98 ± 0.06, 2.52 ± 0.07, 5.04 ± 0.09 and 4.36 ± 0.10 days, respectively. Total larval period lasted for 13 to 16 days with a mean duration of 14.54 ± 0.12 days. This finding is in close agreement with the report of Anonymous (2009) wherein 14.64 days larval period was revealed when *B. suturalis* reared on eggs of *Sitotroga cerealella* (Oliv.). Pupal period was completed within 4 to 6 (av. 4.34 ± 0.08) days. Slightly higher (6.03 days) pupal period of *B. suturalis* was

Table 1. Duration of different life stages of *Brumoides suturalis* on cotton mealybug, *Phenacoccus solenopsis*

Stage	Period of study	Duration (days)	
		Range	Mean
Egg	16.10.09 – 22.10.09	4 – 6	5.12 ± 0.07
Larva			
I instar	22.10.09 – 04.11.09	1 – 2	1.98 ± 0.06
II instar		2 – 3	2.52 ± 0.07
III instar		4 – 6	5.04 ± 0.09
IV instar		3 – 6	4.36 ± 0.10
Total		13 – 16	14.54 ± 0.12
Pupa	04.11.09 – 10.11.09	4 – 6	4.34 ± 0.08
Male		13 – 25	17.72 ± 0.40
Female		23 – 41	34.72 ± 0.60
Fecundity (Eggs / female)	10.11.09 – 20.12.09	102 – 205	142.84 ± 4.72
Hatching (%)		89.23 – 97.78	93.74 ± 1.25
Entire life span		40 – 58	49.18 ± 0.87
Sex ratio (M : F)		–	1:1.48

Table 2. Feeding potential of *Brumoides suturalis* on different life stages of mealybugs

Mealybug species	Average consumption by respective instar				No. of individuals consumed by		
	I	II	III	IV	Grub	Adult	Total consumption
Phenacoccus solenopsis (nymphs)	15.63 ± 0.77 (12 – 21)*	32.88 ± 0.94 (27 – 41)	41.31 ± 1.11 (33 – 48)	46.13 ± 0.79 (41 – 51)	135.94 ± 2.55 (122 – 152)	42.00 ± 1.35 (33 – 52)	177.94 ± 2.75 (155 – 195)
P. solenopsis (adults)	11.75 ± 0.84 (6 – 17)	17.06 ± 0.62 (13 – 21)	38.44 ± 1.19 (31 – 46)	44.50 ± 1.30 (35 – 52)	111.75 ± 2.59 (97 – 125)	37.94 ± 0.98 (31 – 44)	149.69 ± 2.53 (133 – 163)
Coccidohystrix insulata (eggs)	13.63 ± 0.95 (7 – 19)	24.69 ± 0.49 (21 – 28)	39.69 ± 0.93 (33 – 46)	45.13 ± 0.70 (40 – 50)	123.13 ± 2.16 (109 – 139)	39.81 ± 0.61 (37 – 45)	163.38 ± 2.60 (146 – 184)
C. insulata (crawlers)	11.31 ± 0.74 (6 – 16)	15.75 ± 1.05 (8 – 23)	22.38 ± 1.05 (17 – 31)	30.38 ± 0.92 (24 – 36)	79.81 ± 1.54 (67 – 88)	28.50 ± 0.96 (22 – 35)	108.31 ± 1.94 (91 – 117)
S. Em. ±	0.63	1.16	1.15	0.91	2.08	0.97	2.43
C. D. at 5%	1.95	3.58	3.54	2.81	6.41	2.97	7.48
C. V. (%)	9.67	10.29	6.48	4.39	3.70	5.21	3.24

* Figures in parenthesis indicate range values

observed in earlier reports (Anonymous 2009). This variation may be attributed to the effect of food provided to the predator. Longevity of male and female *B. saturalis* ranged from 13 to 25 and 23 to 41 days with an average of 17.72 ± 0.40 and 34.72 ± 0.60 days, respectively. It showed that female *B. suturalis* took almost double time to complete its life. The present findings are contrary to the earlier observations made by Chandrababu *et al.* (1999). According to them, the life-span of male and female was 32 to 37.5 and 38 to 43 days, respectively. Such anomaly in duration may be due to variation in food and environmental conditions prevailed during rearing of the predator. The female deposited 102 to 205 eggs with an average of 142.84 ± 4.72 eggs during her adult period.

Feeding efficiency of *Brumoides suturalis*

Data (Table 2) revealed that among the two species of mealybugs used to determine the feeding potential by *B. suturalis,* significantly maximum (15.63 ± 0.77) numbers of *P. solenopsis* nymphs were consumed by the first instar grub. The feeding potential of the grub on eggs of *C. insolita* and adults of *P. solenopsis* was more or less same (11.75 to 13.63), however, the grub consumed significantly higher number of eggs of *C. insolita* than their crawlers. The trend of feeding potential on different life-stages of mealybug was more or less same in second instar also. Significantly least number of *C. insolita* crawlers were fed by third (22.38 ± 1.05) and fourth (30.38 ± 0.92) instar grub. On the other hand, third and fourth instar grub consumed maximum (41.31 ± 1.11 and 46.13 ± 0.79, respectively) number of *P. solenopsis* nymphs followed by *C. insolita* eggs (39.69 ± 0.93 and 45.13 ± 0.70, respectively) and *P. solenopsis* adults (38.44 ± 1.19 and 44.50 ± 1.30, respectively). Significantly highest (135.94 ± 2.55) numbers of *P. solenopsis* nymphs were predated by *B. suturalis* during its entire grub stage. The grub consumed an average of 123.13 ± 2.16, 111.75 ± 2.59 and 79.81 ± 1.54 individuals of *C. insolita* eggs, *P. solenopsis* adults and *C. insolita* crawlers, respectively. Maximum (42.00 ± 1.35) numbers of *P. solenopsis* nymphs were fed by adults of *B. suturalis* followed by *C. insolita* eggs (39.81 ± 0.61). The beetle consumed significantly higher number of *C. insolita* eggs than its crawlers.

Data on total consumption by the *B. suturalis* indicated that it predated significantly greatest (177.94 ± 2.75) number of *P. solenopsis* nymphs followed by *C. insolita* eggs (163.38 ± 2.60), *P. solenopsis* adults (149.69 ± 2.53) and *C. insolita* crawlers (108.31 ± 1.94). It seems that the predatory beetle preferred more on *P. solenopsis* nymphs and *C. insolita* eggs than their adults and crawlers.

Chandrababu *et al.* (1997) studied feeding potential and associated behavior of *B. suturali* on *Ferrisia virgata, Planococcus pacificus, Maconelicoccus hirsutus* and *Aphis craccivora* and our findings corroborated with the present their findings as the feeding efficiency of the predator increased progressively with the development of the larval stages.

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