IJREB

ISSN **2321-743X**

International Journal of Research in

Engineering and Bioscience

Volume **2** Issue **6** (Pages 135-142)

Journal home page: www.ijreb.org

BIOLOGY AND LIFE TABLE PARAMETERS OF *CORANUS SPINISCUTIS* REUTER (HEMIPTERA: REDUVIIDAE), A POTENTIAL PREDATOR OF TOMATO PESTS

M. A. Claver[1] and D. P. Ambrose[2]

[1]Entomology Research Unit, St. Xavier's College, Palayankottai 627002, TN., India

[2]Department of Zoology, St. Andrew's College, Gorakhpur 273 001, UP., India

ABSTRACT

Coranus spiniscutis Reuter laid down eggs singly as well as in small groups. The eggs hatched in 4.5 ± 2.1 days. Total stadial period (egg to adult) was 31.5 ± 2.5 days, and the nymphal mortality was 13 per cent. Male and female longevity extended between 103 to 163 days and 60 to 111 days, respectively. Preoviposition period was 5.1 ± 0.4 days. Sex ratio of male and female was as 1:0.95. Fecundity was 138.8 ± 61.4. Net reproductive rate (R_0) was 111.9 eggs/females. True rate of natural increase (rm) was 0.0625/female/day. The population multiplied 7.45 times every week and the time taken for it doubling was 11.2 days. Female longevity was 103.7 ± 48.5 days.

KEYWORDS: Biology, life table, *Coranus spiniscutis,* reduviid predator, tomato pests.

INTRODUCTION

Tomato, *Lycopersicom esculentum* Miller, is one of the most important commercial and widely grown vegetable crops of both tropics and subtropics. It is infested by number of insect pests right from germination to harvesting, which reduce not only its yield but also spoil its quality (Gour and Pareek, 2002). The use of insecticides for the control of these insect pests poses health hazards to human beings. The use of biological control agents like reduviid predators with ecofriendly components have been reported to be effective in the management of insect pests in vegetable crops (Singh, 1995; Claver *et al.* 2004).

Among reduviid, the harpatorine reduviids are reported as potential biological control agents. The genus *Coranus* is a predominant group of harpactorine reduviids in south India and its members such as *C. spiniscutis* (Claver *et al*. 2004), *C. nodulosus* Ambrose and Livingstone (Saharaj and Ambrose, 1993), *C. soosaii* Ambrose and Vennison (Vennison and Ambrose, 1992), *C. obscurus* and *C. siva* are very good predators with good biological control efficiency. Among them, C. spiniscutis seems to be a promising biological control agent (Ambrose and Claver, 2001). It was found feeding on *Helicoverpa armigera* and *Spodoptera litura* larvae on tomato and nymphs of *Dysdercus cingulatus* on okra.

The impressive pre record of *C. spiniscutis* prompted the authors to study the feasibility of utilizing this biological control agent by augmenting and subsequently releasing it into the agro ecosystem. The effective utilization of any biological control agent is feasible only when information on its complete biology and life table parameters is available. But the information available on the biology of *C. spiniscutis* is very meager (Bose, 1949). Hence, the authors studied its biology with special emphasis on its life table parameters. This study might helpful for effective utilization of these predators as augmentative biological control agent.

MATERIALS AND METHODS

The adults and nymphal instars of *C. spiniscutis* were collected from the Alankulam (77°45′E; 8°90′N) tomato crop fields at Tirunelveli District, Tamil Nadu, India. They were reared in the laboratory in plastic containers (5×4×3 cm) on flour moth larva *Corcyra cephalonica* Stainton (temperature 30 ± 2.0°C, RH 80 ± 3.0% and photoperiod 12 ± 1.0 h)

The rearing containers were carefully examined at regular intervals to record the eggs laid after successful copulation. The eggs were allowed to hatch in individual containers provided with optimum humidity in plastic containers. The hatched nymphs were reared on *C. cephalonica* individually in plastic containers. The containers were examined daily and the rate of mortality and

moulting changes were recorded. The sex ratio was calculated from the adult emerged in the laboratory. The adult longevity was estimated by rearing the laboratory emerged adult till death. The total number of eggs laid by each mated female was recorded continuously. The predators were reared in the laboratory for two generations to find out the incubation period, stadial period, nymphal mortality, fecundity and longevity.

In the life table study, 100 eggs were allowed to hatch individually in small containers with moistened cotton swabs used to maintain optimum humidity. The cotton swabs were changed periodically to prevent fungal attack. After hatching, all the nymphs were allowed to grow up to adults to estimate their life span. The life table was constructed following the methodology of Birch (1948) and elaborated by Southwood (1978).

RESULTS AND DISCUSSION

Biology

The biological parameters of the predator *C. spiniscutis* are presented in the Table 1. Eggs are brown in colour, is laid either single or in cluster. Each cluster contained 2–22 eggs. Similar kind of oviposition was reported or other harpactorine reduviids (Ambrose, 1999) as well as sister species like C. *nodulosus*, *C. siva* Kirkaldy, *C. soosaii*, *C. subapterus* (DeGeer), *C. vitellunus* (Distant) and *Coranus* (Wallace, 1953; Vennison and Ambrose, 1992; Kamar, 1993; Sahayaraj and Ambrose, 1993). The eggs were attached to the substratum by cementing materials.

Incubation and hatching

The incubation period of *C. spiniscutis* was observed as 4.5 ± 2.2 days. This value is shortest compared with the value of its sister species. The eggs hatched both in the morning and evening hours. The eclosion occurred in regular and series event, i.e., during eclosion the head came first followed by the pro-thorax. Soon after that backwardly folded legs came out, it wriggled out its abdomen from the egg case. The duration of eclosion was 4–7 min. After 1–2 h of emergence, the newly emerged individuals took their feed. The percentage of hatching was 98. The unfertilized eggs were apparently normal when laid, but become shrunk after some days. The hatching percentage observed for *C. spiniscutis* was highest among the *Coranus* species viz., *C. nodulosa* (94.3%), *C. siva* (89.9%), *C. vitellinus* (84.7%), *C. soosaii* (82.9%) (Ambrose and Livingstone, 1985; Kumar, 1993; Sahayaraj and Ambrose, 1993).

Stadial period

The total period from egg to adult was 31.4 ± 2.5 days (Table 1). This was shortest stadium observed among *Coranus* species (Ambrose, 1999). The stadial period of I, II, III, IV and V instars nymphs were 4.6 ± 1.7, 4.2± 1.04, 4.1 ± 0.9, 5.8 ± 1.7, 7.1 ± 1.2 days, respectively when fed on *D.cingulatus* (Table 1). As observed for other harpactorine

species, the shortest stadium was the second and the longest stadium was the fifth (Ambrose, 1999). The higher rate of mortality was observed in the third instar (13%) and the nymphal mortality was almost nil when they attained fourth and fifth instars (Table 1). The lowest nymphal mortality observed among *Coranus* species was 8.3 (*C. nodulosus*) and highest nymphal mortality observed was 57.10 (*C. vitellinus*).

Sex ratio

Among the laboratory raised population of *C. spiniscutis*, the males were more in number than the females. The sex ratio between males and females was recorded as 1:0.95. A similar result was recorded in the sex ratio of *C. nodulosus, C. siva, C. soosaii* and *C. vitellinus* in the laboratory. The male biased sex ratio of this predator reflected the male biased natural population of the reduviid in any ecosystem is normally found regulated by the stage of prey population existed. Generally, population was found to be female biased and this phenomenon was attributed to cannibalistic nature of females over males and that would caused comparatively shorter life span of the males. But the present study was supported by the existence of unbiased sex ratio at higher prey density.

Preoviposition period

The preoviposition period (from emergence to first oviposition was 5.1 ± 0.3 days. However, all other sister species of oriental region reduviid had registered higher preoviposition periods. *C. soosaii* (7.5 days), *C. nodulosus* (7.9 days), *C. siva* (15.3 days) and *C. vitellinus* (26.6 days) (Ambrose and Livingstone, 1985; Ambrose, 1992; Sahayaraj and Ambrose, 1993).

Fecundity

The *C. spiniscutis* was laid 138 ± 61.4 eggs/female in a generation on *C. cephalonica* larva under laboratory condition. The fecundity of reduviid predators is determined by the nutrient components of the prey species (Venkatesan *et al*. 1997).

The average total duration of egg, nymphal stages and preoviposition period (immature stage) was 41 days. The high survival was noted when they were reared on *C. cephalonica* compared with reduviids reared on other prey species. Immature stages of *C. spiniscutis* attained up to 87% survival in the present study. Such greater survival was reported among other reduviids namely *Montina confuse* (Stål) on the larve of sugarcane borer *Diatraea saccaralis* F., *Rhynocoris fuscipes* F. on *C. cephalonica* larva and *Sycanus collaris* F. on *S. litura* (Fretas, 1995; George *et al*., 1998, 2000).

The first instars of *C. spiniscutis* had the highest rate of mortality than the other co-instars. The nymphal mortality was mainly due to pronounced cannibalistic tendency among the nymphal instars. As in

other harpactorine reduviid species (Ambrose, 1999), the first instars fell easy prey to their co-instars and caused the highest rate of mortality. The newly moulted reduviid nymphs with soft cuticle are the main victims if cannibalism. The cannibalistic behaviour was absent in adults. Abnormalities and natural hazards in hatching, moulting, compact against powerful prey etc are a few other causes of nymphal mortality (George *et al*., 2000).

The longevity of ovipositing female of *C. spiniscutis* was the longest (103 ± 48.5 days) of ovipositing female of *C. spiniscutis* was the longest among the *Coranus* species. For instance, adult female longevity of *C. nodulosus*, *C. siva*, *C. soosaii* and *C. vitellinus* were 40.4, 82.0, 363 and 35.7 days, respectively. The female produced an average of 138.9 eggs during their lifespan. It was found as the highest among the *Coranus* species. The fecundity of closely related harpactorine reduviids was found lower than that of *C. spiniscutis* (Venkatesan et al., 1997; George, 1999, 2000). Huffaker *et al*. (1971) stated that one the attributes of good predator is to posses a comparable or higher fecundity than the prey. The male and female offspring ratio was 1:0.95.

The net reproductive rate (R_0), representing the ratio of total female birth in the successive generation was 111.9. It was significantly higher than that of other reduviid predators. For instance, the net reproductive rate of *R. marginatus* on *C. cephalonica* and *Sycanus collaris* on *S. litura* was 27.9 and 30.46, respectively (George *et al*., 1998; George, 1999).

The adults attained mean progeny production of 1.382/females/days (mx) and production ceased by the 111th day after oviposition. The innate capacity of natural increase of *C. spinincutis* was 0.625 per day. Such innate capacity of increase was reported for other reduviids *C. gilvus*, *S._collaris*, *R. marginatus* (Venkatesan *et al*., 1997; George *et al*., 1998; George, 1999).

The hypothetical population of F2 generation *C. spiniscutis* was 212.51 in a generation time of 75.47 days. With a daily finite rate of increase (λ) of 1.0645, the population was able to multiply 7.4514 times every week on *C. cephalonica* and the population doubled in every 11.12 days. The population growth statistics indicated the capability of rapid increase of *C. spiniscutis* population size with a possibility of bringing about effective check of pest populations could be reduced substantially.

ACKNOWLEDGEMENTS

We expressed our sincere thanks to our College Principal Rev. Dr. A. Lourdusamy, S.J for facilities. Financial assistance to DPA from Tamil Nadu state Council of Science and Technology, Chennai (RJ/BSO/ 30031 is gratefully acknowledged

REFERNECES

Ambrose, D.P. 1999. Post embryonic development. In: Schaefer, C.W. and Panizzi, A.R. (eds) Assassin bugs, Chapter 9. pp. 99-134.

Bellows, T.S. Jr., van Driesche, R.C. and Klkinton, J.S. 1992. Life table construction and analysis in the evaluation of natural enemies. Annual Review of Entomology 37:587-614.

Brich, L.C. 1948. The intrinsic rate of natural increase in an insect population. Journal of Animal Ecology 37:

Bose, B.A. 1949. On the biology of Coranus spiniscutis Reuter, an assassin bug. Indian Journal of Entomology 11:203-208.

George, P.J.E. 1999. Development, life table and intrinsic rate of natural increase of three morphs of *Rhynocoris marginatus* Fabr. (Heteroptera:

George, P.J.E. 2000. The intrinsic rate of increase of a harpactorine reduviid *Rhynocoris kumari* Amborse and Livingstone on three lepidopteran insect pests. Entomon 25(4):281-286.

George, P.J.E., Claver, M.A. and Ambrose, D.P. 2000. Life table of *Rhynocoris fuscipes* (Fabricius) (Hemiptera: Reduviidae) reared on *Corcyra cephalonica* (Stainton). Pest Management and Economic Zoology 8(1):57-63.

George, P.J.E., Seenivasagan, R. and Karuppasamy, 1998. Life table and intrinsic rate of increase of *Sycanus collaris* Fabricius (Hemiptera: Reduviidae), a predator of *Spodoptera litura* (Fabricius) (Lepidoptera: Noctuidae). Journal of Biological Control 12(2):107-111.

Gour, I.S. and Pareek, B.L. 2002. Screening of tomato varieties against sucking insect pests and their correlation with weather parameters in semi-arid region of Rajasthan. Indian Journal of Applied Entomology 16(1):60-66.

Huffaker, C.B., Messenger, P.S. and DeBach, P. 1971. The natural enemy component in natural control and the theory of biological control. Pp. 16-67. In: C.B. Huffaker (Ed.), Biological Control. Plenum Press, New York.

Kumar, M.G. and Velusamy, R. 1995. Life table and intrinsic rate of increase of Cyrotohinus lividipennis Reuter (Heteroptera: Miridae). Journal of Biological Control 12(2):82-84.

Sayaharaj, K. Ambrose, D.P. 1993. Biology and predatory potential of Coranus nodulosa Ambrose and Sahayaraj (Heterioptera: Reduviidae) on *Dysdercus cingulatus* and *Oxycarenus hyalinipennis*. Hexapoda5(1):17-23.

Singh, S.P. 1994. Technology for production of natural enemies. Technical Bulletin No. 4, Project.

Table 1. Biological parameters of *C.spiniscutis* on *D. cingulatus, H.armigera* and *M.subfasciatus*.

Parameters	Prey species		
	H. armigera	*D. cingulatus*	*M. subfasciatus*
Incubation period (days)	4.4 ± 1.29	4.5 ± 1.13	4.47 ± 1.57
Mortality (%)	3	2	4
I Stadia (days)	4.5 ± 2.03	4.6 ± 1.78	4.45±0.34
Mortality (%)	10	9	10
II Stadia (days)	4.07 ± 1.72	4.19 ± 1.04	4.21±0.65
Mortality (%)	11	12	14
III Stadia (days)	4.10 ± 1.29	4.11 ± 0.92	4.18±0.50
Mortality (%)	12	13	8
IV Stadia (days)	5.73 ± 2.08	5.82 ± 1.70	5.94±0,71
Mortality (%)	0	0	0
V Stadia (days)	7.2 ± 1.19	7.11 ± 1.24	7.15±0.44
Mortality (%)	0	0	0
Sex ratio	1 : 0.91	1 : 0.95	1 : 0.97
Preoviposition period (days)	5.1 ± 0.94	5.74 ± 0.35	5.47 ± 0.73
Fecundity	143.4 ± 5.6	138.86 ± 61.4	124.3 ± 32.1
Adult longevity (days)			
Male	74.3 ± 28.5	77.62± 23.09	69.72±16.22
Female	93.7 ± 40.57	103.7 ± 48.67	89.96±08.51

Table 2. Life fecundity table of *C. spiiscutis* on *C. cephalonica* under laboratory condition.

Pivotal age in days (X)	Survival of female at the age X (Ix)	Age schedule for female birth (mx)	Ix mx	Ix mx X
0 – 35	-	-	-	-
36	1.0	0	0	0
43	1.0	0	0	0
51	1.0	6.03	6.03	307.53
59	0.90	12.34	11.10	654.90
67	0.90	14.73	13.25	887.75
74	0.80	19.76	15.80	1169.20
82	0.80	22.62	18.09	1483.38
90	0.70	21.87	15.30	1377.00
98	0.70	20.01	14.00	1372.00
106	0.60	9.32	5.59	592.54
114	0.60	6.29	3.77	429.78
122	0.50	5.31	2.65	323.30
130	0.50	4.96	2.48	322.40
138	0.40	4.15	1.66	229.08
146	0.40	3.60	1.44	210.24
154	0.30	1.43	0.42	64.68
162	0.30	0.95	0.28	45.36
170	0.20	0	0	0
177	0.20	0	0	0
185	0.10	0	0	0
192	0.10	0	0	0
198	0	0	0	0
Total		∑ mx 153.37	∑ Ix mx 111.86	∑ Ix mx 9469.14