



BIOLOGY AND PREDATORY NATURE OF STING BUG: *CANTHECONA FURCELLATA* (WOLFF) A MAJOR PEST OF TASAR SILKWORM, *ANTHERAEA MYLITTA* D. IN VIDARBHA REGION OF MAHARASHTRA, INDIA.

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Abstract:

The sting bug, *Canthecona furcellata* Wolff. (Hemiptera: Pentatomidae) is a major pest of tropical tasar silkworm, *A. mylitta*. The total nymphal period of *C. furcellata* with an average was 20 days and the adult life span of male and female were 18.9 ± 1.260 days and 29.5 ± 1.078 days respectively. The nymphal duration and adult life span of *Canthecona furcellata* is long. So they feed for longer duration on tasar silkworm, hence the cocoon production much more reduced due to its regular presence in tasar plantations. The egg laying capacity of *C. furcellata* with an average 28.6 ± 2.826 eggs per batch and 260.4 ± 44.873 eggs per female during her life span. The pre-copulation and copulation period of pentatomid bug varied from 5 - 7 days and 12.45 ± 0.368 hr. respectively as well as the oviposition period was 16.2 ± 1.594 days recorded.

Keywords: *Canthecona furcellata*, *Antheraea mylitta*, Biology, Predatory nature.

Introduction:

The successful tasar sericulture always depends on survival rate during larval development. During winter due to low temperature, duration of the life cycle increases and silkworms remains available for longer period for their predation. Insect population is one of the important tasks in population dynamics which estimates the number of the species present in the target area. In general, the parasitoids are usually specific for one or closely related group of insect. Thus, they are restricted to, and dependent on an individual of host species, their reproductive rate also related to the availability of their host. Thus, parasitoid sampling is the process of sampling of the pest species (Sathe and Jadhav, 2001).

The tasar silkworm *Antheraea mylitta* attacked by Predators like Pentatomid bug, *Canthecona furcellata*, Reduviid bug, *Sycanus collaris*, Praying mantid, *Hierodula bipapila*, Wasps, *Vespa* sp., Red ant *Oecophyla smargdina*, parasitoid like Uzifly, *Blepharipa zebina*, Braconid fly, *Apantallis* sp., Ichneumonid fly, *Xanthopimpla predator* are dangerous natural enemies (Jolly, 1967).

The modern concept of insect - pest management is based on ecological principles and involves the integration and synthesis of different components and control tactics into an insect - pest management system (Ray and Khan, 2011). *Canthecona furcellata* Wolff is a major predator of tasar silkworm in Vidarbha region. *C. furcellata* has been also reported from Southeast Asia, Japan, India, and Taiwan, has been preying on Lepidopteran, Coleopteran and Heteropteran insects (Ahmad *et al.*, 1996; Chu,

1975; Chang, 2002; Jakhmola, 1983; Prasad *et al.*, 1983). The present study was undertaken to study the biology of *Canthecona furcellata* on its host tasar silkworm, *A. mylitta* with relation to nymphal period, adult period, egg laying capacity of the female against the insect population of tasar silkworm and nature of damage.

Materials and Methods:

The experiment was conducted in the laboratory of M. B. Patel college of Arts, Commerce and Science, Sakoli, Bhandara during August to December 2012. Rearing of tasar silkworm, *Antheraea mylitta* D. is conducted out door in field condition on host plant *Terminalia arjuna*. Adult sting bug, *Canthecona furcellata* were collected from *T. arjuna* plant. The bug were kept in one liter capacity plastic jar and provided with sufficient disease free larvae of *A. mylitta* as regular feed along with *T. arjuna* leaves. Jar was covered with sieve cap for aeration. After mating the female bug laid eggs on upper surface of leaves. The eggs were collected from *T. arjuna* leaves and kept in 500ml capacity of plastic jar with sieve cap for hatching. Newly hatched first instar nymph was provided with first instar larvae of *A. mylitta* in a plastic jar (500ml capacity) (Fig. A). The experiment was replicate five times with the larvae of *A. mylitta* as a regular food along with *T. arjuna* leaves. The food of *C. furcellata* changed daily into another jar. Observations of moulting were recorded daily to observe the duration of the different nymphal instars.

The moulting of nymphal instars was clearly observed with moulted nymphal body

and exuvae were clearly seen through necked eyes. Nymph of *C. furcellata* was kept in cluster in plastic jar (1 Ltr. Capacity) with sufficient number of tasar larvae of different instar along with *T.arjuna* leaves. Predatory nymph of different instar was recorded daily. After pass out fifth moult nymph were transformed to an adult stage. Such adult after emergence of 4-5 days, male and female kept in separate plastic jar along with sufficient food (tasar larvae). After copulation male and female were separated. The female was bigger than male. The female was allowed for egg laying with sufficient food along with its host plant. The male was left for life spent with larvae of *A. mylitta*. The newly formed sting bug adults were utilized for studying copulation period, oviposition period, fecundity and adult span.

Results:

Life cycle:

The biology and nature of predation of sting bug, *C. furcellata* was studied during the rearing of tasar silkworm. The life cycle of the sting bug passing through three stages i. e. egg, five nymphal stages and adult. The total life span of male adult was ranged from first instar up to adult was 26-50 days, whereas the period from egg laying to complete life cycle of an adult female bug varied from 39-58 days with an average 48.5 days.

a) Eggs:

Freshly laid eggs are round shaped with spiny, milky white in colour, (Fig. 1) later on the upper portion turned silvery in colour. Before hatching the eggs were reddish in colour. The average incubation period was 9.4 ± 0.221 days and it varied from 8-10 days (Table-1). The single egg measured about 1.017 ± 0.004 mm in length (Table-2).

b) Nymphal stages

i) First instar

The first instar nymph hatched by breaking the dorsal surface of the eggs. The newly hatched nymphs are reddish yellow in colour which slowly turned into blackish red. Neonate nymphs were gregarious in nature (Fig. 2). The average duration was 3.5 ± 0.224 days ranging from 3 - 5 days (Table-1). It measured about 1.00 ± 0.00 mm in length (Table-2). It fed on the first and second instar larvae of *A. mylitta*. First instar nymph were found to be feed gregariously on the first and second instar of tasar silkworm larvae.

ii) Second instar

Second instar nymph also gregarious in nature. It was light red in colour (Fig. 3) and measure

about 2.309 ± 0.033 mm body length (Table-2). The second instar nymphs lasted for a period 3 to 5 days, with an average of 3.6 ± 0.221 days (Table-1). They were found to be feed on the first and second instar larvae of *A. mylitta*. They were also feed on first and second instar of *A. mylitta* larvae in a group till the death of host.

iii) Third instar

Third instar nymph were found to be bigger than second instar with dark reddish in colour. They feed from first instar and onward larvae of *A. mylitta* (Fig. 4). The average nymphal period was 3.0 ± 0.149 days and ranged between 2-4 days (Table-1). Average body length of third instar nymphs were 4.564 ± 0.118 mm (Table-2). As like first and second nymphal instar they were found to be feed on first to third instar larvae of *A. mylitta*

iv) Fourth instar

Fourth instar nymphs were solitary in nature. Newly moulted nymphs were initially light red in colour, later turn to dark red with some yellow, white lining observed on dorsal side (Fig. 5). The average body length of fourth instar was 7.343 ± 0.138 mm were recorded (Table-2). They lasted period of 3-5 days with an average of 3.5 ± 0.224 days (Table-1). Fourth instar nymphs suck the haemolymph from third and onward instar larvae of *A. mylitta*. They were found to be feed on onward second instar larvae of tasar silkworm as well as feed on fully grown fifth instar larvae when they set on moult or during the casting of old skin.

v) Fifth instar

Fifth instar nymphs were also solitary in nature. The colour of nymph was dark reddish black or yellowish black with some whitish lining found on the dorsal side of the body (Fig. 6). They have longer nymphal duration than other nymphs it was 4 - 6 days with an average 5.5 ± 0.269 days (Table-1). It was measured about 8.299 ± 0.140 mm in body length (Table-2). Fifth instar nymphs mostly preferred the third and onward instar larvae of *A. mylitta* for predation. The total nymphal period of ranged from 15 to 25 days with an average of 20 days (Table-1). Fifth instar nymph attack onward third instar up to fully grown fifth instar larvae of *A. mylitta*. Some time it feed on when larvae engaged in to the formation the cocoon.

a) Adult:

For sucking of haemolymph of the host larvae, the adult of *C. furcellata* approach slowly back side of the larvae and insert long sting (rostrum) inside

the body of the larvae (Fig. 7). They were found alone and sometime found with its neonate

nymph predation the tasar larvae in all larval instar.

i) Male:

The male bug of *C. furcellata* was more active than female. Life span of male bug ranged from 11-24 days with an average 18.9 ± 1.260 days (Table -1). The male bug smaller than female bug and they was measure about 10.713 ± 0.076 mm body length (Table-2). The total life span ranged from first instar up to adult was 26-50 days with an average 37.5 days.

ii) Female:

The female bug was larger than the male; it measured about 12.918 ± 0.259 mm in length (Table-2). Life span of female bug was ranged from 24 - 32 day with an average 29.5 ± 1.078 days (Table-1). The period from egg laying to complete life cycle of an adult female bug varied from 39-58 days with an average 48.5 days (Figure. 8).

b) Mating behavior and oviposition:

Newly emerged adult could not copulate immediately. The pre-copulation period varied from 5 - 7 days. Male adults responded to the female call and moved slowly with vibrating

wings. Male adult bug climbed over on the female with vibrating wings. Then both sexes remained stationary in opposite direction in end to end direction (Fig. 9). Generally, female mated only once in her life. But, some time mating occurred twice. The copulation period varied from 10.00 to 13.53 hours with an average 12.45 ± 0.368 hr. The female oviposited after some time of copulation. The eggs were laid on the lower and upper surface of leaves as well as on stem also. The eggs were laid in small batches arranged in 3 - 5 rows. The oviposition period was varied from 11-19 days with an average being 16.2 ± 1.594 days (Table-1).

The egg laying capacity of female ranged from 17 - 45 eggs/batch with an average 28.6 ± 2.826 eggs/batch and 125 - 384 eggs/female during her life span with an average being 260.4 ± 44.873 eggs/female. The nymph and adult live for longer duration, so they can feed upon more larvae of the tasar silkworm hence the maximum cocoon crop loss occurred. The predatory bug *C. furcellata* also has more egg laying capacity for building up the population and can easily be reared in laboratory.

Table: 1. Days required for Development of *C. furcellata*

No. of Sample	Egg/Batch	Incubation Period (Day)	Nymphal Instar (Day)					Adult (Day)	
			I	II	III	IV	V	Male	Female
1	24	10	4	4	3	3	4	24	32
2	23	10	4	4	3	3	4	14	29
3	17	10	5	5	3	4	6	11	25
4	27	8	3	3	3	4	6	21	34
5	35	9	3	3	3	5	6	22	26
6	20	9	3	3	3	3	6	20	30
7	25	9	3	3	3	3	5	17	32
8	30	9	3	4	4	3	6	20	31
9	40	10	4	4	3	4	6	22	32
10	45	10	3	3	2	3	6	18	24
Average	28.6 ± 2.826	9.4 ± 0.221	3.5 ± 0.224	3.6 ± 0.221	3.0 ± 0.149	3.5 ± 0.224	5.5 ± 0.269	18.9 ± 1.260	29.5 ± 1.078
Range	17 - 45	8 - 10	3 - 5	3 - 5	2 - 4	3 - 5	4 - 6	11 - 24	24 - 32

\pm Standard error.

Table: 2 Measurement of length of nymph and adult during development of *C. furcellata*

No. of Sample	Egg (mm)	Nymphal Instar (mm)					Adult (mm)	
		I	II	III	IV	V	Male	Female
1	1.02	1.00	2.46	4.42	7.43	8.07	10.33	14.27
2	1.02	1.00	2.19	4.89	7.79	7.98	10.54	13.77
3	1.02	1.00	2.33	4.28	7.92	7.92	10.68	12.78
4	1.02	1.00	2.18	5.12	7.63	8.1	10.44	12.94
5	1.00	1.00	2.22	5.16	7.53	9.28	10.67	12.26
6	1.00	1.00	2.34	4.24	7.13	8.79	10.88	12.89
7	1.00	1.00	2.4	4.72	7.24	8.1	10.96	12.04
8	1.03	1.00	2.19	4.32	6.72	8.48	10.98	13.77
9	1.03	1.00	2.4	4.28	6.57	8.38	10.62	11.67
10	1.03	1.00	2.38	4.21	7.47	7.89	11.03	12.79
Average	1.017 ± 0.004	1.00 ± 0.000	2.309 ± 0.033	4.564 ± 0.118	7.343 ± 0.138	8.299 ± 0.140	10.713 ± 0.076	12.918 ± 0.259

\pm Standard error



Fig. A. Rearing of *C. fercillata* with *A. mylitta* larvae in plastic container



Fig. 1 Eggs of *C. fercillata*

Fig. 2 Newly hatched first instar nymph of *C. fercillata*

Fig. 3 Second instar nymph of *C. fercillata*

Fig. 4 Third instar nymph feed on second instar *A. mylitta* larva

Fig. 5 Fourth instar nymph of *C. fercillata*

Fig. 6 Fifth instar nymph of *C. fercillata*

Fig. 8 Adult female bug of *C. fercillata* with egg

Fig. 9 Adult male of *C. fercillata* with haemolymph of fourth instar *A. mylitta* larva

Fig. 9. Mating process of adult bug of *C. fercillata*

Figure 1

Discussion:

In the present study the biology and predatory nature of sting bug, *C. furcellata* was studied. The total life span of male adult was ranged from first instar up to adult was 26-50 days whereas the period from egg laying to complete life cycle of an adult female bug varied from 39-58 days with an average 48.5 days. These findings are very close to Ray *et al.* (2011) who reported that complete life cycle to be completed in 43-50 days, with an average it complete life cycle in 58.26 days (Ahmad *et al.*, 1996). The female always laid eggs on the upper surface of leaf or stem in small patches arranged in 3 - 5 rows, while unmated female, laid eggs singly randomly and it could not hatched. Ray and Khan (2011) reported that incubation period which ranged from 7-9 days with an average 7.7 days and in the same species incubation period was noted 4-8 days (Ahmad *et al.*, 1996).

In the present study the fifth instar nymph of sting bug was measured about 8.299 ± 0.140 mm in body length. Ahmad *et al.* (1996) reported that fifth instar nymphal duration ranged from 2 - 5 days and closely result recorded by Ray *et al.*, 2011. Fifth moult nymph transformed in to adult stage. The young adult initially (Newly moulted) were yellowish in colour and after some time changed to dark brown/grayish with shining scutellum having lateral yellow spot near the thoracic margin on both the sexes, with the lateral angles of the pronotum spine (Shrivastava *et al.*, 1987).

According to Ray *et al.* (2011) egg laid by single female ranged from 130-392 which was higher than present investigation and these findings also closed to earlier reported by Ahmad *et al.* (1996), who reported that 128-367 eggs were laid by single female. In the present work, the number of eggs laid by a single female was fluctuating. This was indication that the egg laying capacity of single female depends upon various environmental conditions. Temperature significantly affected *Eocanthecona furcellata* egg development and first instar nymph development. The time required for egg development decreased with increasing temperatures up to 35°C (Khin Thein Nyunt, (2008).

Conclusion:

It is concluded that the tasar silkworm rearing practices outdoor, hence the tasar larvae easily available for longer period for predation of *C. fercillata*. The findings about biology and nature of predation of sting bug are helpful for

identification as a pest of tasar silkworm and saving tasar cocoon crop in Vidarbha region from pest.

Acknowledgements:

It is great pleasure to thanks Mr. Ajay Wasnik, Sericulture Development Officer (SDO), Gondia District Tasar Grainage Centre, Arjuni/Mor. for his active support during tasar rearing.

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