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Biology and Feeding Potential of *Mallada boninensis* (Okamoto), a Chrysopid Predator of White fly *Bemisia tabaci* Gennadius

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ABSTRACT

Biology and feeding potential of a chrysopid, *Mallada boninensis* Okamoto, recorded by us for the first time from Gujarat, were studied under laboratory conditions. The predator laid stalked eggs in groups usually of 11 to 20. The larvae with the habit of carrying trash on its back passed through three instars, the durations of which were 4.11, 4.11 and 4.63 days at a constant temperature of 25.26 ± 2.2 °C and 59.90% RH. The short prepupal and pupal periods averaged 5 to 7 and 13.79 days respectively. The female was slightly bigger than male. The sex ratio of male : female was 1:1.5 with 81.40 per cent emergence of adults. Pre oviposition, oviposition and post-oviposition periods averaged 9.90 ± 1.60, 36.90 ± 4.41 and 18.00 ± 12.24 days respectively. The total number of eggs laid by the female averaged 431 ± 38.62 eggs. The average longevity of females and males were 64.8 ± 15.97 and 27.36 ± 8.03 days respectively. The larva consumed on an average 628.75 eggs of *Corcyra cephalonica* Stainton and 453 nymphs of white flies.

Key Words : *Mallada boninensis, Bemisia tabaci, Corcyra cephalonica,* development, biology, feeding potential

The chryospids popularly known as "Green lacewings" or "Golden eyes" are of considerable importance because of their role in natural control of many pests in different crops. They are reported to feed on aphids, cicadellids, psyllids, coccids, aleurodids, thrips, mites and eggs and young larvae of lepidopterans (Richards and Davies, 1979; Rao and Satyanarayana, 1984; Boussienguet, 1986). *Bemisia tabaci* Gennadius, a serious pest of cotton, has been preyed upon by many species of chrysopids *viz., Chrysoperla carnea* (Steph.), *C. cymbele, C. flavifrons* Brauer and *Nineta (Chrysopa) flava* (Scap.) (Or and Gerling, 1985; Gerling, 1986). Recently, the chrysopid, *Mallada boninensis* (Okamoto) was recorded for the first time by us from Gujarat preying on *B. tabaci* in cotton fields. The information available on its biology was found to be meagre. A detailed study on its biology and feeding potential was, therefore, carried out at Anand Campus of Gujarat Agricultural University during the year 1987-88.

MATERIALS AND METHODS

The culture of *M. boninensis* was maintained in the laboratory throughout the study on frozen eggs of *Corcyra cephalonica* (Stainton) based on the technique reported by Patel *et al.* (1988).

Incubation period of eggs was studied by holding freshly laid eggs individually in plastic bowls (9 cm dia. x 4 cm ht.). The mouth of the bowl was covered with a fine white muslin cloth and held tightly by a rubber band. Observations on hatching were recorded at 24h interval. The freshly hatched larvae were reared individually in the same plastic bowls to study their development and feeding behaviour. The duration of each instar was determined by the presence of exuvium. The

full grown larvae were closely observed at 3 h interval for recording pre-pupal period. The freshly formed cocoons were held individually till emergence of adults to record pupal period. The freshly emerged and mated females were later held individually in one litre capacity glass jar covered with fine muslin cloth and held tightly by a rubber band to study the pre-oviposition, oviposition and post-oviposition periods. A bouquet containing 2 to 3 shoots of lucerne was kept inside the glass jar to facilitate egg laying. The eggs laid by each female was recorded every day until death. The sex ratio was recorded by counting the number of males and females emerged from the cocoons held for the emergence of adults. Measurements of different life stages were also recorded.

Newly hatched larvae of *M. boninensis* were given known number of frozen eggs of *C.cephalonica* till pupation to study the feeding potential. Similarly, feeding potential on the nymphs of *B. tabaci* was also studied. Cotton leaves infested with *B. tabaci* nymphs were collected from the field and placed on a thin layer of wet cotton in plastic bowls, so as to keep the leaf turgid. Newly hatched larvae were released on each leaf containing known number of nymphs. Number of nymphs consumed was recorded at 24 h interval. This procedure was repeated at every 24 h interval till pupation.

All these studies were carried out at 25.23 ± 2.2°C and 59.9 per cent relative humidity.

RESULTS AND DISCUSSION

The freshly laid eggs were stalked, green and oval in shape. They were laid in groups of 1-45 (usually 11-20). The mean incubation period was 4.69 (4.5-5.0) days which is not in agreement with the studies made by Brettell (1979), who found that it was 3.7 days at 25°C. However, he did not mention the relative humidity that prevailed during the course of the observations, which might have played some role in shortening the incubation period (Maurice and Catherine, 1983). The per cent hatching was 99.06. The mean length of egg was 0.920 ± 0.013 mm and the breadth was 0.433 ± 0.003 mm. The mean length of stalk was 7.21 ± 0.22 mm.

The chorion of the egg was burst at the tip to allow the first instar larva to emerge. After eclosion, first instar larva remained on the egg shell until it recovered from its crumped position in the egg. The first instar was campodeiform, pink and alligator shaped. The mouthparts were mandibulo-suctorial type having long, curved sickle shaped mandibles. The body had fine setae arising from dorsolateral tubercles. The larva typically carried preyed victims on its back. The minimum and maximum length of the larva was 2.00 and 2.50 mm respectively with an average of 2.12 ± 0.71 mm.

The second and third instar larvae were almost similar to each other, except in size and to some extent in colour. The third instar larva was larger and stouter than the second instar. They appeared pink to brownish. The brownish blackish bands were more prominent in second instar larva. Mandibles and palpi were red at the tip. As in first instar, setae were more prominent and larvae were concealed by the remains of their victims. The mean length and width of the second instar larvae were 4.21 mm (4.00 to 4.50 mm) and 2.27mm (2.00 to 2.50 mm) respectively, while the mean length and width of the third instar larvae were 7.15mm (6.5 to 8.5 mm) and 4.23mm (3.5 to 5.00 mm) respectively. The mean durations of first, second and third instars were 4.11, 4.11 and 4.63 days respectively. The mean total larval period was 12.85 days. Brettell (1979) also reported 12.00 days at 25°C temperature.

The full grown larvae stopped feeding, became sluggish and swollen. The larvae then started spinning cocoon from a spinneret which was located at the hind end of the body. The pre-pupal period was very short and did not exceed 7.0 h ($\overline{X}$ = 6.10 h). If the larvae were disturbed while spinning the coccons they did not pupate and died in the pre-pupal stage itself

The cocoons were spherical, white and covered with the dead remains of the prey. The cocoons turned greenish a day or two before the emergence of adults. The adult, prior to emergence, made an irregular cut on the cocoon and emerged out. The mean diameter of cocoon was 7.54±0.47 mm. The mean duration of pupal period was 13.79 days. The present finding differs from that by Brettell (1979), who reported that pupal period averaged 10.00 days at 25°C. He, however, did not mention the prevailing relative humidity during the study which has also a key role to play in altering the pupal period as reported by Maurice and Catherine (1983).

The bright green adult had antennae longer than the length of the body. The sexes could easily be differentiated by their size and tip of the abdomon. The female was bigger and its abdomen was swollen and bigger than that of male. The female had a wing expanse measuring on an average 3.13 ± 0.13 cm, Whereas in male, it averaged 2.63 ± 0.19 cm. The sex ratio was 1:1.5 (male : female) and the per cent emergence was 81.4.

The female dabbed a drop of gummy substance from the tip of the abdomen onto the surface on which eggs were to be laid, then raised the abdomen, drew it up into a slender stalk which immediately hardened. The eggs were then laid on the tip of this stalk. The pre-oviposition period was 9 to 14 days with an average of 9.9 ± 1.6 days. The oviposition period was observed to be 29 to 44 days with an average of 36.9 ± 4.4 days. The females had post-oviposition period of 3 to 36 days with an average of 18.0 ± 12.2 days. Lee and shih (1983) reported that the pre-oviposition period lasted for 4 to 11 days and the oviposition period ranged between 11 to 88 days. A female laid 431 ± 38.62 eggs, with a mean of 11.86 eggs/day. Lee and shih (1985) also reported 12.74 eggs/day/female. However, the average facundity reported by them was quite higher (512.3 eggs). This may perhaps be due to effect of nutrition during the larval and adult development.

Males and females survived for 27.6 and 64.8 days respectively. According to Brettell (1979), the longevity of male and female was 21.0 and 31.0 days while Lee and Shih (1983 ; 1985) observed 43 and 47.9 days respectively.

The data on feeding potential (Table 1) showed that the first, second and third instar larvae consumed on an average 15.93, 39.47 and 101.10 eggs of *C. cephalonica* per day

Table 1. Feeding potential of *M. boninensis* (Okam.) on *C. cephalonica* eggs and nymphs of *B. tabaci*

Stage and host	Instar	No. of observations	Mean total number of eggs/nymphs consumed	Mean number of eggs/nymphs consumed/day	Larval period (in days)
Egg of *Corcyra cephalonica*	First	14	63.71 (40-93.)*	15.93 (10.00-23.25)	4.50 (4-5)
	Second	12	157.92 (123-189)	39.47 (30.75-47.25)	3.67 (3-4)
	Third	12	404.42 (336-483)	101.10 (84.00-120.75)	4.33 (4-6)
Nymphs of *Bemisia tabaci*	First	10	63.9 (53-75)	15.98 (13.25-18.75)	4.20 (4-4.5)
	Second	10	156.1 (122-185)	39.03 (30.50-46.25)	4.06 (4-4.5)
	Third	10	260.2 (241-281)	65.58 (60.25-70.25)	3.40 (3-4.0)

* Figures in parentheses are ranges

while it consumed an average of 15.98, 39.03 and 65.58 nymphs of *B. tabaci* per day respectively. The mean total consumption of eggs of *C. cephalonica* and nymphs of *B.tabaci* were 628.75 (548 to 713 eggs) and 453.00 (404 to 499 nymphs) respectively during its entire larval instar. The larval period in *C. cephalonica* averaged 12.5 days while in case of *B. tabaci* nymphs, it was 11.66 days. The feeding potential of *M. boninensis* has not been studied earlier on the above two hosts. However, Lee and Shih (1983 and 1985) have reported that larvae of *M. boninensis* consumed an average of 5.6,14.0 and 62.9 nymphs of *Paurocephala psylloptera* or 21.7, 46.2 and 33.6 per larva per day respectively. The total predation potential, according to them, was 437.75 prey nymphs per larva or 38.80 nymph per larva per day. The larva of *M. boninensis* has also been reported to feed on 237.90 nymphs of grape mealybug, *Maconellicoccus hirsutus* (Green) during its development (Anon, 1987).

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