



Research Note

Silkworm as alternate host material for rearing of green lace wing, *Mallada desjardinsi* (Okamoto) (Neuroptera: Chrysopidae) – a predator of pests of mulberry

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ABSTRACT: Laboratory studies were undertaken to rear *Mallada desjardinsi* (Okamoto) using two species of silkworms (i.e., Mulberry Silkworm, *Bombyx mori* L. and Eri Silkworm, *Samia cynthia ricini* (Boisduval)) as host material. On the *B. mori* larvae (1st instar), the total larval duration lasted for 14.6 ± 0.13 days whereas on that of *S. c. ricini*, it was 14.75 ± 0.19 days at a constant temperature of $25 \pm 2^\circ\text{C}$ and $65 \pm 5\%$ R.H. A single *M. desjardinsi* larva on an average consumed 103.35 ± 2.31 and 100.40 ± 2.05 chawki larvae (1st instar) of *B. mori* and *S. c. ricini*, respectively. The sex ratio of male: female was 1:1.4 & 1:1.2 with 78.9 and 69.3 per cent adult emergence, respectively on *B. mori* and *S. c. ricini*. The study also revealed that silkworms could be utilized as alternate host material for maintenance of culture as well as production of *M. desjardinsi*.

KEY WORDS: *Mallada desjardinsi*, rearing, *Bombyx mori*, *Samia cynthia ricini*

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Amongst the many insect predators, chrysopids are reported to be potential predators due to their high host searching capacity and voracious feeding habit. The adults are non-predatory in nature, feeding on honeydew secreted by host insects and pollen of flowers. The larvae attack and consume a wide variety of insect pests that include aphids, mealy bugs, scale insects, whiteflies, thrips, psyllids, leaf hoppers, lepidopteran eggs / larvae and mites (Krishnamoorthy and Mani, 1989; Mani and Krishnamoorthy, 1999; Canard, 2001; Sujatha and Singh, 2003; Syed *et al.*, 2008; Alasady *et al.*, 2010). They are encountered in most of the agricultural and horticultural ecosystems including plantation crops and mulberry (Narendra Kumar *et al.*, 2001, 2010). Their ability to adapt to a wide range of ecological factors (Ulhaq *et al.*, 2006) and tolerance to insecticides (Bigler, 1984; Vogt *et al.*, 2001) has made them important candidates in the biological control programs. *Mallada desjardinsi* (Okamoto) was found to be an important predator of *Maconellicoccus hirsutus* (Green) in mulberry ecosystem in Karnataka, Tamil Nadu and Andhra Pradesh (Sidde Gowda *et al.*, 1997). They can be successfully reared on eggs of *Corcyra cephalonica* Stainton in the laboratory (Krishnamoorthy and Mani, 1982; Bakthavatsalam *et al.*, 1994; Jalali *et al.*, 2003; Elsiddig *et al.*, 2006; Syed *et al.*, 2008; Riddick, 2009) and on artificial diet (Venkatesan *et al.*, 2000;

Sudhida Gautam, 2010). In the present study, an attempt was made to rear *M. desjardinsi* using first instar larvae (chawki) of silk worm as alternate host, which are usually discarded.

During February 2010, four egg masses each with 21, 18, 20 and 24 stalked eggs of *M. desjardinsi* were collected from the mulberry gardens of CSR & TI, Mysore, destalked and kept individually in vials (25x50 mm) for hatching at a room temperature of $25 \pm 2^\circ\text{C}$ and $65 \pm 5\%$ R. H. and was covered with cotton. After hatching, they were divided in to 2 batches each of forty larva and provided with a known number of chawki worms (1st instar) of mulberry [*Bombyx mori* L] and eri silkworm [*Samia cynthia ricini* (Boisduval)] with the help of hair brush. The larvae which were alive in each vial after 24 hours were counted and the difference was recorded as number of larvae fed by *M. desjardinsi*. The larvae were reared in the same vials till pupation and observations on the feeding potential as well as developmental duration of each instar was recorded. The freshly developed pupae were maintained in the same vials till adult emergence and subsequently the pupal period, sex ratio and fecundity were recorded. The adults were reared in a 50% honey solution, protinex mixture and castor pollen as per the method described by Jalali *et al.*, 2003). The data were

subjected to one way analysis of variance (ANOVA) for determining the level of significance (Gomez and Gomez, 1984).

In the present study, the 1st, 2nd and 3rd instar larvae of *M. desjardinsi* consumed 15.40 ± 0.49 , 30.35 ± 0.39 and 57.60 ± 2.44 mulberry silkworm first instar larvae of *B. mori* respectively with a total consumption of 103.35 ± 2.31 during its whole larval period, which lasted for 14.60 ± 0.13 days. Similarly, each larva of *M. desjardinsi* consumed 15.05 ± 0.30 , 29.40 ± 0.49 and 55.95 ± 2.15 chawki larvae respectively of *S. c. ricini* during 1st, 2nd and 3rd instar (total 14.75 ± 0.19 days) with a total consumption of 100.40 ± 2.05 larvae (Table 1 and 2). The feeding potential of *M. desjardinsi* on different hosts was studied by several workers. Joshi and Yadav (1990) recorded that each larvae of *M. desjardinsi* consumed on an average 628.75 eggs of *C. cephalonica* and 453 nymphs of *Bemisia tabaci* (Gennadius) during its larval stage which lasted for 12.85 days (I & II instar: each for 4.11 days; III instar: 12.85 days). Similarly, More *et al.* (2010) observed that, the larval period of *M. desjardinsi* on mango mealybug, *Ferrisia virgata* (Cockerell), lasted for 14.07 ± 0.78 days, which is more or less in conformity with present finding (with I instar

5.14 ± 0.36 days, II instar 4.66 ± 0.52 days and III instar 3.66 ± 0.47 days). With respect to grape mealybug, *M. hirsutus*, a single larva of *M. desjardinsi* was observed to consume 237.9 nymphs (Anonymous, 1987).

In the present study, egg incubation period of *M. desjardinsi* was recorded to be 4.00 ± 0.14 days (Max. 4.18, Min. 3.22) and 4.8 ± 0.1 (Max. 5.1, Min. 3.96) with a hatching percentage of 92 and 91.

There was no significant difference in pupal period which lasted for 10.40 ± 0.11 and 10.60 ± 0.11 days when fed on mulberry silkworm and eri silkworm, respectively. Percent pupal mortality was recorded to be 0.15 ± 0.08 and 0.35 ± 0.11 , respectively. The parameters such as pre-oviposition, oviposition and post oviposition periods are tabulated in Table 3. The sex ratio (male: female) was 1:1.4 & 1:1.2 with 78.9 and 69.3% adult emergence, respectively on mulberry silkworm and eri silkworm. The fecundity was observed to be significantly different with 229.80 ± 16.99 when fed with *B. mori* chawki larvae compared to that fed with *S. c. ricini* chawki larvae (178.35 ± 8.72). The above observations are in conformity with the studies conducted by Joshi and Yadav (1990) with respect to *M. desjardinsi* on *B. tabaci*. However,

Table 1. Feeding potential of *Mallada desjardinsi* on young age silkworm larvae

Host species	I Instar	II Instar	III Instar	Total consumption
<i>Bombyx mori</i>	15.40 ± 0.49	30.35 ± 0.39	57.60 ± 2.44	103.35 ± 2.31
<i>Samia cynthia ricini</i>	15.05 ± 0.30	29.40 ± 0.49	55.95 ± 2.15	100.40 ± 2.05
NS = Non-Significant	NS	NS	NS	NS

Table 2. Developmental duration of *M. desjardinsi* when fed on silkworm larvae

Host species	I Instar	II Instar	III Instar	Total larva (Days)	pupa	Total Pre imaginal	% mortality
<i>Bombyx mori</i>	4.55 ± 0.11	4.60 ± 0.11	5.45 ± 0.11	14.60 ± 0.13	10.40 ± 0.11	25.00 ± 0.19	0.15 ± 0.08
<i>Samia cynthia ricini</i>	4.60 ± 0.11	4.75 ± 0.10	5.40 ± 0.11	14.75 ± 0.19	10.60 ± 0.11	25.35 ± 0.25	0.35 ± 0.11
NS = Non-Significant	NS	NS	NS	NS	NS	NS	NS

Table 3. Biological parameters of the adult predator, *M. desjardinsi*

Host species	Pre oviposition period	Oviposition period	Post oviposition period	Fecundity
<i>Bombyx mori</i>	6.15 ± 0.25	36.40 ± 0.76	6.30 ± 0.55	329.80 ± 16.99
<i>Samia cynthia ricini</i>	7.20 ± 0.34	31.45 ± 0.74	4.70 ± 0.47	178.35 ± 8.72
NS = Non-Significant	6.184 **	21.666 **	4.953 **	62.905 **

More *et al.* (2010) recorded a female biased sex ratio of 1:1.8 when fed on *F. virgata*.

Based on the results of the current study, it is inferred that *M. desjardinsi* could be successfully cultured and maintained in the laboratory by utilizing the chawki larvae of either *B. mori* or *S. c. ricini* as alternate host. Incidentally, unused male moths of multivoltine races and female moths of bivoltine races which otherwise are discarded during grainage operation could be well utilized for this purpose without any loss in commercial silkworm seed production activity. However, development of suitable protocol for mass production and cost economics in large scale multiplication are to be focused as future thrust area of research.

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