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Predatory efficiency of *Mallada astur* (Banks), a chrysopid predator of coconut leafeating caterpillar, *Opisina arenosella* Walker

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ABSTRACT: **The chrysopid, *Mallada astur* (Banks), recorded for the first time as promising egg and early larval predator of *O. arenosella* in interior Karnataka was evaluated for its predatory efficiency. This predator is predominant on coconut and palmyrah palms of 30m height. Its short life cycle (24.5 days) on a combined diet of eggs and larvae of *O. arenosella*, high fecundity per female (mean=102.3 eggs), and its ability to thrive in the larval galleries of *O. arenosella*, strongly support its utilization as a biocontrol agent during peak period of infestation (September-February) in interior Karnataka. Net house studies revealed that release of one *M. astur* larva (4 day old) per severely infested leaflet with about 35-50 neonate larvae will effectively reduced the population of the pest within a week.**

KEY WORDS: Biocontrol, biology, *Mallada astur, Opisina arenosella*

Chrysopids have been recorded as important natural enemies of lepidopteran pests (Carnard *et al.*, 1984; Singh and Narasimham, 1992). Life tables, comparative biology and feeding potential of four important species of chrysopids namely, *Chrysoperla carnea* (Stephens), *Mallada astur* (Banks), *Mallada boninensis* (Okamoto) and *Apertochrysa* sp. on *Corcyra cephalonica* (Stainton) were studied in order to provide the information on mass production and release in pest infested tracts in Karnataka (Bakthavatsalam *et al.*, 1994a and b). Studies on biology and feeding potential of *Ankylopterix octopunctata candida* Fabr. on *O. arenosella* revealed its efficiency as a biocontrol agent in South Kerala (Sathiamma *et al.*, 1985). *Chrysopa* sp. was recorded on tall palms infested by *O. arenosella* in Gujarat (Yadav and Dhamalia, 1985). Krishnamoorthy (1988) described the life history of *Chrysopa scelestes* Banks feeding on neonate larvae of *O. arenosella.*

The biocontrol potential of chrysopids on *O. arenosella* has been assessed in the laboratory; however, field evaluations have not been done. *Mallada astur* Banks was observed as a promising predator on both coconut and palmyrah infested by *O. arenosella. M. astur* flourished during post monsoon period (September-February) in interior Karnataka. No report is available on the mass production and field release of any of the promising predators of *O. arenosella.* In view of this, studies were initiated on the feeding potential and development of *M. astur* on *O. arenosella* and prey-predator ratio, to find out optimum numbers for field release.

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MATERIALS AND METHODS

Adults of *Mallada astur* were collected from *O. arenosella* infested coconut plots in interior Karnataka and a laboratory culture was built which was utilized for laboratory studies on feeding potential and biology.

Feeding potential and development of *Mallada astur*

Freshly laid eggs of *M. astur* were placed individually in glass vials (7.5x2.5cm) and closed with cloth walled cotton plugs. One day old larva was placed in cylindrical plastic containers (5.3x2 cm) with aerated lids and provided with *O. arenosella* eggs and neonatal larvae enclosed inside fresh coconut leaf bits daily until the formation of cocoons. In another experiment a combined diet of eggs and neonate larvae of *O. arenosella* were provided to *M. astur* larva until the formation of cocoons. Rate of consumption was recorded after 24 hours. The development period was recorded. Similarly, development of *M. astur* on *C. cephalonica* was also recorded by feeding known number of UV treated host eggs daily until the formation of cocoons. Data on total and percent feeding were tabulated.

To study the fecundity of *M. astur*, one pair of adults was released in wide mouthed cylindrical plastic container (15x9cm size) with circular paper base and aerated lids. Cotton swabs with 0.5 ml of protinex mixture (protinex: yeast: honey: sugar in 1:1:1:1 ratio by volume) and water were placed on inner side of the container and replaced daily. Each treatment was replicated 12 times. Containers were checked daily for the presence of eggs and data were recorded till the adults ceased to lay eggs. The studies were conducted during October-November when temperature and relative humidity ranged 20-30°C and 73.0-83.0 per cent, respectively.

Ovipositional preference of *M. astur*

The experiment was conducted to evaluate its ovipositional preference to two palms. Leaf bits cut from coconut and palmyrah seedlings were brought to laboratory and the petiole of the leaf was covered with wet cotton and fixed into narrow mouthed glass bottles (14 cm height x 2 cm diam) filled with water so as to prevent desiccation of leaves. These bottles with leaf bits were placed inside the square glass chamber (30x30cm size) with aerated lid. Two mated females of *M. astur*, reared on *O. arenosella* were released into this glass chamber. Feeding was provided in the form of honey: protinex: water: sugar @ 1:1:1:1 by volume. Number of eggs laid on each host plant was recorded after 24 hours. The data from 12 replications were tabulated and subjected to analysis of variance.

Predatory efficiency of *M. astur* against *O. arenosella*

Potted plants (seedlings) of coconut were selected and four-day-old larvae of *M. astur* were released at the rate of 1 and 2 per leaf, in two sets. Ten numbers of neonatal larvae of *O. arenosella* per single *M. astur* larva were provided daily for first and second set, for a week and consumption of prey was recorded daily. The studies were conducted during August (20-30°C and 62-80 % relative humidity). Each treatment was replicated ten times. The data were subjected to analysis of variance to test the efficiency of two dosages of *M. astur* against *O. arenosella.*

RESULTS AND DISCUSSION

Feeding potential and development of *M. astur*

Feeding trials with eggs and newly emerged larvae of *O. arenosella* revealed no significant difference in the per cent feeding of *M. astur*, which indicated its equal preference to both host stages. Significant difference was not observed between the larval developmental period, when fed on eggs of *O. arenosella* and *C. cephalonica.* But feeding neonate larvae of the pest alone delayed the cocoon formation. It was interesting to note that the combined diet of eggs and neonatal larvae resulted in significantly shorter developmental period (Table 1). Obrycki *et al.* (1989) reported significant variation in the biology of chrysopids when fed on different hosts.

M. astur consumed 376.6 eggs or 70 neonate larvae of *O. arenosella*, respectively, during its development (Table 1). Sathiamma *et al.* (1985) reported that *Ankylopterix octopunctata candida* consumed 160-230 eggs of *O. arenosella* during its development.

Table 1. Development and feeding potential of *M. astur* on different test insects

Test insects	Feeding		Mean developmental period (days)		
	Total	Per cent feeding	Larval period	Pupal period	Total
Opisina arenosella					
Eggs	376.6(19.38)	63.53(52.83)	12.3	10.3	22.7
Neonate larvae	70.0(8.35)	61.87(51.85)	15.7	12.0	27.7
Eggs + neonate larvae	148(12.16)	66.37(54.55)	11.0	8.7	19.7
Corcyra cephalonica					
Eggs	349.0(18.62)	64.33(53.32)	12.0	11.0	23.0
CD (P=0.05)	1.20**	NS	2.24**	2.03*	2.66**

Transformed values (square root and angular) are given in parentheses.

** Significant at 1% * Significant at 5%

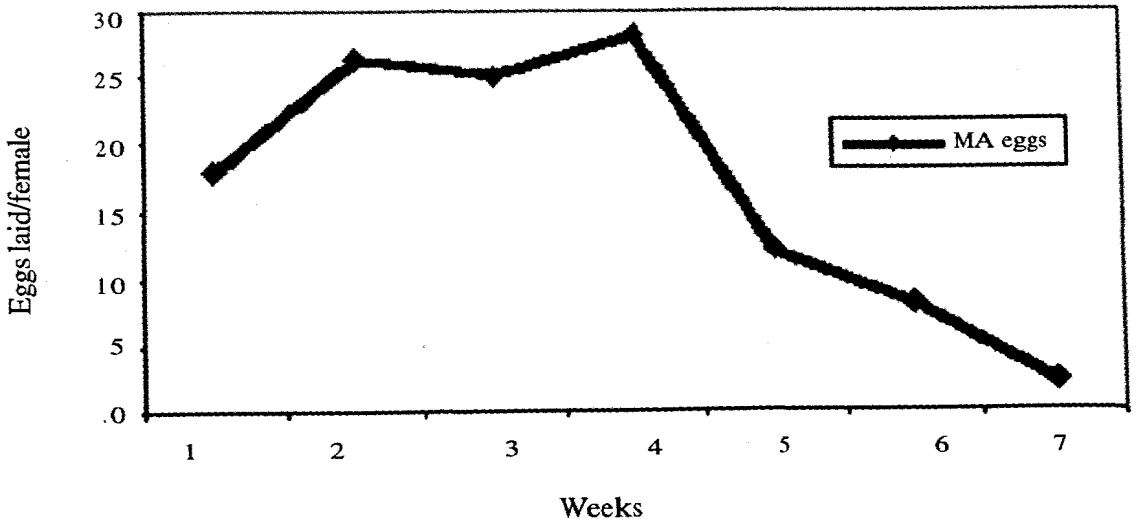

Fig. 1. Oviposition pattern of *Mallada astur* on *Opisina arenosella*

When fed on *O. arenosella* eggs highest egg laying by *M. astur* was observed during second, third and fourth week of oviposition period. Steady decline after fifth week was observed (Fig.1). Preoviposition and oviposition periods were 6.0 and 44.0 days, respectively. The total development period of *M. astur* was 24.5 days on the combined diet of eggs and larvae of *O. arenosella*. Sathiamma *et al.* (1985) reported that *A. octopunctata candida* completed larval and pupal periods in 9-11 and 10-12 days, respectively when reared on *O. arenosella*. Fecundity per female ranged from 101 to 126 eggs (Mean=102.3) during a period of about 40 days. Continued presence of males was required for egg laying process. Bakthavatsalam *et al.* (1994b) reported that *M. astur* when reared on the eggs of *C. cephalonica*, completed its larval and pupal development in 14.3 and 11.0 days, respectively. Jalali and Singh (1994) while observing the effect of prey density on *M. astur* reported that both developmental period and fecundity varied with the quantity of *Aphis gossypii* nymphs (prey) consumed. Mani and Krishnamoorthy (1999) reported on the biology of *M. astur* on *C. cephalonica* and *Aleurodicus dispersus* and recorded significantly longer developmental period (15.6 days) on the latter than on former (13.2 days).

Oviposition preference of *M. astur*

In the free choice test *M. astur* preferred coconut to palmyrah for oviposition. Eggs were laid near the midrib and on outer edges of leaflets. *M. astur* adults reared on *C. cephalonica* eggs preferred to lay eggs on the sides of the containers than on exposed palm leaves. Adults reared on *O. arenosella* eggs/larvae laid significantly number of eggs on coconut leaflets (12 eggs/ pair of females/ 24h) than on palmyrah leaves (4.2).

Though 2-4 larvae per 20% sample leaves per palm *M. astur* were recorded both on palmyrah and coconut palms, infested by *O. arenosella* during November-February in the surveillance studies (1996 and 1997) in interior Karnataka, in the laboratory maximum egg laying was observed on coconut leaves. Pedunculate eggs are laid along the midrib of the leaflet and pupation took place on the ventral side of the leaflet towards the outermost ridge. In palmyrah palm both eggs and cocoon were found on both sides of the leaf. Rearing *M. astur* larvae on *O. arenosella* and its infested host plant at least for one generation may enhance its preference to that particular host plant for oviposition.

Predatory efficiency of *M. astur* against *O. arenosella*

At the dosage of one larva per leaf, 60.4 per cent of neonate larvae of *O. arenosella* were consumed, which was significantly higher than the feeding at a dosage of 2 larvae per plant (Table 2).

The considerable reduction in the rate of feeding in the latter dosage may be due to cannibalism among the larvae of *M. astur*. *M. astur* was not earlier recommended for field release against lepidopteran pests due to lower fecundity and feeding potential, compared to other chrysopids such as *Chrysoperla carnea, Mallada boninensis*

Table 2. Evaluation of different dosages of *M. astur* against *O. arenosella*

Dosages of *M. astur*	Consumption of larvae of *O. arenosella* per day (Mean)	Per cent feeding (Mean)
1 larva	5.60 (3.0-8.0)	60.40 (51.01)
2 larva	3.66 (2.0-6.0)	39.06 (38.60)
CD (P=0.05)	0.23**	5.70**

Range and angular transformed values are given in parentheses.

and *Apertochrysa* sp. (Bakthavatsalam *et al.*, 1994b; Ballal, 1998). It is evident from the above observations that *M. astur* is a potential predator of *O. arenosella* and the release of a single larva (4day old) per severely infested leaflet with about 30-50 neonate larvae of *O. arenosella*, will effectively reduce the population within a week.

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