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EFFECT OF PREY SOURCES ON DEVELOPMENT AND PREDATION POTENTIAL OF LADY BIRD BEETLE

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ABSTRACT

Development and predation potential of lady bird beetle, *Menochilus sexmaculatus* Fab. were studied in the laboratory using different types of prey such as bean aphids, mustard aphids, citrus aphids, scale insects and mealy bugs. Results showed that the larvae of predator passed four instars and prey sources did not affect the development of larval instars. Prepupal and pupal periods were not significantly different. All the prey sources showed that the mean longevity of female was longer than male. The average predation rate of larva gradually increased up to 7th day with feeding rate of 7.5 – 16.5 prey. The adult consumed 48- 52 aphids and 17 - 19 scale insects and mealy bugs on 16th day and dropped until 31th day.

Key words: *Food sources, development, predation, prey*

INTRODUCTION

The lady bird beetle, *Menochilus sexmaculatus* Fab. (Coleoptera: Coccinellidae) is widely distributed in South-Western Asia, Indonesia, Philippines and South Africa as common and efficient aphid feeding species (Rahman *et al*., 1993). It is considered to be of great economic importance in the agroecosystem. Both larval and adult stages are predicious on various important crop pests such as aphids, coccids, thrips, jassids, scale insects, mealy bugs and other soft bodied insects (Mani, 1995). This predator was found in association with these insects infesting wheat, tobacco, cotton, maize, potato, lentil, mustard, bean, citrus, cucurbit, groundnut, cabbage etc (Chandra and Chandra, 1996). Control of aphids, scale insects and mealy bugs in Bangladesh is principally carried out by the conventional use of insecticides. At present emphasis is being given on the use of environmentally safe pest control method. Biological pest management, particularly using predators can play a significant role. The knowledge of development of predation behaviour of *M. sexmaculatus* can increase its utility as a biological agent. This study was undertaken to know the effects of various prey species on the larval development and predation potential of *M. sexmaculatus.*

MATERIALS AND METHODS

Collection and rearing of insect: Adult males and females *M. sexmaculatus* were collected from the Field Laboratory of Bangladesh Agricultural University (BAU), Mymensingh and the observations were done in the Entomology Laboratory of BAU during December, 2005 to March, 2006. The room temperature and relative humidity during the period of study were 23 ± 2 ^{o}C and 75 ± 5%, respectively. The beetles were sexed and paired in Petridishes (9.0 × 1.5 cm) and allowed for oviposition. Newly hatched larvae were provided with aphids every day until pupation. The newly emerged adults were placed in other Petridishes having one male and one female for mating and laying eggs. This procedure was continued for obtaining adequate number of adult beetles for the experiment.

Observation of development: To observe the development duration of larvae, pupae and adult stages, the newly emerged adult males and females were collected from the culture. They were confined in pairs in the petridishes for mating. A single pair of male and female was kept in each petridish (9.0 × 1.5 cm). The adults were provided with bean shoot, inflorescence or stem with

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bean aphid (*Aphis craccivora*), mustard shoots, pods and leaves with mustard aphids (*Lipaphis erysimi*), citrus shoots, pods and leaves with citrus aphids (*Taxoptera citridus*), scale insects (*Aonidiella aurantii*) and mealy bugs (*Pseudococcus virgatus*) as their foods. The foods were supplied every morning and 10 petridishes were maintained for each type. After mating, the female laid eggs and the beetles were transferred to other petridishes. The eggs were observed everyday to note their hatching and the durations of larval instars, prepupal and pupal periods and adult longevity were recorded.

Predation potential of larvae and age specific cannibalism of adult beetle: Just after hatching of eggs, young larvae were transferred individually in Petridishes (9 × 1.5 cm). The bottoms of the Petridishes were covered with blotting paper. From the mass culture of bean aphids, mustard aphids, citrus aphids, scale insects and mealy bugs were supplied every morning at the rate of 40, 50, 60 and 100 in number for first, second, third and fourth instar larvae, respectively. Ten Petridishes were maintained for each type of food. The prey was changed every 24 hours and after moulting. The number of aphids, scale insects and mealy bugs consumed within 24 hours by each larval instar were recorded. For determining the age specific consumption of adult predators, prey species of known number were supplied everyday and the number of preys consumed by adult beetles were recorded every 24 hours and continued till death of the beetles. Data obtained from the experiments were analyzed in computer using one factor Completely Randomized Design (CRD) and means were ranked by Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Larval and pupal development: After egg hatching the blakish larvae came out by making irregular hole through the upper end of the egg shell. Larvae were soft bodied, brownish-black, elongate, somewhat flattened and covered with minute spiny sutures. The larvae passed through four larval instars with three moult as confirmed from observations of exuviae in Petridish. The initial colour of the first instar larvae was brownish-black immediately after hatching. The mean duration of the first instar larva was from 2.40 ± 0.55 to 2.80 ± 0.45 days when fed on bean aphids, mustard aphids, citrus aphids, scale insects and mealy bugs and did not differ significantly (Table 1). Verma *et al*. (1993) reported that the duration of the first instar larva of *M. sexmaculatus* was 1.4 ± 0.2 days when reared on *Aphis gossypii*. Hossain *et al*. (1995) reported that the duration of the first instar larva of *M. sexmaculatus* was 2.67 ± 0.11 days on mustard aphid which was more or less similar to that of the present study.

Table 1: The larval development duration of *M. sexmaculatus* feeding on different prey

Prey sources	Duration of larval instars (days)			
	First instar	Second instar	Third instar	Fourth instar
Bean aphid	2.40 ± 0.55 a	1.40 ± 0.55 a	1.20 ± 0.45 a	2.80 ± 0.88 a
Mustard aphid	2.60 ± 0.55 a	1.60 ± 0.55 a	1.40 ± 0.55 a	3.40 ± 0.55 a
Citrus aphid	2.80 ± 0.45 a	1.80 ± 0.45 a	1.40 ± 0.55 a	3.20 ± 0.84 a
Scale insect	2.80 ± 0.45 a	2.20 ± 0.45 a	1.40 ± 0.55 a	3.40 ± 0.55 a
Mealy bug	2.80 ± 0.45 a	2.20 ± 0.45 a	1.20 ± 0.45 a	3.60 ± 0.55 a

Means within a column followed by same letter(s) are not significantly different by DMRT ($p \leq 0.05$).

The newly emerged second instar larvae were brownish in color. All other parts of the body as well as its habits and general appearance were found more or less same as in the previous instar. The mean duration of the second instar larva was from 1.40 ± 0.55 to 2.20 ± 0.45 days feeding on five different preys and showed statistically identical (Table 1). Verma *et al*. (1993) found that the duration of the second instar larvae of *M. sexmaculatus* was 1.3 ± 0.3 days using *A. gossypii* as host. Their results indicated that the 2nd instar larval duration was slightly shorter than the present study. Debaraj and Singh (1990) described that the duration of second instar larvae of *Coccinella*

transversalis was 3.92 days on *Aphis craccivora* in laboratory condition which was higher than that of the present findings.

Third instar larvae were more elongated and more active than previous instar larvae. The mean duration of this instar was identical and found to be 1.20 ± 0.45 to 1.40 ± 0.55 days when fed on five different types of preys (Table 1). Verma *et al*. (1993) found that the duration of third instar larva of *M. sexmaculatus* was 1.3 ± 0.3 days on *A. gossypii as* prey. Debraj and Singh (1990) reported that the duration of third insrar larvae of *Micraspis discolor* was 5.0 days on *A. craccivora* which was higher than present study. The fourth instar larva appeared black-pinkish white band on the basal side of the thorax and abdomen. The larvae attained a greater size at this stage and became stronger, and their voracious feeding and mobility increased considerably as compared to previous instars. The mean duration of the fourth instar larva did not differ significantly among the prey and was 2.80 ± 0.88 to 3.60 ± 0.55 days. Verma *et al*., (1993) and Hossain *et al*. (1995) reported higher duration of this instar on *A. gossypii* and mustard aphid. Debaraj and Singh (1990) found that the duration of the fourth instar larvae of *C. transversalis* was 7.69 days on *A. craccivora* which was the highest duration.

At the beginning of the prepupal period the larva stopped feeding, became less active and moved slowly. During this period, they curved into C shaped, remained attached to the surface of the rearing container with posterior end by secreting some deep black fluids. The prepupal period averaged from 1.20 ± 0.45 to 1.60 ± 0.45 days when fed on different prey (Table 2). Debaraj and Singh (1990) reported that the prepupal period of *C. transversalis* was 2.62 days using *A. craccivora* as food. Their results were higher than the present study. During pupation all the larval characters, size and shape were completely changed. The newly formed pupae were pinkish orange to reddish in color. The pupal duration averaged from 4.20 ± 0.84 to 4.80 ± 0.45 days (Table 2). Verma *et al*. (1993) reported the pupal period of *M. sexmaculatus* on *A. gossypii* was less than that reared on different prey of this study. The male was distinguished from the female by their sexual dimorphism. The male was slightly smaller than the female with mean longevity of 30.60 ± 1.07 to 34.00 ± 1.22 days, whereas female lived for longer period than male when feeding different prey. Verma *et al*. (1993) reported that females of *M. sexmaculatus* lived longer (52.0 ± 4.9 days) than males.

Table 2: Effect of food sources on the prepupal, pupal duration and adult longevity of *M. sexmaculatus*

Food sources	Duration (day)		Longevity (day)	
	Pre-pupa	Pupa	Adult Male	Adult Female
Bean aphid	1.60 ± 0.54 a	4.80 ± 0.45 a	32.80 ± 0.80 a	34.80 ± 0.86 a
Mustard aphid	1.60 ± 0.54 a	4.20 ± 0.84 a	33.80 ± 0.86 a	35.00 ± 0.89 a
Citrus aphid	1.40 ± 0.55 a	4.60 ± 0.55 a	34.00 ± 1.22 a	35.80 ± 1.15 a
Scale insect	1.40 ± 0.55 a	4.60 ± 0.55 a	32.80 ± 1.49 a	34.40 ± 1.20 a
Mealy bug	1.20 ± 0.45 a	4.60 ± 0.55 a	30.60 ± 1.07 ab	32.00 ± 1.09 ab

Means within a column followed by same letter(s) are not significantly different by DMRT ($p \leq 0.05$).

Table 2: Mean number of predation per day by *M. sexmaculatus* larva on different prey sources

Prey	Day										
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
Bean aphid	3.5	5.5	8.0	9.5	11.5	15.5	16.5	11.0	6.5	-	-
Mustard aphid	3.5	5.0	6.0	7.5	9.5	12.0	14.5	17.0	9.5	-	-
Citrus aphid	3.5	4.5	5.5	7.0	9.5	11.5	13.5	15.0	12.0	6.0	-
Scale insect	1.0	2.0	2.5	4.0	5.5	6.5	7.5	8.5	11.0	9.5	8.0
Mealy bug	1.0	2.0	2.5	5.5	6.5	7.5	8.5	10.5	9.5	6.5	-

The mean food consumption rate of *M. sexmaculatus* larva in the first day after egg hatching was 3.5, 3.5, 3.5, 1.0, 1.0 bean aphids, mustard aphids, citrus aphids, scale insects and mealy bugs, respectively. From the second day, their feeding rate gradually increased to 7th day and then decreased. The maximum of 16.5 bean aphids was consumed by a larva on that day with minimum consumption of 6.5 sale insect.

The sudden decrease of feeding rate after 8th day was due to the initiation of pupa as reported by Rahman *et al*. (1993). Rahman (1990) reported that the feeding rate of *M. sexmaculatus* larva on the first day after egg hatching ranged from 2 to 7 cotton aphids. From the second day the rate of consumption gradually increased and reached 26.8 ± 2.59 aphids. On the 9th day, the feeding rate dropped sharply. Rahman *et al*. (1993) found that the rate of consumption by the larva of *M. sexmaculatus* gradually increased from the first day of hatching up to 8th day for their subsequent growth and development.

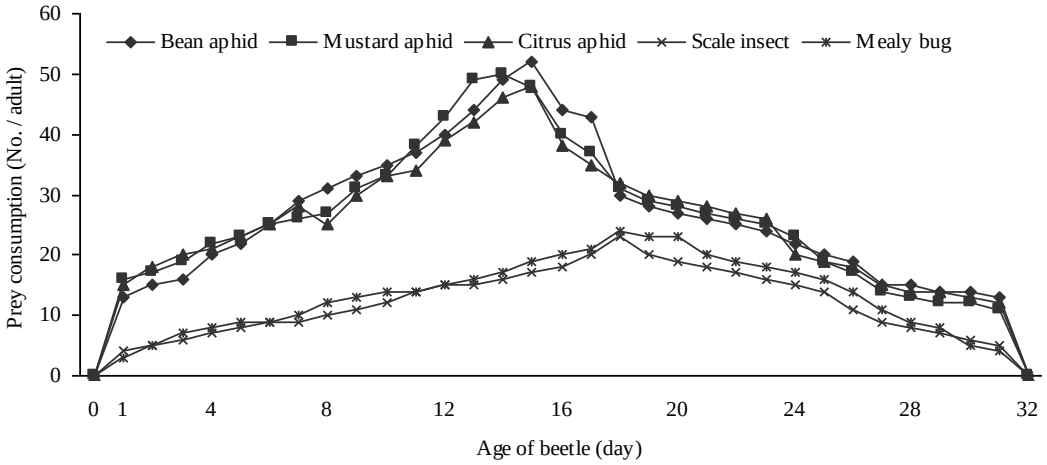

Fig. 1. Age specific consumption of adult *M. sexmaculatus* on different prey sources

An adult predator of *M. sexmaculatus* consumed on an average of 13, 16, 15, 4 and 3 bean aphids, mustard aphids, citrus aphids, scale insects and mealy bugs, respectively on the first day of emergence (Fig. 1). The consumption gradually increased up to 16th day and feeding rate was 52, 48 and 48 on bean aphids, mustard aphids and citrus aphids, whereas 17 on scale insects and 19 on mealy bugs. Afterwards, this rate gradually decreased to 13, 11, 12, 5 and 4 on the 31th day. Rahman (1990) reported that the adult of *M. discolor* consumed 21 aphids on the first day and the rate gradually increased up to 9th day averaging 86.4 aphids, and from the 10th day, the rate declined which averaged 82.0 aphids. Both the larva and adult of *M. sexmaculatus* were very active in preying different species of aphids. *M. sexmaculatus* appeared to be a good predator of bean aphids, mustard aphids and citrus aphids with less preference for scale insects and mealy bugs.

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