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Effect of the Predator, *Menochilus sexmaculatus* (Fab.) in Controlling Potato Aphid, *Myzus persicae* (Sulzer)

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Studies were made on the performance of a coccinellid predator, *Menochilus sexmaculatus* (Fab.) for the control of potato aphid, *Myzus persicae* (Sulzer). The daily feeding of *M. sexmaculatus* larvae increased with age and reached a maximum (30.72) aphids) on the 6th day. The rate of aphid consumption declined at pupal initiation. The predator showed a density dependent response both at the larval and the adult stages. Five larvae of *M. sexmaculatus* consumed 80.67% and 90.63% of aphids in caged potato plants in 72 hours when released on 150 and 160 aphids, respectively. In contrast, the adult beetles consumed 98.25% and 94.25% of potato aphids in 72 hours when the release was made on 80 and 125 aphids respectively. When the number of aphids was 170 at release time, the adult and larvae reduced the aphid population by 69.53% and 67.65% respectively.

Key words: Predator, *Menochilus sexmaculatus*, Aphid, *Myzus persicae.*

Introduction

Potato (*Solanum tuberosum* L.) is an important vegetable crop in Bangladesh. Different insect pests attack the crop every year resulting in severe damage to the crop (Alam 1969). Potato aphid, *Myzus persicae* (Sulzer) is the most common among the insect pests causing curling and yellowing of the leaf. This insect is one of the most important vector of the potato leaf roll virus (PLRV) which causes the leaf roll disease of the crop. It is also known to transmit potato virus A and Y. The losses in yield due to potato leaf roll virus (PLRV) and potato virus Y are estimated to be 40 to 85% (Nagaich and Agrawal 1969.

The predacious coccinellid beetles, commonly known as lady bird beetles are considered to be of great economic importance in the agroecosystem. Aphidophagous coccinellid beetles have been reported to reduce the incidence of aphid infestation (Hodek 1973; Gargav 1980; Chambers *et al* 1983; Aalbersberg 1984; Verma *et al* 1985; Lokhande and Mohan 1990; Islam 1997). Gargav (1980) and Verma *et al* (1985) reported the feeding preference of all stages of the predator, *Menochilus sexmaculatus* on *Aphis craccivora* Koch, a pest of bean in Bangladesh. However, *M. sexmaculatus* is also found to attack the aphid, *Myzus persicae* in the field (Gupta and Yadava 1989). To enhance or augment the effect of the predator on the potato aphid population, the interaction between the predators (natural enemies) and prey should clearly be understood. Since no authentic work was available, the present research work was undertaken to investigate the feeding potentiality of the predator, *M. sexmaculatus* in its immature (larval) and adult stages on potato aphid, *M. persicae.*

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Materials and Methods

The laboratory studies were conducted on the predation performance of the lady bird beetle, M. *sexmaculatus* feeding on potato aphids in the Department of Entomology, Regional Agricultural Research Station, Jamalpur, Bangladesh during 1997-98. Adult lady bird beetles, *M. sexmaculatus* were collected from the potato plant infested with potato aphid, *M. persicae* from the potato field of Tuber Crops Research Centre, Jamalpur. In Bangladesh, *M. persicae* is the dominant aphid species in potato field. Although *Menochilus sexmaculatus* is a primary predator of *A. craccivora,* the present research work was conducted to investigate the feeding potentiality of the predator on potato aphid, *M. persicae.* The temperature, %RH and photoperiod ranged from 16.11°C-24.05°C, 65.41-77.80% and 10-12 L hours, respectively during the study period. The predator beetles collected from the field were reared in petri dishes (9 cm) on *M. persicae.* The aphid population increased in sexual oviparous, parthenogenetic viviparous. So, different sizes of nymphs and adults of *M. persicae* were supplied to the predator. Field collected potato leaves infested with *M. persicae* were supplied to the adult predators as food. Observations were made thrice a day to examine oviposition of the beetles. Once the eggs were found in the petri dishes, they were kept undisturbed for hatching. After hatching, newly emerged larvae were transferred to several petri dishes (14 cm x 1.5 cm) with the help of a fine brush and reared till adult emergence. Based on daily consumption rate

(38.8 *A. craccivora*) of a larva of *M. sexmaculatus* (Islam 1997), 425 aphids of different sizes were supplied to 10 predator larvae per day until pupation. The petri dishes were kept undisturbed during pupation. Age specific consumption of aphids by the predator larvae were recorded daily. The remaining aphids were removed from the petri dishes using a fine brush, every morning, and immediately thereafter fresh aphids were provided on freshly cut pieces of potato leaf. An excess number of aphids were given to predators daily to determine the maximum feeding capacity. The newly emerged adults were placed in other petri dishes of the same size having one male and one female for mating. *M. persicae* were supplied to the adult predators everyday in the same manner as indicated for rearing the larvae of the predator.

The functional response of the larva and adult of *M. persicae* were studied in the potato field. The performance of the predator was investigated by offering different population sizes of the aphids of mixed ages. Effect of the predator on potato aphid population was determined at different time intervals after its release. During the second week of January 1998 all the potato plants per hill infested with mixed number of aphids were covered with a fine mesh nylon net. The fixed number was maintained by removing the excess aphids using a fine brush. Four different sizes of aphid population per hill viz., 170, 150, 160 and 100 for the larva and 170, 125, 80 and 100 for the adult of *M.sexmaculatus* were made for the release of predators in the caged potato plants. Four-day old 5 larvae and two-day old 5 adults were released on the aphid infested plants in each nylon cover. Plant infested with 100 aphids were kept free of the predators and considered as control

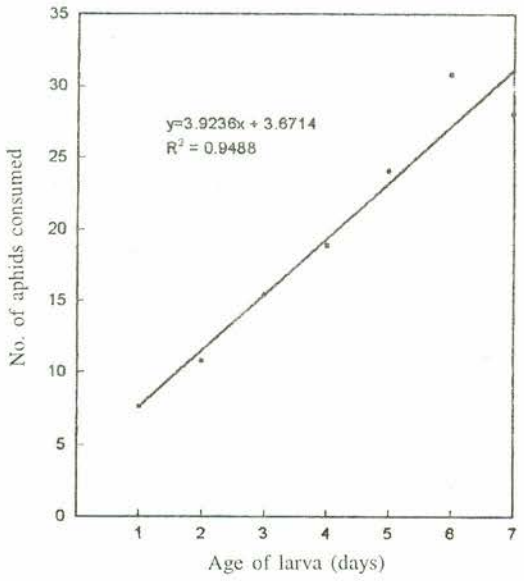

Fig 1. Rate of consumption of aphids at different larval age of the predator *M. sexmaculatus*.

treatment. The number of aphids remaining per plant was counted after 24, 48 and 72 h of the predator release. Different plants were used for different time intervals. The released predators were found alive at the end of all the time intervals. Five replications were made and data was analyzed using one way ANOVA.

Results and Discussion

In evaluating the effect of the predator, *M. sexamaculatus,* on potato aphid, *M. persicae,* it was found that the predator consumed the aphids both in its larval and adult stages.

Age specific prey consumption of the larvae. The prey consumption of *M. sexmaculatus* larvae varied with its age. A highly positive relationship between the age of the larva and the rate of prey consumption (R^2=0.95, y = 3.92x + 3.67) is shown in Fig 1. The average consumption by a 6-day old larva was 30.72 which was 4 fold higher than a one-day old larva. However, the increasing rate of feeding did not continue after 7th day when the larvae reached the final developmental stage. The feeding rate of the larvae declined there after due to initiation of pupation. The larvae passed through 4 instars during 7 days time. The instar-wise prey consumption was not recorded in this study. Islam (1997) found the feeding rate of the larva of *M. sexmaculatus* as 38.8 when fed on the aphid, *A. craccivora.* Islam and Nasiruddin (1977) reported that a *M. sexmaculatus* larva consumed on an average, 11.9 cotton aphids during their first 24 hours after hatching while the consumption reached a maximum of 52 aphids on the 6th day. The feeding rate of the predator larvae on *A. craccivora* and *A. gossypii* reported by the above authors are different from the feeding rate on *M. persicae* in the present study. This could be due to difference in the prey species. The increasing rate of aphid consumption by the older predator larvae might be due to the higher requirement in their subsequent growth and developmental stages. The larva of *M. sexmaculatus* consumed a good number of *M. persicae* in its developmental period and successfully completed its larval development.

Effect of the predator on potato aphid. The larvae and adults of *M. sexmaculatus* caused a significant reduction in the number of potato aphids in the caged potato plants after 24, 48 and 72 h of release (Table 1). Five larvae of *M. sexmaculatus* reduced the aphid population by 80.67 and 90.63% in 72 h of release on 150 and 160 aphids in caged potato plants, respectively. In contrast, the predator reduced the aphid population by only 67.65% when released on 170 aphids.

The reduction of aphid population by the adult predator was higher when the initial aphid density was lower ($P < 0.01$).

Table 1

Effect of the larvae of *M. sexmaculatus** on potato aphids at different time intervals

Treatments	No.of aphid at pretreatment	Percentage of increase (+) and decrease (-) of aphid population on release of an individual predator		
		24 h	48 h	72 h
Predator larvae	170	-14.17	-37.65	-67.65
-do-	150	-22.0	-50.67	-80.67
-do-	160	-24.38	-53.75	-90.63
Untreated	100	+13.40	+42.20	71.20

*Four days old 5 predator larvae were released for each aphid population.

Table 2

Effect of adult predator, *M. sexmaculatus** on potato aphid at different time intervals

Treatments	No.of aphid at pretreatment	Percentage of increase (+) and decrease (-) of aphid population on release of an individual predator		
		24 h	48 h	72 h
Adult predator	170	17.18	-38.35	-69.53
-do-	125	-22.24	-51.20	-94.25
-do-	80	-36.25	-70.75	-98.25
Untreated	100	+13.40	+42.20	+71.20

*Two days old 5 adult predators were released for each aphid population.

When the aphid density was 80 and 125 at release, the predator adults reduced the aphid population by 36.25 and 22.24% in 24 h, 70.75 and 51.2% in 48 h and 98.25 and 94.25% in 72 h (Table 2). In contrast, when the number of aphid was 170, the predators decreased the aphid population by only 17.18, 38.35% and 69.53% in 24, 48 and 72 h, respectively. The aphid population increased by 13.40, 42.20 and 71.20% in 24, 48 and 72 h of time, respectively when 100 aphids on potato plant were maintained in predator-free condition.

The impact of naturally occurring biological control agents on aphid population on potatoes and numerous other crops has been documented by many investigators (Hagen and Vanden Bosch 1968; Shands *et al* 1972; Tamaki and Long 1978; Redcliffe 1982). Shands *et al* (1972) demonstrated that release of aphid predators (*Coccinella septempunctata* L., *C. transversoguttata* Faldermann or *Chrysopa spp.*) into large field cage of potatoes resulted in 26-70% reduction in the peak aphid numbers. Gupta and Yadava (1989) reported that *M. sexmaculatus* might be a promising biological control agent for controlling the aphid, *M. persicae*. Islam (1997) demonstrated that *M. sexmaculatus* can provide a good control of bean aphid, *A. craccivora* when released on fixed number of aphids in the caged bean plants.

The results of the present research work are consistent with the findings of the above authors. Although the age specific prey consumption was made in the laboratory, the rate of aphid consumption was more or less similar to when compared with reduction of aphid in caged potato plants in the field. It was observed that both adult and larva of *M. sexmaculatus* reduced less percentage of aphid population in 72 h when population size was large. The performance of adult predator was better in reducing aphids in the potato field than the immature stage (larva) in specific period of time. The results clearly indicate that both larva and adult of *M. sexmaculatus* were able to suppress the potato aphid population. From the present findings it may be concluded that the protection of potato against the attack of *M. persicae* might be better by using predators in case of low incidence. Release of *M. sexaculatus* in large number of potato aphids could provide a satisfactory control for the pest. Further investigations on the performance of the predator against the past in the field will provide more information. The experimental finding could be useful for future studies as reports on the predation of *M. sexmaculatus* on potato aphid are not available.

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