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BIOLOGICAL PARAMETERS AND PREDATORY POTENTIAL OF *MENOCHILUS SEXMACULATUS* FAB. (COLEOPTERA:COCCINELLIDAE) AT VARYING TEMPERATURE ON *RHOPALOSIPHUM PADI* L.

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ABSTRACT:- The biological parameters of *Menochilus sexmaculatus* Fab., as influenced by different temperature regimes and host were studied at Insectary-Biological Control Laboratories, National Agricultural Research Centre (NARC), Islamabad. The results revealed that there was a significant effect of different temperature regimes on the development and predatory potential of *M. sexmaculatus* reared on *Rhopalosiphum padi*. The egg incubation period of predator beetle was 4.16, 3.66 and 2.24 days at 22±1˚C, 28±1˚C and 34±1˚C, respectively. Mean fecundity was 430.53, 548.67 and 432.43 eggs, respectively. Percentage egg hatchability of the predator was significantly higher at 28±1˚C. The total larval duration of predator was 9.47, 7.70 and 5.49 days, respectively. Duration of pupal period ranged between 2.21 and 4.35 days on *R. padi* at three temperatures. The pre-oviposition, oviposition and post-oviposition periods were between 4.64 and 7.48, 24.99 and 39.93 and 4.76 and 8.09 days, respectively on *R. padi*. Mean predatory potential of all larval instars ranged from 148 to 162 aphids, respectively. The prey consumption of female beetle was significantly higher than male. The adult male consumed from 2294 to 2422 aphids and female consumed from 2912 to 3085 aphids, respectively. Based on results of present study, possibility of quality mass rearing and commercialization of predatory beetle, *M. sexmaculatus* was ascertained.

Key Words: Menochilus sexmaculatus; Rhopalosiphum padi; Predator; Prey Consumption; Biology; Predatory Potential; Pakistan.

INTRODUCTION

The zigzag beetle, *Menochilus sexmaculatus* (Fab.), commonly known as lady bird beetle is a predaceous coccinellid with wide distribution in South Western Asia, Indonesia, Philippines, South Africa, Pakistan and India. The predator beetle is an efficient feeder and prey on a wide range of soft bodied insects including aphids, plant hoppers, thrips, jassids, scale insects, mealy bugs and white fly infesting large number of cultivated crops (Rahman et al., 1993; Solangi et al., 2007). The adult of *M. sexmaculatus* are bright yellow in colour with black vertical zigzag lines. The both adult and larval stages are voracious feeder of aphid species. Many aphid species are serious pests of different cereal

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crops in Pakistan. The bird cherry-oat aphid, *Rhopalosiphum padi* (L) has recently become one of the most important pests of wheat and been considered a serious threat to cereals. Besides causing yield losses directly, the aphid also acts as the vector of barley yellow dwarf virus (Sunil et al., 2007).

Temperature is one of the most important environmental factors that influence the developmental rate of Coccinellids and affect its reproductive and predatory performance. The predacious coccinellids are of great economic importance and have been successfully employed in the biological control of many injurious insects (Ali and Rizvi, 2009). The present studies were aimed to investigate some biological parameters as well as pre-datory potential of *M. sexmaculatus* on bird cherry-oat aphid, *R. padi* at various constant temperature levels.

MATERIALS AND METHOD

The study was carried out under laboratory conditions on the biological parameters of *M. sexmaculatus* feeding on *R. padi*. The experiments were conducted at the Insectary-Biological Control Labs., Insect Pest Management Programme (IPMP), Institute of Plant and Environmental Protection (IPEP), National Agricultural Research Centre (NARC), Islamabad. The predator beetles were collected from the wheat fields at NARC for rearing in the laboratory. The culture of predator was maintained on its host, *R. padi*. The pairs of adult *M. sexmaculatus* were collected from the culture and kept into the plastic jars covered with muslin cloth. Aphid infested, leaves of wheat plant were kept inside the plastic jar to serve as a food for the beetle. Every day, the eggs deposited by the female were removed from jars. Freshly laid eggs (n=50) were transferred into Petri dishes (9cm diameter) with the help of soft camel hair brush and allowed to hatch at three constant temperature levels (22±1˚C, 28±1˚C and 34±1˚C) and 60± 5 % R.H. in the insect holding room. Incubation period and number of eggs hatched per batch were recorded.

In the first set of experiment, 30 predator grubs of the same age were collected from jars and were individually reared on *R. padi* at three temperatures in plastic vials (4.0cm×6.0cm). Counted number of first and second instars of *R. padi* was provided as food to the early instar larvae of *M. sexmaculatus*. The number of aphids increased with the development of larval instars. This procedure was followed till pupation. The data on developmental period and predatory potential of immature *M. sexmaculatus* were recorded.

In another set of experiment, 30 pairs of newly emerged adults were collected from culture and each pair was released in small plastic jars to study predatory potential of adults. Minimum number of aphids (150 nymphs per day) was provided to *M. sexmaculatus* till the predator's mortality. The data on developmental period, predatory potential of adult beetles, and eggs laid by each female were recorded daily. The data obtained was analyzed statistically by ANOVA according to procedure given by Mari et al. (2005). The means of significant differences were compared by LSD at 5% level.

RESULTS AND DISCUSSION

Incubation Period and Percent Egg Hatchability

The data revealed that there was a significant effect of different temperature regimes on the incubation period and egg hatchability of the predator. The incubation period was shorter at 34˚C, whereas, percent egg hatchability was higher at 28˚C (Table 1). The egg incubation period was ranged from 2.24 to 4.16 days and hatchability was between 63.20 and 76.8 % at three different temperature levels on *R. padi*. Solangi et al. (2007) reported incubation period of *M. sexmaculatus* from 7.1 to 7.5 days. However, percent hatchability was very much similar to the present results (64.33-70.69 at 25±2˚C). This difference may be due to the aphid species, the predator was reared on. The mean number of eggs laid per female ranged from 430 to 549 at three different temperatures. The results on mean number of eggs laid per female of *M. sexmaculatus* were also very much closer to the results of Khan and Yousaf (1986) who reported that 347.5, 715.5 and 356 eggs were laid by each female at 26˚C, 28˚C and 34˚C, respectively.

Developmental Period of Larval Stages

The data on developmental period revealed that temperature significantly influenced the development of first, second, third and fourth instars of *M. sex-maculatus* reared on *R. padi*. With the gradual increase in temperature the duration of larval instars reduced (Table 1). The total larval duration was significantly higher (9.47 days) at 22˚C. However, there was no significant difference in total larval duration at 28˚C and 34˚C. Prodhan et al. (1995) also reported total larval period of *M. sexmaculatus* from 7 to 9

Table 1. Biological parameters of *Menochilus sexmaculatus* reared on *Rhopalosiphum padi* at three temperatures regimes

Parameter	Temperature (ºC)			
	22±1	28±1	34±1	LSD
Egg incubation period (days)	4.16 ± 0.15 a	3.66 ± 0.15 b	2.24 ± 0.12 c	0.4350
No of eggs/female	430.53 ± 10.77 b	548.67 ±11.62 a	432.43 ± 7.67 b	28.5690
Percent hatchability	69.20 ± 2.33 ab	76.80 ± 2.05 a	63.20 ± 4.22 b	9.3325
Duration of 1st instar (days)	2.18 ± 0.04 a	1.91 ± 0.03 b	1.12 ± 0.02 c	0.0892
Duration of 2nd instar (days)	2.30 ± 0.04 a	1.91 ± 0.02 b	1.11 ± 0.02 c	0.0807
Duration of 3rd instar (days)	2.08 ± 0.05 a	1.61 ± 0.07 b	1.19 ± 0.04 c	0.1486
Duration of 4th instar (days)	2.91 ± 0.06 a	2.27 ± 0.05 b	2.07 ± 0.04 c	0.1519
Total larval duration (days)	9.47 ± 0.09 b	7.7 ± 0.08 a	5.49 ± 0.07 a	0.2240
Pupal period (days)	4.35 ± 0.08 a	3.90 ± 0.03 b	2.21 ± 0.06 c	0.1789
Pre-oviposition (days)	7.48 ± 0.18 a	6.07 ± 0.14 b	4.64 ± 0.19 c	0.4780
Oviposition (days)	39.93 ± 0.61 a	29.34 ± 0.42 b	24.99 ± 0.40 c	1.3700
Post-oviposition (days)	8.09 ± 0.20 a	5.86 ± 0.17 b	4.76 ± 0.21 c	0.5460
Adult male longevity (days)	41.80 ± 0.44 a	32.73 ± 0.38 b	26.13 ± 0.27 c	1.0383
Adult female longevity days)	55.10 ± 0.47 a	41.27 ± 0.38 b	34.40 ± 0.30 c	1.0946

Means followed by same letter do not differ significantly at P ≤0.05.

days on bean aphid. Pupal period of the predator ranged between 2.21 and 4.35 days at different temperatures. These findings are in confirmation with Mari et al. (2004) who reported the average pupal period of 3.6 days.

Developmental Period of Adults

The data revealed that longevity of adult *M. sexmaculatus* (male and female) ranged between 26.13 and 41.80 and between 34.40 and 55.10 days, respectively, and was longest at 22˚C. The increase in temperature resulted in faster development of the predators by reducing developmental periods (Table 1). The results also showed that adult female lived longer than male on *R. padi* at the three tested temperatures. Similar, findings were also reported by Ngammuang (1987). He found that the longevity of male was less (37.8 days) than female (59.53 days) fed on *A. craccivora* Koch. Pre-oviposition, oviposition and post-oviposition period ranged from 4.64 to 7.48 from 24.99 to 39.93 and from 4.76 to 8.09 days, respectively. These results were in agreement with Millar and Lamana (1995), who found that the oviposition period of *C. trifasciata* Linnaeus was reduced from 44.2 to 11.1 days with the increase in temperature from 18˚C to 34˚C.

Predatory Potential of Immature Stages

Predatory potential of first, second, third and fourth instar ranged from 12.96 to 15.56, from 24.90 to 37.43, from 26.70 to 34.60 and from 73.20 to 87.66 aphids at different temperatures and the total larval potential was between 148.33 and 162.47 aphids (Figure 1). These

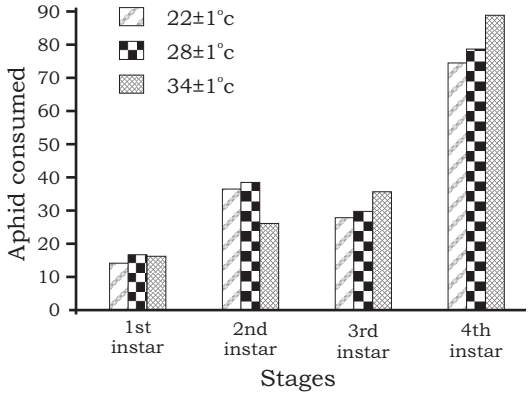

Figure 1. Predatory potential of immature stages of *M. sexmaculatus* feeding on *R. padi* at three temperature levels

results varied from Khan and Yousaf (1986) who reported that the total larval predatory potential ranged from 323 to 614 aphids at constant temperature. These variations may be due to different insect hosts or host density or size of hosts.

Predatory Potential of Adults

In adult female it ranged from 2912 to 3085 aphids and was greater than the adult male, i.e. from 2294 to 2422 aphids at three temperature levels. It may be due to longer adult

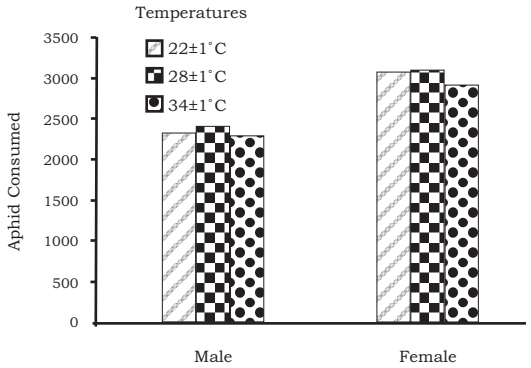

Figure 2. Predatory potential of adult *M. sexmaculatus* feeding on *R. padi* at three temperature levels

longevity period in females than males. Predatory potential of male was significantly higher at 28˚C, however, it was equally good at 22˚C and 28˚C (Figure 2). Similarly, Mari et al. (2005) found that the predatory potential of male *M. sexmaculatus* and *C. undecimpunctata* Linnaeus was 2548 and 2930, and of female 2800 and 3080 alfalfa aphids, respectively.

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