Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

ISSN 2320-7078
JEZS 2014; 2 (3): 160-163

Received: 11-04-2014
Accepted: 29-05-2014

Muhammad Saleem
Assistant Research Officer, Entomological Research Institute, Ayub Agricultural Research Institute, Faisalabad.

Dilbar Hussain
Assistant Entomologist, Entomological Research Institute, Ayub Agricultural Research Institute, Faisalabad.

Habib Anwar
Pest Warning & Quality Control of Pesticides, Punjab, Pakistan.

Muhammad Saleem
Director, Entomological Research Institute, Ayub Agricultural Research Institute, Faisalabad.

Ghulam Ghouse
Pest Warning & Quality Control of Pesticides, Punjab, Pakistan.

Muneer Abbas
Assistant Research Officer, Entomological Research Institute, Ayub Agricultural Research Institute, Faisalabad

Correspondence:
Muhammad Saleem
Assistant Research Officer, Entomological Research Institute, Ayub Agricultural Research Institute, Faisalabad.

Predation Efficacy of *Menochilus sexmaculatus* Fabricus (Coleoptera: Coccinellidae) against *Macrosiphum rosae* under laboratory conditions

Muhammad Saleem, Dilbar Hussain, Habib Anwar, Muhammad Saleem, Ghulam Ghouse, Muneer Abbas

ABSTRACT
To evaluate predatory efficacy of *Menochilus sexmaculatus* Fab. On rose aphid *Macrosiphum rosae,* a laboratory experiment was escorted at 27±2 ºC and 62±5% relative humidity (RH) at Entomological Research Institute, Ayub Agricultural Research Institute, Faisalabad during 2012. Predatory efficacy of the 1st, 2nd, 3rd and 4th instars larvae of *M. sexmaculatus* was recorded as 8.40±0.50, 13.60±0.81, 28.60±1.50 and 57.40±4.67 aphids, respectively and the predatory efficacy of male and female adults was found to be 802. 40±2.56 and 916.60±1.69 aphids respectively. The results unveil the 4th instars larvae with the highest predation performance while the 1st larval instars reported the lowest. The female beetles were found to be more cogent in aphid predation as compared with the males.

Keywords: Biological Control, *Menochilus sexmaculatus*, *Macrosiphum rosae*, predatory efficacy.

1. Introduction

Menochilus sexmaculatus is an important predator of many insects such as aphids, thrips, whitefly, coccicids and psyllids with a worldwide distribution and common aphid feeding species being found in Pakistan, India, Borneo, Jawa Indonesia, U.K. Philippines, Islands of Bali, France, Sumatra and South Africa [16, 13, 11, 15, 7]. Aphids such as Berseem aphid, safflower aphid, wheat aphid and mustard aphid are notorious insect pests of different vegetables in Punjab. *Macrosiphum rosae*, commonly known as rose aphid, is an important pest of rose and many other crops. The adults and nymphs of aphid attack the rose plants and suck cell sap from flowers, tender shoots and buds, ultimately decreasing the market value of rose flowers. Aphid infestation badly affects the flowering capacity of plants, resulting in 20-40% losses [6]. The aphids are apterous and reproduce parthenogenetically. Aphid populations may increase very rapidly under natural conditions. However, in the presence of predators, they do not grow as rapidly as these tiny insects are eaten up by predatory coccinellid beetles [5]. *Menochilus sexmaculatus*, The zigzag beetle (sub family, Coccinellinae) is a generalist entomophagous coccinellid that feeds upon soft bodied insects including aphids. These adult beetles are about 2 mm in size and bright yellow in color with black vertical zigzag lines on the dorsal side of both the elytra. There may be polymorph of various coloration within the species.

Entomologists are well familiar with Integrated Pest Management (IPM) techniques, in which economically affordable, ecologically sound and environment friendly insect pest control measures are applied. Being environment friendly, the use of Bio- control agents is conceived as the back bone of Integrated Pest Management program. Almost 90% of potential insect pests are under biological control [4]. In the developed countries the floriculturists have shun the use of insecticide on flowers and aphids are being controlled by predators and parasitoids since last two decades [2]. The coccinellids have achieved a great economic importance in agro-ecosystem due to effective and efficient predation against many serious insect pests [1]. However, biological control methods are primarily contraceptive but not corrective [12]. The predatory efficacy of *M. sexmaculatus* would increase its ability of biological control agent and be a prime requirement for natural control. The predatory efficacy of *M. sexmaculatus* is flimsy. So, the present study was escorted to ascertain the predation efficiency of *M. sexmaculatus* against *Macrosiphum rosae.*

2. Material and Method

The experiment was undertaken in the toxicology laboratory at the Entomological Research Institute, Ayub Agriculture Research Institute Faisalabad, during March to August 2012. The laboratory conditions were sustained at 27±2 ^{0}C and 62±5% relative humidity.

2.1 Amassing and Mass Culturing

M. Sexmaculatus population was amassed from wheat fields by using sweep net and brought to laboratory for rearing. The beetles were paired and kept exclusively in Petri dishes (6 x 1 cm) by providing them rose aphids. Whatman's filter paper No. 1 was used to cover bottom of Petri dishes. The aphids were also amassed from infested inflorescences, stems and twigs of rose plants. The rearing process continued till considerable population of different instars of *M. sexmaculatus* was procured for further experimentation.

2.2 Use of Predator and Procedure of counting Predation Efficiency

Aphids were provided every morning for 1st, 2nd, 3rd and 4th instars, respectively. The prey was supplied on rose leaf whose base was covered with water soaked cotton to protect against wilting. The food was swapped after 24 hours. The number of aphids devoured within 24 hours and duration of each instars were recorded. For determining the predation efficiency of adult beetle, the newly emerged adults were transferred individually in Petri dishes (6.0 × 1.0 cm). Aphids were supplied everyday to the adult on rose leaf. The number of aphids consumed by an adult beetle was recorded every 24 hours till death.

2.3 Statistical analysis

Data so obtained were subjected to one way ANOVA (Statistic, version 8.1 Tallahassee, USA). Significantly different means ($P<0.05$) were separated using Duncan Multiple Range Test (DMRT) at 5% probability. In graphs and figure, the original data and their standard errors are presented.

3. Results and Discussion

3.1 Predatory efficacy

Predatory efficacy of *M. Sexmaculatus* relies on the searching behavior of the beetle, its size and the surrounding environment. Adults and larvae of *M. Sexmaculatus* voraciously fed on rose aphid but their feeding rate was found to vary different. They feed both night and day time.

Table 1: Predatory efficacy of larvae and adult of *M. Sexmaculatus*

Different stages	Predatory efficacy		No of Aphid Consumed
	Minimum	**Maximum**	
1-larvae			Mean ± S.E
1st instar	7	10	8.40±0.50
2nd instar	12	10	13.60 ±0.81
3rd instar	25	33	28.60± 1.50
4th instar	45	71	57.40± 4.67
2-Adult			
Male	795	810	802.40± 2.56
Female	912	921	916.60± 1.69

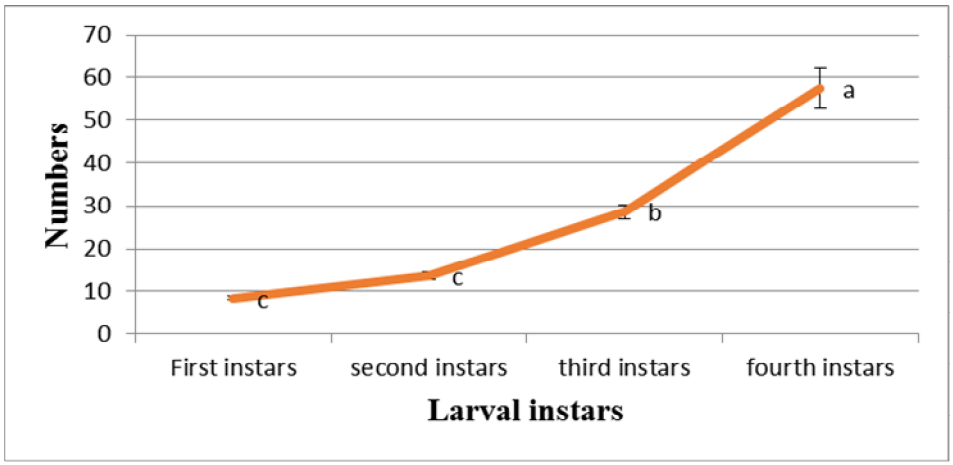

Fig 1: Number of rose aphids consumed per day by larvae of *M. sexmaculatus* Bars with common letter are not significantly different ($p \leq 0.05$)

The predatory efficacy of larvae was ascertained by counting the total number of aphids engrossed by each larval instar within 24 hours (Figure 1 and Table 1). The feeding rate was found to increase steadily from 1st instars to 4th instars. The number of aphids engrossed by the 3rd and 4th instars larvae showed significant difference while the number of aphids engrossed by 1st and 2nd instars were found to be at par (Figure 1). Prey consumption by the 1st instars larvae diverse from 7 to 10 aphids with an average of 8.40±0.50. The 2nd instars consumed a maximum of 16 aphids with an average of 13.60±0.81. The 3rd instars larvae showed better predatory activity and faster response with an average of 28.60 ± 1.50 aphids consumed. The 4th and final instars were much active up to pre-pupal stage. They required larger amount of food than the previous instars due to bigger size, longer durations of larave and also might be food deposition for total pupal period. At this stage they consumed a maximum of 71

aphids with an average of 57.40 ±4.67 aphids (Table 1). The total number of rose aphids consumed by *M. sexmaculatus* during its total larval development period varied 93 to 133 with an average of 111.2 ± 7.19 (Table 2).

Agarwala and Bardhanroy [1] reported the consumption rate of 1st, 2nd, 3rd and 4th instars as 11.4 ± 1.6, 20 ± 2.2, 9.2 ± 1.4 and 41.2 ± 1.8 aphids respectively and the larvae consumed on average 22.1 ± 14.4 aphids during their development period. On the other hand, Solangi *et al*., [14] found the feeding capability of four larval stages as 21.80 ± 3.29, 41. 90 ± 7.78, 66.25 ± 20.13, 122.15 ± 25.20 aphids which was in accordance with our findings. However, slight difference might be due to in food quality, larval period as well as reared season. Current findings showed that aphid consumption by larvae of *M. Sexmaculatus* was higher in subsequent larval instars that are the later instars took more aphid than the previous instars.

Table 2: Numbers of rose aphids consumed by different instars of *M. sexmaculatus*

No of observation	Days											Total
	1st instar		2nd instar		3rd instar			4th instar				
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	
	2	7	4	8	5	8	9	10	12	15	17	93
	3	5	6	7	4	7	11	12	14	17	16	102
	4	4	4	8	5	6	8	14	15	18	20	106
	3	4	7	8	7	10	12	13	17	19	21	122
	5	5	6	10	6	9	13	17	19	21	22	133
Mean ± S.E	3.4	5	5.4	8.2	5.4	8	10.6	13.2	15.4	18	19.2	111.2
	+	+	+	+	+	+	+	+	+	+	+	+
	0.51	0.55	0.60	0.49	0.51	0.71	0.93	1.16	1.21	1.00	1.16	7.13
	8.40+ 0.50		13.60+0.81		28.60+1.50							57.40+4.67

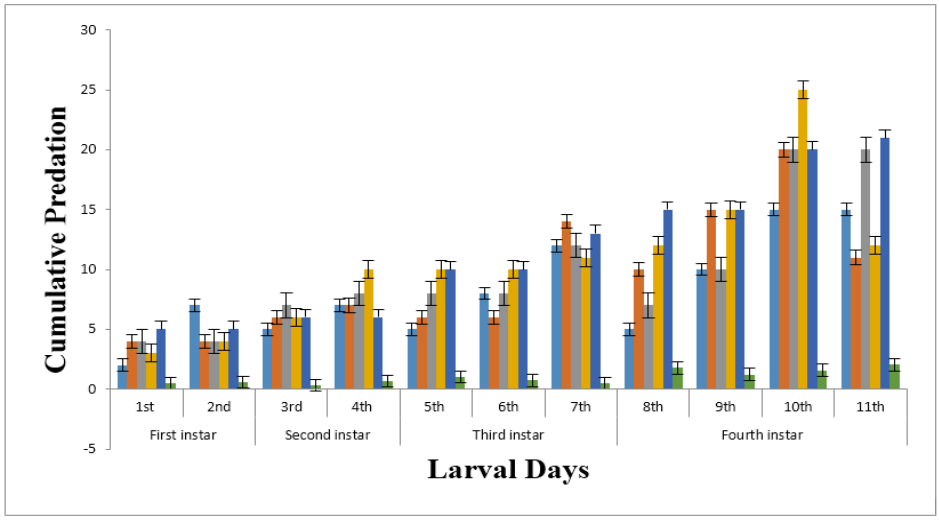

Fig 2: Cumulative predation of aphids by different larval instars of M.sexmaculatus
Depicts the cumulative predation of aphid by different larval instars.

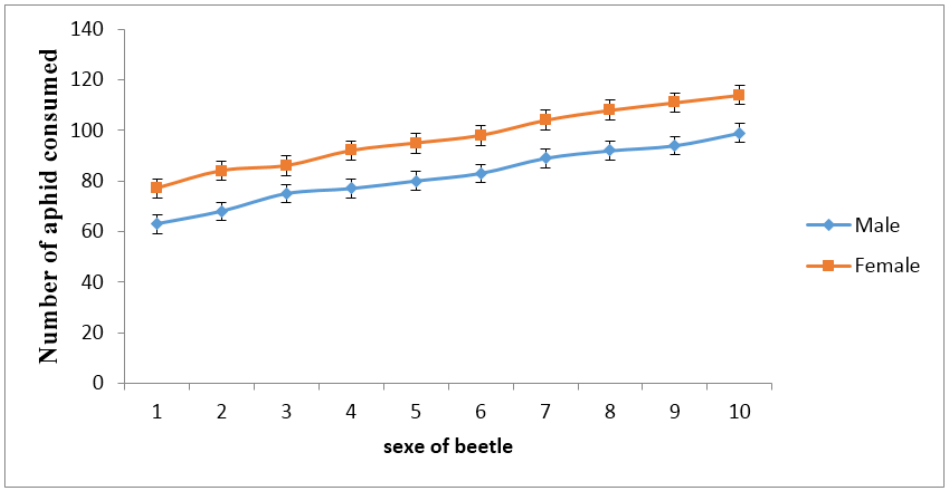

Fig: 3 Cumulative predation of aphid by adult of *M. sexmaculatus*

The predation efficiency of both male and female beetles was also studied. It was found that the female beetle consumed more preys than the male one. The range of aphid predation by the female beetle was 912 to 921 with an average of 916.60±1.69 whereas, the male beetle consumed 795 to 810 aphid with an average of 802.40±2.56 (Figure 3). The aphid predation of the female was much higher than the male one. From the above discussions it was clear that the aphid consumption between male and female beetle differed significantly. Ngammuang [9] observed that the average number of aphids consumed by the adult of *M. sexmaculatus* was 1547.80±552.55. Natapol and Pensook [8] found that the average predation capacity of *M. sexmaculatus* in its adult stage of male and female was 1012.7 and 1109.9 aphids respectively. The result of Ngammuang [9] varied but the result of Napthapol and Pensook [8] was near similar to the present study. It can be said that this variation may be due to variation of the quality of food, physiological activities of beetle and seasonal variation.

It was seen from the experiment that the cumulative predation of aphid by adult female beetles consumed more aphid than male (Fig. 3). In case of male the minimum and maximum aphids prey was 795 and 810 aphids; whereas, lowest and highest consumption by the female beetle was 912 and 921 aphids. The graph indicates that the aphid predation by the both male and female beetle was increasing gradually. So, there was close relation between the age of beetle and consumption rate of aphid. Beetle was growing day by day and predation rate also increasing at certain period and at last of all beetle died. William [17] stated that *M. sexmaculatus* will eat about 300 medium-size aphids before it lays eggs. More than 5,000 aphids eaten by a single about in its life time.

4. Conclusion

From the present investigation, it can be concluded that aphid predation depend on supply of food, temperature, humidity, seasonal variation and age of the beetle. The adults of *M. sexmaculatus* was a promising biological agent and the final instars larvae consumed large number of aphid. So larval instars and adult may be used for the biological control of aphid specially on *Macrosiphum rosae*. This beetle has great potential for use biological control of aphid species.

5. References

1. Agarwala BK, Bardhanroy P. Numerical response of lady bird beetles (Coleoptera: Coccinellidae) to aphid prey (Homoptera: Aphididae) in a field bean in North East India. J Appld Entomol 1999; 123:401-405.
2. Bari MN, Sardar MA. Control strategy of bean aphid with predator *Menochilus sexmaculatus* (F.) and insecticides Bang. J of Entomol 1998; 8:21-29.
3. Begum E, Hussain M, Talukdar FA. Relative effectiveness of some granular insecticides against mustard aphid Liphaphis erysimi (Kair) Bangladesh. J Agril Sci 1991; 18:49-52.
4. Debach P, Rosen D. Biological control by natural enemies. Mc Millan com, New York, London 1991, 5, 97-12.
5. Gilkeson L, Kelin M. Natural enemies of insect pests coop. Ext Cornell Univ Ithea NY 2001, 63.
6. Islam MH. Biology and predation efficiency of lady bird beetle *Menochilus sexmaculatus* (F.) M. S. (Entomology) Thesis, Department of Entomology, HSTU, Dinajpur, 2007, 2.
7. Jagadish KS, Jayaramaiah M, Shivayogeshwara B. Bioefficacy of three promising predators on *Myzus nicotianae* Blackman (Homoptera: aphididae). J Biopesticides 2010; 3:062-067.
8. Napthapol W, Pensook TT. Preliminary study on the predaceous coccinellid (*Menochilus sexmaculatus* F.) in the control of groundnut aphids (*Aphis glycines*). Khon kaen Univ. Khon kaen (Thailand). Proceeding of the Seventh Thailand National Groundnut Meeting 1988, 261-266.
9. Ngammuang Pa-Nan. Study on the coccinellidae *Micraspis discolors* (F.) (Coleoptera: Coccinellidae) and its role as biological control agent. Bankok (Tailand) 1987; 64.
10. Rana JS. Response of *Coccinella septempunctata* and *Menochilus sexmaculatus* (Coleoptera: Coccinellidae) to their aphid prey *Lipaphis erysimi* (Hemiptera: Aphididae) in rapeseed-mustard. Eur J Entomol 2006; 103:81-84.
11. Ross NH, Ross CA, Ross IRD. A. Text Book of Entomology. Ed 4, Pub by John Willey and Sons, New York, 1982, 289-372.
12. Setiawati W, Soetiarso TA, Duriat AS. Whitefly and its control in Indonesia. pp. 211-225. In Proceeding of the International Seminar on Whitefly Management and Control Strategy, Taichung, Taiwan, 3-8 October 2005.
13. Solangi BK, Lohar MK, Lanjar AG, Mahar MD. Biology of zigzag beetle, *Menochilus sexmaculatus* Fab (Coccinellidae: Coleoptera) on mustard aphid *Lipaphis erysimi* Kalt. Sarhad J Agric 2005; 21:261-264.
14. Solangi BK, Hullio MH, Baloch N. Biological parameters and prey consumption by zigzag beetle *Menochilus sexmaculatus* Fab against *Rhopalosiphum maidis* Fitch, *Aphis gossypii* Glov and *Therioaphis trifolii* Monell. Sarhad J Agric 2007; 23:1097-1101.
15. Ulrichs CH, Mewis I, Schnitzler WH. Efficacy of Naeem and diatomaceous earth against cowpea aphids and their deleterious effect on predating Coccinelidae. J Appli Entomol 2001; 125:571-575.
16. William FL. Lady beetle. Ohio State University Extension Fact Sheet, Horticulture and Crop Science. Division of Wildlife, 2021 Coffey Rd. Columbus, Ohio-43210-1086; 2002.