BIOLOGICAL PARAMETERS AND PREY CONSUMPTION BY ZIGZAG BEETLE *Menochilus sexamaculatus* fab. AGAINST *Rhopalosiphum maidis* fitch, *Aphis gossypii* glov. AND *Therioaphis trifolii* monell

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ABSTRACT

In the present laboratory studies of some biological parameters and prey consumption of zigzag beetle *Menochilus sexmaculatus* F. (Coleoptera coccinellidae) with three species of aphids as prey were conducted at the Department of Entomology, Sindh Agriculture University Tandojam during 2005. The result showed that egg incubation period of *M. sexmaculatus* was 7.5, 7.1 and 7.2 days when reared on *R. maidis*, *A. gossypii*. and *T. trifolii* Menell aphids respectively. Mean fecundity of the beetle female was 642, 530, 600, eggs when fed on *R. maidis*, *A. gossypii*. and *T. trifolii* respectively. Egg hatchability percentage of the predatory beetle was 65.42 with *R. maidis*, 64.33 with *A. gossypii* and *70.69* with *T. trifolii*. The grubs passed through four instars to reach pupal stage. Feeding of different host aphids did not significantly influence the duration of various life stages of *M. sexmaculatus* where duration of first, second, third and fourth instars ranged between 6.5-7.0, 4.5-5.5, 3.9-6.5 and 6.5-8.5 days, respectively. Duration of pupal period ranged between 3.1 and 5.5 days. The pre-oviposition, oviposition and post oviposition periods were 3.1-3.7, 23.4-27.7 and 3.5-4.5 days respectively. Adult life span ranged as 30.0-35.0 days. All the immature instars where found voracious feeders of all the tested aphid species. However, the third and fourth instars consumed more prey/day than first and second instars. The fourth instar beetle grubs consumed more *R. maidis.* The adults consumed more *T. trifolii* than the other aphid species. Mean daily prey consumption by the beetle during the 1st, 2nd, 3rd and 4th instar and the adult stage ranged between 6.20-12.00, 20.00-27.00, 30.5-55.00, 43.27-45.27 and 72.00-82.5 prey respectively. Mean total number of prey consumed during entire adult life was 80.08 *R. maidis*, 69.95 *A. gossypii* and 68.96 *T.trifolii*.

Keywords: ***Menochilus sexmaculatus*, Predator, Prey Consumption, *Rhopalosiphum maidis*, Zigzag beetle**

INTRODUCTION

Many aphid species are serious pests of vegetable crops in Sindh, e.g, mustard aphid, safflower aphid, Berseem aphid and wheat aphids, etc. All these aphids are apterous and reproduce parthenogenetically. Aphid populations may increase very rapidly under natural conditions. However, aphid populations do not grow so rapidly as these tiny insects are eaten up by predatory coccinellid beetles (Gilkeson and Kelin, 2001).

The zigzag beetle (sub family, Coccinellinae) is a generalist entomophagous coccinellid that feeds upon soft bodied insects including aphids. These adult beetles are bright yellow in colour with black vertical zigzag lines on the dorsal side of both the elytra. There is polymorphs of various coloration within the species. The average size of an adult is 2.00 mm (Agarwala and Bardhanroy, 1999).

The zigzag, beetle is widely distributed and common aphid feeding species in India, Pakistan, Borneo, Jawa Indonesia, U.K. The Philippines, Islands of Bali, France, Sumatra and South Africa (Lokhande and Mohan, 1990). Biological control measures are successfully established, because they are permanent in their effect and have efficient capability of predation on insect pests. These control methods are primarily preventive but not corrective (Ross *et al.*1982).

M. sexmaculatus is an efficient predator of many aphid species, e.g the population of the mustard aphid, *Lipaphis erysimi* Kalt. is considerably suppressed in field by this beetle (Rizvi *et al*. 1995). The present studies were planned to study some of the biological parameters as well as prey consumption by the predatory beetle of three aphid species under laboratory conditions.

MATERIAL AND METHODS

All the experiments on *M. Sexmaculatus* with three aphid species as prey were conducted under laboratory conditions at the Department of Entomology, Sindh Agriculture University Tandojam during 2005. The adults of *M. sexmaculatus* were collected from the mustard field and reared in the laboratory at 25 ± 2 ^{0}C and 62 ± 5% relative humidity (RH) on three aphid species, *R. maidis*, *A. gossypii* and *T. trifolii*, in a wide mouth plastic jars. The mouths of these jars were secured by muslin cloth. Fresh stock of leaves of respective aphids hosts were provided daily as oviposition substrate for female beetles. The eggs laid by female beetles on aphids-host leaves were transferred to petri-dishes (9 cm dia.) for further rearing. Percent egg hatchability recorded. The grubs were reared singly in petri-dishes on three aphid species. Daily prey consumption of the beetle of each aphid species the grubs were released into

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petri-dishes containing, 20, 30, 60 and 150 aphids. In the choice experiment the grubs of first second, third and fourth instars were obtained from the culture maintained in the laboratory and given the three aphid species in petri-dishes on aphid host (maize, cotton and alfalfa) leaves. The number of prey consumed by the three aphid species was daily recorded and continued till the grubs entered into next developmental stage. The number of dead aphids in each petri-dishes was also noted. For assessing predatory potential of adults and fecundity, one-day old male and female adults of *M. sexmaculatus* F. as a pair were collected from the laboratory culture and were confined in petri-dishes (9 mc dia.) along with 150 aphids daily as food. The sample size was 5 adult pairs (males and females). Mean number of prey consumed and the eggs laid daily recorded.

RESULTS AND DISCUSSION

The results of biological parameters studies of *M. sexmaculatus.* reared on three aphid species is presented in Table-I. Mean incubation period of *M. sexmaculatus.* eggs reared on *R. Maidis, A. gossypii* and *T. trifolli* was 7.5, 7.1 and 7.2 days respectively which was non-significant (chi-square vale 0.040 at 0.05 level). The present results are in agreement with that of Esbijerg (1980). He reported that egg incubation period of *M. sexmaculatus* was about a week.

Mean fecundity of the female *M. sexmaculatus* was 642, 530 and 600 reared on *R. maidis, A. gossypii* and *T. trifolli* which were highly significant at 0.05 level (X^2 = 4.75). Saha (1987) reported 1391 eggs per female when *M. sexmaculatus* F. was fed *A. gossypii*.

The differences in number of eggs laid by beetle *M. sexmaculatus* might be due to one fact the present and earlier experiment were conducted at different climatic conditions. The results of egg hatchability experiment showed that there was no sufficient difference in the percentage of eggs hatched of the predatory beetle reared on the three aphid species (table-I). Egg hatchability of the predatory beetle was 65.42 on *R. maidis* 64.33 *A. gossypii* and 70.69 *T. trifolii.* The present results are in agreement with those of Saha (1987) who reported 48.9-54.80% egg hatchability of the eggs when *M. sexmaculatus* females reared on cotton aphid.

The results of biology experiments of *M. sexamaculatus* showed that there were four instars which was followed by a pupal stage (table-I). Feeding of different aphid species did not significantly influence the duration of various life stages of *M. sexmaculatus*. Mean duration of first, second, third and fourth instar ranged between 6.5-7.0, 4.5-5.5, 3.9-6.5 and 6.5-8.5 days respectively.

Pupal period ranged between 3.1-5.5 days. Rajput (1990) reported that pupal period of *M. sexmaculatus* ranged from 4 to 6 days with an average of 4.7 days.

Pre-oviposition, oviposition and post oviposition periods of female *M. sexmaculatus* were 3.1-3.7, 23.4-27.7 and 3.5-4.5 days, respectively (table-I). Adult life span of *M. sexmaculatus* was 30.00-35.0 days. The results of present study are in agreement with those of Patel and Vyas (1984) who found that adult *M. sexmaculatus* lived for 16-49 days when feed on *aphis craccivora.*

The results of Table-II indicates that all the beetle instar, were voracious feeders of all the aphid species tested. Prey consumption by the beetle was highly significant between 3rd and 4th instar but non-significant between first and second instars. Fourth instar and adult *M. sexmaculatus* consumed more *R. maidis* than the other two aphid species. Verma *et al.* (1983) had reported that mustard aphid is least preferred by *M. sexmaculatus* grubs. Daily total number of aphids consumed by first to fourth instars was 49.47, 25.04 and 57.11 of *R. maidis, A. gossypii* and *T. trifolii* which was highly significant at 0.05 level (12.7 chi-square). Patel and Vyas (1984) reported that *M. sexmaculatus* grubs can consume a higher number of 79 *Aphis craccivora* per day.

The data in Table-III indicates that prey consumption by adult *M. sexmaculatus* of all the three aphid species tested increased with age where maximum number of prey were consumed on 8th day of *R. Maidis* with 109.2 prey on 4th day *A. gossypii* with 100.9 aphid and 8th day of *T. trifolii* with (98.7) aphids. Mean number of prey consumed during entire adult life was 80.08, 69.95 and 68.96 of *R. maidis, A. gosypii* and *T. trifolii* respectively. Gupta and Yadava (1989a and b) reported that adults *M. sexmaculatus* consumed a mean number of 30 *Myzus persicae* per day day.

CONCLUSION

Menochilus sexmaculatus Fab. grubs and adults were voracious feeders on corn leaf aphid, cotton aphid, and alfalfa aphid. This beetle has great potential for use biological control of these three aphid species.

Table I: ***Some biological parameters of Menochilus sexmaculatus reared on three aphid species under laboratory conditions at 25 ± 2 °C***

Parameter	Mean values on			
	R. maidis	*A. gossypii*	*T. trifolii*	Chi-square
Egg incubation Period (days)	7.5	7.1	7.2	0.040 NS
Number of eggs/female	642	530	600	4.75 HS
Percent hatchability	65.42	64.33	70.69	0.49 NS
Duration of first instar (days)	6.6	6.5	7.0	0.04 NS
Duration of second-instar (days)	5.2	5.5	4.5	0.45 NS
Duration third instar days	4.4	6.5	3.9	1.00 NS
Duration fourth instar (days)	8.5	8.4	6.5	0.30 NS
Duration pupal Period (days)	5.5	3.1	3.6	0.36 NS
Duration pre-oviposition	3.1	3.5	3.7	0.03 NS
Duration oviposition Period-days	23.4	23.9	27.7	0.28 NS
Duration post-oviposition period days	4.4	3.5	4.5	0.07 NS
Adult longevity (days)	32.0	30.00	35.0	0.26 NS

NS = Non significant , HS = Highly significant

Table II: ***Mean number of R. maidis, A. gossypii and T. trifolii consumed by Menochilus sexmaculatus under laboratory conditions 25 ± 2 °C***

Parameter	Mean values on			
Number of prey consumed /day	*R. maidis*	*A. gossypii*	*T. trifolii*	Chi-square
First instar	6.20	6.40	12.00	1.43 NS
Second instar	20.82	20.00	27.00	0.37 NS
Third instar	55.00	30.5	44.2	5.4 HS
Fourth instar	115.87	43.27	145.27	51.47 HS
Mean number of prey consumed	49.47	25.04	57.11	12.7 HS
Adult	82.5	72.00	74.00	0.36 NS

NS = Non significant , HS = Highly significant

Table III ***Mean daily number of R. maidis, A. gossypii and T. trifolii consumed by adult Menochilus sexmaculatus under laboratory conditions 25 ± 2 ^{o}C***

Age of beetle	*R. maidis*	*A. gossypii*	*T. trifolii*
1.	71.9	65.8	66.7
2.	82.5	77.5	68.5
3.	93.3	83.2	73.8
4.	107.0	100.9	78.0
5.	113.2	98.2	80.8
6.	114.2	96.7	82.2
7.	119.3	90.3	94.0
8.	109.2	89.5	98.7
9.	100.8	83.4	95.5
10.	95.0	81.0	88.0
11.	91.6	80.6	83.8
12.	89.4	76.9	82.0
13.	86.7	75.0	80.6
14.	82.2	80.0	78.8
15.	84.0	82.0	77.5
16.	83.2	71.2	70.2
17.	80.4	65.5	76.5
18.	78.6	64.0	68.5
19.	77.9	60.5	65.7
20.	80.0	62.2	71.5
21.	68.5	63.0	68.0
22.	74.3	61.8	65.5
23.	76.6	62.6	66.0
24.	70.2	64.0	61.5
25.	67.7	57.0	65.0
26.	58.6	53.3	60.5
27.	65.3	50.6	66.0
28.	67.6	52.2	60.0
29.	56.0	47.8	58.7
30.	69.3	41.0	58.2
31.	61.6	30.8	54.6
32.	37.5	00.00	52.2
33.	30.2	00.00	50.0
34.	00.00	00.00	45.5
35.	00.00	00.00	36.0
36.	00.00	00.00	33.8
Mean	80.08	69.95	68.96

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