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Feeding Potential of Zigzag Beetle, *M. sexamaculatus* Fab. (*Coccinellidae*: *Coleoptera*) Reared on Mustard Aphid, *L. erysimi* Kalt

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Abstract: The study was conducted to compare the feeding potential of male and female zigzag beetle, *M. sexamaculatus* (Fab.) on mustard aphid *L. erysimi* Kalt. Under laboratory conditions during December 2004 to March 2005. Results indicate that the predatory behaviour of different grub instars of *M. sexamaculatus* (Fab.) on aphids varied significantly except 3rd and 4th instars. The mature stages i.e. 3rd and 4th instar grubs were more voracious feeders and each instar consumed 23.20 and 22.10 aphids/grub, respectively. The adult beetles consumed mean 19.28 aphids/adults as compared to the females which consumed 24.91 aphids/adult. The results thus suggested that the predatory potential of female adults was significantly higher than the males.

Key words: *M. sexamaculatus* Fab., *L. erysimi* Kalt., feeding potential, grubs, predator

INTRODUCTION

Injudicious use of pesticides has resulted in the environmental pollution on large scale. Besides, pesticides have been accumulating in the soil, air and water to a critical stage, this calls for a safe and cheep control methods. This can only be achieved by the practice of Integrated Pest Management (IPM) a pest control management which ensures environmental safety[1].

Biological control is a component of integrated pest management strategy which consists mostly the natural enemies of insect pests, I-e predators, parasitoids and pathogens[2]. Among predators, the family Coccinellidae includes major predator insects named as lady beetles. They are predaceous in their larvae and adult stages. They predate on Aphids, Coccids, Aleyrodids, Mites and occasionally on Psyllids. Most of these insects exercise natural control of injurious species in the field[3].

The most common species of lady beetles are *M. sexamaculatus* (Fab). *Coccinella* sp. and *B. suturalis.* Among others, the zigzag beetle *M. sexamaculatus* is one of the main natural enemies on aphids[4,5].

The Zig-zag beetle, *M. sexamaculatus* predates on a numbers of soft bodied insects including the ground nut aphid, *Aphis craccivora* Koch; coffee green bug, *Coccus virtues* Green; mustard aphid *Lipaphis erysimi* Kalt, sugarcane leaf hopper, *Pyrilla perpusilla* Walker, castor whitefly, *Trialeurodes richini Misra,* sorghum shootfly, *pereginus maidis* Ashond, maize aphid *Rhopalosiphum maidis* Fitch, etc.[6].

Due to the importance of Lady beetles as predators of agricultural pests, studies were conducted to observe feeding potential of Zigzag beetle, *M. sexamaculatus* Fab. on mustard aphid, *L. erysimi* Kalt.

The study will be benefited to researchers in implementing biological control strategies in future.

MATERIALS AND METHODS

Adults of Zigzag beetle, *M. sexamaculatus* were collected during December 2004 to March 2005 from mustard fields and reared under laboratory conditions inside wooden cages (25x10x15 cm^3) and were fed with mustard aphid, *L. erysimi* Kalt. The eggs of beetle deposited in mustard leaves were collected twice a day and kept in petridishes. After hatching of grubs, the comparative predatory behaviour of both male and female adults of *M. sexamaculatus* was observed.

One day old grub were collected from Laboratory culture at random. Males and females were confined separately in paired petridishes (9 cm dia.) alongwith aphids for comparative predatory potential of grubs and aduls. The number of aphids was increased from 25 aphids/predator for first five days to 50 aphids/predator in last five days of 30 days observation by increasing 5 aphids after every five days. Five replications of each treatment had been made.

RESULTS AND DISCUSSION

Comparative predatory behaviour:

Grubs: Predatory behaviour of different grub instars varied significantly except third and fourth instar. The feeding of aphids increased with moulting and age. It is evident from the results, that third and fourth instars were

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Table 1: Comparative feeding behaviour of different larval instars of the predator, Zigzag beetle, *M. sexamaculatus* Fab. on mustard aphid *L. erysimi* Kalt. under laboratory conditions

Instar	Age (days)	No. aphids consumed R_1	R_2	R_3	R_4	R_5	Mean±SD
First	1	3	2	3	3	4	3.00±0.31
	2	6	5	4	5	6	5.20±0.37
	3	5	7	6	5	7	5.40±0.51
	X±SD	4.6±1.57	4.6±2.51	4.3±1.52	4.3±1.15	5.6±1.52	4.73±1.55
Second	4	14	13	11	10	12	12.00±0.71
	5	16	17	14	15	16	15.60±0.51
	6	18	16	17	18	16	17.00±0.45
	X±SD	16.0±2.0	15.3±2.08	14.0±3.00	14.3±4.04	14.6±2.30	14.86±2.57
Third	7	23	22	24	22	23	22.80±0.37
	8	24	22	25	23	24	23.60±0.51
	X±SD	23.5±0.70	22.0±00	24.5±0.70	22.5±0.70	23.5±0.70	23.20±0.97
Fourth	9	24	25	23	24	23	23.80±0.37
	10	25	25	24	22	24	24.00±0.54
	11	23	22	24	20	23	22.40±0.52
	12	18	20	16	18	19	18.20±0.66
	X±SD	22.5±3.10	23.0±2.44	21.78±3.86	21.0±2.58	22.2±2.21	22.10±2.69

Table 2: Overall feeding behaviour of different larval (Grub) instars of the Zigzag beetle, *M. sexamaculatus* Fab. On mustard aphid, *L. erysimi* Kalt

Instars	Rep.	No. of aphids provided	No. of aphids predated/grub*	Feeding %age
First	5	25	4.73c	18.13
Second	5	25	14.86b	59.46
Third	5	25	23.20a	92.80
Fourth	5	25	22.10a	88.40

* = Average and percentage of five replications

Means sharing similar letter(s) are statistically non-significant at 5% level

CD_1 = 1.401, CD_2 = 1.866, Prob = 0.0001

significantly more voracious feeders (23.20 aphids/grub and 22.10 aphids/gub, respectively) as compared to second instar (14.86 aphids/grub) and first instar (4.73 aphids/grub). Aphid feeding by grubs increased with the age (Table 1) and reached its peak (i.e. 24.5 aphids devoured) at the end of 3rd instar after which feeding decreased as the larva entered in 4th instar and pupal stage after 12th day of its larval life (Table 1).

Similarly, feeding percentage of the mustard aphid, *L. erysimi* Kalt. (Table 2) by grubs of *M. sexamaculatus* was increased as the grubs underwent successive moulting. Third instar grub devoured 92.8% aphids followed by 4th instars grub which devoured 88.4% aphids. However, first and second instar grubs devoured only 18.13 and 59.46% aphids, respectively. It was observed that the 3rd and 4th instars of *M. sexamaculatus* were more voracious as compared to 1st and 2nd instar grubs and 3rd and 4th instar grubs consumed the mustard aphids with remarkable efficiency as alligator predators. The predatory potential of *M. sexamaculatus* grubs in the 3rd and 4th instars on *L. erysimi* Kalt. was efficient under field conditions[7]. The 3rd and 4th instar grubs are voracious feeders of the *L. erysimi* Kalt[8]. Mustard aphid *L. erysimi* Kalt. could more effectively be controlled under field conditions by using predatory potential of *M. sexamaculatus* grubs[9].

Table 3: Feeding behaviour of adult Zigzag beetles, *M. sexamaculatus* on mustard aphid, *L. erysimi* under laboratory conditions

Age (days)	No. aphid provided	Rep.	Mean No. aphids devoured Male	Female	Feeding percentage Male	Female
1	25	5	5.4	7.0	21.6	28.0
2	25	5	7.0	8.2	28.0	32.8
3	25	5	7.8	10.2	31.2	40.8
4	25	5	12.8	11.6	51.2	46.4
5	25	5	12.0	13.0	48.0	52.0
6	30	5	10.6	14.6	35.3	48.6
7	30	5	10.6	17.4	35.3	58.0
8	30	5	12.6	20.4	42.0	68.0
9	30	5	15.6	23.6	52.0	78.6
10	30	5	15.6	26.0	52.0	86.6
11	35	5	17.2	28.0	49.1	80.0
12	35	5	20.2	29.2	57.7	83.4
13	35	5	23.2	29.2	66.2	83.4
14	35	5	24.8	29.4	70.8	84.0
15	35	5	24.2	27.6	69.1	78.8
16	40	5	25.2	29.0	63.0	72.5
17	40	5	26.6	30.6	65.0	76.5
18	40	5	25.4	31.4	63.5	78.5
19	40	5	26.6	33.6	65.0	84.0
20	40	5	28.0	34.8	70.0	87.0
21	45	5	30.4	34.0	67.5	75.5
22	45	5	32.2	35.0	67.5	77.7
23	45	5	31.2	33.6	69.3	74.6
24	45	5	28.0	35.2	62.2	78.2
25	45	5	24.6	32.8	54.6	72.8
26	50	5	21.8	31.2	43.6	62.4
27	50	5	19.6	30.0	39.2	59.6
28	50	5	16.8	22.2	33.6	44.4
29	50	5	14.0	20.2	28.0	44.8
30	50	5	8.6	18.6	17.2	37.2
X±SE	37.5±8.68	5	19.28 ± 7.91	24.91±8.75	50.7±16.33	65.8±17.97

Adults beetles: The predation of aphids increased with the age of the beetles. It is evident from result (Table 3), that feeding increased with the age of the beetles and reached its peak (32.2 aphids/day/beetle) in 22nd day old males and 22nd day old females (35.0 aphids/day/beetle). The females devoured significantly more aphids than males. It could therefore,

be inferred that feeding behaviour was significantly higher in case of females than males.

The feeding % (Table 3) by both the sexes of beetle also varied significantly. The female beetles devoured significantly more number of aphids and therefore, the overall feeding % by the female (65.8%) was significantly higher than males (50.7%). The statistical analysis indicated that predatory behaviour of the adult beetles varied significantly with the age as well as sex of the beetle. A considerable research has been reported on comparative feeding potential of male and female Zigzag beetle, *M. sexamaculatus*. Mustard aphid was consumed voraciously in the field by *M. sexamaculatus* female as compared to male[10]. The female *M. sexamaculatus* consume significantly more aphids due to the reason that it needs more proteins for oviposition[11]. The *M. sexamaculatus* females generally have been observed more efficient in feeding on mustard aphid *L.* erysimi as compared to their males[12] .

It is concluded that 3rd and 4th instars of Zigzag beetle, *M. sexamaculatus* Fab. is an efficient and quick predator to consumed it prey, mustard aphid, *L. erysimi* Kalt.

M. sexamaculatus adult female is more efficient than male to consumed its prey mustard aphid, *L. erysimi* because they need of protein for oviposition.

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