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Predation of *Adalia tetraspilota* (Hope) (Coleoptera: Coccinellidae) on Green Peach Aphid (*Myzus persicae*. Sulzer)

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Abstract

Studies on prey consumption of larvae and adults of *Adalia tetraspilota* (Hope) (Coleoptera: Coccinellidae) was conducted in the laboratory on green peach aphid, *Myzus persicae* (Sulzer) (Homoptera: Aphididae). In larval form 4th instar was the most efficient consumer with an average of 39.96 ± 1.04 aphids larva^{-1}day^{-1} followed by 3rd instar with an average of 20.90 ± 0.58 larva^{-1}day^{-1}. Feeding potentials of adult coccinellids increased with increase in age. In female the highest consumption of aphids was recorded on the 23rd day of its emergence while in case of male it was recorded on 24th day. Female adult consumed more aphids (39.83 ± 11.39 aphids day^{-1}) than male (31.70 ± 8.07 aphids day^{-1}).

Keywords: Coccinellidae; *Adalia tetraspilota; Myzus persicae;* Larva; Adult male; Adult female; Feeding

Introduction

Biological control is a component of integrated pest management strategy which consists of mostly the natural enemies of insect pests i.e, predators, parasitoids and pathogen. Among predators, the family Coccinellidae includes major predatory insects named as lady beetles. Lady beetles are perhaps the most familiar insect predators in most agricultural crops, fruit orchards and nurseries. Many investigations on coccinellids in different ecosystem were performed in different parts of the world regarding their dynamics, taxonomic composition, feeding potentials and so on [1-3]. Adults and larvae feed voraciously on aphids and other soft bodied insects such as mealy bugs, mites and leafhoppers. Natural enemies, particularly ladybeetle, play an important role in the control of pest in many crops. Their effectiveness in controlling pests has been reported by many authors [4-6]. Considerable works have also been conducted on the feeding behaviours of different coccinellids on different aphids [7-10]. Coccinellidae contains approximately 6,000 species [11] of which over 90% are beneficial predators [12]. Measuring the veracity of predators is an important step in assessing the potential of a biological control agent. *A. tetraspilota* (Coleoptera: Coccinellidae) is a medium sized polyphagous predator. It is a potential biological agent for green peach aphid. To include *A.* spp. in a biological control programme requires detailed information on its vital functions including its numerical and functional responses. And the key component of functional response is the predation effectiveness. The green peach aphid (*Myzus persicae*) (Homoptera: Aphididae) causes economically important damage to the peach plant. Direct damage, observed during attacks by large colonies of peach aphid on young shoot of plant can kill the young shoots. Severely infected plants produce very less fruits. The present study has been conducted keeping in mind the above said factors.

Materials and Methods

A. tetraspilota (H.) was collected from peach orchard. Green peach aphids were captured by excising peach leaves on which they had formed large colonies. The collected leaves were carefully placed in a transparent plastic tube and taken to the laboratory. The collected coccinellid adults and larvae were transferred into transparent plastic tubes containing numbered aphids as their food material. After 24 hours the beetles were transferred in to other plastic tubes and the number of live aphids was recorded. The lids of the plastic tubes were covered with paper with several ventilated holes to provide adequate aeration and preventing the insect to escape. The collected eggs were kept in a petridish covered with muslin for incubation. The effectiveness of *A. tetraspilota* on *M. persicae* in laboratory conditions was examined during March 2011 and April 2011, in rearing cases made up of transparent plastic tubes. Newly hatched larvae were taken and introduced into 4 plastic tubes (V1, V2, V3 and V4) containing numbered green peach aphids.

Instar	Age (days)	Number of aphids consumed				
		V1	V2	V3	V4	Mean ± SD
First	1	2	3	3	2	2.50 ± 0.58
	2	4	4	5	5	4.50 ± 0.57
Mean		3 ± 1.41	3.5 ± 0.71	4 ± 1.41	3.5 ± 2.21	3.50 ± 0.41
Second	3	8	8	7	7	7.50 ± 0.57
	4	10	11	11	12	11.00 ± 0.82
	5	11	12	14	14	12.75 ± 1.5
	6	15	15	16	17	15.75 ± 0.96
Mean		11 ± 2.94	11.50 ± 2.89	12 ± 3.92	12.50 ± 4.20	11.75 ± 0.65
Third	7	16	18	17	18	17.75 ± 0.96
	8	17	20	21	19	19.25 ± 1.70
	9	22	23	19	22	21.50 ± 1,73
	10	22	21	23	24	22.50 ± 1.29
	11	24	23	24	25	24.00 ± 0.82
Mean		20.20 ± 3.49	21 ± 2.12	20.80 ± 2.86	21.60 ± 3.04	20.90 ± 0.58
Fourth	12	26	28	27	25	26.50 ± 1.29
	13	30	32	34	30	31.50 ± 1.91
	14	39	37	38	36	37.50 ± 1.29
	15	46	40	39	45	42.50 ± 3.51
	16	52	46	49	50	49.25 ± 2.5
	17	55	51	54	50	52.50 ± 2.38
Mean		41.33 ± 11.76	39 ± 8.58	40.16 ± 9.87	39.33 ±10.61	39.96 ± 1.04

Table 1: Comparative feeding of different larval instars of *Adalia tetraspilota* (H.) on green peach aphid under laboratory condition.

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Days	No. Of Aphids	No. Of aphids consumed		Feeding percentage %	
	provided	Female	Male	Female	Male
1	25	18	16	72.00	64.00
2	25	24	18	96.00	72.00
3	30	26	19	86.67	63.33
4	30	24	18	80.00	60.00
5	30	27	17	90.00	56.67
6	35	32	25	91.43	71.43
7	35	30	24	85.71	68.57
8	40	38	22	95.00	55.00
9	40	39	33	97.50	82.50
10	40	40	35	100.00	87.50
11	40	21*	38	52.50	95.00
12	45	42	36	93.33	80.00
13	45	40	35	88.89	77.78
14	45	42	29	93.33	64.44
15	50	40	30	80.00	60.00
16	50	44	40	88.00	80.00
17	50	28*	41	56.00	82.00
18	50	42	32	84.00	64.00
19	60	56	30	93.33	60.00
20	60	49	38	81.67	63.33
21	60	54	34	90.00	56.67
22	65	52	34	80.00	52.31
23	65	60	38	92.31	58.46
24	65	34*	42	52.31	64.62
25	65	48	40	73.84	61.54
26	65	47	36	72.31	55.38
27	65	50	35	76.92	53.85
28	65	46	39	70.77	60.00
29	65	58	38	89.23	58.46
30	65	44*	39	67.69	60.00
Mean	**49**	**39.83 ± 11.39**	**31.70 ± 8.07**	**82.36**	**66.30**

(*) Indicated laying of eggs

Table 2: Feeding behaviour of adult *Adalia tetraspilota* (Hope) on green peach aphid under laboratory condition

Results and Discussion

Comparative feeding behaviour

Larvae: After 24 hours, the larvae were transferred it to another plastic tube and the numbers of live aphids were counted. Feeding efficiency of different larval instars varied significantly in all larval stage. The feeding of aphids increased with moulting and age. It is evident through observations and results (Table 1), that fourth and third instars were more voracious feeders (39.96 ± 1.04 aphids larva^{-1} day^{-1} and 20.90 ± 0.58 aphids larva^{-1} day^{-1}, respectively) as compared to second (11.75 ± 0.65 aphids larva^{-1} day^{-1}) and first instars (3.50 ± 0.41 aphids larva^{-1} day^{-1}). The efficiency of feeding of larvae increases with the age and reaches its peak just before pupation. The 1st instar larvae undergo moulting after two days while the 2nd instar larvae undergoes moulting after 4 days. 3rd instar undergoes moulting after 5 days of second moulting and the 4th instar grubs entered pupation after 6 days. No feeding took place during pupation.

Adults: The feeding increased with the age of the beetles. The observations given in (Table 2) show increased consumption of aphids with age. The feeding of aphids reached its maximum (60 aphids) on the 23rd day for female and 24th day for male (42 aphids). The females consumed significantly more aphids than males. The average consumption by adult female and male was 39.83 ± 11.39 +aphid's day^{-1} and 31.70 ± 8.07 aphid's day^{-1} respectively. The female coccinellids devoured considerably more number of aphids and thus, the overall average consumption percentage of adult female *A. tetraspilota* (H.) (82.36%) was much higher than adult male (66.30%). In similar studies mustard aphid was consumed voraciously in the field by *Menochilus. sexmaculatus* (Timberlake) female as compared to male [13]. The female *M. sexmaculatus* (T.) consumed more aphids due to the reason that it needs more proteins for oviposition [14]. In the present study also the higher consumption by females of *A. tetraspilota* may be attributed to their higher requirement of proteins for oviposition, which however, decreased drastically during egg laying. On the basis of this experimental study, it may also be concluded that *A. tetraspilota* has a potential to be used as a biological control agent.

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