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Biology and Feeding Potential of *Coccinella septumpunctata* on Mustard Aphid, *Lipaphis erysimi*

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Abstract: Different developmental stages of *Coccinella septumpunctata* was observed that the egg, larval, pre-pupal and adult stages occupied more duration in first generation as compared to second, total larval period 16±1.73 days and pupal period, 7.5±0.87 days was more in first generation in contrast to second 13.5±0.87 days and 6.5±0.87 days, respectively. However, similar was the trend with respect to longevity of males and females.Adult stage of *Coccinella septumpunctata* consumed more aphids in both generations as compared to larval. Nevertheless, when a comparison was made, between larval instars, it was observed that older larvae consume more number of aphids/day than younger ones.

Key words: Predatory potential, *Coccinella septumpunctata*, mustard aphid

Introduction

Aphids are economically important insects causing severe damage to a number of crop plants. *Lipaphis erysimi* infests mustard plants and reduced yield (Singh and Sachan, 1994). A number of insecticides have so far being recommended to control this pest but consequences of these insecticides lead to the development of resistance, resugance and do not ensure safety to non target organisms (Patel *et al*., 1998; Sonkar and Desai, 1998).

Mustard aphid is preyed and parasitised by a number of natural enemies like *Coccinellids*, syrphids and aphidus species operating in mustard ecosystem. When such natural enemies are exposed to insecticide residues on plant surfaces that resulted into mortality or sub-lethal effects and searching patterns and decreased effectiveness of *Coccinellids* as aphid predator (Singh *et al*., 2001). *Coccinellids* locate their prey by initially searching their habitat extensively but switch to intensive searching following an encounter with prey. This has necessitated the search for ecofriendly substitutes (Omkar and Srivastava, 2003). *Coccinella septumpunctata* is locally available in mustard fields and is the important weapon in the selection of a successful biocontrol agent. The present investigation was designed in this light to study its biology and its predatory potential against mustard aphid.

Materials and Methods

The experiment was performed under ambient room temperature in Department of Plant Protection, Faculty of Agriculture Sciences, Aligarh Muslim University, Aligarh in India during 2002 and 2003.

Adult of *Coccinella septempunctata* were collected from mustard fields infested with *Lipaphis erysimi* to maintain its culture. The field collected adult beetles were released in pairs individually in

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different petridishes for obtaining eggs. Each petridish was provided with card board paper spread over its surface. Fresh twig harbouring these adult beetles, till the egg laying as a food which was replaced daily. Further, counted number of some age old eggs were placed in petridishes and observed daily to note the incubation period. After hatching, the newly emerged larvae were reared individually on *L. erysimi* in glass tubes (10×2.5 cm). First and second instar aphid nymphs were provided as food to the first instar predator larvae, whereas, subsequent instars were provided third, fourth and well developed nymphs. Observations regarding larval duration in each instar, pupal period and adult longevity at each of the post-embroynic development. For studying the feeding potential, daily and total consumption of aphids by the larvae of respective instar and the adult of *C. septumpunctata* were also noted to determine their predation capacity.

Results and Discussion

It was revealed from the data recorded for the developmental period of *C. septumpunctata* (Table 1), that the incubation period varied from 3-5 days (mean 4±0.58 days) to 2-4 days (mean 3±0.58 days) during first and second generation, respectively. Variation was not found significant within different larval stage of first and second generation required more mean time of 4±0.58 and 4.5±0.29 days, respectively. There was a pronounced variation observed for minimum and maximum, total developmental period of larval stage in both generations. The larval exhibited their mean developmental period from 16±1.73 days (first generation) to 13.5±1.45 days) did not show any variation in both generations, it remained between 1-2 days. As far as pupal period was concerned, it was 6±0.58 days in first generation as compared to second generation (5±0.58).

With regard to adult longevity, mean adult male and female was 15.24±8.10 and 20.18±0.41 days in first generation and 12.53±6.07 and 18.4±8.68 days in second generation, respectively (Sethi and Atwal, 1964; Agarwal and Saha, 1986; Singh *et al*., 1994). Different stages of *C. septumpunctata* clearly revealed that both generations exhibited variation from low to high magnitude due to low temperature during the first generation. The differences is also due to prey species and predator.

Different larval instars and adult of *C. septumpunctata* were found to vary in their predation i.e., the rate and ability to feed upon prey, *L. erysimi* (Table 2). The number of aphid consumed per days by an individual predator increased with the advancement of its age. The number of aphid consumed per day by an individual predator increased with the advancement of its age. The number of aphid consumed per day by an individual predator increased with the advancement of its age. During first generation, predation potential increased from 10±1.73 to 52.3±7.23 nymphs while in second generation the corresponding values were 11.5±2.02 to 60.3±9.54 nymphs during development, first, second, third and fourth instar larvae consumed 10±1.73, 29±2.89, 39±1.16 and 52.3±7.23 aphids respectively in first generation while the corresponding figures in second generation were 11.5±2.02, 27±2.89, 51±55.78 and 60.3±9.54 aphids. While consumption by adult beetles was 72±5.20 and 77.5±3.76 aphids by individual adult during first and second generation, respectively. During the entire life cycle of larval stage and adult beetles, total number of aphid consumption was more by adult (1042.3±52.89 aphids: first generation and 1029±20.52 aphids: second generation) as compared to larval 113.25±7.95: first generation and 111.5±9.68: second generation). (Mohammad and Mahmood, 1986), the number of aphids consumed by predator increase with increasing age of larvae and varied according to duration of larval instar. More aphid consumption by audlts is due to higher requiement for reproduction (Prabakar, 1994; Sahayaraj, 1994). The adult beetles consumed more prey than immature stages. This obviously due to the higher nutrition requirement of adults for

Table 1: Duration of different development stage of *C. septumpunctata* on *Lipaphis erysimi*

Stages of *C. septumpunctata*	First generation developmental period (days)			Second generation developmental period (days)		
	Min.	Max.	Mean±SE	Min.	Max.	Mean±SE
Egg	3	5	4.0±0.58	2	4	3.0±0.58
Larval/grub						
Ist instar	3	4	3.5±0.29	2	4	3.0±0.58
II instar	3	4	4.0±0.58	2	3	4.5±0.29
III instar	3	5	4.0±0.47	3	4	3.5±0.23
IV instar	4	6	4.0±0.58	4	5	4.5±0.29
Total larval period	13	19	16.0±1.73	11	16	13.5±1.45
Pre-pupa	1	2	1.5±0.29	1	2	1.5±0.29
Pupa	5	7	6.0±0.58	4	6	5.0±0.58
Total pupal period	6	9	7.5±0.87	5	8	6.5±0.87
Adult						
Male	1	29	15.24±8.10	2	23	12.53±6.07
Female	1	37	20.18±0.41	3	33	18.40±8.68

Table 2: Predatory potential of *C. septumpunctata* against *L. erysimi*

Stage	First generation						Second generation					
	No. of aphids consumed/day/individual			Total No. of aphids consumed			No. of aphids consumed/day/individual			Total No. of aphids consumed		
	Min.	Max.	Mean±SE	Min.	Max.	Mea±SE	Min.	Max.	Mean±SE	Min.	Max.	Mean±SE
Larva												
Ist instar	7	13	10.0±1.73	22	27	24.5±1.45	8	15	11.5±2.02	19	26	22.5±2.02
II instar	24	34	29.0±2.89	78	94	86.0±4.62	22	32	27.0±2.89	61	82	71.5±6.07
III instar	37	41	39.0±1.16	122	144	133.0±6.36	41	61	51.0±5.78	128	176	152.0±13.87
IV instar	40	65	52.3±7.23	176	243	209.3±19.36	44	77	60.3±9.54	171	229	200.0±16.76
Total	-	-	32.6±3.25	-	-	113.25±7.95	-	-	37.5±5.06	-	-	111.5±9.68
Adult	63	81	72.0±5.20	951	1134	1042.3±52.89	71	84	77.5±3.76	994	1065	1029.0±20.52

reproduction (George, 2004). The results clearly showed that the earlier instars of lady bird beetle preferred small sized prey followed by medium sized prey. Adults of lady bird beetle have no discrimination of small or medium sized prey so their predatory potential is more than immature stages.

This study has shown that the developmental period of different larval instars was less as compared to adults of *C. septumpunctata* in both the generations and the longevity of adults females were more as compared to males. Gradual increase in prey consumption was recorded by the progression of the developmental stages of the predator. The adults consumed more prey than the larval. Early instars of *C. septumpunctata* were inefficient to capture large sized prey and are feeble to foraging. However, this study has highlighted importance of improving our understanding in planning its utilization in classical biological control to resource poor farmers.

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