



STUDIES ON THE PREDATION POTENTIAL OF *COCCINELLA SEPTEMPUNCTATA* (LINN.) ON THE PREY: MUSTARD APHIDS (*LIPAPHIS ERYSIMI* KALT.) AND UTILIZATION OF FOOD

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Predation potential of *Coccinella septempunctata* Linn. has been observed in the laboratory which shows seasonal variation and is synchronized with the availability of the prey, aphids (*Lipaphis erysimi* Kalt.) and reproductive cycle of the beetle. Numerically, the number of aphids predated upon by *C. septempunctata* Linn. is maximum in July and minimum in January by larval and adult stages. Females devour more aphids than male due to her egg bearing capacity. Weight gain after starved beetles fed indicates utilization of food. Lady beetle is attracted towards prey aphids from average distance of 3 to 5mm.

The ladybird beetle *C. septempunctata* Linn. feed on different aphids viz; *Schizaphis graminum* Rondani, *Melanaphis sacchari* Zehntner, *Rhopalosiphum maidis* Fitch. Aphids infest their crops of preference but the suitability of the prey species for the predator exhibits different levels of acceptability. The beetle population shifts from one host plant to the other due to fluctuation of prey aphid numbers. The total mass of aphids consumed probably by the lady beetle increases weight is the parameter to judge the utilization of food consumed. Predatory coccinellids are biocontrol agents and play an important role in the population management of *Lipaphis erysimi* Kalt. (mustard aphid). However, the lady beetles are being released under IPM to limit the aphid populations as biological control agent.¹⁻⁸

MATERIALS AND METHODS

The study of population density of aphid on mustard plants was carried out during November to February months. The crop field were divided in five quadrants of 1 m² each and total number of nymphs and adults are counted on the mustard plants either from apex of the stem to the base or base to apex. Likewise, dorsal and ventral surface of leaves and peduncle, pedicel to corolla of flowers as well as on and around the fruits. The observations on the population of mustard aphid *L. erysimi* Kalt., were recorded on seventh day of each week between 8pm. to 12pm during the season. Observations continued from early season of the mustard crop till aphid and lady beetles are available in sufficient number. The predation potential was studied in the laboratory in glass vials covered on the top with thin muslin cloth. The prey aphids were collected and picked up carefully with brush and weighed after counting. Which were released with an infested small twig of the host plant in the glass vial.

An adult beetle is weighed and simultaneously released in a petridish covered by thin muslin cloth. Fresh aphids after weighting are again provided to the beetle during the day length. In the end total number of aphids consumed were subtracted from left over aphids, if any and weighed. Numerical count of the aphids in the laboratory and field was also carried out by providing aphids by count to the larvae and adult both singly. The observation are recorded in Table-2.

RESULTS AND DISCUSSION

The lady beetle in the larval as well as adult stages both are predaceous and feed upon all stages of *Lipaphis erysimi* Kalt. It is very interesting to note that the female devours its own eggs just after the oviposition. Male ladybeetles too move towards egg mass laid and feed incase these eggs are left. The observation on the feeding potential of larval forms of the beetle individually indicate increase in number of aphids with weight with the each moult of the larval stage. The starved lady beetle sample is weighed prior to feeding and released in a small petridish covered on the top with thin muslin cloth. Secondly, a set of five aphids adults were taken in a weighing tube and weighted on an electronic chemical balance. The duration of approach to the prey has also been recorded. Again fresh aphids were supplied as prey as above till the lady beetle stops feeding and the fed adult beetle were weighted. Experiment is repeated 5 times. All the observations are recorded in the Table-1 and observations were used for evaluating the predation potential of the beetle and its stages. In the above reading any increase in weight of beetle is indicates utilization of food in the body of the lady beetle.

The aphid appear on mustard plant in a duration of quater to two months time mid December to mid February after sowing. The mustard aphid population recorded, show that the increase in number of aphids in the field promotes the increase of number of predator *C. Septempunctata* larval and adult forms.

In a nut shell, the earlier outcome that predator and mustard aphid populations show rise or fall i.e. the two populations are inveresley related to each other. Therefore, at a time the population of one increases while the other decreases, in a synchronized manner in nature. The more is the number of lady beetle the lesser is the number of aphids while lesser to the beetle count more is the number of aphids an the host plant.

It inferred from the above observation that one adult male beetle predate on 5 ± 2.3 to 215 ± 21.5 and a female on from 10.3 ± 1.6 to 330 ± 14.3 aphid stages. Consumption and utilization of food (have shown that the beetle weight increases an average of 10mg. in present study) after feeding on aphids after defaecation which occurs after 5 to 6 hours of ingestion. Numerical estimation of predation potential has been recorded in the laboratory study. The number of aphids fed per day by a predator beetle and larval instars has been recorded in Table 2, Fig. 1.

A perusal of the Table-2 shows that the number of aphids fed by the larval stages i.e., first, second, third and fourth instar larvae feed maximum number of aphids i.e. 64 ± 1.8 , 106 ± 4.7 , 129.3 ± 1.1 , 363 ± 9.1 in July 2008 which fell by early December the same year to 4 ± 1.8 , 7.7 ± 2.5 , 14.3 ± 4.5 , 36.3 ± 9.3 , while in January 2009, the number of aphids fed was 3.3 ± 0.7 , 5 ± 2.1 , 7 ± 2.8 and 15 ± 1.4 . The feeding rate by the lady beetle larvae again slightly increased upto April 2009. Likewise, an adult female and male lady beetle feed 330 ± 14.3 and 215 ± 21.5 aphids in July 2008. While it was minimum in January 2009 i.e. 10.3 ± 1.6 and 5 ± 2.3 .

It can be inferred from the study that adult female beetles has more appetite than the males. It may be justifiably attributed to the eggs producing by females. The rate of feeding by the larvae increases from fourth instar due to increasing metabolic and metamorphic changes. The fall in number of aphids fed by the larvae and adult beetle is due to climatic variation in the winter. The observation on the feeding potential of larval forms of the beetle individually indicate increase in number of aphids with weight with the each moult of the larval stage.

Further, it has been adjudged experimentally that a beetle can find the presence of aphid from 3 to 5 cms. distance which shows that predation is motivated even from the distance.

Table-1: Consumption and utilization of food (in mg)* (Release of single lady beetle in the petridish)

S.No.	Average net weight of starved beetle	Average net weigh of aphids	Average weight of beetle after feeding	Net utilization (after defaecation)	Distance (in Cms.) Travelled by the predator to catch prey released
1	40	30	50	10	4
2	35	25	45	10	4.5
3	48	35	58	10	3.5
4	45	40	55	10	3
5	43	48	53	10	5

*Defaecation occurs after 5 hours in female and after 6 hours in male beetle

Table-2: Predation potential of Larval instars and Adults (Male and Female) of *Coccinella septempunctata* Linn.

S.No.	Month and year	Average no of prey consumed per day/predator					
		Larval instars				Adults	
		1 st instar Larva	2 nd instar Larva	3 rd instar Larva	4 th instar Larva	Male	Female
1.	Jul -08	64±1.8	106±4.7	129.13±1.1	363±9.1	215±21.5	330±14.3
2.	Aug -08	46 ±4.7	82.3±5	100±0.9	347±10.0	186±26.8	298.3±18
3.	Sep -08	31.7±3.1	58.3±6.9	74±6.7	316±9.5	132±25.4	277.3±11.7
4.	Oct -08	21.7±3.1	39.3±5.2	55±5.2	265±10.0	109.3±30.4	194.3±35.2
5.	Nov -08	14±1.8	25.3±1.6	36±1.8	210±24	90±27.8	150±28.7
6.	Dec -08	4±1.8	7.3±2.5	14.3±4.5	36.3±9.3	15±4.7	25±7.1
7.	Jan -09	3.3±0.7	5±2.1	7±2.8	15±1.4	5±2.3	10.3±1.6
8.	Feb-09	5±2.3	16±1.8	22±2.3	58.3±10.7	20.3±4.5	45±9.5
9.	Mar-09	8±1.8	24±1.4	37.3±1.6	79.3±13.6	52.3±5.4	59.3±5.4
10.	Apr-09	15±2.3	26±1.8	53.3±3.5	140±14.3	59.3±0.7	110±9.5
11.	May-09	Diapause					
12.	Jun-09	Diapause					

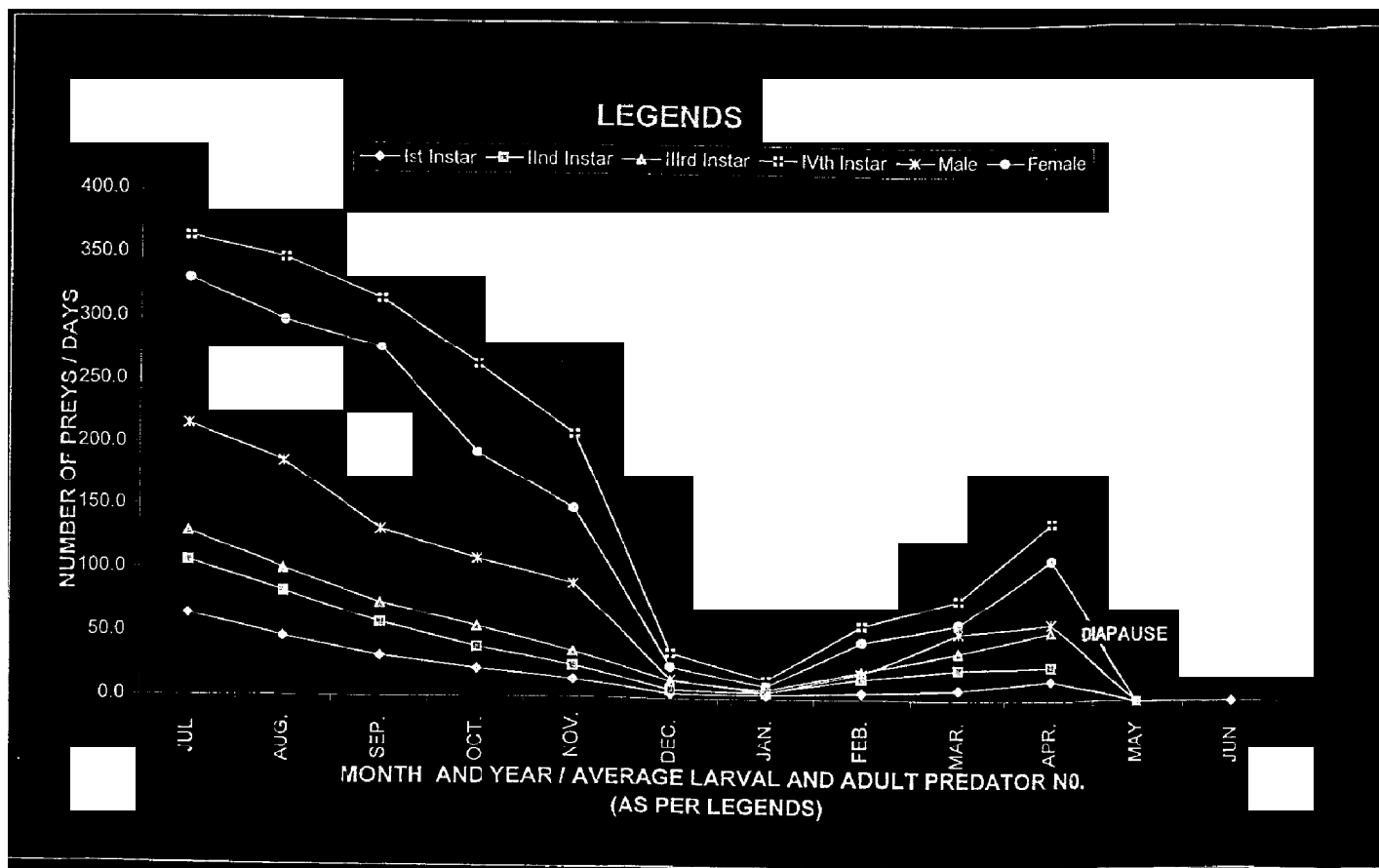


Fig.-1: Graphical representation of predation potential of larval and adult (both sexes) of *C. septempunctata*

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