http://www.pjbs.org



ISSN 1028-8880

Pakistan Journal of Biological Sciences



Predatory Efficacy of *Coccinella septempunctata* L. on Cotton Aphids, *Aphis gossypii* Glov.

Anjum Suhail, Arshed Makhdoom Sabir*, Adil Hussain and Asif Saeed Department of Agriculture Entomology, University of Agriculture, Faisalabad, Pakistan *Beekeeping and Hill Fruit Pests Research Station, Rawalpindi, Pakistan

Abstract

Predatory potential of *Coccinella septempunctata* L. on cotton aphids (*Aphis gossypii* Glov.) was studied under laboratory conditions at $21 \pm 1^{\circ}$ C and 70 ± 5 percent relative humidity. Both adult and larva of predator voraciously consumed on an average, 60.56 and 141.01 aphids per day, respectively and the total developmental period was noted to be 18.75 days.

Introduction

Cotton crop because of its possession of honey nectaries is mainly attacked by insect pests which incur a valuable reduction in yield. Cotton aphids, the members of cotton sucking pest insects complex, cause a considerable damage to cotton crop by sucking cell sap which on heavy infestation may result in failure of cotton crop (Atwal, 1996). Cotton aphids commonly known as green flies or plant lice cause trifold damage to crops. On one hand they suck cell sap and affect the general vigour of plant, on other because of their honey secretions, encourage sooty mould development which disturb the normal physiology of the leaves. Lastly they act as vectors of many diseases, like mosaic of virus and leaf curl disease of potato (Hafeez, 1986), with upto 35 per cent loss of yield on heavy infestation (Atwal, 1996).

Seven spotted ladybird beetle, Coccinella septempuncteta L. has attracted a considerable attention as a biological control agent because of its potential ability to control many insect pests. C. septempunctata L. is a common species with voracious, both larvae and adults predacious, with high reproductive potential and long oviposition period (Karpacheva, 1991). The entomophagous predator principally feeds on aphids, but also attack on wide range of both adult and immature soft bodied phytophagous crop pests (Srivastava et al., 1987). Perez et al. (1992) reported this predator, among the most important beneficial insects (48% of sample collected) in cotton fields and mainly found in these fields in Pakistan after summer rains which usually onset in July (Ghalany, 1976). These beetles have another advantage over other predators that they are tolerant to many insecticides and also the larvae are apparently not killed by systemic insecticides that are injurious to predator (Saharia, 1982).

Plant protection which is a key-note in agriculture husbandry, demands a greater attention for pest control measures, especially in developing countries which wholly depends on pesticides. There is a need for adoption of such methods of plant protection to supplement the chemical control measures (Marizy *et al.*, 1987). In the present studies, feeding potential of *C. septempunetata* L. as a

biological regulator of cotton aphids has been investigated.

Materials and Methods

These studies were conducted under laboratory conditions at 21 ± 1 °C and 70 °5 percent relative humidity in the Department of Agri. Entomology, University of Agriculture, Faisalabad.

Stock Culture of Cotton Aphids: Rearing of cotton aphids was done on cotton plants in semi-natural conditions. Apterous forms of the aphids collected from field in last week of September, 1995, were released on these plants. The pest took a fortnight to establish enough population which was used to check predatory efficacy of both the adults and larval stages of predator.

Rearing of *C. septempunctata*: Adults and eggs of the predator were collected from bringle crop in August, 1995. The adults were kept in plastic jars (15 per jar), each of which was provided with rough filter paper at bottom to avoid possible damage to adults from bottom deposition. Aphids were provided to the adult predators on round discs of cotton leaf and mouth of each jar was covered with muslin cloth. The leaf discs and muslin cloth were replaced daily.

Eggs were laid by the females of C. septempunctata on muslin cloth and leaves. These eggs and field collected eggs were placed in petri dishes. The upper collar portion of these petri dishes were waxed to inhibit the larval escape. These petri dishes were placed in an incubator running $21 \pm 1^{\circ}$ C and 70 ± 5 percent R.H. Super saturated salt of ammonium nitrate was also kept in the incubator (Southwood, 1966) in order to maintain the required humidity. On hatching, these larvae were transferred to clean jars, where these were provided with cotton leaves infested by the nymphs and adults of aphids. Fresh infested leaves were added daily in each jar. On pupation, the leaves from the jars were poured out in rearing cage where the adults were allowed to emerge. After three days of the adults' emergence, these were shifted to the jars for egg laying.

Suhail et al.: Predatory Efficacy, Coccinella septempunctata L., Aphis gossypii Glov., developmental period

Predatory Efficacy Test: To investigate the predatory efficacy of larvae of the predator against aphids, newly hatched larvae of the predator were placed singly in six petri dishes having a Whatman filter paper. A counted number of aphids were provided in each petri dish daily. Upper collar portion of the petri dishes was treated with vaseline and covered with muslin cloth to avoid larval escape. Every day, old leaves were substituted with new ones and unconsumed number of aphids were noted. The larvae of the predator were also checked daily for their moulting to calculate the duration of each larval instar. This practice was continued uptill pupation.

To check the aphid consumption by adult predator, six batches were fed on aphids for 24 hours. Each batch having '10 adults was offered with 1000 nymphs and adults of the prey. After 24 hours unconsumed number of aphids were counted. Data so collected were subjected to statistical analysis by using Completely Randomized Design (CRD).

Results and Discussion

The data on the consumption of aphids by the adult beetles (Table 1) shows that the respective consumption ranged from 59.0 to 62.2 aphids. The over all average consumption turned out to be 60.56 aphids per day. It is also evident from the data that the 4th instar larva is most effective with an average consumption of 47.15 aphids per day while the 3rd, 2nd and 1st instar larva tore away, respectively, 42.23, 36.40 and 15.23 aphids per day. On comparison, the predatory efficacy of the entomophagous adults conducted in the present studies is supported by the results of Ahmed (1976), who reported that adult of C. septemppnctata ate 58.89 aphids on an average per day. Results of Bagal and Trehan (1945) and Akram et al. (1996) do not agree with the results obtained. They recorded average consumption of 106.29 and 87.217 aphids per day in case of C. septempunctata. Similarly the predatory efficacy of the entomophagous larvae in the present studies is not at par with the results of Ahmed (1976), Debaraj and Singh (1989), Zhang and Fang (1983) and Akram et al. (1996) who reported an average 406, 401, 540 and 173 aphids consumption, respectively. These differences may be attributed to the different feeding potentials of coccinellid species involved or different host species served or even

micro climatic conditions under which these experiments were conducted, could have affected the feeding response of these insects. All these informations led to the conclusion that *C. septempunctata* has considerable potential to use as a biological regulator of the cotton aphids.

It is obvious from the data (Table 2) that minimum, maximum and average duration for the eggs was 3.40, 3.71 and 3.53 days, respectively. The respectively figure for cumulative larval and pupal stages were 11.10, 12.06, 11.58 and 3.31, 4.01, 3.64 days, respectively. The average development period calculated was 18.75 days. It is also clear from the observations that the duration of fourth instar was nearly equal to second and third instar put together. The second stage occupied minimum period. The 1st, 2nd, 3rd and 4th larval stages lasted for 3.50, 1.54, 2.21 and 4.32 days, respectively. These results are closely related to the observations recorded by Ahmed (1976) who reported duration of egg stage, 1st, 2nd, 3rd and 4th instar larva and pupa of 3.60, 3.50, 1.56, 2.25, 4.25 and 3.49 days on an average, respectively. But these results disagree with the previous observations recorded by Debaraj and Singh (1989). They recorded duration of egg stage, 1st, 2nd, 3rd, 4th, instar larva and pupa as 8.00, 10.00, 4.69, 3.92, 5.00, 7.69 and 1.22 days, respectively. All these differences may be due to differences in laboratory conditions provided. Nozato and Abe (1988) reported that the rate of development is greatly influenced by the temperature and humidity.

Table 1:	Total number of aphids consumed by an adult
	and in each larval instar of C. septempunctata

	per day								
		Larval Instars							
Adult	 I	 II	 III	IV	Total				
62.2 a	14.57 d	33.75 e	42.22 d	47.90 c	138.44				
62.0 a	16.99 b	35.44 d	50.50 a	48.75 b	151.68				
59.0 d	13.53 e	30.00 f	43.04 b	46.73 d	133.30				
61.1 b	15.20 c	43.16 a	36.20 f	50.37 a	144.93				
60.1 c	13.52 e	39.18 b	38.53 e	44.42 f	135.65				
59.9 с	17.57 a	36.85 c	42.92 c	44.74 e	142.08				
		Overall N							
60.56	15.23	36,40	42.23	47.15	141.01				

Table 2: Duration of various life stages of C. septempunctata L. Feeding on cotton aphids at 21±1°C and 70±5 R.h

	Egg stage	Larval instars				Pupal stage	Total develop- mental periods	
		I	П	111	IV	Total		
1	3.60 b	3.50 c	1.60 b	2.25 b	4.30 d	11.65	3.48 e	18.73
2	3.59 b	3.50 c	1.58 c	2.02 e	4.00 e	11.10	3.31 f	18.00
3	3.40 e	3.40 d	1.70 a	2.30 a	4.60 a	12.00	4.01 a	19.41
4	3.42 d	3.60 b	1.39 f	2.21 c	3.99 e	11.19	3.68 c	18.29
5s	3.71 a	3.70 a	1.48 e	2.31 a	4.57 b	12.06	3.85 b	19.62
6	3.45 c	3.30 e	1.52 d	2.19 d	4.47 c	11.48	3.50 d	18.43
Mean	3.53	3.50	1.54	2.21	4.32	11.58	3.64	18.75

Suhail et al.: Predatory Efficacy, Coccinella septempunctata L., Aphis gossypii Glov., developmental period

References

- Ahmed, M., 1976. Effect of different insecticides on aphids and their predator, *Coccinella septempunctata* L. M.Sc. Thesis, University of Agriculture, Faisalabad, Pakistan.
- Akram, W., S. Akbar and A. Mehmood, 1996. Studies on the biology and predatory efficiency of *Coccinella septemuctata* L. with special reference to cabbage. Pak. Entomol., 18: 104-106.
- Atwal, A.S., 1996. Agricultural Pests of India and South East Asia. Kalyani Publishers, New Delhi, India.
- Bagal, S.R. and K.N. Trehan, 1945. Life history and bionomics of two predaceous and one *Mycophagous* species of *Coccinellidae*. J. Bombay Nat. History Soc., 45: 566-575.
- Debaraj, Y. and T.K. Singh, 1989. Predatory efficacy of the larval *Coccinella tranversalis* F. on the bean aphid. J. Aphidol., 3: 154-156.
- Ghalany, W.A., 1976. Studies on the predacious coccinellids of Lyallpur. M.Sc. Thesis, University of Agriculture, Faisalabad.
- Hafeez, A., 1986. Plant Diseases. PARC., Islamabad, Pakistan.
- Karpacheva, N.S., 1991. Ladybird beetle, *Zaschchita rastenii*. J. Econ. Entomol., 10: 34-35.
- Marizy, F.M.A., F.N. Zaki, G.M. Hegazy, A.G. Antounious and N.A. Frag, 1987. Effect of diflubenzuron on some biological aspects on the predator, *Coccinella undecimpunctata* L. (Coccinellidae, Coleoptera). Ann. Agric. Sci. Ain Shams Univ., 32: 1779-1789.

- Nozato, K. and T. Abe, 1988. Effects of predation of *Coccinella septempunctata* bruckii *Coleoptera coccinellidae* and temperature on seasonal changes of the survival rate of *Aphis gossypii Glover homoptera* aphididae population in the Warmer region of Japan. Jap. J. Applied Entomol. Zool., 32: 198-204.
- Perez, E.N., E.J.T. Morales and J.M.N. Nafria, 1992. Coccinellid (Col.: *Coccinellidae*) predators of aphids (Hom.: Aphididae) on cultivated plants in Leon. Bol. San. Veg. Plagas, 18: 765-775.
- Saharia, D., 1982. Field evaluation of some granular systemic insecticides on *Lipaphis erysimi* and its predator *C. repanda*. J. Res. Asam Agric. Univ., 2: 181-185.
- Southwood, T.R.E., 1966. Ecological Methods with Particular Reference to the Study of Insect Population. Melhuen and Co., London, UK., Pages: 225.
- Srivastava, A.S., R.R. Katiyar, K.D. Upadhycy and S.V. Singh, 1987. Studies on the food preference of *Coccinella septempuctata* (Coleoptera; Coccinellidae). Ind. J. Ent., 49: 551-552.
- Zhang, Y.J. and Y.S. Fang, 1983. Small scale rearing of *Coccinella septempunctata* L. and the efficacy of field release. Nat. En. Insect Kunchong Tiandi, 5: 7-99.