*J.Biol.Control,* 5 (2), 78-80, 1991

# Predatory Potential and Functional Response of the Introduced Ladybird Beetle, *Curinus coeruleus* Mulsant (Coleoptera : Coccinellidae)

J.DIRAVIAM* and C.A.VIRAKTAMATH

Department of Entomology, University of Agricultural Sciences, Bangalore - 560 065

**ABSTRACT**

**Predatory potential and functional response of the exotic coccinellid beetle, *Curinus coeruleus* Mulsant on the subabul psyllid, *Heteropsylla cubana* Crawford were studied in the laboratory. Predatory potential of the larval instars I to IV was 43.64, 83.71, 142.57 and 308.57 nymphs, respectively, whereas, the adult male fed on 4924.4 nymphs and female on 4510.0 nymphs. Functional responses of fourth instar larva, adult male and female on *H.cubana* were similar and showed positive linear response. The fourth instar larva, at a prey density of 20 and 100 nymphs, fed on 20 and 84.2 nymphs, respectively, whereas the adult male and female fed on 37.6 and 38.2 nymphs respectively, at a density of 40, while at a density of 200, the number of nymphs fed was 146.8 and 162.2, respectively.**

KEY WORDS : *Curinus coeruleus, Heteropsylla cubana* Predatory potential, Functional response

Ladybird beetles represent one of the most beneficial and recognizable groups of insects. The exotic coccinellid, *Curinus coeruleus* Mulsant, a shiny, bluish-black ladybird beetle, a native of Maxico is a voracious feeder of the subabul psyllid *Heteropsylla cubana* Crawford (Nakahara *et al.,* 1987). *C.coeruleus* was introduced from Thailand into India during October 1988 (Jalali and Singh, 1989), following the entry of *H.cubana* in February 1988 (Gopalan *et al.,* 1988). Earlier, studies on the predatory potential of *C.coeruleus* on *H.cubana* showed that the third instar larva consumed 225 first instar nymphs (Bahagiawati *et al.,* 1987) whereas, Irianti (1988) reported that first to third instar grubs and fourth instar grub to adult fed on 111 and 232 psyllid nymphs, respectively.

Since detailed studies on the predatory potential and functional response of *C.coeruleus* are lacking in India and elsewhere, the present investigation was made.

## MATERIALS AND METHODS

Twenty freshly emerged, first instar grubs were confined individually in Petri dishes (9.5 cm diameter). Two hundred late instar nymphs (*viz.,* fourth and fifth) of *H.cubana* alongwith the twigs were provided everyday until the emergence and death of the adult beetles. The Petri dishes were covered with mulin cloth, held in position using a rubber band. The Psyllids fed were counted the next day under a stereo-binocular microscope. The psyllids which were fed upon partially, could be recognised by their shrivelled appearance compared to the living and naturally died hosts. The dates of moulting into the next instar were recorded. The number of psyllid nymphs fed by different instar grubs was worked out by taking the mean of 14 individuals which reached the adult stage. The number of psyllids fed by the adults (male and female) was also worked out taking the mean of five adults of each sex. Tempera-

* Present Address : Dept.of Entomology, Tamil Nadu Agricultural University Coimbatore - 641 003

ture and humidity in the laboratory varied from 23°C to 27°C and 61 to 77% respectively, during the experiments.

Functional response of fourth instar grub was studied by taking the progeny of a single female. All the larvae used for the study were starved for 12 h. Predation was measured at prey densities of 20, 40, 60, 80 and 100 of fourth instar *H.cubana*. The fourth instar larvae of *C.coeruleus* were supplied with psyllid nymphs alongwith the subabul twig in 9.5 cm diameter plastic Petri plates covered with muslin cloth and secured with a rubber band. Similarly, seven day old adult males and females reared in the laboratory were taken and predation was measured at prey densities of 40, 80, 120, 160 and 200 separately. Observations were made 24 hr after the commencement of the experiment. There were five replications for each stage, sex and prey density. Functional response data were subjected to regression analysis.

## RESULTS AND DISCUSSION

Freshly emerged first instar larvae remained motionless for 1 to 2 h and later dispersed in search of prey. Larvae moved in a circular path or wide loops inside the Petri plate before feeding. The prey was captured by the predator larva only after actual contact with it. Just after feeding, the larva changed its searching pattern from an extensive to an intensive one, by making frequent turns and slowing its speed. This behaviour continued for a period of 1-2 minutes, and if it did not succeed in finding a prey, the larva once again moved in a circular path. The first and second instar larvae fed on the prey by sucking the body juice while the adults fed on only a part of the psyllid's body (usually the abdomen) and then moved on to another psyllid.

There was an increase in feeding rate from first instar larva to fourth instar larva. The number of psyllid nymphs fed by first to fourth instar larvae varied from 22 to 63, 56 to 112, 94 to 180 and 258 to 365 psyllids, respectively (Table 1). Adult male fed on 4738 to 5306 psyllids, whereas, a female fed on 3953 to 5132 psyllids. Mean psyllid nymphs fed per day by first to fourth instar larvae, adult male and female were 9.36, 30.87, 35.75, 43.53, 41.03 and 41.30 respectively. The present findings are in agreement with that of Irianti (1988).

**Table 1. Feeding potential of *Curinus coeruleus* on *Heteropsylla cubana* nymphs**

| Stage | Number of psyllids fed ± S.D | |
|---|---|---|
| | Per stage | Per day |
| Grub | | |
| I instar | 43.64 ± 14.25 | 9.36 ± 2.19 |
| II instar | 83.71 ± 13.71 | 30.87 ± 7.98 |
| III instar | 142.57 ± 26.84 | 35.75 ± 6.45 |
| IV instar | 308.57 ± 27.56 | 43.53 ± 4.3 |
| I-IV instar | 578.50 ± 40.28 | 31.11 ± 1.91 |
| Adult | | |
| Male | 4924.4 ± 223.16 | 41.03 ± 1.37 |
| Female | 4510.0 ± 526.86 | 41.30 ± 3.96 |

Functional response is the change in feeding rate of a predator for a corresponding change in prey density. The number of psyllid nymphs fed by fourth instar grub, adult female and male increased with the increasing density of psyllid prey (Fig. 1). The mean number of psyllid nymphs fed by the fourth instar larva at the densities 20, 40, 60, 80 and 100 were 20.0, 38.8, 57.6, 73.8 and 84.2, respectively. While adult female at the prey densities of 40, 80, 120, 160 and 200 fed on 38.2, 69.4, 96.4, 129.0 and 162.2 psyllid nymphs, respectively, the adult male fed on 37.6, 71.2, 91.6, 125.8 and 146.8 psyllid nymphs at the prey densities of 40, 60, 120, 160 and 200 psyllid nymphs, respectively.

Regression analysis showed a linear relationship between the prey density and the number of psyllid nymphs fed for all the stages tested. This type of response is a Type I functional response (Holling, 1959). This is true in this case, as the density of prey increased, the proportion of an individual prey consumed decreased and more number of prey were fed partially. This phenomenon was also reported by Mogi (1969) for *Harmonia axyridis* Pallas on *Aphis craccivora* Koch.

Hence, *C.coeruleus* with a high predatory potential and linear functional response can be an efficient predator for reducing the pest population by feeding on more number of indiviauals whenever there is an outbreak of the psyllid population. However, detailed studies on predator-prey interactions will pave way for better management of this pest.

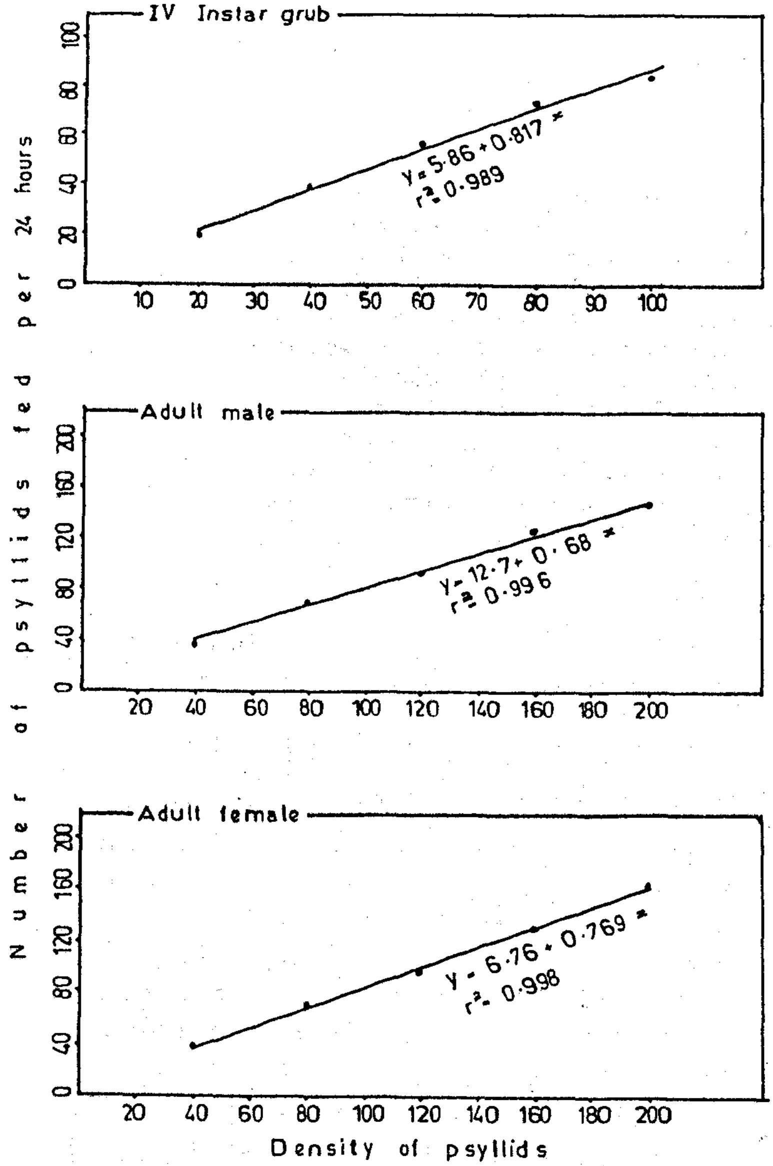


**Fig. 1. Functional response of *C. coeruleus* on *H. cubana***

## REFERENCES :

BAHAGIAWATI,A.H., KAMANDALU,A.A.N.B. and SUASTIKA,I.B. 1987. Potensi daya memangsa predator *Curinus coeruleus* Mulsant terhadap hamakutu loncat lamtoro, *Heteropsylla* spp. (Hom. : Psyllidae). *Balai Penelitian Tanaman Pangan Bogor*. 8 hal (Unpublished ).

GOPALAN,M., JAYARAJ,S., ARIAVANAM,M., PILLAI,K. and SUBBA RAO,P.V. 1988. New record of *Heteropsylla cubana* Crawford (Psyllidae : Homoptera) on soo-babul *Leucaena leucocephala* (Lam.) de Wit in India. *Curr. Sci.*, **57**, 1124-1125.

HOLLING,C.S. 1959. Some characteristics of simple types of predation and parasitism. *Can. Ent.*, **91**, 395-398.

IRIANTI,A.T.P. 1988. Bionomi *C.coeruleus* Mulsant dilaboratorium. *Thesis*. Faculty of Agriculture, Univ. Gadjah Mada, Yogyakarta. 53p. (Unpublished).

JALALI,S.K. and SINGH,S.P. 1989. Release and recovery of an exotic coccinellid predator, *Curinus coeruleus* (Muls.) on subabul psyllid, *Heteropsylla cubana* Crawf. in India. *J. Insect Sci.*, **2**, 158- 159.

MOGI,M. 1969. Predation response of the larvae of *Harmonia axyridis* Pallas (Coccinellidae) to the different prey density. *Jap. J.appl. Ent. Zool.*, 13,9-16.

NAKAHARA,L., NAGAMINE,W., MATAYOSHI,S and KUMASHIRO,B. 1987. Biological control program on the leucaena psyllid, *Heteropsylla cubana* Crawford (Homoptera : Psyllidae) in Hawaii. *Leucaena Res. Rpt.*,**7**, 39-44.