Predation rates of *Coccinella septumpunctata* Linnaeus and *Chilocorus infernlais* Mulsant on aphids

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The functional response of the *Coccinella septumpunctata* Linnaeus and *Chilocorus infernalis* Mulsant to increase the predatory potential of aphids and numerical response with fixed density of prey (aphids) and increasing densities of *C. septumpuctata* and *C. infernalis* were examined. The functional response curve having a curvilinear rise to plateau as prey densities increased from 1 to 64 and curve predicted by the Holling disk equation did not differ significantly from the observed functional response curve. The rate of successful search and the handling time predicted by disk equation were 0.0566 and 1.473 in case of *C. septumpuctata* and 0.0602 and 2.833 in case of *C. infernalis*, respectively. The numerical response having a linear rise to a plateau as aphid density fixed (20) with varying densities of *C. septumpuctata* and *C. infernalis* from 1to7. this response is consist with the view the *Coccinellids* as a group was involved under condition of food limitation and rate of attack was also decrease with interference of other C*occinellids.*

Key word : *Coccinella septumpunctata, Chilocorus infernalis*, Functional response, Numerical response and Aphid.

INTRODUCTION

Around the world about 420 genera and 5500 species of *Coccinellids* have been recorded, while In India, 401 species belonging to 79 genera have been recorded so for (Poorani, 2002). Worldwide, these have 155 attempts to control aphids by introducing ladybirds (Joshi *et al.*, 2003). The out come of these attempts indicate that effectiveness of aphidophagous ladybird beetles (Dixon and Kindlmann.1998).

The ladybird beetle, *Coccinella septumpunctata* Linnaeus and *Chilocorus infernalis* Mulsant is natural predator of the aphids in Kashmir. During the month of June-July this beetle reached high population level which aided significantly in reducing aphid infestations. Hence, as prey population increase in numbers, the predation pressure exerted on them must increases well. The reverse is also true: predator pressure should relax with decreases in prey populations' increase in numbers. Thus, the greater the importance of a given prey to the diet of the predator, the lower the population size at which the predator will effect control (Huffaker and Messenger, 1964). Density-dependent predation is affected by two characteristics of the predator: (i) Feeding behaviour (the functional response) and (ii) Densities (the numerical response) (Huffaker *et al.*, 1971). A response has three essential components: the exposure of preys to predators, instantaneous attack rate and the handling time required for each prey (Hassell *et al.*, 1976, Holling, 1959). This paper presents the predation rate of (functional and numerical response) of *Coccinellids* on aphids.

MATERIALS AND METHODS

The response of *Coccinella septumpunctata* Linnaeus and *Chilocorus infernalis* Mulsant adults exposed to aphids were assessed in the laboratory (60-80% humidity, 17—29^{0}C temperature). The *Coccinellids* captured from fields and starved for two days. The aphids were collected from Eunonymous hedge and maintained culture in cage (25x25x25 cm) for experiments. Twenty four hour before the experiments, aphids were introduced in separate cage. The functional response was evaluated at densities of 1,2,4,8,16,32,64 aphids per predator per cage and numerical response was evaluated at fixed densities 20 aphids with varying densities of predators was 1,2,3,4,5,6,7 per cage. The experiment lasted for 24 hrs for each three replication.

The differences in the two response curves are possibility related to the substrates on which the experiments were preformed. Holling's disk equation (Holling, 1959, 1965, 1966, Hassell *et al.*, 1976) for type II functional response can be written as

$$Na = aT_t \, N/1 + a \, Th \, N \text{.........................[1]}$$

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Where, Na = the number of prey consumed/ predator
a = the rate of successful search
N = the density of prey
Tt = the handling time of each prey and
Th = the total time prey and predator are exposed to each other

RESULTS AND DISCUSSION

The functional response of Coccinellids (*Coccinella septumpunctata* Linnaeus and *Chilocorus infernalis* Mulsant) to prey densities form 1 to 64 aphids is shown in Fig. 1 and 2. The response curve rises curvilinearly to plateau characteristics of a type II functional response curve (Holling, 1965). Hassel *et al.*, (1976) also reported type II curves for *P. persimilis* using different stage of *T. urticae*. Similar predation response of *Coccinella septumpunctata* and *Menochilus sexmaculata* on five species of aphids was reported by Anand (1983). The type II curve reported here differs from the Holling type I and III functional response equations because it is dome-shaped curve functional response (Takafuji and Chant, 1976). The difference in the two response curves is possibly related to the substrates on which the experiments were performed.

The constants 'a' and 'Tt' were estimated by a method given by Holling (1959). To improve the estimates, these constants were placed in an iterative nonlinear-least squares computer programme (R-software). The improved estimates of a, Th and R^2 were 0.0566, 1.473 and 0.7228 in case of *Coccinella septumpunctata* and 0.0602, 2.833 and 0.6478 in case of *Chilocorus infernalis* , respectively. The predicted [1] and observed values of both *Coccinellids* functional response shown in Fig.1 and 2 did not differ significantly (X^2 p= 0.01). The handling time of *Coccinella septumpunctata* and *Chilocorus infernalis* includes the time spent pursuing eating and digesting the aphids (Hassell et al., 1976). Handling time (Th/Ttx100 %) was approximately 6% of the total time available to *Coccinella septumpunctata* and 12% in case of *Chilocorus infernalis*. Temperature during the dark period of this experiment dropped to 17 ^{0}C that would have a marked effect on the number of aphid consumptions by *Coccinellids* decreased with temperature (Pruszynski, 1976).

The numerical response with fixed prey density of 20 aphids with varied densities of *Coccinellds* 1 to 7 is shown in Fig. 3 and 4. The response having linear rise to the plateau (Holling 1965) as the form that attacked behaviour should take for density dependent predations to occur. Specially, if the equilibrium populations of aphids fall with in the accelerating phase of the linear response then this type of response is density dependent contributing to the stability of the predator prey interaction? Hassell (1978) showed that the numerical response procedures generally in predation and reproduction. Alternate ways of obtaining a total sigmoid response between prey that is captured by predators (Na) and prey density (N). The total response curve may be obtained by combining either functional response (Fig. 1

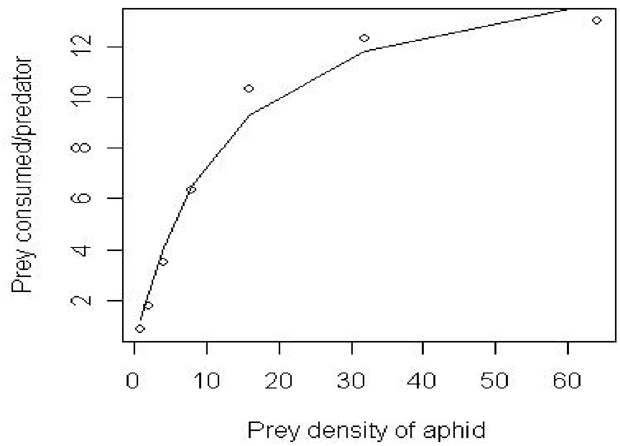

Fig.1: The functional response of adult *Coccinella septumpunctata* Linnaeus (Mean ± SE) to increasing densities of aphids over 24 hrs period. The equation of the solid line is given by disk equation, Na= 14.88N/1+2N, where, N is the density of prey (aphids) and Na in the number of prey consumed. The dots represent the mean of 3 replication.

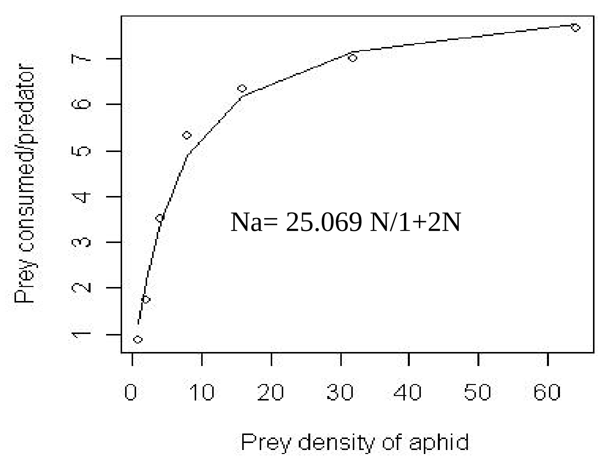

Fig.2 : The functional response of adult *Chilocorus infernalis* Mulsant (Mean ± SE) to increasing densities of aphids over 24 hrs period. The equation of the solid line is given by disk equation, Na= 25.069 N/1+2N, where, N is the density of prey (aphids) and Na in the number of prey consumed. The dots represent the mean of 3 replication.

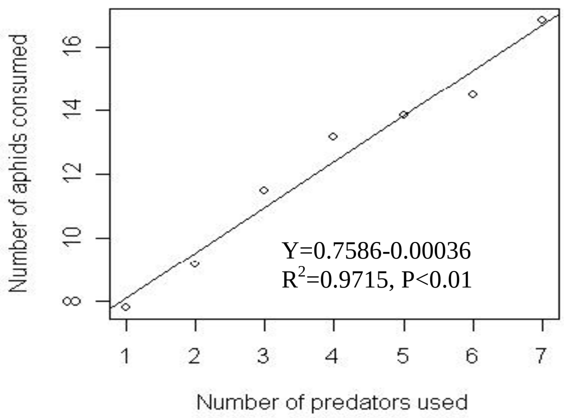

Fig.3 : The numerical response of varying densities of adult *Coccinella septumpunctata* Linnaeus (Mean ± SE) to fixed density of aphid (20) over 24 hrs period. The equation of solid line is given by Linear equation reg.lml,lm(Na~P), where, P is varying number of prey consumed. The dots represent the mean of 3 Replication.

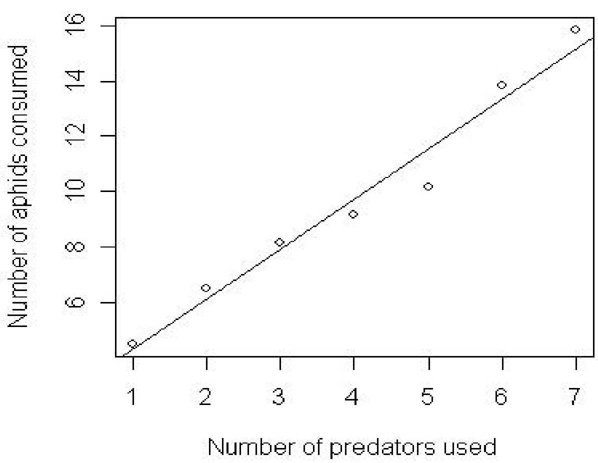

Fig. 4 : The numerical response of varying densities of adult *Chilocorus infernalis* Mulsant (Mean ± SE) to fixed density of aphid (20) over 24 hrs period. The equation of solid line is given by Linear equation reg.lml, lm Na~P), where, P is varying number of prey consumed. The dots represent the mean of 3 Replication.

and 2) with numerical response (Fig.3 and 4), respectively. It should also be obtained by functional response (Hassell and Comins, 1978).

We conclude that a curvilinear functional response curve occur in the interaction between adult *Coccinellids* and aphids. The numerical response having linear rise to plateau and consist with under condition of food limitation and rate of successful search is also in decrease with hindrance of other *Coccinellids.*

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