

Host Parasitoid Density Response to Fecundity of *Chelonus blackburni* Cam.

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For the optimum utilization of the parasitoid, *Chelonus blackburni* Cam. on *Corcyra cephalonica* Stnt. eggs, the host parasitoid ratio was 150 : 1 and the three parasitoids per 150 host eggs resulted in the best utilization of host *C. cephalonica* under laboratory condition.

Key Words: Host parasitoid density response; Fecundity searching efficiency;
Chelonus

Introduction

A density relationship exists between the hosts and their parasitoids and this is one of the major factors for the pest parasitoid equilibrium in nature. The best utilization of a parasitoid lies in its ability to distribute offsprings in a maximum number of host individuals. The density relationship at a particular place also decides the tapping of the reproductive potential of the parasitoid and the host selection or searching process. This sort of density dependence is proved in many parasitoids. The individual insect parasitoid showed an inverse density-dependent mortality Holling (1961). Kuno (1962) reported a density-dependent rise in the reproduction of *Trichogramma japonicum* Ashm. with the eggs of *Ephestia*. *Chelonus blackburni* Cam.

(Braconidae; Hymenoptera) is a solitary, endo, egg-larval parasitoid that attacks all the three bollworms (*Heliothis armigera* H., *Earias vitella* F. and *Pectinophora gossypiella* S.) of cotton and a variety of economic important pests of many crops. Its uniparental nature is considered as an added advantage in its quality as a bio-control agent.

Corcyra cephalonica Stnt. is used as a suitable host in the laboratory to multiply *C. blackburni* (Swamiappan & Balasubramanian 1980). About 900 eggs have been observed as the productive capacity of the *C. blackburni* (Jackson et al. 1978 and Manoharan 1980). This study attempts at finding out the optimum parasitoid and host-density levels.

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Materials and Methods

To study the effect of host density on the parasitoid-utilization, a series of 20, 40, 60, 80, 100, 150 and 200 *Corcyra* eggs were glued on cardboard strips (2.5 × 5 cm) in rows and exposed to a single, one-day old parasitoid adult in specimen tubes (2.5 × 10 cm). Based on experiment result, another study was conducted to study the effective number of host eggs utilised in individual specimen tubes (2.5 × 10 cm), one hundred and fifty eggs of *Corcyra* were exposed to a series of 1, 2, 3, 4, 5 and 6 parasitoid density levels per tube. In both the experiments, after 24 hr of exposure, the host eggs were stained with lactophenol by slight heating and were dissected out to find out the number of parasitoid eggs deposited inside. Three replicates were prepared.

Study with different host densities was conducted in summer 1979 (table 1) whereas study on parasitoid density was conducted in winter 1979 (table 2). The results are expressed in terms of frequency distribution of progenies, the total hosts utilised total parasitoid eggs laid, mean parasitoid eggs per host utilised and the percentage utilisation of parasitoid eggs.

Results and Discussion

The distribution of progenies by single female *C. blackburni* at different host levels had indicated that the mean parasitoid eggs deposited on host egg was 1.23 at 150 eggs level indicating the better distribution of progeny (table 1). The utilization of parasitoid eggs laid was also maximum (81.24 per cent) at that level. As the number of host eggs increased, the distribution of parasitoid progeny in single egg also was

more. This was evident as there were up to 14 parasitoid eggs found inside a single host egg when the host level was 20 eggs. Paul et al. (1980) had observed zero emergence of *C. blackburni* at 1 and 5 host density levels. Superparasitism by *C. blackburni* might have killed the host at the egg stage itself (Jackson et al. 1978). Super parasitism was already reported due to less number of host eggs availability (Kajita 1970). There was always a functional response between the host utilised by the parasitoid and its host density. The lesser the parasitoid eggs deposited in each host egg, the more will be the host utilization. Paul et al. (1980) had tested only up to 90 eggs and reported 90 eggs as the optimal number. In the present study host density was varied up to 200 eggs and found that 150 eggs level was the optimum level.

But varying parasitoid density at constant (150 eggs) level the percentage of host utilised was maximum at three parasitoid level (93.3 per cent) even though the distribution of parasitoid eggs was slightly higher than the single parasitoid level (table 2). Similar observations were made in *C. texanus* and *Parasierola nephantidis* (Mues) (Ulleyett 1949 and Sundaramoorthy Santhanakrishnan 1979). Before egg laying, the parasitoid probed the host eggs with its antennae by going around the eggs and tapping over it. If it is already parasitoided it is used to move to the next one. But it is also observed that the parasitoid sometimes waste the eggs by laying outside the host egg. As the number of parasitoid increased the number of eggs deposited in a single egg also increased, thereby leading to a wastage of the parasitoid eggs. The reason for such behaviour might be due to the decrease

Table 1 Frequency distribution of progenies by single *C. blackburni* female at different levels of host density

Frequency of parasitoid egg deposition	Host density*						
	20	40	60	80	100	150	200
1	0.00	3.33	4.67	10.00	31.00	76.00	77.33
2	0.67	3.00	6.00	10.67	21.67	20.67	28.33
3	1.00	3.33	6.33	15.67	13.33	4.33	4.00
4	1.33	3.00	12.00	17.33	3.33	0.00	0.00
5	0.67	5.67	9.33	13.67	1.00	0.00	0.00
6	0.33	4.33	6.67	1.00	0.00	0.00	0.00
7	0.67	4.33	5.00	0.67	0.00	0.00	0.00
8	2.00	6.33	4.00	1.67	0.00	0.00	0.00
9	1.33	4.00	2.67	0.00	0.00	0.00	0.00
10	1.67	2.33	0.67	0.00	0.00	0.00	0.00
11	3.00	0.00	0.00	0.00	0.00	0.00	0.00
12	4.00	0.00	0.00	0.00	0.00	0.00	0.00
13	2.00	0.00	0.00	0.00	0.00	0.00	0.00
14	1.33	0.00	0.00	0.00	0.00	0.00	0.00
II Total hosts utilised	20.00	39.67	57.33	70.67	70.33	101.00	109.00
III Percentage of host utilised	100.00	99.18	95.55	88.34	70.33	67.33	54.50
IV Total parasitoid eggs deposited	190.00	226.00	268.00	240.00	132.67	124.33	143.00
V Mean parasitoid eggs/host egg	9.50	5.70	4.67	3.40	1.89	1.23	1.33
VI Percentage of parasitoid eggs utilised	10.53	17.50	21.39	29.44	53.02	81.25	75.11

*(Mean of three observations)

Table 2 Frequency distribution of *C. blackburni* eggs with varying parasitoid density per unit area

Frequency of parasitoid egg deposition	Parasitoid density*					
	1	2	3	4	5	6
1	50.33	59.67	80.67	61.00	55.67	44.33
2	19.67	24.67	35.33	37.67	38.00	31.33
3	1.67	7.67	18.33	20.00	20.00	20.66
4	0.00	1.00	5.67	10.67	11.00	12.00
5	0.00	0.00	0.00	2.33	3.67	2.33
6	0.00	0.00	0.00	0.00	1.00	1.67
7	0.00	0.00	0.00	0.00	0.00	1.00
II Total host eggs utilised	67.67	92.71	140.00	131.67	129.34	113.32
III Total parasitoid eggs laid	86.68	136.02	229.00	250.67	260.02	245.64
IV Mean parasitoid egg/host utilised	1.28	1.47	1.64	1.90	2.02	2.17
V Percentage of host utilised	45.11	61.80	93.30	87.78	86.23	75.56

*(Mean of three observations)

in searching efficiency of natural enemies with the increase in the density of searching adults (Watt 1959). However, behavioural aspects in respect of searching efficiency of *C. blackburni* need further study.

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