REPRODUCTIVE STRATEGY OF THE PARASITIC WASP *BRACON HEBETOR* (SAY) (HYMENOPTERA: BRACONIDAE) ON THE RICE MOTH *CORCYRA CEPHALONICA* (STAINT.)

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ABSTRACT

The reproductive strategy of the parasitic wasp Bracon hebetor *(Say) on the larvae of the rice moth* Corcyra cephalonica *(Staint.) was studied under laboratory conditions.* B. hebetor *has a developmental period of about 10 days. A single female* B. hebetor *attacked and killed when offered 5, 10 or 20 host larvae at a time, before oviposition. The sex-ratio (♂: ♀) of the F1 was effected (3.7:1, 3.0:1, 2.9:1). The possibility of using* B. hebetor *to suppress populations of* C. cephalonica *is discussed.*

Keywords: Bracon hebetor, Corcyra cephalonica, *oviposition, developmental period, sex-ratio suppression.*

INTRODUCTION

Bracon hebetor (Say) is a cosmopolitan parasitic wasp attacking many species of stored product moth hosts (Press *et al.* 1981). Various workers have studied the effectiveness of *B. hebetor* as a bio-control agent and its interaction with stored product pyralids such as *Ephestia cautella* (Wlk.), *Plodia interpunctella* (Hubn) and *Cadra cautella* (Wlk.) (Benson 1974; Press *et al.* 1974); Reinert and King 1971; Hagstrum and Smittle 1977, 1978; Press *et al.* 1981, 1982; Ahmed *et al.* 1982; Cline *et al.* 1984). Little has been published on its effect on the rice moth. *Corcyra cephalonica* (Staint.) which is currently one of the most destructive pyralid moth pest of stored products in the tropics and in some cases out-competes *E. cautella* (Allotey and Kumar 1985; Allotey 1986 and 1989). The purpose of the present study was to determine the reproductive strategy of *B. hebetor* on *C. cephalonica* with respect to progeny and sex ratio (sex allocation) as well as other developmental parameters of the parasitoid.

MATERIALS AND METHODS

Laboratory cultures of *C. cephalonica* on cut groundnuts were maintained in the entomology laboratory of the Department of Biological Sciences, River State University of Science and Technology, Port Harcourt, Nigeria. Late instar larvae of *C. cephalonica* were used as hosts in cultures of *B. hebetor* under the same environmental conditions. One male and one female of newly emerged *B. hebetor* (less than 24 hr-old) were placed in each of 20 glass vials (2.5 cm diameter, 7.6 cm long). Each vial contained five half-cut groundnut kernels and late instar larvae of *C. cephalonica*, with 5, 10 or 20 larvae per vial. In all there were 20 replications for each category (i.e. per 5, 10 and 20 larvae). Controls were set up with *C. cephalonica* in the vials but without *B. hebetor*. The vials were covered with a muslin cloth held in place with a rubber band and kept at 30 ± 2 °C and 76.5 ± 4 % r.h. with alternating 24 hr light and 24 hr dark cycle. After 8 - 10 days, the contents of the vials were examined and the number of F1 *B. hebetor* recorded together with the number of parasitised host larvae.

RESULTS AND DISCUSSIONS

Table 1 shows the summary of the reproductive strategy of *B. hebetor* on the host *C. cephalonica*. Female *B. hebetor* attacks the late instar larvae of *C. cephalonica* by stinging them several times. Thereafter *B. hebetor* oviposited on the paralysed larvae. In most cases the number of cocoons of the parasitoid per vial were greater than the number of emerged F1 progeny. This situation could be due to natural death at the pupal stages. The life cycle of the parasitoid was completed in about 10 days (Table 1). The results presented in Table 1 show that the sex-ratio (♂: ♀) decreased (3.71:1; 3.0:1

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Table 1: *Summary of the results of the reproductive strategies of* B. hebetor *on* C. cephalonica.

Experimental set-up	*C. cephalonica* larvae per replicate					
	5 larvae		10 larvae		20 larvae	
Proportion of individuals per F_1 generation of *B. hebetor*	F. generation of *B. hebetor*					
	♂ (n=20)	♀	♂ *(n=11)	♀	♂ *(n=15)	♀
(Mean) x	15.95	4.3	28.18	9.27	30.9	10.53
S	16.67	5.45	8.86	6.57	15.28	15.37
(Total) Σx	319	86	310	102	464	158
Σx^2	10367	934	9522	1378	17622	4970
S.E.	3.73	1.22	2.67	1.98	3.95	3.97
(Sex ratio) ♂: ♀	3.71:1		3.0:1		2.9:1	
Date set	17/3/88		25/3/88		29/3/88	
Date of first emergence	25/3/88		2/4/88		6/4/88	
Range of emergence	25/3 - 26/3		2/4 - 3/4		6/4 - 7/4	
Dev. Period (days)	9-10		9-10		9-10	
N = 20						

N = Number of replicates

n = Actual number of replicates used in statistical analysis

* Where some F_1 parasitoids escaped, such vials were not included in statistical analysis, but cocoons in such vials were counted and significance is explained in the text.

and 2.9:1) with increasing number of host larvae per vial. *B. hebetor* has been reported to parasitize the late stage larvae of stored product moths and can effect significant natural control of moth populations (Benson 1973; Press *et al.* 1981). Reinert and King (1971) on the basis of laboratory studies reported that mortality of the moth population (*P. interpunctella*) was a logistic function of the number of female *B. hebetor* present and that *B. hebetor* decreased the moth population by 97%. Kamin-Belsky *et al.* (1986) noted that *B. hebetor* in laboratory studies reduced the moth population size to extinction.

Press *et al.* (1977) reported that *B. hebetor* paralyses more host larvae than it actually parasitizes. As mentioned earlier, the life cycle of *B. hebetor* in the present study was about 10 days. Anonymous (1979) gave the life cycle of *B. hebetor* as about 2 weeks. Under favourable condition *B. hebetor* develops from egg to adult in less than 2 weeks (Anonymous 1979; Press *et al.* 1981). The life history of *B. hebetor* has been studied by Morrill (1942).

Considering the short developmental period of *B. hebetor* (about 10 days) on *C. cephalonica* and the known mean developmental periods of 35.5 and 38 days for *C. cephalonica* reared on maize and groundnut (Allotey 1990) it is possible for *B. hebetor* to complete at least two or even three generations of *C. cephalonia* infesting maize or groundnuts in West Africa. Press *et al.* (1981) suggest that *B. hebetor* would quickly increase in number in alarge population of *E. cautella* and that the numbers of hosts killed per parasite would also increase. In the present study not only did mortality increase with increasing host larvae per female *B. hebetor* but also the sex-ratio was affected by the increasing host larvae. Thus with limited host resource (5 larvae), more males were produced compared to the number of females (almost 4:1), however with increase in host resource (20 larvae), the sex-ratios changed as the number of males produced were found to be reduced (2.9:1). Therefore the sex-ratios in favour of females with the provision of more host larvae. According to Waage and Ming (1984) natural selection acts to produce a strategy of progeny and sex allocation which maximizes fitness. Thus increasing female populations of *B. hebetor* will lead to more host larvae being attacked.

Present studies therefore suggest that *B. hebetor* can be used to suppress populations of *C. cephalonica*, with the added advantage that the sex-ratio of the parasite tends to shift in favour of the female parasitoid with the increasing host population.

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