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Effect of host diet on life table statistics of *Bracon hebtor* Say (Hymenoptera: Braconidae)

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ABSTRACT: **Experiments were conducted to investigate the effect of different host diets on the life table statistics of *Bracon hebetor* Say, a gregarious ectoparasitoid. The progeny sex ratio was female biased when host diet was maize or wheat. The net fecundity rate (R_o) and total fecundity rate (R_t) were highest on host diet wheat followed by maize, jowar and rice. The innate capacity for increase in number (r_c), the intrinsic rate of increase (r_m), the finite rate of increase (λ_m) and weekly multiplication rate (r_w) were highest on host diet wheat followed by maize, jowar and rice. The doubling time (DT) was shorter on wheat than maize, jowar and rice showing an inverse ratio to r_m and r_w. On the basis of life table statistics of *B. hebetor*, the diets of its host *Corcyra cephalonica* can be placed in order of their suitability for parasitoid population growth as: wheat > maize > jowar > rice.**

KEY WORDS: *Bracon hebetor*, host diet, life table, parasitoid

INTRODUCTION

Bracon hebetor Say is a minute gregarious ectoparasiotid of several lepidopterans (Gerling, 1969). The effect of the host on the dynamics of the parasitoid is equally important to the ability of the parasitoid to find the host affecting host population. It has been reported that quantity and quality of the natural nutrients of host affect developmental time, adult size, longevity, fecundity and sex ratio in progeny of the parasitoid (Tillman & Cate, 1993). Because the importance of host feeding and natural food supplied to parasitoid by host species is related to host-parasitoid interactions for biological control applications, the success rate is closely related to how much we know about them. Therefore, in this study, adult longevity, sex ratio and different life table parameters of *B. hebetor*, a minute gregarious ectoparasite of several lepidopterans (Gerling, 1969), were compared when its host *Corcyra cephalonica* (Stainton) was reared on different natural diets.

MATERIAL AND METHODS

The rearing technique for the *C. cephalonica* and *B. hebetor*, described herein, is a minor modification of the technique followed by Pathak *et al.* (1993) and Antolin & Strand (1992), respectively. To maintain the mass culture of rice moth, its eggs were kept with coarsely ground jowar (*Sorghum vulgare* Pers.) seeds in large plastic containers (45 x 25 x 15 cm). After adult emergence, equal number of males and females were paired in a

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beaker (250 ml) covered with a black muslin cloth. The eggs were collected from the beaker and were again placed with fresh nutrients. Full-grown larvae from this culture were taken to feed and rear the parasitoid.

For the culture of *B. hebetor*, one male and one female insect were paired in a beaker (250 ml) covered with a fine muslin cloth. The adults were provided 30 per cent honey solution as food and 10 full grown 5th instar larvae of rice moth were placed in beaker for parasitization. The parasitized larvae were kept for further development of wasp. To avoid any carry over effect, adults were utilized for experiments only after third generation

To see the host diet-parasitoid relationship, ten full-grown larvae of *C. cephalonica* developed on rice, sorghum, maize and wheat were kept separately with a freshly emerged pair (1♂ & 1) of *B. hebetor* inside a glass chamber (7 cm diam; 10 cm ht) covered with fine muslin cloth. The adult's wasps were provided 30 per cent honey solution through a cotton swab. The reproductive chamber having host larvae and moist cotton was daily changed till the end of the egg laying of *B. hebetor* female. The number and age of the male and female parasitoid emerged from each day eggs were observed. Five replicates were arranged with each natural diet at 27 ± 2° C, 70 per cent relative humidity and 12 h L: D and any replicate showing only male progenies was not considered as a result.

Life table parameters like innate capacity for increase in number ($r_c = \log e\ R_o/T_c$, where R_o = net fecundity rate and T_c = mean generation time), the finite rate of increase ($\lambda_m = \exp^{rm}$), weekly multiplication rate ($r_w = l_m^7$) and doubling time (DT = ln $2/\lambda_m$) were calculated from life tablets (Birch 1948) of insect for different for different host diets. The arbitrary $r_m = r_c$ was corrected graphically using values of r_m in the Lotka – Euler equation (Andrewartha and Birch, 1954):

$$\Sigma\, l_x m_x . \exp^{(-rmx)} = 1$$

The data were subjected to F-test and LSD (Least Significant Difference) – test (Snedecor & Cochran, 1967) for interpretation.

RESULT AND DISCUSSION

Majority of *B. hebetor* males showed a shorter life than females and no significant difference in the female longevity was noticed on using different host diets. Significant effect of quality of host diet on female longevity in *Apanteles galleriae* (Hymenoptera: Braconidae), a koinobiont, solitary and early instar larval endoparasitoid of lepidopterous species may be attributed to its peculiar or different nature of parasitism and degree of difference in host diets.

The progeny sex ratio (proportion of males in the population) of the parasitoid was affected significantly by variation in host diet ($F = 4.61$, $P<0.025$). LSD – test shows significantly higher proportions of males in the progeny of the parasitoid developed on jowar fed *C. cephalonica* larvae than those maintained on maize fed or wheat fed host larvae and getting an equal opportunity of mating (Table 1). Observation on ratio of males in progeny suggest possible effect of host larval nutrition on sex ratio as on life expectancy and adult ♀ emergence described by Radhika and Chitra (1998) and Werren (1984).

The net fecundity rate (R_o) and total fecundity rate (R_t) of *B. hebetor* were highest in experimental regimes where hosts were reared on wheat. A significant statistical difference was noticed between net fecundity rates ($F = 18.17$, $P<0.001$) and total fecundity rates ($F=4.86$, $P<0.025$) calculated for different host diets. Significantly higher value of R_o for wheat shows its nutritional superiority as a host diet over maize, jowar and rice (Table 1).

The innate capacity for increase in number (r_c) of the parasitoid was highest when its hosts were reared on wheat followed by maize, jowar and rice. Similarly, the intrinsic rate of increase (r_m) which is an "Index of fitness" for an entomophagous insect, finite rate of increase (λ_m), weekly multiplication rate (r_w) and doubling time (DT) varied effect varied effectively when host larvae were reared on different diets (Table 2). Kumar *et al.* (1988) demonstrated the parasitoid – host inter –

TABLE 1. Effect of host diet on net fecundity rate (R_o), total fecundity rate (R_t) and sex ratio of *B. hebetor*

Host diet	Mean ± SE number of female offspring/ female	Mean ± SE number of total offspring/ female	Sex –ratio
Wheat	$23.4^{a} \pm 1.56$	$40.6^{a} \pm 5.37$	$0.40^{a} \pm 0.04$
Maize	$15.6^{b} \pm 1.96$	$28.0^{ab} \pm 3.10$	$0.44^{a} \pm 0.04$
Jowar	$10.2^{c} \pm 2.10$	$27.4^{ab} \pm 6.83$	$0.61^{b} + 0.03$
Rice	$6.6^{c} \pm 1.10$	$14.6^{b} \pm 2.71$	$0.52^{ab} \pm 0.05$
LSD (5%) (1%)	5.10 7.04	14.44 19.89	0.13 0.18

Means with same alphabet in a column do not differ significantly at 5% level of significance.

TABLE 2. The effect of host diet on different life table parameters of *B. hebetor*

Parameter	Host diet			
	Wheat	Maize	Jowar	Rice
Innate capacity for increase (r_c)	0.2075	0.1830	0.1495	0.1266
Corrected intrinsic rate of increase (r_m)	0.21078	0.18560	0.15137	0.12750
Finite rate of increase (λ_m)	1.2346	1.2039	1.1634	1.1360
Weekly multiplication rate (r_w)	4.2730	3.6655	2.8847	2.4415
Doubling time (DT)	3.29	3.73	4.58	5.44

relationship in *Trioxys indicus* (Hymenoptera: Aphidiidae), though a taxonomically different species, and also noticed behavioural change in parasitoid when its host was reared on different diets. In present study, like Radhika and Chitra (1997), there is a significant effect of host diet on the life table statistics of *B. hebetor*. Presumably, qualitative and quantitative differences in the Chemical composition and physical characteristics of the host diets are responsible to bring about such a significant difference between the life table indices, which are indicator of the population growth.

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