

## Influence of different diets on intrinsic rate of natural increase ( $r_m$ ) of *Bracon hebetor*. say (hymenoptera: braconidae) reared on *Corcyra cephalonica*. stainton (lepidoptera: pyralidae)

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### ABSTRACT

The effect of different host diets on the Intrinsic rate of natural Increase ( $r_m$ ) of *Bracon hebetor* was observed and calculated. The experiments were conducted by supplying host with four types of natural diets. All experiments related to the effect of diets were conducted at  $27 \pm 2^\circ\text{C}$ , 70% relative humidity and 12h L:D photoperiod. The fecundity, innate capacity of increase in number and intrinsic rate of natural increase were highest when host larvae were reared on wheat when compared to 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 *Bracon hebetor*, wheat and maize are the most suitable diets of its host *Corcyra cephalonica*

**KEYWORDS:** *Bracon hebetor*, *Corcyra cephalonica*, Host diet, Life table, Parasitoid,

### INTRODUCTION

In addition to environmental factors such as temperature, diet and humidity (Mendel et al., 1987), the larval period of parasitoid species is considerably affected by several factors depending upon the host itself (Tillman et al. 1993). The quantity and quality of the food source provided by host have an impact on both immature stages of development and some physiological activities of adult. By and large, the host species allowing a parasitoid species to develop into maturity is considered nutritionally suitable for that parasitoid species (Gülel 1988).

The studies conducted on artificial diets to determine the nutritional need of parasitoids are not

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always efficient because of low nutritional quality and contamination during preparatory methods (Gülel 1991). On the contrary, the importance of host feeding and natural food supply by host species that is related to the long lasting host-parasitoid interactions still maintains its validity and reliability (Uckan and Ergin 2002)

*Bracon hebetor* Say is a cosmopolitan ectoparasitoid that attacks the larval stage of stored-grain pyralid moths (Lepidoptera: Pyralidae) such as *Corcyra cephalonica* (Stainton). It has been widely used in the studies of host-parasitoid interaction because of its high reproductive rate, short generation time and considerable range of host species (Gunduz and Gülel 2005). It has potential as a biological control agent of stored product moth (Yu et al. 2002).

Because of the importance of host feeding and natural food supplied to parasitoid by host species is related to host-parasitoid interaction for biological control applications, the success rate is closely related to how much we know them. Therefore in this study the intrinsic rate of natural increase, which is an "index of fitness" for an entomophagous insect,

was observed and calculated along with other  $r_m$  dependent life table parameters.

### MATERIAL AND METHODS

The rearing technique for *C. cephalonica* (Lepidoptera: Pyralidae) and *B. hebetor* described herein, is a technique followed by Pathak et al. (1994) and Antolin and Strand (1992). To maintain the mass culture of ricemoth, its eggs were kept with coarsely ground favour (*Sorghum vulgare* Pers) seeds in large plastic container (45x25x15 cms). After adult emergence, equal number of males and females were paired in a 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 insects were paired in a beaker (250 ml) covered with a fine muslin cloth. The adults were provided 30 percent honey solution as food and 10 full grown 5<sup>th</sup> instar larvae of rice moth were placed in a beaker for parasitization. The parasitized larvae were kept for further development of wasp. To avoid any carry over effect, adults were utilized for experimentation only after third generation.

The performance of the parasitoid was observed at four constant temperatures, 10°C, 20°C, 30°C and 40°C. A freshly emerged male and female *Bracon hebetor* were released in a reproductive glass chamber (7 cm diameter; 10 cm height) having 10 healthy full grown *Corcyra* larvae. The adult wasps were provided 30% honey solution through a cotton swab. The parasitoids were transferred to a new reproductive chamber on each day at a specific time until the death of the parasitoids. The age of the parasitoids and the number and sexes reproduced by them were observed for each day of their reproductive life at above constant temperatures. Five replicates were arranged for each temperature at 70±10% relative humidity and 12h L: D.

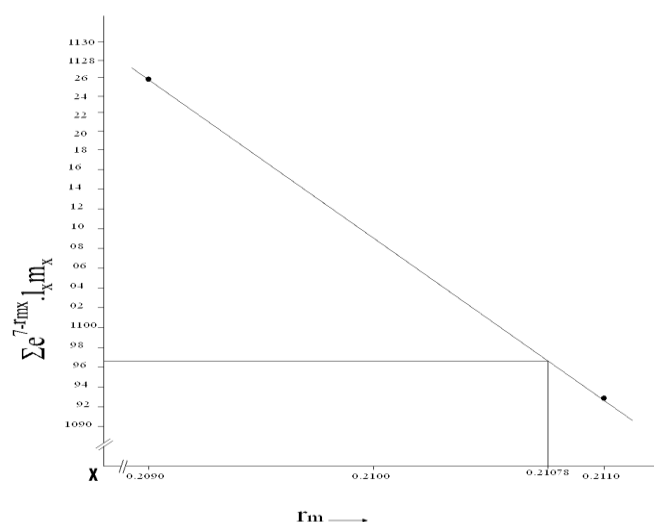
Life table parameters like Intrinsic rate of Increase ( $r_m$ ), arbitrary  $r_m = r.c$  (corrected graphically using values of  $r_m$ ) were calculated by Lotka-Euler equation (Andrewartha and Birch 1954)  $\sum l_x m_x \cdot \exp^{-r_m x} = 1$ , at different temperature regimes.

### RESULT AND DISCUSSION

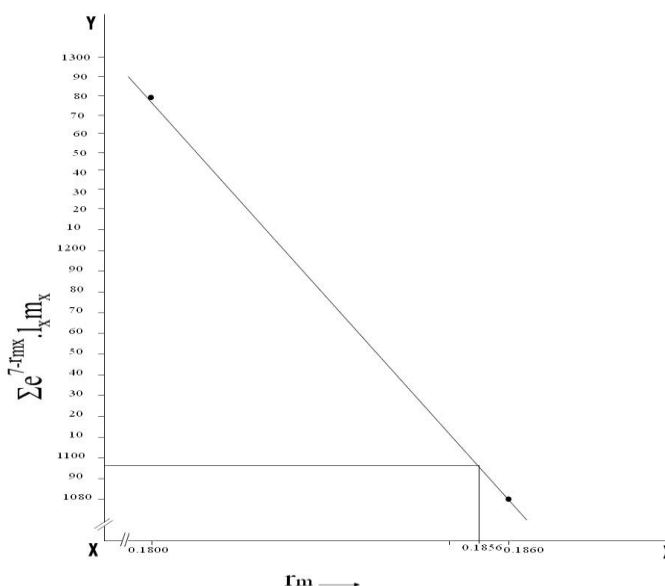
Significant effect of quality of host diet on longevity of female have been observed in *Apanteles galleriae* (Hymenoptera: Braconidae) a koinobiont, solitary and early instar larval ectoparasitoid of

Lepidopterous species (Uckan and Ergin 2002) and *Bracon hebetor* Say (Hymenoptera: Braconidae), a gregarious and last instar larval ectoparasitoid of *Corcyra cephalonica* Stainton (Lepidoptera: Pyralidae) (Radhika and Chitra 1997). Life table of *Bracon hebetor* showed higher value of the survivorship during the first half of the adult female than the second half. In insects this part of female life is called period of intensive egg laying (PIEL).

**Figure-1. Graph Showing corrected value of  $r_m$  (Intrinsic rate of Increase) of *Bracon hebetor* Say when its host was reared on wheat (*Triticum aestivum* .Linn ).**



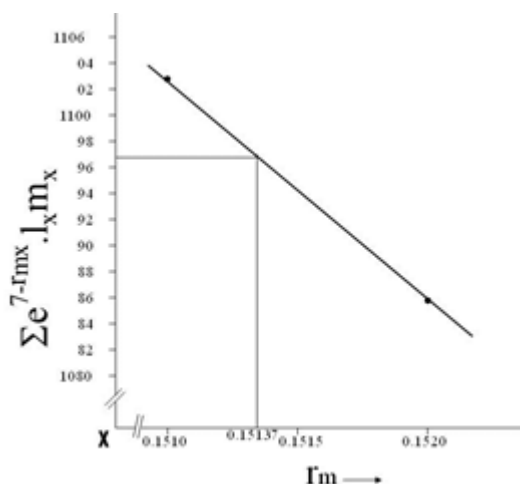
**Figure 2. Graph Showing corrected value of  $r_m$  (Intrinsic rate of Increase) of *Bracon hebetor* Say when its host was reared on maize (*Zea mays*).**



The intrinsic rate of natural increase is a basic parameter which an ecologist may wish to establish for insect population.  $R_0$ , a measure of population growth, finite rate of per capita population growth

over the length of one generation, number of offsprings produced/female originally present cohort and total offspring produced/ female were significantly affected by host diet. The innate capacity of increase in number ( $r_c$ ) (number of female offspring produced/female/day) of parasitoid *Bracon* was highest when its host were reared on wheat (0.2075) followed by maize (0.1830), jowar (0.1495) and rice (0.1266).

**Figure 3. Graph showing corrected value of  $r_m$  (Intrinsic rate of Increase) of *Bracon hebetor* Say when host was reared on jowar (*Sorghum vulgare* Pers.)**

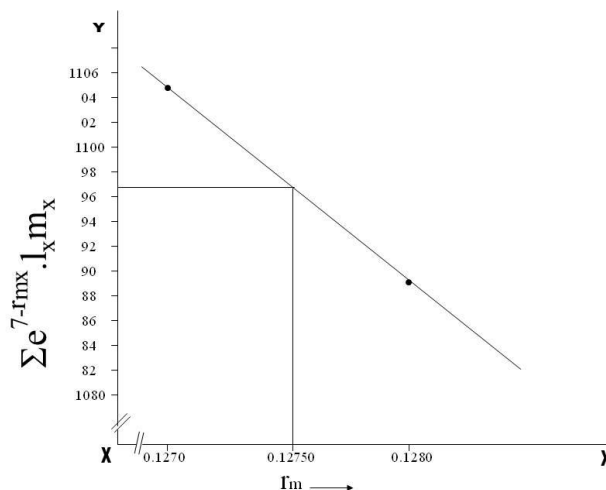


The intrinsic rate of natural increase,  $r_m$ , which is an "Index of fitness" for an entomophagous insects, of *Bracon hebetor* varied effectively when its host was reared on different diets. The results, corrected graphically by placing the value in Lotka- Euler equation  $\sum l_x m_x \cdot \exp^{-r_m x} = 1$  (Andrewartha and Birch 1954), demonstrated that the Intrinsic rate of natural increase ( $r_m$ ) of the parasitoid was maximum on wheat (0.21078) (Fig 1.) followed by maize (0.18560) (Fig 2.), jowar (0.15137) (Fig 3.) and rice (0.12750) (Fig 4.). As the finite rate of increase,  $\lambda_m$ , and the weekly multiplication rate,  $r_w$ , are directly proportional to the value of  $r_m$ , their values were also higher on wheat followed by maize, jowar and rice. Doubling time (D.T.) is inversely proportional to the parasitoid and therefore the D.T. of parasitoid was recorded in an increasing order when host diets were wheat, maize, jowar and rice.

Riggin et al. (1992) observed significant difference in longevity and parasitism of *Cotesia marginiventris* (Cresson) (Hymenoptera: Braconidae) on *Sodoptera frugiperida* (Lepidoptera: Noctuidae) reared on different diets but they had observed the fate of parasitism in terms of population growth. Life table parameters by Nikam and Pawar; Youm and Gilstrap (1993) show some difference in the value of

intrinsic rate of natural increase from this study which is result of differences in overall ecological factors.

**Figure-4. Graph showing corrected value of  $r_m$  (Intrinsic rate of Increase) of *Bracon hebetor* Say when host was reared on rice (*Oryza sativa* Linn.)**



Radhika and Chitra (1997) have explained a significant difference in mean longevity, total number of eggs, larvae, pupae and adult of *Bracon hebetor* Say when its host *Corcyra cephalonica* (Stainton) was provided different types of diet. In this study there is a significant effect of host diet on life table parameters of *Bracon hebetor* Say presumably due to chemical composition and physical characteristics of host diet which are responsible to bring about such significant differences.

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### Conflict of Interests:

The authors declare that there is no conflict of interests regarding the publication of this paper.

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