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INFLUENCE OF HOST DIET ON THE BIOLOGICAL PARAMETERS OF ECTO-LARVAL PARASITOID BRACON HEBETOR SAY ASSAM, INDIA

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ABSTRACT

The influence of host diet on the biological parameters of Bracon hebetor Say (Hymenoptera: Braconidae) was studied under laboratory condition during 2010 -2011 at epartment of Entomology, Assam Agricultural University, Jorhat, Assam. The parasitoid B. hebetor showed quicker development period, maximum fecundity and maximum fresh body weight of full grown larva when they were allowed to parasitize on the larvae of Corcyra cephalonica Stainton reared on rice, wheat and groundnut mixture (5:5:1). Among the six tested diets, the shortest development period of Bracon hebetor was found to be 8.90 ± 0.17 days in summer and 15.40 ± 0.35 days in winter, maximum fecundity per female of the parasitoid was 150.55 ± 1.21 and 146.90 ± 1.61 in summer and winter respectively , highest adult emergence was 81.30 ± 0.21 in summer and 74.15 ± 0.82 in winter and the sex ratio (1:3.05) of B. hebetor was quite high when C. cephalonica was fed on rice, wheat and groundnut mixture (5:5:1). Diet groundnut alone proved to be the least preferred by the host so weak performance in all the parameters for the parasitoid.

KEYWORDS: *Bracon hebetor*, ecto-larval parasitoid, *Corcyra cephalonica*, fecundity, sex ratio.

Introduction

Bracon hebetor Say is a gregarious, idiobiont arrhenotokous ectoparasitoid that parasitizes lepidopteran larvae and is an important biological control agent for several stored product moth pests (Darwish *et al.*, 2003). *Bracon hebetor* has been widely used in various studies related to host-parasitoid interactions because of its high reproductive rate, short generation time, and considerable range of host species (Yu *et al.*, 2002; Gunduz and Gulel, 2005). The success of biological control programs is highly dependent on the nature of the host-parasitoid interaction, which has led to many host-parasitoid systems being investigated in great detail by Baker and Fabrick (2000); Salvador and Consoli (2008). Knowledge of the physiological and biochemical interactions in host-parasitoid systems is important for the efficient production of biological control agents (Nakamatsu and Tanaka, 2003). *In vitro* rearing techniques have been used to determine the quantitative and qualitative needs, as well as the nutritional biochemistry of natural enemies. However, improvement of these techniques depends on knowledge and understanding of the physiology, nutrition, genetics, and behavior of parasitoids (Magro and Para, 2004). In laboratory, the culture of this larval ecto-parasitoid species can be maintained on larva of *C. cephalonica* Stainton, a stored grain pest. Nutrition received by the natural enemies from the host organism is vital for their normal growth, reproduction, longevity and parasitization. It is necessary to study the effect of various larval diets on growth and development of *C. cephalonica* Stainton as well as on the parasitoid biology in the process of laboratory multiplication, so that a suitable diet of the host may be recommended for the mass multiplication of *B. hebetor*. The present study was conducted under laboratory condition to evaluate influence of different diet on the biological parameters of *B. hebetor* (Say) (Hymenoptera: Braconidae).

Materials and Methods

Pure culture of *Corcyra cephalonica* was collected from the Bio control Laboratory, Department of Entomology, Assam Agricultural University, Assam. The present study was under taken at Department of Entomology, Assam Agricultural University, Jorhat, Assam in

the year 2010 and 2011. The plastic containers (size 22 cm x 12 cm diameters) were used as rearing unit of *C. cephalonica* under laboratory condition. The larvae of *C. cephalonica* were reared by providing six different diets *i.e.* partially ground rice, wheat and groundnut alone and rice with groundnut (10:1) and wheat with groundnut (10:1) and mixture of rice, wheat and groundnut (5:5:1) as standard diet with ten replications of each. Each rearing unit contained 275 g of test diets. Before use, all the test diets were sterilized in an oven at 45ºC for 12 hrs. After preparation of the rearing units, 100 eggs were placed in each diet so that the emerging larvae develop in different rearing media since emergence. The rearing units were wrapped with black coloured paper to provide darkness and restrict the active movement of growing larvae. The top of container was covered with muslin cloth to provide sufficient aeration. In order to record the larval weight another stock culture was also maintained for each of the diets as mentioned.

Mass rearing of *B. hebetor* was successfully done on full grown larvae of *C. cephalonica* obtained from standard culture media. The adult parasitoid soon after emergence become ready for mating and oviposition. The mated female was held in transparent plastic container (size 10 cm x 6 cm dia.) and fed with 50% honey solution. The mouth of container containing the parasitoid was covered with a muslin cloth and full grown larvae of *C. cephalonica* carefully placed on top of the muslin cloth with the help of a forceps and again covered with a muslin cloth which was tightly secured with rubber bands was done in Sandwich methods. After one day, the parasitoid larvae are removed gently with the help of a forceps and kept on paper plates (3 x 8 cm) so as to avoid falling of eggs laid on host body. Then the larvae were left undisturbed till cocoon formation, kept inside a transparent plastic container and covered the mouth with muslin cloth. After cocoon formation the ruminants of dead host larvae were removed. The cocoons remained stick on the paper and the paper with cocoons was placed again inside a transparent plastic container (size 10 cm x 6 cm dia.) for emergence of adult. Honey solution (50%) soaked in cotton and paste in the wall of container as a food for adult parasitoids. In the present investigation the *Corcyra* larva obtained from different rearing media were kept separately and these larvae were used for maintaining the culture of *Bracon hebetor* for subsequent laboratory investigation. The *B. hebetor* cultures were maintained separately on host larvae obtained from different diets.

The matured 5th instar larvae of *C. cephalonica* from all the six diets were allowed to parasitized by already mated female parasitoid of *B. hebetor*. The parasitized larvae were kept separately in plastic containers to determine the total development period and percent adult emergence. The parasitized larvae of *C. cephalonica* were counted under microscope (40X) After count, the larvae were transferred to paper plate kept inside the container and the top of container covered with muslin cloth. After one day, the parasitized larvae were removed gently with the help of forceps and kept on paper plates so as to avoid falling of the eggs laid on the host body. The eggs which were kept in the paper plate inside the container after emergence of *B. hebetor* were counted. The number of adults emerging from different rearing media were recorded and expressed as per Bordoloi (1994).

$$\text{Adult emergence} = \frac{\text{Number of adults emerged}}{\text{Total number of eggs inoculated}} \times 100$$

The number adults emerged were separately counted for both male and female to find out the percent female emergence and sex ratio with the help of its ovipositor present in the female. The data statistically analyzed using Fisher's method of analysis of variance (Fisher, 1925). The standard error of difference of means (S.Ed) was calculated by the following expression:

$$\text{S.Ed } (\pm) = \sqrt{\frac{2 \times \text{Error Mean Square}}{\text{Total no. of replications}}}$$

The significances or otherwise differences between means were ascertained by comparing with appropriate critical difference (C.D).

Results and Discussion

The total development period of *B. hebetor* (Table 1 and 2) was quicker when larvae were fed diet combination of rice, wheat and groundnut in summer (8.90 ± 0.17 days) and winter (15.40 ± 0.35 days) and the development was comparatively prolonged in summer (11.05 ± 0.21 days) and in winter (18.20 ± 0.56 days) when larvae were fed on groundnut**.** The finding is in agreement with Landge *et al*. (2010) who reported that *B. hebetor* developed 8.25 and 19.56 days on *C. cephalonica* and *Opisina arenosella* Walker, respectively. Significantly highest fecundity 150.55 ± 1.21 and 146.90 ± 1.61 were registered when the larvae of *C. cephalonica* were fed on rice, wheat and groundnut mixture in both the season followed by

rice and groundnut mixture. On the other hand, significantly least number of eggs per female were recorded when larva of *C. cephalonica* reared on groundnut alone. This result revealed with Dabhi *et. al.* (2011) that they reported 154.25 numbers of eggs from *C. cephalonica*. Maximum parasitoids emerged from the eggs obtained from host larvae fed on rice, wheat and groundnut mixture in summer and winter, followed by rice and groundnut mixture. The lowest of adult emergence was found in the diet the groundnut in both the season. The highest percentage of female parasitoid emergences in both the season as well as the sex ratio of *Bracon hebetor* favoured towards female was recorded from the host larvae fed on rice, wheat and groundnut mixture, followed by rice and groundnut mixture and per cent female emergence in the groundnut was the lowest among the other diets. This result also similar with Dabhi *et. al*. (2011) that the sex ratio (Female: Male) of *B. hebetor* reared on different host larvae revealed the minimum male population of the parasitoid was registered in case of *C. cephalonica.* The present investigation indicated that rice, wheat and groundnut mixture can be recommended as the best and ideal diet for rearing *C. cephalonica* and its larval ecto-parasitoid *B. hebetor*.

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Table 1. Effect of different host diets on total development period, fecundity and adult emergence of ecto-larval parasitoid, *Bracon hebetor.*

Diets	Total development period		Fecundity female-1		Adult emergence	
	Summer (days)	Winter (days)	Summer (No of egg female^{-1})	Winter (No of egg female^{-1})	Summer (No.)	Winter (No.)
Rice	9.40±0.30	16.20±0.16	148.35±0.90	137.50±1.81	79.50±0.60	71.40±1.00
Wheat	10.40±0.25	17. 60±0.37	143.80±0.44	133.75±1.89	77.00±1.04	69.00±0.94
Groundnut	11.05±0.21	18.20±0.56	142.50±0.31	130.95±2.52	76.50±0.97	68.80±0.86
Rice + Groundnut (10:1)	9.15±0.35	16.05±0.27	148.60±1.51	142.20±2.40	80.45±0.30	72.10±1.18
Wheat + Groundnut (10:1)	9.60±0.28	17.00±0.24	145.20±0.49	134.05±1.73	78.55±0.77	70.30±1.20
Rice + wheat + groundnut (5:5:1)	8.90±0.17	15.40±0.35	150.55±1.21	146.90±1.61	81.30±0.21	74.15±0.82
S.Ed	0.39	0.48	1.60	0.57	1.02	1.43
CD (P=0.05)	0.75	0.93	3.07	1.10	1.97	2.75
CD (P=0.01)	0.97	1.21	3.99	1.43	2.5	3.57

Note: Data based on twenty replications

Table 2. Effect of different host diets on Per cent female emergence, Sex ratio in Summer and Winter of ecto- larval parasitoid, *Bracon hebetor*.

Diets	Female emergence (%)		Sex ratio in Summer			Sex ratio Winter		
	Summer (%)	Winter (%)	Female (%)	Male (%)	Sex ratio	Female (%)	Male (%)	Sex ratio
Rice	58.50±1.18	52.05±0.49	58.50±1.18	21.85±0.15	1:2.67	52.05±0.49	25.50±1.13	1:2.04
Wheat	47.35±0.27	46.45±0.69	47.35±0.27	29. 40±0.91	1:1.61	46.45±0.69	30.50±2.39	1:1.52
Groundnut	42.90±0.76	42.50±0.56	43.90±0.76	33.20±0.17	1:1.29	42.50±0.56	33.00±2.38	1:1.28
Rice + Groundnut (10:1)	60.10±0.98	57.00±0.47	60.10±0.98	20.70±0.24	1:2.90	57.00±0.47	22.50±0.55	1:2.53
Wheat + Groundnut (10:1)	51.55±1.24	50.00±1.07	51.55±1.24	26.30±1.19	1:1.96	50.00±1.07	27.00±1.31	1:1.85
Rice + wheat + groundnut (5:5:1)	61.05±0.45	59.00±0.27	61.05±0.45	20.00±0.52	1:3.05	59.00±0.27	21.70±0.10	1:2.71
S.Ed	1.70	2.63	1.26	0.94		2.63	2.21	
CD (P=0.05)	3.26	5.06	2.43	1.80		5.06	4.26	
CD (P=0.01)	4.23	6.56	3.15	2.34		6.56	5.52	

Note: Data based on twenty replications.