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Biology and Biometry of Bracon Hebator Say (Hymenopera: Braconidae) An Ectoparasitoid of Helicoverpa Armigera Hubner

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Abstract

This paper deals with information on Biology and biometry of Bracon hebator Say, an ectoparasitoid of Helicoverpa armigera Hubner. In B.hebator four larval instars with first caudate type occur. Eggs are elongated and slightly curved, medially increase in the size of the larva correlate with the progressing age of parasitoids. The biometrical observations are based on the length and width of the larval instars, mandibles, and head capsules structural details of herds of the instars and diameter of spiracle of larvae are produsedd. The 'r' valves was 0.9881 for length and 0.9735 for width (P< 0.001 for length and P<0.01 for width)

Keyword: Bracon hebator, Helicoverpa armigera

Introduction:

The task to control injurious insect pest of several crops has attracted the attentions of Entomologists. Majourity of pest species show resistance to the modern pesticides and thus become more injurious to crops.

Knowledge of basic biology of the parasitoids and their interaction with their hosts provide information that is needed for their biological control in the pest management. Species of parasitic hymenoptera are numbered in thousands which play an important role in determining the population densities of their respective host, and being extensively used in biological control programme.

De bach (1964) showed that more than 225 cases involving about 110 spcies of pests and as have been controlled by biological means in 60 countries. t is for the first time in nineteenth century various parasitic insects were suggested by Darwin to control a number of economic pests(Copel and martin,1977).Simmonds (1970) reported 11 pest

species which were controlled by parasitoids and predators in various countries in collaboration with Commonwealth institute of Biological control. Johansen(1957), CIBC1971), Greathead(1971), Rao(1971), Sailar(1972), Hagen and Franz(1973) and Martin and Coppel (1974) have suggested some means for biological pest management.

The study on biology and biometry correlate the probable phylogeny of the group. Taxonomic assessments in the parasitic hymenoptera were generally made by adult characters. Studies on the biology and biometry provide the information on development of the species and morphological details of immature forms for authentic identity. Details on the biology and biometry also provide the basic information which is needed for their utility on biological control programme, mass rearing etc. It also contribute basic data for workers on taxonomy.

The present investigations were made on biology and biometry of larval stages of B.hebator. In this immature forms viz,. egg, larvae and the cocoons were studied.

Present investigation gives significance information on biology and biometry of parasitoids studied here. It also provides details on the existence of definite larval instars and gives more precise assessment of the duration of their development.

Material and Method:

Present study were conducted in laboratory by maintaining continuous breeding stocks of hosts viz., Heliothis armigera and B.hebator as an internal larval parasitoid. Ten larvae were exposed to B.hebator. Parasitism of host larvae with exact time was recorded so as to calculate the egg to larval period and to know the definite larval instars.

The observations were continued till sufficient numbers of all immature stages were collected for present study. Significance between length and width of the larvae and relationship with age was examined by regression analysis.

The study were conducted in plant growth chamber and B.O.D. incubator at 220c and 54% and 250c and 80 RH.While doing this research Heliothis larvae were kept in wooden cages with pods of cajanus cajan (Pea plant) and 50% honey solution to B.hebator as a food.

Result and Discussion:(Fig 1and 2)

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Egg

The ovarian eggs were somewhat elongated, curved. Freshly deposited eggs were creamy white, elongated, thicker at anterior end. Chorion is smooth surfaced, opaque and white. Twenty five eggs were taken out from the dissected female. The mean length and width an egg was 0.6 mm and 0.2 mm respectively. The female deposit the eggs randomly in the host body. The eggs hatched out after 2 days. The incubation period of an ovarion egg is 24 hours to 30 hours. The eggs are typically hymenopteri forms.

Larvae:

In B.hebator five larval instars have been noticed. The larval stages have been designated with the help of mandibular size and external appearance of the larvae. The mandibles are broad at base and tapper sharply at apex. Mandibles has no teeth and hook. Histographs of the length width of the larval body, head capsule and mandibles were plotted.

First instar:

Immediately prior to hatching with the help of mandible larva ruptured the chorion and come out from the egg. Results were shown in table…

This larval form is creamy or opaque white and has post cephalic segments and long tapering tail. Early first instars have translucent body with quadrate head. Mean length and width of 10 individuals were 1.10 mm and 0.46mm respectively. The mean length and width of head capsule was 0.22 mm and 0.14 mm respectively and mean length and width of mandibles of 10 individuals were 0.04 mm and 0.02 mm respectively. This form appeared for 2.5 to 3 days. Considerably increase in size have been noticed within few days after its hatching from the egg. The new hatched larva crawls on the surface of the host body and begins to feed by inserting its mandibles into the body tissue and embedding the body fluid.

Second instar:

The second instar larvae were longer than the first instar. Body was cylindrical, straight and segments were white except the first one. Caudal tail completely disappeared in this instar. Body segments were clearly visible. The mean length and width of 10

individuals were 1.34 mm and 0.51 mm. respectively. The head capsule was 0.26 mm in length and 0.20 mm in width. The length and width of mandible were 0.06 and 0.02 mm respectively. This stage remains for 16 to 20 hours. Measurement of larval forms was shown in table…

Third instar :

Body was creamy white and opaque. It consists of head and 13 segments. This larva was larger than previous one. No caudal tail was seen. Body segments were increased proportionally in shape and size than the second instar and flattened on lateral sides. Average length and width of 10 individuals were 1.70 mm and 0.85 mm respectively. Length and width of head capsule were 0.46 mm and 0.26 mm respectively. Length and width of mandible was 0.1 mm and width was 0.02 mm. Tracheal system was well developed and spiracles were seen on lateral sides of the body. There were 9 spiracle(Fig.2) and measured as 0.039 mm in diameter (Table no.1-4)

Fourth instar:

The body was elongated and hymenopriforms. This instar larva was more active than previous three instars. Body length and width of 10 individuals were 1.81 mm(1.80-1.82mm) and 1.01 mm (1.00 – 1.02 mm) respectively. Length and width of head capsule were 0.4 mm (0.3-0.5) and 0.24 mm(0.23-0.25mm) respectively. The length and width of mandibles were 0.1 mm (0.1-0.1 mm)and 0.02 mm (0.02-0.02 mm) respectively. Siracles were 9 in number and slightly the same diameter as in third instar larvae. All above measurements were shown in table no.1.

Fifth instar :-

Comparatively this stage was larger than the above four instars. This was very active stage feed frequently on the host body. Length and width of 10 individuals were 2.02 mm(2.01-2.03 mm) and 1.4 mm(1.3-1.5 mm) respectively. Length of head capsule was 0.42 mm (0.41-0.43 mm) and the width was 0.52 mm(0.51-0.53 mm) respectively. Spiracles were 9 in number and measured 0.042 mm in diameter (Table 1 and Fig,2).

Anterior and posterior portion of the mandible can be differentiated by pleurostoma. Pleurostoma articulate to with mandible. Hypostoma is curved and surrounds stapital sclerite. Sclerotic stfur extend towards stapital sclerite,' U'shaped labial sclerite occupies

central portion of the structure. The labial sclerite surrounds the prelabium, labial palpi, and salivary orifice. Maxillary palpi are small located dorsally to labial sclerite.

Biometry:

Statically results were shown in table no.1and fig.1.These findings indicate that larval instar of B.hebator increases in the length and width as development processes. The results were tested by regressing analysis and students 't'test for calculation of 9P0 values. It showed that there was significant relationship in the increase of length and width of larval instars and their age. The ;r; value was 0.9881 for length and 0.9735 for width and p value was (p/-0.001 for length and p/-0.01 for width.(Table No.2 and 3)

Discussion :

The braconids play an important role in biological control of insect pests.

The present investigations were undertaken to study the biology and biometry of B.hebator. Fisher(1959) observed five larval instars in Campoletis choloridae Uchida in which first two are caudal type and remaining are hymenopriform.In present study B.hebator has five larval instars.

Five larval instars are present in Diadegma trichoptilus Cameron,a larval parasitoids of Exalastis atomosa Washigham (Sathe,1987).First to fifth larva measured in length and width 1.2 mm,1.85 mm,3.0 mm,4.0 mm,4.73 mm and 0.158 mm,0.250 mm,0.51 mm0.754 mm,1.070 mm, respectively. While in present in present study diameter of B.hebator in first to fifth instars measures 0.030 mm,0.050 mm,0.70 mm,0.010 mm,0.015 mm respectively. Sathe (19880 reported the biology and biometry of Cotesia orientalis Chalikwar and Nikam (Hymenoptera: Braconidae).In this species first instar larva floats into the body cavity of its host.In B.hebator the mature larva has 13 body segments. Spiracles occur on mesothorax and each of the first eight abdominal segments. Larva is capable of repiration. The tail is still reduced. The head and mouth parts were well developed. mandibles are simple and sickle shaped.

TableNo.1
Biometrical measurements of five larval instars of B.hebator

Larval body structure	Larval instars				
	First	Second	Third	Fourth	Fifth
Larval body Length	1.10 mm	1.34 mm	1.70 mm	1.81 mm	2.02 mm
Larval body Width	0.46 mm	0.50 mm	0.85 mm	1.01 mm	1.04 mm
Head capsule Length	0.216 mm	0.248 mm	0.404 mm	0.424 mm	0.440 mm
Head capsule Width	0.156 mm	0.2 mm	0.24 mm	0.258 mm	0.322 mm
Mandible Length	0.040 mm	0.060 mm	0.100 mm	0.105 mm	0.110 mm
Mandible Width	0.020 mm	0.022 mm	0.023 mm	o.o25 mm	0.027 mm
Spiracle diameter			0.039 mm	0.041 mm	0.042 mm

Table No. 2
Statistics of linear regression relationship of larval age and length of B.hebator

Sr.No	Age in days(X)	X^2	Larval length(Y)	Y^2	XY	Expected value
1.	2	4	1.10	1.210	2.2	1.14
2.	3	9	1.34	1.795	4.02	1.34
3.	4	16	1.70	2.890	6.8	1.59
4.	5	25	1.81	3.276	9.05	1.81
5.	6	36	2.03	4.120	12.18	2.02
∑	20	90	7.98	13.292	34.25	

Mean $\overline{X}$ =4.0, Mean $\overline{Y}$ =1.596, a=0.416, b=0.295, r = 0.9881

Table No.3
Statistics of linear regression relationship of larval age and Width of B.hebator

Sr.No	Age in days(X)	X^2	Larval length(Y)	Y^2	XY	Expected value
1.	2	4	0.46	0.2116	0.92	0.46
2.	3	9	0.50	0.25	1.5	0.65
3.	4	16	0.85	0.7225	3.4	0.83
4.	5	25	1.01	1.020	5.05	1.02
5.	6	36	1.4	1.96	8.4	1.02
∑	20	90	4.22	4.1642	19.27	

Mean $\overline{X}$ =4.0, Mean $\overline{Y}$ =0.844, a=0.112, b=0.239, r=0.9735

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Time after oviposition	No. of parasitized larvae	No.of eggs laid	No.of first instar larvae	No.of second instar larvae	No.of third instar larvae	No.of fourth instar larvae	No.of fifth instar larvae	No.of pre-pupae	No.of pupae	No.of adults
1	2	3	4	5	6	7	8	9	10	11
1 day ±± 2h	10	75	-	-	-	-	-	-	-	-
2 day ± ±2h	10	50	40	-	-	-	-	-	-	-
3 day ± ±2h	10	5	20	30	-	-	-	-	-	-
4 day ± ±2h	10	-	5	19	25	-	-	-	-	-
5 day ± ±2h	10	-	-	-	10	30	-	-	-	-
6 day ± ±2h	10	-	-	-	-	10	40	-	-	-
7 day ± ±2h	10	-	-	-	-	-	15	-	-	-
8 day ± ±2h	10	-	-	-	-	-	10	-	-	-
9 day ± ±2h	10	-	-	-	-	-	5	-	-	-
10 day ± ±2h	10	-	-	-	-	-	-	15	-	-
11 day ± ±2h	10	-	-	-	-	-	-	10	25	-
12 day ± ±2h	10	-	-	-	-	-	-	5	19	-
13 day ± ±2h	10	-	-	-	-	-	-	-	30	10
14 day ± ±2h	10	-	-	-	-	-	-	-	30	18
15 day ± ±2h	10		-	-	-	-	-	-	10	30
16 day ± ±2h	10	-	-	-	-	-	-	-	-	40
17 day ± ±2h	10	-	-	-	-	-	-	-	-	-

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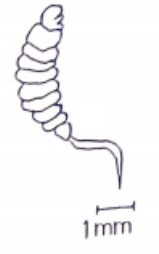
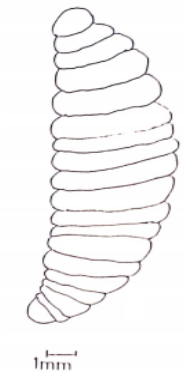
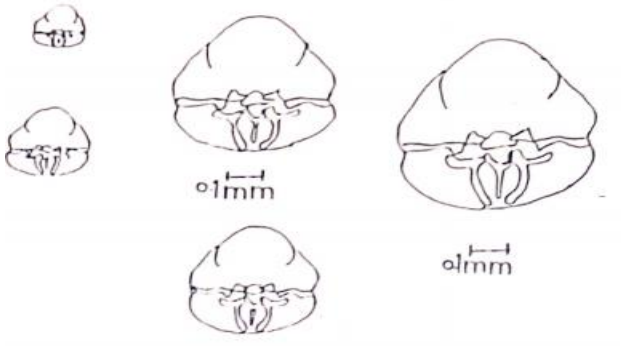
Total	**170**	**130**	**65**	**49**	**35**	**40**	**70**	**30**	**114**	**98**

Table No.4
Duration of developmental stages of B. hebator
Fig.1 Immature stages of Bracon hebetor.

<table>
<tr><td> 
Ovarian egg</td><td> 
First instar larva</td><td> 
Second instar larva</td><td> 
Third instar larva</td></tr>
<tr><td> 
Fourth instar larva</td><td> 
Fifth instar larva</td><td> 
Pre-pupae</td><td> 
Pupa</td></tr>
<tr><td colspan="4"> 
Systematic represtiation of head capsule of
First – Fifth instar larvae</td></tr>
</table>

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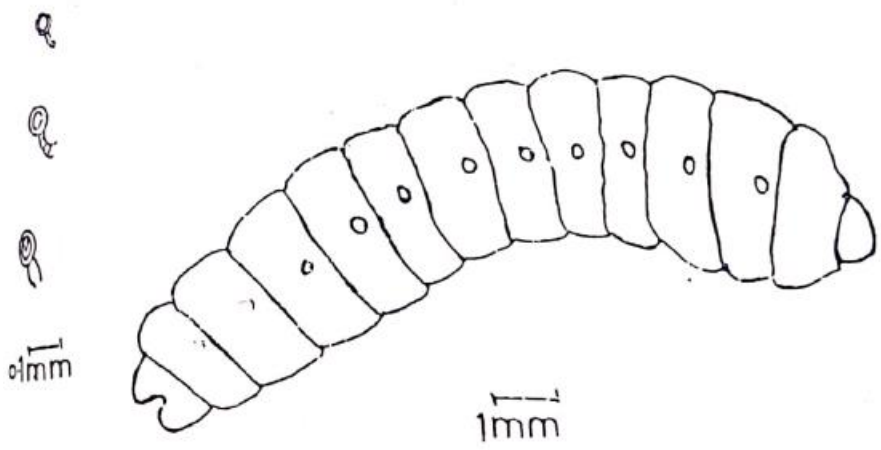
Mandible of first instar larvae	Mandible of Second instar larvae	Mandible of third instar larvae	Mandible of fourth instar larvae
Mandible of fifth instar larvae			

Fig. 2 Spiracle of third, fourth & fifth instar larvae



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