RESEARCH ARTICLE

BIOLOGY OF *BRACON HEBETOR* SAY (BRACONIDAE: HYMENOPTERA) A LARVAL ECTO- PARASITOID ON RICE MEAL MOTH, *CORCYRA CEPHALONICA* STAINTON (LEPIDOPTERA : PYRALIDAE)

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Abstract: Biology study was made on reproductive parameters of *B. hebetor* reared on Rice meal moth**,***Corcyra cephalonica* Stainton at ordinary room temperature under laboratory conditions. The mean incubation period was 1.5 day and larval period 0.37 days. The pupal period lasted for 0.37 days with a range from 5-4 days. The mean development period of the parasitoid was 18.78 days. The females lived longer period (10.20 days) than males (6.40 days).

Keywords: Biology, *Bracon hebetor*, Rice meal moth, *Corcyra cephalonica*

INTRODUCTION

Biological control has been a valuable tactic in pest management programs around the world for many years. Biological control is a natural phenomenon of plant and animal regulation by their natural enemies. Biological control is a tool used in Integrated Pest Management (IPM) for several field agricultural systems and in protected crops systems. This technology is economically viable, of low environmental impact, and does not present risks of environmental contamination, human health nor for domestic animals (Orr, 2009). In the case of pest management, the major natural enemies are other insects, known as entomophagous, or microorganisms as entomopathogens. The entomophagous group is represented by predators and parasitoids. Most of the natural enemies belong to the order Hymenoptera.

Hymenopterans are one of the four megadiverse orders at world level. Females typically have a special ovipositor for inserting eggs into hosts or otherwise accessible places. The ovipositor is often modified into a stinger. Braconidae is the second largest family of Hymenoptera, comprising about 4,000 species. The braconid (Hymenoptera:Braconidae) is a cosmopolitan, gregarious, idiobiont arrhenotokous, ecto-parasitoid of Lepidoptera, Coleoptera and Diptera. Braconid is an important biological control agent for several insect pests (Heimpel *et al*., 1997; Darwish *et al*., 2003). Braconids have been widely used in various studies related to host-parasitoid interactions due to its high reproductive rate, short generation time, and considerable range of host species (Yu *et al*., 2002). Life cycle (biology) information on *B. hebetor* is not available. Such information is necessary for projecting population growth and designing insect mass rearing programs. Considering the above facts the present study was undertaken with the following objectives to measure the duration of different developmental stages and other related parameters of *B. hebetor* reared on the larvae of *Corcyra cephalonica.*

MATERIAL AND METHOD

2.5 kg of grains (Jwar+Maize+Bajra) were kept in wooden cages (45cm× 30cm×15cm). The grains were sterilized in hot air oven for one hour at 100^0C. After cooling the grains were grinded coarsely. 5 ml of 10% honey solution along with 5g of yeast and a pinch of Streptomycin were mixed in each container. Finally the containers were charged with 0.25cc (about 4750 eggs) of *C. cephalonica.* A study was made on reproductive parameters of *B. hebetor* on *C.cephalonica* at ordinary room temperature under laboratory conditions. The mouth of glass jar (15 cm x 9 cm) containing newly emerged one males and one females of *B. hebetor* was covered with a piece of white muslin cloth over which one full grown larvae of *C. cephalonica* were placed. After placing the larvae on the mouth of glass jar again another piece of white muslin cloth of same size was placed over the host larvae and kept in position with the help of rubber bands. Five replicates were used for each host species. After 24 h the parasitized larvae of each host species were removed gently without damage and were kept individually in plastic bowls (4.50cm x 3.50cm) for further study on various biological parameters of *B. hebetor*.

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RESULT AND DISCUSSION

Bracon hebetor Say mated frequently during day and night. Its females preferred to attack and oviposit on the fourth instar larval host. Ovipositing females were found to locate their hosts probably via trails containing semiochemicals produced in the mandibular gland of the host larvae (Shonouda and Nasr, 1998). Once the host was located, the female *B. hebetor* injected venom, which resulted complete paralysis of host within 15 min. It was also reported by Hagstrum and Smittle (1978). After the host was paralyzed, the female oviposited, usually placing a clutch of several eggs on the ventral surface of the host or on the side that was in contact with the substrate. Similar behavior of oviposition was also reported by Benson (1973) and Strand and Godfray (1989). The developmental periods of each life stages of *B. hebetor* observed in the present studies are shown in Table 1 and 2.

Egg: Freshly laid eggs were creamy white in colour and become translucent later. The deposited eggs were spindle shaped slightly curved, hyaline colourless and loosely attached to the surface of the host body. The mean incubation period of egg was 1.50 days which varied from 1 to 2 days (Table 1).

Larvae: The mature larvae were creamy white in colour and apodous. The mean larval duration was 3.60 days which varied from 3 to 4 days (Table 1).

Pupae: There was a pre- pupal stage, which lasts from 0.63 to 0.83 days. Pupation was found to take place outside the host body within a white coloured cocoon. Pupa was attached with each other by silken threads. The mature pupae were dark brown and exarate type. The mean pupal duration was 4.6 days with a range of 4.0 to 5.0 days.

Adult: The colour variation of adult parasitoid of *B. hebetor* was common with variable pterostigma having dark brown, sometimes with a large pale basal spot; body is nearly completely yellowish brown to largely dark brown or black. The last abdominal segment of the adult female was acute and possessed very short ovipositor. The last abdominal segment of male parasitoid being almost round. The average adult longevity was 6.40 and 10.20 days for male and female, respectively. In case of male, the minimum adult longevity was 5.0 days and maximum was 8.0 days. In this study the longevity of female is longer than male because female are larger and heavier than males due to slower rate of weight loss than that of males (Griggs, 1959).

Dabhi *et al.* (2011) studied the biology of *B. hebetor* on *G. mellonella* and found that the egg, larva and pupal period were 1.12, 3.42 and 4.64 days respectively. Longevity of male and female adult of *B. hebetor* was 8.27 and 24.12 days, respectively. Landge *et al.* (2009) studied the comparative biology of *Bracon hebetor* on *C. cephalonica* and *Opisina arenosella* Walker. In their study they found the incubation period, larval period and pupal period lasted for 23.32 hr and 24.26 hr, 64.8 hr and 72.48 hr, and 4.37 and 5.3 days on *C. cephalonica* and *O. arenosella*, respectively. Larval stage completed within five instars, pupation took place in white silken cocoon close to the host. Male and female adults from *C. cephalonica* and *O. arenosella* survived for 14.2 and 37.9, 12.05 and 20.85 days, respectively. Life-cycle of *B. hebetor* on *C. cephalonica* and *O. arenosella* was completed within 8.25 and 10.56 days, respectively. Farag *et al*., (2012) recorded adult longevity of *Habrobracon hebetor* reared on *Cadra* (*Ephestia*) *cautella* was 7.9 and 6.6 days for female and male, respectively. Pre-ovopositional and ovipositional periods lasted <12 h and 7.4 days, respectively. Total number of eggs/female was 69.3 eggs, with a mean of 9.45 eggs/day. Mean durations of immature stages reached 14.99 hrs, 2.48 and 5.65 days for egg, larval and pupal stages, respectively. These three observations were in agreement with the findings of the present study.

CONCLUSION

The biological study is important for mass rearing program in inundative release to ensure successful biological control of insect pests. So there is a great opportunity to use *Bracon hebetor* as a component of Integrated Pest Management programme for the suppression of lepidopteran pests.

Table 1. Development time (days) of different life-stages of *B. hebetor* reared on *Corcyra cephalonica* Stainton

Egg	Larva	Pre-pupa	Pupa	Adult		Female			Total life cycle	
				Male	Female	Pre-oviposition	Oviposition	Post - oviposition	Male	Female
1.50	3.60	0.78	4.60	6.40	10.20	0.62	8.20	2.00	16.88	20.68

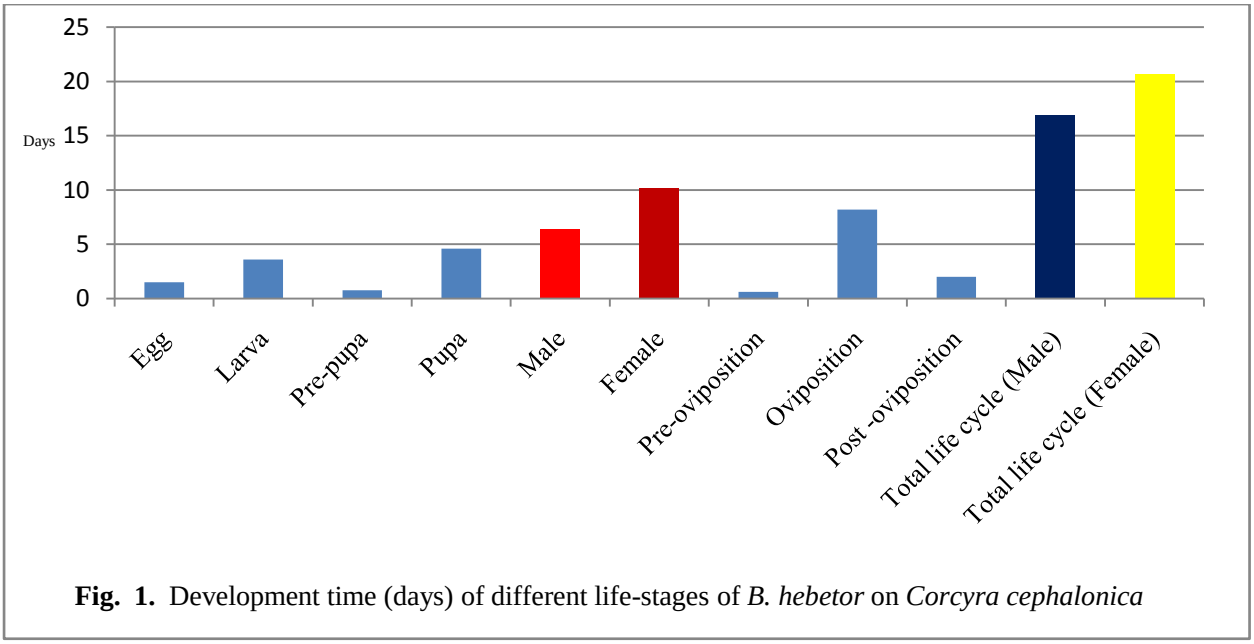

Fig. 1. Development time (days) of different life-stages of *B. hebetor* on *Corcyra cephalonica*

Table 2. Influence of *Corcyra cephalonica* larvae on fecundity, egg hatching (%), eclosion (%), viability (%) and sex ratio of *B. hebetor.*

Fecundity	Egg hatching (%)	Eclosion (%)	Viability (%)	Sex ratio (F : M)
112.80	70.79	91.25	44.53	1.67

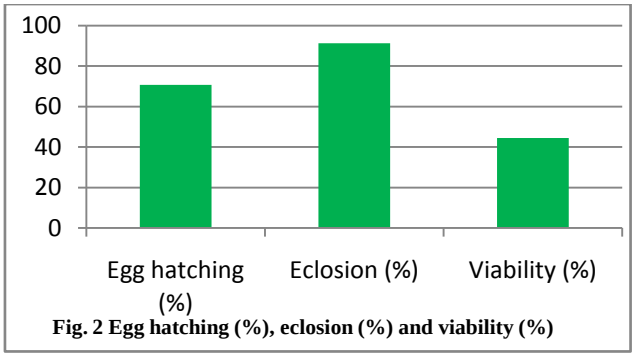

Fig. 2 Egg hatching (%), eclosion (%) and viability (%)

Table 3. Percentage of survival of immature stages of *Bracon hebetor* reared on six lepidopteran host species.

Survivorship (%)			
Egg	**Larva**	**Pupa**	**Egg-adult**
70.79	68.92	91.25	44.53

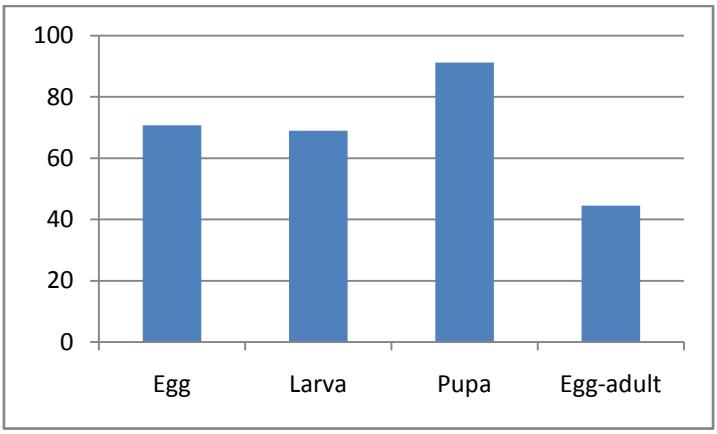

Fig. 3. Survivorship (%) of *Bracon hebetor*

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