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Biological Studies on the Larval Parasitoid Species *Bracon brevicornis* Wesm. (Hymenoptera: Braconidae), Reared on Different Insect Hosts

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ABSTRACT

The ecto-larval parasitoid species, *Bracon brevicornis* Wesm. (Hymenoptera: Braconidae) was reared in the laboratory on three different insect host species; the corn borers, *Ostrinia nubilalis* Hb., *Sesamia cretica* Led. and the black cut worm, *Agrotis ipsilon*. Full grown larvae of each host were exposed individually to the parasitoid females for one or two days until death of the parasitoids. Mean numbers of parasitoid's progeny per host larva were 9.6 (on *O. nubilalis*), 9.3 (on *S. cretica*) and 7.3 (on *A. ipsilon*) when host larvae were exposed daily to the parasitoid female. Respective figures when host larvae were exposed every two days reached 17.1, 11.4 and 6.4 individuals. Sex ratio (male: female) was found to be 1: 0.9, 1: 0.3 and 1: 0.6, when the parasitoid was reared on *O. nubilalis, S. cretica* and *A. ipsilon*, respectively at one day exposure period. The respective sex ratios at the 2-day exposure period were 1: 0.4, 1: 0.5 and 1: 0.3. Among the studied three insect hosts, *O. nubilalis* seemed to be the recommended host for mass rearing of *B. brevicornis*.

Key words: *Bracon brevicornis*, biology, *Ostrinia nubilalis, Sesamia cretica, Agrotis ipsilon.*

INTRODUCTION

The parasitoid, *Bracon brevicornis* Wesm. is an indigenous, primary gregarious ectoparasitoid on *Sesamia cretica* Led.; *Ostrinia nubilalis* Hb.; *Chilo agamemnon* Bles.; *Earias insulana* Boised.; *Helicoverpa armigera* (Hubner) and *Pectinophora gossypiella* Saunders. The parasitoid is widely distributed over lower and upper Egypt and has 24 generations in the laboratory per year (Megahed *et al.*, 1981).

In addition, several authors over the world have recorded the parasitoid on different hosts; In Turkey, Yasarakinci and Kornosor, (1990) recorded percentages of parasitism by *B. brevicornis* on 5th and 6th instar larvae of *Heliothis viriplaca* (Hufn) by 47.6 and 38.8%, respectively. In India and Srylanka, the parasitoid was recorded parasitizing *Opisina arenosella* Walker (Pillai and Nair 1995) and cashew leaf and blossom Webber, *Lamida moncusalis* Walker (Mohapatra and Mohapatra 2003). In South Africa, the parasitoid was reared from *Plutella xylostella* (Kfir, 1997) and from *Busseola fusca* Fuller (Ebenebe *et al.*, 2001). In China (He *et al.*, 2002) considered the parasitoid as one of the main natural enemies of tobacco storage pests. In Iran, (Habibpour *et al.*, 2002) surveyed insects and a mite associated with stored products and their parasitoids, *B. brevicornis* was among the natural enemies of these pests. In Germany (Politz *et al.*, 2007) detected parasitism of *O. nubilalis* by *B. brevicornis*.

Several authors studied the biology of this parasitoid (Abbas, 1977; Temerak 1984 a & b; Fayad *et al.*, 1984 and Lutfallah and Kares 1989).

Aim of this investigation is to study the effect of the insect host on some biological parameters of the parasitoid species, *B. brevicornis* under laboratory conditions.

MATERIALS AND METHODS

In December 2008, full grown hibernated larvae of *S. cretica* and *O. nubilalis* were collected from stored corn stalks, while larvae of *A. ipsilon* were collected from infested clover fields at the Experimental Farm of the Faculty of Agriculture at Moshtohor, Qaluobia Governorate, Egypt.

1- Rearing of Insect Hosts

A- *S. cretica*

Groups of 10 larvae, each were confined in glass jars 15×20 cm. and provided with pieces of soft tissue papers to serve as pupation sites. Jars were covered on the top by muslin cloth and were kept until pupation of larvae. The obtained pupae were differentiated into males and females groups. Each group was kept in a glass jar, 20 × 25 cm. provided at the bottom by moistened soft tissue papers and kept in position by rubber bands for moths emergence. Ovipositional cage consisted of a lamp chimney, 18 cm. long and 8 cm. diameters, set on a maize seedling, planted in a plastic pot. *S. cretica* moths (1 female: 2 males) were placed in the ovipositional cage and covered with muslin. Within each cage, the moths were provided with a piece of cotton wool moistened with 10% honey solution for feeding. Deposited eggs were collected and placed

among envelopes of fresh green maize ears, as suitable food supply for hatching larvae. The infested ears were placed into glass jars, 20 × 25 cm. covered with muslin cloths. Fresh green maize ears were renewed as the larvae grew older and so on until full grown larvae were obtained.

B- *O. nubilalis*

Full grown hibernated *O. nubilalis* larvae were collected and placed in plastic pans of 15 cm. diameter and 4 cm. deep provided with strips of corrugated paper of 3 cm. wide, treated with hot wax to serve as hibernation sites. Pans were placed into glass jars, 20 × 25 cm. covered with muslin cloth and kept until moths' emergence. Mass rearing method and technique, described by Ebaid (2004) was used.

C- *A. ipsilon*

To establish a stock culture of *A. ipsilon*, in the laboratory, larvae were collected from the clover field and kept, individually, with pieces of castor been leaves in glass vials, 7 × 2.5 cm. Stoppard with pieces of cotton wool, until pupation. Pupae were sexed and placed into glass jars, 20 × 8 cm. in a sex ratio of 1:1, containing soft dry powder wood at the bottom to a depth of 2 cm. and covered with muslin cloths. Within each cage, the moths were provided with a piece of cotton wool moistened with 10 % honey solution for feeding, and a strip of cotton cloth for egg-laying. The cloth strips were inspected daily, and those carrying eggs were removed and new strips were added instead. Eggs were placed into glass jars, 30 × 20 cm. containing a layer of soft dry powder wood at the bottom, until they hatched. The newly hatched larvae were provided with fresh castor been leaves until reached 3rd instar. To avoid cannibalism, the 3rd instar larvae were separated and kept individually in glass vials, until full grown larvae were obtained.

D- *B. brevicornis*

Laboratory culture of *B. brevicornis* began with cocoons and other different stages collected during December from maize stalks containing parasitized hibernated larvae of *O. nubilalis*. Cocoons were confined in glass jars, 10 × 7 cm. covered with muslin. After emergence, droplets of honey on oleander leaves were offered to feed parasitoid's adults and were left for 48 hours for feeding and mating. Each mated female was confined in a glass vial, 7 × 2 cm. and one larva of *O. nubilalis* was exposed to each female for 24 hours and then removed by means of a pair of forceps. Fresh larvae were introduced instead and so on until the death of the females. Parasitized larvae were kept into jars, 20 ×10 cm, and left until adults emerged.

2- Treatments:

Rearing *B. brevicornis* on three different host species and two different exposure periods

Six groups of female wasps, each of 10 newly mated females (10 replicates) were kept in plastic jars, 4 × 4 cm. covered with two layers of organdy and fixed by a rubber band. Ten full grown larvae from each of *S. cretica*; *O. nubilalis* and *A. ipsilon* were exposed to ten mated parasitoid females. The larvae were placed between the two organdy layers (to avoid larval crawling). Larvae of the first three groups were exposed to adult females for 24 hours, while those of the second three groups were exposed for 48 hours. The paralyzed larvae which carried the parasitoid eggs were removed to be replaced by other fresh ones for 24 or 48 hours and so on until the death of the parasitoid females. Parasitized larvae, of each group were kept individually in glass test tubes 8 × 2 cm. covered by muslin cloth and kept until emergence of the parasitoid adults. In different treatments ovipositional period; number of emerged adults and sex-ratio were estimated.

All studies were carried out at 26.6±2 °C and 65±5 % R.H.

3- Statistical analysis

L.S.D. values were estimated to test the differences among treatments of the three host species. As well, t-test values between the two exposure periods were used.

RESULTS AND DISCUSSION

1- Ovipositional Period

Ovipositional periods of adult females of *B. brevicornis* which were supplied daily and every two days with *O. nubilalis* larvae were 34.6 and 41.4 days, respectively (Table 1). Statistical analysis showed insignificant difference between the two periods.

As shown in Table (1), ovipositional period of adult females was considerably shorter when supplied with *A. ipsilon* larvae daily or every 48 hours. Statistical analysis indicated insignificant difference between the two ovipositional periods (21.7 and 20.6 days).

In case of *S. cretica,* the ovipositional periods were 30.6 and 20 days for females left with *Sesamia* larvae for 24 and 48 hours, respectively. Such data indicated insignificant difference between the two treatments.

According to the L.S.D. values, the two means of ovipositional period (34.6 and 41.4 days) resulted from parasitism on *Ostrinia* larvae, were found

Table (1): Effect of host species, exposed daily or every two days, on ovipositional period, number of progeny/female and sex ratio of *Bracon brevicornis*.

Biological parameters	Exposure period								t-values
	24 hours				48 hours				
	O. nubilalis	*S. cretica*	*A. ipsilon*	L.S.D.	*O. nubilalis*	*S. cretica*	*A. ipsilon*	L.S.D.	
Ovipositional period (days)	34.6 ± 9.7 (18 – 48)	30.6 ± 9.9 (10 – 41)	21.7 ± 8 (11 – 37)	7.579	41.4 ± 5.6 (34 – 50)	20 ± 7.8 (10 – 32)	20.6 ± 6.8 (10 – 28)	6.046	*Ostrinia* = 0.682 *Sesamia* = 1.48 *Agrotis* = 0.141
No. of progeny/ female	461.7 (201–686)	381.3 (140–556)	205.2 (166–326)		427 (365–505)	182.5 (23 – 336)	95.4 (23–336)		
No. of progeny/ larva	9.6 (1.9– 19)	9.3 (0.5–22.1)	7.3 (0.2–18.4)	1.884	17.1 (4.8–29.8)	11.4 0.6– 25.4)	6.4 (0.2–11.9)	5.251	*Ostrinia* = 4.99** *Sesamia* =1.224 *Agrotis* = 0.634
Sex-ratio (♂: ♀)	1 : 0.9	1 : 0.3	1 : 0.6		1 : 0.4	1 : 0.5	1 : 0.3		

**Highly Significant

significantly different from those recorded from *Agrotis* larvae, at the two tested exposure periods. The mean ovipositional period obtained from daily parasitism on *Sesamia* larvae (30.6 days) was insignificantly different from those obtained from *Ostrinia* larvae exposed for 24 or 48 hours. *Sesamia* larvae exposed for 48 hours showed less significant means of ovipositional period (20.0 days) than that obtained from *Ostrinia* larvae. Temerak (1983) stated that the female of *B. brevicornis*, supplied daily with a fresh *Sesamia* larva lived significantly longer than those kept with unchanged larvae.

2- Parasitoid progeny

As presented in Table (1), the mean numbers of progeny/*B. brevicornis* female were 461.7, 381.3 and 205.2, when reared on *O. nubilalis, S. cretica* and *A. ipsilon*, respectively, for daily exposure to parasitoid female. Respective values for 48 hours exposure were; 427, 182.5 and 95.4. The mean numbers of progeny/host larva were 9.6, 9.3 and 7.3 for *O. nubilalis, S. cretica* and *A. ipsilon*, respectively, at daily exposure to the parasitoid. The respective values for 48 hours exposure were 17.1, 11.4 and 6.4. It should be noted that many parasitoid larvae and pupae failed to develop on rearing on *A. ipsilon* larvae. Statistical analysis showed that the difference in the number of parasitoid progeny on *O. nubilalis* or *S. cretica* larvae exposed daily and for 48 hours was highly significant. The same was found for the mean number of progeny/host larva. L.S.D. values showed that at 48 hours exposure, the difference in the mean number of parasitoid progeny/larvae was significantly higher between *O. nubilalis* and *S. cretica*. However, this difference was insignificant at daily exposure.

3- Sex Ratio

Sex-ratio of *B. brevicornis* varied, insignificantly, according to the host species (Table 1). Sex ratio (male: female) was found to be 1: 0.9 (on *O. nubilalis*), 1: 0.3 (on *S. cretica*) and 1: 0.6 (on *A. ipsilon*) when new larvae were daily exposed to parasitoid females. The respective figures when larvae were exposed at two day intervals were; 1: 0.4, 1: 0.5 and 1: 0.3. Such sex ratios seem to be in favor of males. This fact could be interpreted that all progeny of the parasitoid was only males after a certain period of the ovipositional period. Such a certain period was 28 days (in *O. nubilalis*), 31 days (in *S. cretica*) and 26 days (in *A. ipsilon*) when new larvae were exposed daily to female parasitoids. The respective periods were 36, 24 and 22 days, when the larvae were exposed every two days.

Obtained results are in agreement with the findings of Megahed *et. al.*, (1981) who studied the effect of six different host species, including *S. cretica* and *A. ipsilon*, on sex ratio of *B. brevicornis* reared at 27 °C & 65% R.H. The sex ratio differed according to the species of host larva. Highest sex ratio (females: males) 2.06: 1 was obtained in case of *S. cretica* opposite to 0.35: 1 obtained in case of *A. ipsilon*. Lutfallah and Kares (1989) indicated that laboratory rearing of *B. brevicornis*, at 27 °C & 65% R.H. on *S. cretica* led to a sex ratio of 1 female: 1.37 male; showing a slight increase in the ratio of males comparing to that (1 female: 1.19 male) on *O. nubilalis*.

As a conclusion, from the obtained data, *O. nubilalis* could be recommended for mass rearing of *B. brevicornis*. The total number of produced progeny / female and sex ratio (in favor of females) were higher compared to *S. cretica*. In addition, rearing of *O. nubilalis* in laboratory is much easier than *S. cretica*.

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