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Evaluation of the Biological Parameters of the Interaction the Parasitoid, 
\textit{Bracon brevicornis} Wesmael (Braconidae: Hymenoptera) vs. Four 
Different Hosts under the No-Choice Situation

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ABSTRACT
\textit{Bracon brevicornis} Wesmael (Braconidae: Hymenoptera) is a generalist idiobiont ecto-parasitoid that parasitizes a wide range of Lepidoptera. In the present context, our study aimed to examine under laboratory conditions the effect of host size on the biological parameters of parasitoids \textit{B. brevicornis} for efficient laboratory rearing of that parasitoid. Under the no-choice situation, we compared biological parameters of this parasitoid wasp on four host species belonging to the Lepidoptera, viz. \textit{Pectinophora gossypiella} (Gelechiidae) and \textit{Earias insulana} (Noctuidae) as small size hosts, \textit{Helicoverpa armigera} (Noctuidae) and \textit{Spodoptera littoralis} (Noctuidae) as large size hosts. The biological parameters of the parasitoid on \textit{P. gossypiella} or \textit{E. insulana} (Small size) in most case proved to have a significant effect on their egg-adult developmental stages compared to its interaction vs. \textit{H. armegra} or \textit{S. littoralis} host (large size). The hosting on \textit{P. gossypiella} or \textit{E. insulana} the parasitoid produced excellent paralyzing and parasitism capacities but this capacity was less efficient on large size hosts and they received a significantly lower number of eggs as compared to \textit{H. armegra} or \textit{S. littoralis} which they received a good number of eggs. No variation was observed considering the egg-to-adult development time of \textit{B. brevicornis} parasitizing \textit{P. gossypiella} (small size) and \textit{S. littoralis} (large size), but the lowest egg-to-adult development time was observed on \textit{H. armegra} (large size). The biochemical analysis showed that the larger size hosts contained more resources for the growing the parasitoid, this was reflected only on fecundity. The other biological parameters: hatchability, longevity, lifetime and the percentage of hosts producing parasitoid offspring and sex ratio were not dependent on host size regardless of parasitoid generation. The results indicate that the parasite's behaviour of \textit{B. brevicornis} can develop under no-choice situation equally successfully on both small and large size host.

INTRODUCTION

In Egypt and in recent years, biological control began to take its place in the cotton fields, especially for control of the bollworms, Pink bollworm (\textit{Pectinophora gossypiella} (Saund.) Lepidoptera: Gelechiidae) and Spiny bollworm (\textit{Earias insulana} (Saund.) Lepidoptera: Noctuidae). These pests are the main pests of cotton in Egypt causing high losses to cotton production. The parasitoid \textit{Bracon brevicornis} Wesmael is a generalist parasitoid that parasitizes a wide range of Lepidoptera. It is a generalist parasitoid that parasitizes a wide range of Lepidoptera. It is therefore important to examine its ability to parasitize different hosts under laboratory conditions. The present study is aimed to evaluate the effect of host size on the biological parameters of \textit{B. brevicornis} parasitoid under laboratory conditions.
The Ministry of Agriculture has established several mass rearing laboratories for production of Trichogramma evanescence in most provinces of Lower and Upper Egypt. Among the various groups of biocontrol agents, braconid parasitoids are well known for the management of different lepidopteran larvae (Yu et al., 2002; Gül and Güle, 1995; Heimpel et al., 1997; Darwish et al., 2003; Altuntas et al., 2010 and Thanavendan and Jeyarani, 2010). *Bracon brevicornis* Wesmael (Hymenoptera, Braconidae) has attracted interest as a potential biological control agent, is an idiobiontic and develops as a gregarious ectoparasite on its host. There are many biological studies on *B. brevicornis* and the relative impact of parasitism on pink bollworm and different lepidopteran larvae were reviewed by (Abbas, 1980; Temerak, 1981a and b; Temerak, 1983; Jackson and Butler, 1984; and Thanavendan and Jeyarani, 2010).

With the wide application of biological control technologies, natural enemy insects mass-reared on substitute hosts are an important part of biological control success (Yang et al., 2014). Some biological control studies have recognized the important role of the behavioural and physiological interactions between parasitoids and different hosts to ensure the success of biological control programs (Uckan and Gule, 2002 and Quicke 2015). Host-size-dependent host-selection is common among parasitoids because the size of hosts is a determinant of host quality (Charnov & Skinner, 1984; Godfray, 1994; Goubault et al., 2004; Rehman & Powell, 2010; Liu et al., 2011). In contrast, recent work has shown that host size at the time of oviposition may have little influence on the fitness functions in some of the koinobiont species (Harvey 2000, Harvey et al., 2004). Also, understanding such host-size effects is important for biological control using parasitoids (Jervis & Kidd, 1996; Heimpel & Lundgren, 2000; Ode & Heinz, 2002; Hajek, 2004). The aim of our study was to examine the effect of host size on the biological parameters of parasitoids *B. brevicornis* on four different host species belonging to the Lepidoptera, viz. *Pectinophora gossypiella* (Gelechiidae) and *Earias insulana* (Noctuidae) as small size hosts, *Helicoverpa armigera* (Noctuidae) and *Spodoptera littoralis* (Noctuidae) as large size hosts.

**MATERIALS AND METHODS**

1. **Parasitoid Origin and Rearing:**

   *B. brevicornis* used in this study originated from field-collected dried boll samples from the cotton crop in Qaliubiya province, Lower Egypt. To form stock populations the larval parasitoid *B. brevicornis* was cultured on the pink bollworm full-grown larvae and grew up several generations in a glass jar (5 cm diameter x 12 cm height) under laboratory condition (25 ± 2°C). As food for the adult parasitoids, three drops of honey was provided on the inside wall of the jar.

2. **Hosts:**

   The host species studied in this experiment was pink bollworm *P. gossypiella*, spiny bollworm, *E. insulana*, American bollworm, *H. armegira*, and cotton leafworm, *S. littoralis*. They obtained from rearing laboratories of plant protection research institute (PPRI), Agricultural research centre, Egypt.

3. **Evaluation of the Biological Parameters of the Parasitoid, B.Brevicornis Vs. Four Different Hosts under the No-Choice Situation:**

   Both *P. gossypiella* and *E. insulana* larvae are distinguished by their small size compared to *H. armegira* and *S. littoralis*. The interaction of the parasitoid, *B. brevicornis* with these hosts was evaluated under no-choice situation as follows: Three replicates each of ten pairs (10♀&10♂) of freshly emerged parasitoids were
Evaluation of the Biological Parameters of the Interaction the Parasitoid

confined with five full-grown pink bollworms, P. gossypiella larvae as a host for parasitization in a glass jar closed by gauze cloth. The experiments were conducted under laboratory conditions (25 ± 2°C). Several droplets of honey bee were streaked on the surface of each glass jars lid as a source of food. The interaction between the parasitoid and the host was assessed on the following approach: Every day, the host exposed to the parasite is replaced with another and the same procedure was followed until parasitoid death. Each replacement larva inspected immediately by stereoscopic and photographs were taken. The following biological parameters were recorded in terms: the number of alive larvae, number of paralyzed larvae, number of larvae that were parasitized and number of the parasitoid eggs they had. As well as immature stages of the parasite were followed daily in terms of development period to pupation, mature stage and sex ratio, also, hatching ratio was calculated. As with the previous manner, the interaction between the parasitoid, B. brevicornis Vs. spiny bollworm larvae, E. insulana were evaluated. In the same approach, and through three replications for both the H. armegira at 6th instar and S. littoralis at 5th instar, the biological parameters were evaluated for the parasite's interaction on each of them.

4. Biochemical Analyses:

Analyses technique of total soluble protein, lipids, carbohydrate in total homogenate for different kinds of larvae were done at insect Physiology Dept. Plant Protection Researches Institute (PPRI). Samples from Full-grown larvae /P. gossypiella and E. insulana, 5th instar larvae / H. armigera and 6th instar larvae / S.littoralis were collected for biochemical analyses. The total soluble protein, lipids, and carbohydrate analyses were determined according to technique methods as described by Knight et al. (1972) and Bradford (1976).

5. Statistical Analysis:

The recorded data of the biological characteristics of the interaction of the parasitoid, B.brevicornis vs. four different hosts under the no-choice situation were analyzed using analysis of variance (ANOVA) using costat software program, 1990.

RESULTS AND DISCUSSION

1. Effect of Different Host Species on the Biological Parameters of the Parasitoid, B.Brevicornis under the No-Choice Situation:

The percentage of both the parasitized and paralyzed host was 91.0, 83.0, 69.0 and 76.0 when the parasitoid, B.brevicornis interacted with the larvae of P. gossypiella, E. insulana, H. armigera and S. littoralis under no-choice situation (Table 1).

The results in Table 1, as well as the illustrations in Figure 1, shows that the numbers of eggs deposited by the female parasite B. brevicornis were varied according to host species, and the number of eggs increased with the presence of the large-sized host. In this context, the daily examination of the replicates showed that the number of eggs during the test period ranged from 8 to 36 / S. littoralis and from 12 -26 eggs / H. armigera respectively. At the same time, the number of eggs placed on hosts of pink and spiny larvae recorded numbers ranging from 6 – 12 and 8 - 14, respectively. The recorded results showed that the highest percentage of the cocoon formation occurred in the case of interaction whether between the P. gossypiella or E.insulana larvae and recorded 96 and 93% respectively, whilst it decreased to 76.0 and 63.0 % on the larvae of S. littoralis and H. armigera, respectively. The results showed that the sex ratio of the offspring of the parasite originating from that different hosts has varied and the percentage of female individuals exceeded the rate of male individuals and recorded 0.65♀: 0.35 ♂ / P.gossypiella, 0.73♀: 0.27♂ / E.
insulana, 0.69: 0.31♂ / S. littoralis, while the sexual ratio was nearly balanced on the, H. armigera and recorded 0.56♀: 0.44 ♂.

### Table 1: The Biological parameters of the parasitoid, B.brevicornis that had hosted on four different species under the no-choice situation.

<table>
<thead>
<tr>
<th>The parasitoid vs. host</th>
<th>Range of daily numbers of deposited eggs/interaction period</th>
<th>% parasitized &amp; paralyze d / host</th>
<th>% Hatchability</th>
<th>% Pupation</th>
<th>% Adult emergence</th>
<th>Sex Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small size host</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. brevicornis vs. P. gossypiella</td>
<td>6 - 12</td>
<td>91.0</td>
<td>97.0</td>
<td>96.0</td>
<td>98.0</td>
<td>0.65 / 0.35</td>
</tr>
<tr>
<td>B. brevicornis vs. E. insulana</td>
<td>8 - 14</td>
<td>83.0</td>
<td>95.0</td>
<td>93.0</td>
<td>95.0</td>
<td>0.73 / 0.27</td>
</tr>
<tr>
<td>Large size host</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. brevicornis vs. H. armigera</td>
<td>12 - 26</td>
<td>69.0</td>
<td>89.0</td>
<td>76.5</td>
<td>75.0</td>
<td>0.56 / 0.44</td>
</tr>
<tr>
<td>B. brevicornis vs. S. littoralis</td>
<td>8 - 36</td>
<td>76.0</td>
<td>83.0</td>
<td>63.5</td>
<td>60.0</td>
<td>0.69 / 0.31</td>
</tr>
</tbody>
</table>

**Fig. 1** Expressive photograph of low fecundity level of the parasitoid B.brevicornis on small size host (P.gossypiella) compared to good fecundity on large size host (S. littoralis)

The recorded results showed that the highest percentage of the cocoon formation occurred in the case of interaction whether between the P. gossypiella or E.insulana larvae and recorded 96 and 93% respectively, whilst it decreased to 76.0 and 63.0 % on the larvae of S. littoralis and H. armigera, respectively. The results showed that the sex ratio of the offspring of the parasite originating from that different hosts has varied and the percentage of female individuals exceeded the rate of male individuals and recorded 0.65♀: 0.35 ♂ / P.gossypiella, 0.73♀: 0.27 ♂ / E. insulana, 0.69: 0.31♂ / S. littoralis, while the sexual ratio was nearly balanced on the host, H. armigera and recorded 0.56♀: 0.44 ♂. Larval and cocoon duration of the parasitoid B. brevicornis reared on four hosts species in a no-choice way were recorded in Table (2). The duration of the larval stage of the parasitoid B. brevicornis hosted on E. insulana, H.armigera and S. littoralis did not produce significant differences and ranged from 6.3 – 6.5 days, whilst that period was significant longest on the P.gossypiella compared to each of the previous hosts and recorded 7.6 days. On the other hand, cocoon duration on P. gossypiella, E. insulana and H.armigera ranged from 5.3 – 5.6 days without significant difference, while this period prolonged significantly with the host, S. littoralis compared to each one of those three hosts and recorded 6.3 days. The results recorded in Table 3 indicate that the duration pre-oviposition of the parasitoid, B.brevicornis hosted on that four different
species larvae were not significantly affected by this difference and the period had ranged from 1.6 – 2.4 day. The results (Table 3) showed that the oviposition period was affected by the diversity of the hosts. The shortest period with significant difference occurred with those that were hosted on *S. littoralis* and recorded 9.4 days. In contrast, the parasitization on the host, *P. gossypiella* recorded the longest oviposition period (13.9 days) with a significant difference from the other hosts. The oviposition period for both hosts, *E. insulana* and *H. armigera* recorded 12.7 and 11.3 days, respectively with no significant difference when compared to each other. On the other hand, the females, *B. brevicornis* that were hosted on the *P. gossypiella* and *E. insulana* did not produce significant differences between each of them in terms of the total number of the deposited eggs (fecundity) and recorded 142.0 ± 0.2 and 139.0±0.1, respectively. Female the parasitoid hosted on *H. armigera* and *S.littoralis* showed pronounced fertility (169. ± 0.3 and 155.0 ± 1.1, respectively) with significant differences, and both had recorded superiority with significant difference compared to those recorded on *P gossypiella* and *E. insulana*. In terms of female longevity, the females which hosted on the *P. gossypiella*, recorded the prolonged period of life span (17.5±01.4 days) with a significant difference compared to others. Females hosted on *E. insulana* and *H.armigera* were the next in the order of longevity (15.5±0.9 and 15.3.0±1.5 days ) with no significant differences between them occurred. By contrast, the female who accompanied by the *S. littoralis* host was distinguished by a short life span (13.9 ± 1.1 days) with a significant difference compared to the others.

**Table 2:** The times (days) of the immature stages of the parasitoid, *B.brevicornis* on the four hosts under the no-choice situation.

<table>
<thead>
<tr>
<th>The parasitoid vs. host</th>
<th>Eggs Incubation period(days)*</th>
<th>Larva Period (days)</th>
<th>Cocoon Period (days)</th>
<th>The entire life cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Small size host</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>B.brevicornis</em> vs. <em>P. gossypiella</em></td>
<td>2.0±0.1a</td>
<td>7.6±0.2b</td>
<td>5.4±0.4b</td>
<td>15.0±1.2c</td>
</tr>
<tr>
<td><em>B.brevicornis</em> vs. <em>E. insulana</em></td>
<td>2.30±0.3b</td>
<td>6.5±0.1*</td>
<td>5.6±0.3b</td>
<td>14.3±1.3b</td>
</tr>
<tr>
<td><strong>Large size host</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>B.brevicornis</em> vs. <em>H. armigera</em></td>
<td>2.40±0.1b</td>
<td>6.3±0.3*</td>
<td>5.3±0.2b</td>
<td>13.0±0.5*</td>
</tr>
<tr>
<td><em>B.brevicornis</em> vs. <em>S. littoralis</em></td>
<td>± 02 c*</td>
<td>6.4±1.1*</td>
<td>6.30±0.4a</td>
<td>15.3±1.1c</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>0.213</td>
<td>1.055</td>
<td>0.642</td>
<td>1.226</td>
</tr>
</tbody>
</table>

The mean inside each column followed by the same letter do not differ significantly from each other by the L.S.D at the 0.05 level

**Table 3:** Duration of pre-oviposition, oviposition, and post-oviposition (days), longevity and fecundity of the parasitoid, *B.brevicornis* hosted on four different species under the no-choice situation.

<table>
<thead>
<tr>
<th>The parasitoid vs. host</th>
<th>Pre-oviposition</th>
<th>Oviposition</th>
<th>Post-oviposition</th>
<th>Longevity</th>
<th>Fecundity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Small size host</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>B.brevicornis</em> vs. <em>P. gossypiella</em></td>
<td>1.6±0.2a</td>
<td>13.9±0.8c</td>
<td>2.0±0.2b</td>
<td>17.5±1.4 c</td>
<td>142.0±0.2 a</td>
</tr>
<tr>
<td><em>B.brevicornis</em> vs. <em>E. insulana</em></td>
<td>1.9±0.1a</td>
<td>12.7±1.1b</td>
<td>0.9±0.2a</td>
<td>15.5±0.9 b</td>
<td>159.0±0.1a</td>
</tr>
<tr>
<td><strong>Large size host</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>B.brevicornis</em> vs. <em>H. armigera</em></td>
<td>2.2±0.3a</td>
<td>11.3±1.3b</td>
<td>1.8±0.2b</td>
<td>15.3±1.5 b</td>
<td>169±0.3c</td>
</tr>
<tr>
<td><em>B.brevicornis</em> vs. <em>S. littoralis</em></td>
<td>2.4±0.4a</td>
<td>9.4±0.6a</td>
<td>2.1±0.2b</td>
<td>13.9±1.1 a</td>
<td>155.0±1.1b</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>0.336</td>
<td>1.314</td>
<td>0.420</td>
<td>0.551</td>
<td>6.511</td>
</tr>
</tbody>
</table>

*The mean inside each column followed by the same letter do not differ significantly from each other by the L.S.D at the 0.05 level*
2. Total soluble Protein, Lipid, and Carbohydrate in the Haemolymph of the Four Tested Hosts:

Data presented in Table (4) revealed that the four tested hosts clearly differ in total soluble protein, lipid, and carbohydrate. The total soluble lipid was 33.0, 31.4 and 27.93 in *H. armigera*, *S. littoralis* and *P. gossypiella*, while, it decreased to 19.77 mg/ml in *E. insulana*. The total lipid increased approximately by 6 to 5 times (46.0 to 57.3mg/m.) in *H. armigera* and *S. littoralis* compared to 8.59 and 35.60 mg/m in *P. gossypiella* and *E. insulana*. The highest value of the total soluble carbohydrate recorded / *P. gossypiella*, 51.66 mg/m. whilst, the lowest value was recorded / *E. insulana*, 28.27 mg/m.

Numerous examples of biological control studies indicated that to produce effective control methods, detailed knowledge of the biology, ecology, and biochemistry of parasites and predators is important and necessary to achieve success and produce effective control methods. In this context, the group of braconidae parasites is defined as a biological control agent for the management of different lepidopteran larvae (Abbas, 1980; Temirak, 1981a, and b; Temirak, 1983; Jackson and Butler, 1984; Tanafandan and Jayarani, 2010 Shalaby et al., 2015). The present study comes in the context of more studies on the behaviour of *B. brevicornis* on *p. gossypiella, E. insulana, H. armegra* and *S. littoralis* which many studies have indicated response and suitability of these pests and others to the development of parasitoid (Yu et al., 2002; Darwish et al., 2003 and Thanavendan and Jeyarani, 2010 ). The data obtained in the present investigations were generated under laboratory no-choice conditions in which the host was available to the adults and that the parasite and its host were artificially brought together.

Table 4: The total soluble protein, lipid and carbohydrate in the haemolymph of *P. gossypiella, E. insulana, H. armigera* and *S. littoralis*.

<table>
<thead>
<tr>
<th>Hosts</th>
<th>Total Protein and (rang) mg/m</th>
<th>Total lipid and (rang) mg/m</th>
<th>Total Carbohydrate and (rang)mg/m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>Range</td>
<td>mean</td>
</tr>
<tr>
<td>Small size host</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>P. gossypiella</em></td>
<td>27.93± 0.7b</td>
<td>21 -54</td>
<td>8.59 ±0.19a</td>
</tr>
<tr>
<td><em>E. insulana</em></td>
<td>19.77±0.29a</td>
<td>17 -26</td>
<td>35.60±0.95b</td>
</tr>
<tr>
<td>Large size host</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>H. armigera</em></td>
<td>33.2±1.1c</td>
<td>21-37</td>
<td>46.0±2.4c</td>
</tr>
<tr>
<td><em>S. littoralis</em></td>
<td>31.4±1.3c</td>
<td>23-39</td>
<td>57.3±20.95d</td>
</tr>
<tr>
<td>LSD</td>
<td>1.487</td>
<td>7.211</td>
<td>5.316</td>
</tr>
</tbody>
</table>

*The mean inside each column followed by the same letter do not differ significantly from each other by the L.S.D at the 0.05 level

The results indicated that the host’s species had an effect on the behavioural and ovipositional responses of *B. brevicornis*. Temerak (1983) reported that *B. brevicornis* preferred to parasitize and complete its life cycle on *Earias spp.*, *H. armigera, P. gossypiella* than other host insects offered. The results showed that the duration and viability of the parasitoid biological cycle (egg-adult) were affected by the host species with seemingly inconsistent effects. Although many studies (Xie et al. 1989, Yu et al. 2003 and Khalil et al. 2016) reported that the host size plays an important role on the oviposition behaviour of braconid ectoparasitoid and the large-sized larvae like noctuids receives a significantly higher number of eggs when compared to the smallest host larvae, the biological parameters of the parasitoid on
P. gossypiella or E. insulana (Small size) in the most case proved to have a significant effect on their egg-adult developmental stages compare to its interaction vs. H. armegra or S. littoralis host (large size). The results indicated that P. gossypiella and E. insulana were similar hosts for B. brevicornis, this is similar to that reported by Kandil, 2001; Kandil et al. 2013 and Alam et al. (2016). The hosting on P. gossypiella or E. insulana the parasitoid produced excellent paralyzing and parasitism capacities but this capacity was less efficient on large size hosts but they received a significantly lower number of eggs as compared to H. armegra or S. littoralis which they received a good number of eggs. Xie et al. (1989) and Khalil et al. (2016) revealed that B. hebetor prefers to lay more eggs on large larvae as compared to smaller ones. Khalil et al., (2016) mentioned more hosts can be paralyzed than the number that is needed for oviposition; even when no egg is deposited, Doten (1911) and Richards and Thomson (1932) reported females of the parasitoid H. hebetor to paralyze many more hosts than needed for oviposition and only a small proportion of the paralyzed larvae are actually used for oviposition. No variation was observed considering the egg-to-adult development time of B. brevicornis parasitizing P. gossypiella (small size) and S. littoralis (large size), but the lowest egg-to-adult development time was observed on H. armegra (large size). Considering adult production related to hosting species, a difference was observed in the parasitoid sex ratio. The highest percentage of female progeny came from E. insulana (small size) followed by S. littoralis (large size) and P. gossypiella (small size) followed by H. armegra (large size). Our results are opposite to what Godfray’s (1994) found that under the choice conditions that small hosts received more male eggs and large hosts more female eggs. Thus our results showed that the parasite's behaviour of B. brevicornis did not match when it hosted on different hosts under the no-choice condition in terms of using its ability to cause the paralysis, parasitism, longevity, sex ratio of the progeny and life cycle. Ghimire and Phillips (2010) reported H. hebetor females can paralyze and lay eggs on several host species, but it cannot necessarily develop and reproduce optimally on all host species that it can paralyze and parasitize. On the other hand, our results for the biochemical analysis of the natural total content of proteins, fats, and carbohydrates in the tissues of the hosts’ body tissue before parasitism occurred showed that it is proportional to the host's size as its content was high in large compared to small size. In the current study, the biological parameters of the parasitoid interaction on these hosts were inconsistent and contradicted with this trend. Although the larger size hosts contained more resources for the growing the parasitoid, this was clearly reflected only on fecundity. The other biological parameters: hatchability, longevity, lifetime and the percentage of hosts producing parasitoid offspring and sex ratio were not dependent on host size regardless of parasitoid generation. Thus, our results indicate that the parasite's behaviour of B. brevicornis can develop under no-choice situation equally successfully in both small and large. The results indicate that B. brevicornis can parasitize a wide range of hosts of different sizes.

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تقييم المعالم البيولوجية لطفيل براكون بريفينكورنيس (عائلة براكونيدى-رتبة هيمنوبترا) على عوائِل مختلفة بدون إتاحة الاختيار

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الطفيل براكون بريفينكورنيس (عائلة براكونيدى-رتبة هيمنوبترا) طفيل خارجي يتغلط على عوائِل عدة من يرقات حرشفية الأجنحة وفي هذا السياق تستهدف هذه الدراسة إعلاة هذا الطفيل معملياً على أربعة عوائِل من يرقات حرشفية الأجنحة تتميز طبيعياً بتنوع أحجامها وهي يرقات اللوز الوردي بكتينوفورا جوسبيليا ويرقات اللوز الشوكية أرياس إسولانا وكلاهما أصغر حجماً من كل من يرقات اللوز الأمريكي هليكوفيلا أرميجرا ويرقات دودة ورق القطن بريتوريلا ليتوتراس وكلاهما طبيعياً ذوي أحجام كبيرة وذلك في تجريب لاينتيج للطفيل اختبار عائِلة بهدف اختبار مدى تأثير العوائِل متبائنة الأحجام على المعايير البيولوجية للطفيل. وقد أظهرت النتائج تأثيرات معنوية متباينة بين العوائِل المختبرة حيث تميزت قدرات الطفيل على احداث الشلل والتغلط في تفاعل مع اليرقات صغيرة الحجم مقارنة بالأكبر حجماً في حين أن العوائِل الأكبر حجماً استقبلت من بيض الطفيل اعداد تفوق ما وضع على العوائِل الأصغر حجماً وعلى جانب اخر لم تتبَّع مدة تطور الطفيل من البيض الى الطور اليافع على مختلف الأحجام المختبرة لكن أقل مدة تطور سجلت على العائِلة كبيرة الحجم. وقد أظهرت نتائج التحليل البيوكيميائي لمكونات البروتين والإهود والكربوهيدرات للعوائِل الطبيعية المختبرة تفوق محتوى هذة المكونات بالعوائِل الكبيرة الحجم مقارنة بالصغر إلا ان المعايير البيولوجية للطفيل من حيث نسب الفقس وطول عمر الإناث ومدة التطور والنسب الجنسية للذرية الناتجة لم تتبَّع بين العوائِل الأصغر والأكبر حجماً تبعاً لهذا المحاولة. استدل من نتائج التجريب ان الطفيل براكون بريفينكورنيس تحت الظروف المعملية استطاع التطور بنجاح على العوائِل المختبرة.