

LONGEVITY OF *BRACON BREVICORNIS* [HYM :
BRACONIDAE] ADULTS AS INFLUENCED BY NOURISHMENT
 ON ARTIFICIAL AND NATURAL FOODS

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Laboratory trials were undertaken to investigate the nutrition of *Bracon brevicornis* Wesmael adults on : (1) artificial diets (sucrose, treacle, honey bee and tap water) ; (2) *Sesamia* larvae (exposed under 3 manipulations) ; (3) 5 host species (*Galleria*, *Ephestia*, *Sesamia*, *Spodoptera* and *Ostrinia*) ; in addition to starvation at 12, 15, 20, 25, 30, 35 and 40 °C. Among artificial diets, honey bee solution was the most suitable that prolonged significantly each sex to be more than 1 month at 25 °C. A *Bracon* female supplied daily with a fresh *Sesamia*-larva was significantly longer-lived than when kept with the "unchanged" *Sesamia*-larva. Larvae of borers (*Sesamia* and *Ostrinia*), gave significantly the highest longevity for females among other host species. Adult-longevity was significantly decreased with an increase in temperature.

Females were significantly longer-lived than males when kept only with living host insects. However, such sex difference was generally uncertain when either was supplied with an artificial diet or starved under temperatures ranging from 12-40 °C.

Conservation and enhancement of indigenous natural enemies can have a significant role in pest population programs. Enhancement is the use of measures that increase natural enemy's longevity or reproduction, or attractiveness of an area to these enemies (Stehr, 1975).

Provision in the habitat of supplementary foods for adult natural enemies is of paramount importance in their distribution, manipulation and effectiveness. Temerak (1976) observed that *Bracon brevicornis* Wesmael activity was greatly influenced by the presence of honey dew on sorghum stalks in El-Badari (Assiut Governorate). In this regard, McKnight (1971) speculated that honey dew probably served as a common food for both ♂♂ and ♀♀ of *B. politiventris*. Also, DeBach (1965) indicated that some species of parasitoids require special nutritional elements found in fresh honey dew.

In a trial to manipulate the environment to make it more favourable for *B. brevicornis*, Temerak (1976) sprayed treacle-honey solution on stacked sorghum stalks during winter. He found that application of honey (in form of treacle) had significantly enhanced the effectiveness and the biology of this parasitoid.

On the other hand, the presence of host insects is obligatory for some species of adult Hymenoptera for promoting ovogenesis and for preventing inducement of diapause in their progeny (DeBach, 1965). Stinging is a primary behavioral event in many species of parasitoids to acquire a meal of hemolymph as food (e.g. McNight, 1971 ; Mathews, 1974).

Nutrition would be also needed in storage of parasitoid adults for successful shipping or timing of appropriate field liberation. Therefore, the present study was conducted to investigate longevity of *B. brevicornis* adults when fed on artificial diets and on living host species (natural food).

MATERIALS AND METHODS

In the following trials, 1 pair of a ♀ and a ♂ of the parasitoid, *B. brevicornis* was kept in each vial (6 length × 5 width cm) containing 1 host larva. With exception of 1 trial, wasps were utilized on the same day of their emergence with 5 replicates per each trial. All vials were normally incubated at 25 °C and 50 ± 5 % R.H.

ARTIFICIAL DIETS

Diets of sucrose, treacle, honey-bee solutions (10 % per each in tap water) and tap water only, were prepared. A droplet of a given diet was streaked on the respective glass vial each 2 days.

NATURAL FOOD (a. *S. cretica* only)

Larvae of *Sesamia cretica* Led. were exposed to the wasps under 3 cases of host manipulations : (1) the host larva was "unchanged" thereafter : (2) the same as in (1) plus removed daily of the parasitoid's eggs ; and (3) the larva was "changeable" each 24 h (daily fresh larva was supplied).

NATURAL FOOD (b. 5 species of larvae).

Full grown lepidopterous larvae : *Galleria mellonella* L., *Ephestia cautella* Walker, *Sesamia cretica*, *Spodoptera littoralis* Boisduval and *Ostrinia nubilalis* Hübner were exposed separately to the wasps. Ten replicates were used per given host species. Adult wasps herein are 48-h-old.

TEMPERATURES (no food)

Degrees of 12, 15, 20, 25, 30, 35 and 40 °C were tested.

STATISTICAL ANALYSES

Data were analyzed by f-test. Duncan's Multiple Range Test was used for comparisons among means.

RESULTS AND DISCUSSION

The longevity of *B. brevicornis* adults when fed on artificial diets at 25 °C, is shown in table 1. Among artificial diets utilized, honey bee solution occupied the 1st rank and was considered the most suitable diet. It prolonged significantly both ♂♂ and ♀♀ to more than one month. Difference between sucrose and treacle solutions was generally insignificant. However, the mean length of life of *Macrocentrus ancyliivorus* was longer on a 10 % sucrose than on a 10 % honey solution (Pielou, & Glasser, 1953, cf. DeBach, 1965).

TABLE 1

Average longevity (days) of B. brevicornis adults fed different artificial diets (at 25 °C)

Type of Food	Female	Male
None (Starvation) (a)	7.2 a	5.8 a
Sucrose	22.4 c	29.2 d
Treacle (honey)	24.6 c	24.6 c
Honey bee	35.0 e	36.2 e
Tap water	7.6 ab	8.6 b
Average	19.36 A	20.88 A

Within given letter (small or capital), figures followed by the same letter are not significantly different. Significant at 0.01.
(a) from table 4.

Honey usually suffices as an adult diet. The need for a carbohydrate by parasitoid adults is usually critical and is obligatory for egg maturation and longevity (DeBach, 1965). In his excellent review of the factors affecting mortality of natural enemies in cotton fields in Egypt, Hafez (1972) emphasized the need of testing the spraying of cotton plants with artificial food solutions composed of nutrients that will attract more entomophagous insects and help to increase their longevity and fecundity. In this respect, Temerak (1976) sprayed a supplementary food source, a treacle (honey) solution, on stacked sorghum stalks in El-Badari during winter, in a trial to make the environment more favorable for *B. brevicornis* than it was due to the scarcity of pollen, honey dew and floral nectaries as natural foods for wasps, during winter. He found that live borer larvae had significantly decreased and *Bracon* cocoons significantly increased after spray treatment.

The lowest longevity was recorded in case of tap water or "none" (starvation). Generally, longevity of ♀♀ was equal with that of ♂♂, when using an artificial diet.

The longevity of the wasps, after being kept with *Sesamia* larvae, under 3 different manipulations of hosts, is shown in table 2. When a ♀ was daily supplied with a fresh larva, it had

TABLE 2

Average longevity (days) of B. brevicornis adults fed on Sesamia cretica larvae under 3 different manipulations (at 25 °C)

<i>Sesamia</i> Larva	Female	Male
Unchanged (permanent)	10.8 b	6.2 a
Unchanged + daily removed of <i>Bracon</i> 's eggs	15.4 c	5.6 a
Changed/each 24 h.	25.2 d	7.8 ab
Average	17.13 A	6.53 B

Within given letter (small or capital), figures followed by the same letter are not significantly different. Significance at 0.01.

significantly the longest lifetime. Consequently, it might be assumed that in the field when parasitoid ♀♀ are present in low numbers compared with the host larvae, a ♀ would have the opportunity to contact more than 1 larva. Accordingly, parasitoid longevity would be greatly increased.

Temerak (1981) indicated that ♀♀ of this parasitoid associated with hibernating forms of *Sesamia* larvae were significantly longer-lived than ♀♀ kept with active larvae of the same host species. Within any given type of *Sesamia* treatments, ♀♀ had significantly longer lifetimes than ♂♂.

The longevity of adults associated with different living host insects is presented in table 3. Borer species, *Sesamia* or *Ostrinia*, gave significantly the highest longevity for ♀♀. The opposite was true with that of *Spodoptera* or *Ephestia*, in this regard. It is generally speculated that the borer larvae might have special nutritional value for this braconid since they represent the common natural hosts in the field. Also, ♀♀ had significantly longer lifetime than ♂♂ per any given host species.

TABLE 3
Average longevity (days) of B. brevicornis adults fed on different species of host larvae (at 25 °C)

Hosts	Female	Male
<i>Galleria</i>	7.8 b	4.9 d
<i>Ephestia</i>	6.3 c	5.1 d
<i>Sesamia</i>	9.6 a	4.6 d
<i>Spodoptera</i>	6.7 c	5.2 d
<i>Ostrinia</i>	9.8 a	5.1 d
Average	8.04 A	4.98 B

Within given letter (small or capital), figures followed by the same letter are not significantly different. Significance at 0.01.

TABLE 4
Average longevity (days) of B. brevicornis adults incubated at different constant temperatures

Temperature °C	No Food		Kept with <i>Sesamia</i> (a)		Kept with <i>Galleria</i> (b)	
	Female	Male	Female	Male	Female	Male
10	---	---	88.2 k	22.2 i	---	---
12	27.0 h	27.6 h	---	---	---	---
15	18.2 f	21.0 g	29.7 j	11.3 g	29.3 f	12.9 e
20	9.2 d	12.2 e	13.5 h	6.1 de	13.0 e	6.3 cd
25	7.2 c	5.8 bc	9.3 f	4.9 cd	7.8 d	4.9 bc
30	4.0 b	4.4 b	7.4 e	3.9 bc	6.2 cd	3.2 ab
35	4.6 b	4.4 b	6.0 de	2.4 ab	5.7 cd	2.2 a
40	1.8 a	2.0 a	5.6 d	1.7 a	---	---
Average (among sex)	10.3 A	11.1 A	22.8 A	7.5 B	12.4 A	5.9 B
	ns		**		**	

Within given nutrition, figures followed by the same letter (small or capital) are not significantly different. **= Significant at 0.01, ns= Not significant.

a) Temerak (1982).

b) Temerak *et al.* (1982).

In case of "no food", females and males were used after emergence (immediately), while in case of (1) or (2), they were 48-h-old.

The longevity of braconid adults incubated without supplementary food at temperatures ranging from 12-40 °C is presented in table 4. Longevity increased significantly with a decrease in temperature. In general, longevity difference between both sexes was insignificant.

Generally, through comparison among 2, 3 tables on one hand and 1, 4 tables on the other, it was found that, using a living host insect resulted significantly in higher longevity for ♀♀ than ♂♂. However, when using an artificial diet or "none" the both sexes had the same longevity. Also, by comparing tables 1 and 2, ♀♀ had longer longevity when fed on honey bee solution than on *Sesamia* larvae at 25 °C. **Temerak** (1982) recorded 88 days for a ♀ kept with larva of *Sesamia* at 10 °C. Therefore, it is generally believed that the highest longevity might occur when honey bee solution is utilized as a supplementary food for wasps at 10 °C.

CONCLUSIONS

The present investigation should serve as the basis for subsequent studies to manipulate the environment to make it favorable for parasitoid wasps, through spraying artificial food solutions. Also, it may help in storage of adults for successful shipping or timing of appropriate field liberation.

RÉSUMÉ

Longévité des imagos de *Bracon brevicornis*
[Hym. : Braconidae] selon leur alimentation sur
des aliments naturels ou artificiels

Des expériences en laboratoire ont été réalisées pour étudier la nutrition des adultes de *Bracon brevicornis* Wesmael sur : (1) des milieux artificiels (sucrose, mélasse, miel et eau du robinet), (2) des chenilles de sésamie (présentées de 3 façons, (3) 5 espèces d'hôtes (*Galleria*, *Ephestia*, *Sesamia*, *Spodoptera* et *Ostrinia*) et aussi soumis au jeûne, à 12, 15, 20, 25, 30, 35 et 40 °C.

Parmi les aliments artificiels, l'eau miellée est le meilleur, car elle augmente la longévité des 2 sexes de plus d'un mois à 25 °C. La femelle de *Bracon* pourvue chaque jour d'une larve de sésamie vit significativement plus longtemps qu'en présence de la même chenille. Avec les chenilles des foreurs (*Sesamia* et *Ostrinia*) on obtient la longévité des femelles la plus élevée parmi toutes les autres espèces-hôtes. L'augmentation de la température diminue la longévité de manière significative.

Les femelles vivent plus longtemps que les mâles en présence seulement d'insectes hôtes vivants. Cependant cette différence est généralement moins nette lorsque les *Bracon* sont nourris avec un aliment artificiel ou laissés à jeûn à des températures allant de 12 à 40 °C.

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