

## Research Note

# Comparative studies on biology of *Chelonus blackburni* (Cameron) (Hymenoptera: Braconidae) on *Phthorimaea operculella* (Zeller) and *Corcyra cephalonica* (Stainton) under laboratory conditions

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**ABSTRACT:** *Chelonus blackburni* (Cameron) that parasitizes eggs of potato tuber moth is widely distributed and occurs commonly in potato fields throughout the country. Studies on its biology and ovipositional performance were carried out on both hosts i.e. *Phthorimaea operculella* and *Corcyra cephalonica* in laboratory conditions. Average number of eggs laid per female was found to be  $210.9 \pm 16.62$  on *P. operculella* and  $118.4 \pm 7.49$  on *C. cephalonica*. Incubation period of the parasitoid on *P. operculella* was  $24.5 \pm 1.62$  hours on an average, while on *C. cephalonica*, it was found as  $25.2 \pm 1.33$  hours. Total larval duration was 14.5 days and 19.2 days on *P. operculella* and *C. cephalonica*, respectively. Pupal period was  $10.6 \pm 0.70$  days on *P. operculella*, whereas it was slightly higher on *C. cephalonica* ( $13 \pm 0.57$  days). The average life span was observed to be 6.8 days on *P. operculella* and 7.7 days on *C. cephalonica*.

**KEY WORDS:** *Chelonus blackburni*, *Corcyra cephalonica*, parasitoid biology, *Phthorimaea operculella*

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*Chelonus blackburni* (Cameron), a uniparental species, is an egg-larval parasitoid of *Phthorimaea operculella* (Zeller). Being uniparental, parthenogenetic and having fairly wide host range. Such species can relatively survive using host specific parasitoids. It has also been used for the biological suppression of various cotton pests, *Pectinophora gossypiella* Saunders in Maharashtra State, *Earias vittella* Fabricius in Karnataka State and *Helicoverpa armigera* Hubner in many other states (Jasrotia, 2003). Thompson (1953) listed thirteen hosts from eight families in Hawaii and Muesebeck *et al.* (1951) added *Anagasta kuehniella* (Zeller) as a host of *C. blackburni*. Limited studies on biology of *Chelonus* spp. has been reported in the literature (Vance, 1932; Broodryk, 1969; Subha Rao and Gowda, 1961; Patel *et al.*, 1958; Butler 1966). Hence, an experiment was conducted to compare the biology of *C. blackburni* on two hosts i.e. *P. operculella* and *C. cephalonica* under laboratory conditions.

The stock culture of *C. blackburni* was procured from National Agricultural Research Project, Ganeshkhind and then maintained in the laboratory on *C. cephalonica*. However, the biological studies of parasitoid were studied on two laboratory hosts viz., *P. operculella* and *C. cephalonica*.

Crushed sorghum grains were used as food material for rearing *C. cephalonica*. Fresh eggs of *C. cephalonica* were

glued on paper-strip by smearing 10% gum solution. The egg-card thus prepared was exposed to adult parasitoids in plastic jar for oviposition. After 24 hours, the egg-card was taken out and placed in glass-jar having crushed sorghum grains. And then top of plastic-jar was closed by muslin cloth. On hatching, the larvae developed in the jar and simultaneously the parasitoid, *C. blackburni* was also developed in the developing larvae of *C. cephalonica* and observations were recorded.

## Biology of *Chelonus blackburni*

To study the developmental period of *C. blackburni* on *P. operculella* and *C. cephalonica*, 100 host eggs was exposed to adult parasitoids for parasitization. After every 6 hours the eggs was dissected to note the incubation period of the parasitoid and these dissections was continued till all the eggs hatched. Similarly for recording the larval duration, parasitized host eggs and larvae were dissected till pupation. Pupal period was recorded by taking out the cocoon and placing them in the petriplates for the adult parasitoids emergence. At every step dimensions of each developmental stage was taken with the help of ocular micrometer (Jasrotia, 2003). Fecundity of *C. blackburni* on *P. operculella* and *C. cephalonica* was recorded by exposing 100 eggs of both the hosts to a freshly emerged adult female in glass tubes (15x3

cm). From the time of its emergence till death the host eggs where dissected daily after every 24 hours to record the number of eggs laid. The longevity of the parasitoid was also recorded simultaneously (Ghoghari, 1993).

### ***Chelonus blackburni* egg stage**

The observations and data revealed that the eggs of *C. blackburni* were minute, colourless and crescent in shape with rounded ends. Cephalic end was broad which slowly tapers towards rounded caudal end. Incubation period of the parasitoid on *P. operculella* ranged between 14.0 to 33.0 hours with an average of  $24.5 \pm 1.62$  hours, while on *C. cephalonica* it ranged from 18.0 to 32.0 hours with an average of  $25.2 \pm 1.33$  hours, respectively.

### **Larvae**

The developmental stages of larvae of *C. blackburni* had five instars with larval duration ranging from 10 to 22 days.

#### **I Instar**

Newly hatched larva of *C. blackburni* was very small and faint with a broad head. Body was soft and dirty white in color. Head distinctly sclerotized, exceedingly large and somewhat flattened with two sickle shaped mandibles. The larval body was eight segmented. Duration of first instar was documented to be 1 to 3 days with an average of  $2.0 \pm 0.25$  days on *P. operculella*, while on *C. cephalonica* it was slightly higher 2 to 5 days with an average of  $2.8 \pm 0.32$  days, respectively.

#### **II Instar**

Second instar larva was similar to first instar and had 10 body segments. The instar took 1-3 and 2-6 days with an average of  $2.3 \pm 0.21$  and  $3.5 \pm 0.42$  days when reared on *P. operculella* and *C. cephalonica*, respectively.

#### **III Instar**

Third instar larva was white in color with tubular shaped body. Body segments were found to be 12. Head was much reduced and mandibles were not seen externally. It took a short period of 2 to 5 days with an average  $2.8 \pm 0.32$  days when reared on *P. operculella*, while on *C. cephalonica* 2 to 7 days with an average  $4.3 \pm 0.47$  days to complete its stage

#### **IV Instar**

Fourth instar larva was slightly yellowish white in color with cylindrical body and the body segments were thirteen.

Duration varied from 2 to 6 days with an average  $3.3 \pm 0.42$  days on *P. operculella* and  $4.3 \pm 0.39$  days it was observed slightly higher on *C. cephalonica*.

#### **V Instar**

Fifth instar was grub like having translucent body with thirteen segments. Anterior end was pointed with a broad posterior end. Mandibles had fine serrations on the inner margin. It took an average 4.1 days and 4.3 days on *P. operculella* and *C. cephalonica*, respectively to complete its life stage.

### **Cocoon**

Cocoon of the *C. blackburni* was white having barrel shaped body with both ends rounded. Pupal period varied from 7 to 14 days with an average of  $10.6 \pm 0.70$  days on *P. operculella*, whereas, on *C. cephalonica* it was found slightly higher 10 to 16 days with an average of  $13 \pm 0.57$  days, respectively.

### **Developmental period**

Total development period of *C. blackburni* was completed in 17 to 39.2 days with an average of 25.1 days on *P. operculella*, whereas, on *C. cephalonica* it was found slightly more time 21.6 to 48.2 days with an average of 32.2 days, respectively.

### **Fecundity**

Female adult of *C. blackburni* laid on an average  $210.9 \pm 16.62$  eggs ranging from 111 to 284 eggs that was reared on *P. operculella*. However, on *C. cephalonica*, the fecundity was found slightly less ranging from 94 to 167 eggs with an average of  $118.4 \pm 7.49$  eggs per female, respectively.

### **Longevity**

Average longevity of *C. blackburni* was found to be  $6.8 \pm 0.64$  days on *P. operculella*, while on *C. cephalonica* it was found  $7.7 \pm 0.7$  days. There was no much difference in longevity of *C. blackburni* when reared on both the hosts. The parasitoid survived for maximum duration of 11 days and minimum duration of 4 days.

*Chelonus blackburni* required less time to complete its developmental period when reared on *P. operculella* than *C. cephalonica* and also exhibited higher fecundity and shorter life cycle on *P. operculella*. So, it can be concluded that *P. operculella* can be an alternate potential laboratory host to rear *C. blackburni*.

**Table 1. Developmental period of different life stages, fecundity and longevity of *Chelonus blackburni* on *Phthorimaea operculella* and *Corcyra cephalonica***

Parameters	<i>P. operculella</i>	<i>C. cephalonica</i>
Incubation period (hours)	24.5 ± 1.62 (14.0-33.0)	25.2 ± 1.33* (18.0-32.0)**
Larval period (days)		
I instar	2.0 ± 0.25 (1-3)	2.8 ± 0.32 (2-5)
II instar	2.3 ± 0.21 (1-3)	3.5 ± 0.42 (2-6)
III instar	2.8 ± 0.32 (2-5)	4.3 ± 0.47 (2-7)
IV instar	3.3 ± 0.42 (2-6)	4.3 ± 0.39 (2-6)
V instar	4.1 ± 0.45 (3-7)	4.3 ± 0.44 (3-7)
Total larval duration (days)	14.5 (9-24)	19.2 (11-31)
Pupal period (days)	10.6 ± 0.70 (7-14)	13 ± 0.57 (10-16)
Total developmental period (days)	25.1 (17-39.2)	32.2 (21.6-48.2)
Fecundity (egg/female)	210.9 ± 16.62 (111-284)	118.4 ± 7.49 (94-167)
Longevity (days)	6.8 ± 0.64 (4-10)	7.7 ± 0.7 (4-11)

\*Based on 10 observations

\*\*Figure in parentheses are range value

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