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RESEARCH ARTICLE

Biology of the Anthocorid Bug, *Cardiastethus exiguus* on UV Irradiated Eggs of *Corcyra cephalonica*

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ABSTRACT

Cardiastethus exiguus Poppius is a beneficial predatory anthocorid bug. The biology of *C. exiguus* was studied on eggs of the alternate host, *Corcyra cephalonica* (Stainton) in the laboratory, at 28 ± 2^{0}C and relative humidity of 70%. The results revealed that *C. exiguous* had three life stages*: egg, nymph and adult.* Eggs of *C. exiguus* were thrust within the plant tissue and hatched after a mean incubation period of 3.5 days. Nymphs, when reared on UV sterilized eggs of *C. cephalonica*, developed normally with five instars, each having a mean duration of 3.50, 3.00, 2.50, 4.50 and 6.00 days, respectively. The adults were reared on UV-irradiated eggs of *C. cephalonica.* The mean longevity of the adults was found to be 46.5 days.

Keywords: *Cardiastethus exiguus, Corcyra cephalonica,* life stages, predatory anthocorid bug

INTRODUCTION

Anthocorids are minute predatory bugs with slender, elongated oval bodies, that closely resemble the soft bugs of the Miridae family. These remarkable anthocorid predators are hailed as promising biocontrol allies, distributed across all global zoogeographical regions. They feed on small lepidopteran larvae, small grubs, psocids, thrips, aphids, mites and even storage pests and are commonly known as minute flower bugs or minute pirate bugs. Natural populations of anthocorid predators have successfully maintained pest populations at low levels. In countries like France, the United Kingdom, the Netherlands, Germany, *etc*., several anthocorid predators are commercially available. They are released in greenhouses and fields to manage insect pests, especially sucking pests such as thrips and mites (Muraleedharan and Ananthakrishnan, 1978 and Ballal & Yamada, 2016).

Cardiastethus exiguus Poppius is a potential predator of eggs and newly hatched larvae of *Opisina arenosella* Walker (Lyla *et al*., 2006). Also, its association with a wide variety of pests, such as thrips, mites, and mealybugs on cashew, papaya, rose, mango, jamun, and *Tecoma stans* (L.) Juss. ex Kunth, *Butea monosperma* (Lam.) Taub., *Thespesia populnea* (L.) Sol. ex Corrêa, *Cassia javanica* L., *Caesalpinia pulcherrima* (L.) Sw., *Aegle marmelos* (L.) Corrêa and the dry fruits of *Adenanthera pavonina* L. and *Delonix regia* (Boj. exHook.) Raf. has been recorded (Ballal and Yamada, 2016). It has been studied extensively as an effective predator of coconut palm pests in India (Nasser and Abdurahman 1998, Lyla *et al*., 2006). However, most of the biology studies on anthocorid bugs are related to *Blaptostethus pallescens* Poppius*, Orius* sp. *etc*., and information regarding the biology of

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C. exiguus is very limited, hence a study was conducted to investigate the biology of *C. exiguus* on eggs of the factitious host, *Corcyra cephalonica*.

MATERIAL AND METHODS

The culture of *C. exiguus* was obtained from the National Bureau of Agricultural Insect Resources, Bengaluru, Karnataka, India. The biology of the anthocorid bug was studied at 28 ±2^{0}C and 70% RH at the College of Sericulture, Chintamani, University of Agricultural Sciences, Bangalore, Karnataka, India. The culture was maintained and multiplied on UV-treated eggs of rice meal moth, *C. cephalonica* as per the procedure described by Ballal *et al*. (2003).

Adults were provided with the bean pods as ovipositional substrate. The bean pods with eggs laid on them were collected after 24 h, transferred to a separate plastic box with tissue paper lining, and observed daily for hatching. Freshly emerged nymphs were transferred singly into individual glass vials of 5 ml capacity using a fine camel hair brush. Nymphs were provided with an adequate supply of UV sterilized *C. cephalonica* eggs. A thin piece of paper strip was provided inside each glass vial to facilitate movement of the nymph. The vials were observed daily under a stereo microscope (30X) till adulthood to record the total developmental period. Newly emerged adults were reared in separate transparent plastic containers (1 ltr capacity). A thin layer of absorbent cotton was provided at the base. UV sterilized rice meal moth eggs were sprinkled over cotton on alternate days as food and bean pods were given as oviposition substrate. The bean pods were replaced daily. A cotton swab soaked in water and honey was stuck inside the container to maintain humidity and as food for adults, respectively, and was replaced every day. These containers were covered using muslin cloth and held in position using rubber bands.

RESULTS AND DISCUSSION

Duration of life stages of C. exiguus

The life cycle comprises three different developmental stages, namely, egg, nymph and adult. The duration of different developmental stages of *C. exiguus* recorded during the study is presented in Table 1.

Newly laid eggs were creamy white, later turned into pink color. The eggs were relatively small (1.5–5 mm) with an elongate-oval shape and an operculum. The eggs were laid singly into the tissues of bean pods and on the cotton strands. The mean incubation period was 3.50±0.71 days. The nymphs emerged through the operculum, which opened like a lid. The nymphal stage consisted of five instars. The first instar nymphs, upon hatching, were light pink. The duration of the first instar ranged from 2 to 5 days with an average of 3.50±2.12 days. The second instar nymphs were uniformly pink in color and the duration ranged from 2 to 4 days with an average of 3.00±1.41 days. The third instar nymphs were uniform reddish to brown and darker than the second instar. The development of wing pads was visible. The duration of the third instar ranged from 2 to 3 days with an average of 2.50±0.71 days, which recorded the shortest instar.

The fourth instar nymphs were dark reddish brown with well-developed wing pads. The duration of the fourth instar ranged from 3 to 6 days with an average of 4.50±2.12 days. The fifth instar nymphs were brown with well-developed wing pads. They recorded the longest duration which ranged from 4 to 8 days with the mean value of 6.00±2.83 days. The total nymphal duration ranged between 13–26 days with an average of 19.50±9.19 days. Adults were black or brownish-black in colour with functional wings. Sexual dimorphism was evident in *C. exiguus*. Females

Table 1. Duration of life stages of Cardiastethus exiguus on Corcyra cephalonica eggs

LIFE STAGE	RANGE (in days)	Mean days ± standard deviation
Incubation period	3 - 4	3.5±0.71
First instar	2-5	3.5±2.12
Second instar	2-4	3±1.41
Third instar	2-3	2.5±0.71
Fourth instar	3-6	4.5±2.12
Fifth instar	4-8	6±2.83
Total nymphal period	13- 26	19.5±9.19
Adult longevity	28-65	46.5±26.16

were larger than males and had broader abdomens. The abdomen was narrow in the case of males. The longevity of adults ranged between 28 – 65 days with mean value of 46.5±26.16 days.

Naseer and Abdurahman (1998) reared *C. exiguus* on the UV-sterilized eggs of *C. cephalonica*. They observed that the incubation period of *C. exiguus* was 3-5 days and the 1st, 2nd, 3rd, 4th and 5th larval instars lasted 3-5, 2-3, 2-3, 3-4 and 4-5 days, respectively, these results are on par with the findings of the present investigations. Jose and Subramanian (2020) observed the mean duration of 2.63, 1.92, 2.01, 2.50 and 5.10 days, in 1st, 2nd, 3rd, 4th and 5th larval instars respectively on another anthocorid predator bug, *B. pallescens*. The biology of the predatory anthocorid bug *C. exiguus* was studied using rice moth egg, *C. cephalonica*. The results revealed that *C. exiguus* had three stages with the average egg, nymphal and adult periods of 4.18, 17.72 and 49.13 days, respectively, where our findings are similar to these findings (Kaewpradit *et al*., 2019).

The nymphal duration observed in the present study ranged between 13-26 days, whereas Naseer and Abdurahman (1998) recorded a range of 14 - 20 days. The mean nymphal duration of *C. exiguus* and *B. pallescens* was found to be on par with each other. Jose and Subramanian (2020) recorded a mean nymphal duration of 13.46 days on *B. pallescens*. Tawfik and El- Husseini (1971) reared *B. pallescens* on different hosts like lepidopterous larvae, aphids and mites. They recorded the five nymphal instars with a duration of 2-6, 2-3, 2-3, 2-4 and 4-6 days respectively. However, Ballal *et al*. (2003) observed a mean nymphal duration of 16.3 days when *B. pallescens* were reared on the UV-sterilized eggs of *C. cephalonica,* while, a mean nymphal duration of 18.3 days was recorded in *B. pallescens* by Devi (2012). The mean nymphal duration of *C. exiguus* 19.5 is also on par with the nymphal duration of *B. pallescens*.

CONCLUSION

Preliminary studies revealed that, when both the nymphs and adults of *C. exiguus* were supplemented with the nymphs and adults of aphid, they were found to feed on them. *C. exiguus* is a promising predator that can be easily mass reared at low cost and also, no cannibalism was observed during the study, thus it can be exploited commercially for large-scale production.

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