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Life History and Biology of *Diloba caeruleocephala* (Figure of Eight) (Lepidoptera ; Noctuidae)

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ABSTRACT. *Diloba caeruleocephala* (L.) is an important pest in fruit-growing areas of Turkey where its hosts include almond, apple, pear, plum, peach, apricot, and cherry. We studied the life history of this species using *Amygdalus communis* L. (Rosacae) as its host at 26ºC, 60±5% RH, with 16: 8 (L: D) photoperiod and fluorescent lighting in the laboratory. Their eggs are laid in clusters on shoots of the host and hatch in about 6 days. The life cycle from egg to adult requires 27-35 days. Adults mate 3-4 days after emergence, and females begin laying eggs 3 days later.

KEY WORDS : *Diloba caeruleocephala*, Figure of Eight, Moth, Noctuidae

INTRODUCTION

Diloba caeruleocephala (L.) (Lepidoptera: Noctuidae: Dilobinae) is a polyphagus pest, with almond, apple, pear, plum, peach, apricot, and cherry among its most important hosts. First instars attack newly opened buds of the host, while older instars feed along the main leaf veins. Damage to fruit was documented by MAÇAN (1986). BODENHEIMER (1958) discussed the importance of this species to fruit trees in Turkey.

Diloba caeruleocephala is reported from all Europe, Lebanon, Israel, North Africa, the Russian states of federation and Asia (CAYROL, 1972 ; DOLLMAN, 1958 ; MÜLLER, 1953 ; POPOV, 1962). MAÇAN (1986) reported it from the southeastern and eastern Anatolia region of Turkey ; and KANSU (1995) and NIZAMLIOĞLU (1961) documented its distribution to Ankara and Istanbul.

Because of its considerable economic importance and given that details of the life history are poorly documented, we studied the biology of this species in the laboratory. The results are presented in this paper.

MATERIALS AND METHODS

Diloba caeruleocephala adults (n=50) were captured in the vicinity of Diyarbakır in the autumn of 2002. Eggs were obtained by placing the females in a screen cage (40x30x30cm) with 15cm lengths of *Amygdalus communis* L. shoots. Newly laid eggs were removed daily, counted, and kept in petri dishes (10cm diameter) on moist filter paper. Larvae were fed with freshly cut host-plant leaves and the larvae were transferred to new leaves every second day. The development of larvae was observed daily, and shed larval head capsules were collected, measured and preserved in 70% ethyl alcohol. Pupae were harvested daily and transferred to a new cage (40x30cm) containing a potted host plant. The larvae and pupae were weighed individually, and pupal length was also measured. The colony was maintained under controlled laboratory conditions at 26ºC with 16: 8 (L: D) photoperiod. All data were subjected to analysis of variance (ANOVA), and means were separated using Fisher's Least Significant Difference (LSD) ($P<0.05$).

RESULTS

Eggs

The eggs were laid in clusters on the upper surface of the host shoot, leaves or on the cage (Fig. 1A). The number of eggs in each cluster varied from as few as 12 to as many as 155. The egg clusters are covered with hair-like scales left by the female moth (Fig. 1B). The eggs are elliptical and light green to brownish, about 0.81±0.02mm (mean ± SD) in length and 1.00±0.02mm in width (n=25) with a flattened base and slight depression at the micropyle (Fig. 1C-D). They are sculptured with 13-16 vertical raised ridges (Fig. 1C). Incubation requires 5.8±0.4 days at 26ºC, and the colour of the egg changes from light green to brownish yellow at about 4 days.

Larvae

Larvae develop through five instars. Larval weight, length, and head capsule measurements (n=15) in each instar are shown in Table 1.

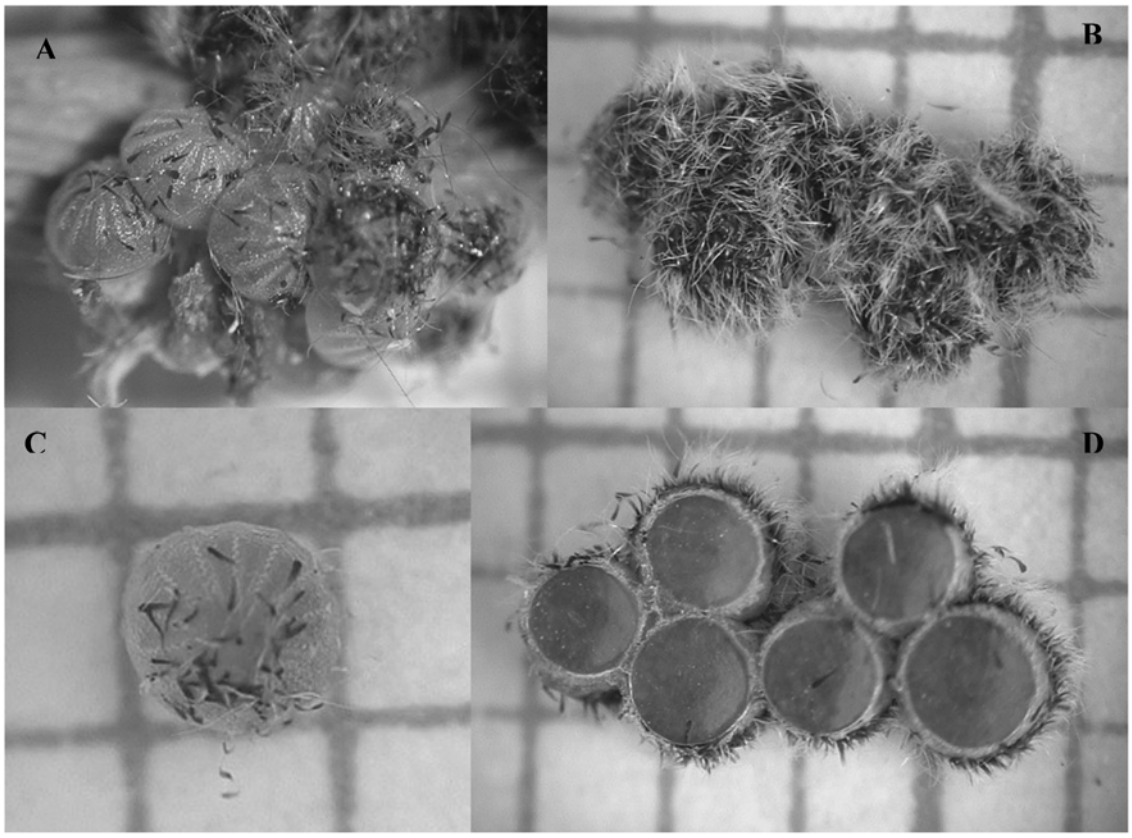

Fig. 1. – A composite photo of egg stages of *Diloba caeruleocephala* (Scale=4X)

TABLE 1

Measurements of head capsule length, weight, and length of each larval instar of *Diloba caeruleocephala* (n=15) and their developmental times in days (n=25)

Instar	Head capsule measurements (mm)	Weight (mg)	Length (mm)	Development duration (days)
First	0.35±0.01 e	4.2±1.0 e	2.2±0.9 e	4.1±0.6
Second	0.68±0.01 d	11.5±3.9 d	7.1±0.5 d	4.2±0.7
Third	0.81±0.01 c	21.3±4.3 c	14.4±1.4 c	4.5±0.3
Fourth	1.44±0.01 b	46.8±5.5 b	22.2±1.2 b	4.0±0.5
Fifth	1.95±0.01 a	65.3±8.2 a	38.2±0.9 a	4.1±0.6

Means within a column followed by a different letter are different (P<0.05) (Fisher's Least Significant Difference tests).

The first instar is light brown to dark brown, with long setae over the body (Fig. 2). The head capsule in the first instar has many long setae brownish in colour with two large brown patches. The legs and prolegs are light brown and tarsal segments were black to brown. The anal prolegs are dark brown. Antennae are black, with dark black basal area. The larvae eat their eggshells and aggregate on the underside of the leaf, typically spinning some silk web on the leaf. They chew a small amount of leaf tissue on the underside of the leaf, creating a small pit, which is gradually enlarged as the larvae continue to feed.

Fig. 2. – The first instar of *Diloba caeruleocephala* (Scale=4X)

The second instar is black with yellow subdorsal bands. Each segment has a row of short, branching small spines. The head is cream with two black dorsal stripes extending posteriorly (Fig. 3).

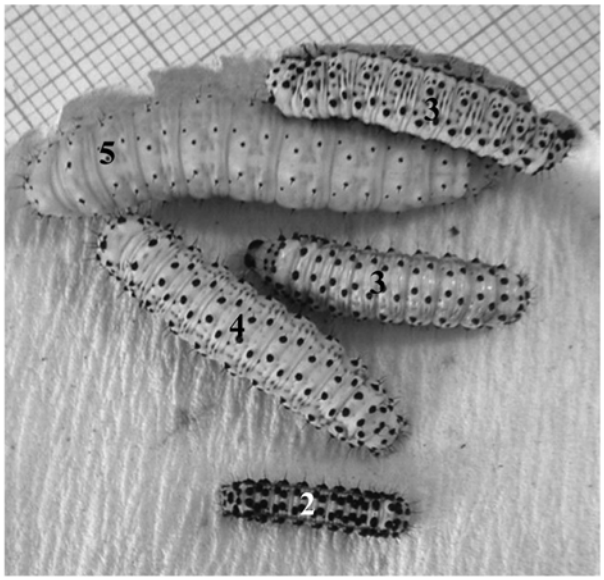

Fig. 3. – The second (2), third (3), fourth (4) and fifth (5) instar stages of *Diloba caeruleocephala* (Scale=1X)

The mouthparts are black. The integument is textured with black spots (Fig. 3). The longitudinal, dorsal and subdorsal bands are more evident in the second instar than in the first instar. The thoracic legs are black with the tarsal claws darkened.

The third instar differs in appearance to the second instar but has similar black patches on the head capsule. The body is grayish blue with yellow dorsal and subdorsal bands (Fig. 3). The head is grayish blue with two large black patches. The third instar generally rests on the sides of leaves and feeds on leaf edges. The fourth instar is similar in appearance to the third instar. The body of the fifth instar is light green with light yellow dorsal and subdorsal bands (Fig. 3).

Pupae

Pupae are initially soft and light tan in colour with speckled black and brown markings (Fig. 4).

The 10th segment of the pupa bears the cremaster by which the pupa attaches to a substrate. The pupae are in cocoons made of soil or leaf debris (Fig. 5). They measured 17.4±0.5mm in length, 0.6±0.2mm in width and weighed 21 to 42mg (average 32.1±7.0mg, n=25). The duration of the pupal stage is 6.2±1.2 days.

Adults

Males and females are similar in appearance (Fig. 6) but differ in their size and antennae. The male's antennae have a double comb, whereas the female's antennae are thin and long.

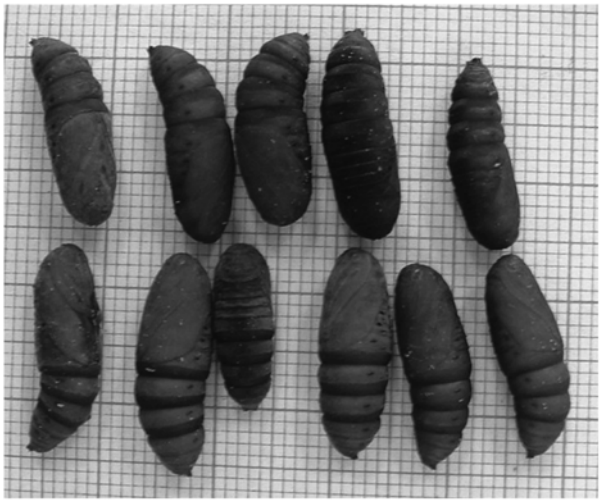

Fig. 4. – The pupae of *Diloba caeruleocephala* (Scale=1X)

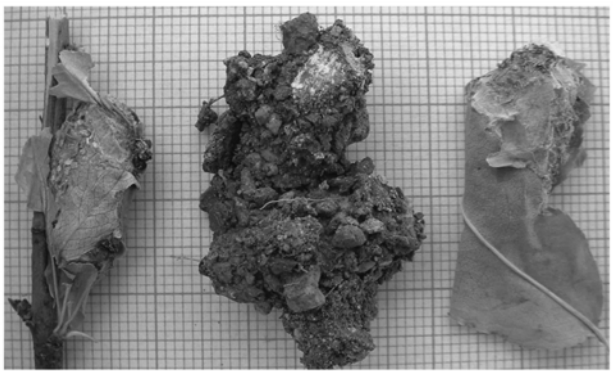

Fig. 5. – The cocoons of *Diloba caeruleocephala* (Scale=1X)

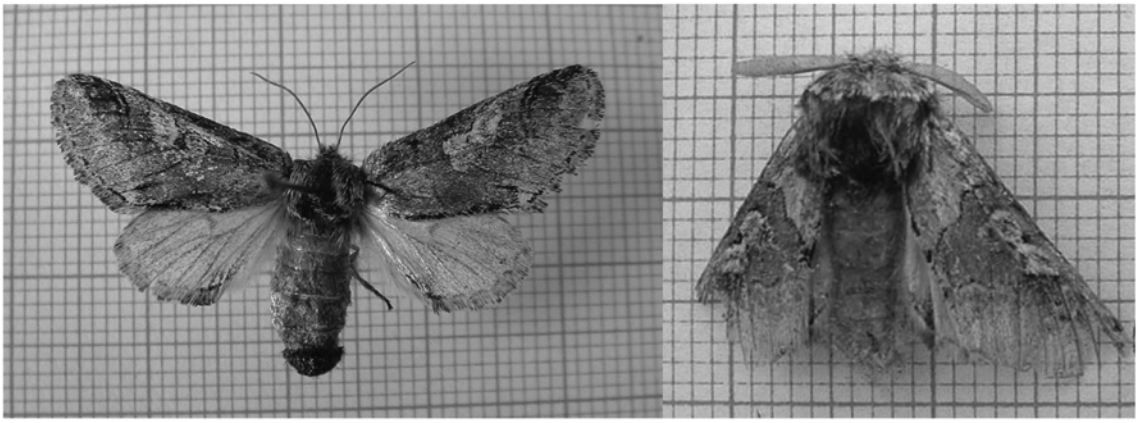

Fig. 6. – The female and male of *Diloba caeruleocephala* (Scale=1X)

The wingspan is 38±0.4mm in females and 34±0.5mm in males (n=25). Mating pairs often rest together for 4-6 hours. Females started laying eggs about 3 days after mating and each laid from 130-174 eggs (n=25). Adults survived about 2 weeks in the laboratory.

The duration from egg to adult emergence is 27-35 days at 26ºC, 60±5% RH, 16: 8 (L: D) photoperiod in the laboratory.

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