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Determination of Almond Saw Fly (*Cimbex quadrimaculata* Müller, 1766, hymenoptera: cimbicidae)'s larval development time in controlled conditions

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Abstract

The study was conducted to compare the larval development stages, cocoon knitting and cocoon completion of *Cimbex quadrimaculata* (Müller, 1766) (Hymenoptera: Cimbicidae) in climate cabinets where 65% humidity, $25\text{C} \pm 2^\circ\text{C}$ and $30\text{C} \pm 2^\circ\text{C}$ temperature and 16:8 illumination conditions are provided. A statistically significant difference was found between 25°C and 30°C in terms of larval development times. It has been determined that as the temperature increases, the duration of the advanced larval stages shortens, and at 30°C , it has been observed that the larval development stages, cocoon knitting and full cocoon time are statistically shorter. These data have the characteristics of being the basis study for determining the biology of the pest under controlled conditions. The data of the study is important in terms of the bioecology and control of the pest.

Keywords: Almond, *Cimbex quadrimaculata*, larval and cocoon development time, Turkey.

Introduction

Almond (*Prunus dulcis* Miller) culture play a great economic role in Turkey ^[1]. Unfortunately, there are many pests in the almond orchards that affect almond cultivation negatively. So far, many harmful and beneficial insect species have been detected in almond orchards and some harmful insects have been reported to cause economic damage ^[2, 3]. *Cimbex quadrimaculata* Müller, 1766 a pest mainly on almond, but also feeds on apple, apricot, cherry, peach and pear in Turkey ^[4]. It is an important pest of almond trees ^[2]. The pest causes damage by feeding on the leaves, especially in the end twigs. In recent years, it has caused economic damage especially in newly planted almond plantations in Diyarbakır and Elazığ provinces. Growth retardation is observed in trees with intense damage. The pest usually hides behind the leaves at the time of feeding, and feeds on the sunless parts of the twigs at noon (Figure 1). It feeds on the fresh leaves at the ends of the twigs in the sunless parts of the tree, leaving the trees without leaves. In large crowned trees, this damage is not very remarkable, but it creates negative effects on the crowning and yield of the trees in the following year. In the next larval stages, they are protected from the attack of natural enemies by the yellow colored liquid that they eject in case of fear when they are disturbed. It is very difficult to carry out a full biological period study since clear data on the ovulating behavior of the pest under controlled conditions are not available ^[5, 6, 7]. However, both in observations made in natural conditions and in culturing studies conducted in the laboratory, and by determining the periods of emergence of the pest from nature, the transition times of the pest from the larval period to the pupal period were investigated with larvae brought from natural habitats.

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Fig 1: Resting time of *Cimbex quadrimaculata* on almond upper shoots later feeding

Materials and Methods

Materials

Almonds leaves in the provinces of Elazığ (Şaluşağı village), Larvae of *Cimbex quadrimaculata* specimen, larvae rearing boxes, climate cabine with controlled condition, Steiner funnel, sweep-net, stereo binocular microscope, etc. various laboratory materials constituted the material of the study.

Methods

All of specimens collected in Elazığ Merkez Şaluşağı village in same wild almond trees at 28.05.2021 (Fig.2). Studies were carried out in a climate cabinet with 65%

humidity and $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $30^{\circ}\text{C} \pm 2^{\circ}\text{C}$ temperature conditions, 16:8 lighting periods (Figure 3). When the larvae started to appear in nature, 20 1st instar larvae were collected and brought to the laboratory.

Cimbex quadrimaculata larval stages are regularly controlled in laboratory every day at 7 pm. An equal amount of almond leaves was given to the larvae as food on a daily basis. In order for the larva to form a comfortable cocoon during the cocoon formation period, soil, a piece of stone and a dry almond branch were left on the bottom of the container after the fifth larval period to allow the larva to move comfortably.



Fig 2: Collecting tree of *Cimbex quadrimaculata* larvae



Fig 3: Climate Cabinet, 5st larvae in plastic containers and Cocoon made of *Cimbex quadrimaculata*

Results and Discussion

As seen in Table 1, there is a statistically significant difference between the periods observed at 25°C and 30°C ($P < 0.05$). The third period time observed at 25°C is

significantly longer than the third period time observed at 30°C . The fourth period time observed at 25°C is significantly longer than the fourth period time observed at 30°C . The fifth period time observed at 25°C is significantly longer

than the fifth period time observed at 30 °C. The cocoon made “web” period (Fig 4) time observed at 25 °C is significantly longer than the cocoon made period time observed at 30 °C. It has been determined that the full

cocoon period time observed at 25 °C is significantly longer than the full cocoon period time observed at 30 °C (Figure 4).

Table 1: Comparison of Larval Development Times with Mann-Whitney U Test at Two Different Temperature Conditions

Stages	Temperature	N	Mean Rank	Std. Deviation	Mann-Whitney U	P
1st Larvae stg	25°C	10	12.25	0.5271	32.50	0.190
	30°C	10	8.75	0.5676		
2st Larvae stg	25°C	10	13.10	0.9718	24.00	0.052
	30°C	10	7.90	1.1738		
3st Larvae stg	25°C	10	15.20	1.1353	3.00	0.000
	30°C	10	5.80	1.2649		
4st Larvae stg	25°C	10	15.40	1.1972	1.00	0.000
	30°C	10	5.60	1.2867		
5st Larvae stg	25°C	10	15.50	1.1353	0.00	0.000
	30°C	10	5.50	1.1972		
Cocoon Made Time	25°C	10	15.50	0.6667	0.00	0.000
	30°C	10	5.50	1.0801		
Full Cocoon	25°C	10	15.50	0.6667	0.00	0.000
	30°C	10	5.50	1.0749		

Asymptotic significances are displayed. The significance level is 0, 05.

Exact significance is displayed for this test.



Fig 4: Larvae of inside cocoon (black spot) and Full cocoons.

Conclusions

As a result of the study, the following results were obtained:

1. With this study, statistically was determined that the larval development times and the cocoon formation times of the pest were directly proportional to the temperature increase
2. As the larval stage progressed, it was determined that the temperature increase and the duration were faster than the first larval stages.
3. With the increase in temperature, the feeding and growth of the pest accelerated.
4. It was observed that the foliage feeding of the larvae decreased during the daily leaf insertion.
5. Bioecological factors should be detailed in the struggle against this pest and the control strategy should be planned by considering many climatic factors.
6. For complete cocoon formation, the larvae needed a piece of branch or a support, and the completion of this process is possible by the larva throwing itself into the soil.

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