



## INFESTATION RATE OF ALMOND SEED WASP (*EURYTOMA AMYGDALI* ENDERLEIN, HYMENOPTERA: EURYTOMIDAE) ON IMPORTANT COMMERCIAL ALMOND VARIETIES IN MALATYA PROVINCE (TURKEY)

Talip Yiğit<sup>\*1</sup>, İnanç Özgen<sup>2</sup>, Adnan Canbay<sup>1</sup>, İbrahim Koç<sup>3</sup>

<sup>1</sup>Apricot Research Institute, Malatya, Turkey

<sup>2</sup>Firat University, Faculty of Engineering, Department of Bioengineering, Turkey

<sup>3</sup>Bitlis Eren University, Faculty of Engineering and Architecture, Department of Environmental Engineering, Turkey

### Abstract

Original scientific paper

Almond seed wasp (*Eurytoma amygdali* Enderlein) (Hymenoptera: Eurytomidae) is one of the most important pests of almond. Pest's infestation ratio can be as high as 95% in some areas in case if the pest is not tackled. The study was conducted to determine the preferences of Almond seed wasp seed wasp for some almond varieties (Ferragnes, Ferraduel, Nonpareil, Drake, Cristomorto and Garrigues) in the years 2017 and 2018. Furthermore, times of emerging of the pest in Malatya Province and the number of individuals emerging from damages fruits based on years were determined. Cage observations were carried out and fruits were counted under field conditions and results were discussed with meteorological data. As a result of the study, it was found that the lowest infestation rate of *E. amygdali* was in Ferragnes variety (81%) followed by Cristomorto variety (85%) while the highest infestation rate was found in Nonpareil variety (97%). While the rate of emerging of the pests as adults in 2017 was 89.3%, rate of individuals passing down to the next generation was 10.6%. It was found in the study that the time of emergence as adults of Almond seed wasp seed wasp in Malatya was the end of April when the maximum air temperature was 25°C and the daily mean temperature is higher than 15°C, and when the temperatures are routinely around these levels.

**Keywords:** Almond, *Eurytoma amygdali*, Infestation rate, IPM

### 1 Introduction

Global almond production is about 2.25 million tons. USA takes the first place with about 1 million tons. Turkey, however, takes the 5<sup>th</sup> place in the world with an annual production of 100,000 tons on an area of 42200 ha (TÜİK 2018; FAO 2017). There are several pest species that have adverse on this production amount. Almond seed wasp (*Eurytoma amygdali*) in almond cultivation lands is in the position of the most important species as regards the wideness of spread and loss ratio. It affects the product amount directly by creating damage on the fruit. It reproduces once a year or every two years (Anonymous, 2019). Almond seed wasp infestation rate occurs between 50% and 95% if there is no pest management applications (Cakar, 1980; Katsoyannos et al., 1992; Haltrich and Marko, 1998; Bolu and Özgen, 2007; Duval and Millan, 2010; Yeşilyaprak, 2015). There are many studies on the biology, natural enemies, form of damage caused by and control of the pest. However, studies carried out with the purpose of determining the preference of the pest among the almond varieties are limited in number. the control strategies of almond seed wasp is generally based on determining the time of emerging of the adults, and keeping the trees treated with pesticides throughout the emerging period of adults in order to destroy them before mating and laying eggs (Anonymous, 2019). However, chemicals have adverse effects on humans, environment,

balance of the nature and they also can increase tolerance of insects to the chemical. A way to reduce these adverse effects is the use of a variety resistant against the pest. It is possible to use less amounts of pesticides by using resistant varieties.

This study was conducted determine the preferences of *Eurytoma amygdali* for some almond varieties in Malatya province in years 2017 and 2018.

### 2 Material and Method

In this study, different almond varieties grown on the altitude of 1005 m in the almond application parcel of the Malatya Apricot Research Institute, Central Campus. *Eurytoma amygdali* Enderlein pest species, culture cages, chiffon branch cages and laboratory materials were used as main materials.

No chemical pesticides were used on the almond trees grown in the application parcel starting from the emerging time of almond seed wasp in the year 2017 till their period of laying eggs.

#### 2.1 Determining the Time of Emerging of *Eurytoma amygdali*

One chiffon branch cage was installed on 3 almond trees in the application parcel on branches 1.5m in height

\* Corresponding author.

E-mail address: talipyigit79@hotmail.com (T. Yiğit) | ORCID Number : 0000-0002-4871-9132

Received 15 May 2020; Received in revised form 12 June 2020; Accepted 13 June 2020

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Doi: <https://doi.org/10.46460/ijiea.737755>

before the blossoming of the tree (April 1). After following the phenologic period of the tree, and Then 10 fruits of the previous year infested with almond seed wasp were placed in each cage. Cages were checked weekly till the blossoming time and daily after blossoming in order to determine the first emerging adults of the pest. This process was evaluated together with the meteorological data obtained from the meteorology station.

## 2.2 Determining the Preference of the Pest among the Almond Varieties

The study was carried out on Ferragnes, Ferraduel, Nonpareil, Drake, Cristomorto and Garrigues almond varieties grown in the application parcel. This study was conducted to four repeatedly rows of trees (four ages). No chemicals were applied on the trees starting from the end of the blossoming time. When the fruits reached the harvesting stage, 200 fruits in total for each variety each 50 belongs to each repeat row were harvested from the trees. All the fruits were picked on branches selected randomly from the same side and same height of each tree. Fruits harvested were brought in the laboratory and cracked in order to detect the pest. All the fruits were counted and subjected to Chi-Square test and percentage analyses to determine statistical differences between the varieties.

## 3 Results and Discussion

### 3.1 Determining the Emerging Time of *Eurytoma amygdali*

The initial emerging of adults from fruits infested with almond seed wasp in cages occurred in April 28, 2017. It was observed at that time that almond trees of the parcel was in the beginning stage of the phenological small fruit stage. Meteorological data obtained from Meteorology Station are given in Table 1.

Evaluation of the initial emerging time of the pest together with the meteorological data revealed that the initial emerging time of the pest started with the daily maximum temperature reached 25°C and daily mean temperature reached 15°C and when these temperatures became the routine. Yeşilyaprak (2015) has reported in a study that the initial emerging of the pest started on the second week of April, and the infestation rate reached 54% in Bozova District and 70% in the Central District in case no efforts are exerted to control the pest. Çağlar (2018), however, found that the date of initial emerging of the pest in Adıyaman Province, Kahta and Besni districts was 24-27 March, and the pest needed 207.1 – 228.2 day-degrees for emerging of adults in these districts.

**Table 1.** Temperature values of April, 2017.

Days	Daily maximum temperature (°C)	Daily minimum temperature (°C)	Daily average temperature (°C)
1	13,5	5,1	9,4
2	17,3	3,6	9,5
3	15,9	2,8	9,2
4	19,2	2,2	11,4
5	21,1	3,9	12,3
6	18,7	5,0	12,1
7	14,4	8,3	11,1
8	16,3	5,2	9,8
9	10,9	1,8	6,2
10	12,3	1,5	6,5
11	14,9	1,0	8,0
12	14,1	0,1	7,7
13	11,4	6,7	8,6
14	16,8	8,3	11,7
15	16,0	9,0	11,6
16	20,2	4,9	12,2
17	19,4	6,8	13,9
18	15,1	8,2	11,6
19	18,9	5,6	11,9
20	20,6	6,0	14,2
21	20,6	7,5	15,4
22	26,5	11,9	19,7
23	23,2	11,8	19,9
24	17,4	3,4	10,0
25	17,6	3,6	10,2
26	20,8	1,6	11,2
27	23,3	4,1	14,0
28	26,4	7,0	16,3
29	25,7	7,8	16,9
30	26,2	7,8	17,0

In their study on this pest carried out in France, Duval and Millan (2010) reported that the time of initial emerging of the pest was April 13 in 2005, April 18 in 2006 and April 2 in 2007. They also reported that a single pest control sufficed carried out at the beginning of the emerging of adults, ratio of infected fruits was as low as 1-4%, and the loss ratio in the control parcel that pest control was not carried out exceeded 60%. Ekici and Günaydın (1969) reported in their study conducted in Elazığ Province that *E. amygdali* caused product loss of 51% in almond cultivation areas in 1964. Bolu and Özgen (2007) reported that the almond orchards in Diyarbakır, Elazığ and Mardin provinces were infested with *E. amygdali* and infestation rate exceeded 50% in some cultivation lands.

### 3.2 Determining the Preference of *Eurytoma amygdali* among Almond Varieties

Data obtained in the study are given Table 2. Nonpareil variety was the most preferred by *E. amygdali* with %97 infestation rate while Ferragnes variety was the least preferred by almond seed wasp with 81%. Upon statistical evaluation of the preference of the pest among the almond varieties, differences are observed. However, although the Ferragnes variety was the least preferred one, its

contamination rate is high resulting in serious loss of yield. In a study conducted in Kahramanmaraş within the years 2005 and 2006, Gökalp Barut (2007) reported that the highest contamination rate among 27 varieties and types was seen in Sonora almond variety with 84% and 88%. Infestation rate was reported between 1% and 88% although it different among varieties.

Results obtained in works carried out to determine the number of individuals of *E. amygdali* in years one and two are given in Table 3. Accordingly, the rate of emerging as adults of the pest in the year one was 89.3%, while the rate of individuals giving rise to the next generation was 10.6%.

In conclusion, consideration of all these data shows that the pest has some preference among the almond varieties to be certain level. However, this selectivity was not sufficient to reduce the level of loss under the economic loss level even in the least preferred variety. With this reason, the time for control of the pest must be determined and management applications must be initiated in areas where the pest is found in high populations disregarding the variety. Furthermore, studies involving the chemical control against the pest and use of varieties against the pest should be carried out together. This approach can emerge as a potential method that could reduce the population density.

**Table 2.** Loss Rate of *Eurytoma amygdali* on Important Commercial Varieties

Types	Fruit checked (pieces)	Fruit contaminated with pests (pieces) *	Pest contamination rate (%)
Ferragnes	200	162	81
Ferraduel	200	190	95
Nonpareil	200	194	97
Drake	200	182	91
Cristomorto	200	170	85
Garrigues	200	186	93

**Table 3.** Adult Outputs of *Eurytoma amygdali* by Years (pieces)

Total number of contaminated fruit checked	Number of adults emerging in 2017 (1 <sup>st</sup> year)	Number of adults emerging in 2018 (2 <sup>nd</sup> year)
178	159	19

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