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Original article

Population development of the *Anthonomus amygdali* Hustache (Coleoptera: Curculionidae) in almond orchards in Gaziantep, Kahramanmaraş and Adıyaman provinces

Gaziantep, Kahramanmaraş ve Adıyaman illerinde bulunan badem bahçelerinde *Anthonomus amygdali* Hustache'nin popülasyon gelişimi

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ABSTRACT

This study was carried out between 2016 and 2017 to determine the population development of *Anthonomus amygdali* Hustache, which is a pest in almond orchards in Gaziantep (Şahinbey), Kahramanmaraş (Pazarcık) and Adıyaman (Besni) provinces. The study used the beating method in almond orchards, where the population was followed. It was determined that *A. amygdali* started its flights between April and May in the region where the study was conducted and continued until the end of June. While the pest reached its highest level, with 52 units/100 knocks in Besni district on 20 May 2016, the next year, its population reached its maximum level with 44 units/100 knocks, in Besni district on 01 June 2017. Thus, the highest pest population was Besni district of Adıyaman province. The pest has also been found to be an early pest in almond orchards, feeding on the buds and flowers of almonds.

INTRODUCTION

Almond (*Prunus dulcis* Miller) is from the Rosaceae family and is native to Central and Western Asia and Southwestern Asia. It was first grown in Iran, Türkiye, Syria, and Palestine and was taken from there to Spain, Italy, North Africa, Greece, and then to North America (Küden et al. 2014).

All regions of our country are suitable for almond cultivation except the coastal areas of the Black Sea region and high plateaus. Almond cultivation is mainly carried out in the Aegean, Mediterranean, and South-eastern Anatolia regions of the country.

There are many factors affecting yield and quality in almond production areas. These factors begin with pest and disease control and cultural practices such as fertilization, irrigation, and pruning. Especially pests and diseases are the most important factors that cause a loss in almond production. Due to our country's continuous enhancement of almond

orchards in recent years, plant protection problems are expected to increase.

Many insect species cause yield losses in almond orchards. The adult or pre-adult stages of these insects cause damage to the fruit directly, as well as causing severe yield losses by damaging different parts of the tree and drying the trees from the root. There have been many studies on almond pests and diseases in the World (Adaskaveg et al. 1998, Barnet 1965, Dicenta et al. 2003, Ivanov et al. 1962, Russo et al. 1993, Talhouk 1977, Vasileva 1974). In our country, some studies showed that harmful insect species reduce yield and product quality in almond orchards (Bolu et al. 2005a, Bolu and Özgen 2007, Bolu and Özgen 2010, Ekici and Günaydın 1969, Maçan 1986, Nizamlıoğlu 1961).

Anthonomus species belonging to the Curculionidae family are among the insects that cause yield losses in orchards. Tolga and Yoldaş (2020) identified *A. amygdali* and *A. pyri* species that cause damage to almond orchards in their study in Datça, Fethiye, and Seydikemer, Akhisar, and Kula districts. Bolu and Özgen (2007) obtained *A. amygdali*, *A. bituberculatus*, *A. brevipennis* and *A. variabilis* species in their study on the determination of *Anthonomus* species that cause damage in the almond orchards of Diyarbakır, Elazığ and Mardin provinces. *A. amygdali* has an important place among these harmful insect species. Lodos et al. (1978) reported that this species is an important almond pest and that the larvae of the pest develop in the flower buds of almond trees, but these flower buds do not open. In addition, it has been determined that *A. amygdali* causes severe yield losses in almond orchards in the South-eastern Anatolia Region (Bolu et al. 2005b). Önuçar and Zümreoğlu (1985) determined that *A. amygdali* caused 20-32% infestation in almond orchards in Datça on *Anthonomus* spp., which damages fruit trees in the Aegean region.

In the region where the study was conducted, almond orchards are increasing. However, detailed studies have not been conducted on the insects that cause damage to almond orchards in this region. Herein, the population of *A. amygdali* in almond orchards in Gaziantep, Kahramanmaraş and Adıyaman provinces was tried to be determined. Thus, the critical periods that must be combated with the pest have been determined. It aims to contribute to the farmers' success in the control of *A. amygdali*.

MATERIALS AND METHODS

Material

The study material consisted of adult almond trees, *A. amygdali* adults, a Steiner funnel, a suction bottle and a stick with a rubber tube.

Method

This study was conducted in Gaziantep (Şehitkamil), Kahramanmaraş (Pazarcık) and Adıyaman (Besni) provinces between 2016 and 2017 to determine the population development of *A. amygdali*, one of the important almond harmful insect species. Population monitoring was realized in one orchard in each district. Pest population monitoring was carried out once a week between March and November of each year in two almond orchards in each of the indicated provinces. Samples were collected from orchards that were not treated with chemicals. In the study, the method used by Bolu and Özgen (2007) before was used.

The beating method was used in the study to monitor the pest population. Four branches of 25 trees selected randomly from the orchard were knocked three times with a stick with a rubber tube on end, causing the adult stages of the motile pest to fall on the Steiner funnel, and the falling insects were collected with a suction bottle. After the collected insect samples were killed with the help of a killing bottle, they were brought to the laboratory and counted.

RESULTS AND DISCUSSION

In the almond orchards where the study was carried out, it was observed that *A. amygdali*, belonging to the Curculionidae family, which is seen as one of the important pest species, is an early-period pest of almond trees and causes intense flower shedding in the almond orchards where it is located. Lodos et al. (1978) reported that this species is an important almond pest and that the larvae of the pest develop in the flower buds of almond trees and these flower buds do not open.

Population change of Anthonomus amygdali in Gaziantep/ Sahinbey district

In Şahinbey district, the first adults of *A. amygdali* were sighted in early May 2016, and adults continued to be encountered until the end of June. The first adults were sighted on 2 May 2016, and the highest population was recorded on May 23, with 20 adults/100 knocks. It was noted that the average air temperatures when the pest started its flights were between 14-16 °C (Figure 1).

Bolu and Özgen (2007) determined the highest population density of the pest as 28 adults/100 knocks on May 29, 2003, in Gezin district of Elazig province.

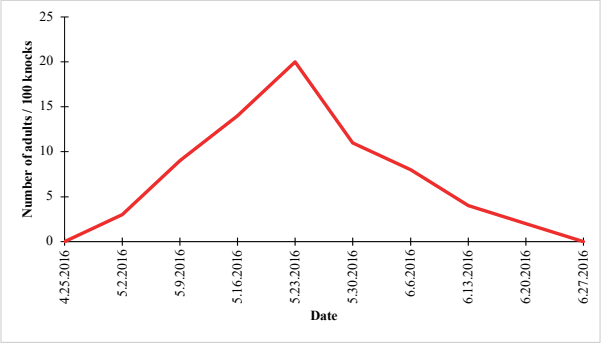

Figure 1. Population change of *Anthonomus amygdali* in Şahinbey in 2016

The first adults of *A. amygdali* started to appear on May 15 2017, and adults continued to be encountered until June 26 2017, the highest population ratio was recorded on May 29, 2017 with 17 adults/100 knocks (Figure 2).

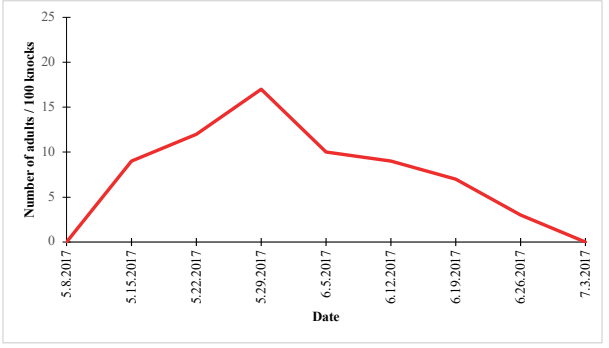

Figure 2. Population change of *Anthonomus amygdali* in Şahinbey in 2017

During the period when the adult emergence begins, the maximum air temperatures are 22-24 °C and the minimum air temperatures vary between 15-17 °C. Bolu and Özgen (2007) stated that the pest appeared in Çermik district of Diyarbakır province in 2004 from the end of April and beginning of May and continued to fly until the end of June.

Population change of Anthonomus amygdali in Kahramanmaraş/Pazarcık district

The development of the population of *A. amygdali* in Pazarcık district in 2016 is shown in Figure 3. According to this, the first adults were encountered on May 3, 2016. The highest population value of the pest was recorded on 24 May 2016 with 30 adults/100 knocks, and the last adults were seen in mid-June (Figure 3). Bolu and Özgen (2007) reported in their study conducted in Akbağ and Ömerli districts in Mardin province that the adults of the pest were still found until the end of June.

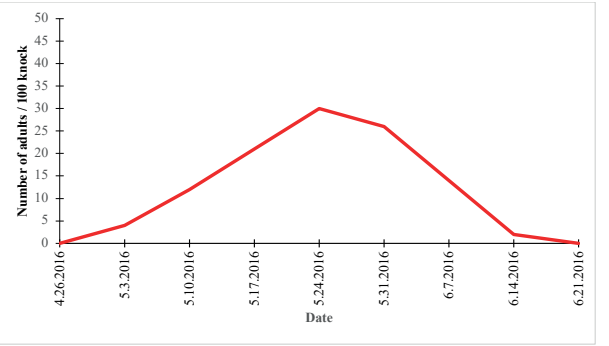

Figure 3. Population change of *Anthonomus amygdali* in Pazarcık district in 2016

The first adults of *A. amygdali* were sighted in Pazarcık on 10 May 2017, and adults continued to be encountered until the end of June. The highest population ratio was recorded on 24 May, 2017 with 17 adults/100 knocks (Figure 4).

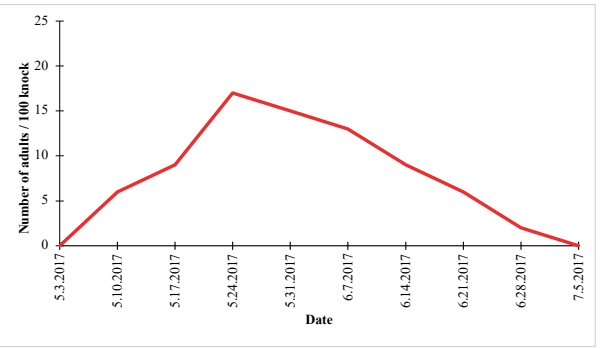

Figure 4. Population change of *Anthonomus amygdali* in Pazarcık district in 2017

The two-year population changes were parallel to each other, and the first adult flights started later in 2017 compared to the previous year due to the climate difference. In addition, it was noticed that the general population of the pest decreased slightly in 2017.

Population change of Anthonomus amygdali in Adıyaman/ Besni district

Figure 5 shows the population change of *A. amygdali* in Besni district in 2016. It was determined that the first adult flights of the pest started in almond orchards at the end of April, and the maximum population value was determined as 52 adults/100 knocks on May 20, 2016 (Figure 5). It was determined that the average air temperatures ranged between 16-20 °C on the dates when the pest started to fly. Adult flights of the pest continued until the end of June. This study shows parallelism with the study mentioned above.

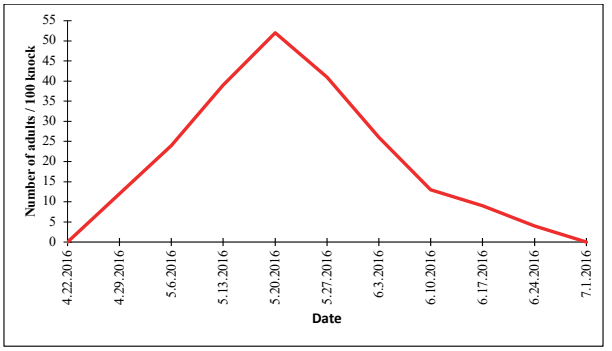

Figure 5. Population change of *Anthonomus amygdali* in Besni district in 2016

The first adult flights of *A. amygdali* in 2017 in Besni district started on May 4 and continued until May 22. Flights of adults continued for about two months in Besni district, and the population reached its maximum value at the end of May with 44 individuals/100 knocks (Figure 6). Among all the regions where the study was conducted, it was observed that the densest population of the pest was in Besni district.

Besides, it has been determined that adults are withdrawn under tree bark, soil and crevices in the soil at the end of June and the first week of July.

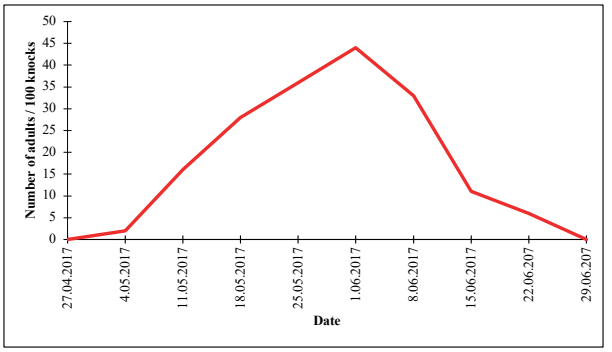

Figure 6. Population change of *Anthonomus amygdali* in Besni district in 2017

It has been observed that the pest is a high-potential pest in the regions where the study was conducted. In general, it was determined that the flight of the pest started between April and May and continued until the end of June. It has been revealed that the region where *A. amygdali* is most concentrated in almond orchards in Adıyaman/Besni district; less density was found in Şahinbey and Pazarcık districts, and parallelism was observed between the development of the populations. In the study conducted by Bolu and Özgen (2007) in almond orchards in Diyarbakır, Elazığ and Mardin provinces, they reported that the highest population of *A. amygdali* was in Diyarbakır and flight of the pest started between April and May and continued until the end of June. The results obtained from the two studies are similar to each other.

It has been determined that the hatched larvae feed on the flower petals, ovary and anther part of the male organ in almond trees. In addition, it was observed in the study that the damaged flowers did not open, the opened flowers did not produce fruit, and the adults retreated under the tree bark, soil and crevices in the soil between the end of June and the first week of July. Tolga and Yoldaş (2020) reported that in the study conducted in Muğla and Manisa provinces, it was determined that the pest feeds on ovaries, stalks, anthers and male organs. In the study, it was determined that the pest overwintered in its adult stage. Monaco (1967) reported that adults also feed on fresh leaves, sprouts and shoots and adults spend the winter under tree barks, stones, and leaf debris or in cracks and cracks in the soil.

Although there are not many studies on the pest in question in our country, it is necessary to carry out studies to determine the economic damage threshold of the pest. To control the pest, the producers must conduct the necessary surveys by the end of April. By shaking the branches of the trees from the time the buds burst until the flower buds appear fallen adults and damaged flowers can be collected and destroyed in gardens where the pest is present. Moreover, during pruning, branches with damaged buds should be cut and removed. It is of great importance to carry out studies on the biological and biotechnical control of the pest in the future.

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Author's Contributions

Authors declare the contribution of the authors is equal.

Statement of Conflict of Interest

The authors have declared no conflict of interest.

ÖZET

Bu çalışma Gaziantep (Şahinbey), Kahramanmaraş (Pazarcık) ve Adıyaman (Besni) illerinde badem bahçelerinde zararlı durumunda bulunan *Anthonomus amygdali* Hustache'nın popülasyon gelişimini belirlemek amacıyla 2016-2017 yılları arasında yürütülmüştür. Çalışmada popülasyon takibinin yapıldığı badem bahçelerinde darbe yöntemi kullanılmıştır. Çalışmanın yürütüldüğü bölgede, *A. amygdali*'nin uçuşlarına nisan-mayıs ayları arasında başladığı ve haziran ayı sonuna kadar devam ettiği saptanmıştır. Zararlı Besni ilçesinde 20 Mayıs 2016 tarihinde 52 adet/100 darbe ile en yüksek seviyesine ulaşırken bir sonraki yıl ise yine Besni ilçesinde 01 Haziran 2017 tarihinde 44 adet/100 darbe ile popülasyonu maksimum seviyesine ulaşmıştır. Böylece

zararlının popülasyonunun en yüksek olduğu ilçe Adıyaman ilinin Besni ilçesi olmuştur. Ayrıca zararlının badem bahçelerinde erken dönem zararlısı olduğu ve bademde tomurcuk ve çiçek içinde beslendiği tespit edilmiştir.

Anahtar kelimeler: *Anthonomus amygdali*, badem popülasyon gelişimi, Curculionidae

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