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Determination Of Some Biological Characteristics Of Poppy Root Weevils (*Ethelcus denticulatus* (Schrank) (Coleoptera: Curculionidae) For Struggle

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ABSTRACT

With this project, it is aimed to determine the time of the struggle with the poppy root weevils (Ethelcus denticulatus Schrank) (Coleoptera: Curculionidae), which is the most important pest of poppy fields (Papaver somniferum L.) (Rhoedales; Papaveraceae). According to the findings, it has been determined that after the second week of March in the Uşak province, poppy root weevils start to emerge from the soil and adults may be found until the first week of July. The most important factor in the emergence of the pests from soil to surface is temperature. In the second week of March in which effective temperature reached to 14 ºC, the poppy root weevils started to emerge to the soil surface in 2014 and 2015. Peak of the poppy root weevils was determined to be in the second week of April. The sum of effective temperatures at this date was determined to be 70.6 ºC in 2014 and 90.4 ºC in 2015. After the poppy root weevil's emergence reached the peak, the first larvae began to appear about 10 days later. According to this, when the insect populations are the highest and the sum of effective temperatures is 70 - 90 ºC, it is suggested to make chemical struggle.

Key words: *Ethelcus denticulatus*, *Papaver somniferum*, Effective temperature, Chemical struggle, Usak province.

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INTRODUCTION

Poppy, *Papaver somniferum L.*, is an annual plant native from Southeastern Europe to western Asia. Its species is cultivated extensively in many countries, including some European, Asian and Central and South American countries. The opium poppy is currently still an important agricultural crop grown for purposes of the food industry in the Turkey [1,2]. Poppy is allowed to be grown in all parts of the Afyon, Burdur, Denizli, Isparta, Kütahya, Tokat, Uşak and in some districts of Konya province since 1974 [1-3].

Poppy seeds are used as a condiment with baked goods and pastries for their nutty odor and flavor. Poppy oil is widely used as edible cooking oil. The oil is also used in the manufacture of paints, varnishes, and soaps. Poppy has had a tremendous impact on several societies as an opiate [1,2]. Currently, there is an interest in developing poppy plants rich in thebaine and poor in morphine as the former could be converted to codeine and other legal pharmaceutical products with less morphine available for illegal conversion into heroin [2,3].

Opium is used in the production of morphine, codeine, other alkaloids, and deodorized forms of opium. Morphine is the raw material from which heroin is obtained. Poppy plants are important as ornamental plants in flower gardens [1,3,4]. Poppies are one of the most important medicinal plants. Traditionally, the dry opium is considered an astringent, antispasmodic, aphrodisiac, diaphoretic, expectorant, hypnotic, narcotic, and sedative. Poppy has been used against toothaches and coughs. The ability of opium from poppy to serve as an analgesic is well known. Opium and derivatives of opium are used in the pharmaceutical industry as narcotic analgesics, hypnotics, and sedatives. These compounds are

also used as antidiarrheal, antispasmodics, and antitussives. Opium and the drugs derived from opium are addictive and can have toxicological effects [3,4,5].

With the increasing area where the poppy is grown, the problem of pests becomes more important. One of the most significant pests is the poppy root weevil (*Ethelcus denticulatus* Schrank). As a result; various complaints from producers have created the obligation to work on harmful insects of poppy. With this project, it is aimed to determine the time for the struggle with the poppy root weevils, which is the most important pest of poppy fields.

MATERIALS AND METHODS

Determination of emergence time and density of poppy root weevils in Usak province

Experiments were established in farmer's poppy fields in one research located in Uşak province Hacıkadem village (38º 32' K 29º 31' D) in 2014 and 2015. The meteorological data of Hacım village were collected from Ağaçlı meteorological station (1km away) [11]. Yellow traps were used to determine the first emergence time of the pest. For this, the first week of March, numbers of ten yellow water pitfall traps (plastic boxes (120 × 100 × 60 mm) were diagonally placed in poppy field [6,7]. There was a distance of 20 meters between each other. To determine the poppy root weevil density, the 4 different points of the field of one m^2 were checked by visual control method and the number of poppy root weevil in the yellow water pitfall trap was calculated [6,7].

Determination of some biological characteristics of poppy root weevils for Chemical struggle in Usak province

When the temperature reached 14 ºC, the poppy field was controlled every day, so that poppy root weevil was checked whether found or not. After the first adults were seen or the first insect caught in the trap effective temperature summation was calculated. Effective temperature summation was calculated according to the formula given below.

$ET = \sum t_{max} - DT$ [6,7]

ET = sum of the daily maximum temperatures exceeding 14 °C

t_{max} = daily temperature, which exceeds the threshold of 14 °C.

DT = threshold value for the activity of the poppy root weevil +14 °C.

Calculations continued until the beginning of adult deaths or the first larvae were detected. Days with maximum daily temperatures below 14 °C were not taken into account. Thus, the relation between poppy root weevil populations and effective temperatures has been determined [6,7].

Statistical analysis

In statistical analysis the relationship among measured variables was evaluated using Pearson correlation and multiple regression analysis to identify factors that might effect the number of poppy root weevil in poppy fields. SPSS for windows Version 16.0 was used for all statistical analyses. The analysis process was performed by combining the average data obtained from each field in 2014 and 2015.

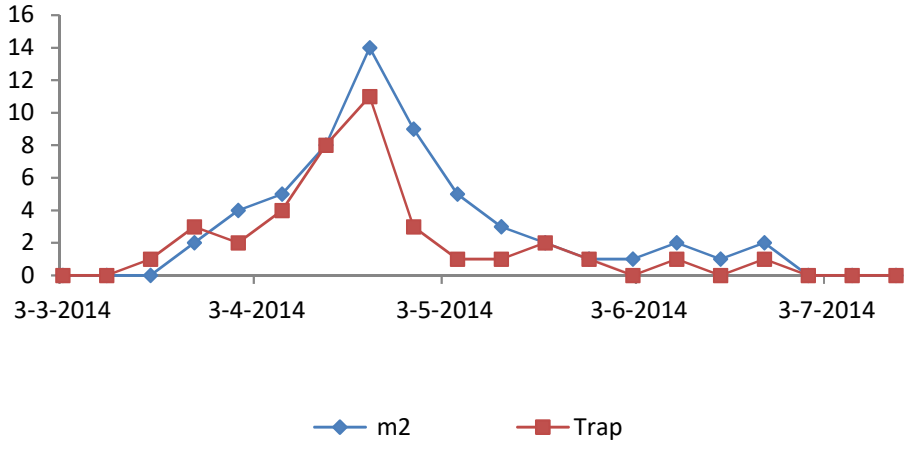

Figure 1: Seasonal population fluctuation in the trap and m^2 of Poppy root weevil in poppy field in 2014.

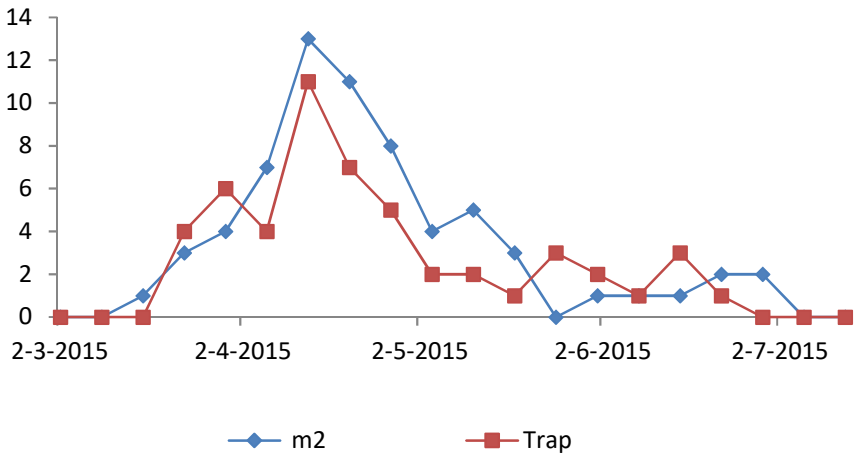

Figure 2: Seasonal population fluctuation in the trap and m² of Poppy root weevil in poppy field in 2015.

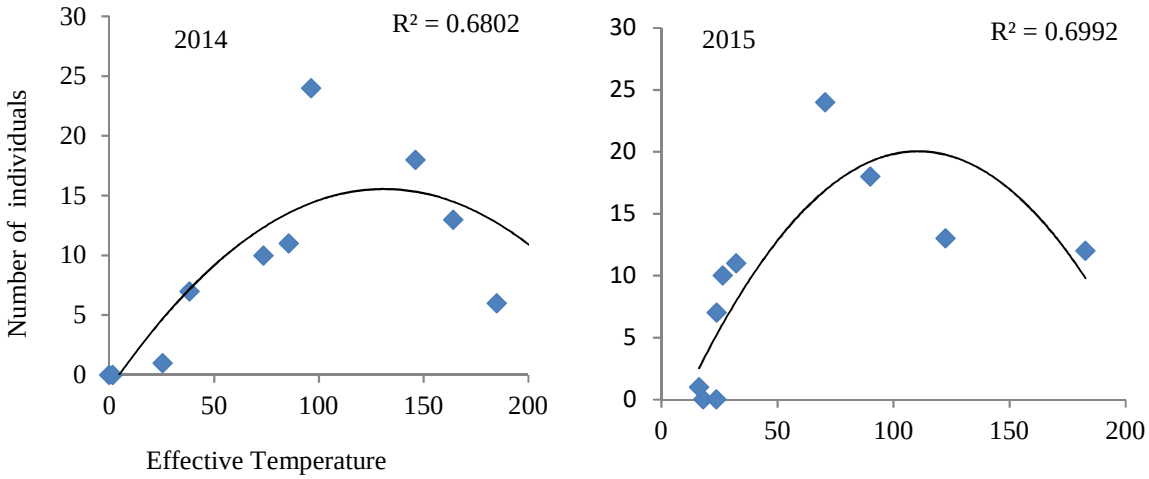

Figure 3. Correlation between the number of Poppy root weevil (in trap and m²) and effective temperatures

RESULTS

Determination of emergence time and density of poppy root weevils in Usak province

Seasonal fluctuations of poppy root adults in m² and trap in 20014 were shown in Figure 1.

When Figure 1 is examined, the first adults were seen on the soil on March 10, 2014. It has been observed that as the temperature of the air increases, the number of adults on the soil surface also increases. Thus, it was determined that the number of adults in square meters reached the highest level on April 21, 2014. After this date, it was determined that the number of wintering adults decreased gradually. After June 30, 2014, adults were not seen because of the growth of plants and the decrease in insect populations. After this date, no overwintered adult was found on the surface of soil.

Similar population fluctuations were observed for adults caught in traps. The first adults in traps were determined on April 17, 2014. And then, it was determined that the number of adults in traps reached the highest level on April 21, 2014. It was also determined that the last adult caught in traps was on June 30, 2014. After this date, no adult was found in the trap.

While the first insect on the surface of the field was caught on March 09, 2015, it was determined that the trap was captured on March 16, 2014. It was determined that the number of additional high individuals caught on the soil surface and in the traps was on April 13, 2015. After this date, it was determined that both the trapped insects and their numbers in m2 decreased. The last adult individual caught in the traps was caught on June 29, 2015 and it was determined that the last adult individual was seen on the soil surface on July 06, 2015 (Figure 2).

When 2014 and 2015 are evaluated together, it has been determined that after the second week of March in the Uşak province, the first adult poppy root weevil starts to emerge from the soil and that adults may be found until the first week of July. The most important factor in the emergence of the pests from soil to surface is temperature.

Determination of some biological characteristics of poppy root weevils for struggle in Usak province

It was determined that in January and February 2014 there was no temperature exceeding the development threshold of the bug. However, the temperature was determined to exceed the threshold of insect development during the second week of March. After this date, it was determined that the temperature continuously increased and accordingly the rate of emergence of the beetle on the ground surface increases. While in the 2th, 3th, and 4 th weeks of March the effective temperatures were 1.6, 25.5, and 38.3, respectively, the total effective temperatures in March were determined to be 30. In April, it was determined that the total of effective temperatures was 30. In the 1th, 2th, 3th, and 4th weeks of April the sum of effective temperatures was 12, 13, 14, and 15 respectively. Effective temperatures in May were only calculated in the first week. It is determined that the total of effective temperatures in the first week of May was 30. After this date, the sum of effective temperatures was not calculated, because both the wintered adults died and the first larvae were seen (Figure 3).

Temperatures exceeding the development threshold of the bug were not determined in January and February 2015. While the sum of the effective temperatures in the first week of March were determined as 15.2, the temperatures exceeding the threshold in the second and third weeks of March was not determined. The total effective temperatures during the fourth week of March were found to be 7,7. In April, it was determined that the total of effective temperatures was 30. In the 1th, 2th, 3th, and 4th of weeks of April the sum of effective temperatures was 12, 13, 14, and 15 respectively. As it was in 2014, effective temperatures in May were only calculated in the first week. It was determined that the total of effective temperatures in the first week of May was 30. After this date, the sums of effective temperatures were not calculated because both the wintered adults died and the first larvae were seen.

DISCUSSION

When the insect population and the sum of the effective temperatures are evaluated together for struggle, in the second week of March in which effective temperature reached to 14 ºC, the bug started to emerge to the soil surface in 2014 and 2015. Effective temperatures after this date started to increase. In 2014 and 2015, the peak of the beetle was determined to be in the second week of April. The sum of effective temperatures at this date was determined to be 70.6 ºC in 2014 and 90.4 ºC in 2015. After the insect emergence reached the peak, the first larvae began to appear about 10 days later. According to this, when the insect populations are the highest and the sum of effective temperatures is 70 - 90 ºC, it is suggested to make chemical struggle. It is thought that it will not be successful because the emergence continues in an early struggle. In a drug to be made later, it is not more likely to be successful; because it will lay insects eggs and even descend into the roots of the larvae.

Similar results have been obtained from studies conducted in the world and our country. In a study conducted by D. Becka at al. they reported that existence of a dependency between the gradual increase in the occurrence of poppy root weevil adults in the emerging poppy and the gradual increase in the sum of effective temperatures (over 14 °C) calculated from the beginning of the emergence of the poppies [6]. In addition, they stressed that sprays applied for 18 days after the first record of poppy root weevils in trials showed the highest effects on a decrease in the levels of root damage. Then they determined that applied sprays exceeded to 20°C indicated significant effects on decreasing the levels of root damage. But the highest effects were usually recorded in sprays whose applied value exceeded to 100°C. [6,7,9]. Cakar (1960) stressed that bug may descend into the soil until 3 cm to 21 cm and most of winter passed at the depth of 10 cm and the slow warming of the soil could be the cause of the adults gradually leaving their wintering places [10]. In another study, It is reported that *Stenocarus fuliginosus* (Marsham) and *C. denticulatus* of females oviposited under the leaf epidermis from mid-April to the end of May, laying an average of 175 eggs each in batches of 1-4 [9]. In studies conducted in Turkey, it was stated that poppy root weevil took place in the soil at depths of 1.7-4.8 in., its pupal stage lasted 8-12 days, its total development was completed in 32-56 days, there was only one generation a year, it wintered at 3-21 cm depth and it was fed in poppy leaves at the beginning of spring, usually in the middle of March[8].

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Conflict of Interest
There is no conflict of interest

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