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Determination of distribution, emergence period, population fluctuation and infestation rate of cherry fruit fly (*Rhagoletis cerasi* L.) (Diptera: Tephritidae) in cherry orchards of Mardin province (Turkey)

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Abstract

This study was carried out to determine distribution, emergence period, population fluctuation of Cherry Fruıt Fly (*Rhagoletis cerasi* L.) (Diptera: Tephritidae) in cherry orchards of Mardin province in 2013 and 2014. Studies were conducted through vegetation period in the orchards which have at least 50 cherry trees of Napolyon (Ziraat 900) varieties in each orchard. In the studies, visual yellow colored adhesive attractive traps were used in the monitoring of the pest. As a result of studies, adults of cherry fruit fly were seen first time in traps in the first week of May when the fruits were in the hay-yellow period. In addition, it was determined that the adults of the pest produced the highest density and damage in this period. It was determined that the population development of the pest continued about 21-42 days and the adult population continued until the third and last week of June, the infestation rate was between 0.1% and 0.7%.

Keywords: Cherry, Cherry Fruit Fly, *Rhagoletis cerasi* L., Visual traps, Mardin

Introduction

Cherry is a tasty fruit, besides it is a fruit with a very high nutritional value. In addition, in terms of both the production and marketing stages, the use of intensive workforce, creating a wide range of employment opportunities, significant currency income due to foreign sales, it has got great importance for the country's economy.

In the production and export of cherries, Turkey took the first place with 639,564 tons of cherry production in the world in 2018. Turkey exported 70 thousand tons and 162 million dollars (Anonymous, 2018a). Cherry production of Mardin province was 3.338 tons of in 2018 (Anonymous, 2018b). Although the amount of cherry production in the region seems to be relatively low, the cherry that is cultivated in the region is early and therefore the economic yield is high.

There are many pests that negatively affect quality and yield in cherry orchards directly or indirectly. Among the many factors that negatively affect yield and quality in cherry production, plant protection problems are the most important. Insect pest the cherry fly [*Rhagoletis ceras* L. (Diptera: Tephritidae)] is the most important pest of the cherry fruit both in other cherry-producing countries and in our country. The larva of the pest feeds on the fleshy parts of the fruit, causing some fruit to be dumped prematurely and cause significant economic losses too. As the quality of the harvested fruits with

worms is low, the market value also decreases. The damage of the pest is mostly seen on average, especially in June. The damage rate can be up to 80% during the epidemic years. Loss tolerance in exports is zero (Anonymous, 2011). Pesticides are widely used to control of the pest.

Recently, the increase in the use of pesticides for the controlling of harmful insect species in the orchards in the region leads to the deterioration of the natural balance between living beings. These increase the likelihood of pests in the future. The elimination of these problems is important in terms of the introduction of both environmentally sound and healthy products.

In this study, in order to make an effective struggle against the cherry fly, it was aimed to determine the distribution areas of the pest, time of emergence and population development.

Materials and Method

The main materials of the study are cherries grown in the province of Mardin (Central, Ömerli and Yeşilli) and samples of larvae, pupae and adults of *Rhagoletis cerasi* L. (Diptera: Tephritidae) which are harmful to them. materials.

The experiments were carried out cherry orchards of the towns and villages in the districts of Center, Ömerli and Yeşilli of Mardin province where pesticide was not applied and infested with pest. The sampling was carried out according to the Grigorov sampling method (1974) in the selected gardens. According to this method; all trees in the orchards with 20 trees, 21-30 trees in 21-70 trees, 31-40 trees in 71-150 trees, 41-80 trees in 151-300 trees, 15% in 301-1000 trees, and more than 1000 trees 5 were checked. In the study of determining the distribution areas and population intensities of the pest, attractive rebel traps with an ammonia salt were hung in the cherry trees in the gardens where there was no closure or closed cultivation. The traps were placed at 1.5-2 m height of the trees in the direction of the prevailing wind and they were placed at the end of the side branches of the trees (Özdem and Kılınçer 2008).

The traps were adjusted to be 2 pieces per deciare and the trap distance was 15-20 m and the attractive ammonia capsules were replaced every 3-4 weeks. Surveys during April-July months, traps were controlled by controlling the traps and spreading areas of the cherry fly for two weeks. To determine the population development of cherry fly; Mardin Central district of Sultan village, Ömerli district of the village of Anıttepe and the village of Ömerli district of the village Dereyani a total of three trappings hanging in the garden were checked weekly and the number of adult flies trapped was recorded. Thus, the distribution areas of *R. cerasi* L. were determined at the time of the first exit, the peak of the population and the end of the population of the pest.

Results and Discussion

As a result of surveys carried out in Mardin province in 2016-2017, it was determined that cherry production areas were infested with Cherry fly (*Rhagoletis cerasi* L.). In the traps containing Rebel + Ammonium acetate suspended from the third week of April in the cherry orchards, the first adult emergence in the traps and the population change follow-up were determined weekly.

In the observations made at the Anıttepe Village (Ömerli) in 2016, the first capture in the mass traps was observed with 3 adults on 05.05.2016, 10 adults on 12.05.2016, 8 adults on 19.05.2016, 5 adults on 26.05.2016, 2 adults on 02.06.2016 and the number of adults captured on 09.06.2016 has fallen to zero. In the following study conducted in 2017, the first adult was observed with 1 fly on 11.05.2017, 13 flies on 18.05.2017, 11 flies on 25.05.2017, 2 flies on 01.06.2017 and population dropped to zero on 08.06.2017. Taking this data into consideration, the population duration is approximately 21-28 days in Anıttepe Village (Yeşilli) (Table 1.).

Table 1. Population fluctuation of *Rhagoletis cerasi* in cherry orchards of Mardin province in 2016 and 2017.

	Trial locations				**Trial locations**		
Date	Anttepe Vilage	Dereyanı Village	Sultan Village	**Date**	Anttepe Vilage	Dereyanı Village	Sultan Village
		(Fly/Trap)				**(Fly/Trap)**	
28.04.2016	0	0	0	04.05.2017	0	0	0
05.05.2016	3	0	0	11.05.2017	1	1	4
12.05.2016	10	6	0	18.05.2017	13	9	10
19.05.2016	8	10	5	25.05.2017	11	5	5
26.05.2016	5	10	13	01.06.2017	2	2	5
02.06.2016	2	4	9	08.06.2017	0	0	6
09.06.2016	0	3	5	15.06.2017	0	0	5
16.06.2016	0	2	6	22.06.2017	0	0	3
23.06.2016	0	0	0	29.06.2017	0	0	0

During the study conducted in Dereyanı Village (Yeşilli) in 2016, the emergence of first grown-ups in yellow sticky visual trap has been observed with 6 flies on 12.05.2016, followed by 10 flies on 19.05.2016, 10 flies on 26.05.2016, 4 flies on 01.06.2016, 3 flies on 08.06.2016, 2 flies on 15.06 2016 and finally no flies were observed on 22.06.2016. In the following study conducted in 2017, the first adult was observed with 1 fly on 11.05.2017, 9 flies on 18.05.2017, 5 flies on 25.05.2017, 2 flies on 01.06.2017 and population dropped to zero on 08.06.2017. Taking this data into consideration, the population duration is approximately 21-35 days in Dereyanı Village (Yeşilli) (Table 1).

During the study carried out in Sultan Village (Central Mardin) in 2016, the first adult capture in yellow sticky visual traps has seen observed with 5 flies on 19.05.2016, 13 flies were seen on 26.05.2016, 9 flies were seen on 02.06.2016, 5 flies were seen on 09.06.2016, 6 flies were seen on 16.06.2016 and population fell to zero on 23.06.2016, indicating a short lifespan of the population. Then in the following study conducted in 2017, the first grown-ups were observed with 4 flies on 11.05.2017, 10 flies on 18.05.2017, 5 flies on 25.05.2017, 5 flies on 01.06.2017, 6 flies on 08.06.2017, 5 flies on 15.06.2017, 3 flies on 22.06.2017 and population fell to zero on 29.06.2017. Population duration has been observed to be 28-42 days in Sultan Village (Mardin-Center) (Table 1).

At the end of the study the population growth of the pest continued for approximately 21-42 days in two years, and the end date of the population coincided with the third and last weeks of the month of June. Ecological conditions, altitude, plant and vegetation period all have an influence on the date of becoming adolescent, and the growth and end of the population. As a matter of fact, studies conducted abroad have similarities with the findings of this study; Mitić-Mužina (1960) concluded that the flight of this species under our local conditions lasted about 2 months (began in mid-May and ended in the first half of July). The life span of flies under laboratory conditions depends on the type of diet, size and abundance of flies, and can last up to 100 days (Ranner, 1988b). It is difficult to estimate the life span of adult flies in natural environment because of unpredictable environmental effects, but in most cases it lasts between four and seven weeks (Samoggia 1932, Sprengel 1932a, Wiesmann 1933b, Bohm 1949), setting the total annual adult flight phenology to 7-11 weeks (Jancke and Bohmel 1933, Bohm 1949, Stamenković et al. 1996a).

In the cherry gardens where the studies were carried out, it has been determined that the number of flies caught in traps and the duration they were seen in nature changed by each year in 2016 and 2017. Since the sampling gardens are the same in both years, this is thought to be caused by climatic conditions. In fact, Özdem and Kılınçer (2009a) emphasized that between 2007 and 2009, they tried several mass capture traps against the Cherry fly and the number of populations and population

duration for each trial year had changed. In the cherry orchards of the province of Mardin in May, after the start of the cherry fly, the highest population was found in the straw-yellow period and the majority of the damage was found in this period. It was determined that the population decreased to zero at the end of the harvest period. In a study conducted in the cherry orchards of the province of Çanakkale, which is similar to the results of this study, it was reported that the flight of the Cherry fly continued until the end of April and mid-June (Ertop and Özpınar, 2011). However, another study conducted by Tezcan and Gülperçin (2000) between 1998-2000 reported the first sight of grown-up cherry flies in May with the pest population coming to an end towards mid-June.

In another study, Ulusoy et al. (1999) reported that *R. cerasi* began to emerge in late May in the Pozantı region and the flies were seen in the traps until mid-August; Tezcan & Gülperçin (2000) stated that *R. cerasi* is the main harmful in İzmir and Manisa provinces; reported that adults emerged at the end of April and they had determined at the end of May that their adult output had ended.

In 2016, the infestation rate was determined 0.2% in Anıttepe village, 0.4% in Dereyanı village and 0.6% in Sultan village by controlling 1000 fruits in each orchards during harvest time. In 2017, randomly controlled 1000 fruits were found to be infested with *R. cerasi* 0.1% in Anıttepe village, 0.3% in Dereyanı village and 0.7% in Sultan village. Indeed, Tezcan and Gülperçin (2000), in order to capture the *R. cerasi* (L.) In ecological cherry production gardens in İzmir and Manisa, the average size of the tree from the yellow colored visual traps made of 15x20 cm fiberglass have made checks weekly by hanging 4 (2-7) traps / tree. In 1998, the rate of infestation was found to be 0.2% in İzmir and 0.1% in Manisa. medium and late varieties have not been infested with the pest.

Conclusion

At the end of the study, it was determined that the cherry fly was distributed in all areas of Mardin Merkez, Ömerli and Yeşilli district where cherry was produced widely in Mardin province. Grown-up cherry flies have been first observed in first week of May in visual yellow-color sticky traps in gardens. Following the emergence of cherry fly, the highest population caught in the visual yellow sticky traps was observed during the straw-yellow period and most of the damage was done during this period. Approaching the harvest season, pest population decreased, hence its damage has also decreased, and the population decreased to zero in the post-harvest period. The population growth of the pest continued for approximately 21-42 days in both years, and the end of the population coincided with the third and last weeks of June. Ecological conditions, altitude, plant and vegetation periods all have an influence on the date of grown-ups emerging in nature, their spread in nature and the growth and end of the population. In every thousand fruits controlled at the cherry orchards during harvest season, respective infestation rates (worms in fruit) of 0.1% and 0.7% have been observed.

In conclusion, this study has yielded significant findings with regards to the cherry fly, its emergence in nature, population growth and disappearance in cherry production areas in Mardin province.

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