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DINAMICA POPULAȚIEI DE *DROSOPHILA SUZUKII* (MATSAMURA) ÎN PLANTAȚII DE CIREȘ ȘI VIȘIN DIN ZONA CENTRALĂ A MUNȚILOR BALCANI

POPULATION DYNAMICS OF *DROSOPHYLA SUZUKII* (MATSAMURA) IN SWEET AND SOUR CHERRY ORCHARDS IN THE CENTRAL BALKANS MOUNTAINS

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Abstract

The spotted wing drosophila (SWD) *Drosophila suzukii*, Matsumura is a polyphagous for many stone and soft fruits species. The pest was recorded in 2014 at sweet cherry orchards in our country and has become a real pest, because SWD attack the fruit when they start to ripe. During 2017-2019 the study was carried out in the Institute of Mountain Stockbreeding and Agriculture in Troyan – Central part of the Balkans Mountain. For monitoring were used traps with red wine and apple vinegar. The first flies at the sweet cherry were found during the second decade of May and in the sour cherry - a little later, at the beginning of June, when the fruit start to ripe. The peak of the population dynamics was established in the second half of June, after which the density began to decreasing. It was found that *D. suzukii* was preferred more the sweet cherry fruits than sour cherry fruits.

Cuvinte cheie: *Drosophila suzukii,* dinamica populației, cireș, vișin.
Key words: *Drosophila suzukii*, population dynamics, sweet cherry, sour cherry.

1. Introduction

Drosophila suzukii (Matsumura) is a polyphage, who attacks plants from different botanical families, but particularly preferred fruit with thin skin, including sweet cherry, sour cherry, plum and others (Aspen et al., 2015; Baroffio and Fisher, 2011; Rauleder and Köppler, 2015).

In 2008 *D. suzukii* was introduced in the USA (California) and Europe (Spain, Italy) from Southeast Asia most probably by importing fruits (Cini et al., 2012). Currently in many countries *D.suzukii* is a key pest in fruit production (Asplen et al., 2015; Bolda et al., 2010; Cini et al.,2012; Goodhue et al., 2011; Kanzawa, 1939; Lee et al., 2011; Walsh et al., 2011; Kinjo, 2014).

They were found serious losses from this pest in prunes, blackberries, sweet cherry, raspberries, strawberries, blackberries and peaches. No application control events in the Western States of the USA damages from *D. suzukii* are reaching 500 million dollars a year, but in the Eastern States of the USA they are valued at 27.5 million dollars.

The sweet cherry is one of preferred cultures of *D. suzukii*, which is the main food host, when there are no other alternative hosts (Kenis et al., 2016). Significant damage on sweet cherry have been found in the United States (Beers et al., 2011) and Europe (Cini et al., 2012; Mazzi et al., 2017).

After the first spoting in 2009, *D. suzukii,* quickly became the key pest of sweet cherry and other stone fruits in Trentino, Northern Italy, (Grassi et al., 2016)

D. suzukii prefers to lay its eggs in ripening and ripe fruits such as sweet cherry, blueberry, raspberry and strawberry (Lee et al., 2011; Ioriatti et al., 2015). The female individual with they make their jagged egg-holes in the fruits and lay their eggs secondary infections are following by pathogens, as fungi, yeast, and bacteria, occur (Mitsui et al., 2010; Walsh et al., 2011).

The larvae develop inside the fruits, which become soft and rot quickly, leading to reduced yields and significant economic losses (Walsh et al., 2011; Farnsworth et al., 2017; Yeh et al., 2020).

Drosophila suzukii (*Diptera: Drosophilidae*) is reported as a new pest on the sweet cherry in Western part of North America in 2009, where about 97% of the production sweet cherry in the country (Beers et al., 2011).

The first reports of damage to sweet cherry of *D. suzukii* are from the Southern and Northern regions of California in 2009. In the autumn of 2009, *D. suzukii* was established in the main sweet cherry production area of Oregon, as well as in British Columbia, Canada.

In the spring of 2010 have been established damage from SWD in the warmest areas for production of sweet cherry in California and later in State Washington (Beers et al, 2011).

D. suzukii massively presented in sweet cherry orchards of China after 2010.

According to a number of authors Yang et al., (2011); Wang et al., (2012); Dai (2013); Guo et al., (2014); Liu et al., (2014); Zhang and Gao, (2014); Zhang et al., (2015), low temperatures in the spring, lead to slowing ripening of fruits, as a result to which they are increased damage on the later season varieties of sweet cherry.

Gargani et al., (2013), report about massively multiplication of *D. suzukii* in sweet cherry orchards in Larry, Italy, in 2013. Significant numbers of flies are registered in pending food snares, as well in organic orchards, so in conventional reared sweet cherry. In laboratory studies the authors are found, that between 20 and 50% of the fruits are damaged by 0,2-0,9 larvae per fruit. They point out this species as a key pest in sweet cherry in this area.

Cuthbertson et al. (2014) establish that in the cherries 11% of the eggs of *D. suzukii* are laid in unripe, 34% in beginning ripened and 55% - in fully ripe fruit. In laboratory tests on blackberries, blueberries, sweet cherry, raspberries and strawberry is found, that the fruits are sensitive and *Drosophila suzukii* attacks them during start of maturation, i. e when the of the embryogenesis begins. No eggs are laid in green fruits, only single cases, when they are found in over ripened fruit of grapes and blueberries.

2. Material and methods

The studies are conducted during the period 2017-2019 in Research Institute of Mountain Stockbreeding and Agriculture Troyan, in sweet cherry orchards with variety 'Octavia' and in sour cherry orchards with variety 'Oblachinska'. Monitoring of *Drosophila suzukii* was done through food traps with a mixture of natural apple vinegar and red wine in ratio 2:3.

The traps have set, when the fruit began to ripen, and the readings are they did once weekly. The blend renewed after every reporting. The collected material from traps in plastic bags and was determined in the laboratory.

3. Results and discussions

The appearance of *D. suzukii* in orchards is associated with the ripening of the fruits. Daily mean temperatures above 10 °C create favorable conditions for the development of this pest. The first adults of *D. suzukii* in sweet cherry and sour cherry orchards in 2017 were found on 2 June - 7 number (Fig.1). The development of the pest in 2017 is with 14 days later than in 2018, we can explain it with the cooler spring.

During this period mean daily temperatures reached to 13.6°C, and the maximum is we're approaching 20.4°C (Fig. 2).

Gradually density of *D. suzukii* increased and in the middle of June the reported maximum was 52 flies in the sour cherry, respectively 107 flies at sweet cherry. By harvesting fruits density of *D. suzukii* began to decrease and in July were established only 2 adults.

From Fig. 3 it can be seen that, in *D.suzukii* phenological development in the sweet cherry and sour cherry orchards in 2018 has begun earlier, in comparison with the previous 2017.

The first adults have been found during the second decade of May (18, May), 2 number on sweet cherries.

In 2018, flies are appeared 14 days earlier in orchards, which we connect with the warmer spring, when mean daily temperatures for the period reached to 16.9°C and the maximum 24.5°C (Fig. 4). Gradually, with warming of weather, the density of *D. suzukii* started to increases.

Peak in multiplying *D.suzukii* at sweet cherry were reported at the beginning of June (June 1st), when were spotted 98 flies and a number 40 flies in the sour cherry. At the end of June density of pest decreases, due to harvesting of the fruits, *D. suzukii* passing on others food sources.

In 2019, the first flies were found in the second ten days of May, two days later compared to the previous year (May 20) a number of one for sweet cherry and a number of two in sour sherry (Fig. 5), which we associate with the warmer spring in 2018. During this period, the average daily temperatures in 2019 reached 12.7^{o}C, and the maximum 19.7^{o}C (Fig. 6). Gradually, the density of *D. suzukii* began to increase with increasing temperatures. In the highest number of the SWD in sweet cherry was reported in mid-June (June 13) 85 and 68 in sour cherry. In early July, *D. suzukii* switches to other food sources, due to which its density decreases.

In 2017, *D. suzukii* was found in the highest number (426), compared to 2018 and 2019 when 291 flies were registered in the set traps in 2018, from which 345 flies in 2019 (Fig. 7). These differences are due to the temperature factor in the last two years.

In sweet cherry, the species was found in higher density - 595 flies, compared with 467 flies on sour cherry, respectively. This can be explained by the fact that the larvae of *D. suzukii* prefer to grow in fruits containing more sugars.

4. **Conclusions**

The differences in the phenological development of *D. suzukii* during the studied years of the study can be explained by the influence of environmental factors, mainly temperature. In 2017, due to the cooler spring, the first flies were found in early June, and in 2018 and 2019 they appear earlier, i.e. in the second decade of May.

During the three years of the study, *D. suzukii* was at a higher density - 595 in sweet cherry orchards and - 467 in sour cherry orchards.

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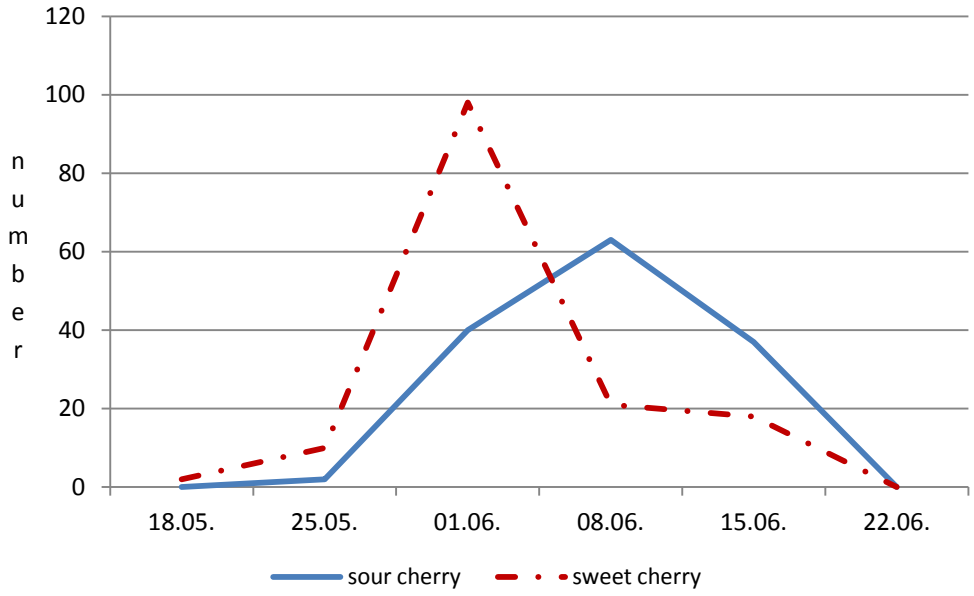
Figures



Fig, 1. Population dynamics of *Drosophila suzukii* in sweet and sour cheery orchards in 2017

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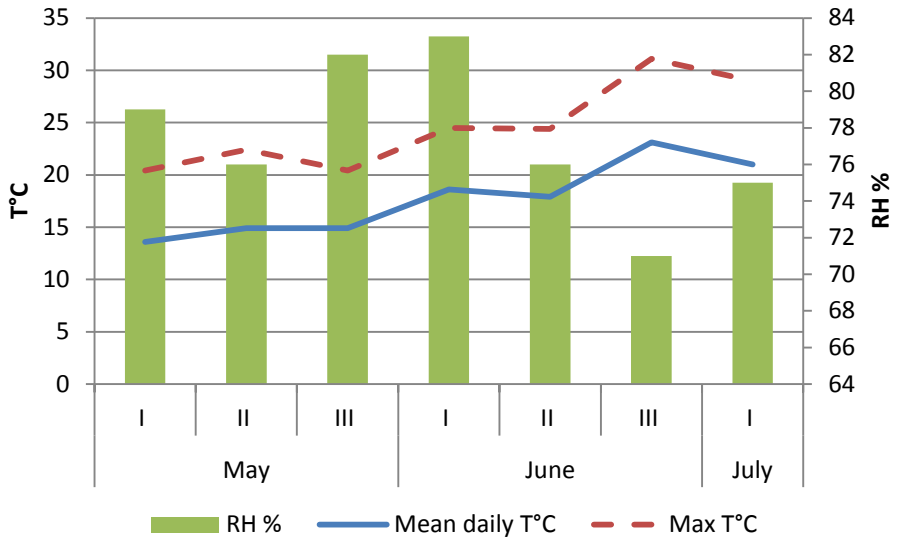

Fig. 2. Agrolimatic indicators (mean daily and maximum temperature, relative humidity) for the region of Troyan in 2017 (by decades)

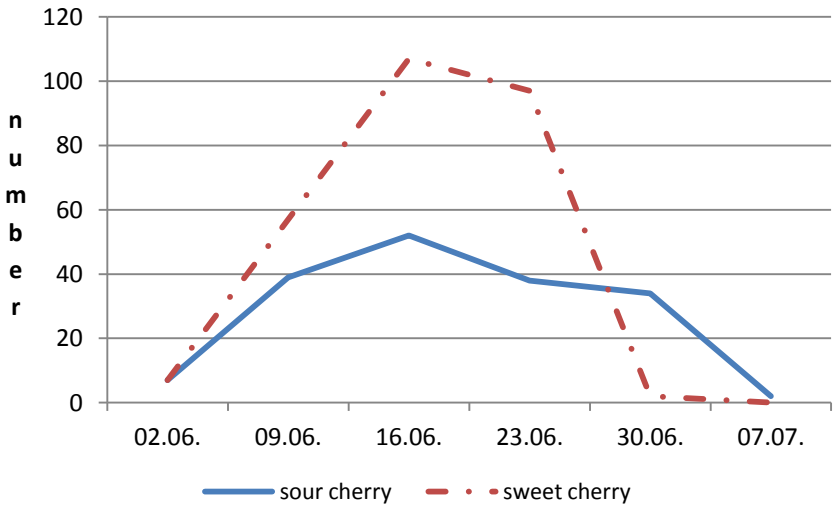

Fig. 3. Population dynamics of *Drosophila suzukii* in sweet and sour cheery orchards in 2018

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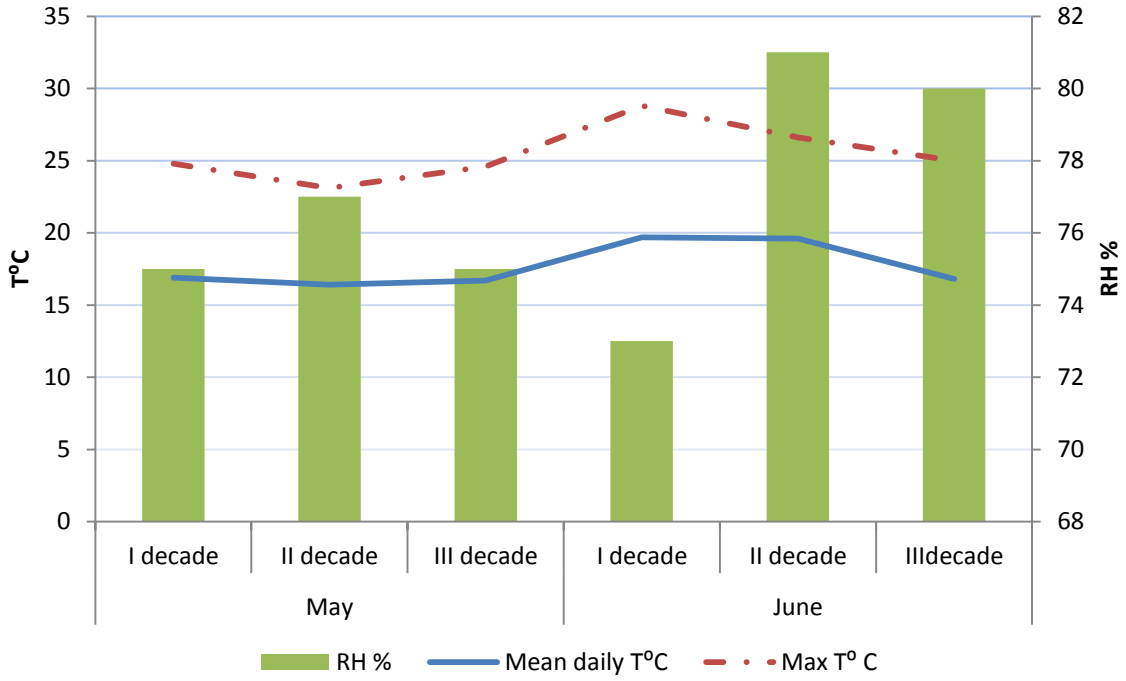

Fig. 4. Agrolimatic indicators (daily mean and maximum temperature, relative humidity) for the region of Troyan in 2018 (by decades)

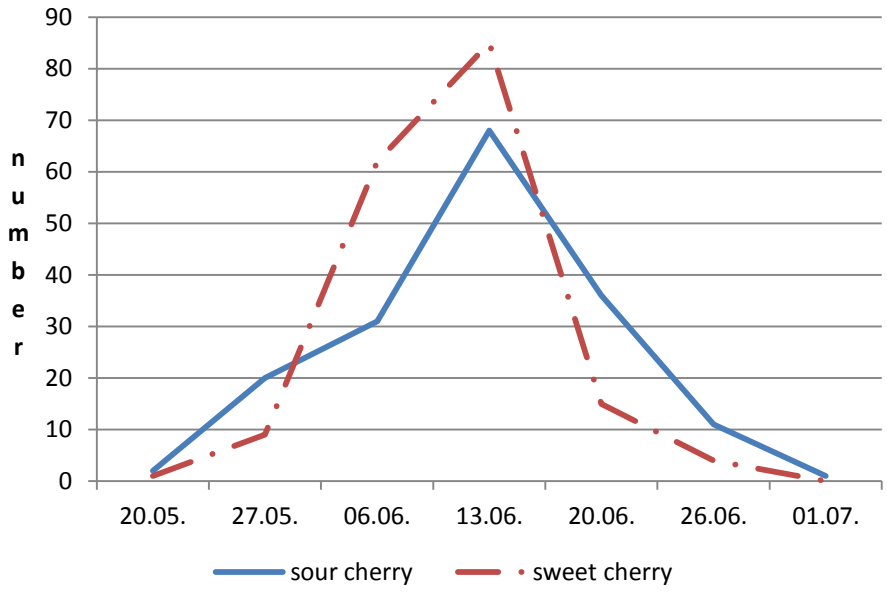

Fig. 5. Population dynamics of *Drosophila suzukii* in sweet and sour cheery orchards in 2019

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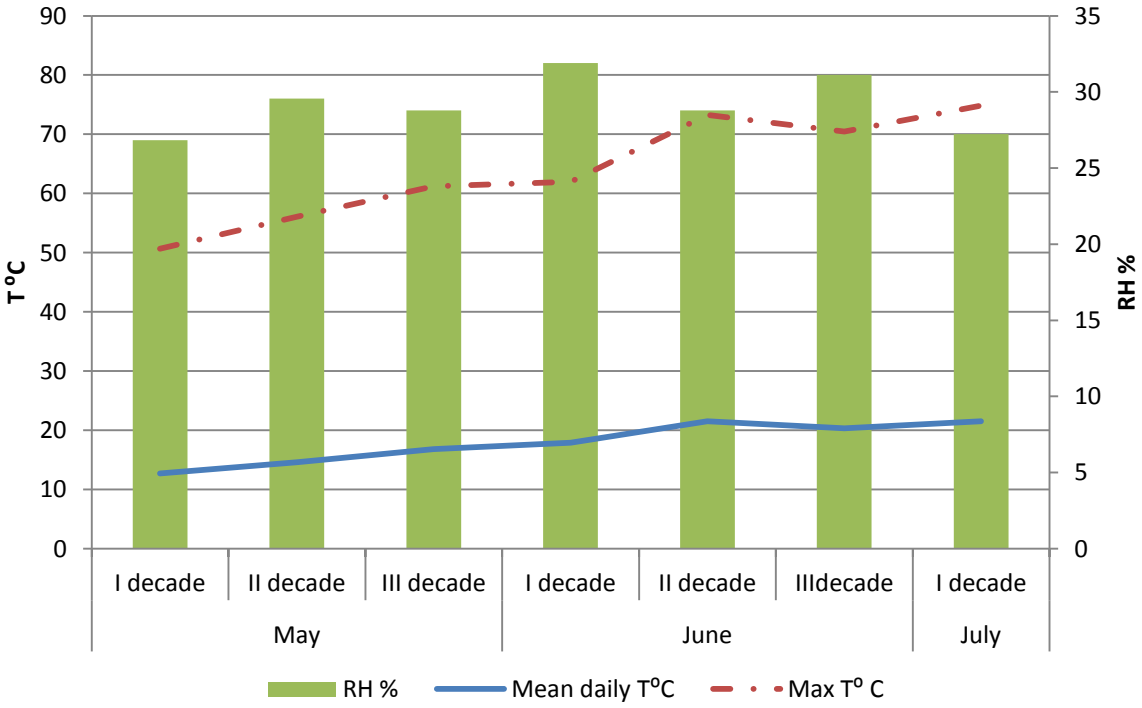

Fig. 6. Agrolimatic indicators (mean daily and maximum temperature, relative humidity) of Troyan region in 2019 (by decades)

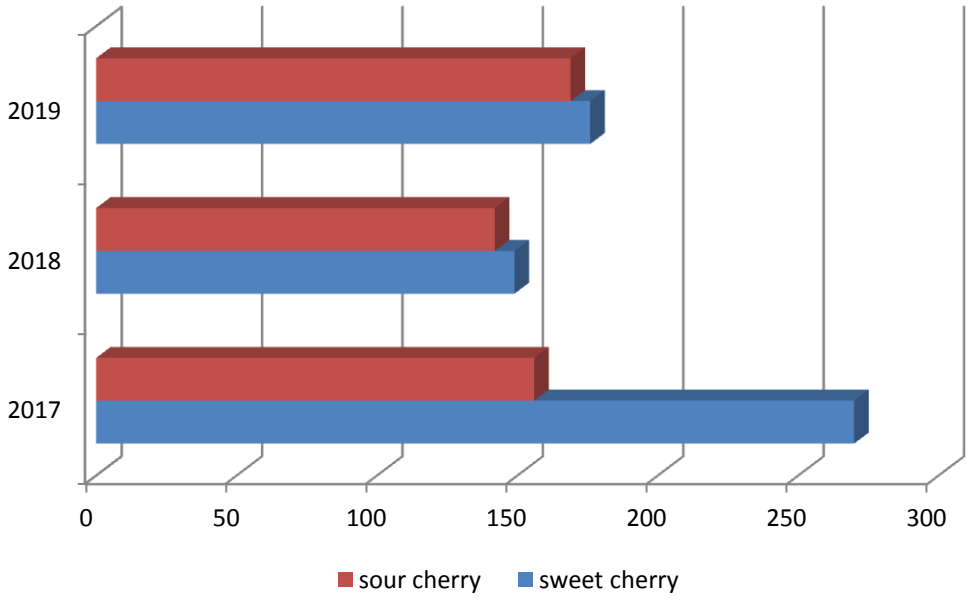

Fig. 7. Population density of *Drosophila suzukii* in sweet and sour cherry orchards in 2017-2019