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DAMAGE BY *DROSOPHILA SUZUKII* (MATSUMURA) FRUITS OF BLACKCURRANT CULTIVAR `TITANIA`

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Abstract

Drosophila suzukii (Matsumura) is a particularly dangerous species of tree fruit and berry fruit species in Europe and all over the world. It was first reported in 2014 in the regions of Blagoevgrad, Kyustendil, and Plovdiv in Bulgaria. Its harmful activity directly threatens the yield and in some years it can compromise the harvest. The present study aims to monitor the population density and fruit damage to blackcurrant fruits of the 'Titania' variety. The studies were conducted in the period 2019-2020 at the Research Institute of Mountain Stockbreeding and Agriculture of Troyan. Insect traps were used for monitoring, which were placed at the beginning of fruit ripening. As a result of the conducted observations, it was found that the spotted wing drosophila appeared at the beginning of fruit ripening, and its peak was reported during large-scale fruit ripening.

Key words: *Drosophila suzukii, damages, insect traps, blackcurrant.*

INTRODUCTION

Insects with broad food specialization cause significant economic losses in agriculture (Oerke, 2006). One such species is *Drosophila suzukii* (Matsumura), which attacks plants from various botanical families but has a particular preference for thin-skinned fruits such as cherries, sour cherries, plums, etc. (Baroffio and Fisher, 2011; Aspen et al., 2015).

According to Olazcuaga et al. (2019) Olazcuaga et al. (2023) females prefer to lay their eggs on fruits (blackberries, cherries, blackcurrants) rich in phosphorus. Phosphorus is present as inorganic or organic phosphate in fruits. A positive correlation was found between oviposition and phosphorus content in fruits. Phosphorus is important for the development and reproduction of female insects, including some species of the genus *Drosophila* (Bergwitz, 2012; King & Wilson, 1955; Markow et al., 1999). According to Markow et al., (1999), females actively seek phosphorus-rich foods because they use phosphorus for RNA transcription during oogenesis.

The homeland of *D. suzukii* is considered to be Southeast Asia (Bolda et al., 2010), where it was first found in 1916 on cherries in Japan by Kanzawa. Later in 1931, the species was described by Matsumura (Kanzawa, 1939).

D. suzukii was recorded in Europe and the USA almost simultaneously in 2008 (Cini et al., 2012). In the USA, damages of this species were first detected in September 2008 in raspberry plantations in Santa Cruz, California. At the end of 2009, the species was registered in many districts of the State of California, as well as other states of the USA such as Florida, Oregon, and Washington, as well as in the province of British Columbia in Canada (ERRO, 2010).

In Bulgaria, *D. suzukii* was detected for the first time in 2014 on the territory of three regions - Blagoevgrad, Plovdiv, and Kyustendil, in plantations with plums, cherries, peaches, and apples (Laginova and Ivanova, 2015). At first, it was discovered in a cherry orchard in Blagoevgrad, and in autumn in a plum plantation with the Stanley variety in the village of Tarnovlag. In the Plovdiv region (the village of Voyvodinovo and the village of Kalekovets), it is registered in apple and peach orchards, and in the fruit and vegetable market in the village of Parvenets. On the Black Sea

coast in Varna, *D. suzukii* was found in a warehouse for fruit imported from Turkey, Greece, and Poland (Laginova and Ivanova, 2015), and in 2018, for the first time, flies were caught in the city of Burgas in fig plantations. In the same year, *D. suzukii* was also discovered in the village of Trun (Pernik region) in a nursery of raspberry mother plants, and in the village of Brashlen (Ruse region) in October 2018 in raspberry plantations.

D. suzukii prefers varieties with red fruits or late-ripening berries, with no firm fruit skin (Ioriatti et al., 2018).

Lee et al. (2011) found that *D. suzukii* has different preferences between individual varieties, as well as among varieties of the same species.

This study aimed to observe the population dynamics of *Drosophila suzukii* in blackcurrant plantations.

MATERIALS AND METHODS

The studies were conducted in the period 2019-2020 at the Research Institute of Mountain Stockbreeding and Agriculture of Troyan in blackcurrant plantations with 'Titania' variety.

The 'Titania' variety has large berries that reach a weight of 3.5 g and a high sugar content. The fruit skin of the berries is tough.

The monitoring of *Drosophila suzukii* was conducted with insect traps. For this purpose, traps were prepared, using plastic containers in the upper part, on which several holes with a diameter of 2-3 mm were made. Suzukii Trap nutritional mixture of the Spanish company Bioiberica and a classic mixture (red wine and apple cider vinegar in a ratio of 3:2) were poured into them. The traps were placed in the middle of the rows in early May when berries began to ripen. The mixture was renewed at each report. The collected material was placed in polyethylene bags and analyzed in a laboratory.

Damages on berries by *D. suzukii* were determined by visual observations on 50 randomly placed plants.

The data were processed statistically (Statistika v.7) and visualized in graphs.

RESULTS AND DISCUSSIONS

The appearance of *D. suzukii* in blackcurrant plantations is related to the ripening of the fruits because the larvae develop only in fruits with a minimum sugar content of about 14%, and average daily temperatures above 10ºC favor the development and multiplication of the species (Kanzawa, 1939).

The first adults of *D. suzukii* in the 'Titania' variety in 2019 were recorded in the second ten days of May (one fly in the classic trap and three flies in the Suzukii Trap, Figure 1). During this period, the average daytime temperatures were 14.8ºC, and the maximum reached 21.8ºC (Table 1).

With the warming of the weather, a period of increase in the number of pests in both types of traps began, which was directly related to the ripening of the fruits. During the first ten days of June, the fruits ripened to a large extent, and the pest significantly increased its number (24 flies in the classic trap and 45 flies in the Suzukii Trap). During this period, the soluble dry matter content of the fruit in terms of Brix was 12%. The density of flies in the traps decreased due to fruit harvesting.

Table 1. Agroclimatic characteristics for the area of Troyan

2019	**Average T⁰C**	**Min T⁰C**	**Max T⁰C**	**RH %**	**Rainfall mm**
May	14.8	8	21.8	73	82.4
June	19.9	13.6	26.6	79	234.6
July	20.2	13	27.8	75	106.7
2020	**Average T⁰C**	**Min T⁰C**	**Max T⁰C**	**RH %**	**Rainfall mm**
May	14.7	8.6	20.6	78	63.8
June	17.8	12.6	24.6	81	129
July	20.4	27.1	13.5	78	75.4

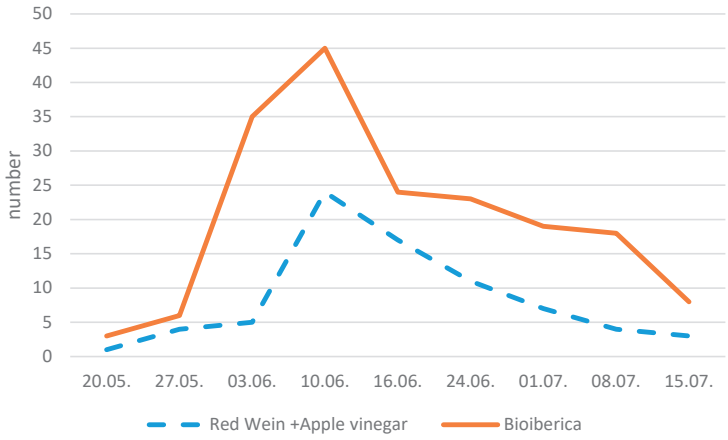

Figure1. Population dynamics of *D. suzukii* in blackcurrant variety 'Titania' in 2019 in the area of city Troyan

The first adults of *D. suzukii* were registered again in the second ten days of May 2020 (2 flies in the classic trap and 2 flies in the Suzukii Trap, Figure 1).

As the temperatures rose and the fruits ripened, their number increased in both types of traps. A peak in the multiplication of the species was recorded in the second ten days of June (44 flies in the classic trap and 55 flies in the Suzukii Trap).

During this period, the soluble dry matter content of the fruit in terms of Brix was 11%. As the fruits were harvested, the density of flies in the traps decreased.

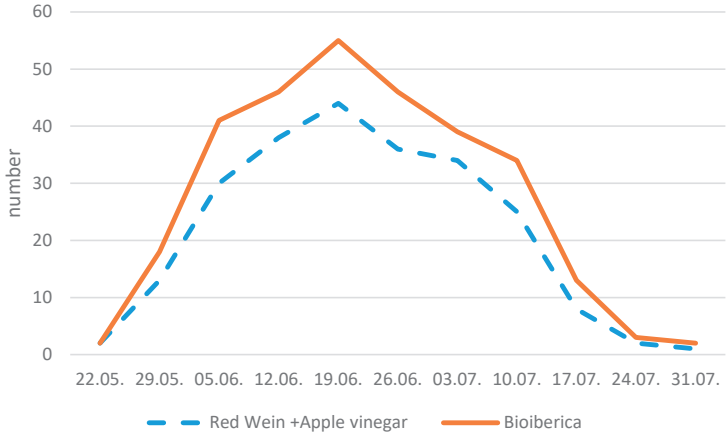

Figure 2. Population dynamics of *D. suzukii* in blackcurrant variety 'Titania' in 2020 in the area of city Troyan

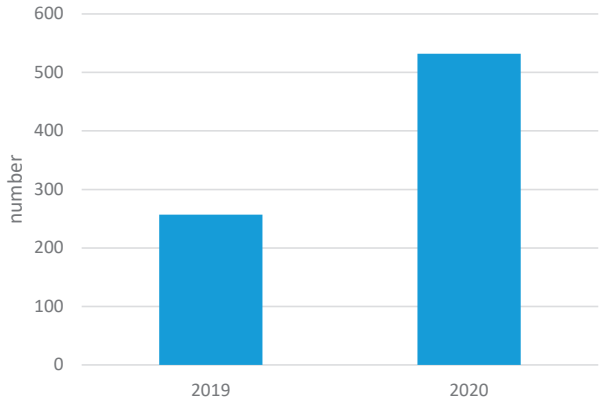

Figure 3. Caught adults of *D. suzukii* in 2019 and 2020 in 'Titania' blackcurrant plantations

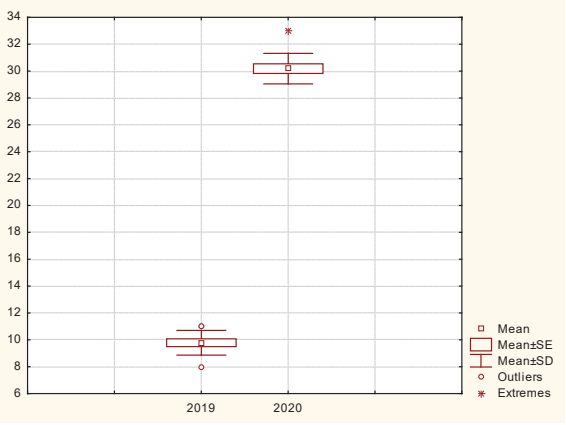

Figure 4. Detected damages on the fruits of the blackcurrant variety 'Titania' (%)

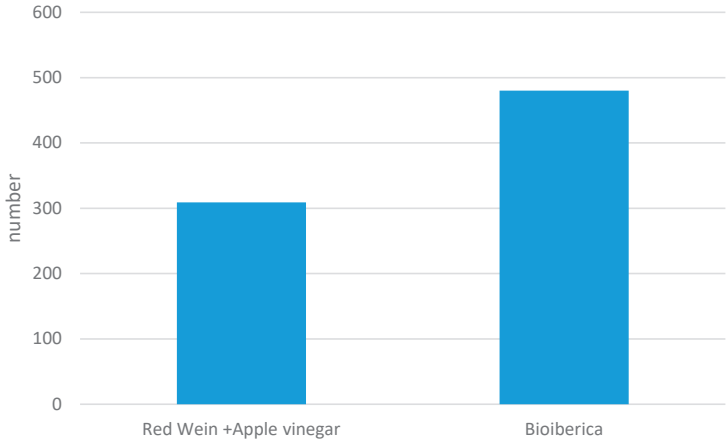

Figure 5. Caught adults of *D. suzukii* in the traps in 2019 and 2020

Damages to the fruits were also found during the inspections. In 2019, *D. suzukii* was registered in a lower number (257 flies) (Figure 3), as a result of which 10±0.01% damaged fruits were reported. In 2020, the environmental conditions favored the development of the species, 532 flies were recorded. 30±0.01 % damaged fruits were found (Figure 4).
During the research period, 480 flies were caught with the Suzukii Trap, and 309 flies with the classic trap. This can be explained by the higher pH in the "Bioiberica" nutrient mixture (Figure 5).

CONCLUSIONS

The following conclusions can be drawn as a result of the conducted studies:
The first adults of *D. suzukii* in the food traps of blackcurrant variety Titania were found in the second ten days of May (May 20-22), at that period the fruits begin to ripen for the Troyan area.
The highest number of *D. suzukii* flies was found during the large-scale fruit ripening when was registered the highest content of soluble dry matter according to Brix (12%).
In 2019, 257 flies were caught in the food traps, as a result of which the damaged fruit was 10 ± 0.01%; and in 2020, 532 flies were caught, and respectively 30 ± 0.01% of the fruit was damaged.
480 flies were caught in the Suzukii Trap, and 309 flies in the classic trap. This can be explained by the higher pH of the "Bioiberica" nutrient mixture.

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