Suzukii trap and traditional traps for monitoring *Drosophila suzukii* (Matsumura) – potentially dangerous pest by the strawberries

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ABSTRACT

Drosophila suzukii (Matsumura) (Diptera: Drosophilidae) is a significant pest of berry crops in Europe and beyond. The rise of worldwide markets and the unrestricted movement of commodities is heightening the risk of *D. suzukii* proliferation. The research was carried out from 2022 to 2023 in the village of Mirolyubovo, Burgas region, focusing on strawberry plantations of the "Buddy" and "Petra" kinds. Food traps, specifically the Suzukii Trap from "Bioiberica," together with traditional traps utilizing apple cider vinegar and red wine, were employed for monitoring purposes. The initial adult *D. suzukii* specimens in the food traps were detected in early June, coinciding with the onset of fruit ripening. The pest's population density peaks during the mass ripening of fruits, coinciding with their maximum sugar content. At elevated concentrations, *D. suzukii* may pose a significant threat to berry crops for fruit producers.

Keywords: *Drosophila suzukii*, damage, food traps, strawberries.
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INTRODUCTION

Drosophila suzukii (Matsumura) (Diptera: Drosophilidae), is an economically important pest of thin-skinned fruits worldwide (Dam *et al.*, 2019). This species is native to Asia, but now is reported in several countries in North America, Europe, parts of South America, and North Africa (Kwadha *et al*., 2021; Baena *et al*., 2022).

Drosophila suzukii is polyphagous and prefers hosts with thin epicarp, such as strawberry (Fragaria × ananassa Duchesne), raspberry (*Rubus idaeus* L.), cherry (*Prunus avium* L.), blackberry (*Morus nigra* L.), and blueberry (Vaccinium spp.) (Wollmann *et al.*, 2020). The species also attacks many wild hosts (Arnó *et al.*, 2016). Losses caused by *D. suzukii* in strawberry production are estimated at 20% and 30% in the United States and Brazil (De los Santos, 2014). The choice of food host by *D. suzukii* includes a number of indicators such as color, pH and others (Lee *et al.*, 2011). It has been found that *D. suzukii* is more sensitive than other species of the genus Drosophila in detecting volatile substances released by the plant during fruit ripening (Arnó *et al.*, 2016). During this period, pH increases, skin thickness decreases. The degree of attack by *D. suzukii* is directly related to the variety and the ripening period of the fruit (Hwang *et al.*, 2020). According to Lee *et al.* (2011) in strawberry varieties Hood and Totem, the largest number of eggs and larvae were observed in partially or fully colored fruits, which are sweeter, firmer than green fruits (Arnó *et al.*, 2016).

Another important factor in *D. suzukii* host selection is the volatile organic compounds released by the fruit, which are used as cues for egg laying (Cai *et al.*, 2019). Volatile substances released during ripening strawberry fruits can be very attractive to *D. suzukii* (Kessey *et al.*, 2015). There are about 360 volatile organic compounds in strawberries, which are specific to individual strawberry varieties. Unlike other Drosophilidae flies, *D. suzukii* females cause damage to healthy fruit due to their serrated ovipositor, which the fly uses to pierce the skin of ripening fruit. Damaged fruit is also exposed to secondary infestation by

other flies and pathogens, resulting in reduced commercial value (Kwadha *et al.*, 2021). The aim of this study is to track the population dynamics of *Drosophila suzukii* on strawberries and to analyze the risk of attack during the growing season.

MATERIALS AND METHODS

The research was conducted during the period 2022-2023 in strawberry fields of the varieties "Buddy" and "Petra" with an area of 0.2 ha in the village of Mirolyubovo, Burgas region. To monitor the appearance and density of *Drosophila suzukii*, food traps were installed. Plastic containers were used with a Suzukii Trap nutrient mixture from the Spanish company "Bioiberica" and a classic one (a mixture of red wine and apple cider vinegar in a ratio of 3:2) was poured into them. The traps were placed in the middle of the rows in early June, when the fruits began to ripen. The attack by *D. suzukii* was established through visual observations. Damage to the fruits was determined on 100 plants, randomly located. The statistical processing of the results of the experiments was carried out with the Statistica program.

RESULT AND DISCUSSION

The appearance of *D. suzukii* on strawberries in 2022, of the variety "Buddy", was recorded in early June and coincided with fruit ripening. Three flies were recorded with the classic trap and five (1 ♂ and 4 ♀) with the Suzukii Trap (Fig. 1). In June 2022, the average daily temperatures for the period reached 21.6oC, and the maximum 33.1oC. The rainfall was 19 mm (Fig. 2). As the pest enters the crop and the fruit ripens, the density of the species increases. The highest number of *D. suzukii* was recorded during fruit ripening – in the third decade of June - 11 flies (2 ♂ and 9 ♀) with the classic traps and 27 flies (3 ♂ and 24 ♀) with the Suzukii Traps.

During the months of July and August, the average daily temperatures ranged from 24.6 to 26°C, and the maximum reached 37.2°C. The sugar content in the fruits by Brix is 10.8%, which is an important condition for the development of the larvae and it is in accordance with the data of other authors Ioriatti *et al.* (2015).

In 2023, the first adults were established in early June during the ripening of the first fruits of the "*Petra*" variety, at average daily temperatures of 21.6°C and maximum 33 °C. Three flies (1 ♂ and 2 ♀) were recorded with the classic trap and six (2 ♂ and 4 ♀) with the *Suzukii Trap* (Fig. 3). With mass ripening of the fruits, the density of the species increased. The highest number of *D. suzukii* was recorded in the third decade of July - 15 (8 ♂ and 7 ♀) with the classic traps and 22 (10 ♂ and 12 ♀) with the *Suzukii Traps*. The average daily temperatures for July reached 24.9°C, and the maximum temperatures approached 41.1°C (Fig. 2). The density of flies in the traps decreases due to harvesting of the produce and lack of a food host. In the variety "*Petra*", the soluble dry matter content in the fruits according to Brix is 10.2%.

The results of the population dynamics show that the density of the *D. suzukii* in both years increased significantly, which is directly related to the increase in the content of sugars in the fruits.

The examinations revealed damage to the fruits. In the Buddy variety, 15±0.01% of damaged fruits were recorded with an average number of larvae in one fruit of 5.5±0.01, and in the Petra variety, 25±0.01% of damaged fruits were found. They are deformed, softened and filled with larvae, with an average of 10±0.01, in one fruit (Fig. 4 and 5).

The results of the observations show that a critical period in strawberries in relation to *D. suzukii* is the phenophase of fruit ripening, when the sugar content increases, and this is an important condition for the development of the larvae. During this period, the control is difficult, due to the residual amounts of insecticides, which are dangerous to the humans.

To reduce the density of *D. suzukii*, it is necessary to carry out a system of measures, which includes: placing food baits during the ripening period of the fruits to establish the appearance of the species, collecting and destroying damaged fruits, timely harvesting of the ripe fruits and at high density, carrying out treatment.

Figure 1. Population dynamics of *D. suzukii* by strawberries variety "Buddy" in 2022.

Figure 2. Meteorological characteristics of the area in the village of Mirolyubovo, Burgas region in 2022–2023.

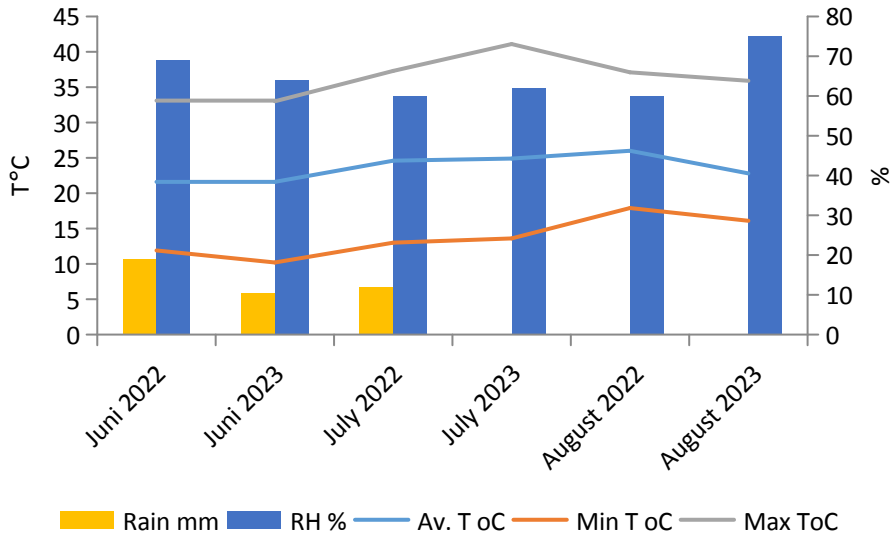
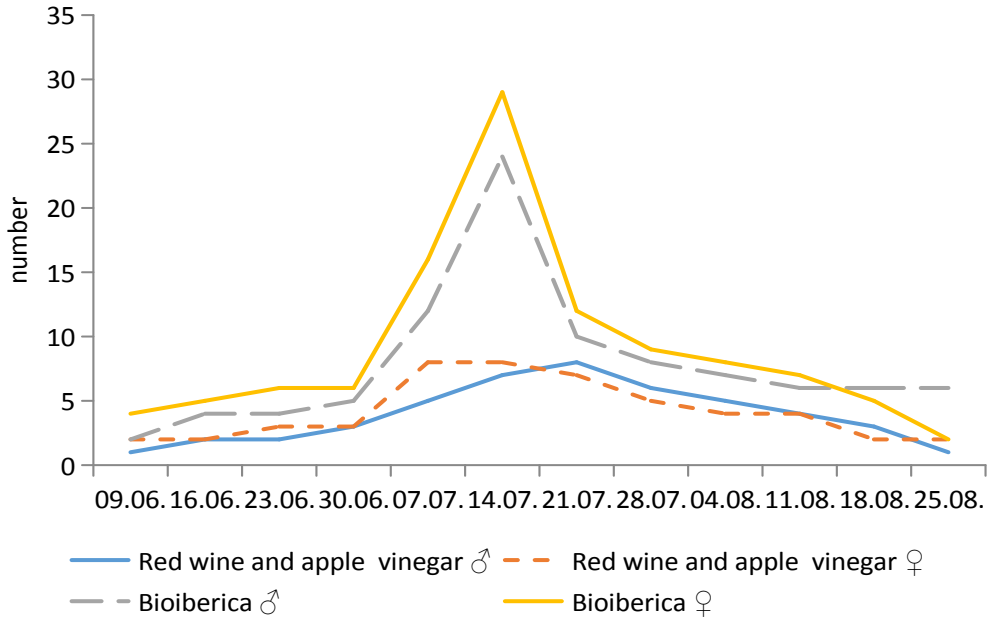


Figure 3. Population dynamics of *D. suzukii* by strawberries variety "Petra" in 2023.



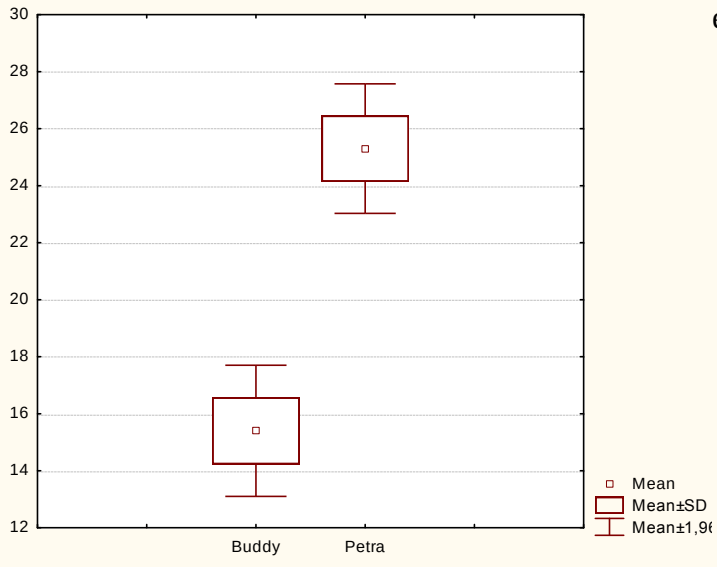


Figure 4. Damaged fruits (%) by varieties "Buddy" and "Petra"

The investigations indicate that the initial adult specimens in the food traps were identified within the first ten days of June, coinciding with the ripening of fruits and the presence of sugars. The peak of the pest's flight was determined during the mass ripening of the fruits, when their sugar content is at its highest. The Suzukii Trap is more effective, capturing twice as many flies.

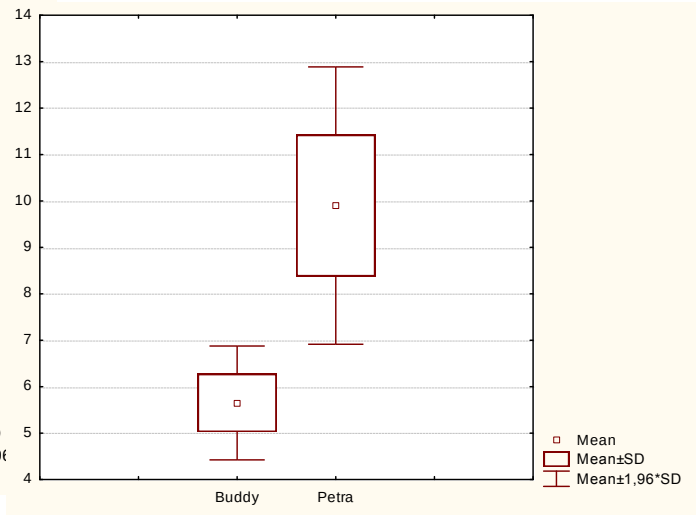


Figure 5. Average number of larvae in one fruit by varieties "Buddy" and "Petra"

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