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Population monitoring and status evaluation of the new invasive pest, *Drosophila suzukii* (Matsumura) (Diptera: Drosophilidae), in various crop systems of Georgia (Sakartvelo)

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Summary The spotted wing drosophila, *Drosophila suzukii* (Matsumura, 1931), population fluctuations and distribution were monitored in four susceptible crops (blueberry, strawberry, cherry, wine grapes) and five major agricultural regions of Georgia (Guria, Samegrelo, Imereti, Kartli and Kakheti) during the years 2021 and 2022 with the aim to study the population size and evaluate the pest status. Population monitoring was conducted in four locations of each studied region on a weekly basis from May to November using PHEROCON® SWD traps with PHEROCON® SWD PEEL-PAK™ Broad Spectrum Lures. The investigation indicated significant growth of population from 2021 to 2022 in most of the studied locations. Population increase was detected in all crop orchards except cherries. The absence of alternative host plants at crop proximity was of critical importance to save the crop from pest invasion. The crop plant species did not have a significant impact on *D. suzukii*. Pest population was significantly larger in summer and autumn compared to spring, possibly influenced by the ripening of alternative crops such as blackberry and elderberry. The sex ratio between male and female individuals was almost 1:1 and remained consistent through the two-year study period and across regions. We consider that *D. suzukii* entered the country from the southwestern part and extended its distribution range towards the east. No strategies for *D. suzukii* control have been elaborated in Georgia so far. Sprays of effective pesticides based on pest monitoring as well as sanitation measures involving removal of alternative host plants and any crop residues from the field are necessary to avoid pest outbreak.

Additional keywords: Georgia, pheromone traps, population monitoring, spotted wing drosophila

Introduction

The spotted wing drosophila (SWD), *Drosophila suzukii* (Matsumura, 1931) (Diptera: Drosophilidae), has become a major invasive pest impacting small fruits such as berries and stone fruits in America and Europe. The pest is native to Asian countries (Kanzawa, 1939; Peng, 1937; Lee *et al*., 2011; Walsh *et al*., 2011; Asplen *et al*., 2015). In North America it was first detected in Hawaii in 1980 and on the mainland (California) in 2008 (Lee *et al*., 2011; Walsh *et al*., 2011). In Europe (Italy and Spain) SWD was detected in 2009 (Calabria *et al*., 2012) and currently it is distributed across the whole Western Europe (Asplen *et al*., 2015) with a continuous expansion of its range. While Caucasian ecoregion is located on the favored latitude for the pest (40 – 47°) (Calabria *et al*., 2012), the presence of SWD was officially registered in 2017, only when it was accidentally discovered in traps installed close to the agricultural markets in Khelvachauri municipality and Batumi city (Western Georgia) (Japoshvili *et al*., 2018).

Although SWD prefers small and soft fruits like cherries and berries, its host range includes apricots, nectarines, figs, grapes and peaches (Stacconi, 2022). The total yield loss by damage of SWD reached up to 80% of strawberry crops in France, and 30-40% of various berries in Italy in 2010. Economic losses also include labor fees, costs for

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chemicals, and other expenses (Lee *et al*., 2011).

Georgia is considered as one of the promising contributors of blueberry export in Eastern Europe with increasing share in country's export market. In 2019, the country's income from blueberry export equaled to 983.3 thousand US$, while according to the 2023 data from January to July, the income has increased to the 21,228.14 thousand US$ (https://www.geostat.ge/). On the other hand, Georgia is an ancient wine-producing country (McGovern *et al*., 2017), and wine is considered as one of the major export products, accounting for 4.2% share of the country's overall export in 2022. Vineyards occupy 41.2% of the country's cropland territory (https://www.geostat.ge/).

The growing demand for agricultural products encourages Georgian farmers to expand cultivation areas, thus increasing the preferable host range for SWD. Although a population outbreak has not been recorded, monitoring and evaluation of the population size of SWD in Georgian susceptible croplands has not yet conducted. This is the first attempt to monitor and evaluate population of *D. suzukii* across the whole country in different susceptible crops such as blueberry, strawberry, cherry and grape. The goal of this paper is to: 1) monitor the population of *D. suzukii* in susceptible crop orchards located in Guria, Samegrelo, Imereti, Kartli and Kakheti regions of Georgia for two consecutive years; 2) evaluate the pest status with the aim elaborating effective management tools to prevent a population outbreak from reaching economically damaging levels.

Material and Methods

Population monitoring of *D. suzukii* was conducted in major agricultural regions in both western and eastern parts of Georgia (Guria, Samegrelo, Imereti, Kartli and Kakheti) during the years 2021 and 2022, from May (5th and 15th, respectively) to October. The major susceptible agricultural crops which are commercially produced countrywide, were included: blueberries, strawberries, wine grapes and cherries.

The regions Guria and Samegrelo are located in Plain and Piedmont hilly subtropical humid (Kolkhic forest) landscapes with subtropical climate, influenced by close vicinity of Black Sea, with high annual rainfall (1400-1500mm) and annual average temperature 14°-15°C. In Imereti, the impact of Black Sea is less remarkable, the annual precipitation is 800-1300mm and the annual average temperature is 7°-14°C. The Kartli region is characterized by Plain and Piedmont hilly sub-Mediterranean semi-humid landscapes with forest and shibliak landscapes, 400-500mm annual precipitation and 10°-13°C annual average temperature. Moderately warm plain semi-humid forest landscapes transient to the subtropical type are spread within the limits of Alazani Plain of Kakheti region, where our investigation was conducted, with 400-600mm annual precipitation and 11°-13°C annual average temperature (Bolashvili and Neidze, 2022; Elizbarashvili, 2007).

In Guria investigations were carried out in three blueberry and one strawberry field, in Samegrelo in three blueberry fields, in Imereti in three vineyards and one strawberry field, in Kartli in three cherry orchards and one strawberry field and in Kakheti in three vineyards and one strawberry field. In each region, four cropland sites of 2ha area were selected, with three sites representing the major susceptible crops for SWD (blueberry, vine grape or cherry) and one strawberry field. (Table 1). The distances between the sites within the regions ranged from 3 to 5 km (Table 1, Fig. 1). Each site received the scheduled pesticide applications by the farmers according to the schemes provided by the National Food Agency (www.nfa.gov.ge).

For the SWD population monitoring, PHEROCON® SWD Trap with PHEROCON® SWD PEEL-PAK™ Broad Spectrum Lures (Trécé Inc., Adair, OK, USA) were used. In 2021, the traps were installed in the first week of May, while in 2022, they were placed in the last week of April. Five traps were placed

Table 1. List of in five major agricultural regions of Georgia (Guria, Samegrelo, Imereti, Kartli and Kakheti) and monitoring locations/sites (2ha size of each) of *Drosophila suzukii* with GPS coordinates and key crops where monitoring traps were located.

Region	Monitoring Location	Number of traps	GPS coordinates and altitude	Key crop and dominant cultivar	Site description
Guria	Laituri	5	N41.917912° E41.867443° 25m a.s.l	Blueberry: Legacy	Homogeneous blueberry plantation, scarce wild vegetation in surroundings. Drip irrigation. Pesticide application scheme proposed by nfa.gov.ge. Imported bumble bees (*Bombus terrestris*) for pollination
	Naruja	5	N41.904938° E41.958540° 135m a.s.l	Blueberry: Legacy	Homogeneous blueberry plantation, wild vegetation by herbs including elderberry. Drip irrigation. IPM scheme proposed by nfa.gov.ge.
	Natanebi	5	N41.910132° E41.787358° 0m a.s.l.	Strawberry: Fortuna	Strawberry plantation with dense wild vegetation around, mostly elderberry Drip irrigation. Pesticide application scheme proposed by nfa.gov.ge.
	Tsetskhlauri	5	N41.871870° E41.873768° 57m a.s.l.	Blueberry: Legacy	Homogeneous blueberry plantation, scarce wild vegetation in surroundings. Drip irrigation. IPM scheme proposed by nfa.gov.ge.
Imereti	Melauri	5	N42.193969° E42.367201° 33m a.s.l.	Strawberry: Elsanta	Subsistence farm. Multicropping. Different crop varieties harvested at different periods of season. No insecticide application. Fungicides and NPK fertilizers applied
	Obcha	5	N42.123688° E42.89659° 181m a.s.l.	Grapevine: Tsitska and Tsolikauri	Homogeneous partially organic vineyard, scarce wild vegetation in surroundings.
	Rokhi	5	N42.116746° E42.720127° 112m a.s.l	Grapevine: Tsolikauri	Homogeneous vineyard, scarce wild vegetation in surroundings. Pesticide application scheme proposed by nfa.gov.ge.
	Sazano	5	N42.190810° E43.05072° 196m a.s.l.	Grapevine: Tsolikauri	Small scale vineyard surrounded by some fruit trees and wild vegetation including elderberry and blackberry. Pesticide application scheme proposed by nfa.gov.ge.
Kakheti	Kondoli	5	N41.960772° E45.596703° 370m a.s.l	Grapevine: Saperavi and Cabernet Sauvignon	Homogeneous vineyard with fruit trees (plum, peach) around. Pesticide application scheme proposed by nfa.gov.ge.
	Kurdgelauri	5	N41.95217° E45.529221° 427m a.s.l	Grapevinee: Rkatsiteli	Vineyard surrounded by wild vegetation mostly represented by blackberry. Pesticide application scheme proposed by nfa.gov.ge.

Region	Monitoring Location	Number of traps	GPS coordinates and altitude	Key crop and dominant cultivar	Site description
Kakheti	Mukuzani	5	N41.810777° E45.711029° 512m a.s.l.	Grapevine Saperavi	Vineyard surrounded by wild vegetation mostly represented by blackberry and other perennial herbs. Pesticide application scheme proposed by nfa.gov.ge.
	Shashiani	5	N41.822433° E45.6679821° 669m a.s.l	Strawberry: Kakheti 1	Strawberry field surrounded by wild vegetation mostly represented by blackberry, other perennial herbs and mulberry. Pesticide application scheme proposed by nfa.gov.ge.
Kartli	Agara	5	N42.024877° E43.796545° 646m a.s.l.	Strawberry: Fortuna	Homogeneous strawberry field with almost no wild vegetation in surroundings. Drip irrigation. Pesticide application scheme proposed by nfa.gov.ge.
	Apnisi	5	N41.995626° E43.900884° 662 m a.s.l.	Cherry: Lapins	Cherry orchard with adjacent apples. Drip irrigation. Pesticide application scheme proposed by nfa.gov.ge.
	Kvenatkotsa	5	N42.045033° E 43.831335° 639 m a.s.l	Cherry: Lapins	Homogeneous cherry orchard, almost no any wild vegetation in surroundings. Drip irrigation. Pesticide application scheme proposed by nfa.gov.ge.
	Skra	5	N41.988408° E43.995987° 618m a.s.l	Cherry: Regina	Cherry orchard with some wild vegetation around
Samegrelo	Ingiri	5	N42.471770° E41.797044° 50m a.s.l	Blueberry: Legacy	Homogeneous blueberry plantation, wild vegetation in surroundings including elderberry. Drip irrigation. Pesticide application scheme proposed by nfa.gov.ge.
	Narazeni	5	N42.422460° E41.923300° 131m a.s.l.	Blueberry: Legacy	Homogeneous blueberry plantation, wild vegetation in surroundings including elderberry. Drip irrigation. Pesticide application scheme proposed by nfa.gov.ge.
	Rukhi	5	N42.534009° E41.879254° 133m a.s.l	Blueberry: Legacy	Homogeneous blueberry plantation, wild vegetation in surroundings including elderberry. Drip irrigation. Pesticide application scheme proposed by nfa.gov.ge.

at each site with 4 traps placed at the edges and one in the middle of the field as recommended by the producer. They were installed at the height of 1-1.5 m from the ground. The traps were placed at the shaded areas of the canopy and were checked for the SWD presence once a week. Lures in each trap were changed once per month as recommended by the producer company. In total, for twenty-three study sites, 95 SWD

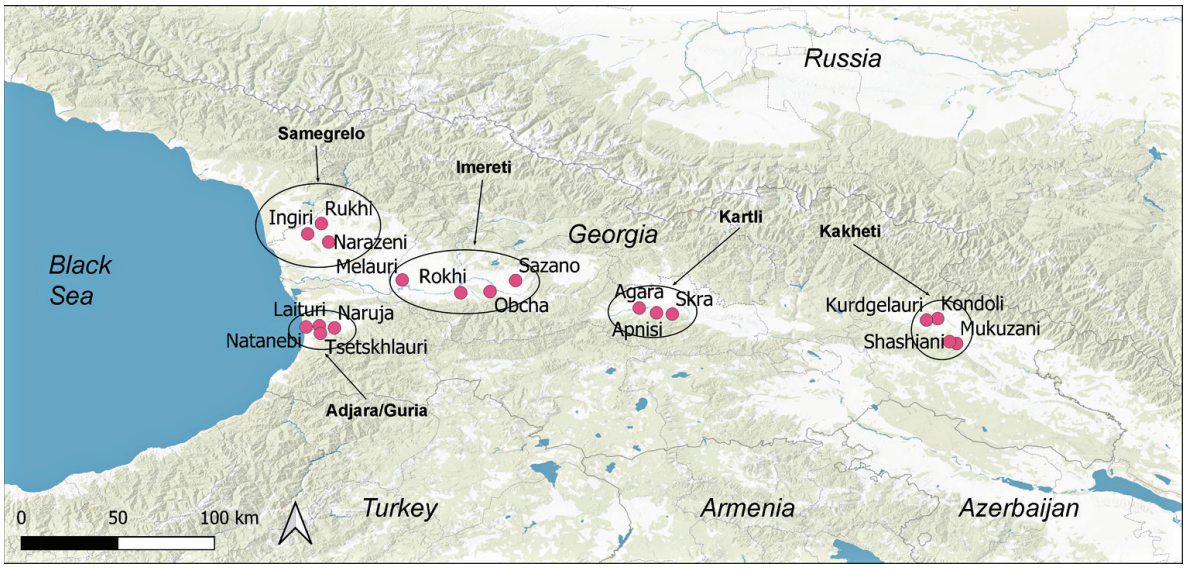

Figure 1. Map showing the distribution of study locations of *Drosophila suzukii* in five major agricultural regions of Georgia (extracted from Murvanidze *et al.*, 2022).

traps were used.

Temperature data for each region were retrieved from local weather stations. Daily minimum, mean and maximum temperature data were retrieved from 1st January 2021 to October 30st 2022. Degree-days (DD) were calculated using 7.2°C as a lower development threshold (Tochen *et al.*, 2014). Cumulative daily DD totals were calculated for each site until the end of monitoring in the end of October.

The captured flies were extracted from traps using a fine painting brush and stored in 95% alcohol for further sorting, identification and morphological analyses. The flies were identified and sex-separated using stereoscope UNITRON Z850 to confirm presence of *D. suzukii*. Identified flies were counted and separated into the male and female adult individuals. After identification, the sampled material was stored in 70% alcohol and voucher specimens are stored to the insect collection of the Agricultural University of Georgia.

Data analysis

For the population dynamics, the average SWD captures was calculated per week, per region for major crops, namely blueberry for Guria and Samegrelo, grapevine for Imereti and Kakheti, and cherry for Kartli region. To estimate the sex-ratio of SWD, the weekly average numbers of male and female individuals were used.

The effect of the year, season, region and crop species on the SWD captures was analyzed independently using a "linear mixed effects model" with random factors of trap and date (of weekly monitoring); the function "lmer" of the lme4 package (Bates *et al.*, 2014) and ANOVA of the "car" package (Fox and Weisberg, 2018) were used. Data on *D. suzukii* captures were log transformed before the analysis to improve homogeneity of variances. All analyses were carried out using R version 4.3.2 (R Core Team 2022).

Results

The first SWD adults in all study regions were observed in the beginning of May. The first SWD flies were captured in Guria and Samegrelo regions when average daily high temperatures exceeded 13°C and 10°C (172 and 246 DD7.2 respectively). In Imereti region first flies showed up on 21 June (745 DD7.2) in 2021 season, while in 2022, they were already present in the field on 15 May (254 DD7.2). In Kakheti region they first appeared

on 28 June in 2021 (954.5 DD7.2) and on 14 June in 2022 (672 DD7.2) and in Kartli they were trapped on 17 July in 2021 (957.3 DD7.2) and on 22 June (563.4 DD7.2) in 2022.

In blueberry fields in Guria and Samegrelo regions, the number of SWD captures increased in the end of July and the beginning of September (Fig. 2). In vineyards, the increase of pest abundance started with the beginning of ripening of grapes from August. However, in the Imereti region it dropped in September, while in Kakheti the numbers continued to increase until October (Fig. 2).

The year was a significant factor for overall population of SWD captures (DF = 1, p<0.001, Table 2) which were lower in 2021 compared to 2022 (Fig. 3, Table 2). The region significantly affected the captures of SWD (DF = 4, p < 0.001, Table 2). The effect of time was different in each region: from 2021 to 2022, the number of individuals increased by 365% in Imereti, by 200% in Guria, by 150% in Kartli, by 1600% in Kakheti and by 4380% in Samegrelo (Table 3, Fig. 4).

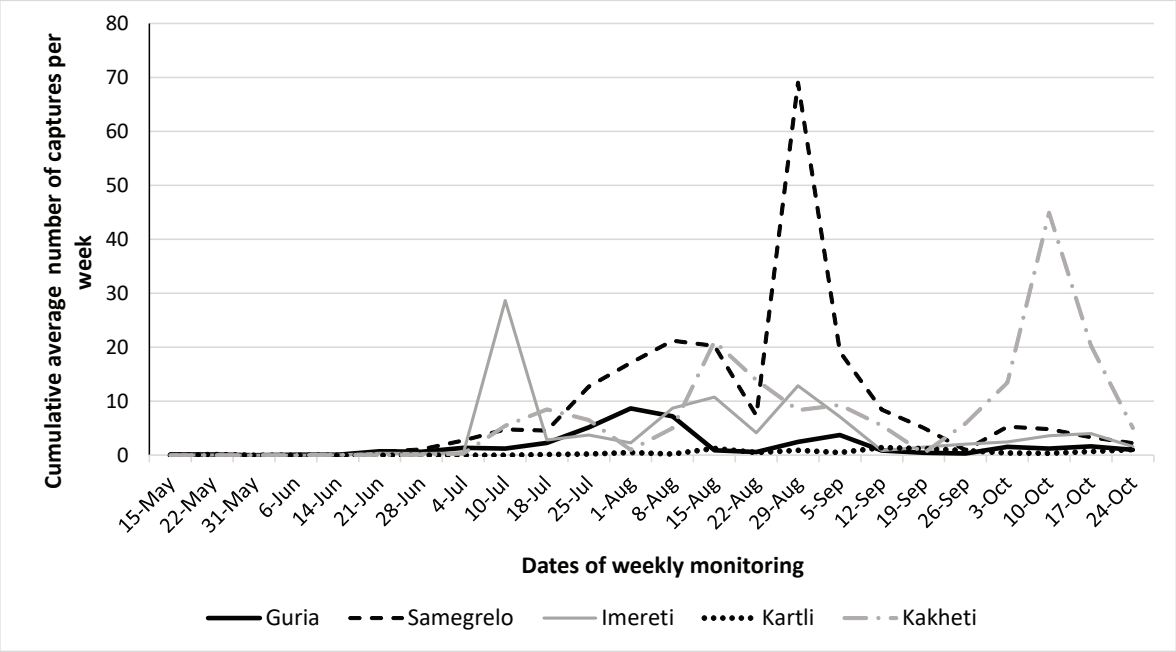

Figure 2. Fluctuation of *Drosophila suzukii* population in Guria, Samegrelo, Imereti, Kartli and Kakheti agricultural regions of Georgia. Abundance represents average of weekly trap captures of adult *D. suzukii* in the years 2021 and 2022.

Table 2. Effect of year, season, region and crop on the abundance of *Drosophila suzukii* three crops (blueberry, strawberry, cherry, wine grapes) in five major agricultural regions of Georgia (Guria, Samegrelo, Imereti, Kartli and Kakheti). Parameter estimates of linear mixed effects model with the random factor trap and date of observation with fixed factors year, season, region and crop. Data of *D. suzukii* abundance were log transformed before the analysis (Significance codes: 0 '***'0.001 '**' 0.01'*' 0.05'.' 0.1''1).

	Chisq	DF	Pr (> Chisq)
Year	141.5	1	<0.001***
Season	61.7	5	<0.001***
Crop	8	3	<0.05 *
Region	27.8	4	<0.001***

The crop (blueberry, strawberry, vine grapes, cherry) was a less significant driver of pest abundance (DF = 4, p<0.05, Table 2), with lower captures in cherry orchards compared to blueberry, strawberry and grapes (Fig. 5).

The season was another significant contributor (DF = 5, p < 0.001, Table 2) to the pest density. While the pest population remained low during the 2021 monitoring period, in 2022, the number of captures were

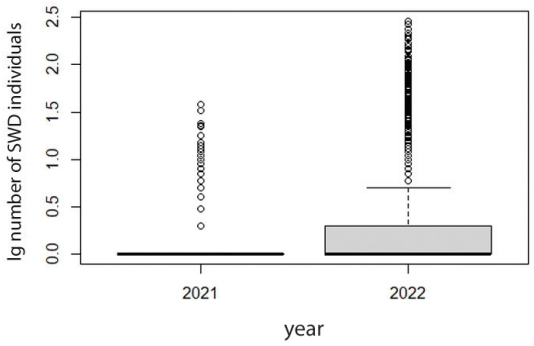

Figure 3. Population of *Drosophila suzukii* (average number of individuals after log transformation of data) across five major agricultural regions of Georgia during the years 2021, 2022.

higher in autumn and summer compared to spring (Fig. 6).

Sex ratio between the average numbers of male and female individuals of *D. suzukii* was almost equal both, in 2021 and 2022 years (Fig. 7A). The same pattern was observed on a regional basis with the exception of Samegrelo and Kakheti regions where number of females exceeded the number of males in 2022 (Fig. 7B).

Discussion

As mentioned above, the presence of *D. suzukii* in Georgia was first detected in 2017 (Japoshvili *et al*., 2018) and by 2021 it was already distributed countrywide (Murvanidze *et al*., 2022). However, the initial date and the route of the pest invasion remain unknown. The preliminary, small-scale monitoring in blueberry and strawberry fields (Guria region) conducted in 2020 (in the same locations as in the current study) from early July to the end of October, showed presence of SWD individuals started in early July (own unpublished data). These and continued observations confirm the existence of well-established population of SWD in this region and lead us to assume that the pest invaded Georgia much earlier prior to the first detection in 2017. According to early simulation models (Cini *et al*., 2012) spread of the pest was predicted all over Europe, towards more humid areas compared to the dry Mediterranean environments. Indeed,

Table 3. Mean population of *Drosophila suzuki* in five major agricultural regions of Georgia (Guria, Samegrelo, Imereti, Kartli and Kakheti) during 2021 and 2022.

Sites		Mean SWD ± Stdev	
		2021	2022
Kakheti	Kondoli	0.64 ± 0.29	9.87 ± 4.71
	Kurdgelauri	1.38 ± 0.32	16.07 ± 4.94
	Shashiani	2.25 ± 0.59	28.20 ± 5.57
	Mukuzani	0.71 ± 0.14	30.96 ± 11.59
Kartli	Skra	0.27 ± 0.08	0.81 ± 0.22
	Apnisi	1.13 ± 0.23	1.99 ± 0.70
	Agara	0.16 ± 0.08	0.61 ± 0.18
	Kvenatkoca	0.01 ± 0.01	0.59 ± 0.29
Imereti	Melauri	1.45 ± 0.38	13.78 ± 5.47
	Obcha	1.46 ± 0.42	5.24 ± 1.72
	Rokhi	0.74 ± 0.19	2.64 ± 1.13
	Sazano	2.43 ± 0.81	6.63 ± 1.33
Samegrelo	Rukhi	0.28 ± 0.11	6.92 ± 2.20
	Ingiri	0.46 ± 0.22	30.75 ± 10.89
	Narazeni	1.43 ± 0.48	23.35 ± 10.63
Guria	Tsetskhlauri	0.37 ± 0.08	1.81 ± 045
	Natanebi	0.54 ± 0.14	0.83 ± 0.27
	Naruja	2.28 ± 0.65	7.17 ± 2.81
	Laituri	0.33 ± 0.09	0.67 ± 0.20

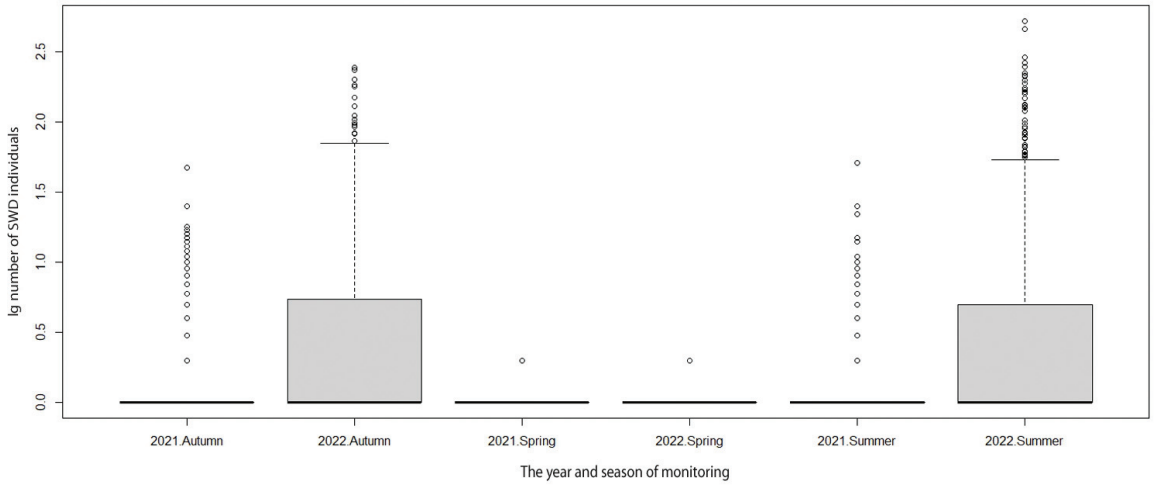

Figure 4. Population of *Drosophila suzukii* (average number of individuals after log transformation of data) in different seasons (spring, summer, autumn) across five major agricultural regions of Georgia during the years 2021 and 2022.

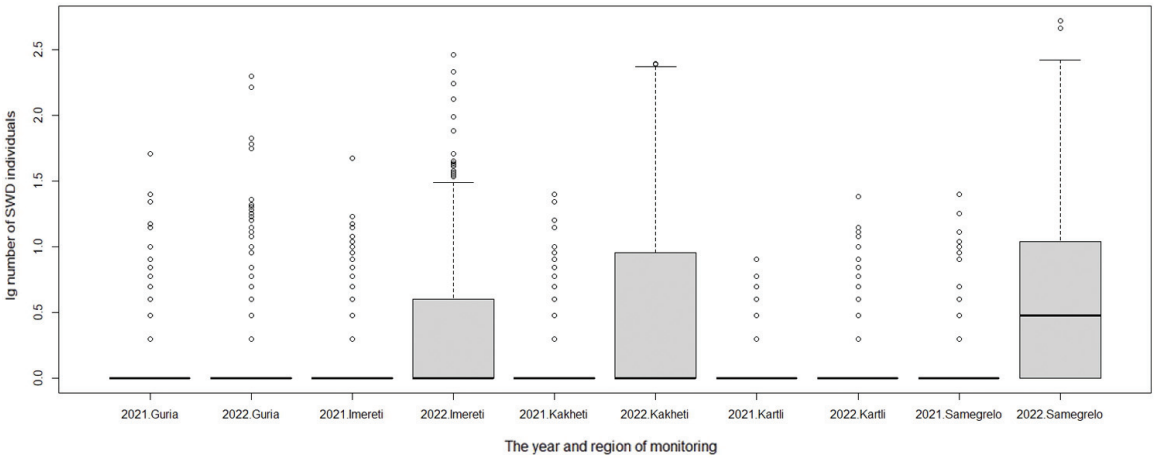

Figure 5. Population of *Drosophila suzukii* (average number of individuals after log transformation of data) in the agricultural regions Guria, Samegrelo, Imereti, Kartli and Kakheti, in Georgia, during the years 2021 and 2022.

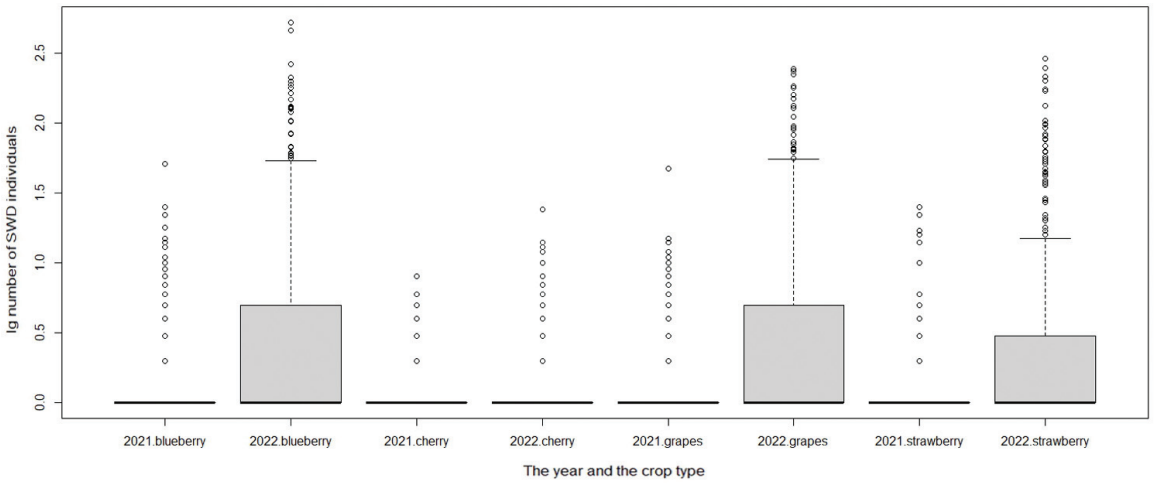

Figure 6. Population of *Drosophila suzukii* (average number of individuals after log transformation of data) in different crops (blueberry, strawberry, cherry, grapevine) in Georgia during the years 2021 and 2022.

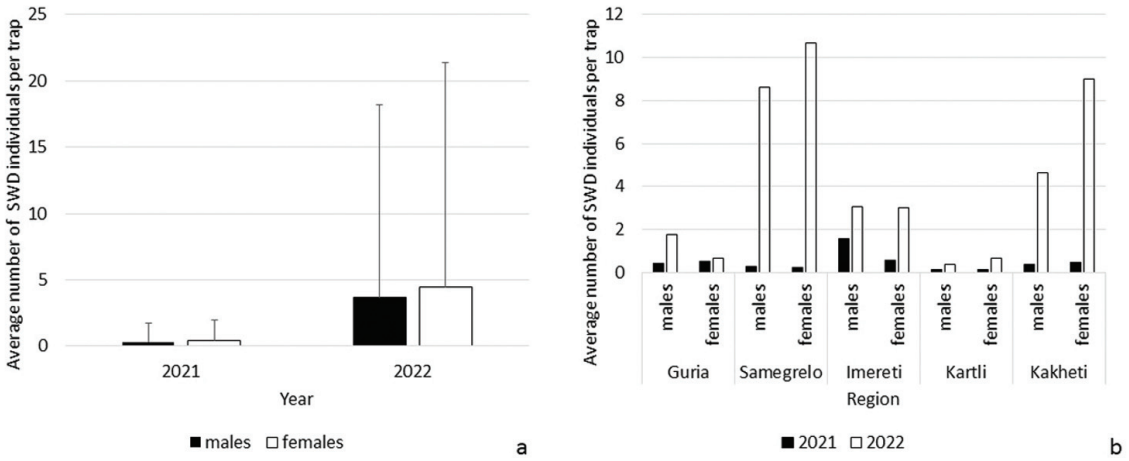

Figure 7. Average number of male and female individuals of *Drosophila suzukii* captured per trap a) in years 2021 and 2022; b) in the regions Guria, Samegrelo, Imereti, Kartli and Kakheti, Georgia during the years 2021 and 2022.

our studies confirm spread of SWD from the Western part of the country, areas with humid subtropical climate towards the East, regions with dry continental climate.

The pest population started to build up from July and continued to increase through August and September. In wine producing regions, SWD population increased in autumn, close to the vine grapes harvesting season. These observations are in accordance with the phenological records provided in regions of a similar latitudinal range (Joshi *et al*., 2016; Walton *et al*., 2019; Swoboda-Bhattarai and Burrack, 2020). This allows to state that the early season crops are out of the risk of infestation (Joshi *et al*., 2016).

The year was a significant contributor showing a population increasing pattern from 2021 to 2022. However, the difference was less significant for Guria region, where pest was first detected. This finding supports our previous assumption about the initial invasion of SWD from Southwestern part of the country. We speculate that the pest entered Georgia from neighboring country - Turkey, where its presence was first recorded in 2014 in Erzerum, close to Guria-Achara part of Georgian border (Orhan *et al*., 2016). On the other hand, *D. suzukii* was first recorded in Russia in 2017 in Sochi (Bienkowsky and Orlova - Bienkowskaya 2020), which is close to Abkhazeti and Samegrelo regions of Northwestern border of Georgia. As the abundance of *D. suzukii* in Samegrelo orchards was significantly lower in 2021 compared to 2022, we assume that 2021 was the establishment year for the pest followed by the dramatic increase of population in 2022. In cherry orchards and the strawberry field located in Kartli region, the pest population remained low. These locations represent homogeneous cherry plantations without wild vegetation that could serve as alternative host for the pest.

The suggested pathway of pest distribution from west to east Georgia is further supported by the dates of first observation events: in Imereti region during the 2021 season, the presence of SWD individuals was first detected on 21 June, while in 2022, the pest was already present on 15 May. The same applies for Eastern Georgia - Kartli (first observation in 2021 – 10 July, in 2022 – 15 May) and Kakheti (first observation in 2021 – 28 June, in 2022 – 14 June). This pattern is an indicator of unstable, still establishing population, while close dates of first observations confirm adaptations of the pest to specific climate conditions (Drummon *et al*., 2019).

Crop type had a less significant effect on the pest distribution and abundance. Indeed, we could observe an increase of the pest population in blueberry plantations in the end of the summer when the main crop was long harvested. These plantations were

surrounded with wild alternative susceptible host plants for SWD such as blackberry (*Rubus* spp.) and elderberry (*Sambucus nigra* L.). In vineyards, the increase of pest population coincided with ripening of grapes, however, the highest increase in abundance in vineyards was observed in early October, when harvest was already finished. Remaining over ripe grapes together with surrounding blackberries may have supported the presence of the pest. The importance of alternative hosts to maintain the population of *D. suzukii* has been reported by a number of other studies (Asplen *et al*., 2015; Arnó *et al*., 2016; Drummond *et a*l., 2019).

The proportion of male : female individuals of *D. suzukii* individuals captured in the traps supported 1:1 sex ratio for Guria, Imereti and Katli region in both years, while in Samegrelo and Kakheti proportion of females was higher in 2022. Drummond *et al.* (2019) reported that drop of proportion of male individuals over seven years of observations, could affect overall population size in a long-term period, although, he indicated that this pattern was probably due to bacterial (*Wolbachia*) infestation. Similarly, different factors, including crop phenology or diseases could affect patterns of sex ratio which therefore might not serve as a reliable indicator of future population growth.

Provided investigation in current work confirms well established population of *D. suzukii* all over the country and in all susceptible crops. There is a rapid increase of the pest population and widening dispersal within two observation years, indicating the urgent need of evaluation of the applied management strategies to prevent economic losses. Studies in other berry production countries report 20% or higher yield losses if SWD is left uncontrolled (Bolda *et al*., 2010, Goodhue *et al*., 2011; Walsh *et al*., 2011).

At the same time the importance of preventative control tactics is widely acknowledged (Lee *et al*., 2011; Leach *et al*., 2017; Knapp *et al*., 2020). None of such strategies for *D. suzukii* control are elaborated in Georgia so far. Pesticide applications and sanitary procedures are known as immediate solutions, but there is low likelihood of gaining long-term effect. Insecticides used for control of SWD population are broad-spectrum, killing also beneficial insects (Walsh *et al*., 2011; Cini *et al*., 2012; Hoffmann Schlesener *et al*., 2017). The problem is even worse for organic crop producers as there are no species-specific insecticides for *D. suzukii* (Tait *et al*., 2021).

The most important objective in integrated pest management of *D. suzukii* is to monitor the population dynamics of the pest, showing seasonal fluctuation and peek activity (Drummond *et al*., 2019). Various baits for monitoring are available in the market or self-made (Walsh *et al*., 2011). Also, our study showed a clear increase of SWD correlating with the ripening of alternative crops such as blackberry or elderberry in the surroundings of the crop field. Rapid harvest of crops and removal of surrounding alternative host plants that maintain pest population when the crop plant is not available, is crucial to maintain population below the threshold level as reported by literature (Cini *et al*., 2012; Leach *et al*., 2017). Maintenance of spoiled fruit or other plant residues, as well as storage containers in the field is another possible shelter for the pest as detected in strawberry field in Guria region (trap close to such area showed higher captures of flies compared to other traps in Natanebi) and confirmed by other studies (Cini *et al*., 2012; Leach *et al*., 2017).

Based on our findings, integrated pest management of *D. suzukii,* in our perception, should include the following major components: continuous monitoring of pest population using commercially available or hand-made traps; minimize the use of broad-spectrum insecticides in cases of increased captures in traps; sanitation procedures including removal of and of any plant residues, compost, containers in field and of alternative hosts surrounding crop fields/orchards.

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Παρακολούθηση πληθυσμού και αξιολόγηση της κατάστασης του νέου χωροκατακτητικού εντόμου, *Drosophila suzukii* (Matsumura) (Δίπτερα: Drosophilidae), σε διάφορα συστήματα καλλιέργειας της Γεωργίας (Sakartvelo)

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Περίληψη Πραγματοποιήθηκε παρακολούθηση της διακύμανσης του πληθυσμού και της κατανομής της κηλιδόπτερης δροσόφιλας *Drosophila suzukii* (Matsumura, 1931) σε τέσσερις ευπαθείς καλλιέργειες (μύρτιλο, φράουλα, κεράσι, οινοποιήσιμα σταφύλια) σε πέντε κύριες γεωργικές περιοχές της Γεωργίας (Guria, Samegrelo, Imereti, Kartli and Kakheti) κατά τα έτη 2021 και 2022 με στόχο τη μελέτη του μεγέθους του πληθυσμού και την εκτίμηση της κατάστασης του εντόμου. Η παρακολούθηση του πληθυσμού διεξήχθη σε τέσσερις τοποθεσίες κάθε περιοχής μελέτης σε εβδομαδιαία βάση από τον Μάιο έως τον Νοέμβριο, με τη χρήση παγίδων PHEROCON® SWD με δόλωμα ευρέως φάσματος PHEROCON® SWD

PEEL-PAK™. Η έρευνα έδειξε σημαντική αύξηση του πληθυσμού από το 2021 έως το 2022 στις περισσότερες από τις τοποθεσίες που μελετήθηκαν. Αύξηση πληθυσμού διαπιστώθηκε σε όλους τους οπωρώνες εκτός από τις κερασιές. Η απουσία εναλλακτικών φυτών ξενιστών σε γειτνίαση με την καλλιέργεια έχει κρίσιμη σημασία για την προστασία της καλλιέργειας από την επέκταση του εντόμου. Το καλλιεργούμενο είδος δεν είχε σημαντική επίδραση στο *D. suzukii*. Ο πληθυσμός του εντόμου ήταν σημαντικά μεγαλύτερος το καλοκαίρι και το φθινόπωρο σε σύγκριση με την άνοιξη, πιθανώς λόγω της ωρίμανσης των καρπών εναλλακτικών καλλιεργειών όπως το βατόμουρο και ο σαμπούκος. Η αναλογία φύλου μεταξύ αρσενικών και θηλυκών ατόμων ήταν σχεδόν 1:1 και παρέμεινε σταθερή κατά τη διάρκεια της διετούς περιόδου μελέτης σε όλες τις περιοχές. Εκτιμούμε ότι το *D. suzukii* εισήλθε στη χώρα από το νοτιοδυτικό τμήμα της και επεκτάθηκε προς τα ανατολικά. Μέχρι στιγμής στη Γεωργία δεν έχουν αναπτυχθεί στρατηγικές για τον έλεγχο του *D. suzukii*. Επεμβάσεις με αποτελεσματικά φυτοπροστατευτικά σκευάσματα με βάση την παρακολούθηση το εντόμου καθώς και μέτρα υγιεινής που περιλαμβάνουν απομάκρυνση των εναλλακτικών φυτών ξενιστών και τυχόν υπολειμμάτων της καλλιέργειας από το χωράφι είναι αναγκαία για να αποφευχθεί πιθανή πληθυσμιακή έξαρση του εντόμου.

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