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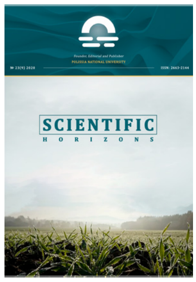

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Phenology and Population of Strawberry Mites and Effectiveness of Using Strawberry Protection in the Conditions of the Right-Bank Forest-Steppe of Ukraine

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Abstract. Growing strawberries is a promising and profitable field of agriculture. However, there are a number of limiting factors that determine the productivity of the crop, in particular pests-phytophages. The study aims to determine the features of the phenological phases of strawberry mite (*Tarsonemus fragariae*) and to examine the effect of protection on the population of phytophagous mites, the impact on physiological and biochemical processes in strawberry plants Murano and Vivara. The study is based on generally accepted methods in entomology and ecology. The degree of damage to strawberry plants was determined on a five-point scale, which on average for 2016-2020 was estimated at 0-1 point. A phenological map of strawberry mite development was created, the dependence of phytophage phenophases on weather conditions was established. In the Murano strawberry plantations, the average population of strawberry mite eggs in 2016-2020 was in the range of 105.3-165.0 pcs/100 leaves, larvae – 37.0-61.3 pcs/100 leaves, imago – 20.8-96.3 pcs/100 leaves. In the Vivara strawberry plantations, the population of mite eggs was in the range of 90.8-180.0 pcs/100 leaves, larvae – 37.0–57.0 pcs/100 leaves, imago – 17.3-95.3 pcs/100 leaves. The effectiveness of the chemical plant protection systems under study (Masai® (0.4 kg/ha) + Biskaiia® (0.8 L/ha); Apollo® (0.5 l/ha) + Tsezar™ (0.2 L/ha) + Mavrik™ (0.6 l/ha)) against phytophage mites was almost at the same level. The exception was a direct ovicidal effect of the Masai and a mixture of Apollo + Tsezar; on the 3rd day after their introduction, the larvae in the eggs were unviable and the eggshells were mummified. The application of strawberry protection systems ensured berry yields of 33.4 t/ha in the Murano variety and 25.4-25.6 t/ha in the Vivara variety and a yield increase of 16.6-16.7 t/ha and 12.4-12.5 t/ha, respectively. The positive effect of plant protection systems against pests on the indicators of physiological and biochemical processes in the leaves of strawberries of both varieties was established. An increase in the content of chlorophyll by 33-58%, phenolic compounds – by 7-15%, sugars – by 6-10%, vitamin C – by 2-6% compared to the control was recorded in strawberry leaves. Given the high environmental safety requirements for berry growing technologies, the search for alternative biological products in the control of *Tarsonemus fragariae* is promising

Keywords: integrated plant protection system, phytophages, *Tarsonemus fragariae*, acaricides

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INTRODUCTION

Marketing research shows a constantly growing market for berry products worldwide [1]. The main factors determining the increase in berry production are the active development of modern trends related to healthy eating, vegetarianism and new storage and processing technologies in the food industry. Strawberries remain the most popular berry on the global market and about 70% of the global berry production is accounted for by this crop [2]. The chemical composition of strawberries is rich in pectin (1-2%), contains 8-10% sugar, 0.8-1.8% organic acids (dominated by citric, malic, oxalic, ascorbic, folic, salicylic, quinic). Berries contain trace elements such as potassium, phosphorus, calcium, magnesium, iron, and iodine. The special value of berries – is the high content of antioxidants and vitamins (A, C, PP, B, E, K). In terms of vitamins C and P, strawberries are second only to black currants [3].

Strawberries (*Fragaria x ananassa* Duch.) is a valuable berry crop with a high content of vitamins and antioxidants, which is grown in many countries of the world and is called the "Queen of Fruits" [3; 4]. The main countries producing this berry are the United States, Mexico, Turkey, Spain, Egypt, South Korea, Japan, Poland, Ukraine, and Germany. The average yield of strawberries in the world is 6.9 t/ha. According to official data [2], the global cultivation of strawberries in 2019 reached 4.5 million tonnes and is projected to grow in individual countries due to increased yields, the introduction of innovative methods of production and business organisation, and the expansion of berry plantations.

According to the State Statistics Service of Ukraine, the area of wild and garden strawberry plantations in the fruitful age in 2020 in Ukraine covered 8.1 thousand hectares, its gross annual harvest is 55.2 thousand tonnes, which is 20-30% more than other berry crops [5]. Considering the agroclimatic and resource potential of Ukraine, the cultivation of strawberries and the sale of berries in the EU countries is a promising and competitive area for national producers of fruit and berry products, the consumption of which is constantly growing worldwide [1].

A considerable reserve for improving the quality of crops and increasing the productivity of Berry plantations is to improve their protection against pests and pathogens. This can be achieved only with the complex application of agrotechnical, quarantine, mechanical, physical, and chemical measures [6].

Notably, berries are a product that is consumed mainly fresh, so there is an urgent issue of developing technologies for protecting berry crops, which allow minimising the ingress of pesticides on the organs of plants that are eaten [7; 8]. One of these measures is the use of resistant varieties, predecessors, biological products, etc. In addition, organic production is actively developing in the world with strict requirements for the use of chemicals in agricultural technologies and high-quality standards for grown products.

Ensuring optimal agroecological and technological conditions during the growing season contributes to obtaining stable berry yields. When greening agricultural production, new alternative approaches should be used, which consider the complete elimination or reduction of the use of chemical plant protection products and the introduction of biological methods in combination with adapted elements of cultivation technology. To prevent the spread of pests, a set of preventive and extermination measures is used, the implementation of which considerably reduces, and sometimes prevents, the development and spread of harmful organisms. It also corresponds to the ideology of integrated plant protection, the implementation of which is aimed at greening chemical plant protection, reducing the use of pesticides, choosing less toxic preparations, and preserving the natural environment. Now the scientific community is widely discussing the environmental hazards of modern agricultural technologies due to the use of chemical plant protection products and unpredictable results of biological control.

The purpose of the study is to examine the biological and ecological features of strawberry mite (*Tarsonemus fragariae*) in strawberry plantations of Murano and Vivara varieties in the Vinnytsia region and to determine the effectiveness of plant protection chemicals in controlling strawberry mite population and their impact on plants.

LITERATURE REVIEW

Experience shows that one of the important reserves for the fulfilment of the yield potential of strawberries is the prevention of losses through the use of effective protection of crops from pests [6; 8; 9]. More than 380 species of arthropods have been found in strawberry plantations located in the right-bank forest-steppe zone of Ukraine. Strawberries are damaged by 66 species of insects, mites, and nematodes, 19 of which are the most numerous and harmful. More than 100 species of invertebrates live in the biocenosis of strawberries, but their harmfulness is minor. The development of the species composition of pests on berry crops from the beginning of their planting occurs in different ways, with the age of plantations harmful fauna is increasingly diverse [8; 9].

The most common species in Ukraine are beetles, including June beetle (*Amphimallon solstitiale* L.), western May beetle (*Melolontha* L.), eastern May beetle (*M. Hippocastsni* Fabr.), marble beetle (*Polyphylla fullo* L.), hairy May beetle (*Anoxia pilosa* Fabr.), mole cricket (*Gryllotalpa grillotalpa* L.), blossom feeder (*Epicometes hirta* Poda.), field slug (*Agriolimax agrestis* L.), strawberry mite (*Tarsonemus fragariae*), spider mite (*Tetranychus urticae* Koch.), a strawberry-blossom weevil (*Anthonomus rubi* Hrbst.), small root strawberry aphid (*Aphis forbesi* Weed.), strawberry nematode (*Dytilenchus dipsaci* Filipjeu.), strawberry leaf beetle (*Pyrrhalta tenella* L.), curled rose sawfly (Allantus cinctus L.) [9]. Among the numerous types of pests, *Tetranychus urticae* Koch is the most common and dangerous one [10; 11].

In the late 1950s, an integrated plant protection system was proposed, which provided a long-term containment of pests with means and measures that would ensure minimal negative consequences for the environment [12-14]. Since then, systems of integrated protection of crops from harmful organisms have been given a lot of definitions. Thus, Yu.N. Fadieiev and K.V. Novozhylov [15] established that the integrated system involves the use of available methods and measures in space and time, which give energy conservation, environmental impact, and are environmentally friendly.

An integrated plant protection system against pests is defined as one that provides for a rational combination of a number of tactical protection measures – agrotechnical, mechanical, biological, chemical, considering the economic thresholds of harmfulness and the presence of entomophages and acariphages in plantings under certain meteorological conditions [16]. Therewith, the pest population is kept below the economic level of harmfulness not only by applying pesticides. Not all methods can be suitable for a particular economic management system, so integrated protection systems should be developed separately for each region and culture.

Based on the above definitions, it should be noted that integrated plant protection systems should be based on a biocoenotic approach to the use of chemical pesticides [12; 17; 18]. It is known that the biocoenotic approach consists in investigating relationships in agrocenoses and based on this it is possible to model and regulate them. The rapid and effective action of chemical pesticides has helped to increase the pace of their production and use. However, uncontrolled use of pesticides has led to many negative consequences, from local to global. In particular, between 400,000 and 2 million cases of pesticide poisoning are reported worldwide each year.

The concept of plant protection, which is characterised by the transition from total destruction to the reduction of the population of pests at environmentally and economically efficient levels, is very important. Current "integrated" systems should be considered as more or less coordinated chemical protection programmes, which are the basis for their transformation into truly integrated ones [9; 13; 16]. This is especially relevant to growing strawberries [19].

MATERIALS AND METHODS

Field research was conducted during 2016-2020 in the Experimental Farm of Podolsk Horticulture Station (Vinnytsia region) on two varieties of remontant strawberries: Vivara and Murano. During the growing season, the phenological phases of strawberry mite development were determined using common entomological methods. During the examination period, plants, fallen leaves, and soil were inspected, and samples of soil and damaged plants were taken for detailed analysis in the laboratory. Due to the wide variety of pests on the experimental site, it was examined and accounted for several times during the growing season.

Assessment of the settlement of strawberry plantations of various varieties by strawberry mites is conducted from the II-III decade of April to the I decade of August – during the mass reproduction of the pest. Due to its very small size and hidden way of life (mainly in the folds of young unbroken leaves), strawberry mites were counted in the laboratory using a microscope on young leaves collected from registered plants (at least 100). To examine the dynamics of the population of strawberry mites, 50 young unopened strawberry leaves were periodically selected every 15 days during the growing season, on which the number was calculated in the laboratory using binoculars and the phases of pest development were determined.

The degree of damage to strawberry plants was determined on a five-point scale:

- 0 – no damage, leaf colour and plant development are normal;
- 1 – weak damage, the change in leaf colour is barely noticeable;
- 2 – medium, clear colour change on less than half of the leaves, green shades predominate, plant suppression is weakly expressed;
- 3 – strong, most of the leaves are yellowed, the leaves and berries are small, deformed, the growth and development of plants is very suppressed;
- 4 – very strong, all leaves turn yellow, the plant dies [20].

The effectiveness of systems for protecting strawberries from pests, which included chemical preparations was also examined:

1. Control, water treatment.
2. Etalon – Sanmait® (0.7 kg/ha) + Mospilan® (0.5 kg/ha).
3. Option I – Masai® (0.4 kg/ha) + Biskaiia® (0.8 l/ha).
4. Option II – Apollo® (0.5 l /ha) + Tsezar™ (0.2 L/ha) + Mavrik™ (0.6 l/ha).

The experiment is repeated three times, the area of the experimental site is 36 m^2 (18 m each^2 for each strawberry variety). Scheme of the planting of the crop in experiments: a strip with 2 rows of 30 cm between them, the distance between plants in a row is 25 cm, the distance between strips is 70 cm. According to this scheme, 84,204 plants are placed per 1 ha. There were 152 Murano bushes and 152 Vivara bushes at the experimental sites. The area without insecticides and acaricides was taken as the absolute control, the approved technology of garden strawberry protection on the production areas of the experimental farm was taken as the standard, and the options with insecticide and acaricide consumption rates were examined.

The effect of insecticides on strawberry plants was determined by the content of chlorophylls, sugars, phenolic compounds and their derivatives, and vitamin C. The content of vitamin C was determined by photocolorimetric method using Tillmans' paint, GOST 24556-89 [21]. The content of sugars in leaves and berries – according to Bertrand's method of DSTU 4954:2008 [22], phenolic compounds – using Folin-Denis' reagent, colourimetry (in leaves), and spectroscopy (in berries) [23]. The content of chlorophylls in strawberry leaves was determined by generally accepted methods [23]. Statistical processing of experimental data was performed by the method of variance analysis using Microsoft Excel.

RESULTS AND DISCUSSION

In the conditions of the experimental farm of the Podolsk horticultural station (Vinnytsia region) strawberry plantations are represented by a large number of high-yielding varieties. The complex of pests that live in the soil and on its surface causes great damage to strawberries. In years of mass development of such phytophages, especially after relatively warm winters, crop losses may exceed 10-15% [10; 24; 25]. During the period under study, the development of phenological phases of strawberry mites was observed. A close dependence of the phenological phases of strawberry mite development on the weather conditions of the year was established. The long autumn with high air temperatures (14.6°C) in October allowed a number of wintering pests to enter the winter diapause. In 2017, in the first decade of May, the air temperature was at +12.5°C and humidity at 61%, that is, the conditions were not favourable for the development of strawberry mites, so the development of various generations was somewhat prolonged. Weather conditions in 2018 and 2019 were characterised by a very high daytime air temperature of +18.2-24°C and humidity of 74-80%, so the development of the pest was very fast and its population grew rapidly (Table 1).

***Table 1**. Phenology of the development of Tarsonemus fragariae Zimm., T. pallidus Banks, 2016-2020*

Year	Months																				
	April			May			June			July			August			September			October		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
2016																*	*				
																₴	₴				
																		§	§	§	§
																ℵ	ℵ				
2017						*	*	*	*	*	*	*	*	*	*	*	*				
							₴	₴	₴	₴	₴	₴	₴	₴	₴	₴	₴				
	§	§	§	§	§	§	§	§										§	§	§	§
								ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ				
2018		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*				
		₴	₴	₴	₴	₴	₴	₴	₴	₴	₴	₴	₴	₴	₴	₴	₴				
	§	§	§															§	§	§	§
			ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ				
2019					*	*	*	*	*	*	*	*	*	*	*	*	*	*			
					₴	₴	₴	₴	₴	₴	₴	₴	₴	₴	₴	₴	₴	₴			
	§	§	§	§	§	§													§	§	§
						ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ			
2020							*	*	*	*	*	*	*	*	*						
							₴	₴	₴	₴	₴	₴	₴	₴	₴						
	§	§	§	§	§	§	§	§													
								ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ	ℵ						

* – egg,	₴ – larva,	§ – female imago (wintering stage)	ℵ – imago of both sexes		
	Active stages		Mass appearance		Wintering stage

After almost five years under study, the degree of damage to plants by strawberry mites (*Tarsonemus fragariae* Zimm., *T. pallidus* Banks) in experiments using pesticides can be estimated at 0-1 on a five-point scale [20; 25]. In experiments where chemical means of protecting strawberries from strawberry mites were examined, the number of all stages of the pest was recorded after processing plantings for 10 days. Accounting for the strawberry mite population of Murano and Vivara strawberry using various protection systems is presented in Tables 2 and 3.

***Table 2**. Strawberry mite population of Murano strawberry using various protection systems, 2016-2020*

Option	Name of the preparation and application rate, l, kg/ha	2016	2017	2018	2019	2020	Average for 5 years
				Egg, pcs /100 leaves			
Control	–	105.3	117.8	110.0	165.0	109.8	121.6
Etalon	Sanmait, 0.7	58.8	87.8	65.5	75.0	84.0	74.2
Option I	Masai, 0.4	0.0	0.0	0.0	0.0	0.0	0.0
Option II	Apollo, 0.5 + Tsezar, 0.2	0.0	0.0	0.0	0.0	0.0	0.0
				Larva, pcs /100 leaves			
Control	–	61.3	37.0	57.0	48.8	40.8	49.0
Etalon	Sanmait, 0.7	8.8	30.5	2.5	0.5	1.3	8.7
Option I	Masai, 0.4	0.3	0	0	0.3	0	0.1
Option II	Apollo, 0.5 + Tsezar, 0.2	0.3	0	0.3	0	0	0.1
				Imago pcs /100 leaves			
Control	–	20.8	52.5	96.3	54.8	48.8	54.6
Etalon	Sanmait, 0.7	0.5	1.0	0.5	0.8	1.0	0.8
Option I	Masai, 0.4	0.3	0.8	0.3	0.0	0.3	0.3
Option II	Apollo, 0.5 + Tsezar, 0.2	0.3	0	0.3	0	0	0.1

***Table 3**. Strawberry mite population of Vivara strawberry using various protection systems, 2016-2020*

Option	Name of the preparation and application rate, l, kg/ha	2016	2017	2018	2019	2020	Average for 5 years
				Egg, pcs /100 leaves			
Control	–	101.5	115.8	90.8	180.0	122.0	122.0
Etalon	Sanmait, 0.7	64.0	89.0	68.5	86.0	79.5	77.4
Option I	Masai, 0.4	0	0	0	0	0	0
Option II	Apollo, 0.5 + Tsezar, 0.2	0	0	0	0	0	0
				Larva, pcs /100 leaves			
Control	–	37.5	57.0	37.0	39.8	47.8	43.8
Etalon	Sanmait, 0.7	7.5	30.5	3.5	1.0	1.5	8.8
Option I	Masai, 0.4	1.0	0	0	0	0	0.2
Option II	Apollo, 0.5 + Tsezar, 0.2	0.3	0	0	0	0	0.1
				Imago pcs /100 leaves			
Control	–	17.3	95.3	51.5	51.0	38.0	50.6
Etalon	Sanmait, 0.7	0.8	0	1.0	1.3	2.0	1.0
Option I	Masai, 0.4	0.5	1.8	0.3	0.3	0.3	0.6
Option II	Apollo, 0.5 + Tsezar, 0.2	0.3	0	0.3	0	0	0.1

It was established that the effectiveness of options I and II is almost the same. In addition, a direct ovicidal effect of Masai and a mixture of Apollo + Tsezar preparations was detected. On the 3rd day after the application of the Masai and Apollo + Tsezar mixture, the larvae in the eggs were non-viable and the eggshells were mummified. In contrast to the Sanmait (Etalon), where the effectiveness of ovicidal action over the years ranged from 23-55%. It is also necessary to note the resistance of the mixture of Apollo + Tsezar preparations to washing away by precipitation that fell 2 hours after spraying in 2018. According to the results obtained, precipitation did not reduce the effectiveness of the preparations. The use of pest control products also had some effect on the physiological and biochemical processes in the leaves of Murano and Vivara strawberries (Tables 4, 5).

Table 4. *The content of chlorophyll, sugars, phenolic compounds and their derivatives, vitamins in the leaves of strawberries at the beginning of the growing season (Murano variety, average for 2016-2020)*

Experiment scheme	Name of the preparation and application rate, l, kg/ha	Content			
		Chlorophyll, mg/g of dry matter	Sugars, mg/g	Phenolic compounds, mg/g	Vitamin C, mg%
Control	–	1.4	11.0	31.6	101.2
Etalon	Sanmait, 0.7	1.6	11.0	32.0	103.0
Option I	Masai, 0.4	1.9	11.7	33.9	103.6
Option II	Apollo, 0.5 + Tsezar, 0.2	2.0	11.7	35.0	107.1
	NIR	0.80	0.56	0.81	0.19

Table 5. *The content of chlorophyll, sugars, phenolic compounds, and vitamins in the leaves of strawberries at the beginning of vegetation recovery (Vivara variety, average for 2016-2020)*

Experiment scheme	Name of the preparation and application rate, l, kg/ha	Content			
		Chlorophyll, mg/g of dry matter	Sugars, mg/g	Phenolic compounds, mg/g	Vitamin C, mg%
Control	-	1.2	10.7	30.8	100.3
Etalon	Sanmait, 0.7	1.6	11.0	32.5	102.2
Option I	Masai, 0.4	1.6	11.6	33.3	104.1
Option II	Apollo, 0.5 + Tsezar, 0.2	1.9	11.8	35.4	105.7
	NIR	0.83	0.51	0.34	0.46

According to Tables 4 and 5, on average, Murano plants had the lowest chlorophyll value of 1.4 mg/g of dry matter in the control, the highest of 2.2 mg/g of dry matter in option II; the Vivara variety, respectively, 1.2 mg/g of dry matter in the control, 2 mg/g of dry matter in option II. Affecting the content of chlorophyll in the leaves, that is, indirectly, the activity of photosynthesis, pesticides positively influenced the sugar content in the leaves of strawberries at different stages of organogenesis. On average, over the years under study, the Murano variety had the lowest sugar values of 11 mg/g in the control, the highest values of 11.7 mg/g in plants of both varieties. The Vivara variety, respectively, 10.7 mg/g in the control, 11.7 in the I and 11.8 mg/g in the II option.

Chloroplasts are the site of the synthesis of water-soluble phenolic compounds and their derivatives. In plants, the role of phenolic compounds is associated with protein synthesis, enzyme activity, and photosynthesis of structural components. According to the data in Tables 4 and 5, an increase in the indicators of phenolic compounds and their derivatives occurred in all experimental options in relation to control when using pest control products at various stages of strawberry organogenesis. Therewith, the lowest rate of phenolic compounds at the beginning of the growing season of strawberries on the Murano variety was – 31.6 mg/g in the control. The highest rate is 35 mg/g in option II.

One of the factors of plant resistance to pest damage is the content of ascorbic acid in their organs, as A. Olkhovska-Burkova notes [26]. Increased solar activity and drought contribute to the strengthening of biochemical processes in plants at the cellular level and activate the antioxidant protection system [27-29]. The results have shown that the content of antioxidants: ascorbic acid (vitamin C), in the leaves depends on the phase of plant development. Notably, the ascorbic acid content is very sensitive to soil and air humidity – these indicators decrease during the dry period.

On average, over the years under study, the Murano variety had the lowest ascorbic acid index of 101.2 mg% in the control, the highest - 109.4 mg% in option II; the Vivara variety, respectively, 100.3 mg% in the control and 108.2 mg% in option II. All the processes that took place in strawberries also affected the yield of the crop in a certain way (Table 6).

Table 6. *The yield of strawberries of Murano and Vivara varieties under various plant protection systems, the average for 2016-2020*

Experiment scheme	Name of the preparation and application rate, l, kg/ha	Murano variety		Vivara variety	
		t/ha	Crop growth, t/ha	t/ha	Crop growth, t/ha
Control	–	16.7	–	13.1	–
Etalon	Sanmait, 0.7	33.2	+16.5	25.1	+12.1
Option I	Masai, 0.4	33.4	+16.6	25.4	+12.4
Option II	Apollo, 0.5 + Tsezar, 0.2	33.4	+16.7	25.6	+12.5
	NIR	3.17	–	1.84	–

The yield of Murano and Vivara strawberries varied according to the experimental options. The average yield control (without the use of pesticides) was 16.7 t/ha for Murano and 13.1 t/ha for Vivara. The reference variant showed yields of 33.2 and 25.1 t/ha, respectively, by variety. The yield of strawberries in options I and II was at the same level of 33.4 t/ha for the Murano variety and 25.4-25.6 t/ha for the Vivara variety.

CONCLUSIONS

Based on the data obtained, the expediency of using a mixture of Apollo + Tsezar preparations and Masai acaricide as effective means to prevent an increase in the population of strawberry mites is confirmed. It is also necessary to note the resistance of the mixture of Apollo and Tsezar preparations to washing away by precipitation that fell 2 hours after spraying in 2018 and emphasise that this circumstance did not reduce the effectiveness of the preparations. The use of pesticides had a positive effect on the adaptation of plants to environmental conditions and the response to phytophage damage. Namely, the content of chlorophyll, phenolic compounds, and ascorbic acid in the leaves of strawberries grew.

The yield of strawberries in the use of pesticides notably exceeded both the control and reference options but was at the same level. The difference between the control and experimental options is confirmed by the results of statistical processing.

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Фенологія і чисельність кліща суничного та ефективність застосування засобів захисту суниці садової в умовах правобережного лісостепу України

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Анотація. Вирощування суниці садової – перспективний і прибутковий напрям у галузі сільського господарства. Однак існує низка лімітуючих чинників, які визначають продуктивність культури, зокрема шкідники-фітофаги. Метою роботи було визначення особливостей проходження фенологічних фаз розвитку кліща суничного (*Tarsonemus fragariae*) та вивчення ефективності застосування засобів захисту на чисельність кліща-фітофага, вплив на фізіолого-біохімічні процеси в рослинах суниці садової сортів Мурано і Вівара. Дослідження проводили згідно із загальноприйнятих у ентомології і екології методик. Ступінь пошкодженості рослин суниці садової встановлювали за п'ятибальною шкалою, який у середньому за 2016–2020 рр. було оцінено в 0–1 бал. Сформовано фенологічну карту розвитку кліща суничного, встановлено залежність фенофаз фітофага від погодних умов. У насадженнях суниці сорту Мурано у середньому за 2016–2020 рр. чисельність яєць кліща суничного була в межах 105,3–165,0 шт./100 листків, личинок – 37,0–61,3 шт./100 листків, імаго – 20,8–96,3 шт./100 листків. У насадженнях суниці сорту Вівара чисельність яєць кліща була в межах 90,8–180,0 шт./100 листків, личинок – 37,0–57,0 шт./100 листків, імаго – 17,3-95,3 шт./100 листків. Ефективність досліджуваних систем хімічного захисту рослин (Масаї® (0,4 кг/га) + Біскайя® (0,8 л/га); Аполло® (0,5 л/га) + Цезар™ (0,2 л/га) + Маврік™ (0,6 л/га)) від кліща-фітофага була майже на одному рівні. Винятком був варіант, де наявна пряма овіцидна дія препарату Масаї та суміші препаратів Аполло+Цезар, – уже на 3-тю добу після їх унесення личинки в яйцях були нежиттєздатні, а оболонки яєць муміфіковані. Застосування систем захисту суниці садової забезпечило отримання врожайності ягід на рівні 33,4 т/га у сорту Мурано та 25,4–25,6 т/га у сорту Вівара та приросту врожаю 16,6–16,7 т/га і 12,4–12,5 т/га відповідно. Встановлено позитивний вплив систем захисту рослин від шкідника на показники активності перебігу фізіолого-біохімічних процесів у листках суниці садової обох сортів. Фіксували у листках суниці підвищення вмісту хлорофілу на 33–58 %, фенольних сполук – на 7–15 %, цукрів – на 6–10 %, вітаміну С – на 2–6 % порівняно з контролем. Враховуючи високі вимоги екологічної безпеки до технологій вирощування ягідних культур у подальшому перспективним є пошук альтернативних біологічних препаратів у контролі *Tarsonemus fragariae*

Ключові слова: інтегрована система захисту рослин, фітофаги, *Tarsonemus fragariae*, акарициди