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POPULATION MANAGEMENT OF *MYZUS PERSICAE* (SULZER) IN *SOLANUM TUBEROSUM* AGROECOSYSTEM USING CHEMICAL AND BIOLOGICAL PRODUCTS

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Abstract

Myzus persicae produces significant economic losses in the agroecosystem of Solanum tuberosum, through direct and indirect damage. The aim of this study was to control the population of Myzus persicae, in the potato crop, by applying the substance acetamiprid and biological products based on potassium salt (Kabon and Konia) and Bacillus thuringiensis (Bitoxybacilin). The study included seven variants, acetamiprid was applied in three doses (0.13 l/ha; 0.09 l/ha; 0.08 l/ha), 0.900 l/ha was applied in the variants treated with Kabon and Konia K Plus and 1.0 l/ha Bitoxybacilin. The efficiency of the biological and chemical products was compared with the control variant (untreated). Phytosanitary products were applied on 27.05.2022. The efficacy of the treatments was assessed 3, 7, 14, 21, 28 days after application, by analyzing 25 plants/variant. On the day of the treatments application, the number of individuals of Myzus persicae was 274-284/25 plants. Acetamiprid 0.13 l/ha significantly reduced the aphid population. Among the biological products, Konia K Plus stood out. 28 days after application, the effectiveness of the products to control the Myzus pericae species decreased.

Key words: *Myzus persicae, efficacy, Solanum tuberosum, treatments, biological products.*

INTRODUCTION

Myzus persicae (Sulzer) is a hemipteran with a wide distribution, according to the information provided by CABI (https://www.cabidigitallibrary.org), being present in Africa, Asia, Europe, North America, South America and Oceania (Figure 1).

Myzus persicae (Sulzer) is present in all European countries (CABI, 2024) (Figure 1), the first report was in Sweden, in 1885 (Seebens et al., 2017 quoted by https://www.cabidigitallibrary.org).

This species is characterized by high polyphagism, attacking more than 400 plant species from 50 families, including *Brassicaceae, Fabaceae, Compositae, Solanaceae*, causing serious economic losses (Chiriloaie-Palade et al., 2020; Georgescu et al., 2020; Jiang et al., 2022). The green peach aphid attacks more than 24 species of plants in the Solanaceae family, including *Solanum tuberosum* (CABI, 2024). The first report of this species on potato plants dates back to 1986 (Jansson et al., 1986). The green peach aphid is considered an important pest in potato agroecosystems, being capable of reducing production by 10 to 80% in crops where it is present (Ali et al., 2023; Oprisiu et al., 2023).

Figure 1. Distribution of the *Myzus persicae* species on the continents and in Europe (map overtaken from https://www.cabidigitallibrary.org)

The damages produced by *Myzus persicae* (Sulzer) are classified as direct (sucking sap from the phloem) and indirect (through "honeydew" it favors the development of pathogens and thus the processes of photosynthesis and respiration are disturbed) (Capinera et al., 2020). In addition, the peach green aphid plays an important vector in the transmission of potyviruses, leading to significant yield losses (Naga et al., 2020; Qi et al., 2020; Bera S. et al., 2022). Studies by various researchers have highlighted the fact that this species causes both qualitative and quantitative losses in agricultural production, causing fruit abortion, wilting, chlorosis, necrosis and defoliation (Ali et al., 2023). *Myzus persicae* (Sulzer) is a challenge for entomological researchers and farmers because of the damage and factors that ensure the ecological success of the species (Figure 2).

Figure 2. The factors that determine the ecological success of the species M*yzus persicae* (Sulzer) as a polyphagous and cosmopolitan pest (diagramm made by Ștef R., after the information presented by Ali et al., 2023)

From the up to date published studies, it appears that the management of the population of *Myzus persicae* (Sulzer) has been done using chemical, biological and cultural methods (Ali et al., 2023). The most common control methods, applied to the species *Myzus persicae* (Sulzer), were chemical, due to their availability, effectiveness and ease of use (London et al., 2020; Deguine et al., 2021). The most used pesticides to reduce the population of *Myzus persicae*, from antropic ecosystems, have as active ingredients: pyrethroids (sodium channel modulators), organophosphates (acetylcholinesterase inhibitors), carbamates (acetylcholinesterase inhibitors) and neonicotinoids (binds nicotinic acetylcholine receptors). Neonicotinoids are very effective against hemiptera species (Ștef et al., 2023; Lin et al., 2021). In 1990, the first neonicotide (imidacloprid) was introduced to the market, since then other types have been synthesized: thiamethoxam, acetamiprid, thiacloprid, clothianidin, dinotefuran, nitenpyram, sulfoxaflor, flurofuranone and triflumezopyrim (Matsuda et al., 2020). Even if *Myzus persicae* exerts a certain level of resistance to some neonicotinoids, some chemical compounds still have a high potential to be used in the control of the "target" species, so the application in doses lower than those approved and the study of the efficacies must continue. According to the studies published by Sabra et al. (2023), the population of *Myzus persicae* was significantly reduced by the use of new insecticides: flonicamid (chordotonal organ nicotinamidase inhibitors), spirotetramat (acetyl COA carboxylase inhibitors) and Afidopyropen (chordotonal organ TRPV channel modulators). Reducing pest populations by biological means is an alternative to chemical control (Grozea et al., 2016; Barratt et al., 2018, Marcu et al., 2020; Costea et al., 2023; Georgescu et al., 2023), involving the use of living organisms belonging to various kingdoms and phyla, including fungi, bacteria and viruses, nematodes and insects (parasitoids and predators). As biological control of the green peach aphid 150 predators, 50 parasitoids and 40 entomopathogens (Ali et al., 2023) including potassium salts of fatty acids (insecticidal soaps) (Oprisiu et al., 2023) have been reported.

Insecticides based on potassium salts of fatty acids are used against aphids, thrips (Wafula et al., 2017), flies, mites, etc. (https://blogs.k-state.edu).Their effectiveness is higher when applied to young life stages (nymphs, larvae).

The aim of the present study was to control the population of *Myzus persicae* (Sulzer), in the potato agroecosystem, using chemical insecticides (acetamiprid - applied in doses lower than those approved) and of biological products (based on *Bacillus thuringiensis* and based on potassium salts). We believe that the present study is important, in the context in which, at the level of the European Union, the reduction of the doses of pesticides applied and the withdrawal of some neonicotinoid substances are being discussed more and more frequently.

MATERIALS AND METHODS

Site location

The experimental plots in which the chemical and biological products were applied, in order to control the population of *Myzus persicae*, were located in the western part of Romania (Timiș County), in the localities of Beregsău Mic - Săcălaz Commune (45.748180, 20.986419) and Vizejdia - Tomnatic commune (45.960329, 20.645269) (Figure 3).

Figure 3. Trial location (https://www.google.com/maps)

Experimental design and Efficacy Assessments

The experimental plots (Figure 4), in which chemical and biological insecticides were applied, were arranged according to the Randomized Complete Block (RCB) with 4 replications for each treatment. The size of the variants was 30 m^2/plot. The potato variety used in both experimental lots was Actrice. The experimental field, located in Beregsău Mic, included five treatments: untreated (T1), acetamiprid 0.13 l/ha (T2); acetamiprid 0.0975 l/ha (T3); acetamiprid 0.078 l/ha (T4); thiacloprid (Calypso – T5) 0.015 l/ha. Thiacloprid was chosen as the reference product for acetamiprid. The first assessment of the population of *Myzus persicae* was performed on the day of application of the chemical treatments (19.05.2022).

The effectiveness of chemical treatments was assessed counting the number of larvae and adults/25 leaves (Figure 5).

The assessments were made on the diagonal of the plot, on the same leaf floor. Evaluations were made at 3 DAA, 6 DAA, 14 DAA, 21 DAA, 28 DAA.

The trial regarding the biological control of the *Myzus persicae* species was located in Vizejdia – Tomnatic and included four treatments: untreated (T6), Kabon (50% potassium salt from vegetable oil extract) 0.900 l/ha (T7); Bitoxybacillin (*Bacillus thuringiensis* 1.0×10^{9} CFU/cm^3) 1,0 l/ha (T8); Konia K Plus 0.900 l/ha (fat acids potassium salt) (T9).

Figure 4. Aspects regarding the experimental fields (photo Cărăbeț, 2022)

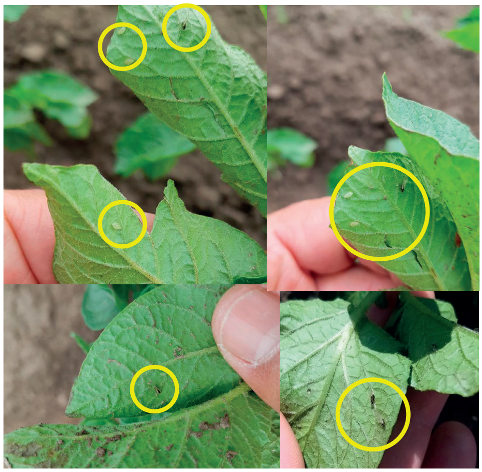

Figure 5. Assessing the effectiveness of treatments by counting the number of larvae and adults of *Myzus persicae* (Photo Cărăbeț, 2022)

Biological treatments were applied in BBCH 22-23 (potato plants had 2 lateral shoots - 5 cm) and BBCH 32-33 (20% plants closes the row).

The effectiveness of biological products was determined at: 5 and 10 DAA (from the second application), by analysing 10 plants diagonally. The value 0, in the statistical analysis of the results, represents the population level from the second application day (BBCH 32-33), which overlapped 10 days after the first application.

Statistical analysis

The statistical analysis was performed with the help of the statistical software IBM-SPSS 18. Elements of descriptive statistics were calculated (mean, standard deviation, minimum value and maximum value). The data were analysed by applying the ANOVA test and LSD post-hoc tests (least significant difference) at 5% significance level. The data were graphically represented by Box-plot diagrams and by representing the averages and the confidence intervals for the averages (Chiș, 2011).

RESULTS AND DISCUSSIONS

The results of variance analysis (Table 1) show us that both treatments timing had a real distinctly and significant influence on the number of adults and larvae during the study under homogenic condition across replicates. In respect of adults number, a significant higher variations from one assessment to another, compared to the variation of different treatments. The dose of the treatment exerted a highest contribution to the variability of the number of larvae of *Myzus persicae*, significantly superior to the effect of the period. Likewise, the interaction between the two factors showed significant influences on the variation in the number of larvae, but considerably less than the separate effects of the factors.

Table 1. ANOVA for adults number and larva number on surface of *Myzus persicae* plants

Source of variation	DF	Adults number		Larva number	
		MS	F value	MS	F value
Period	5	25.411	211.59***	9.256	38.563***
Treatment	4	3.744	31.17***	11.145	46.434***
Period x Treatment	20	0.329	2.73***	1.518	6.326***
Error	90	0.120		0.240	

*Significant at p<0.05; **Significant at p<0.01; ***Significant at p<0.001

In order to analyse the effectiveness of the treatments, at al six assessments the average values of the number of adults and the standard deviations were calculated, based on the experimental data (Table 2).

Table 2. Variation of adults number/25 plant leaves under the effect of different treatment during different period of evaluation

	Days after treatments						Treatment mean
Treatment	**0**	**3**	**6**	**14**	**21**	**28**	
Control I (T1)	0.62±0.91a	1.21±1.22a	1.18±1.78a	2.76±2.27a	3.84±2.44a	4.00±3.34a	2.26±2.52X
0.13 L/ha Acetamiprid (T2)	0.60±1.21a	0.58±0.84b	0.37±0.79bc	1.55±1.53b	2.00±2.01c	2.05±2.73b	1.19±2.79Z
0.0975 L/ha Acetamiprid (T3)	0.61±1.14a	0.54±0.78b	0.50±0.83bc	2.19±2.17ab	2.67±2.77bc	2.77±3.08b	1.54±2.25Y
0.078 L/ha Acetamiprid (T4)	0.63±1.32a	0.52±0.85b	0.79±1.30ab	2.42±2.25a	2.95±2.42ab	2.99±2.81ab	1.71±2.23Y
0.015 L/ha Calypso (T5)	0.63±1.13a	0.53±0.87b	0.34±0.62c	2.20±1.99ab	2.65±2.34bc	2.78±2.89b	1.52±2.10Y
Period mean	0.62±1.15A	0.68±0.96A	0.64±1.19A	*2.22±2.09B*	2.82±2.47C	2.92±3.03C	1.64±1.15

Values represents mean ± SD. Values with different letters (a, b, c) in the column indicate a significant variation at p<0.05. For comparisons of period's means (A, B, C) and treatment's means (X, Y, Z) capital letters were used.

At spraying of the chemical treatments, there were no significant differences between the number of adults, among variants studied, the average values laying between 0.60 adults/25 leaves and 0.63 adults/25 leaves.

In the control untreated variant, the minimum average number of adults was 0.62 adults/25 leaves, at the beginning, and the maximum was 2.29 adults/25 leaves, at 28 DAA. Table 2 reveals that the minimum level of *Myzus persicae* population was recorded in the plot treated with acetamiprid 0.13 l/ha (T2) (the average number being 1.19 adults/25 leaves), and the maximum in the untreated (with an average number of 2.26 adults/25 leaves). By calculating the average number of adults, recorded in the 28 days (DAT – days after treatment), we observed that the chemical treatments significantly reduced the population of *Myzus persicae* compared to the untreated variant (T1). The number of adults (1.71 adults/25 leaves) recorded in the variant treated with acetamiprid 0.078 l/ha (T4) exerted significant differences compared to the population in the variants in which acetamiprid 0.13 l/ha was applied (T2 – 1.19 adults/25 leaves); acetamiprid 0.0975 l/ha (T3 – 1.54 adults/25 leaves) and thiacloprid 0.015 l/ha (Calypso - T5 - 1.52 adults/25 leaves). The first assessment, performed at 3 DAT, features the fact that all chemical treatments significantly reduced the adult population of *Myzus persicae* compared to the untreated control, the minimum average of 0.52 adults/25 leaves being recorded in the plot treated with acetamiprid 0.13 l/ha (T2), and the maximum average of 1.21 adults/25 leaves in the untreated plot.

The insecticides efficacy, expressed by the number of adults, at 6 DAA, from the variants treated with acetamiprid 0.13 l/ha (T2 – 0.37 adults/25 leaves) and thiacloprid (T5 – 0.34 adults/leaves) was superior to the other treatments (acetamiprid 0.0975 l/ha and acetmiprid 0.078 l/ha), the differences being significant. Chemical treatments, at 6 DAT, significantly reduced the population of *Myzus persicae* compared to the untreated. No differences were obtained between the variant in which acetamiprid was applied at a dose of 0.078 l/ha and the control (untreated). The III assessment, carried out at 14 DAA, highlights an increase in the population of *Myzus persicae*, possibly due to the overlap of generations. The average number of adults ranged between 1.55 (T2 – acetamiprid 0.13 l/ha) – 2.76 (T1 – untreated control), the differences between these two variants being significant (Table 2). In variants T3, T4 and T5, the number of adults was between 2.19 and 2.42.

The population growth trend was also observed at 21 DAA, in all experimental variants. However, the variance analysis shows that the applied insecticides significantly reduced the *Myzus persicae* species, from the potato agroecosystem, the results being significant compared to the control. Acetamiprid applied at a dose of 0.078 l/ha failed to significantly reduce the pest population compared to the untreated control.

At the last assessment, performed at 28 DAA, the minimum average of 2.05 adults/25 leaves was reached at T2 (acetamiprid 0.13 l/ha) and the maximum of 4 adults/25 leaves in the control group. The results from the variants treated with: acetamiprid 0.13 l/ha; acetamiprid 0.0975 l/ha; thiacloprid 0.015 l/ha exerts significant differences compared to the control. Acetamiprid 0.078 l/ha did not provide significant protection to potato plants against *Myzus persicae*, the results showing no significant differences compared to the untreated variant (Table 2). During the study, in the case of the control variant, the average number of adults varied from 0.62, at the beginning, to 4 adults, at 28 days, the significant increase being recorded from 6 to 14 days, with insignificant variations at 21 and 28 DAA (Figure 6).

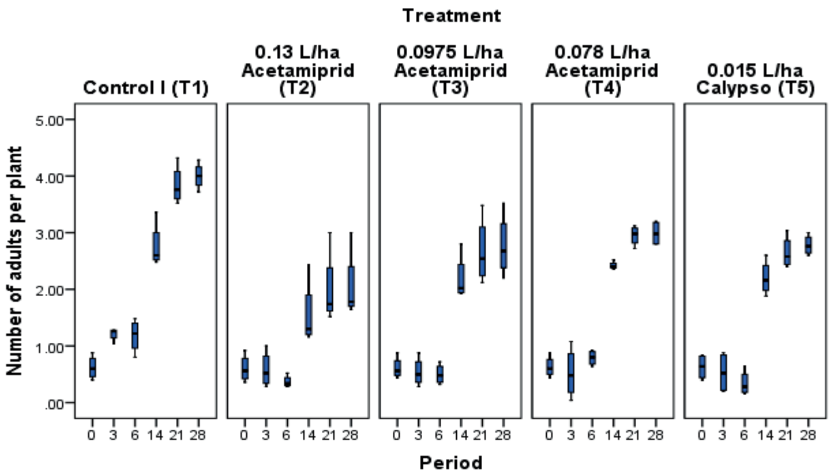

Figure 6. Boxplots of *Myzus persicae* number/25 leaves for different treatments

In the variants treated with acetamiprid 0.13 l/ha, the best efficacy in reducing the number of *Myzus persicae* adults was obtained at 6 DAA (0.37 adults). The result showing significant differences compared to the values recorded at 14, 21 and 28 DAA (Figure 6).

In the case of the variant treated with 0.0975 L/ha acetamiprid (T3), the average number of adults showed significant differences from 6 DAA to 14 DAA, registering an increase from 0.54 adults/25 leaves to 2.19 adults/25 leaves, the more specimens of *Myzus persicae* (2.77 adults) were observed at 28 DAA (Figure 6).

Acetamiprid at a dose of 0.078 L/ha (T4) protected the potato crop for 6 DAA after this interval the population of *Myzus persicae* started to increase, tripling (0.79 adults – 2.42 adults) from 6 days at 14 days (Figure 6).

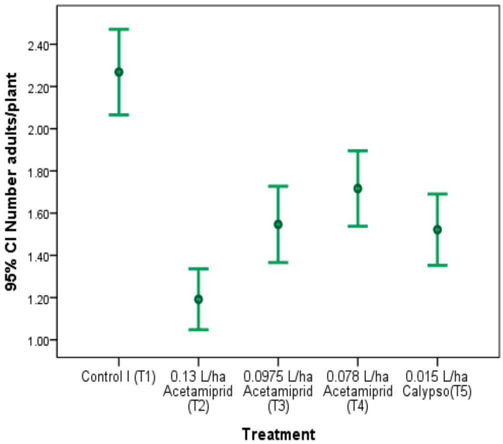

Figure 7. Mean and 95% CI for number of adults/25 leaves for different treatments

In the case of the 5 variants, significant differences were obtained between the number of adults as follows: between the control variant T1 and all the other variants, respectively between the variants treated with acetamiprid 0.13 l/ha and the variants treated with acetamiprid 0.0975 l/ha, acetamiprid 0.078 l/ha, thiacloprid 0.015 l/ha (Calypso) ($F=2.981$, $p=0.022$) (Table 2, Figure 7).

Analysing the number of larvae recorded in the experimental variants, the averages and standard deviations were calculated for each experimental variant, for each evaluation (3 DAA, 6 DAA, 14 DAA, 21 DAA, 28 DAA).

At the time of chemical treatments, the number of larvae in the experimental variants did not register significant differences, the minimum average being 2.11 larvae/25 leaves and the maximum 2.24 larvae/25 leaves. At 3 DAA, significant differences were observed between the average number of larvae in the case of the control group (3.67 larvae/25 leaves) and all other groups. Calypso insecticide 0.015 l/ha reduced the number of larvae to 0.28/25 leaves (Table 3).

From Table 3 it can be observed that at 6 DAA the significant differences are maintained as in the case of the previous assessment, the average maximum number of larvae, 3.26 larvae/25 leaves, being observed in the case of the control variant and the minimum in the variant treated with Calypso, of 0.15 larvae /25 leaves.

At the third evaluation, at 14 DAA, no significant differences were observed between the 5 experimental variants in terms of the average number of larvae.

Tabel 3. Variation for number of larva/25 leaves under the effect of different treatment during different period of evaluation

	Days after treatments						Treatment mean
Treatment	0	3	6	14	21	28	
Control I(T1)	2.14±0.47a	3.67±1.30a	3.26±1.31a	2.46±0.50a	3.47±0.42a	3.15±0.46a	3.03±0.93Z
0.13 L/ha Acetamiprid (T2)	2.24±0.59a	0.42±0.24b	0.3±0.05b	1.8±0.25a	1.78±0.38b	1.75±0.36b	1.38±0.82X
0.0975 L/ha Acetamiprid (T3)	2.15±0.39a	0.34±0.14b	0.39±0.15b	1.97±0.21a	2.26±0.31bc	2.16±0.31bc	1.55±0.89XY
0.078 L/ha Acetamiprid (T4)	2.19±0.37a	0.36±0.32b	0.6±0.18b	2.1±0.11a	2.56±0.21c	2.49±0.26c	1.72±0.93Y
0.015 L/ha Calypso (T5)	2.11±0.36a	0.28±0.14b	0.15±0.06b	1.57±0.77a	2.27±0.61bc	2.4±0.52c	1.46±1.03XY
Period mean	2.16±0.40B	1.01±1.46A	0.94±1.31A	1.98±0.50B	2.46±0.68C	2.39±0.58BC	1.83±1.10

Values represents mean ± SD. Values with different letters (a, b, c) in the column indicate a significant variation at $p<0.05$. For comparisons of period's means (A, B, C) and treatment's means (X, Y) capital letters were used.

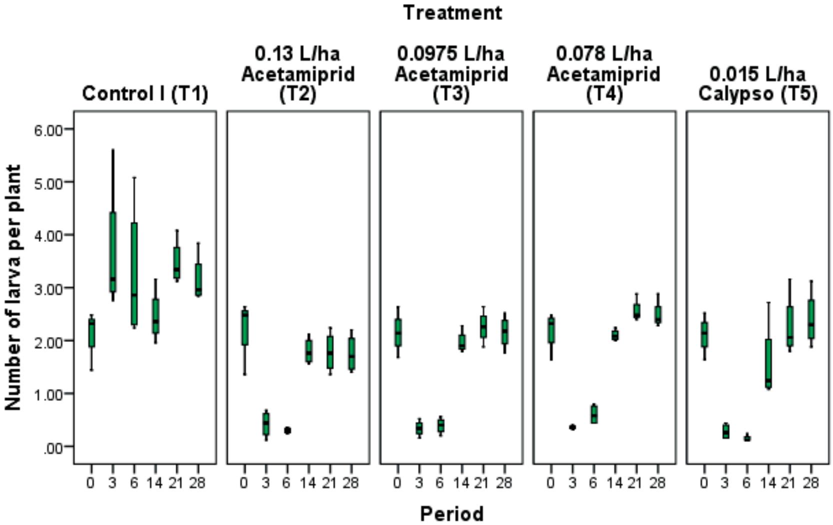

Figure 8. Boxplots of *Myzus persicae* number larvae/25 leaves for different treatments

At 21 DAA, the minimum average of 1.78 larvae was recorded in the variant treated with 0.015 L/ha Calypso and the maximum of 3.47 larvae in the control variant.

The last assessment, the one from 28 DAA, showed that the number of larvae in the experimental variants presents significant differences, and the minimum value (1.75 larvae/25 leaves) was established in the variant treated with 0.13 L/ha acetamiprid and the maximum (3.15 larvae/25 leaves) in the untreated version (Table 3, Figure 8).

In the case of the five variants, significant differences were obtained: between the control and all the other variants, respectively between acetamiprid 0.13 l/ha and acetamiprid 0.078 l/ha (Table 3). In the case of biological insecticides, it was found that both the period and the treatment had a distinctly significant influence on the number of aphids, throughout the study, in conditions of homogeneity between repelicates. The biological treatments showed the highest contribution to the variability of the number of aphids, significantly superior to the effect of the period. Likewise, the interaction between the two factors showed significant influences on the variation in the number of aphids, but considerably less than the separate effects of the factors (Table 4). Analysing the number of aphids in the variants treated with biological preparations, it was found that there are significant differences, depending on the treatment applied at 5 days, the minimum average, 1.85 aphids/10 plants, was recorded in the variant treated with Konia K Plus and the maximum in untreated control variant (6,275 aphids/10 plants). Bitoxybacillin and Konia K Plus did not lead to significant differences for the average amount of adults/plant.

Tabel 4. ANOVA for adults number on surface of 25 plants

Source of variation	DF	Adults number	
		MS	F value
Period	2	5.2589	38.93***
Treatment	3	45.9541	340.22***
Period x Treatment	6	3.3773	3.37***
Error	36	0.1350	

*Significant at p<0.05; ** Significant at p<0.01;
*** Significant at p<0.001

The maximum control of the *Myzus persicae* population at 10 DAA was recorded in the plots treated with Konia K plus (2.37 aphids/10 plants) (Table 5). The most abundant population was recorded, at 10 DAA, in the untreated variant (7.20 aphids/10 plants. The efficiencies recorded in the variants treated with Kabon and Bitoxybacillin showed significant differences in the number of aphids/10 plants, only in relation to the control variant (Table 5 and Figure 9).

Throughout the evaluation period, significant differences were recorded between all biological treatments, the minimum number (1.91 aphids/10 plants) being obtained in the case of the plot treated with Konia K Plus, and the maximum in the untreated (6,225 aphids/ 10 plants) (Table 5). The maximum effectiveness of biopreparations was recorded at 5 DAA. Comparing the results between the two trials, it was found that there are significant differences between the number of individuals registered in the case of applying the treatments Calypso 0.015 l/ha, Kabon 0.9 l/ha, Bitoxibacillin 1.0 l/ha, Konia K Plus 0.9 l/ha (F=8.707, p=0.000).

Tabel 5. Variation of aphids number /10 plants under the effect of different treatment during different assessments time

Treatment	Days after treatments			Treatment mean
	0	5	10	
Control II (T6)	5.20±0.35a	6.275±0.50a	7.20±0.32a	6.225±0.9W
KABON(T7)	2.65±0.26b	2.85±0.34b	3.175±0.46b	2.90±0.40X
BITOXIBACILIN(T8)	1.95±0.34c	2.10±0.35c	3.10±0.39b	2.38±0.62Y
KONIA K PLUS(T9)	1.50±0.29c	1.85±0.35c	2.37±0.39c	1.91±0.49Z
Period mean	2.83±1.50A	3.26875±1.87B	3.96±1.99B	3.35±1.82

Values represents mean ± SD. Values with different letters (a, b, c) in the column indicate a significant variation at p<0.05. For comparisons of period's means (A, B, C) and treatment's means (W, X, Y, Z) capital letters were used.

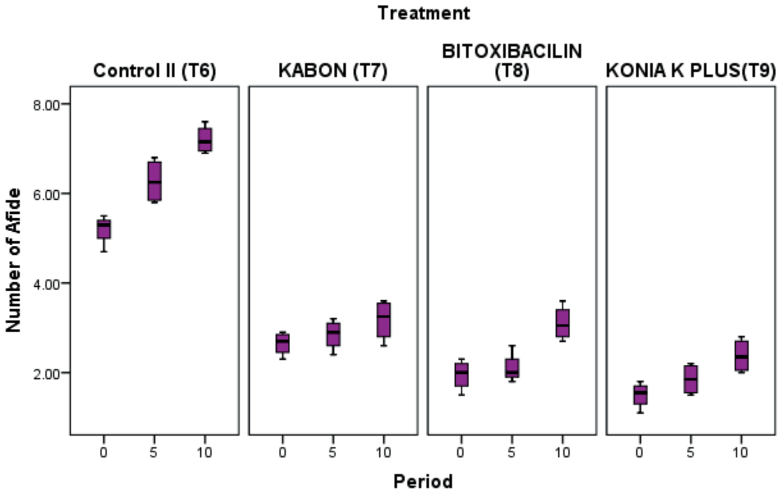

Figure 9. Boxplots of *Myzus persicae* aphids/10 plants for different treatments

Tabel 6. Mean difference of *Myzus persicae* between Calypso and biological treatments

Dependent Variable: Number of adults/plant					
(I) Treatment	(J) Treatment	Mean Difference (I-J)	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
0.015 L/ha Calypso (T5)	Kabon (T7)	-1.3700***	0.0000	-2.1202	-0.6198
	Bitoxibacilin (T8)	-0.8616*	0.0180	-1.6118	-0.1115
	Konia K Plus (T9)	-0.3866	0.5260	-1.1368	0.3635
*The mean difference is significant at the 0.05 level.					

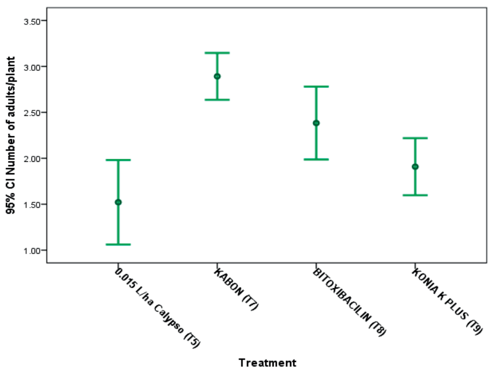

Figure 10. Mean and 95% CI for number of aphids for treatments T5, T7, T8, T9

The statistical analysis between the nine variants (found in the two fields) shows that the results regarding the reduction of the population of *Myzus persicae* in the variant treated with Calypso 0.015 l/ha are superior to those obtained in the variants treated with Kabon (T7) (p=0.000) and Bitoxybacillin (T8) (p=0.0180) (Table 6, Figure 10).
The Tukey test shows that there are no significant differences, regarding the control of the *Myzus persicae* population, between acetamiprid 0.0975 l/ha, acetamiprid 0.078 l/ha, thiacloprid 0.015 l/ha and Konia K Plus 0.9 l/ha (Tukey test, p=0.062) (Figure 11).
The results obtained are consistent with those published by Oprişiu et al. (2023), Wafula et al. (2017), Mohamad et al. (2013), Dheeraj et al. (2013), Liu et al. (2000).

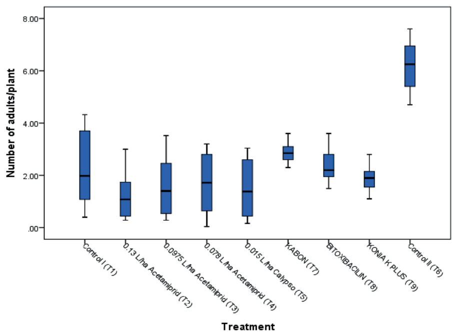

Figure 11. Comparison of the population level of *Myzus persicae* from all experimental variants

Comparing the results between the two fields, significant differences were found in the number of individuals recorded in the case of applying the treatments Calypso 0.015 l/ha, Kabon 0.9 l/ha, Bitoxibacillin 1.0 l/ha, Konia K Plus 0.9 l /ha (F=8.707, p=0.000).
Statistical analysis among the nine variants (which are present in the two trials) highlights that the results regarding the reduction of the population of *Myzus persicae* in the variant treated with Calypso 0.015 l/ha are superior to those obtained in the variants treated with Kabon (T7) (p=0.000) and Bitoxybacillin (T8) (p=0.0180) (Table 6, Figure 10).

CONCLUSIONS

Acetamiprid applied at a dose of 0.13 l/ha had the best effectiveness in reducing the population of *Myzus persicae*, during the entire observation period, the maximum protection of the potato crop was at 6 DAA.
Thiacloprid 0.015 l/ha came in second place, this product causing high mortality of green peach aphid in the first 6 DAA, after which the effectiveness decreased.
The effectiveness recorded, at 28 DAA, in the variants where acetamiprid was applied at a dose of 0.975 l/ha was similar to the Calypso product 0.015 l/ha.
Reducing the dose of acetamiprid to 0.078 l/ha led to poor management of the *Myzus persicae* species.
The biopreparations used in the control of the *Myzus persicae* species had high efficacy at 5 DAA.
The effectiveness of the biopreparation Konia K Plus is like that recorded in the variant treated with Calypso 0.015 l/ha.
The biopreparation Bitoxibacilin (1.0 l/ha) based on *Bacillus thuringiensis*, controls the *Myzus persicae* species well, but over a short period of time (5 days).

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