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USE OF ACETAMIPRID IN THE MANAGEMENT OF *Athalia rosae* POPULATION FROM OILSEED RAPE AGROECOSYSTEM

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Abstract

Athalia rosae larvae attack can lead to complete defoliation of the plant leaving untouched the main veins. Knowing these aspects, in the western part of Romania, research was carried out aiming to reduce the population of Athalia rosae using acetamiprid applied in four doses (0.04 kg/ha; 0.06 kg/ha; 0.08 kg/ha ; 0.1 kg/ha). The effectiveness of the treatments in respect of larval population reduction was determined at 3, 6 and 9 days after application. At the time of treatments spraying, the population level of Athalia rosea showed close and statistically undifferentiated values, between 0.23 and 0.4 larvae/plant. It was observed that, both, the period and the treatment, had a real influence on the number of larvae during the study. Six days after the treatment, the number of larvae was significantly reduced, followed by a increases in the next period. During the study, the treatment applied at 0.08 kg/ha exerted the highest efficiency in terms of Athalia rosea larvae control, registering values of 95.70 and 90.18% after six and nine days after application.

***Key words**: Athalia rosae, synthetic pyrethroids, acetamiprid, oil seed rape, management.*

INTRODUCTION

Oilseed rape (OSR - *Brassica napus*), is the main oilseed crop in the European Union, along with sunflower and soybean (FAO, 2023). The large OSR growing countries in Europe, which provide approximately 80% of the production, are: France, Germany, Poland, the United Kingdom, Romania, the Czech Republic (AHDB, 2018).

In Romania, the popularity of rapeseed culture is continuously increasing. According to the National Institute of Statistics, the cultivated area of rapeseed increased by 21 thousand hectares in 2022 compared to 2021. The increase being from 446 thousand hectares in 2021 to 467 thousand hectares, representing an increase of 4.70% (https://insse.ro/cms /sites/default/files/com_presa/com_pdf/prod_v eg_r22.pdf). In Timiș County, in 2023, the cultivated surface increased by 14,246.17 ha, reaching from 51,306.05 hectares in 2022 to 65,552.22 hectares in 2023, an increase of 27.76%.

The success of establishing agricultural crops as well as guaranteeing production is conditioned by climatic conditions and compliance with the technological links of plant protection against harmful organisms (weeds, pathogens, insects) (Chiriță et al., 2004; Ștef et al., 2013; Paraschivu et al., 2021; Velea et al., 2021; Zală et al., 2023, Ștef et al. 2022). Scientifical paperwork shows that with the increase in the areas cultivated with rapeseed, the attack of harmful species has also increased, which is constantly on the rise. In Romania, in the last twenty years, studies on the harmful entomofauna of rapeseed culture have been carried out by: Trotuș et al., 2001; Trotuș, 2007; Trotuș et al., 2008; Trotuș et al., 2009; Tălmaciu et al., 2010; Buburuz et al., 2012; Rîşnoveanu and Burtea, 2012; Rîşnoveanu et al., 2012; Popovici and Tălmaciu, 2013; Răileanu and Tălmaciu, 2014; Raicu and Mitrea, 2019; Trotuș et al., 2019; Apostol et al., 2020; Trotuș et al., 2020; Vîrteiu et al., 2022; Georgescu et al., 2023.

These harmful organisms can cause losses of 35% (Trotuș et al., 2008), sometimes even higher (over 60%). The pest complex includes approximately 48 species of the class Insecta Systematically, these insects belong to the following orders: Coleoptera 25 species; Lepidoptera 9 species; Diptera 6 species; Heteroptera 4 species; Hymenoptera 1 species; Homoptera 3 species (Răileanu and Tălmaciu, 2014; Apostol et al., 2020). According to the studies carried out by Ursache et al. (2017) Coleoptera species represent 77%, and those belonging to the Lepidoptera order 6%. This situation is similar in other European countries.

In autumn, the main pests that attack OSR crops, in Romania, are *Phyllotreta* spp. *Psylliodes chrysocephala*, *Athalia rosae* and *Pieris brassicae* (Trotuș et al., 2009; Rîșnoveanu et al., 2012; Buburuz, 2012; Trotuș et al., 2019).

Athalia rosae (Hymenoptera: Tenthredinidae) is one of the species that can cause significant damage to canola crops, especially in warm and dry autumns. The damage stage is the larval stage, when an individual consumes, in 24 hours, twice its body weight (Raicu and Mitrea, 2019), a fact that can lead to a very accelerated rate of defoliation. Having two generations per year, the attack takes place in spring and autumn as well. The spring attack is not so dangerous for the rape crop. The most dangerous is when the rape crop is in the first stages of development and the climatic conditions are favourable. The lack of monitoring of the OSR crop, in the first part of the vegetation period, as well as the failure to apply insecticides can compromise/lose the entire crop. To control the main pests in the OSR crops, Romanian farmers relied on seed treatment with neonicotinoids or foliar treatments with neonicotinoids and insecticides pyrethroids (Wang, 2021; Trotuș, 2001; Georgescu, 2015). Seed treatment with neonicotinoid insecticides was the most effective method of protecting rapeseed crops in Romania against pests that attack this crop in the early stages of vegetation in autumn (Trotuș, 2009; Trotuș, 2019; Trașcă, 2019). After the ban of neonicotinoids in the EU in 2018 (Commission implementing regulation, 2018), the only active ingredient available for the treatment of rapeseed in Romania remains cyantraniliprole. This is an insecticide of the ryanoid class, authorized in November 2017, used for the treatment of rapeseed in autumn for the control of the species: *Phyllotreta* spp., *Psylliodes chrysocephala*, *Athalia rosae* and *Delia radicum* (National Commission for the Registration of Plant Protection Products, 2023). At the same time, only a few active ingredients from the pyrethroid class remained available for foliar treatments in OSR crops to control the main pests in autumn or spring. These facts can affect the costs of controlling these pests (Kathage, 2018). Without effective control methods, the canola pest population may increase in the future (Ortega-Ramos, 2022). In the coming years, most insecticides are likely to be banned due to the European Union's Green Deal policies to halve the use of chemical pesticides by 2030 (Prandecki, 2021; Tataridas, 2022).

The chemical method is the most used to control this pest, applying mainly insecticides from the group of synthetic pyrethroids and neonicotinoids (Brandes et al., 2018). Acetamiprid is an odorless neonicotinoid insecticide with a chloropyridinyl group that acts on acetylcholine receptors (nACh), which are used to combat pests present on fruit trees, vegetables, ornamental plants (Shi et al., 2011; Wang et al., 2021). It is an organic compound with a molar mass of 222.67 g/mol and the chemical formula C10H11ClN4. This neonicotinoid insecticide is usually a xenobiotic and can have harmful effects on non-target insect predators and vertebrates (Fogel et al., 2013; Padmavathi et al., 2021; Su et al., 2022). Consequently, acetamiprid, effective on several insect pests, may have harmful side effects and should be used sustainably at low concentration. Therefore, the present study was conducted to control the population of *Athalia rosae* with the most effective dose of acetamiprid by applying a low concentration.

MATERIALS AND METHODS

Site location. The research was carried out in the western part of Romania, near Șag (45.640843º 21.174 8 21º), Timiș county, in year 2020/2021 (Figure 1).

Figure 1. Trial location
(image retrieved https://www.google.com/maps/place/%C8%98ag and processed by Ștef)

The site where the research was carried out is characterized by a moderate continental climate, with slight Mediterranean influences. The average annual temperature is 10.9°C, and the annual precipitation rate is 623 mm (Ștef et al., 2020; Ștef et al., 2022). The water need of the crops can be supplied by Timis river flowing nearby trough irrigation systems (Lazu et al., 2019). The soil is favourable for the cultivation of agricultural plants, mainly cereals, technical and fodder plants.

Experimental design

The study regarding the control of the *Athalia rosae* species, from the rapeseed agroecosystem, consisted by five treatments, untreated control included and four were treated with acetamiprid applied in different doses (0.04 kg/ha; 0.06 kg/ha; 0.08 kg /ha; 0.1 kg/ha). The experiment was arranged in a randomized block design (RBD), with 4 replicates for each treatment (Figure 2). Plot net size was 30 m^2.

Figure 2. The experimental plots (photo Carabet Alin, 2020)

The OSR hybrid used in the experiment was Umberto KWS, drilled on 18.08.2020.
The application of acetamiprid-based treatments was performed when the rapeseed plants were in the BBCH 12-14 growth stage (19.09.2020) (Figure 3).

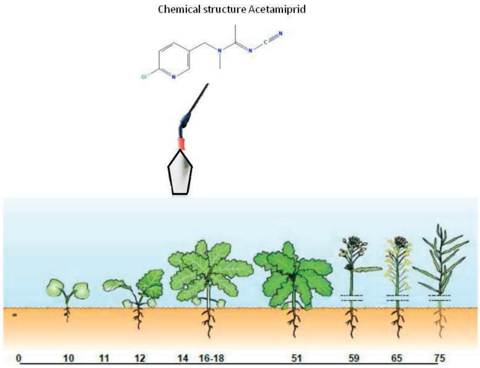

Figure 3. BBCH stage of application of acetamiprid treatments (image taken https:/pubchem.ncbi.nlm.nih.gov /compound/213021#section=2D-Structure/ http://www.g c ic -global.com/oilseed-rape/ and processed by Ștef)

Chemical treatments were applied when the turnip sawfly exceeded the economic damage threshold (P.E.D. - 2 larvae/plant) (Figure 4).

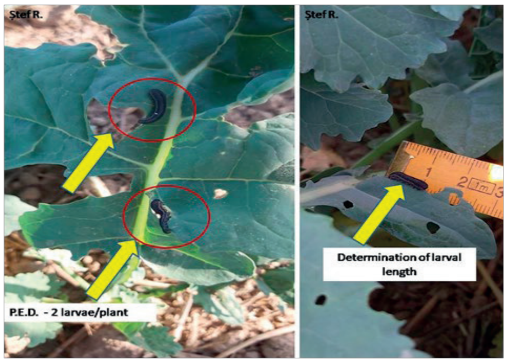

Figure 4. Assessment of *Athalia rosae* population of before the application of treatments (photo by Stef, 2020)

Damage and efficacy assessments

On the day of applying the acetamiprid-based treatments, 25 plants/plot were marked (Figure 5), after which the number of attacked plants, the number and size of *Athalia rosae* larvae and the intensity of the attack were determined (Figure 6).

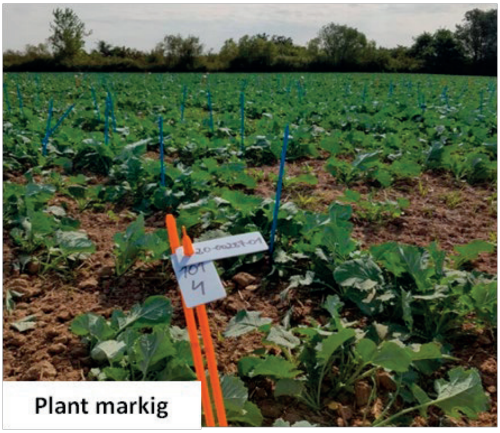

Figure 5. Marking of rapeseed plants that were observed throughout the experiment (Photo Carabet, 2020)

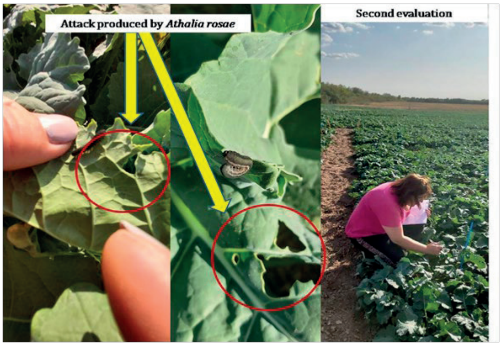

Figure 6. Assessing the attack frequency and population of *Athalia rosae* (Photo Ștef R., 2020)

Following applications of the treatments, the efficacy of the insecticides against *Athalia rosae* larvae was determined. Three assessments were performed: 3 days after application (22.09.2020), 6 days (25.09.2020) and 9 days after treatments (28.09.2020).
The intensity of the attack was determined visually for the whole plant affected, using the EPPO rating scale.

Statistical analysis
The data were subjected to statistical analysis using ANOVA, and the differences between treatments were tested by least significant difference (LSD) test at 5% significance level (Ciulca, 2006).
The efficacy of treatments was calculated by Henderson-Tilton's formula (Henderson and Tilton 1955) using the following equation: E (%) = [1-(Ta/Ca) × (Cb/Tb)] ×100, where: Ta - number of larva after treatment; Tb - number of larva before treatment; Ca - number of larva in control plots after treatment; Cb - number of larva in control plots before treatment.
Population Density Change (PDC %) = [(Ni−N0)/N0] × 100, where: N0 - mean number of larva before treatment; Ni - mean number of larva after treatment.

RESULTS AND DISCUSSIONS

Taking into account the results of the analysis of variance (Table 1), can be observed that both the period and the treatment had a real, distinctly significant influence on the number of larvae during the study, in conditions of homogeneity between the repetitions. The dose of acetamiprid showed the highest contribution to the variability of the number of *Athalia rosea* larvae, 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. Regarding the affected surface/plant (disease on surface), significantly higher variations are found between assessments, compared to the variations between the different treatments. Overall, the variability of the affected surface/plant was influenced to a lesser extent by the studied factors, compared to the number of *Athalia rosea* larvae.

Table 1. ANOVA for larva number ATALCO and disease on surface of *Brassica napus* plants

Source of variation	DF	Larva number		Disease on surface (%)	
		MS	F value	MS	F value
Replication	3	0.02	0.98	1.97	1.40
Period	3	0.94	59.00**	42.33	30.25**
Treatment	4	1.36	84.81**	15.39	11.00**
Period x Treatment	12	0.31	19.45**	3.25	2.32*
Residual	57	0.02		1.40	

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

Regarding the effect of the treatment, (Table 2) mean values of the number of *Athalia rosea* larvae/plant were found with the limits from 0.27 in the case of the dose of 0.08 kg/ha of acetamiprid to 0.97 in the case of the control. In general, under the effect of the different treatments, a significant reduction in the number of larvae/plant was observed compared to the control variant. Under the effect of the dose of

0.4 kg/ha, a significant reduction in the number of larvae is observed compared to the doses of 0.08-0.1 kg/ha.

Table 2. Variation for number of *Athalia rosea* larva per *Brassica napus* plant under the effect of different treatment with acetamiprid during different period of evaluation

Treatment Acetamiprid (kg/ha)	Days after treatments				Treatment mean
	0	3	6	9	
Control	0.32±0.03 a	1.00±0.11 a	0.93±0.04 a	1.63±0.14 a	0.97±0,13 A
0.04	0.28±0.04 a	0.89±0.09 ab	0.10±0.01 b	0.38±0.08 b	0.41±0,05 B
0.06	0.23±0.04 a	0.76±0.21 b	0.08±0.03 b	0.28±0.03 bc	0.34±0,07BC
0.08	0.40±0.07 a	0.43±0.07 c	0.05±0.02 b	0.20±0.02 c	0.27±0,08 C
0.1	0.30±0.05 a	0.51±0.03 c	0.11±0.02 b	0.28±0.05 bc	0.30±0,04 C
Period mean	0.31±0,02 Z	0.72±0,06 X	0.25±0,08 Z	0.55±0,13 Y	0.46±0,05

Period - $LSD_{5\%}$=0.09; Treatment - $LSD_{5\%}$=0.08; Treatment x Period - $LSD_{5\%}$=0.18
Values represents mean ± SE. Values with different letters (a, b) in the column indicate a significant variation at p<0.05. For comparisons of period's means (X, Y, Z) and treatment's means (A, B, C) capital letters were used

Regarding the assessmnet period, at the level of the whole experiment it is found that three days after the treatment the number of larvae was significantly higher than in the other periods. Also, six days after the treatment, the number of larvae is significantly reduced, to then increase in the last period.

At the time of application, the level of infestation with *Athalia rosea* presented close and statistically undifferentiated values between 0.23 and 0.4 larvae/plane.

Three days after the treatment DAT, there are significant variations in the number of larvae/plant, from 1 in the case of the control variant to 0.43 for the dose of 0.08 kg/ha. So that in this period under the effect of the doses of 0.08-1 kg/ha, the number of larvae was significantly reduced compared to both the control version and the doses of 0.04-0.06 kg/ha.

At 6 DAT, the doses of acetamiprid showed the highest effect on the larvae of *Athalia rosea*, against the background of a significant reduction compared to the control variant and compared to the evaluations in the other periods. Between the doses applied, there were no significant variations in terms of their effect, against the background of an amplitude of the number of larvae from 0.05 to 0.11.

At 9 DAT, the number of larvae/plant showed values between 0.2 for the dose of 0.08 kg/ha and 1.63 for the control variant. During this period, the the dose of 0.08 kg/ha determined a significant reduction in the number of larvae compared to the dose of 0.04 kg/ha, otherwise there were no significant variations between the other doses. All four studied doses generated a significant decrease in the number of larvae compared to the control variant.

Regarding the untreated check in Figure 7A, it is observed that during the study the number of larvae/plant varied from 0.32 to 1.63, against the background of a significant increase 3 days after treatment, an insignificant variation between 3 and 6 days and subsequently a significant increase in the last period. Also, the degree of infestation in the plot is more homogeneous at the beginning of the evaluation and 6 DAT.

Under the effect of the dose of 0.04 kg/ha (Figure 7B), the number of larvae/plant presented an amplitude of 0.1 after 6 DAT and respectively 0.89 after 3 DAT. As such 3 DAT a significant increase in the number of larvae is observed, followed by a consistent reduction at 6 DAT and then a new increase in the last period.

The research carried out by Trotuș et al. (2020) claims that by applying treatments with Imidacloprid, Clothianidin and Thiamethoxam they reduced the density of the *Athalia rosae* species very significantly compared to the untreated control.

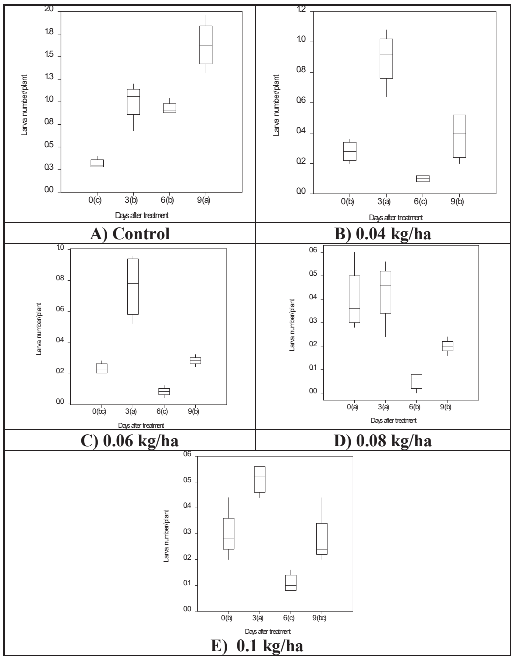

Figure 7. Boxplots of *Athalia rosea* larva number/plant for different treatments (A-E) with acetamiprid Different letters (a, b, c) indicate significant difference at p < 0.05

For the plots treated with 0.04 kg/ha, the *Athalia rosea* attack was more uniform after six days and considerably more heterogeneous at the end of the evaluation.

Related to the application of the treatment with 0.06 kg/ha (Figure 7C), an irregular variation in the number of larvae/plant was observed, from 0.28 at the beginning of the evaluation, followed by a significant increase up to 0.89 after three days , then a strong decrease to 0.1 after six days and finally a new significant increase to 0.38. The variability of the attack on the plant was higher at three days and more homogeneous in the last two periods.

Regarding the treatment with 0.08 kg/ha in Figure 7D, it can be observed that, during the study, the number of larvae/plant remained relatively constant (0.4-0.43) at the first two evaluations, against the background of a significant reduction at 6 days after treatment, and subsequently a significant increase in the last period. Also, the degree of infestation in the plot was more homogeneous at 6 and 9 DAT.

Under the effect of the dose of 0.1 kg/ha (Figure 7E), the number of larvae/plant showed an amplitude of 0.11 after 6 days and up to 0.51 after three days of application. As such, 3 DAT a significant increase in the number of larvae is observed, followed by a high reduction after six days and then a slight increase in the last period. For the plots treated with 0.04 kg/ha, the *Athalia rosea* attack was more uniform after six days and considerably more heterogeneous at the beginning and end of the evaluation.

Table 3. Variation for disease on surface of *Brassica napus* plant under the effect of different treatment with acetamiprid during different period of evaluation

Treatment Acetamiprid (kg/ha)	Days after treatments				Treatment mean
	0	*3*	*6*	*9*	
Control	3.34±0.43 a	5.80±0.44 a	6.11±0.99 a	9.20±1.02 a	6.11±0.64 A
0.04	2.48±0.35 a	5.59±0.36 a	5.26±0.54 a	5.75±0.39 b	3.47±0.42 C
0.06	2.48±1.17 a	4.57±0.99 ab	4.61±1.33 ab	5.55±1.22 b	4.30±0.39 BC
0.08	2.09±0.19 a	3.27±0.77 b	3.41±0.48 b	5.11±1.02 b	4.77±0.39 B
0.1	2.08±0.39 a	4.33±0.63 ab	4.47±0.48 ab	5.87±0.20 b	4.19±0.40 BC
Period mean	2.49±0.19 Z	4.71±0.30Y	4.77±0.33 Y	6.30±0.44 X	4.57±0.22

Treatment x Period - $LSD_{5\%}$=1.68

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

The mean values of the affected surface/plant under the effect of different doses of acetamiprid showed an amplitude of 2.64%, with the limits from 3.47% in the case of applying the dose of 0.04 kg/ha to 6.11% in untreated, against the background of a medium variability between treatments (Table 3). Compared to the untreated plots, it is found that the application of different doses allowed a significant reduction of the surface affected by the attack. In general, changing the doses of acetampiride had small and insignificant effects on this attack indicator. However, it is found that under the effect of the treatment with 0.08 kg/ha, a significant decrease of the affected surface was manifested compared to the treatment based on 0.04 kg/h.

Very good results in terms of reduction of leaf area attacked by *Athalia rosae* were obtained by applying the Lumiposa 625 FS treatment - 11.4 l/t (3.7%) (Trotuș et al., 2020; Raicu and Mitrea, 2019).

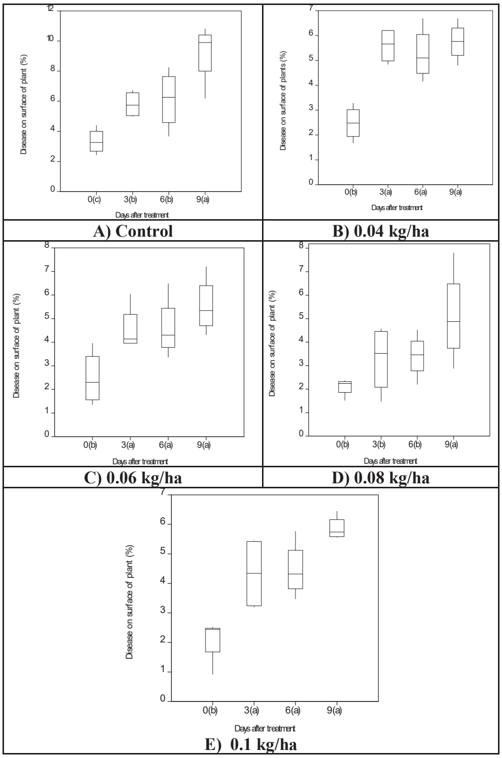

Figure 8. Boxplots for disease on surface of plant for different treatments with acetamiprid
Different letters (a, b, c) indicate significant difference at p < 0.05

Overall, at the level of the entire experiment, a significant increase in the affected area/plant is found after three days of monitoring, these damages are kept at a constant level up to 6 days, so that the affected area will be significantly higher at the end of the evaluation. At the beginning of the evaluation, when the treatments were applied, the affected surface/plant showed significantly equal values between 2.08 and 3.34%.

After 3 DAT, the doses of acetamiprid showed a faded effect on the affected areas/plant, on the background of a significant reduction only in the case of the treatment with 0.08 kg/ha, which was significantly higher than the treatment with the dose of 0.04 kg/ha. Between the other doses, there were no significant variations in terms of their effect.

Six days after the treatment, the affected surface/plant showed values between 3.41% for the dose of 0.08 kg/ha and 6.11% for the control variant. In this period, the application of the dose of 0.08 kg/ha was the most effective, causing a significant reduction of the affected area/plant compared to the dose of 0.04 kg/ha, otherwise no significant variations were manifested between the other doses.

At the end of the evaluation, 9 DAT, significant reductions of the affected surface/plant are found, compared to the untreated check, against the background of small and insignificant variations between the different doses applied.

In the case of the untreated variant (Figure 8A), the affected surface/plant showed an amplitude from 3.34% at the first evaluation to 9.2% nine days after application. As such, 3 DAT, a significant increase in the affected surface is observed, relatively constant even 6 DAT, in order to record a new increase in the last period. For the plots of the untreated variant, the affected/plant surface was more uniform in the first two evaluations and considerably more heterogeneous at the end of the evaluation.

Regarding the treatment with 0.04 kg/ha from Figure 8B, it can be observed that during the study the affected surface/plant registered a significant increase after three days from the treatment, to subsequently remain relatively constant (0.4-0.43) until the end 5.26-5.75%. Also, the degree of infestation in the plot was more homogeneous at the first evaluation and more heterogeneous after six days from the treatment.

Under the effect of dose 0.06 kg/ha (Figure 8C), a progressive variation of the affected area/plant is found, from 2.48% at the beginning of the evaluation, followed by a significant increase up to 4.57% after three days, then a constant evolution up to 4.61% after six days and finally a new increase up to 5.55%. The variability of the attack on the plant was higher at the first evaluation and more homogeneous after three days of treatment.

For the treatment with 0.08 kg/ha in Figure 8D, can be observed that the affected area/plant showed small and insignificant variations of 2.09-3.41% in the first three evaluations and subsequently a significant increase in the last period. Also, the degree of infestation in the plot was more homogeneous at the beginning of the evaluation and more heterogeneous nine days after the treatment.

When applied at 0.1 kg/ha (Figure 8E), the affected surface/plant presented an amplitude of 0.92% at the first evaluation and respectively 5.87% after nine days of application. As such, in the evaluations after the application of the treatment, a significant increase of the affected surface compared to the initial attack was found, against the background of small variations from one period to another.

For the plots treated with 0.1 kg/ha, the *Athalia rosea* attack was more uniform at the end of the evaluation and considerably more heterogeneous after three days.

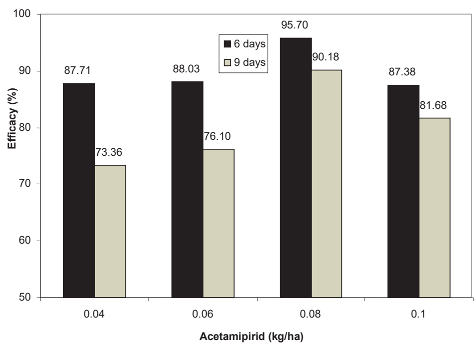

Figure 9. Efficacy of acetamipirid treatments against *Athalia rosea* larva on *Brassica napus*

Considering the data in Figure 9, can be observed that the treatment with 0.04 kg/ha exerted a superior efficiency of 87.71% at 6 DAT and an efficiency of 73.36% after nine days. In the case of the treatment with 0.06 kg/ha, a similar trend is manifested, based on an efficiency of 88.03% after six days and respectively 76.10% after nine days of application. During the study, the treatment with the dose of 0.08 kg/ha showed the highest efficiency in control of *Athalia rosea* larvae, exerting values of 95.70 and 90.18% 6 and 9 DAT. Against the background of an efficiency of 81.68-87.38%, the treatment with 0.1 kg/ha proved superior to the doses of 0.04-0.06 kg/ha. Based on the results of the variance analysis, in table 4, can be observed that in homogeneous experimental conditions at the replicates level, the treatment with acetamipyrid significantly influenced the population density of *Athalia rosea* only three days after the treatment.

The insecticides applied, by Buburuz et al. (2012), against the species *Athalia rosae* had a good efficacy, between 90.2% (Warrat 200 SC - 0.1 l/ha) and 94.3% (Proteus 110 OD - 0.4 l/ha), at a frequency of attacked plants in the untreated control of 53.5%.

Table 4. ANOVA for change of *Athalia rosea* population density after treatment

Source of variation	DF	3 days after		6 days after		9 days after	
		MS	F value	MS	F value	MS	F value
Replication	3	6732	0.91^{NS}	506	2.23^{NS}	1402	0.72^{NS}
Treatment	3	49298	6.65*	555	2.45^{NS}	4604	2.37^{NS}
Residual	9	7418		227		1942	

*Significant at $p < 0.05$; NS - No significant at $p < 0.05$.

In terms of *Athalia rosea* population dynamics from Table 5, an increase in the density of larvae/plant can be observed three days after the application of the treatments, with variations from 18.04 to 245.69%. Thus, in the plots where doses of 0.08-1 kg/ha were applied, a significantly lower increase in population density is observed compared to doses of 0.04-0.06 kg/ha, or compared to the control variant. Six days after the treatment, all the doses applied caused a significant reduction in the population density of *Athalia rosea*, compared to the initial value, from -57.60% for the dose of 0.1 kg/ha to - 84.73% for the dose of 0.08 kg/ha. After nine days, under the effect of the treatment with 0.08 kg/ha, the population density of *Athalia rosea* was reduced by 44.61% compared to when the treatment was applied. In the case of the other treatments, at the end of the evaluation the populations of *Athalia rosea* showed a higher density with values from 7.92% for the dose of 0.1 kg/ha, up to 30.90% in the case of the dose of 0.04 kg/ha. As such, the treatment with acetamipyrid showed the highest efficacy against the larvae of *Athalia rosea*, six days after the treatment. Later, the pest populations showed a higher density.

Table 5. Change of *Athalia rosea* population density after treatments

Acetamiprid (kg/ha)	Days after treatment		
	3	***6***	***9***
Control	227.32	194.46	421.34
0.04	245.69 a	-63.96 a	30.90 a
0.06	226.55 a	-64.52 a	22.74 a
0.08	18.04 b	-84.73 a	-44.61 a
0.1	81.10 b	-57.60 a	7.92 a
$LSD_{5\%}$	*137.77*	*24.08*	*70.49*

Different letters (a, b) indicate significant difference at $p < 0.05$

Based on the data shown in Figure 10, it can be seen that the length of the *Athalia rosea* larvae at the time of application of the treatments varied from 1.76 in the case of plots where the dose of 0.06 kg/ha was applied, to 2.61 in the case of related plots treatment with 0.08 kg/ha. It is also observed that the intra-population variability for this character recorded close values between the experimental plots. As such, considering the insignificant differences between the sizes of the larvae in the trial plots, it can be concluded that the efficiency of the application of the different treatments was not influenced by the developmental stage of the *Athalia rosea* larvae.

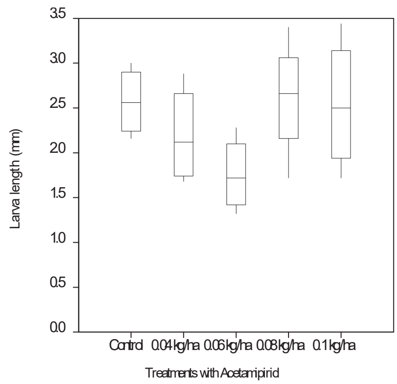

Figure 10. Boxplots of *Athalia rosea* larva length for plots of different treatments with acetamiprid

CONCLUSIONS

The four doses (0.04 kg/ha; 0.06kg/ha; 0.08 kg/ha; 0.1 kg/ha) significantly reduced the population of *Athalia rosae* compared to the untreated control.

The best efficacies in controlling the population of *Athalia rosae* were recorded in plots treated with doses of 0.08 kg/ha and 0.1 kg/ha.

The maximum period of acetamiprid effectiveness in reducing the population of *Athalia rosae* was six days after application. The size of the larvae did not influence the efficacy of the treatments.

The active ingredient acetamiprid protects the OSR crop very well for six days, after this time interval, its protection decreases.

The attacked leaf surface showed significantly lower values at the doses: 0.06 kg/ha; 0.08 kg/ha and 0.1 kg/ha.

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