SOME ASPECTS IN THE CONTROL OF RAPE PESTS THROUGH THE USE OF PREPARATIONS BASED ON ACETAMIPRID 200G/L + LAMBDA-CYHALOTRIN 150G/L, IN THE CONDITIONS OF THE REPUBLIC OF MOLDOVA

UNELE ASPECTE ÎN COMBATEREA DĂUNĂTORILOR RAPIȚEI, PRIN UTILIZAREA PREPARATELOR PE BAZĂ DE ACETAMIPRID 200G/L + LAMBDA-CIHALOTRIN 150G/L, ÎN CONDIȚIILE REPUBLICII MOLDOVA

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Abstract.
If prevention and control measures are not applied, the harvest losses of rapeseed crops can reach 30-70% of the potential harvest. Taking into account the particularities of the rapeseed culture, it is important that chemical treatments are applied with selective phytopharmaceutical products, with little residue and a low degree of toxicity and only with warning in strictly necessary numbers, to avoid the formation of toxic residues. It is necessary to pay more attention to the activity of the numerous species of pests, which attack the rape crop during the entire vegetation period, from sowing to harvesting. As a result of the research carried out, it was demonstrated that, in the integrated complex of rape pest control, in the Republic of Moldova, chemical control plays an important role, and the composition of phytosanitary products must be constantly renewed. Thus, the chemical treatment of rape plants, with the insecticide with the active substance acetamiprid, 200 g/l + lambda-cihalotrin, 150 g/l, with a consumption rate of 0,2 l/ha, ensured an essential reduction in the numerical density of the species Meligethes aeneus F., (98,99 – 91,48%), Ceuthorychus quadridens Pany (100,00 – 90,20%) and Brevicoryne brassicae L., (97,76 – 91,17%).
Key words: : *OSR, Meligethes aeneus* F., *Ceuthorychus quadridens* Pany, *Brevicoryne brassicae* L., *Biological and control particularities.*

Rezumat.
Pierderile de recoltă, cauzate culturilor de rapiță, dacă nu se aplică măsuri de prevenire și combatere, pot ajunge la 30-70% din recoltă. Ținând cont de specificul culturilor de rapiță, este important ca

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tratamentele chimice să se aplice cu produse fitofarmaceutice selective, cu remanentă mică și un grad de toxicitate redus și numai la avertizare în număr strict necesar, pentru a evita formarea reziduurilor toxice. O atenție sporită este necesar de acordat activității numeroaselor specii de dăunători, care atacă cultura rapiței pe parcursul întregii perioade de vegetație, de la semănat până la recoltare. În rezultatul cercetărilor efectuate s-a demonstrat că, în complexul integrat de combatere a dăunătorilor rapiței, în Republica Moldova, un rol important prezintă combaterea chimică, iar componența produselor de uz fitosanitar trebuie permanent reînnoită. Astfel, tratarea chimică a plantelor de rapiță, cu insecticidul cu conținut de acetamiprid, 200 g/l + lambda-cihalotrin, 150 g/l, cu norma de consum 0,2 l/ha, a asigurat asigură o reducere esențială a densității numerice a speciilor Meligethes aeneus F., *(98,99 – 91,48%), Ceuthorychus quadridens* Pany, *(100,00 – 90,20%) și Brevicoryne brasicae* L., *(97,76 – 91,17%).*

Cuvinte cheie: Rapița de toamnă, *Meligethes aeneus* F., *Ceuthorychus quadridens* Pany, *Brevicoryne brasicae* L., *Particularități biologice și de combatere*.

INTRODUCTION

Autumn rapeseed, being one of the main crops for the production of vegetable oil used for both food and technical purposes, offers several advantages over sunflower: it ensures a higher and more stable yield; it has a shorter growing period; it prevents soil erosion; it does not require high cultivation costs; it has a high oil content; it allows early field clearance; and offers the possibility of producing biofuel [Zbancă *et. al.*, 2017].

However, for the most rational use of material and human resources, it is necessary to develop the cultivation technology for this crop, including an integrated pest management system. During its growing period, this crop can be attacked by a variety of polyphagous pests or, less frequently, pests with a narrower feeding specialization [Croitoru *et. al.*, 2016].

In autumn, rapeseed crops may be attacked by cabbage white butterflies, the second generation caterpillars of the cutworm (*Agrotis segetum* L.), the rapeseed sawfly (*Athalia colibri* Christ.), and adult crucifer flea beetles (*Phyllotreta atra* F., *Ph. nigripes* F., *Ph. nemorum*).

In early spring, rapeseed seedlings are attacked by the overwintering adults of the corn rootworm (Tanymecus dilaticollis Gyll.), the sand beetle (*Opatrum sabulosum* L.), and crucifer flea beetles (Ph*yllotreta atra F., Ph. nigripes F., Ph. nemorum*). During the same period, but later, the leaves, floral buds, and inflorescences are attacked by various species of aphids, the most common being: the gray cabbage aphid (*Brevicoryne brassicae* L.), the black bean aphid (*Aphis fabae* L.), and the green peach aphid (*Myzodes persicae* L.). Defoliating pests that can cause damage include the caterpillars of cabbage white butterflies (Pieris brassi*cae* L.), the cabbage moth (*Mamestra brassicae* L.), the rapeseed sawfly

(*Athalia colibri* Christ.), larvae and adult rapeseed weevils (*Ceuthorhynchus* spp.), the red turnip beetle (*Entomoscelis adonidis* Pall.), and the mustard beetle (*Colaphellus sophiae* Schall.) [Panuța *et. al.*, 2022].

During the summer, from the group of sucking pests, three species of aphids mentioned above can be found, along with crucifer bugs (*Eurydema oleracea L., E. ornata L., Dolycoris baccarum* L.). Defoliating pests are represented by the species listed above, including *Meligethes aeneus* F., *Ceuthorychus quadridens* Pany., *C. assimilis* Payk, the caterpillars of cabbage white butterflies (*Pieris* spp.), the cabbage moth (*Mamestra brassicae* L.), the diamondback moth (*Plutella maculipennis* Cust.), and sawflies (*Athalia colibri* Christ.).

In the integrated pest management system for rapeseed in the Republic of Moldova, chemical control plays an important role, and the composition of phytosanitary products must be constantly renewed.

Based on the above, the aim of the research is to study the biological efficacy of an insecticide containing acetamiprid, 200 g/L + lambda-cyhalothrin, 150 g/L, in controlling the complex of rapeseed pests.

MATERIAL AND METHOD

Experiments to determine the biological efficacy of the insecticide containing acetamiprid (200 g/l) + lambda-cyhalothrin (150 g/L) were conducted in 2023 in the autumn rapeseed field of SRL “Agro Panfil” in Plop village, Dondușeni district. The autumn rapeseed was sown in the first decade of September 2022, using a planting scheme of 20 x 15 cm and the Mercurii variety. The experiments were set up with 4 repetitions. Each plot measured 10 x 10 m, resulting in a total area of 100 m². The plots in the experimental field were compactly and randomly arranged [Croitoru *et al.*, 2022].

Four treatments were included in the experiment: V1 (control) - untreated; V2 (standard) - the insecticide with acetamiprid (200 g/l) + lambda-cyhalothrin (150 g/l) at a consumption rate of 0.15 l/ha; V3 - the same insecticide at 0.15 l/ha; V4 - the insecticide at a consumption rate of 0.20 l/ha. Throughout the research period, chemical treatments were applied using a portable sprayer. To maintain a unique differentiation between treatments and to avoid phytotoxic effects, all chemical treatments were carried out on the same day in the morning hours.

To detect the cabbage aphid and flea beetles, records were kept for 20 plants in each plot. The monitoring of cabbage white caterpillars and armyworms was done by counting caterpillars per plant, and for the green caterpillar, additional counts were made for caterpillars around the plants. Observations were conducted before treatment and on the 3rd, 7th, and 14th days after treatment. For the rape beetle, 20 model plants were marked in each plot. The number of flower buds and flowers per model plant, as well as the number of adults and larvae, was recorded.

The density of the soil beetle and corn rootworm was calculated based on pest monitoring in each plot through 3 surveys on the soil surface, each measuring 0.25 m². The influence of ecological factors on the development of harmful and beneficial fauna was assessed based on data from the meteorological station in Northern Moldova. The determination of the biological efficacy of the insecticides was carried out in accordance with the requirements and methodological guidelines for testing plant protection products and fertilizers (Chișinău, 2002).

RESULTS AND DISCUSSIONS

In 2023, from the broad complex of polyphagous and oligophagous pests, only the population of the pollen beetle and the cabbage stem weevil exceeded the Economic Damage Threshold (EDT). On the record from April 27, the density of the pollen beetle was 11.00–12.00 individuals per plant, while the numerical value of the cabbage stem weevil reached a maximum of 5.63–6.00 weevils per plant. Therefore, chemical treatment was applied on April 27th. The results of the records and observations are shown in Table 1. From the data presented in the table, it can be observed that before treatment, the pest density was uniform, ranging from 11.00 individuals per plant in the control variant to 12.00 in the fourth variant.

Research at 3, 7, and 14 days after treatment showed a significant reduction in overwintering adults across all treated variants. On day 3, the lowest pollen beetle density was in the fourth variant, significantly lower than in the control and third variants. By day 3, pest density in all experimental variants was reduced to 1.08-6.67% of initial levels, while the control reached 106.82%. The fourth variant showed a reduction of 98.99%, surpassing both the standard and third variant (94.93%). On day 7, only the fourth variant reduced pest density above 95%, with the third variant at 93.10%. By day 14, efficacy declined, but differences between variants remained.

Alongside the research aimed at determining the biological efficacy of two application rates of the insecticide containing 200 g/L acetamiprid + 150 g/L lambda-cyhalothrin against the pollen beetle, records were also kept on the cabbage stem weevil, whose numerical value also exceeded the economic damage threshold.

The results of the records and the calculation of the biological efficacy of the products are shown in Table 2. From the data in the table, it can be seen that prior to treatment, the density of adults varied from 5.63 individuals per plant in the control variant to 6.00 individuals per plant in the fourth variant. On the third day after treatment, the pest was not detected in the fourth variant. In the other experimental variants, adult density ranged from 0.50 individuals per plant in the standard variant to 0.38 individuals per plant in the third variant. In the control variant, after this time interval, the pest density reached 6.75 individuals per plant.

The results obtained on the seventh day after treatment demonstrate that the pest was detected in all experimental variants; however, the lowest density of overwintered adults was recorded in the fourth variant. In the third variant, this index was 0.50 individuals per plant, significantly lower than in the fourth variant and at the standard level.

The results recorded on the fourteenth day after treatment indicate that the efficacy of the products is still evident after this period. Thus, the lowest indices were marked in the fourth variant (0.63 individuals per plant). In the standard and the third variant, the density of weevils was 1.13 and 1.00 individuals per plant, respectively.

Table 1.

Biological efficacy of the insecticide containing 200 g/L acetamiprid + 150 g/L lambda-cyhalothrin in controlling the pollen beetle (2023)

Experimental Variants	Application Rate, L/ha	Numerical density of beetles per model plant				Pest density, as a percentage compared to the initial value, on the ... day after treatment (see below number)			Pest density reduction compared to the control variant, as a percentage, on the ... day after treatment (see below number)		
		Before treatment	On the .... day after treatment (see below number)								
			3	7	14	3	7	14	3	7	14
V_1 (Control)	untreated	11.00	11.75	12.88	15.75	106.82	117.09	143.18	0.00	0.00	0.00
V_2 (Etalon, acetamiprid, 200 g/L + lambda-cihalotrin, 150 g/L)	0.15	11.25	0.75	1.00	1.88	6.67	8.89	16.71	93.76	91.89	86.33
V_3 (acetamiprid 200 g/L + lambda-cihalotrin, 150 g/L)	0.15	11.63	0.63	0.88	1.75	5.42	7.57	15.05	94.93	93.10	87.69
V_4 (acetamiprid 200 g/L + lambda-cihalotrin, 150 g/L)	0.20	12.00	0.13	0.25	1.25	1.08	2.08	10.42	98.99	98.10	91.48
DEM 95%, p.- 5%			0,45	0.59	0.49	3.12	3.84	4.27	3.25	4.06	3.59

Another criterion in determining the efficacy of the products is the pest density relative to the initial value. Comparing results based on this index across the three records, the lowest indices were observed in the fourth variant (10.50; 2.17; 0.00%).

It is well known that the most convincing criterion for determining the biological efficacy of the products is the reduction in pest density relative to the control, expressed as a percentage. Comparing the experimental variants based on this index shows that on the third day after treatment, absolute reduction was achieved in the fourth variant, which significantly surpassed both the standard and the third variant. This variant also showed a reduction of over 95% on the seventh day after treatment. Regarding the third variant, the reduction in pest density ranged from 94.61% to 84.13%, with these indices at the standard level but significantly lower than in the fourth variant.

Based on the research conducted during the growing season of 2023, it was found that the most effective insecticide against the cabbage stem weevil is the one containing 200 g/L acetamiprid + 150 g/L lambda-cyhalothrin, with an application rate of 0.2 l/ha, which ensures a reduction of the pest by 100.00 – 90.20% over 10-12 days after treatment. The same product, at an application rate of 0.15 l/ha, is significantly less effective than the fourth variant, being at the standard level.

Records taken after flowering revealed that the frequency of the gray cabbage aphid attack was above 5-10%, with a ratio of beneficial insects to aphids exceeding 1:30. In this context, the population of the gray cabbage aphid exceeded the Economic Damage Threshold (EDT) and was quite uniform. Therefore, after flowering, on May 20, a second chemical treatment was carried out to control this pest.

From Table 3, it can be seen that the density of the gray cabbage aphid before treatment was quite uniform, varying from 54.88 individuals per plant in the control variant to 56.25 individuals per plant in the fourth variant. Records taken on the third day after treatment demonstrated a significant reduction in the density of the gray cabbage aphid across all experimental variants, with densities of 3.63 individuals per plant in the standard variant, 1.38 individuals per plant in the fourth variant, and 3.50 individuals per plant in the third variant. In the control variant, this index reached 60.13 individuals per plant. In the following two records, the density of the pest continued to increase, reaching 4.88 – 8.00 individuals per plant in the standard variant and 2.13 – 5.38 individuals per plant in the fourth variant.

In the third variant, a reduction in the density of the gray cabbage aphid was also noted; however, this index was significantly lower than in the fourth variant and was at the standard level. In the control variant, the pest density on the fourteenth day after treatment reached 69.75 individuals per plant, which is 1.27 times higher than this index prior to treatment.

Table 2

Biological efficacy of insecticide with 200 g/L acetamiprid + 150 g/L lambda-cyhalothrin in controlling cabbage stem weevil (2023)

Experimental Variants	Application Rate, l/ha	No. density of beetles per model plant				Pest density, as % compared to the initial value, on the X day after treatment (see below no.)			Pest density reduction compared to control variant, as %, on the X day after treatment (see below no.)		
		Before treatment	On the X day after treatment (see below no.)								
			3	7	14	3	7	14	3	7	14
V_1 (Control)	untreated	5.63	6.75	7.00	7.50	119.89	124.33	133.21	0.00	0.00	0.00
V2 (Standard, acetamiprid, 200 g/L + lambda-cyhalothrin, 150 g/L)	0.15	5.75	0.5	0.63	1.13	8.70	10.96	19.65	92.75	89.43	81.66
V3 (acetamiprid, 200 g/L + lambda-cyhalothrin, 150 g/L)	0.15	5.88	0.38	0.5	1.0	5.46	8.50	17.01	94.61	91.8	84.13
V4 (acetamiprid, 200 g/L + lambda-cyhalothrin 150 g/L)	0.20	6.00	0.0	0.13	0.63	0.00	2.17	10.50	100	97.91	90.2
DEM 95%, p. - 5%			0.31	0.34	0.34	3.25	4.17	5.29	5.89	4.24	5.16

Table 3

Biological efficacy of insecticide with 200 g/L acetamiprid + 150 g/L lambda-cyhalothrin in control of gray cabbage aphid (2023)

Experimental Variants	Application Rate, l/ha	No. density of beetles per model plant				Pest density, as % compared to the initial value, on the X day after treatment (see below no.)			Pest density reduction compared to the control variant, as %, on the X day after treatment (see below no.)		
		Before treat ment	On the .... day after treatment (see below no.)								
			3	7	14	3	7	14	3	7	14
V1 (Control)	untreated	54.88	60.13	64.38	69.75	109.57	117.31	127.10	0.00	0.00	0.00
V2 (Standard, acetamiprid, 200 g/L + lambda-cyhalothrin, 150 g/L)	0.15	55.63	3.63	4.88	8.00	6.53	8.74	14.38	94.04	91.81	86.75
V3 (acetamiprid, 200 g/L + lambda-cyhalothrin, 150 g/L)	0.15	56.00	3.50	4.75	7.88	6.25	8.48	14.07	94.30	92.08	87.01
V4 (acetamiprid, 200 g/L + lambda-cyhalothrin, 150 g/L)	0.20	56.25	1.38	2.13	5.38	2.45	3.79	9.56	97.76	96.46	91.17
DEM 95%, p. - 5%			2.07	2.01	2.34	3.16	4.07	3.89	3.25	3.31	3.84

The analysis of the reduction in the density of the gray cabbage aphid compared to the initial value showed that both in the standard and in the fourth variant, a reduction was recorded, specifically from 6.53% to 14.38% and from 2.45% to 9.56%. Comparing these variants, it is clear that the deviation is significant. The third variant is significantly lower than the fourth variant and is at the standard level.

The calculation of the reduction of the gray cabbage aphid relative to the control revealed that the highest reduction was achieved in the fourth variant, where this index reached 97.76% on the third day after treatment, significantly exceeding the standard. In the third variant, a much lower reduction was marked, which is significantly lower than in the fourth variant but is at the standard level.

Generalizing the results obtained, it can be concluded that the most effective insecticide against the gray cabbage aphid is the one containing 200 g/L acetamiprid + 150 g/L lambda-cyhalothrin, with an application rate of 0.2 l/ha, which ensures a reduction of the pest at the level of 97.76% – 91.17% over 10-12 days, significantly surpassing the standard. The same product, at an application rate of 0.15 l/ha, provides a reduction of 94.30% – 87.01% over 7-10 days and is at the standard level, but is significantly lower than in the fourth variant

CONCLUSIONS

In 2023, favorable conditions were created for both the growth and development of autumn rapeseed and for the spread and development of the main pest species of this crop.

During the research period, the most intensive development was observed in the rapeseed weevil and the cabbage stem weevil, while after flowering, the gray cabbage aphid showed more intensive growth.

The insecticide containing 200 g/L acetamiprid + 150 g/L lambda-cyhalothrin, with an application rate of 0.15 l/ha, ensured a significant reduction of autumn rapeseed pests at the standard level.

The chemical treatment of rapeseed plants with the insecticide containing 200 g/L acetamiprid + 150 g/L lambda-cyhalothrin, at an application rate of 0.2 l/ha, achieved a reduction of the rapeseed weevil at the level of 98.99% – 91.48%, the cabbage stem weevil at 100.00% – 90.20%, and the gray cabbage aphid at 97.76% – 91.17%, over a period of 10-12 days.

Based on the research conducted and the results obtained, the insecticide containing 200 g/L acetamiprid + 150 g/L lambda-cyhalothrin can be included in the state register as an insecticide for controlling the rapeseed weevil, cabbage stem weevil, gray cabbage aphid, and other rapeseed pests, through 1-2 treatments at an application rate of 0.15 - 0.20 l/ha.

REFERENCES

1. **Croitoru N., Panuţa S., Lăcătuşu O. M., 2016**- *Some aspects of winter rapeseed pests combating.* Scientific Papers – Vol. 59 (1), 2016, Series Agronomy, "Ion Ionescu de la Brad" University of Agricultural Sciences and Veterinary Medicine, Iași, Romania. p. 65-69. Print ISSN: 1454-7414; Electronic ISSN**:** 2069-6727.
2. **Croitoru N., Magher M., Panuţa S., Peşteanu A., 2022-** *Methodology and Ethics of Research in Plant Protection: Methodological Guidelines for Laboratory Work for Master's Students in Integrated Protection of Agroecosystems* (MS.15) and Integrated Plant Protection (MP.16)UASM, Chișinău: Editorial Center of the Agricultural State University of Moldova (UASM)., 2022, 54 p., 2,73 c.a. ISBN 978-9975-164-40-5.
3. **Panuţa S., Croitoru N., Magher M.**, **2022**- *The Evolution of Pests in Autumn Rapeseed Cultivation and Some Control Elements*. In: Proceedings of the International Scientific Symposium."*Sectorul agroalimentar – realizări și perspective*" *Scientific Papers*, UASM, Chișinău 2022, vol. 56., pp. 331-336, 0,36 c.a. ISBN 978-9975-64-271-2.
4. **Zbancă A., Panuţa S., Morei V., Baltag G. 2017**.- *High value agriculture in the Republic of Moldova, comparative analysis and feasibility of investment.* Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development", University of Agricultural Sciences and Veterinary Medicine Bucharest, Vol. 17, 2017, pag 473, 0,8 c.a. ISSUE 1, PRINT ISSN 2284-7995,
5. ****** 2002**, -*Methodological Guidelines for Testing Chemical and Biological Plant Protection Products Against Pests, Diseases, and Weeds in the Republic of Moldova*. Chișinău: Central Printing House., 2002. 286 p. ISBN 9975-9597-3-3.