OBSERVATIONS ON THE ATTACK CAUSED BY *EURYGASTER* SPP. ON CEREAL CROPS IN THE MOLDOVA-ROMANIA AREA

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Abstract
The assessment of the damage caused by the Eurygaster spp. genus in wheat crops was carried out during the period 2020-2024, analyzing their impact on grain quality. In 2020, a significant attack was recorded in the localities of Comarna, Prisăcani and Dolheşti, where most of the grains were affected, and the frequency of infestation varied between 0.1-1% and 3.1-4%. In 2021, the attack was more extensive, with a large number of grains affected, and the localities of Prisăcani and Dolheşti recorded severe infestations, with over 80% of the production affected in the categories 2.1-3% and 3.1-4%. In 2022, a positive trend was observed in some areas, with a decrease in the intensity of the attack, especially in the localities of Comarna and Răducăneni. In 2023, the attack continued, but was less severe than in previous years, with a significant decrease in affected grains in the higher infestation categories. In 2024, a low level of infestation was recorded in most localities, with a decrease in severe attacks. The data suggest increased efficiency of control measures and less favorable conditions for pest development. However, the constant presence of attacks highlights the need for continued protection measures to limit the economic impact on wheat producers.

Keywords: efficiency of control, Eurygaster spp., frequency of infestation

1. INTRODUCTION

In today's context, competitive results cannot be achieved through large and quality productions without taking into account plant protection, both preventive and curative. Worldwide, the average losses caused by the above-mentioned factors amount to a huge percentage, approximately 35 - 38% of the productive potential of existing varieties and hybrids. (Antonescu et al., 2012) These figures vary depending on the pedo-climatic conditions, the level of agriculture practiced, but also on the facilities available to farmers. In our country, according to some statistics, it is estimated that the losses caused by the main factors are divided as follows: - weeds - 10% - phytopathogenic agents - 10% - pests - 22%.

The double percentage of damage caused by pests compared to other damage factors is also maintained worldwide. In order to understand the role of entomology among agricultural sciences, we must mention that, worldwide, over a million insects are known to this day.

Under the concept of modern agriculture, based on the development of intensive and super-intensive crops, plant protection through the entomological discipline has experienced great

development, recording progress after progress in the fields of prevention, chemical and biological control, but especially integrated control (Demydov et al., 2023).

In countries with advanced agriculture, out of all agricultural specialists, 20-33% of all researchers work in plant research. To these is added an equally large number of biologists, chemists, who develop research in the field of phytopharmacy in the laboratories of large chemical plants in the field of pesticides.

Knowledge of dangerous insects, their evolutionary stage and their distribution area allows the application of plant protection measures and pest control by shaking, sorting, suction, the use of light traps or those with pheromones, various food baits to attract insects, etc. (Mocanu et al 2016)

The approach to the status of dangerous insects started from the connection of the field of plant protection and phytosanitary quarantine and that of mammal protection. Despite all the achievements obtained in integrated pest control, the use of multi-purpose pesticides prevails, without taking into account the harmful effects produced on the flora and fauna of agro-ecosystems, but especially on the environment through air, soil and water pollution.

2. MATERIALS AND METHODS

During the research, classical methods were used: species detection through observations on host plants, use of identification sheets according to morphological appearance and symptoms (characteristics) of attack, manipulation of a work protocol regarding the presence and spread in the country, manipulation of traps in areas of storage and preservation of cereal products, phytosanitary control. (Gündüz and Ölmez, 2021)

For the taxonomic identification of insects, classical keys and the insect collection of the Entomology Museum of the Institute of Zoology were used. The list of harmful and dangerous species was updated based on data available in the specialized literature .

Data on the Economic Damage Threshold (EDT), alert cases from the epidemiological sector regarding the attack of harmful insects on human health target the algorithm for describing the degree of damage and the expansion of the area over time.

Wheat crops are affected by the attack of shield bug, starting from April and until harvest. The degree of damage varies depending on the stage of vegetation and the attacked plant organs. (Talmaciu et al., 2016)

In order to analyze the structure, dynamics and evolution of the attack of shield bug on cereals, systematic observations were carried out in wheat crops in 10 localities of Iași County, over a period of five years (2020 - 2024).

To identify and evaluate the numerical density of pests in the soil, control surveys will be carried out using the metric frame.

The number of surveys required varies depending on the area of agricultural land, as follows:

☐ For areas between 1 and 10 ha - 20 surveys;
☐ For areas between 10 and 50 ha - 35 surveys;
☐ For each additional 100 ha - 5 more surveys.

The insects collected at each survey were stored separately, in appropriately labeled jars. The labels, written in black pencil, contained essential information: the location and date of the survey.

The collected material will be analyzed in the laboratory to identify the shield bug (figure 1), and the numerical density will be calculated and expressed in relation to the area of one square meter.

The collected biological material was analyzed and the species were identified was *Eurygaster integriceps*, *Eurygaster maura* and *Eurygaster austriaca*.
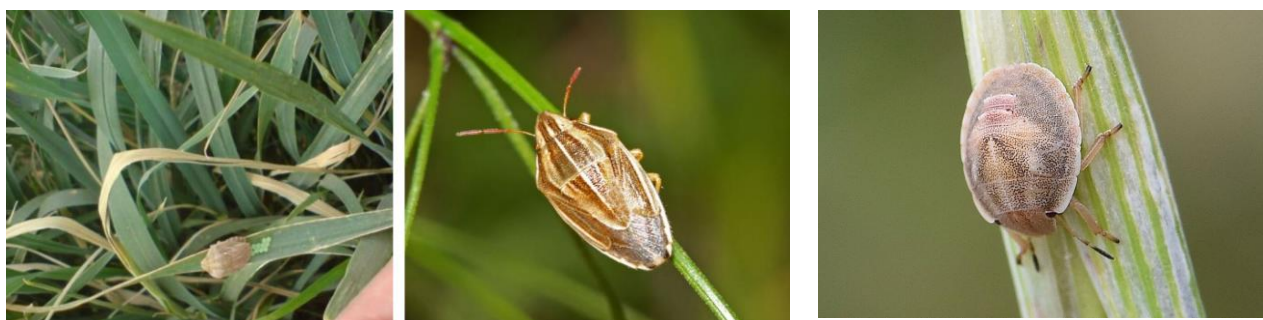
Figure 1. Plants under attack

Depending on the number of specimens captured per square meter, it was possible to calculate the intensity of damage, expressed in number per square meter, plant, linear meter of sown row, kilograms of seeds, etc. (Talmaciu et al. 2016)

Another relevant indicator is the frequency of attack (F%), which represents the ratio between the number of plants or organs attacked and the total number of plants or organs analyzed. The calculation formula is as follows:

$$F\% = (n / N) * 100,$$

where:

        n -is the number of plants or organs attacked,

        N- is the total number of plants or organs analyzed.

The intensity of attack (I%) represents the percentage of plants or organs attacked and destroyed by the pest. Given that this indicator can be subjective, a rating scale is used, as follows:

        0 = no attack (0%),

        1 = attack between 1-3%,

        2 = attack up to 10%,

        3 = attack between 10-25%,

        4 = attack between 25-50%,

        5 = attack between 50-75%,

        7 = attack between 75-100%.

Based on this scale, the intensity of attack (I%) is calculated with the formula:

$$I\% = \Sigma(i * f) / n,$$

where:

        i -represents the percentage of the attack class,

        f -is the number of plants or organs attacked for each class marked with x,

        n -is the total number of plants or organs examined.

The attack grade (GA) is determined as the product of the attack intensity and the attack frequency:

$$GA = F\% * I\%.$$

It is important to note that these observations are made during the vegetation period, and losses cannot be estimated at this stage.

PED can vary depending on several factors. For the concrete application of treatments, tables are used that indicate the densities and attack levels depending on the vegetation phases of the plants, thus establishing the timing and necessity of treatment. Implementing PED on larger areas helps save pesticides and fuel, stimulating the activity of natural enemies, parasites and predators.

Numerical density represents the number of individuals of a species (insects, larvae, pupae, eggs, plants, microorganisms, etc.) that are found on a certain unit of surface or volume. This parameter is essential in ecology, agriculture and plant protection to determine the degree of infestation or the distribution of a population in a habitat.

The numerical density is expressed as follows:

$$D = S/N$$

where:

D = numerical density (individuals/m² or individuals/m³);

N = total number of individuals recorded;

S = surface area (m²) or volume (m³) surveyed.

In plant protection, numerical density is used for:

• Evaluation of pest infestation – E.g. number of wireworm larvae/m² of soil;

• Determination of the economic damage threshold (EDT): the level above which treatment intervention is necessary;

• Monitoring the efficiency of phytosanitary treatments by comparing density before and after pesticide application;

• Analysis of crop productivity by determining the number of plants/m² to optimize the harvest.

Numerical density is a fundamental indicator for ecosystem assessment and integrated crop management. By correctly measuring this parameter, farmers and specialists can make informed decisions regarding pest control and optimizing agricultural production.

3. RESULTS AND DISCUSSIONS

Evaluation of damage caused *by Eurygaster spp*. in wheat crops, correlating the stage of plant development with the intensity of the attack.

Analysis of wheat grains attacked by larvae, nymphs and adults of the *Eurygaster integriceps* species

Analysis of wheat grains stung (attacked) by the *Eurygaster integriceps* bug from different localities in the research area of Comarna, during 2020, shows that, in most of the localities analyzed, all harvested grains were affected by the insect attack, with the exception of Moșna, Țuțora, Gorban and Cozmești, where variable quantities of unaffected grains were recorded.

The largest total quantity of berries analyzed came from Comarna (1276 kg), where a high incidence of the attack was also observed, with 1020 kg of affected berries having an infestation degree of 0.1-1%, 176 kg in the 1.1-2% category, and 80 kg in the 2.1-3% category (Table 1).

Table 1. The results of the analyzes regarding the frequency (%) of the grains pricked by Eurygaster spp. in 2020

No.	Locality	No. of grains analyzed	No. of grains without attack	No. of grains attacked	frequency of attack (F %)			
					0,1-1%	1,1-2%	2,1-3%	3,1-4%
1.	PRISĂCANI	84	0	84	20	20	24	20
2.	VF. CÂMPULUI	125	0	125	0	80	45	0
3.	DOLHEȘTI	130	0	130	0	90	40	0
4.	MOȘNA	135	32	103	0	72	31	0
5.	GROZEȘTI	28	0	28	5	15	8	0
6.	ȚUȚORA	40	10	30	2	13	15	0
7.	GORBAN	142	40	102	12	30	20	40
8.	COMARNA	1276	0	1276	0	1020	176	80
9.	COSTULENI	215	0	215	60	80	45	30
10.	COZMEȘTI	325	34	291	120	140	31	0
	Total	**2500**	**116**	**2384**	**219**	**1560**	**435**	**170**

The localities of Răducăneni and Dolhești recorded a generalized attack, with no amount of unaffected berries. Cozmești also stands out for a large number of attacked berries (291 kg), with a significant distribution in the infestation categories of 0.1-1% and 1.1-2%.

Regarding the distribution of the attack, the most affected category was the 1.1-2% (1560 kg), followed by the 2.1-3% category (435 kg). Severe infestation (3.1-4%) was lower, totaling 170 kg, but was significantly observed in the localities of Gorban, Comarna and Costuleni.

In 2021, the analysis of the frequency of berries infested by *Eurygaster spp.* in the Comarna area highlights a significant increase in the total amount of berries analyzed compared to the previous year, but also an expansion of the pest attack. Of the 3007 kg of berries evaluated, only 330 kg were unaffected, indicating a high degree of infestation, especially in the localities of Prisăcani and Dolhești, where over 80% of the production was classified in the 2.1-3% attack category (Table 2).

Table 2. The results of the analyzes regarding the frequency (%) of the grains pricked by Eurygaster spp. in 2021

No.	Locality	No. of grains analyzed	No. of grains without attack	No. of grains attacked	Frecvența atacului (F %)			
					0,1-1%	1,1-2%	2,1-3%	3,1-4%
1.	PRISĂCANI	1267	0	1267	0	118	1049	100
2.	VF. CÂMPULUI	145	0	145	0	105	40	0
3.	DOLHEȘTI	864	0	864	0	122	742	0
4.	MOȘNA	120	0	120	0	90	30	0
5.	GROZEȘTI	150	70	80	0	70	10	0
6.	ȚUȚORA	8	5	3	1	2	0	0
7.	GORBAN	40	35	5	1	3	1	0
8.	COMARNA	5	0	5	0	5	0	0
9.	COSTULENI	320	260	60	20	30	10	0
10.	COZMEȘTI	88	0	88	48	40	0	0
	Total	**3007**	**330**	**2637**	**70**	**585**	**1882**	**100**

Although in some areas, such as Țuțora, Gorban and Comarna, the infestation was minimal, in other localities a significant distribution of the attack was observed in the 1.1-2% and 2.1-3% categories, considerably affecting the quality of agricultural production.

Compared to 2020, Comarna, one of the most affected localities previously, recorded a drastic decrease in infestation, while Prisăcani and Dolhești became critical points for the spread of the pest.

In conclusion, the data highlight the need for effective phytosanitary protection measures, especially in areas with severe attack, where the impact on crops is considerable.

In 2022, the analysis of the frequency of grains infested by *Eurygaster spp.* in localities in the Comarna area shows a decrease in the total quantity of grains analyzed (2048 kg, compared to 3007 kg in 2021), but also a different distribution of the pest attack.

All samples analyzed were affected by the attack, with no uninfested grains recorded. Prisăcani remains the most affected locality, with 1083 kg of attacked grains, of which over 50% are classified in the 0.1-1% category, and 180 kg were classified in the 2.1-3% category, indicating a moderate degree of infestation. Also, in Costuleni, the attack was significant, with 410 kg of affected grains, most of which are classified in the 1.1-2% and 2.1-3% categories (Table 3).

In contrast, the localities of Răducăneni, Dolhești, Moșna, Grozești and Țuțora recorded relatively small amounts of attacked grains, predominantly in the 0.1-1% and 1.1-2% categories, suggesting a reduced impact on agricultural production. Gorban and Comarna had the lowest infestation levels, with only 5 kg and 29 kg of affected berries.

Compared to the previous year, a reduction in the severity of the attack is noted in many localities, with a significant decrease in berries falling into the 2.1-3% category (340 kg compared to 1882 kg in 2021) and those in the 3.1-4% category (40 kg compared to 100 kg in 2021).

This trend suggests a possible efficiency of the control measures applied or less favorable climatic conditions for the development of the pest.

Table 3. The results of the analyzes regarding the frequency (%) of the grains pricked by Eurygaster spp. in 2022

No.	Locality	No. of grains analyzed	No. of grains without attack	No. of grains attacked	Frecvența atacului (F %)			
					0,1-1%	1,1-2%	2,1-3%	3,1-4%
1.	Prisăcani	**1083**	0	1083	550	313	180	40
2.	Răducăneni	**38**	0	38	30	8	0	0
3.	Dolhești	**45**	0	45	30	15	0	0
4.	Moșna	**30**	0	30	10	20	0	0
5.	Grozești	**80**	0	80	45	35	0	0
6.	Țuțora	**112**	0	112	70	42	0	0
7.	Gorban	**5**	0	5	3	2	0	0
8.	Comarna	**29**	0	29	20	9	0	0
9.	Costuleni	**410**	0	410	0	250	160	0
10.	Cozmești	**216**	0	216	116	100	0	0
	Total	**2048**	**0**	**2048**	**874**	**794**	**340**	**40**

In conclusion, although the Eurygaster spp. attack was present in all the analyzed localities, its overall impact was lower compared to previous years. Areas with severe infestation, such as Prisăcani and Costuleni, still require protection measures, but the general trend shows a decrease in the pest pressure on crops.

In 2023, the analysis of the frequency of grains infested by *Eurygaster spp.* in the localities in the Comarna area indicates a significant decrease in the total quantity of grains analyzed compared to previous years, reaching 1460 kg. However, the pest attack remained at a high level, with only 70

kg of grains being unaffected, and the remaining 1390 kg showing varying degrees of infestation (Table 4).

The most affected localities were Prisăcani, Grozești, Țuțora and Gorban, where most of the attacked grains were classified in the 0.1-1% and 1.1-2% categories, and in the case of Prisăcani, over 60% of the infested production was in the 2.1-3% category, indicating a considerable impact on the quality of the harvest. Costuleni was the only locality where grains in the 3.1-4% category were recorded, although in reduced quantity. In contrast, in Moșna and Cozmești, the attack was less severe, being among the few areas where unaffected grains were reported.

Compared to previous years, the data show a reduction in the intensity of the attack in the higher infestation categories, signaling either a greater efficiency of the control measures or less favorable conditions for the development of the pest.

However, the presence of the attack in all analyzed localities highlights the need for ongoing strategies to protect crops and reduce the economic impact on agricultural producers.

Table 4. The results of the analyzes regarding the frequency (%) of the grains pricked by Eurygaster spp. in 2023

No.	Locality	No. of grains analyzed	No. of grains without attack	No. of grains attacked	Frecvența atacului (F %)			
					0,1-1%	1,1-2%	2,1-3%	3,1-4%
1.	Prisăcani	400	0	400	0	150	250	0
2.	Răducăneni	110	0	110	90	20	0	0
3.	Dolhești	70	10	60	0	52	8	0
4.	Moșna	60	20	40	40	0	0	0
5.	Grozești	180	0	180	130	50	0	0
6.	Țuțora	190	0	190	110	80	0	0
7.	Gorban	160	0	160	100	60	0	0
8.	Comarna	100	0	100	60	40	0	0
9.	Costuleni	130	0	130	20	40	60	10
10.	Cozmești	60	40	20	10	10	0	0
	Total	**1460**	**70**	**1390**	**560**	**502**	**318**	**10**

In 2024, the analysis of the frequency of grains infested by *Eurygaster* spp. in the Comarna area indicates a significant decrease in infestation compared to previous years, both in terms of the total number of grains analyzed (1298 kg) and in terms of the severity of the attack (Table 5).

Although a considerable number of affected grains (1138 kg) is still recorded, their distribution shows a preponderance of the attack in the 0.1-1% and 1.1-2% categories, which suggests a decrease in the intensity of the infestation.

The most affected localities were Gorban, Costuleni and Grozești, where over 100 kg of berries were attacked, most of them falling into the lower infestation categories. Prisăcani, although affected, has a lower number of berries falling into the 2.1-3% category (40 kg) and only 10 kg in the 3.1-4% category, which marks an improvement compared to previous years.

In contrast, the localities of Moșna, Răducăneni, Dolhești and Comarna recorded low levels of infestation, and in Răducăneni and Dolhești, a significant part of the production was completely free of attack.

Table 5. The results of the analyzes regarding the frequency (%) of the grains pricked by Eurygaster spp. in 2024

No.	Locality	No. of grains analyzed	No. of grains without attack	No. of grains attacked	Frecvența atacului (F %)			
					0,1-1%	1,1-2%	2,1-3%	3,1-4%
1.	Prisăcani	130	0	130	0	80	40	10
2.	Răducăneni	60	40	20	0	15	5	0
3.	Dolhești	70	40	30	15	15	0	0
4.	Moșna	10	0	10	5	5	0	0
5.	Grozești	148	0	148	110	38	0	0
6.	Țuțora	90	0	90	0	55	35	0
7.	Gorban	410	0	410	210	170	30	0
8.	Comarna	120	80	40	25	15	0	0
9.	Costuleni	190	0	190	100	90	0	0
10.	Cozmești	70	0	70	40	30	0	0
	Total	1298	160	1138	505	513	110	10

This positive trend suggests a possible efficiency of the control measures or less favorable climatic conditions for the pest.

Compared to previous years, a reduction in severe infestation is noted, with only 10 kg of berries falling into the 3.1-4% category. This indicates a stabilization of the situation and a possible return of crops to a higher level of safety.

However, the persistence of the attack in all the analyzed localities emphasizes the need for careful monitoring and continuous preventive measures to avoid the recurrence of massive infestations in the coming years.

The percentage of attack (%) caused by bedbugs (*Eurygaster spp*.) on wheat grains in the period 2020 – 2024

The analysis of the degree of attack caused by *Eurygaster spp.* on wheat grains in the research area, in the period 2020-2024, highlights a significant infestation, with variations in both the total quantity of grains analyzed and the distribution of the attack by intensity categories.

It is observed that, in all the years analyzed, the proportion of unaffected grains was reduced, which indicates a constant presence of the pest in wheat crops.

In some cases, such as the example of the 2670 kg lot analyzed, over 96% of the grains were affected, which underlines the major impact of bedbugs on production (Tab. 6).

The most affected categories were generally 1.1-2% and 2.1-3%, with significant shares, which suggests that the infestation did not manifest itself predominantly in mild forms, but had a considerable impact on the quality of the wheat.

Table 6. The percentage of attack degree (%) produced by Eurygaster spp. on wheat grains in the research area during the period 2020-2024

Total quantity analyzed (T_0)	Cant. without attack (T_0)	Cant. with attack (T_0)		From which:							
			%	0,1-1%	%	1,1-2%	%	2,1-3%	%	3,1-4%	%
2670	85	2585	100	37	0.70	540	29.12	1006	52.26	103	32.18
898	140	758	100	212	2.79	333	17.96	103	5.55	110	34.37
1422	10	1412	100	567	40.15	468	25.24	303	16.34	74	23.12
1125	35	1090	100	398	36.51	355	25.14	306	16.50	31	9.69
1020	177	843	100	335	39.73	158	8.52	348	18.77	2	0.62

Another important aspect is the distribution of the attack according to severity. For example, plots with an attack of 3.1-4%, indicating a high level of damage, were more frequent in some situations, even exceeding 34% in one case, which could indicate either a vulnerability of certain crops or favorable conditions for the development of the pest in certain periods.

In contrast, other plots recorded a more moderate attack, with lower weights for the higher infestation categories, suggesting a possible efficiency of the control measures applied.

Overall, the data reflect an extensive and recurrent infestation, highlighting the need for constant prevention and control measures to limit the economic impact on agricultural producers and maintain wheat quality at an optimal level.

4. CONCLUSIONS

Following observations made during 2020-2024, the localities of Prisăcani, Dolhești and Costuleni were the most affected by *Eurygaster spp*. attacks, with a significant impact on the quality of the harvest, especially in the infestation categories of 1.1-2% and 2.1-3%.

In 2024, a decrease in the intensity of the attack was observed compared to previous years, with a significant reduction in infested grains in the higher categories (3.1-4%), indicating the possible effectiveness of control measures or less favorable climatic conditions for the pest.

Following the statistics and evaluation of the collected data, some localities, such as Gorban, Comarna and Moșna, recorded a reduced or even zero infestation impact, while others, such as Prisăcani and Costuleni, had considerable attacks, requiring stricter protection measures.

Since 2022, a decrease in the severity of the attack has been noted, with a significant reduction in grains in the severe infestation categories, suggesting increased efficiency of control measures and improved crop management.

Although there is a trend towards a reduction in severe infestation, the pest attack was present in all localities, highlighting the need for continuous monitoring and effective prevention strategies to protect crops in the long term.

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