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THE DEGREE OF ATTACK PRODUCED DURING STORAGE BY *Sitophilus granarius* ON SOME WHEAT GENOTYPES

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ABSTRACT

This paper presents the attack by the wheat weevil during seed storage. Sitophilus granarius is an important pest of stored cereals because it causes great damage by destroying the embryo and affecting germination. The biological material consisted of 10 winter wheat genotypes, 8 varieties and 2 lines. The material was analyzed and the frequency of attack, intensity and degree of attack produced by the pest were determined for each genotype in 4 repetitions. The aim of the study was to determine whether there are differences in attack between the studied wheat genotypes. Following statistical analysis, both distinctly significant positive and highly significant positive differences were obtained between the studied wheat genotypes, compared to the Miranda control.

INTRODUCTION

Agricultural and food products are frequently infested with stored product pests. Some of these can cause quantitative and qualitative losses and negatively impact food safety (Athanassiou et al. 2003, 2005, 2011, Stejskal & Hubert 2008, Trematerra et al. 2011). Grain weevils in particular pose a global threat during storage (Velez et al. 2017). Stored product pests can cause direct losses in product weight, but also indirect losses, the stock is affected, the products are damaged by weight reduction and by their contamination (Belda & Riudavets 2010). An increase in food production would be sufficient when post-harvest losses are considerably reduced, according to calculations made by Grethe et al. 2011. One step in reducing post-harvest losses is to reduce damage caused by harmful insects (Niedermayer & Steidle 2013).

MATERIAL AND METHODS

The research was conducted in the research laboratory of the Agricultural Research Development Station Pitești with winter wheat seed, which has been stored in the warehouse in paper bags since 2024. The biological material was represented by ten variants, eight varieties (Miranda-martor, Ursita, Pitar, Abund, Izvor, Otilia, Glosa, Trivale and two lines (A4-10, A44-13) of winter wheat, which was analyzed in 4 repetitions, after one year of storage (figure 1). The Miranda wheat variety was taken as a control variant, because it was found to have greater resistance following the attack caused by the wheat weevil.

Figure 1. Attacked wheat seeds by *Sitophilus granarius*

For each wheat genotype, 100 grains were analyzed for each repetition (100 grains x 4 repetitions), where the frequency, intensity and degree of attack produced by the wheat weevil *Sitophilus granarius* were monitored. The MMB values (thousand grain mass) were also compared, before storage with those after the attack. The weight of the grains was weighed with a precision balance Kern 600.

For frequency, the grains attacked by the pest were determined according to the formula:

$$F\% = \frac{n}{N}100$$

- the attack frequency (F%) represents the number of attacked grains (n) related to the number of analyzed grains (N).

For the intensity of the attack, the attacked surface of each grain was analyzed with a magnifying glass and the intensity was calculated according to the formula:

$$I\% = \sum(ixf)/n$$

The attack intensity represents the relative value of the degree of coverage of the analyzed grain expressed in percentage (%) of the total surface, where:

- i=percentage of the grade awarded; f=number of grains scored with the respective grade; n=total number of attacked grains analyzed.

The attack degree (AD%) was calculated acording the formula;

$$AD\%=\frac{FxI}{100}$$

F-frequency of attack;
I-the intensity of the attack.
These formulas were calculated according to the Guide to Good Agricultural Practices for Variety Testing and Registration (2010). The obtained data were statistically processed by analysis of variance using the PoliFact program (Ivan, 2001).

RESULTS AND DISCUSSIONS

The results obtained after one year of winter wheat seed storage highlighted an increased degree of attack by the wheat weevil on wheat genotypes compared to the control variety.

The wheat weevil attacks stored grains, causing damage, as it gnaws the grains in the form of galleries inside them. From figure 2, it is observed that the MTG grams-(mass of thousand grains) of the nine winter wheat genotypes (Ursita, A4-10, A44-13, Pitar, Abund suffered a considerable decrease following the attack of *Sitophilus granarius* between 3 and 9 grams, and in the Miranda variety it had a decrease of 2 grams.

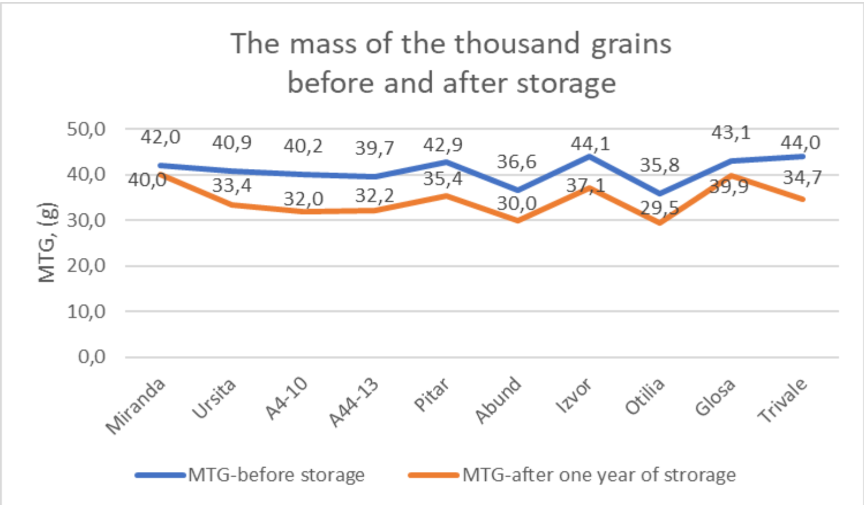

Figure 2. The mass of the thousand grains before and after the attack of the wheat weevil

From the data statistically processed through variance analysis, it is observed that the percentage of attack frequency obtained very significant positive differences between the wheat variants studied, namely the wheat genotypes Ursita, A4-10, A44-13, Pitar, Izvor, Otilia, Glosa and Trivale, compared to the Miranda control, which recorded a lower attack frequency, while the Abund variety had a distinctly significant positive difference compared to the control (table 1).

Table 1

The frequency attack produced by *Sitophilus granarius* on stored seed

No.	Variants	Frequency (%)	%	Difference	Significance
1.	Miranda	8.75	100.00	0.00	Mt.
2.	Ursita	19.25	220.0	10.50	***
3.	A4-10	54.50	622.9	45.75	***
4.	A44-13	44.00	502.9	35.25	***
5.	Pitar	16.25	185.7	7.50	***
6.	Abund	14.50	165.7	5.75	**
7.	Izvor	24.00	274.3	15.25	***
8.	Otilia	19.00	217.1	10.25	***
9.	Glosa	24.00	274.3	15.25	***
10.	Trivale	46.75	534.3	38.00	***
			DL 5 %	4.07	
			DL 1 %	5.50	
			DL 0.1 %	7.33	

From the statistical analysis regarding the intensity of the attack (table 2), it can be seen that the Ursita and Glosa varieties did not register significant differences. The Otilia variety a significantly positive difference, Pitar a distinctly significantly positive difference, while Abund, Izvor, Trivale and the two lines (A4-10 and A44-13) the differences were statistically assured, with very significantly positive differences compared to the Miranda control.

Table 2

The attack intensity produced by *Sitophilus granarius* on stored seed

No.	Variants	Intensity (%)	%	Difference	Significance
1.	Miranda	10.78	100.0	0.00	Mt.
2.	Ursita	10.98	101.9	0.20	-
3.	A4-10	15.95	148.0	5.18	***
4.	A44-13	24.85	230.6	14.08	***
5.	Pitar	12.68	117.6	1.90	**
6.	Abund	13.48	125.1	2.70	***
7.	Izvor	15.88	147.3	5.10	***
8.	Otilia	11.93	110.7	1.15	*
9.	Glosa	10.58	98.1	-0.20	-
10.	Trivale	26.03	241.5	15.25	***
			DL 5 %	1.12	
			DL 1 %	1.52	
			DL 0.1 %	2.02	

The assessment of the degree of attack, according to table 3, shows that all nine winter wheat genotypes are statistically assured, so that the Ursita, Pitar and Abund varieties recorded distinctly significant positive differences compared to the Miranda control. The increased degree of attack was recorded in the winter wheat lines A4-10 and A44-13, but also in the Izvor, Otilia, Glosa and Trivale varieties, which obtained very significant positive differences compared to Miranda.

Table 3

The attack degree produced by *Sitophilus granarius* on stored seed

No.	Variants	AD (%)	%	Difference	Significance
1.	Miranda	0.95	100.0	0.00	Mt.
2.	Ursita	2.08	218.4	1.13	**
3.	A4-10	8.70	915.8	7.75	***
4.	A44-13	10.95	1152.6	10.00	***
5.	Pitar	2.05	215.8	1.10	**
6.	Abund	1.98	207.9	1.03	**
7.	Izvor	3.80	400.0	2.85	***
8.	Otilia	2.25	236.8	1.30	***
9.	Glosa	2.53	265.8	1.58	***
10.	Trivale	12.20	1284.2	11.25	***
			DL 5 %	0.64	
			DL 1 %	0.87	
			DL 0.1 %	1.16	

CONCLUSIONS

The weevil wheat attack during the storage period of wheat seeds affects their quality, causes major damage, and the establishment of subsequent crops is compromised.

The recorded attack frequency had high percentages in all winter wheat genotypes and very significantly positive differences were obtained, with the exception of the Abund variety, a distinctly significantly positive difference, compared to the control variant.

Following the intensity calculation for the winter wheat varieties Ursita and Glosa, were obtained no significant differences compared to the Miranda control, while for the other genotypes the differences were significantly positive.

From the statistical analysis, a degree of attack with distinctly significant positive differences was obtained in the wheat varieties Ursita, Pitar and Abund, while in the other genotypes Izvor, Otilia, Glosa, Trivale, A4-10 and A44-13, the differences were very significantly positive, compared to Miranda.

The thousand grain mass was affected in all winter wheat genotypes following the attack by *Sitophilus granarius.*

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