RESEARCH ON THE AMINO-ACID CHANGES IN THE WHEAT GRAIN AFTER INFESTATION BY *RHIZOPERTA DOMINICA*

CERCETĂRI PRIVIND MODIFICĂRILE AMINOACIZILOR DIN BOBUL DE GRÂU , ÎN URMA INFESTĂRII CU *RHIZOPERTA DOMINICA*

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Abstract: *The presence of storage pests in the stored produce leads to the impurification of the latter and to the diminution of bread-making and germinating features of the seeds, sometimes making them improper for use as such. The biological value of the proteins in the wheat grains is high, since they contain all essential amino-acids, acids that the human body alone cannot synthesise. Compared to the requirements of the human body, requirements that somehow limit the biological value of the proteins in the wheat, the amino-acid lysine is in small amounts; compared to lysine, there are even smaller amounts of methionine, isoleukine, and triptophane. The goal of research was to monitor the changes of the amino-acids in the wheat grains infested by Rhizoperta dominica. They have published relatively very little on the effects of the infestation by this insect of essential and non-essential amino-acids in the wheat grain. Results of bio-chemical analyses with modern methods, high-performance liquid chromatography (HPLC) shall be supplied to all interested farmers, to milling and bread-making enterprises, as well as to similar academic institutions in Romania and abroad. Quantitative changes of the amino-acids were monitored on a number of 5 sample variants infested with 25, 50, 75, and 100 insects of Rhizoperta dominica, respectively. As a result of the measurements, we can see that the essential amino-acid the most consumed by Rhizoperta dominica is valine, followed by isoleukine and histidine, while the most consumed non-essential amino-acid preferred by this pest species is praline. As a conclusion, after a month of attack by the pest species Rhizoperta dominica, there is considerable biological value decrease of the proteins in wheat caused by the consumption of essential amino-acids.*

Rezumat: *Prezența dăunătorilor de depozit în masa de produse conduce la impurificarea acestora şi reducerea însuşirilor de panificație şi germinative ale semințelor, făcându-le uneori improprii utilizării. Valoarea biologică a proteinelor din boabele de grâu este ridicată, deoarece ele conțin toți aminoacizii esențiali, acizi pe care organismul uman nu-i poate sintetiza. Față de cerințele organismului uman, şi care într-un fel limitează valoarea biologică a proteinelor din grâu, aminoacidul lizină se află în canități mai mici. Iar comparativ cu lizina, într-o proporție mult mai mică se află aminoacizii metionină, izoleucină şi triptofan. Scopul cercetărilor a fost urmărirea modificărilor aminoacizilor din boabele de grâu infestate de Rizopertha dominica. S-a publicat relativ foarte puțin despre efectele infestării cu insecte asupra aminoacizilor esențiali şi neesențiali din bobul de grâu. Rezultatele analizelor biochimice efectuate prin metode moderne, cromatografie lichidă de înaltă performanță (HPLC), vor fi puse la dispoziția fermierilor interesați, a intreprinderilor de morărit şi panificație, precum şi institutelor de învățământ superior. Modificările cantitative ale aminoacizilor au fost urmărite pe un număr de 5 variante de probe infestate cu 25, 50, 75 respectiv 100 de exemplare de Rhizoperta dominica. În urma determinărilor efectuate se poate constata faptul că, aminoacidul esențial consumat într-o proporție mai mare de către Rhizoperta dominica este valina, izoleucina şi histidina; iar dintre aminoacizii neesențiali, prolina este preferată de această specie. În consecință, după o lună de atac a speciei Rhizoperta dominica scade simțitor valoarea biologică a proteinelor din grâu, prin consumul aminoacizilor esențial.*

Key words: *infestation, Rhizoperta dominica, modifications, aminoacids*
Cuvinte cheie: *infestare,Rhizoperta dominica, modificări, aminoacizi*

INTRODUCTION

Bread-making quality in wheat is a complex feature that develops mainly during the grain filling period and it depends on the content and quality of gluten. Glutenins and gliadines confer the gluten different qualities. Thu, glutenines confer the dough elasticity, since they are richer in arginine, lysine, and triptophane, and due to the di-sulphur links they contain, they confer gluten strength. Gliadines, having an extremely high content of glutamic acid and praline, confer gluten extensibility.

In time, most researchers in the world have studied the main changes of the bio-chemical components of the stored seeds at different room temperatures and with different moisture degrees, but there are no sure data or deep studied on the nutritious changes produced inside cereals and derived produce stored that are infested by *Rhizoperta dominica* insect pests.

Eating grains by insects results in weight losses and in considerable nutrient losses, in the changing of nutrients and in low quality nutritious compounds.

MATERIALS AND METHOD

Research was carried out in the Laboratory of Entomology and Produce Protection of the Agricultural and Veterinary University of the Banat in Timisoara, in laboratory conditions. The biological material we used was the Dropia wheat cultivar and insects of the *Rhizoperta dominica* species.

The laboratory equipment we used was as follows: top pots with small-hole sieves, a growth bowl, scales, binocular magnifying glass, a Preten mill, and a HPLC apparatus. Insects were grown in laboratory conditions, in a growth bowl and at the necessary parameters (temperature 26°C and relative humidity 65%).

We purposely infested the grains with a known number of insects from the above mentioned species to precisely determine the changes in the essential amino acids contained in the wheat grains after the attack by the *Rhizoperta dominica* insect pest and after a known period of time.

We introduced 100 g of wheat in each of 15 pots, and 12 of the pots were infested with 25, 50, 75, and 100 insects, respectively. The first 3 wheat samples were the control. We thus established 5 variants with 3 replications. We monitored the attack by the *Rhizoperta dominica* insect pest on wheat for a month.

After a month, the insects in the 12 pots were removed, and wheat grains were milled to allow laboratory analyses.

Meal samples were analysed with an HPLC apparatus: we measured the essential and non-essential amino acid amounts that changed compared to the control.

Chromatographic analysis with the HPLC apparatus is a sensitive and precise method of determining amino acids.

The reactants we used were as follows: standard samples for the amino acids under study. We determined 7 essential amino acids: arginine, histidine, lysine, leucine, isoleucine, methyonine, and valine, and 3 non-essential amino acids: alanine, glycine, and proline.

RESULTS AND DISCUSSION

All the results in the tables below represent the means of the 3 replications of each of the trial variants.

Table 1 shows the following changes of the essential amino acids after a month of attack by 25 of the *Rhizoperta dominica* insect pest compared to the control:

- the amount of *arginine* intact is 95,73%, the difference of 4,27% being eaten by the *Rhizoperta dominica* insect pest.

Table 1

Changes of the essential amino-acids in the wheat grain a month after infestation with *Rhizoperta dominica*

Aminoacids essentials	Moisture	Infestation with 25 insects	Infestation with 50 insects	Infestation with 75 insects	Infestation with 100 insects
Arginine	4,85	4,6624	3,7882	3,2539	3,0597
Histidine	1,75	1,6832	1,3676	1,2624	1,1046
Isoleucine	3,36	3,192	2,6208	2,2512	2,0496
Leucine	7,30	7,0874	5,6992	5,1877	4,384
Lisine	3,77	3,6224	2,9565	2,5658	2,264
Metionine	1,60	1,5392	1,2666	1,1223	0,9940
Valine	4,51	4,2876	3,6106	3,2947	2,7531

- the amount of *isoleucine* intact is 93,882%, the difference of 6,118% being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *lisine* intact is 95,830%, the difference of 4,170% being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *histidine* intact is 95,636%, the difference of 4,364% being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *metionine* intact is 95,012%, the difference of 4,988% being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *leucine* intact is 96,296 %, the difference of 3,704 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *valine* intact is 94,232 % the difference of 5,768 % being eaten by the *Rhizoperta dominica* insect pest.

The changes of the essential amino acids after a month of attack by 50 of the *Rhizoperta dominica* insect pest compared to the control:

- the amount of *arginine* intact is 77,786 %, the difference of 22,214 %being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *isoleucine* intact is 77,082 %, the difference of 22,918% being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *lisine* intact is 78,214 %, the difference of 21,786 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *histidine* intact is 77,704 %, the difference of 22,296 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *metionine* intact is 78,185 % the difference of 21,815 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *leucine* intact is 77,434 %, the difference of 22,566 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *valine* intact is 79,353 %, the difference of 20,647 % being eaten by the *Rhizoperta dominica* insect pest.

The changes of the essential amino acids after a month of attack by 75 of the *Rhizoperta dominica* insect pest compared to the control:

- the amount of *arginine* intact is 66,815 %, the difference of 33,185 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *isoleucine* intact is 66,211 %, the difference of 33,789% being eaten by the *Rhizoperta dominica* insect pest.

- the amount of *lisine* intact is 67,878 %, the difference of 31,122 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *histidine* intact is 71,727 %, the difference of 28,273 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *metionine* intact is 69,277 % the difference of 30,723 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *leucine* intact is 70,485%, the difference of 29,515% being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *valine* intact is 72,410 %, the difference of 27,590 % being eaten by the *Rhizoperta dominica* insect pest.

The changes of the essential amino acids after a month of attack by 100 of the *Rhizoperta dominica* insect pest compared to the control:

- the amount of *arginine* intact is 62,827%, the difference of 37,173% being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *isoleucine* intact is 60,282 %, the difference of 39,173% being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *lisine* intact is 59,894%, the difference of 40,106 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *histidine* intact is 62,761 %, the difference of 37,239 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *metionine* intact is 61,358 % the difference of 38,642 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *leucine* intact is 59,565 %, the difference of 40,435% being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *valine* intact is 60,507%, the difference of 39,493 % being eaten by the Rhizoperta *dominica* insect pest.

Table 2 shows the following changes of the nonessential amino acids after a month of attack by 25 of the *Rhizoperta dominica* insect pest compared to the control:

- the amount of *alanine* intact is 94,501% the difference of 40,435% being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *glicine* intact is 94,342%, the difference of 5,658 % being eaten by the *Rhizoperta dominica* insect pest.
- the amount of *praline* intact is 95,749%, the difference of 4,251% being eaten by the *Rhizoperta dominica* insect pest.

Table 2

Changes of the non essential amino-acids in the wheat grain a month after infestation with *Rhizoperta dominica*

Aminoacids nonessentials	Moisture	Infestation with 25 insects	Infestation with 50 insects	Infestation with 75 insects	Infestation with 100 insects
Alanine	4,66	4,5266	3,6866	3,1733	2,80
Glicine	4,14	4,0190	3,3146	2,8589	2,5274
Praline	11,47	11,0112	9,0613	7,9143	7,2261

The changes of the nonessential amino acids after a month of attack by 50 of the *Rhizoperta dominica* insect pest compared to the control:

• the amount of *alanine* intact is 76,964% the difference of 23,036% being eaten by the *Rhizoperta dominica* insect pest.

• the amount of *glicine* intact is 77,807 %, the difference of 22,193 % being eaten by the *Rhizoperta dominica* insect pest.

• the amount of *praline* intact is 78,793%, the difference of 21,207% being eaten by the *Rhizoperta dominica* insect pest.

The changes of the nonessential amino acids after a month of attack by 75 of the *Rhizoperta dominica* insect pest compared to the control:

• the amount of *alanine* intact is 66,248% the difference of 33,752% being eaten by the *Rhizoperta dominica* insect pest.

• the amount of *glicine* intact is 67,110%, the difference of 32,890% being eaten by the *Rhizoperta dominica* insect pest.

• the amount of *praline* intact is 68,820%, the difference of 31,180% being eaten by the Rhizoperta *dominica* insect pest.

The changes of the nonessential amino acids after a month of attack by 100 of the *Rhizoperta dominica* insect pest compared to the control:

• the amount of *alanine* intact is 58,455% the difference of 41,545% being eaten by the *Rhizoperta dominica* insect pest.

• the amount of *glicine* intact is 59,328%, the difference of 40,672% being eaten by the *Rhizoperta dominica* insect pest.

• the amount of *praline* intact is 62,835%, the difference of 37,165% being eaten by the Rhizoperta *dominica* insect pest.

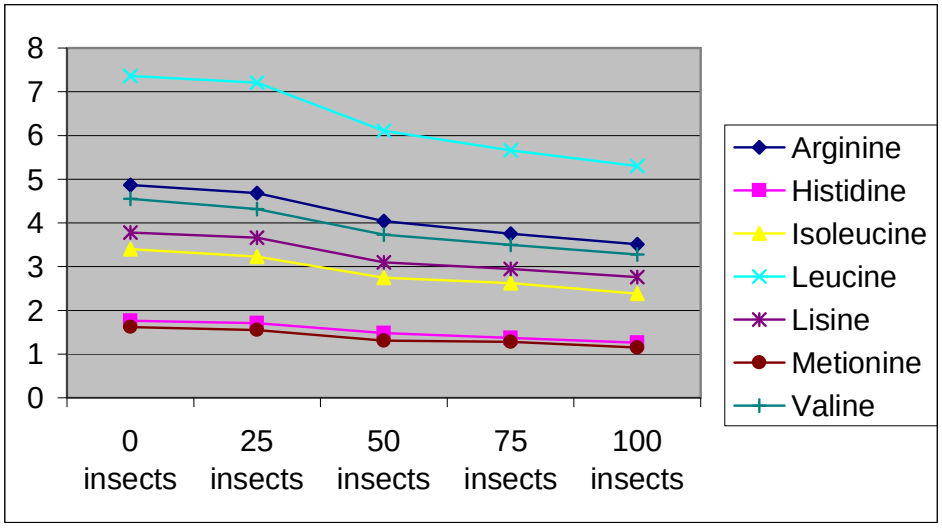

Fig.1. Values of the essential amino acids after a month of attack by the *Rhizoperta dominica* insect pest.

Figures 1 and 2 show a decrease of the share of each of the amino acids depending on the number of insects attacking the sample.

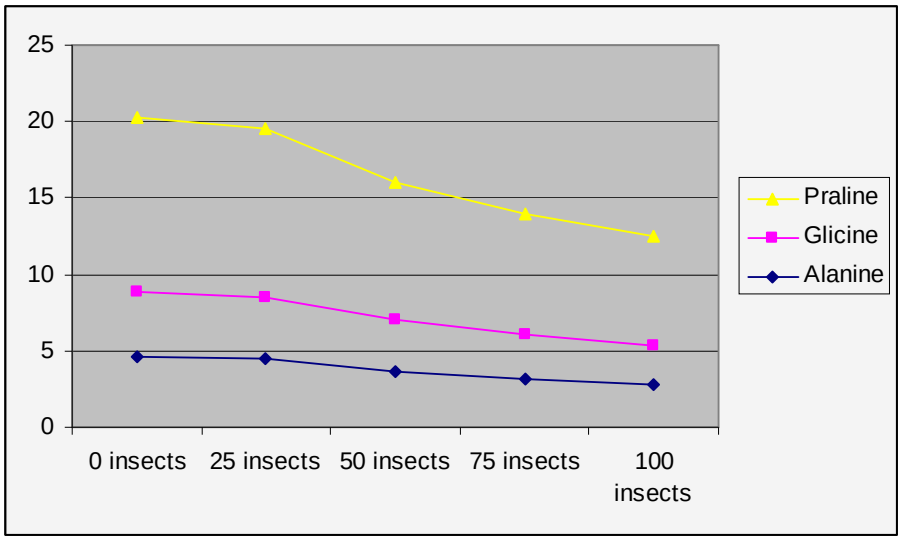

Fig.2. Values of the non-essential amino acids after a month of attack by the *Rhizoperta dominica* insect pest.

CONCLUSIONS

The essential amino-acid the most consumed by *Rhizoperta dominica* is valine, followed by isoleukine and histidine.

While the most consumed non-essential amino-acid preferred by this pest species is praline.

As a conclusion, after a month of attack by the pest species Rhizoperta dominica, there is considerable biological value decrease of the proteins in wheat caused by the consumption of essential amino-acids.

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