RESEARCH REGARDING CHANGES IN LIPIDS AND FATTY ACIDS IN THE WHEAT GRAIN AFTER INFESTATION BY *RHIZOPERTA DOMINICA*

CERCETĂRI PRIVIND MODIFICĂRILE LIPIDELOR ŞI ACIZILOR GRAŞI DIN BOBUL DE GRÂU, ÎN URMA INFESTĂRII CU *RHIZOPERTA DOMINICA*

Lavinia Mădălina MICU, Doru Ion PETANEC

USAMVB Timişoara
Calea Aradului, no.119, Timisoara, LMICU@personal.ro

Abstract: *Insects are one of the main causes of the losses produced in stored cereals and seeds. Rhizoperta dominica F. infests cereals and develops inside the grains thus producing the 'hidden infestation' of the cereals and increases of temperature and moisture in the produce. The grains look healthy and undamaged, even if the embryo, the endosperm or both of them are partially eaten. In wheat grains, lipids are rather low (1,5 - 2%), being stored mainly in the embryo and aleuronic layer. Seeds contain rather active anti-oxidants and fats in intact seeds are pretty well protected against the action of the aerial oxygen. Changes related to seed fat degradation can have either an oxidating nature leading to the appearance of rancid taste and smell, or hydrolytic leading to free fat acid production. The goal of the research was to monitor the changes in the lipids and fat acids in wheat grains infested by Rhizoperta dominica F. Results of bio-chemical analyses with eteroclorhidric method shall be supplied to all interested farmers, to milling and bread-making enterprises. Quantitative changes the lipids and fat acids were monitored on a number of 5 sample variants infested with 25, 50, 75, and 100 insects of Rhizoperta dominica, respectively. Contents in fat acids extracted and determined among the total general lipids was low compared to the control, except for the palmitic, oleic and stearic acid which were much more degraded. As a result, a month after the attack by Rhizoperta dominica F., degradation of lipids and fat acids in the wheat grain was significant.*

Rezumat: *Insectele sunt una din cauzele principale ale pierderilor ce se produc la cerealele şi semințele depozitate. Rhizoperta dominica F. infestează cerealele şi se dezvoltă în interiorul boabelor constituind „infestarea ascunsă" a unei mase de cereale, provocând deasemenea şi creşteri ale temperaturii şi umidității produsului. Semințele conțin antioxidanți destul de activi, iar grăsimile din semințele intacte sunt destul de bine apărate împotriva acțiunii oxigenului din aer. Scopul cercetărilor a fost urmărirea modificărilor lipidelor şi acizilor graşi din boabele de grâu infestate de Rhizoperta dominica F. Rezultatele analizelor biochimice efectuate prin metoda eteroclorhidrică, vor fi puse la dispoziția fermierilor interesați, a intreprinderilor de morărit şi panificație. Modificările cantitative ale lipidelor şi acizilor graşi au fost urmărite pe un număr de cinci variante de probe infestate cu 25, 50, 75 şi respectiv 100 de exemplare de Rhizoperta dominica F. În urma determinărilor efectuate, analizându-se valorile obținute cu privire la conținutul de lipide din probele infestate față de proba martor se constată o diminuare a acestuia, după o lună de atac.Conținutul în cei zece acizi graşi extraşi şi determinați din totalul de lipide în general a înregistrat valori mai mici față de valoarea probei martor, cu excepția acidului palmitic, oleic şi stearic,degradați într-o proporție mult mai mare.În consecință, după o lună de atac a speciei Rhizoperta dominica F., degradarea lipidelor şi acizilor graşi din bobul de grâu este semnificativă.*

Key words**:** *grain, infestation, Rhizoperta dominica, modifications, lipids, fatty acids*
Cuvinte cheie**:** *grâu, infestare, Rhizoperta dominica, modificări, lipide, acizi graşi*

INTRODUCTION

Rhizoperta dominica F. infests cereals and develops inside the grains thus producing

the 'hidden infestation' of the cereals. Females lay eggs outside the grains, and after hatching most small larvae penetrate the grains. Both larvae and adults produce an excessive amount of excrements.

Bread-making quality is also influenced by polar lipids (glycolipids) which establish hydrophilous and hydrophilic links with glyadins and glutenins making up a complex that ensures gas-retention stability of the gluten. In wheat grains, lipids are rather low (1,5 - 2%), being stored mainly in the embryo and aleuronic layer.

Lipids are made particularly of oleic and linoleic acids that can easily turn rancid, thus altering the organoleptic features of flours. Under the action of lipases, in favorable conditions of temperature and moisture, fat acids are freed. A high content in fat acids in the wheat grain leads to an increase of acidity in flours after grinding.

MATERIAL AND METHODS

The number of insects that attacked the wheat samples varied from zero (the control variant) to 100. The period of time in which the insects had contact with the grains was of 1 or 4 weeks. After that, each wheat sample was ground with the help of a mill, and the grounding that resulted was sieved through a sieve with openings of 0.1 diameter. Then it was packed in airtight plastic bags and stored -20^0C until they were analyzed (figure 1).

In the analysis of the changes in lipids and fatty acids, the ground wheat samples were analyzed employing the ether-chlorhydric method.

We determined the changes that appeared in the quantity of lipids and fatty acids in the wheat samples that were infested by 25, 50, 75 and 100 insects belonging to species *Rhizoperta dominica* F. for a month.

Figure 1. Forming lab samples for analyses

RESULTS AND DISCUSSIONS

As a result of measurements made one month after the attack by 25 and 50 insects,

respectively, of the species *Rhizoperta dominica* F. (table 1) we noticed that fat acid content decreased on the average compared to the control.

In the case of the 25 and 50 insects, respectively, that attacked the flour for four weeks, acid fat values are shown in table 1.

Table 1

Quantitative changes cause by the attack of insect pests (*Rhizoperta dominica*) on lipids and fatty acids in wheat, after a month under atta

Determined substances	Valoarea determinată (%)				
	25 samples	50 samples	75 samples	100 samples	control (0 samples)
Lipide	1,834	1,751	1,677	1,503	1,99
Acid miristic (C_{14})	0,158	0,150	0,13	0,11	0,18
Acid palmitic (C_{16})	28,30	26,85	26,40	25,35	29,50
Acid palmitoleic (C_{16})	0,058	0,057	0,048	0,040	0,08
Acid stearic (C_{18})	2,90	2,85	2,55	2,30	3,40
Acid oleic (C_{18})	27,50	27,00	26,80	26,30	30,30
Acid linoleic (C_{18})	34,00	33,80	33,65	33,00	34,24
Acid linolenic (C_{18})	1,38	1,28	1,00	0,290	1,50
Acid arachidic (C_{20})	0,58	0,59	0,62	0,75	0,20
Acid eicosenoic (C_{20})	0,31	0,29	0,28	0,27	0,33
Acid arachidonic (C_{20})	0,31	0,355	0,376	0,42	0,27

For the samples attacked by the 75 insects (table 1) we noticed a decrease of the *oleic acid* content of 3.5% compared to the control, a decrease of 0.059% of the *linoleic acid content*, a decrease of 0.5% of the *linolenic acid* content and a decrease of 0.05% of the *eicosenoic acid*.

In the sample infested by 100 insects, fat acids decreased compared to the control as follows: myristic acid decreased with 0.07%; palmitic acid decreased with 4.15%; palmitoleic acid decreased with 0.04%; stearic acid decreased with 1.1%; oleic acid decreased with 4.0%; linoleic acid decreased with 1.24%; linolenic acid decreased with 1.21%; arachidic acid decreased with 0.55%; eicosenoic acid decreased with 0.06%; arachidonic acid increased with 0.15%.

Analyzing the values concerning lipid content in the samples infested (figure 2) compared to the control we noticed a decrease in value one month after the attack.

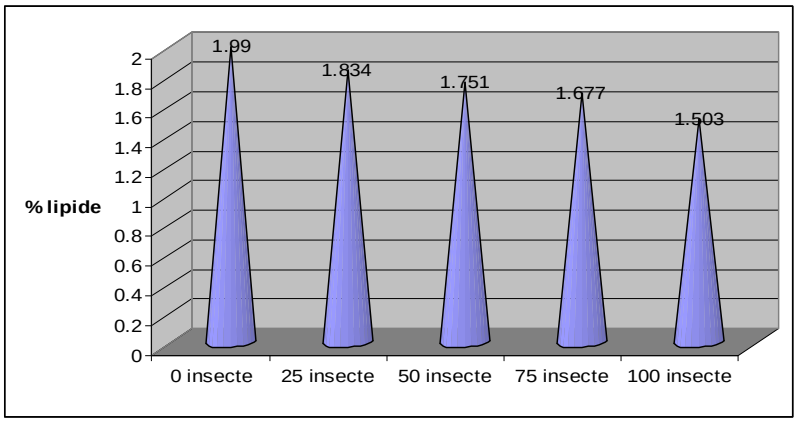

Figure 2. Quantitative values of lipids after a month under attack by *Rhizoperta dominica*

CONCLUSIONS

After measurements made one month after the attack by 25 and 50 insects of the species *Rhizoperta dominica* F. of the fat acid content of the samples, we noticed a decrease compared to the control.

For the samples attacked by 75 insects the decrease of the *oleic acid* was 3.5% compared to the control, 0.059% in the *linoleic acid,* 0.5% in the *linolenic acid* and 0.05% in the *eicosenoic acid*.

As for the fat acids in the samples infested by the 25, 50, 75 or 100 insects, they were lower, in general, than those in the control sample, except for the arachidic and arachidonic acids, because the individuals of the species *Rhizoperta dominica* F. metabolised these acids but in insignificant amounts, except for the palmitic, oleic and stearic acids, which were degraded in larger amounts.

BIBLIOGRAFY

1.ARBOGAST T.R., KENDRA P.E., MANKIN R.W., MCGOVERN J.E., 2000 – Monitoring insect pests in retail stores by trapping and spatial analysis, Journal Econ.Entomol., 93: 1531 -1542;
2. BERATLIEF C., 1975 – Dăunătorii produselor agroalimentare din depozite, Ed. Ceres, Bucureşti;
3. BUSUIOC M., 2003 – Dăunătorii produselor agricole depozitate şi combaterea integrată a lor, Univ.Agrară de Stat din Moldova, Chişinău;
4. COMES I., BOBÂRNAC G., 1957 – Bolile şi dăunătorii produselor vegetale depozitate, Ed.Agro-Silvică, Bucureşti;
5. GERGEN I., 2004 – Analiza produselor agroalimentare, Editura Eurostampa, Timişoara;
6. JOOD S., KAPOOR A., SINGH R., 1995 – Polyphenol and phytic acid contents of cereal grains as affected by insect infestation, Journal of agricultural and food chemistry, ISSN 0021- 8561;
7. JOOD S., KAPOOR A., SINGH R., 1996 – Effect of insect infestation and storage on lipids of cereal grains, Journal of agricultural and food chemistry, 44 (6), 1502 – 1506;
8. MICU Lavinia, Cercetări privind efectele ataculuiinsectelor dăunătoare asupra calității cerealelor depozitate - Teză de doctorat, Timişoara, 2008;
9. MUNRO J.W., 1966 – Pests of stored products, Hutchinson Ed., London;
10. OLARIU Lucia, CHIȘU Iuliana, 2006 – Biochimie generală, Editura Politehnica, Timişoara;