CHANGES IN THE FAT-SOLUBLE VITAMIN E (TOCOPHEROL) IN STORED WHEAT AFTER INFESTATION BY *RHIZOPERTA DOMINICA* F.

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ABSTRACT

Besides quantitative losses, which can be evaluated accurately enough, the infestation with insect pests can have other consequences as well, such as qualitative depreciation of the stored products, diminished or absent germination capacity, apparition of toxic products, development of various moulds, etc. We studied the changes in the quantity of tocopherol after a month from the initial attack by 25, 50, 75 and 100 insects belonging to species *Rhizoperta dominica* F., as compared to the values of the control sample. We found a decrease in vitamin E of 0.15% in the sample attacked by 25 insects, 0.41% for the sample attacked by 50 insects, 0.51% for the sample attacked by 75 insects, and 0.60% for the samples infested by 100 adults of species *Rhizoperta dominica* F. as compared to the quantity of vitamin E in the control sample. The losses increased with time.

Key words: infestation, stored wheat, *Rhizoperta dominica* F., tocopherol.

INTRODUCTION

Agricultural products are exposed to the attack by storage pests during their entire storage period. The damage produced by these pests can be huge if we take into account the amount of seeds consumed, as well as the reduction of their quality (Beratlief, 1975).

The nutritious environment has an impact on the insects' multiplication rate. Cotton et al. (1963) showed that adding riboflavin to the wheat flour increases the reproduction rate in the pest *Tribolium castaneum* with 72.50% compared to the control, and that the pests multiplied quicker in graham flour, in bran and in whole meal flour, which are naturally richer in this vitamin than meal flours.

Proskuriakov et Bundel (1942) carried out vast research on the fundamental requirements of the pest *Tribolium castaneum* and of other pests of stored cereals. According to these authors, all insects need vitamins of the group B. At least seven vitamins of this group are essential for the good development and growth of the pest *Tribolium castaneum*: thiamin (B_1), riboflavin (B_2), nicotinic acid, pyridoxine, pantotenic acid, coline and biotin, and perhaps inositol and the p-amino-benzoic acid. These authors claim that some pests specific to stored produce have fewer requirements in vitamins than others, maybe because of the presence in their bodies of inter-cellular microorganisms or of symbionts that supply them with accessory nutrients. Pests that infest cereal products stored in sacks tend to gather close to the outer layers.

In 1996, Jood et al. determined and analysed the vitamin content of cereal grains affected by store insects and recorded substantial losses in thiamin, riboflavin, and niacin in wheat, maize, and sorghum. They have also noticed the fact that storing cereals not affected by the pests for 1 to 4 months did not result in considerable changes of the vitamin content.

MATERIAL AND METHODS

In order to analyse the changes in vitamin E in wheat infested by store pests, in laboratory conditions, we infested wheat samples of the Dropia cultivar, with a variable number of pests of the species *Rhizoperta dominica.* The insects were grown in laboratory conditions, in a growth vase and at the parameters necessary to their development (26°C and relative moisture 65%).

We introduced 100 grams of wheat grains in jars and we infested them with 0 (as control), 25, 50, 75, and 100 insects respectively in 3 replications. The observations were made after thirty days.

The number of insects that attacked wheat samples varied from 0 (in the control) to 100. The period of time within which the insects were in direct contact with the wheat grains was 4 weeks. Each wheat sample was then ground in a mill, and the grounds were sieved (0.1 mm in diameter), packed in close tight plastic bags and stored at -20°C until the analysis.

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The sample to be analysed was saponified with an ethanol solution of potassium hydroxide, and the vitamin E was then extracted in petroleum ether. The extraction solvent was evaporated, and the residue was dissolved in methanol. As an analysis method of the vitamin content we used high-performance liquid chromatography with inverse phase and with fluorescent detection. Vitamin E was separated using an inverse C18 column, and its concentration in wheat grains was determined using a fluorescence detector (wave length of excitation 295 nm and that of excitation 330 nm).

The calibration curve corresponding to vitamin E is shown in the figure 1:

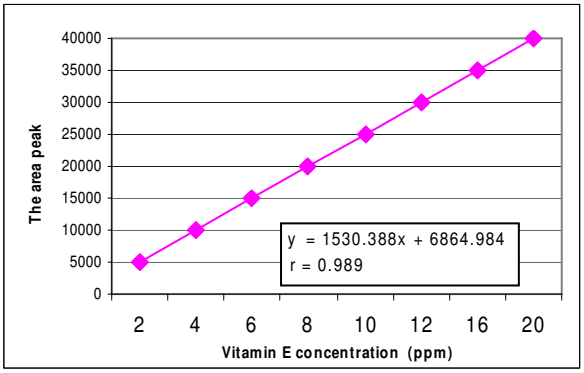

Figure 1. Calibration curve corresponding to vitamin E

RESULTS AND DISCUSSION

Wheat grains are, in general, a good source of thiamin (vitamin B_1), pyridoxine (vitamin B_6), niacin, inositol, biotin (vitamin H) and tocopherol (vitamin E). Reproduction rate, as well as the development rate of store insects, is strongly influenced by the nutritious environment (Hoseney and Finhey, 1970).

A month after the infestation and the attack by the species *Rhizoperta dominica* F. we could notice a reduction of the amount of tocopherol compared to the control (Table 1 and Figure 2).

Wheat samples attacked by 25 individuals of the species *Rhizoperta dominica* F. had a tocopherol content 0.15% smaller than the control. In the samples attacked by 50 individuals of *Rhizoperta dominica* F. we determined a vitamin E content 0.41% smaller as compared to the control (Micu, 2008).

In the case of the samples attacked by 75 individuals of *Rhizoperta dominica* F. the tocopherol content was 0.56% smaller than the control.

Table 1. Quantitative values of vitamins E in the wheat grain, after a month under attack by *Rhizoperta dominica* F.

Proba	R1 %	R2 %	R3 %	Average %	Standard deviation
Control	15.37	15.36	15.39	15.373	0.015275
25 insects	15.12	15.20	15.36	15.226	0.122202
50 insects	14.89	15.09	14.90	14.960	0.112694
75 insects	14.76	14.89	14.79	14.813	0.068069
100 insects	14.80	14.75	14.76	14.770	0.026458

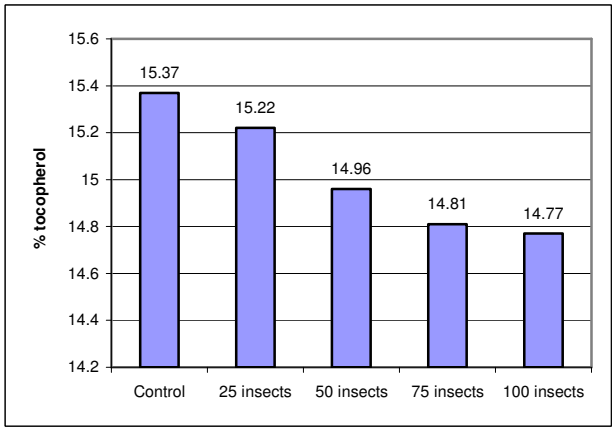

Figure 2. The proportion of vitamin E metabolized by *Rhizoperta dominica* F. after a month under attack

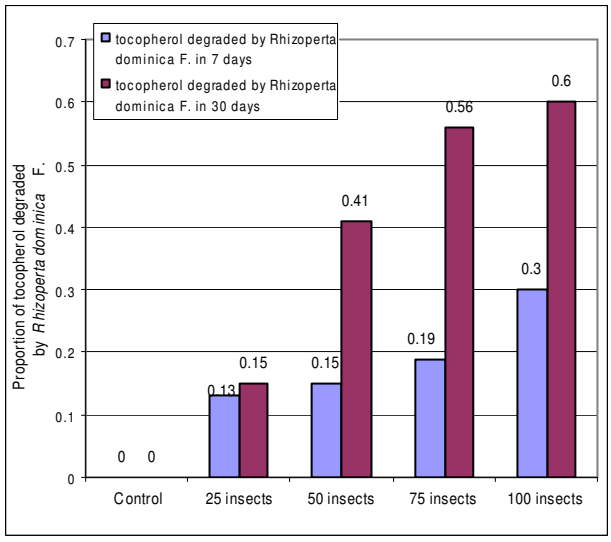

Figure 3. The proportion of tocopherol degraded by *Rhizoperta dominica* F. in 21 days

Analysing data in figure 3 we can see that, three weeks after the attack by the species *Rhizoperta dominica* F., the amount of vitamin E degraded by the pest increases significantly. Twenty-one days after the attack by 50% of the insect pests, the content in tocopherol metabolised by the latter was 0.21%.

About the same was recorded when the attack was by 75% or 100% of the insect pests three weeks after infestation: the amount of vitamin E damaged was 0.37% and 0.27%, respectively.

CONCLUSIONS

A month after infestation and attack by the species *Rhizoperta dominica* F. there was an important reduction of the amount of tocopherol, when compared to the control sample.

In the case of the samples attacked by 75 insects of *Rhizoperta dominica* F. we registered a tocopherol content 0.56% smaller than the one in the sample that had not been infested.

The 100 adults of *Rhizoperta dominica* F. metabolized 0.6% vitamin E as compared to the value of the sample that had not been infested.

As a result of the research, we can say that the attack by the pest species *Rhizoperta dominica* F. causes important changes of the stored wheat, the amount of tocopherol diminishing with the duration of storage and with the abundance of pests in the storehouse.

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