

FEEDING OF THE KHAPRA BEETLE ON BARLEY, MALT AND BUCKWHEAT NUTLETS

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Abstract: The objective of the study was to determine feeding preferences of the khapra beetle (*Trogoderma granarium* Everts) towards some plant products. The material for the investigations was composed of grain of four barley varieties: Brenda, Krona, Maresi, Rasbet; barley malt, and nutlets of three varieties of buckwheat: Hruszowska, Emka and Kora. The reference material comprised wheat grain of the commercial variety Alinari. The results showed that the development of *T. granarium* larvae on barley grain and malt took longer than on wheat grain. The authors observed that buckwheat nutlets were comparable to barley kernels as a food for the development of the pest. The pest showed more feeding preferences to buckwheat products, grits and meal to barley grain.

Key words: khapra beetle, infestation, buckwheat, barley, food

I. INTRODUCTION

The khapra beetle is one of the most harmful storage pests, which has adapted completely to plant food. By testing resistance of 20 wheat genotypes, Khataak et al. (1995) found evidence confirming the damaging effect of *Trogoderma granarium* Everts feeding. None of the genotypes tested proved to be totally resistant to the khapra beetle.

It has been suggested that the losses caused by this pest should be viewed not only in terms of depressed energy and protein content in grain, but also as resulting in lower levels of vitamins, especially group B vitamins (Jood et al. 1996). Damages caused by this pest, the only stored product pest present on the quarantine list of all the European Plant Protection Organisation (EPPO) member countries, are very well investigated and documented for wheat grain (Gołębiowska 1981; Jood et al. 1996).

The authors of this report based their study on the assumption that food other than wheat grain is comparable as regards their infestation by the khapra beetle.

II. MATERIAL AND METHODS

1. Material

Barley grain, barley malt and buckwheat nutlets were used as a food for larvae. Nutlets of buckwheat Emka, Kora and Hruszowska varieties, supplied by the Chair of Plant Breeding and Seed Production, University of Warmia and Mazury in Olsztyn, were prepared as follows:

- whole nutlets,
- with 80% seed hull removed and ground to granulation, overtails from 2–2.5 mm and 0.8 μm mesh sieves.

Grain of four barley varieties (Brenda, Krona, Maresi and Rasbet) was obtained from the Regional Experimental Station for Varieties Testing in Wrocikowo. Commercial barley malt was supplied by the malt-house of Kormoran Brewery. Variety Almari commercial wheat grains was used as a reference food.

2. Entomological studies

One g of the whole and ground buckwheat nutlets, barley grain, barley malt and wheat was infested with ten one-day-old khapra beetle larvae. The insects were reared in plastic dishes, 10 cm in diameter, with a 1-cm ventilation hole. The growth and mortality of larvae were screened at 7-day intervals. Each combination was carried out in ten replications. The experiment was conducted in a CL-65 Elkon incubator, at 30°C (+/-5°C) and 70% (+/-2%) relative air humidity.

During the 14-week observations on buckwheat nutlets and 7-week observations on malting barley, malt and wheat results has been described. The standard error was estimated to compare the mean values obtained from different cultivars.

III. DISCUSSION OF THE RESULTS

1. Barley grain and malt

Barley grain and malt are two types of storage pest food that have been an object of extensive research for many times. It seems, however, that since barley plays an important role in cereal production and food economy, the question of damage caused to barley grain and its products by the khapra beetle deserves more recognition.

The results of the investigations on the duration of development of larval stages on barley grain indicated large differences between barley and wheat grain as food (Fig. 1). On barley grain, the number of larvae, which did not complete development ranged from 10 to 30, depending on the variety. On the other hand, barley malt as a food was comparable to wheat grain, on which all larvae finished development. About 90 larvae reached the imago stage on wheat grain, compared to about 70 on malt and 40 to 50 on barley grain. These re-

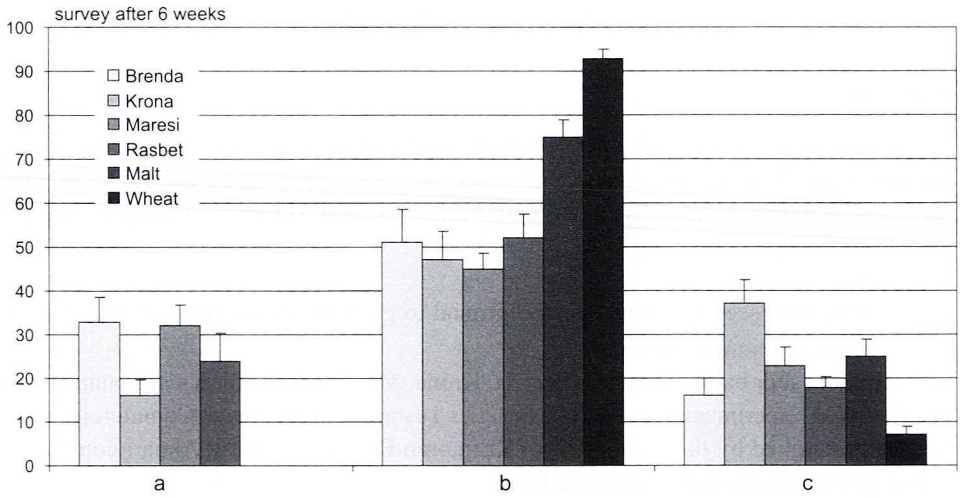


Fig. 1. Development of the khapra beetle (*T. granarium* Everts) larvae on barley grain and malt (the results recalculated per 100 larvae)

sults are further confirmed by the observations on mortality of larvae. The lowest mortality was recorded for wheat grain; on barley grain and malt it was 2–3 times as high (Fig. 2).

Different total mortality rates of larvae feeding on barley and wheat grain could be attributed to some differences in seed coats (hulled and dehulled grain) and in availability of energy and protein. Similar level of mortality of larvae on var. Maresi barley grain and barley malt was observed. Variety Maresi is a malting variety, and all the biochemical processes, which occur during the malting process, do not affect the khapra beetle developmental stages. The results obtained by the authors have proved, however, that the khapra beetle larvae can develop on barley grain, even though their mortality rate is three-fold that on wheat grain. This is confirmed by the results of the dynamics of different mortality rates for successive larval stages. On barley grain, the first larval stage L_1 typically

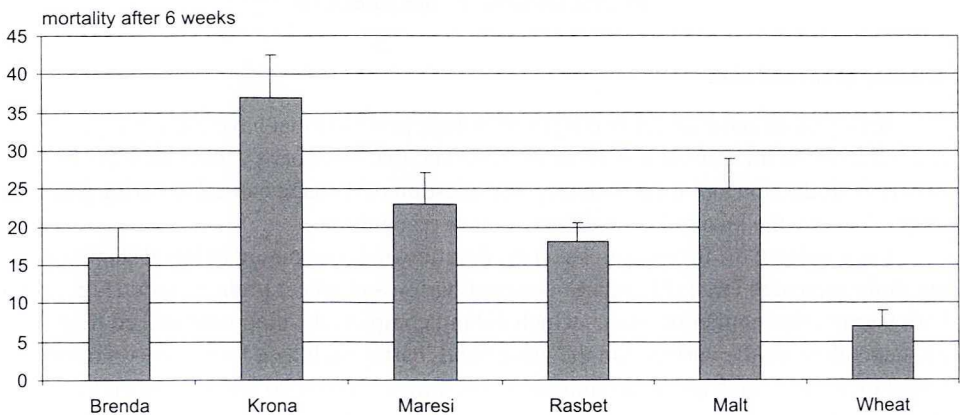


Fig. 2. Total mortality of the khapra beetle (*T. granarium* Everts) larvae on barley grain and barley malt (the results recalculated per 100 larvae)

gave the highest mortality rate in the first week of its development; the mortality rate was highly variable depending on the variety. L_2 stage reached approximate mortality dynamics in the second or third week of development.

2. Buckwheat nutlets

The obtained results have shown that buckwheat nutlets have a high natural tolerance to infestation by stored product pests (Pierzynowska-Korniak et al. 1991; Ciepielewska et al. 1998). Natural resistance decreased significantly when nutlets had been dehulled and ground. The results of the study on the development of khapra beetles on whole buckwheat nutlets showed clearly varietal preferences (Fig. 3). The highest number of larvae of unfinished development was detected on Emka variety nutlets. The number of larvae, which had reached imago, varied from about 20 (Emka) to about 60 (Kora). These observations are similar to the results obtained for barley grain (Fig. 1).

The removal of seed coat and seed grinding did not depressed the number of larvae which had not finished development on Hruszowska and Kora buckwheat nutlets, but it certainly depressed the mortality of larvae (Fig. 4, 5).

Although the development of larval stages of *T. granarium* Everts on buckwheat meal was varietal specific, in each case the mortality rate of larvae and number of adult specimens was similar when compared buckwheat grain ground to grits. Analogously to barley grain of the four studied variety, total mortality rate on whole buckwheat nutlets was 5 to 10 times as high as on wheat grain. This dependence was much weaker in the case of dehulled and ground buckwheat (Fig. 6).

Dynamics of mortality at L_1 , L_2 and L_3 larval stages depended on the variety, dehulling and grinding of grains. Very high mortality was observed on the whole nutlets in the first

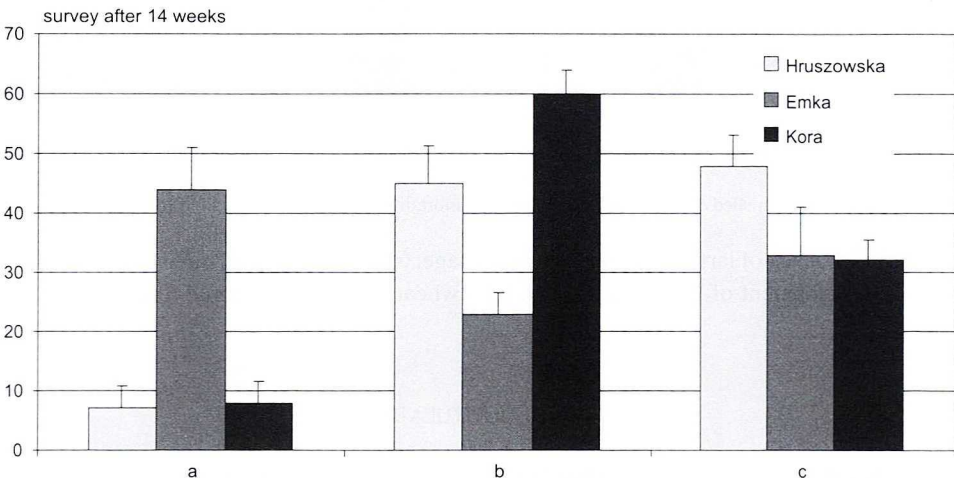


Fig. 3. Development of the khapra beetle (*T. granarium* Everts) larvae on the whole buckwheat nutlets (the results recalculated per 100 larvae)

a – larvae of the unfinished development; b – imago; c – mortality of larvae

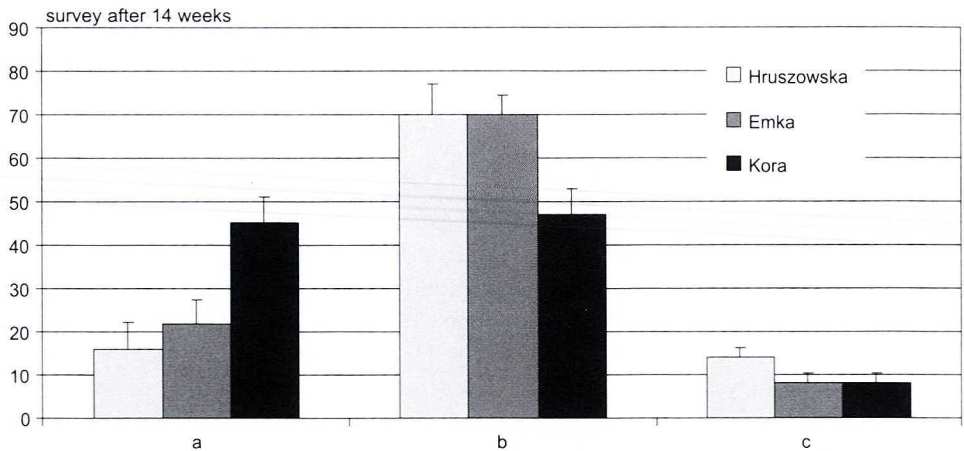


Fig. 4. Development of the khapra beetle (*T. granarium* Everts) larvae on crumbled buckwheat nutlets (the results recalculated per 100 larvae)

a – larvae of the unfinished development; b – imago; c – mortality of larvae

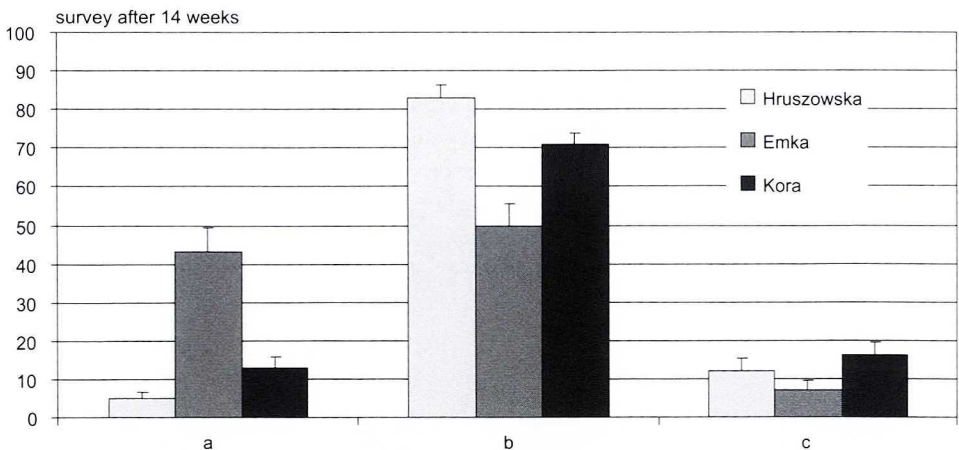


Fig. 5. Development of the khapra beetle (*T. granarium* Everts) larvae on buckwheat meal (the results recalculated per 100 larvae)

a – larvae of the unfinished development; b – imago; c – mortality of larvae

and second week of larval development at L_1 stage. On the other hand, highly varied dynamics of development of larvae feeding on buckwheat meal was observed, particularly at L_2 stage.

IV. RECAPITULATION

Development of the khapra beetle (*Trogoderma granarium* Everts) larvae on barley grain and malt is different from the dynamics of their development on wheat grain. A high number of adult specimens of the pest were detected on malt.

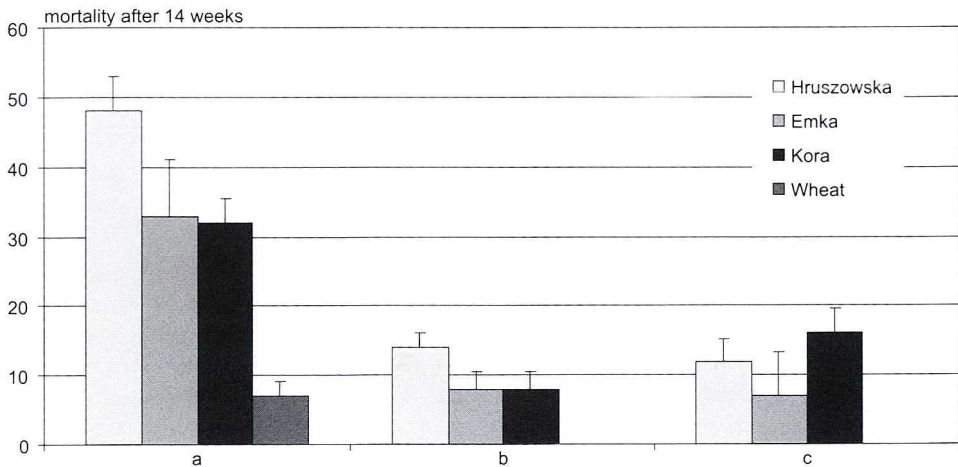


Fig. 6. Total mortality of the khapra beetle (*T. granarium* Everts) larvae on buckwheat and buckwheat products (the results recalculated per 100 larvae)

a – whole buckwheat nutlets; b – granulation 2–2.5 mm; c – granulation 0.8 µm

For development of the khapra beetle (*T. granarium*) buckwheat nutlets constitute food that is comparable to barley grain. The khapra beetle can show greater feeding preferences towards buckwheat food products (grits, meal) than towards barley grain.

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ŻEROWANIE *T. GRANARIUM* EV. NA JĘCZMIENIU, SŁODZIE I ORZESZKACH GRYKI

STRESZCZENIE

Celem prowadzonych badań było określenie preferencji pokarmowych skórka zbożowego (*Trogoderma granarium* Everts) w stosunku do wybranych produktów roślinnych. Materiałem badań było: ziarno jęczmienia czterech odmian – Brenda, Krona, Maresi, Rasbet; sód jęczmienny oraz orzeszki gryki trzech odmian – Hruszowska, Emka i Kora. Materiał porównawczy stanowiło ziarno pszenicy handlowej odmiany Almari. Wyniki uzyskanych badań wykazały, że rozwój larw *T. granarium* na ziarnie jęczmienia i słodzie był dłuższy niż na ziarnie pszenicy. Stwierdzono również, że orzeszki gryki są porównywalnym z ziarnem jęczmienia pokarmem umożliwiającym rozwój tego szkodnika. Przetwory z gryki, kasza i mąka mogą być preferowanym przez szkodnika pokarmem w większym stopniu niż ziarno jęczmienia.