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## **THE INFLUENCE OF FOENICULUM VULGARE FRUIT POWDER ON THE SITOPHILUS ORYZAE L. FERTILITY**

Aleksandra Błażejewska, Krystyna Wyrostkiewicz

*Chair of Entomology, University of Technology and Agriculture, Bydgoszcz, Poland*

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### **ABSTRACT**

*Sitophilus oryzae* L. was bred on wheat grains with different doses of ground *Foeniculum vulgare* fruit powder. The powder added lowered the fertility of *Sitophilus* not only in the generation exposed to it but also in the succeeding generation (F1) bred with no *Foeniculum vulgare* powder added.

**Key words:** *Sitophilus oryzae* L., *Foeniculum vulgare*, powder, fertility

## INTRODUCTION

Chemical control of insects feeding on cereal and flour products stored does not always bring expected results. For that reason for many years an intensive search for other alternative bio-rational methods to fight them has been taking place [2]. The new research profiles aim at defining possibilities to reduce pest population and not a direct destruction but scaring them away or control-ling their behaviour and development process [3, 5]. Natural plant substances can be applied here which interfere with the development and fertility of the pest.

For the last few years the influence of different plant dried materials (added as powder to the products the pests feed on) on the cereal and flour pests has been widely researched [1].

The aim of the present research was to define the direct and consequent influence of the *Foeniculum vulgare* fruit powder applied in different doses on the fertility of the *Sitophilus oryzae*. The *Foeniculum vulgare* fruit was selected referring to the results of the earlier research [2].

## MATERIALS AND METHODS

The research focused on the *Sitophilus oryzae*. The leaf beetles were bred in glass vessels filled with 100 g wheat grains. Breeding took place in an air-conditioned laboratory at the constant temperature of 25 - 27°C and humidity of 70 - 80 %. The material applied in the tests was ground dry *Foeniculum vulgare* fruit. The powder was added to the vessels with wheat and shaken for about 5 min. The research consisted of three tests, three series each. In each of them the procedure was repeated 10 times - 1 breeding vessel as one.

In the first test the *Sitophilus oryzae* individuals were bred in vessels filled with wheat grains with some *Foeniculum vulgare* fruit powder added. The following doses were applied: the 1st series: 0.625 g, the 2nd series - 1.25 g and the 3rd series 2.5 g.

The leaf beetles of the descendant generation (F1) in test 1 were used to establish the 2nd and 3rd tests. In the second test the *Sitophilus oryzae* individuals were bred in 3 series on wheat with the same powder doses added as in the 1st test. In the third test, the leaf beetles were bred in all the series with nothing added. Control tests were conducted for each series with no powder added.

The breeding was established as follows: 10 female and 10 male *Sitophilus oryzae* aged 2 - 4 days were placed in vessels filled with wheat sprinkled with 5 ml distilled water. The vessels were hermetically covered with mill gauze. After 20 days all the leaf beetles were removed. When the first descendent generation individuals appeared, vessels were controlled every two days, new leaf beetles were counted and removed. Control and calculations were conducted as long as new individuals appeared.

The data obtained was analysed statistically. The object means were verified with the Tuckey test. Besides fertility index was defined for each of the series (the number of descendent individuals divided by the number of females of the parent generation).

## RESULTS

After 20 days, when removing the initial generation leaf beetles, no dead individuals were observed in the series. In the first test, the lowest dried material dose slightly stimulated the *Sitophilus oryzae* fertility (48.1, and 36.4 in control test) (Table 1). In the other series with bigger powder doses applied, the leaf beetles fertility decreased when compared with the control test. The statistical analysis showed significant differences in the mean number of individuals between the control test and the 2nd and 3rd powder doses.

**Table 1. The influence of *Foeniculum vulgare* fruit powder on the *Sitophilus oryzae* L.**

Test no	Observations	Number of samples	Control test	Powder doses			
				0.625 g	1.25 g	2.5 g	NIR LSD
I with powder added	mean number of F1 individuals	10	364.0	481.1	335.0	269.2	132.44
	Min.		280	279	134	173	
	Max.		479	711	558	449	
	initial generation fertility index		36.4	48.1	33.5	26.9	
II with powder added	mean number of F2 individuals	10	485.8	208.4	34.1	8.1	184.10
	Min.		376	75	1	3	
	Max.		634	324	60	16	
	F1 generation fertility index		48.5	20.8	3.4	0.8	
III	mean number of F2		485.8	303.6	243.0	171.7	111.71

with no powder added	individuals	10					
	Min.		376	175	123	69	
	Max.		634	491	324	365	
	F1 generation fertility index		48.5	30.4	24.3	17.2	

The 2nd test was a repetition of the 1st one; to start the breeding of *Sitophilus oryzae* F1 generation from the 1st test was applied. A sequence of series and powder doses were like in the 1st test. The mean number of descendent individuals (F2) in the series with the powder added was much lower than in the control test and in the 1st test and it amounted to 8.1 individuals in the test with the highest powder dose to 208.4 at the lowest dose. In the control test 485.8 leaf beetles were obtained. The significance of differences between the number of the *Sitophilus oryzae* was defined statistically.

In the 3rd test, the descendant leaf beetles from the 1st test were bred in subsequent series with no powder added. The fertility index in all the three series was much lower than in the control test and similarly to the 2nd test, it decreased with the increase in the powder dose. However it was higher than in the 2nd test.

The analysis and comparison of the results obtained in the three tests shows that the *Foeniculum vulgare* fruit powder added to wheat lowered the fertility of the *Sitophilus oryzae*. From the data obtained in the 3rd test one can conclude that the powder not only directly limited the fertility of *Sitophilus oryzae* (the 1st and 2nd tests) but also had some consequent effect on the F2 gene-ration when the powder was no longer used in the breeding (the 3rd test).

## DISCUSSION

The coverage on the influence of fruit powders on storage pests has been inconsiderable, with the data provided being frequently contradictory [1]. It has been suggested that the powders obtained from plant dry materials can be toxic and act as a deterrent. There is not much coverage on the influence of fruit powders on *Sitophilus oryzae* fertility and development available in easily accessible literature. Sharaby [9] observes that powdered pear (*Psidium guajawa*) and eucalyptus (*Eucalyptus globulus*) leaves limited the development of *Sitophilus oryzae*. The initial results of research conducted by Błażejewska and Cieślińska [2] show that also *Foeniculum vulgare* fruit powder can have unfavourable effect on the development of *Sitophilus oryzae*, which was confirmed in the present research. Jacobson [5], Ignatowicz and Wesółowska [3] claim that *Foeniculum vulgare* can act as a deterrent due to its ethereal oils. One can conclude that in our experiment it was also true with *Foeniculum vulgare* dried fruit powder containing ethereal oils. It can be suggested, as Nawrot and Winiecki [7] observe, that the powder tested could have influenced wheat grain cuticula properties, lowering the number of *Sitophilus oryzae* individuals. It seems that both, ethereal oils and cuticula properties, can be significant here.

## CONCLUSIONS

1. The *Foeniculum vulgare* fruit powder applied in the tests did not influence *Sitophilus oryzae* mortality.
2. The lowest powder dose (0.626 g) slightly stimulated fertility of leaf beetles.
3. Higher powder doses (1.25 i 2.5 g) lowered *Sitophilus oryzae* fertility considerably.
4. The results of the 3rd test showed that *Foeniculum vulgare* fruit powder not only directly limited the fertility of *Sitophilus oryzae*, but also had some consequent effect on F2 genera-tion.

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Aleksandra Błażejewska, Krystyna Wyrostkiewicz  
Chair of Entomology,  
University of Technology and Agriculture  
20 Kordeckiego St., 85-225 Bydgoszcz, Poland  
tel. (+48 52) 3790365  
e-mail: [ento@adm.atr.bydgoszcz.pl](mailto:ento@adm.atr.bydgoszcz.pl)

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