

ESTIMATION OF ACTIVITY OF POWDERED FRUITS OF COMMON FENNEL  
(*FOENICULUM CAPILLACEUM* GILIB) ON THE FECUNDITY OF  
*SITOPHILUS ORYZAE* L.

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**Abstract:** The influence of powdered fruits of *Foeniculum capillaceum* Gilib. on the fecundity of *Sitophilus oryzae* was examined. The powder was added in paper bags to the rearing of the insects to prevent a direct contact. The significant reduction of the fecundity of females was recorded. The sequent effect of activity of the powder was also observed. It resulted in the decrease of the fecundity of offspring generation – F2 reared on wheat grains without the powder.

**Key words:** *Sitophilus oryzae*, *Foeniculum capillaceum*

## I. INTRODUCTION

The storage pests are a serious problem in the food production process due to their harmfulness. Using different methods can reduce the losses they caused. Chemical control can be a risk as there is always the possibility to contaminate the storage food. Insecticides used for stored product pest control are not entirely effective in controlling the insects, which develop in cereal grains. The alternative methods to fight those pests are searched for. There are many researches being conducted throughout the world to establish the new plant protective products based on biological active substances that are natural compounds of plants. Some of them acting as insecticides or deterrents show an activity in reducing the fecundity of insects. It seems unlikely that they will become the only tools used in controlling insects. However, they can reduce the usage of chemical plant protection products.

The main goal of undertaken studies was to examine the influence of powdered fruits of *Foeniculum capillaceum* Gilib. on the fecundity of *Sitophilus oryzae*. The selection of common fennel's fruits referred to the results from the previous research (Błazejewska and Cieślińska 1996; Błazejewska and Wprostkiewicz 1998) when the powder from those fruits was added directly to wheat. The direct activity (F1) and the sequent effect (F2) were investigated.

## II. MATERIALS AND METHODS

*Sitophilus oryzae* was the objective of the studies. The powder was obtained by grounding dry fruits of *Foeniculum capillaceum* Gilib. and added in paper bags to the rearing of the insects to prevent a direct touch. The rearing was maintained in glass flasks on consumption wheat grains in laboratory conditions at the temperature of 25°C and the relative humidity 70–80%.

Two experiments were set up and each of them contained 3 series. In the first experiment the powder was added at the doses of 0.625 g (I series), 1.25 g (II series), and 2.5 g (III series). To study the sequent effect of the powder activity the second experiment was set up without the powder. The beetles collected during the first experiment were used in the second experiment. The beetles from series I (F1) became Ia series (F2), from II series – IIa and from III series – IIIa. There were 10 replications in each series. One glass flask stayed for one replication.

The rearing was set up as follows:

- 10 males and females at age 2–5 days were put into flasks filled with 100 g of wheat grains;
- each flask was tightly covered with a mill gauze;
- 20 days after the establishment of rearing all beetles were removed;
- after first individuals of offspring generation emerged the rearing was checked every other day, the new leaf beetles were counted and removed.

The checking and counting was performed twice a week as long as new individuals were emerging.

The obtained data was analyzed statistically. The means were verified with the Tuckey test. Besides, the fecundity index was defined for each series (the number of individuals from the offspring generation divided by the number of females of the parental generation).

## III. RESULTS

The fecundity index of *Sitophilus oryzae* was the highest in the control series of the first experiment (Tab. 1). It decreased in the series with the powder added and amounted to 21.4 in the series with the highest dose of the powder.

The statistical analysis revealed the significant differences between the control and all series with powdered common fennel fruits. There were no significant differences only between the series with the powder added at the dose at 1.25 g and 2.5 g.

In the second experiment the beetles collected during the first experiment were used and there was no powder added. The sequence of the series was the same as in the first experiment. The mean number of individuals of F2 generation was lower in all series than in the control. The fecundity index was on the similar level. The least beetles of F2 generation emerged in the third series that contained the individuals originating from the series with the highest applied dose of powder. The fecundity index was 8.1.

Table 1

**The influence of powdered fruits of *Foeniculum capillaceum* Gilib. on the fecundity of *Sitophilus oryzae***

Experiment	Observations	Number of samples	Control	Dose of powder in g			NIR
				0.625	1.25	2.5	
I with powder	Mean number of individuals from F1 generation	10	603.3	420.7	235.8	213.9	88.7
	Fecundity index		60.3	42.1	23.6	21.4	
II without powder	Mean number of individuals from F2 generation	10	535.5	484.6	380.0	80.7	135.9
	Fecundity index		53.5	48.4	38.0	8.1	

The statistical analysis of the mean number of F2 individuals showed the significant differences between the control and the second and the third series. Also the significant differences were noted between the series I and II and III. Insignificant differences were recorded for the I series. In this rearing the *Sitophilus oryzae* originated from the series with the lowest powdery dose.

No beetles died of starvation during the time of conducting both experiments.

## IV. DISCUSSION

The conducted investigations have showed that the supplement of powdered fruits provided in paper bags into the rearing of *Sitophilus oryzae* decreases the fecundity of insects. Błażejewska and Cieślińska (1996) and Błażejewska and Wyrastkiewicz (1988) obtained similar results. Also the sequences effect of applying the powder into the rearing was observed. The fecundity of offspring generation F2 reared on the wheat grains without powder was reduced.

There is still lack of knowledge concerning the influence of plant powder on the development and the fecundity of *Sitophilus oryzae* is insufficient. The behavior and the reproduction processes of *Sitophilus oryzae* beetles can be affected either by one component or the complex of biological active substances present in plant material. The common fennels' fruits are a good source of aromatic oil containing anethol, pinene and limonen, and coumarin derivatives and flavonoids. Ożarowski and Jaroniewski (1987) and Banasik and Ignatowicz as well (1995) suggest that powders obtained from dried materials of various plants can be toxic or act as repellents. Sharaby (1989) has documented that dried leaves of common guava and blue gum limit the development of *Sitophilus oryzae*. Powder and plant oils can affect cuticle features of wheat grains. Putting the plant powder on the insect's body can also result in its dehydration. This factor can play an important role in reducing the density of grain colonization by this species while the pest comes into a direct contact (Nawrot and Winiecki 1994). Since in the carried out experiments the powder was applied

in the paper bags one can conclude that the beetles responded to the ethereal oils. The powder from dry fruits of common fennel can also act as the deterrent due to its ethereal oils contents (Ignatowicz and Wesołowska 1994; Jacobson 1975).

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#### VI. POLISH SUMMARY

##### OCENA DZIAŁANIA PROSZKU Z OWOCÓW KOPRU WŁOSKIEGO (*FOENICULUM CAPILLACEUM* GILIB.) NA PŁODNOŚĆ WOŁKA RYŻOWEGO (*SITOPHILUS ORYZAE* L.)

Celem badań było poznanie wpływu proszku z owoców kopru włoskiego na płodność wołka ryżowego. Proszek dodawano do hodowli w papierowych osłonach, żeby wyeliminować bezpośrednie stykanie się z nim chrząszczy. Prześledzono działanie bezpośrednie (F1) i następcze (F2) proszku. Hodowlę prowadzono na ziarnie pszenicy konsumpcyjnej w kolbkach szklanych w klimatyzowanym laboratorium w temperaturze 25°C i wilgotności 70–80%. W wyniku przeprowadzonych testów stwierdzono, że dodatek suszu z owoców kopru włoskiego w papierowych osłonach do hodowli wołka ryżowego powodował istotne obniżenie płodności szkodnika. Stwierdzono także następczy wpływ suszu polegający na ograniczeniu płodności pokolenia potomnego – F2, hodowanego na ziarnie pszenicy bez dodatku proszku roślinnego.