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POTATO BEETLE (*LEPTINOTARSA DECEMLINEATA* SAY) AS A BIOINDICATOR OF SOIL CONTAMINATED BY HERBICIDES

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Abstract: Soil, the main element of natural environment is constantly contaminated and degraded by various man's activities. Big industrial factories, which emit to the atmosphere excessive quantities of harmful solid, liquid and gaseous substances, are the main cause of this phenomenon. Improper usage of fertilisers and chemical plant protection agents effects the soil in a lesser degree, but it is still unfavourable. The aim of this research was to use potato beetle larva in stage L_4 as a soil bioindicator from the plantations of spring wheat, potatoes, and corn which were treated with herbicides. The obtained results did not show any negative effect of herbicides used on potato beetle larva growing in the soil.

Key words: potato beetle larva, soil, herbicides

I. INTRODUCTION

Apart from atmospheric air and water, soil is the main element of natural environment which is systematically polluted and damaged by various man's activities. In agricultural production, its fertility has the particular importance, yet every, even small level of contamination of soil by industrial emissions decreases its quality. This remark may concern improper usage of fertilisers and chemical plant protection agents, however in a lesser degree. Soil contamination would result not only in decreasing its fertility but, what is more important, in decreasing biological quality of crops. The contaminated soil negatively affects the development of flora and fauna of the soil as well as the organisms whose specific development stage takes place in soil. Potato beetle belongs to those organisms. Several years of studies on the influence of soil contaminated by sulphur compounds showed that it is a good bioindicator of contaminated soils by industrial emissions (Przybylski 1999). Research on the influence of chemical plant protection agents on beneficial fauna of cultivated fields was carried out by Lipa and Trojanowski (1977). Laboratory experiments on ecotoxicology of plant protection agents were done, using among others earth worms – *Eisenia foetida*, by Łakota (1993), and Kostecka (1999).

The aim of this research carried out in 1997 was to answer the question whether the herbicide residues in soil after chemical treatment have the negative impact on the larva of potato beetle still existing in the soil.

II. MATERIALS AND METHODS

Potato beetle larvae in stage L_4 descending to soil after pupation were the bioindicator of the soil contaminated by herbicides after treatment. The subjects of the examination were the soil samples collected from the following trial grounds on the third day after chemical treatment:

1. Spring wheat – Lontrel 300 SL, biologically active substance – chlopyralid in dose 0.3 l/ha + Starane 250 EC, biologically active substance – fluroksypyr in dose 0.5 l/ha.
2. Potatoes – Afalon 50 WP, biologically active substance – linuron in dose 1.0 kg/ha + Command 480 EC, biologically active substance – chlomazon in dose 0.2 l/ha.
3. Corn – Azoprim 50 WP, biologically active substance – atrazyna in dose 3.0 kg/ha.

The date of the chemical treatment was in accordance with the plant protection recommendations issued by Institute of Plant Protection in Poznań for years 1996–1997.

The subjects prepared for examinations were in trial grounds of Agriculture Counselling Centre in Boguchwała near Rzeszów. The soil samples from the given plantations were collected on the third day after chemical treatment on the given crop. Due to the time difference between the treatment date and the occurrence of potato beetle larva in stage L4 and its descending to soil for pupation, the samples collected to plastic bags were stored in a freezer. This procedure was necessary because of the possibility of a progressive vanishing of herbicide content. More detailed methodology concerning the research on the impact of contaminated soil on the development of potato beetles was given in another work (Przybylski 1994).

Bioindicative examination was carried out in the laboratory of the Experimental Station of Plant Protection Institute. The flower pots half filled with the soil kept in the freezer were the subject of the examination. The flower pots with soil collected from the phenological garden of the Regional Plant Protection Inspectorate in Rzeszów were the control subjects. The experiment was done in four replications. The moment the larva occurred ready to descend to soil for pupation, they were collected from the plantation where the insect had not been chemically treated. After transporting them to the laboratory, they were weighed and placed in vases, 20 items in each, without feeding them. The beetles emerging from the soil were weighed in like manner for every control subject, getting the average larva body mass and then beetle one for each trial ground. The obtained results were statistically worked out getting the lowest significant difference between the control and experimental subjects.

III. RESULTS

The influence of contaminated soil environment on potato beetle larva results mainly in decreasing the beetle body mass after pupation of its larva what was shown after several years of study in the region of sulphur factory near Tarnobrzeg. For this reason the presented herein experiment concerned the average body mass of larva and beetles of the insect as well as the beetle number which after pupation emerged from the soil. The obtained re-

sults are presented in tables 1, 2 and 3. The average larva body mass collected from the potato plantation which were placed in flower pots of individual experimental plantations, was not significantly different from the control one (Tab. 1). After fourteen days from the descent of larva into soil, the full occurrence of potato beetle happened. The statistical calculations did not show any significant difference in the average insect body mass between the plantations containing the soil after herbicide treatment and the control ones (Tab. 3).

The number of potato beetle, which after pupation emerged from the soil, was also controlled in individual plantations.

The differences in the beetle number between the plantations were insignificant and limited to several items. Less number of beetles occurred in the pots containing the soil collected from the potato plantation and in the control one. Several items more were observed in the "spring wheat" and "corn" pots. The statistical calculations did not show any significant differences between the pots (Tab. 2).

Table 1

The average body mass of potato beetle larva in stage L_4 before placing them in vases of individual experimental plantations

Test location	Mass in grams
Control	0.157
Wheat plantation	0.151
Potato plantation	0.156
Corn plantation	0.151
LSD at P=0.05	1.122

Table 3

The average potato beetle body mass after pupation in individual experimental plantations

Test location	Mass in grams
Control	0.06
Wheat plantation	0.07
Potato plantation	0.05
Corn plantation	0.05
LSD at P=0.05	0.119

Table 2

The number of potato beetle which emerged from the soil in individual plantations after pupation

Test location	Number of beetles
Control	11
Wheat plantation	14
Potato plantation	10
Corn plantation	12
LSD at P=0.05	8.980

IV. CONCLUSION

1. The bioindicative experiments showed that the chemical weed control done according to good agricultural practice were not the danger to the proper development of potato beetle whose particular development stage took place in the soil.
2. The lack of significant difference in the average number of beetles, which occurred in individual plantations, signifies the minimal danger of the used herbicides to the pupating larva. The used herbicides, apart from Command 480 EC, belong to the IVth toxic class. The agent Command 480 EC was classified to IIIrd toxic class.

V. REFERENCES

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VI. POLISH SUMMARY

STONKA ZIEMNIACZANA (*LEPTINOTARSA DECEMLINEATA* SAY) JAKO BIOINDYKATOR GLEBY ZANIECZYSZCZONEJ HERBICYDAMI

Gleba będąca podstawowym składnikiem biocenozy jest systematycznie degradowana różnorodną działalnością człowieka. Obok zanieczyszczeń przemysłowych przyczyną tego zjawiska, choć w mniejszym stopniu, mogą być również niewłaściwie prowadzone chemiczne zabiegi zwalczania chwastów. Niniejsze badania wykonane w 1997 roku dotyczyły wykorzystania larw stonki ziemniaczanej jako bioindykatora skażonej herbicydami gleby zastosowanymi w uprawie pszenicy jarej, ziemniakach oraz kukurydzy na polach doświadczalnych Ośrodka Doradztwa Rolniczego w Boguchwale. Otrzymane wyniki badań nie wykazały negatywnego wpływu wykonanych zabiegów chwastobójczych na przepoczwarczające się w glebie larwy tego szkodnika.