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HERBICIDE AND PESTICIDE EFFECTS ON THE EARTHWORM SPECIES *EISENIA FOETIDA* (SAVIGNY, 1826) (OLIGOCHAETA, LUMBRICIDAE).

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Herbicides and pesticides have a crucial role in agrotechnology, but can adversely affect beneficial soil organisms and thereby contribute to environmental concerns. This necessitates permanent monitoring of their use and effects on the growth and development of representatives of the soil macro and micro flora and fauna, particularly earthworms (Oligochaeta, Lummbricidae). Earthworms are highly susceptible to changes of ecological factors, particularly those intrinsic to the soil, and earthworm behavior can therefore reflect soil contamination. It is known that earthworms reflect changes taking place in the soil, particularly changes of soil physical, chemical, and biological properties, as well as changes in the water-air and thermal regimes.

Studies similar to the present one were conducted previously by L a n n et al., (1962), S t r i n g e r and W r i g h t (1973), S t e n e r s e n (1973), H a q u e and E b i n g (1983), H e i m b a c h (1984), S t o j a n o v i ć et al. (1993), K a r a m a n et al., (1995), O g n j a n o v i ć et al. (1996).

The experiment was conducted under laboratory conditions. Glass containers measuring 25x30x40 cm were used. The earthworms developed on a medium consisting of soil with the addition of dry leaves and some organic substances intended for nutrition. Ten individuals of the species *Eisenia foetida* (Savigny, 1826) were placed in each container with a previously prepared medium. The earthworms were taken from naural ecosystems in the vicinity of Kragujevac (Central Serbia) and measured before being put in the containers. The trial was set up with three treatments in four replications:

1. Control-without use of herbicides or pesticides; 2. The herbicides Alahlor+Atrazine (C11H20ClNO2 + C8H14ClN5) in the form of the compound Laso-Atrazine used in an amount of 7 l/ha; and 3. Carbaryl insecticide (C12H11NO2) in the form of the compound Sevin G-5 used in an amount of 20 kg/ha.

All variants were regulary wetted under equal conditions. Changes in number (N) and biomass (B) of the earthworms were monitored four times throughout the experiment. The variational statistical method was employed for data processing. The results are presented in tabular form.

The behavior of *Eisenia foetida* was tested in the presence of herbicides and pesticides under laboratory conditions without taking into account other factors that are essential for agroecosystems (cropping, soil tilth, fertilization, plant protection, crop rotation, soil properties, climatic conditions, and the like).

The herbicides and pesticides decomposed after being used, and their chemical composition was altered. The process of their decomposition lasted only a few hours.

In addition to direct toxic effects, the tested substances were observed to indirectly damage the environment while undergoing degradation. It should be pointed that the residues of degraded herbicides are able to act either individually or in association with other compounds. As a result, a number of toxic compounds accumulate in the soil, water, plants, and animals. This gives rise to serious environmental concerns.

Herbicides and pesticides have become an inseparable part of modern agricultural production and technology. Unfortunately, more attention is paid to their production and use than to their adverse effects on agroecosystems, above all environmental contamination.

All available information about herbicides and pesticides cautions us to handle them with the utmost care, complying closely with adopted regulations to prevent accumulation of residues, agroecosystem imbalances, and above all environmental contamination.

It can be seen from Table 1 that the herbicides Alahlor+Atrazine (C11H20ClNO2 + C8H14ClN5) had a strong depressive effect, on the number of individuals. In addition, the herbicides used also had a strong negative impact on earthworm biomass.

As for the Carbaryl insecticide (C12H11NO2), it too had a highly pronounced depressant impact on the number and biomass of earthworms. In the course of the experiment, this insecticide underwent degradation due to regular wetting of the medium, whose moisture and temperature were maintained at 30% and 20°C, respectively. As a result, the number of individuals increased 7.5%, while their biomass declined by 3,7%. As can be seen from Table 1, highly significant statistical differences relative to the control were detected in both the number and the biomass of earthworms in the variant with Carbaryl.

The herbicides Alahlor+Atrazine (C11H20ClNO2 + C8H14ClN5) used in an amount of 7 l/ha and the Carbaryl insecticide (C12H11NO2) used in an amount of 20 kg/ha had a

Table 1. Effects of Herbicides and Pesticides on the Number (N) and Biomass (B) of Earthworms.

	Measurement I		Measurement II		Measurement III		Measurement IV		Average		%	
	Number N^0	Biomass B	Number N^0	Biomass B	Number N^0	Biomass B	Number N^0	Biomass B	Number N^0	Biomass B	Number N^0	Biomass B
Control	10.00		34.00**	6.50**	35.00**	9.50	56.00**	12.00**	33.75	8.12	337.50	80.44
Alahlor + Atrazin	10.00	42.00	10.00	3.90	9.00*	3.70*	21.00	5.40	12.50	4.32	125.00	102.86
Carbaryl	10.00	4.10	9.00*	3.40*	13.00	4.30	11.00	4.00	10.75	3.95	107.50	96.34
Average	10.00	4.30	17.70	4.60	19.00	5.80*	29.30	7.10**	19.00	5.46	190.00	126.98
%	100	95.55	52.06	70.77	54.28	61.05	52.32	59.17	56.30	67.24	56.30	70.37

	N	B
LSD :	0.05-17.050	0.05-1.325
	0.01-25.930	0.01-2.014

* statistically significant at 0.05 (positive significant difference)
** statistically significant at 0.01 (positive highly significant difference)

severe depressant impact on the number and biomass of the earthworm *Eisenia foetida*.

Compared to the control without use of herbicides and pesticides, the number and biomass of earthworms in the variants with treatment declined either significantly or highly significantly.

The obtained results suggest that this species can be used for bioindication of pollution by herbicides and pesticides applied in agrotechnology.

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