

EARTHWORMS (*LUMBRICIDAE*) - AN IMPORTANT ROLE IN THE SOIL FORMATION

Olesea COJOCARU¹, Rodica MELNIC¹

e-mail: o.cojocaru@uasm.md

Abstract

The Lumbricidae investigations were performed in the village of Chetrosu. The galleries that the *Lumbricidae* makes in the soil allow his venting and roots breathing the micro-fauna composed of other worms and insects, oxidation reactions of microorganisms in the soil and by calcium carbonate which eliminates via faeces and helps ensure microgranular structure of the soil and in the neutralization pH variations. The factor that determines the productivity and diversity of soil biota is fertility, the correlation coefficient being 0.82 to 0.99. Thus the number of invertebrates varies from 110-135 ex/m² subtypes chernozems north of Republic 42-64 to ex/m² in the South. The number of the fungi - corresponding to 53-68 thousand/g of soil up to 15-22 thousand/g of soil. In the regions with very low temperatures, they are missing because for their activities optimum temperature is between + 6°C and 14°C. So they are where temperatures are moderate, especially in the hilly areas, lowland and plains. Experiences made on terrestrials *Lumbricidae*s shows that an individual consumes an average of 80 mg dried leaves wet weight per gram and by day, which returns annually on about 2,000 kg per hectare. In the soil and through galleries, deep I can therefore accumulate rather high amounts of minerals from 1 hectare during 1 year so it can work at depths over 60 kg of Na, 30 kg of phosphorus, 5 kg of K, 70 kg of Ca. As a result of long exploitation of soils the quantity and the biota of biomass was reduced by 2-3 times. Increased share of species of that causes degradation of humus. Their activity has increased to 7.8 to 15.9 mln/g of soil and saprofages biomass among invertebrates decreased to 17.2 to 6.1 g/cm². And according to research invertebrate diversity index, decreases to 0.582, and *Lumbricidae* family composition does not attest only 5 species compared to 9 species by 6 years ago.

Key words: *Lumbricidae*, the soil, the village of Chetrosu, Republic of Moldova

Motto: *"We should love the earth which we explore every day .., for the future of our grandchildren ..."*

Chetrosu village is a locality in the district of Anenii Noi located at latitude 46.9163 and 29.0436 longitudes and altitude of 51 meters above sea level. This village is in city administration of Anenii Noi. Direct distance till the town of Anenii Noi is 20 km and direct distance till the town Chisinau is 22 km.

The soil is one of the components of the environment, which is particularly important in the existence of terrestrial life, especially in the development of human society. The environment consists of a series of natural components, such as air, water, vegetation and fauna, topography, lithology and the soil that carried through the terrestrial ecosystem properties (Florea N., 2003).

The soil is simultaneously a reservoir of energy; it accumulates chemical energy in the form of humus, humus resulting from the processing of organic substances formed by plants by converting solar energy during photosynthesis. This chemical

energy can be released through the mineralization being used by living creatures.

Soil is an important natural resource, its key role is to participate in biomass production and decomposition of organic remains embedded in it. In this way a continuous exchange of substances and energy; leading to a continuous recycling of nutrients. The soil is therefore a renewable resource also because of Lumbricides leading to its formation (Andriuca V. *et al*, 2011; Florea N., 2003).

Soil is a wealth of all humanity, and the rational use and protection of objectives are requirements that must be applied by every inhabitant of Earth.

A major problem consists in soil induced changes in work methods quantitatively and qualitatively affects populations of creatures by their numerical reduction by changing their diversity and activity.

In their turn populations of soil creatures show a great influence on the physical and chemical conditions. Organisms larger as

¹ State Agrarian University of Moldova, Chisinau, Republic of Moldova

Lumbricidae through their drill soil produce changes in internal morphology of the soil by creating pores wide, with particularly important role in processes of movement of water and air, and in the development of the root system of plants. At the same time by moving them into the soil they swallow considerable amounts of soil that remove it in a state of advanced humification, and a mixture of mineral and organic fine particles united in microaggregate natural structural high quality called coprolite. Multiplication and their movement in the soil are conditioned by the need to oxygen, water and food (Chapin F. *et al*, 1996; Cerbari V., 2010).

The study of microorganisms in the soil in different directions - the biological, the ecological, the agricultural of the soil, attached to so much importance that the issue of this organisms has now developed into one of the independent and important problems. In the Republic of Moldova for the first time a systematic study of the existence of microorganisms and their importance (*Lumbricidae*) was started in 1960 in the laboratory of soil chemistry, of Pedology department headed by Krupenikov I.A. The need to study the microorganisms (*Lumbricidae*) in soils and grounds of the republic pointed Dimo N.A., more in 1948 in the "The soil science in Moldova and its main task". Later these issues have joined, and other scientific institutions of the republic: State Agrarian University; State University of Moldova; Institute of Animal Science and others. Each institution conducted a study on this issue according to its profile of work (Krupenikov I. and Boincean B., 2004; Krupenikov I., 2008).

For 50 years the use of arable soil humus content has decreased by an average of 20-25% of its initial level. Annual losses as a result of mineralization processes comprise 0.01-0.02%. During this period there was a decrease in the number saprophages and seed biomass. *Lumbricidae* by 25-35%. If in 1960 in soils agrotocenozov been identified 9 species of the family *Lumbricidae* (Prohina N. *et al*, 1972; Striganova B., 1968), it is now - no more than five species. Among them dominant positions in the structure of the faunal assemblage occupy only 2 - *Apporectodea roseus* and *Lumbricus terrestris*.

MATERIAL AND METHOD

The most important soil invertebrates are earthworms. They belong to the family *Lumbricidae* and depending on the habitat in which they live.

Earthworms (the Latin name *Lumbricidae*) have an important role in the formation of soil structure. The galleries that it digs into the ground allow venting his breath root of microfauna

consisting of other worms and insects, the oxidation reactions of microorganisms in the soil and by calcium carbonate which eliminates via faeces and helps ensure structure microgranular of the soil and neutralize the pH variations (Andriuca V. *et al*, 2011; Chapin F. *et al*, 1996).

Research in the field were made on 25 March 2015 and that by March 28, 2016 experimental lot of the village of Chetrosu. As a research object has been selected the village of Chetrosu, Anenii Noi district. Existing 7 crop rotation scheme on experimental lot is as follows (figure 1):

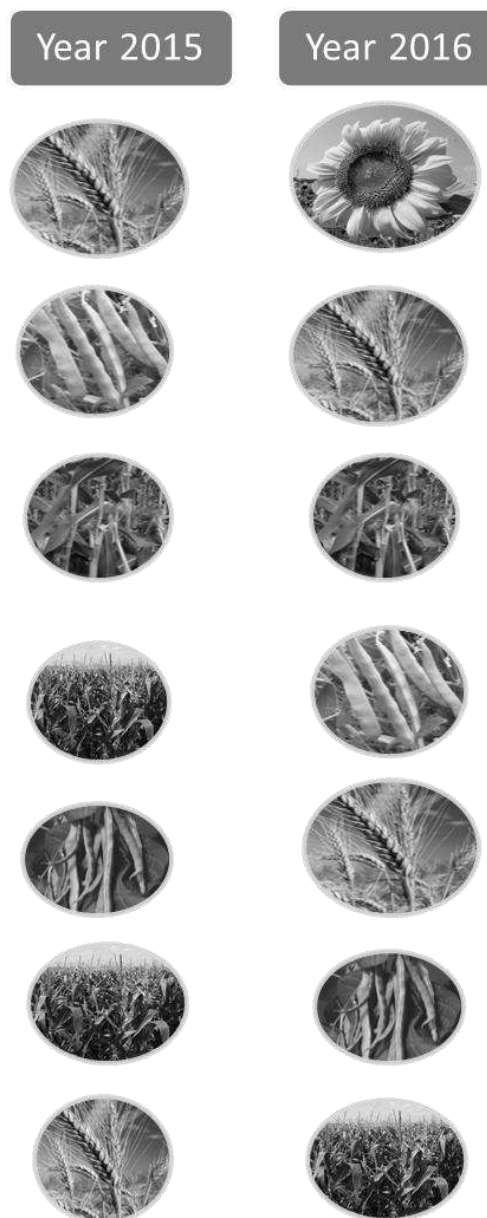


Figure 1 Crop rotation scheme on the experimental lot of the Chetrosu village

The extraction of *Lumbricidae* from experimental lot was carried out by the direct method. In the field, the experimental area was chosen by a characteristic sector for proposed version for examination (scoreless in crops, density and normal plant development), on the field sowing

with sunflower in 2016 (wheat in 2015, *figure 1*). It measured one meter square (1x1 m) in four repetitions. Soil surface was cleaned of debris plant and was produced *Lumbricidae* unearthed, layer after layer, at each 10 cm. The soil removed was placed on a polyethylene pellicle, crumbled by hand and extracted earthworms put then in special containers prepared in which grass was moistened with water, after which the ship was covered with a lid with holes that be enough oxygen for *Lumbricidae* respiration.

After extracting earthworms, they were weighed and were determined by each variant number and depth, specifying and color. In the laboratory has been made further investigations, assessing the species and age of each copy (Andriuca V. *et al*, 2011).

It was found that the scientific activity of earthworm's bioedafical useful can be summarized as follows:

- they favor the formation and stabilization of glomerular structure formation of the soil, aeration and water circulation better;
- they decay during of feeding, mix and combine with inorganic components of humic substances in the soil and thus contribute to increased adsorption capacity of the soil, so important for higher plants by increasing the so-called humic clay complex;
- are an important component of soil food chains;
- dead animals enrich the soil with valuable compounds, especially proteins rich in nitrogen and this activity they favor the biological activity and therefore fertility and soil formation.

RESULTS AND DISCUSSIONS

Influence of earthworm activity on the soil peculiarities can be immense, because they are a good indicator of fertility and his formation.

According to our results, obtained in the investigation into the crop rotation soils,

earthworm's amount is very low and this shows a consequence and also an indicator not only of dehumification, and soil pollution.

The number of earthworms by sunflower crop rotation after wheat varies from hundreds to dozens per ha, reaching their biomass values of 1 – 1.5 kg/ha. In spite of their small number of spread, they transform, mix and loosen the soil, often coming down to 2 m deep, sometimes to groundwater.

Earthworms transform annually to 30 kg of soil. So in such a rhythm within 2-3 decades whole layer of soil is passed through the earthworm intestines, where it mixes with crop residues and animal manure, forming clay-humic aggregates, agriculture high-value (Blagodatsky S. *et al*, 1987; Prohina N. *et al*, 1972; Senicovscaia I. *et al*, 2010).

The presence the earthworm in soil is criterion of health and soil fertility. The farther the earthworm they are numerous, the soil can be considered more fertile.

It has been demonstrated according to research that if the a population of 100 ex./m² and mass of 50 g/m² may carry in the time of 210 days during summer approx. 1000 m galleries, ensuring its soil porosity, aeration.

It concluded that the factor that determines the productivity and diversity of biota of crop rotation is fertility, and correlation coefficient of from 0.82 to 0.99 being. Thus the number of invertebrates by experimental lot in the village Chetrosul, according to the received results, ranges from 48-65 ex/m² on no-till soils and up to 36-48 ex/m² for every year worked soil.

As a result of long exploitation of soils and biomass biota amount was decreased by 2-3 times (*table 1*) (Cerbari V., 2010; Senicovscaia I. *et al*. 2010).

Table 1

Status of chernozems biota in the process of their exploitation in the Republic of Moldova in period 2008-2015 (Cerbari V.V., 2010)

Subtype of chernozem	Year	Humus %	The microorganisms			The invertebrates	
			amonificatores	actinomycetes	the fungus	the total number	Biomass family Lumbricidae
			mln./g of soil		thousands/ g of soil	ex/m ²	g/m ²
Typical	2008	5.18	5.0	3.4	39.0	227.0	25.0
	2015	4.00	4.3	2.2	31.0	135.0	17.1
Lachate	2008	4.24	3.6	1.8	50.0	88.0	13.0
	2015	3.30	3.1	1.4	25.0	76.0	8.3
Ordinary	2008	4.30	5.5	5.6	60.0	72.0	10.0
	2015	3.30	3.3	2.5	15.0	62.0	6.7
Carbonate	2008	3.70	3.2	4.3	14.0	47.0	8.0
	2015	2.92	2.2	2.0	30.0	44.0	5.8

Table 2

The average state of Lumbricides by experimental lot on carbonate chernozems in the period 2015-2016

The variants of experience field crop rotation	Number of Lumbricides	Mass of earthworms. g	Mass of a copy. g
1. Wheat - Sunflower	46	8.28	0.18
2. Beans - Wheat	53	11.66	0.22
3. Monoculture maize - Monoculture maize	48	9.12	0.19
4. Mais - Beans	55	12.65	0.23

During this period approximately 100 ex./m² transformed into coprolite (the petrified excrement containing phosphate natural calcium. used as fertilizer in agriculture) 10.5 kg/m² and 1 hectare - 105 t/ha of organic humic substances (Blagodatsky S. *et al.* 1987; Prohina N. *et al.* 1972).

According to other researchers, the territory of republic of Moldova populations of microorganisms in the top 10 cm of the soil is lower in conventional tillage systems. compared to those where direct seeding is practiced. Also according to the data in Table 1.1 under the action of anthropogenic soil biota in the years 2008-2015 substantially degraded (Cerbari V., 2010). They intensified microbiological processes of mineralization of humus, saprofares activity decreased 4-10 times; the coefficient of humus accumulation was reduced from 1.7 to 3.3 times. Substantially increased number of toxic species. Decreases sharply fixation biological of atmospheric nitrogen in the soils. Based on the obtained results in the Table 1.2 notes that the crop rotation number 2 and 4. the amount of *Lumbricidae* is bigger than the other.

The importance of *Lumbricides* in the soils as a process of pedogenesis and maintaining fertility and soil formation has been recognized for a long time, but support for scientific research on the relationship between soil organisms and physico-chemical processes that take place at this level were, until recently, extremely low. We consider the soil as a living and dynamic system in which most physical and chemical processes are mediated of *Lumbricides* (Andriuca V. *et al.* 2011; Florea N., 2003; Striganova B.R., 1968).

CONCLUSIONS

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According to our results obtained in the investigation into the crop rotation soils, earthworm's amount is very low and this shows a consequence and also an indicator not only of dehumification, and soil pollution.

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