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Species Composition Of The Earthworms In The Central Ciscaucasia.

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ABSTRACT

The Central Ciscaucasia is characterized by a high diversity and complexity of the reliefs, the presence of several soil-climatic zones. Typical podzolized and leached chernozem, chestnut and brown forest soils can be marked here. The diversity of soil conditions has a significant impact on the distribution of earthworms in different natural landscapes. Earthworms are actively involved in the grinding and transformation of organic residues, they play a key role in the soil circulation of nutrients, formation of humus and soil homeostasis [5,6].
Keywords: earthworms, distribution, species composition, seasonal population dynamics.

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INTRODUCTION

Earthworms belong to the type Annelida, the class Oligochaeta, the family Lumbricida, they include more than 200 species [5]. The realization of soil-zoological researches allows us to establish the species composition of soil invertebrates, the seasonal dynamics of their populations, and determine their average numbers in various biotopes. These data can serve as a criterion for assessing the anthropogenic impact on the soil, and form the basis of models for predicting changes in soil fertility; also it can be used in bioindication. The obtained data can be used in the planning of environmental activities in nature reserves and national parks.

Quantitative records of soil invertebrates, in particular earthworms, were conducted on test plots, on the maximum possible number of sites belonging to the selected type of soil and with the maximum possible variety of climatic and geographical features.

MATERIALS AND METHODS

Researches of the species composition and seasonal dynamics of earthworms were conducted in the period from 2011 to 2016. A detailed analysis of the species composition of earthworms of each sample area was performed; patterns of distribution of invertebrates by soil type, depth of stay were established; the percentage ratio of different groups of earthworms was calculated. Rare and dominant species were established. At least 6 experimental plots with an area of 10 square meters were selected to study the species composition of earthworms in each soil zone. In accordance with the soil type of the experimental plots were laid in the following manner. Typical and leached chernozem is located in Mikhailovsk city area (3 plots), in the village of Tatarka (3 plots), in the Predgornii region: in the vicinity of the city of Essentuki (3 plots), in the city of Zheleznovodsk (3 plots). Chestnut chernozem is located in the area of the city Izobilnii (4 plots), to the North from the city of Novoaleks and rovsk (4 plots), near the city of Ipatovo (2 plots). Gray forest soil is located in the Russian forest in the South-West of Stavropol (4 plots), in the Predgornii region: near the cities of Kislovodsk (5 plots) and Zheleznovodsk (3 plots). Chernozem-like mountain-meadow soil is located in the vicinity of the city of Kislovodsk (6 plots). Alluvial soil of river floodplains is located in the city of Blagodarnii (2 plots), in the city of Georgievsk (4 plots), in the city of Svetlograd (4 plots), in the village Kursk (3 plots). 50 to 50 cm tested plots were laid in an amount of not less than 9 pieces at the same distance from each other in the corners, in the center and at the edges of each of the sites. The analysis was carried out manually, layer by layer from a depth of 0 – 10 cm, 10 – 20 cm, 20 - 30 cm and 30 - 50 cm. All found earthworms were fixed in a formalin solution. Screening of soil samples for the determination of physico-chemical properties of the soil was conducted simultaneously with the selection of worms.

Selection, packaging, labeling and storage of soil samples were carried out in accordance with GOST 17.4.4.02-84 and GOST 17.4.3.01. Soil moisture (by Turina method in CINAO (Central Institute of agrochemical service of agriculture) modification) was determined according to GOST 28268-89. The content of organic matter was determined according to GOST 26213-91 [1-4]. The definition of species belonging of earthworms was conducted by the determinant of T.S. Perel [5]. Methods of correlation analysis were used for statistical processing of the results.

RESULTS AND DISCUSSION

15 species of earthworms belonging to 8 genera out of 10 described on the territory of the Russian Federation genera were found on 7 main types of soils of the Central Ciscaucasia. The species composition of earthworms for different types of chernozem, chestnut, forest, mountain-meadow and alluvial soil of river floodplains was studied. The results of the study of species composition, seasonal dynamics and average number of earthworms in different types of soils of the Central Ciscaucasia and statistical processing of the data are presented in Tables 1 and 2.

Table 1: Species composition, seasonal dynamics and average number of earthworms in chernozem and grey forest soil, instance per sq. m. (inst./sq.m.)

Type of earth worms	Typical and leached chernozem			Chestnut chernozem			Grey forest soils		
	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn
Eiseniella tetraedra	-	-	-	-	-	-	0,1	-	0,1
Eisenia foetida	-	-	-	0,1	0,1	0,1	0,1	0,1	0,1
Dendrobaena schmidti	3,6	-	4,4	0,8	0,4	1,1	4,4	3,1	5,2
Dendrobaena mariupoliensis	2,7	0,8	3,7	0,4	0,2	0,4	0,5	0,1	1,1
Nicodrilus roseus	9	4,1	11,7	22,6	14,8	31,6	8,1	5,1	9,1
Nicodrilus jassyensis	-	-	0,1	-	-	-	-	-	0,1
Octolasion lacteum	9,6	5,1	11,8	7,4	6,6	12,1	11,4	9,7	15,2
Octolasion transpadanum	1,7	0,2	2,9	-	-	0,1	-	-	-
Lumbricus terrestris	4,8	0,6	7,2	-	-	0,1	4,1	1,1	4,9
Lumbricus rubellus	12,3	7,1	21,7	7,8	2,9	14,6	21,3	19,1	32,1
Subtotal	43,7	17,9	63,5	39,1	25	60,1	39,6	39,3	67,9

Table 2: Species composition, seasonal dynamics and average number of earthworms in chestnut, mountain-meadow and alluvial soils, inst./sq.m

Type of earthworms	Chestnut soil			Chernozem-like mountain-meadow soil			Alluvial soil of river floodplains		
	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn
Eiseniella tetraedra				0,1	-	0,3	-	-	-
Eisenia foetida	0,1	0,1	0,1	0,1	0,1	0,1	-	-	0,3
Eisenia nordenskioldi	-	-	-	-	-	-	2,2	3,5	3,1
Dendrobaena schmidti	-	-	-	3,8	2,2	4,6	3,1	2,4	3,8
Dendrobaena schmidti f. surbiensis	0,5	0,1	0,6	-	-	-	-	-	-
Dendrobaena mariupoliensis	-	-	-	0,2	0,1	0,6	2,1	0,8	6,1
Nicodrilus roseus	9,2	3,6	12,4	6,1	2,4	6,9	3,1	2,2	5,2
Nicodrilus caliginosus f. typica	1,1	0,1	1,4	-	-	-	-	-	-
Nicodrilus caliginosus f. trapezoides	-	-	-	-	-	-	11,3	2,8	17,6
Octolasion lacteum	0,5	-	0,7	10,1	4,4	12,2	12,1	7,4	14,9
Lumbricus terrestris	0,1	-	0,1	0,1	-	0,1	4,4	2,7	5,1
Lumbricus rubellus	-	-	-	17,8	6,4	23,1	8,8	6,4	9,2
Subtotal	11,5	3,9	15,3	38,3	15,6	48	47,1	28,2	65,3

Gray forest soil is favorable habitat for earthworms. Precisely in it is found the highest density (inst./sq.m.) of lubrication and met all life forms such as soil, soil litter and litter types. This soil is typical for broad-leaved forests and rich in humus, is characterized by a granular structure, good aeration and low acidity, as well as an abundance of un decomposed plant residues. Soil-litter worms, which include rubellus, are dominated in it. This species mainly lives in the upper layers of the soil, at a depth of 20 cm, especially in areas with optimal moisture for earthworms-from 60 to 75%.The high number of this type of earthworm is typical for all types of soil with a high content of organic substances. The L. terrestris species was found at a depth of 20 to 50 cm, in relatively dry areas with soil moisture of about 45 - 50% and organic matter content of at least 4.6 % (in terms of dry matter). This type of contact is always found in areas of grazing cattle in the vicinity of

the middens. In this soil is revealed a sufficiently high number of *O. lacteum* and *N. roseus* - from 11.8 to 15.2 and 9.1 to 34.6 inst./sq.m. respectively. High faunistic similarity of earthworm complexes for chernozem and gray forest soil was noted.

In the grey soils of the Russian forest in the South-West of Stavropol and in the typical chernozem in the vicinity of the village of Tatarka, a typical worm of the Central Russian forest-steppe was found. However, its presence was not recorded in the study of the species composition of gray forest soils of the Predgornii region. Presumably, the appearance of this species is associated with accidental introduction from traditional habitats. Probably, we should expect an increase in their numbers in the Stavropol Territory as soil and climatic conditions correspond optimum for its activity.

The soil-growing species *N. roseus* has high numbers in the black chernozem. It is found on well-moist soils (at least 60%) and rich in organic matter; it is characterized by a wide range of variability - from 9.1 to 31.6 inst./sq.m. this species was the only one in the soil sample in two areas of the Predgornii region.

The chestnut soils with an average humidity of 60% and humus content of 2.6 to 3.1%, *N. roseus* is absolutely dominant. The second highest number is the earthworm *Nicodrilus caliginosus f. typica*, resistant to drying out the soil and can survive prolonged drought. These two species form the core of the soil biocenosis, and the abundance of each species seems to be determined by the abundance of precipitation during the growing season.

A weakly acid reaction in the upper layers (up to 20 cm), a slightly alkaline environment in the deeper horizons of chernozemlike mountain - meadow soil and a high organic matter content provide optimal conditions as for soil-inhabiting species *O. lacteum* and *N. roseus*, as for soil and litter species *D. schmidtii* and *L. rubellus*.

Alluvial soils of river floodplains are characterized by water logging, difficult aeration, high content of organic substances, its acidity varies from slightly acidic to neutral. Typical inhabitants of wetlands, such as *El. tetraedra*, and highly adaptable to high humidity habitats were found here. The cosmopolitan species *Nicodrilus roseus* was found everywhere in the Central Ciscaucasia. It should be noted that in the analysis areas, depending on the season from 10% in the autumn of up to 60% in spring and summer juveniles of this species were found.

CONCLUSION

The conducted researches allowed to reveal the following regularities:

1. On the territory of the Central Ciscaucasia 15 species of earthworms belonging to 8 genera were found. Zoogeographical composition is represented by such types as Caucasian, Asian, European and Mediterranean earthworms.
2. Lumbricids expressed species-specific, prevalent in different types of soils has been established. The most populated layer of earthworms soil is from 5 to 20 cm. Cosmopolitan species which you can occur everywhere on the territory of Central Ciscaucasia is *Nicodrilus roseus*.
3. The species diversity of earthworms depends on the content of organic compounds in soils, aeration conditions and humidity which close to optimal for the dominant species of earthworms.
4. A pronounced period of summer rest is observed in the seasonal dynamics of lumbricide in all types of soils. The maximum proportion of immature earthworms up to 40% of the total observed during summer dormancy. In the autumn period, the proportion of detected instances of juvenile age does not exceed 6% of the total population.
5. These patterns allow us to predict the species composition and dominant species of earthworms in each type of soil, as well as the dynamics of the number and seasonal activity of earthworms of the Central Ciscaucasus.

REFERENCES

- [1] GOST 28268-89 Soils. Methods of determination of moisture, maximum hygroscopic moisture and moisture of steady plant fading.



- [2] GOST 26213-91 Soils. Methods for determination of organic matter.
- [3] GOST 17.4.3.01-83 Nature protection. Soils. General requirements for sampling.
- [4] GOST 17.4.4.02-84 Nature protection. Soils. Methods for sampling and preparation of soil for chemical, bacteriological, helminthological analysis.
- [5] Tkatchenko M. E. General forestry. M., L.: Goslesbumizdat, 1952. 596 p.
- [6] Vsevolodova – Perel T.S. Earthworms of the fauna of Russia: the inventory and the determinant / Vsevolodova – Perel T.S. – M.: Nauka, 1997. – 102 p.