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ECOLOGICAL MONITORING OF MESOBIONTIC FAUNA IN AREAS OF INTENSITIVE AND BIOLOGICAL FARMING

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Abstract. An ecological monitoring was conducted in the year 2000 to establish the state of mesobiontic fauna in areas, subjected to pesticide pollution, and others free of any chemical treatments. Comparative studies were made on the main ecological properties – density, frequency, abundance and the Simpson diversity index. The main climatic factors in the two regions – the agricultural territories of the villages of Topolovo and Dobrostan, were also studied. A negative effect of pesticides upon the state of mesobiontic soil fauna was established.

Keywords: ecological monitoring, mesobiontic fauna, environment, climatic factors, climate changes.

AIMS AND BACKGROUND

The production of ecologically sound agricultural products is a tendency observed all over the world. It affects positively the maintenance and increase of biodiversity in agroecosystems and their natural environment. Modern agroecology uses successfully natural ecosystems as a standard for comparing the ecological processes occurring in agroecosystems. The use of chemicals is often connected with some negative effects on biodiversity and ecological properties of the populations of organisms in agricultural areas. The soil and its inhabitants are subjected to the direct effect of these substances. The use of ecological-monitoring methods enables the assessment and forecasting of the status of biocenoses, subjected to pesticide effects as well as the measures for their decrease.

A number of authors have studied ecology and the effect of pesticides on soil mesobionts and mesobiontic cenosis. J. Jglisch (1981) substantiated the use of soil arthropods as test-objects in ecotoxicological investigations. The negative effect of pesticides on soil invertebrates was reported in Refs 1-3.

The objective of the present work was to compare the main ecological properties of soil mesobiontic faunas from two regions – the one with conventional

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farming (v. Topolovo) and the other with biological farming (v. Dobrostan) with a view to establishing the effect of pesticides on mesobiontic populations and the soil fertility, respectively.

EXPERIMENTAL

The study was conducted in the spring of the year 2000. Two sites were investigated – in the villages of Topolovo and Dobrostan – meadow and pasture. The arable lands of Topolovo received periodically mineral fertilizers, while those of Dobrostan were not fertilized. Soil mesobionts were collected according to the classical methodology cited in Ref. 4. Four experimental plots of 50×50×15 cm soil were cultivated. The mesobionts were kept in 70% ethyl alcohol by the time of their taxonomic assessment. The ecological parameters density, frequency, abundance and the Simpson diversity index for each taxon were calculated. The density was expressed as number of organisms per 1 m^3 soil, the abundance – number of the taxon organisms in relation to the total number of organisms (in the tested sample), and the frequency – the abundance, expressed in percent. The Simpson diversity index was calculated after Bigon et al.[5] Agroclimatic characteristics of the tested regions were made and the peculiarities of the agroclimatic conditions in the separate years were estimated using the method of linear interpolation between three representative meteorological stations (Konstantinov et al., 1971).

RESULTS AND DISCUSSION

The status of the soil mesobiontic cenosis from the two regions is given in Table 1.

Table 1. Status of soil mesobiontic faunas in the studied regions (number)

Taxon	v. Dobrostan		v. Topolovo	
	meadow	pasture	meadow	pasture
Fam. Lumbricidae	10	22	8	7
Genus Arachnida	10	15	-	5
Genus Coleoptera-1	-	5	-	-
Class Myriapoda	8	-	4	-
Fam. Formicidae	many	many	many	many

The results obtained showed that the species compositions of the soil cenoses in both regions as a whole were comparatively reduced, a total of 5 taxa being established. Obviously, the effects of agroclimatic conditions that showed significant deviations from the climatic normal in the study year was determinant. The investigations made in this respect showed that the year 2000 was not only one of

the hottest years, but it also proved to be the year with the longest and most intensive drought of the 20th century, especially in the Thracian lowland[6]. The low soil moisture led to a vertical migration of geobionts and a low biodiversity. Nevertheless, in the region of Dobrostan, *Coleoptera* larvae were established, which were not found in the lands of Topolovo, and all taxa from Dobrostan had more individuals than those from Topolovo. Due to the higher altitude of Dobrostan, irrespective of the established general precipitation reduction in Bulgaria[7], their amount in the region was relatively higher, and the temperatures lower in comparison with those in the neighbouring climatic regions. These climatic peculiarities undoubtedly influenced the ecological parameters of the mesobiontic fauna in the studied regions.

The density, frequency and abundance of the tested soil cenoses are given in Tables 2, 3 and 4. The ecological properties reflect the higher number of individuals from each taxon, established in the samples from the meadow and the pasture of v. Dobrostan, as compared to those from the v. Topolovo.

In the pasture of the v. Dobrostan the highest density of three of the taxa was established – Lumbricidae, Arachnida, Coleoptera-1. The representatives of class Myriapoda showed also a twice higher density in the meadow of v. Dobrostan as compared to that in the meadow of v. Topolovo.

Table 2. Density of soil mesobiontic fauna in the studied regions (number/m^3)

Taxon	v. Dobrostan		v. Topolovo	
	meadow	pasture	meadow	pasture
Fam. Lumbricidae	66.6	146.6	53.33	46.66
Genus Arachnida	66.6	99.9	-	33.3
Genus Coleoptera-1	-	33.3	-	-
Class Myriapoda	53.33	-	26.66	-
Fam. Formicidae	many	many	many	many

Table 3. Abundance of soil mesobiontic fauna in the studied regions (number)

Taxon	v. Dobrostan		v. Topolovo	
	meadow	pasture	meadow	pasture
Fam. Lumbricidae	0.342	0.523	0.66	0.583
Genus Arachnida	0.342	0.357	-	0.291
Genus Coleoptera-1	-	0.119	-	-
Class Myriapoda	0.277	-	0.33	-
Fam. Formicidae	many	many	many	many

Table 4. Frequency of soil mesobiontic fauna in the studied regions (%)

Taxon	v. Dobrostan		v. Topolovo	
	meadow	pasture	meadow	pasture
Fam. Lumbricidae	34.2	52.3	66.0	58.3
Genus Arachnida	34.2	35.7	-	29.1
Genus Coleoptera-1	-	11.9	-	-
Class Myriapoda	27.7	-	33.0	-
Fam. Formicidae	high	high	high	high

In the composition of the two studied soil cenoses, the highest share was held by the representatives of fam. Lumbricidae, followed by those of genus Arachnida. The greater species diversity in the soil fauna of the sites from the v. Dobrostan was connected with the established insignificantly lower values for the frequency and abundance of the predominating taxa in the community. The Simpson diversity index showed insignificantly higher values in the region of v. Dobrostan – 1.09 for the meadow, and 1.01 for the pasture, versus 1.00 and 1.01, respectively, for the v. Topolovo.

The results obtained from the present study warranted our conclusion that the soil mesobiontic fauna in the region of v. Dobrostan had a greater taxonomic diversity and a higher density of mesobiontic populations than that of v. Topolovo. Besides to the climatic peculiarities of the region, this was probably due to the type of conventional farming which though not directly applied to the meadow and pasture, exerted as a whole a negative effect on the status of soil cenosis.

CONCLUSIONS

The species composition of soil cenosis in both regions was relatively reduced. A determinant effect for this reduction was exerted by the agrometeorological conditions in the specific year and the spatial distribution of the climate changes towards warming and drying, occurred in our country.

In the soil cenosis of the region of v. Dobrostan, where biological farming was practiced, 5 taxa of mesobiontic organisms were established, while in the region of conventional farming (the village of Topolovo) the respective number was 4.

The population density of soil mesobionts in the meadow and pasture of v. Dobrostan was higher than that in v. Topolovo.

The soil mesobiontic fauna in the region of v. Dobrostan showed a higher Simpson diversity index than that in v. Topolovo.

The practising of biological farming as a whole led to improvement of the ecological status of the mesobiontic fauna.

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