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A STUDY OF BIODIVERSITY IN AN AGRICULTURAL REGION ADJACENT TO THE PROTECTED "CHINAR DERE" SITE

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Abstract. A study was conducted on the status of biodiversity in agricultural areas, adjacent to the protection of "Chinar Dere" site, in the natural habitat of species, subjected to the impact of anthropogenic climate changes. A significant reduction of species was established in the agrophytocenosis, in comparison with the natural biocenosis as well as between two consecutive years in the same habitat, which was the first indication for the occurrence of climate changes in the studied region. A list of the taxa established was made and comparative analyses of the results were conducted.

Keywords: biological diversity, biological agriculture, environmental protection, climate changes, agrometeorological conditions.

AIMS AND BACKGROUND

The last years were characterised by a particularly strong increase of problems related to climate changes, concerning seriously the respective scientific community. The losses caused by climate anomalies amounted to thousands of human lives and billions of dollars. The climate changes, forecasted 20 years ago and rather sensible now, impact significantly all spheres of the economic life. While on a world scale the economic indices, investments, production and trade are consistently positive, more and more environment-related indices are negative. An immediate indicator for the planet health is the status of biodiversity.

This compelled many countries to give a new meaning to their economic policies. In a number of countries, intensive research was initiated on climate changes, crop adaptation and the status of genetic resources, especially in semi-arid and arid regions. Our investigations on that particularly important issue[1] established for the first time the presence of significant climate changes in Bulgaria towards heating and drying and their spatial distribution. The results obtained necessitated giving a new meaning to the status and conservation of biological diversity as a basis for our existence.

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Although Bulgaria is a relatively small in territory, it ranks among the countries with the highest biodiversity of plant and animal communities with examples for almost all main types of habitats in Europe. This, however, imposes to the greatest extent the unification of the efforts of a large number of scientists for their conservation. For the exclusive actuality and seriousness of the problem on a global and regional scale, we studied the status of the biological diversity in agricultural areas in the natural habitats of species subjected to the effect of anthropogenic climate changes.

EXPERIMENTAL

The study was conducted in the period 1999-2000 in agricultural areas, adjacent to the protection of "Chinar Dere" site on the territory of the village of Topolovo. Periodic observations were made in different seasons and in dynamics for two consecutive years under conditions of natural biocenosis (a traditionally cut meadow) and agrophytocenosis (a wheat crop), immediately adjacent to the protected site. To study phytocenoses, the methodology of Sakuchaev-Shennikov (1966) was used; the entomofauna – by basket mowing, the vertebrates – by the method of visual observations[2-3], and ornithofauna – by studying sounds and nests[4], as well. A list of the taxa established was made and the results obtained were analysed comparatively as well as the meteorological peculiarities in the years of study.

Climatic characteristics of the region were made. As main climatic factors, air temperature and precipitation amount were used, on the basis of which other agro-climatic parameters were determined. For the lack of a climate station near the region of Topolovo, the method of linear interpolation between 3 representative stations was used.

RESULTS AND DISCUSSION

The protected "Chinar Dere" site was announced on 11 November 1995 by virtue of the Law for Protected Territories in the Republic of Bulgaria, with a view to conservation of the natural sycamore (*Platanus orientalis*) habitat. The natural sycamore forest was of the suckers' type, 50-70-year old, individual trees being over 100 years of age and 17-20 m tall. The tree vegetation was presented by one association – *Platanus orientalis*. Dominating in the bush vegetation were the associations of genera Prunus and Rubus, and in the grasslands – *Trifolium* sp. and the families Geraniceae, Fabaceae, Cariophilaceae, and Poaceae.

In 1999, 46 invertebrate taxa were established, 16 of which determined by species, 19 by genus, 7 by family, and 4 by order. Dominating were the representatives of order Aranaceae, fam. Aphidoidae, fam. Formicidae, fam. Curculioni-

dae, *Calocoris* sp., *Phytococcus ulmi*, *Palomena prasina*, *Cetonia aurata*. In 2000, 40 invertebrate taxa were established, 9 of which determined by species, 17 by genus, 10 by family. There were 1 suborder, 2 orders and 1 class. Dominating were the representatives of class Gastropoda, order Aranei, suborder Cicadoidae, suborder Aphidae, fam. Formicidae, fam. Curculionidae, genus Lygaeus, *Palomena prasina*, *Calocoris* sp., *Phytococcus ulmi*, *Cetonia aurata*.

The status of the invertebrate fauna and the list of the dominating taxa, established in the natural biocenosis (a meadow) and the agro-phytocenosis (a wheat crop are given in Tables 1 and 2).

Table 1. Number and density of predominating insects in a natural biocenosis (a meadow), adjacent to the protected "Chinar Dere" site – the village of Topolovo in 1999-2000

No	Taxa	1999		2000	
		individual number	density per 1m²	individual number	density per 1m²
1	Order Opiliones	5	0.71	23	1.09
2	Order Aranei	41	5.86	70	3.33
3	*Lygus pratensis*	30	4.28		
4	*Phytococcus ulmi*	15	2.14		
5	*Calocoris* sp.	17	2.43		
6	*Palomena prasina*	19	2.71		
7	*Cetonia aurata*	15	2.14		
8	Fam. Formicidae	15	2.14	28	1.33
9	Suborder Aphidae	29	4.14	40	1.90
10	Class Gastropoda			80	3.80
11	*Isponia* sp.			65	3.09
12	*Oadipoda* sp.			72	3.43
13	Fam. Reduviidae			11	0.52
14	Fam. Pyrrhocoridae			15	0.71
15	Fam. Chrysomelidae			12	0.57
16	*Dorcadidion* sp.			14	0.66
17	Suborder Cicadoidae			35	1.66

The results obtained showed that in the natural biocenosis (a meadow) dominating were the land snails, represented generally as class Gastropoda, the spiders – a lot of species represented as suborder Araneae, the locusts of genera Isophia and Oedipoda. Representatives of families Coccinelidae, Chrysomelidae, Braconidae, and Curculionidae were also found, some of their species being "harmful" and others – "useful", but at low densities. Despite the increased frequency and duration of observations, the invertebrates established in 2000 were less than those found in the previous year, which was the first biological indicator for the climate changes occurred in the studied region. Particularly indicative in this

respect was the year 2000, which proved to be not only one of the hottest years, but also the year with the longest and most intensive drought in the 20th century, especially notable in the Thracian lowland[5]. Under such a complex of agrometeorological conditions, in the same year a locust outbreak was established.

Table 2. Number and density of predominating invertebrates in an agro-phytocenosis (a wheat crop), adjacent to the protected "Chinar Dere" site – the village of Topolovo in 1999-2000

No	Taxa	1999		2000	
		individual number	density per 1m²	individual number	density per 1m²
1	*Macrosiphum avenae*	40	5,71	32	1.52
2	Fam. Carabidae	14	2.00	23	1.09
3	*Cantharis* sp.	11	1.57	15	0.71
4	Suborder Cicadoidae	80	11.43	82	3.90
5	Order Araneae	63	9.00	75	3.57
6	*Anthomyza* sp.	5	0.71	11	0.52
7	*Aulagaster* sp.	6	0.85	16	0.76
8	*Periscelis*	8	1.14	12	0.57
9	Fam. Elateridae			18	0.85
10	Fam. Formicidae			12	0.57

Unlike the natural biocenosis, the biodiversity in the agro-phytocenosis (a wheat crop) was reduced, which was a clear evidence for the determinant role of the anthropogenic factor. Here, dominating were the representatives of wheat pests (*Oulema melanopus*). The tendency for decreasing species composition and density, established in the natural biocenosis (a meadow), was also present in the agro-phytocenosis (a wheat crop), which confirmed our conclusions about the impact of the climate changes occurred in our country, and what is most important – the role of the anthropogenic factor for the degree of their manifestation. In 1999, 22 invertebrate taxa were established in the agro-phytocenosis, including 1 to order, 1 to suborder, 2 to family, 11 to genus, and 7 to species, in contrast to 2000, where both the total invertebrate number and that by taxa were smaller, the respective figures being: a total number of 17 taxa established: 1 – to order, 1 – to suborder, 3 – to family, 7 – to genus, and 5 – to species.

Predominant in the agro-phytocenosis (a wheat crop) during the whole period of vegetation were fam. Cicadoidae, as well as the predatory insects of fam. Coccinelidae, genus Chrysopa and genus Syrphidae, which feed on leaf aphids. The smallest populations were those of genera Chrysopa and Zabra.

The protected territory and its adjacent areas are an ideal combination of different habitats, providing a very varied vertebrate fauna. Water areas provided the presence of some amphibians, the dominating species of which was *Rana*

ridibunda. The reptiles were presented by: genus Natrix natrix, *Coluber jugularis*, but dominating were *Lacerta viridis* and *Lacerta muralis*. The adjacent small dams provided the presence of a number of water-related birds, too. Predominating birds in the region are of order Passeriformes, genus Corvidae. Of the mammals, as permanent inhabitants could be pointed the genera Microtus, Mustela, Lepus, and Stelis.

CONCLUSIONS

The biodiversity studied in the natural biocenosis was greater than that in the agro-phytocenosis – an evidence for the less intervention by man.

In the agro-phytocenosis, a comparatively lower biological diversity was established, which was related to the determinant role of the anthropogenic factor and mostly to the intensive treatment of the adjacent farm lands with pesticides and mineral fertilizers.

The status of biodiversity and the density of the taxa established were directly dependent on the agrometeorological conditions in the respective year, confirming the impact of the climate changes occurred in our country towards heating and drying.

This necessitated the elaboration of special measures for control and conservation of biodiversity near the protected site, the anthropogenic factor being determinant in that.

REFERENCES

1. B. PEEV, K. KOUZMOVA: Climate Changes in the Agricultural Regions of Bulgaria. In: The II International Conference of Balkan Environmental Association on "Industrial Pollution", 19-21 November, 1999, Sofia, Bulgaria. 6 p.
2. P. ANGELOV: Anatomy, Morphology and Systematics of Invertebrates. Plovdiv, 1992. 383 p.
3. Tz. PESHEV: Vertebrate Zoology. Sofia, 1993. 573 p.
4. A. DARAKCHIEVA: Ornithology Handbook. Sofia, Nauka i izkustvo, 1988. 309 p.
5. K. KOUZMOVA: Analysis of the Drought in the Year 2001 in the Plovdiv Region for the Needs of Agriculture. In: Proc. of Academic Session "Civil Society in Action", Sofia, 2001, 219-225.

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