Comparison of Collembola communities in different habitats on some drainage area of Lake Balaton

By
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Abstract. Collembola fauna was investigated in different habitats of drainage area of Lake Balaton. Three large areas (shore of the Lake, inflows of the Lake, Kis-Balaton Nature Conservation Area) were divided into smaller study areas, which differ from each other in vegetation and the degree of wetness. I collected samples from suitable places using mainly 3 different methods: (1) Berlese funnel, (2) Pitfall traps, (3) Vacuum hoover.

Investigation of collembolan communities was carried out by comparing the species composition of different habitats. The species compositions reflect the microclimatic characters of the different habitats. Both diversity and abundance were highest in the large reeds where collembolans found large number of microhabitats. Diversity and abundance were lowest in dry and warm areas. The composition of the Collembola fauna collected from sites of similar humidity and vegetation were similar. Finally I conclude that some of the study areas proved to be valuable places. The most diverse places are mosaic-like habitats. It is especially important to conserve these mosaic-like habitats for their high biodiversity.

Springtails are one of the most important animal groups of the soil fauna. Not only because they take part in decomposition of the organic matter of the soil but sometimes they could be so abundant that they become very important members of the food-chain. On the other hand, in consequence of their small size, they are very sensitive of the environmental circumstances (humidity, texture of soil, vegetation) so they are suitable for characterization of different habitats. The species composition, diversity and density of species could be changed in larger habitats. These parameters show the natural value of a place and indicate the human influences.

Protection of water quality and natural values of Lake Balaton is impossible without the protection of streams and other inflows running into the Lake, since most of the pollutants reach the Lake by this way. For this reason investigation of these streams is of great importance.

Some members of the Collembola fauna, mainly the smaller ones could drift by heavy rainfalls into the large reeds surrounding the shore, or drift directly into the Lake. Sometimes drift processes play significant role in inhabitation of the Lake area. On the other hand, the change of the fauna could indicate the changes in the Lakes characteristics which occur only later.

Pollutants carried in by Zala River cause one of the most serious problems of Lake Balaton. Therefore scientists attach great hope to the recreation of the original Kis-Balaton area comprising large swamp and reeds. The recreation of the Kis-Balaton area is being realized in two periods. The first one resulted in a shallow lake with a large extension (Reservoir I). The second step just now occurs (Reservoir II). Recently habitats of Kis-Balaton Nature Conservation Areas are in continuous change.

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The aim of the present study was to make a comparison among Collembola fauna of different habitats of Lake Balaton, Kis-Balaton Nature Conservation Area and some inflows of Balaton. Previously I gave an account of Collembola fauna of Lake Balaton's shore (FARKAS, 1995).

Materials and Methods

Site description

Shore of Lake Balaton

I investigated 3 large areas. Each of them was divided into smaller habitats. These smaller habitats are as follows:

Close to Balatonkenese. Large reeds bordereding a stone dam

1. The 2 or 3 year old debris of reeds on top of the dam. This area is moderately wet and dry during most of the summer.
2. The fresh reed debris on lake side of the dam where it is always wet.
3. Moss on the dam where it is dry during the summer.
4. Among the reeds where it is always wet.
5. Shore of a small swamp where it is always wet and rich in organic matter.
6. Large reedy area close to Alsóörs.

Area of large reeds and a patch of willow trees between Alsóörs and Palóznak

7. Area with horsetails and sedges. A warm and dry place where bushes grow.
8. An area of reeds and willow tree where with the exception of summer it is always wet.
9. Areas comparison. I collected samples from other parts of the lake, for example from Ábrahámhegy, Szigliget, Keszthely, Siófok, etc.

Inflows of Lake Balaton

To characterize every each stream in whole length is impossible because they flow through different types of areas, so their faunas are under different influences. According to this, the investigated streams and canals were divided into smaller but characteristic habitats.

Lovasi Stream

Two localities were monitored along the stream, where not only current velocity and water discharge but the vegetation was also different.

II. 1. Damned stream section at Lovas: lake with an extensive reed belt.

II. 2. Section between the railway lines and Lake Balaton: reed and sedge dominated area with a fluctuating water cover.

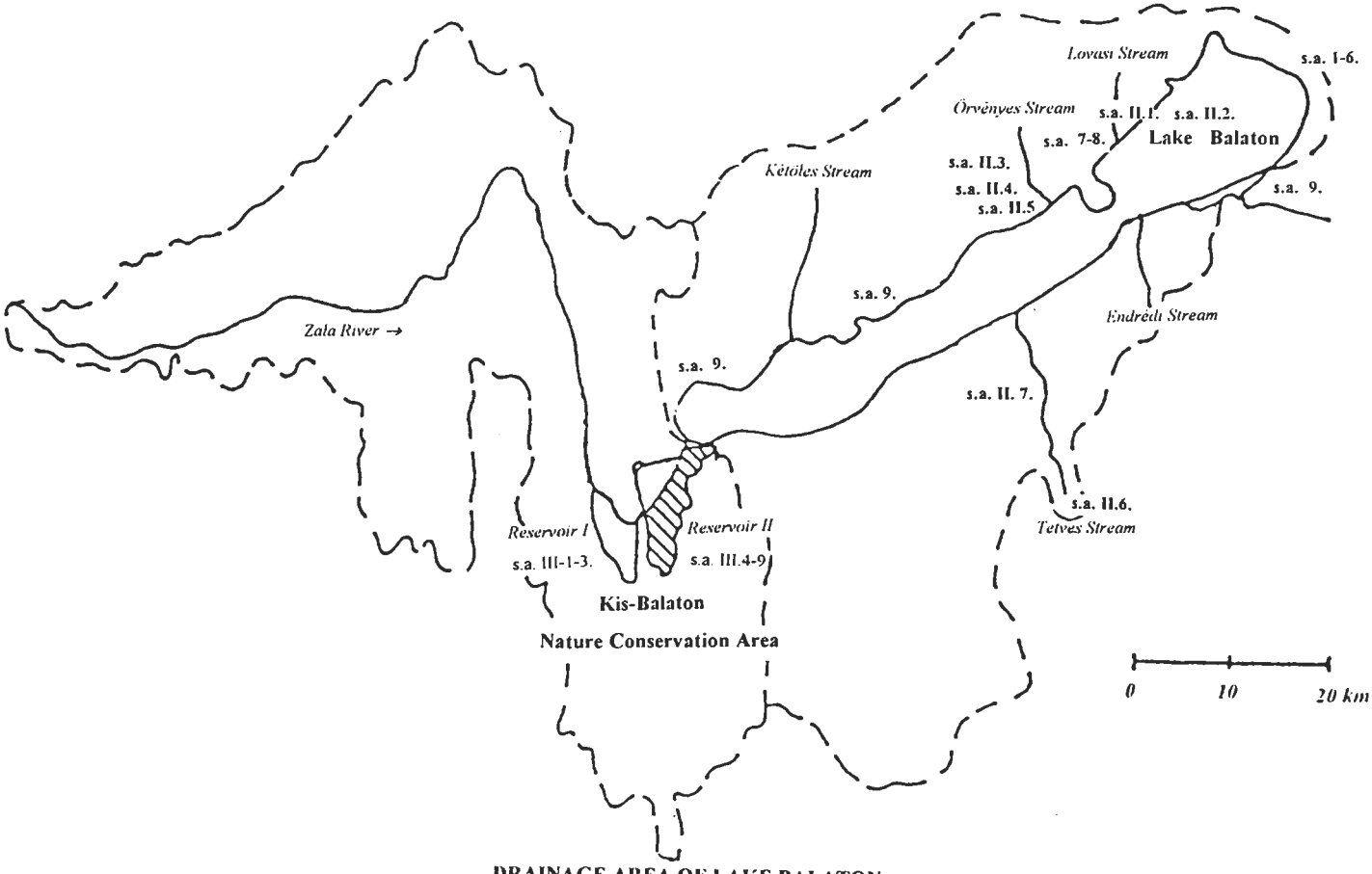
Örvényesi Stream

The Örvényesi Stream is permanent running water connecting areas with different vegetation types. Three areas were selected for investigation.

II. 3. Section above the mill: dense bush and wood.

II. 4. Section at the railway: concrete stream channel surrounded with an open meadow.

II. 5. Mouth area: reed-covered wetland directly at Lake Balaton.



DRAINAGE AREA OF LAKE BALATON

Table 1. The list of Collembola species which are abundant in at least one habitat of shore of Lake Balaton

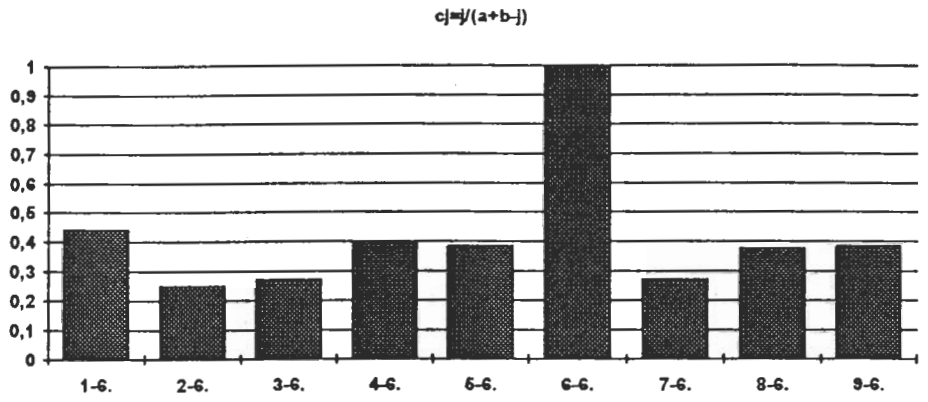
Species	Study area								
	1	2	3	4	5	6	7	8	9
Poduridae									
Podura aquatica Linné	-	*	-	*	*	*	-	+	-
Hypogastruridae									
Pseudachorutes corticicola (Schaff.)	+	-	+	+	*	+	+	-	+
Hypogastrura denticulata (Bagn.)	-	+	*	*	*	*	-	+	-
Friesea mirabilis (Tull.)	+	-	+	+	+	+	-	-	+
Neanura conjuncta Stach	+	-	-	-	-	+	-	+	+
Isotomidae									
Folsomia nana Gisin	*	+	+	+	+	*	*	*	*
Folsomia candida (Wilem)	+	-	-	-	-	+	+	-	+
Folsomia multiseta Stach	-	-	-	-	+	-	-	-	-
Proisotoma minuta (Tullb.)	*	-	+	*	*	*	+	*	*
Isotoma notabilis Scaff.	+	-	-	-	-	*	-	-	*
Isotomurus palustris (Müll.)	+	+	-	*	*	+	-	*	*
Entomobryidae									
Entomobrya marginata (Tullb.)	-	-	-	-	-	-	+	-	-
Orchesella flavescens (Bourl.)	-	-	-	+	+	*	-	+	-
Lepidocyrtus lanuginosus (Gmelin)	*	+	+	*	*	*	+	*	*
Lepidocyrtus paradoxus Uzel	*	-	-	+	+	*	*	*	*
Tomocerus longicornis (Müller)	-	-	+	-	-	-	+	-	+
Sminthuridae									
Sminthurides aquaticus (Bourl.)	-	*	+	*	*	-	-	*	*
Dicyrtoma ornata (Nic.)	+	-	-	-	-	*	-	-	-

Explanation: - non-existing species, + existing but not abundant, * abundant, dominant species, 1–9 habitats as mentioned in the text

Table 2. The list of Collembola species which are abundant in at least one habitat of inflows of Lake Balaton

Species	Study area						
	1	2	3	4	5	6	7
Poduridae							
Podura aquatica Linné	*	*	-	-	*	+	-
Hypogastruridae							
Pseudachorutes corticicola (Schaff.)	+	-	-	-	*	+	-
Hypogastrura armata Nicolet	*	+	+	+	+	+	-
Friesea mirabilis (Tullberg)	+	+	*	-	+	-	+
Onychiuridae							
Onychiurus armatus (Tullberg)	*	-	-	-	+	-	-
Isotomidae							
Folsomia nana Gisin	*	*	+	+	*	*	-
Folsomia candida (Willem)	*	+	+	-	-	+	-
Isotomurus palustris (Müller)	+	*	-	-	+	+	-
Entomobryidae							
Orchesella flavescens (Bourlet)	+	*	-	-	*	+	-
Lepidocyrtus curvicollis Bourlet	*	*	+	+	*	*	+
Lepidocyrtus lanuginosus (Gmelin)	*	*	+	+	*	*	-
Tomoceridae							
Tomocerus longicornis (Müller)	*	*	+	-	*	+	+
Tomocerus vulgaris (Tullberg)	*	+	+	-	+	*	+
Sminthuridae							
Sminthurides aquaticus (Bourlet)	+	-	-	-	+	+	-
Sminthurides pumilis (Krausbauer)	+	*	-	-	+	-	-
Sminthurus viridis Linné	-	+	+	+	-	-	-
Dicyrtoma fusca (Lucas)	-	+	*	-	-	-	-

Explanation: - non-existing species, + existing but not abundant, * abundant, dominant species, 1-7 habitats as mentioned in the text

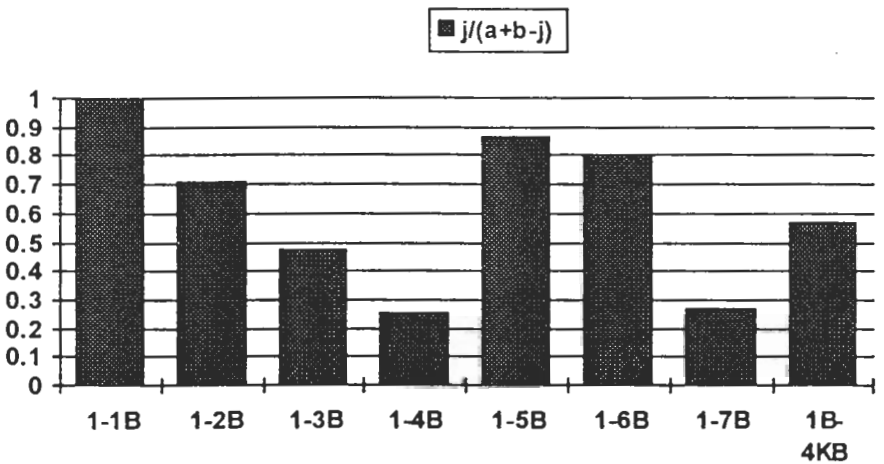


Explanation:

1. Study area I.1.
2. Study area I.2.
3. Study area I.3.
4. Study area I.4.
5. Study area I.5.
6. Study area I.6.
7. Study area I.7.
8. Study area I.8.
9. Study area I.9.

Study areas see those mentioned above

Fig. 1. Similarities of species (Jaccard Index) in different habitats of Lake Balaton



1B. Study area II.1.
2B. Study area II.2.
3B. Study area II.3.
4B. Study area II.4.
5B. Study area II.5.
6B. Study area II.6.
7B. Study area II.7.
4KB Study area III.4.

Fig. 2. Similarities of species (Jaccard Index) in different habitats along the inflows of Lake Balaton

Table 3. The list of Collembola species which are abundant in at least one habitat of Kis-Balaton Nature Conservation Area

Species	Study area								
	1.	2.	3.	4.	5.	6.	7.	8.	9.
Poduridae									
Podura aquatica Linné	*	-	*	*	+	-	-	*	+
Hypogastruridae									
Pseudachorutes corticola (Scaff.)	-	-	+	*	-	-	-	+	-
Hypogastrura denticulata (Bagnall)	*	-	*	*	*	-	-	+	+
Friesea mirabilis (Tullberg)	-	-	-	+	-	-	+	*	-
Proisotoma crassicauda (Tullberg)	-	-	+	*	-	-	-	-	-
Proisotoma minuta (Tullberg)	+	+	*	*	*	-	*	*	+
Onychiuridae									
Onychiurus armatus (Tullberg)	-	-	*	+	+	-	-	-	-
Folsomia candida (Willem)	+	*	+	+	-	*	*	+	-
Folsomia nana Gisin	-	*	+	+	+	*	*	*	+
Isotomidae									
Isotomurus palustris (Müller)	-	-	+	+	-	-	+	*	+
Entomobrya lanuginosa (Nic.)	-	-	+	-	*	-	+	+	+
Entomobryidae									
Orchesella flavescens (Bourlet)	+	-	*	*	*	-	-	-	-
Lepidocyrtus lanuginosus (Gmelin)	*	-	+	+	+	-	-	*	*
Lepidocyrtus curvicollis Bourlet	-	-	+	*	-	-	-	-	*
Heteromurus nitidus (Templ.)	-	-	-	*	-	-	*	+	-
Tomoceridae									
Tomocerus longicornis (Müller)	-	+	-	-	*	-	-	-	*
Tomocerus vulgaris (Tullberg)	-	+	-	-	*	+	-	*	+
Sminthuridae									
Sminthurides aquaticus (Bourlet)	*	-	+	+	-	-	-	*	-
Sminthurides pumilis (Krausbauer)	+	-	*	*	+	-	-	*	+
Dicyrtoma ornata (Nic.)	-	-	+	*	-	-	-	-	-
Dicyrtoma fusca (Lucas)	-	-	*	+	-	+	-	+	-

Explanation: - non-existing species, + existing but not abundant, * abundant, dominant species, 1–9 habitats as mentioned in the text

Balatonendréd

The Endrédi Stream is damned above Balatonendréd near the source creating a siltated pond. The water flows through a meadow before reaching the village. Upstream the village two artificial ponds are in the floodplain near the stream. The stream bed has been deepened downstream the village resulting in a canal like appearance of the stream.

II. 6. Source area: meadow with two ponds.

II. 7. Canal-like section downstream the village: ruderal, open area.

Kis-Balaton Nature Conservation Area

Collembola fauna was investigated in some characteristic habitats in areas of reservoir I and II of Kis-Balaton Nature Conservation Area. Habitats differ from each other in the composition of the vegetation and the water regime of the soil. The selected three large areas were divided into smaller habitats. These smaller habitats are as follows:

Reservoir I

III. 1. Shore of damned lake
There are only a few plants. Vegetation is composed of herbosa mainly of sedge and grass. It is always wet.

III. 2. Steppe close to the shore
Area with horsetails, sedges and grasses. It is always dry.

III. 3. Large reeds and swamp
It is always wet and rich in organic matter.

Reservoir II

III. 4. Large reedy area
Similar to study area III.3. Always wet and rich in organic matter.

III. 5. Reedy area along the shore of Zala River
Narrow reeds with willow trees and bushes. It is moderately wet during most of the year.

III. 6. Steppe between a forest and a large reeds
Similar to study area III.2. This area a warm and dry place during most of the year.

Diás Island (Reservoir II)

III. 7. Clearing area in Diás Island
This grassy area is very wet during spring and moderately dry during summer.

III. 8. Small swamp in the edge of a forest in Diás Island
Always very wet area with open water surface and with diverse vegetation.

III. 9. Shore of Zala River close to Diás Island
Similar to study area III.6. Narrow reeds with bushes and trees. It is moderately wet.

Collection of specimens

Springtails were collected from suitable places using mainly 3 different methods: (1) The majority of the animals was collected using pitfall traps. 2 dl plastic glasses were placed in five meter distance from each other. The glasses were filled up with ethylene glycol. The traps were emptied generally monthly. If it was necessary we used the isolation method of salting. The collected material was stored in 70% methanol until examination. (2) We collected samples of soil and leaf litter from which the animals were isolated using the Berlese method. (3) Samples mainly from Kis-Balaton and along of inflows were collected by vacuum hoower frequently. Sometimes I used singling and sweeping techniques.

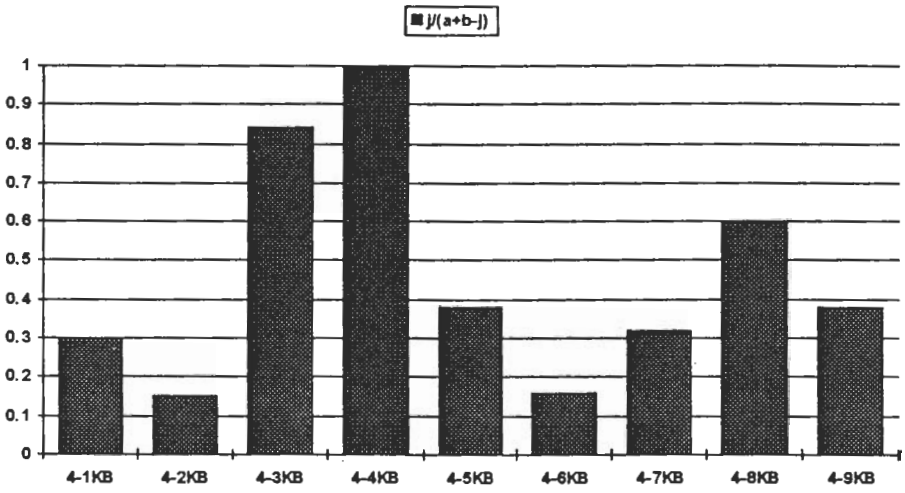


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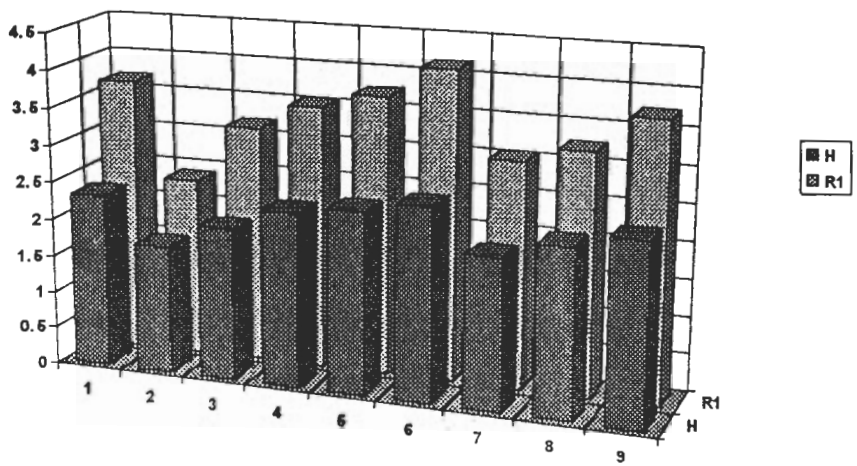
Fig. 3. Similarities of species (Jaccard Index) in different habitats of Kis-Balaton Nature Conservation Area

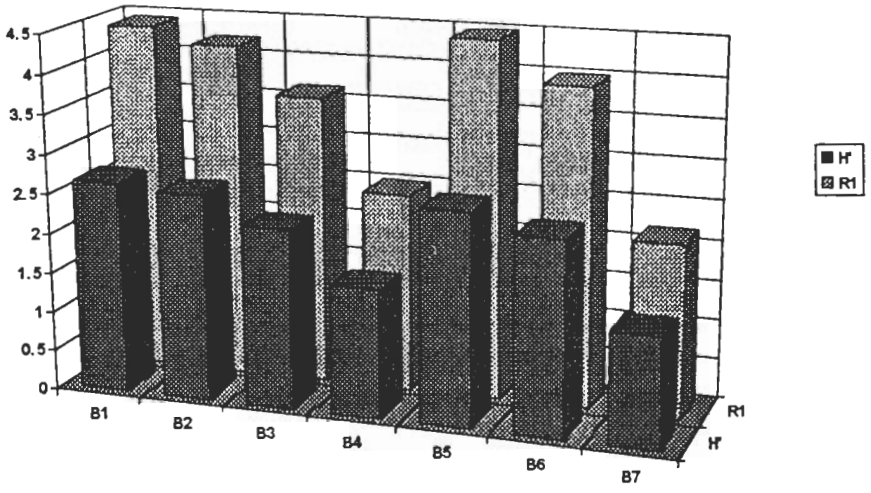


Explanation:

1. Study area I.1.
2. Study area I.2.
3. Study area I.3.
4. Study area I.4.
5. Study area I.5.
6. Study area I.6.
7. Study area I.7.
8. Study area I.8.
9. Study area I.9.

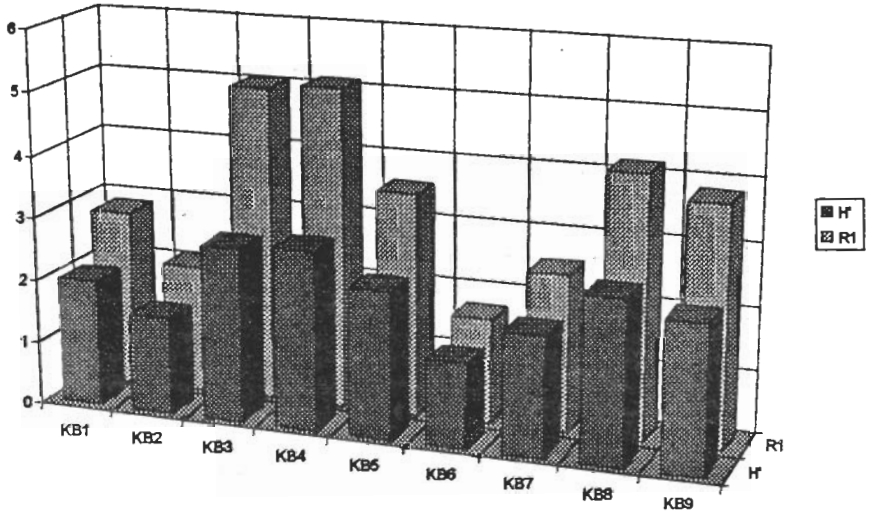
Study areas see those mentioned above

Fig. 4. Richness és Shannon Index Shore of Lake Balaton



B1. Study area II.1.
B2. Study area II.2.
B3. Study area II.3.
B4. Study area II.4
B5. Study area II.5.
B6. Study area II.6.
B7. Study area II.7.
4KB. Study area III.4.

Fig. 5. Richness és Shannon Index Inflows of Lake Balaton



1KB. Study area III.1.
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5KB. Study area III.5.
6KB. Study area III. 6.
7KB. Study area III.7.
8KB. Study area III.8.
9KB. Study area III.9.

Fig. 6. Richness és Shannon Index Kis-Balaton Naturel Conservation Area

Results

Works of GISIN (1960), FJELLBERG (1980) and DUNGER (1994) were used to identify species.

Generally, making comparison between Collembola fauna of large areas, such as Lake Balaton (shore and inflows) and Kis-Balaton Nature Conservation Area is very difficult. Actually, we can compare only the smaller habitats because of the fragmentation of the larger areas.

The species composition reflected the microclimatic characters of the individual habitats. Collembolans are the most sensitive to temperature and the degree of moisture because of theirs small size. Species detected in different habitats are many kind of and their claims are also different.

Both species diversity and the frequency of occurrence were highest in the large reedy areas (study areas I 6, II. 1, III. 3, III. 4) which consisted of more smaller habitats. Study areas I. 2, II. 4, II. 7, III. 2, III. 6 proved to be the least diverse ones because of their dry nature. The largest differences were found between the permanently wet reedy areas (study areas I. 6, II. 1, III. 3, III. 4) and the steppe like habitats (study areas I. 7, II. 4, III. 2, III. 6).

Sometimes human influence (e.g. creation of new habitats by impounding a stream) results in an increase diversity. Poorer composition of vegetation and most kind of human influences (e.g. concretion of stream-bed) decrease both species and individuals numbers.

Large reeds in all three investigated large areas (shore of Lake Balaton, along inflows, Kis-Balaton Nature Conservation Area) were very similar regarding the Collembola abundances and diversity values. Results from the comparison of smaller areas show that species composition is a function of humidity of the area.

The rate the species diversity was a little higher in Kis-Balaton Nature Conservation Area (study areas III. 4, III. 3) than in the other places (study areas I. 6, II. 1).

Finally, I concluded that large areas without human influences have a diverse Collembola fauna. The similarity of species composition in different habitats reflected the microclimatic characters of each habitat.

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