Nachrichtenblatt der Ersten Vorarlberger Malakologischen Gesellschaft | 12 | 19 - 29 | Rankweil, 20. Dez. 2004

The aquatic mollusc fauna of river Tisza and its tributaries.

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Abstract
The author has been investigating the mollusc fauna of the river Tisza and its tributaries as a member of the Tisza Research Workgroup since 1958. His personal findings, as well as data collected from the literature on the malacofauna of these rivers have been utilized for the determination of the faunal composition of the individual streams. The area-analytical zoogeographical classification of the species afterwards enabled the delineation of those floodplain areas or rivers, which had not been subjected to analysis so far and require further investigations regarding the mollusc fauna.
Keywords: river reaches, dead arms, floodplains, tributaries, faunal elements and refugial areas

Material and methods

The major aim of this paper was to collect all available information on the malacofauna of the Lower, Middle and Upper Tisza and its tributaries plus the backwater areas as well as the dead arms, along with those of the rivers Maros and Körös and the accompanying channels. The rivers, tributaries as well as the channels are depicted on Fig.1 and numbered in Table 1. The dead arms and the floodplains have not been assigned numbers, as they were taken to be part of the rivers in this work.

The previous works of the author have been utilized as a basis for the zoogeographical classification of the aquatic mollusc fauna. A part of the referred papers are in press or to read in the list of references. The following faunal elements and their refugial areas are considered: 1. Pacific-Palearctic; 2. East Siberian (Kazakhstan and Manchurian Refugial Areas); 3. Central Siberian (Angaran Refugial Area); 4. West Siberian; 5. Central Asian; 6. Ponto-Caspian; 7. Caspian-Sarmatian, and the Refugial Areas of the Holomediterranean elements: 8. Ponto-Mediterranean; 9. Ponto-Pannonian; 10. Boreo-Alpine; 11. Atlanto-Mediterranean; 12. Holomediterranean with occurrences in the Palearctic and North America; 13. Holarctic elements.

The distribution of the species in the studied streams and aquatic habitats

65 species are mentioned from 14 streams, channels and reaches. Three channels were investigated in detail as depicted in Table 1: 13. the Körös channel; 14. the Keleti main channel; 15. the Jászság main channel (Fig.1).
Out of the 70 Hungarian aquatic species known from the literature, 24 of which are bivalves (PINTÉR 1984), 65 have been found in the river Tisza and its tributaries as well as the main channels. The distribution of the individual species shows large scale variation. The least known and investigated are the areas: 5. Száraz brook with 2 mollusc species, 7. the dead arms of the Hármas-Körös with 5 species, 9. the dead arms of the Sebes-Körös with 9 species, 11. the dead arms of the Fehér-Körös with 1 species, 12. the dead arms of the Fekete-Körös with 2 species, 14. the Keleti main channel 3, 15. the Jászság main channel 4, 18. Zagyva 7, 20. Takta 2, 23. Túr 1, and finally 24. Kraszna with 2 species. The stream investigated most carefully is the river Tisza and its floodplain areas as well as dead arms.

The regions of the Lower and Middle Tisza as well as the accompanying dead arms yielded the greatest number of species. The best known and studied area is the Lower Tisza, known from the works of CZÓGLER, HORVÁTH and BÁBA with 52 species. The least studied and known reach is the Upper Tisza including the dead arms and floodplain areas. The three major reaches of the Tisza yielded a total of 57 species while 51 mollusc species have been recorded from the 5 Körös rivers. The dead arms of the Hármas-Körös yielded a total of 31 species, the river Maros a total of 27 species, plus 15 species were recorded from its dead arms. Finally 35 species were recorded from the streams, brooks and rivers of the Hortobágy. These areas were the most rich in species.

According to literature the rarest species are: *Theodoxus transversalis* (C. PFEIFFER 1828) in all reaches of the Tisza, one trench from the Middle Tisza region and the rivers Bodrog and Szamos. *Theodoxus prevostianus* (C. PFEIFFER 1828) in the rivers Sebes-Körös and Zagyva. *Theodoxus fluviatilis* (LINNE 1758) in the Lower and Middle Tisza, a trench of the Lower Tisza and the rivers Maros, Hármas-Körös and Zagyva. *Valvata pulchella* (STUDER 1820) from the Lower and Middle Tisza as well as the dead arms, the river Hármas-Körös and its dead arm as well as the Zsaro brook. *Fagotia acicularis* (FERUSSAC 1823) from the river Fehér-Körös; *Melanopsis parreysi* PHILIPPI 1847 also from the Fehér-Körös. *Lymnaea corvus* GMELIN 1791 from the Lower Tisza, a dead arm of the Upper Tisza and a trench of the Middle Tisza, as well as a dead arm of the Sebes-Körös. *Aplexa hypnorum* (LINNE 1758) from the Upper Tisza, a single dead arm of the Middle and Upper Tisza, a trench of the Middle Tisza, as well as the river Szamos. *Planorbis carinatus* (O. F. MÜLLER 1774) has come to light from the Upper Tisza and a dead arm of the Middle Tisza, while *Anisus leucostoma* (MILLET 1813) has been recorded in the Upper Tisza, a dead arm of the Middle Tisza, the Romanian part of the river Maros as well as the river Hármas-Körös. Out of the mussels *Casertiana casertana* (POLI 1791) was recorded from a dead arm of the Middle Tisza, the Romanian part of the river Maros and the Szamos. *Casertiana milium* (HELD 1836) was mentioned from a dead arm of the Upper Tisza, as well as *Casertiana personatum* (MALM 1855) and *Casertiana supinum* (A.SCHMIDT 1850), *Casertiana henslowanum* (SHEPPARD 1823) from a dead arm of the Middle Tisza and the river Fehér Körös, while *Casertiana pulchellum* (JENYNS 1832) was only recorded from the Lower Tisza. *Casertiana hibernicum* (WESTERLUND 1894) occurs in the Lower Tisza and a dead arm, as well as in a trench of the Upper Tisza. Finally, *Casertiana pseudosphaerium* (SCHLESCH 1947) and *C. subtruncata* (MALM 1857) was collected from both the Lower and Upper Tisza and a dead arm of these. (Table 1.)

The distribution of faunal elements

The prevailing forms in both the best and least studied waters were East-Siberian elements with a value of 33-66 %. This is followed by the West-Siberian elements with values between 17-23 % in the thoroughly studied areas and 4-12 % of Holarctic elements. The Ponto-Caspian elements are present with a rate between 9-12 %. The ratios of the East-Siberian, West Siberian and Holarctic elements are the highest in the Upper Tisza forming the coldest part of the river valley during the winter and the one enjoying the most precipitation during the summer (KOKAS 1960). This seems to point to the importance of climatic influences on even the distribution of the aquatic fauna as well (Fig. 2.).

A detailed zoogeographical analysis of the molluscs inhabiting the tributaries originating from the Romanian mountains may yield further justifications in connection with this statement. These are the Túr, Szamos, Kraszna, Berettyó, Sebes-Fehér, Fekete-Körös and the river Maros (depicted with numbers 23, 22, 24, 9, 10, 11, 12. in Table 1). Another proof might be

that the ratio of the East-Central Siberian elements in the montane areas of the river Maros in Romania is higher than the value for the Hungarian part (6). Furthermore the Boreo-Alpine elements have a ratio of 2 - 5.88 % in the dead arms and backwaters of the Upper Tisza (*Casertiana hibernicum* (WESTERLUND 1894)).

Summary

In this paper all available information on the mollusc fauna of the Lower, Middle and Upper Tisza and its tributaries plus the backwater areas as well as the dead arms, along with those of the rivers Maros and Körös and the accompanying channels have been summarized and reevaluated based on information from the literature. Out of the 70 Hungarian aquatic species known from the literature 65 have come to light from the river Tisza and its tributaries as well as the main channels. The best investigated streams are the river Tisza with 57 species, and the rivers Körös with 51 species. 19 species are highly sporadic in 24 sites. According to the zoogeographical analysis of the collecting sites, 13 faunal elements are present in the studied material. The ratio of the East, West and central Siberian elements is higher in the northern parts of the Tisza valley indicating a possible role of the climate in the creation of the distribution patterns of the aquatic mollusc fauna.

Great Hungarian Plain.

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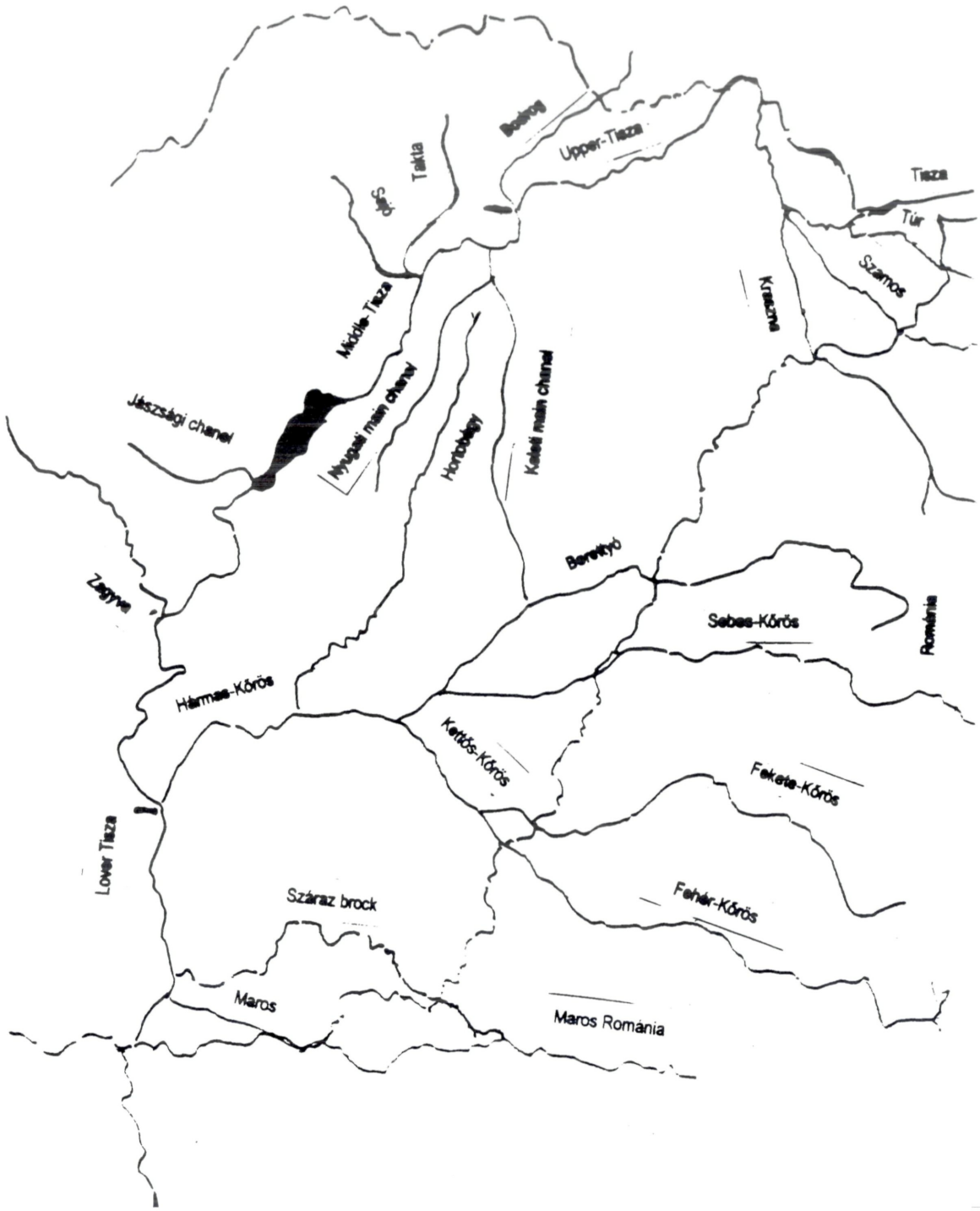


Fig. 1.: The analyzed rivers, brooks, streams and channels of the Tiszaian part of the Great Hungarian Plain.

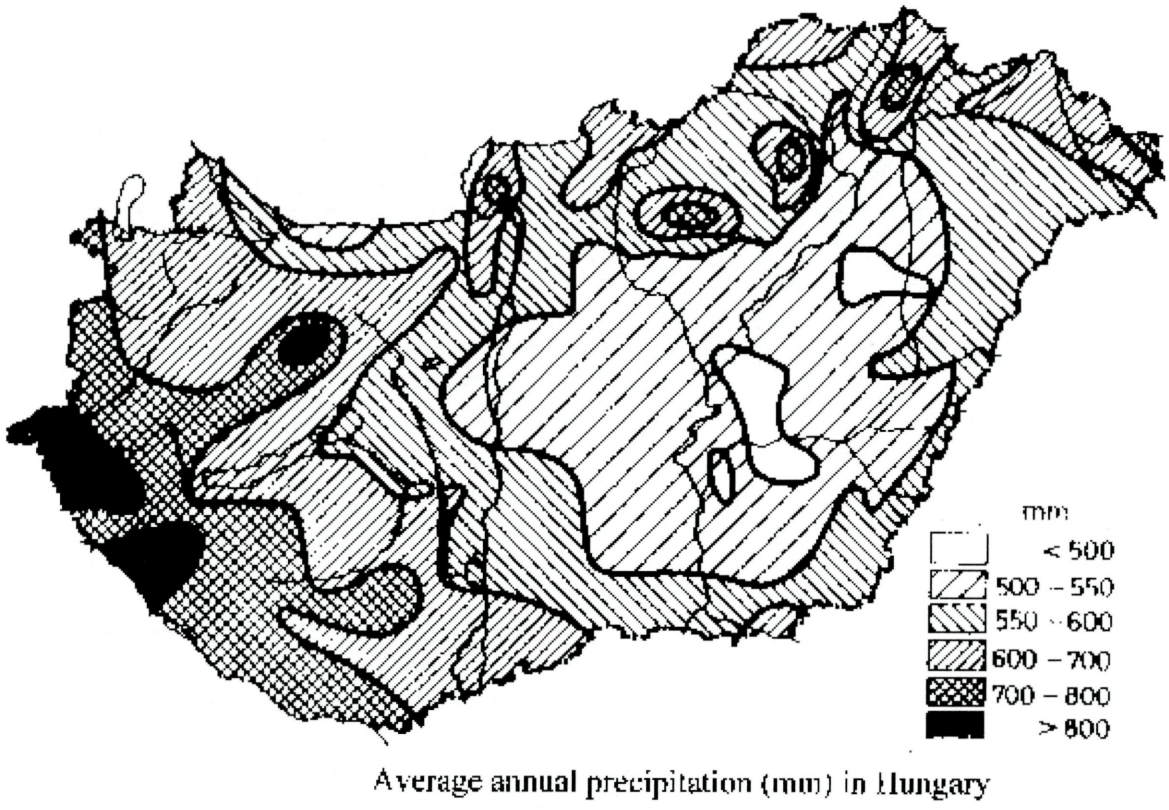
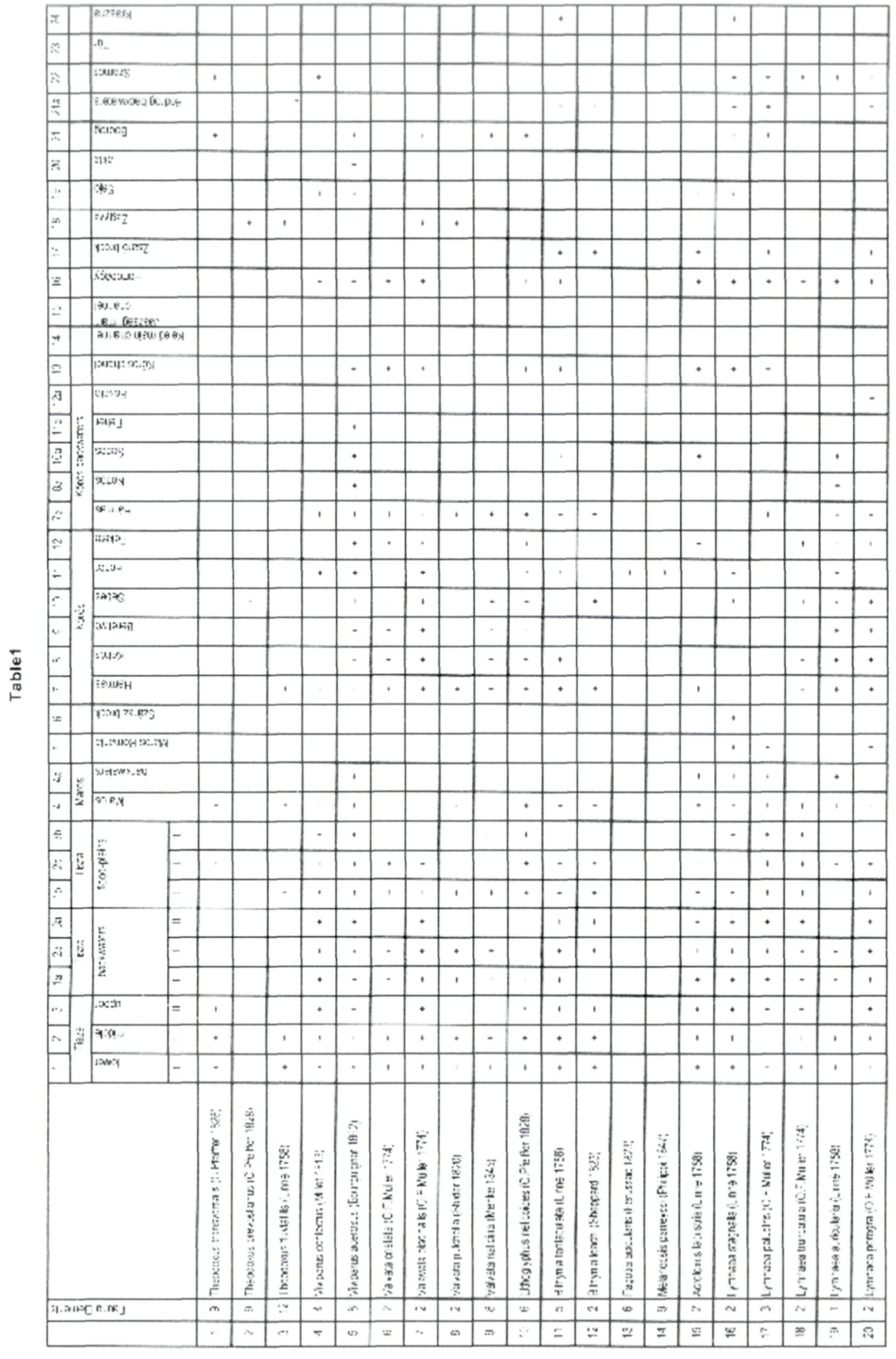


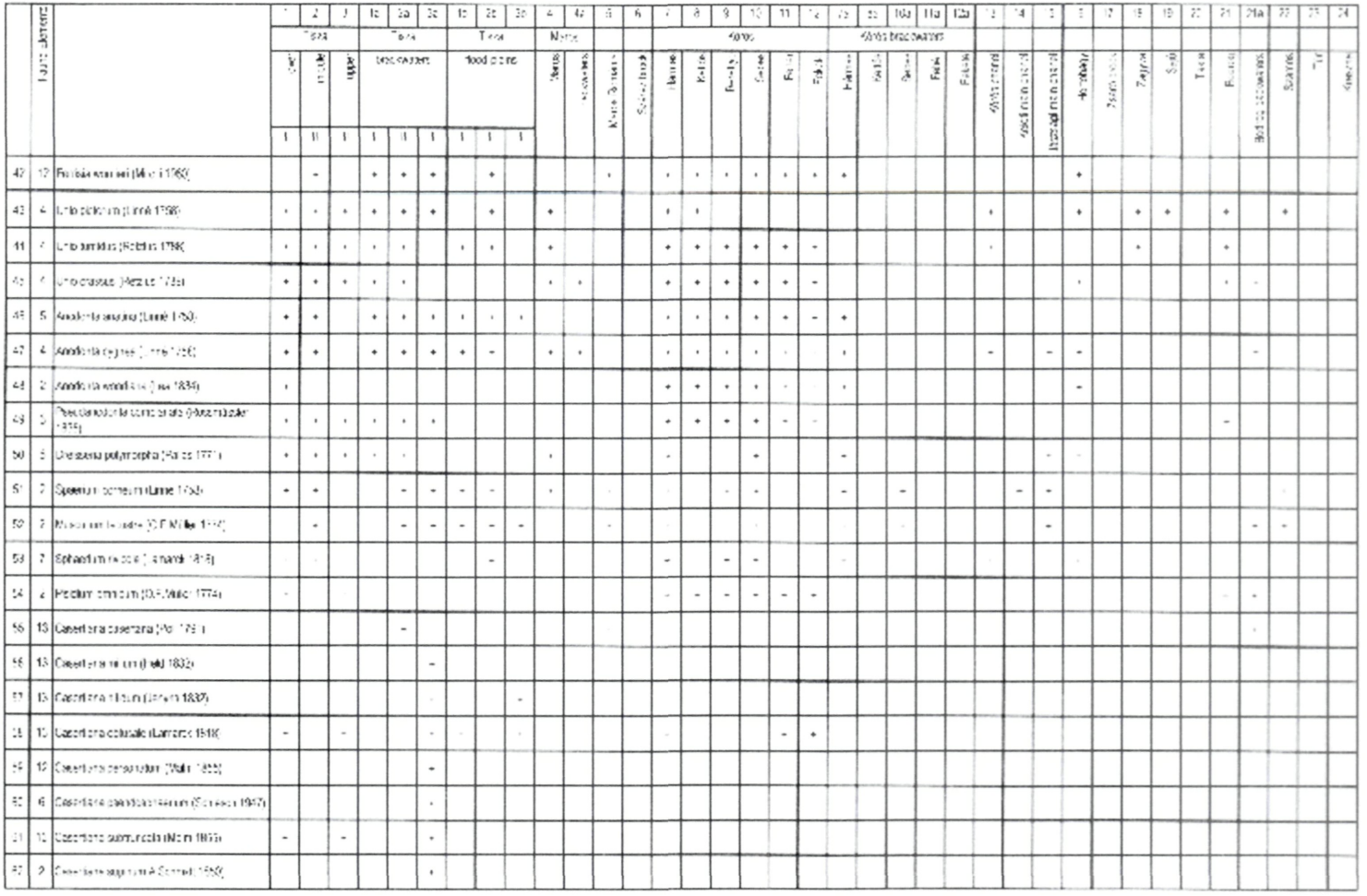
Fig. 2.: The average annual precipitation rates in Hungary.

Table 1.: The species recorded and their distribution for the individual streams.



	Faunal Elements		1	2	3	1a	2a	3a	1b	2b	3b	4	4a	5	6
			Tisza			Tisza			Tisza			Maros			
			[illegible]	[illegible]	[illegible]	[illegible]			[illegible]			Maros	backwaters	Maros Romania	[illegible]
			I	I	I	I	I	II	I	I	II				
21	2	Lymnaea [illegible] (Draparnaud 1801)	+	+	+	+	+	+	+	+			+		
22	6	Lymnaea turricula (Held 1836)	+		+		+	+	+						
23	6	Lymnaea corvus (J.F. Gmelin 1791)	+					+		+					
24	2	Aplexa hypnorum (Linné 1758)			+		+	+		+					
25	2	Physa fontinalis (Linné 1758)	+	+	+	+	+	+	+	+	+				
26	11	Physa acuta (Draparnaud 1805)	+			+	+			+	+	+	+		
27	2	Planorbarius corneus (Linné 1758)	+	+	+	+	+	+	+	+	+	+	+	+	
28	2	Planorbis planorbis (Linné 1758)	+	+	+	+	+	+	+	+	+	+	+		+
29	4	Planorbis carinatus (O.F. Müller 1774)			+		+								
30	4	Anisus septemgyratus (Rossmässler 1835)	+	+	+		+		+	+					
31	3	Anisus leucostoma (Millet 1813)			+		+							+	
32	4	Anisus spirorbis (Linné 1758)	+	+	+	+	+	+	+	+	+	+	+	+	
33	4	Anisus vortex (Linné 1758)	+	+	+		+	+		+					
34	4	Anisus vorticulus (Troschel 1834)	+	+	+		+	+	+	+					
35	2	Bathyomphalus contortus (Linné 1758)	+		+				+	+					
36	12	Gyraulus albus (O.F. Müller 1774)	+	+	+	+	+	+		+		+	+		
37	6	Gyraulus laevis (Alder 1838)	+	+	+	+	+	+	+	+					
38	12	Gyraulus crista (Linné 1758)	+	+		+	+		+	+			+		
39	2	Hippeutis complanatus (Linné 1758)	+	+	+	+	+	+	+	+		+	+		
40	2	Segmentina nitida (O.F. Müller 1774)	+		+	+	+	+	+	+	+		+	+	
41	11	Ancylus fluviatilis (O.F. Müller 1774)	+	+	+							+		+	

			7	8	9	10	11	12	7a	8a	10a	11a	12a	13	14	15	16	17	18	19	20	21	21a	22	23	24
			Körös						Körös backwaters																	
			Hármas	Kettős	[illegible]	Sebes	Fekete	Fehér	Hármas	Kettős	Sebes	Fekete	Fehér	Körös channel	[illegible] channel	[illegible]	[illegible]	[illegible]	Zagyva	Sajó	[illegible]	Bodrog	Bodrog backwaters	Szamos	Túr	Kraszna
21	2	Lymnaea [illegible] (Draparnaud 1801)	+	+	+	+		+									+			+			+			
22	6	Lymnaea turricula (Held 1836)												+		+				+						
23	6	Lymnaea corvus (J.F. Gmelin 1791)									+															
24	2	Aplexa hypnorum (Linné 1758)																						+		
25	2	Physa fontinalis (Linné 1758)	+		+			+									+	+				+	+			
26	11	Physa acuta (Draparnaud 1805)	+	+	+	+	+	+	+					+			+						+	+		
27	2	Planorbarius corneus (Linné 1758)	+	+	+	+	+	+	+	+	+			+			+					+	+	+		
28	2	Planorbis planorbis (Linné 1758)	+	+	+	+	+	+	+	+				+	+		+			+		+	+	+	+	
29	4	Planorbis carinatus (O.F. Müller 1774)																								
30	4	Anisus septemgyratus (Rossmässler 1835)	+	+	+	+	+	+									+									
31	3	Anisus leucostoma (Millet 1813)	+														+									
32	4	Anisus spirorbis (Linné 1758)	+	+		+	+	+	+				+		+		+		+	+	+	+	+	+		
33	4	Anisus vortex (Linné 1758)	+	+		+			+								+	+								
34	4	Anisus vorticulus (Troschel 1834)	+			+			+																	
35	2	Bathyomphalus contortus (Linné 1758)		+			+							+	+		+									
36	12	Gyraulus albus (O.F. Müller 1774)	+	+	+	+	+	+	+		+			+			+	+				+	+	+		
37	6	Gyraulus laevis (Alder 1838)	+			+	+	+	+															+		
38	12	Gyraulus crista (Linné 1758)					+	+						+			+									
39	2	Hippeutis complanatus (Linné 1758)	+				+	+	+					+			+	+								
40	2	Segmentina nitida (O.F. Müller 1774)	+				+										+					+	+			
41	11	Ancylus fluviatilis (O.F. Müller 1774)	+				+	+																+		



			1	2	3	1a	2a	3a	1b	2b	3b	4	4a	5	6	7	8	9	10	11	12	7a	9a	10a	11a	12a	13	14	15	16	17	18	19	20	21	21a	22	23	24
			Tisza			Tisza			Tisza			Maros				Körös						Körös backwaters																	
	Faunal Elements		[illegible]	[illegible]	[illegible]	backwaters			flood-plains			[illegible]	[illegible]	[illegible]	[illegible]	Hármas	Kettős	Fekete	Sebes	Fehér	[illegible]	Hármas	Kettős	Sebes	Fehér	Fekete	Körös channel	[illegible] main channel	[illegible] main channel	Hortobágy	[illegible]	Zagyva	Sajó	Tarna	Bodrog	Bodrog backwaters	Szamos	Túr	Kraszna
			I	I	II	I	I	II	I	I	II																												
63	13	Casertiana henslowanum (Sheppard 1823)					•														•																		
64	10	Casertiana hibernicum (Westerlund 1894)	+					•			•																												
65	2	Casertiana pulchellum (Jenyns 1832)	+																																				
		Σ	52	41	39	33	42	39	36	41	17	27	15	12	2	46	26	25	33	30	31	31	5	9	1	2	20	3	4	35	10	7	10	2	18	13	23	1	2