MALACOLOGICAL SURVEY ON THE MUREŞ (MAROS) RIVER

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Introduction

The freshwater mollusks living in the bed and flood area of the Mureş River have a significant role in the life of the river. The mollusks often form over 90% of the benthic biomass (1120 g/m^2, Gorneşti-Mureş). They serve as food for fish, birds and mammals. They contribute to biological water purification, and by consuming they retard algal bloom. The different species have different sensitivities to water pollution, therefore the various degrees of pollution can be measured with these species functioning as bio-indicators (Sárkány-Kiss 1977,1988).

In the course of our investigations since 1968 we have explored the Mollusca fauna of the Mureş valley and we have examined, case by case, its qualitative and quantitative changes. The present paper compares these former research results with the results of our newer research made in the summer of 1991. This comparison enables us to draw some conclusions referring to the quality of the environment.

A brief historical sketch of the research

In the literature one can find only scattered data about the range of the water mollusks in the Mureş valley.

Kobelt (1911) describes a new form in Mureş: Unio crassus marisaensis Kobelt 1911.

Soós (1943,1955,1959) mentions the occurence in the Mureş of the following species: Theodoxus transversalis, Aiud; Lithoglyphus naticoides, Bălaj and Aiud; Bithynia leachi, Aiud; Valvata cristata, Alba Iulia. In the case of other species we can find only more general remarks like 'rare, often in Transylvania.

Wagner (1943) identifies the Anodonta cygnea, Ancylus fluviatils and Theodoxus prevostrianus species in the material of a Transylvanian research expedition.

Horváth (1943,1955) reports on the surprising occurence of the Ancylus fluviatilis, investigated in 1938, around the mouth of the Mureş River(above its flowing into the Tisza River).

Bába (1958) on the basis of his collection made in 1956-1957, lists from the Mureş river-bed between Makó and Szeged: Theodoxus transversalis (in great numbers around Makó), Litholyphus naticoides, Unio pictorum balatonicus, Unio tumidus zelebori, Unio crassus ondavensis decurvatus and he describes several cosmopolitan gastropods from the flood-area of the Maros in Hungary.

Grossu (1955,1956,1962,1986,1987) in his fauna-volumes based on the material collected from the whole territory of Romania and on the bibliographical data, mentions

some species in the Mureş without giving the exact data referring to their occurrence (Theodoxus transversalis, Lithoglyphus naticoides, Unio crassus decurvatus).

Gyurkó and Nagy (1965,1971) investigating the basic food resource of fish of the Mureş, in the benthometer examples they found the Ancylus fluviatilis species in great numbers on the upper and middle area of the Mureş down to Gorneşti.

Materials and methods

The malacological investigations started in 1968 ranged from the source to the mouth (768 km). Besides the river bed we have explored the flood area and 46 tributaries.

The research work was divided in time and zones as follows:

- Between 1968 and 1974 we explored the area from the source to Iernut (230 km). We traversed the area in 10- 50 km zone - divisions on both banks, on foot and by rubber boat.
- During the years 1974-1991 we extended our research to the entire length of the river in the upper area on foot, in the lower area by boat.
- We explored the entire river in 1978, 1989 and in 1991, but in the meantime we returned to certain areas for research several times. In July 1991 we traveled on the river by boat from Luduş to Pecica, and in August from the source to Szeged.

We performed the collecting manually and by means of the following equipment:

- limnological net (1.5 mm and 7 mm diameter of one mesh)
- triangular dragnet (7 mm of one mesh)
- shell-collector dragnet with rake (20x40 cm, 7 mm diameter of one mesh)
- shell-collector rake
- Peterson dredger (18x31 cm)
- benthometer (28x31.5 cm)

The collected material used for research (about 10,000 ex.) can be found in the Tîrgu Mureş Museum, but in many cases the samples, after having been identified, were taken back to their original biotope.

Results and discussion

As Tables 1., 2., and 3. show we identified 41 Mollusca species and subspecies in the biotops of the Mureş valley between 1968 and 1991. Of these 9 are bivalvia species and 32 gastropods. When comparing our results with previously published data we realized that Theodoxus prevostrianus and T. transversalis species, often mentioned in the literature, have not been found during our research. Wagner (1944) and Soós (1943, 1956) mentioned the occurrence (Răstolița valley - Secu source) of Theodoxus prevostrianus following the fact of an empty shell of a single specimen. It is known that this species likes

Table 1. Range of Unionidae species in 1978

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SPECIES															
Lythoglyphus naticoides (C. PFEIEF. 1828)	-	-	-	-	-	xxx xx	xxx xxx	xxx xxx	xxx xxx	xxx xxx	xxx xxx	xxx xxx	xxx x	xxx xxx	xxx xxx
Lymnaea stagnalis (L. 1758)	-	-	-	-	-	xx	-	-	-	-	-	-	-	-	-
Stagnicola palustris (O.F.Muller 1774)	-	xxx	-	x	-	xx	-	-	-	-	-	-	-	-	-
Radix peregra (O.F.Muller 1774)	xx	xxx	-	xx	xx	-	-	-	-	-	-	-	-	-	-
Planorbarius corneus (L. 1758)	-	xx	-	-	-	xx	-	-	-	-	-	-	-	-	-
Planorbis planorbis (L. 1758)	-	xx	-	xx	-	xx	-	-	-	-	-	-	-	-	-
Ancylus fluviatilis (O.F.Muller 1774)	-	33	-	37	80	-	-	-	-	-	-	-	-	-	-
Unio pictorum (L. 1758)	-	-	-	-	-	xxx xxx	xxx xx	xxx xx	xxx xx	xxx xx	xxx xx	xxx xx	-	xxx xx	xxx xx
Unio tumidus (Retz. 1758)	-	-	-	-	-	xxx xxx	xxx xx	xxx xx	xxx xx	xxx xx	xxx xx	xxx xx	-	xxx xx	xxx xx
Unio crassus (Retz. 1758)	-	xxx xx	-	xxx xx	-	xxx	xxx x	xxx x	xxx x	xxx	xxx	xxx	xx	xxx	xxx
Andonta cygnea piscinalis (Nilss. 1822)	-	-	-	-	-	xxx xx	xxx x	xxx	xxx	xxx x	xxx x	xxx xx	-	xxx x	xxx x
Andonta cygnea anatina (L. 1758)	-	-	-	xx	-	-	-	-	-	-	-	-	-	-	-
Pseudanodonta complanata (Rossm. 1865)	-	-	-	-	-	-	-	xx	xx	xx	xx	xx	-	xx	xx
Sphaerium rivicola (Lamarck. 1799)	-	-	-	xx	-	-	-	-	-	-	-	-	-	-	-
Sphaerium corneum (L. 1758)	-	-	-	-	-	-	-	-	-	-	-	xxx	-	xxx	xxx
Pisidium amnicum (O.F.Muller 1774)	-	-	-	xxx x	xxx x	-	-	-	-	-	-	-	-	-	-
Pisidium casertanum (Poli. 1791)	-	xxx	-	xx	xxx	-	-	-	-	-	-	-	-	-	-
Pisidium subtruncatum (Malm. 1855)	-	-	-	-	xx	-	-	-	-	-	-	-	-	-	-
Pisidium personatum (Malm. 1855)	-	xx	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 2. Range of Unionidae species in 1991

SPECIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Lythoglyphus naticoides (C. PFEIEF. 1828)	-	-	-	-	-	XXX	XX	XX	X	-	-	-	-	-	-
2. Lymnaea stagnalis (L. 1758)	-	-	-	-	-	XX	-	-	-	-	-	-	-	-	-
3. Stagnicola palustris (O.F.Muller 1774)	-	XXX	-	X	-	XX	-	-	-	-	-	-	-	-	-
4. Radix peregra (O.F.Muller 1774)	XX	XXX	-	XX	XX	-	-	-	-	-	-	-	-	-	-
5. Planorbarius corneus (L. 1758)	-	XX	-	-	-	XX	-	-	-	-	-	-	-	-	-
6. Planorbis planorbis (L. 1758)	-	XX	-	XX	-	XX	-	-	-	-	-	-	-	-	-
7. Ancylus fluviatilis (O.F.Muller 1774)	-	3	-	21.3	46.3	-	-	-	-	-	-	-	-	-	-
8. Unio pictorum (L. 1758)	-	-	-	-	-	XXX	XX	XX	XX	-	-	-	-	-	-
9. Unio tumidus (Retz. 1758)	-	-	-	-	-	XXX	XX	XX	XX	-	-	-	-	-	-
10. Unio crassus (Retz. 1758)	-	XXX XX	-	XXX	-	XXX	XX	XX	XX	-	-	-	-	-	-
11. Andonta cygnea piscinalis (Nilss. 1822)	-	-	-	-	-	XXX	XX	XX	XX	-	-	-	-	-	-
12. Andonta cygnea anatina (L. 1758)	-	-	-	XX	-	-	-	-	-	-	-	-	-	-	-
13. Pseudanodonta complanata (Rossm. 1865)	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-
14. Sphaerium rivicola (Lamarck. 1799)	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-
15. Sphaerium corneum (L. 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16. Pisidium amnicum (O.F.Muller 1774)	-	-	-	XXX X	XXX	-	-	-	-	-	-	-	-	-	-
17. Pisidium casertanum (Poli. 1791)	-	XXX	-	XX	XXX	-	-	-	-	-	-	-	-	-	-
18. Pisidium subtruncatum (Malm. 1855)	-	-	-	-	XX	-	-	-	-	-	-	-	-	-	-
19. Pisidium personatum (Malm. 1855)	-	XX	-	-	-	-	-	-	-	-	-	-	-	-	-

warm water, so its existence in the cold springs of the M. Călimani is quite doubtful. We could not find it there even after careful search.

Teodoxus transversalis is mentioned by several researchers (Soós, Bába and Grossu) as noticed between Aiud and Szeged between1943 and 1957. It is especially remarkable that Bába still found it in large quantities in the area belonging to Hungary on 16. 9.1956. In 1978 and during our later investigations we could nowhere identify this species. Its extinction was probably caused by the growing pollution of the river.

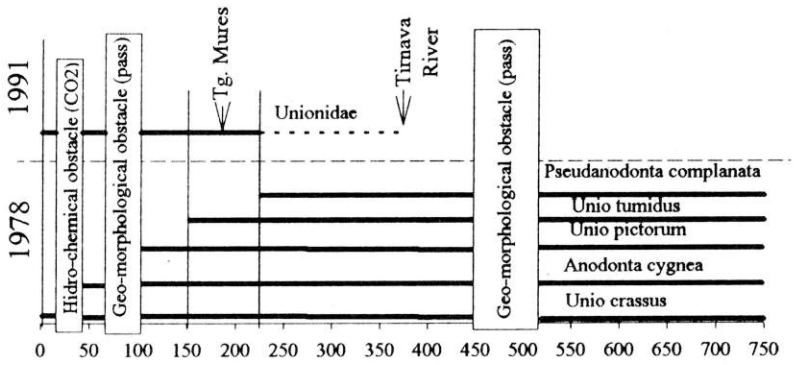
The range and dynamics of the Mollusca in the Mureş riverbed.

Between 1973 and 1983 we noticed the decrease of Ancylus fluviatilis (609 specimen/m^2 in 1973; 80 spec./m^2 in 1979 at Răstolița) as well as the narrowing down of the area of this species. As an earlier paper described in detail (Sárkány-Kiss,1986), Nalbant in 1956 collected this species still in Tîrgu Mureş (personal communication). Comparing to occurrence the species has with-drawn around 70 km, that is up to Deda-Bistra. As known from the literature Durrant (1976,1977) Ancylus fluviatilis needs much oxygen; thus its extinction can be explained by the significant amount of decomposing organic material found. Table 2 shows the actual range of the species.

Table 1 reflects that the Unionidae still populated the Mureş riverbed all along its length in 1978. During our research (Sárkány-Kiss, 1977, 1988) according to the range of 6 species of the Unionidea shells, we divided the river into 9 portions. From the second reach (Voşlobeni - Remetea, 27 km) the shells and the huge mollusks were completely absent, because here the carbonic mineral water forms a hydro-chemical obstacle to the spreading of the Unionidae.

The fourth reach, the Toplița-Deda defile (40 km, 210 m level difference) constitutes a new barrier against the range of the shells, due to the geo-morphological structure of the section. The fast water and the changing water level have a modifying effect on the bottom of the water which is unfavorable for the establishment of the shells. The only young specimen Unio crassus collected in 1991 (Table 2) in this research of the river can be considered an accidental occurrence, drifted by the rising river.

Fig. 1. Range of Unionidae in 1978 and 1991



The research conducted in 1989 found drastic changes, in comparison with the 1978 results, in the range of the Unionide (Fig. 1). As Table 2 shows, from the portion where the Tîrnava flows into the Mureş (350 km down from the source of the Mureş) downward there was not found a single living example. This decay affected Sphaerium rivicola and Lithoglyphus naticoides previously generally well spread here. Some living examples of the L. naticoides, however, could be detected at a single spot, the Ilia - Zam pass. According to the chemical examinations we concluded that the water of the Tîrnava is polluted, in an increased measure, by mercury and chromium.

Table 3. Distribution of mollusks in the three part of the river

	Upper P.	Middle P.	Lower P.
SPECIES			
1. Viviparus contectus (Mill. 1813)	-	-	–
2. Viviparus acerosus (Burg. 1862)	-		-
3. Bythinella austriaca (Frauen. 1859)		-	-
4. Bithynia leachi (Schepp. 1823)	-		
5. Bithynia tentaculata (L. 1758)	-	-	
6. Acroloxus lacustris (L. 1758)	-	–	–
7. Lymnaea stagnalis (L. 1758)	-	–	–
8. Stagnicola palustris (O.F.Muller 1774)			
9. Stagnicola corvus (Gmel. 1788)	-		-
10. Radix auricularia (L. 1758)			
11. Radix peregra (O.F.Muller 1774)			-
12. Galba truncatula (O.F.Muller 1774)	+	–	–
13. Physa fontinalis (L. 1758)	-	–	–
14. Physa acuta (Drap. 1805)	-		
15. Aplexa hypnorum (L. 1758)			
16. Planorbarius corneus (L. 1758)			
17. Planorbis planorbis (L. 1758)			
18. Anisus septemgyratus (Rossm. 1835)	-	–	–
19. Anisus spirorbis (L. 1758)	+	–	-
20. Anisus vortex (L. 1758)	-		-
21. Bathyomphalus contorus (L. 1758)		-	
22. Armiger crista (L. 1758)	-		-
23. Gyraulus albus (O.F.Muller 1774)			-
24. Segmenta nitida (O.F.Muller 1774)	+	–	-
25. Hippeutis complanatus (L. 1758)	-	–	-
26. Succinea oblonga (Drap. 1801)			
27. Succinea putris (L. 1758)			
28. Oxyloma elegans (Risso. 1826)	-	-	
29. Unio pictorum (L. 1758)	-		
30. Unio tumidus (Retz. 1758)	-	–	–
31. Unio crassus (Retz. 1758)	+	–	–
32. Andonta cygnea piscinalis (Nilss. 1822)	-		
33. Andonta cygnea anatina (L. 1758)			-
34. Spaerium lacustre (O.F.Muller 1774)	-		
35. Pisidium amnicum (O.F.Muller 1774)		-	-
36. Pisidium casertanum (Poli. 1791)	+	-	-
37. Pisidium subtruncatum (Malm. 1855)	+	-	-
38. Pisidium personatum (Malm. 1855)		-	-

It is obvious in the literature that the shells are sensitive to heavy metals (Boyden, 1977), and it is more than probable that this caused the extinction. During our malacological investigations (1982) on the Tîrnava Mică we also noticed that Unio crassus sp. pollutes proportionally the riverbed as far as the chemical factory of Tîrnaveni, but there could not be found any example of this species along the rest of the riverbed. The extinction of the shells in the Mureş probably happened two or three years before our 1989 research, since we found only very few and much abraded scallops in the alluvium. In our opinion in the last ten years the concentration of the polluting substances in the water of the river has significantly increased, owing to the almost chronic lack of precipitation and to the low water level.

Comparing the results of Table 1 and 2 one can see that the number of shell populations has greatly decreased also on the upper and middle portions of the river. The danger of extinction is especially present in the portion after Tîrgu Mureş. In the middle reaches of the river, in 1991 we could find a few examples of Unionidae only after strenuous searching, while in the seventies the density of 10-20 ind./m^2 was not rare. We identified 80 specimens per m2 at the mouth of the Luţ stream in 1974. The Pseudanodonta complanata appeared only at one spot and in one example near the locality Gheja in 1991.

The Lymnaea and Planorbis species (Table 1 and 2) occur only in the riverside lentical biotops and in the portions of retained water, and they are not characteristic species of the river-bed.

The range and dynamics of flood area mollusks

Table 3 reflects the range of the species in the upper, middle and lower reaches. The composition, dynamics of certain populations, the evolution of the cenosis have been described in detail in the mentioned papers (Sárkány-Kiss,1977,1983a, 1983b, 1986). In these biotopes the water pollution had a smaller effect. We noticed the decay of Physa fontinalis only in the case of the dead branches of the river which have a continuous or frequent relation with the water of the river. The existence and the population dynamics of the mollusks in the flood area biotopes depend entirely on the chages of the water level of the river. The chronic lack of precipitation in the last ten years has caused violent changes in the composition of the cenoses. Table 4 shows the changes of the flood area lakes in Moreşti in this respect.

The number of the shells in the flood area biotopes has also decreased. We can mention two causes:

a) The riverbed has been deepened by the ever increasing, large-scale extraction of pebbles. Because of this much water has been drawn away from the dead branches of the river and from the smaller lakes in the flood area.

b) The lack of floods in the last few decades; it obviously affects negatively the proliferation of the freshwater mollusks (Sárkány-Kiss, 1977).

Conclusions and proposals

Examining the mollusis of the Mureş and its flood area, and their dynamics over many years we can draw the following conclusions:

1. The mollusk population has greatly decreased in the middle portion and has totally disappeared from the riverbed in the lower portion on a 418 km length, due to water pollution (Figure 1). We consider the extinction of Unionidae to be a particularly alarming loss, due to their important role in biological water purification.

2. Theodoxus transversalis and Sphaerium corneum are now permanently extinct in the Mureş valley. Extinction endangers Pseudanodonta complanata in the very near future.

3. The degree of the water pollution was aggravated by low water levels in the last ten years. The low water level and the lack of floods are themselves impediments to the proliferation of the mollusks.

4. The fauna of the river has been heavily affected by large pebble extraction. The deepening of the riverbed in many cases drew the water away from the flood area biotopes, and annihilated the most important places of proliferation and nutrition.

5. The mollusk fauna of the flood area has in store significant resources of the species; this would make the repopulation of the riverbed possible if the quality of the water improved.

6. We suggest that the still unpolluted upper portion of the Mureş (Izvorul Mureş-Deda) should be absolutely protected, the collateral rivulets as well. In the same region, we suggest the creation of strictly protected reserves, such as the Voşlobeni peat bog, the stream Gudea and Ilva. We propose to stop urgently any further drainage and river regulation. These activities lead to the annihilation of a natural water reserve, and of its rare and characteristic flora and fauna.

7. In the middle and lower sections, significant change may come only with the proper purification of the industrial and communal outlet waters.

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