

THE ROLE OF THE DANUBE HYDROGRAPHIC BASIN IN THE DISTRIBUTION OF GASTROPODS WITHIN THE FAUNISTIC PROVINCES OF ROMANIA

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Abstract. The paper presents preliminary data regarding the patrimony of gastropods from the main rivers of the Danube hydrographic basin, which are specific to the zoogeographical provinces of Romania. It is highlighted the fact that there have been identified 82 species of gastropods in the continental water bodies. The distribution of the species in the five provinces is as it follows: Dacian – 8 species, Moessic – 17 species, Pannonian – 2 species, Pontic – 21 species, and Moldavian – 1 species. As number of species, there predominated the gastropods from the Pontic and Moessic provinces, which emphasizes that the gastropods spreading centre within Romania is the Danube, the Danube Floodplain, and the Danube Delta.

Keywords: gastropods, Danube, faunistic provinces, Romania.

Rezumat. Rolul bazinului hidrografic al Dunării în răspândirea gastropodelor în provinciile faunistice din România. Lucrarea prezintă date asupra patrimoniului gastropodelor din principalele râuri ale bazinului hidrografic al Dunării, specifice provinciilor zoogeografice din România. Se evidențiază că în apele continentale au fost identificate un număr de 82 specii gastropode. Răspândirea speciilor în cele 5 provincii este: Dacică – 8 specii, Moesică – 17 specii, Panonică – 2 specii, Pontică – 21 specii și Moldavă – 1 specie. Au dominat prin număr de specii gastropodele din provinciile Pontică și Moesică, ceea ce arată că centrul de răspândire al gastropodelor în ecosistemele acvatice de pe teritoriul României este Dunărea, zona inundabilă și Delta Dunării.

Cuvinte cheie: gastropode, Dunăre, provincii faunistice, România.

INTRODUCTION

The Danube hydrographic basin within Romania comprised 15 hydrographic basins of the main tributary rivers (ARDELEAN et al., 1964; BREZEANU & GRUIȚĂ, 2002) (Fig. 1). The total number of gastropods identified in the river system reaches 82 species (CIOBOIU, 2003; 2006; 2008). Analysing the figure below, we notice that the highest number of species is characteristic to the Danube, while in the other hydrographic basins the number is relatively uniform, varying between 54 and 28 species: 1. The upper Tisa – 30 species; 2. The Someș – 30 species; 3. The Crișuri rivers – 39 species; 4. The Mureș – 35 species; 5. The Bega, the Timiș, the Caraș – 54 species; 6. The Nera, the Cerna – 51 speies; 7. The Jiu – 28 species; 8. The Olt – 31 species; 9. The Vedeia – 29 species; 10. The Argeș – 29 species; 11. The Ialomița – 31 species; 12. The Siret – 29 species; 13. The Prut – 31 species; 14. The Danube – 113 species (54 species along the Romanian sector); 15. The shore area – 96 species (82 species on the continental platform of the Black Sea, the Romanian sector). These species cover a specific space within the biogeographic provinces of Romania.

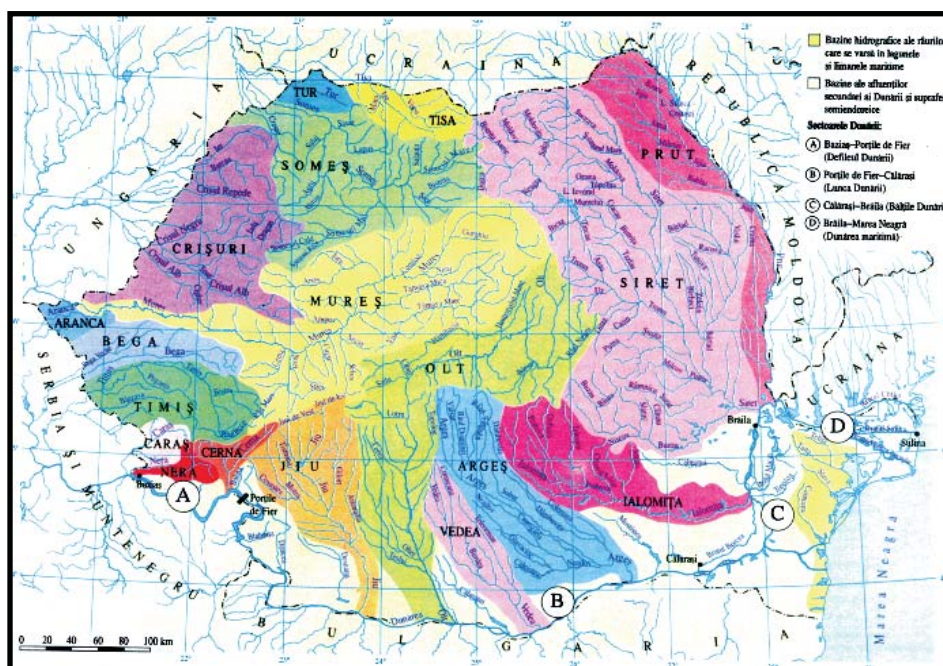


Figure 1. Distribution of gastropods within the hydrographical basins of Romania (after DRUGESCU, 1994).
Figura 1. Distribuția gastropodelor în bazinele hidrografice din România (după DRUGESCU, 1994).

By analysing the position of the hydrographic basins of the main rivers, it results that the Danube and the lower sectors of the Jiu, the Olt, the Argeş, the Ialomiţa rivers belong to the Moessic province. The lower sector of the Danube, starting from the mouth of the Argeş and the lower part of the Siret basin, as well as the small streams from Dobroudja belong to the Pontic province. Most of the rivers from Romania are located within the Dacian province. Among these, we mention the Mureş, the upper sectors of the main tributaries of the Danube (the Jiu, the Olt, the Argeş, the Ialomiţa). The Prut River is placed in the Moldavian province, while the Crişuri rivers, the Bega, the Nera, the Caraş, the Cerna rivers are included in the Pannonian province (BĂNĂRESCU, 1970; CĂLINESCU et al., 1972) (Fig. 2).

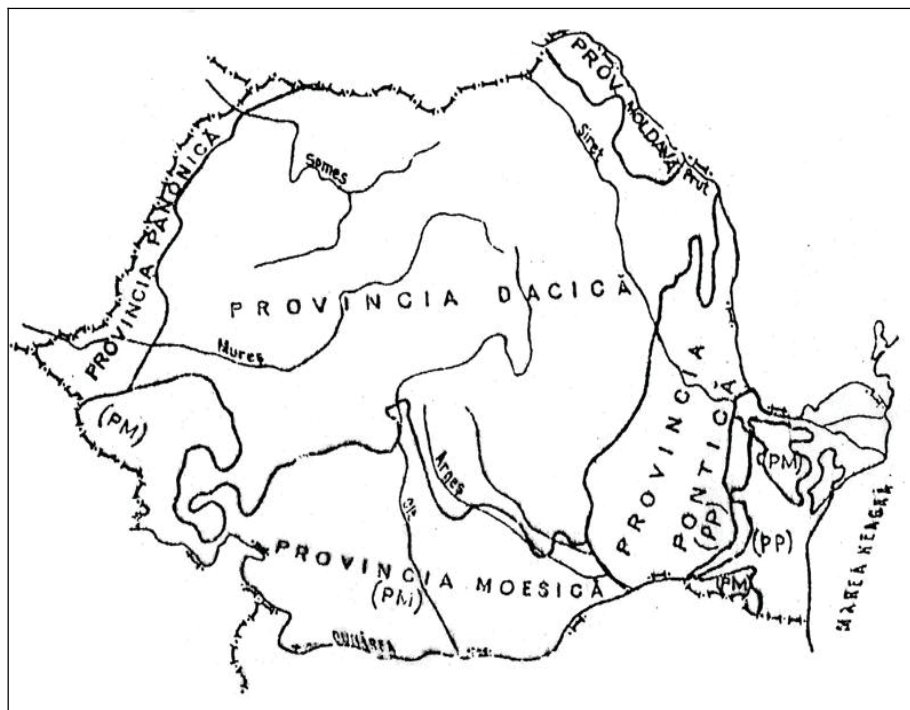


Figure 2. Biogeographic regions of Romania (after CĂLINESCU et al., 1972).
 Figura 2. Regionarea biogeografică a României (după CĂLINESCU et al., 1972).

MATERIAL AND METHODS

In order to globally evaluate the diversity and distribution of the species, there was performed an inventory of the aquatic gastropods patrimony in the five Romanian faunistic provinces. For rendering the specific features of the aquatic ecosystems gastropods live in and emphasizing their distribution within the zoogeographical provinces, there were taken qualitative and quantitative samples from the Danube and its tributaries, the Jiu, the Olt, and the Argeş. Within this framework, it has been achieved a synthesis of the zoogeographical distribution of the fresh water gastropods on the territory of Romania for the first time (BĂNĂRESCU, 1990; BĂNĂRESCU & BOŞCAIU, 1973; COSTACHE, 1996; DRUGESCU, 1994).

RESULTS AND DISCUSSIONS

Following the distribution of the gastropods on faunistic provinces, it results that out of the total number of 82 species located within all the rivers, 8 species are characteristic to the Dacian province, 17 to the Moessic province, 2 to the Pannonian province, 21 to the Pontic province, and one species to the Moldavian province (Table 1).

Table 1. Distribution of the gastropods characteristic to the faunistic provinces of Romania.
 Tabel 1. Răspândirea gastropodelor caracteristice în provinciile faunistice din România.

No.	Species	Faunistic provinces of Romania				
		Dacian	Moessic	Pannonian	Pontic	Moldavian
1.	<i>Theodoxus (Th.) danubialis</i> (C. PFEIFFER 1828)	+	+	+	+	+
2.	<i>Theodoxus (Th.) d. stragulatus</i> (C. PFEIFFER 1828)		+			
3.	<i>Theodoxus (Th.) euxinus</i> (CLESSIN 1887)				+	
4.	<i>Theodoxus (Th.) fluviatilis</i> (LINNAEUS 1758)		+		+	
5.	<i>Theodoxus (Th.) pallasi</i> LINDHOLM 1924				+	
6.	<i>Theodoxus (Th.) prevostianus</i> (C. PFEIFFER 1828)			+		
7.	<i>Theodoxus (Th.) transversalis</i> (C. PFEIFFER 1828)		+	+	+	
8.	<i>Viviparus acerosus</i> (BOURGUIGNAT 1862)	+	+	+	+	+
9.	<i>Viviparus contectus</i> (MILLET 1813)	+			+	

10.	<i>Viviparus viviparus</i> (LINNAEUS 1758)			+		+	
11.	<i>Valvata (Cincinna) piscinalis</i> (O. F. MULLER 1774)	+		+		+	+
12.	<i>Valvata (Cincinna) piscinalis antiqua</i> MORRIS 1838			+			
13.	<i>Valvata (Valvata) cristata</i> O. F. MULLER 1774	+					+
14.	<i>Borysthenia naticina</i> (MENKE 1845)			+		+	
15.	<i>Pseudamnicola (P.) dobrogica</i> GROSSU 1986					+	
16.	<i>Pseudamnicola (P.) leontina</i> GROSSU 1986					+	
17.	<i>Pseudamnicola (P.) penchinati</i> (BOURGUIGNAT 1870)					+	
18.	<i>Pseudamnicola (P.) razelmiana</i> GROSSU 1986					+	
19.	<i>Pseudamnicola (P.) bacescui</i> GROSSU 1986					+	
20.	<i>Grossuana codreanu</i> GROSSU 1946					+	
21.	<i>Paladilhia (Paladilhopsis) transylvanica</i> ROTARIDES 1943	+					
22.	<i>Paladilhia (Paladilhopsis) carpathica</i> SOOS 1940	+					
23.	<i>Paladilhia (Paladilhopsis) leruthi</i> C. R. BOETGER 1940	+					
24.	<i>Bythinella austriaca</i> (FRAUENFELD 1857)	+					
25.	<i>Bythinella a. melanostroma</i> BRANCSIK 1889					+	
26.	<i>Bythinella dacica</i> (GROSSU 1946)	+					
27.	<i>Bythinella grossui</i> FALNIOWSKI, SZAROWSKA & SÎRBU 2009	+					
28.	<i>Bythinella molcsany</i> (J. WAGNER 1941)	+					
29.	<i>Potamopyrgus jenkinsi</i> (SMITH 1889)					+	
30.	<i>Lithoglyphus apertus</i> (KUSTER 1852)			+			
31.	<i>Lithoglyphus naticoides</i> (C. PFEIFFER 1828)	+		+		+	
32.	<i>Lithoglyphus pygmaeus</i> FRAUENFELD 1863			+			
33.	<i>Bithynia (Bithynia) tentaculata</i> (LINNAEUS 1758)	+		+		+	+
34.	<i>Bithynia (Codiella) leachii</i> (SHEPPARD 1823)	+		+		+	+
35.	<i>Bithynia (Codiella) troschelli</i> (PAASCH 1842)			+		+	
36.	<i>Turricaspia (Clessiniola) variabilis</i> (EICHWALD 1838)					+	
37.	<i>T. (Laevicaspia) lincta</i> (MILASCHEWITCH 1908)					+	
38.	<i>T. (Oxygyrgula) ismailensis</i> (GOL. & STAROB. 1966)					+	
39.	<i>T. (Turricaspia) dimidiata</i> (EICHWALD 1841)					+	
40.	<i>T. (Micromelania) ostroumovi</i> (GOL. & STAROB. 1966)					+	
41.	<i>Melanopsis parreyssi</i> PHILIPPI 1847					+	
42.	<i>Esperiana esperi</i> (A. FERUSSAC 1823)	+		+		+	+
43.	<i>E. (Microcolpia) daudebardii</i> (PREVOST 1821)	+		+		+	+
44.	<i>E. (Microcolpia) daudebardii acicularis</i> (FERUSSAC 1823)			+		+	
45.	<i>Amphimelania holandri</i> (C. PFEIFFER 1828)			+			
46.	<i>Physa fontinalis</i> (LINNAEUS 1758)	+		+		+	+
47.	<i>Physella (Costatella) acuta</i> (DRAPARNAUD 1805)	+		+		+	+
48.	<i>Aplexa hypnorum</i> (LINNAEUS 1758)	+		+		+	+
49.	<i>Lymnaea stagnalis</i> (LINNAEUS 1758)	+		+		+	+
50.	<i>Stagnicola corvus</i> (GMELIN 1791)	+		+		+	+
51.	<i>Stagnicola palustris</i> (O. F. MULLER 1774)	+		+		+	+
52.	<i>Stagnicola turricula</i> HELD 1836	+				+	
53.	<i>Radix ampla</i> (W. HARTMANN 1821)			+		+	
54.	<i>Radix auricularia</i> (LINNAEUS 1758)	+		+		+	+
55.	<i>Radix balthica</i> (LINNAEUS 1758)	+		+		+	+
56.	<i>Radix labiata</i> (ROSSMASSLER 1835)	+		+		+	+
57.	<i>Galba truncatula</i> (O. F. MULLER 1774)	+		+		+	+
58.	<i>Ancylus fluviatilis</i> O. F. MULLER 1774			+		+	
59.	<i>Ferrissia (Pettancylus) clessiniana</i> (JICKELI 1882)			+		+	
60.	<i>Acroloxus lacustris</i> (LINNAEUS 1758)	+		+		+	+
61.	<i>Planorbis (Planorbis) carinatus</i> O. F. MULLER 1774	+		+		+	+
62.	<i>Planorbis (Planorbis) planorbis</i> (LINNAEUS 1758)	+		+		+	+
63.	<i>Biomphalaria tenogophila</i> (ORBIGNY 1835)			+		+	
64.	<i>Anisus (Anisus) calculiformis</i> (SANDBERGER 1874)						+
65.	<i>Anisus (Anisus) leucostoma</i> (MILLET 1813)	+		+			
66.	<i>Anisus (Anisus) septemgyratus</i> (ROSSMASSLER 1835)	+		+		+	+
67.	<i>Anisus (Anisus) spirorbis</i> (LINNAEUS 1758)	+		+		+	+
68.	<i>Anisus (Disculifer) vortex</i> (LINNAEUS 1758)	+		+		+	+
69.	<i>Anisus (Disculifer) vorticulus</i> TROSCHER 1852			+		+	
70.	<i>Bathyomphalus contortus</i> (LINNAEUS 1758)	+		+		+	+
71.	<i>Gyraulus (Armiger) crista</i> LINNAEUS 1758	+		+		+	+
72.	<i>Gyraulus (Gyraulus) acronicus</i> (A. FERUSSAC 1807)	+		+		+	+
73.	<i>Gyraulus (Gyraulus) albus</i> (O. F. MULLER 1774)	+		+		+	+
74.	<i>Gyraulus (Torquis) laevis</i> (ALDER 1838)	+		+		+	+
75.	<i>Gyraulus (Lamorbis) rossmaessleri</i> (AUERSWALD 1852)			+		+	
76.	<i>Hippeutis complanatus</i> (LINNAEUS 1758)	+		+		+	+
77.	<i>Segmentina nitida</i> (O. F. MULLER 1774)	+		+		+	+
78.	<i>Planorbarius corneus</i> (LINNAEUS 1758)	+		+		+	+
79.	<i>Planorbella duryi</i> (WETHERBY 1879)			+		+	
80.	<i>Oxyloma (Oxyloma) dunkeri</i> (L. PFEIFFER 1865)			+		+	
81.	<i>Oxyloma (Oxyloma) elegans</i> (RISSO 1826)			+		+	
82.	<i>Oxyloma (Oxyloma) pinteri</i> GROSSU 1987			+		+	+

The Dacian Province is the largest zoogeographical unit on the territory of our country and includes the entire mountain region and partially the hilly region. Most of the species living in this province display a Central-European distribution. The main gastropods characteristic to the province are (GROSSU, 1946; GROSSU & NEGREA, 1984; FALNIOWSKI et al., 2009): *Valvata (V.) cristata* O. F. MULLER 1774, *Paladilhia (Paladilhiopsis) transsylvanica* ROTARIDES 1943, *P. (P.) carpathica* SOOS 1940, *P. (P.) leruthi* C. R. BOETGER 1940, *Bythinella austriaca* (FRAUENFELD 1857), *B. dacica* (GROSSU 1946), *B. grossui* FALNIOWSKI, SZAROWSKA & SÎRBU, 2009; *B. molcsany* (J. WAGNER 1941).

The Moessic Province includes the high and low plains, as well as the hilly or even the mountain regions from Banat, Oltenia, Muntenia and North and South Dobroudja. Most of the fauna present in this province is made up of species that usually live in the plain and hilly regions of the country and are common to all the zoogeographical provinces (GROSSU, 1955; BOTOȘĂNEANU & NEGREA, 1976). Aquatic gastropods developed in a significant number in this province. Thus, we mention the species – *Theodoxus (Th.) d. stragulatus* (C. PFEIFFER 1828), *Th. (Th.) transversalis* (C. PFEIFFER 1828), *Viviparus viviparus* (LINNAEUS 1758), *Valvata (Cincinna) piscinalis antiqua* MORRIS 1838, *Borysthenea naticina* (MENKE 1845), *Lithoglyphus apertus* (KUSTER 1852), *L. pygmaeus* FRAUENFELD 1863, *Bithynia (Codiella) troschelli* (PAASCH 1842), *Esperiana (Microcolpia) daudebardii acicularis* (FERUSSAC 1823), *Amphimelania holandri* (C. PFEIFFER 1828), *Physella (Costatella) acuta* (DRAPARNAUD 1805), *Stagnicola palustris* (O. F. MULLER 1774), *Radix ampla* (W. HARTMANN 1821), *R. labiata* (ROSSMASSLER 1835), *Galba truncatula* (O. F. MULLER 1774), *Ancylus fluviatilis* O. F. MULLER 1774, *Ferrissia (Pettancylus) clessiniana* (JICKELI 1882), *Biomphalaria tenogophila* (ORBIGNY 1835), *Anisus (Anisus) leucostoma* (MILLET 1813), *Anisus (Disculifer) vorticulus* TROSCHER 1852, *Gyraulus (Gyraulus) albus* (O. F. MULLER 1774), *Gyraulus (Lamorbis) rossmaessleri* (AUERSWALD 1852), *Planorbella duryi* (WETHERBY 1879).

Ancylus fluviatilis, a specific reophilic form, was quite often identified on the river rocks in Banat, at the mouth of the Danube tributaries (BĂNĂRESCU & SÎRBU, 2002). *Radix ampla* and *R. labiata*, more or less limnophilous species, appear in the areas with still water, where aquatic vegetation finds appropriate development conditions. In the springs located on the valleys of the Mraconia and Berzeasca rivers, the species *Radix labiata* was identified in a biocoenosis on the sandy bottoms in moss.

In the components of the biocoenoses from permanent or temporary stagnant waters, gastropods make up relatively dense populations, which develop in almost all the pools located in the Iron Gates area. In this province, there were also identified the species belonging to the *Planorbis* and *Anisus* genus, as well as the species *Amphimelania holandri* (NEGREA, 1994).

The Pannonian Province is located in Banat-Crisana Plain, in the west of our country. In terms of age, it is younger than the Dacian province. From the physical-geographical point of view, it covers a flat surface with forest steppe vegetation (oak forests, Turkish and Hungarian oak alternating with gramineous plants), rivers characterized by a high discharge and a moderate continental climate (BOTOȘĂNEANU & NEGREA, 1976; BĂNĂRESCU & ARION, 1982; GROSSU, 1986). The gastropods from this province are represented by the species *Theodoxus (Th.) prevostianus* (C. PFEIFFER 1828) and *Melanopsis parreyssi* PHILIPPI 1847.

The Pontic Province covers the low plain and hilly regions from Bărăgan, Dobroudja Plateau, and Covurlui Plain (GROSSU, 1939; CIOBOIU, 2003). In this province, there were identified the most numerous aquatic gastropod species from Romania – *Theodoxus (Th.) euxinus* (CLESSIN 1887), *Th. (Th.) fluviatilis* (LINNAEUS 1758), *Th. (Th.) pallasi* LINDHOLM 1924, *Viviparus contectus* (MILLET 1813) (Ponto-Dacian species), *Pseudamnicola (P.) dobrogica* GROSSU 1986, *P. (P.) leontina* GROSSU 1986, *P. (P.) penchinati* (BOURGUIGNAT 1870), *P. (P.) razelmiana* GROSSU 1986, *P. (P.) bacescui* GROSSU 1986, *Grossuana codreamui* GROSSU 1946, *Bythinella a. melanostroma* BRANCSIK 1889, *Potamopyrgus jenkinsi* (SMITH 1889), *Turricaspia (Clessiniola) variabilis* (EICHWALD 1838), *T. (Laevicaspia) lincta* (MILASCHEWITCH 1908), *T. (Oxypyrgula) ismailensis* (GOL. & STAROB. 1966), *T. (Turricaspia) dimidiata* (EICHWALD 1841), *T. (Micromelania) ostroumovi* (GOL. & STAROB. 1966), *Esperiana esperi* (A. FERUSSAC 1823), *Hippeutis complanatus* (LINNAEUS 1758), *Oxyloma (O.) dunkeri* (L. PFEIFFER 1865), *O. (O.) elegans* (RISSO 1826), *O. (O.) pinteri* GROSSU 1987.

The Moldavian Province (Sarmatic) presents a fauna characteristic to forest steppe regions (GROSSU, 1987). Among gastropods, we mention *Anisus (A.) calculiformis* (SANDBERGER 1874).

The endemic species hold a great share in the total number of gastropods. Even if their spreading area is limited, there are rich populations (GROSSU, 1993; Fauna Europaea, 2005). These are elements that originate in Romania and so far they have been identified only in our country, the decisive role being played by the Danube hydrographic basin. Among these species, we mention:

➤ **endemic species within the Pontic Province:** *Theodoxus (Th.) euxinus* (CLESSIN 1887), *Th. (Th.) pallasi* LINDHOLM 1924 (ponto-caspică), *Pseudamnicola (P.) dobrogica* GROSSU 1986, *P. (P.) leontina* GROSSU 1986, *P. (P.) penchinati* (BOURGUIGNAT 1870), *P. (P.) razelmiana* GROSSU 1986, *P. (P.) bacescui* GROSSU 1986, *Grossuana codreamui* GROSSU 1946, *Turricaspia (Laevicaspia) lincta* (MILASCHEWITCH 1908), *T. (Oxypyrgula) ismailensis* (GOL. & STAROB. 1966), *T. (Turricaspia) dimidiata* (EICHWALD 1841);

➤ **Ponto-Danubian endemic species:** *Theodoxus (Th.) danubialis* (C. PFEIFFER 1828), *Th. (Th.) transversalis* (C. PFEIFFER 1828), *Borysthenea naticina* (MENKE 1845) (Ponto-Danubian-Baltic species), *Viviparus viviparus* (LINNAEUS 1758), *Lithoglyphus naticoides* (C. PFEIFFER 1828) (endemic species in the Danube basin), *L. apertus*

(KUSTER 1852), *L. pygmaeus* FRAUENFELD 1863, *Bithynia (Codiella) troschelli* (PAASCH 1842), *Amphimelania holandri* (C. PFEIFFER 1828), *Oxyloma (O.) pinteri* GROSSU 1987);

➤ **endemic species within the Dacian Province:** *Paladilhia (Paladilhiosis) transsylvanica* ROTARIDES 1943, *P. (P.) carpathica* SOOS 1940, *P. (P.) leruthi* C. R. BOETGER 1940, *Bythinella dacica* (GROSSU 1946), *B. grossui* FALNIOWSKI, SZAROWSKA & SÎRBU 2009, *B. molcsany* (J. WAGNER 1941);

➤ **endemic species within the Pannonian Province:** *Melanopsis parreyssi* PHILIPPI 1847.

Relict species are old species that develop on extremely reduced areas. Some of them are near extinct. Among the relict Pontic-Caspian species, we mention: *Theodoxus (Th.) prevostianus* (C. PFEIFFER 1828), *Borysthenia naticina* (MENKE 1845), *Turicaspia (Micromelania) ostroumovi* (GOL. & STAROB. 1966), *Melanopsis parreyssi* PHILIPPI 1847, *Amphimelania holandri* (C. PFEIFFER 1828).

A particular category is represented by **immigrant species**, which come from the neighbouring areas, extending their geographical area and, many times, replacing the local species. The most representative gastropods are: *Theodoxus (Th.) danubialis* (C. PFEIFFER 1828), *Th. (Th.) fluviatilis* (LINNAEUS 1758), *Viviparus acerosus* (BOURGUIGNAT 1862), *Valvata (Cincinnati) piscinalis* (O. F. MULLER 1774), *Esperiana esperi* (A. FERUSSAC 1823), *Ancylus fluviatilis* O. F. MULLER 1774.

From the analysis of the Danube hydrographical basin, we may notice that the distribution of the 82 species within the river system of Romania is relatively uniform. This can be explained through the unitary, integrative character of the river system, the main role being played by the Danube, its floodplain, and the Danube Delta, where there were identified the most numerous species (CIOBOIU, 2010; NEGREA, 1994).

CONCLUSIONS

In the continental water bodies from Romania, there were identified 82 species belonging to two large systematic groups: 45 Prosobranchiata and 37 Pulmonata. From the analysis of the species distribution in the five faunistic provinces, it results that there predominated the gastropods characteristic to Pontic and Moessic provinces, 45 species, due to the density of the river system.

We may conclude that the distribution centre of gastropods in the aquatic ecosystems from Romania is the Danube, its floodplain, and the Danube Delta, due to the diversity of ecosystem types (streams, lakes, pools, swamps) integrated within this zoogeographical space. The origin of the species characteristic only to the faunistic provinces is more or less linked to the Danube, its floodplain, and the Danube Delta.

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