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## CONTRIBUTIONS TO THE KNOWLEDGE OF THE PRESENT LIMNOCARDIIDAE FAUNA (MOLLUSCA: BIVALVIA) FROM ROMANIA

OANA P. POPA, ANDREI SARKANY-KISS, BEATRICE S. KELEMEN,  
ELENA I. IORGU, DUMITRU MURARIU, LUIS O. POPA

Abstract. Present Limnocardiidae species are relicts of a spread fauna during the geological past, in the Pontic-Aral-Caspian range. Family Limnocardiidae has a distribution range formed of the Caspian Sea, Aral Sea and the lagoons of the Black Sea. In the Romanian fauna, three genera were reported as belonging to this family: *Didacna* Eichwald, 1838, *Adacna* Eichwald, 1838, *Monodacna* Eichwald, 1838. During the field studies, only two genera, *Adacna* and *Monodacna*, were found, and important decreases were observed in the distribution area of these relict mussels within the last 50 years.

Résumé. Les espèces actuelles de Limnocardiidae sont des reliques d'une faune très répandue dans le passé géologique du bassin Ponto-Aralo-Caspique. La famille Limnocardiidae a une aire de répartition limitée formée par la Mer Caspique, la Mer Aral et les lagunes de la Mer Noire. Dans la faune de la Roumanie trois genres ont été cités comme appartenant à cette famille: *Didacna* Eichwald, 1838, *Adacna* Eichwald, 1838 et *Monodacna* Eichwald, 1838. Au cours des recherches effectuées sur le terrain on a retrouvé seulement deux genres, *Adacna* et *Monodacna* et on a observé des réductions importantes dans l'aire de répartition de ces coquillages reliques au cours des dernières 50 années.

Key words: Limnocardiidae, Romania, faunistics, *Didacna*, *Monodacna*, *Adacna*.

### INTRODUCTION

Limnocardiidae are bivalves molluscs with a general aspect similar to the marine clams of the family Cardiidae, with a much thinner shell, with radial ridges and ribs more or less regular. Cardinal platform is very thin, narrow with a much reduced rudimentary dentition. Both in the fossil species and in the present ones there is a high variability, species delimitation being made difficultly, the morphological criteria used in the identification rising confusions and uncertainties (Borcea, 1926).

The exaggerate variability occurred within this family is considered an adaptation to the brackish water, with different salinity percentages, changes appearing to different direction, either concerning the shell thickness or the dentition structure, in the siphon or the pallial sinus elongation (Grossu, 1962).

Subfamily Limnocardiinae includes fossil genera as *Plagiodacna* Andrusov, 1923, *Pseudoprodacna* S. Gillet, 1943, *Prosodacna* Tournouër, 1882 and *Limnocardium* Stoliczka, 1870, vanished since the Pliocene, as well as present genera, appeared in the remote past but which survived till now, as *Didacna* Eichwald, 1838, *Adacna* Eichwald, 1838 and *Monodacna* Eichwald, 1838.

Present Limnocardiidae species are relicts of a very wide spread fauna during the geologic past in the Pontic-Aral-Caspian basin. Family Limnocardiidae has a restricted distribution range, formed of the Caspian Sea and some lagoons of the Black Sea.

English translation by Mihaela Barcan Achim.

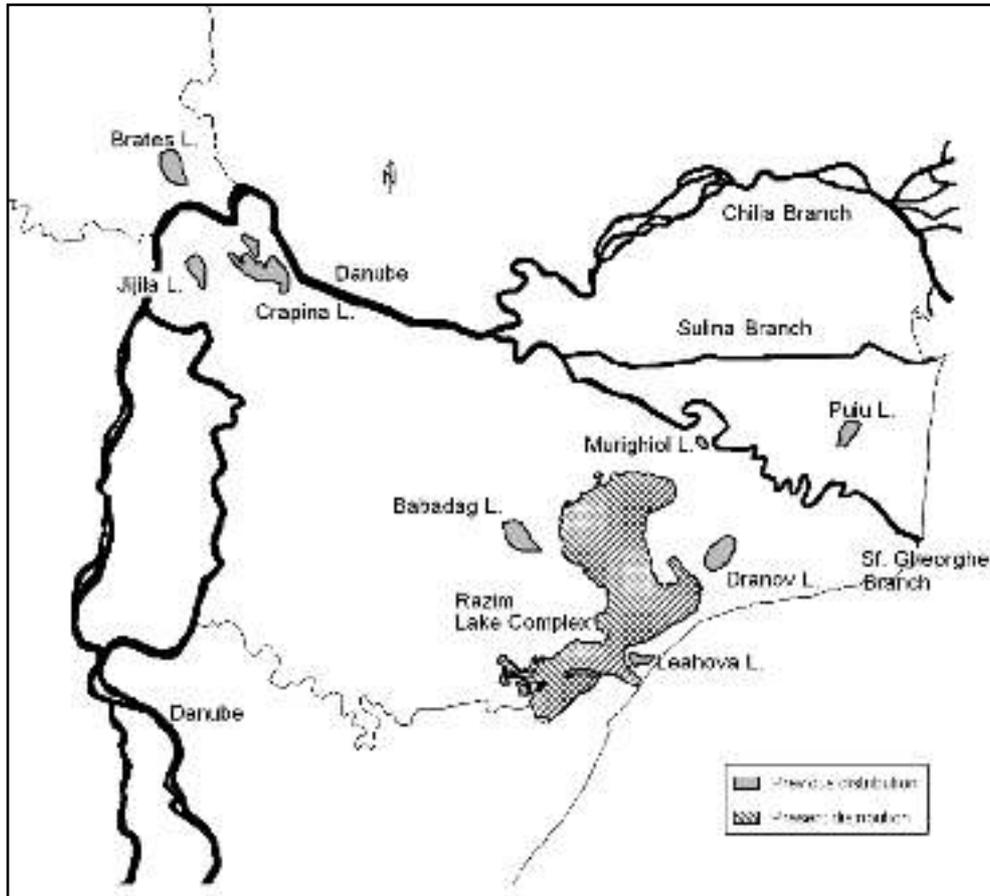


Fig. 1 – Distribution of family Limnocardiidae in Romanian fauna.

All species included in *Limnocardiidae* family are of national interest and need strict protection, basing on Order no 1198 of the 25<sup>th</sup> of November 2005. In Romanian fauna there are 3 genera included in this family, but, during the last 50 years, there was no systematic and faunistic study which may prove or not these assertions: *Didacna* Eichwald, 1838, *Adacna* Eichwald, 1838, *Monodacna* Eichwald, 1838.

In Romania, family *Limnocardiidae* was not intensely studied. The first papers on this bivalves group were written in 1926 by Ioan Borcea. Data on the distribution and the biology of the family *Limnocardiidae* in the Romanian fauna were published in “*Mollusca Bivalvia*”, a monograph paper (Grossu, 1962). Grossu (1973) published a study regarding this family, presenting its structure in present species and their distribution in the Romanian fauna.

Also, at the international level, *Limnocardiidae* species were little studied. Taxonomic studies based exclusively on morphological features were approached by the Ukrainian scientists Yurishinets, Kornushin & Munasyova (2001), Yurishinets & Kornushin (2001), Munasyova-Motyash (2006).

In Romania, in the specialized literature, sporadic reports were published from some studies on Unionidae and Gasteropoda population inventories from the flooding area of the Danube by Tudorancea (1972) and Negrea & Negrea (1975). Sarkany-Kiss (1995) published observations on the four species of the family Limnocardiidae from the Danube Delta.

During our field studies as well as after consulting the specialized literature only two genera, namely *Adacna* and *Monodacna*, were found again in a living state.

As a living way of life, present Limnocardiidae need water rich in organic substances and planktonic elements, which are abundantly present in the freshwater flow confluences with the sea or in lagoons, places also very rich in oxygen, so necessary to these animals which live deep in mud or in sand, using a little their foot for locomotion. The siphons have an important part because they help them to create the water current in the pallial chamber.

In a study made within the period 1972-1984 Limnocardiidae species were reported from some lakes which laid in the "Danube Delta Biosphere Reservation," that is Puiu, Dranov, Agighiol, Ceamurlia, Babadag, Istria, Nuntași, Leahova Mare and Leahova Mică (Mihăilescu & Artin, 1984). The studies from the period 1989-1994 from the "Danube Delta Biosphere Reservation" on the Limnocardiidae species recorded an alarming decreasing of these species populations as well as a diminishing of the collecting points observed before, the distribution range of this family being limited only to the Razelm Complex (Fig. 1) (Sarkany-Kiss, 1995).

#### MATERIAL AND METHODS

The methods of the mussel collecting used in this study are represented by:

- Direct collecting by observing the mussels at the beach level;
- Sediment collecting which is analyzed later for the mussel sorting;
- Mussel collecting by the substratum palpation;
- Specimen collecting using Băcescu dredge.

As an alternative to the direct collecting by supervising, the specialist can chose a part of the river/lake sediment which can be excavated, and then sorted for collecting the bivalve species of interest. Sediment displacement is a difficult process, and mainly time and energy consumer, but very efficient in the bivalve collecting, including here both the buried and juvenile forms which might not be observed.

Morphological identification of the collected individuals was made according to criteria as: shape of the coasts (higher or more flattened), how dense they are, after the dentition of the cardinal platform and the thickness of the valves (Jardin, 1952; Grossu, 1962).

#### RESULTS AND DISCUSSIONS

##### Genus *Didacna*

This genus appeared in Miocene, represented by numerous species, some of them surviving till now. Numerous present species were described from the Caspian Sea.

In 1926, Borcea collected some valves off Sulina, which he identified as *Didacna crassa* Eichwald. Grossu (1962) collected three valves from the beach of Razelm Lake, similar to those from Sulina, therefore the presence of this genus in the Romanian fauna remaining disputable.

Because the species was not found in a living state in the Romanian fauna, in order to create a complete image of the biotope as well as of some ecological particularities of this species, there is no certainty that this is a species of the genus

*Didacna* (Grossu, 1962). In the Romanian fauna, as well as in the basin of the Black Sea, no specimen of the genus *Didacna* was reported in a living state.

#### Genus *Monodacna*

It is one of the newest genera of this family, which appeared in Pliocene and it is widely spread in the Caspian Sea and in the lagoons around the Black Sea. In the Romanian fauna two species were identified, *Monodacna pontica* and *Monodacna colorata*, with a very large variability.

*Monodacna pontica* Eichwald, 1838 (Fig. 2) is specific to the Pontic basin, being present in all shores of the western side of the Black Sea. On the banks of Dnieper and of Bug rivers it is rarer. Data from the specialized literature are more numerous than for the other Limnocoardiidae species. Its distribution range is not limited only to the lagoons of the Black Sea, it penetrated upstream the Danube almost up to Galați, being reported from the Brateș Lake and from the Crapina-Jijila pool complex (Tudorancea, 1972; Negrea & Negrea, 1975).

Borcea collected numerous large sized specimens, up to 40 mm long, from the Dranov marsh of the Danube Delta. Also, he collected many specimens from Razelm complex, near the Bisericuța Island, by dredging. Grossu reported it also from Razelm and the Brateș Lake.

At present, because of the training and improving works of the floodplain of the Danube, *Monodacna pontica* remained with a limited distribution within the Razelm-Sinoe Lagoon Complex. Brateș Lake and Crapina-Jijila Pool Complex, habitats, from where the species was collected in the 60's, were subjected to important changes, Jijila pool being completely drained, this thing leading to the extinction of this species from these collecting places.

The species is reported in the lists which deal with the biodiversity of Dobrogea and in the papers which deal with the structure of the thanatocenosis from Portița-Periboina area (Nicoară, Mustață & Palici, 1996).

Collecting places for the species *Monodacna pontica* are presented in the table 1, being reported after recent collecting as well as a synthesis of the data from literature.

*Monodacna colorata* Eichwald, 1829 (Fig. 3) is considered a species characteristic to the banks of Dniester, Bug and Don. The specimens from the banks of Bug can be considered typical, but they also occur in Razelm, with a

Table 1

Collecting points for *Monodacna pontica* Eichwald, 1838.

<i>Monodacna pontica</i> Eichwald, 1838		
COLLECTING LOCALITY	COLLECTING DATE	LEGIT
Lac Golovița	15.08.2007	L. O. Popa, O. P. Popa, E. I. Iorgu, B. Kelemen
Lac Golovița	01.04.2008	Beatrice Kelemen
Ghiolul Crapina	1966	Alexandrina Negrea
Japsa Podu	1966	Alexandrina Negrea
Lacul Brateș	05.09.1958	Aurel Papadopol
Razelm Tulcea	1974	Dan Manoleli
Lac Dranov	1924	Ioan Borcea
Bisericuța (Razelm)	1924	Ioan Borcea

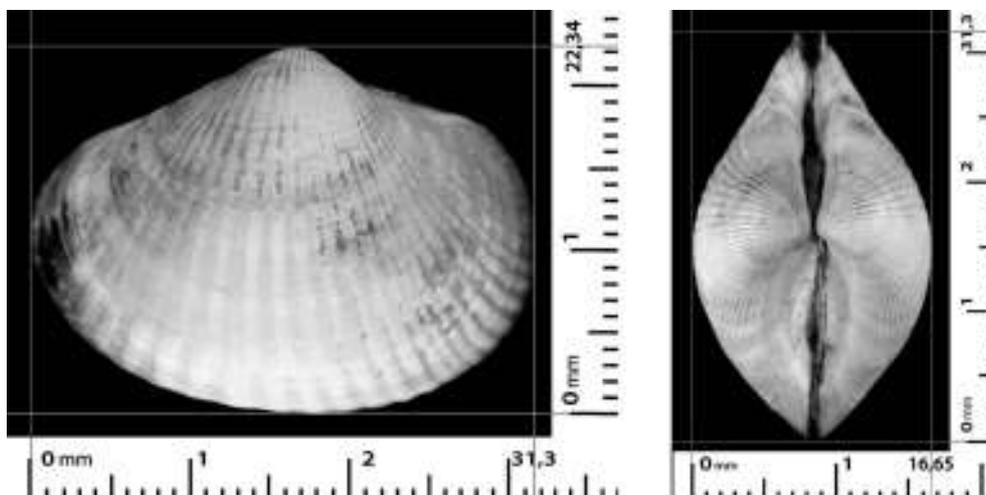


Fig. 2 – *Monodacna pontica* Eichwald, 1838.

large variability, this thing leading Borcea (op. cit.) to describe numerous varieties according to the rib number, their form and the distance between them, as well as to the ratio between the anterior-posterior diameter and the umbono-ventral one.

The large variability of the populations of this species was also remarked by Grossu (1962) in the collected and analyzed material from the Razelm-Sinoe lake complex.

Basing on the morphological features presented above, Borcea identified numerous varieties, as follows:

- *M. colorata* var. *ialpugensis* (ribs are very wide, especially in the anterior and central side) reported from Ialpug Lake (Ukraine) but also from Razelm and Golovița (near Jurilovca);
- *M. colorata* var. *angusticostata* (more regulated and narrower ribs) collected from Ialpug Lake, from Brateș and Razelm lakes;
- *M. colorata* var. *razelmiana* (higher shell and regulated ribs) – Razelm (Jurilovca, Doloșman Cape), Gura Portița, Sfântul Gheorghe Branch (near the Sărăturile sand bank);
- *M. colorata* var. *lucida* (white translucent shell) – near Doloșman Cape.

In table 2, the collecting places for *Monodacna colorata* during the period 2007-2008 are presented as well a synthesis of the reports from literature.

Table 2

Collecting places for *Monodacna colorata* Eichwald, 1829.

<i>Monodacna colorata</i> Eichwald, 1829		
COLLECTING LOCALITY	COLLECTING DATE	LEGIT
Lac Golovița	15.08.2007	L. O. Popa, O. P. Popa, E. I. Iorgu, B. Kelemen
Lac Golovița	01.04.2008	Beatrice Kelemen
Razelm Tulcea	12.06.1965	Alexandru V. Grossu
Lacul Brateș	1924	Ioan Borcea

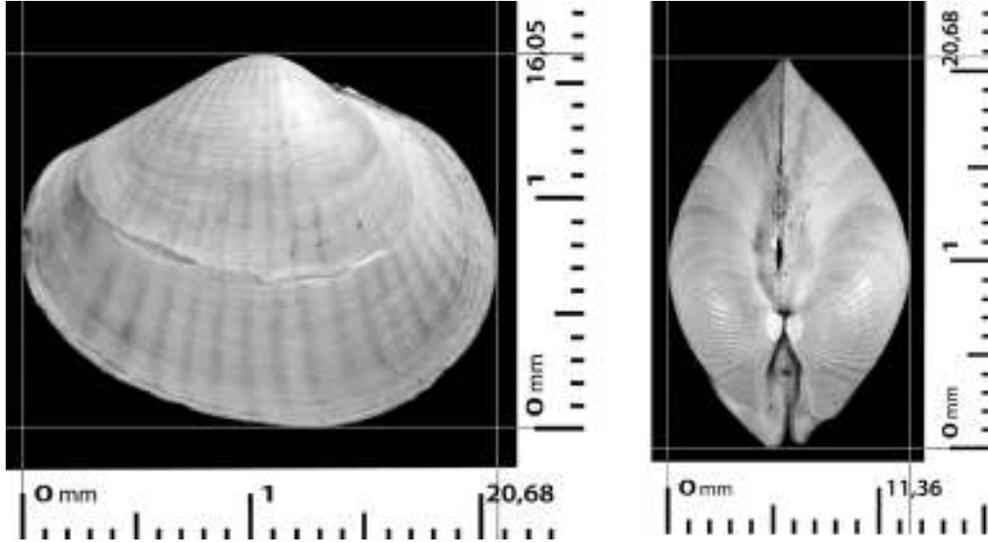


Fig. 3 - *Monodacna colorata* Eichwald, 1829.

#### Genus *Adacna*

It is an old genus which appeared in Miocene, with numerous fossil species, the present ones being spread in the Caspian Sea and in the shores and riparian lakes to the Black Sea.

*Adacna (Hypanis) plicata relictata* Milashevich, 1916 has an elongated oval shell, very thin and friable. Anterior part is shorter than the posterior one, having the ventral margin of the valves almost parallel with the cardinal line (Fig. 4).

Outer surface of the shell is furrowed by numerous radial thin, high and very sharp ribs, which transform in thin dense strips towards the valve end. The cardinal and lateral teeth are absent.

It is a species characteristic to the Caspian Sea but it was also collected from the lagoons of the Black Sea. It lives in the sands and the shores of the shallow lakes. The siphon length, sometimes great enough, proves us that the animal can be buried in the sand or in the shore up to 10-15 cm. It was collected in a high number from Golovița Lake, near the shore.

In table 3, the collecting places for *Adacna (Hypanis) plicata relictata* Milashevich, 1916 are presented, those reported in literature as well the last collecting made during the period 2007-2008.

Table 3

Collecting places for *Adacna plicata relictata*.

<i>Adacna plicata relictata</i> Milashevich, 1916		
COLLECTING LOCALITY	COLLECTING DATE	LEGIT
Lac Golovița	15.08.2007	L. O. Popa, O. P. Popa, E. I. Iorgu, B. Kelemen
Razelm Tulcea	04.06.1968	Alexandru V. Grossu
Razelm Tulcea	1974	Dan Manoleli
Cap Doloșman	1924	Ioan Borcea

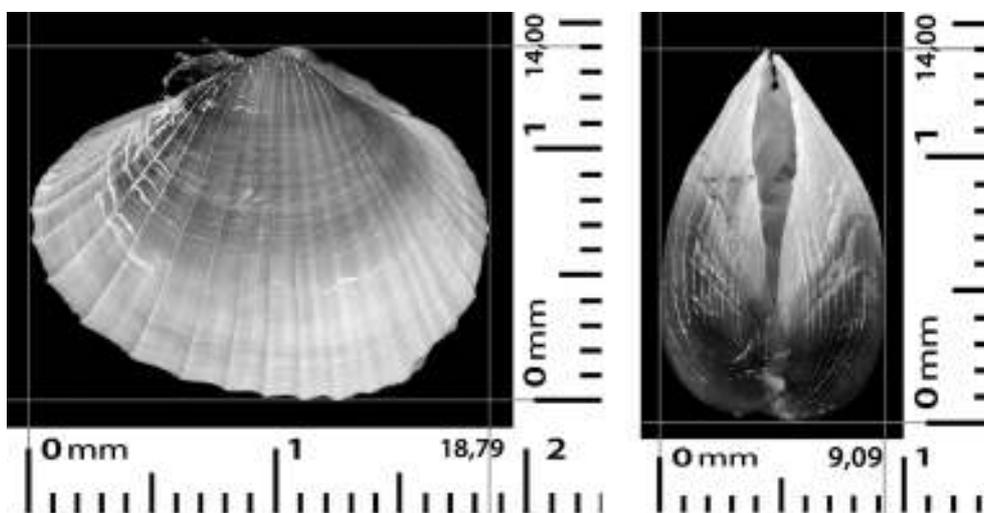


Fig. 4 – *Adacna plicata relicta* Milashevich, 1916.

*Adacna (Adacna) fragilis* Milashevich, 1908 – a mussel smaller than the other adacnids, reaching maximum 25 mm long and 17 mm high. The shell is thin and fragile, almost transparent, especially in the young specimens. The surface of the shell has numerous radial ribs, very flattened, narrowed anteriorly and widened posteriorly (Fig. 5).

*Adacna fragilis* has very elongated siphons, leading us to the conclusion that this species lives deep in the sand. Borcea collected it by dredging in Holbina Gulf, from the Great Razelm, as well as from the Golovița Lake, near Jurilovca and Doloșman, but in a small number. Later, it was collected also from Razelm by Grossu, not in a living state but valves, thrown by waves on the beach of Portița. In the collecting made during 2007-2008, only four specimens of *Adacna fragilis* were found again, in the dredging made in Golovița Lake. Collecting places reported in Romania up to now for *Adacna fragilis* are presented in table 4.

#### Conclusions

In the Romanian fauna there are two genera: *Monodacna* and *Adacna*. Genus *Didacna*, reported in the specialized literature after some empty valves, found again on the beach of Gura Portița and identified by Borcea as belonging to *Didacna crassa*, is not present in the Romanian fauna. Its distribution range is maintained at the level of the Caspian Sea, not being reported from the basin of the Black Sea.

Table 4

Collecting places for *Adacna fragilis* Milashevich, 1908.

<i>Adacna fragilis</i> Milashevich, 1908		
COLLECTING LOCALITY	COLLECTING DATE	LEGIT
Lac Golovița	15.08.2007	L. O. Popa, O. P. Popa, E. I. Iorgu, B. Kelemen
Lac Golovița	01.04.2008	Beatrice Kelemen
Razelm Tulcea	03.07.1967	Alexandru V. Grossu
Golf Holbina Razelm	1924	Ioan Borcea

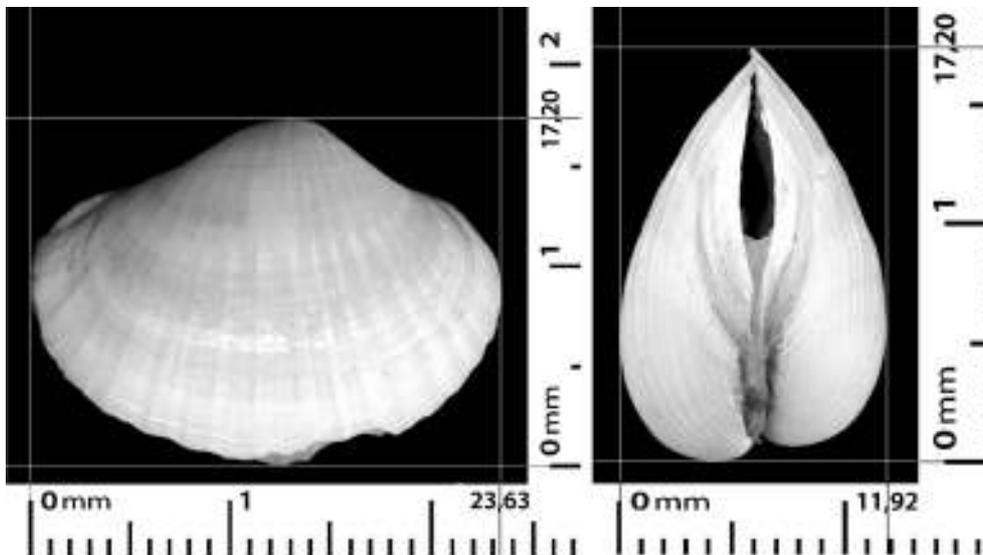


Fig. 5 – *Adacna fragilis* Milashevich, 1908.

The range covered by the present Limnocardiidae was much larger 100 years ago. Now, the range of the Limnocardiidae species is limited to the Razelm-Golovița lake complex.

The extinction of the Limnocardiids species in some habitats populated before can be considered the serious consequence of the excessive eutrophication of these aquatic basins as well as of the wrong management of the fish breeding farms organized within the last 100 years in these basins.

Besides the morphological features used in identification, the extremely high individual variability imposes a study based on molecular markers which can establish the taxonomic statute and the structure of this family of relict bivalves in the Romanian fauna.

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#### CONTRIBUȚII LA CUNOAȘTEREA FAUNEI DE LIMNOCARDIIDAE ACTUALE (MOLLUSCA: BIVALVIA) DIN ROMÂNIA

#### REZUMAT

Speciile actuale de Limnocardiidae sunt relice ale unei faune răspândită în trecutul geologic în bazinul Ponto-Aralo-Caspic. Familia Limnocardiidae are un areal de răspândire format din Marea Caspică, Marea Aral și lagunele de la Marea Neagră. În fauna României au fost citate 3 genuri ce aparținând acestei familii: *Didacna* Eichwald, 1838, *Adacna* Eichwald, 1838, *Monodacna* Eichwald, 1838. În cercetările de teren efectuate s-au regăsit numai 2 genuri: *Adacna* și *Monodacna* și au fost observate reduceri importante în aria de răspândire a acestor scoici relice în ultimii 50 de ani.

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Oana P. Popa, Elena I. Iorgu, Dumitru Murariu,  
Luis O. Popa

„Grigore Antipa” National Museum of Natural History  
Sos. Kiseleff No. 1, 011341 Bucharest, Romania

e-mail: oppopa@antipa.ro

elenap@antipa.ro

dmurariu@antipa.ro

popaluis@antipa.ro

Andrei Sarkany-Kiss

„Babes-Bolyai” University,

5-7 Clinicilor Street, Cluj-Napoca, Romania

e-mail: esarkany@gmail.com

Beatrice S. Kelemen

„Babes-Bolyai” University

Institute for Interdisciplinary Experimental Research

Molecular Biology Center, Treboniu Laurian Street 42

400271 Cluj-Napoca, Romania

e-mail: bea.kelemen@gmail.com