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Water beetles of the Danube delta, Romania (Coleoptera: Gyrinidae, Haliplidae, Noteridae, Dytiscidae, Hydrophilidae, Hydraenidae, Dryopidae, Heteroceridae)

Vodní brouci Dunajské delty v Rumunsku (Coleoptera: Gyrinidae, Haliplidae, Noteridae, Dytiscidae, Hydrophilidae, Hydraenidae, Dryopidae, Heteroceridae)

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Abstract. Faunistic investigation of aquatic Coleoptera in the Danube delta was carried out, based on the survey of available literature and authors' collection data. Altogether 95 species of water beetles is recorded from the area. Along the salinity gradient, typical inhabitants of fresh water habitats in the river delta are slowly replaced by the assemblages of halophilous and halobiont species in the fluvio-marine delta and in the coastal habitats. Species with a wide distributional range in the north-western part of the Palaearctic are prevalent; species with a restricted distribution, such as Ponto-Pannonic or Pontic elements, are also represented. No true endemics are present due to the recent geological origin of the area. The most remarkable record is *Agabus zimmermanni* Scholz, 1920 - a new species for Romania. The importance of this territory for the survival of many rare plants and animals is emphasized and some endangering factors are pointed out.

INTRODUCTION

River deltas and coastal habitats harbour specific and often quite unique fauna and flora. Ribera et al. (1996) pointed out the significance of these habitats for beetle assemblages. They recommended to emphasise the importance of invertebrates in the conservation plans and designation of protected areas. They also drew attention to the importance of small temporary and marginal habitats, which often provide the only suitable conditions for specific invertebrate communities.

The Danube delta is recognised as a unique phenomenon of world importance, whose most valuable parts have been more and more devastated recently. It still harbours an enormously diverse fauna and flora concentrated in a relatively small territory. Thanks to the geographical location, moderate climate, trophic conditions and a wide range of different habitats, the delta is inhabited, for example, by 110 fish species and about 300 species of birds, that is 4% of the world's avifauna. As about 80% of the territory of the delta is temporarily or permanently flooded, numerous water invertebrates find appropriate living conditions there (Štěrba 1979).

Water beetles belong to the most diverse groups among water invertebrate fauna, forming an important part of aquatic ecosystem food chains and providing significant bioindicators of the water and ecosystem quality. From the Pontic province, to which the Danube delta belongs, 180 species of water beetles have been mentioned (Ienistea 1978). Only 50 species have been recorded from the Danube delta (Ienistea 1968, Negru 1968), which reflects the insufficient knowledge of the local water beetle fauna.

In the present paper, we provide a review of the families Gyrinidae, Haliplidae, Noteridae, Dytiscidae, Hydrophilidae, Hydraenidae, Dryopidae and Heteroceridae (family classification sensu Lawrence & Newton 1995) from the Danube delta, based on literature data and our own collections.

STUDY AREA

A short history of the Danube delta

The process of the evolution and formation of the Danube delta can be divided into the following stages (Štěrba 1979, adapted):

1) the end of the Würm Glacial - early Dryas (about 10 000 B.C.) was characterized by successive warming and melting of glaciers, causing the rise of the Black Sea water level; consequently, a bay was formed in the area of the contemporary delta;
2) in the Preboreal - Atlantic (about 8 300 - 4 000 B.C.) period, sedimentation of bed-loads in the middle of the bay took place and transverse sandbanks were formed as later foundations of contemporary islands (called "grindul" in the Danube delta) in the line Letea - Caraorman - Crasnicol;
3) during the Epiatlantic - Subboreal - Subatlantic (about 4 000 B.C. - 0), retardation of the current of the Danube river in front of the island causey caused successive siltation of the lagoon and invasion of reed vegetation - the inner delta was evolved; at the end of this period, the basis of the contemporary net of branches with the Sf. George channel was already clearly perceptible, and also with the Sulina channel later raised, the Chilia channel was not formed yet;
4) during the Subatlantic - Subrecent (0 - 1700 A.D.) period, the main deposition activity of the Danube river was transferred beyond the island line; river sediments together with sea sand constituted longitudinal sand banks; the lagoons raised were being gradually silted and overgrown by reeds, then brought through by secondary branches - the fluvio-marine delta originated;
5) the Recent - the activity of the stream has been gradually transferred from south to north since the middle of the 18th century, and the Chilia channel with two inland deltas has been formed.

Recent geography of the Danube delta

The Danube delta is of a triangular shape, both the base line and its height are about 80 km. It begins behind the town of Tulcea by the bifurcation of the main channel into the Chilia channel (117 km long) and the Tulcea channel that again bifurcates after 9 km into the direct and partly artificial Sulina channel (71 km), and the oldest one - the Sf. George channel (113 km). These three main channels are mutually connected by a dense net of secondary channels, branches and canals, which have a total length of about 3,500 km (Štěrba 1979).

The climate of the delta is of a continental character, with certain peculiarities, which are caused by the proximity of the sea and the delta specificity itself. The average annual temperature is 11°C, the average temperature in summer is 23°C. The average annual precipitation about 350 mm is typical for arid areas; air humidity in summer remains between 60-70% (Anonymous 1983).

Four main geographic parts can be distinguished in the Danube delta (Štěrba 1979, see Fig. 1):

1) the river delta with a surface area of approximately 206,550 ha, that is 47.6% of the whole area of the Danube delta, extending eastwards from Tulcea to the line Periprava - Letea - Caraorman -Ivancea - Crasnicol - Perisol in a north-south direction;
2) the fluvio-marine delta (130,950 ha - 30%) lying between the river delta and the sea;
3) southern lagoons of the Razelm - Sinoe complex (88,000 ha - 20%);
4) channels, branches, and canals of the Danube river (8,500 ha - 2.4%).

Hundreds of lakes, channels, branches and vast areas of reed swamps are the key landscape elements of the Danube delta. In addition to that, sand-islands (so called "grinduls") with quite different fauna and flora are remarkable. These isolated areas in the middle of wetland habitats are distinguished by a steppe to semi-desert climate.

MATERIAL AND METHODS

The material used in the work was gained by both authors on individual expedition to the Danube delta (10.vi.-30.vi.1988, J. Šťastný lgt., det. et coll.; 25.v.-10.vi.1995, D. Trávníček lgt. et det., coll. Museum of South-Eastern Moravia, Zlín). Moreover, some individuals of *Rhantus* (*Nartus*) *grapei* (Gyllenhal, 1808) and *Dytiscus dimidiatus* Bergsträsser, 1778 were obtained from Mr. P. Vonička's expeditions (vii.1982, viii.1985, J. Šťastný det. et coll.). Literature data are taken from Ienistea (1968) and Negru (1968); we are not aware of any more recent faunistic paper dealing with the study area.

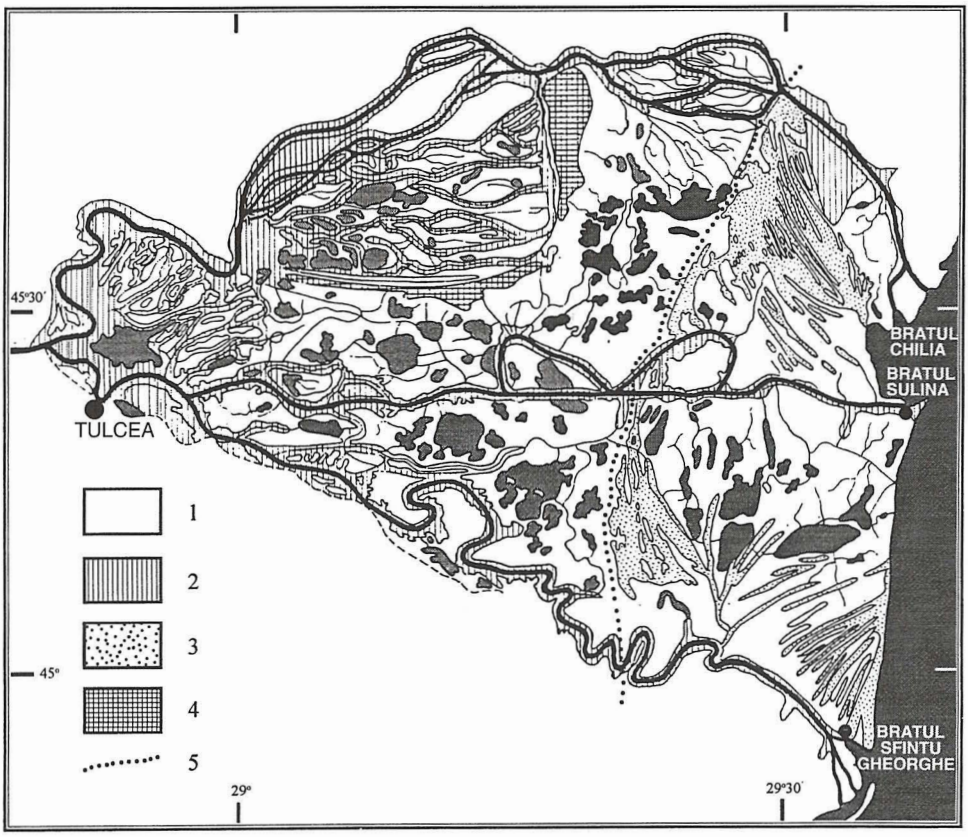


Fig. 1. Map of main habitats in Danube delta (according to Radu (1979), modified). 1. swamps, 2. aluvial sediments, 3. seaside sediments, 4. continental sediments, 5. boundary of the river and fluviomarine delta.
Obr. 1. Mapa hlavních typů prostředí delty Dunaje (podle Radu (1979), upraveno). 1. bažiny, 2. aluviální sedimenty, 3. sedimenty mořského původu, 4. pevninské sedimenty, 5. hranice říční a fluviomarinní delty.

The usual limnological methods were used. Water beetles were sampled with a strainer and a pond net with a mesh size of 0.3 mm. Part of the material was collected by splashing banks and coastal vegetation, as well as by rinsing out the coastal sediments. All species were recorded in the table on the presence/absence basis in the particular habitat types.

The terms for the palaearctic faunal elements are used according to the definitions of De Lattin (1967).

RESULTS

A total of 86 species of water beetles were collected in the course of the expeditions. The survey was completed with the data formerly published from this region (Ienistea 1968, Negru 1968). The list of all 95 species which have been so far recorded in the Danube delta is given in the Table 1.

Fresh water species without marked specialisation are prevalent in the river delta. Most of them are inhabitants of stagnant and slowly running water bodies, whether perennial or

Table 1. List of species. Comments: + presence, - absence; N. I. - species mentoined by Ienistea (1968) and Negru (1968); Š. T. - species reported herein; rd - river delta; fmd - fluviomarine delta; eu - fresh and eutrophic water; s - saline habitats; * *Berosus bispina* - probably wrongly determined by Ienistea (1968).
Tabulka 1. Přehled druhů. Vysvětlivky: + prezence, - absence; N. I. - druhy uváděné v pracích Ienistea (1968) a Negru (1968); Š. T. - druhy zjištěné autory; rd - říční delta; fmd - fluviomariní delta; eu - sladké eutrofizované vody; s - slaniska; * *Berosus bispina* - pravděpodobně chybná determinace Ienistea (1968).

Species druh	faunal elements faunistické prvky	N. I.	Š. T.	rd	fmd	eu	s
GYRINIDAE							
Gyrinus caspius Ménétries, 1832	Euro-West Asian	+	+	+	+	+	+
Gyrinus distinctus Aubé, 1838	Euro-Siberian	+	+	+	+	+	+
Gyrinus paykulli Ochs, 1927	Euro-West Asian	-	+	-	+	-	+
Gyrinus substriatus Stephens, 1828	Euro-West Asian	-	+	+	-	+	+
Gyrinus sufriani W. Scriba, 1855	Euro-West Asian	+	+	-	+	-	+
Aulonogyrus concinnus (Klug, 1834)	Holoarctic	+	-	+	-		
HALIPLIDAE							
Haliplus heydeni Wehncke, 1875	Euro-Siberian	+	+	+	-	+	-
Haliplus ruficollis (De Geer, 1774)	Euro-Siberian	-	+	+	-	+	-
Haliplus flavicollis Sturm, 1834	Euro-Siberian	+	+	+	-	+	-
Haliplus fulvus (Fabricius, 1801)	Euro-Siberian	-	+	+	+	+	-
Haliplus variegatus Sturm, 1834	Euro-Caucasian	+	+	+	+	+	-
Peltodytes caesus (Duftschmid, 1805)	Euro-Caucasian	+	+	+	+	+	-
NOTERIDAE							
Noterus clavicornis (De Geer, 1774)	Euro-Siberian	+	+	+	+	+	-
Noterus crassicornis (O. F. Müller, 1776)	Euro-Siberian	+	+	+	-	+	-
DYTISCIDAE							
Copelatinae							
Copelatus haemorrhoidalis (Fabricius, 1787)	Euro-Caucasian	-	+	+	-	+	-
Laccophilinae							
Laccophilus minutus (Linnaeus, 1758)	Palaearctic	+	+	+	-	+	-
Laccophilus poecilus Klug, 1834	Euro-Caucasian	+	+	+	+	+	-
Hydroporinae							
Hyphydrus ovatus (Linnaeus, 1761)	Euro-Siberian	-	+	+	+	+	-
Hydrovatus cuspidatus (Kunze, 1818)	Euro-West Asian	-	+	+	-	+	-
Bidessus nasutus Sharp, 1887	Euro-West Asian	-	+	+	-	-	+
Bidessus unistriatus (Schrank, 1781)	European	-	+	+	-	-	+
Hydroglyphus pusillus (Fabricius, 1781)	Euro-West Asian	-	+	+	+	+	+
Hygrotus decoratus (Gyllenhal, 1810)	Euro-Siberian	-	+	+	-	+	-
Hygrotus enneagrammus (Ahrens, 1833)	Euro-West Asian	-	+	-	+	-	+
Hygrotus impressopunctatus (Schaller, 1783)	Holoarctic	+	+	+	-	+	+
Hygrotus inaequalis (Fabricius, 1776)	Euro-Siberian	+	+	+	-	+	-
Hygrotus lernaeus (Schaum, 1857)	Ponto-Mediterranean	+	+	-	+	-	+
Hygrotus pallidulus (Aubé, 1850)	Holomediterranean	-	+	-	+	-	+
Hygrotus parallelogrammus (Ahrens, 1812)	Euro-Siberian	+	+	+	+	-	+
Hydroporus planus (Fabricius, 1781)	Euro-West Asian	-	+	+	-	+	-
Hydroporus striola (Gyllenhal, 1827)	Holoarctic	-	+	+	-	+	-
Hydroporus angustatus Sturm, 1835	Euro-Siberian	-	+	+	-	+	-
Porhydrus lineatus (Fabricius, 1775)	Euro-West Asian	-	+	+	-	+	-
Colymbetinae							
Agabus zimmermanni Scholz, 1920	Pontic	-	+	-	+	-	+
Agabus conspersus (Marsham, 1802)	Euro-West Asian	-	+	-	+	-	+
Ilybius quadriguttatus (Boisduval et Lacordaire, 1835)	Euro-Caucasian	+	+	+	-	+	-
Ilybius guttiger (Gyllenhal, 1808)	Euro-Siberian	+	-	+			
Rhantus grapii (Gyllenhal, 1808)	Euro-Siberian	-	+	+	+	+	-
Rhantus exsoletus (Forster, 1771)	Euro-Siberian	-	+	+	-	+	-
Rhantus latitans Sharp, 1882	Euro-Siberian	-	+	+	-	+	-
Rhantus frontalis (Marsham, 1802)	Holoarctic	+	-	+	-	+	-
Rhantus suturalis (MacLeay, 1825)	Austral.-Orient.-Palaearct.	+	+	+	+	+	-
Colymbetes fuscus (Linnaeus, 1758)	Euro-Caucasian	-	+	+	-	+	-

Table 1 continued.
Tabulka 1 - pokračování.

Species druh	faunal elements faunistické prvky	N. I.	Š. T.	rd	fmd	eu	s
Dytiscinae							
Hydaticus seminiger (De Geer, 1774)	Euro-Siberian	+	+	+	-	+	-
Hydaticus transversalis (Pontoppidan, 1763)	Euro-Siberian	+	+	+	-	+	-
Graphoderus austriacus (Sturm, 1834)	Euro-Siberian	-	+	+	-	+	-
Graphoderus bilineatus (De Geer, 1774)	Euro-Siberian	+	-	+	+		
Graphoderus cinereus (Linnaeus, 1758)	Holoarctic	-	+	+	-	+	-
Dytiscus dimidiatus Bergsträsser, 1778	Euro-West Asian	+	+	+	-	+	-
Dytiscus marginalis Linnaeus, 1758	Palaearctic	+	-	-	+		
Cybister lateralimarginalis (De Geer, 1774)	Euro-Siberian	+	+	+	+	+	+
HYDROPHILIDAE							
Helophorinae							
Helophorus brevipalpis Bedel, 1881	European	-	+	+	+	+	-
Hydrochinae							
Hydrochus carinatus Germar, 1824	European	-	+	+	-	-	-
Hydrochus elongatus (Schaller, 1783)	Euro-Siberian	-	+	+	+	-	-
Spercheinae							
Spercheus emarginatus (Schaller, 1783)	Euro-Siberian	+	+	+	+	-	-
Hydrophilinae							
Paracymus aeneus (Germar, 1824)	Euro-Caucasian	-	+	-	+	-	+
Hydrobius fuscipes (Linnaeus, 1758)	Holoarctic	+	+	+	+	+	-
Limnoxenus niger (Zschach, 1788)	European	+	+	+	+	-	-
Laccobius biguttatus Gerhardt, 1877	European	-	+	+	-	-	-
Laccobius minutus (Linnaeus, 1758)	Euro-Siberian	-	+	+	-	+	-
Helochares obscurus (O. F. Müller, 1776)	European	-	+	+	+	+	-
Enochrus melanocephalus (Olivier, 1792)	Euro-Caucasian	+	-	+	-	-	-
Enochrus bicolor (Fabricius, 1792)	Euro-Caucasian	+	+	+	+	+	+
Enochrus politus (Küster, 1849)	Ponto-Mediterranean	-	+	-	+	-	+
Enochrus quadripunctatus (Herbst, 1797)	Palaearctic	+	+	+	+	+	+
Enochrus testaceus (Fabricius, 1801)	Euro-Siberian	-	+	+	+	+	-
Enochrus affinis (Thunberg, 1794)	Palaearctic	-	+	+	-	-	-
Enochrus coarctatus (Gredler, 1863)	European	-	+	+	-	-	-
Cymbiodyta marginella (Fabricius, 1792)	Euro-Caucasian	+	+	+	+	-	-
Hydrochara caraboides (Linnaeus, 1758)	Euro-Siberian	+	+	+	-	-	-
Hydrochara flavipes (Steven, 1808)	Ponto-Mediterranean	+	+	+	+	-	-
Hydrophilus aterrimus (Eschscholtz, 1822)	Euro-Siberian	+	+	+	+	-	-
Hydrophilus piceus (Linnaeus, 1758)	Palaearctic	+	+	+	+	-	-
Berosus luridus (Linnaeus, 1761)	Euro-Caucasian	-	+	+	+	-	-
Berosus signaticollis (Charpentier, 1825)	Euro-Caucasian	+	+	+	-	-	-
Berosus frontifoveatus Kuwert, 1888	Palaearctic	-	+	+	+	+	+
Berosus bispina Reiche, 1855*	Holomediterranean	+	-	-	+	-	+
Berosus spinosus (Steven, 1808)	Palaearctic	+	+	-	+	-	+
Sphaeridiinae							
Coleostoma orbiculare (Fabricius, 1775)	Palaearctic	-	+	+	+	-	-
Cercyon marinus C. G. Thomson, 1853	European	-	+	+	-	-	-
Cercyon sternalis Sharp, 1918	European	-	+	+	-	-	-
HYDRAENIDAE							
Hydraeninae							
Limnebius atomus (Duftschmid, 1805)	European	+	+	+	+	-	-
Ochthebiinae							
Ochthebius minimus (Fabricius, 1792)	European	+	+	+	+	-	-
Ochthebius peisonis Ganglbauer, 1901	Ponto-Pannonic	+	+	-	+	-	+
Ochthebius viridis Peyron, 1858	Euro-Caucasian	+	+	+	+	-	+
DRYOPIDAE							
Dryops auriculatus (Geoffroy, 1785)	Euro-Caucasian	+	+	+	+	+	+
Dryops rufipes (Krynicki, 1832)	Euro-Caucasian	-	+	-	+	-	+
Dryops similaris Bollow, 1936	Palaearctic	-	+	+	-	-	-

Table 1 continued.
Tabulka 1 - pokračování.

Species druh	faunal elements faunistické prvky	N. I.	Š. T.	rd	fmd	eu	s
HETEROCERIDAE							
Heterocerus fenestratus (Thunberg, 1784)	Palaearctic	+	+	+	+	+	+
Heterocerus flexuosus Stephens, 1828	European	+	+	-	+	+	+
Heterocerus fossor Kiesenwetter, 1843	Euro-Siberian	+	-	-	+	+	-
Heterocerus fusculus Kiesenwetter, 1843	Euro-Siberian	-	+	+	+	+	-
Heterocerus marginatus (Fabricius, 1787)	Euro-Siberian	-	+	+	+	+	-
Heterocerus obsoletus Curtis, 1828	Euro-Siberian	+	+	-	+	+	+
Heterocerus parallelus Gebler, 1830	Euro-Siberian	+	-	-	+	-	+
Total (Celkem): 95		50	86	77	55	52	31

temporary, e.g. *Bidessus unistriatus* Schrank, 1781, *Colymbetes fuscus* (Linnaeus, 1758), *Dytiscus dimidiatus* Bergsträsser, 1778, *Graphoderus austriacus* (Sturm, 1834), *Hygrotus inaequalis* (Fabricius, 1777), *Hydaticus seminiger* (De Geer, 1774), *Ilybius quadriguttatus* (Boisduval et Lacordaire, 1835), *Porhydrus lineatus* (Fabricius, 1775), *Rhantus frontalis* (Marsham, 1802), *Haliplus flavicollis* Sturm, 1834, *Peltodytes caesus* (Duftschmid, 1805), *Gyrinus substriatus* Stephens, 1828, *Dryops auriculatus* (Geoffroy, 1785), *Noterus crassicornis* (O. F. Müller, 1776), *Limnebius atomus* (Duftschmid, 1805), *Spercheus emarginatus* (Schaller, 1783), *Hydrochus carinatus* Germar, 1824, *Hydrochara caraboides* (Linnaeus, 1758), *Limnoxenus niger* (Zschach, 1788), *Cymbiodota marginella* (Fabricius, 1792) and *Berosus luridus* (Linnaeus, 1761). Representatives of tyrphophilous species, namely *Hydroporus striola* (Gyllenhal, 1827) and *Enochrus coarctatus* (Gredler, 1863), were also found here. Great numbers of beetles inhabiting all kinds of biotopes, including even strongly eutrophic ones, occur here as well. They can be mostly classed with eurytopic as quite ubiquitous species: *Hydroporus planus* (Fabricius, 1781), *Hydroglyphus pusillus* (Fabricius, 1781), *Laccophilus minutus* (Linnaeus, 1758), *Hygrotus impressopunctatus* (Schaller, 1783), *Hyphydrus ovatus* (Linnaeus, 1761), *Rhantus suturalis* (MacLeay, 1825), *Haliplus heydeni* Wehncke, 1875, *Haliplus ruficollis* (De Geer, 1774), *Helophorus brevipalpis* Bedel, 1881, *Coelostoma orbiculare* (Fabricius, 1775), *Hydrobius fuscipes* (Linnaeus, 1758), *Laccobius minutus* (Linnaeus, 1758), *Helochares obscurus* (O. F. Müller, 1776), *Enochrus quadripunctatus* (Herbst, 1797) and *Enochrus testaceus* (Fabricius, 1801). It is more or less possible to find these species in the whole territory of the delta, excluding habitats with extreme salinity.

The species spectrum is slowly changed behind the line between the river and fluvio-marine delta. The species which are sensitive to advanced salinity gradually disappear and halophilous beetles begin to occur. Halobionts are quite prevalent at inland salt marshes as well as in coastal lagoons, marginal lakes and in the estuaries of channels, branches and canals. Almost exclusively these species are found at the easternmost sand-bar of the delta, that is at the Sacalinul Isle in the Black Sea. *Bidessus nasutus* Sharp, 1887, *Hygrotus parallelogrammus* (Ahrens, 1812), *Hydrovatus cuspidatus* (Kunze, 1818), *Hygrotus lernaeus* (Schaum, 1857), *Gyrinus caspius* Ménétries, 1832, *Ochthebius viridis* Peyron, 1858, *Enochrus bicolor* (Fabricius, 1792), *Berosus frontifoveatus* Kuwert, 1888, *Berosus spinosus* (Steven, 1808) and *Heterocerus obsoletus* Curtis, 1828 belong to halophilous species; *Agabus conspersus* (Marsham, 1802), *Hygrotus eneagrammus*

(Ahrens, 1833), *Hygrotus pallidulus* (Aubé, 1850), *Ochthebius peisonis* Ganglbauer, 1901, *Paracymus aeneus* (Germar, 1824), *Enochrus politus* (Küster, 1849), *Heterocerus flexuosus* Stephens, 1828 and *Heterocerus parallelus* Gebler, 1830 are classified as halobionts. *Agabus zimmermanni* Scholz, 1920 evidently belongs to halobiont species as well.

The Danube delta was colonized by water beetles of very various origin. Euro-Siberian species are prevalent (32); Euro-Caucasian (15), Euro-West Asian (12) as well as European elements (12) are also represented in large numbers. Similarly, Palaearctic (10) and Holoarctic (6) species with a wide distributional range are well represented; *Rhantus suturalis* (MacLeay, 1825) is classified as an Australian-Oriental-Palaearctic element. On the other hand, species with restricted distribution, such as *Ochthebius peisonis* that occurs only in the Carpathian Basin and at the Neusiedler See lake (a Ponto-Pannonic element), were also found here. *Agabus zimmermanni* is a very rare Pontic species, which has been so far known only from three other sites along the Black Sea coast. Finally, the presence of Holomediterranean (2) and Ponto-Mediterranean species (3) points to the links with the Mediterranean region.

DISCUSSION

The presence and distribution of water beetles in the Danube delta is undoubtedly strongly affected by the geological history of the area as its formation started only at the end of the last glacial period. In the course of formation the area went through an intensive evolution process characterised by frequent changes of biotopes both in the delta and in coastal parts. Recent natural conditions settled down only 200 years ago. From the zoogeographical point of view, the assemblages of water beetles are not settled yet and thus the expansion of other species is possible. Moreover, the occurrence of endemics sensu stricto cannot be expected due to the short and dynamic development of this area.

Nine species of water beetles mentioned by Ienistea (1968) and Negru (1968) were not found in our material. Nevertheless, none of these species requires special habitats and they are rather common in the neighbouring areas. Apparently, the presented list is not complete, and other species can be expected to be found in the future.

Berosus bispina Reiche, 1855 was probably misidentified by Ienistea (1968). Schödl (1991) made a revision of the Palaearctic species of the subgenus *Enoplurus* Hope, 1838 and there was no *B. bispina* among the specimens which he had at his disposal from Romania. *B. frontifoveatus* Kuwert, 1888 used to be identified as *B. bispina* in Central and South Eastern Europe before the revision (e.g., Lohse 1971).

Numerous populations of *Dytiscus dimidiatus* Bergsträsser, 1778, *Cybister lateralimarginalis* (De Geer, 1774), *Hydrophilus piceus* (Linnaeus, 1758) and *Hydrophilus aterrimus* (Eschscholtz, 1822) are still prosperous here. This fact is enjoyable because these large species have disappeared from many places and they are listed in Red Data Books of some Central European countries (e.g. Geiser 1984, Korbel 1992, Wewalka 1983). Thanks to the enormous biological self-purification power of the delta, there are many lakes and channels with clean water there and perhaps *Dytiscus latissimus* Linnaeus, 1758 has also survived in the area, although it is not mentioned in the available literature or present in our material.

Agabus zimmermanni Scholz, 1920 (J. Šťastný det. et coll., A. Nilsson revid.) belongs to the most remarkable records from the delta. Its habitat is of special interest due to the scarcity of

published data and its rarity. Three specimens (1 ♂, 2 ♀♀; 1 ♂, 1 ♀ in coll. J. Šťastný, 1 ♀ in coll. Lars Hendrich, Berlin) were found (28.vi.1988) at a salt marsh in two crater-shaped hollows near the village of Sfintu George about 300 m from the seashore. The craters were 3 m deep and 8 m in diameter, the water was up to 1 m deep. Water in both hollows was densely overgrown by filamentous algae. Nilsson (1990) published the survey of known records of *A. zimmermanni*: two sites in Asia Minor and two others in East Europe (the Ukraine and the Bulgarian Black Sea coast); all records are dated before 1970. Apart from that, this is the first record corroborating the occurrence of the species in Romania.

Undoubtedly, salinity strongly influences water beetle assemblages. Nonetheless, other related variables can not be omitted, such as the distance from the sea, the soil type, the type and amount of vegetation. Ribera et al. (1996) suggested that rather than the salinity itself, some other associated characteristics such as suitable soil structure for pupation or lack of predators in saline waters can be the key environmental factors for some species.

The Danube delta is a vast, valuable and well preserved complex of various habitats that was proclaimed a Biosphere Reserve by UNESCO in 1990. However, economic pressure impairing natural conditions is still strong and its negative influence is obvious. Excessive exploitation of reeds and drying of vast areas in the delta still occurs. Overfishing has meant that certain species of fish have not been recorded for several years, important bird nesting sites have been devastated by uncontrolled cattle grazing (such as the Sacalinul Isle) and the shore has been affected by sea shelf oil exploitation (Šebela 1995).

Water beetles inhabit almost all kind of aquatic habitats, all year round, sometimes in large numbers, and most species have ecological demands limited enough either to allow useful predictions to be made about changes in quality and land use history, or simply to characterise the community and the habitat (Ribera & Foster 1992). In this connection, the realisation of faunistic investigations with a view to the inventory of invertebrates appears to be an urgent task in such important areas as that to which the Danube delta unquestionably belongs. Having the results at our disposal, it would be possible to suggest measures to ensure keeping a rich biodiversity in the territory.

Nowadays, the coastal habitats of the Danube delta are threatened the most. Here, in shallow lagoons influenced at different rates by the sea, very interesting water beetle assemblages adapted to the specific conditions ruling there were found. The fact that these parts are afflicted by oil spills coming from shelf exploitation is alarming.

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SOUHRN

V původních pracích rumunských entomologů, zabývajících se faunou vodních brouků, bylo z dunajské delty uvedeno 50 druhů náležejících do čeledí Gyrinidae, Haliplidae, Noteridae, Dytiscidae, Hydrophilidae, Hydraenidae, Dryopidae, Heteroceridae (Ienistea 1968, Negru 1968). Autoři příspěvku nalezli v této oblasti během svých expedic 86 druhů. Celkem bylo v dunajské deltě dosud zjištěno 95 druhů vodních brouků z výše uvedených čeledí (Tab. 1).

Dominujícími krajinotvornými prvky delty jsou mokřadní ekosystémy představující široké spektrum vodních a bažinných biotopů, ve kterých je patrná vzrůstající salinita směrem k pobřeží moře. Podle tohoto kritéria lze sledované území rozdělit na dvě hlavní části: říční deltu a fluviomarinní deltu (obr. 1). Říční delta se sladkovodními biotopy je osídlena především euryekními, iliofilními a ubiquistními druhy, jako jsou *Bidessus unistriatus* (Schrank, 1781), *Colymbetes fuscus* (Linnaeus, 1758), *Dytiscus dimidiatus* Bergsträsser, 1778, *Graphoderus austriacus* (Sturm, 1834), *Hygrotus inaequalis* (Fabricius, 1776), *Hydaticus seminiger* (De Geer, 1774), *Ilybius quadriguttatus* (Boisduval et Lacordaire, 1835), *Porhydrus lineatus* (Fabricius, 1775), *Rhantus frontalis* (Marsham, 1802), *Haliplus flavicollis* Sturm, 1834, *Peltodytes caesus* (Duftschmid, 1805), *Gyrinus substriatus* Stephens, 1828, *Dryops auriculatus* (Geoffroy, 1785), *Noterus crassicornis* (Müller, 1776), *Limnebius atomus* (Duftschmid, 1805), *Spercheus emarginatus* (Schaller, 1783), *Hydrochus carinatus* Germar, 1824, *Limnoxenus niger* (Zschach, 1788), *Cymiodyta marginella* (Fabricius, 1792), *Hydrochara caraboides* (Linnaeus, 1758), *Berosus luridus* (Linnaeus, 1761). Tito brouci jsou běžní po celém území delty, ale vyžadují zachovalé či jen málo narušené prostředí. V této části byly též zjištěny dva tyrfofilní druhy *Hydroporus striola* (Gyllenhal, 1827) a *Enochrus coarctatus* (Gredler, 1863).

Na území fluviomarinní delty se druhové spektrum posunuje ve prospěch halofilních druhů *Bidessus nasutus* Sharp, 1887, *Hygrotus parallelogrammus* (Ahrens,1812), *Hydrovatus cuspidatus* (Kunze, 1818), *Hygrotus lernaeus* (Schaum, 1857), *Gyrinus caspius* Ménétries, 1832, *Ochthebius viridis* Peyron, 1858, *Enochrus bicolor* (Fabricius, 1792), *Berosus frontifoveatus* Kuwert, 1888, *Berosus spinosus* (Steven, 1808) a *Heterocerus obsoletus* Curtis, 1828 a halobiontů *Agabus*

conspersus (Marsham, 1802), *Hygrotus eneagrammus* (Ahrens, 1833), *Hygrotus pallidulus* (Aubé, 1850), *Ochthebius peisonis* Ganglbauer, 1901, *Paracymus aeneus* (Germar, 1824), *Enochrus politus* (Küster, 1849), *Heterocerus flexuosus* Stephens, 1828, *Heterocerus parallelus* Gebler, 1830 a *Agabus zimmermanni* Scholz, 1920. Se vzrůstající salinitou mizí druhy citlivé na zvýšený obsah solí.

Ze zoogeografického hlediska (v práci je použita klasifikace podle De Lattina (1967)) je na území dunajské delty soustředěno velké množství faunistických elementů. Dominují především druhy se širokým rozšířením v severozápadní části Palearktu, reprezentované eurosibiřským (32 druhů), eurokavkazským (15), eurozápadoasijským (12) a evropským (12) faunistickým prvkem. Vedle toho jsou zastoupeny i druhy palearktické (10), holoarktické (6) a jeden australsko-orientálně-palearktický. Šíření druhů z oblasti Středozemního moře dokazuje přítomnost holomediterráních (2) a pontomediterráních (3) prvků. Přítomny jsou i druhy s omezeným rozšířením - element ponticko-pannonský (1) a pontický (1). Vzhledem k relativně krátkému a dynamickému vývoji celého území nelze předpokládat výskyt endemických druhů.

K nejvýznamnějším nálezům bezesporu patří potápník *Agabus zimmermanni* Scholz, 1920. Tento vzácný druh byl uloven 28.VI.1988 (1 ♂, 2 ♀♀) na slanisku poblíž vesnice Sf. George asi 300 m od mořského pobřeží. Lokalita byla tvořena dvěma kráterovitými jámami v písčitém podloží, z nichž každá byla o průměru asi 8 m a hluboká 3 m. Voda v nich dosahovala přibližně 1 m pod okraj jámy a byla hustě zarostlá vláknitými řasami. Doposud byly známy pouze čtyři lokality, kde byl tento druh nalezen - dvě v Malé Asii, jedna z Ukrajiny a zbývající je na pobřeží Černého moře v Bulharsku. Všechny dosud publikované nálezy však již byly učiněny před rokem 1970. Tento údaj je teprve třetí z Evropy a zároveň jde o první záznam o výskytu tohoto druhu na území Rumunska.

Prokázaná vysoká diverzita společenstev vodních brouků je důkazem kvality a zachovalosti přírodního prostředí delty. Předložená práce by měla poskytnout podklady pro další faunistické výzkumy, na jejichž základě by bylo možno navrhnout opatření, která by zabezpečila existenci těchto ekosystémů. Zachování diverzity společenstev bezobratlých živočichů je důležitým předpokladem pro přežití některých ohrožených druhů obratlovců (např. ryb a ptáků), pro které území delty Dunaje představuje jedno z posledních refugií, popřípadě sehrává důležitou roli při migračních cestách. I přesto, že dunajská delta byla v roce 1990 vyhlášena biosférickou rezervací UNESCO, přetrvávají mnohé dřívější problémy jako nadměrný lov ryb, nekontrolovaná pastva dobytka, exploatace rákosových porostů a vysušování rozsáhlých ploch. Ve fluviomarinní části delty jsou cenné lokality s halofilními společenstvy v současné době ohroženy především těžbou ropy z šelfových ložisek.