NEW RECORD OF *LEUCORRHINIA PECTORALIS* (CHARPENTIER, 1825) (INSECTA: LIBELLULIDAE) IN THE REPUBLIC OF MOLDOVA

BUȘMACHIU Galina

Institute of Zoology, Academiei str. 1, Chisinau, MD-2028

Several species of Odonata are protected by law locally and internationally. One of such species is *Leucorrhinia pectoralis* (Charpentier, 1825), dragonfly from the family Libellulidae, extremely rare on the territory of the Republic of Moldova. Till now, the species has been cited from the south region of the Republic of Moldova along the bank of Dniester River.

Site description

Lake in the Plaiul Fagului Reserve

The Plaiul Fagului Reserve is situated in the North – West of the Central Moldavian Hills, 70 km away from Chisinau, at approximately 47˚17'28"N 28˚3'16"E in the Central Region of the Republic of Moldova. This reserve is an important part of the Moldavian protected areas with a total surface of 5,558.7 sq km. The rare species of plants, vertebrate and invertebrate animals are mentioned here, including some Carpathian elements. On the territory of the reserve there are several lakes with an area of 24 ha and 7 ha of swamps.

In summer of 2021, several field trips were made to collect entomological materials. In order to identify the species of dragonflies from the Plaiul Fagului Reserve, the specimens of Odonata were collected around the lakes and the photos of the large species were captured.

Male of *Leucorrhinia pectoralis*

Results and Discussion

Among the species identified in the Plaiul Fagului Reserve one species - *Leucorrhinia pectoralis* is the most interesting. The male of this species was photographed on 24 June 2021 on the palustral vegetation on the water of lake about 5 meters from the water edge. For the first time on the territory of the Republic of Moldova *Leucorrhinia pectoralis* was found near the border of the forest and swampy meander, downstream from the Cioburciu village (Stefan-Vodă District) on 24 Mai 2009 and then cited from Lower Dniester Region in ”Grădina Turcească” and Olănești-Crocmaz Valley without any data of collection.

According to the Red Book of the Republic of Moldova *Leucorrhinia pectoralis* is critically endangered species which lives in the southern part of Moldova, especially in the Lower Dniester Region. The species prefers mesotrophic freshwater basin, isolated ponds in the forest and swamps.

In the summer of 2014, after fifty years, *Leucorrhinia pectoralis* was rediscovered in Romania. Two males of this species were registered in the “Tinovul Mare Poiana Stampei”, Suceava country.

In Ukraine the species is regularly observed in the Volynska, Zhytomyrska, Kharkivska, Dnipropetrovska, Kyivska and other regions.

At international level the species *Leucorrhinia pectoralis* is protected and included in the Bern Convention (Appendix II), the Habitats Directive (Council Directive 92/43/EEC) (Annexes II and IV), the IUCN European Red List of Dragonflies, the IUCN Red List of Mediterranean Dragonflies and in the Red List of Dragonflies of the Carpathians.

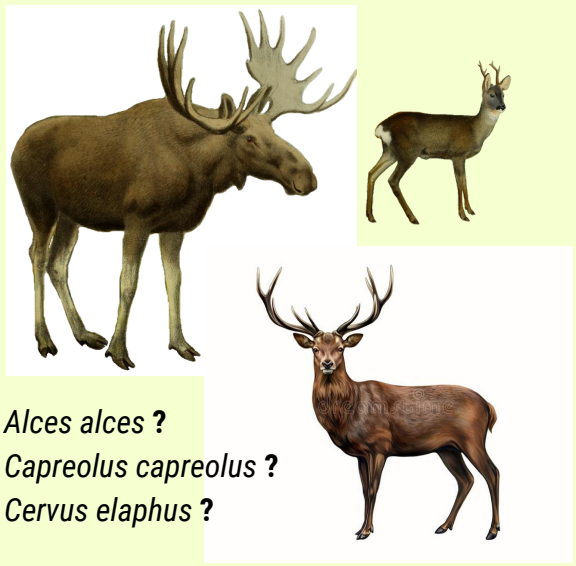
Leucorrhinia pectoralis

Conclusions

In spite of investigation carried out in the Plaiul Fagului Reserve during the long time, new insects’ species can be still identified. The presence of the rare and protected on European and local level species such as *Leucorrhinia pectoralis*, indicate the importance and conservation value of a wide range of habitats, including lakes from the Plaiul Fagului Reserve.

A REAPPRAISAL OF THE "EAST CARPATHIAN TEMPERATE CLIMATE REFUGIUM" DURING THE LAST GLACIAL MAXIMUM

Roman CROITOR, Institute of Zoology, Chișinău, MOLDOVA



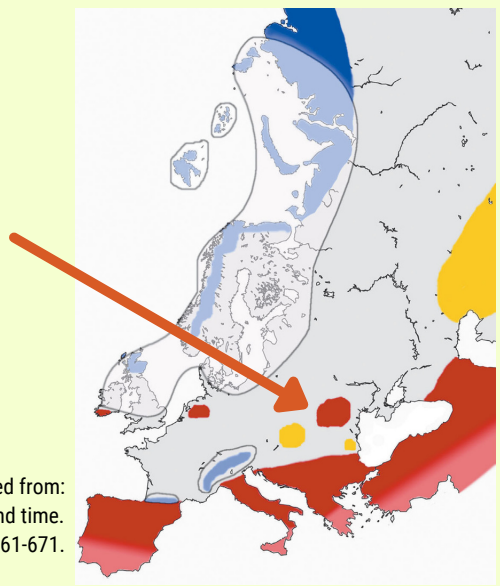
Alces alces **?**
Capreolus capreolus **?**
Cervus elaphus **?**

Concept of the "East Carpathian Temperale climate Refugium"

Proposed by Sommer & Benecke (2005) on the basis of reported "warm-loving" faunal elements from the Late Paleolithic sites of Moldova that co-existed with typical "tundra-steppe" faunal elements.

"Criptic refugium" of tempetare adapted taxa?

Stewart et al. (2010) regarded the East Carpathian refugium as one of the cryptic northern refugium of temperate-adapted taxa during the Late Glacial Maximum (LGM).



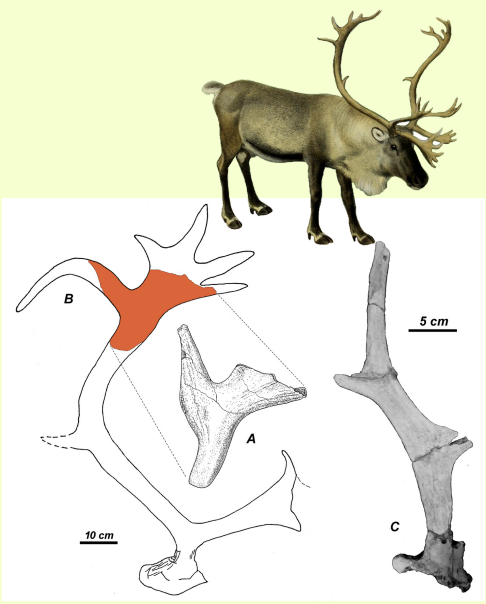
Adapted from:
Stewart et al. 2010. Refugia revisited: individualistic responses of species in space and time. *Proceedings of the Royal Society B: Biological Sciences*, 277: 661-671.

Was red deer present the East Carpathian area during LGM?

A part of remains from Rașcov 7 (22 000 - 17 000 years BP: Chetraru et al., 2007) ascribed to *Cervus elaphus* actually belong to musk ox *Ovibos moschatus*. This is the case of the musk ox talus "P-VII-62 Ш-4/2-12" from Rașcov 7. Other remains belong to wapiti *C. canadensis* (Croitor & Obada, 2018).

Did elk and roe deer inhabited the East Carpathian area during LGM?

Cultural layers of Cosăuți were accumulated during the short period between 19 000 BP and 17 000 years BP shortly after the peak of the LGM. The fragment of palmated antler from layer 6 (A) belongs to *Rangifer tarandus (B)*. Some of variants of juvenile antler of reindeer resemble the antler shape of roe deer (C).



Conclusions

- The available data do not support the concept of "East Carpathian Glacial refugium;
- Reports on the occurrence of temperate climate species during the glacial phases of the the Late Pleistocene of Hungary and southern Slovenia (Sommer & Nadakhowski, 2006) require further attention;
- The Pannonian Plain protected from the glacial climatic influence by the Carpathian Mountains could act as the "**Pannonian Glacial Refugium**".

roman.croitor@zoology.md

A PITFALL TRAPPING SURVEY OF BEETLES IN STEPPE ECOSYSTEMS OF THE REPUBLIC OF MOLDOVA

Natalia MUNTEANU-MOLOTIEVSKIY, Anna MOLDOVAN, Ion TODERAS

Laboratory of Systematics and Molecular Phylogeny, Institute of Zoology, 1 Academiei Str., Chisinau, MD 2028, Republic of Moldova,
e-mail: munteanu_natalia_v@yahoo.com

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INTRODUCTION

Grasslands are considered regional biodiversity hotspots being of high conservation value. Unfortunately, the steppe is one of the most transformed and overworked ecosystems, and at the same time the most underrated of landscapes. In ecosystem processes, insects have an important role as pollinators, food chain elements, maintenance, and improvement of soil quality, also, they are good indicators at the landscape level. Insects are of increasing interest to conservation practitioners, among which beetles have been widely proposed as a model for biodiversity inventory and monitoring.

Despite the conservation value of the steppe-like grassland of the Republic of Moldova, little is known about the beetle diversity and community structure. This study aims to survey the fauna of beetles in steppe ecosystems.

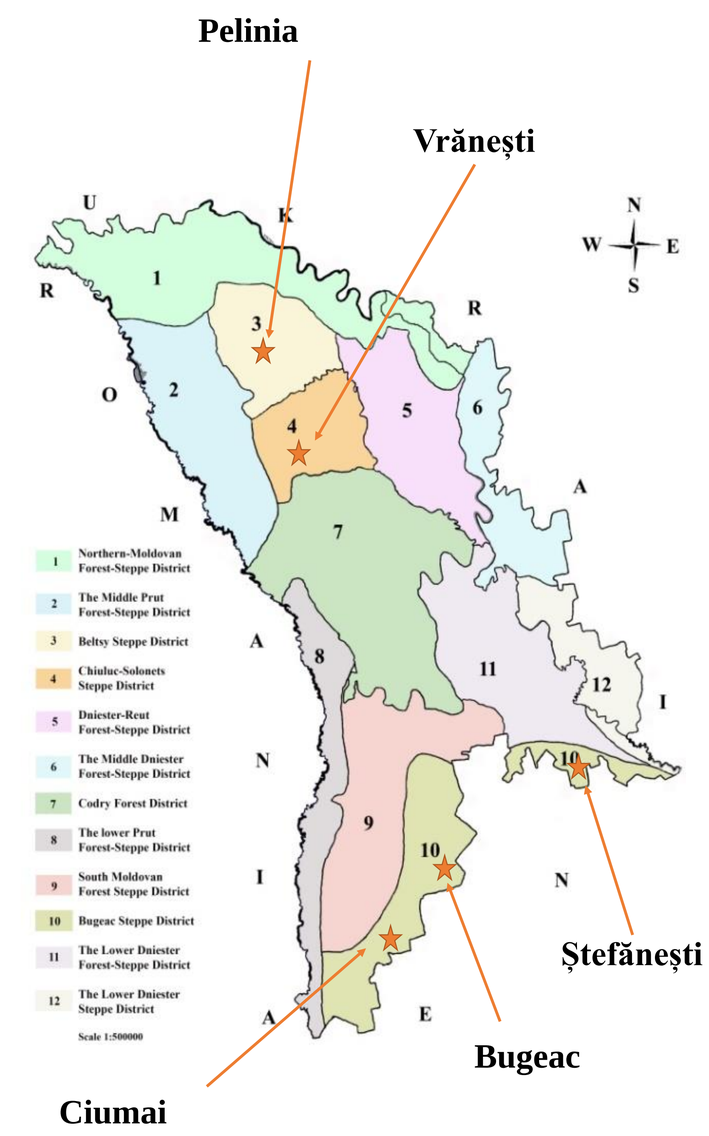

Fig. 1. **Sampling localities**

MATERIALS AND METHODS

The study was conducted in 5 sites across steppe ecosystems of the Republic of Moldova. Specimens were captured out using pitfall traps (by ten traps on each site). Samples were collected every 7-10 days and transported to the laboratory for further counting and identification.

Taxonomic identification of collected beetles was carried out using Keys to Insects of the European Part of the USSR, vol. 2 (1965), and some additional online resources (Mike's Insect Keys and Käfer Europas).

RESULTS AND DISCUSSION

As a result of the survey from five localities, a total of 563 beetle specimens, belonging to 98 species, 51 genera, and 15 families were caught. The largest family proved to be Carabidae, which includes 51 species, followed by Curculionidae, with 9 species. Also, from all collected beetles, ground beetles represented the greatest proportion in terms of number of individuals (368 specimens), followed by darkling beetles with 50 specimens. According to hygropreference the typical xerophilous species were represented by 34 species, followed by mesophilous (28), mesoxerophilous (26); mesohydrophilous (5), halophilous (3), and hygrophilous (2). By trophic specialization, six groups were distinguished, of which omnivorous counted 31 species, followed by phytophagous (27), zoophagous (20), necrophagous (13), coprophagous (5), and fungivorous (2).

CONCLUSIONS

Obtained results confirmed our expectation that steppes are still important biodiversity reservoirs within the boundaries of our country. There is an urgent need towards rising attention on the priority of the biodiversity conservation measures in the steppe region. The most important areas from steppe ecosystems of the Republic of Moldova must be identified and conserved.

ACKNOWLEDGMENT

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MINISTRY OF EDUCATION AND RESEARCH
INSTITUTE OF ZOOLOGY

ENVIRONMENTAL POLLUTION - PARASITIC POLLUTION

Dumitru ERHAN
e-mail: dumitruerhan@yahoo.com

The ecological aspects of zooparasitology began to develop intensively in the first half of the twentieth century.

The term "ecological parasitology" was introduced and gradually this direction became dominant.

The subject of ecological parasitology are parasites, their hosts and the environment with the full diversity of their interactions. These components form parasitic systems with varying degrees of complexity, outside of which the existence of parasites is impossible. The most significant contribution to the development of the concept of parasitic systems was made by academician Beclemishev (1951, 1954).

Environmental pollution with parasitic elements is permanent, throughout the time when humans and infested animals eliminate in nature eggs, larvae, proglottids of parasites or even adult parasites. The dimensions of this phenomenon are almost incomprehensible in a short period of time. The issue of the phenomenon is part of the coordinates of ecological parasitology.

Until the 90s of the last century in the republic there were 19 pig breeding complexes of 54 thousand heads each, 38 complexes - of 12-24 thousand each, 12 complexes - of 9-11 thousand each, 22 complexes pigs of 7-9 thousand heads each. In the republic there were 3 milk-cargo complexes (with over 1000 milking cows), 26 reed breeding complexes, 31 bull fattening complexes, in 837 households in the republic there were milk-cargo farms. In 1990 alone, there were about 3.430.000 pigs in the republic, about 477.630 head of cattle and about 1.243.000 sheep/goats.

The results of our research showed that cattle in households with various maintenance technologies, ages and geographical areas of the Republic of Moldova are infested with echinococci in 13.4-83.3% of cases, fascioles - 16.9-59.5%, dicroceles - 23.5-63.5%, strongyloids - 20.0-47.5%, eimers - 54.4-94.4% (2-6 months), sarcocysts - 81.2-97.6% and cryptosporids - in 20.0-34.5% (calves up to 2 months) of cases.

It is mention that canine youth in urban and rural areas in Chisinau were infested with *Echinococcus granulolosus* - in 3.3-6.3% of cases, *Dipilidium caninum* - 5.5-18.5%, *Toxocara canis* - 9 , 6-12.6%, *Toxascara leonine* - 40.9-64.9%, *Ancylostoma caninum* - 5.4-9.4%, *Trichocehpalus vulpis* - 5.5-6.2% and *Eimeria canis* in 30.9 -35.9 cases, and adult stray dogs were infested with *Echinococcus granulolosus* in 14.3-42.7% of cases, *Dipilidium caninum* - 25.5-47.3%, *Toxocara canis* - 39.6-52.8 %, *Toxascara leonina* - 1.9-12.4%, *Ancylostoma caninum* - 7.4-16.2%, *Trichocehpalus vulpis* - 10.5-24.6% and with *Eimeria canis* - in 2.9-4.2 % of cases.

It has been established that each species of *Eimeria* is genetically programmed for a number of merogonic generations. It is estimated that around 92,000,000 merozoids can result from a single oocyst.

Krull (1941) demonstrated that from a single miracle of Fasciola hepatica, which enters a snail - *Lymnaea truncatula* (intermediate host), about 4000 searches can occur, which turn into metacercises - the invasive form.

From an egg ingested by terrestrial gastropods, the first intermediate host, then the search finds the second intermediate host - ants, where up to 400.000 metacercariae can appear - form infesting.

Ecological aspects refer, first of all, to pathogenic parasitic agents, whose biological development cycles are closely related to the environment.

In the strategy to combat parasitosis, this direction, in terms of science and application, requires independent development. Global environmental pollution, associated with anthropogenic pressure, requires the development of integrated control methods.

We emphasize in particular the fact that, in the last years, there is an obvious orientation of the promotion of ecological parasitology both in general, theoretical, and in applicative, medical plan.

PARASITE FAUNA DIVERSITY IN RED FOX (*Vulpes vulpes,* Linnaeus, 1758) FROM NATURAL AND ANTHROPIZED ECOSYSTEMS OF THE REPUBLIC OF MOLDOVA

CHIHAI Oleg, RUSU Ștefan, TALAMBUȚĂ Nina,
NISTREANU Victoria, LARION Alina, SAVIN Anatol, NAFORNIȚĂ Nicolae

Institute of Zoology

INTRODUCTION: Canids play a key role in the stability of the development cycles of a large number of parasitic species, including those with zoonotic impact, by environment pollution with parasitic forms.The presence of these animals in close contact with humans is a potential risk of increased infection, through contact with soil, vegetables, grapes and berries contaminated with parasitic forms.

PURPOSE: The bioecological study on the role of canids (*Vulpes vulpes*) in the transmission of parasitic species in the zoonotic and epizootic chain of natural and anthropogenic ecosystems.

MATERIALS AND METHODS: Parasitological investigations, according to the methods Popova, Baermann, Fuileborn, Darling, of the successive washing, were performed in the laboratory of Parasitology and Helminthology of the Institute of Zoology, on biological samples collected from foxes from natural and anthropized biotopes from different areas of the Republic of Moldova. In the ovocoproscopic diagnosis, the Teneidae oncospheres (*T. hydatigena, T. pisiformis, M. multiceps, M. serialis E. granulosus, E. multilocularis*) are very similar to each other, which is why they are noted as Tenea sp. oncospheres.

RESULTS: The taxonomy of parasitofauna in foxes (tab. 1) includes 12 parasitic invasions (*Isospora canis* – 14,3%, *Alaria alata* – 51,0%, *Mesocestoides lineatus* – 21,7%, *Taeniidae* spp – 27,0%, *Syphacia obvelata* – 17,0%, *Strongyloides stercoralis* – 13,3%, *Toxocara canis* – 59,0%, *Toxascaris leonina* – 65,5%, *Ancylostoma caninum* – 8,7%, *Trichuris vulpis* – 26,1%, *Trichuris muris* – 4,4%, *Capilaria hepatica* – 35,0%), which belong to 5 classes, 10 families, 11 genera and about 12 species. An important fact is that 100% of the total numbers of parasitologically investigated foxes were infested.

Table 1. Parasite fauna in *Vulpes vulpes*

Class	Family	Species	Prevalence, (%)	Intensity, (sp.)
Sporozoa	Eimeriidae	*Isospora canis* (Levine, 1977)	14,3	2-8
Trematoda	Diplostomidae	*Alaria alata* (Goeze, 1792)	51,0	1-2
Cestoda	Taeniidae	*Taenia spp*	27,0	3-4
	Mesocestoididae	*Mesocestoides lineatus* (Goeze, 1782)	21,7	3-15
Secernentea	Oxyuridae	*Syphacia obvelata* (Rudolphi, 1802)	17,0	3-4
	Strongyloididae	*Strongyloides stercoralis* (Bavay, 1876)	13,3	50-100
	Ascarididae	*Toxocara canis* (Werner, 1782)	59,0	2-5
		Toxascaris leonina (Linstow, 1902)	65,5	12
	Ancylostomatida	*Ancylostoma caninum* (Ercolani, 1859)	8,7	1
Adenophorea	TRichuridae	*Trichuris vulpis* (Froelich, 1789)	26,1	2
		Trichuris muris (Scrank, 1788)	4,4	2-3
	Capilariidae	*Capilaria hepatica* (Bancroft, 1893)	35,0	3-4

RESULTS: The epidemiological characteristics (tab.2) highlights 2 categories of parasitosis, zoonotic (10 species) and canine specific (2 species).

Table 2. Epidemiologic characteristics of parasite fauna in fox

Impact	Class					
	Sporozoa	**Trematoda**	**Cestoda**	**Secernentea**	**Adenophorea**	**Total**
Zoonotic	-	*A. alata*	*Taenia spp* *M. lineatus*	*S. obvelata* *S. stercoralis* *T. leonina* *T. canis* *A. caninum*	*C. hepatica* *T. vulpis*	**10 (83,3%)**
Fox	*I. canis*	-	-	-	*T. muris*	**2 (16,7%)**

CONCLUSION: The study of the diversity of parasite communities in the investigated foxes, denotes an increased level of infestation with parasitic species – of 100%. The results obtained from parasitological investigations represent the premise of developing new procedures to control / reduce parasitosis in wild canids in order to strengthen bioecological and epidemiological security in natural and anthropogenic ecosystems.

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1 Academiei str., MD – 2028, Chisinau, Republic of Moldova,
E-mail:olegchihai@yahoo.com

CONTRIBUTIONS TO THE STUDY OF WATER AND SEMI-WATER BIRDS IN THE

Viorica Paladi

Institute of Zoology, Chisinau; Natural Reserve „Prutul de Jos", Slobozia Mare, Republic of Moldova, vioricapaladi.c@gmail.com

Abstract. The Republic of Moldova a has few wet areas. One of them, was designated in the year 2000 with the status of Wetland of International Importance (Ramsar). The ecosystems of lakes and ponds are home to a multitude of bird species. Aquatic and semi-aquatic species make up a major component of the studied sector and consists of 94 species. Thousands of specimens transit the area during spring and autumn migrations; others retreat in the winter to be safe and to feed; the summer guests arrive in the warm period of the year to breed. Out of the total number of aquatic and semi-aquatic birds, 26 species are protected nationally and internationally. During the study period, rare or accidental species were recorded, such as: *Bubulcus ibis, Cygnus columbianus, Branta ruficollis, Grus grus, Sterna caspia, Arenaria interpres, Larus ichthyaetus*, etc.

Figure. 1. ***Anser anser & Bubulcus ibis***

Figure 2. ***Cygnus olor & Aythya ferina***

Conclusions

The Ramsar wetland "Lakes of the Lower Prut" has an important role for 94 aquatic and semi-aquatic species of birds. Out of these, 26 are under national and international protection, with varying degrees of danger: 14– vulnerable species; 6 - critically endangered species; 4 - endangered species. The studied area is used by thousands of birds during the autumn and spring migrations, also in the summer when they find favorable conditions for reproduction. According to the types of nutrition are distributed: 1- ichthyophagous/entomophagous; 1- entomophagous; 1– zoophagous/ entomophagous; 7– ichthyophagous; 10 – phytophagous; 16– ichthyophagous/ zoophagous; 25 – phytophagous/ zoophagous; 33 – zoophagous.

From a phenological point of view, 46 species are short-sighted visitors; 21 are passage species; 16- winter visitors; 4 - partially migratory; 3 - sedentary; 3 - meet accidentally; some species fall into several phenological categories. The following species have an irregular presence in the area: Bubulcus ibis, *Cygnus columbianus, Grus grus, Sterna caspia, Arenaria interpres, Larus ichthyaetus,* etc.

Result and Discuss. The sector of Lower Prut provides vital conditions for numerous aquatic and semi-aquatic species of birds. Some of them we can meet during the spring and autumn migrations; other species arrive for reproduction on summer period. In 2019 in this area were mentioned 75 species. According to the latest data from the studied territory, 93 species of birds were identified (tab. 1).

Table 1.Taxonomic structure of aquatic and semi-aquatic avifauna

No.	Order	Share in the studied area			Share of the avifauna of the area from that of the Republic of Moldova
		Spe-cies	Share of the order from all the aquatic and semi-aquatic avifauna (%)	In the Republic of Moldova	
I.	Gaviiformes	1	1,1	2	50,0
II.	Podicipediformes	4	4,3	5	80,0
III.	Pelecaniformes	4	4,3	4	100,0
IV.	Ciconiiformes	13	13,9	13	100,0
V.	Anseriformes	26	27,9	28	92,8
VI.	Gruiformes	9	8,7	10	80,0
VII.	Charadriiformes	37	39,8	50	74,0
Total:		**94**	**100**	**116**	**81,0**

Analyzing the share of the avifauna of the area with that of the Republic of Moldova, we notice that the orders of Charadriiformes (37 species) and Anseriformes (26 species) have the highest degree of participation. The order Gaviiformes is represented by one of the two species encountered in the republic.

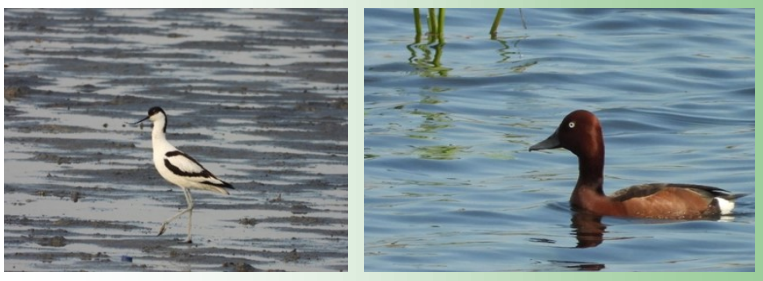


Figure 3. ***Recurvirostra avosetta & Aythya nyroca***

Figure 4. ***Podiceps nigricollis & Egretta garzetta***

Figure 5. ***Phalacrocorax pygmaeus & Pelecanus onocrotalus***

EVALUATION OF THE ACTION OF SOME COORDINATIVE COMPOUNDS ON INFUSORIA PRODUCTIVITY *PARAMECIUM CAUDATUM* (Ehrenberg, 1833)

Roscov Elena[a], Toderas Ion[b], Gulea Aurelian[c], Floquet Sebastien[d], Fuior Arcadie[d], Garbuz Olga[e]

[a]*Institute of Zoology, Chisinau, elena.arcan@gmail.com,* [b]*Institute of Zoology, Chisinau, iontoderas@yahoo.com*
[c]*Moldova State University, Chisinau, guleaaurelian@gmail.com,* [d] *Universite Versailles St-Quentin-en-Yvelines, Republic of France*
[e] *Institute of Zoology, Chisinau, olhamos@mail.ru*

Introduction

As a part of the study, the classical methods of biological analysis was used in order to determine the effects of test substances and their weakness test - objects *P.caudatum*.

This article presents data on the analysis of the action of the new chemical compounds AF 177 and AF 123 on the reproductive particularities of ciliates *Paramecium caudatum* in concentrations of 100, 10, 1 and 0,1 uM.

Materials and methods

The assurance of the methodology of scientific research was carried out on the basis of the concepts and researches reported in the works: Toderaş I., Gulea A., et.all. (2017); Sonnenborn T. (1970); Суханова К. (1968); Кокова, В. (1982).

In this work, unicellular organisms *Paramecium caudatum* were used as test objects to detect the toxicity of active substances. For the investigation, important was the complex study of the remedies obtained AF 177 and AF 123 on the viability of the test-organisms, the number herd and their reproductive rate. Inhibition of cell growth was evaluated according to LC_{50}.

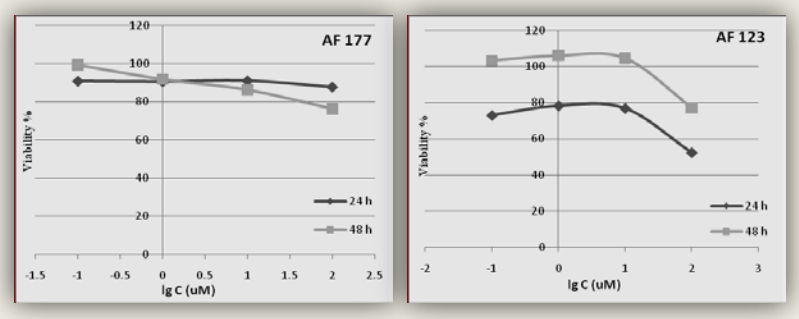


Figure 1: Viability of *P.caudatum* ciliates at the action of preparations AF 177 and AF 123, in concentrations of 100, 10, 1 and 0,1 uM, for 24 and 48 h.

Results

The paramecia in the experimental group to which the remedy AF 177 was administered, during the evolution of the experiment, the viability increases at concentrations of 1 - 0,1 uM, with an insignificant decrease in the given index at doses of 10 - 100 uM (Fig.1).

When administering the preparation AF 123, the viability index increases insignificantly. The vector of the toxic index $LC_{50,}$ of the compounds studied AF 177 and AF 123 is ≥100, which indicates that the indicated preparations have a well-stressed stimulatory effect after 48 hours .

The scientific results have determined the need for research of these preparations AF 177 and AF 123 according to hydrobiologist standards methods. The incubation time was of 144 h, at 25 - 28 ^{0} C.

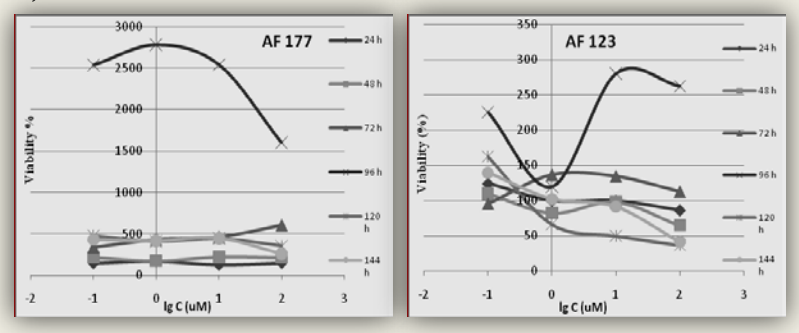


Figure 2: Viability of *P. caudatum* ciliates at the action of AF 177 and AF123, in concentrations of 100, 10, 1 and 0,1 uM, for 144 h.

During the first 48 h, there is an increase in the viability of the organisms tested of administration of the AF 177 compound. After 120 and 144 h of research respectively, the index in question decreases at all doses of administration of the given compound. Thus, during the experiment the viability of the cells permanently increases, reaching its peak after 96 h of incubation, which represents about 8 times the control group, with a decrease after 120 h (Fig.2).

Compared to the previous preparation, the compound AF 123, during the investigation period, registers the same tendence to increase the viability of individuals after 72 h of incubation, reaching its peak after 96 h, with its decrease towards the end of investigations, only this index is much lower.

It's usual, that viability of the animals tested can change depending on the remedies administered. The most essential changes of the index in the given study are recorded in the case of the experiment with the AF 177 remedy. Less effective is AF 123. Therefore, preparations AF 123 and AF 177 are not toxic to microorganisms tested by *P. caudatm,* conditioning their productivity increase compared to the control group. Therefore, the methods used in our research demonstrate the stimulating effect of the given compounds.

Conclusions

Of the coordinating compounds under investigation, a more pronounced imprint on the increase in viability belongs to the AF 177 remedy. The vector of the given index is directed towards permanent enhancement. This trend is based on the data obtained during the investigations. After 96 h of incubation, the viability, on average, increases significantly to 2782,4 % at the concentration of 1 uM, which represents approximately 8 times higher than the control group.

The test compound AF 177 has been recommended as a supplement for *Apis mellifera* bee families, with the aim of increasing the productivity of honey products.

USING *IN SILICO RFLP* METHOD FOR THE STUDY OF *MC1R* GENE ALLELES IN THE SPECIES *SUS SCROFA*

Victor Sitnic

Institute of Zoology

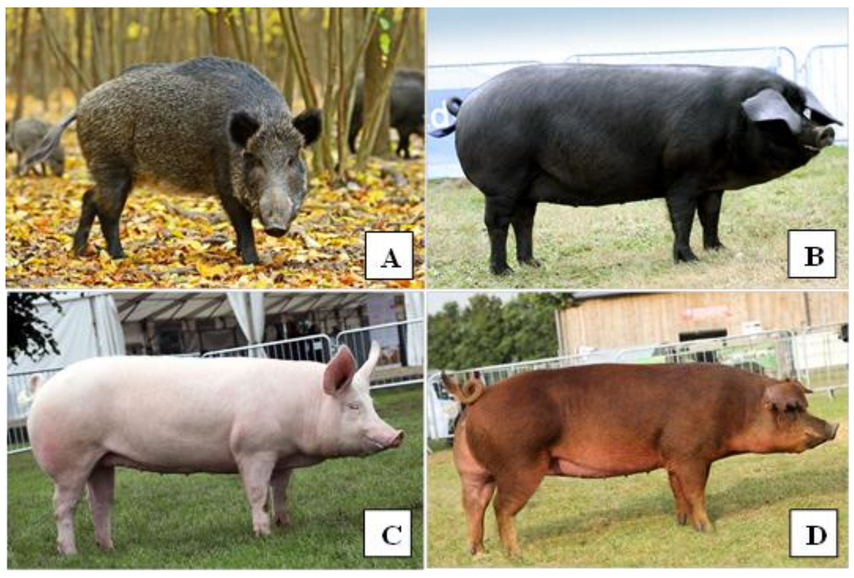
Moldova State University

Abstract

In the present study we aimed to use a bioinformatics algorithm that predict *RFLP* fragmentation of swine *MC1R* alleles simulating the sequence digestion with over 700 restriction enzymes. The results show several restriction enzymes that have the potential to be used for genotyping of *Sus scrofa* individuals and for differentiation between hybrids and pure line wild boars (WB)/domestic pigs (DP). Genotyping studies of wild boars and domestic pigs in Moldova populations would allow the determination of introgression/backcrossing degree and would contribute to the elaboration of adequate conservation measures.

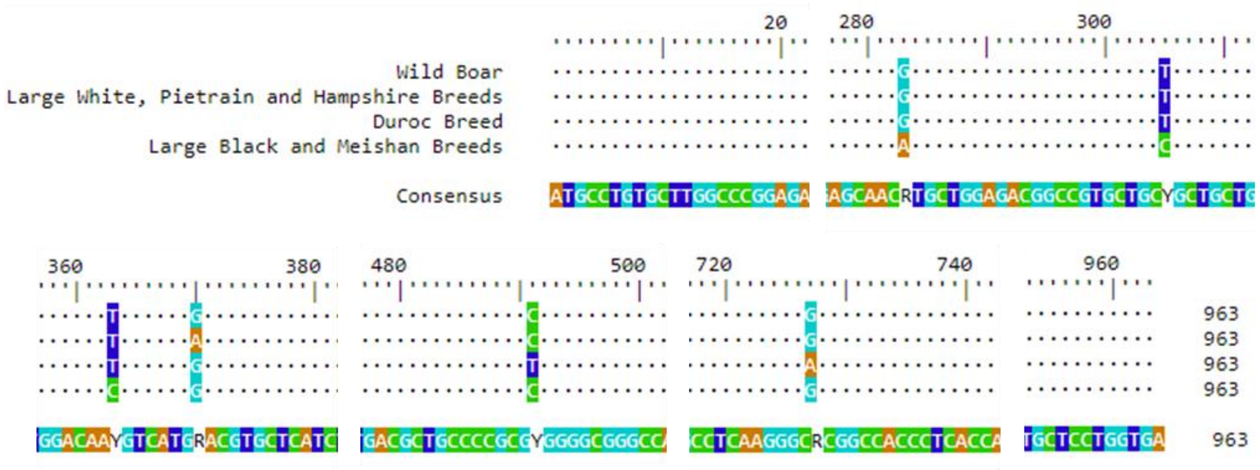
Introduction

The *MC1R* is a gene that regulates melanin synthesis and in some animals plays a central role in the pigmentation process. It contains instructions for producing the protein *Melanocortin 1 Receptor* which is located in the melanocyte membrane. Sequencing analyzes showed that species *Sus scrofa* has several alleles of this gene. The multiple allelism of the *MC1R* gene can be observed phenotypically through the diversity of skin pigmentation in pigs. The wild-type allele named $\boldsymbol{E^{+}}$ has been identified in wild boars, $\boldsymbol{E^{D1}}$ allele – in domestic breeds Large Black and Meishan, $\boldsymbol{E^{PD2}}$ in Hampshire, Large White and Pietrain breeds [1,2], while recessive allele ***e*** is associated with the breed Duroc. The *MC1R* gene has 963 base pairs and wild-type allele (E^{+}) is fully expressed in pure line wild boars. Other alleles differ by changes in the following positions [1,2]: 370G>A - Hampshire, Large White and Pietrain breeds (E^{PD2}); 283G>A, c.305T>C and c.363T>C - Large Black and Meishan (E^{D1}); 491C>T and c.727G>A - Duroc breed (e).



Phenotypic skin color traits in the species *Sus scrofa* with different *MC1R* alleles (A - Wild Boar [3], B - Large Black [4], C - Large White [4], D – Duroc [4])

Materials and methods



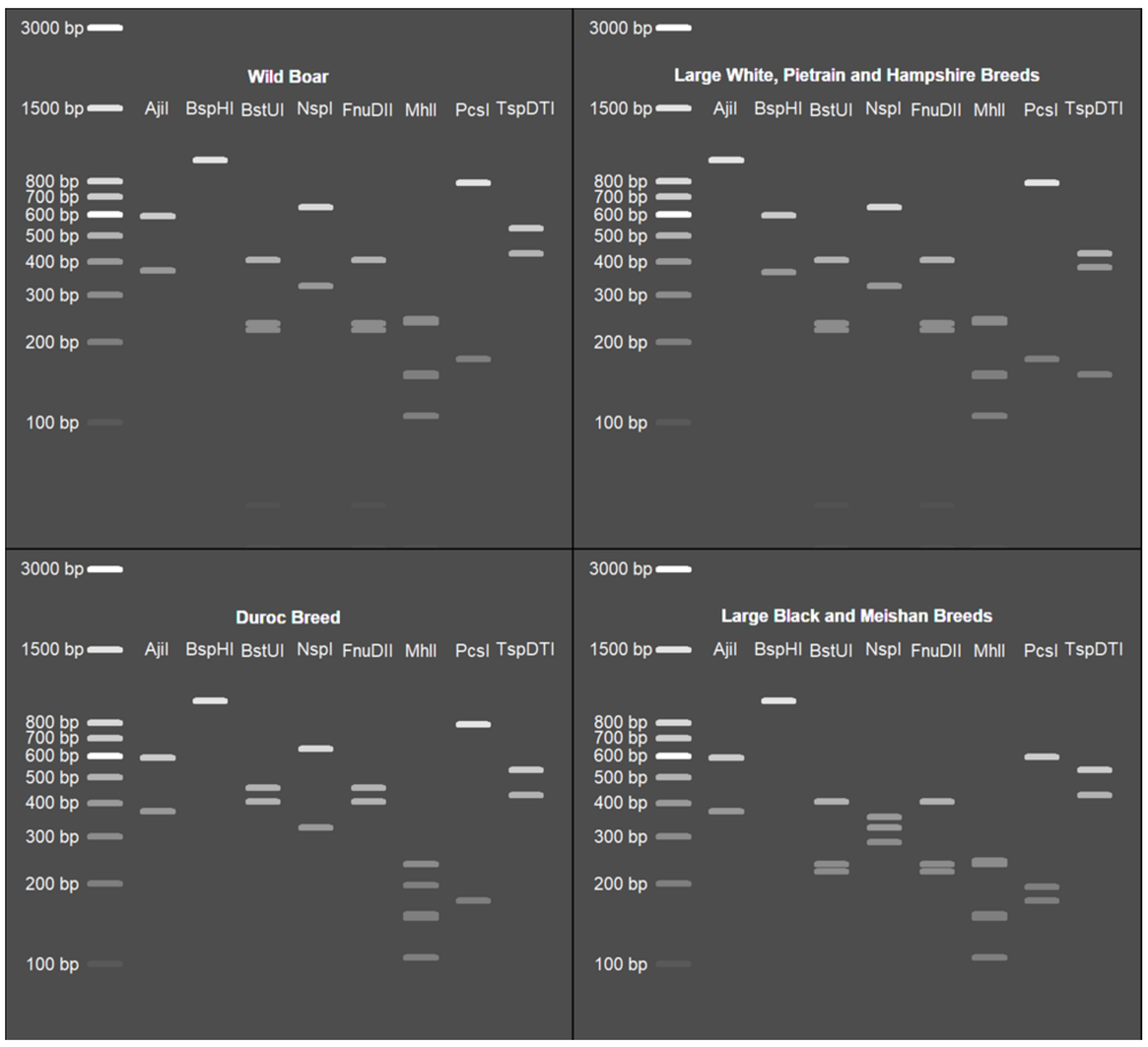
The wild-type *MC1R* sequence has been extracted in *FASTA* format from *NCBI* [7], and alleles alignment has been performed in *R language* [8] using *DECIPHER* [9] and *Biostrings* [10] packages. Simulation and visualization of *Restriction Fragment Length Polymorphism (RFLP)* patterns from DNA sequences were accomplished utilizing *seqRFLP* package [11] in R. This package includes functions for handling *DNA* sequences, especially for simulating *RFLP* patterns based on selected restriction enzymes and *DNA* sequences.

Results and discussions

In silico digestion of the studied sequences allowed the identification of several restriction enzymes that have the potential to be used for genotyping of *Sus scrofa* individuals and for differentiation between hybrids and pure line WB/DP. In the figure on the right is shown the simulated electrophoregram obtained after virtual digestion of studied allelic sequences with the next restriction enzymes: *AjiI, BspHI, BstUI, NspI, FnuDII, MhlI, PcsI, TspDTI.* These enzymes were selected following individual *in silico* analyzes of over 700 candidates and they can discriminate between sequences as follows: *AjiI, BspHI* and *TspDTI* – distinguish among $\boldsymbol{E^{PD2}}$ and other alleles; *BstUI, FnuDII* and *MhlI* – distinguish among ***e*** and other alleles; *NspI* and *PcsI* – distinguish among $\boldsymbol{E^{D1}}$ and other alleles.

In the current study we used *MC1R* gene polymorphism for identification of swine genotyping possibilities with *in silico RFLP* method. Good results for differentiation between hybrids and pure lines could be achieved only by correct enzymes selection and by their combination. Genotyping studies of wild boars and domestic pigs in Moldova populations would allow the determination of introgression/backcrossing degree and would contribute to the elaboration of adequate conservation measures. We recommend the wet laboratory testing of the above mentioned enzymes and the *in vitro* evaluation of their genotyping potential.

The study has been conducted within the national project coded 20.80009.7007.02.



Simulated electrophoregram obtained after virtual restriction enzymes (*AjiI, BspHI, BstUI, NspI, FnuDII, MhlI, PcsI, TspDTI*) digestion of *Sus scrofa* allelic sequences

References

[1] Kijas JM, Wales R, Törnsten A, Chardon P, Moller M, Andersson L. Melanocortin receptor 1 (MC1R) mutations and coat color in pigs. Genetics. 1998 Nov;150(3):1177-85. PMID: 9799269; PMCID: PMC1460407. [2] Dzialuk, A., Zastempowska, E., Skórzewski, R. et al. High domestic pig contribution to the local gene pool of free-living European wild boar: a case study in Poland. Mamm Res 63, 65–71 (2018). https://doi.org/10.1007/s13364-017-0331-3 [3] https://www.alimentarium.org/en/knowledge/wild-boar [4] https://www.britishpigs.org.uk/ [5] Wilson CJ (2013) The establishment and distribution of feral wild boar (Sus scrofa) in England. Wildl Biol Pract. doi:10.2461/wbp.2014.un.1 [6] Frantz AC, Zachos FE, Kirschning J et al (2013) Genetic evidence for introgression between domestic pigs and wild boars (Sus scrofa) in Belgium and Luxembourg: a comparative approach with multiple marker systems. Biol J Linn Soc 110:104–115. doi:10.1111/bij.12111 [7] Maselli,V. and Fulgione,D. Submitted (20-MAY-2015) Department of Biology, University of Naples Federico II, Campus Monte S. Angelo, Naples, Campania 80126, Italy. https://www.ncbi.nlm.nih.gov/nuccore/KR865958.1?report=fasta [8] R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/. [9] Wright ES (2016). “Using DECIPHER v2.0 to Analyze Big Biological Sequence Data in R.”_The R Journal_, *8*(1), 352-359. [10] H. Pagès, P. Aboyoun, R. Gentleman and S. DebRoy (2019). Biostrings: Efficient manipulation of biological strings. R package version 2.52.0. [11] Qiong Ding and Jinlong Zhang (2012). seqRFLP: Simulation and visualization of restriction enzyme cutting pattern from DNA sequences. R package version 1.0.1. https://CRAN.R-project.org/package=seqRFLP.

ACADEMY OF SCIENCES OF MOLDOVA
INSTITUTE OF ZOOLOGY
1, Academiei str., Chisinau, MD-2028, Republic of Moldova
Phone: (3732) 73-75-11; Fax: (3732) 73-98-09
E-mail: mariazamornea@gmail.com
rusus1974@yahoo.com

VARIATION OF SOME MEAT QUALITY INDICES IN ECTOPARASITE POLYPARASITIZED AND ANTIPARASITIC TREATED HENS

AUTHORS: **Zamornea Maria, Erhan D., Rusu St., Chihai O., Bondari Lidia**

One of the main directions of the technical and scientific policy of the state, in the direction of maintaining a decent food supply of the population, is to provide it with quality food products. In the Republic of Moldova, a number of legislative documents have been adopted in recent years to protect the domestic.

Was established, that the meat quality of hens polyparasitized with malophages (Cuclotogaster heterographus, Eomenacanthus stramineus, Goniocotes gallinae, Goniocotes maculatus, Goniodes dissimilis, Lipeurus caponis, Menopon gallinae, Menacanthus cornutus, Menacanthus pallidulus) fleas Ceratophylus gallinae, C. hirundinis) and mites (Dermanyssus gallinae, D. hirundinis), then treated with Ectostop T5%, Ectostop P5%.

Batch	Probe numb.	pH	Protein, %	Lipid, %	Moisture, %
I	5	5,3±0,08	21,0±0,01	6,22±0,14	63,78±0,52
II	5	7,2±0,15	16,22±0,03	2,54±0,15	74,52±0,18
III	5	5,5±0,17	20,36±0,27	9,16±0,06	65,1±0,05
IV	5	5,5±0,16	20,5±0,20	9,24±0,11	65,0±0,05
V	5	5,5±0,17	20,3±0,10	9,20±0,13	65,0±0,05
VI	5	5,3±0,12	19,0±0,10	8,50±0,21	65,40±0,21
VII	5	6,3±0,13	17,02±0,87	7,22±0,13	70,10±0,05

Therefore, the analyses carried out show that the meat quality of birds polyparasitised with malophages:(Cuclotogaster heterographus, Eomenacanthus stramineus, Goniocotes gallinae, Goniocotes maculatus, Goniodes dissimilis, Lipeurus caponis, Menopon gallinae, Menacanthus cornutus, Menacanthus pallidulus) fleas: (Ceratophylus gallinae, C. hirundinis) and mites (Dermanyssus gallinae, D. hirundinis), then treated with Ectostop T5% , Ectostop P5% plant preparations, showed a higher protein content (20.5%±0.20), a lower pH level (5.3±0.12) and a lower moisture content (65.4%±0.21), these indices being within the level of the non-infested batch (control).

Protein content is low in the meat samples in batch II (untreated infested), constituting 16.22%±0.03 and in batch VII treated with Ivomec preparation constituting 17.02%±0.87. The meat moisture index is characterized by a greater difference for batch II and VII constituting 74.52%±0.18 and 70.1%±0.05 respectively.

The PH level determined in both infested, untreated (batch II) and Ivomec-treated chickens is alkaline and constitutes 7.2±0.15 and VII 6.3±0.13 respectively, which will lead to a decrease in keeping capacity.

Based on the results obtained, the meat of the chickens in batches III-VI has a higher protein content, lower pH level and lower moisture content, which allows it to be preserved for a longer period of time and is therefore of a much higher quality compared to batch II (untreated) and batch VII (treated with Ivomec).

The use of extracts of natural origin with anti-parasitic action ensures that the preparation is not toxic to the animal organism and does not impose restrictions on the use of products and by-products

SUSTAINABLE USE AND PROTECTION OF ANIMAL WORLD IN THE CONTEXT OF CLIMATE CHANGE dedicated to the 75th anniversary from the creation of the first research subdivisions and 60th from the foundation of the Institute of Zoology
Chisinau, 16-17 September 2021

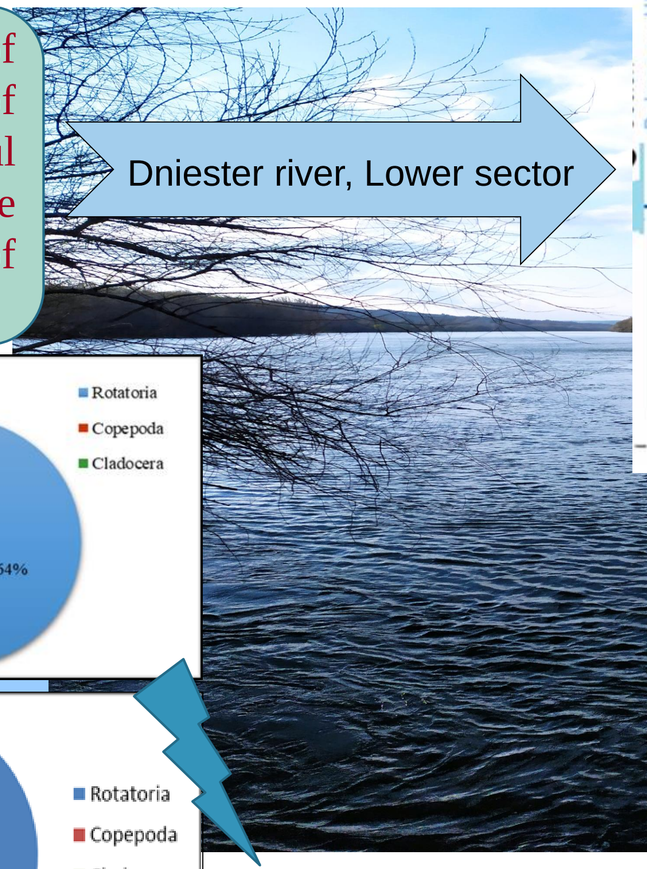
THE STATE OF ZOOPLANKTON COMMUNITIES IN THE LOWER DNIESTER AREA UNDER THE CONDITIONS OF RIVER REGULATION AND ACTUAL CLIMATIC CHANGES

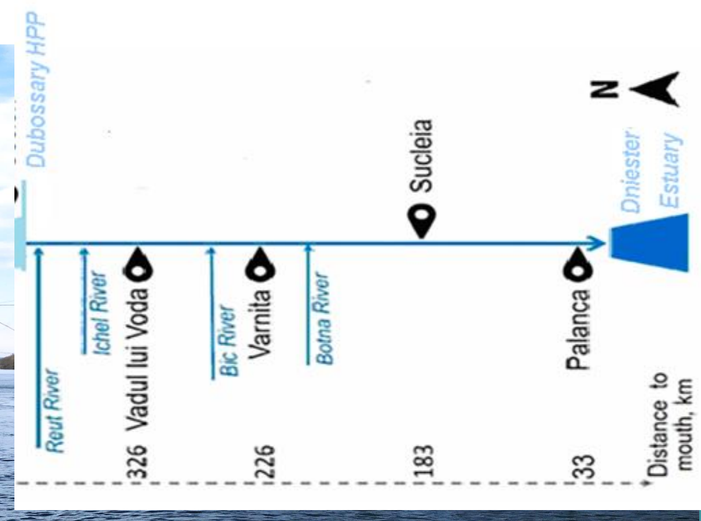
L.A. Lebedenco, N.N. Andreev, S.P. Kovalishina*, M. V. Nabokin*
Institute of Zoology, Chisinau, Republic of Moldova, *Ukrainian scientific center of Ecology of Sea, 89 Frantsuzsky Blvd., 65009, Odessa, Ukraine, e-mail:liubovilebedenco@zoology.md e-mail: m.nabokin1@gmail.com

In recent years, several factors, including the hydrochemical and hydrobiological status of the river ecosystems have produced significant changes. Dniester river has undergone considerable modifications, following the construction of the Dubasari (1953) and Novodnestrovsc (1980) reservoirs, which caused the rupture of the longitudinal connectivity of the river, the disruption of the hydrological, thermal and hydrochemical regimes. This resulted in harmful effects first of all on the hydromorphological balance of the rivers, but also on the aquatic fauna and habitats.

Materials and methods

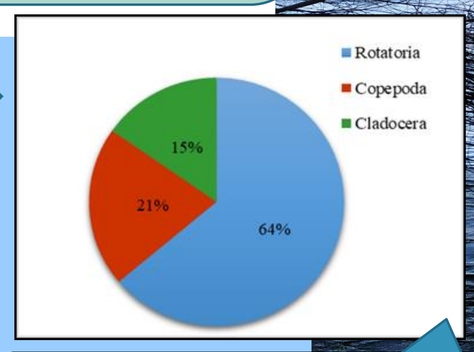
This paper presents the results of investigations of zooplankton communities of the Dniester river, in the lower sector (Vadul lui Voda - Palanca) on the territory of the Republic of Moldova and the delta of Dniester river (Palanca - Maiaki) of Ukraine.





Results and Discussions

The specific diversity of zooplankton during 2020 in the lower sector of the Dniester was represented by 72 taxonomic units (fig. 1), with the predominance of the group of rotifers which constituted 64% or 46 taxonomic units of the total number. Copepods were represented by 15 (21%) taxonomic units including the stages of nauplii and copepods and cladoceres 11 units or 15%. The diversity of zooplankton in the Dniester delta (fig. 2) constituted 37 taxonomic units: Rotatoria - 23 (62%), Cladocera 5 (13%), Copepoda -4 (11%) and other groups of organisms (Varia) - 5 (14%) taxonomic units.



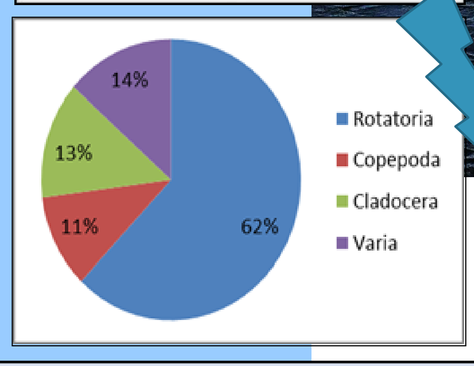
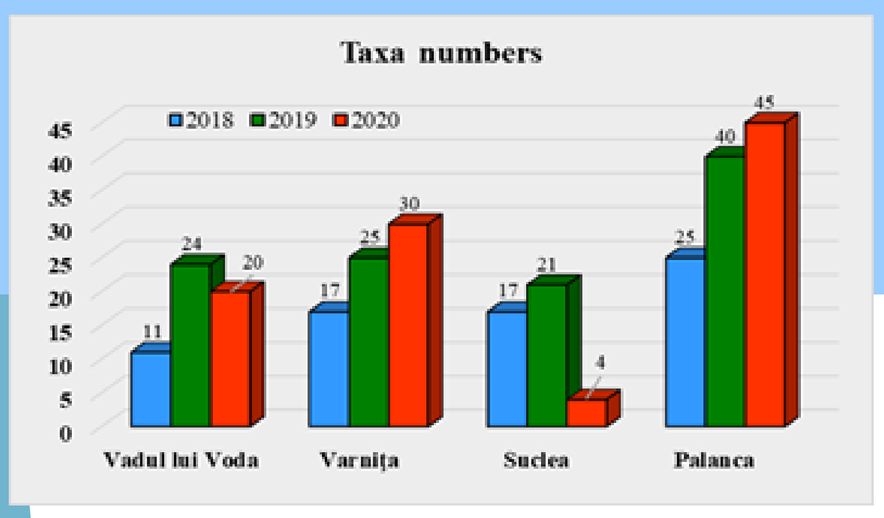


Fig. 1-2 Taxonomic diversity and the contribution of the main groups of zooplankton in the Lower Dniester and Dniester delta, 2020



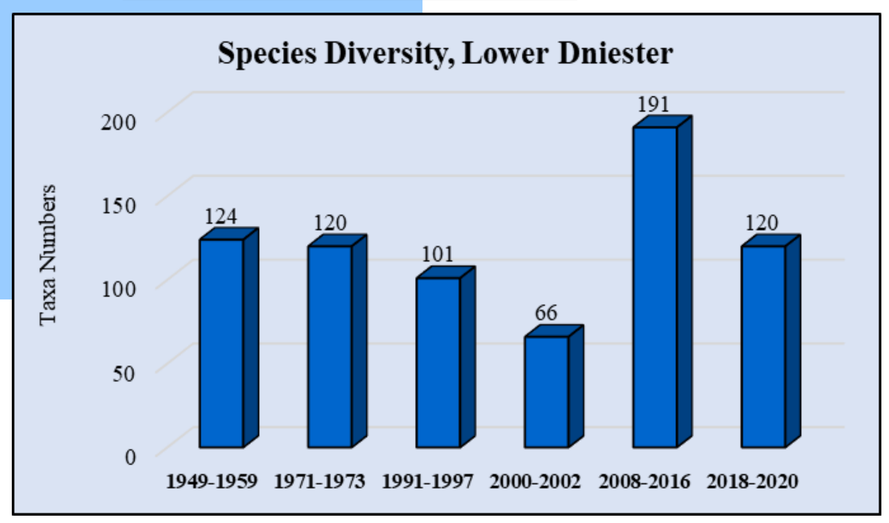
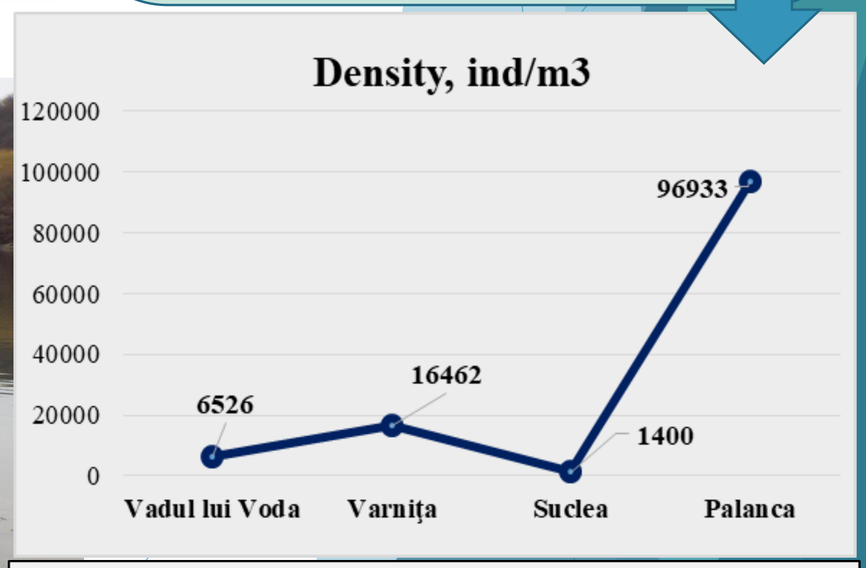
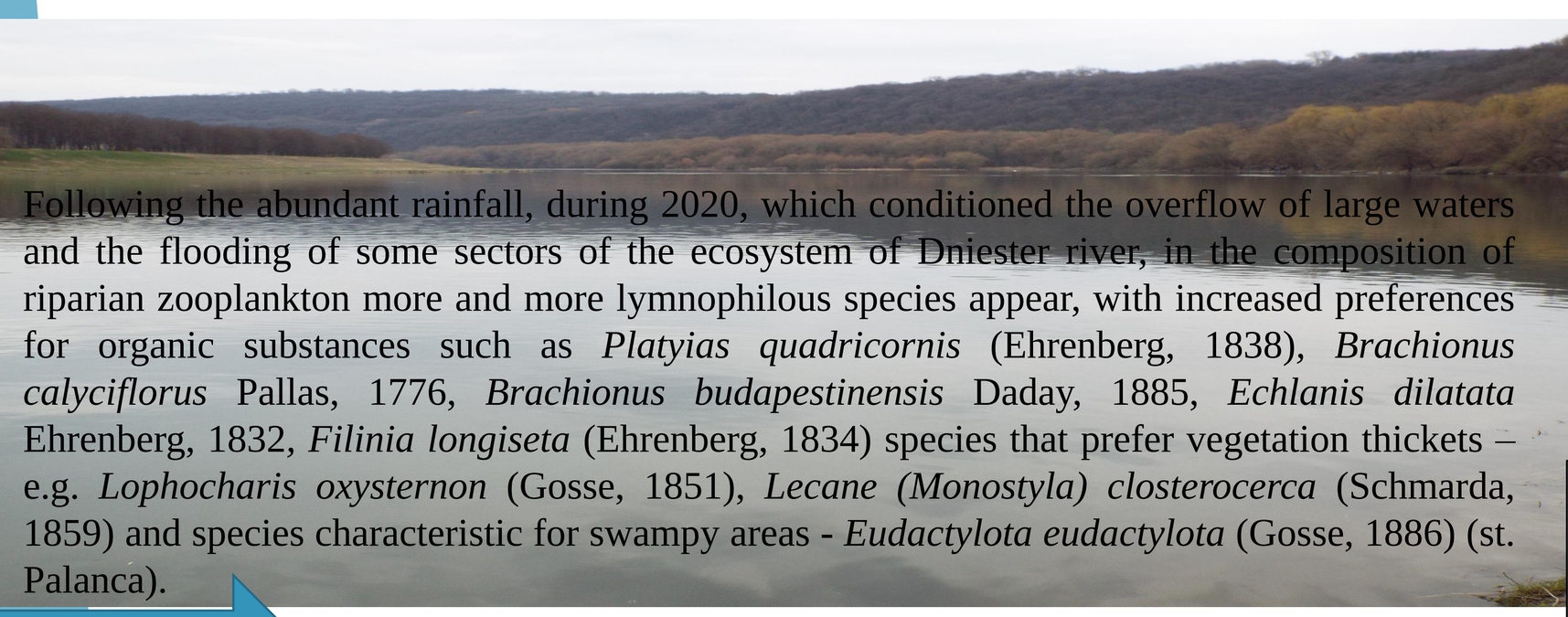


Fig. 3-4 The distribution of the number of taxa registered on the Lower Dniester in the dynamics.

Quantitative development of zooplankton in the Dniester river during 2020 was largely determined by unstable climatic conditions and water level fluctuations. The average density of the zooplankton of lower Dniester during 2020 varied in the limits of 1.4 - 96.9 thousand ind/m^3, with a maximum development at Palanca station and minimum at Sucleia station (Fig.5)

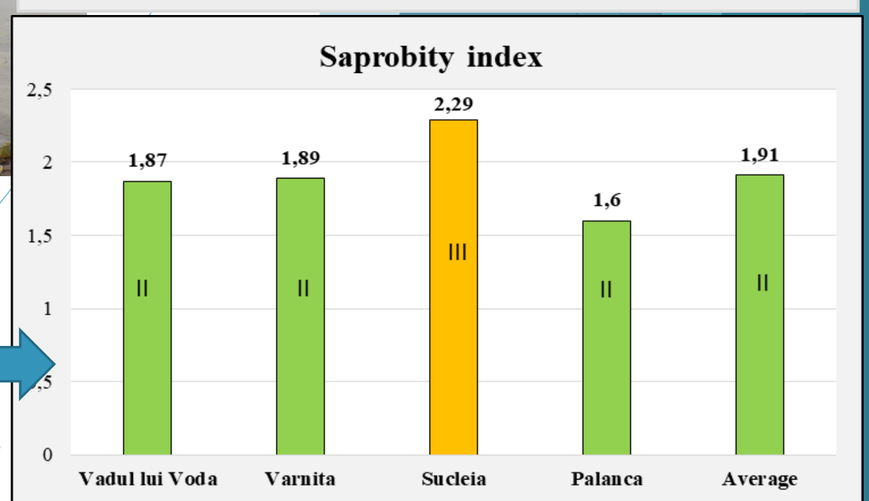




Following the abundant rainfall, during 2020, which conditioned the overflow of large waters and the flooding of some sectors of the ecosystem of Dniester river, in the composition of riparian zooplankton more and more lymnophilous species appear, with increased preferences for organic substances such as *Platyias quadricornis* (Ehrenberg, 1838), *Brachionus calyciflorus* Pallas, 1776, *Brachionus budapestinensis* Daday, 1885, *Echlanis dilatata* Ehrenberg, 1832, *Filinia longiseta* (Ehrenberg, 1834) species that prefer vegetation thickets – e.g. *Lophocharis oxysternon* (Gosse, 1851), *Lecane (Monostyla) closterocerca* (Schmarda, 1859) and species characteristic for swampy areas - *Eudactylota eudactylota* (Gosse, 1886) (st. Palanca).

Conclusions

The ecological status of the investigated ecosystems, according to the parameters of the zooplankton communities corresponds to the b-mesosaprobe area, and the water quality according to the values of the saprobity index is attributed to classes II - III and is characterized as good - moderately polluted.



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ORNITOFAUNA INVENTORY OF THE SARATA NOUA LAKE (2016 – 2021)

1,2,3 **Vitalie AJDER** (ajder.vitalie@gmail.com)
1,2 **Silvia URSUL** (lavricsilvia@gmail.com)

1. Society for Birds and Nature Protection, Chișinău, Republic of Moldova
2. Institute of Zoology, Terrestrial vertebrates Laboratory, Chișinău, Academiei Street, 1, Moldova
3. Institute of Ecology and Geography, Laboratory of Natural and Anthropogenic Ecosystems, Chișinău, Academiei Street, 1, Moldova

INTRODUCTION

The Sarata Noua Lake is an average-sized lake located in Republic of Moldova, near the village of the same name (Leova county), situated in the middle course of the river Sarata, which is a Prut river tributary. The lake has a water surface of 139.50 ha and is one of the largest artificial lakes from the Sarata river basin.
Due to lack of any study regarding the ornithofauna of the Sarata river basin and particularly on Sarata Nouă Lake., there is few knowledge regarding its biodiversity.

MATERIALS AND METHODS:

The ornithofauna study of the Sarata Noua lake is based on regular observations conducted during the last 6 years (2016 to 2021), covering the phenological seasons of spring and autumn migration, breeding and wintering.
The field observations were carried with a monthly frequency during the migration and breeding season using point counts and line transects. The wintering observations were carried out every two or three months.

MIGRATION

*The Sarata Noua lake is situated on the East-Elbic migration route, being an important stop for 109 species of migratory birds. The place hosts regular migrants, including rare species such as **Kentish Plover** (Charadrius alexandrinus), **Common crane** (Grus grus), **White-tailed eagle** (Haliaeetus albicilla), **Osprey** (Pandion haliaetus), **Red-necked phalarope** (Phalaropus lobatus), **Mediterranean Gull** (Ichthyaetus melanocephalus).*

BREEDING

*The Sarata Noua lake hosts 75 breeding species, most common being **Mallard** (Anas platyrhynchos), **Moorhen** (Gallinula chloropus), Red-backed shrike (Lanius collurio), **Turtle Dove** (Streptopelia turtur) and **Eurasian golden oriole** (Oriolus oriolus). The **Ruddy Shelduck** (Tadorna ferruginea), **Black-winged stilt** (Himantopus himantopus) and **Mute swan** (Cygnus olor) show a sporadic breeding character. In the recent years the nesting of the **Black Kite** (Milvus migrans) was documented.*

WINTERING

*During the mild winters, large groups of **Mallards** (Anas platyrhynchos), **Mute swan** (Cygnus olor), **Green-winged teal** (Anas crecca), **Northern lapwings** (Vanellus vanellus), **Yellow-legged gulls** (Larus cachinnans) and other water birds gather here constantly in order to feed. The presence of **Hen Harrier** (Circus cyaneus) and **Common Buzzard** (Buteo buteo) is common during the winter months.*

RESULTS & DISCUSSION

During 2016-2021, we documented the occurrence of 126 bird species, out of which 109 were migratory, 75 breeding and 37 wintering. These 126 species represent 46% of the total number of bird species registered in the Republic of Moldova and are distributed in 16 orders of the Aves class.

Due to its location in a arid region and following the severe drought and lack of precipitation which happens in some years, the Sarata Noua lake varies greatly in size and water depth. This impacts the local birds such as pelicans, cormorants and other diving species, making difficult for them to obtain food.

On the other hand, the lake is a very important stopover for an impressive number of migratory birds, which use the location as a feeding and resting site during the spring and autumn migrations.

Bibliography:
1. Ajder Vitalie , Cioflec Vlad , Bolboacă Lucian Eugen, Grosu Ion , Emanuel Ștefan BALTAG. New bird species recorded in Republic of Moldova during 2011-2014. International Zoological Congress of "Grigore Antipa" Museum 19 - 22 November 2014 BUCHAREST, ROMANIA.
2. Cazac V., Mihailescu C. Resursele acvatice ale Republicii Moldova. Apele de suprafata. Vol.1. Editura: Știința. An:2010 Chișinău, Republica Moldova
3. Ursul Silvia, Ajder Vitalie, Petrencu Laurentiu, Baltag Emanuel Ștefan: „Ruddy shelduck distribution in the Republic of Moldova", Sustainable use, protection of animal world and forest management in the context of climate change", Book of Abstracts, Chișinău, 2016.

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ABOUT CHEMICAL COMPOSITION OF THE NEMATODE *DITYLENCHUS DIPSACI*

MARIA MELNIC, OLESEA GLIGA.
e-mail: mariamelnic@gmail.com
oleseagliga@gmail.com

In the article are presented data on the quantitative variations of bound amino acids (AA) in the tissue protein of the nematode *Ditylenchus dipsaci* Kuhn, 1857, parasite of *Allium sativum* crops. Determination of amino acids was performed by ion exchange chromatography on the automatic amino acid analyser, hydrolysis method with hydrochloric acid (HCl) 6n.

-It was established that in the tissue of populations *Ditylenchus dipsaci* (mature forms, larvae and eggs), which were extracted from the bulbs of *Allium sativum*, infested in the early stages of ditylenchosis, contains an increased amount of protein - 22.14mg/100 mg product.

-In the composition of proteins the presence of 19 amino acids: cysteic acid, aspartic acid + asparagine, threonine, serine, glutamic acid + glutamine, proline, glycine, alanine, valine, cysteine, methionine, isoleucine, leucine, tyrosine, phenylalanine, tryptophan, lysine, histidine, arginine, were detected.

Figure 1. a. Garlic bulbs infested with *Ditylenchus dipsaci* populations in the initial stage; *b.* nematodes *Ditylenchus dipsaci* after washing

- It was found that the largest share has: glutamic acid + glutamine -21.0%, aspartic acid + asparagine - 11.0%, glycine -12.6% and alanine -10.5%, of the total amount of amino acids, and nitrogen increased with: 0.3044, 0.5200, 0.6084 and 0.4296 mg/100 mg, respectively.

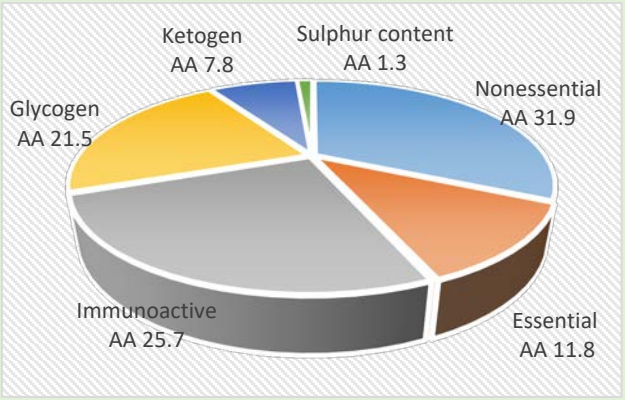

Figure 2. Percentage distribution of the main groups of amino acids in *Ditylenchus. dipsaci* homogenate.

In the group of non-essential amino acids, which is also the largest group, 12 amino acids are included: Asp + Asn, Ser, Glu + Gln, Pro, Gly, Ala, Val, Cys, Ile, Tyr, His, Arg, which account for the highest percentage of the total amount of amino acid groups.

- According to the distribution of AA by groups, were determined that nonessential AA (12 amino acids), have the highest percentage of total - 31.9%, followed by immunoactive AA - 25.7%, glycogen - 21.5%, essential AA - 11.8% and ketogen - 7.8% (Figure 2).

Project funded by EUROPEAN UNION

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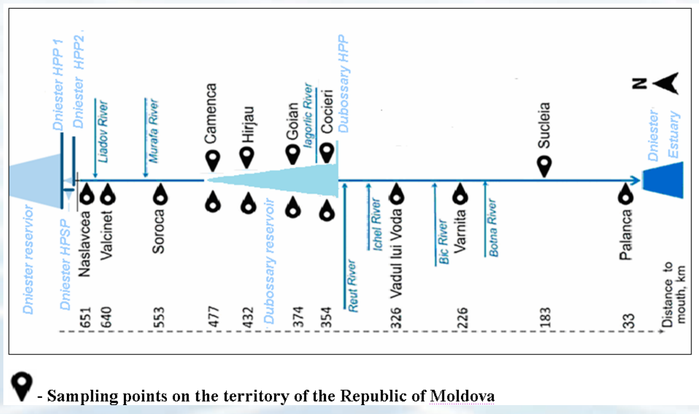
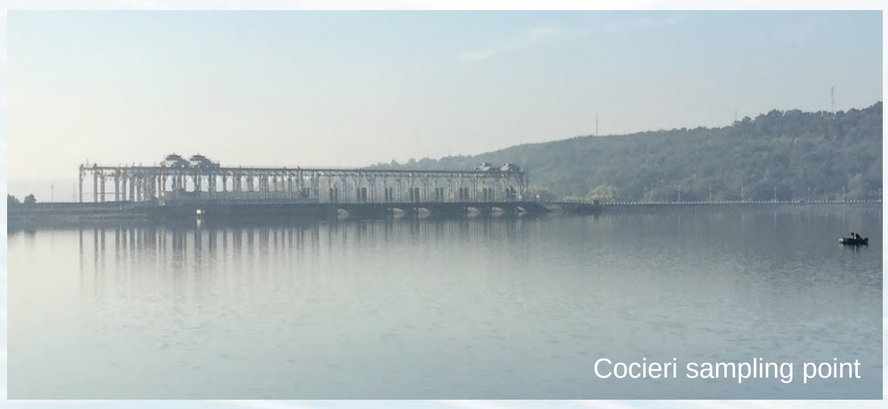
Zoobenthos of the Dniester River on the territory of the Republic of Moldova for the period 2018-2021

Oxana Munjiu, Nadejda Andreev

Institute of Zoology, Chișinău, Republic of Moldova, e-mail: munjiu_oxana@mai

Abstract. The data on the influence of dams on the structural and functional parameters of the macrobenthos of the Dniester River on the territory of the Republic of Moldova are presented. A decrease in the biodiversity and number of groups most sensitive to negative environmental changes (mayflies, stoneflies and caddis flies) was noted. The results indicate the number of most sensitive species to negative environmental changes can serve as suitable indicators of the impact of hydropower facilities on the Dniester River.





Introduction. The study on the influence of the regulation of the Dniester riverbed by the dams of the Dnestrovsk HPPs and Dubossary HPPs on benthic communities contributes with recommendations for decision-making on the conservation of biodiversity of the river and sustainable use of aquatic ecosystems. This is especially important for transboundary rivers, which water resources are used for hydropower, water supply, irrigation of navigation, recreation and environmental protection.

Material and methods. Samples were collected from the Dniester riverbed, from 2018 to May 2021, at 11 sampling points: Naslavcea, Vălcineț, Soroca, Camenca, Erjovo, Goieni, Cocieri, Vadul-lui-Voda, Varnița, Sucleia and Palanca. In total, more than 250 samples of benthic fauna were collected and processed. At the sampling points: Camenca, Erjovo, Goieni, Cocieri, samples were collected from both the left and right banks, at Soroca sampling point, samples were collected downstream of the city and Soroca 1, a few kilometers away from the city.
Quantitative samples were taken using an Ekman bottom grab and a dredge; for qualitative samples, a net and manual collection from various substrates were used. The identification of species was carried out to the smallest possible taxon level in the laboratory using identification keys [Kutikova, Starobogatov, 1977; Tsalolikhin 1994,1995,1997,1991,2004]. Species were identified using an Axio Imager A.2 microscope (Zeiss) and a SteREO Discovery.V8 binocular microscope (Zeiss). The abundance and biomass were recalculated as ind./m2 and g /m2, respectively.

Results and Discussion.. According to the obtained data, the average lowest multiannual (2018-2021) abundance of total and zoobenthos without molluscs were noted at sampling points located downstream of the dams of reservoirs, namely at Naslavcea and Vadul-lui-Vodă (Figs 1.1 and 1.2). These indices accounted for 3055 and 3461 ind./m2 of total zoobenthos, and 2370 and 2585 ind./m2 of zoobenthos without molluscs, respectively.

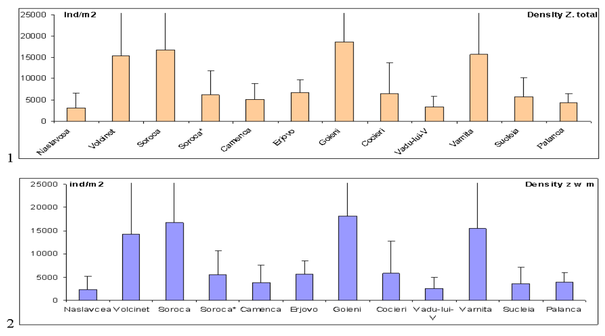


Fig 1. 1 The mean (± SD) density of total zoobenthos (2.1) and zoobenthos without molluscs (2.1) from Dniester River during 2018-2021

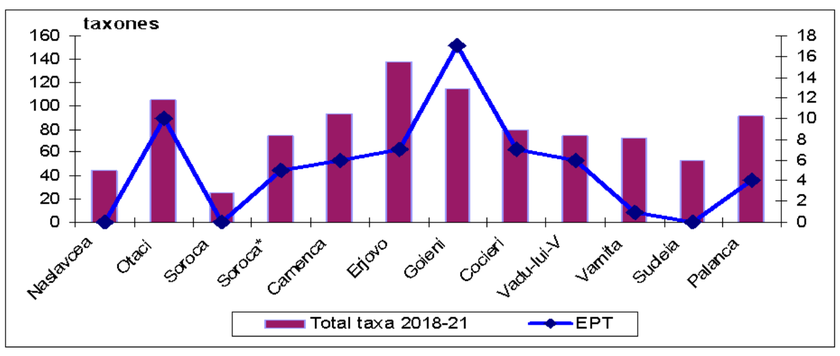


Figure 3. The number of taxa of benthic invertebrates in Dniester river and Dubosari reservoir for the period 2018-2021.

Comparing the species composition using the Jaccard index, it could be seen that such sites as Naslavcea and Soroca were considerable different from other sites (Fig. 4). These differences, first of all, could be caused by the sharp changing water level in Naslavcea and the discharge of untreated wastewater in Soroca which negatively affected the development of benthic invertebrates

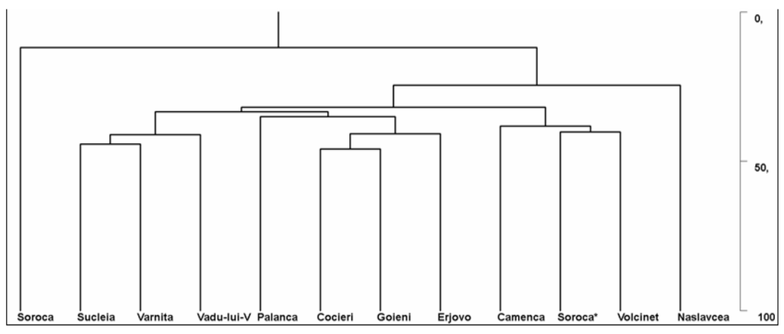


Figure 4. The dendograme of species similarity between communities of benthic macroinvertebrates in the Dniester and Dubăsari reservoir for the period 2018-2021.

Alien species which became a common in the macrobenthos communities: *Branchiura sowerbyi* Beddard, 1892, *Dreissena rostriformis bugensis* Andrusov, 1897, *Ferrissia fragilis* (Tryon, 1863), *Macrobrachium nipponense* (De Haan, 1849). Artificial ecosystems such as reservoirs are most susceptible to the penetration and rapid spread of alien species


Macrobrachium nipponense (De Haan, 1849)

The taxonomic structure and distribution of species along the river, indicated the smallest number of taxa at Soroca sampling point, downstream of the city, with only 25 taxa and at Naslavcea – with 45 taxa (Fig. 3). At these sampling points, as well as at Sucleia, no representatives of the groups most sensitive to negative environmental changes such as: mayflies, stoneflies and caddis flies, the so-called EPT taxa (Ephemeroptera, Plecoptera, Trichoptera) were registered (Fig. 3). This would be related to the unfavorable environmental conditions in these sections of the river. The largest number (138) was recorded at Erjovo.

The highest biodiversity of EPT taxa in 2015-2019 was recorded at the Camenca and Goieni sampling points, in 2018-2021 3 taxa of Trichoptera and 3 of Ephemeroptera were recorded at Camenca and 12 taxa Trichoptera and 5 Ephemeroptera at Goieni (Fig. 3). It is important to note that on October 25, 2019, in Camenca a new species for the fauna of Moldova the mayflies *Ephemera lineata* Eaton, 1870 was recorded.

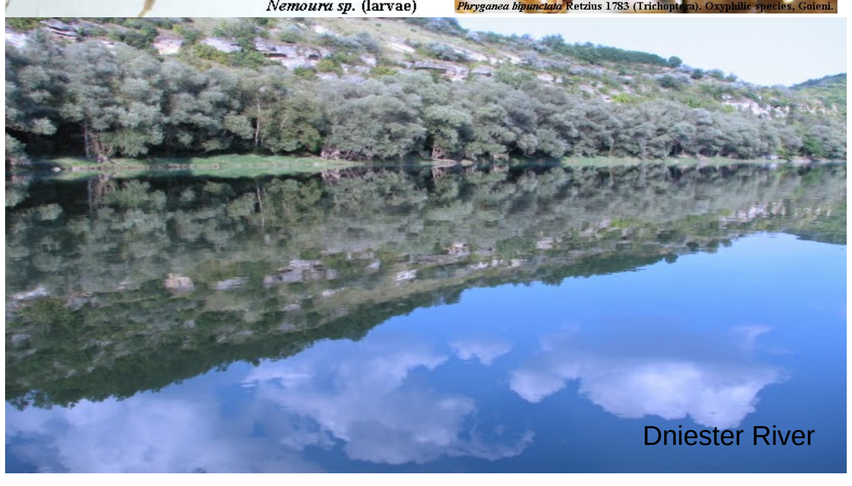

Ephemera lineata Eaton, 1870

Comparing historical data on the composition of macrobenthos, it can be observed that species sensitive to negative environmental changes have disappeared, such as: *Oligoneuriella rheana* (Imhoff, 1852), *Ecdyonurus*, Dniester endemic *Behningia lestagei* Motas & Bacesco, 1937 and others. Almost complete extinction of mayflie *Palingenia longicauda* (Olivier, 1791) (Ap.II, Bern Convention, 1998) and *Unio crassus* Philipsson, 1788, a rare protected Natura 2000 species of bivalve molluscs, which is currently found only in the upper part of the Dubossary reservoir with dense overgrowth of Dreissena (Fig.4). Plecoptera were recorded only twice in 2012, and in May 2021.


Dense overgrowth of Dreissena the protected Natura 2000 species *Unio crassus*

Nemoura sp. (larvae)


Phryganea bipunctata Retzius 1783 (Trichoptera). Oxyphilic species, Goieni.


Dniester River


Palingenia longicauda (Olivier, 1791)

All photos by O. Munjiu

Conclusions: the total number of species, rare species and the number of species of groups most sensitive to negative environmental changes such as mayflies, stoneflies and caddis flies (EPT) can serve as indicators of the impact of hydropower facilities on the Dniester River.

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